Proxy Accounts and Behavioural Nudges: Investigating Support for Older Adults and their Financial Delegates

Zach Havens* Celine Latulipe†

University of Manitoba
Winnipeg, Manitoba, Canada

Abstract

Older adults sometimes delegate banking tasks to trusted close others (family or friends). Increasingly those tasks are completed online, with older adults sharing passwords or account ownership to give delegates account access, which introduces privacy, security and financial misconduct risks. We propose that proxy accounts can support financial delegation while preserving older adults' agency and that behavioral nudges can help delegates maintain financial propriety while performing banking tasks. We developed a high-fidelity proxy account prototype that uses behavioural nudges, and present findings from a think-aloud interaction study (n=21). We present results from the first empirical study of proxy accounts in the delegated banking context. Our results show: 1) positive responses to the fiduciary controls provided by proxy accounts, 2) that some nudges may have the potential to encourage propriety, and 3) that both mechanisms improve the delegate's experience of banking on behalf of an older adult, while legitimizing their role as delegate.

Index Terms: H.5.2 [User Interfaces]: User Interfaces—Graphical user interfaces (GUI);

1 Introduction

One critical activity of daily living is managing finances, which includes tasks such as paying bills, monitoring balances, and transferring money between accounts. While many older adults independently manage these tasks, some older adults desire occasional or regular assistance with such tasks for a variety of reasons [22]. We borrow the term *close other* from occupational therapy to describe someone who provides support to an older adult [13], whether informally as a family member or friend, or formally as a paid caregiver. We use the term *delegate* to refer to a close other who performs banking or financial transactions *on behalf of an older adult*, which differs from helping an older adult to use an online banking system themselves [22]. When delegation occurs, the older adult may not be present to witness transactions taking place and the delegate typically has increased autonomy and access to the older adults' accounts. Our previous work showed that the assistance older adults need with financial tasks varies along a spectrum from not needing assistance at all, to needing occasional or regular assistance, to a lack of financial decision making capacity where financial matters typically fall to a guardian or power of attorney [22]. Many researchers have noted that there is a need for the development of financial technologies that recognize the nuances of older adult support needs along this spectrum [48; 11; 22]. While there are benefits to older adults receiving assistance with banking tasks from a family member or friend, an older adult having someone else conduct financial tasks on their behalf can introduce a variety of privacy [15; 12] and security concerns [22; 44; 34; 36; 9]. Despite these risks, the vast majority of delegates are providing extremely valuable support that helps older adults to age in place [43].

Proxy accounts are a mechanism in which a trusted individual is provided access to another person's accounts through distinct, personalized login credentials [23]. This provides three potential benefits. First, actions performed in the accounts are attributable to either the main account holder or one of their proxies, enabling better detection of inappropriate use. Second, the main account holder does not need to share their own credentials with the proxy, which helps protect the security of the main account holder. Third, proxy accounts can be set up with limitations on what can be done/seen by the proxy which can provide control and privacy protection for the main account holder. In the banking context, a proxy account could be set up by an older adult in a way that allows a close other to log in with their own credentials and only have the ability to pay bills and monitor balances.

Providing a close other with a proxy bank account can provide benefits but still entails some risk given that the close other has at least some access to the older adult's financial assets. One potential method that could be used to discourage financial misconduct is to deploy behavioural

*e-mail:zach.havens@umanitoba.ca
†e-mail:celine.latulipe@umanitoba.ca

nudges [29] within the online banking interface to encourage delegates to act with financial propriety. However, such nudges also have the potential to harm the trust relationship between the older adult and their delegates. Thus, there is a need to investigate how such nudges are experienced and perceived. To explore this, we conducted a study in which participants engaged in delegated banking tasks using a high-fidelity online banking prototype that enabled them to experience proxy banking and behavioural nudges. Our participants included both older adults and people who provide financial task support to older adults in the Canadian banking context. We present the prototype we developed and the results of this investigation, along with a discussion of the potential role that proxy accounts and behavioural nudges could play in supporting older adults with financial tasks. This paper makes the following contributions: first, we present a prototype of an online banking interface designed to support proxy accounts with behavioural nudge elements aimed at promoting financial propriety of delegates; second, we present the first empirical evidence demonstrating that both older adults and close others see great benefit in the use of proxy accounts for delegated banking; and third, we present evidence that some behavioural nudges have the potential to support financial propriety of delegates.

2 Related Work

2.1 Banking Technologies and Older Adults

Banking tasks are listed as a component of Lawton's Instrumental Activities of Daily Living scale [24]. The exact portion of older adults engaged in *online banking* worldwide is unknown, but a recent Italian survey showed 79% of adults aged 60+ used the internet for banking [33], while a pre-pandemic 2019 study in Canada showed 42% of adults aged 55+ used online banking [32].

Management of finances becomes more difficult as older adults age [2; 25]. These difficulties, combined with limited comfort with technology [14], can lead older adults to seek help from close others with the use of banking technologies [30; 22]. Data from a 2018 Statistics Canada survey shows that 38% of caregiver respondents reported helping older adults with banking tasks [5]. This assistance is a valuable component of informal care work [3; 30] that can enabling aging in place [43].

2.2 Banking Access for Close Others

Close others serving as financial delegates are making greater use of online banking: it is geographically convenient when the delegate does not live close to the older adult and temporally convenient when delegates cannot easily get to a bank during business hours [22]. Banking information is highly sensitive and contextually specific, which increases the privacy concerns older adults may consider [39; 37] when granting account access to close others [15; 16]. Previous work has shown that technologies sometimes acknowledge older adults' desire for privacy while simultaneously assuming that they do not actually need it [27; 28]. When delegating financial tasks, older adults may share account credentials with close others [22] because the benefits outweigh perceived risks.

There are other possible mechanisms that financial institutions could offer to support older adults delegating banking tasks to close others. One-Time Passwords (OTPs) are generated passwords that are only valid once, and allow a delegate access to an account for a single session [31]. Proxy accounts allow an older adult to give a delegate limited access and permissions through a separate set of credentials [11]. Joint accounts (which may also support separate credentials) are distinct from proxy accounts in that joint accounts entail equal authority and ownership over accounts by both parties [50]. This is not typically appropriate except in cases where the close other is the spouse. In a proxy setup, the primary user maintains full authority and ownership of the assets, and can limit a delegate's access with fine-grained controls. Power of Attorney (PoA) is a legal framework that may be used to justify delegate access. Banks in Canada provide 'trustee accounts' to delegates who have invoked a PoA, but this removes account control from the older adult entirely.

2.3 Financial Risk and Routine Activity Theory

When older adults delegate banking tasks to close others, it can expose them to a risk of misconduct by the close other [41]. While the vast majority of close others are well-intentioned and maintain financial propriety, statistics show that financial abuse by caregivers is a real problem, with at least 6.8% of older adults globally having experienced financial abuse [51]. It is important to differentiate financial misconduct from fraud: fraud is committed by individuals unknown to the victim, whereas misconduct is perpetrated by known and trusted individuals [9]. Financial misconduct occurs on a spectrum ranging from minor financial improprieties to serious financial abuse. Prior research shows that older adults tend to *over-estimate* the risk of fraud perpetrated by strangers and *under-estimate* the risk of financial abuse perpetrated by close others [34]. Given the sensitive and personal nature of financial abuse, and the fact that older adults may be dependent on the perpetrator for various types of care, it is likely that financial abuse goes under-reported [20].

Routine Activity Theory (RAT) posits that many criminal trends are born from non-malicious behaviour that an individual partakes in frequently [44]. The theory has been applied to describe the origin of financial and cyber crimes [42]. Setterlund et al. have proposed RAT as an explanation for the connection between financial misconduct and informal care [44]. They explain that routine access to an older adult's bank account could provide the repeated ease of access that might lead to close

others engaging in initially minor financial improprieties. Close others might self-rationalize these improprieties as compensation for their care burden, and/or as familial entitlements. Over time, and if not detected, these improprieties could devolve into more serious and serial forms of financial abuse. The authors suggest that the participation of a "guardian" providing oversight and monitoring of the close other's behaviour can mitigate this abuse [44].

2.4 Behavioural Nudges

Behavioural nudges [46] have been used in digital interfaces across many domains [49; 47]. The principle of behavioural nudges is to manipulate a user's decision-making context by changing the value proposition of certain actions to influence their choices without limiting their options or removing agency [29]. Caraban et al. have investigated the similarities in psychological heuristics that nudges leverage and grouped nudges into 6 higher level categories: facilitation, confrontation, deception, social influence, fear, and reinforcement [6]. They also placed the nudges along two different axes: one indicating how transparent the nudge mechanism was to the user, and another that specified whether the nudge engaged the user's reflective versus automatic thinking [6].

Research into the efficacy of behavioural nudges has identified some important overall design considerations. For example, there is evidence that nudges that attempt to dissuade individuals from specific behaviour have more impact when presented to the person *before* they exhibit the behaviour, such as in dissuading smoking [18]. This is of particular relevance in delegated online banking as it suggests that nudges related to financial impropriety will be more effective at preventing small *initial* acts of misconduct by delegates as opposed to stopping an existing pattern of financial abuse, an idea supported by Routine Activity Theory [44].

Some researchers consider the use of behavioural nudges to be *completely inappropriate and unethical* given that nudges inherently attempt to manipulate the choices of the user. In contrast, Thaler claims that nudges are ethical in that they are unavoidable (as designers are *always* influencing behaviour whether they are doing so intentionally or not) and in that they do not actually constrain behaviour but rather provide guidance [46]. Hansen and Jespersen discuss both of these positions, concluding that the ethics of a nudge are nuanced and a nudge is more ethical when it is transparent and/or targets reflective (as opposed to automatic) thought [17].

2.5 The Good Carer

Research on the attitudes and behaviours of informal caregivers has led to the introduction of the 'good carer' concept, which has been used in interview-based studies as a lens to help understand the motivations for caregiver responses [4], or to help guide study methodology [19]. The 'good carer' describes the tendencies of informal caregivers to position themselves as ethically virtuous, even in the face of conflicting motivations [35]. Caregivers in these studies gave performative narratives to emphasize their virtuous position, and were reticent to share any negative emotions regarding the care they provided.

3 Research Questions & Prototype

Prior work illuminates the challenges that older adults and their close others face which have motivated us to investigate the combination of proxy accounts and behavioural nudges. Proxy accounts may enable privacy, security and control for older adults while supporting their delegates. Behavioural nudges may help well-intentioned delegates to maintain financial propriety. Thus, our research questions in investigating these mechanisms are:

RQ 1: How do older adults and close others experience the proxy account as a mechanism for close others to provide banking support to older adults?

RQ 2: How do older adults and close others experience behavioural nudges to promote financial propriety?

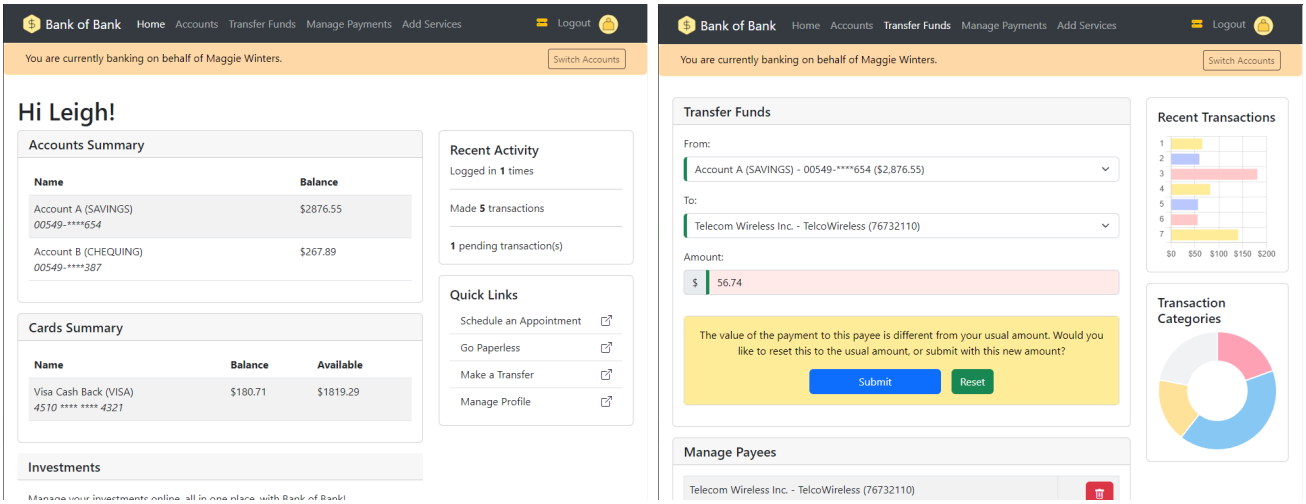
In order to gather detailed feedback about the use of proxy accounts and behavioural nudges in banking, we determined that it was appropriate to create an interactive, high-fidelity prototype. The prototype assumed the person logging in was a delegate doing banking on behalf of an older adult, with both the proxy account and relevant control settings were already in place. The high-fidelity interaction was designed to allow participants to experience the interface in a more natural way and 'stumble upon' the nudges, while the system logged their interactions. The interface was intentionally designed to look similar to Canadian bank interfaces, leveraging elements from many of them, and using language and terminology consistent with existing solutions (see Figure 1).

3.1 Nudge Selection

Our prototype included 11 nudges leveraging a variety of mechanisms. The following considerations related to the delegated banking context guided our design process:

Targeted Banking Tasks: We determined that almost all banking tasks can be subtly influenced in the appropriate context. Nudges were spread out across tasks to avoid over-exposing close others [45].

Appropriate Nudge Categories: To support close others and promote financial propriety *without causing harm to the relationship*, we avoided nudge mechanisms that leverage negative psychological effects even if they could potentially deter misconduct.



(a) Home Screen

(b) Transfer Screen

Figure 1: Screenshots of the prototype. The banner below the navigation bar highlights that the user is logged in as a delegate.

Message Tone: We wanted to explicitly take a supportive position towards close others, so the tone of messages in the nudges was positive and supportive in order to avoid alienating close others.

We intentionally chose to omit nudges we considered inappropriate in a context where the close others are likely to be trusted by the older adults. These included any mechanisms Caraban et al. categorized as leveraging deception-based or fear-based psychological effects [6]. We also chose to omit nudges that target users' 'automatic mind' in a non-transparent way, as we agree with Hansen and Jesperson that these types of nudges are akin to deceit [17]. We prioritized nudges leveraging mechanisms such as raising visibility, creating friction, or public commitment. The banner at the top of the prototype, reminding the proxy that they are banking on behalf of an older adult, is an example of a transparent nudge targeting the proxy's 'reflective mind' (see Figure 1).

4 Study Methodology

The purpose of this study was to gather feedback from relevant parties about the use of proxy accounts and behavioral nudges in delegated online banking contexts. During study sessions we sought to understand the caregiving dynamics participants were involved in, gave participants an opportunity to interact with a high-fidelity prototype featuring a proxy account with behavioural nudge design elements, and discussed the participants' experiences with the prototype. The study was approved by the University of Manitoba's Ethics Review Board.

4.1 Recruitment

Participants were required to currently use online banking services in Canada. We recruited using posters posted on the University of Manitoba campus and throughout Winnipeg, along with mailing lists for gerontological research communities, university alumni, and credit union associations. For this study we aimed to gather feedback and insights from the following groups:

Close Others: Adults (18+) who already perform online banking tasks on behalf of an older adult (65+).

Older Adults: Older adults (65+) who currently use online banking, with or without delegated assistance.

Banking Professionals: Adults who work in client-facing roles in a Canadian financial institution.

Older adults are intended to be the beneficiaries of our designs, though not necessarily the direct users. Including older adults in our study, whether or not they delegate any banking tasks, allowed us to ask them how they would feel if banks used nudges to influence the behaviour of a current or future delegate. We recruited 21 participants; each was given an ID based on age group and status as close others. Of the 21 participants, 4 were *close others* who provided banking support to older adults (CO1-4), 6 were *older adults* who were not currently receiving any assistance with banking tasks (OA1-6), and 10 were *older adults who also held the role of being a close other*

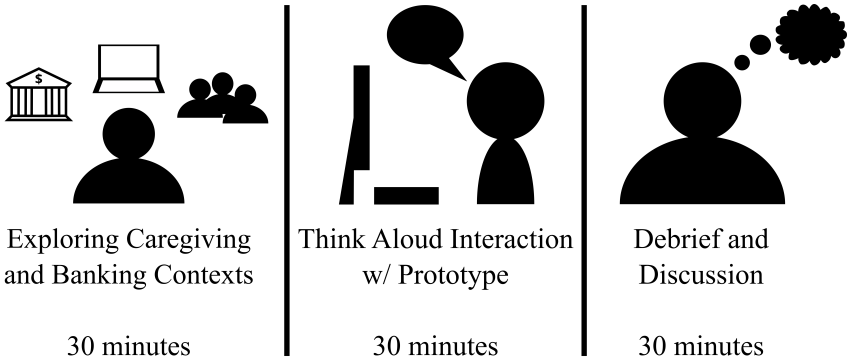


Figure 2: An outline of the study session structure.

providing banking support to other older adults (OC1-10). We had one banking professional (BP1).

Though eligible, we did not have any older adult participants who currently delegate banking tasks to a close other. We expect that some older adults who delegate banking tasks may do so *because* they are not comfortable using online banking systems. Our study eligibility required familiarity with online banking to ensure participants would be comfortable working with our online prototype. We hoped some of the older adult participants we recruited would report that they occasionally delegated banking tasks to close others, but all of our older adult participants were very independent, quite tech savvy, and did not require any delegated assistance.

4.2 Session Structure

Participants took part in a single audio-recorded session lasting from 60 to 90 minutes, during which they were guided through 3 distinct phases (as illustrated in Figure 2): a pre-interaction interview, a think-aloud interaction with the high-fidelity prototype, and a post-interaction interview and debrief. Compensation for taking part was $30 delivered to the participant directly via e-transfer or donated to one of 5 pre-selected charities on their behalf. Participants could attend via Zoom or in-person on our campus.

4.2.1 Phase 1: Pre-Interaction Interview

The first phase of the session was an open-ended interview. The goal was to gain insight into the participant's context related to banking support for older adults. We did not steer discussion towards issues of financial misconduct during this interview in order to prevent priming effects. Close other participants were asked questions about how they gained access to the accounts of the older adult they support, the kinds of tasks they performed, and how they felt about providing this support. Older adult participants were asked about their current use of online banking, how much they delegate banking tasks currently, and any plans for delegating banking tasks in the future. The banking professional was asked questions related to the kinds of support dynamics they see in their professional capacity.

4.2.2 Phase 2: Think-Aloud Interaction

Participants were asked to think out loud while completing a set of common banking tasks using our prototype, which included internal and e-transfers, bill payments, and payee management. All participants were asked to perform these tasks from the perspective of a close other acting on behalf of an older adult, accessing the assets via a proxy account set up for them by the older adult they support. Participants were told to assume that the proxy account (including limits on what they could see or do) had already been set up by the older adult they were supporting. Participants were not made aware of the presence of the behavioural nudges in the design, in order to avoid priming effects and ensure unbiased responses.

4.2.3 Phase 3: Semi-Structured Interview

Participants shared their experiences using the prototype during a semi-structured interview. Participants were asked to identify things they noticed that seemed specifically directed at them in their capacity as a proxy for an older adult. Then they were debriefed about the presence and intent of the behavioral nudges designed to encourage financial propriety (see Appendix A for debriefing script). Once debriefed, participants were asked questions about specific nudges encountered during their interaction. Discussions branched into the ethical appropriateness of the nudges, their potential efficacy at deterring financial misconduct as described by RAT, and how participants would feel if nudges were used in their own contexts.

4.3 Data Collection and Analysis

The primary data sources for the study were the audio recordings of the sessions, manually transcribed by the

first author. Log entries from the prototype were inserted into the transcripts to provide additional context.

Responses to questions asked during the initial open-interview phase were analyzed independently of the topics explored during and after interaction with the prototype. A lightweight content analysis [21] was performed on responses to questions given to multiple participants, and the results were used to provide a broad understanding of our participant pool. Additionally, all of the responses from a single participant were used to build an understanding of each of their informal caregiving contexts that was in turn used to help characterize later responses.

We employed content analysis for the think-aloud interaction and semi-structured post-interaction interview data. Each participant's response to a question was quoted in a large table and, where applicable, was given a high-level tag characterizing the attitude of their response (such as "positive", "skeptical", or "disliked"). The responses were examined by both researchers for commonality of responses and for notable outliers, taking the participant's contexts and attitudes from the pre-interaction interview into account. From this we derived the prevailing attitude of our participant pool as well as the extreme perspectives. Our justification for this approach was to allow ourselves to provide an indication of the attitudes towards both proxy accounts and behavioural nudges that may be common within our participants' demographics while also highlighting the varied perspectives that should be taken into account.

5 Results

To present the results, we first describe the online banking support contexts of our participants and concerns they expressed related to financial abuse. We then describe their experiences with and perceptions of the proxy accounts and behavioural nudges, and their thoughts on how such mechanisms would work in their own contexts.

5.1 Online Banking Support Contexts

During initial discussion about their banking habits and/or support contexts, participants who assisted older adults were asked questions related to their methods of accessing the assets of the older adult they support, what kinds of tasks they performed, and how they managed the workload of providing banking assistance. When discussing access mechanisms, none of our participants reported using proxy accounts. Two of the 14 participants used the password set up by the older adult they help, while in five cases, they themselves set up the online banking credentials under the persona of the older adult (with their permission). In these cases, the banks were not aware that the close other was "impersonating" the older adult to set up the online banking access. OC7 opted to stay out from under the bank's eye by handling all communications through their aunt's email:

> What I do is I *am* [aunt], and that's the easiest way for me. I have her email, I do everything. I don't want stuff about her coming through my email, so it's as if she's doing the banking herself. I mean that's what it seems like [to the bank], but it's me. - OC7

For some close others whose banks were aware of them as a close other, admonishment by the banks about password sharing made them feel uncomfortable, but it was still most convenient. CO2, who provided banking assistance to their mother-in-law who is in her late 90s and lives alone on the other side of the country, explains:

> Yes, I have to lie to them. We went in... My wife and I got set up [to assist mother-in-law]... Anyway, the bank allows me to do financial things for them, but they don't let me use the internet. I can use the telephone, but they don't trust the internet. - CO2

This participant went on to explain the effort they expend switching mobile sim cards in order to impersonate their mother-in-law to complete her banking tasks online:

> Except for now, they've got this two step verification using my cellphone number, but because I'm in the States for 3 months I got a new cell phone, we took out my old SIM card ... so I'm gonna have to pull out the new SIM card, put in the old SIM card to get my verification and that's *fine*, I get it, it just slows things down a little. - CO2

This participant explained that careful attention was required to ensure legitimate transactions they made on behalf of their mother-in-law *appeared* legitimate:

> ... I wanna go out of my way to avoid the appearance that anybody might think I am [taking advantage of mother-in-law], which is why I put my wife's email on there, because it says [wife's last name, same as mother-in-law's last name]. You know, just little things that we're trying to do, that I'm maybe overly sensitive of, but am definitely sensitive of. - CO2

Seven of the 14 participants who act as close others provided banking help using *joint accounts*, an access mechanism that is more acceptable to, and supported by, the banks. Some of these were created under an invocation of a Power of Attorney, while others were set up in collaboration with the older adult. Four of these participants explained that joint accounts also make handling of estates easier in the event of the older adult's passing.

Only one participant (CO1) indicated that they preferred to help the older adult they support by directing

them through the process (in-person or over the phone) of how to do the transactions in the online banking system, without having any way of directly accessing the older adult's accounts. CO1 highlighted that they saw this as a way of fostering their mother's independence:

> I want her to hold it, and I want her to be able to do it so she has the confidence later, so if she's not pushing the buttons herself she's not, uh, learning any of the technology and she's not equipped to work with it later. - CO1

Despite some hurdles, banking on behalf of an older adult was not considered too much of a burden. Most of the older adults being assisted by study participants had simplified financial situations and automated bill payments. Once an access mechanism was established, the close others reported the workload to be low: typically less than 1 hour of time spent on such tasks each week.

The majority of our older adult participants planned to rely on their adult children for banking task assistance in the event their abilities decline. The four that did not have children were unsure about how they would get help with financial tasks in the future. Most mentioned spouses or more distant relatives, but they did so with much less confidence in those hypothetical arrangements due to perceptions of ability (close others also being older adults) and/or levels of trust (for more distant relations). Only one participant said that they would consider delegating banking tasks to a professional caregiver in the future.

5.2 Concerns About Financial Misconduct

Both pre- and post-debrief, multiple participants shared personal stories and fears about financial abuse or misconduct perpetrated by people close to older adults, demonstrating that this is an issue our participants cared about. For example, OC6, an older adult who provides banking support to their parent, shared information about ongoing financial abuse of a different older adult relative:

> You know I'm really worried about people who steal from older adults. That's a problem. I don't steal from mine, I never did, but I have a cousin who would help herself to her mother's money, and I think that's wrong, but obviously there's no regulation for that ... I mean my cousin is not an evil person but she, you know, her mother [unknowingly] helped finance her house, which is not nice. ... When her mother eventually passes away, that estate is going to be a whole lot less. - OC6

When asked about how they expected to be supported when they aged, one close other participant mentioned fears of financial misconduct happening to them:

> This is more problematic, because I don't have children. And, although I have nieces and nephews, who knows where they will be at the time I need that assistance? So in fact, that is a bit of a concern for me, you know. ... I'm very grateful that banks, if they see a big cheque go through, they'll call you, because I think elderly people, especially those with cognitive impairment, are horribly vulnerable to, um, mistakes by caregivers or worse! - OC4

Our banking professional said concerns around financial abuse is something that is salient in their job:

> I've seen a situation where there was an older member who has, I believe, a couple of kids on their account, it wasn't just one. And there was a situation where funds were being transferred through online banking, right? One of them had access to their online banking just because they were joint. So, there was a situation like that where funds were being e-transferred and the member wasn't aware of that, the elderly member. And it caused a big problem... - BP1

5.2.1 Support for Routine Activity Theory

A high-level description of Routine Activity Theory was given as part of the deception debrief in the post-interaction interview. Some participants did not offer specific responses to the theory, but four participants indicated that they saw it as a potentially valid explanation for how financial abuse happens. For example, OA2 thought it could be an explanation, but expressed dismay about it:

> Well I think the potential is there for sure. But I... wouldn't sleep at night if I did that. - OA2

Two participants indicated that they did not see the possibility of escalation. Specifically, OC6 did not see the correlation between routine access to accounts and emerging financial misconduct, but rather felt that misconduct was always fully intentional and malicious.

In the pre-interaction interview, OC4 shared an anecdote that aligned with RAT's explanation for how close others might end up committing financial misconduct, due to caregiving burden and sense of entitlement:

> You know I've heard horror stories where families get, they take this on initially but as time goes on they get tired and resentful and start paying themselves. And, uh.. You know I had a friend who's family member who had power of attorney wrote himself a cheque for $25,000. It was a big hassle in the family to get him, his power of attorney revoked. Thank goodness somebody else was checking! - OC4

5.3 Perceptions of Proxy Accounts

Participants were unanimously positive about the idea of using proxy accounts, volunteering thoughts about this throughout the study. Participants noted potential legal or logistical aspects to consider, but felt that if banks offered them, proxy accounts would be helpful to close others and older adults. OC1 noted that the proxy settings provide agency and control to the older adult, giving them some control over the potential actions of the close other:

> I do like the proxy options, and the permissions, you know the gradient of permissions that a person can authorize. So I think that that has a lot of potential. - OC1

One notable benefit identified was the legitimacy that proxy accounts could provide to close others. For example C02, who banks for his mother-in-law, explained:

> I think the whole concept of a surrogate account is great, because I feel, guilty but annoyed that my bank...is making me do this *nefarious route* of pretending to be her. - CO2

The banking professional also saw value in this:

> ...our institution or other institutions could adapt something like this where they have a proxy system. ... this is something that would work... there are a lot of situations where our elderly members don't want to use online banking but, you know, their caretakers do and it makes it easier for everyone, so I think that this is something that's important. - BP1

5.3.1 Multiple Proxies

Attitudes towards supporting and encouraging multiple proxies were quite positive. Perceived benefits ranged from being able to share banking assistance workload across multiple close others to the possibility of enabling pure oversight roles. Oversight could be beneficial in some cases, such as the situation described by OC6:

> And maybe for, like I said, for this cousin of mine who's helping herself [to her mother's money] and her siblings have no idea and will have no idea, unless they really want to go through every . . . sheet of... finance ... - OC6

In this case, it is possible the cousin in question might not have embezzled money from her mother if she and her siblings all had proxy accounts and could see what each other were doing in the mother's account. OA5 suggested that having multiple proxies could help with accountability explicitly, stating:

> ...that's important when there's maybe more than one child involved in doing things for the parent. You know, like the second person can see what is happening? But sometimes, in the family, sometimes you have one who'll take advantage and one who will not. - OA5

Helping to coordinate and share the load was also seen as a benefit of setting up multiple proxies by multiple participants. When asked about whether having multiple proxies could be beneficial, OC9 saw benefits, noting:

> Like she [sister] would say to me: "you know mum took out all of this money. Do you know what she bought this month, like on her credit card?" ... so I'd say "sure, I can look", but I'd have been just as fine with her looking herself, you know? - OC9

OC5 commented on the importance of taking breaks:

> ...because [adding another proxy] might have, in some instances, allowed me to step back. Like when I went away for a week, it would allow somebody to take over and do something.

In considering the idea of multiple proxies, older adults did want assurances that the proxies would not be able to add additional proxies without the express consent of the older adult. For example, OA3 expressed this concern:

> Now would that be something that legally could be done in a situation like this? Like if I was a proxy to somebody, I would've thought that I would have to jump through all kinds of hoops to become that proxy, and I can't just go and willy-nilly add anybody at all. - OA3

The only negative comments made about enabling multiple proxies were related to the possibility of confusion or duplication of effort. OC7 described this possibility:

> I guess two people could step on each other's toes. Like each person thinking "oh I've got to pay the plumber" and they both go and do it. - OC7

5.4 Perceptions about Behavioural Nudges

In the following sections we summarize responses to the nudges that garnered the most reaction from participants during their interactions with the prototype. Not all participants saw every nudge; some nudges simply existed in the interface and may not have been encountered depending on how much the participant explored the interface, while other nudges were part of the study task interaction flows. A table showing participant nudge exposure can be found in Appendix B.

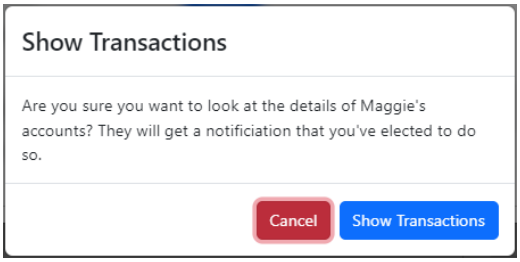


Figure 3: Show Hidden Transactions Confirmation Nudge

5.4.1 Hidden Transactions

OC9 had mentioned in the pre-interaction interview that they had concerns about seeing transactions they were not supposed to. As it happens, one of the first nudges that many participants encountered was the nudge that caused transactions to be hidden by default. When participants looked at the details of an account, the list of transactions was blurred out, and a button indicated that they could click it to show the transactions. When clicked, a confirmation box popped up, indicating that the older adult would be notified if they continued (see Figure 3).

Attitudes towards this nudge were lukewarm. While a few participants appreciated it conceptually, most found it unnecessary. Twelve of the 14 participants that encountered the nudge clicked "Show Transactions" and confirmed without any additional consideration. One participant initially cancelled, but returned and opted to show the transactions the second time. Only one participant made strong positive statements about this nudge:

> Oh, I see, oh that's good... She will see that I'm snooping around in her account, that's good! I *like* that... - CO2

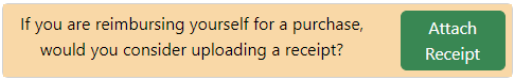


Figure 4: Uploading Receipt Nudge

5.4.2 Uploading Receipts

One nudge prompted participants to upload a receipt for a transfer reimbursing themselves for groceries (see Figure 4). This nudge was regarded positively, with 7 of 8 participants finding value in this. Participants saw this as a way of providing additional accountability and transparency for their banking tasks:

> ...then I'm leaving a paper trail, or at least an information trail, of what's happening. Which is a good idea in those situations. - OA4

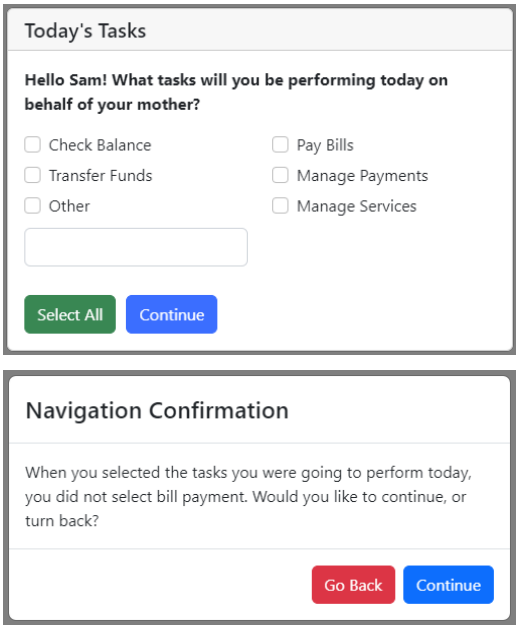


Figure 5: Task Selection and Navigation Nudges

CO4 was initially uncomfortable uploading receipts, worried about providing the banks with too much detailed spending information, but was okay uploading non-itemized receipts:

> ... because if we're using this bank and their credit card and all that, then they already have that information... and if they're just trying to confirm that, it seems alright. -C04

On the other hand, OC6 did not like this nudge at all as they were concerned by the possibility that close others would feel obligated to upload receipts, causing additional burden when performing tasks.

5.4.3 Task Selection

Nudges related to task selection and navigation confirmation were perceived at best as unnecessary and at worst as extremely annoying. Upon their first login, participants were asked to select and submit the types of tasks they would be performing during that session. If they later attempted to navigate to a page that was not related to the selected tasks, they were asked to confirm their navigation or return to the previous page (see Figure 5). Participants did not see enough value in these nudges to justify the annoyance of having to interact with them.

5.4.4 Transaction and Payee Notifications

Certain nudges indicated that a notification would be sent to the older adult, such as in response to a large transac-

tion being completed or a new payee being added (see Figure 6). All participants who discussed these notifications were in favour of their inclusion as they felt that they improved transparency. For example, OC5 commented:

> Adding a new payee and somebody would need to check? I think that's *very* useful because, especially if somebody else is helping you with your banking, you don't really want them to add more payees out of your account. So that's actually probably good that it would come back to the owner of the account. - OC5

The banking professional had a similar view:

> I think adding that feature... some way to notify the member when something's going on with their account, I think that's really important. Because that member, the one in my situation, they had no clue until they came to the bank and I told her... So I think transparency with the member and what's going on with whoever's taking care of their accounts, that's extremely important... - BP1

Many participants had concerns about notification delivery given that not all older adults use online banking, cell phones, or other digital tools that would be the communication channel for such notifications. Participants suggested sending the notifications through the mail or to other proxies, if applicable, to ensure they are received and reviewed by a trusted and capable individual.

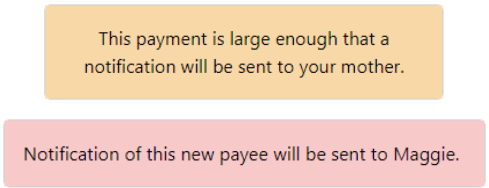


Figure 6: Notification Nudges: large payment above, new payee below. These would appear above "Submit" buttons.

5.4.5 Reminding of Consequences

Nudges that highlighted the prevalence of financial abuse of older adults (Figure 7) were somewhat well-regarded, with 6 of 11 participants who discussed these nudges expressing positive reactions. Participants appreciated the reminder of risks. This was the only passive informational nudge in our design that did not mention the older adult's name (as the "banking on behalf of" banner does). It was also the only nudge that participants thought might be ignored after repeated exposures.

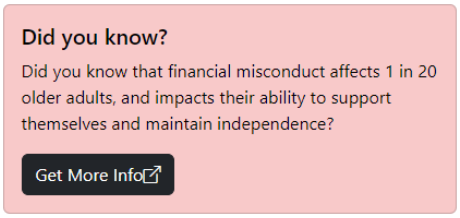


Figure 7: Reminding of Consequences

In summary, reaction to nudges was mixed. Participants were generally in favour of nudges that provided transparency, tracking of information, and notifications to the older adult, but were less positive about nudges that were seen as 'just extra clicks' with no repercussions.

5.5 Perceptions of Nudge Ethics & Efficacy

Participants were asked various questions about their thoughts on the use of behavioural nudges overall.

5.5.1 Ethics of Nudging

All participants considered our application of behavioural nudges in this context to be ethical. This was primarily due to the perceived vulnerability of older adults and our stated intent of protecting older adults' privacy and financial security. CO1 stated this plainly:

> Well, in a case like this it's ethical. You know, I guess, you know, you need to use the ethics lens before you start guiding or manipulating behaviour, but as long as it has the best interest of the client in mind, both the client and the user, yes, I think it's very appropriate. - CO1

When asked directly if nudging was appropriate, OA1 noted that it might be bothersome to some people, but they would consider it okay:

> It depends on the character of the person. If I was doing this... I wouldn't care and I would just click this and say that's just the way it's set up and that's the way you've gotta go. If it was somebody who was thinking, was worried about people watching what they're doing, then they might get a little annoyed. - OA1

5.5.2 Perceived Efficacy of Nudges

When asked about the potential efficacy of RAT-guided nudges at deterring financial misconduct, participants were split. Participants who were considering initially altruistic close others believed that the nudges would help keep them more accountable, and diligent. In response to being debriefed on the nudges, C02 said this about the concept of encouraging financial propriety:

> No, I thought that was great! I thought the idea of reminding people of good practices, was, was good! - CO2

Participants who considered any close others engaging in financial misconduct as having inherently malicious intentions were skeptical of the efficacy of nudges in deterring acts of misconduct, believing such proxies would ignore all nudges. Those participants saw greater effectiveness in the limits and controls enabled by proxy accounts. OA4 shared this view:

> I don't think there's any way to have something like this that's impervious to malicious... If somebody's out there to really take advantage of the person ... And I can't think off the top of my head how to manage that except, you know, putting limits on things. - OA4

OC6, who was aware of actual misconduct, mentioned the notification nudges as potentially effective:

> So you're trying to set up deterrents for people who help themselves? I don't know how you would do that ... You discourage them? You let them know you're keeping track? - OC6

5.5.3 Attitudes Towards Use in Personal Case

Most of our older adult participants noted that they fully trusted the people they expected to delegate banking tasks to in the future. When asked how they would feel about the nudges used in our study being presented to their future delegates, only OC6 expressed a concern, noting the nudges gave an impression of being watched:

> ...you know, being the caregiver of a senior is a lot, so the last thing you want is somebody breathing [down your neck] and asking questions about what you're doing. - OC6

The rest of the older adult participants were positive about nudges being used in their personal case. C03 was positive, stating:

> Yeah, it's necessary and it's beneficial in the sense that it actually reminds you that you're not the owner of the bank account, and its trying to guide you with your conduct of how you use the bank account. - CO3

In summary, participants found the use of nudges in this context to be ethical and were generally okay with those nudges being used in their own personal cases, with a few exceptions. However, our participants were mixed in their perceptions about whether the nudges would actually be effective at preventing financial misconduct.

6 Discussion

Our older adult participants helped us understand concerns from the perspective of those who may delegate banking tasks in the future, while our close other participants provided valuable context about their experiences serving as financial delegates. The stories shared by close others were particularly poignant. These participants may have been comfortable sharing these stories because they align with their own 'good carer' personal narratives [35]. We provide our interpretation of the findings, highlighting security postures, issues around legitimacy for close others, and participants' perceptions about the value of proxy accounts and behavioural nudges.

6.1 Security Posture and Concerns

The feelings of trust our participants had in their informal care relationships defined their security postures and their attitudes towards financial misconduct. The only participants who discussed concerns about misconduct perpetrated by a close other were those who had personal or second-hand experiences with it. Participants that had not experienced or heard about misconduct affecting someone they knew were either dismissive of the possibility of such misconduct, or were significantly more concerned about fraud perpetrated by unknown parties. These results align with research that shows people are likely to underestimate risks of financial misconduct by family members or other people close to them [34].

Our older adult participants were comfortable with the possibility of sharing their credentials in order to delegate banking tasks, reinforcing previous findings [22]. This illustrates a potential gap in our participants' knowledge about digital security: none of them spoke of any concerns about what might happen if they lost control of their passwords, likely because they had such high levels of trust in their potential future delegates. Given that password reuse across different systems is common [1; 8], the scope of access to their personal information granted by a single password may be much greater than our participants realize.

Given the trust most older adults have in their close others, our results suggest that security and privacy features in online banking interfaces should be incorporated in a way that makes them beneficial to both older adults and their delegates. For example, encouraging delegates to attach receipts for transactions not just as a method of validation or accountability, but also for easy reference. Similarly, a banking interface that encourages a logged in delegate to add a second delegate can both serve to enable oversight *and* share the financial task workload.

6.2 Challenges of Legitimacy for Close Others

Our results uncover serious challenges around legitimacy of close others supporting older adults with financial tasks.

There are clear benefits to the practice of sharing passwords for financial accounts that cause older adults and close others to leverage this practice. However, this causes additional friction because this access mechanism violates bank policies. Five of our close other participants had to impersonate the older adult they support in order to set up online banking accounts that they used to conduct banking on behalf of the older adult, which demonstrates a clear need for legitimate access mechanisms. Close others should not need to feel like criminals while supporting older adults with banking tasks. Close other participants spoke of these issues with bafflement and discomfort as they highlighted several ways that they would attempt to more accurately impersonate an older adult they supported in order to complete banking tasks and avoid the disapproving eye of the financial institutions. This negatively impacts close others, making them feel like they are acting inappropriately even while they are performing a valuable service and acting as 'good carers' [35].

6.3 The Value of Proxy Accounts

Our prototype enabled participants to experience using proxy accounts to access an older adult's bank account and provide banking assistance, instead of logging in using the older adult's password. Our participants were in favour of this access mechanism because it would eliminate close others' needs to impersonate an older adult for the sake of convenient access, enabling the close other to feel supported and acknowledged by the financial institution. The ability of the older adult to set limits on transactions was perceived to provide some level of control over the extent of damage that could be caused by a malicious actor (either an ill-intentioned close other, or an unknown criminal stealing the close other's credentials).

Proxy accounts would also allow the older adult to set up multiple close others as proxies. This was seen as positive by our participants and could help older adults remain independent and age in place [43]. This expands on results showing that older adult spouses examining bank transactions together helps create a shared understanding and added sense of security [26], and from Setterlund et al. who claim that the presence of 'guardians' can help deter financial misconduct by an informal caregiver arising from routine activities [44]. Additionally, some close other participants noted that having multiple delegates would allow sharing of the workload and flexibility in how and when they provide assistance, which could help to lessen the overall caregiving burden [3; 7; 40].

The implementation of proxy accounts would potentially require a non-trivial effort from financial institutions. This effort would be worthwhile, given the increasing use of online banking [10], the aging population [38], and the recognition that proxy accounts could be useful in informal care dynamics for older adults as suggested by Dunphy et al.[11], and supported by our results.

While adding more proxy accounts to support additional delegates does cause a slightly increased attack surface by virtue of creating more login credentials that can be lost or misappropriated, careful configuration of the associated accounts would greatly mitigate the impact of such events by ensuring that malicious actors can be easily detected through logging and notification controls and have limited ability to manipulate assets through restricted permissions.

Ultimately, proxy accounts would give older adults *more* control over their financial affairs as the current choice is very binary: do all the banking themselves, or give a close other unilateral access to their assets through joint accounts or shared passwords.

6.4 Nudging as a Support Mechanism

The behavioural nudges that we included allowed us to successfully gather a wide-ranging set of perspectives that effectively highlights some of the pros, cons, and considerations about their use within the context of delegated online banking. Given that the primary concerns of participants were related to fraud instead of misconduct, the strict limits enabled by proxy accounts were perceived as more likely to minimize financial damage in the case that an untrusted individual managed to gain access to the account. By comparison, the idea of mitigating misconduct via subtle suggestion was not considered as effective. The lukewarm opinions expressed by our participants in hypothesizing about the potential efficacy of nudges at deterring financial misconduct is unsurprising given the high level of trust our participants had in their relationships. Participants also raised concerns of over-burdening close others with more interactions and repeated exposure, potentially reducing the nudges' effectiveness, which is a known issue with behavioural nudging [45].

Despite these concerns, the nudges were still seen to have merit. The nudges' utility, from our participants' perspectives, was in encouraging and supporting visibility and communication within the support dynamic and reminding the close others of their fiduciary responsibilities. For both older adults and close others alike, the ability to have greater awareness of the actions performed by a close other could increase the sense of security and trust between them. Nudges may also help support the close other's 'good carer' self-image by providing visible evidence of both diligence and accuracy. Using nudges to remind users that the information is being automatically shared, or to encourage them to volunteer more information, elicited positive responses from our participants for these reasons. Given that participants had no ethical concerns, including nudges in interfaces could have a positive impact on both the users' experiences and their caregiving dynamics, so long as any burden they place on the close others is carefully balanced. Further investigation is needed to determine whether such nudges would actually

be effective at deterring financial misconduct.

7 Limitations

Our older adult participant pool were mostly recruited from university alumni mailing lists, so they may be more educated than the average older adult, skewing our results. We have not gathered insights from two other groups: older adults who currently receive online banking assistance but don't use online banking, and close others who are known to have committed financial misconduct. Gathering insights from these groups would require quite different methodologies. With only one banking professional participant, we were unable to provide any generalization about banking professionals' perceptions of proxy accounts and behavioral nudges. This work was conducted in a Canadian context and the research team identifies with Western cultures of both informal caregiving relationships and financial management and privacy. Thus, we note that proxy accounts and nudges could be perceived differently in other cultural contexts.

8 Conclusions & Future Work

In this paper we have presented a high fidelity prototype that supports delegated banking for older adults through the use of proxy accounts and behavioural nudges aimed at helping close others maintain financial propriety. We have presented results from a study that investigated how older adults and close others experienced proxy accounts and behavioural nudges in the context of delegated banking. While previous work suggested that proxy accounts would likely be suitable for contexts in which older adults want to delegate banking tasks to close others [11; 22], ours is the first study to empirically examine the experience and effectiveness of proxy accounts for close others and older adults.

Our results show that the use of proxy accounts is perceived as highly positive by older adults and close others, enabling close others to feel legitimized in their role as delegates and enabling them to show accountability for their actions. They also provide older adults with visibility of, and control over, what their delegates are seeing and doing in their bank accounts. We show that behavioural nudges may also help support close others in their role as financial delegates. While our participants were not fully convinced that the nudges would be effective deterrents against financial misconduct, the nudges were mostly viewed as neutral or helpful, with only a few participants feeling the nudges would be problematically annoying. Thus, we conclude that behavioural nudges show promise and are worth considering in this context, and should be further investigated with longitudinal real-world deployments to gauge their effectiveness at preventing financial misconduct. With regard to proxy accounts, further work is needed to investigate how to enhance the functionality and control, and how to enable older adults to set up and monitor the accounts, even if they are not comfortable with online banking themselves. Additionally, participatory design with banking experts would help ensure that proxy accounts are designed in a way that satisfies regulatory frameworks and financial institution cultures.

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References

[1] Aiswarya, J. Raveendran, and V. Banahatti. Behavioral attributes in password reuse: Analysis of password practices in work and personal spaces. In *Proceedings of the 13th Indian Conference on Human-Computer Interaction*, pp. 1–19, 2022.

[2] N. Bleijenberg, A. K. Smith, S. J. Lee, I. S. Cenzer, J. W. Boscardin, and K. E. Covinsky. Difficulty managing medications and finances in older adults: A 10-year cohort study. *Journal of the American Geriatrics Society*, 65(7):1455–1461, 2017.

[3] L. B. J. Bosch and M. Kanis. Design opportunities for supporting informal caregivers. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, pp. 2790–2797, 2016.

[4] G. Boyle. The moral resilience of young people who care. *Ethics and Social Welfare*, 14:266–281, 7 2020. doi: 10.1080/17496535.2020.1771606

[5] S. Canada. General social survey - caregiving and care receiving (gss): Detailed information for 2018 (cycle 32), January 2020.

[6] A. Caraban, E. Karapanos, D. Gonçalves, and P. Campos. 23 ways to nudge: A review of technology-mediated nudging in human-computer interaction. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, CHI '19, p. 1–15. Association for Computing Machinery, New York, NY, USA, 2019. doi: 10.1145/3290605.3300733

[7] Y. Chen, V. Ngo, and S. Y. Park. Caring for caregivers: Designing for integrality. In *Proceedings of CSCW '13*, pp. 91–102. ACM, New York, NY, USA, 2013.

[8] A. Das, J. Bonneau, M. Caesar, N. Borisov, and X. Wang. The tangled web of password reuse. In *NDSS Symposium*, p. 23–26. Internet Society, San Diego, CA, 2014.

[9] M. DeLiema. Elder fraud and financial exploitation: Application of routine activity theory. *The Gerontologist*, 58(4):706–718, 2018. Significantly more fraud victims were childless compared with financial exploitation victims. Fraud perpetrators took advantage of elders when they had no trustworthy friends or relatives to safeguard their assets.

[10] A. Demirgüç-Kunt, L. Klapper, D. Singer, and S. Ansar. *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. The World Bank, Washington, DC, 6 2022. doi: 10.1596/978-1-4648-1897-4

[11] P. Dunphy, A. Monk, J. Vines, M. Blythe, and P. Olivier. Designing for spontaneous and secure delegation in digital payments. *Interacting with Computers*, 26(5):417–432, 2014.

[12] J. Ellefsen and W. Chen. Privacy and data security in everyday online services for older adults. In *Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-Exclusion*, DSAI '22, p. 203–207. Association for Computing Machinery, New York, NY, USA, 2023. doi: 10.1145/3563137.3563149

[13] L. L. Engel, D. E. Beaton, R. E. Green, and D. R. Dawson. Financial management activity process: Qualitative inquiry of adults with acquired brain injury. *Canadian Journal of Occupational Therapy*, 86(3):196–208, 2019.

[14] A. Frik, J. Bernd, N. Alomar, and S. Egelman. A qualitative model of older adults' contextual decision-making about information sharing. In *Workshop on the Economics of Information Security (WEIS 2020)*, pp. 1–62. Workshop on the Economics of Information Security, Brussels, Belgium, 2020.

[15] A. Frik, L. Nurgalieva, J. Bernd, J. S. Lee, F. Schaub, and S. Egelman. Privacy and security threat models and mitigation strategies of older adults. In *Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security*, SOUPS'19, pp. 21–40. USENIX Association, Berkeley, CA, USA, 2019.

[16] R. Ghaiumy Anaraky, K. A. Byrne, P. J. Wisniewski, X. Page, and B. Knijnenburg. To disclose or not to disclose: Examining the privacy decision-making processes of older vs. younger adults. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, CHI '21. Association for Computing Machinery, New York, NY, USA, 2021. doi: 10.1145/3411764.3445204

[17] P. G. Hansen and A. M. Jespersen. Nudge and the manipulation of choice: A framework for the responsible use of the nudge approach to behaviour change in public policy. *European Journal of Risk Regulation*, 4:3–28, 3 2013. doi: 10.1017/s1867299x00002762

[18] M. Harbach, M. Hettig, S. Weber, and M. Smith. Using personal examples to improve risk communication for security &; privacy decisions. In *Proceedings of the SIGCHI Conference on Human Factors*

in Computing Systems, CHI '14, p. 2647–2656. Association for Computing Machinery, New York, NY, USA, 2014. doi: 10.1145/2556288.2556978

[19] B. Horrell, C. Stephens, and M. Breheny. Capability to care: Supporting the health of informal caregivers for older people. *Health Psychology*, 34:339–348, 4 2015. doi: 10.1037/hea0000144

[20] B. G. Knight, S. Kim, S. Rastegar, S. Jones, V. Jump, and S. Wong. Influences on the perception of elder financial abuse among older adults in southern california. *International Psychogeriatrics*, 28:163–169, 1 2016. doi: 10.1017/S1041610215000587

[21] K. Krippendorff. *Content analysis: An introduction to its methodology*. Sage publications, 2018.

[22] C. Latulipe, R. Dsouza, and M. Cumbers. Unofficial proxies: How close others help older adults with banking. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*, CHI '22. Association for Computing Machinery, New York, NY, USA, 2022. doi: 10.1145/3491102.3501845

[23] C. Latulipe, S. F. Mazumder, R. K. Wilson, J. W. Talton, A. G. Bertoni, S. A. Quandt, T. A. Arcury, and D. P. Miller. Security and privacy risks associated with adult patient portal accounts in us hospitals. *JAMA Internal Medicine*, 180(6):845–849, 2020.

[24] M. P. Lawton and E. M. Brody. Assessment of older people: self-maintaining and instrumental activities of daily living. *The gerontologist*, 9(3_Part_1):179–186, 1969.

[25] S. Maqbool and C. Munteanu. Understanding older adults' long-term financial practices: Challenges and opportunities for design. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, CHI EA '18, pp. LBW546:1–LBW546:6. ACM, New York, NY, USA, 2018. doi: 10.1145/3170427.3188677

[26] N. Mcdonald and H. M. Mentis. "citizens too": Safety setting collaboration among older adults with memory concerns. *ACM Trans. Comput.-Hum. Interact.*, 28(5), Aug. 2021. doi: 10.1145/3465217

[27] A. McNeill, P. Briggs, J. Pywell, and L. Coventry. Functional privacy concerns of older adults about pervasive health-monitoring systems. In *Proceedings of the 10th International Conference on PErvasive Technologies Related to Assistive Environments*, PETRA '17, pp. 96–102. ACM, New York, NY, USA, 2017. doi: 10.1145/3056540.3056559

[28] A. R. McNeill, L. Coventry, J. Pywell, and P. Briggs. Privacy considerations when designing social network systems to support successful ageing. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, CHI '17, pp. 6425–6437. ACM, New York, NY, USA, 2017. doi: 10.1145/3025453.3025861

[29] T. Mirsch, C. Lehrer, and R. Jung. Digital nudging: Altering user behavior in digital environments. In *Proceedings der 13. Internationalen Tagung Wirtschaftsinformatik (WI 2017)*, vol. 13, pp. 634–648, 2 2017.

[30] S. Murthy, K. S. Bhat, S. Das, and N. Kumar. Individually vulnerable, collectively safe: The security and privacy practices of households with older adults. *Proceedings of the ACM on Human-Computer Interaction*, 5(CSCW1):1–24, 2021.

[31] T. Nishide. One-time delegation of unlinkable signing rights and its application. In *Provable and Practical Security: 14th International Conference, ProvSec 2020, Singapore, November 29–December 1, 2020, Proceedings 14*, pp. 103–123. Springer, 2020.

[32] F. C. A. of Canada. Survey on banking of canadians. Final Report POR 114-18, Financial Consumer Agency of Canada, 2019.

[33] E. Pantelaki, E. Maggi, and D. Crotti. Who is online? a latent class analysis of internet activities and determinant characteristics of older people. *Computers in Human Behavior*, 147:107830, 2023. doi: 10.1016/j.chb.2023.107830

[34] J. C. Peterson, D. P. Burnes, P. L. Caccamise, A. Mason, C. R. Henderson, M. T. Wells, J. Berman, A. M. Cook, D. Shukoff, P. Brownell, et al. Financial exploitation of older adults: a population-based prevalence study. *Journal of general internal medicine*, 29(12):1615–1623, 2014.

[35] S. Pickard. The 'good carer': Moral practices in late modernity. *Sociology*, 44:471–487, 2010. doi: 10.1177/0038038510362482

[36] I. Polyak. Preventing elder fraud. *Journal of Accountancy*, 226(2):14–14, 2018.

[37] A. Quan-Haase and D. Ho. Online privacy concerns and privacy protection strategies among older adults in east york, canada. *Journal of the Association for Information Science and Technology*, 71(9):1089–1102, 2020.

[38] P. Raina, C. Wolfson, S. Kirkland, L. E. Griffith, C. Balion, B. Cossette, I. Dionne, S. Hofer, D. Hogan, E. Van Den Heuvel, et al. Cohort profile: the canadian longitudinal study on aging (clsa). *International journal of epidemiology*, 48(6):1752–1753j, 2019.

[39] H. Ray, F. Wolf, R. Kuber, and A. J. Aviv. "woe is me": Examining older adults' perceptions of privacy. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, CHI EA '19, pp. LBW2611:1–LBW2611:6. ACM, New York, NY, USA, 2019. doi: 10.1145/3290607.3312770

[40] S. C. Reinhard, L. F. Feinberg, R. Choula, and A. Houser. Valuing the invaluable: 2015 update. *Insight on the Issues*, 104:89–98, 2015.

[41] J. Rentezelas and L. Santucci. Combining forces to combat elder financial victimization how consumers can avoid the financial pitfalls of cognitive aging and what they should be asking their financial institutions. *FRB of Philadelphia Payment Cards Center Discussion Paper*, 18-2:1–21, 2018.

[42] B. W. Reyns. Online routines and identity theft victimization: Further expanding routine activity theory beyond direct-contact offenses. *Journal of Research in Crime and Delinquency*, 50:216–238, 5 2013. doi: 10.1177/0022427811425539

[43] D. Sacks, D. Das, R. Romanick, M. Caron, C. Morano, and M. C. Fahs. The value of daily money management: An analysis of outcomes and costs. *Journal of Evidence-Based Social Work*, 9(5):498–511, 2012. PMID: 23092378. doi: 10.1080/15433714.2011.581530

[44] D. Setterlund, C. Tilse, J. Wilson, A.-L. McCawley, and L. Rosenman. Understanding financial elder abuse in families: the potential of routine activities theory. *Ageing and Society*, 27(4):599–614, 2007. doi: 10.1017/S0144686X07006009

[45] C. R. Sunstein. Nudges that fail. *Behavioural Public Policy*, 1:4–25, 5 2017. doi: 10.1017/bpp.2016.3

[46] R. H. Thaler. *Nudge : improving decisions about health, wealth, and happiness*. Yale University Press, New Haven, 2008.

[47] J. Turland, L. Coventry, D. Jeske, P. Briggs, and A. van Moorsel. Nudging towards security: Developing an application for wireless network selection for android phones. In *Proceedings of the 2015 British HCI Conference*, British HCI '15, p. 193–201. Association for Computing Machinery, New York, NY, USA, 2015. doi: 10.1145/2783446.2783588

[48] J. Vines, M. Blythe, S. Lindsay, P. Dunphy, A. Monk, and P. Olivier. Questionable concepts: Critique as resource for designing with eighty somethings. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '12, p. 1169–1178. Association for Computing Machinery, New York, NY, USA, 2012. doi: 10.1145/2207676.2208567

[49] S. Wang, K. Bolling, W. Mao, J. Reichstadt, D. Jeste, H.-C. Kim, and C. Nebeker. Technology to support aging in place: Older adults' perspectives. *Healthcare*, 7(2):60, Apr 2019. doi: 10.3390/healthcare7020060

[50] D. Wiseman. Joint bank account trusts and the protection of older adults from financial abuse: Exploring equity's preference for beneficiary-direction over beneficiary-protection. *Can. J. Comp. & Contemp. L.*, 2:679, 2016.

[51] Y. Yon, C. R. Mikton, Z. D. Gassoumis, and K. H. Wilber. Elder abuse prevalence in community settings: a systematic review and meta-analysis. *The Lancet Global Health*, 5:e147–e156, 2 2017. doi: 10.1016/S2214-109X(17)30006-2

A Participant Debriefing Script

To be read to the participant verbatim when appropriate during the interview. In the event that the participant wishes to withdraw at any point after they have begun interacting with the prototype, this should also be read to them before ending the session to ensure that all deception is disclosed.

> The interface that you just interacted with has some specific design elements that are added to support informal caregivers that you may or may not have noticed. Examples of these elements included the pop-ups, confirmation questions, and information panels. These are all examples of a class of elements called "behavioural nudges". Our specific goal with these nudges is to encourage continued financial propriety by caregivers who may use online banking interfaces like this on behalf of older adults they are helping. There are many studies that show that financial misconduct against older adults does occur and theorize that it often stems from mundane, routine behaviour, rather than from specific malicious intent. The nudges that we included are intended to be supportive of caregivers and discouraging financial misconduct. We are not presenting them because we suspect you of any misconduct yourself, but are interested in understanding how the presence of these nudges makes you feel and how useful you think they may be in discouraging misconduct by those who may be susceptible to it.

B Nudge Exposure Table

Table 1: The nudges presented to each participant by the prototype as they performed the tasks during the interaction phase. E = Exposed, NE = Not Exposed

PID	Add Close Other	Task Selection	Navigation Confirmation	Behalf Of Banner	Show Transactions Button	Show Transactions Prompt	Colored Amount Field	Unusual Amount Prompt	Automatically Set Balance	Add Receipt Prompt	Financial Misconduct Info	Large Amount Notification	Adding Payee Notification
CO1	E	NE	NE	E	E	E	E	E	E	E	E	E	E
OA1	E	NE	NE	E	E	NE	E	E	E	E	E	E	E
CO3	NE	NE	NE	E	NE	NE	E	NE	E	E	E	NE	NE
OC1	E	NE	NE	E	NE	NE	E	E	E	E	E	E	E
CO2	E	E	NE	E	E	E	E	NE	E	E	E	E	E
OC2	E	E	E	E	E	E	E	E	E	E	E	E	E
OC3	E	E	NE	E	E	E	E	E	E	E	E	E	E
OA3	E	E	NE	E	E	NE	E	NE	E	E	E	E	E
OC4	E	E	E	E	NE	NE	E	E	E	E	E	E	E
OC7	E	E	E	E	NE	NE	E	E	E	E	E	E	E
CO4	E	E	NE	E	E	E	E	E	E	E	E	E	E
OC6	E	E	E	E	E	E	E	E	E	E	E	E	E
OC5	E	E	E	E	E	E	E	E	E	E	E	E	E
OC10	E	E	NE	E	E	E	E	E	E	NE	E	E	E
OC8	E	E	NE	E	E	E	E	E	NE	E	E	E	E
OA2	E	E	E	E	E	E	E	E	NE	NE	E	E	E
OA5	E	E	NE	E	E	E	E	E	E	E	E	E	E
OA4	E	E	NE	E	NE	NE	E	E	E	E	E	E	E
OA6	E	E	NE	E	E	E	E	E	E	E	E	NE	E
OC9	E	E	E	E	NE	NE	E	E	E	E	E	E	E
BP1	E	E	E	E	NE	NE	E	E	E	E	E	E	E