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SUMMARY OF THE DIARY STUDY
“Please feed the Digital Parrot”

Andrea Schweer

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©Andrea Schweer
Department of Computer Science
The University of Waikato
Private Bag 3105
Hamilton, New Zealand

Summary of the Diary Study “Please feed the Digital Parrot”

Andrea Schweer
schweer@cs.waikato.ac.nz

Supervisors: Annika Hinze, Steve Jones, Ian Witten

This document summarises the findings of the diary study “Please feed the Digital Parrot” conducted in May 2007. The aim of this study was to collect real-world examples of remembering behaviour.

We show the most interesting entries we collected, highlighting the kinds of information people wish to remember, the situations in which they wish to remember this information and how they go about remembering information. We discuss in which ways the findings deviate from our expectations and the implications of our observations for context-aware systems research and for future diary studies.

1. Introduction

In the Digital Parrot project, we are developing personal, context-aware software to augment people’s memory of the events of their lives. More information about this project can be found in [2, 3, 4].

In May 2007, we conducted an exploratory study to find out more about what and how people remember. In particular, we aimed to collect real-world examples for

1. the kind of information that people want to remember;
2. the situations in which people wish to remember something;
3. how people go about remembering.

This document first gives more details about the study (Section 2) and our expectations (Section 3). Section 4 contains general statistics about the collected data and shows the most interesting items collected in the study. Section 5 relates these findings to the expectations described above and draws conclusions from this study, for the Digital Parrot and also for other, similar systems.

Appendices A and B show the Participants’ instructions and the Research Consent Form, respectively, as distributed to the participants of the study.

2. Method

Each participant received a paper diary to use for the time of the study (approximately two weeks). The paper diary was used to capture the moments where a participant would turn to an electronic Digital Parrot system to record memories or to retrieve recorded memories.

They were asked to use the diary to record two kinds of situations:

1. when they *encountered information* they thought they might want to remember later;
2. when they *tried to remember information* that they didn't remember straightaway. It did not matter whether they succeeded in remembering or not. It also did not matter whether they first encountered this information before or during this study.

The reason for including this second kind of situation in the study is that we hoped to gain additional insights about the remembering process from participants' expectations about when they would want to remember newly encountered information.

Each page spread in the diary was designed to hold records of one incident. Each diary contained a plastic front cover, a title page and short summary of the instructions, two examples, pages to record up to 40 incidents and a cardboard back, all held together at the top edge by plastic spiral binding. We considered two usability concerns when designing the size and materials of the diary: the diary needed to fit into pockets of every-day clothes, and it should be possible to hold the diary comfortably in one hand while writing.

Odd and even numbered pages of the diary were designed differently. Each odd-numbered page in the diary was left blank so that the participants could fill in their answers to the questions on the preceding even-numbered page. Figure 1 on the following page shows a sample of an even-numbered diary page: The two types of usage of the diary are distinguished (encountering and recalling information). For recording encountered information, participants had to describe the situation (context), the kind of information they encounter, and the means they undertake in this situation to aid their memory. Explicit recording of the information itself was not part of the study. For recall attempts, participants were asked to describe the situation (the context) and to describe and reason about their attempts to recall data they had encountered earlier. Question 6 (recalling) mirrors Question 3 (encountering) as the data typically would have been originally encountered outside the interval of the study.

The study had 13 participants. All except one were graduate students, visitors and lecturers in the Computer Science Department at the University of Waikato, one was a family member of another participant. This had practical reasons only; a Computer Science background was not necessary to participate. To match the target group of the Digital Parrot, we only recruited participants that considered themselves computer-literate. Further demographic data (e.g. age, gender) about the participants were not recorded.

6 Date & Time: _____

This diary entry is about...

...encountering new information

- 1) In which situation are you?
- 2) What is it you think you might want to remember later? Why?
- 3) Do you do something to help you remember?
Yes → What do you do?
No → Why not?

...remembering information

- 1) In which situation are you?
- 2) What it is you want to remember?
- 3) Why do you want to remember this here and now?
- 4) How do you go about remembering?
- 5) Are you successful?
Yes / No / Partially (*circle*)
- 6) When you encountered this information: Did you do something to help you remember?
Yes / No (*circle*)
If yes:
 - a) What did you do?
 - b) Do you use it now?
Yes → In which way does it help you?
No → Why not?

Figure 1: Sample diary page (original size ca. 8.5 cm × 14 cm)

3. Expectations

Based on our understanding of human memory at the time the study was designed and conducted, we had some expectations about the data we would obtain. We describe our expectations using the examples we provided in the diaries (Entries E.1 and E.2).

Entry E.1 – Encountering Information

Situation	I'm in Auckland for the day and just discovered a really interesting shop. It's not open today, so I'll want to come back some other time.
Information	The shop's opening hours
Reason	So I can time my next trip to Auckland better
Memory Aid	There's a sign listing the shop's opening hours in the window. I take a picture of this sign with the camera in my mobile phone.

Entry E.2 – Remembering Information

Situation	Whitcoull's, Centre Place (Hamilton)
Information	The title of a cookbook that a friend recommended to me.
Reason	I saw the shelf of cookbooks and remembered that I want to buy the book.
Recalling	I walk along the shelf because I hope that one of the titles will catch my eye. Then I remember that the title was something with "positive chef" or so. I ask a salesperson. The salesperson still can't help me, so I call my friend and ask her. She tells me the title: "Confident Cook" by Lauraine Jacobs.
Success	Yes

Types of Information We expected the participants to record situations related to factual information. The examples reflect that: the shop’s opening hours; the title of the cookbook. We also expected that when participants attempt to recall information, this information need would in most cases have been triggered by a task that they were performing (the need to remember the book title was triggered by the task “buying books”).

Situations We expected that participants would wish to recall information in situations in which cues are present that are related to the situation in which they first encountered this information or related to the information itself (wish to remember the book title triggered by seeing the shelf of cookbooks).

Remembering Process We expected to see examples of rather simple retrieval processes (e. g. staring into space until the participant remembers the information) and examples of more elaborate “retrieval journeys”. An example of the latter type of process can be seen in Entry E.2: Several attempts and sources are required (reading titles; asking salesperson; calling friend) until the information need has been satisfied.

Furthermore, we assumed that there is a clear separation between the two kinds of situations that participants were asked to record in their diaries: encountering new information that they would wish to remember later, and attempting to recall previously encountered information. We also assumed that besides these two kinds of situations, there were only two other kinds of situation with regards to encountering/recalling information:

- encountering new information that the participant assumes they will not want to remember later;
- spontaneous or effortless recall of previously encountered information.

We did not ask participants to record these latter kinds of situations.

4. Results

All but one of the 13 diaries that we distributed to the study participants were returned to us. We collected 81 entries in total. Figure 2 shows a box plot of the distribution of entries per diary. The number of entries per diary ranges from three to 17, with a median of 4.5 entries per diary. Half of all diaries contain between 3.75 and 8.75 entries each.

55 entries describe situations where the participant encountered information that they thought they would want to remember. This includes four entries that were misclassified by the participant. The other 26 entries describe situations where the participant tried to remember some information that they already knew.

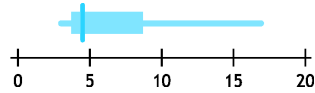


Figure 2: Number of entries per diary: minimum, 1st quartile, median, 3rd quartile, maximum

4.1. Information Types: Reference and Reminders

The most obvious classification of the entries according to the type of information they describe is that into *reminders* and *reference information*. Reminders concern a task to be performed by the participant in a certain situation. Reference information consists of non-actionable facts.

Examples for these types of entries are: Entry 7.3 for reminder-style information; Entry 8.4 and Entry 1.3 for factual information.

Entry 7.3 – Encountering Information

Situation	At home, got a phone call
Information	New time for hairdresser appointment
Reason	Hairdresser called and asked to reschedule appointment
Memory Aid	Write new time on piece of paper and put it under my mobile phone to remind me to take it to uni tomorrow and write the new appointment in my diary

Entry 2.4 – Encountering Information

Situation	In the lab at uni
Information	Website address
Reason	Someone mentioned it to me
Memory Aid	Write it on back of my hand

Entry 8.4 – Remembering Information

Situation	Preparing a meal
Information	Name of exotic fruit we bought
Reason	So we can look up how to prepare it
Recalling	Ask partner who was there when we bought it
Success	No, partner doesn't remember either

4.2. Situations

As expected, several of the entries described situations in which an environmental cue triggered an information need or spontaneously made the participant think of some information that they would wish to remember later.

An example for the first kind of entry is Entry 9.5, where something mentioned in a conversation (Hell Pizza rubber ducks) made the participant remember an earlier

conversation, which triggered the need to remember another topic (idea for birthday present) that came up in the earlier conversation.

Entry 9.5 – Remembering Information

Situation	At lunch
Information	Idea I had the other day for a birthday present for my sister
Reason	Hell Pizza rubber ducks were just mentioned in conversation, which also was an idea for a birthday present for her
Recalling	Asked a friend who was present when I had the idea
Success	No, friend didn't remember either

An example for the second kind of entry is Entry 6.16, where a certain image (crunchie bar, which contains a special New Zealand candy called hokey pokey) made the participant remember an earlier conversation about hokey pokey and their promise to give a hokey pokey recipe to somebody.

Entry 6.16 – Encountering Information

Situation	Tea room at uni
Information	Give hokey pokey recipe to a visitor to the department
Reason	Saw a colleague eat a crunchie bar and remembered conversation about hokey pokey with visitor
Memory Aid	Nothing – will remember next time I see the visitor or another crunchie bar

4.3. Retrieval Strategies

Entry 4.11 describes a situation in which recalling the information was relatively straightforward. The participant an external representation of the sought-after information (calling card) and knew where to find this representation (desk drawer).

Entry 4.11 – Remembering Information

Situation	At uni, making a phone call
Information	Call card number
Reason	To make the call
Recalling	Take calling card out of desk drawer to read number
Success	Yes

Recall in Entry 5.6 was more complicated: The participant did have external representations (printout; e-mail) of the required information (membership number for frequent flier programme). However, it took them several attempts (physical folder; bookshelf; e-mail program) to locate the information because they had to search for these representations. Figure 3 shows a diagram of this search process and the backtracking steps.

This search process can be described as a loop in which the person has an information need and then generates new ideas for representations and locations. The loop terminates either when the person cannot generate no more ideas or when the information has been found.

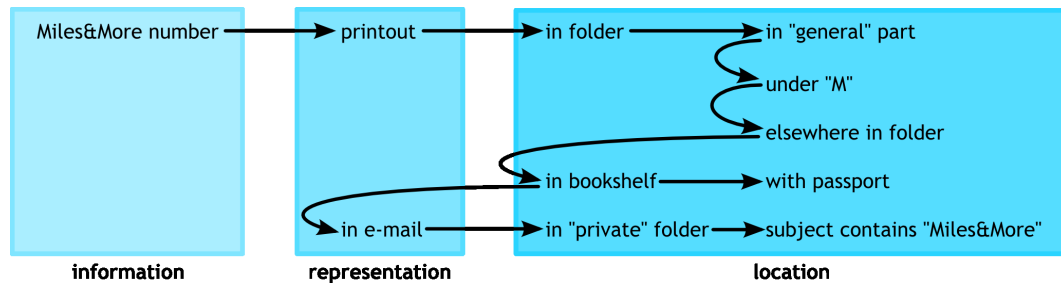


Figure 3: Search process in Entry 5.6

Entry 5.6 – Remembering Information

Situation	At home
Information	My Miles&More membership number
Reason	Will go to travel agent later today and will need number then
Recalling	Try to find printout of number in my “important stuff” folder; look in “general” and under “M”, don’t find it there; look through entire folder. Look for printout in bookshelf with passport. Give up on printout. Remember the number probably is in an e-mail; go to “private” e-mail folder, search for e-mails with frequent flier programme name in subject; find e-mail with number
Success	Partially: found the number, but not the printout I’d originally searched for

In contrast, Entry 6.6 and Entry 6.8 describe situations in which the participant could not easily obtain the information from any external source. The participant tried to recall the information by trying to follow associations from pieces of information they did remember. While these two entries are from the same participant, less clearer examples of the same kind of behaviour can also be found in other participants’ diaries.

Entry 6.6 – Remembering Information

Situation	Birthday party
Information	Name of friend’s father
Reason	Is at party, might be in situation to speak to father
Recalling	Tried to remember her in relation to name of friend’s mother: Maria and ...?
Success	No

Entry 6.8 – Remembering Information

Situation	In car, driving to work
Information	Task to perform
Reason	Have vague feeling that there is a task I forgot to do the previous day – want to remember to put it on today’s to-do list
Recalling	Tried to think about all the likely people who might ask me to do something and whether or not they had phoned me yesterday
Success	Yes

Looking at situations where people took note of information they thought they would want to remember later, there is one strategy that can be observed in many entries:

The person places an external representation of the information in a “place” (physical or electronic) and assumes they will remember to check this place in appropriate situations. Examples of this strategy are Entry 2.9 and Entry 3.5.

Like in Entry 2.9, the external representation for reminder-style information is usually placed so that the participant is certain they will come across it in the situation in which they will want to be reminded.

Entry 2.9 – Encountering Information

Situation	Home
Information	To return this diary to the researcher
Reason	—
Memory Aid	Put the diary somewhere I can't miss

Entry 3.5 is typical for reference-style information in that here, the external representation is placed so that it is rather unlikely that the participant will come across it by chance in the right situation. Instead, the participant relies on their knowledge of their own habits, or indeed on their own memory, to look at the pictures stored on their phone in appropriate situations (for example the next time they are in the bookshop and carry enough money with them to buy these books or the next time they have a chance to read book reviews to help them make a decision about purchasing these titles).

Entry 3.5 – Encountering Information

Situation	In bookshop
Information	Titles of books
Reason	Want to buy them later
Memory Aid	Take picture of book covers with camera cell phone

This behaviour is illustrated by the following comment made by one of the participants.

To sum up: To remember [something,] I write it on my hand, add it to my phone, email it to myself, add it to google calendar [or] write it to a text file. To remember above, I rely on coming across what I had left for myself! (2)

5. Discussion

Observations vs Expectations The findings of the situations in which people wish to remember previously encountered information and also of common retrieval processes agree with our expectations. However, the examples we collected do not only concern factual information. In addition, participants recorded situations concerning reminders.

The large number of reminders is surprising. Figure 4 on the next page shows the proportions of entries related to reference information and reminders in encountered information compared to remembered information. Of the 55 entries concerning encountered information, 33 (60%) are about reminders and the remaining 22 (40%) are about reference information. With the 26 entries concerning remembering information,

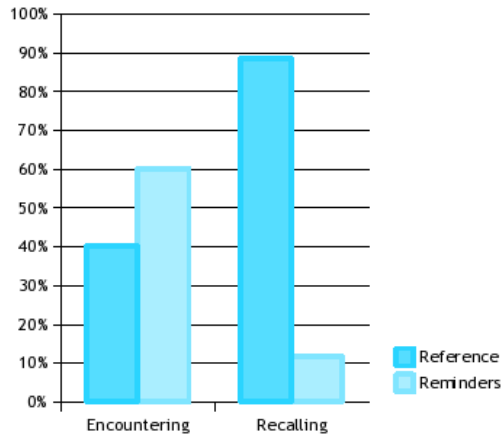


Figure 4: Reference information vs reminders in encountering and recall

these proportions are reversed: Only 3 (11.54%) of these entries are task-related, all others (88.46%) relate to factual information.

One explanation for this observation is that it lies in the nature of the information. Reminders are usually either remembered in the appropriate situation and the associated task is successfully performed, or they are forgotten about and only remembered when the appropriate situation has passed. In contrast to this, reference information is more commonly remembered incompletely and can thus lead to a genuine information need that is perceived as such.

We are not planning to support reminders in the Digital Parrot. As explained in [4], the Digital Parrot does not target everyday situations like those investigated with the diary study. Further investigation is needed to verify or reject our explanation above and also to determine whether the proportion of reference information and reminders is different in the kinds of situations targeted by the Digital Parrot.

Another observation that deviates from our expectations is that participants recorded one further type of situation in their diaries, in addition to encountering new information and attempting to recall previously encountered information. Several entries, for example Entry 6.16 shown in Section 4.2, describe situations in which the participant spontaneously remembers some information that is of no use to them at that very moment but that they will want to remember at a later time. The difference to encountering new information is that this information is not *new* – the participant had encountered it before and thus a recall process was involved. This seems to have created some confusion for the participants. Three out of the four misclassified entries describe such a situation.

Context-Aware Reminders Based on the findings of our study, we consider context-aware reminders a topic that deserves further attention. Currently, users can set reminders (for example on their mobile phones) for certain *times* where in fact they want to specify a given *context*. A reminder for buying groceries at 6 pm would turn into a

reminder when passing the shop on the way home from work.

The development of context-aware reminder systems and also of other augmented memory systems like the Digital parrot poses several challenges for research on context-aware systems. On the system level, a stronger model of context is needed than just simple context such as time or location (for example “when phoning the hairdresser”).

On the user interface level, means of specification for contexts (e. g. in queries or when setting up reminders) are required that can be employed by ordinary users. This has previously been investigated [1] but conceptions of context have changed substantially since then.

Feasibility of Diary Studies Overall, we are happy with the results of our study and with the examples we were able to collect. We see this as an indicator that diary studies can be a very helpful tool. However, we did not anticipate that taking part in our study would be a stressful experience for some of the participants.

When returning the diary to us, several participants in the study commented on their “performance” as study participants. Even participants with more than the average number of entries seemed to find it necessary to apologise. Most were very relieved to hear that other participants had made the same experiences. One participant went so far as to speculate that they “should get a life”, seeing that in two weeks they had only had such a small number of experiences they found worth remembering.

One of the participants commented on this phenomenon in their diary, giving a possible explanation.

Note – I was trying to work out why this was so hard – i. e. why I’ve done such a [poor] job at filling this in – I think maybe it’s because often we go through the thought-processes outlined (when trying to retrieve info) that we’re barely conscious of them? (7)

Future diary studies should take this into account and take measures to protect their participants. At the very least, participants should be briefed accordingly so that they do not set their expectations too high.

Acknowledgements

We thank all participants in our study for their time and effort.

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A. Instructions for the Participants

I'm Andrea Schweer, a PhD student at the University of Waikato. The goal of my PhD project is to help people remember their own past experiences.

Think of the system I want to build as a digital parrot: something that sits on your shoulder (figuratively speaking) when you're in a situation you'll want to remember and that pays attention to whatever you're experiencing. Afterwards, your parrot can help you remember. The good thing about the digital parrot is that it can do more than just speak to you. Exactly what kind of information is stored (for example text, pictures, audio, video) depends on how its owner's memory works.

Purpose of the experiment

With this study, I want to find out what *kind of information* people would like to remember, which *memory triggers* there are and which *steps* people take to recall information that isn't "just there" when they want to remember it.

I'm especially interested in information about your own experiences. Examples are the year in which you were on vacation at a certain place or the title of a book recommended to you by a friend.

Over the next one to two weeks (until Friday, June 1), please use the diary that I have given to you to record

- when you **encounter information** you think you might want to remember later;
- when you **try to remember information** that you don't remember straightaway. It doesn't matter whether you succeed in remembering or not. It also doesn't matter whether you first encountered this information before or during this study.

The diary contains more detailed instructions for both types of situations and an example for each situation.

Please return the diary to me on Friday, June 1. You can either give it to me or put it into the box I will provide in the CS reception (G1.21).

Thank you for participating in this study!

B. Research Consent Form

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, please ask. Please take the time to read this form carefully and to understand any accompanying information.

Research Project Title

Context-Aware Augmented Memory – Feeding the Digital Parrot

Experiment Purpose

For my PhD project, I will build a system that helps people store and recall information about their own past experiences.

With this study, I want to find out what *kind of information* people would like to remember, which *memory triggers* there are and which *steps* people take to recall information that isn't "just there" when they want to remember it.

While developing my system, I have to decide which types of information items it should be able to store and which attributes and relationships between items can exist. I will use the information collected in this study to ensure that my system is expressive enough to hold real-life memories.

Participant Recruitment and Selection

Undergraduate students, graduate students, visitors and lecturers from the University of Waikato will be recruited for this experiment. This is just for practical reasons; having a Computer Science background is not a requirement for participating in this study. To match the project's target group, participants should consider themselves computer-literate.

Procedure

I will give you a diary. Please use it, over the next one to two weeks (until Monday, May 27), to record certain information about situations in which you either encounter information you might want to remember later, or in which you attempt to remember information you have encountered before. More detailed instructions are attached and can also be found in the diary.

It is not important for this study that the diaries are a complete record of *all* such situations. If you feel uncomfortable recording a particular situation, simply leave it out of the diary.

The study does not look at your memories themselves. If you wish, you may record some or all situations in an abstract rather than a specific way (for example, "I'm at

a bookshop” is abstract while “I’m at Whitcoull’s, Downtown Plaza (Hamilton)” is specific).

This experiment is not a test—in particular, I am not measuring or evaluating the performance of your long-term memory. The objective of this study is to collect data about which kind of information people wish to remember regarding their own experiences and about when and how they try to do this.

Data Collection

No video, audio or notes will be taken throughout the observation period. The only data collected will be the information that was written into the diaries by the participants.

Data Archiving/Destruction

No data transcribed from the diaries into any other form will contain content that would allow the identification of any research participant. All recordings that are written in a specific way will be transformed into an abstract way (for example, “I was trying to remember whether my friend Anna’s phone number is 123 4567 or 123 4568” would become “I was trying to remember whether my friend *name*’s phone number is *xxx xxxa* or *xxx xxxb*”).

The diaries will be kept in a locked space to which only the researcher and her supervisor have access. No record will be kept about which diary has been returned by which participant. The diaries will be destroyed at the end of the research project.

Confidentiality

Confidentiality and participant anonymity will be strictly maintained. All information gathered will be used for statistical analysis only and no names or other identifying characteristics will be stated in the final or any other reports.

Likelihood of Discomfort

There is no likelihood of discomfort or risk associated with participation.

Researcher

Andrea Schweer is working on her doctorate in the Computer Science Department at the University of Waikato, New Zealand. This study will contribute to her research on Context-Aware Augmented Memory Systems. Her supervisor is Dr. Annika Hinze.

Andrea can be contacted in room G2.06 of the School of Computing and Mathematical Sciences building at the University of Waikato. Her phone number is 838 4466 ext. 6011 and her email address is schweer@cs.waikato.ac.nz.

Finding out about Results

The participants can find out the results of the study by contacting the researcher after June 15, 2007.

Agreement

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a participant. In no way does this waive you legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to not answer specific items or questions in interviews or on questionnaires. You are free to withdraw from the study at any time without penalty. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. If you have further questions concerning matters related to this research, please contact the researcher.

Participant

Date

Researcher

Date

A copy of this consent form has been given to you to keep for your records and reference.