Designing and Evaluating a Slow Technology for Personal Media Sharing

by

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Abstract

Personal media sharing of photos and video has become a spectacle of the immediate, yet it may come at the cost of meaning and significance. To explore this design space, I created a new tool, Postulater, which supports time-delayed photo and video sharing. The goal of my research was to understand how media sharing tools should be designed and how they might be used for sending media, if users were able to select delivery time explicitly. I conducted a field evaluation of Postulater over six weeks and found that participants valued sending time-based messages to send reminders, share personal memories and reflections, affect future time periods, and send social greetings. These messaging acts often garnered strong emotions from the participants. The implication is that time-based messaging systems should be designed in a cautionary way that balances the need to send messages 'into the future' with the complex human emotions that such practices can create.

Keywords: Slow Technology, Reflective Design, Family Communication, Asynchronous Communication, Media Sharing, Photo Sharing

Dedication

This thesis is dedicated to my Mom and Dad for their endless support. You are a constant source of love and encouragement. Thank you for everything.

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I would like to express my gratitude and appreciation to my senior supervisor, Carman Neustaedter. Your work ethic and constant support is beyond inspiring; I often wonder where I would be without your guidance and mentorship. It has been a great pleasure working with you over these years and I am truly thankful to you for taking me under your wing at SFU. I would also like to thank my committee member, Lyn Bartram, for her support. And a special thanks to the SIAT Faculty for their inspiration, the SIAT Staff for their patience, and the rest of my colleagues at SIAT for their support.

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1. Introduction

Imagine the following scenario:

Neil is ninety-five year old grandfather who wishes to be a part of his grandchildren lives in the future, long after his passing. His grandchildren at this point are too young to remember him. He decides he wishes to preserve the memory of him by capturing photos of himself holding his grandchildren in his arms. He then sends the pictures to his daughter, the parents of the grandchildren, and asks for them to be shared with the children on there birthdays ten years in the future. Many years later, after Neil has passed away, the grandchildren are shown the photos (which have been safely stored). The grandchildren are touched by this act, but they still feel disconnected from their grandfather, having never interacted with them.

Now imagine instead, another scenario, where Neil decided to use an application that allowed him to send time-delayed photo messages into the future from him directly. In this scenario, Neil has prepared birthday greetings and photos for his grandchildren when they turn eleven years old. Not only are the photos safely stored, and contain annotation from the day when the photo was captured, but the grandchildren can also experience more direct means of communication from Neil. This system is the focus of this thesis.

1.1 Background

Technology has increasingly provided ways for more immediate communication across time and space. The merger of social sharing (social media) and ubiquitous computing (including cloud-computing platforms) has allowed for instantaneous and synchronous communication at any time. This trend is especially prevalent in media

sharing applications where we now see photos or videos being shared, and subsequently viewed, in-the-moment with applications like Instagram, Facebook, Twitter, Vine, and SnapChat. In the last ten years alone, photo sharing has become more and more immediate. Moving from albums that captured users past few weeks, it is now common place to share photos in the moment. My particular interest is in examining an area of research exactly opposite to immediate photo and video sharing: delayed media sharing. Moreover, I am interested in knowing what would happen if we created stronger ties to the notion of time in relation to media sharing by forcing users to delay their media sharing and let them decide *when* their media would be sent for viewing by others. Giving users control of when media is shared could create novel uses of media sharing, and also cause users to slow down and create introspective reflection in a fast-paced world, a growing concern in the HCI community.

With a growing number of people capturing and sharing instant photos everyday on social networking sites (~60 million and ~350 million photo uploads per day on Instagram and Facebook respectively), photo capturing and sharing behaviours have shifted to a constant and pervasive phenomenon. Medelson and Papacharissi explore how digital photography and social networking sites (SNS), particularly amongst emerging adults, have given rise to new habits of photo sharing (Mendelson & Papacharissi, 2010). Where photos, in the case of analog, were once used for memory-based practice, (e.g., with family photo albums) digital photos now are commonly used for in-the-moment self-presentation and status, or as they refers to, "collective narcissism" (Mendelson & Papacharissi, 2010). New Media and SNS's have provided channels for digital exhibitionism; a means of social capital (Panck et al., 2013). Consequently, social pressures arise where users are compelled to stay constantly connected and upkeep an in-the-moment online presence (Kuss & Griffiths, 2011; Kim et al., 2011). Other research has explored the negative effects of hyper-connectivity with respect to addiction, loneliness and depression (Kim et al., 2009). The purpose of this work however is not to investigate the effects of instantaneous media sharing, but rather to explore the design of an application that offers a slower way of sharing multimedia. Designing a tool that strays away from immediate media sharing, where instead the focus is on deliberately delaying messages may a) allow users to behave differently when sharing multimedia on social networking sites (i.e. contemplation, introspective

reflection, reminisce, relax, pause) and b) provide people with novel uses that have not been described previously.

Time-delayed communication exists in many forms, including physical and digital time capsules. On a basic level, Microsoft Outlook and other email providers allow users to send time-delayed emails. WhenSend, allows users to send future messages (i.e. emails) to themselves or others to any time in the future. However, WhenSend is only text-based, and does not support sharing of multimedia. Similarly, but designed for shorter delays and reflection, The Ripening Room (Bae et al., 2014), allows for users to post to SNS, but provides a time-delay between when the post is written and when it is shared. This small time delay is meant to facilitate moments of self-reflection before going public with one's thoughts. FutureMe, which does support sharing of photos, is a popular way to send messages to oneself in the future, which have the option to be shared publically and with others. The system uses email addresses to send future letters, which users have the ability to retract. FutureMe has been in use for over 12 years, with over one million users, and has currently been used to send over 3 million letters. Surprisingly, none of these applications have been studied in terms of their design and usage to explore what makes them work well (if at all) or how people use them. To date, researchers have not explored the design space of time-delayed multimedia messaging.

1.2 Thesis Problems

This thesis explores the design, use and evaluation of time-delayed messaging for sending and receiving personal multimedia. It addresses the overarching research problem: *we, the HCI community, do not know how such a system should be designed to send time-delayed messages into the future.* This is further subdivided into the following sub-problems:

1) **We do not know how to design a slow technology messaging system for sending multimedia.** While there are tools that support sending delayed messages, we have not yet examined the design principles for a digital system that supports delayed sharing of multimedia, for friends and family, to the future.

2) **We do not know how to design a slow technology messaging system for receiving and viewing multimedia.** Given that we can determine when message should be delivered, we do not yet know how an interface should be designed which supports receiving and viewing time-delayed messages from the past, nor do we know the form of such digital messages.
3) **We do not know the ways in which people will use a slow technology multimedia application.** When people are given the possibility to control when their messages are sent, novel applications could arise in a various number of ways. Understanding how people will interact and use such an application will inform our design decisions.

1.3 Thesis Goals

My primary goal for this thesis is to provide an understanding of how individuals share time delayed media, and their behaviour associated with this practice, which will inform the design of an application that supports time delayed multimedia sharing and further insight into the overall design strategy beyond this specific application. To address this overarching goal, I seek to address the following objectives, which are aligned with the aforementioned thesis problems:

1. **I will design a time-delayed messaging application that supports sending multimedia.** I will use this design and evaluation to help better understand ways in which time-delayed systems should be designed to better facilitate sending messages. This involved the creation of the application Postulater (see Figure 1.1).
2. **I will design an interface which supports receiving and viewing time-delayed multimedia.** I will use this design and evaluation to help better understand ways in which time-delayed systems should be designed to better facilitate receiving and viewing messages.
3. **I will investigate the usage of a time-delayed messaging application through an evaluation.** I will conduct a user-study and classify the behaviours and habits into different categories. I will explore the behaviour and seek to understand how people interact and use such systems.

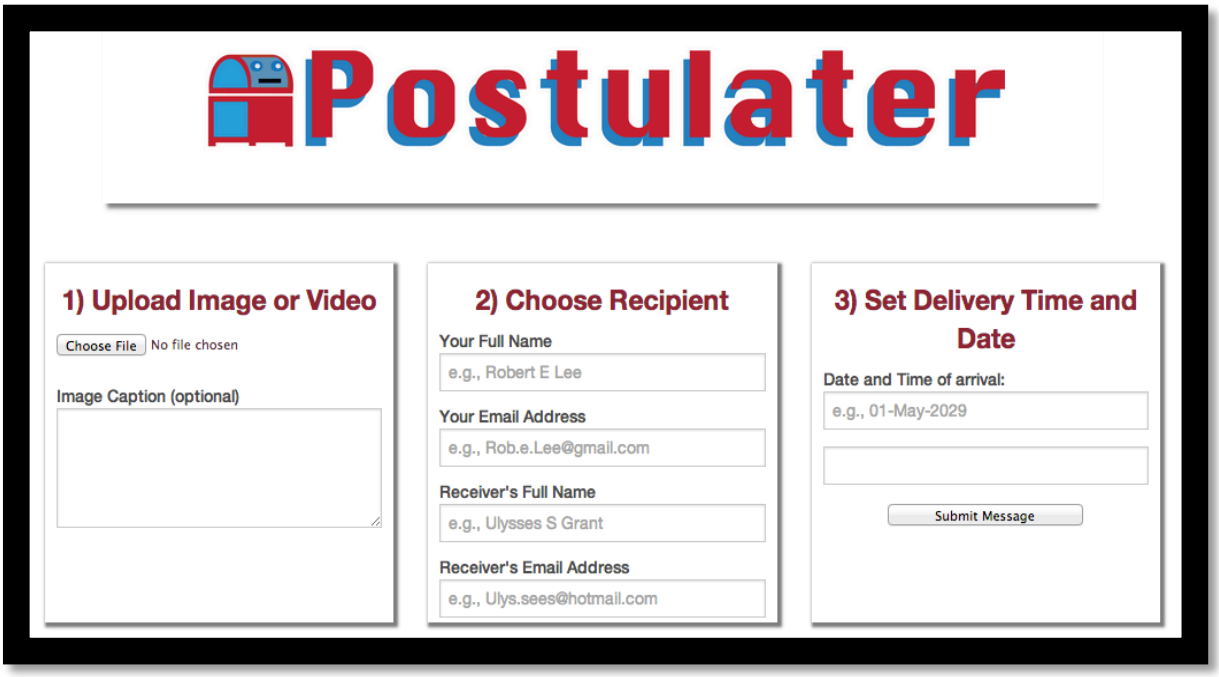


Figure 1.1 Time-delayed messaging system: Postulater

1.4 Methodological Approach

My research focuses on understanding time-delayed multimedia sharing behaviours amongst friends, family, and oneself. This research falls into the domain of human-computer interaction (HCI), which concerns itself with the design, implementation and evaluation of interactive computing systems for human use (Figure 1.2). Specifically, HCI, and the research presented here, seeks to understand how systems will be used, by whom, and how we can design more effective and valuable tools based on our objectives.

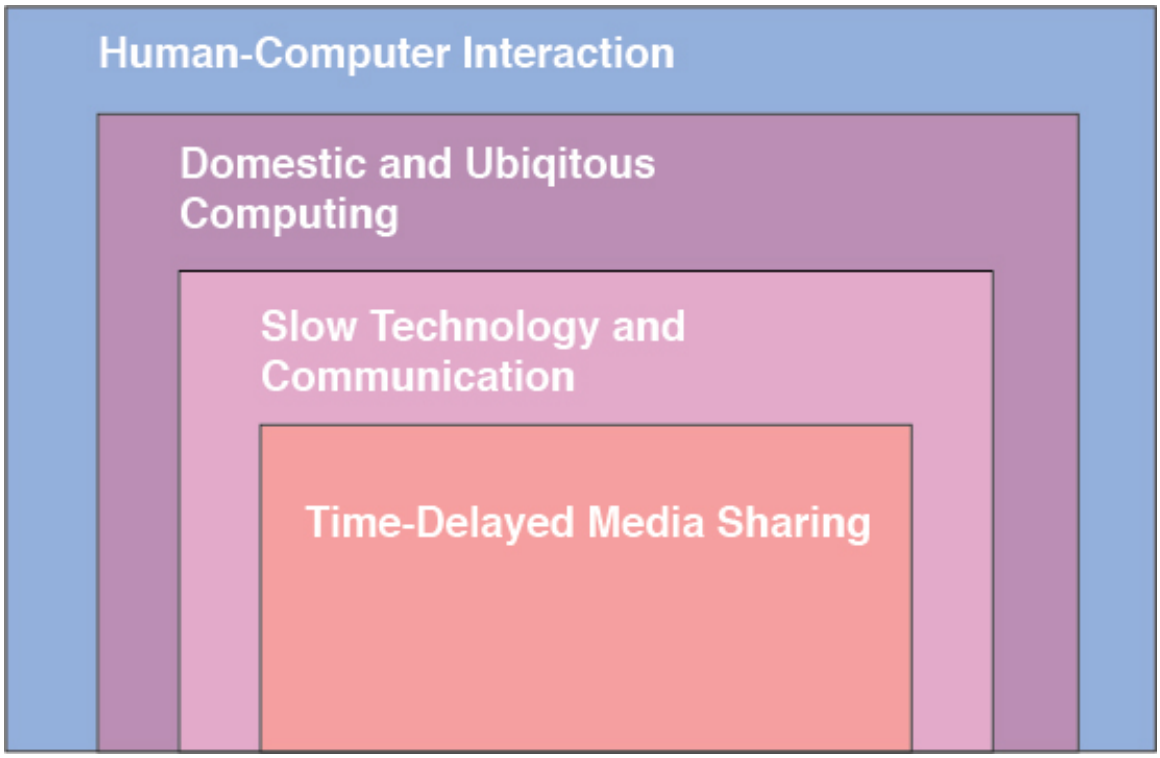


Figure 1.2 Context of research within the domain of HCI

This thesis addresses the design and evaluation of a time-delayed messaging system. In doing so, I first begin with designing an application that supports sending time-delayed multimedia messages. This follows an iterative design process. Second I evaluated Postulater through a qualitative field deployment study. A qualitative, rather than a quantitative, study was conducted, in order to understand the behaviours and needs of the participants because little is known in the research space to date. My qualitative approach involves a field deployment with nineteen participants over a six-week period to understand how people used the application as a way to communicate into the future with others. The evaluation focused on the behaviour of the sender (including the kinds of messages they sent), as well as the perception and reception of the message by the recipient. Using a semi-structured interview, I was able to further explore participants; experiences in depth. Semi-structured interviews, as noted by Schensul et al. (1999), allow for the flexibility and potential for either the interviewer or interviewee to expand on open-ended questions. During interviews, I was able to discuss the content of each message sent by participants, and ask open questions regarding things like who they sent messages to, why, when, and what was the context

or significance of each message. I also explored quantitative aspects of each question, such as the frequency of messages, the time in delay, the mode (e.g. smartphone versus desktop), and compared the use of captions and non-captions, as well as image versus video based messages. I discuss the findings of this study in Chapter 5.

1.5 Organizational Overview

In Chapter 2, I provide a literature review. I discuss how families use technology to communicate with each other, both synchronously and asynchronously. Then I review family media sharing practices, including collocated and immediate sharing routines. Lastly, I describe slow technologies and reflective design as an approach to technology design.

In Chapter 3, I discuss the design of Postulater, a prototype time-delayed messaging system. Here I discuss the rationale for the design decisions I made when creating Postulater, from both a technical and aesthetic viewpoint. In addition, I introduce scenarios of how I imagine a system like Postulater would be used.

In Chapter 4, I discuss the methodology for a qualitative study that investigates a time-delayed messaging system, Postulater. The study uses semi-structured interviews to examine the experiences of participants over a six-week period, and seeks to understand users behaviours and routines with the system.

In Chapter 5, I discuss the results of the qualitative study, which includes a classification of different behaviours identified during the six-week period. I also provide a descriptive overview of message sending patterns.

In Chapter 6, I discuss the results and identify design implications for future systems to facilitate time-delayed multimedia sharing. This involves discussing both positive (advantages, novel uses of the system, new uses of photos, relationships) and negative experiences (retracting and logging messages).

In Chapter 7, I conclude this thesis by summarizing how I achieved each of my research goals. I also list my research contributions and suggest areas for future work.

2. Related Work

In this chapter I review the related literature and work. First, I review the subject of family communication routines, and discuss related work on how families use technology to communicate with each other, both synchronously and asynchronously. Secondly, I review media sharing practices, including collocated and immediate sharing routines. Thirdly, I describe slow technologies and reflective design as an approach to technology design and systems that facilitate reflection amongst users. Lastly, I review research on time capsules and digital artefacts as a means to explore memorabilia and time-delayed systems.

2.1 Family Communication Routines

There is a wealth of research on how family members communicate with one another using technology. This provides a basis for understanding how people's practices might change when using a technology like Postulater.

First, research shows that families use a mixture of synchronous and asynchronous communication tools to connect with one another and share information, where each mode serves particular needs (Cao et al., 2010; Neustaedter et al., 2006; Tee et al., 2009). Synchronous technologies (e.g., phone and video chat) are typically desired for emotional conversations (Neustaedter et al., 2006; Pang et al., 2013; Tee et al., 2009) as well as in situations with large time zone differences and distributed families (Cao et al., 2010). Asynchronous technologies, on the other hand, help individuals broadcast information to large groups of family or friends (Pang et al., 2013) and can also be helpful for the micro-coordination of activities (Neustaedter et al., 2006; Tee et al., 2009). However, overall people tend to prefer sharing information when it is in-the-moment and targeted (Romero et al., 2007). Neustaedter et al. (2006) revealed that the use of synchronous and asynchronous technologies for maintaining *interpersonal*

awareness of friends and family varied across different social groupings (e.g. *home inhabitants, intimate socials, extended socials*). For example, home inhabitants (individuals living in the same house) generally desired detailed (low-level) local information of day-to-day activities, whereas intimate socials (individuals from different households, but in close relationships) desired slightly less low-level details but also wanted details about past and future locations (Neustaedter et al., 2006).

Second, there is a focus on immediacy in communication. This is often because of carefully planned activities amongst immediate family members (Neustaedter *et al.*, 2006; Tee et al., 2009). It can also be a result of the desire to instantaneously let others know what one is up to (Neustaedter et al., 2006), or be part of an attempt to feel like one is with others 'in-the-moment'. For example, Inkpen et al., (2013) explored how mobile video could be used to support shared experiences (such as kid's birthday parties and sporting events) for distributed family members. Using a prototype (Experience2Go), they showed that their a strong desire to share activities outside the home with remote family members, despite the technical difficulties (Inkpen et al., 2013). Turning to the use of social media sites like Facebook, we see usage focused on maintaining an awareness of friends' activities (Barkhuus et al., 2008), coordinating offline socialization (Barkhuus et al., 2010), and building relationships (Joinson, 2008). Again, these acts are described mostly as being in-the-moment activities.

Third, research has shown that despite the desire for immediacy, people do value deliberate and planned exchanges of information with family members (Romero et al., 2007). Romero et al. (2007) designed and studied the use of the ASTRA awareness system for connecting family members. ASTRA allowed users to capture and send asynchronous messages (similar to email) containing photos and handwritten notes. The system was intended for short term, not long term, asynchronous communication, to provide users with a way to become more involved with, and aware, of everyday activities. In a one week field study amongst four families, participants expressed the ability to stay connected and share experiences with family and friends. Participants also expressed the benefit of using an asynchronous system to communicate without disrupting the recipient's daily flow, and they could later choose more convenient times to communicate directly. Asynchronous messages were intended to act as triggers for

talking-points for later intended synchronous communication. This suggests that even though contemporary trends value immediate exchanges of information between family and friends, there may be a place for technologies that slow the pace of such exchanges.

2.2 Media Sharing Practices

There is also a wealth of research on the media sharing practices of family and friends, largely focused on photo sharing and display. First, there is research that explores the act of collocated media sharing where people come together as part of social activities to share photos and reminisce about their experiences (Crabtree et al., 2004; Frohlich et al., 2002; Van House, 2009). Frohlich et al. (2002) demonstrates this in their study involving photo-sharing practices and self-recording techniques, where eleven families were interviewed on their photoware behaviours and were asked to create archives (i.e. photo diaries) of photos to be viewed at a later date in the future. In addition to the difficulties of keeping up with the organization and annotation of photos over time, participants expressed their frustration with forgetting specific details of the old photos (e.g. people and events). The authors commented that "when the images are recent and everyone who participated is alive, there is not as much demand or perceived value for detailed annotations". This notion has interesting implications for time-delayed photos, where the user is specifically sending photos to a future moment where they can proactively reflect on what information, such as people names or events, that may be valuable in the future. Participants also expressed the preference for "co-present sharing" of old photos with family members, as well as the practice of participants coming together to create moments of storytelling with the photos. Based on these findings, the authors proposed a few design implications for co-present sharing, one of which includes accompanying photos with a storytelling audio annotation. In many ways, this slow, deliberate sharing of media long after an event is most similar to the positioning of this thesis.

Second, research documents the immediacy that has encompassed much of digital photo sharing. Photos are shared on mobile devices immediately after capture or when one meets up with others (Ames et al., 2010;, Kindberg et al., 2005; Neustaedter

and Fedorovskaya, 2009; Stelmaszewska et al., 2008). Even in the latter case, this is often close to the time at which a photo was taken and not further into the distant future. For example, Miller and Edwards (2007) explored the photo sharing practices of two different groups: Kodak Culture people and Snaprs. Kodak Culture people tend to capture more personal photos of family and friends, and kept the sharing to that same circle. Snaprs on the other hand tended to capture less personal and more 'artsy' photos (e.g., everything and anything), and are more likely to share their photos in online communities, like Flickr, often immediately after capture. The authors suggested that Kodak Culture people sought a photo sharing application that matched their needs; one that was more similar to email and allowed for more personal, direct and intentional sharing (Miller and Edwards, 2007). Snaprs, conversely, sought photos sharing applications that were more immediate and could reach a wider audience. Today, social networking sites like Facebook facilitate immediate photo sharing and viewing for a wide audience (Joinson, 2010).

Lastly, researchers have even tried to create prototype designs that provide even more immediate sharing of photos through the automated image transfers between capture devices and digital photo frames (Neustaedter and Fedorovskaya, 2009). For instance, in the prototype design *Ubiquitous Collection* by Neustaedter and Fedorovskaya (2009), when users capture photos they are automatically shared across all devices "without explicit[ing] transfer[ing]" the photos. While the automation of transfer makes the process of sharing photos easy and seamless, the user is likely to be less cognizant of the photos they are sharing. This is very much in contrast to our design explorations.

2.3 Slow Technologies and Reflective Design

The goal of slow technology is to support experiences of reflection, mental rest, slowness and solitude (Hallnäs and Redström, 2001; Odom, et al., 2012). While the concept of slow technology may sound counterintuitive in the context of developing newer technologies that are faster and more efficient, tools that facilitate slowness can provide benefits. The idea of slow technology is also similar to reflective design, which focuses on critical reflection and "bringing unconscious aspects of experience to

conscious awareness, thereby making them available for conscious choice" (Sengers et al., 2005). In reflective design, designers seek to support users in reflecting on their own lives, and the practice of reflection is meant to be incorporated into the experience and activity of the user, whereby the technology can be used as a reflective tool or probe (Sengers et al., 2005). Like my design and study of Postulater, reflective design practices seek to answer questions such as: how can we help users become more reflective about the role of technology in their lives?; and, how can reflection become both a desirable and useful part of technology design?

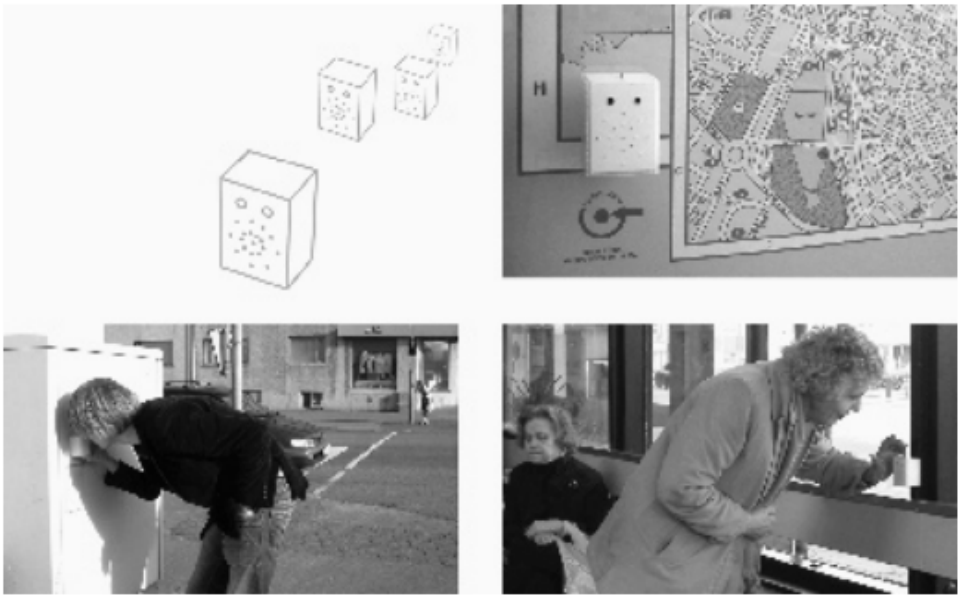


Figure 2.1 Audio Tags from the Tejp Project (Image copied from Maze and Redstrom, 2005)

Similar to my work, researchers have investigated the temporal relationship humans have with computational objects including how people's perception and association with an object changes over time (Mazé and Redström, 2005). For example, in the Tejp project, Jacobs et al. *(*2003) explored the use a number of simple audio devices, "audio tags" (Figure 2.1), that could record and play short 20-second audio clips in pubic settings. These objects were placed in public spaces that could be played back at a later time when passer-by's approached them. Essentially, this created a digital time capsule for sound. Mazé and Redström (2005) describe the significance of this work in relation to time: "The central actor in the communication experience is time – the

limitation on the length of message, the short-term 'memory' of the system through continual message replacement, and the asynchronicity of an experience that is designed for continual spatial and temporal reconfiguration". Because the audio messages could be "replaced" by anyone at any point by recording over the message, the temporal memory of the message was short lived. This contrasts my work where I explore sharing media over potentially longer periods of time.

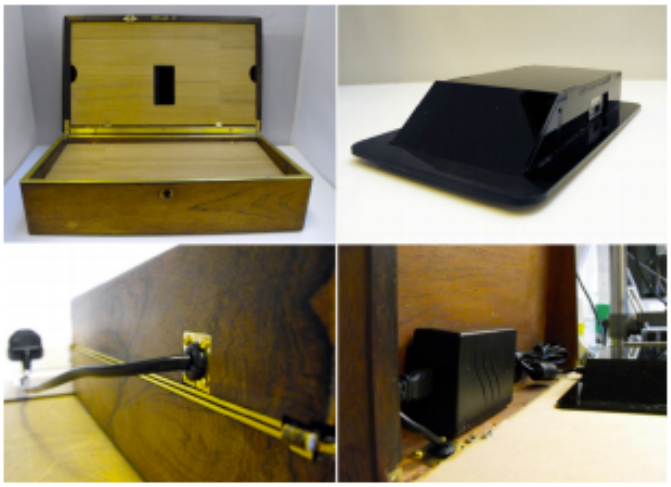


Figure 2.2 The Photobox Prototype (Image copied from Odom et al., 2014)

Photobox (Odom, et al., 2012) was a prototype that explored the ways in which people could manage personal digital content as well as their digital legacy once they passed away. Photobox (Figure 2.2) stored digital photos inside a wooden box and, at random dates in the future, the owner's photos were indiscriminately printed onto film paper to be viewed and shared. Here the individual had no control over when, or which, photos were printed. Photobox prototypes were placed in three varied (couples, roommates, friends) households over a fourteen-month study period. Participants felt the slow technology created more meaningful experiences because of the time delay, and reflected on how Photobox made them "critically think about the role of technology in their everyday lives". The study also revealed the trajectory of experiences with Photobox over time: initially Photobox caused frustration and disappointment amongst users, but overtime people began to accept it, and expressed feelings of "pleasurable anticipation" in waiting for the next photo to be printed (Odom, et al., 2014). The authors also describe the tension in designing for anticipation: "people's desire to be in control"

conflicts with the “enjoyment that can emerge if control is ceded to the system in a meaningful way”. Users also expressed how Photobox allowed for experiences of reflection and “re-visitation of the past” once their digital photos were physically printed. The authors commented how physical instances of the digital photographs permitted re-visitation and reflection, as users could adopt the photographs into their daily lives (e.g., stick the photos on the fridge or slip them under their pillow).

Figure 2.3 Collective Photo Frame prototype (Image copied from Lo, 2013)

In response to the constant hyperconnectivity in the household, Lo (2013), designed a number of tangible devices for creating reflection and downtime with commonly digital content found in domestic settings. For instance, one prototype, Collective Photo Frame (Figure 2.3), allowed users to manually adjust a slider to visit digital photos of the past in chronological order. The goal was to encourage shared recollection and reflection, in a slow and social experience.

Figure 2.4 GoSlow mobile application, showing the Reflection interface (Image copied from Cheng, 2011)

GoSlow, developed by Cheng et al. (2011), is a mobile application which is designed to facilitate slowness, contemplation and solitude. GoSlow has three main features: 1) suggestions, where the user is prompted with strategies for slowness (e.g. deep breathing), 2) reflection (Figure 2.4), where the user is prompted to describe their day through text, colours and photos, and 3) reminiscence, where the user is able to view past reflections. Participants (seven total) were asked to use the system over a seven-day period. Cheng et al. (2011) described how GoSlow allowed users to reflect, even by giving them a few seconds to ponder everyday experiences, as well as look inwards rather than being occupied with connecting with others. The authors suggest incorporating slow technology applications into other everyday systems to leverage 'dead times' (e.g., waiting for a program to load) with moments of reflection, relaxation and solitude.

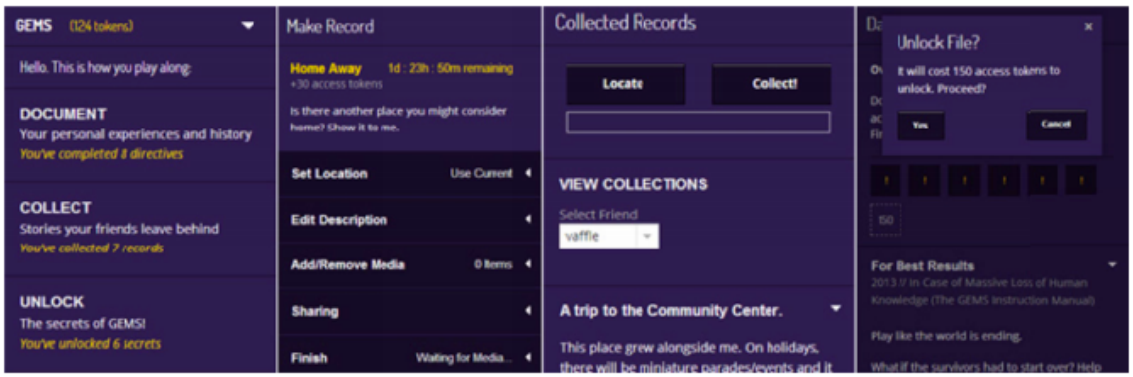


Figure 2.5 GEMs interface on a mobile device (Image copied from Procyk and Neustaedter, 2014)

Similar to the Postulater system is the location-based game, GEMS (Figure 2.5), that allows people to capture media-based stories and 'attach' them to real world locations (Procyk and Neustaedter, 2014). In a three-week study of GEMS, players (15 total) were prompted with game narratives to document (through photos and videos) and share personal memories that were tied to a particular location. Later, other players were able to visit the location of the geo-tagged memories. The authors examined the experiences of the players 'leaving behind' and discovering the stories, both in the case for future generations, as well for current close contacts. Study results showed that people valued the experience yet it was often difficult to imagine a future audience without one being explicitly identified. This thesis explores time-based media sharing without the tie to geographic locations.

Figure 2.6 SloganBenches from the Projected Realities project (Image copied from Gaver et al., 2003)

While ambiguity is often regarded as a design flaw, Gaver et al. (2003) suggests that we can also begin to use ambiguity as strategy for facilitating reflection in design and interactive systems. Through four different projects, Gaver et al. (2003), used ambiguity to create closer engagement and greater reflection with users. One prototype, Projected Realities (Figure 2.6) combined public benches with electronic displays of handwritten messages and images, curated by elderly people from the community. The project acted as a neighbourhood communication system, however, there was very little context. For instance, viewers were unaware that the messages were created by elderly people. As a result, viewers had to interpret the meaning reflected in the messages. In addition, the benches created a tension between sitting and viewing the message (as the former precludes the latter). The authors described this as “balancing the familiar with the strange”, and assert that this sense of ambiguity attracted local people to interact with the benches. Gaver et al., go on to describe this appeal stating “by thwarting easy interpretation, ambiguous situations require people to participate in making meaning”. These concepts can be applied to delayed photo-sharing (or to slow

technology more broadly): today when we consider sharing a photo with someone, we expect it will be delivered and received almost instantly. When suddenly this process is slowed down, our engagement with the system and media has the potential to change.

2.4 Time Capsules and Digital Artefacts

Documenting and recording our lives for the purpose preserving future memories is as old as the technology used to create them (e.g. writing, photography, blogging, etc.). Today many new digital technologies have made recording our everyday lives more seamless, making the ability to capture and record “everything” possible. This concept of recording everything to be accessed and relived in the future, lifelogging, was first introduced by Vannevar Bush in 1945, then referred to as MEMEX, from “memory” and “index” (Sellens and Whitaker, 2010). Many years later, in 2003, DARPA (Defense Advanced Research Projects Agency of USA) launched their project termed “LifeLog” which aimed to “trace the threads of an individual’s life in terms of events, states, and relationships” (O’Hara et al., 2010). The growth of digital has also leant itself to problems in personal management. In an age of ubiquitous computing and immense storage, people are capturing and producing digital information in such large volumes that challenges have arisen in managing and retrieving personal digital data (Czerwinski et al., 2006; Boardman and Sass, 2004).

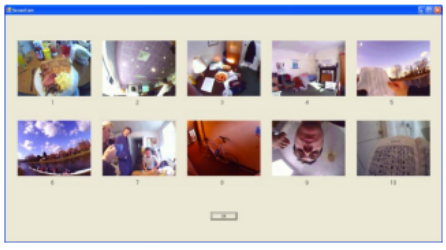


Figure 1. An example of SenseCam images as presented in the temporal “ordering” task.

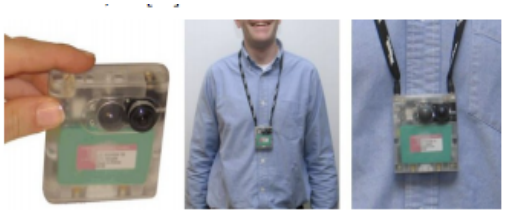


Figure 2. The SenseCam v2.3 prototype.

Figure 2.7 SenseCam (Image copied from Sellen et al., 2007)

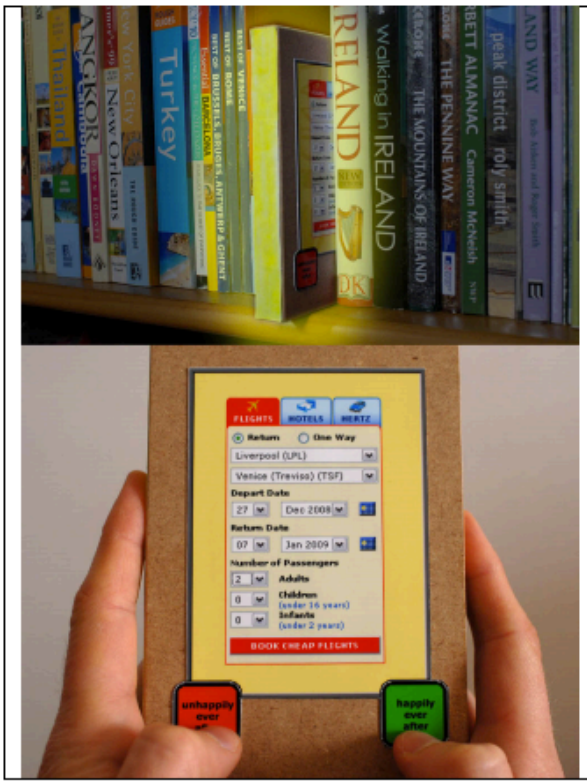
Much has been done to explore the technology and tools for lifelogging, such as SenseCam (Sellen et al., 2007) (Figure 2.7) and eLifeLog (Kim and Giunchiglia, 2013), as well as the social practices around lifelogging (Sellen et al., 2007; Petrelli et al., 2009). For example, Petrelli et al., (2009) explored ways in which people created "long-term mnemonic representations of their lives" by investigating ten families on how they created time capsules and examined the ways in which they used objects to "trigger remembering" in the future (Figure 2.8). The focus of their work was to explore what people wished to preserve for their future selves and why (e.g., motivations, values, etc.). For example, in the instance of using photos, the authors wanted to know if participants placed more emphasis on people versus experiences, or important events versus mundane everyday life. They found that people mainly used photos as a way to remember people, rather than events or place. Three interesting findings were revealed: First, roughly 3% of the photos were used to capture "today's world" (e.g. images depicting current technology). Second, people were more likely to select photos of friends and acquaintances, over family, as they felt that these people would likely be more easily forgotten. Third, very few people were concerned with providing explanations or annotations of their curated time-capsule objects (Petrelli et al., 2009).

"I would have never done it, but there was a reason and it was just fab. I enjoyed it greatly!"

Figure 2.8 A time capsule created by participants and their comments (Image copied from Petrelli et al., 2009)

In their more recent work, Petrelli and Whittaker (2010) compared physical and digital mementos in the home (e.g., how and why particular objects act as mementos, how they are shared, etc.). In studying seventeen people across thirteen families, they found that digital artifacts were regarded as "invisible, hard to access and inexpressive compared to analogue equivalents", as well as being "more ephemeral and unstable". People found digital artifacts more difficult to organize and maintain, and had little

enthusiasm for doing so. While they did regard them as valuable, they were not concerned with “low level maintenance activities, such as migrations across file formats/applications as they change”. To address this, the authors suggest designing technology that makes integration seamless, by considering the entire user experience when it comes to digital media (from capturing, organizing, managing, accessing and sharing). For example, the authors note that participants tended to overlook incorporating mundane physical objects into their digital memorabilia. The authors stress how including mundane objects is crucial for future memories, as these objects are “persistently reencountered”. Petrelli and Whittaker (2010) suggest various ways to make integration of physical and digital memorabilia seamless, such as creating embodied objects that are augmented with digital information.



Once upon a web is a device that you might put amongst your travel guidebooks. It is also wirelessly connected to your home computer and stores copies of the website forms that you submit. Occasionally, at random, the device’s spine glows indicating that it has turned on. At this point it shows web forms stored from one or more years previously. You can then choose to rate forms as ‘happily ever after’ or ‘unhappily ever after’ according to whether they should be kept as mementos (and shown again) or deleted (for boring tax returns, perhaps).

Figure 2.9 Once upon a web (Image copied from Bowen and Petrelli, 2011)

Through multiple field studies, Bowen and Petrelli (2011) explored the use of various digital memento and devices with the aim to support personal reflection with memories. In designing for reflection, the authors stressed the importance of understanding human values by incorporating factors like ambiguity, play, and "magicalness" over issues like usability. For instance, in one prototype, *Once upon a web* (Figure 2.9), webforms submitted by participants are wirelessly connected and stored on an external device. At random times in the future, the device glows and displays webforms submitted from previous years. The user can then rate the form "Happily Ever After" to keep it as a future memento or "Unhappily Ever After" to delete it. The field studies suggested that digital mementos "should be accessible [and] (re)discoverable". Further, the authors suggest that digital memento devices and systems should be "serendipitously discoverable and self organizing" as well be able to capture a wide range of digital material that could be deemed mementos in the future (Bowen and Petrelli, 2011).

Figure 2.10 DataFade (pictured above) and BitLogic (pictured below) systems (Image copied from Gulotta et al., 2013)

As a slightly different approach that preserving ones own memory and mementos, Gulotta et al. (2013) explored individuals perception and use of digital information and artefacts in relation to death, family and inheritance, in creating a digital legacy. This was explored through the use of three online prototypes, BlackBox, DataFade and BitLogic which store and manipulate photos, making them more ephemeral. In BitLogic for instance, complete photos are uploaded to a website, and will decay into individual pixels and bits. In general, participants were critical, sceptical and perplexed by the idea of making digital information behave more like physical artefacts (e.g. age or decay), as it went against their belief of what digital information is. They also did not find any personal value (other than artistic value) in seeing their digital photos fade over time (as demonstrated in DataFade, Figure 2.10) as may be the case in physical objects given additional value though patina and gradual wear. While never having inherited any form of digital heirlooms (only physical), people were open to the idea of passing along a digital legacy to their children, yet many had not considered or prepared how they would do this, and were wary of passing along personal or private information (e.g. passwords or personal emails). The authors also acknowledge that the potential value less curated (e.g., embarrassing or revealing) information may provide for future children, as it gives more insight into ones candid life. As such, they suggest provoking people to deeply consider what they sacrifice when they exclude crucial aspects of their lives, that could one day help form an honest depiction of their digital legacy.

Figure 2.11 'What are the Odds', images from dice playing used as memory cues for photographs (Image copied from Dirk van Erve et al., 2011)

HCI research has also explored how we make memories and associations, with memories. Dirk van Erve et al. (2011) explored the use of embodied interactions (with interactive systems, like dice combined with photos) in storing, retrieving and enriching everyday memories. Here physical (dice) and digital (photos) objects were used to create and narrate memories (Figure 2.11). Using tags on dice like whom, when, what, where, and weather (as a memory cue), users can browse through photos through dice rolling, thus producing memory cues.

Figure 2.12 The Memory Box prototype (Image copied from Frolich and Murphy, 2000)

The Memory Box (Figure 2.12), created by Frolich and Murphy (2000), is a prototype similar to a jewellery box, where a recorded narrative is recorded and played which corresponds to the memorabilia kept inside. The researchers explored how people used it, and what kinds of stories and objects people would store for memorabilia. Overall, people found emotional value in attaching stories to artefacts, especially in the case of sharing and giving. Participants expressed great use and value derived from sharing souvenirs and memorabilia, such as giving back the memorabilia to their children once they've become adults. This led authors to conclude that similar technologies ought to be designed to be self-contained to the extent that they can be given away as one entity. For instance, online photos sent for birthdays could include an accompanied voice tag description or narration.

Figure 2.13 The Living Memory Box (Image copied from Stevens et al., 2003)

The Living Memory Box (Stevens et al., 2003) has users place physical objects in a (jewellery) box and make written and audio records (e.g. a narrative) of the object, including information like its appearance or other metadata (Figure 2.13). An ethnographic study of the system ran in the homes of the participants (13 parents) who were asked to collect mementos for their children, then later use The Living Memory Box to record information about the items. The process was intended to support retrieval and memories for future family members. A week later, during focus groups, Stevens et al., explored questions around "who, what, where, when and why of [parents] saving memories" for their children. The participants reacted positively, expressing the pleasure from storytelling and recorded voices (for emotional context). Findings showed that personal archival systems need to support more natural interactions, like touch and voice.

2.5 Summary

This literature review has explored four areas in the field of time-delayed media sharing. First, I discussed how families use different technologies to communicate, both synchronously and asynchronously, with each other. Next I reviewed media sharing practices and routines amongst friends and family, as well as routines around collocated and immediate media sharing. I then discussed literature from slow technology, and how designers and researchers have explored solutions for "slowing down" from pervasive, instant, and constant technology that infiltrates our everyday lives. In addition, I looked at reflective design, and introduced design practices and research that facilitate moments and behaviours of reflection. Lastly, I reviewed literature surrounding time capsules an life logging, as well as future-based digital artefacts, in order to understand the motivation and practices around creating future memorabilia. In this section I also describe similar time-delayed systems that explored distant future retrieval.

In this literature review we revealed many important lessons. We learnt that while synchronous communication tends to support more personal and emotional conversations, asynchronous communications are still valued for more deliberate exchanges of information, especially for awareness amongst family and close friends. Further, asynchronous technologies also can trigger discussions for future moments of synchronous communication. This suggests that while there is a desire for immediacy, slower forms of communication may still be valued.

With respect to photo-sharing practices, we learnt that people enjoy revisiting photos and reminiscing through shared experiences. We also learnt that while people value detailed annotations of the photo, they are often to unorganized or concerned with recording details (such as names of people or events), which sometimes become forgotten. This suggests that there is a need to support individuals in being made more aware of future values and to encourage users to take the time to annotate their photos. We also learnt the preference for collocated sharing, particularly through the act of storytelling through past photos.

We also discussed two types of photo-sharing personalities: Kodak Culture people and Snappers. We learnt that Kodak Culture people, less concerned with broad and immediate photo-sharing, desired an application that supports their needs

for sending more personal and direct (intentional sharing) photos, similar to email.

Next we discussed many slow technologies, and explore designs that supported moments of reflections. Most of the technologies (save for GoSlow and GEMs) we explored were physical prototypes. Based on my extensive review, this suggests that there is a need to explore digital artifacts as we have a limited amount of knowledge surrounding digital and web-based slow technologies, especially for photo-sharing. However, we did learn from these slow technologies that people valued these applications for creating moments of reflection. We also learnt that these slowing the process of photo-sharing can create pleasurable moments of anticipation. In terms of reflective design, we also learnt that ambiguous design can help support reflection and awareness, which can be applied to delayed photo messaging, considering we most often expect more immediate forms of sharing.

Lastly, in our discussion of time capsules and digital artifacts, we discovered many lessons. In the instance of time-capsules, we learnt that people were more interested in archiving photos of things they were likely to forget (compared to familiar photos of friends and family), and they they were not very interested in capturing photos depicting “today’s world”, as well, people are less concerned with annotating their photos. In addition, we found that people found digital artifacts more difficult to organize and maintain, and as such, had little enthusiasm to do so. In terms of our digital legacy, people tend not to consider how or what information they would like to pass on (perhaps maybe because they are the first generation to do so), yet they are open to the concept. Lastly, we explored lessons in annotating memorabilia, for instance, by creating audio recordings.

The subsequent chapters will draw upon the literature described in this chapter as a means to better understand how to design time-delayed messaging systems. The following chapter explores the design of a prototype messaging system, Postulater, to share time-delayed multi-media.

3. The Design of a Time-Delayed Multi-Media Sharing Tool

In order to understand how individuals share time-delayed multi-media, and the routines associated with delayed sending, I designed a prototype messaging system, Postulater. This chapter relates to the first two research questions: how do we design an application for time-delayed messaging which supports 1) *sending* and 2) *receiving* multimedia, In this chapter, I discuss the design of the system, including the rationale for the design decisions from both a technical and aesthetic viewpoint. In addition, I introduce a few scenarios that I imagine a system like Postulater could be used in.

3.1 Motivation

Motivation to explore the use of time-delayed messaging comes from my own personal interest in the future, memory and slowing down. I am curious to know how people perceive the future, and how, if possible, they would interact with someone else in the future. What kinds of messages and media would they share with friends and family? What time periods will they consider? What role does time play in the meaning of media? Related to this, I am interested in what we value from preserving memories through media. If we provided individuals with a tool that made sharing multi-media at future dates easier, how would they use it? What would they use it for and what meaning would they gain from using it? Lastly, I am curious about the practices and values my generation associates with media sharing, specifically in the context of how the role of photos and media have shifted to up-to-the-moment representations and display of "social status", where photos are used to showcase experiences, essentially becoming a "social hierarchy" tool. The dominance of social media tools like Instagram demand instantaneous photo sharing, and may have changed our relationship with media. Consequently, I am curious to know what would happen if we gave people the ability to

delay this process, and *slow down*. What is the effect of slowing down - would it create more meaning or broaden our perspective of media sharing?

Thus, the design and implementation of Postulater acts as a probe (Hutchinson et al., 2003) for exploring these questions, and ultimately addressing the nature of the problems presented in this thesis.

3.2 Early System Design

I created an online application called Postulater that allows users to send multimedia messages, including images or videos, to a future date and time. We chose the name Postulater (pronounced “post-you-later”) to suggest a delayed postage-mailing system, as well as a play-on-words with *Postulate*, meaning to “posit” and “put forward”. The system was made accessible on the web for desktop computers, tablets and smartphones, to ensure users could use the system anywhere with Internet connection in order to perform a study.

My lab colleague Jason Procyk, a fellow graduate student at SFU’s School of Interactive Art + Technology, created a Node.js server-side application that supports uploading, storing, scheduling, and delivering messages. The messages were stored on MongoDB (database), where the images and videos were stored using a secure cloud service. Together we developed the frontend interface using HTML and Javascript.

The interface design began with envisioning a logo for Postulater which encapsulates the aesthetic and direction for the interface. Initially, the concept was to make Postulater appear antiquated and mysterious, by giving it a retro sci-fi 1970’s and 1980’s feeling. The retro-futuristic design (e.g.,1980’s IBM advertisements) was intended to evoke feelings of time-travel and future-thinking, as well as to evoke curiosity and intrigue amongst users with a feeling of ambiguity (see Figure 3.1).

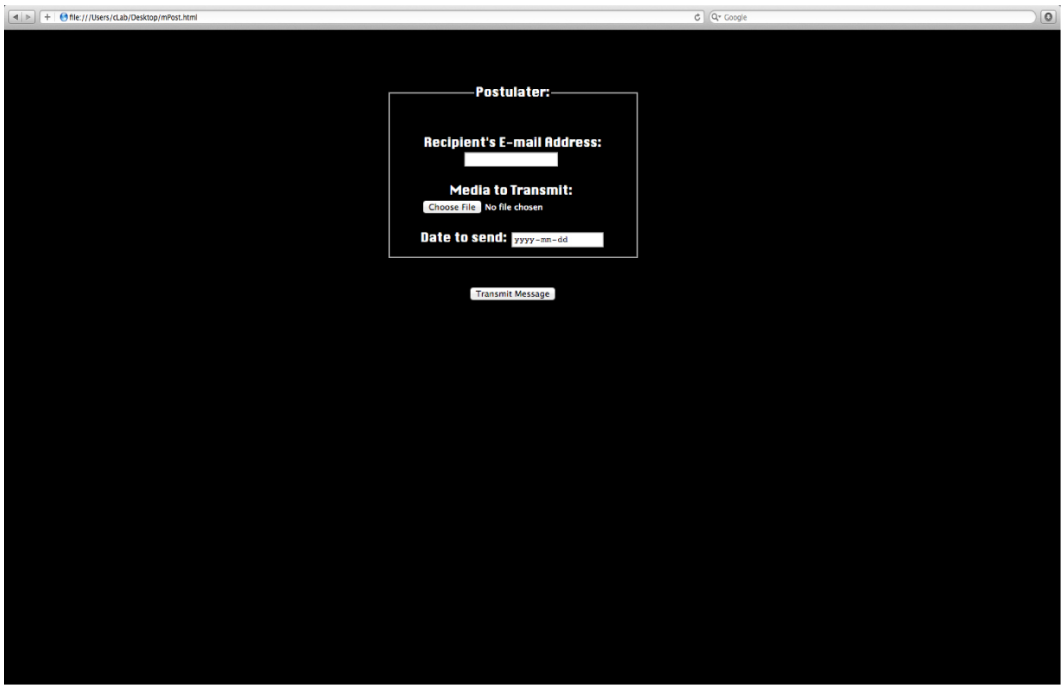


Figure 3.1 Retro-future design of Postulater's mage page

The aesthetic changed with the iteration of the logo (see Figure 3.2 and 3.3), to have a more user-friendly, inviting and playful sentiment. The design sketches of the logo, which eventually led to the robotic mailbox, steered this direction away from the mysterious sci-fi aesthetic, and reflects a more modern web application page found commonly today. The final logo represents a genial robotic mailbox, the Postulater icon, which is intended to give the users the sense that they are interacting with a fun and playful system.

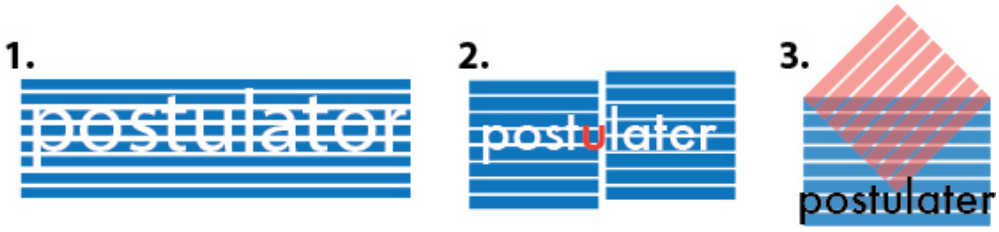


Figure 3.2 Logo iteration for retro-futuristic aesthetic

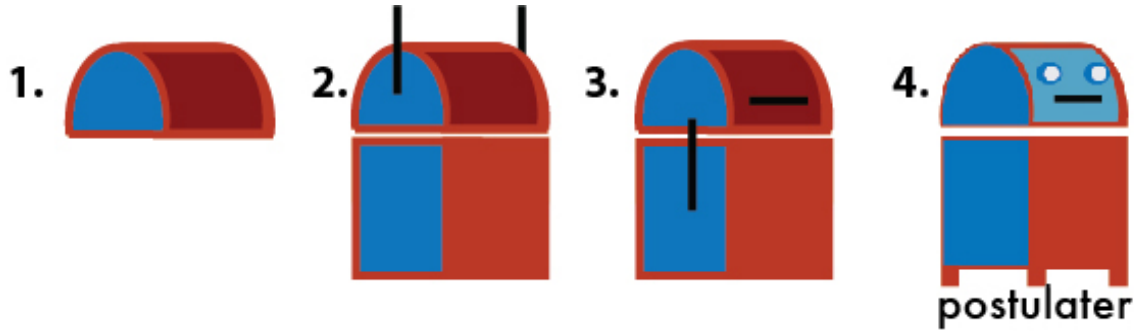


Figure 3.3 Logo iteration for a friendly and play aesthetic

Postulater was designed to be as simple and intuitive as possible, using one easy-to-use webpage. Our initial design (Figure 3.4) included playful drawings and a few additional options for senders, such as warning the receiver that they will receive a message at date *X*, and giving senders a few different options for the time-delay period. These options included a Telegram setting (delivering randomly anytime between 1-7 days), Snail Mail (1-3 weeks) and Pony Express (between 3-5 weeks). These options were intended to mimic older forms of communication and delivery methods, and allow senders to reflect on the speeds of communication. Having open and loose dates (e.g. 1-3 weeks) was also meant to elicit feelings of surprise, playfulness and anticipation for the sender. I also imagined a *Random* option giving senders the option to send to completely random points in the future, where they too would be unaware of when their message would arrive. However in the end, I decided to limit the options for the sender to select a specific date when they wished to have their message delivered, in order to understand how senders would behave in an open system. Lastly, I also imagined a scenario where the Postulater platform would host all the images and videos on a live-feed, much like Instagram, where media could be shared publically. Thus, I wanted to give senders the option to make their future messages *Private* or *Public*. This idea was rejected because I wanted to explore the use of more personal (direct peer to peer) media sharing, capturing a closer resemblance to a slow technology.

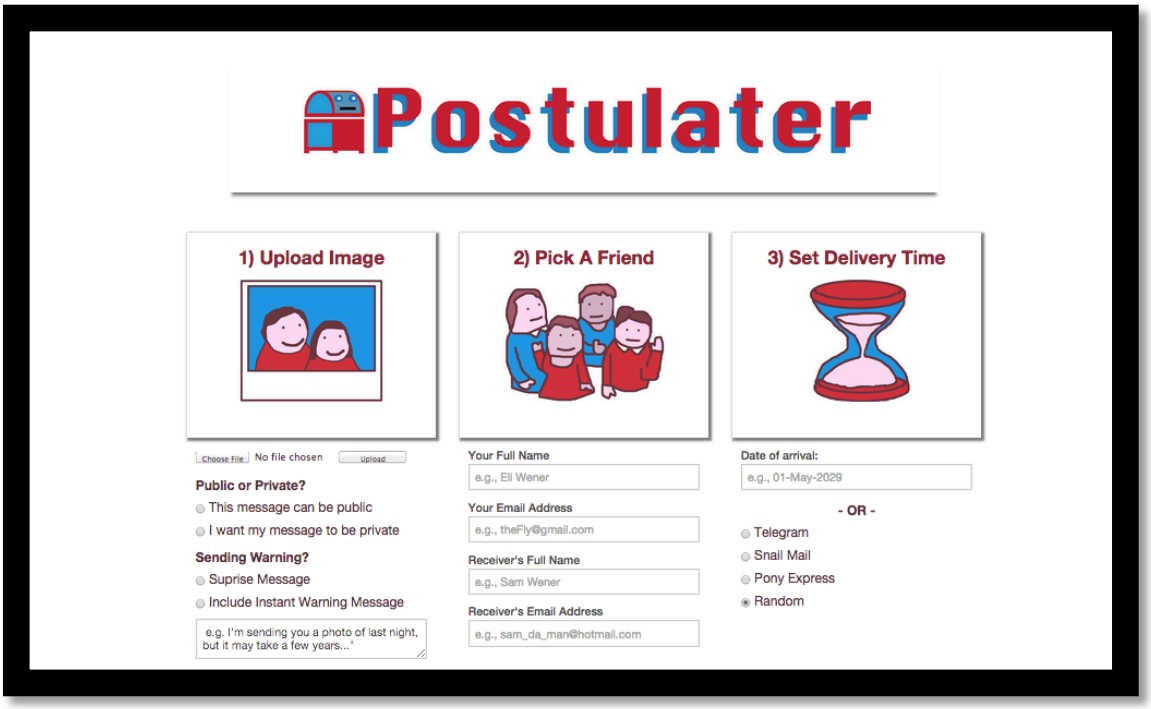


Figure 3.4 Early version of the Postulater main page, viewed on a desktop

3.3 Final System Design

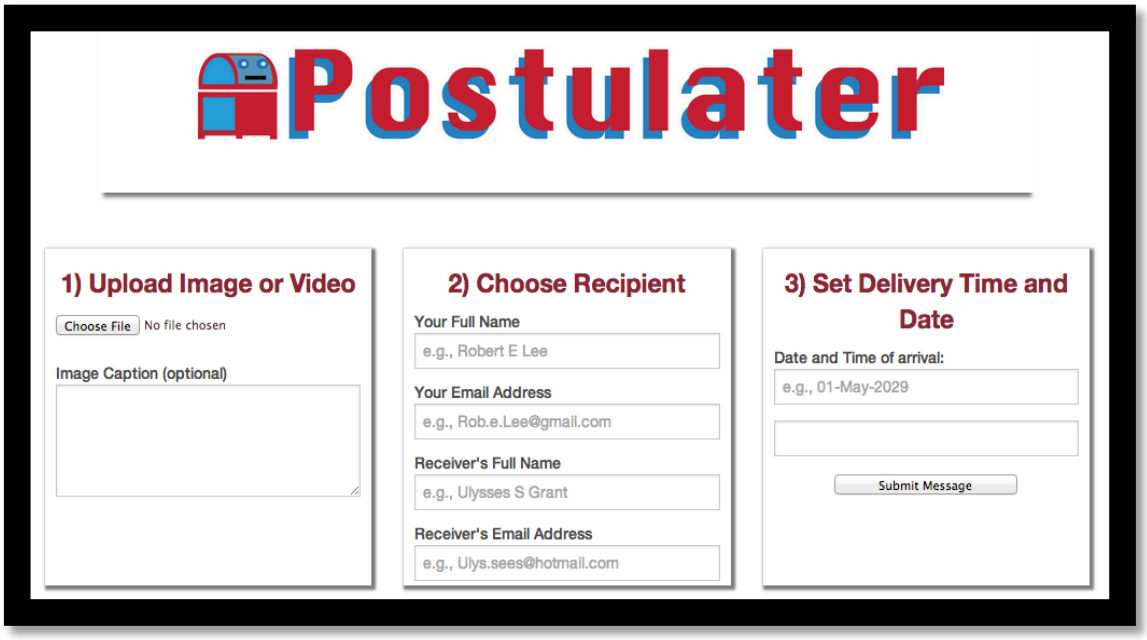


Figure 3.5 Final version of the Postulater main page, viewed on a desktop

By removing the additional sending options and images, the final homepage reflects a more minimal and user-friendly interface (Figure 3.5). However, I added one feature which allowed senders to choose specific hours and minutes. During the design iterations, I tested different levels of date/time specificity and felt that it was important to give senders the ability to send to specific times in the day (e.g., to time messages for arrival during one's lunch break, at the end of a workday). I believed it was important to allow users to send to specific times (to the hour and minute) to explore if users would use this level of minutiae, and how and why they might use this time-specific feature for sending messages.

When users visit Postulater, they are given three instructions (Figure 3.6, left to right):

1) Upload Image or Video: In the first step, users upload images or videos from their computer or mobile phone library and are given the option to include a short text caption (140 characters) to annotate the media. The inclusion of an image or video is mandatory as I am interested in media-based messaging (i.e. not text). The addition of

text is optional as I wanted to explore if users felt a caption was necessary to explain their images or video clips. A maximum of 140 characters is used to ensure any caption is brief.[1] Overall, I wanted to encourage users to *show* their message, rather than *tell* it.

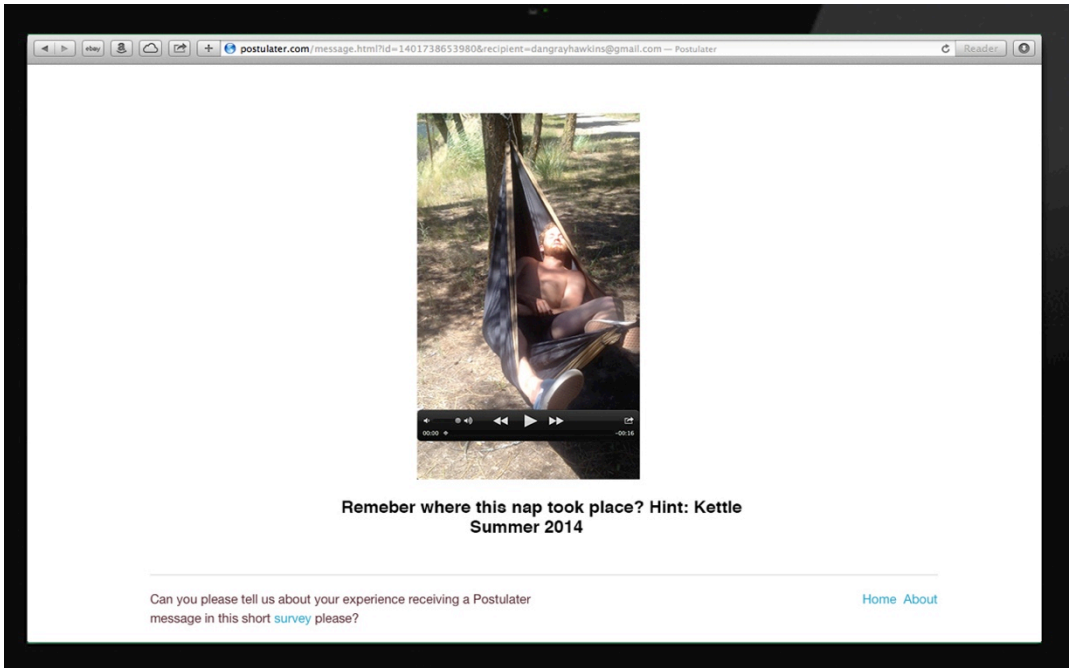
2) Choose Recipient: Next, the user enters the name and email address of their desired recipient. They also (optionally) enter their own name and email address to let the recipient know who has sent the message. The use of email addresses reflects the underlying architecture for sending the messages: URLs pointing to the messages are sent through an email server to notify recipients of the arrival of a message. We chose email as a vehicle for notifications because of its relative ubiquity amongst users. For example, users of Postulater could conceivably send messages to anybody who had an email address. This would likely give more sending options than, say, people who had a particular type of social media account (e.g., Twitter, SnapChat). Longer term, email may also be the technology that continues to stay around if messages were sent very far into the future.

3) Set Delivery Time and Date: In the final step, users can select when they want their message to be sent to the recipient by selecting a date (day, month, and year) and time (hour and minute). The freedom to select specific dates and time (e.g., the exact minute) offers users the ability to select very specific moments in the future that may be of personal significance. Whether or not such precision is actually needed is a question I address in my system evaluation, Chapter 5.

Once submitted, the message is uploaded to a server. At the designated delivery date the recipient receives an email with the sender's name, the sent date, and a hyperlink directing the recipient to the Postulater media page that shows the actual message (Figure 3.6). Figure 3.6a shows the message content displayed on Postulater's media page viewed on a desktop or laptop computer. In this example, the recipient is viewing a video sent to them and a caption describing the event. Figure 3.6b shows the media page displayed on a tablet computer. The message depicts an image and short caption sent from a father to a son, several years in the future, of a highway construcion

[1] The use of 140 characters also coincides with the maximum character length of a Twitter message, used for shorthand notation, initially designed to be compatible with SMS messaging.

plan. Figure 3.6c depicts the media page as seen on a smartphone. In this example, the image and caption convey a memory of a canoe trip done by friends, and is sent to decades into the future. Our hope was that by including the sent date in the message we could create more nostalgia and a stronger tie to the moment it was sent. Our goal was also to create the impression that the image or video (and the intent of sending the message) was “living” the entire time and travelling slowly through cyberspace. We created a media page, rather than having the media embedded in an email, so we could make the viewing experience more unique. We designed the media page to be very minimal (a blank white webpage); thus, the focus is on the media/message alone. When the user is taken to the media page, they are prompted to click a button to reveal the image, rather than displaying the image directly on the page. This subtle action is intended create additional anticipation and suspense for the receiver, moments before viewing the message.



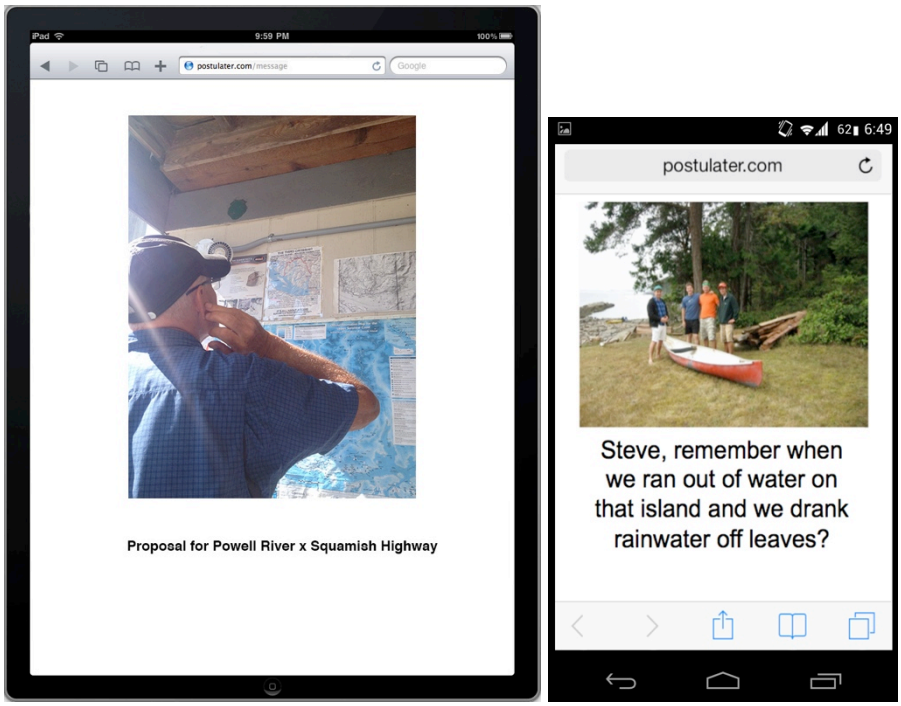


Figure 3.6 Viewing a Postulater message (media page) on a (a) desktop, (b) tablet, (c) and smartphone device

3.4 Example Usages

Based on my own design intuition, I imagine Postulater being used in a variety of ways, these include:

1. *Time Delayed Greetings:* We expect that users will want to share time-delayed greetings with their family and friends for holidays and events such as birthdays and anniversaries. The following is an example of this scenario:

Ben captures an image with his son Chris on his 5th birthday, August 15th, 2014, and wants to share the image, but doesn't want it to be shared at that moment. Instead, Ben wants to share the image at a later date, when Chris will be surprised to receive it. Ben decides to use Postulater to send the image of the two of them (which Chris has never seen) to a future date. Later that evening, Ben uploads the image to the Postulater site and includes a caption "Thinking of you on your birthday." He sends the message to Chris's email address with the delivery date of August 15th, 2034 – this will be Chris's

25th birthday. Twenty years later, Chris and Ben are living in different cities, Chris receives an email from Postulater with a link to Ben's message. Chris clicks on the URL and views the image for the first time, 20 years later. He then phones Ben to reflect on the moment.

2. *Revealing Playful Information:* I imagine some users will want to use Postulater to reveal media only at a particularly time. For example, users could make predictions (short or long term) about a particular event or date. In the example below, the user, Dave, uses Postulater to send playful information to a friend (Figure 3.5a):

Dave and his friend Max are on an overnight camping trip on July 15th, 2014. Dave takes a video of his friend Max who is napping in a hammock and wants to share the video, but doesn't want it to be shared at that moment. Instead, Dave wants to share the video with Max, who is unaware of the video, and surprise him with it. Dave decides to use Postulater to send the video of the two of them to a date 10 years in the future, July 15th 2024. While Max is still sleeping, Dave uploads the video to Postulater and includes a caption "Remember where this nap took place? Hint: Kettle. Summer 2014." 10 years later, when Max opens the message from Dave, and watches the video, he is at first puzzled by the video (having never seen this footage before), and calls his friend Dave who he hasn't spoken to in a while, and the two reflect on memories of that trip.

3. *Digital Time Capsules:* We also imagine that some users will want to preserve their memory, especially with future family descendants. For example, grandparents may send messages to future grandchildren so they arrive long after the grandparents expect to be alive. In addition, we expect many users will send messages, for instance of special reminders and memories, to themselves or others, much like a digital personal time capsule. The example below (seen in Figure 3.5c), illustrates an example where teenage friends wish to preserve memories of their friendship.

Pat is at home going through old photos on his desktop computer. He finds photos from a canoeing trip with a group of his teenage friends from last summer that he hasn't shared yet. Pat decides he wants to preserve this memory and share it with his friend, Steve, to a very distant point in time. Because the memory is fresh in his mind, Pat is able to recall details of the trip, like how they ran out of water. He is afraid that

those detailed memories may be lost, so he includes the caption: "Steve, remember when we ran out of water on that island and we drank rainwater off leaves?" Pat sends similar messages to each of his friends for 50 years in the future, when the boys will be in their late 60's. Here, Pat has used Postulater like a digital time capsule to store fond memories.

4. *Time Significant Media:* Lastly, we expect to find users send media that may be particularly useful or special at a future date. For instance, we imagine users may take a photograph of something not particularly interesting at the present date, but will likely be more interesting with time. For example, users may decide to photograph a landscape that they believe will likely look different in five years, and send it to that future date. The following example (captured in Figure 3.5b), explores the idea of sending time-significant information:

During a family outing Colin and his dad, Bob, are examining proposal plans for a highway project that may take place over several years time. Colin decides to take a picture of Bob and the map of the plans, because he feels that one day in the future this image may be interesting to reflect on the time where the highway plans were still in an early conception phase. Colin initially hesitates to take the photo, realizing that the photo is currently not very interesting and of little value, and will likely be forgotten on his mobile device. Colin then realizes he can use Postulater to send the photograph to his dad, to a date seven years in the future, when the photograph will perhaps be more interesting. Colin adds the caption "Proposal for Powell River x Squamish highway" to create a memory cue, and sends it to Bob's email address.

This scenario also illustrates the idea that Colin has become more aware of prosaic, day-to-day, experiences that could have more meaning in the future. Perhaps with continued use of Postulater, Colin will become more connected to his present environment and conscious of how things change around him.

These scenarios assume that the technology will still exist long into the future. While this may not be the case, it does illustrate an interesting set of possibilities for systems like Postulater.

3.5 Summary

In this chapter, I discussed the motivation and rationale for the design of a system to support time-delayed multi-media sharing. I then described the early iterations of the design process for developing the homepage and interface, including the aesthetics and feelings I wished to evoke from users. As well, I discussed the various features of communication and delivery options that were explored in the early design phase. Then I described the final interface for sending messages, as well as the interface for receiving messages. Finally, I explored various examples and scenarios I envision for Postulater to describe what I believe are potential applications for users.

4. Evaluation Method for a for Time-Delayed Multi-Media Sharing Tool

In the preceding chapter, I discussed the motivation, rationale, design iterations and decisions, and final design implementation of a system to support time-delayed multi-media sharing. In addition, I proposed four different example scenarios that I envision users of Postulater will explore. In this chapter, I discuss the method used to evaluate my time-delayed multi-media sharing tool. The evaluation method used in this research takes an exploratory approach, where I look to see how people use and appropriate the technology and whether this is similar to scenarios from Chapter 3. This chapter describes the qualitative approach involved in a user-study to understand how people used the slow technology application as a way to communicate into the future with friends and family. The evaluation focuses on the behaviour of the sender (including the kinds of messages they sent), as well as the perception and reception of the message by the recipient. Thus, the evaluation method described in this chapter addresses the third research question of identifying user behaviour and habits, and how people interact with a time-delayed multimedia sharing tool. I begin by describing the participants, then the study methods, and conclude with the data collection and analysis.

4.1 Participants

I recruited nineteen participants (10 female, 9 male) via Facebook and email advertisements, and snowball sampling through family and friends. Participants who responded to the study recruitment poster (Appendix A) were emailed a brief questionnaire (Appendix B) to ensure I had a diversified participant pool. Specifically, I wanted a broad range of participants based on mixed ages, mixed habits of media-sharing and a range of tech savvy individuals, in order to capture a wide range of media-sharing practices and potentially explore wider uses of Postulater. Thus, in addition to screening for an equal gender and diverse age distribution, the questionnaire also

explored their routines, access to, and familiarity with technology. Participants under the age of 19 were screened from the study based on concerns that minors could use the application to send or receive inappropriate and sexually explicit material. Table 4.1 shows the demographic breakdown of the participants along with the number of photos and videos that they sent during the study. Of the 19 participants, ten were between the age of 20 and 29, three participants were between 30 and 38, five participants were between 55 and 67, and one participant was of age 94. Participants' occupations varied widely. All had experience with using email, but their use of experience with social media and habits with sharing photos and videos varied heavily: some had never used social media while others used it daily.

Table 1 Description of Participants

Participant #	Age	Sex	Occupation	# of Photos	# of Videos
1	26	F	Nurse	4	0
2	31	F	Home parent	10	3
3	29	F	Post Doc	6	0
4	27	M	Architect	5	0
5	27	M	Business Sales	6	0
6	28	M	Student	11	0
7	27	F	Nurse	13	0
8	64	F	Nurse	14	0
9	37	M	Financial Advisor	7	0
10	23	F	Student	9	0
11	30	M	Architect	10	0
12	94	M	Retired	9	0
13	22	M	Student	21	0
14	55	F	Teacher	7	0
15	65	M	Retired	8	0
16	60	F	Marketer	5	1
17	64	F	Professor	10	0
18	26	M	Student	10	0
19	27	F	Interior Designer	8	0
TOTAL				173	4

4.2 Methods

Once screened, participants completed an Office of Research Ethics (ORE) consent form as well as a pre-study survey regarding their routines around capturing and sharing multimedia, and their communication habits with friends and family. Participants were then instructed to use the delayed messaging prototype system, Postulater, for a period of six weeks, by visiting the Postulater website (http://www.postulater.com/). A study period of six weeks was chosen because I wanted to give participants enough time to become familiar with the technology and be able to incorporate it into their daily lives. A period of six weeks was also used to try and span special occasions (birthdays, holidays, anniversaries, etc.) that may lead to different user behaviours. Participants were told to use Postulater as much as they liked over the six-week period, but were encouraged to use it at least a few times a week. Sending multimedia messages via Postulater involved a three staged process: first, participants uploaded multimedia (an image or video) of their choosing, then selected who they wanted to send it to, and finally decided upon when they wanted the multimedia to arrive in the recipient's mailbox.

For the first three weeks of the study, participants used Postulater freely without any prompts or suggestions, and during the second half of the study they were given a list of suggested ways that they could use the application (e.g., I sent them the list of scenarios described in Chapter 3). I suggested scenarios via email to help inspire or spark novel uses of Postulater in the case that participants were not able to think beyond the media sharing practices of present day (focused on immediacy). A low usage rate was detected among users during the first few weeks, so the list of suggested scenarios also acted as a way to increase usage. Participants were also reminded periodically (i.e. weekly) via email to use Postulater. I monitored participants throughout the six-week period by reviewing server data and checking in through email.

After the six-week period, I conducted semi-structured interviews over Skype and in-person. Interviews began with a review of the messages that participant sent to

ensure we understood when and why they sent them as such. Then I focused on the positive, negative, unique, memorable, and enjoyable moments with Postulater, using sample questions (Appendix C). I also asked questions regarding the types of messages they were most interested in sending, to what time periods, and to whom, and why. Some example questions asked: 1) “Did you feel the images you sent had more meaning than normal pictures? Do you think the time delay creates more meaning?, 2) “What time frame were you most interested in communicating to? Why?”, and 3) Did using Postulater change any of your habits or decisions in what media you chose to capture? If so, can you describe a time it did?”. These questions allowed me to classify the types of messages people were sending and why it was particularly useful or interesting. Interviews lasted between 30 and 60 minutes. All participants were entered into a draw for a gift card ($200). Participants names were entered into the draw based on the number of times they sent messages, with a maximum of ten entries (i.e., ten messages). Thus, the extrinsic motivation to participate was small. I hoped that this would be enough to trigger a basic level of participation and then intrinsic motivation might prompt additional message sending.

One obvious caveat of the study is that the study time period did not last longer than six weeks. This meant participants may have only been motivated to send messages of a shorter time duration. This is likely true for some participants; however, I did see some messages sent longer term and outside of the study time period. I report on these in the following chapter. My study period spanned April and May, which means we could have easily missed some time periods where unique life experiences, such as special occasions, birthdays, or holidays occurred for participants. This should be taken into account when considering my results. Participants were also told that their multimedia would be reviewed by the researchers to ensure appropriate subject matter. This could have also affected what was shared.

In order to explore the experience of *receiving* a time-delayed multimedia message from Postulater, I included a hyperlink in the media viewing page, asking for recipients to fill out a short survey (Appendix D). The survey was used to understand the reaction of the recipient by exploring such things as what emotions did the message evoke, what was the effect of the time delay, and how the recipient would envisage

using Postulater in the future. Some example questions included: “Did the time delay on the message add any value? If so, what and how?” and “What emotions did the message evoke? How did you feel when you saw the message?” This survey received five responses.

In addition, three months after the study concluded, I followed up with our participants and asked them to complete a short survey over email (Appendix E). This survey examined their reflections on their original messages and also asked them about any reactions that they might have received from others to the messages they sent via Postulater (if any were received in this time period), as well as explored their reactions to any Postulater messages they have received. 10 people replied to the survey and I include these reactions throughout the results.

4.3 Data Collection and Analysis

All interviews were audio recorded and digital transcripts were transcribed by myself. Included in these were the responses to the follow-up surveys which were qualitative and open-ended. The first analysis was broken into a quantitative and descriptive analysis. A quantitative analysis included categorizing messages sent by participants by capturing the number of messages sent (minimum, maximum, and median), the number of delayed days messages were sent (minimum, maximum, and median), if the message was an image or video, and whether the message contained a caption or not. I then examined the descriptive data (transcripts from the interviews with participants). Interviews typically started with a review of the messages they sent, to jog the memory of the participant. From this data, I examined descriptive data such as to whom they were sending messages to and why, how they were sending messages, as well as to what time periods and why. Lastly, I used open, axial, and selective coding to analyze the data for each participant to examine and classify their habits and uses of Postulater.

Observations and data were classified and grouped according to patterns of usage to create a low-level coding map (Figure 4.1) by comparing experiences and responses across the participants. For example, in the top left of the figure, under “Changing Future Events”, I identified behaviours of participants who were using Postulater to spark later conversations with the recipient and maintain friendships, or hoping to change things in the future. In another example, under the label “Leisure & Reflective Sharing”, I found that participants were making use of older photos that they rarely used or discovering old photos and moments. These were examples of participants experiencing a reflective state of sharing past photos. During the coding phrase, I also compared the participants’ experiences across different age levels but did not find any obvious differences amongst age groups, nor based on technology experience.

CHANGING FUTURE EVENTS
- Sparking Later Conversations
- Maintain Friendship
- Change Something in future
- Staying in Touch
- Hoping for things

REFLECTING ON FUTURE
- Future Predictions + Curiosity for future
- Goals for oneself
- Check in with self
- Reflection at later life
- Sent Good Vibes
- Thinking about oneself and others in the future

UTILITARIAN
- Practical Reminders For Onself & Others
- Image vs Text dependent reminders
- Short term vs Long term

LEISURE & REFLECTIVE SHARING
- Down Time + Reflection
- Discovering Old Photos
- Making use of "normal" photos

SURPRISING / INTERESTING SCENARIOS
- Sending on behalf of others 3rd Party
- Communication strategies

PLAYFUL SHARING
- Playful + Fun + Silly
- Random + Surprise

USER EXPERIENCE
- Positive Experiences
- Negative Experiences
- Future Uses
- Technical Problems + Functionality (ex no Feedback/control)

SPECIAL OCCASIONS
- Birthday Messages
- Special Anniversaries

TECHNICAL USER BEHAVIOUR
- Using Mobile
- Using Desktop /Tablet
- Sending new photos vs old photos
- Image specific vs Recipient specific

Figure 4.1 Coding map for low level classification of uses/habits

The low-level coding map was compiled and then reviewed with the help of my supervisor and revised (Figure 4.2) to organize the observations into higher-level themes. Figure 4.2 shows this process of how themes and labels were unpackaged and reorganized. For example, "Interesting/Surprising Scenarios" from Figure 4.1 were explored in greater depth, and collected into a higher-level theme. For instance, we found that some participants were sending messages to a specific time when they knew they'd be with the recipient, so they could share the message together. We created a theme for "Sending to Collocated Time-Periods", and looked for similar practices across each participant.

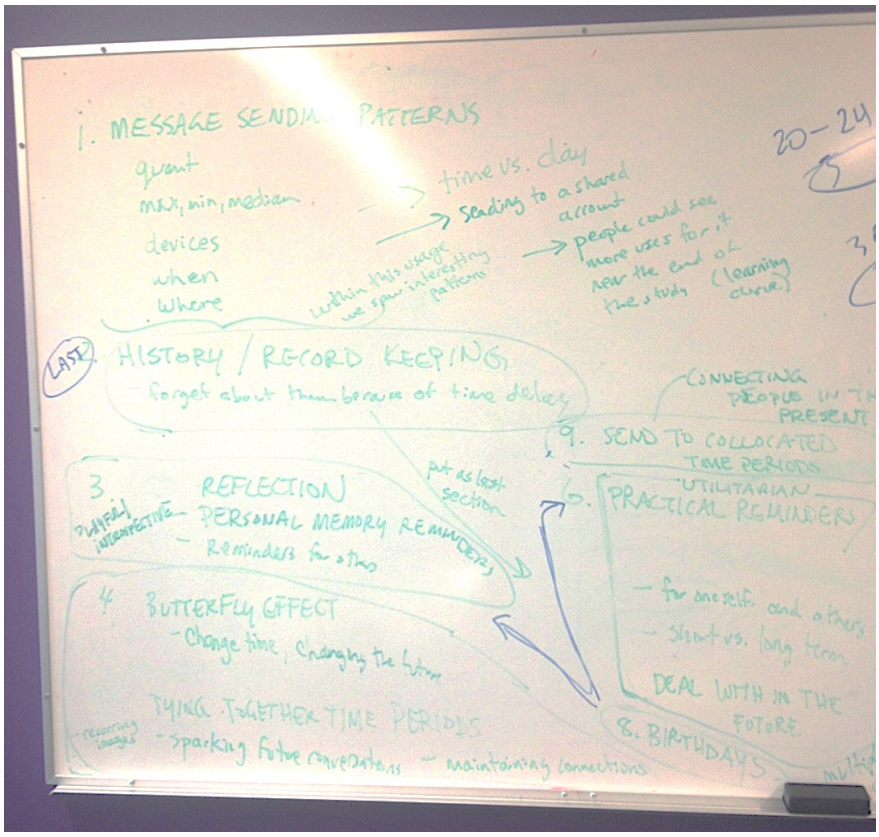


Figure 4.2 Reiteration of coding map: themes

The reiteration of the initial coding map, and revision of the transcripts then produced the higher-level themes shown in in Figure 4.3. These higher-level themes formed the basis for the presentation of my results.

Figure 4.3 Higher level themes

4.4 Summary

In this chapter, I discussed the 1) recruitment and 2) demographic of participants, as well as the study methods, including the 3) pre-study survey, 4) follow-up interview, 5) recipient survey and 6) post study questionnaire. Finally, I discussed the data collection and methods used to analyze the data. In the next chapter I discuss the results from our study. This includes presenting the quantitative description of usage behaviour, the main ways in which participants used Postulater as well as highlighting the ways that Postulater caused participants to extend their thinking when it came to sending messages to the future. Lastly, I describe the challenges that users faced when using the system.

5. The Appropriatrions of a Time-Delayed Multi-Media Sharing Tool

In this chapter, I address the third and final research question: how do people use a time-delayed messaging tool? Specifically, I seek to understand how people interact and use this tool to send messages to friends and family members by evaluating the user-study and examine user behaviours and habits. I begin with a quantitative overview, which describes the number of messages that our participants created, and how far into the future they were sending, comparison of video and images, inclusion of caption, and who (relationship) they were messaging. I then classify the way in which participants used Postulater, and describe common behaviours. Within this classification, I highlight the ways that Postulater caused participants to extend their thinking when it came to sending messages to the future. Lastly, I describe the challenges that users faced when using the system.

5.1 Message Sending Patterns

Across all nineteen participants, 177 Postulater messages were sent during the study period. This included a median of 9 messages per participant with a maximum of 21 and minimum of 4. The median number of time that messages were sent to in the future (i.e. delayed) was 32 days, with a minimum of 1 day and a maximum of 21900 days (60 years). The number of messages sent during the first three weeks of the study (81) increased slightly during the last three weeks (96), but I did not notice any significant changes in the kinds of messages sent. 142 of the 177 messages (80%) contained an accompanied text message in the caption. Most striking was the number of videos sent: 4 of the 177 (2%) messages were a video, compared to the 173 (98%) images sent. Some participants commented that they do not normally use or send video.

Participants used desktop and laptop computers, tablets, and mobile phones to send Postulater messages. Device preference was mainly based on convenience of functionality and schedule of participant (e.g., if traveling via train to work, etc.), as well as availability of photos (e.g., photos stored on mobile or desktop). While many photos (and all videos) were taken specifically for sending with Postulater, a majority of messages contained pre-existing photos, from within the last year. Participants generally decided who they wished to send a message to first, and then found a relevant photo. Although, it was common for participants to discover old photos that they wished to share first, and thus the recipient was a secondary thought.

Postulater messages were sent to a variety of people, including oneself, partners, close friends and family. In general, older participants tended to send more messages to their partners and family, whereas younger participants were more likely to message close friends. A majority of participants sent at least one message to themselves at some point in the future.

In general, participants reacted positively to Postulater and liked the idea of slowing down the act of sending messages.

> *"I think it's romantic. Everything is so immediate now. We are all so immediate…So there is something so nice.. you know, like you text someone, they text you right back. You have multiple ways of getting in touch with them,,, call them, text them, Facebook them, Instagram them, whatever… it's nice to think it's time delayed."* – P9

> "*It's just funny, to send these jokes to the future. Ones that you will forget. It's a delayed reward"* – P13

> *"I would never have any use for these mundane pictures. Otherwise they'd just sit there. Maybe in 5 years, I could send those pictures now, to Dustin. It would be far enough in the past.. The more time that passes, between the experience and you receive it, the more special that picture becomes."* – P13

Sometimes our participants would sit down and go through older multimedia content to try and find items to share. At other times they would come across something during their day, capture it, and then send it to a friend or family member.

"I sent a couple, just kind of scrolling through my photos, and rather than just going with a specific sender in my mind, I would try to find a photo, Like oh look there's a memory, then I sent it to someone, a few of them, with a little "hey, how are you doing" I can't remember the caption, but I found a photo, of a friend, just doing something, or me and a friend, like "hey", "here you go", like as a way of getting in touch with someone." – P8

Within the above sending patterns, our analysis revealed that participants were sending messages for a mix of reflective reasons and also for more utilitarian purposes. I discuss these uses in detail next. The sections are divided into) 1) Personal Memories and Reflection, 2) Practical Reminders, 3) Butterfly Effect, and 4) Greetings for Special Occasions. I now step through each of these messaging styles to more fully describe our participants' behaviours.

5.2 Personal Memories and Reflection

First and foremost, our analysis revealed that Postulater was used as a way to share personal memories and reflect on the present or future. Thus, participants clearly saw Postulater as a means to change the nature of message sending from one of 'immediacy' to one that was slower and more thought-provoking. The fact that participants did this on their own accord and repeatedly shows that there was an underlying desire to do so. Acts of self-reflection occurred in several ways, which I describe next.

5.2.1 Sending to Close Friends and Family

First, participants used Postulater to send introspective, reflective messages to their partners, close friends, and family members. Participants expressed how messages sent to longer periods in the future tended to carry more meaning for them. For example, P9 commented, "*With the warm loving sentiments, further in the future, increases that*

weight, that weight of that message." Participants shared media from special moments in the present as well as images of things they saw in the present that they felt might have some cultural significance in the future. For example, P1 took a photo of a "No Smoking" sign and sent the image to a friend in 2054. In the caption, he asked the question, "*Are people still smoking in 2054?"*

P13 used Postulater almost exclusively to send images of hand drawn messages to the same close friend at varying years and stages in life. He sent 16 of these in total to the same person. P13 chose hand written messages over the image caption option because he felt handwriting offered a more personalized feeling to it. The goal of his messages were to remind his friend of different moments they shared in their lives. P12 (age 94) used Postulater to send personal memories and reminders into the future to his children, grandchildren and great grandchildren. He wanted them to know that he was thinking about them even if he might not be around to see them or tell them this in person in the future.

Participants also sent playful messages to both short and long time periods into the future. Some of these were even sent to random times for surprise arrivals. For example, P16 (a mother) sent a playful message to her daughter the night before running a marathon together. It was set to arrive the next day following the race.

"When I was at the Boston Marathon, we were taking pictures of our gear all laid out. Fun to take picture, 24 years later; how are you feeling now. Being fun and silly. It was just one more way to take advantage of what I knew was going to be a celebration. We're making a big deal about ourselves. It was one more way to say we're so cool. *<laughing>*" – P16

Even though the message was only sent to the next day, it still had a fun impact when received "*…it was really funny. The next day, 'oh Annie, remember we were doing this?' now we're celebrating."* – P16

Sometimes participants would tell other people that they had sent them a message into the future. These situations often created additional anticipation for the arrival of the message, at least in the near term.

"*I told Nora that I sent her a message to six years in the future. And she was like, 'what, what was it?' I told her I couldn't tell her. Because it defeats the purpose. But the fact that she knew she couldn't access it for six years, made her want to see it that much more, because it was unattainable… She joked about paying money to receive the message earlier."* – P11

5.2.2 Sending to Oneself

Participants also used Postulater to send messages to *themselves* as a tool for passing along good vibes or wishful thoughts as well for setting goals and then checking-in with oneself. For example, one participant wanted to send positive sentiment to her future self about her current job which she loved but was worried that one day she would become jaded about it.

"*It's an awesome job… but when you start working for a while, you start taking things for granted… and you forget how good you got it. So I was just reminding myself like 'this is great, work hard' just sending myself good vibes."* – P7

P8 used Postulater to help 'ground herself' in the near future as she prepared for a trip to Bangladesh by sending positive images to herself.

"*The reason I did that was [to] ground us, while we were here. In anticipation of coming to Bangladesh, I anticipated that it would be overwhelming when we first arrived. I wanted to send relaxing photos, like a picture of palm trees from our vacation in Hawaii and our grandkids… I sent words of encouragement because I was anticipating it was going to be sort of an ordeal. I found it quite helpful. I've enjoyed receiving them."* – P8

"*I anticipated that it would be overwhelming when we first arrived. I wanted to send relaxing photos, like a picture of palm trees from our vacation in Hawaii and our grandkids… I sent words of encouragement because I was anticipating it was going to be sort of an ordeal. I found it quite helpful. I've enjoyed receiving them."* – P8

5.2.3 Self Reflection During and After Sending

Sending messages about personal memories and reflections into the future was not always as easy as it might sound. Our participants talked extensively about the emotions that such acts created and *could* create in the future. That is, they actively thought about themselves in the future as well as their recipient and wondered what the moments might be like when the messages would be received and what the people would be like. For example, P11 wondered about his future self, which was not a normal activity for him:

"I think an interesting part, when you're sending a message to say, 20 years into the future, you have to consider the fact you're going to be 50, and what it would like to be 50, I don't often think that far ahead into the future about my age. Or consider it in anyway… all of a sudden you are kind of connecting yourself to a very specific moment…In a way its like time travelling." – P11

Some participants commented that sending messages into the future made them feel uneasy. For example, P6 sent a message 10 years into the future to himself, but it felt perturbing for him:

"I think again, when I used it to send myself a photo of me on the moon, it made me very acutely aware that when I received this, it would make me look back, and inventory what I had done during the last 10 years…landing on the moon is not the goal I'm thinking of, but setting a goal in the future for yourself, and then you receive it, it will trigger something, because you will have made it or you will wont have made it. And it wont be something you have thought about over the last 9 and half years, or whatever, perhaps, and so it can kind of trigger some emotions of success or failure…" – P6

Some messaging acts also created regret after the messages were sent. Here people would reflect on whether or not they should have sent the messages. I had purposely not included functionality in Postulater to 'withdraw' messages before their arrival because I wanted to see if such instances would occur and they clearly did. Because the messages would not arrive for some time, participants had more time to reflect on their decisions to send particular messages. In some cases, this was not

immediately desirable, but it did create personal reflective moments where people thought more about life. One could argue that in some cases this may ultimately benefit a person. It also reveals that the act of reflection is not a short-term thing. It can extend from the point at which someone contemplates sending a Postulater message all the way to the time when it is received. Of course, if the message is sent far enough into the future, the sender could easily forget about it.

The most prominent example of regret comes from P3 who sent a message to her boyfriend into the future after their breakup. She sent the message to him three weeks into to the future to a point when they would both be back in the same city. The goal was to rekindle the romance.

"*We broke up on May 3rd, and I sent it on May 7th, so I was just back to [the city we lived in] after the break up, he was in [another city visiting]. And I guess I was in a mode of still hoping that it will work out again. So I sent that message, and I chose the time for it arrive, the day right before he comes back to [the city where we live]. … I sent him a picture of a ticket of a concert, and the message I sent, which I now regret, was a hope message for getting him back I guess."* – P3

This shows that people's thoughts can easily change between the point when a message is sent and when it is received. Participants expressed feeling uneasy when sending messages to the future, which you cannot retract, knowing that things can change between these two points in time.

5.3 Practical Reminders

Participants also used Postulater to send reminders of a practical nature to themselves or others in the future. This was the more utilitarian usage of Postulater that I saw in the study. A large number of practical reminders were textual-based and contained no images. Thus, even though this was not the intent of Postulater—it was meant to be a media-sharing tool—participants appropriated it in this way because they

had a need for such message sending. In these cases, the focus of the message was in the image's caption and the image was secondary (or non-existent) and not pertinent to the message. For example, P15 used Postulater almost exclusively for sending text-based reminders to himself, akin to how one might use a "Reminder" app on a smartphone.

Other participants sent visual reminders using photos that they captured on their mobile phone, usually in the moment. The intent was to check on something at a certain point in the future. For instance, P16 described a time while travelling in Italy where she purchased an item from a vendor that would be mailed to their home in Atlanta, USA, six weeks later. P16 took a picture of the item as "*…a reminder to see if we got it. The guy didn't give us a receipt. And we paid cash."*

P16 described how she often takes photos of things to remind herself of something at a future date. She described how Postulater was a convenient in some instances where she would come across an older photo on her mobile phone, but *"didn't want it to get buried in all my stuff"* so she would sent the image to herself for a future date.

Practical reminders were also sent between partners and within households for sharing responsibilities. For example, P2 sent her husband an image of a newspaper next to the front door so he would remember to take it when he left for the airport.

"It was supposed to be sent for the next morning. So I took the picture in the afternoon, and sent it to the next morning at 5 am, when he was leaving to the airport. Just so he would see it, by the door. Because sometimes that's the place he always forgets to look, by the door." – P2

P2 also described how she sent her husband an ad about groceries using Postulater. He was away at a conference and the information was not relevant currently, but would be when he returned home. As such, she sent a Postulater message about the ad to the point in time when he would arrive home.

"There was something in the paper, about free $40 worth of groceries, if you sign up for an organic vegetable box, there's a website. So I sent a picture of it, and told him to sign up for it…. I knew he couldn't deal with signing up for it till he got home. So I took a picture of it, so he could look at the ad when he got home." – P2

P6 used Postulater to send a humorous reminder message to someone else, with the intent to remind them of a shared memory but also as a practical reminder of their own upcoming birthday:

"*This is a photograph of me wearing a shirt she got me for my birthday, last year. And it's timed to arrive 5 days before my birthday this year. Reminding her. Kind of like a reverse birthday reminder… Don't forget to buy me a gift!"* – P6

In general, many participants commented on discovering new practical uses through capturing visual-based reminders as the study period continued, and their exposure to Postulater grew.

5.4 Greeting for Special Occasions

Nearly all of our participants used Postulater at least once to send a date specific greeting, such as a birthday or anniversary. Some participants sent many birthday greetings in one sitting, for different friends and family members. Some participants even sent birthday greetings over several years, one for each year. Participants had a mixture of feelings about this practice; some felt that it was beneficial while others disagreed and felt it was less thoughtful if birthday greetings were sent out all at once.

"I think it's good. But if someone sits down and does all their friends in one day… They're like 'I'll do all my birthdays now'… It won't come out as thoughtful." – P6

In two instances, participants had sent a birthday greeting using Postulater but forgot the recipients' birthday on the actual day. They also forgot that they had sent the Postulater birthday message. In both cases, the sender was relieved they had sent the Postulater message because it saved them from a socially awkward predicament.

"This got me out of the dog house… because the paper card I had sent hadn't arrived yet, and I had completely forgotten that I had sent a Postulater message. And she said, thank you so much for the Postulater. I said you're welcome!" – P6

In some cases, using Postulater was a convenient way of sending birthday greetings due to travelling and time differences. For instance, participants who anticipated they would be travelling and possibly away from the Internet during a special occasion, used Postulater to send messages in advance. Participants also expressed how it was convenient for sending date-specific messages (e.g. special occasions like Birthdays) to recipients who were in different or unknown (e.g. recipient travelling) time zones. For instance, participants trying to message recipients would send Birthday messages to early in the day, and not worry about their message not being received on that day.

"*He was living in Ireland. It worked out well because I didn't have to worry about the time changes. As soon as it turned midnight, he received the message… it was also nice because it would be the first email he got on his birthday."* – P5

P12 sent birthday messages from her and her husband to their grandchildren so that they would continue to arrive after they passed away. However, she only did this for birthdays prior to the grandchildren becoming teenagers. When asked why, she said they would mean more to them when they were younger.

Overall, participants expressed a mixed reaction towards "planning" multiple messages in advance. Participants felt that this made the message less personal; one participant commented that if you waited to send a message closer to the date, you'd have more information to include. Others reacted positively, as they felt they the message also contained consideration with respect to "when" in addition to the message itself.

5.5 The Butterfly Effect

Participants also used Postulater in somewhat of an unexpected way where they tried to tie together different time periods and affect the future through the past. I call this the 'Butterfly Effect.' Such messages were meant to send feelings about moments into the future, spark future conversations, and maintain friendships and social intimacy. These messages or thoughts could have been shared presently, yet, instead, they were meant for a future time period that a person wanted to affect. Sometimes people wanted to share their feelings about a situation but did not want to do it in the present because it was simply too difficult or they feared the immediate consequences. Instead, they would send their true feelings as part of a Postulater message into the future where they fully expected that the message might change their future situations or relationships. Thus, time delayed messaging allowed people to communicate in a way that they previously would not have, by using the passage of time as a medium.

For example, P7 would capture her feelings at the moment and try to express it to the future with the hope of trying to reinforce relationships down the road. In one example, she sent a message to a friend in the year 2019 to congratulate her on her life achievements as well as to maintain and rekindle a relationship that she felt might deteriorate. She described it as a way to change the future of their relationship through an act in the present.

"That's when she'll be graduated from medical school. Also, the point of that, is that maybe over time we'll grow apart, with 4 years of her living far away…so just to reinforce our love…So its maybe a way to rekindle or spark a conversation later… Yeah it's kind of crazy like to throw a rock into your future... Its like the butterfly effect" – P09

P7 described how she messaged her recent ex-boyfriend using Postulater to express her current feelings towards him. She used Postulater because she did not want to communicate instantaneously and disturb their current 'friend' status. She was okay, however, in having the message affect their relationship in the future, be it positively or negatively.

"I don't feel like messaging him now, like why get back into it? You know what I mean? But it was a way of expressing that sentiment without having to deal with it… does that make sense?...But I still miss them as a friend… but I can't message them, because then what? you know? I don't want to give them false hope… it's such a weird thing… so I think this is a good way maybe." – P7

Participants described 'Butterfly Effect' messages as having potentially powerful consequences on the future. This made participants feel vulnerable because they did not know how people would react in the future, or if their messages would be viewed in a positive light. This feeling of vulnerability of sending messages far into the future may also explain why participants sent such few video messages, as video has the potential to reveal more than still images. This finding is similar to the uneasiness participants felt about sending a message into the distance future, knowing that things could change.

"*It's sort of a powerful tool. There are consequential things you can use it for...You send something out, and you are vulnerable until the message is received."* – P11

"I guess the fact that you were acting upon the future, is a powerful thing, … you are doing something now, that has repercussions, or affecting your life in in the future…it's kind of powerful to do something, in a time that you don't own usually, so that idea, of being able to do that, was beautiful." – P3

Participants also felt that they could affect the future in an even more profound way by sending messages to a time when they felt they would no longer be alive. However, there were mix attitudes towards this. One participant (P12) who sent 'post-partum' messages to their very young grandchildren to 10 years in the future, commented afterwards that "*Upon reflection, this was an error, for the recipients would have no memory of the sender*". After considering their messages, P12 felt that messages didn't feel as impactful. The repercussions of post-mortem messages were harder to imagine for the participants, who haven't experienced receiving one. When exploring this topic, participants also described uncertainty around whether or not it would be rewarding or creepy to receive a message from a deceased relative or loved one, who can unexpectedly reappear in the recipient's lives without their choosing. The

fact that the recipient's response is uncertain and that they have no control of receiving this message present potential issues that need to be further addressed in the HCI community.

Most information regarding the receivers' response were gathered from study participants during the interview, who had received a message from another participant. This included the Birthday greeting scenario described above. In this case, the recipient expressed how receiving a message via Postulater was special and unique, compared to the other normal messages they received from friends and family. Other scenarios included recipients receiving messages while they were co-located with the sender. In this scenario, the recipient was able to share the message, which came as surprise, and was a special moment because the sender and receiver were able to view the message together.

5.6 Usability Issues

Our analysis also revealed challenging aspects of Postulater and delayed messaging in general. Foremost, because participants could not undo or delete sent messages, many participants were fearful of sending too far into the future, and were generally concerned how their message would be interpreted in the future, as well as what would happen if relationships and situations change.

"Things change in time, and some messages that you want to send now, you may not want to send them in 2 weeks time…your relationship with someone may change, then you sent love messages thinking about the person in the present into the future, and then you're like… I should have never sent that, I look like a fool." – P3

"That was the other thing, you worry about what your friendship will be like, once that message will be opened?... You know. Would you want to send something to a significant other, if you're ever concerned about not being together in 10 years…what if something happened that would make this message really awkward… which is something I was mindful of, of sending something more than a year or two into the

future, is this social consequences of that happening…It's like the further out you get, it really made me anxious." – P6

Similarly, some participants were frustrated that they could not view a log of their sent messages, and often forgot about the ones they did send.

"I would have used it more regularly… if it had [a log]… the thing is… I no way of knowing of things I had sent.– P6

Other participants commented on the lack of feedback of Postulater. P3 expressed how it made her worried and frustrated that she had no feedback from Postulater or the recipient (i.e. if it was received or not) once the message was sent:

"So I have no clue, no reaction back, no feedback. Either I forget about it, or I'm worried about it… and I had no control over anything…. That's my feeling about this app. You send something and you don't remember what you send, or when you send it, and when its supposed to be received, you don't know when it's received, and you don't know how it's interpreted, because people don't give you feedback, because it's not on the same channel." – P3

In addition to "feedback" and "logging" messages, many participants also commented on their frustration with having to enter sender and recipient information each time they sent a message. Participants described the desire to have Postulater "remember" contact information, as commented by P9: "I might have used it more if it was easier to link up with my address." Interestingly, this minor nuisance was the most common reason why participants did not use Postulater more frequently to send messages. Another common remark given by participants related to accessing the Postulater website on mobile devices. Because most participants captured and stored media on their smartphones, they felt that Postulater was "more smart phone friendly". For instance, P13 felt it would be "much easier on the phone if it were an app… less typing".

Naturally, participants also commented on the longevity of Postulater and expressed doubt that it would still be around after a long time period. This included faith

that the Postulater website would be operational, but also that email addresses would still be functional. However, this typically did not stop them from sending messages into the far future. I did not gather reactions from participants on how they would feel if those messages were lost or not received.

While the purpose of our study was to explore time-delayed multimedia sharing, participants expressed the desire to send strictly text messages without having a mandatory image or video attached. While there are other applications that do this exclusively (which I've previously described) this is still interesting to note for the consideration of our design. I discuss this in further detail in the next chapter.

5.7 Summary

This chapter addressed the final research question: how do people use a time-delayed multimedia messaging tool? In this chapter, I described the behaviours and habits of people using Postulater to send messages to friends and family members. First, I presented the quantitative results of the messages, such as the total number and the time delay of messages sent during the study period, as well as a comparison of video and images, and inclusion of text (i.e. a caption). Next, I classified the way in which participants used Postulater, which included sending messages for 1) Personal Memories and Reflection, 2) Practical Reminders, 3) Butterfly Effect, and 4) Greetings for Special Occasions. Broadly speaking, Postulater usage was typically either reflective or utilitarian. Reflective acts included senders reflecting on the recipients, as well as their own, current and future status (e.g., What will my relationship be with this person in 10 years?). This differed with utilitarian acts, which mainly focused on more practical reminders for both sender and receiver (e.g., photographing objects in their location for cueing memory) as well as for sending time-sensitive messages (e.g., special greetings like Birthdays). Lastly, I also presented the challenges participants experienced while using Postulater. In Chapter 6, I summarize the main findings presented in this chapter, and use these findings to discuss the future design implications of a messaging technology like Postulater,

6 Design Implications

In this chapter I summarize the study's main findings and discuss the implications for the design of messaging technologies like Postulater This chapter addresses all three research questions. I apply the knowledge of how participants used a time-delayed messaging application (Research Question 3), to iterate on how to design a time-delayed messaging application which supports both sending (Research Question 1) and receiving (Research Question 2) multimedia.

6.1 Reflection

My study revealed that participants highly valued being able to create and send personal memories and reflections to family members and close friends into the future. This provided them with another avenue for sharing media-based messages not provided by other communication tools. The fact that messages could arrive at a particular time period meant that people could think about and plan for these moments. This allowed people to consider the implications for their message, and when it would be most meaningful, including what that future date may hold. Reflection generally occurred in two settings: 1) moments when people were sending pre-existing media, and would reflect on past experience and the future impact of that media, and 2) moments when people were capturing and sending *in-the-moment* (i.e. live) messages. Deciding what to capture for future use (using Postulater *in-the-moment*), allowed people to reflect on their current environment, and consider what may be interesting in the future. In other words, this prompted people to consider what present information is interesting to record and preserve for the future, and in what time periods (when) will it be interesting. Deciding when to send *in-the-moment* also prompted reflection from people capturing "ordinary" photos and videos (i.e. media that they would normally record and share in their daily lives) when considering the impact of this media in the future. For instance, instead of instantly sharing the image with the intended receiver (or social network, e.g.,

through Instagram), senders reflected on the significance of the picture or video, and considered a time when the memory would be impactful.

6.1.1 Reflection through Continued Use and Awareness

It's worthwhile to compare these moments of reflection to common uses of photo-sharing via social media applications. Mediums like Instagram, for instance, support a more in-the-moment showcase of one's status, where the memory is shared instantly and broadly. This behaviour begs the question: to what extent does instantaneous sharing support moments of reflection, and how does the time delay change the nature of photo-sharing? Time plays a curious role here. When we begin to consider the effect of time, when capturing and sharing media, we begin to realize some moments are much more significant at a future time. These moments of realizations may not occur for people while sharing instantaneously. Delaying photo-sharing with tools like Postulater, may not only provide people with moments of reflection but it may also support different behaviours. We observed that with continued use, participants discovered new uses and began delaying photos that they felt would be more compelling in the future. I imagine with even more use, participants would build this into their daily routine. As an speculative example, consider an individual on a busy street who comes across city construction plans for where she is currently standing. Having used a tool like Postulater for a few months, the individual may be more inclined to reflect on their current environment and how it may change in the future. Considering how things may drastically change, she takes a photo and sends the image using Postulater to a specified date 10 years in the future. In this scenario, the image at that moment may hold little meaning, but the sender is able to reflect on a time when the image would be interesting – at the future date after the construction is completed. Moreover, reflecting on how this image will look in 10 years time, she may also consider including other contextual details in her photograph, like current fashion and technology. Of course, this can be done without the use of Postulater, by simply taking that photo and storing it for that future date. But by providing a tool designed for this action, people may begin to reconsider every day moments. The ability to more easily send media to specified dates fosters a new way of reflecting on these moments, and I believe, through enough experience with Postulater, allows individuals to reflect on their current and future state.

I believe that tools like Postulater offer an interesting way to manage multimedia and provide a more meaningful way to preserve and share memories. While stumbling across an old photo on a future device is valuable, the study suggests that systems like Postulater would provide additional significance to such moments. This includes any added caption as well as the notion that a particular photo was specifically chosen to be sent to a certain time period, as well as from a specific individual. Richer information about the photo is provided because the record is made near the moment of capture, rather than later, when received, and also because it comes from another source (e.g., another perspective and time period). This suggests that delayed messaging tools should consider the social aspects of information sharing across time, rather than just acting as personal digital time capsules for preserving individual records. While some participants did this, it may not come natural to all users. Designers could consider how they can provoke awareness in users, and get users think or imagine how their messages may be perceived in the future, or what information may become valuable in the future, or what minor details may become forgotten in the future. Using a time-delayed tool as a standalone application (i.e. not integrated with other more immediate sharing tools, like Instagram) that is used strictly for sending delayed messages will help reinforce this idea.

Again, this would likely become common practice with continued use of a time-delayed messaging system, but initially it may not come naturally. Perhaps users would begin to record media differently for the purposes of time-delayed messaging. For example, consider the difference between a portrait that is zoomed in on the subject versus a photograph that contains more information about the surrounding. While the first image may be more suitable in that moment, the latter image captures subtle details about popular fashion trends or contemporary technology of that time period. These minor details are not normally considered meaningful, because it is not obvious from a day-to-day perspective. Thus, designers should consider how to broaden this perspective. For example, in addition to including a caption, users could record meta-data (e.g., location, temperature, feelings, etc.). The difficult task would lie with the users: choosing which information could become valuable in the future.

Through the convenience and awareness of Postulater, the sender is made more mindful of the role of time, and can begin exploring the impact of delayed messaging. This suggests design implications that support convenience and awareness. Designing for convenience is often an obvious decision, but it is tricky in the case of a slow technology. On one hand, designers should be including actions that force careful consideration for specific dates. On the other hand, to encourage users to more easily capture and share everyday content, as well as time-specific media, users should be able to send via Postulater through a minimum number of actions: select media, select recipient, select date. To make selecting a recipient easier, this includes user accounts, with one-touch selection of recipients, rather than manual entry of email addresses. Other options may include other date selection methods. For example, instead of selecting a specific date, users may want to send to a random period 3 to 5 years from now, and may choose a Years option, compared to a Months or Decades option. Conversely, should designers make the date selection process more deliberate, to reinforce moments reflection? I argue that designing for convenient, yet more open and random styles of date selection may drive more reflection if the practice is fun and easy, as someone would interact more with a playful system that delays messages and makes them consciously consider their action (e.g. sending to an imprecise year in the future by holding down the send button).

By designing for awareness, I mean how do you design a time-delayed messaging system that encourages users to become more aware of their present and future standing (e.g. in their environment). For instance, designers could consider prompts and notifications such as “What does your living room look like now, and what do you imagine it will look like in 10 years?” Users could respond by capturing a photo of their living room, and sending a message to themselves with a caption describing what they hope for in the future. Prompts could be curated to match user needs and desires. For instance, users could request temporal (e.g. weekly or monthly) prompts about spatial and descriptive information (e.g. specifically capturing photos of types of food they eat or clothes they wear: something already done commonly today). Lastly, designers should also consider including an immediate follow-up text-only message indicating that a delayed message has been sent to them for a time in the future. Perhaps the message may not even specify the arrival date of the delayed message to

keep it a mystery. This way, recipients will also be included in connecting present and future self, as well as a sense of anticipation.

6.1.2 Reflection through Impacting Future Events

Using Postulater (capturing and selecting photos, writing messages, and selecting recipients) also forced people to reflect on their current relationships with friends and family, as well as contemplate how their relationships may change in the future. For instance, some participants discovered pre-existing media on their personal devices of a shared memory with a friend. This prompted them to reflect on their current relationship with that friend, and begin to imagine what their relationship will be like in a few years time. Through the *Butterfly Effect*, I discovered how participants acted on this reflection, and used Postulater to impact future events. For example, participants who contemplated how their relationship may dwindle in months to come, particularly for long distance relationships, felt they could reinforce their present feelings by projecting their sentiments to a future date.

This begs the question of Postulater's role in the *Butterfly Effect*. On one hand, Postulater offers a simple way to send delayed messages, but what would be changed if the sender waited one year to send that message instantly? The present sentiment may change: as time passes, the relationship can fade. Postulater was used to freeze frame today's sentiment, and preserve the feeling for future dates. However, some people felt that when their *Butterfly* message (messages meant to preserve a sentiment) arrived, the recipient would regard them as a passed moment, in that the sentiment no longer holds the same validity from when it was sent. With this in mind, some people regarded Postulater as a mechanism to convey affection outwardly, while protecting their future self, because people felt more comfortable expressing themselves knowing that the receiver would be aware of when the message was sent. While these examples demonstrate that Postulater allowed people to carefully consider their interpersonal relationships at a current and future period, it also brings up an important design implication. Given that some people felt their message (e.g. *Butterfly* message) would not hold as much sentiment or validity as more time passes between when the message was sent and when it arrives, should designers allow senders to conceal the date when

the message was sent? Imagine receiving a nostalgic photo message from a friend where the “sent date” is unknown. In this scenario, the message would be more mysterious, and the recipient would be less able to tie the intention and sentiment of the sender to a particular time. While this may feel less personal, this ability may evoke a more timeless sentiment and emotional response.

The Butterfly Effect also touched upon the idea of senders messaging recipient’s post-mortem. Participants were uncertain if the experience of receiving a message would be emotional or creepy. Either the case, this demonstrates the powerful consequences senders can have by intervening, perhaps unexpectedly and unwillingly, in the recipient’s life. The fact that the recipient’s response is uncertain and that they have no control of receiving this message present potential issues that need to be further addressed in the HCI community.

6.2 Location and Time Communication

The study revealed that when participants were using Postulater to send future messages, they were often thinking of where their recipient would be (both spatially and temporally) when their messages were set to arrive.

6.2.1 Locative Communication

I was surprised to find participants using Postulater to send messages to friends and family who were physically removed, to a time when they knew they would be together. The rationale from the participants was that they wanted to share the message in person. As most media sharing has moved passed the days of photo albums to more dispersed sharing, recreating the photo-album experience for dispersed individuals is an interesting area to explore. One obvious experience absent from co-located sharing is user reaction. SnapChat is in the process of developing a feature that records the receiver’s reaction of sent messages, which is then sent to the sender, for their satisfaction. While this is a clever way of mimicking real life interactions, users of Postulater used the tool to prompt in person, co-located reactions. I imagine a tool like Postulater could explore this area in a few different scenarios. For instance, users could

upload messages to Postulater, but they are only delivered once they are co-located with the recipient (through location-aware software). In this sense, all media sent through Postulater that was intended for the recipient would only be shared once they were co-located with the sender. Interestingly, this would facilitate more in-person interaction; however, this may cause an inconvenience for both parties, such that they are physically constrained to 'meet up' to share messages. This too could also present awkward or less desirable scenarios, for example if the sender loses track of the shared media content and doesn't want to share that particular message at that time. One solution could be to make the delivery less automatic: senders could receive a prompt message from Postulater, asking if they would like to share their media at this point in time with the recipient. However, this could also alter the experience and intent of a time-delayed system.

With shared media becoming increasingly consumed by dispersed individuals, designing for co-located sharing experiences will surely be a valuable feature for media sharing. Designers should also be aware of location-based privacy issues that may arise from locative-based media. For instance, locative media has the potential of sharing unwanted locations of individuals, thus encroaching on personal privacy preferences.

6.2.2 Time-Based Communication

Having participants use Postulater for an extended time allowed them to become more cognizant of delayed sharing. Some participants explored this by planning their delivery dates, to be sent to and from more convenient times. This was demonstrated when participants were travelling and were uncertain when they would be in an area with an Internet connection. Participants were still able to send multiple messages (e.g. travel pictures) across many days while travelling by using Postulater before their "unconnected" periods. I also found that many people wished to use the tool for sending future date specific greetings, such as birthdays, to many years into the future. However, as shown in the results, participants did express mixed feelings towards "planning" multiple messages in advance, because it can be interpreted as less personal. Thus, the social implication of *planning* messages needs to be further explored. In the future, if delayed messaging becomes more broadly used, perhaps

some form of social etiquette would evolve. While designers should strive for creating an avenue for more personal and thoughtful exchanges of media, they should also be aware of the social response to such a tool, and respond appropriately. Likewise, senders of delay-messages should also be made aware of the implications of sending a *planned* message (i.e. be conscious of how it could be perceived by the receiver).

6.3 Element of Surprise

In regards to making the content more unique, I was surprised to discover that most messages sent using Postulater were of images that both the sender and receiver had seen previously. I anticipated this would be a main attraction for users: to have the ability to share unseen photos and videos, until the date of delivery. For example, consider an individual who captures a video of a friend napping during a camping trip. Instead of sharing the video with the friend the moment after they woke up, the individual decides to Postulater to send the video to a random year in the future. This way, the sender believes the message will have additional significance because the receiver will have to actively recall that memory. Again, if this video was shared immediately after the receiver woke up, the significance would be minimal. Time reinforces the impact, especially in the case of everyday moments or otherwise less significant photos and videos. By this token, time, via Postulater (*the medium*), acts by making everyday content (*the message*) meaningful. To paraphrase McLuhan, it's the *medium, not the message* which is important.

Instant cameras, then later with digital photography, have paved way for an expectation of the immediate, making surprises obsolete. It has demanded instant satisfaction. Legend has it that the invention of the first instant camera, Polaroid, by Edwin Land, came about when he and his six-year old daughter were walking along the beach taking photos, and his daughter asked "Why can't I see the picture now?" (Bonanos, 2012, pg. 32). But what happens when we don't see these pictures till many years later? This question is difficult to answer in such a short study period, but I imagine various features that would explore this idea. One feature I propose is allowing users to capture images that are immediately uploaded, without been seen or shared first, and can only be viewed at a future delivery time. Thus, the surprise would be experienced by

both the sender and viewer. Another possible feature would be the automatic deletion of the image or video once it was uploaded to the delayed-messaging system. In this scenario, users could still upload pre-existing media, but once uploaded, users could not view the content until the date of arrival, thereby increasing the anticipation and impact of the delay. While these two features offer a unique way of increasing suspense and anticipation, it is unlikely that it would be willingly adopted by all users. Conversely, if it were made optional, would users voluntarily opt to have their photos temporarily removed? Given the adoption of limitations by users with applications like ephemeral photos in SnapChat, it's very possible (Pierce & Paulos, 2014). Thus, designers should carefully consider what limitations and options to include in future systems.

In addition to the surprise of seeing an unseen photo, I also imagine the potential of including "random" delivery date functionality. One participant (P6) described their habit of sending messages to "random" dates by pulling down on the date picker wheel on their smartphone to select random dates, mostly because they didn't care when the photo arrived. However, I imagine this feature would produce positive experiences for both the sender and receiver, if the message arrived at unpredictable times (Leong et al., 2006). I propose a feature that allows users to send to random dates in the future (e.g., 13 months), where the date is not revealed to the sender or receiver, which in turn would create a greater feeling of anticipation and surprise.

6.4 The Virtue of Waiting: Slowing Down and Sending Into The Future

*"Ask me a question. Okay, now suppose I say, if you will come back in seven days, I will give you the answer. Are you impatient?… Look, if the picture you get instantly is as beautiful as the picture you get by waiting seven days, then it is absolute madness to say that there is virtue in waiting" – Dr. Edwin Land, (*Bonanos, 2012, pg. 41)

In an environment saturated with immediacy, I discovered that people enjoyed the experience of delaying media sharing. Knowing their message would be opened in the future, this also offered a sense of anticipation for the sender – an experience that is perhaps seldom felt with instantaneous media sharing. Where immediacy is the norm for

today's younger generation, time delays can offer subtle implications. One participant likened the feeling of using Postulater to dropping off a roll of film – a rare practice today, but one rich with nostalgia and anticipation.

I also discovered that the process of slowing down media sharing could create meaning for senders and receivers. As participants became aware that seemingly "boring" images may become more interesting in the future (increasing with time), they felt more willing to send average photos and videos, knowing they'd hold value in the future. Clearly a delay in time can create more meaningful impact, but the relationship (time vs. meaning) is difficult to measure (e.g., linear or exponential). What is clear, however, is the desire for delayed memories. Take for instance the popular hashtag #tbt on Instagram. Every Thursday, users post old photos to Instagram using the "throw back Thursday's" hashtag which, at the time of writing this, contains over 243,654,785 posts. Not only do users post older photos from years back, but it is also common to share relatively recent photos and memories, such as earlier that year. That is, users deliberately wait to share (reveal unseen) photos that they have captured on their smartphone, as if the coveted photo has increased meaning with time. Based on this popular practice, designers should consider incorporating a delayed sharing function into existing applications, like Instagram, where users have more autonomy in regards to when their media is shared.

In terms of the length of delay, I expected to find a greater number of messages sent to more distance points in the future, and were surprised to see so many messages sent to within the same year. This is likely due to a combination of factors. First, participants may not have sent very distant messages because they saw no need or they weren't familiar with contemplating such future dates. Second, not all participants had faith that Postulater would still be functional in the distant future. Thus, in developing a tool like Postulater, designers should instil a sense of confidence by promising the longevity of the tool. Lastly, I acknowledge that some participants felt uneasy about sending messages far into the future due to the changing status of their lifestyle and relationships. One solution would permit senders to review their messages closer to the day of sending. I propose various features as a solution to these last two factors in the next section.

6.5 Guaranteeing Service

A leading priority for any time-delayed messaging system should be to instil confidence that the sender's message will arrive, at any point in the future. Otherwise, users will be dissuaded to send messages to the far future, rendering any time-delayed messaging system useless. Furthermore, even if such a tool can guarantee service for years to come, there is still the issue of reaching the recipient. Our initial design used email for simplicity, but there is no guarantee email addresses will be active or a mode of communication in years to come, lesser still is the chance that the recipient's email account will be functional. Consequently, designer's need to question what sort of guarantee they can make to its users that such a system will be around in years to come, and be able to successfully deliver their message, in order to preserve the cherished messages they've created. What degree of trust should people place in such guarantees? This is an ethical dilemma for designers and companies that may offer such a system. Applications like PostHaven, which guarantees a way to store personal digital media indefinitely, have recently begun to make similar long-term promises for online media, but the user response is unknown. On one hand, there is a desire to offer people the ability to send messages into the future for a myriad of positive reasons, yet, on the other hand, there is the pragmatic reality that such tools may be hard to maintain in the longer term. The disappearance of seemingly important messages due to server failure or a discontinued service could cause negative emotional effects especially for people who send very treasured messages. Moreover, how do you design for future addresses (like email accounts), assuming this will change with new technologies. Thus, I imagine a system that would require the creation of user accounts to send and receive messages. As the half-life of social media technologies tend to wane, user accounts would have to exist permanently, and be accessed at any point in the future. The issue of long-term system availability presents an open design problem for time-delayed messaging systems, especially considering how practical it is to design a technology that will be used indefinitely (given that technology is always evolving). However, given the difficulties (including costs) in creating a delayed messaging system, perhaps there is also a great monetary value for the creators of these services in terms of user retention. By creating user accounts, which would naturally grow by inter-user messaging, owners of a delayed messaging platform would ensure retaining a beneficial user base.

Given that participants were asked to send personal messages to friends and family, which sometimes resulted in emotional experiences, designers need to be cautious of the ethical implications in having participants emotionally invest in a study. This is a challenge for the HCI community more broadly in studying long-term systems. As researchers seeking to understand candid and natural behaviours of these systems, we are morally obligated to inflict no emotional detriment on the participant. Thus, designers could design and build more robust prototypes for deployments that will meet the promised needs of the participant.

6.6 Message Reviewing

The second issue for the lack of long term messaging users expressed, was the inability to review their messages in the future. Participants felt uncomfortable sending to messages to far away dates assuming all kinds of uncertainty that may arise. While I do feel that allowing users to review their messages at the time of delivery would shift the focus of Postulater to self-sharing, as opposed to directly sharing with others, there may be various benefits. Designers could explore possible solutions and mechanisms for reviewing messages. For instance, once a message has been received from one's past self, the user would have control over whether to send that message onwards, thus acting as a safe-check to avoid awkward or unwanted past messages. Users could also share any multimedia sent from the past with the desired recipient using the contemporary or preferred multi-media sharing platform of that future time. Lastly, as email addresses and account information changes, this would assure that the message would be delivered to the correct address. I imagine that the system design then would need to include a user account that would guarantee indefinite use into the future. This would address users' needs by avoiding email accounts and confidence with longevity, as expressed previously. However, focusing the system around self-sharing, as opposed to directed-sharing with others, may change the experience of the receiver, as the effect of the perceived time delay would be diminished. I feel that self-sharing would shift the focus of Postulater away from a social messaging tool to an isolated digital time capsule application. The significance of communicating into the future would be sacrificed, as the self-sharing halts the sender-receiver relationship. Consequently, senders would no

longer be communicating to receivers directly through delayed time, instead they are communicated to themselves first, then to the receiver more immediately. To illustrate this point, imagine receiving a message in your inbox that was sent from ten years ago, versus a message that was sent yesterday. The self-sharing approach would also mean that users could not send messages to future dates past their own life, to their grandchildren, for example. As an alternative, users could be given the option to review messages closer to the date of delivery, before they were sent out. In this scenario, users could choose which messages should be reviewed. This would allow for future messaging beyond ones' life. But perhaps the ability to review message would also diminish the effect of time for the receiver. Following the example of a message arriving from ten years ago versus yesterday, would the effect be altered if the receiver knew it was reviewed first? In one sense, it feels less direct: the message is travelling from A to A to B, rather than A to B. On the other hand, one could argue the sender is merely observing the message, rather than sending it to themselves directly. While a review mechanism may not alter the qualitative affect of the message, it would affect the quantity of messages: naturally fewer messages would be sent overall.

6.7 Message Retraction

I also believe designs should consider whether it is important to include features that may allow one to retract messages after they are sent, or provide a history of sent messages. I purposely did not include this feature, as I wanted to understand how people would react to this situation. In essence, I felt that by not including these features, one would be even more careful about sending messages into the future, and, thus, be even more reflective. I feel this was indeed the case in our study, yet in practical terms, and future use, there could be negative situations that may arise if hurtful or harmful messages are sent on a whim or without careful thought. Designers should carefully weigh this consideration when creating systems like Postulater. By including a retraction mechanism, users may be less reflective in their behaviour, and send messages without much thought. However, if designers wish to include a message retraction option, a possible solution would be to allow users to review their messages at the date of delivery, as I discussed in the previous section. But considering the potential

drawbacks mentioned, users could instead keep a log of all their pending messages, and choose at any point to delete unwanted messages. Given the reaction from users who were hesitant to send messages beyond a few years, based on their fear how their relationship may change, providing a log of retractable messages would likely mean users would send to greater lengths in time. Yet, in terms of facilitating reflection through a slow technology, maybe having a sense of contemplation is a desired attribute. One potential problem may arise where users forget to check their log of pending messages. This could be counteracted by including a reminder, much like the review feature, but again, this may interfere with the sentiment of “direct messaging”, as mentioned above.

6.8 Text versus Media

Many participants expressed the desire to have a larger caption area to include more text, so they could write longer (and more meaningful) messages to themselves and their recipient. Some participants expressed a great interest in sending strictly text messages, with no interest in sending images. I expected these users to send “blank” or insignificant images, with text-focused messages, but this was not the case. Likewise, when I asked why they didn’t handwrite messages on paper, then photograph and send the message, they explained they had not thought of that but liked the idea. On the other hand, I was surprised to see one participant write long messages via Adobe Illustrator, to be sent as an image. Because I did not anticipate this use, this suggests designers should also learn from the creative uses from its’ users. Thus, I feel designers should consider providing a list of novel or interesting user scenarios generated by the users (e.g. writing notes and photographing them), as examples for other users. This would be beneficial for inspiring new uses amongst users.

The Adobe Illustrator example brings up two other interesting points. First, with the nostalgia for handwritten messages in the digital age, and perhaps more meaning they bring, a tool like Postulater should consider how to incorporate and easily facilitate these messages. One obvious solution is to prompt users who wish to send “text based messages” to simply write the message on paper, photograph, and send as a JPEG. Another solution would be to incorporate this as a feature in the application or support file types that record digital handwritten applications. This brings us to our second point:

file type. To what extent should design limit users? Applications like Vine limit their videos to six seconds, and SnapChat prevents users from uploading pre-existing media. Limiting users of a time-delayed messaging system to image (e.g., JPEG) and video (e.g., MOV) files, forces them to push their boundaries and use the application in creative ways. On the other hand, supporting all files types and media forms (e.g. GIFs), would allow users to share and explore all forms of media in conjunction with elements of time-delay. Thus, I would argue for opening the possibilities of multiple file formats.

6.9 Message Display

This brings us to another important design feature: how to best display messages. I used a minimalist design approach with Postulater, to emphasize the content of the message. While I do think this is important, designers should also consider previously mentioned and additional features. For instance, anticipating meta-data in future recording devices (like weather, location, aroma? etc.), how should this be displayed? Or will media even be displayed on screens, in years to come? This suggests that the display of future messages will have to adapt with technology. It makes little sense to design for decades to come; instead, we should design the display of messages as they arrive. This means the message display will constantly evolve, naturally, like all social media tools do, such as Facebook features. Presently, this looks like a minimal design which highlights the message and media itself.

6.10 Usability Issues

Many participants expressed the desire to have more awareness of the messages they sent, as some participants lost track of what messages they sent and to whom. This would certainly pose a greater problem if the system was used for periods greater than six weeks. Thus, as participants described, a log of messages would help organize messages.

At the same time, the receiver may want to organize incoming messages, as they may potentially become overloaded with large volumes of messages over time with a

system like Postulater. As delayed messages hold a variety of meaning for the recipient (e.g. utilitarian vs. personal memories) the management of messages may be a challenging task. Options may include a message log that prioritizes messages based on their delay, given that we saw longer messages tended to carry more significance. Or perhaps the sender and receiver could manually tag or rank the photo based on significance and value. The message log could also automatically remove messages based on an expiry date, making the message more ephemeral, in order to remove burden on the receiver. However this may result in the deletion of desired messages and media.

Lastly, should some messages be withheld until a "good moment"? Some participants in this study sent messages to specific time of the day, where the sender was aware of the receiver's daily schedule and their availability. But designers could also consider giving autonomy to the receiver, where they can set appropriate times for receiving messages. While this may provide a convenience for the sender and receiver, this could also perhaps take away from the spontaneity and surprise of the message, and thus designers should carefully consider this option.

6.11 Summary

Chapter 6 summarizes the main findings from the user study and explores various implications and design considerations for the future design of a messaging technology like Postulater. All three thesis research questions were addressed here: how to design a time-delayed messaging application which supports both sending (Research Question 1) and receiving (Research Question 2) multimedia, and apply the knowledge of how participants used a time-delayed messaging application (Research Question 3). Specifically this chapter examined major themes such as Reflection, Location and Time Communication, Element of Surprise, Virtue of Waiting, Guaranteeing Service, Message Reviewing, Message Retraction, Text versus Media, and Message Display.

In summary, through continued use of a tool that is designed to deliberately delay messages, it is my hope that users will begin to reflect on every day moments, and

slowly adjust their mind frames to consider their current and future state. To help foster this mind frame, designers should make the experience engaging as well as a stand-alone application that is made specifically for delayed messages. Moreover, I argue sending direct messages to others (rather than to oneself, or publicly) will help facilitate moments of reflection. It was also revealed that there are benefits to delayed messaging, in addition to the utilitarian uses, like personal and social reminders, where individuals used delayed messaging to share media together (i.e. collocated) with the recipient spatially, as well as the opportunity to plan messages for specific times (i.e. temporally). However, the social etiquette of planned messages needs to be further explored. In addition to the act of reflection, a delayed messaging tool offers feelings of anticipation and an element of surprise, and I argue certain design implications, like randomness and ambiguity, can help facilitate these emotions. This discussion also describes the design implications for making users feel confident in using such a tool, including a feeling of prolonged service and functionality over long periods of time, and allowing users to review, manage, and retract messages after they've been sent. Lastly, I described the design implications for how to support user preferences with text and media, and how they are displayed, which I put forward is a dynamic process. In Chapter 7, I discuss the research contributions made in this thesis and provide a final conclusion.

7 Conclusion

This final chapter summarizes the research contributions in this thesis. First I reiterate the research objectives I presented in Chapter 1, I then describe my research contributions by outlining how I achieved each my thesis goals from Chapter 1. Lastly, I provide directions for future work in the field of time-delayed multimedia sharing.

7.1 Research Objectives

This thesis explored the design, use and evaluation of time-delayed messaging for sending and receiving personal multimedia. We do not know how such a system should be designed to send time-delayed messages into the future.

1) **We do not know how to design a slow technology messaging system for sending multimedia.** While there are tools that support sending delayed messages, we have not yet examined the design principles for a digital system that supports delayed sharing of multimedia, for friends and family, to the future.
2) **We do not know how to design a slow technology messaging system for receiving and viewing multimedia.** Given that we can determine when message should be delivered, we do not yet know how an interface should be designed which supports receiving and viewing time-delayed messages from the past.
3) **We do not know the ways in which people will use a slow technology multimedia application.** When people are given the possibility to control when their messages are sent, novel applications could arise in a various number of ways. Understanding how people will interact and use such an application will inform our design decisions.

7.2 Research Contributions

The primary goal for this thesis was to provide an understanding of how people use a time-delayed messaging tool, that can be used to inform the design of an application that supports time-delayed multimedia sharing. In doing so, this thesis makes the following contributions:

1. A Time-Delayed Messaging System: After exploring the related literature in this field (Chapter 3), I discussed the motivation for designing a tool to send time-delayed multimedia. I then described this process, by first describing the early iterations for developing the homepage and interface, including various features of communication and delivery options. I also explored the various scenarios I envisioned for Postulater to describe what I believe are potential applications for users.

2. Method for Studying Time-Delayed Messaging Systems: In Chapter 4, I presented an evaluation method for understanding a slow technology for time-delayed multimedia sharing. Here, I described the recruitment and demographic of participants, as well as the the study methods. This included, 1) pre-study survey, 2) follow-up interview, 3) recipient survey and 4) post study questionnaire. Lastly, I discussed the data collection and methods used to analyze the data.

3. Appropriations of a Time-Delayed Messaging System: In Chapter 5, I described the behaviours of people using Postulater to send messages to friends and family members. First, I revealed a quantitative description of the messages, such as the total number and the time delay of messages sent during the study period, as well as a comparison of video and images, and inclusion of text (i.e. a caption). I then classified the way in which participants used Postulater, which revealed that users sent messages for 1) Personal Memories and Reflection, 2) Practical Reminders, 3) Butterfly Effect, and 4) Greetings for Special Occasions. In general, Postulater was used to send messages that were typically either reflective or utilitarian. Reflective acts included senders reflecting on the recipients, as well as their own, current and future status (e.g., What will my relationship be with this person in 10 years?). This differed with utilitarian acts, which mainly focused on more practical reminders for both sender and receiver (e.g., photographing objects in their location for cueing memory) as well as for sending time-

sensitive messages (e.g., special greetings like Birthdays). The challenges that participants experienced while using Posutlater are also revealed at the end of this chapter, which included usability issues such as feedback, longevity of the system, and managing and retracting sent messages.

4. Implications for the Design of Time-Delayed Messaging Systems: In Chapter 6, I summarized the main findings from the study and presented the future design implications of a time-delayed messaging technology. This chapter addressed all three research questions: how to design a time-delayed messaging application which supports both sending (Research Question 1) and receiving (Research Question 2) multimedia, and applied the knowledge of how participants used a time-delayed messaging application (Research Question 3). By exploring the findings derived from Chapter 5, I explored major themes that included future design implications. These included: 1) Reflection, 2) Location and Time Communication, 3) Element of Surprise, 4) Virtue of Waiting, 5) Guaranteeing Service, 6) Message Reviewing, 7) Message Retraction, 8) Text versus Media, and 9) Message Display.

Past research has explored time-delayed media, through the creation of physical time capsules (Petrelli et al., 2009), digital mementos (Bowen and Petrelli, 2011), slow technologies (Odom et al., 2012) and digital legacies (Gulotta et al., 2013), but this thesis extends this work by exploring this area in the context of sharing digital media, specifically, with friends and family. In doing so, I revealed the ways in which people sent messages and media not only to themselves in the future, but to others as well. This approach not only revealed fun and playful uses for people, but this technology also provided ways for strong emotional ways for people communicate and connect. Moreover, while past studies (Petrelli et al., 2009; Petrelli and Whittaker, 2010; Gulotta et al., 2013,) have focused on long-term capsules for moments far into the future (e.g., towards the latter years of one's life) our study revealed how people share media on multiple time periods (e.g., 2,10, and 20 years into the future). Here we revealed how people used time-delayed messaging to also affect future time periods through the Butterfly Effect. In sum, by providing an understanding of how and why we share time-delayed media, designers can now incorporate the design implications outlined previously.

7.3 Limitations and Future Work

It is important to acknowledge the limitation of performing a six-week period to study a slow technology application for sending time-delayed messages into the far future. By its very nature, a study involving the use of time-delayed messaging could take decades. To address this problem, I centered my research on the sending of messages, rather than the receiving of messages. Thus, we still do not fully know the experiences of receiving future-past messages. Future studies focusing on the reception of messages should allow for longer study periods (i.e. years) that would be able to capture the emotional affect of receiving a message from the distant past.

While one caveat of a longer study would be the effect of time (longer delays in time will likely have more significance), a prolonged study period may benefit the findings in two other ways. First, with continued awareness and use, people will begin to adopt the technology into their daily routines and will develop new uses and experiences with the technology. Secondly, by using the technology over a longer period like a year, situations that that arise at specific times of the year could give way to more novel uses. This may include certain holidays, travel and vacation, or even occasions and life events that span multiple years. However, this second issue of capturing date-specific events, could also be resolved by using a larger sample size.

In addition, it would also be advisable to deploy the technology within multiple group settings, where friends and family members can send messages to each other. Not only would this reveal group dynamics of sharing time-delayed media, it would also be easier to evaluate the reception of messages from actual participants. Lastly, future work should consider exploring the design implications presented in the discussion, such as retracting messages, collocated sharing, random date sending, and user prompts.

7.4 Final Words

As media sharing becomes more immediate and pervasive, particularly with Millennial's, designing Slow Technologies that allow for moments of reflection will become more and more vital. It's important that we understand the effects pervasive and

immediate media sharing has on us, and how it shapes the way we communicate and share media with the ones we care about. As designers we need to carefully consider solutions for creating more meaningful connections and venues for reflection.

While the work presented here has focused on the use of media sharing, these lessons can and should be applied more broadly to include other aspects of slow technology. Firstly, Slow Technologies can serve both utilitarian and reflective purposes; the guidelines for slow technology put forth by Hallnas and Redstrom (2001), do not have to exclude more conventional uses of a tool. In other words, we need not consider the two design goals at odd with each other. Designing a time-delayed messaging tool will inherently involve some aspects of slow technology design, but the purpose will be derived from the user's experience. Secondly, by creating pathways for users to connect to the future, they can also connect more with the *now*, and ultimately achieve moments of present-mindfulness. Lastly, by adopting Slow Technologies into our lives, we can begin reflecting on the purpose of our tools, explore how they can be used, and begin to become aware of what matters most to us in a increasingly hyper-connected landscape.

References

Ames, M., Eckles, D., Naaman, M., Spasojevic, M., and House, N. Requirements for Mobile Photoware, Personal & Ubiquitous Computing, 14(2), (2010)

Barkhuus, L., Brown, B., Bell, M., Hall, M., Sherwood, S., and Chalmers, M., From Awareness to Repartee: Sharing Location within Social Groups, Proceedings of CHI 2008, pp. 497- 506.

Barkhuus, L., and Tashiro, J., Student Socialization in the Age of Facebook, Proceedings of CHI 2010, pp. 133-142.

Bonanos, C. Instant: The Story of Polaroid. First Edition. Princeton Architectural Press, (2012).

Cao, X., Sellen, A., Brush, A. J. B., Kirk, D., Edge, D., and Ding, X. Understanding family communication across time zones. Proc. CSCW, ACM Press (2010).

Crabtree, A., Rodden, T., and Mariani, J. Collaborating around Collections: Informing the Development of Photoware, *Proc. CHI*, ACM Press (2004).

Czerwinski, M., Gage, D. W., Gemmell, J., Marshall, C. C., Pérez-Quiñones, M. A., Skeels, M. M., & Catarci, T. Digital memories in an era of ubiquitous computing and abundant storage. *Communications of the ACM*, *49*(1), 44-50 (2006).

Frohlich, D., Kuchinsky, A., Pering, C., Don, A., and Ariss, S. Requirements for photoware, *Proc. CSCW*, ACM Press (2002).

Hallnäs, L., & Redström, J. Slow technology–designing for reflection. *Personal and ubiquitous computing*, *5*(3), (2001), 201-212.

Hutchinson, H., Mackay, W., Westerlund, B., Bederson, B. B., Druin, A., Plaisant, C., & Eiderbäck, B. (2003, April). Technology probes: inspiring design for and with families. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 17-24). ACM.

Inkpen, K., Taylor, B., Junuzovic, S., Tang, J., and Venolia, G., Experiences2Go: Sharing Kids' Activities Outside the Home with Remote Family Members, *Proc. CSCW*, ACM Press (2013).

Jacobs, M., Gaye, L., & Holmquist, L. E. Tejp: ubiquitous computing as expressive means of personalizing public space, *Proc. Ubicomp,* Springer (2003).

Joinson, A., 'Looking at', 'Looking up' or 'Keeping up with' People? Motives and Uses of Facebook, Proceedings of CHI 2008, pp. 1027-1036. (2008)

Kim, Yoojung, Dongyoung Sohn, and Sejung Marina Choi. "Cultural difference in motivations for using social network sites: A comparative study of American and Korean college students." *Computers in Human Behavior* 27.1 (2011): 365-372.

Kim, Junghyun, Robert LaRose, and Wei Peng. "Loneliness as the cause and the effect of problematic Internet use: The relationship between Internet use and psychological well-being." *CyberPsychology & Behavior* 12.4 (2009): 451-455.

Kindberg, T., Spasojevic, M., Fleck, R., and Sellen, A. The Ubiquitous Camera: An In-Depth Study of Camera Phone Use, IEEE Pervasive Computing, 4(2), IEEE Computer Society (2005).

Kuss, Daria J., and Mark D. Griffiths. "Online social networking and addiction—a review of the psychological literature." *International journal of environmental research and public health* 8.9 (2011): 3528-3552.

Lampe, C., Ellison, N., and Steinfield, C., Changes in Use and Perception of Facebook, CSCW 2008 ACM, pp. 721-730.

Leong, Tuck Wah, Frank Vetere, and Steve Howard. "Randomness as a resource for design." *Proceedings of the 6th conference on Designing Interactive systems*. ACM, 2006.

Lo, Vivian. "Pausitive: Designing for digital downtime and reflection in the homespace." Master Thesis. Umeå University, Sweden (2013).

McCarthy, John, and Peter Wright. "Technology as experience." *interactions*11.5 (2004): 42-43.

Mazé, R., & Redström, J. Form and the computational object, *Digital creativity*, *16*(1), (2005), 7-18.

Mendelson, Andrew L., and Zizi Papacharissi. "Look at us: Collective narcissism in college student Facebook photo galleries." *A Networked Self: Identity, Community* (2010).

Miller, A., and Edwards, K. Give and Take: A Study of Consumer Photo-Sharing Culture and Practice, Proc. CHI, ACM Press (2007).

Mota, Sara Pargana. Memory, Selfhood and Sociality in the Age of Networked Photography, *Past, Future and Change: Contemporary Analysis of Evolving Media Scapes: 175*. (2012)

Neustaedter, C., Elliot, K. and Greenberg, S., Interpersonal awareness in the domestic realm. Proc. OzCHI, ACM Press (2006).

Neustaedter, C., & Fedorovskaya, E. Understanding and improving flow in digital photo ecosystems, *Proc. Graphics,* ACM Press (2009), 191-198.

O'Hara, K., Tuffield, M., & Shadbolt, N. Lifelogging: Issues of identity and privacy with memories for life. (2008)

Odom, W., Banks, R., Durrant, A., Kirk, D., & Pierce, J. Slow technology: critical reflection and future directions, *Proc. DIS*, ACM Press, (2012), 816-817.

Odom, W., Selby, M., Sellen, A., Kirk, D., Banks, R., & Regan, T. Photobox: on the design of a slow technology, *Proc. DIS,* ACM Press, (2012), 665-668.

Odom, W, Sellen, A., Banks, R., Kirk, D., Regan, T., Selby, M., Forlizzi, J., and Zimmerman, J. Designing for Slowness, Anticipation and Re-visitation: A Long Term Field Study of the Photobox, *Proc. CHI,* ACM Press (2014).

Pang, C., Neustaedter, C., Riecke, B. E., Oduor E., Hillman, S. Technology Preferences and Routines for Sharing Health Information during the Treatment of a Chronic Illness, Proc. CHI, ACM Press (2013).

Pierce, James, and Eric Paulos. "Some variations on a counterfunctional digital camera." *Proceedings of the 2014 conference on Designing interactive systems*. ACM, 2014.

Panek, Elliot T., Yioryos Nardis, and Sara Konrath. "Mirror or Megaphone?: How relationships between narcissism and social networking site use differ on Facebook and Twitter." *Computers in Human Behavior* 29.5 (2013): 2004-2012.

Procyk, J. and Neustaedter, C., GEMS: The Design and Evaluation of a Location-Based Storytelling Game, Proc. CSCW, ACM Press (2014).

Procyk, J. and Neustaedter, C., GEMS: A Location-Based Game for Supporting Family Storytelling , Proc. CHI, ACM Press (2013).

Romero, N., Markopoulos, P., Baren, J., Ruyter, B., Ijsselsteijn, W. and Farshchian, B. Connecting the family with awareness systems. Personal Ubiquitous Computing, 11 (4), (2007), 299-312.

Sellen, Abigail J., and Steve Whittaker. "Beyond total capture: a constructive critique of lifelogging." *Communications of the ACM* 53.5 (2010): 70-77.

Sengers, P., Boehner, K., David, S., & Kaye, J. J. (2005, August). Reflective design, *Proc. Critical Computing,* ACM Press (2005), 49-58.

Stelmaszewska, H., Fields, B., and Blandford, A. The Role of Time, Place, Value and Relationships in Collocated Photo Sharing with Camera Phones, British Computer Society, (2008).

Stevens, M. M., Abowd, G. D., Truong, K. N., & Vollmer, F. Getting into the Living Memory Box: Family archives & holistic design. *Personal and Ubiquitous Computing*, *7*(3-4), (2003). 210-216

Strauss, A., and Corbin, J., Basics of Qualitative Research, 2nd Edition, Sage Publications (1998). 101-161.

Tee, K., Brush, A.J. and Inkpen, K. Exploring communication and sharing between extended families. International Journal of Human-Computer Studies, 67 (2), (2009), 128-138.

Van Erve, D., Vos, G. W., van den Hoven, E., & Frohlich, D. Cueing the past: designing embodied interaction for everyday remembering. In *Proceedings of the Second Conference on Creativity and Innovation in Design* (pp. 335-345). ACM. (2011)

Van House, N. Collocated photo sharing, story-telling, and the performance of self, Int. J. Human-Computer Studies, 67, Elsevier (2009).

Appendix A.
Recruitment Poster

Do you want to communicate into the future?

Researchers from Simon Fraser University are looking for you to participate in an exciting study about a new time-delayed image and video sharing tool.

To be eligible, you must:

- 19 years of age or older; and
- Not have any major physical (i.e., immobility) or cognitive disabilities (i.e., diagnosis of a mental disability).

We want to understand:

- How you would use such a tool?
    - What kinds of images and video (i.e. themes) do you capture?
    - When are you sending images and video to?
    - Can this tool be used in new and innovative ways?
- Does having the ability to decide "when" to send multimedia messages change the way you communicate?

Your participation:

This study will involve you capturing and sharing multimedia with friends and family over a six-week period, where you will be sending a few messages per week. A short interview will be conducted (in person or via Skype) after the study period. Total time commitment is about ~2 hours. Participants will be entered into a draw to win a $200.00 prize.

If you are interested in participating, please contact: Daniel Hawkins

Appendix B.
Pre Study Survey

Postulater: Sender Pre-Survey

Postulater Pre Study Survey

Thanks for taking the time to complete this short survey. Postulater is an application that allows friends and family to send images and video to each other, to any point in the future. We are interested in understanding your current habits related to sharing images and videos.

Q1 . What is your gender?

- [ ] Male
- [ ] Female

Q2 . What is your age (in years)?

Answer :

Q3 . Do you use a smartphone?

- ◯ Yes
- ◯ No

Q4 . On average, how often do you take photographs or record video?

- ◯ Hourly
- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Less than once a month
- ◯ Never

Q5 . How often do you use any of the following platforms to share photos or video?

	Hourly	Daily	Weekly	Monthly	Less than once a month	Never
Facebook :	○	○	○	○	○	○
Instagram :	○	○	○	○	○	○
Snap Chat :	○	○	○	○	○	○
Twitter :	○	○	○	○	○	○
Flicker :	○	○	○	○	○	○
Email :	○	○	○	○	○	○
Other :	○	○	○	○	○	○

Q6 . Examples of "Other" platforms that you use to share images or video?

Q7 . What kinds of photos and videos do you mostly capture and share?

	Hourly	Daily	Weekly	Monthly	Less than once a month	Never
Status and live updates :	○	○	○	○	○	○
Everyday life :	○	○	○	○	○	○
Memories :	○	○	○	○	○	○
Reminders or Information :	○	○	○	○	○	○
Other (please specify below) :	○	○	○	○	○	○

Q8 . Examples of other activities or things you capture or share?

Q9 . How do you observe photos or videos from your social network?

	Hourly	Daily	Weekly	Monthly	Less than once a month	Never
In person :						
Facebook :						
Instagram :						
Snap Chat :						
Vine :						
Other :						

Q10 . Who do you share your photos and videos with?

	Hourly	Daily	Weekly	Monthly	Less than once a month	Never
Close Family :						
Close Friends :						
All Friends :						
Acquaintances :						

Q11 . What is your Participant Number?

*

Submit

Appendix C.
Sample Interview Questions

i) Background Information

1. Demographics
    a. How old are you?
    b. Male or Female?
    c. Where do you live?

2. Technology
    a. How would you describe your computer skills?
    b. Do you access the Internet frequently?
    c. Do you take pictures or videos frequently? [Daily, weekly, monthy]
    d. Do you own and use a SmartPhone?

3. Capturing images (how do you capture and share images)
    a. Do you use photo and video sharing applications?
        i. Instagram,
        ii. Facebook,
        iii. Flickr,
        iv. Twitter,
        v. Vine
        vi. Other, Specify (scale on amount use) [Daily, Weekly, Monthly]

4. What kinds of photos and videos do you mostly capture and share?
    a. Status and live updates,
    b. Everyday life
    c. Memories,
    d. Reminders

5. Who do you share your photos and videos with?
        i. Friends (close friends, all friends, acquaintances?)
        ii. Family
        iii. Other

6. Do you capture and share videos differently from photos? How so?

7. How do you observe and receive photos and videos?
    a. In person,
    b. Online
        i. Facebook,
        ii. Instagram,
        iii. Tumblr,
        iv. Vine,
        v. Other

ii) Follow Up Questionnaire / Interview (for Sender)

1. Can you describe the images you sent, and why you chose to send them? What led to your decision to "when" to send them? How would you classify what kind message you were sending?
    a. Predictive
    b. Occasion or Date Specific
    c. Memories
    d. Reminder or Practical
    e. Other?

2. Can you tell me about a time when using Postulater was particularly positive
    a. Fun,
    b. Interesting
    c. Useful

3. Can you tell me about your most memorable experience using Postulater?

4. Can you tell me about your favorite experience with Postulater?
    a. Was this experience unique to Postulater?

5. Can you tell me about a time when using Postulater was negative?
    a. Uninteresting,
    b. Tedious,
    c. Other

6. Can you tell me about your least favorite experience with Postulater?
    a. Was this experience unique to Postulater?

7. With who you were you sharing images with (family, close friends, etc.)?
    a. With who were you mostly sharing with? Why?

8. How many messages did you send?
    a. With how many people were you sharing with?
    b. Did you share with some people more than others? Why?

9. Were you sending the same message (e.g. photo) to different people? Would you have? Why?

10. When would you normally send messages (e.g. a particular time of day or place)? And through mobile or desktop?

11. What time frame were you most interested in communicating? Why?
    a. Day
    b. Week
    c. Month
    d. Years
    e. Decades

12. Do the images you shared using Postulater differ from normal pictures you share? How so?

13. Do you think that the time delay will add anything to the message? How so?

14. Did you contact the person after you sent them a Postulater message, before it arrived? For instance warning them that they'd receive a message in the future? If so, can you describe their reaction (e.g. anticipation?)?

15. Did using Postulater change any of your habits or decisions in what images you chose to capture? If so, can you describe a time it did?

16. Can you tell us about a time where you felt using Postulater allowed or forced you to do anything differently? How so?

17. Did using Postulater offer any conveniences or inconveniences?

18. Did you feel the images you sent had more meaning than normal pictures? Do you think the time delay creates more meaning?
    a. Meaning?
    b. Reflection?
    c. Connection?

19. Would you use Postulater in the future?
    a. Why? Why not?
    b. For what purposes?

20. Can you describe any moments or ideas you had when you wanted to use Postulater to send messages, but didn't? And why did you not?

21. Can you imagine other ways how you might use Postulater?

22. Did the fact that you knew your messages would be reviewed effect the kinds of messages you sent? (ie personal or confidential messages?) How so? Would you have acted differently if you knew they would have been private?

23. Did the fact you couldn't "undo" your sent message effect your decision? For example, maybe you were hesitant to send a message because your relationship with that person may change?

24. How did sending messages into the future make you feel? Do you normally spend thinking in the present? Past? Future?

25. What would you change about the Postulater?

Appendix D.
Recipient Survey

Postulater: Recipient Survey

Postulater

Thanks for taking the time to complete this short survey. Postulater is an application that allows friends and family to send images and video to each other, to any point in the future. We are interested in hearing your feedback on your experience with Postulater.

Q1 . What type of relationship do you have with the person who sent you a postulater message?

- ◯ Romantic partner
- ◯ Close friend
- ◯ Friend
- ◯ Immediate family member
- ◯ Extended family member
- ◯ Work colleague
- ◯ Stranger

Q2 . If "Other", please specify below:

Q3 . How do you normally receive images and video from the person who sent you the Postulater? (click any that apply)

- ☐ Text/ SMS
- ☐ Email
- ☐ Social Media (e.g. Facebook, Instagram)
- ☐ Other?

Q4 . Describe the message you received with Postulater

*

Q5 . Had you seen the image/video that you received before now?

- ◯ Yes
- ◯ No

Q6 . Were you aware that the image/video existed before now?

- ◯ Yes
- ◯ No

Q7 . What emotions did the message evoke? How did you feel when you saw the message?

*

Q8 . Did the time delay on the message add any value? If so, what and how?

*

Q9 . What do you think is the best thing about Postulater?

*

Q10 . What do you think is the worst thing about Postulater?

*

Q11 . In what ways do you think you would like to use Postulater to send or receive messages?

*

Submit

Appendix E.

Follow-Up Survey

1. Have you thought about the messages you sent?

2. Are you happy with the sent messages still?

3. Would you change anything in your message?

4. Have you had any reactions from messages that would have arrived since we last talked?

5. What was their reaction?

6. Would you like to receive Postulater messages from others?
What kinds?

7. Why Postulater, and why not other mediums (e.g. Instagram)?