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Hsiang Chen
Syracuse University

Michael Nilan
Syracuse University

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Hsiang Chen (hchen04@mailbox.syr.edu), Michael S. Nilan (mnilan@syr.edu), Syracuse University

Abstract

The experience sampling method was transformed into a digital format and examined in the Web environment to elicit on-line Web users' experiences through multiple iterations of an on-line questionnaire. By sampling Web users' on-line experiences and detecting Web users' situated experiences from a time point very close to their actual experiences, this tool can collect reliable and valid data with minimal distortion. This tool can effectively and unambiguously tap Web users' internal experiences associated with their use of the Web. Data on Web users' on-line experiences were collected and analyzed to evaluate the reliability and validity of the tool. This tool should be applicable to other fields to elicit Web users' situational experiences and perceptions in a variety of research contexts.

Experience Sampling Method

The experience sampling method (Csikszentmihalyi, Larson & Prescott, 1977) was originally designed to systematically examine the interaction between human beings' internal experiences and their reports of their externally observable behaviors. The original format of the ESM consisted of providing respondents with an electronic pager and a questionnaire booklet. The researchers randomly activated the pagers several times a day. Upon receiving a signal on his pager, the respondent would fill out one questionnaire from the booklet. By the end of the study, which usually lasted from one to two weeks, the booklet contained a systematic description of the person's life in different situational contexts, at different given moments, including their behaviors, perceptions and other internal experiences. The behaviors might have included the activities performed, places visited, and people encountered at given moments. Internal experiences refer to perceptions and other cognitive behaviors, i.e., what a person feels and thinks during specific moments in his/her perception of self and the world, such as emotions, motivational states, challenges encountered and skills brought to the situation (Csikszentmihalyi & Csikszentmihalyi, 1988). The ESM has been extensively and continuously employed in a variety of research settings since it was developed at the University of Chicago in 1976.

The ESM has been described as an appropriate and useful tool to study interaction among situations, personality, and the environment (Hormuth, 1986). The randomness of signals sent out from the researcher to subjects' pagers over time makes the random sampling of subjects' experiences possible. As a general-purpose research tool which is not limited to any specific research question or domain, we felt it could be applied to the on-line environment, such as the World Wide Web. In this paper, we introduce the transformation of the ESM to the environment of the World Wide Web and its recent applications in studying Web users' internal experiences.

On-line Transformation of ESM

There are a few important features of the ESM which must be preserved during the transformation: the scheme of the random signaling and the format of the questionnaire. In the original formulation of the ESM, the signaling device is usually a pager, carried by each subject. The format of the questionnaire is usually a booklet with multiple copies of the same questionnaire. To explore the Internet and the Web environment, the signaling device and the booklet were transformed into digital versions.

The Signaling Device

In general, there are several possible approaches for the transformation but here we only discuss the approaches we tested out. The first approach was to employ a stand alone computer application, which interrupts Web users' behavior by popping up a questionnaire repeatedly. In this approach, a computer application was created to interact with subjects' Web browsers (either Microsoft's Internet Explorer or Netscape's Communicator) via the technology of DDE (Dynamic Data Exchange). Through the interaction over DDE, the application accesses the browser and records data related to Web users' browsing behaviors, such as the URL visited, length of time subject stays at each Web page, and entry, idle and exit times. In the beginning of a study, subjects are asked to download the application from the researcher's server and run it on their local machines, along with their browsers. The application then pops up the questionnaire on their Web browsers and asks subjects to fill out the questionnaire in accordance with their situated experiences immediately before the questionnaire appeared. The questionnaire reappears several times at random intervals as long as the Web users stay on-line. At the end of a study, data collected are sent

to the researcher's server via email (SMTP) or Web (HTTP) protocols.

The other approach we examined was to incorporate all the required mechanisms into Web pages themselves. In this approach, the main Web page was coded with JavaScript to enable the creation of a new window. In the beginning of a study, all subjects are asked to visit this main Web page first. Once this JavaScript coded page is read by the subject's browser, it will then create another window on the subjects' computer screens. Subjects are then asked to use the Web in their normal way. The newly created tiny window stays on the top-left of the subject's screen. After a predetermined interval, this tiny window will trigger another window into which the questionnaire from the researcher's Web server is loaded. Subjects are asked to fill out the questionnaire and submit their responses by clicking on the "send" button. The questionnaire reappears randomly as long as the Web users stay on-line. Data collected is sent to the researcher's Web server via CGI (Common Gateway Interface). This approach is more simple than the approach described above but it does not record data related to the Web users' navigation information, such as URLs visited and the time spent on each web page.

Booklet and Questionnaire

One advantage of the distributed computing environment is that the questionnaire in its digital form can be duplicated and distributed without any additional cost. The interval for iterations of administrations of the questionnaire can be predetermined or randomly assigned in the run time. Interactive procedures can also be included in the application or JavaScript pages to customize the questionnaire so that it unambiguously represents contingency questions. The logic of if-then-else can also be easily integrated into the application or JavaScript pages.

The questionnaire can be displayed in a scrollable box so respondents can drag or scroll down the questionnaire as they proceed. Further, different fonts, sizes, styles and text colors can be used to represent different purposes. Dialogue boxes or more computer windows can be used to enhance the communication process between the application and subjects.

On-line Implementation of ESM

From our two implementations of the on-line ESM (the standalone application and the JavaScript Web pages) we are able to provide some insights into this kind of instrumentation. In our first implementation, a total of 201 data points (i.e., iterations of the questionnaire representing discrete descriptions of subjects' experiences) were collected. The second included 350 data points. The following section discusses validity and reliability issues of this on-line ESM implementation.

Validity refers to the extent to which any measuring instrument measures what it is intended to measure. Reliability concerns the extent to which a measuring procedure generates the same results on repeated trials (Carmines & Zeller, 1979).

To assess the validity and reliability of the on-line ESM tool, we devised two tests. First, if the on-line ESM was able to take valid snapshots of subjects' experiences during the moment immediately before the questionnaire appeared on their computer screens, several theoretically correlated dimensions which attempted to detect subjects' internal experiences should also appear closely tied to each other. For example, if a Web user felt enjoyment at a given moment, he/she should be likely to feel positive affect as well; if a Web user concentrated on an activity at a specific moment, he/she should also experience the sense of "time going very fast." Our argument is that if there is a statistical correlation between two dimensions which are theoretically related, it will provide us with an indication of the extent to which the on-line ESM is validly tapping Web users' internal experiences in a given situation.

Table 1 shows Pearson *r* correlations between several theoretical concepts where we would expect significant correlations. Notice that all relationships are significantly correlated, some at very high levels.

Table 1. Correlation (Pearson r) between Theoretically Correlated Dimensions

	A	B	C	D
I	.85*			
II		.43*		
III			.58*	
IV				.34*

A = autotelic experience; I = positivity of affect;
B = immediate feedback; II = clear goal;
C = concentration; III = time distortion;
D = loss of self-consciousness; IV = merger of action/awareness
* p <. 001

Our argument for the second test is that if the tool is not reliable, the data collected via this tool will not be reliable. Therefore, we employed the internal consistency method to obtain an assessment of reliability of the on-line ESM tool by computing the reliability alpha of the items in our questionnaire.

Table 2 shows the results of Cronbach's alpha test for the reliability of specific questionnaire items. Reliability alpha greater than .80 are typically considered reliable. The data in Table 2 indicates good reliability across our questionnaire items.

Table 2. <u>Results of Cronbach's Reliability alpha</u>

Concentration	.85
Sense of potential control	.74
Time distortion	.91
Telepresence	.77
Autotelic experience	.89
Positivity of affect	.75
Flow experiences	.80

Lessons Learned

During the process of implementation, we learned several lessons and believe they are worth reporting. First, we found that the length of intervals between iterations of the questionnaire affects the dropout rate of subject participation. If intervals were increased to 10 to 15 minutes, participants were less likely to complete the second or third iteration of the questionnaire. As the intervals were decreased to five to eight minutes, most participants completed three iterations. However, if the intervals were decreased to less then five minutes, we believe it is not likely that the on-line ESM tool can detect different experiences because of the intrusiveness of the questionnaire and also because subjects' mental focus may not change much during such a short period.

Second, according to exit interviews made after the second study, the questionnaire should not be too long. If the questionnaire takes longer than a few minutes to complete, the subjects lose track of their experiences immediately prior to the appearance of the questionnaire and therefore, are unable to report their situated perceptions. There seems to be an interaction effect between length of the questionnaire and subjects' ability to recall.

Third, at any one sitting, an individual subject's desire to responsibly respond to the questionnaire is limited because the burden of answering the same questionnaire can become too onerous. We found that Web users are less likely to respond responsibly to the same questionnaire more than three times.

We believe that there are several limitations associated with conducting research employing the on-line ESM. First, a questionnaire popping up was considered annoying and intrusive when Web users' navigation behavior were interrupted. This may decrease the quality of data unless subjects are interested in the research. By employing self-selected content and limiting the number of iterations, we believe we minimized this effect. Second, a random interval of five to eight minutes

is not considered optimal but considering the fact that the length of time required to complete the questionnaire three times affects respondents drop out rate, we felt it was the most practical interval. Increasing either the number of iterations of the administration of the questionnaire or the length of intervals between iterations will increase respondents' reluctance to participate in and complete the research.

In summary, we believe that by eliciting subjects' situational contexts and their experiences via the on-line ESM tool, we were able to reconstruct subjects' internal and external experiences during their interaction with the Web. By not relying heavily on subjects' recall ability or the constant intrusion of talk aloud protocols, we believe our data revealed relatively accurate descriptions of users' internal experiences. By interrupting subjects' navigation behavior both physically and cognitively, we were able to capture subjects' fresh, situated memory at given moments during their use of the Web.

The on-line ESM tool can be used in other fields to assess Web users' internal experiences. To increase the usefulness of this data collection tool, it may be possible to extend the data collection period from a single on-line session to multiple sessions. In other words, collecting data via the on-line ESM on different days and over a period of one or two weeks is a viable strategy. This may substantially improve its validity in tapping Web users' internal experiences. To better assess the reliability and validity of this tool, we suggest further research employing interviews (for example) to make comparisons between data collected from on-line ESM and data collected from the interviews.

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