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Introduction

There have been dramatic changes in the banking industry in recent decades. Automated Teller Machines (ATMs) have superseded human tellers for many banking tasks. Many users prefer ATMs to human tellers, but ATMs can sometimes be slow since they enforce a simple, linear use flow. For users who want to complete many transactions, this means spending several minutes at an ATM. Whether they have a long line behind them, in front of them, or are simply alone late at night, time spent at an ATM is something most users would rather avoid. Online banking (OLB) has made it possible to do many kinds of transactions at home, avoiding this problem, but users must still go to an ATM if they wish to withdraw physical cash or deposit cash or cheques.

Our system proposes a new macro transaction feature that allows users to shift more of their banking time from ATMs to online banking. Users can pre-define sets of multiple transactions from a flexible web-based interface. These become available at the ATM and require only authentication and confirmation rather than a long string of sequential operations. This cuts down on undesirable ATM interaction time considerably, improving user experience. Furthermore, our system will potentially increase ATM throughput, reducing wait times in ATM queues and perhaps reducing the number of ATM machines that banks must deploy. In particular, this work presents the third phase of our project design. Previous phases are included in this portfolio as well to show the progression of our work.

In this work, we study the feedback from the user evaluation on the low-fidelity prototype implemented on the previous phase of the project, and identify the major concerns and issues expressed by the participants. Based on their input, we design a medium-fidelity prototype and carry out a user evaluation. This report presents the redesign rationale, evaluation protocol, evaluation results and future work.

As we are designing a banking system that can be used to perform a number of standard transactions, we must take a wide variety of users into account. Most of these users want their banking systems to be simple and intuitive. It is safest to design for a novice rather than an expert user, although advanced functions can be beneficial if they do not overly complicate the system. We should also keep in mind the fact that most potential users have an existing mental model of how various banking operations work based on current ATM interfaces.

For the purposes of this project we are assuming that we would be unencumbered by most technological concerns. Our system is designed to be deployed on a new generation of ATM which will be standardized, will have flexible and fast connections to back-end databases, and will have new features such as high-resolution touch screen displays and biometric identification. For the OLB piece of our project we are assuming that our system will run on a standard home computer with a standard web browser and internet connection. Identical or similar web applications could be accessed through web-enabled devices such as cellular phones, but dealing with small screen displays and other compatibility issues is out of scope for this project.
Redesign Rationale
We received a considerable amount of feedback from the evaluation of our low-fidelity prototype. We carefully studied this feedback in order to determine what the most significant problems with our system's user interface were. Within this problem set, we considered which problems were genuine deficiencies in the design and which were simply consequences of limitations of our paper prototype. Many subjects were confused about "total" fields in the early prototype, for example, which is unsurprising since they were not given visual cues (e.g. Deposit total updated when a new cheque is added) that would exist in a more dynamic system. Of the issues that arose during evaluation of the low-fidelity prototype, the following are major concerns that we believe merited the most attention in the redesign of our medium-fidelity prototype:

1) Deposit Screen

Users had trouble understanding the deposit screen of the low-fidelity prototype. This screen is the first thing the user sees and is a critical part of our system. The following are specific concerns related to the deposit screen:

• We allowed users to choose destinations for their deposits. Normally these destinations would be bank accounts (chequing, savings), but in our system we also gave users the option of paying a bill directly with a deposit or of effectively withdrawing cash by selecting "cash" as a destination. This was highly confusing to them. As a result, the medium-fidelity prototype only lists bank accounts as possible deposit destinations.
• The low-fidelity prototype allowed users to divert a chosen amount of a deposit to one destination and then divert the remainder elsewhere. This was confusing and has been removed.

2) Account Balances

Users generally wanted to see their current account balances. Our medium fidelity prototype includes account balances on the withdrawal screen as well as in the summary.

3) Recurring Transactions

One user expressed a desire to perform a pre-defined set of transactions on a regular basis rather than just once. This is similar to the "Fast Cash" option available on some ATMs, although our system would allow for a wider variety of operations. This has been included in the medium fidelity prototype. Users can select whether they want the current ATM reservation to appear once or if they would like it to be available every time they visit an ATM.

4) Operate in Dollars Only

Some operations in the low fidelity prototype allowed users to work in terms of
percentage of deposit amounts or account balances. Users understood how this worked but felt that it was unnecessary. As a result, giving values in terms of percentages is no longer an option.

In addition to making these changes, we generally attempted to make the design of our medium-fidelity prototype as simple as possible. In some cases, dynamic features were also added that would have been unwieldy in the paper prototype. For example, we hide fields relating to ATM transaction expiry date and time unless the user indicates that they wish to set them. The overall design of our medium fidelity prototype allowed us to present the users with fewer fields while giving them more visual feedback and allowing them to accomplish the same set of tasks.
Evaluation
The evaluation of our medium-fidelity prototype focused on gathering qualitative usability data. We were particularly interested in information about the changes we have made since our initial paper prototype, including the persistent summary, the option for recurring transactions, and the simplified deposit screen.

Protocols
Each participant completed a series of five tasks with our prototype as well as pre- and post-questionnaire.

Pre-questionnaire
The pre-questionnaire contained basic demographic information and two questions about banking needs and ATM usage. The goal is to be able to correlate this information to each participant’s performance with and attitude about our interface to detect trends and discover problems that arise within a specific population segment.

Tasks
While ATM-Reserve can be used for any kind of ATM transaction, its benefit becomes most apparent in complex tasks that involve distribution of deposits to multiple accounts (now handled through transfers) or withdrawals from multiple accounts with the need for specific bill denominations. With this in mind, we developed two main categories of tasks: withdrawal-based tasks and transfer-based tasks. For each of these categories, we created one task which presented the user with only the end goals (the “goals only” task), and one which gave step by step instructions for how to accomplish the task (the “tutorial” task). The task order was varied for the participants so that we could examine whether having completed the “tutorial” task influences successful completion of the “goals only” task. Additionally, there was one task to create a simple recurring transaction in order to test the visibility and obviousness of that feature.
Table 1: User Evaluation Tasks

<table>
<thead>
<tr>
<th>“Tutorial” Transfer Based Task</th>
<th>“Goals Only” Transfer Based Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In the deposit tab</td>
<td>• Deposit your cash and cheques</td>
</tr>
<tr>
<td>• Deposit all cheques to your savings account</td>
<td>• You want the money to be split up as follows</td>
</tr>
<tr>
<td>• (you will now split that money among your different accounts)</td>
<td>• $84.35 to gas bill</td>
</tr>
<tr>
<td>• In the transfer tab</td>
<td>• $35.66 to water bill</td>
</tr>
<tr>
<td>• Transfer $59.95 from savings to pay the cable bill</td>
<td>• $700 to investment</td>
</tr>
<tr>
<td>• Transfer $300 from savings to the investment account</td>
<td>• $40 cash</td>
</tr>
<tr>
<td>• Transfer $75 from savings to the chequing account</td>
<td>• The rest goes to chequing account</td>
</tr>
<tr>
<td>• (you will now get some cash back from your deposit)</td>
<td></td>
</tr>
<tr>
<td>• In the withdrawal tab</td>
<td>For each task, the participants were presented with several mock cheques and bills that would serve as the items to be deposited.</td>
</tr>
<tr>
<td>• Withdraw $20 from savings</td>
<td></td>
</tr>
</tbody>
</table>

Post-questionnaire

The post-questionnaire contained questions about the participant’s experience with our prototype. The survey form asked targeted questions about specific parts of the interface regarding ease of use and desirability. Additionally, we asked each participant for specific feedback on the positive and negative aspects of our interface verbally.

Equipment

The tasks were completed using the Firefox 2 web browser running on a Windows XP laptop with a full sized mouse attached. The facilitator sat beside the participant and watched the laptop screen. The observers sat on the opposite side of the table and viewed the interactions through an external monitor that mirrored the laptop display. A video camera was set up to capture the image from the external monitor as well as the participant’s face.

Participants

We recruited six UBC graduate students who have bank accounts and use ATMs at least occasionally. They did not perfectly represent our target users because college students tend not to use ATMs for complicated transactions. However, those were all the participants we could find in the limited time that we had. Although the tasks did not
represent typical ATM interactions for our participants, they were well understood, and we feel that the data we obtained can generalize well. The participants were offered a selection of donuts, pizza, and chocolate in exchange for their time.

Evaluation Results
Six subjects participated in our user evaluation. The following sections present the results of pre-questionnaire, observations while using the prototype and post-questionnaire.

Pre-questionnaire
Participants consisted of 2 females and 4 male graduate students with ages ranging from 20 to 35 years old. Their ATM Use Frequency is shown in the following Figure 3.

![Use Frequency of ATMs](http://www.ccsd.ca/drip/research/dis7/index.htm)

Figure 3: Use Frequency of ATMs

Please note that only one participant uses an ATM every week, whereas the rest uses it monthly, rarely or never. This constitutes a limitation of our study, which shows that the participants may not be properly represent our target users. According to the Canadian Council on Social Development statistics, more than 60% of individuals use ATM bank machines at least once a week.¹

¹ Disability Information Sheet: [http://www.ccsd.ca/drip/research/dis7/index.htm](http://www.ccsd.ca/drip/research/dis7/index.htm)
**Observations**

In this section, we describe in detail our observations for three of the users interviewed which portray and summarize well the feedback collected from all interviewed subjects when using the prototype.

**Subject 1:**
The user seemed to be comfortable with the interface. He became acquainted with the functionality by browsing through the different options presented on each tab. In general, he was able to perform the transactions smoothly. He liked being able to specify bill denominations, but experienced some confusion when he was trying to have the system randomly select the bills for him. He would have liked to see the selected bills on the summary.

When setting a recurring operation, the options presented on the screen were not clearly understood. The task consisted of pre-arranging a $70 withdrawal so that this operation would always be available when using the ATM. The option presented on the system was worded as ‘Show reservation Every time I use an ATM’. The user interpreted this option as if, every time he uses an ATM, he would have to carry out this specific transaction, instead of just having the option available.

He mentioned he would not be interested in pre-arranging transactions before going to the ATM, since he is not a frequent ATM user and does not spend much time completing the transactions he needs at the machine.

**Subject 2:**
As soon as the subject started using the interface, he made several comments about the layout. He complained about the summary being too far to the right and hard to see. He would like to have the summary on top of the page, and be able to see all transactions without having to scroll down, if possible. It was not clear what the ‘Name’ input box referred to. On the confirmation screen, he liked that transactions are highlighted when the cursor passes over each of them. Nonetheless, he would have liked to be able to click on any transaction and go back directly to it, in case he needs to make changes. Also, the user mentioned that the summary and confirmation screens should only contain the transactions made, instead of having static transaction name that has never been used.

When depositing multiple cheques, the user commented it would be nicer to have smart lists, where the system detects the repetitive selection of cheques, automatically adds extra rows and pre-selects the cheque option. Smart lists could also be used for transfers.

Regarding the selection of bills, he liked having this feature available, but questioned the capability of machines to do so. Additionally, he suggested it would be helpful to have the bill selection automatically filled in by default amounts at the beginning -instead of starting off with zeros- and dynamically change them when the user modifies a value. Also the max button was not intuitive in his opinion.
As for pre-arranging transfers, the user was not clear about the difference between the balances in brackets listed next to each account, and the expected balances listed at the bottom of the page.

On a broader perspective, pre-arranging multiple complex transactions did not seem very intuitive. He would prefer to have the traditional sequential single-transaction approach, where each operation is performed one at a time. In his opinion, people use ATMs for impromptu atomic transactions. So it seems to require planning too far ahead for someone to actually perform multiple operations in a single transaction.

The subject commented that his bank already provides the option of saving recurring transactions on the ATM, thus if he still needs to go to the ATM to complete the transaction, it does not seem useful to pre-arrange them on a different machine.

He would like this whole idea if there were just a button on the online banking system, to have some of the online transactions available at the ATM and/or if the system were to be used on a cell phone, while waiting in line at the ATM.

**Subject 3**
The user managed to successfully complete all tasks. However, it took him longer than other participants to figure out how the system worked. He attempted to carry out one subtask at a time, by accepting and confirming each operation separately, which resembles the sequential way in which ATMs currently work. The user noted that he would like to have help links available throughout the interface to clarify the model. Other comments made by the user have already been addressed by previous subjects.

**Expert’s Evaluation**
From meeting with our professor, the advisor of this project, we have also identified more issues that should be addressed in the future:

- **Implications of reserving operations**: If the system is to be implemented, it is necessary to define what happens if users’ account balances change between the time after a reservation has been made and the time when the transactions are executed at the ATM.
- **Order of transactions**: Define the order in which transactions pre-arranged in a reservation are executed from the bank’s perspective.

**Post-questionnaires**

Figure 4 summarizes the results gathered on the post questionnaire. It shows whether participants would like to have the ATMReserve system available, and whether they found it intuitive to perform various tasks on the interface, such as deposits, withdrawals, transfers, bill selection and recurring operations.
Figure 4: Results from Post-Questionnaires
Future Work
We designed a medium-fidelity prototype for evaluating the on-line ATM concept. However, there are a couple of issues, which are listed below, needed to be addressed in the real design.

Interface Detail
Because the medium-fidelity prototype is a concept design in limited time, some interface details are not well implemented. That will significantly affect the operation performance of those participants, which make the efficiency measurement inaccurate. Improving the user interface detail will be the first-priority task of future work. The user interface design guideline can be applied to in doing self-evaluation. The major concerns would be to improve graphical user interface outlook and provide more interaction feedback when the action is either achieved or not.

Error Handling
Error handling must be implemented in the future design. It is closely related to the interface detail design. Users will feel confused and uncomfortable to the service without well error handling. The existing error handling mechanism and design guideline can be harvested to solve the problem well.

Transaction Sequence
Since the new on-line ATM can handle the multiple transactions, how to deal with the sequence of each individual transaction will be very important. During this project, we did not evaluate this factor well by examining complex multiple-transaction tasks. Based on the participants’ feedback, we recognized most of them hesitated to use the multiple-transaction feature because they felt it was too complex to go even in other banking services. That is a challenge in future study –how can we provide a nice multiple-transaction UI design to make this feature acceptable, instead of providing a “bloat”.

Word Review
Some sentences or words were confusing those participants. For example, some of them thought “Name” was their own name instead of meaning of transaction name. Furthermore, the reservation feature, “deposit / withdrawal” might be good to be changed to “deposit portfolio / withdrawal portfolio”. Reviewing these linguistic issues could also be an important future work.

More Evaluation
Besides collecting more samples for our study, we should also further evaluate our system on broader demographics as well as with the bank. We probably need to interview the bank to evaluate how the new on-line ATM system can affect their routine work. It is also quite important to study from that direction to evaluate the resistance of pushing this service into the real industry. For instance, how does this on-line ATM service affect the job of regular bank tellers? From those historic experiences, we recognized this evaluation was necessary and important.
Conclusions

We have identified a problem with current ATM systems and identified a possible solution that appears to meet the needs of typical ATM users. Our initial research showed that one of the major concerns about ATM use is the amount of time spent in line and at the ATM itself. While ATM user interfaces have been slowly evolving into something that is much easier to use and understand, we feel that a more significant change is required in order to greatly reduce the time spent at ATMs.

We proposed the idea of reserving an ATM transaction over the Internet through a PC or mobile device, so that the interaction with the actual ATM is reduced to identification, insertion of deposit items, and removal of withdrawal items. We discussed many approaches to creating this web site, created and evaluated a low-fidelity prototype, and finally created and evaluated a medium-fidelity prototype.

Our final prototype was not a perfect product by any means, but we feel that it represents a significant step in the right direction for the future of ATM usage. We have identified several areas that need to be reexamined on the web site itself. A larger question that remains open is whether this system would truly save time at the ATM. We cannot make any conclusion without designing and testing the ATM interface, but intuition tells us that the simplified interaction would save a large amount of time.

Overall, our design and evaluation successfully matched our goal. On-line ATM service is acceptable to bank customers. The new on-line ATM service was not designed to totally replace the traditional ATM service. It just provided an extra way to extend the business-line of banking service. Harvesting from the on-line service and bigger display of the home computer, the on-line ATM service can provide more sophisticated features to the participants. That makes the service a good candidate of 24-hour banking services in future.
Appendix A: Canadian Council on Social Development
Information Sheet
Appendix B: User Evaluations Materials & Signed Consent Forms
Appendix C: Project Video

The first part of our video demonstrates the functionalities of our medium-fidelity prototype and the rest of the video shows part of our user evaluations, capturing some of the feedback that we discussed in our report.