

Features for the future Experience Sampling Tool

Vassilis-Javed Khan
Eindhoven University of Technology
Den Dolech 2
5612AZ Eindhoven
+31 40 247 5256
v.j.khan@tue.nl

Panos Markopoulos
Eindhoven University of Technology
Den Dolech 2
5612AZ Eindhoven
p.markopoulos@tue.nl

Berry Eggen
Eindhoven University of Technology
Den Dolech 2
5612AZ Eindhoven
j.h.eggen@tue.nl

ABSTRACT

Based on our experiences with Reconexp, a distributed application which partly runs on a mobile device and partly on a website, and a review of tools developed to help researchers survey user attitudes, experiences and requirements in field studies we present a list of requirements for future experience sampling tools.

Categories and Subject Descriptors

H.4.m [Information Systems]: Information Systems – Miscellaneous.

General Terms

Human Factors

Keywords

Experience Sampling, Day Reconstruction, Diary Studies

1. INTRODUCTION

Existing research and evaluation methods have been shaped to address the evaluation of task-oriented interaction, usually contained within a short time span. Extending characterizations and evaluation methods to address user experiences as they occur in context reflecting social interactions between several people and various environmental and technical contingencies, requires scaling up the sampling of data in frequency, duration and in the richness of the records made.

The objective of the evaluation has also changed significantly. Transcending usability, evaluations of ambient applications need to consider higher level aspects of user experiences and user needs relating to persuasion, fun, engagement, trust, etc. Evaluation practices must be able to account for, capture and investigate the variability of contexts described above allowing experimenters to manipulate and control those environments or, when working in the field, to capture sufficient contextual information them.

Contextualized methods of data collection should allow reports of attitudes, opinions, or appraisals of subjective experiences to be captured close to the moment that a particular experience occurs, in the context that events and activities unfold. Also, such sampling of user attitudes can occur repeatedly over time, allowing the study of behaviors and experiences over medium or long periods of time, to uncover temporal patterns or to examine

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patterns of use over time.

One well established method that addresses these requirements to a large extent is the diary method whereby informants are asked to keep a journal or a log, where they record events, activities and experiences regularly over a specified period of time. In traditional diary studies informants record data, usually in writing, but often combining or even replacing written records with other recording media, see for example [2].

In diary studies, the initiative for capturing information is left completely up to the informants who have to remember and take the initiative to report in their diaries. This may be detrimental to the quality of the data collected for several reasons. Informants may forget to enter information in diaries, or entries may be made at moments that they have the time and appetite to do so, rather than the ones of interest to the researcher. This can lead to loss of data and systematic response biases.

For these reasons, the Experience Sampling Method (ESM) [7] is gaining ground in human-computer interaction studies for understanding human behavior to design better products and services and for studying use in the field. The ESM is a quasi-naturalistic method that involves signaling questions at informants repeatedly throughout the sampling period. For example, informants may be given a pager or even another notification device through which they may be reminded to fill in a set of questions in a diary. To allow for flexible sampling and surveying approaches, researchers have turned to the use of handheld computing devices (Smartphones or PDA's), that participants are required to carry through the study period and through which the question-asking protocol is applied.

The ESM method is gaining in popularity in the field of human-computer interaction. Consolvo and Walker [4] have used the ESM for evaluating an Intel Research system called Personal Server. Hudson et al. [8] have used the ESM to explore attitudes about availability of managers at IBM Research. Froehlich et al. [6] used ESM to investigate the relationship between explicit place ratings and implicit aspects of travel such as visit frequency.

2. Challenges and Pitfalls of ESM

Although very useful in prompting the reporting of subjective experiences over time and in context, ESM also has shortcomings such as interrupting the subject at inappropriate moments, the onus of repeatedly answering the same or similar questions, the difficulty of entering self-report data in some social and physical contexts, the need to sample more frequently when some activities take place and less frequently otherwise, etc. Moreover, ESM is

expensive; it puts high burden on participants, and provides little information about uncommon or brief events, which are rarely sampled [11]. These problems lead to loss of data, inaccurate reporting and nuisance to participants. Current research in this field is concerned with developing methodological innovations and corresponding tools to remedy these shortcomings.

Loss of data seems to be a major problem. Froehlich et al. [6] report completion rate of 80.5% similar to Consolvo and Walker [4] who report an 80% completion rate (on average 56 out of 70) with as low as 28.5% (20 out of 70). Even worse, these numbers are silent regarding the significance of the data lost. It is reasonable to assume that the data loss occurs when people are busy or engaged in social or professional activities. Depending on the goals of the investigator, these might be precisely the situations that researchers are interested in studying.

On the other hand, the unique advantage of ESM is its ability to capture daily life as it is directly perceived from one moment to the next [5], providing a rich set of data to researchers.

3. Methodological variations to address ESM shortcomings

An alternative to ESM, proposed by Kahneman et al. [11] is the Day Reconstruction Method (DRM), which was designed to assess how people experience their various activities and settings of their lives. Subjects in this case are asked to record a detailed diary of activities and events during one day. These do not relate directly to the focus of inquiry of the researcher, which is not disclosed to them at this point, but are meant as a memory aid, a kind of scaffolding, to allow informants to recall and reconstruct the experiences and feelings of the last day during a follow up interview the day after. This is an in-depth semi-structured interview, during which the researcher probes regarding experiences and feelings that the investigation aims to explore. Kahneman produced strong evidence regarding the efficacy of this method; however DRM suffers from low accuracy regarding factual aspects of the experience (e.g., time when events occur, factual details and environmental aspects which are easy to capture with ESM), similar to those of diary studies reported above.

By its nature, DRM is appropriate for short studies. Its efficacy for providing rich and contextualized accounts of user emotions in the last 24 hours is achieved by means of an elaborate interview which is not meant to be carried out repeatedly in a study and is practically difficult to repeat over longer sampling periods. Field studies in the domain of ambient intelligence typically exceed two weeks in duration, reaching some times even half a year. For such cases, DRM can help understand only a small fraction of the activities and experiences of informants, missing out a lot of information regarding the context in which it takes place.

A combination of ESM and DRM has the potential to compensate for their complementary weaknesses. Such a combination is the Experience Sampling and Reconstruction Method (ESRM) introduced below. Following this hybrid method participants follow procedure as with ESM through which a partially complete (given the data loss issues discussed above). Furthermore, at regular intervals (e.g., daily) participants are required to complete, elaborate and even reflect on the reported experiences using the partially complete ESM log as a scaffolding. Reconstruction is

done partly by completing gaps in the data collection of the day and partly by elaborating and reflecting on this recent data. Crucially, this stage is still lightweight enough that it can be repeated daily for some. The queries which are missed during the sampling day can then be recovered through an interface with the log.

4. Reconexp

The “Reconexp” (“reconstructing experience”) tool [12] was developed to support the ESRM method. It is a distributed application partly running on a mobile phone (from now on mentioned as “device”) and partly on a website.

The procedure is described below from the perspective of the participant.

The exact procedure for an informant is as follows (Figure 1):

- Personalization of experience sampling protocol
- Combined ESM and DRM data collection
- Debriefing interview

These steps are discussed in detail below.

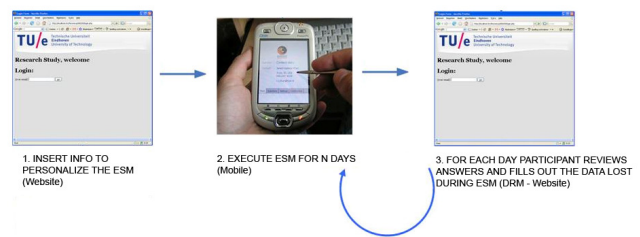


Figure 1: The steps of the ESRM method. First, participants insert information to personalize the experience sampling step. Then the experience sampling is executed using a hand-held device and for each experience sampling day participants are asked to access the web application to review their answer and fill out the data which were lost during the sampling day

4.1 Personalization step

The motivation for having the personalization step is to subsequently minimize the time and effort needed for participants to respond to the mobile device when prompted to do so. Reducing the effort required is expected to help prevent data loss but also encourage accurate reporting.

Personalization can mean a few things: adjusting the timing of the sampling procedure, personalizing defaults and choice items offered to the user and thus reducing the effort for entering data. Personalization has several advantages. From a research point of view it enables the researcher to compare the answers given for the personalization step with the experience sampling itself. This comparison can be interesting to analyze since it relates participants’ expectations with what actually happens in situ. It also allows more intensive text entry to be done on the website rather than in situ with a pen (an inherently slower and more cumbersome way of entering data). The information thus obtained is used to populate list-boxes offering choices to participants at sampling time. Personalization helps also set some parameters for the sampling protocol thus allowing better timing for the sampling events.

4.2 Sampling and reconstruction step

During the day the device prompts participants to enter information as in a standard experience sampling approach. As with all computer supported experience sampling, prompting can be programmatically controlled to occur in regular intervals, at random moments or when some conditions regarding the context and the informant activity have been specified.

The informant can respond by selecting between choices of items describing his/her activity, context or emotions, or even by free text entry to answer more open questions.

The information entered on the handheld device is stored on the online database and is available for retrieval and review directly.

The reconstruction step should happen as close as possible to the collection of data through experience sampling, e.g., within 24 hours. It requires the visualization of the experience sampling logs, the ability to edit them and provide extra information. The interaction requirements for the tool support are different than those applicable for experience sampling: whereas mobility and speed of entry of some brief information is the priority during experience sampling, it is now required to have a good visualization, and efficient ways of editing and inputting text, e.g., using a desktop computer. Of course, one could also allow revision and editing of answers using a small handheld device also for the reconstruction, but this could be at the expense of obtaining richer and more extensive descriptions from informants.

Appropriate visualization of earlier answers can help informants reconstruct their experiences and provide richer descriptions/information about them. Also important, such visualization can help researchers track the progress of the study, opening up the possibility to adapt the sampling protocol while the study unfolds. Researchers can, for example, provide additional incentives or further instructions if they notice that a particular participant is not responding to the daily queries. It also enables researchers to prepare questions for debriefing interviews while the sampling is still unfolding.

4.3 Debriefing interview step

During the debriefing interview participants are asked to reflect upon their opinions to the queries posed during the sampling period. The interview can be utilized to understand in depth the reasons participants responded to the research questions. This step becomes even more useful if the logs of answers are reviewed before approaching each participant. For example, researchers might spot in the log a pattern in the way a participant had answered to a particular question. Based on such an observation the researcher has a unique opportunity in discussing the pattern in detail with the participant. Moreover, the researcher conducting the interview can go through the logs together with each participant and let the participant give further explanations of the underlining reasons behind the participant's answers.

5. Features of the future ES tool

Reconexp was used in an investigation of intra-family communication needs and the way pervasive computing would be able to support family members have awareness of each other through the day [12]. Based on the Reconexp study findings and the review of tools used in research studies a list of requirements for can be drawn. The event-triggering of queries, for example

when a participant enters a location, is supported by some of the tools reviewed however it is either a built-in function, in the case of Reconexp for example, or in the best case (MyExperience [5]) it is programmable by using XML. Although XML is in many ways easier than programming in C or VB it still requires a certain expertise in markup up languages. Therefore, a requirement for an even more accessible tool would be the even-triggering of queries to be end-user programmable. End-user programming would be much easier to learn and apply when having a plethora of events that could potentially be available to the researcher.

In the reviewed studies tools presented the queries either in the screen of a mobile device or a desktop. However, a participant might have left the device in her bag while she is working in front of her desktop computer. A future tool can certainly include the possibility of smart presentation of queries. More specifically, queries can be prompted in multiple devices, in either desktop PCs or mobile devices according to which device is more accessible and available to participants.

Support for multimodal participant input has been already included in several tools. Text, audio, photos and video can provide richer data to the researcher [3]. On the other hand, participants can choose the most efficient and convenient modality for addressing the query.

In the case of CAES [10], MyExperience [5] and Reconexp [12] among others, user context factors are automatically captured. The location and possibly the activity of a participant can serve as examples. Automatic capture of participants' context would provide different perspectives for researchers to look at the gathered data and obviously provide more in-depth results.

All of the reviewed tools require extensive installation procedures and in most cases management of database or web servers. In tools that combine mobile phones and desktop PCs installation procedures have to be followed in both devices. This fact brings another obstacle to researchers who lack technical skills. Extremely quick and easy installations on mobile devices and even no installation procedures for desktops would be another important requirement for such tools.

Another requirement is support for optional, user initiated input. In the case of Reconexp, participants could not initiate the queries. That would be useful in cases where participants would recognize the importance, in terms of research, of the context they currently are and initiate the research queries. In that way salient information will be saved.

An important shortcoming of Reconexp was the difficulty participants had in synchronizing the data. Automatic synchronization of captured on the device data to a remote server would both secure the data as well as provide the grounds for feeding the data back to participants as the case with Reconexp was. MyExperience already supports such a feature and according to our experience of Reconexp it is a must have feature.

Automatic and configurable information visualization tools of the collected data would be a crucial feature for helping researchers disambiguate the data and quickly provide useful results. Alternative visualizations in the form of graphs can enable researchers to view the data in new, fresh ways and provide therefore opportunities in identifying new results. This analysis

tool should be able to support visualization of events that occur both frequently and infrequently [1].

Participants might become less motivated during the course of the research study. Programmable by researchers email or SMS notifications to the participants can help to keep participants highly motivated. In addition, support for notifications for researchers when certain events occur would also be of added value [1].

In most cases, ESM tools which use a mobile device force participants to carry another mobile device along with their personal one. It would be even more convenient if such tools would run on participants' phones. In this way such studies could be widespread and the reliability of results enhanced. However, a researcher would thoroughly need to have tested the tool so that it would not interfere with the participant's device. Moreover, agreements with the mobile service provider must be made in advance so that participants are not buried with the cost of the service. Therefore, agreements with mobile phone providers must be in place to easily refund costs participant occurred during the study.

Another important feature beyond the ability of participants to review the collected data would be the ability to participants in annotating the data and also to fill out the gaps. Moreover, giving feedback to participants during an experience sampling study has already been proven to be beneficial to participants' motivation [9].

In case researchers need to visually explain something to remote participants the support of video streaming between participant and researchers (video phone calls) would be handy.

Furthermore, mobile devices in comparison to desktops have limited processing and memory. The data collection tool on the mobile device should not noticeably impact the performance of the participant's mobile phone [3]. If that happens it might affect the results of the study since participants will experience a lag in the presented queries.

In a previous study [3] it was found that the tool on the mobile device should provide mechanisms to avoid interruptions at inopportune moments. Inappropriate moments will create frustration to participants and negatively bias them in answering the queries.

In case where a mobile device is lost, the tool on the mobile device should offer mechanisms to protect the security and privacy of the data [3].

Finally, in a more abstract level the tool on the mobile device should be easy to use. Thus, participants should be able to increase the color contrast, the font size [3].

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