# An Overview of *In Situ* Self Report and the MyExperience Tool


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**ABSTRACT**

We present the MyExperience tool, a software application for in situ data collection to support the study of human behavior and the evaluation of mobile computing technologies. MyExperience extends prior work in computerized self-report and context-aware experience sampling done on PDAs to the mobile phone. The combination of a small mobile platform paired with context-aware computing provides researchers with an opportunity to capture human behavior in ways previously not possible. This paper serves as an introduction to in situ self report procedures and provides an overview of MyExperience.



**Author Keywords**

In situ self-report, experience sampling, ubicomp, mobile computing, PDA and mobile phone


## INTRODUCTION

In situ, self-report procedures such as the diary method and the experience sampling method (ESM) have been used extensively in psychology and HCI to capture data on participants' thoughts, feelings, and behaviors as they are experienced [1, 3, 9]. Such procedures have a distinct methodological advantage over ex-situ inquiries in that they do not rely on the reconstruction of information from memory, but rather involve reporting on experiences as they occur, thus minimizing recall bias.

We have built a software framework called the MyExperience tool to support computerized self-report in the field. Although MyExperience runs on both TabletPCs and PDAs, the tool was specially designed to run on mobile phones. We strongly believe that the mobile phone presents an ideal platform for in situ data collection as it is a familiar device to most subjects and has a small, unintrusive form factor. MyExperience supports a variety of data collection methodologies from diary studies to the experience sampling method. Preformatted questionnaires ("self-report surveys") can be administered to subjects via the device according to set parameters by the researcher. These parameters may, for example, involve regular prompting intervals or, more interestingly, may be tied to sensor data in the field. MyExperience also takes advantage of the multimedia features now common in mobile phones such as audio recording, digital photography and digital video to provide richer forms of participant response. The data collected in the field (including multimedia content) can be wirelessly transferred back to the researchers in near real time.

The rest of this short paper is organized as follows: first, we provide background on traditional in situ self-report methods and then show how technology has changed their implementation. We then introduce MyExperience and discuss its capabilities as an in situ self-report tool for naturalistic studies.

### Traditional In Situ Self-Report

In the past, in situ self-report has been done via paper-and-pencil; participants would carry around and fill out small notebooks, typically formatted with predefined questions, or scantron sheets containing a series of Likert-scale inquiries [1]. Traditionally, three different methodologies of self-report have been employed: interval-contingent recording, signal-contingent recording and event-contingent recording [9].

*Interval-contingent recording.* In this method, participants are asked to record their experiences at recurring intervals. These intervals could be situated at temporally meaningful times (e.g., at the end of the day or during breaks at work), or at set times during the day (e.g., every three hours).

*Event-contingent recording.* Rather than being instructed to fill out notebooks at specified intervals, participants are asked to record their experiences as a result of a particular event of interest. For example, in a study examining dietary practices amongst teenagers the participants would be asked to record food consumption details whenever they ate. One disadvantage of this method is that the quality of data is contingent on the participant's ability to be cognitively engaged into his/her own actions so that the "event of interest" may be recognized and recorded accordingly.

*Signal-contingent recording.* This method is most commonly associated with ESM. Participants are asked to report their experiences whenever signaled by the researcher, which may occur randomly or at fixed intervals or a combination of both. The signals themselves are typically triggered via technology. For example, in the past, participants would carry beepers that could be triggered by the researcher to signal the participant to fill out a questionnaire.

### Computerized In Situ Self-Report

Modern technology has allowed us to extend these self-report procedures to collect data in ways previously not possible. With the popular adoption of mobile phones and PDAs, computerized in situ self-report is a natural progression from the paper-and-pencil method and offers a host of advantages over its non-digital counterpart.

First, participant compliance can be more accurately assessed [1]. Previously, it was not possible to determine the validity of in situ self-reports—participants could fake or change entries post-hoc reducing the overall quality of data collected. Computerized self-report allows the researcher to, for example, have a better idea of exactly when a self-report was completed, how long it took to fill out, and if any of the answers changed before completion.

Second, wireless connectivity provides the researcher with real-time knowledge of participant behavior and allows the researcher to access collected data in an ongoing fashion. This provides a multitude of unique benefits: researchers can prepare more knowledgeable and concise ex situ inquiries (e.g. individualized mid-point interviews based on in-progress data), preliminary data analysis can begin almost immediately after the study begins, and researchers have the ability to identify and troubleshoot problems as they occur during the course of the study. In addition, new data can be downloaded onto the participants' devices in real time. For example, researchers could remotely load a new set of questions onto the devices or trigger a questionnaire dynamically.

Third, auxiliary inputs like cell-phone cameras or microphones can be used to augment text answers. This is particularly important given that most electronic devices do not offer the same ease of writing as pencil-and-paper. Moreover, media captured by the participant can be used to gain a richer understanding of his or her experience and can be captured during the normal course of a self-report questionnaire.

Fourth, computerized self-reports can be much more sophisticated in their presentation of questions. For example, self-report questionnaires can contain conditional questions (i.e., ask question C only if the answer to question B was false), multi-media questions (e.g., video based questions), specific question frequencies (i.e., only ask question E once per unique answer to question D), and question/answer order randomization (i.e., the presentation of answer data is randomized from questionnaire to questionnaire to reduce response bias [1].

Finally, data collected via computerized self-report is intrinsically structured for computer-based analysis. This reduces the data management burden on the researcher as well as the potential for coding errors. Non-textual data like audio recordings and pictures are automatically bound to the self-report that captured them, providing richer context for analysis.

### A New Method Using Context-Aware Computing

In addition to these advantages, computer-based self-report offers a completely new form of in situ data collection, called "context-triggered sampling." This technique, pioneered by MIT's Context-Aware Experience Sampling (CAES) toolkit [7] for the PocketPC, uses sensors to infer context, which then triggers a self-report questionnaire. For example, a research study on the influence of distance running on emotional state could use sensors (e.g., an accelerometer) to determine when the participant is running for at least a 20 minute interval and then prompt them with a questionnaire a few minutes after they stop.

Context-triggered sampling is most closely related to event-contingent sampling, where the participant is asked to fill out a self-report as the result of some event of interest. The key difference, however, is that event-contingent sampling relies on the participant to be cognitively engaged into his or her own activities in order to recognize when a recordable event occurs [9]. Context-triggered sampling, in contrast, uses sensor data to automatically infer when an event of interest has occurred and prompts the user accordingly—thereby shifting the cognitive burden to the technology. This new technique has several advantages:

1. Sampling questionnaires become more targeted, occurring only during events of interest, which reduces participant disruption when compared with other sampling methods.
2. Context data can be continuously saved, allowing the researcher to validate participant responses and, perhaps, to uncover new behavioral patterns not initially considered;
3. Sensor data paired with participant responses can be used to test the effectiveness and accuracy of new UbiComp sensor technologies and to evaluate UbiComp prototype designs in the field.

Though very promising, context-triggered sampling is still subject to some of the methodological issues that affect interval-contingent and signal-contingent sampling. For example, it is probably not the most appropriate technique for studying events related to when a participant cannot do something because of a limitation. In this case, an event-contingent based method (i.e., a diary study) or a hybrid between the two may be more appropriate because it would give the participant control of when to record an event.

## THE MYEXPERIENCE TOOL

The MyExperience tool developed jointly by the University of Washington (UW) and Intel Research, Seattle provides all of the benefits of computerized self-report and context-triggered sampling highlighted above on a familiar, unintrusive platform—the mobile phone. See Figure 1. Both the UW and Intel have a precedence of building tools to study behavior in situ [4, 5]. MyExperience is the culmination of these past efforts and builds on the research efforts of others in the fields of psychology, ubiquitous computing, human-computer interaction, and medical science [1, 2, 5, 8]. MyExperience is meant to be a comprehensive self-report tool and is built to support a variety of methodologies and study designs.

At the time of this writing, MyExperience has been used in one study, which explored the relationship between place visit behavior and preference [6]. A GSM motion sensor was used to trigger self-report questionnaires when a subject became stationary for 10 minutes. A random time sensor was also used to augment the context-triggered questionnaires.


**Figure 1: The MyExperience tool on the Audiovox SMT 5600**

### Self-Report Questionnaire

A MyExperience self-report questionnaire can range in length depending on response but is typically between one to twenty questions. The questionnaires are preconfigured by the researcher to trigger in any of the following four ways:

1. Calendar-triggered sampling permits specific scheduling of questionnaire times at flexible recurrence patterns (e.g., 2PM each weekday, 11AM every MWF).
2. Context-triggered sampling associates automatically detectable events to questionnaires (e.g., subject heart rate exceeded 150 beats/minute)
3. Random-triggered sampling provides a mechanism to trigger questionnaires at random intervals.
4. Manually-triggered sampling allows the participants themselves to trigger questionnaires.

The triggering methods can be used alone or in combination. For example, a diary study may only need manually-triggered sampling, which allows participants to self-report at their discretion. In the past, we have used random-triggered sampling and context-triggered sampling in combination to ensure that self-report questionnaires still get administered in the case of sensor failure. Both calendar-triggered sampling and random-triggered sampling can be used to provide sampling coverage throughout the day.

Multiple questionnaires can be loaded on the device so that different triggers can administer different sets of questions. For example, in a study of travel behavior one might use a location-aware sensor like GPS to trigger a “workplace questionnaire” when the participant is observed to be at work and a “home questionnaire” when the participant is observed to be at home.

### Questions

Currently, MyExperience supports three classes of questions: closed-form, open-form and multimedia capture. Closed-form questions refer to those that provide predetermined response options (e.g., Likert-scale, Yes/No, etc.). Open-form questions, on the other hand, allow the participant to freely enter their own responses. See Figure 2. Given the cumbersome input capabilities on mobile devices, open-form questions tend to be limited to simple text entry (e.g., “please enter the number of people with you right now”). Questions that require a more sophisticated, prose-like response may be better suited to using audio capture rather than text entry.


**Figure 2: (left) An auto-completion based open-form question. (right) An example of two closed-form question types.**

Audio recordings (or “voice memos”) have been shown to be a fitting alternative to text entry both in recording a participant’s free narrative response [2] and in situations where the subjects themselves are not comfortable with the existing mobile text entry methods (e.g., T9, Graffiti, etc.). Beyond audio, MyExperience also allows participants to capture digital photography and video. All of the multimedia features are seamlessly integrated into the surveys themselves, making usage straightforward. This also eases data analysis as the multimedia response is situated in the survey data. Multimedia content can also be used in asking questions on the device. For example, audio recordings of question text may play back when the question is displayed on the device.

### Question Flow
Questions can be asked in a predefined order or randomized. MyExperience also allows question branching, which allows the questionnaire to react dynamically to participant response. Six "relational operators" are used to establish conditions for branching (==, <. >, <=, >=, !=). For example, ask follow-up question D if the answer to question C was greater than four. Researchers can also loop questions around previous responses. For example, in a study of chronic pain, an initial question may ask "Please checkmark each area in which you are experiencing pain." A follow-up question may loop on each are marked and inquire about the level of pain experienced. Finally, questions can be assigned probabilities, which effect how often they are asked.

### Wireless Connectivity
A concern with many naturalistic data capture studies is sustained subject participation. The MyExperience tool offers the ability to monitor participant behavior in real-time via wireless uploads. In this way, researchers are better able to understand the engagement of their participants and make proper adjustments as needed (e.g. a friendly reminder e-mail or phone call). Additionally, real time access to study data provides a wealth of opportunity for researchers to create more targeted *ex situ* inquiry – from better, more knowledgeable interview preparation to the creation of other contextualized inquiries like online surveys or paper questionnaires. Finally, wireless connectivity allows the researcher to detect errors and technology failures early before they result in high data loss.

## CONCLUSION
We believe that MyExperience offers researchers in a breadth of fields the ability to conduct field studies that were simply not possible before. The mobile phone is quickly becoming the most pervasive technology in the world and its computational power is only increasing. We leverage the popularity of mobile phones to provide an easy self-report interface to subjects and the computation to perform advanced sensor calculations and context-triggered sampling. With the available multimedia features, MyExperience is not simply a quantitative data collection tool but also one that can be used qualitatively in photo-elicitation and related studies.

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