

# A Digital Pen and Paper Email System for Older Adults

Taciana Pontual Falcão, Xiaofeng Yong, Elisabeth Sulmont, Robert Douglas Ferguson, Karyn Moffatt

School of Information Studies, McGill University, 3661 Peel St, Montreal, Canada

{taciana.pontualdarochafalcao; xiaofeng.yong; elisabeth.sulmont;  
robert.douglas.ferguson}@mail.mcgill.ca; karyn.moffatt@mcgill.ca

## ABSTRACT

As communication technologies continue to rapidly evolve, older adults face challenges to access systems and devices, which may increase their social isolation. Our project investigates the design of a digital pen and paper-based communication system that allows users to connect to their family and friends' e-mail inboxes. Given the unique needs of older adults, we opted for a participatory design approach, prototyping the system with 22 older adults through a series of design workshops in two locations. Four individuals used our resulting system over a period of two weeks. Based on their feedback and a review of design workshops, we are currently in the process of refining our interface and preparing for a larger deployment study.

## Author Keywords

Older adults; Participatory design; Communication technologies; Digital pen; Pen and paper interaction.

## ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces: User-Centered Design.

## INTRODUCTION

While younger generations tend to fluidly adapt to ever evolving communication practices, older adults risk becoming socially isolated as rapidly changing technologies outpace their ability to adapt to them, creating barriers to access and potentially leading to loneliness, depression and cognitive decline [1, 4]. Alternative solutions for older adults' communication have emerged from recent research, such as InTouch, a tablet-based application for asynchronous communication through tapping or swiping [2]; and V-Mail, a voice-based email system accessible via traditional phones [3]. Although email is the primary form of online communication for older adults, its use presents challenges related to health, mobility, cost and complexity of the interface (even in the case of simplified interfaces specifically designed for older adults) [3]. With the goal of enabling participation in email communication without the need to interact via a computer or smartphone, we investigate the design of a communication system based on

digital pen and paper technology which evokes the emotional character of handwritten letters, valued by many older adults [6].

In light of the known difficulties of trying to envisage and integrate older adults' unique needs and capabilities into new systems [9], and the growing evidence that involving older adults in design may result in more relevant solutions for them [8], we opted for a participatory design approach. In this paper, we present an initial design based on findings from our participatory design with older adults, feedback from a limited deployment of an initial prototype of this design, and suggestions for refining the design based on this process.

## METHOD

Participatory design sessions were undertaken with two groups of older adults in Ottawa, Canada, and facilitated by two researchers who were also part of the design team. The first group was recruited from a day center within the Chinese community and consisted of 19 older adults (14 female, aged 66–91, mean=73). 84% of them (16 out of 19) used a smartphone or tablet and were frequent users of the WeChat instant messaging application (which is currently very popular in China). The second group, recruited from a residential facility, consisted of 3 older adults (2 female, aged 85–87;). One was a frequent e-mail user, while the other two had little familiarity with modern technologies and relied on phone calls for communication.

Five weekly sessions were conducted with each group. The initial session consisted of an overview of the purpose of the study, followed by a semistructured interview with each older adult about their current communication practices and challenges and experiences with communication technologies. Subsequent sessions consisted of brainstorming ideas for potential prototypes of a communication system based on an initial workflow of writing a message with a Livescribe digital pen [7], having it automatically sent to a recipient's e-mail (through wifi), and receiving replies through a wifi connected printer. Sessions also included design critiquing activities to help participants to reflect on the strengths and weaknesses of digital pen technology and to help familiarize them with the design process. Participants worked within this general framework to develop a more comprehensive interface, tackling design challenges such as how to specify recipients, indicate when a message is complete and ready to send, and what to do if a mistake ('typo') is made.

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In the next section, we present the main ideas that emerged from our process, starting with the design workshops of the first group and a limited deployment of an initial prototype with a subset of that group. We then present the outcomes of the second round of workshops, focusing on differences in their preferences and designs.

### DESIGN IDEAS FROM WORKSHOPS

Participants in the first group focused primarily on the challenge of specifying recipients within a paper-based system. Ultimately, they decided that as their number of contacts was small (10 or less), their preferred method would be to assign each recipient a predefined number akin to the speed-dial buttons on an older phone. Contacts would be stored on the server and managed by a family member or caregiver. Numbered checkboxes printed on each page would be used to indicate the recipient or recipients. To minimize the chance of errors, participants suggested the checkboxes should be repeated at the top and bottom of the page, and messages only sent if the two sets matched.

Participants also focused on the ability to correct mistakes, wanting to retain this feature from electronic communication. Acknowledging the permanence of ink on paper, they offered as a reasonable compromise the ability to mark erroneous text (by circling or underlining), and having that text expunged from the digital version sent, such that there would remain some evidence of a correction (via the blank space) but without the ability for the recipient to see exactly what error was made. This group also prioritized the ability to pause and resume writing, noting that many older adults fatigue easily and need to take breaks. Thus, they designed a send button, in the form of a checkbox at the bottom of each page. Finally, participants designed their system to automatically add additional information to their messages, including the sender's name, the date, the current weather conditions (for the sender at the time of writing), and the sender's personal health (although they did not discuss how this information would be collected or what exactly should be shared).

From the first round of workshops, we developed a working prototype and invited participants from the first group to test it for a two-week period (4 agreed). This prototype was mostly true to what had been envisioned in the sessions; however, due to technical and time limitations, the features of blanking-out errors and automatically attaching weather and personal health information were not implemented. Participants were generally enthusiastic about the system and the realization of their design, but usage of the system was nonetheless infrequent (e.g., 2-5 times for the period of study). On follow-up, it became apparent that while participants liked the idea of paper-email as an alternative approach, they generally found their existing methods of communication (e.g., WeChat) more efficient.

The relatively low use of our system during deployment suggested that further refinement of the interface was needed and that the approach would, perhaps, be better

sued to a slightly different demographic of older adults (e.g., one with less experience with technology). Thus, we pursued an additional round of design workshops with a group from a residential facility; these participants had less technical experience and more assistive needs. The design ideas from the first round of workshops were integrated to the discussion with the second group of older adults.

In general, the second group found the participatory design process much more difficult given their limited computer experience. In terms of concrete design suggestions, participants in this group strongly rejected the notion of assigning recipients numbers, preferring a design based on inputting the recipient's name, and felt that it would be better to have a physical button integrated into the pen for sending, stressing also the need for some form of confirmation that the message was sent (e.g. using a light on the pen to indicate sending, sent, and error states).

Other feature suggestions were more abstract. For example, participants desired an automatic system spell check and "eraser mode", echoing the first group's desire for error correction but without the same attention to the limits of paper seen in the design from the first group. The second group also desired support for attaching pictures to messages and/or taking and attaching photos with the pen, "saving" drafts, and password protection (while acknowledging they would likely forget them). While these ideas did not directly translate to a concrete interface design, they nonetheless shed light on the participants' values, priorities, and concerns for a paper-based email interface.

### EVOLVING DESIGN AND NEXT STEPS

The design ideas offered by participants reflected a certain difficulty dissociating their mindset from graphical digital interfaces, challenging us, as designers, to conciliate their expectations with the constraints (and benefits!) of a paper interface. In this sense, we are now examining alternative technologies that could be integrated into our system to realize some of the participants' priorities. For instance, as participants suggested the use of lights for providing feedback, Illumipaper [5], which builds on paper-based electronics and thin-film displays to seamlessly integrate illuminated elements to standard paper, could be an interesting avenue for exploration. An embedded camera could also be added for taking and sending pictures, as interest in sharing images came up frequently in the discussions. An effective way of correcting mistakes is still under investigation.

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## REFERENCES

1. Adams, K. B., Leibbrandt, S., Moon, H. A critical review of the literature on social and leisure activity and wellbeing in later life. *Ageing & Society* 31 (2011), 683–712.
2. Baecker, R., Sellen, K., Crosskey, S., Boscart, V., Neves, B. B. Technology to Reduce Social Isolation and Loneliness. In *Proc. ASSETS'14*, ACM Press (2014), 27 – 34.
3. Brewer, R. Garcia, R. C., Schwaba, D. G., Piper, A. M. Exploring Traditional Phones as an E-Mail Interface for Older Adults. *ACM Trans. on Accessible Computing* 8, 2 (2016).
4. Cloutier-Fisher, D., Kobayashi, K., Smith, A. The subjective dimension of social isolation: A qualitative investigation of older adults' experiences in small social support networks. *J. of Ageing Studies* 25, 4 (2011), 407-414.
5. Klamka, K., Dachselt, R. IllumiPaper: Illuminated Interactive Paper. In *Proc. CHI '17*, ACM Press (2017), 5605–5618.
6. Lindley, S., Harper, R., Sellen, A. Desiring to be in touch in a changing communications landscape: attitudes of older adults. In *Proc. CHI'09*, ACM Press (2009), 1693 - 1702.
7. Livescribe wifi smartpen basics. [http://www.livescribe.com/en-ca/media/pdf/sky\\_wifi\\_smartpen\\_basics\\_guide.pdf](http://www.livescribe.com/en-ca/media/pdf/sky_wifi_smartpen_basics_guide.pdf)
8. Newell, A., Arnott, J., Carmichael, A., Morgan, M. Methodologies for Involving Older Adults in the Design Process. In *Proc. UAHCI 2007* (2007).
9. Sixsmith, A., Gutman, G. (Eds.) *Technologies for Active Aging*. International perspectives on aging, volume 9. Springer, New York, NY, USA (2013).