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Catching and Displaying Memory Cues for a mobile Augmented Memory System

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Abstract

This report goes over and details the progress of the 2013 COMP477 project "Augmenting Memory: The Digital Parrot on Mobile Devices" undertaken by Jake Bellamy and supervised by Annika Hinze at the University of Waikato.

The report begins with an overview on the problem with remembering events in people's lives and details the background information on the Digital Parrot system. It also describes the previous project that preceded this one, which began to conceptualize the Digital Parrot on mobile devices. It analyses problems with the current design of the system and addresses them.

The report then goes on to conduct an in depth user study with the functioning version of the software. The user study finds design flaws and incorrect functionality in the application that would not have otherwise been apparent.

Finally, the report concludes with a proposed user interface concept that addresses all of the issues found in the user study and describes how the system would work. It describes the initial implementation that has begun in building this system.

1 Introduction

Humans have an incredible memory system that is regularly able to store and retrieve vast amounts of information with a simple thought. However, as amazing as our memories are, they are regularly fallible, often during the worst of times. There are simple and common techniques to improve memories that have been around for millennia such as repeatedly rehearsing the items that are required to remember. However, these techniques require regular practice and time to help with any significant improvement. This also means the person to be aware that they will be required to retrieve these memories at a later date therefore they do nothing to help memory failures due to lack of attention.

Today our digital world is filled with computational devices that we use to store these memories for us reliably. Every time a person takes a photograph with a camera they are capturing a snapshot of that moment so that later it may be accessed to renew their memory, as alone their memory is not sufficient to reconstruct it in a sufficient level of detail without training to transfer it into their long-term memory. Every time a person records a conversation on an audio recording device they are capturing exactly what was said so later they may again retrieve it later to renew their memory.

There are digital systems that exist already which are based on these concepts. The one that this report will be based on is the Digital Parrot, an augmented autobiographical memory system that has been conceptualized and developed by Ph.D. student Andrea Schweer, which aims to support users in retrieving cues and factual information related to experiences as well as reconstructing those experiences by accessing the interactive software system on a personal computer.

The goal of this project was to investigate the usefulness of the Digital Parrot if it were to be brought to mobile devices. The thesis introducing the software touches on this role in the system software. This role is not expanded however and is strictly left in the realm of capturing and light editing of moments to be later viewed on a PC.

The intent is to expand on the role of the mobile device in aiding people's memory, implementing some of the functionality that was proposed along with adding the abilities of the computer application. Allowing the mobile device to filter, search and display the recorded events that have been captured would extend the user experience vastly and allow the users of such devices to use the application anywhere at any time, which was a limiting factor of the initial concept.

2 Background

The Digital Parrot is an interactive software system that aids users in remembering past events in their life. This has been selectively implemented after research of existing systems with their capabilities and limitations. The bulk of the work on implementing the software had gone into the "remembering phase and the system components required for this stage", as that had been the focus of the thesis.

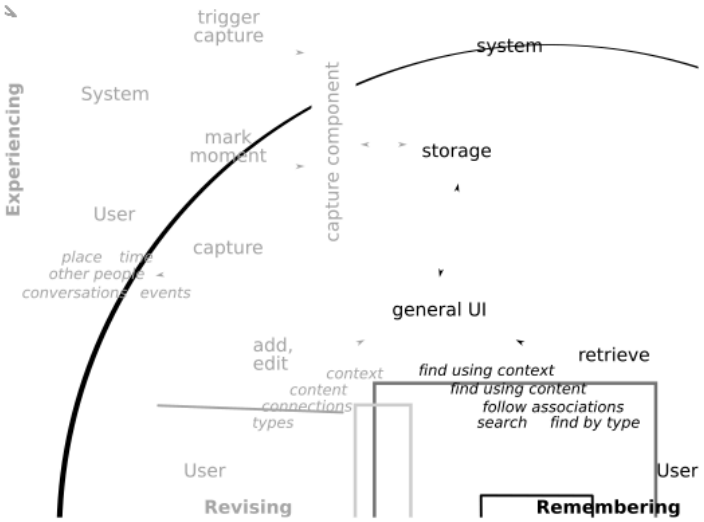


Figure 2.1. Implemented parts of The Digital Parrot's conceptual design.

The Digital Parrot introduced interactive ways in which the user would work their mobile device to capture information about events in their life. They had envisioned scenarios in which users' use their iPhone to automatically capture aspects about their experiences by telling the phone to "mark this moment". The phone would then collect data about where they were, what time and day it was, and associate these with a picture and audio recording the user had subsequently taken to provide a context to the data.

The Digital Parrot also briefly touched upon viewing the collected data on mobile devices. Initially the system had been designed with the ability to view on a mobile device as well as a desktop computer, with a list view as the main window proposed to use to show the context and content data which could be used directly on either machine. However, the user studies that they had conducted had concluded that the list view was not effective at displaying links between events and hindered navigation, so the researchers decided to focus on the graph view instead. The graph view can potentially show many items in close proximity. While this may be adequate for a mouse pointer to select an event, it is not for a much smaller screened mobile device and varying user's finger sizes.

"The current version of the Digital Parrot was developed for desktop computers. The mobile/wearable component mentioned in the design sketches and scenarios is used mostly during the experiencing and revising phases. Since the Digital Parrot focuses on the remembering phase, it was decided to implement it for desktop computers only." [Q1]

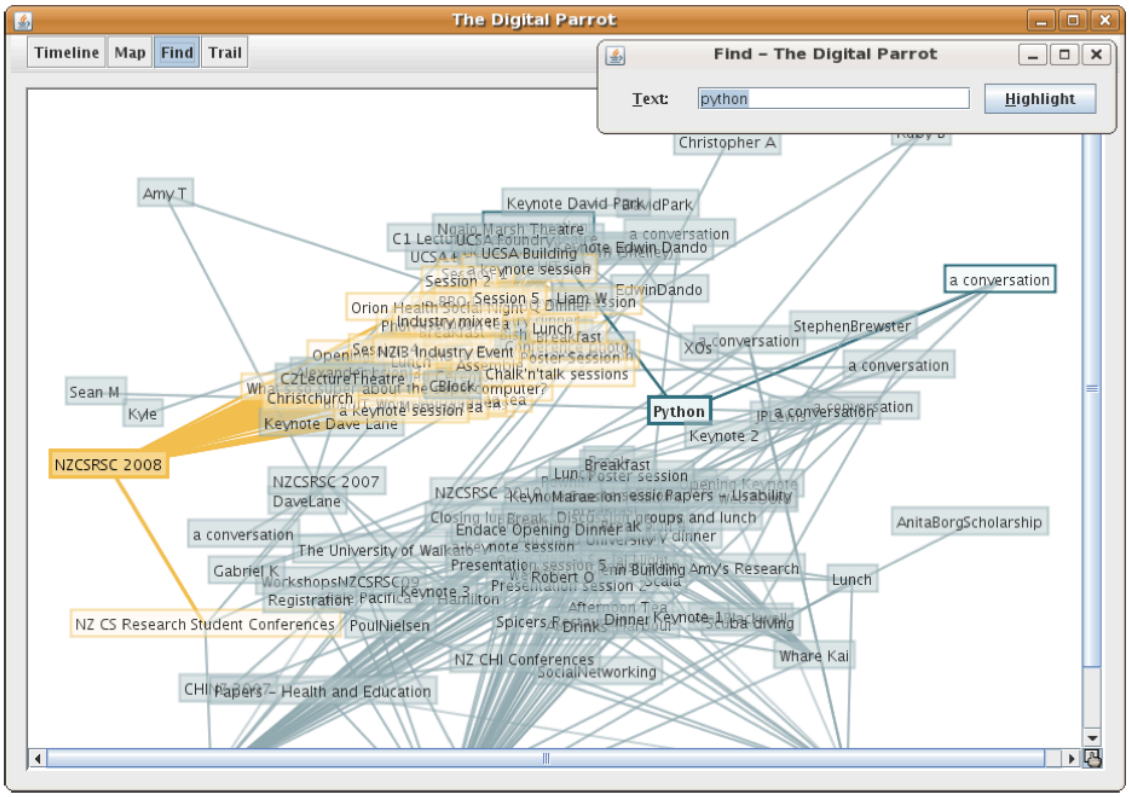


Figure 2.2. The Digital Parrot's original graph view for displaying events and relationships.

3 Analysis of Existing Project

There had been already been some progress made to building this memory system on mobile devices. A previous project had been completed in which the developer had built a skeleton system on the Android platform after prototyping different concepts for the design. Because there was already an existing design that could be continued, the decision was made to continue to use Android devices so that existing code could be reused instead of designing the entire system from scratch.

After installing all of the toolkits necessary to begin development and opening the existing code it was found that the capabilities of this system were more limited than initially expected. There had been two applications made, rather than one, each with its own singular purpose. These two applications were named 'Catchit' and 'Displayit' respectively.

3.1 Design

Using the Catchit application it was possible to take a photo, note or audio recording and successfully save them into the mobile device's external storage. The option for taking videos was available, however it had not been implemented to save to storage and as such could not use it for the user study. Files were grouped on the underlying file structure by the time they were taken, splitting each save by the minute. This meant that if the user had taken two recordings within quick succession but the latter happened to be over the minute boundary it would save them in two different folders, implying by the system that they were two separate events.

The Displayit application had been designed to display the recorded data that the Catchit application had stored on the device. Some initial design had been conceptualized and implemented, which consisted of cubes spaced from each other in a three dimensional space with the ability to swipe left and right, or up and down on the screen to move between each cube. Swiping left on the screen moved the cubes left, swiping right moved the cubes right, swiping up moved the cubes inwards as if the user was walking forward through the cubes, and down moved the cubes backwards. The centered cube was highlighted to indicate that is the object selected.

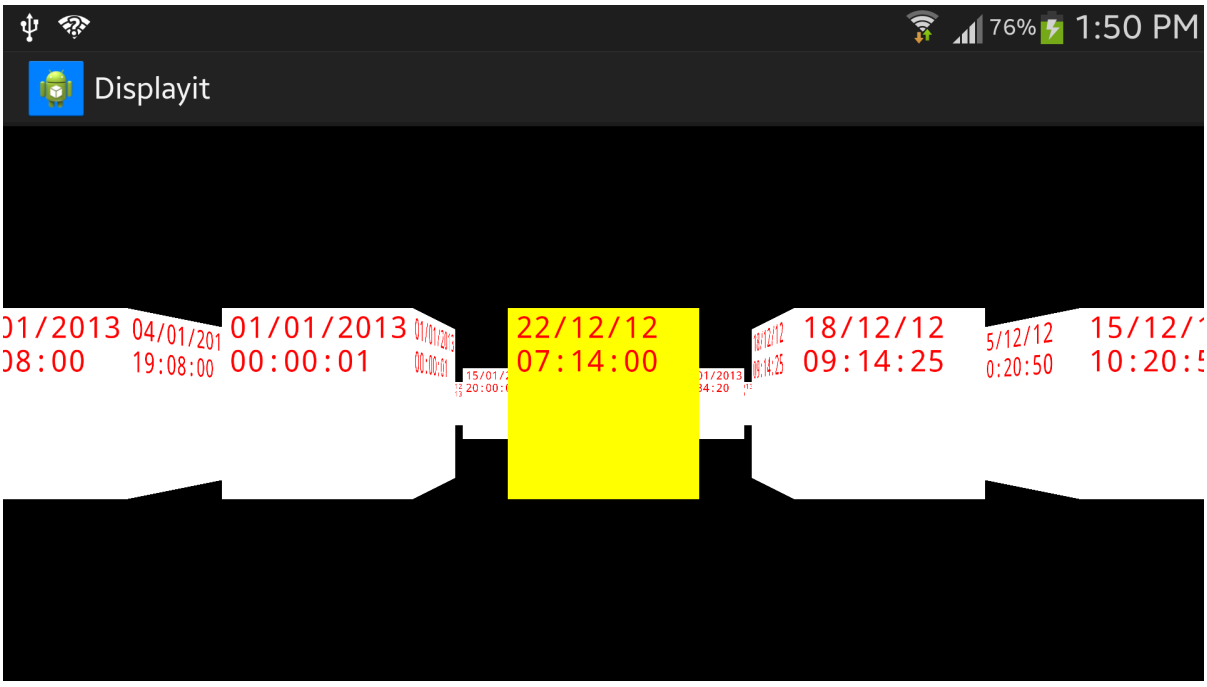


Figure 3.1 The initial design of 'Displayit' before continuation of the project.

3.2 Analysis and Limitations

Separating each function of the core function of the project into two separate applications did not make any sense since they both are reliant on each other. There is no use case scenario where the end user would be using only one application without the other, so it would only be suitable to combine the functionality of both into one app.

In the Displayit application, when viewing the events, the only displayed content on each cube was the date and time making it difficult to differentiate what type of data in each record or even what each record is about. The use of only dates to show each entry does not achieve the goal of helping people remember past events because there is no guarantee that the users will remember exactly what they did on a certain day after a significant period of time. The date format is not human reading friendly as it is only displaying numbers, which can get difficult to immediately differentiate when skimming through multiple entries.

Static time codes with a preset number of cubes to display had been hard-coded into the source. Though navigation was possible through the cubes to select the desired event, there was no ability to open it to display what was inside. This coupled with the fact that no reading from the file system ever occurred, meant that the status of the application was not functional for displaying the user's recorded events at all.

The design decision of large cubes representing each event, with the ability to scroll through each one by one would not scale well with hundreds or even thousands of entries. In the hard-coded example provided in the source code there were thirteen event entries, and as shown in Figure 3.1 only seven events are visible on screen at once. This would not show the scope of the data to the user and could easily lead to mindless scrolling to get to the desired event.

3.3 Extensions

To be able to conduct a user study on the existing mobile application it had to be in a functioning state. As it had stood after installing and analyzing the software, it was not capable of being used for its intended purpose of retrieving memories or able to be evaluated by others in a study. It was required that additional extensions to the design to be implemented before the study could be conducted.

The main focus of the development effort on the application at this stage was working on Displayit to bring it to a working state. This was achieved by firstly removing the hard coded variables including the static number of cubes and implementing a file system reader, which created a cube representation for each folder in the underlying structure. As each folder was already time stamped, the folder names were converted into a readable date time format that was displayed on each cube.

A new layout view and corresponding Android XML file were then created to display the contents inside each event cube when the user tapped on them. The file reader was extended to skim through the contents of each folder to determine what type of content it had inside it (picture, audio, or note). This information was used to construct each cube object with the ID of its unique folder and the names of all the files inside. Three free icons were sourced and imported into the project, a camera representing a picture type, a notepad representing a note type, and a microphone to represent an audio type. These icons were set up so they would only display on the cube face if the corresponding type of files were found inside the folder.

An Android linear layout was chosen as for the new view as it allowed simple resizing of the screen elements to display a variable amount of elements, with each element stacking below the previous. This worked well to display text from a note as well as a picture and even audio recording on the screen all at once. If a picture were the only data to show then it would stretch to fill the screen automatically.

With the most critical functionality implemented and the application now displaying the recorded data that it had taken for each event and, attention was then turned to constructing an icon picker inside the Catchit application so that each event could be categorized. Another layout file was created and five icons were chosen; food, books, party, shopping, and people (conversations). These were chosen because they worked in with the user scenario that had already been constructed for the upcoming study, and as such were relevant to include them for the participants to select and use.

The Displayit application was quickly updated to make use of the new icons and display them in the middle of the cube faces taking the rest of the available space. The layout of the cubes was changed so that instead of moving sideways and in and out, they were in a vertical stack and only moved up and down. This change occurred because it did not make any sense to have depth in the navigation and as such it was much simpler to only have the cubes moving along one dimension. The direction of swiping was also reversed to be more consistent with typical smartphone gestures. This meant that swiping up now moved the cubes down, and swiping down moved the cubes up.

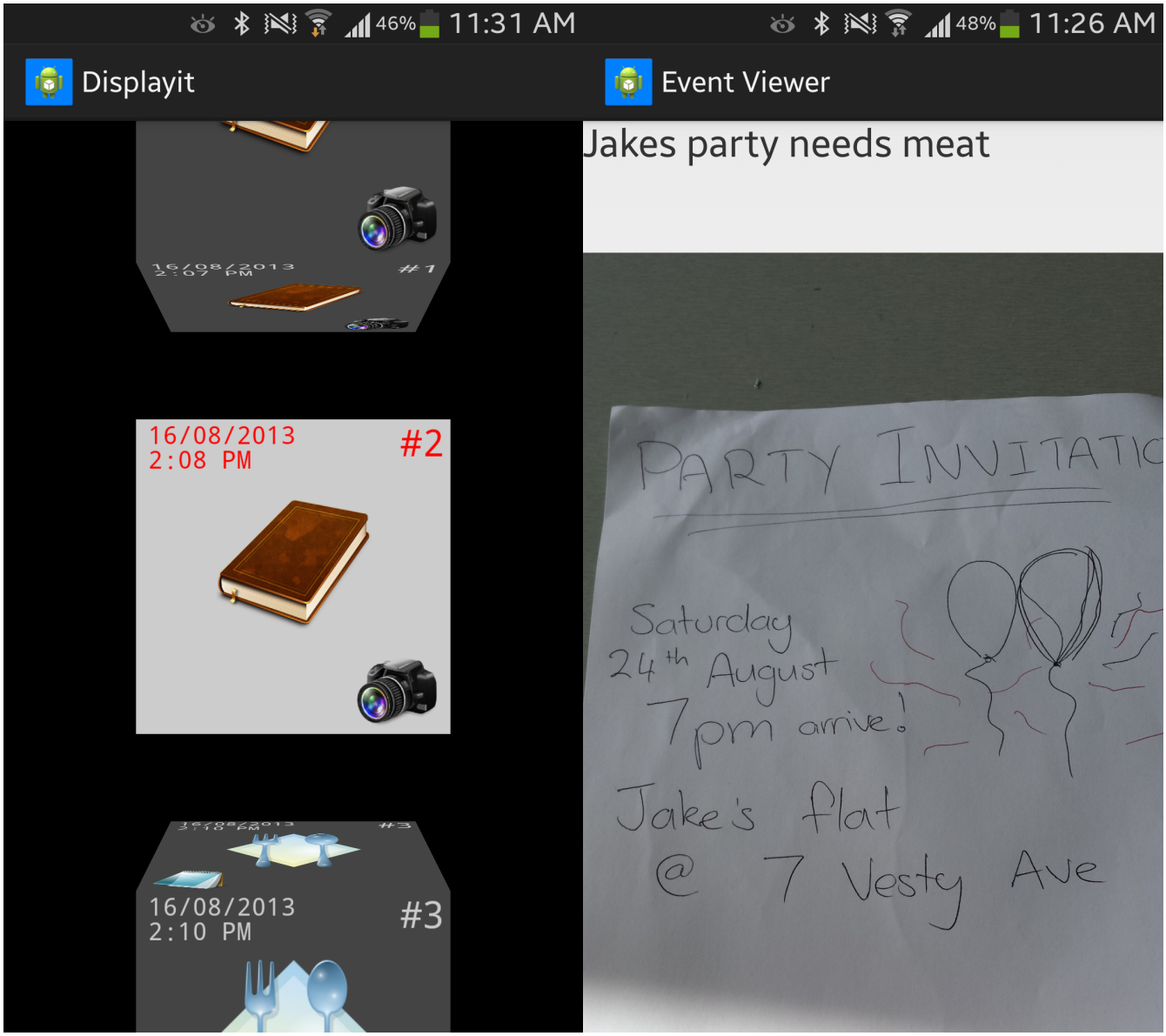


Figure 3.2 The 'Displayit' application after changes had been made to it to make it functional.

Some additional changes that can be seen in Figure 3.2 is the addition of a cube number so that each event can be uniquely identified, and a change of colours to make the application more appealing.

These changes in the application address some of the issues with the original design such as adding icon categories to make it easier to see what each event is about without having to go into it. Unfortunately it does nothing to solve the scalability issue, which would require a complete redesign of the interface.

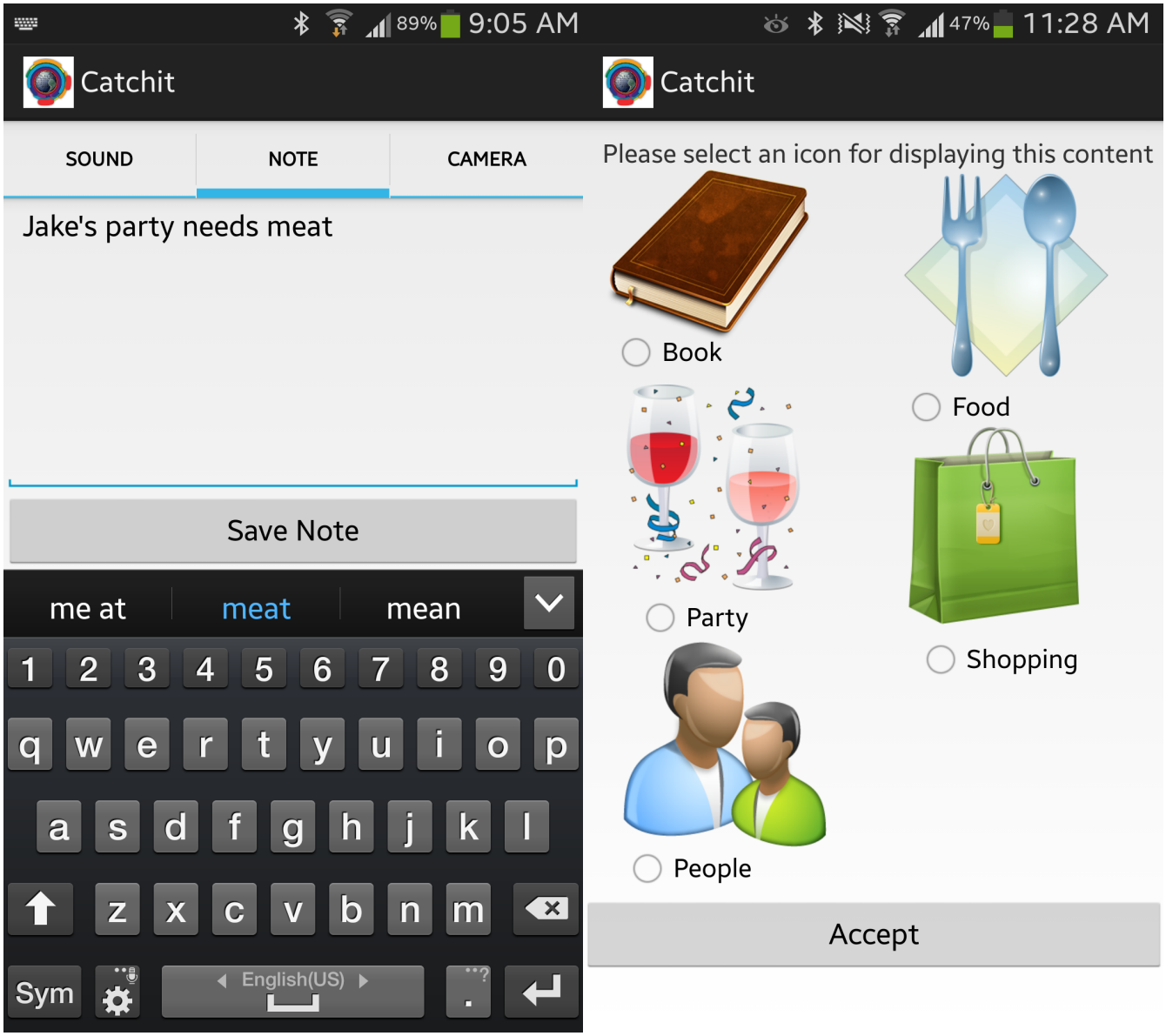


Figure 3.3 The 'Catchit' application showing the new icon picker window after saving an event.

4 User Case Study of Existing Software

4.1 Goal

The study had two main goals regarding usability and usefulness of the software. The first goal was to find design issues inherent in the current user interface of the application so they may be rectified before conducting a second user study. The second goal was to evaluate how effective the application is at retrieving memories by observing the participants using the application to answer questions about

events they were involved in. Details of the ethical application and study description are available in Appendix A1.

4.2 Participants

The study was done over three days and had twelve participants. All participants were students in the Computer Science department at the University of Waikato, and all were between the ages of 20 to 35. Nine participants were male, and three were female.
The study was done as part of the participants' assessment for one of their papers (COMP539), in which they were required to experience a user study as a participant.

4.3 Procedure

Each participant was invited to enact a scenario together with me and to make recordings in the software as they felt appropriate. They were asked to think out loud about their interactions with the software. After the scenario, participants were asked to fill in a questionnaire.

Scenario

For the scenario, I took each user individually to the university library where they acted as a student at the University of Waikato studying for a degree in a subject of their choosing. There was an upcoming test for one of their papers in a couple of days, so they had gone to the library with one of their friends to study for it. While they were looking for books to help them with the test, they find a book that intrigues them and would like to read in their spare time. However, as it is not related to their work they put it back so as to not be distracted by it and also to not go over their book limit. Before putting it back they use the memory aid application to record the details of the book so they may return later to get it out once the test is over. After doing some study we then took a break outside on the patio. I bought a coffee, which my subjects recorded, and then invited them to a party I was hosting, which they also recorded. We then talked about some current events and I told them a specific event that they recorded as well. All of the subject's recordings into the application were part of the setup, and cues were provided for them to begin recording each event during the scenario only if necessary.

After the scenario had been acted through and each user had recorded sufficient data into the application I asked them some questions about what we had done during the scenario and prompted them to use the memory aid application to help them answer.

Questionnaire

After the interactions with the software, participants filled in a questionnaire that asked them about both their habits for using memory aids and their experiences with using our software. The questions that were asked are shown in Appendix A2.

4.4 Results from questionnaire

The results in this section were calculated from a questionnaire handed to the user immediately after having completed the scenario and having them fill it out. Those answers were then aggregated to get an overview of any trends if they exist about the users' experience.

Closed Format Questions

From the chart seen in Figure 4.1, we can see that the participants use a spread of techniques to help themselves remember events rather than one preferred method, though most users have a preference of using some form of digital documentation at least sometimes.

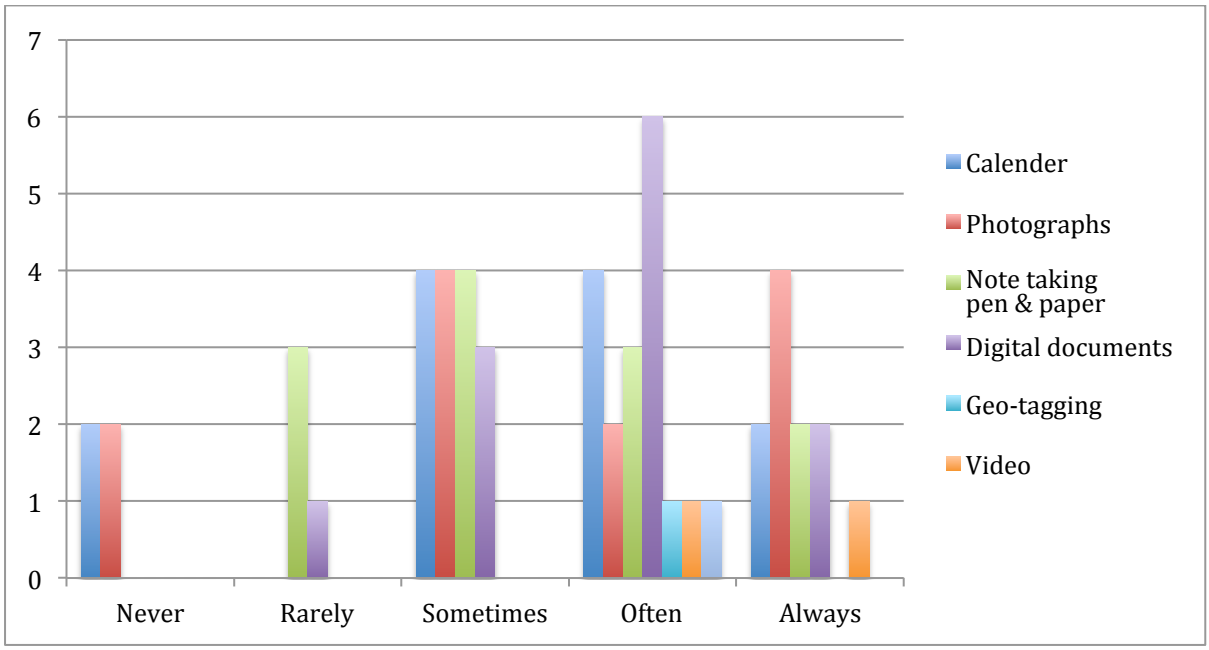


Figure 4.1. A graph of the student's preferred methods of remembering both past and future events.

As summarized in Figure 4.2, most users felt that recording their data into the application was easy with 80% answering agree or strongly agree. Retrieving their data back was more mixed however, with only 60% of the users reporting that it was easy or very easy to navigate through to find their stored memories.

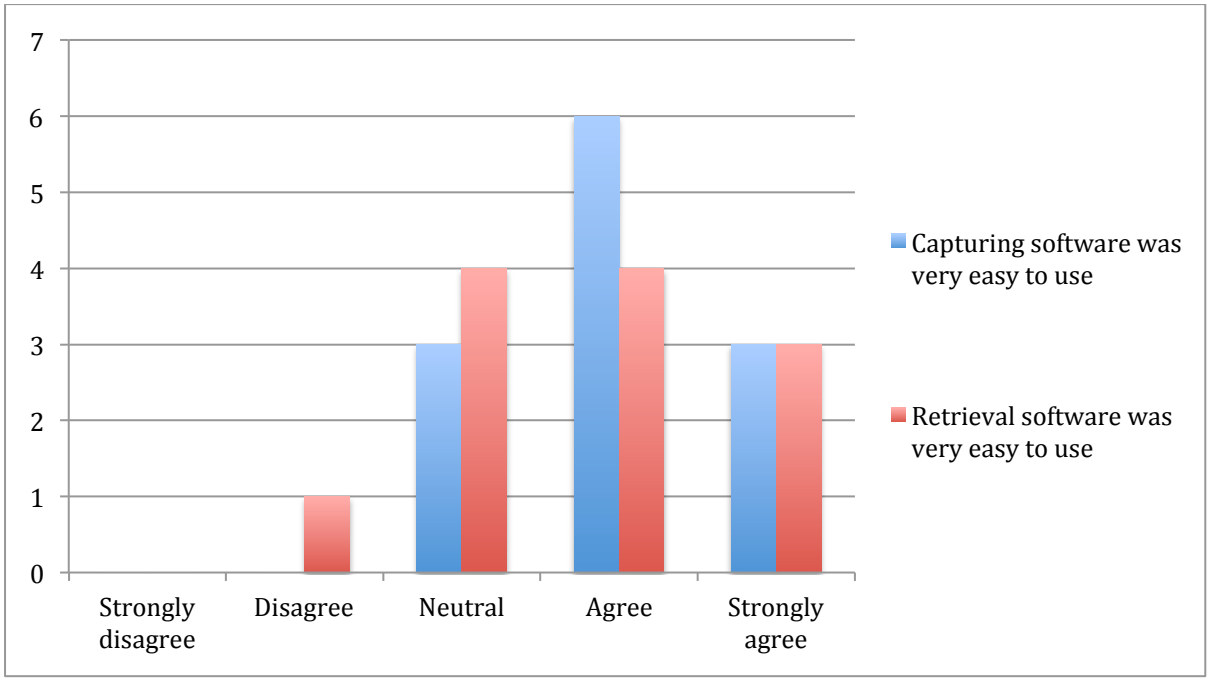


Figure 4.2. How easy the users felt the software was to use.

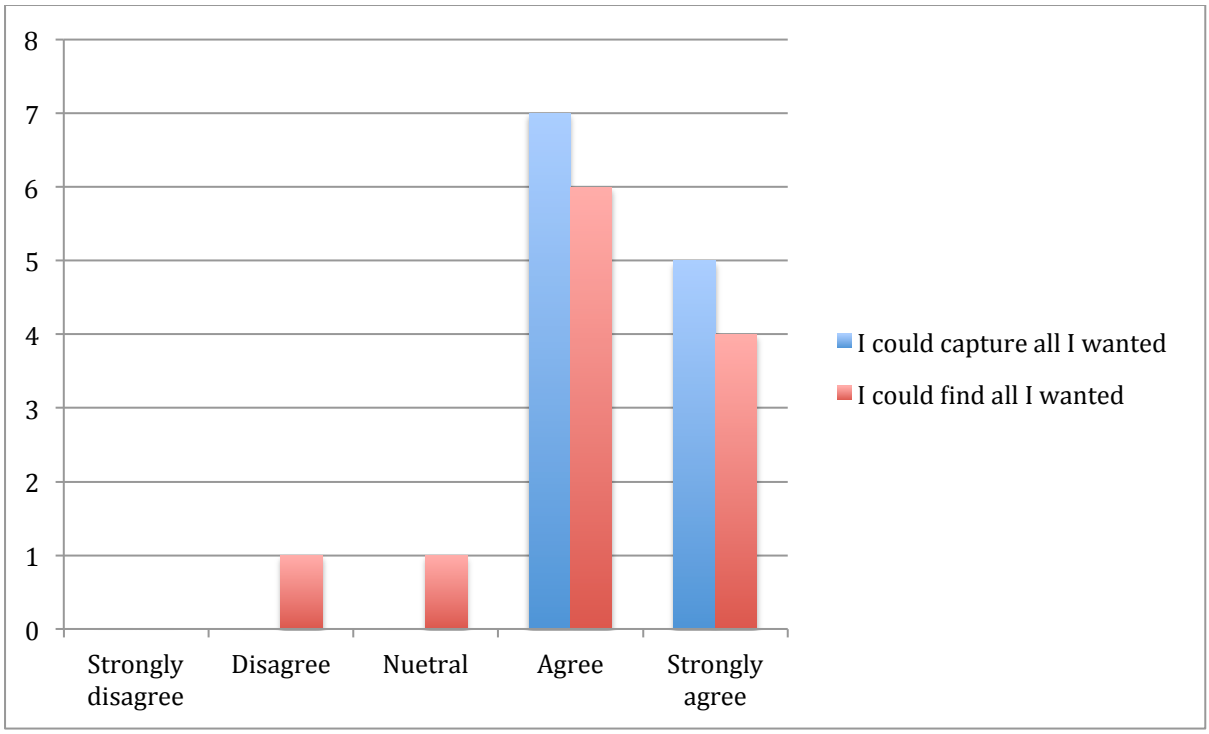


Figure 4.3. How functional the users felt the software was.

The chart in Figure 4.3 shows that all cases the users felt that they could use the capturing software to capture all they wanted during the scenario. However when asked if they could find all they wanted, one user disagreed and another was neutral. The remaining 80% of participants responded that they felt they could find all they wanted.

Asking the users which type of information they felt was useful for recording events lead to the result shown in Figure 4.4, with all 100% of users stating that the photographs they had taken were useful or very useful in recalling events. Note taking had a high percentage of participants stating that it was useful, with 80% stating they agree or strongly agree. One user responded with neutral and the remaining user did not respond. Audio recording received slightly more mixed reviews. 60% of the participants stated that they agreed or strongly agreed that it was useful, one user was neutral and two users disagreed. The remaining two users did not respond.

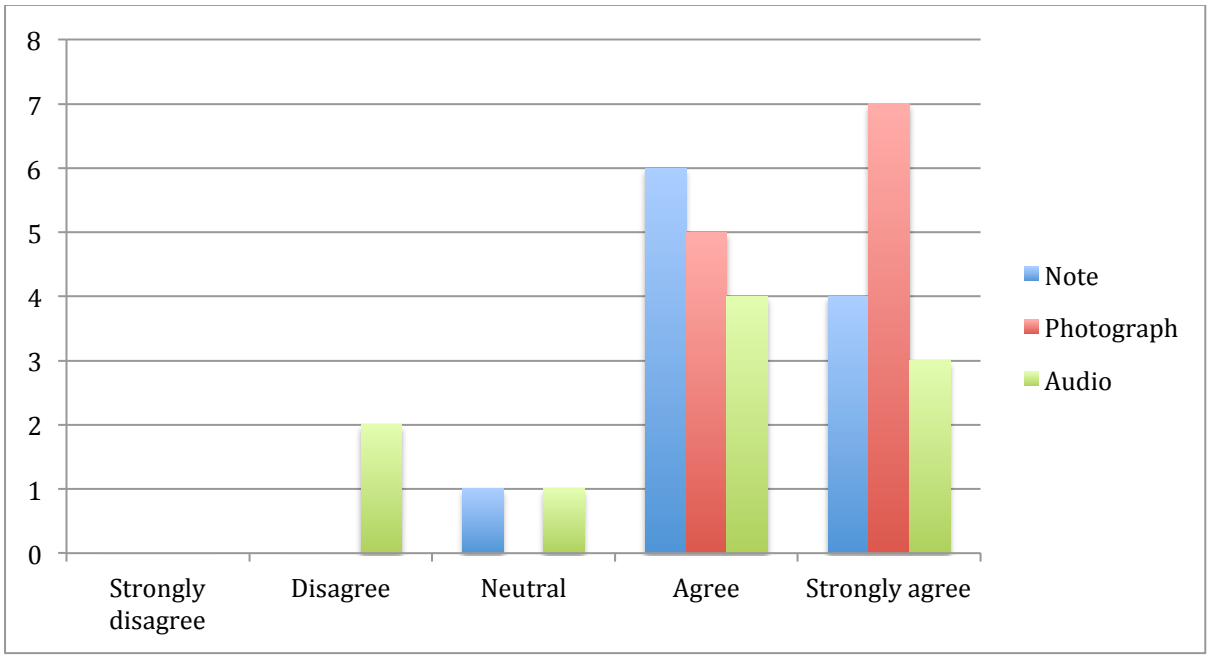


Figure 4.4. How effective the users felt each type of data was in aiding their memory.

Open Format Questions

When asked about one thing that could be changed during recording events, participants #3, 6, 7, 8, and 9 commented on improving the icon selection page. Some comments were it that needed "more event types eg. news" (#3), and they "cannot select [the] icon pictures" (#7), with one user noting that the radio buttons were too small to press, simply noting down "bigger buttons" (#8). Two users (#6

and #9) picked up on a software bug that prevents a user from selecting a radio button when another was pressed and noted it in the questionnaire.

Though many users responded with changes to the icon picker page, some of those exact users praised the visibility of them when finding their recorded notes. Participants #3, 6, and 9 commented that the one very good thing that they liked was the usefulness of the category icons when browsing through the event listings. Participant #3 stated he liked the "Icons and info when previewing / scrolling through notes".

Participants #5 and #10 liked that when the system grouped two recordings from the same event together they would display on the same page, stating "Displaying notes on the respective image" (#5) and "The note saved with the photo, showed up with the photo too" (#10). However, the system would occasionally group incorrectly and put two different events together. This happened to participants #4 and 6 as they had stated in their response to any issues noticed when finding notes "Just the grouping issue (two different events put together)" (#4) and "Two notes are merged together" (#6). User #2 noted that no grouping was done for him as they had commented "Can not mix picture and notes".

Some participants had noted issues with the cube design layout for displaying the events. These people had commented stating "Challenge to find when viewing the cubes" (#9), "The 'boxes' were confusing to start with, I didn't know what was required of me when I was retrieving information" (#10), and "Organizing of event folders [is an issue]" (#1), though user #1 went on to state "Displaying events was good" when asked what one good thing about viewing the events was.

Participant #4 was the only user that had commented on concerns about how application's cube design could scale to a much larger dataset outside of the scenario. They had stated in the question to change one thing about the event viewing that they were "unsure how it would work with a lot of data (not scalable)".

4.5 Results from Observations During the Scenario

1. • Tapped box straight away. Seems understand straight away with scrolling • Went to party to look at current event question • Audio clip merged into party event. BBQ note incorrectly made into new event	**2.** • People radio button too close to accept button, user accidentally clicked accept without selecting icon. • User swiped left on picture to go to next photo taken. • Photo did not rotate correctly for party invitation picture.

3.	• App merged two events together that were in incorrectly. Confused user • Party and coffee drink was merged and additional party event made. • Noticed radio buttons can select more than one and cannot deselect. • Did not use any audio recordings, opted for brief text input.	**4.**	• Tapped top button to go back multiple times.
5.	• Tapped pictures for icon selection instead of radio buttons. • Navigated to party for current event topic. Got lost. • Two events merged together incorrectly.	**6.**	• Tapped top/bottom boxes to display them without swiping to center them on screen first. Multiple times. • Tapped pictures for icon selection instead of radio buttons and did not realize. Pressed save without the icon. Caused confusion later as they did not think it was a book event. • Screen turned off during audio recording and split the recording into another event.
7.	• Swiped left and right to navigate. • Tapped bottom box without swiping to it to open. • Audio does not stop.	**8.**	• Not sure on android back button. • Tried zooming in on photo to get more detail. • Clicked on wrong squares and had to repeatedly go through each square to find what wanted. • Saved empty notes no way to delete.
9.	• Tapped into first event. Tried swiping left and right on photo to go to next • Tapped back on box screen. Took user out of application • Tapped party icon when looking for food. • Got lost when looking for food for BBQ memory. Started looking in all events to find it.	**10.**	• Swiped left and right, pressed back button • Bit confusing swiping up and down • Audio needs a stop, pause button. Seek. • Audio stops recording when screen turns off • Good that it displays text with photos all in one • Cubes did not look like something that user could tap or interact with. • What were the numbers in the corner?
11.	• Went right to end, accidentally selected wrong item. • Notes taken in succession do not show up as only one note shows per cube • "Oh god I have to listen to a recording" • "I am not listening to the whole thing." Needs a seek • NEED A STOP BUTTON	**12.**	• Swiped down then up to see interactivity, then tapped on correct cube to bring up book picture. • User noted they would be more comfortable searching by event types (book, party, food etc) than by listing them in time order.

Figure 4.5. Observations of all the participants.

An unforeseen issue found while recording audio when capturing events was that the application would not prevent the device from going into sleep mode, and subsequently stopping recording when the screen turns off. Participants #10, 11, and 12 had picked up on this and commented on it in the questionnaire, with #12 simply stating “fix the sound recording”.

For some of the participants using the software to retrieve their memory for the first time, there was confusion as to how to operate it. Participant #1 was swiping left and right then actually exiting the application while trying to get it to do anything. In all cases, when the users learned to swipe up and

down to move the cubes and tapping them opens them then they had little or no problems with navigating their way through the events to open and view them.

4.6 Analysis

There are some key issues highlighted with the design of this application by conducting this study.

Learning Curve

Because the application uses common gestures that the users are very likely to already know, such as swiping to move between the cubes and tapping them to open, the learning curve was particularly small. I suspect this may be the reason for the high rate of feedback indicating that retrieval of the data was easy even when there are observations of confusion initially (observation #1, 10).

Question of Scalability

As stated by participant #4 with regards to the scalability of the design, I think that his feelings are accurate as shown by the issues listed.

It is only possible to scroll through one event at a time ordered by the earliest events going through to the most recent meaning it would take a considerable amount of effort and time to scroll through thousands of entries.

There is no ability to filter the events by record type, date range, location, or people.

Since only three events are displayed on screen at once it does not show how many events there are altogether, and does not give any indication of which cube is highlighted on a larger scale.

Issues of Touch Interface

A common unexpected occurrence found was that many users would press the large picture icons to select the category after recording an event rather than pressing the radio button itself (observation #6). I had overlooked users' expectations of interactive content and so the radio buttons should be removed in the next iteration of the program as additionally some users had difficulty pressing them and had to try multiple times since they were much smaller than the icons themselves.

Insufficient Context

Although the icons were very helpful, as the users had noted, they were not enough on their own to eliminate some users resorting to the classic search strategy of opening everything one by one and seeing what is inside. Though this is not much of a problem with the small set of data created through the scenario, it would quickly become tedious when trying to find a particular event in amongst

hundreds or even thousands of entries. Adding the ability to name each event, displaying the location and also having different colours for each cube type could alleviate this.

4.7 Issues and constraints of the study

Because of the time constraints it was not realistic to have participants come back some weeks or months later when their memory might have been fragmented to some degree, so I was forced to ask them to pretend that some time had passed.
They needed to use the memory aid for every question that I asked even though participants could sometimes immediately recall what the answers were. So the study was more geared to identifying usability issues than identifying usefulness.

Some issues with the user study itself were the incomplete state of the available software. There was insufficient time available to incorporate all of the needed functionality, which resulted in rushing at the last minute to include the most important parts. A side effect of this were some small bugs that were apparent during testing and did not get resolved, such as the ability to select two or more radio buttons at once and not being able to deselect them once checked. Some users had picked up on this by accidentally selecting the wrong button and trying to change their selection, and promptly told me as well as adding it in their review.

There were some inconsistencies for two of the users participating in the study. Work was still being done on the project after the user study had begun and so this lead to a slightly different experience for those two users. This was entirely unintentional as the deadline to commence had been hit and the project still had a major feature missing. After talking with my supervisor about this, we both agreed it would be better to add the functionality in as we felt we did not need all of the remaining users to tell us they needed a better way of differentiating events by type. The functionality that was added was the ability to select an icon immediately after taking a note, picture or audio to categorize an event. This icon would be shown while browsing through the recorded events to help aid the user in which each was about. Five icons were chosen that suited the scenario that I was taking the users through, which were people, party streams, food, books, and shopping bags.

4.8 Conclusions

With these findings in mind there should be changes to the design of the application to address the usability issues found during this study. One of the goals of this study was achieved to great effect:

issues were found in the user interface that can now be rectified. Unfortunately the second goal of evaluating how effective the application is at retrieving memories could not be fully realized because of the limited scope and time available to conduct the study.

5 New Design

5.1 Concept

With the valuable feedback provided from the user study, work had begun conceptualizing a new design that addresses the issues that were found. An approach similar to the graph view in the Digital Parrot has been adopted which shows links between each event and allows filtering of many types. This new design addresses the problems raised in the user study in the following ways:

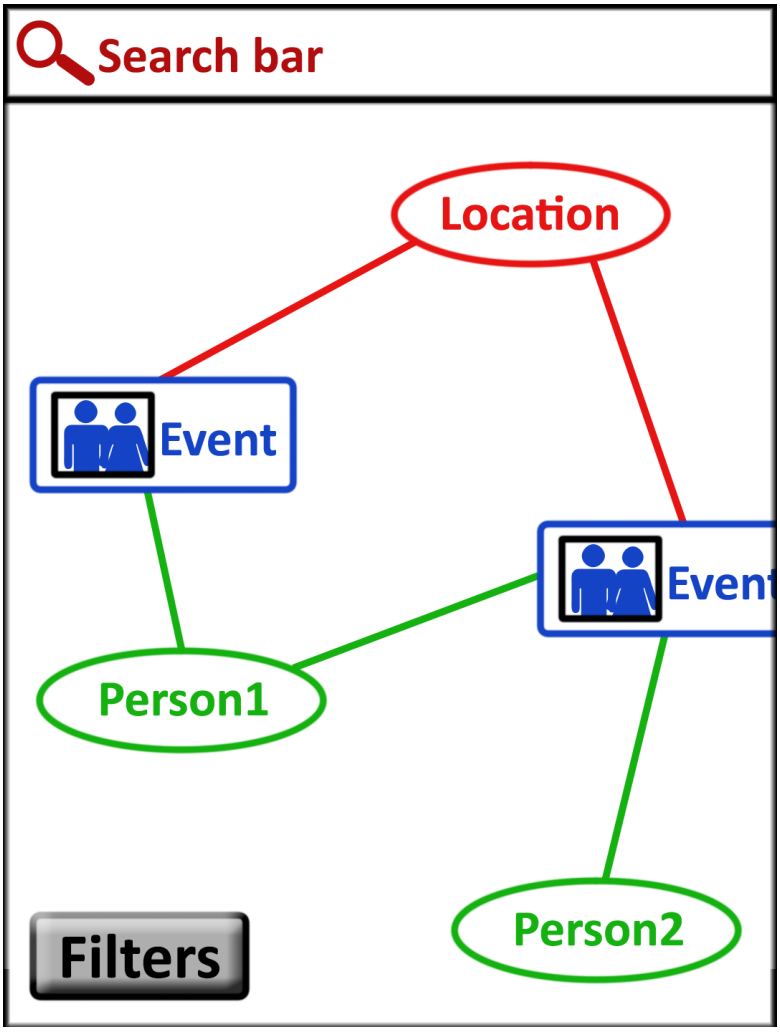


Figure 5.1. A concept mocked up digitally showing a graph view of links between events.

Insufficient Context

In Figure 5.1 two events are shown with two people and a singular location. Each event now has it's own name as well as icon, which will enable the user to understand what is in each event without having to open it to see. In conjunction with the links provided between people at each event and the location they are at, this will help the problem of not having enough context to tell what the event is at a glance.

Question of Scalability

To solve the problem of the graph getting too cluttered as thousands of entries are added, two filtering techniques are used. These will be separated into type 1 filters and type 2 filters. The type 1 filter, when enabled, will display that corresponding type of entry and the links between them on the main screen. The type 1 filters are location and people. The type 2 filter on the other hand does not have any associations with events therefore will not show up on the screen. Instead when it is checked, it will show or hide the events that match that description. These filters are time, weather, and record type.

Issues of Touch Interface

Each item on the screen will automatically position itself a suitable distance in relation to others depending on its links to others, and no two objects on screen will overlap. These will provide large areas for the user to touch as well as dead zones around the events so that the wrong event is much less likely to be tapped. In addition, the screen will support pinch-to-zoom so that these touch areas may be made bigger and smaller as required.

Learning Curve

With the additional functionality of this concept comes a slightly higher learning curve for the user. Again the concept would still be using common gestures that the users are likely to know such as pinch-to-zoom and swipe to pan. Tapping on each event will still open the details for it, making the concept intuitive enough for a user to pick up and learn quickly how it works, even with initial confusion.

5.2 Implementation

Before implementing the concept directly, a little ground work had to be done first. The two applications 'Catchit' and 'Displayit' were merged into one with a main menu to switch between

capturing and displaying. The user can get to the main menu by pressing the Android back key so they can easily switch between the two.

The icon picker page in the capturing phase of the program was revamped, with the radio buttons below each image removed. The icon images themselves were removed and replaced with image buttons. Each button is selected only one at a time so they retain the same functionality as the radio buttons, but with a much larger touch zone making it far easier to select. This is shown in Figure 5.2.

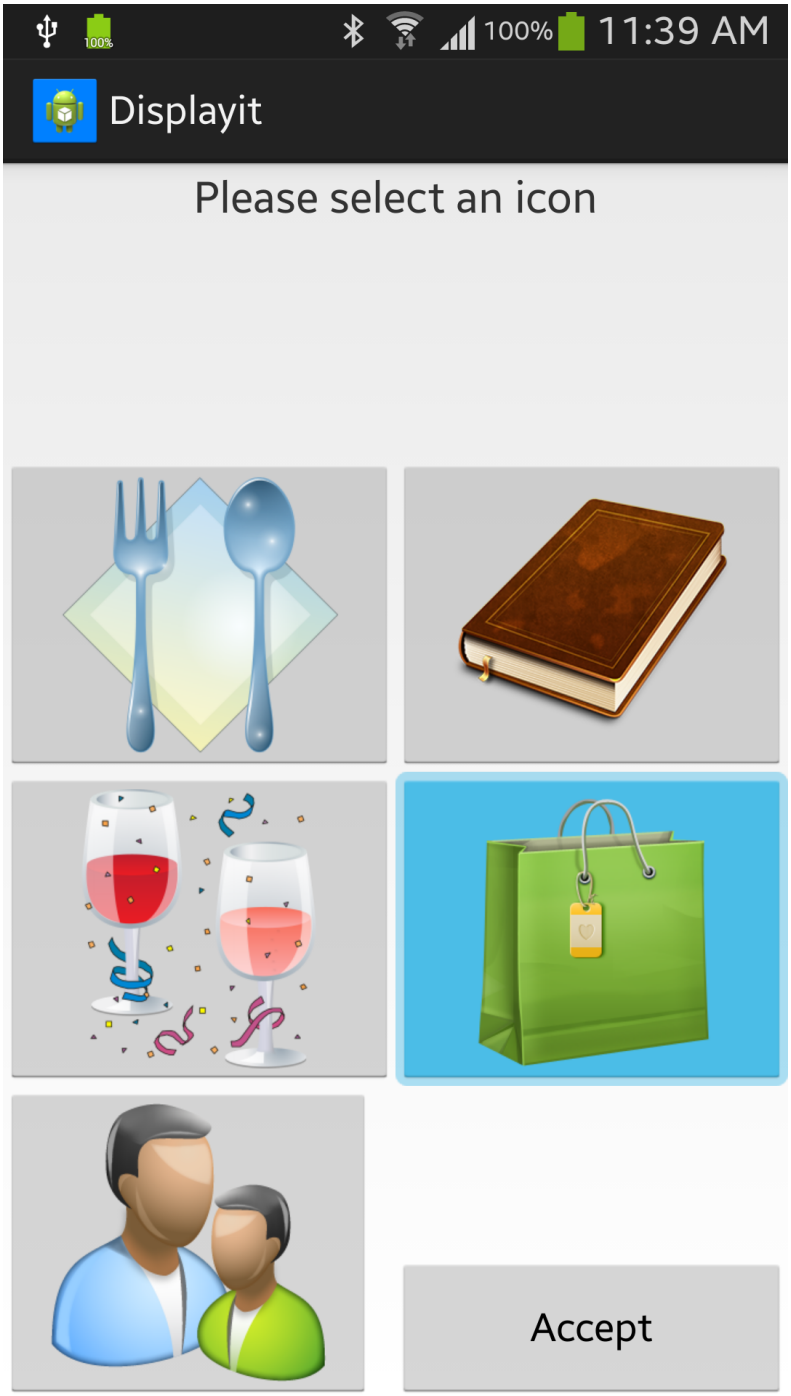


Figure 5.2. The improved icon picker screen.

The initial code refactoring has been done to allow for the complete new user interface to be integrated in. The Cube object has been renamed and refactored into a new Event class, initiating the change into the new design. The old stage that rendered the cubes using OpenGL ES has been scrapped, as it is no longer necessary to draw three-dimensional objects. Instead everything will be drawn on a single canvas, which will make the code simpler and easier to maintain.

Currently the concept implementation is up to the point of drawing an ellipse around text of a variable length, and drawing a rounded rectangle to fit around a square icon and a variable length text.

6 Conclusion

There has been good progress made towards implementing the Digital Parrot on mobile devices. The existing project that had been picked up has been implemented and is working successfully. Problems with the design have been found by conducting a user study on an existing project which otherwise might not have been apparent, such as the scalability issues and the cubes not having enough context for users to see what they are without opening them.

After evaluating these weaknesses of the cube design, a new graph interface concept with filtering and search capabilities has been developed which addresses the weaknesses of the old design. Initial work has begun on implementing this new design, with the base Event class already coded and loading event data in from the mobile device's storage.

6.1 Future Work

Though good strides have come from this project in implementing the Digital Parrot on mobile devices, there is still work that can be done to continue towards this goal.

Firstly, finishing the implementation of the new concept would help greatly. This can be broken down into many smaller subtasks as the concept has quite a wider scope than the original project. Examples include:

- Finishing the GUI, building the visual event objects that are displayed on the screen (eg. Ellipse around text), and creating visual animations and gestures.
- Implementing the filtering functions to hide and show events and links, and building the interface to activate them either through menus or other means.

- Implementing an algorithm to determine where the best location for each node on the screen based on its links and spacial proximity to other nodes.
- Implementing the search function, preferably an instant search that displays results as soon as the user starts typing.
- Adding an editing function so events may be renamed and have their attributes changed if incorrect. Moving data from one event to another if it is in the incorrect one.

Adding in the additional specifications taken from the Digital Parrot thesis as well as other non-critical functionalities gives us more work that could be done to improve the software once it has been implemented, such as:

- Voice commands, eg. “Mark this moment” where the phone will save the location, time and other data that is available and construct a more specific event at a later time when the user enters them in.
- Speech-to-text and text-to-speech so the user can have additional ways of entering in and reading back text notes that have been saved.
- Synchronization between the phone application and the desktop software.
- Adding cloud-based services and user accounts for securely backing up data.

References

The Digital Parrot Thesis Schweer, A. (2011) "Augmenting Autobiographical Memory: An Approach Based on Cognitive Psychology" Ph.D. Thesis, Department of Computing and Mathematical Sciences, University of Waikato, New Zealand.

Figure 2.1 Above paper, page 103.

Figure 2.2 Above paper, page 108.

Mobile device interaction examples Above paper, page 80. Section 4.4, "Interaction Examples"

Q1 Above paper, page 104.

Appendix A1

Application for Approval
Outline of Research or Related Activity
Ethics Committee, Faculty of Computing and Mathematical Sciences

Note: add your project details to this document – do not delete any of the existing content

Details of Proposed Activity

1. Identify the project

1.1 Title of Project

Mobile memory aid

1.2 Researcher(s) name and contact information

Annika Hinze
Department of Computer Science
The University of Waikato
Private Bag 3105
Hamilton 3240
NEW ZEALAND
hinze@cs.waikato.ac.nz

07 838 4052 (Annika)

1.3 Supervisor's name and contact information (if relevant)

Annika supervises Jake's 477 project

1.4 Anticipated date to begin data collection

7 August 2013

1.5 Does your application involve issues of health or disability with human participants? If so, please refer to the guidelines as to whether your application needs to be submitted to the Northern Y Regional Ethics Committee.

The application does not involve issues of health or disability with human participants.

2. Describe the research or related activity

2.1 Briefly outline what the project is about including your goals and anticipated benefits. Include links with a research programme, if relevant.

The study explores the participants' use of a mobile memory aid software we developed. The goal is to find out the participants opinion about the memory aid software. The anticipated benefit is feedback about the software so that we can improve its interface and user experience.

2.2 Briefly outline your methods.

The study will be performed as a field study with participants using mobile software in the Hamilton followed by semi-structured interviews. The participants will be given a smart phone to use for the study by the researcher. The participants will be asked to use an electronic memory aid while they walk around public places in Hamilton (such as university grounds and Hillcrest neighborhood). Follow-up questions will be asked after the walk to analyse usability and affordance of the system, and explore in detail the reasoning for the usage during the study. Examples of questions are given in the additional sheet. The follow-up interview is done at the university and in situ in Hamilton. The phone they use is one supplied by the researcher (UoW project phone).

2.3 Describe plans to give participants information about the goals of the research or related activity.

Participants will receive an information sheet about the study. They will also have the opportunity to receive information about the outcome of the study in summarized form.

2.4 Identify the expected outputs of this research or related activity (e.g., reports, publications, presentations).

The researchers plan to publish the results in working papers, academic conferences and journals. The results will be presented at talks at these conferences or during visits to other universities. The results will also be used in Jake's 477 project. The results may also be used for applications to funding bodies. The results of the research may be made available in summarized form to potential funding bodies. All publication and presentation of the results will be done in anonymised form.

2.5 Identify who is likely to see or hear reports or presentations arising from this research or related activity.

Reports and presentations are planned as described in section 2.4. Expected readers and listeners are national and international researchers, tourism agencies and funding bodies.

2.6 Identify the physical location(s) for the research or related activity, the group or community to which your potential participants belong, and any private data or documents you will seek to access. Describe how you have access to the site, participants and data/documents. Identify how you obtain(ed) permission from relevant authorities/gatekeepers if appropriate and any conditions associated with access.

The participants will take the phone with the installed software to public places in Hamilton (such as university grounds and Hillcrest neighborhood). They will participate in a follow-up interview either in situ or at university. Participants will be student from the university (comp539 course participants). The software has been written by the researchers. No permission is needed to access the sites as they are public places.

3. Obtain participants' informed consent without coercion

3.1 Describe how you will select participants (e.g., special criteria or characteristics) and how many will be involved.

People have to be willing to use a smart phone with the memory aid. The study is planned to have 10 to 30 participants.
Participants will be recruited from comp539-2013 as these students have to take part in a user study as part of their studies.

3.2 State clearly whether this is an application under section 10 of the Ethical Conduct in Human Research and Related Activities Regulations: Large Random Sample Surveys.

This is not an application under section 10 of the Ethical Conduct in Human Research and Related Activities Regulations.

3.3 Describe how you will invite them to participate.

Participant will be contacted via email (at the university) or via their lecturer (COMP539 paper participants).

3.4 Show how you provide prospective participants with all information relevant to their decision to participate. Attach your participant information sheet, cover letter, or introduction script. See document on informed consent for recommended content. Information should include, but is not limited to:

- what you will ask them to do;
- how to refuse to answer any particular question, or withdraw any information they have provided at any time before completion of data collection;
- how and when to ask any further questions about the study or get more information.
- the form in which the findings will be disseminated and how participants can access a summary of the findings from the study when it is concluded.

Participants will receive an information sheet and a consent form (as attached) before the study commences. The study will also be explained to them by the researchers.
All data as per bullet points is explained in the information sheet and consent form, which the researcher will use to talk about the project.

3.5 Describe how you get their consent. (Attach a consent form if you use one).

Participants will be asked to sign the attached consent form.

3.6 Explain incentives and/or compulsion for participants to be involved in this study, including monetary payment, prizes, goods, services, or favours, either directly or indirectly.

No incentives will be used. Comp539 participants have to take part in the study as part of the course. There is *no relationship* between the participants' answers and feedback in the interview and how their study involvement is assessed in the comp539 course.

4. Minimise deception

If your research or related activity involves deception – this includes incomplete information to participants -- explain the rationale. Describe how and when you will provide full information or reveal the complete truth about the research or related activity including reasons for the deception.

The research does not involve deception.

5. Respect privacy and confidentiality

5.1 Explain how any publications and/or reports will have the participants' consent.

The participant will be giving consent by signing the consent form

5.2 Explain how you will protect participants' identities (or why you will not).

Only the two researchers will know participant's details (and the comp539 lecturer). No personal details will be recorded for the study itself. If participants wish to receive a summary of the study outcomes, they will need to give contact details. However, these details will be separated from the notes. None of the contact details will be used in any publications; contact details will be destroyed by the end of study analysis.

5.3 Describe who will have access to the information/data collected from participants. Explain how you will protect or secure confidential information.

Data collected will be kept as paper records and as electronic summaries. After the summaries have been sent out, no confidential information is kept buy the researchers. The collected data is anonymous and therefore does not need specific protection. All data will be kept for long term-archiving in the FCMS data archive (5 years as required).

6. Minimise harm to participants

'Harm' includes pain, stress, emotional distress, fatigue, embarrassment and exploitation.

6.1 Where participants risk change from participating in this research or related activity compared to their daily lives, identify that risk and explain how your procedures minimize the consequences.

There is no risk of harm for the participants.

6.2 Describe any way you are associated with participants that might influence the ethical appropriateness of you conducting this research or related activity – either favourably (e.g., same language or culture) or unfavourably (e.g., dependent relationships such as employer/employee, supervisor/worker, lecturer/student). As appropriate, describe the steps you will take to protect the participants.

If a dependent relationships exist between participants and one of the researchers, the other researcher will conduct the interview.

6.3 Describe any possible conflicts of interest and explain how you will protect participants' interests and maintain your objectivity.

There is no conflict of interest.

7. Exercise social and cultural sensitivity

7.1 Identify any areas in your research or related activity that are potentially sensitive, especially from participants' perspectives. Explain what you do to ensure your research or related activity procedures are sensitive (unlikely to be insensitive). Demonstrate familiarity with the culture as appropriate.

No areas of the research are identified as being particularly sensitive to the participants. However, participants will be able to refuse answering questions as laid out in the information sheet. Care will be taken to explain to participants from comp539 that their interview answers will not be fed back to their lecturer and are therefore independent of their performance in that course.

7.2 If the participants as a group differ from the researcher in ways relevant to the research or related activity, describe your procedures to ensure the research or related activity is culturally safe and non offensive for the participants.

The research is not offensive or culturally unsafe.

Appendix A2

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Mobile memory aid

1. Please indicate your gender :

   Female: ☐ Male : ☐

2. Please indicate your age group:

   Younger than 20: ☐

   20 – 35: ☐

   36-50: ☐

   51-65: ☐

   66 or over: ☐

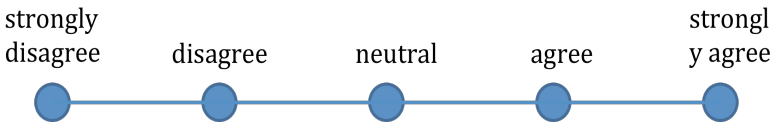
3. Use of memory aids (please name any additional you use)

	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Calender	☐	☐	☐	☐	☐
Photographs	☐	☐	☐	☐	☐
Note taking pen & paper	☐	☐	☐	☐	☐
Digital notes / documents	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐

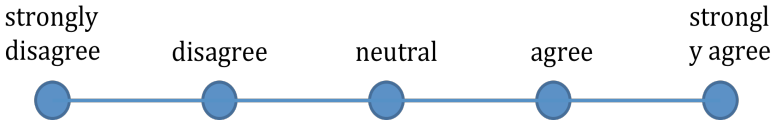
Appendix A2

4. Usability and affordance of the mobile memory aid

- The capturing software was very easy to use



- The retrieval software was very easy to use

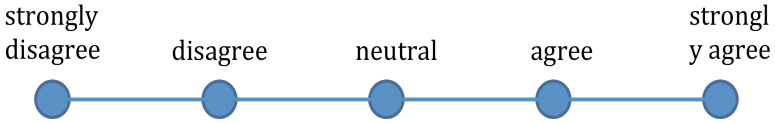


- Issues that participants noticed

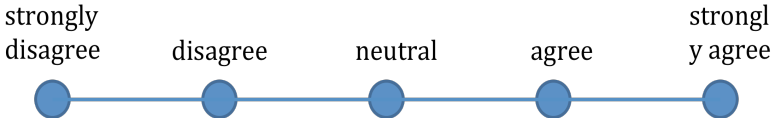
Capturing of events	Finding notes

5. Usage analysis of the mobile memory aid

- The capturing software allowed me to capture all I wanted to capture



- The retrieval software allowed me to find all I wanted to find



Capturing of events	Finding notes

Appendix A2

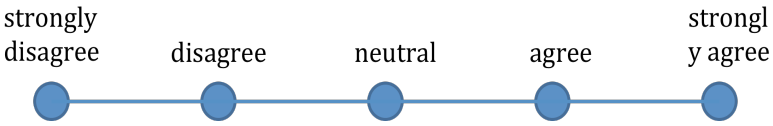
• One thing that was very good • One thing to change •	• One thing that was very good • One thing to change

What types of information did you capture?

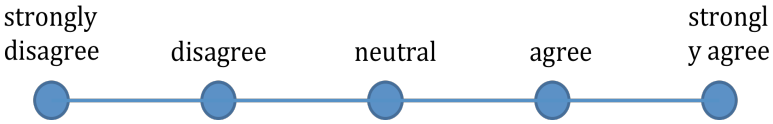
□ Note □ Photo □ Audio

This type of information was very useful in recalling my memory.

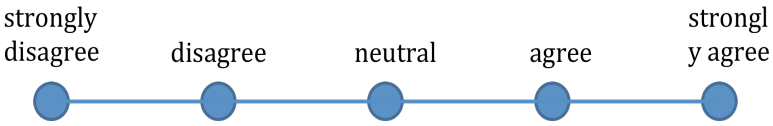
- Note



- Photo



- Audio



Were there any features of the software that you did not use?

Are there any more comments you would like to make?