Next-Generation ATM

Phase II Report

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Section 1

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 Automated Teller Machines (ATMs) have superseded human tellers for many banking tasks.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 increase ATM throughput, reducing wait times in ATM queues and perhaps reducing the number of ATM machines that banks must deploy.

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.

The capture the diversity of our user population, we created three imaginary users with different goals, levels of sophistication, and disabilities. The first is Edmond, an elderly man who prefers to do banking in person and deals with large numbers of cheques. Edmond requires a system that is simple and easy to use. Next is Jen, a young manager at an IT company, who has a higher expertise and would like her banking interfaces to be fast and powerful. Finally, Mary is an intermediate user with standard needs. We have developed tasks for these three users.

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.

**Task Examples**

**Task 1:**

It is Christmas day, and among the family gathered together are Edmond and his 16 year old grandson, Kyle. As Kyle is now at a rebellious age, many of his relatives have found it too difficult to choose a gift for him and have given him cheques instead. Kyle has seven cheques valued at $25, $35, $50, $70, $82.71, $100, and $300.

As the festivities come to a close, Kyle decides that it is imperative to deposit his cheques into the bank immediately. Kyle announces that he is going to drive to the bank, and Edmond decides to come along for the ride. On the ride, Kyle decides that it would be nice to save some time by making a transaction reservation through his mobile phone. Edmond, being the good citizen that he is will not allow Kyle to use the phone while driving and volunteers to make the reservation himself.

Edmond does not own a mobile phone. He has used one only on rare circumstances when family members hand him one, and only for making phone calls. Kyle states that he wants $100 in cash to buy a new skateboard and the rest of the money should go to his savings account. Edmond needs lots of help and makes several typos and similar errors, but by the time they reach the bank, he has managed to correct the errors and successfully submitted the reservation.

Upon reaching the ATM, Kyle identifies himself, and the system asks if he would like to carry out the transactions that he reserved. Kyle reads through the transactions to be sure that Edmond input everything correctly and chooses to accept the list. Kyle inserts his cheques and receives his cash.

Discussion: This task illustrates the fact that many users of the transaction reservation system will be people who are not technology or computer literate. An addition factor introduced here is errors caused to poor motor skills in the elderly or disabled. The take away messages are that the operation of the system must be very obvious from looking at the UI, and that it must be easy to correct errors made at any point during the process.
**Task 2.1 (Existing System):**

Jen, a junior manager at an IT company, receives a $800 cheque from one of her investments. She would like to deposit half of it into her chequing account and would like to give the other half of it to her sister, who is saving to buy a car. It is 6:30 p.m. and Jen has just left the office. She has 30 minutes to complete her tasks since she must be at a meeting by 7:00.

Jen decides to perform her transactions at an ATM. She has no other option since it is after normal bank hours, but even if a teller were available she'd prefer to use the machine. Jen travels to the nearest ATM location. She notices that it is already getting dark and there is nobody around. She enters the ATM room, inserts her bank card, and enters her PIN. She then selects “Deposit” by pressing one of the buttons on the ATM. She types in the value of her $800.00 cheque on the numeric keypad and confirms that she wants to deposit the money. She puts her cheque into an envelope and inserts it into the open deposit slot in the ATM. The ATM then asks if she would like to perform another transaction. Jen indicates that she would indeed like to perform another transaction and is brought back to the same initial screen she saw before. She then selects “Withdrawal” and enters in $400.00. She would rather not handle cash, but there doesn't seem to be any other option. She is given twenty $20 bills. Nervously glancing around, she quickly puts the money in her purse, takes her bank card and receipt, and leaves.

Discussion: This task illustrates the fact that there is redundancy in the current ATM system and that some tasks cannot be performed at all. Furthermore, the task helps to show that safety is sometimes at concern at ATMs.

**Task 2.2 (New System):**

Jen, a junior manager in an IT company, received an $800 cheque from one of her investments overseas. She wants to deposit half of this amount in her chequings account and the other half in her younger sister’s savings account. Her younger sister is saving to buy a car and Jen is helping her out. Today at 6.30 pm, Jen has just come out of her office and needs to go to a business dinner at 7 pm. Time is usually pressing for her, so she prefers using the operation reservation system to make deposits and withdrawals, which she can access either from her cell phone or the bank’s website. On her way to the parking lot, she uses her cell phone for less than one minute to preset the deposit, both on her account and her sister’s. She then drives to the closest ATM and parks near by. She authenticates herself at the machine, and the system requests her confirmation to proceed with the preset operations. She agrees, introduces the cheque in the machine and both deposits are immediately reflected in the corresponding accounts. She goes back in her car and arrives to her business dinner just in time.
Discussion: This task exemplifies the fact that being able to preset banking transactions is very convenient to users for whom time is pressing, since it can be done anywhere from a cell phone or website, and it reduces the time spent at the ATM.

\textbf{Task 3.1 (Existing System):}

Today is the end of the month--it is a pay day! Mary, a mother of four who works part-time at Safeway, has just received her pay cheque in the amount of CAD$500. She wants to deposit her pay cheque into her checking account so that she can later withdraw CAD$100 cash for the next week's groceries.

After work, she rushed to the ATM, nearest to Safeway because she would have to go to picked up her youngest kid from the kindergarten. The ATM was installed in a close environment surrounded by transparent walls. She entered the compartment. There was only one (out of 3) ATM available. She glanced back over her shoulder once to notice that there were two more people coming into the compartment. She took out her cheque and her pass book. She hastily wrote down her account number the back of the cheque and signed it. Then, she entered her ATM card into the card slot. The machine asked for her PIN, so she typed it, very carefully. After that, she followed the instruction to specify what account she wants to deposit the cheque in, and how much the amount is. Once she finished all that, she pulled out the envelope from the side of the ATM. She quickly put her cheque in the envelope, while another slot was opened. She inserted the envelope into the slot as soon as possible, fearing that the deposit slot will be closed soon. After the slot is closed, she told the machine that she wanted to withdraw CAD$100 from her checking account. The machine then dispensed five $20 bills for her.

She told the machine that she is done, so the machine ejected her ATM card followed by a receipt, because she has asked for one. Mary did not forget to take her card back and she drove out to the kindergarten right away.

Discussion: Since Mary is working at Safeway, she regularly needs to deposit her pay cheque at the ATM. However, due to her maternal instincts, she's very careful in doing things such as entering the PIN number and remembering to take the ATM card back.

\textbf{Task 3.2 (New System):}

Mary has just received a $500 cheque she would like to deposit into an account. She would also like $100 in cash. Mary dislikes spending time at an ATM, so she decides to use her bank's new transaction macro feature to do some of the work ahead of time on her cell phone from the comfort of her own car, where there is nobody impatiently waiting or trying to peek over her shoulder.
Mary starts by logging onto her bank's OLB website. She then navigates to the pre-set transaction page. She begins a new transaction set, clicks on "Withdraw", and indicates an amount of $100. She then decides to pay her electricity and credit card bills. When she adds those items to the list a visual queue appears indicating that she does not have the available funds. She then clicks on the “Deposit” tab and adds her two cheques to the list. The system asks her if she would like to queue up her bill payments until the end of the transaction. Mary confirms that she would like to queue her payments. She also decides to name her group of transactions by entering text in a field at the top of the page. This will allow her to quickly confirm that she is completing the right transactions when she arrives at an ATM.

Mary's transactions are bundled and displayed to her in the order that they will be performed at an ATM, which is Deposit-Withdrawal-Automatic Payments. She is presented with default options allowing her to perform these pre-queued operations at any ATM at any time, but she can also easily customize these and can access a page that indicates to her the location of different ATMs. Finally, Mary continues to a confirmation screen. She confirms her transactions and closes her cell phone.

Mary leaves her car and enters the ATM building. Her children are safe in the car, within eyesight, for a few minutes since her transactions will be very fast. Once she is in the ATM room she notices that there are people using one ATM, but that the other is free. This ATM is free because it is dedicated to people who use pre-bundled transactions and those people complete their operations much faster.

Mary is biometrically authenticated. The ATM immediately recognizes her and displays her list of transactions. Mary is used to using this system so she briefly skims over the summarized description and confirms. The deposit slot opens and she feeds in her cheques. The ATM confirms that her deposit has been received and also displays the amount to be withdrawn. Mary confirms this amount and receives her cash. The final screen indicates which queued transactions will be performed. If she didn't have sufficient funds, the transactions would appear in red and she would have the option to change them. However, she does have sufficient funds and presses the "Finished" button on the screen, indicating that she is done using the ATM. In three button presses she has done what would have taken her five to ten minutes on an old ATM.

Discussion: Mary saves a significant amount of time by pre-setting her transactions. She also benefits from the fact that there is nobody going long transactions in front of her.
Requirements

The new on-line ATM service provides extended deposit and withdrawal functions by preserving transactions from the internet. Based on our investigation, all current existing ATM services should be available in the new on-line ATM service. Furthermore, the new service should include the new features which are not included in current ATM machine due to hardware limitations. For example, the current ATM machine’s input keyboard is too simple to handle complex tasks. The major problems which the participants like the new on-line ATM service can solve or achieve are listed below:

1. **Pre-defining Transaction Sets or Macros:** Customer can easily use the new on-line ATM service to pre-set transactions. For security issue, the customer also can fully control the life-time of the transaction. Busy users think it would be a good idea to reduce the time which is cost for operating the machine.

2. **Bill Selection:** Customer can use the new on-line ATM service to select bills. The current ATM machine does not support select bills function well. Essentially, only $20 bills will be output in ATM. If customer wants to specify the bills, getting service from teller is the best choice right now. It would be a good idea if ATM machines could handle that function.

3. **Select ATM location:** Customer can specify the ATM machine to finalize the preserving service. Based on our investigation, customer might be interested in knowing which ATM machine they should go to in order to finalize the pre-set transaction service. The function to specify a particular ATM is not a major concern although most users think it is not a bad idea.

4. **Multiple Transaction Services:** Since the existing ATM machine cannot easily deal with complex the multiple transactions and all our participants want the new service can totally replace the teller in future, we believe the new on-line ATM service should include this feature in.

5. **Extended Investment Accounts Services:** Again for making the new service as close as traditional teller’s service, new on-line ATM service should have the capability to deal with not only saving and checking accounts but also investment accounts.

6. **Extended Information Query Services:** Customers are interested in not only the transaction statement of the current two months but also all transaction history information or other banking service information such as exchange rate, interest rate, montage rate and so on.

7. **Customer Profile Services:** Right now, customers only can manage their personal information by visiting the bank, partially by telephone banking or partially by on-line banking. The participants agree it will also be good if there exists one more way to easily manage their personal profile and other metadata.
8. **Simple Human Interface**: User will be easily confused when they are facing to a complicate user interface.

Overall, based on our study, the customer is looking for a new ATM which can do everything as which can be done by a traditional teller. Compared to the on-line banking security services, the participants are more comfortable to the security services of ATM’s. Recently, less ATM services are called by customers since the booming-up on-line banking service. The only frequently used function of ATM so far is withdrawing cash. We believe that a large percentage of participants don’t use ATMs as frequently as they could because they are missing lots of useful functions. Furthermore, some people are not comfortable with full service ATMs and prefer traditional tellers.

Besides getting the feedback from the participants, we arranged a meeting with a potential service provider. We contacted with HSBC’s ATM service team to gather advice based on the bank’s point of view. Because of privacy concerns, we cannot get user data from the bank. Instead, our goal is to try to get feedback from the bank based on their expertise and listen to the things which they are really interested in. As we know there exists gap between individual person’s behavior and the banking operation standard. We believe the new on-line ATM system design should be satisfied with two common criteria from the bank’s aspect. First of all, all functions should not be against the existing financial regulation. Second, banks will be interested in putting money to provide the service. After gathering their feedback, we know the bank really concerns about the following things:

1. To get a leg up on their competitors, banks are looking for novel ideas which can attract or benefit existing customers or potential new customers.

2. Technically, the new service should be designed in reasonable budget.

3. Banks will not be able to put new services into practical use unless they can make sure it will not confuse or mislead customers.

In another words, banks are looking for good ways to improve service levels without introducing new potential security problems. As we know, banking is service industry. More than that, banks are also businesses that deal with money. The reputation of a bank comes from how it deals with the money of its customers safely and conveniently. They want the new system to focus on extending the traditional banking service by using different media. They think that novel ideas outside the normal scope of banking services are acceptable and exciting. For example, an ATM could be used to sell theatre tickets.
Banks also believe that ATMs should be distinguished from the existing on-line banking service. They agree that the proposed pre-set transaction macro service is interesting. They are not interested in the idea of using ATMs to fully replace the traditional tellers. That will raise too many security, resource reallocation and social reality problems. However, they also agree that it would be good if the new on-line ATM system could reduce the routine workload of tellers, especially during busy periods.

Based on these studies, we believe the new on-line ATM service should focus on providing major routine functions which are currently performed daily by tellers. The key feature of the on-line ATM is providing the pre-set transaction service. Customers can pre-set a group of service by on-line ATM service which is a part of the standard online banking website. Customers can then visit ATM machines to finalize the transactions. Usually, the group of transactions will include either withdrawing cash or depositing cheques. Those actions could not be done by using existing on-line banking service. Physically accessing ATM or visiting a bank teller is necessary. The new on-line ATM service can extend the banking service time to 24 hours without paying too many extra costs. For balancing the different customers and bank concerns, we group the requirement of new on-line ATM service to four categories: a) absolutely must include; b) should include; c) could include; and d) exclude. The details are listed below:

a) absolutely must include
   1. **Pre-set transaction feature:** In general, all actions done by one-line ATM service are preserving service. Customer need to access the ATM machine physically to finalize the service.
   2. **Traditional deposit feature:** As an ATM machine, the new on-line version should guide the customers to deposit cheques.
   3. **Traditional cash withdrawal feature:** As an ATM machine, the new on-line version should guide the customers to do cash withdrawal operation.
   4. **Security feature:** To make customers to feel safe using the service, advanced security features are compulsory.
   5. **ATM locations map feature:** Since not all ATM machines can support the on-line ATM machine function, the customer needs to know where and which ATM machine they can physically access to finish the operation.

b) should include
   1. **Multiple transactions feature:** The on-line ATM service should have the ability to deal with multiple transactions.
   2. **Investment banking account feature:** It should be possible to deal with the money in investment banking accounts by the new service. Customer can treat the on-line ATM machine as a teller.
   3. **Select Bills feature:** Customers should feel easy to select bills which they want to withdraw based on their personal requirements. By the default, the system can be set up to withdraw $20 bills only. However, the customers
can easily configure that by themselves without a significant amount of extra work.

4. **Confirmation Information feature:** The system should provide reasonable confirmation feedback, such as transaction details with confirmation number. A printable version is necessary. Customer also can get a physical copy when they access the ATM machine physically.

5. **Transaction expiry:** For providing more secure service, on-line ATM service can enforce an expiry time/date for pre-set transactions.

6. **Simple UI feature:** All customers want the on-line web-based UI to be reasonably simple and understandable. Users are not interested in self-training to use either OLB or ATMs.

c) **could include**

1. **Specify ATM location feature:** It could be nice if customers can specify a particular ATM location to finalize the task. All of our participants are not against this idea, but a large percentage also said they didn’t care about that very much.

2. **Account Information Query feature:** This feature will make customer to query the statement, balance and other personal information by on-line ATM service. Some participants are interested in that. But, some of them do not care about that since they already existed in the current on-line banking service.

3. **Deposit allocation feature:** This feature can allow a customer to deposit money into multiple accounts by percentage. For example, the customer may put 10% of total amount into saving account, 30% of them into investment account and the left 60% are transferred to the 3rd part. Some participants believe this is intuitive and useful, but others believe that it is too complicated. None of them believe it is a very important feature in the new on-line ATM service.

4. **Pay bills feature:** Participants agree that if on-line ATM service can pay bills as same as on-line banking do is good. However, they don’t think it is very necessary since the flexible feature already existed in current on-line banking or telephone banking service.

d) **Exclude**

1. **Non-traditional banking services:** Other non-traditional banking services, such as booking tickets and so on, are not suitable for the on-line ATM service. It would confuse the customer. Based on our study, large parts of participants believe the ATM service is more secure than on-line banking service. Customers might lose confidence if ATM service can deal with some non-traditional banking services. That could potentially raise the social engineering issue, which both customers and banks both want to avoid.
Section 2

Design Alternatives

Based on the requirements presented in the previous section, our group has brainstormed some design alternatives for the new web-based ATM system. The main goal is that our new web-based ATM system should allow users to reserve basic traditional transactions online, such as depositing, withdrawals, and multiple combinations of those two. Moreover, we would like our ATM to accommodate other needs (based on the tasks analysis), such as paying bills and managing investment. All of the transactions should be easy to perform by users.

Flow Chart

The following flow chart demonstrates how the work flow of our new ATM system should be. The design alternatives that we will present later have to be consistent with this work flow.

Figure 1: Flow chart of web interface for ATMReserve
Based on the results from our survey (please see the Appendix, questions 30 - 31), users would like to be able to divert funds from one deposit to multiple destinations and most of them expressed that they do not have trouble calculating the total amount of their deposits. We will try to accommodate those needs in our design for Deposit Interface, as you will see that all the alternatives allow users to specify multiple destinations for their deposits.
**Alternative #1:**

![Figure 3: Deposit Interface Alternative #1](image)

This alternative allows users to specify more than one source of deposits (of course, users can choose to specify only one) and the total amount of the deposit will be shown on the screen. More importantly, users can specify multiple destinations of the deposit, and there is a pie chart that shows the distribution of their deposit into various destinations. Users can choose various destinations, including their traditional chequing and saving accounts, their investment accounts, their billers, and “cash” (meaning they want to cash it out right after). Please note that the number of destinations and the number of sources do not need to be the same.

**Alternative #2:**

![Figure 4: Deposit Interface Alternative #2](image)

This alternative is similar to Alternative #1, except that it provides a different way to add more sources and more destinations for a deposit.
Alternative #3:

This alternative provides the same mechanism of how to add more sources and destinations for a deposit as in Alternative #1. However, since we are aware that the list of sources and destinations of deposits can get very long, we decided to put the two lists side-by-side, instead.

Alternative #4:

Alternative #4 would be similar to Alternative #3, except that we will allow users to adjust the funds that go to different destinations by interacting with the pie chart directly. The hands on the pie chart would reflect the number of destinations that users have added.

Discussions

All the design alternatives have their pros and cons. The first alternative would be very appropriate for small display if the list of sources is not long. However, if the list of sources get too long, then users will lose information about their destinations, which they might not know that it exists.

The advantage of Alternative #2 is that the functionality for adding sources and destinations are located in one spot, which minimizes the scrolling. However, it has the same disadvantage as in Alternative #1.
Alternative #3 is appropriate on a medium to large display, since it minimizes scrolling and users will not lose information about sources and destinations of the deposit. The disadvantage is that users might mistake that the number of sources and the destinations have to match because the two lists appear side by side.

As for Alternative #4, the disadvantage of it would probably be the ease of adjustment of funds distribution. Moreover, it is an innovative way to interact with an ATM. The disadvantage of this alternative is that it may be hard for users to give precise distribution by moving the hands on the pie chart.

In the end, we decided to implement our low-fidelity prototype following the Alternative #3 because we assume that our system will be used on a medium-to-large display and we assume that users would like to select many destinations or sources.

Withdrawal Interface
Based on the results of the questionnaire (question 36, in Appendix), majority of users have expressed that they would like to be able to choose denominations of bills to withdraw. So, we try to accommodate that in our design.

**Alternative #1:**

![Figure 7: Withdrawal Interface Alternative #1](image)

In this alternative, the withdrawal screen is divided into two parts to make it appear consistent with the deposit screen. On the left-hand side, there is a list of withdrawal sources, which looks almost the same as the list of sources in the deposit interface, except that the list items now reflect that destinations that the users have selected during deposit. If the users previously selected “cash” as destination in the deposit, that amount will appear on the withdrawal screen as the initial amount to be withdrawn. Of course, users can select to withdraw from more destinations or increase the amount of withdrawal as they like. On the right-hand side of the screen, there is a option for users to “choose types of bills”.

If users select this option, another screen (or half-screen), as shown on the right hand side, will appear and let users choose the number of bills they want their withdrawal to be. “Unallocated” field indicates the mount of withdrawal, whose types of bills have not
been selected, and so the default type (which is $20 bills) will be applied to it. In the case that the unallocated amount is not a multiple of 20, the system will dispense the appropriate bills for the remainder, unless it is smaller than $5. If the system cannot allocate appropriate bills for the leftover amount, it will give an error message and will not let users to proceed to submit the reservation.

**Alternative #2:**

![Stacking Bills Interface](image)

Figure 8: Stacking Bills Interface

The difference between this alternative and the first one is the way users can select the denominations of bills. We were thinking about employing a rich graphical interface, which will allow users to stack the number of the types of bills that they want.

**Alternative #3:**

![Withdrawal Interface Alternative #3](image)

Figure 9: Withdrawal Interface Alternative #3

This interface is also very similar to Alternative #1, except that we do not divide the screen into two parts, and provides the “choose bills” option on the top of the list of withdrawal sources, instead.
**Discussions**

Alternative #1 and #3 do not have a significance advantages over each other. However, alternative #1 would appear more consistent with the deposit interface. As for alternative #2, we have decided that it would require users more time to learn to “stack” their bills (e.g. selecting the bills from the pile and moving it to the allocated space).

Therefore, we decided to implement our low-fidelity prototype following design alternative #1.

**Header/Footer**

Since users may need to do multiple operations before submitting reservation, such as finding the locations of accessible (i.e. the ones that accept the reservation) physical ATM’s and adjusting their deposit and withdrawal reservations, our system will provide them crucial information during all of those operations. The common and crucial information, such as total amount of deposit and withdrawal, and the expiry time of this reservation will be displayed on the header and footer, whose design alternatives are presented below.

**Alternative #1:**

![Figure 10: Header/Footer Alternative #1](image)

This alternative shows all the relevant information on the header. Other information, such as expiry date and ATM locations, will appear under the “Preferences” tab.
Alternative #2:

Figure 11: Header/Footer Alternative #2

In this alternative, the total amount of deposit and withdrawal will appear in the footer and the name of the reservation (optional) and the expiry time of the reservation will appear in the header. It also displays the pie chart which shows the distributions of the current deposit. There is going to be another tab, called “ATM Location”, which leads to the page that shows locations of accessible ATM’s nearby.

Discussions

We decided to go for alternative #2 because it shows the expiry time, which is crucial in the header. Moreover, with alternative #2, users can also see the pie chart on the top as well. For alternative #1, all the information is clustered into the header. It may not be helpful, and in turns, become overwhelming to users.
Section 3:

Prototype

Please see paper prototype included in portfolio, or Appendix A for overview photos.

Task Centered Walkthrough

We performed a cognitive walkthrough of our prototype using task example #3. The results are below:

<table>
<thead>
<tr>
<th>What is the next step?</th>
<th>Is the next step visible and obvious in the UI?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input the first cheque</td>
<td>It was visible, but our terminology might be confusing. We expect that some users might not understand “sources”, “types”, and “destinations.”</td>
</tr>
<tr>
<td>Input the second cheque</td>
<td>Yes, with same caveat as above</td>
</tr>
<tr>
<td>Select $100 of cash back</td>
<td>It was visible, but perhaps unclear to some users. In addition to the terminology issue, we expect that our layout might cause some users to see a 1-to-1 correspondence between sources and destinations.</td>
</tr>
<tr>
<td>Select $75 to pay cable bill</td>
<td>Same as above</td>
</tr>
<tr>
<td>Select $35 to pay water bill</td>
<td>Same as above</td>
</tr>
<tr>
<td>Choose to put the remaining deposit in the investment account</td>
<td>NO! The functionality for assigning the remainder to a destination is hidden in a menu. Additionally, the term “remainder” might be unclear.</td>
</tr>
<tr>
<td>Name the transaction</td>
<td>Yes</td>
</tr>
</tbody>
</table>

This is unclear from the paper prototype. If the name field is simply a text field, it may not be obvious that the system has
<table>
<thead>
<tr>
<th>Set the expiration date</th>
<th>Yes</th>
<th>registered the change.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch to withdrawal mode</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Select $40 from chequing account</td>
<td>Yes, but there might be some confusion with the cash back from the deposit appearing as a withdrawal</td>
<td>Yes</td>
</tr>
<tr>
<td>Open the dialog for choosing bills</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Select six $5 bills</td>
<td>It is visible, but maybe not obvious. We predict that if all bills start at zero, this action will be obvious.</td>
<td>Yes</td>
</tr>
<tr>
<td>Choose remaining bills</td>
<td>It is visible, but should perhaps be more obvious. We want users to select an “auto-allocate remaining” button, but expect that many will try to do calculations in their heads to determine the bills of each type</td>
<td>Yes</td>
</tr>
<tr>
<td>Submit the transaction</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Confirm the transaction</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

We identified several issues with our first prototype that we were not able to properly address before our user evaluation. The feedback in our interface was determined to be adequate overall, but some of the steps involved in deposits, withdrawals, and especially choosing bill denominations may not be well presented in the interface. These are areas that we planned to pay particular attention to during the user evaluations.

**Informal User Evaluation**

For the evaluation phase, three subjects were interviewed. Each subject was presented with a paper prototype of the ATMReserve website. One team member, acting as the facilitator, explained the purpose and dynamics of the activity, and at the beginning of each interview, the following lines were read aloud to the participant.

“We are creating a new way to interact with ATMs. To help improve the efficiency and reduce the time spent at the ATM, we are creating a website that will allow you to pre-set your ATM transactions. You would access the website at your home or through your mobile phone to do all of the ATM input. This way,
when you get to the ATM, you can simply identify yourself with your card and PIN, review your transactions, and it will execute automatically. If you have specified a deposit, the ATM will ask you to insert the money, and if you have specified a withdrawal, cash will be dispensed.

For this evaluation, you will be using our web site to enter a hypothetical transaction. Please assume that you have logged on to your regular online banking, and you found a link to ATMReserve page, which is the page that you see in front of you at the moment.”

The hypothetical transaction consisted of the following tasks:

- Deposit two cheques of $250 each
- You want $100 in cash
- Pay $75 for cable bill
- Pay $35 to water bill
- The rest should go to your investment account
- Get $40 cash from your chequing account
- You want 6 $5 bills from the ATM
- You don't care about the rest of the bills
- Name the transaction if you want
- You can set an expiration date if you want
- Submit the transaction

With the purpose of having a dynamic interaction, one team member updated the screens, displays, menus, and options of the paper prototype every time the user clicked on a specific functional button.

**Observations**

**Subject 1:**
In general, the subject seemed to be comfortable with the interface and was able to complete the transactions successfully. He was only confused when specifying the destinations of the deposit, since he interpreted that each source (check 1, check 2, cash, etc), was linked to a specific destination (chequings, savings, bills, investments, etc). However, the idea of the proposed interface is for the user to be able to specify how he wants to allocate the total funds, so this is an opportunity of improvement for the prototype. Also, the user was at first unclear about what unit and remainder meant, but he learned them right after clicking for the corresponding options to be displayed.

**Subject 2:**
As soon as the subject saw the first screen (‘Deposit Sources’ and ‘Deposit Destinations’ screens), he complained that the interface was too complicated and contained too much information. He commented that, as the population is growing older, more people have visual impairments. Thus, in his opinion, the interface should begin with only the basic
most common operations, and provide a separate link for expert users to carry out multiple transactions.

He then attempted to perform the tasks, so he input the two $250 cheques. When he realized that he needed to pay two bills and allocate some funds to his investments, he objected that he would not normally deal with transfers—or several fund allocations—right after depositing a cheque. If he were to go to an ATM to deposit a cheque (which he rarely does, since he does not get paid by cheques), he would deal with bill payments and investments at the comfort of his home through online banking. He considered that the multiple destinations would only be useful for large amounts of money and sophisticated users. He questioned how many people would actually perform these multiple operations on an ATM, and mentioned that he only uses the ATM once a week to withdraw $400.

Since he performs the very same transaction on a weekly basis at the ATM, he finds it advantageous to pre-set this transaction only once online, and have the machine complete this operation when he identifies himself at the ATM and confirms it.

After these remarks, the subject did not complete the hypothetical tasks on the prototype, and just barely browsed through the rest of the interface. He was not clear what the expiration date meant, and he is not interested in being able to choose different bill denominations.

He also suggested that it would be convenient for each user to be able to set a withdrawal limit. More specifically, he is not comfortable—for security reasons—that his withdrawal limit is $500 per day, since he only withdraws $400 a week. He would like to set his limit to the latter amount. Finally, he’s interested in both incorporating biometrics to the system and being able to check stocks on ATMs, as it would provide an additional way to check the market, allowing to make investment decisions on the spot.

**Subject 3:**
The subject was able to correctly input the two $250 cheques on the ‘Deposit Source’ screen, however immediately after this, he was interested in checking his balance, even though he had not yet specified to which accounts the money would go to. He looked at the ‘Deposit Destinations’ screen and didn’t understand what the ‘Total Allocated’ meant. After a few seconds, he clicked to display the menu under ‘select destination’ and realized that he could pay the bills right away. So he decided to pay the cable bill. When he clicked on the ‘unit’ box, he chose ‘$’, but was not clear what ‘%’ means. On the next box, he opened the menu and did not understand what ‘remainder’ was, so he typed in the month of the cable bill. One team member explained that on this box, he can input either the exact amount to be allocated or choose what is left from the deposit transaction to be allocated. So he was able to pay the other (water) bill. After setting the payment of bills, the ‘Total allocated’ field updated, so he figured out what this field meant and better understood the dynamics of the interaction. However, when he tried to withdraw $100, he was not clear whether the cash would come from his current balance or from the deposit being made, so he didn’t know whether to go to the ‘Withdrawal’ tab or specify
‘cash back’ as one destination. He commented that having the option of ‘cash back’ as one destination can be confusing, nonetheless it could also be helpful, as he wouldn’t have to go a different screen to get it.

After completing the deposit destinations, he performed the next tasks: withdraw $40 from current balance and get six $5 bills. He had no trouble setting the six $5 bills, but he clicked the accept button without choosing bills for the rest of the withdrawal. Finally he named the transaction, set the expiration date, left open the ATM location, and submitted the transaction. These operations were performed more intuitively.

As general remarks, he expressed that it is counterintuitive and not common to pay bills at the same time that one is depositing a cheque. He would just use the ATM to deposit cheques or withdraw money, and would deal with bills from online banking. He did like the fact that the most important fields (Total Deposit and Total Withdrawal) are always visible on the interface. When asked if he would feel more secure being able to specify which ATM the transaction would occur at, he said no and commented that he would simply select all of the available ATMs. This participant stated that he liked the fact that the most important information is always visible and wondered if we might be able to fit the whole summary somewhere that will always be shown.

Walkthrough and Evaluation Summary

The walkthrough and evaluation revealed several areas that will need to be reexamined for the next phase of the project. The biggest place for improvement is our deposit screen. There were consistent issues here including unclear terminology, false mapping of sources to destinations, and confusing menu choices. One of the biggest problems was the concept of selecting a destination for the “remainder.” This menu option was unclear to our users, who were still a bit confused even after having it explained. One option we have considered for the next prototype is to have a destination at either the top or bottom somewhat separated from the others that is clearly labeled as the destination for the remaining balance.

Another issue raised was whether it is intuitive to pay bills and get cash on the deposit screen. We will consider moving all cash transactions to the withdrawal screen and adding a separate screen for paying bills. All of our users mentioned that they would like to see their account balances when dealing with deposits and withdrawals. This had not occurred to us during the design phase, and we will certainly include it in our next prototype. Another feature to emerge from our evaluation was the concept of creating pre set transactions that will be used more than once at ATMs. This would be similar to creating a custom “fast cash” option. We will consider this for our next prototype.

The participants all felt that the main tabbed interface was intuitive. There were no problems with selecting deposit sources or using the withdrawal page. The ATM Locations page was very straightforward and did not yield any problems during the evaluations. The study yielded positive comments for our footer which contains a brief summary of the transaction, and we will consider adding even more information here.
Appendix A: Low-Fidelity Prototype Photos
Figure 12: Pictures of the Low-Fi Prototypes
Appendix B: Questionnaires