CONTEXT-SPECIFIC EXPERIENCE SAMPLING FOR EXPERIENCE DESIGN RESEARCH

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ABSTRACT
Despite apparent benefits, Experience Sampling (ES) has been scarcely used for experience design and research. Among the reasons are of methodological that conventional ES lacks a conceptual framework enabling researchers to systematically explore and extract meaningful experience value themes which can be practically used for design application. Likewise, conventional ES lacks contextual information as it is solely based on participants' description. Addressing these issues, the present researchers have developed an adapted ES model, entitled 'Context-Specific Experience Sampling' which incorporates a rigorous experience data processing for pertinent experience theme extraction for effective ES together with the corresponding contextual information collected from video recordings. This paper explains the structure and the application procedure of the model comprising three key steps of experience data processing: 'pooling, sorting and extracting'. Integrating contextual data to the adapted ES, the proposed model is believed to be a useful tool for experience design research. The paper presents a case example from a small scale office lighting environment study.

Keywords: Experience Sampling, Experience Design, Lighting Research

1 INTRODUCTION
The term "Experience Sampling Method (ESM)" refers to a set of technique for collecting information about people's behavior, thoughts or feelings in the context and content of the daily life [1]. ESM is often used in psychology and social psychology, medical, political and design, HCI, UX and design fields. Experience Sampling can be broadly categorized into three distinct types: 1) Interval-contingent sampling, 2) Event-contingent sampling, 3) Signal-contingent sampling. The last form of sampling is typically called ESM (cf. [2]).

In the usual application of ESM, participants deliver self-reports or answer structured questions at certain regular times, or receive randomly sent electronic signals during the study period. As technology develops, such portable electric gadgets as pager, palmtop computer, PDA, mobile phone, personal data assistants have been used. The unique contribution of this method is that researchers can obtain data on real-time experiences as they occur in natural settings. Main strengths of ESM are: 1) contingencies can be noted, 2) supports investigation of within-person processes, 3) helps to reduce memory bias, 4) can be equipped with multiple methods assessment, and 5) is recognized as a method with ecological validity [2].

Despite these benefits of ES, it is peculiar to find that there are few research cases discussing application of ES in the field of experience design, main philosophy of which emphasizes importance of understanding the use context. The significance of understanding the context in experience design is well presented in the following statement: "In addition to sequential context effects, the situational and environmental context in which products are encountered can alter our experiences of them. …The number of different environmental, situational, and other contextual factors that can alter product experiences is quite large." [3].

Although investigation of context for experience design is recognized as critical, there has been a lack of reliable and pragmatic theoretical framework enabling researchers to systematically investigate user experience. One of the experience design research applying ES as a data collection method is a study

conducted by Demir, Desmet and Hekkert [4] in which the researchers used ES to identify emotion appraisal patterns in the use of products. However, it is yet quite far from practical design research and the study also did not specify the context of user and a product.

Despite many apparent benefits for experience design, ES use as a practical tool in design process has been very limited. This issue may be attributable to some weaknesses of ES for experience design research. Namely, 1) ESM has not been applied to assess certain product experience at fixed settings such as home appliances. Using portable ES devices, the method has not been used for the setting dependent product experience. 2) Conventional ES is not capable of rigorously investigating participant's situations and activities which are the context as it simply casts questions about the participants' context information without objective means of gathering such information. For example, "How do you feel after using this device?" [5], "As you were beeped, where were you?" or "As you were beeped what was the main thing you were doing?" [1].

Contextual information is often gathered by the description of participants. In this case, time lag between signal and response is often an issue. Participants are likely to record details of the context when it occurred or real-time situations. ES usually poses open-ended questions which is yet another factor resulting in response delays (or even response absence), and in case of delay respondent might forget details of the actual situation as it occurred. To enable fast response, ES also uses emotional emoticons which pose a risk of too simplified answers missing out on pieces of meaningful information.

There is a need for ES framework allowing to rigorously collect contextual data via an objective method, applicable to place-dependent products, encompassing efficient and pertinent experience measures which enable participants to quickly and pertinently answer, and supporting ease of objective and comparable data generation and application across settings and contexts.
To address these issues, we have developed an adapted ES model entitled, *Context Specific Experience Sampling*.

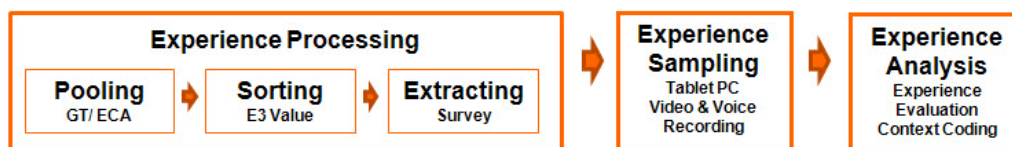## 2 CONTEXT-SPECIFIC EXPERIENCE SAMPLING FRAMEWORK

Figure 1. Context-specific experience sampling framework

At the start phase of experience analysis process is the video recording of a sample setting where target users experience the environment. Its purpose is to collect primary data about the setting context under the study through analyzing the visual data containing various information of the users, the behavior, the environment, and etc. Video recording covers general views and movements of users within and across the setting boundaries as well as specific views over individuals' behavior. The collected data is to be systematically analyzed with computer software (e.g. Interact) in order to visualize the information such as types of functional or social behavior, types of spaces and configurations, and patterns of movements. The data also helps to identify any other contextual features which need to be considered along the research. The main purpose of video observation is to identify target behavior or environmental factors to be investigated along the classification of setting space.

2.1 Experience Processing

Experience Pooling
As shown in the diagram above, 'experience processing' which is aimed at extracting key experience value themes of the light experiences from divergent to convergent experience data processing is one

of the main pillars of the suggested lighting experience design research framework. It is to extract context-specific evaluative experience value themes to be used for design ideation. The process consists of five steps:

1.   GT (Generative Tools);
2.   ECA (Experience Cut-In Analysis);
3.   Experience value structuring;
4.   Survey and Experience themes extraction;
5.   Experience Analysis

GT and ECA are the primary data collection tools while experience value structuring is applied for an experience theme extraction method for the subsequent survey. The experience analysis is framed to enhance the context-based and user-centered approach in lighting experience design. The following sections describe concept and logic of each step in detail.

Generative Tools
Generative Tools is one of the generative techniques which have been developed in the design research to extract insights from depths of the consumers' mind. It is based on the philosophy that people's thoughts, feelings, dreams and new ideas can be better explored when they actually *say, do,* and *make* [6]. Because of the difficulty to express tacit knowledge and latent needs in words, toolkits (containing a large number of components such as words, images, or drawing materials) are offered to support people to create 'artifacts' which express their thoughts, emotions, and ideas in common GT sessions. These 'toolkits' help to reveal participants' tacit and latent needs [7]. Also, participants work on the tasks individually by using toolkits in group session and then they describe verbally what they have done or made.
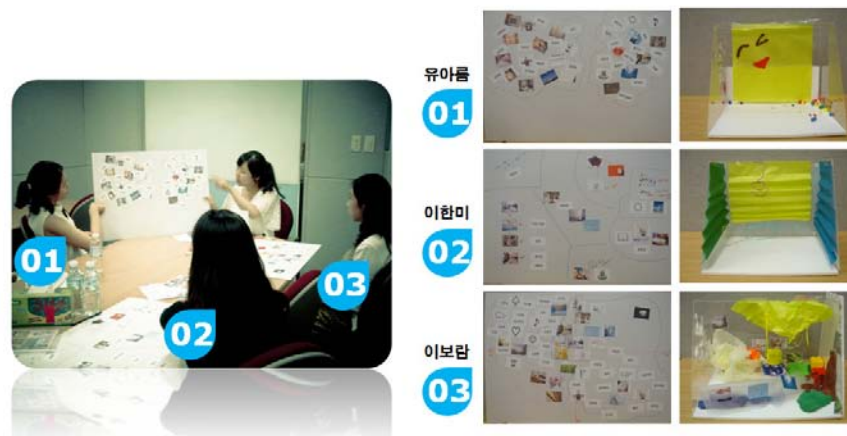

Figure 2. Example photos for generative tools

A key strength of GT comes from the fact that GT is future-oriented in a way to reveal the needs and wishes for new experiences as well as ideas, whereas the conventional user study techniques (interviews, observations and focus groups) generally focus on uncovering explicit and observable knowledge about contexts offering a view of people's current and past experience [6]. Similar methods are Cultural Probes [8] which is known as self-reporting diary studies providing information about people and their activities. This method utilizes a kit of materials for a participant to note specific events, feelings or interactions over specified period after which a follow-up interview is carried out. Another method is Context mapping consisting of preparation, sensitizing participants, group sessions, analysis and communication [7].

Experience Cut-In Analysis
Definition of the term 'cut-in' in Experience Cut-In Analysis is derived from the film industry thus means as a noun "something that is cut in, as a close-up of some object inserted into a film sequence." Sometimes, 'cut-in' is utilized in film or photo editing to take a close look into an object or a part of an object.
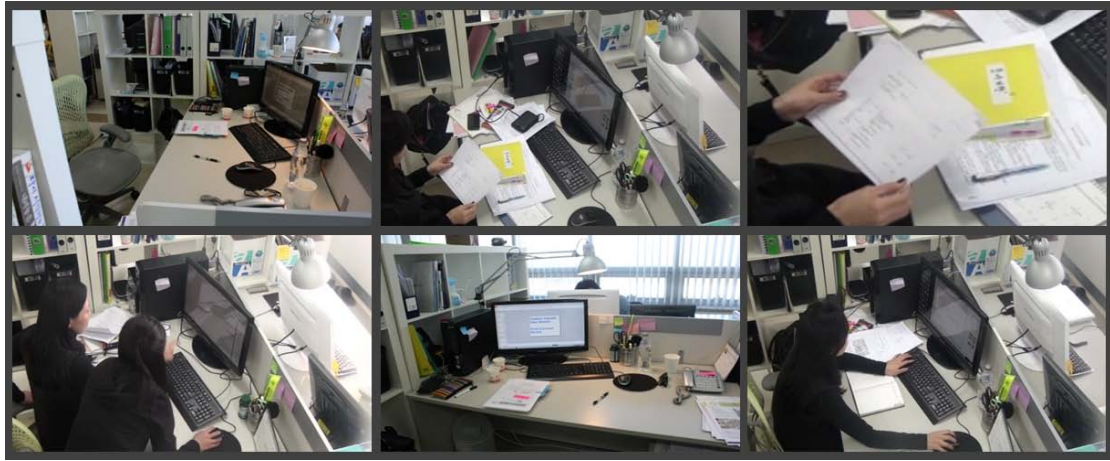
Figure 3. Example photos for experience cut-in interview

Conceptually applied for experience analysis, it becomes a method of interview in which interviewer and participants have a discourse over the cut-in photos, shown in Figure 3, from the recorded video of the participant using a certain product or of the setting view where the activity takes place. The cut-in photos are the *experience cut-ins* of the participants in his/her own real life context. Having discourse over the cut-in photos, an interviewer asks structured or open questions to systematically explore the participants' direct or related experiences of the product.

Interviews are primarily focused on re-occurring experiences based on the assumption that these experiences are meaningful or important ones which should be addressed. Thus, if a re-occurring event is what the user needs or wants more to experience, it is to be targeted to be enhanced by design. On the other hand, if a certain experiences is what the user wishes to avoid, it should be inhibited by design. This process can be further supported by the theory of component analysis especially for the exploration of emotional experiences [13, 14]. It is to ask component related questions exploring the underlying component process of emotions so as to identify possible causes of the elicited emotions. This perspective is also compatible with the theory of basic model of product emotions [15].

During the interview, the cut-in photos are projected on the wall through a beam projector in a room of quiet environment with a light-off ambiance. This is to support the interviewee to comfortably and easily recall the memories and emotions. The cut-in photos help participants to easily recall and fully explain their experiences while also helping the interviewer to conduct context-based discourse which otherwise may not be possible as many meaningful cues can be lost without the memory recalling scenes. Under the present framework, ECA is designed as a tool to collect information of user's past experiences while GT focuses on the experiences that a user wishes to have in future. ECA enables a context based discourse over the participant's experiences.

Experience Sorting
Experience Values
In marketing research, Product-Service System (PSS) design has been recognized as an alternative solution and new product strategy with many successful examples of product and services integration. The main idea of PSS is to afford what the users are looking for in use of the designed products or services so as to realize the needs, wants, and wishes of target users. For the experience design perspective, this philosophy is also essential to best tailor the design in order to satisfy the users. In other words, identification of the themes and structures of human experiences should be carried out in a systematic and theory-guided manner rather than a designer's intuitive approach. Experience value structure (Figure 4) suggested by Cho, Kim and Lee [9] adopting the consumer value frameworks of Holbrook [10] and Sheth et al. [11] offers a pragmatic and useful conceptual model which can be directly applied for experience design research. The main theme of the framework is that successful design process requires understanding the experience values that product or service users expect or want to obtain from a product or service.
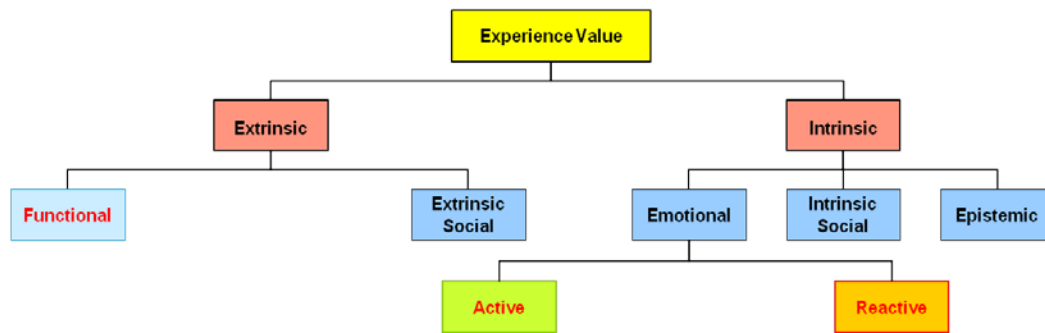
Figure 4. Experience values

The experience value structure under the concept of E3 values consists of five main dimensions which are functional, extrinsic social, intrinsic social, epistemic and emotional, where the latter is further classified into active and reactive emotional values. The classification of the five dimensions of experience values at first level begins with the differentiation of extrinsic and intrinsic values where functional and extrinsic social values are further categorized, while emotional, intrinsic social and epistemic values belong to the latter. Detailed explanation of Experience value definitions and concepts is to found in the articles by Cho, Kim and Lee [9]. The usefulness of applying experience values in sorting contextual experiences is the experience value structure which helps to guide a researcher to systematically classify the large number of experience vocabularies pooled from GT and ECA. Likewise, the experience value definitions help to further identify 'experience value themes' from the sets of value keywords. An illustration showing the experience keyword soring process is presented in Table 1.

Table 1. Sorting experience keywords into experience value structure

Experience Statements (ECA/ GT)	Experience Values - Key Words				Experience Value Themes
	Functional	Social (Ext./Intri.)	Epistemic	Emotions (Ac./Re.)	
I want to recognize accurate color by lighting.	recognizing accurate color				visibility
To be installed on a wall, available to twist its leg, and adjustable its direction by a knuckle.	adjustable, control				adjustability, control
I want lighting to make me comfortable.				comfortable	comfortable
I want lighting to create various color combinations.			various color combinations		variety
Variable and flexible lighting.	flexible		variable		flexibility, variety
I want lighting help to protect my privacy.		privacy			privacy
Good to have lighting matching my lifestyle.		matching my lifestyle			favor
I want to have more warm and natural lighting.				warm and natural lighting	worm, natural
I want more exciting lighting environments.				exciting	fun
I want an adjustable lighting according to my needs.	adjustable to my needs				adjustability
I want my own task lamp for concentration.	task lamp for concentration				task concentration

Reading the first line in the table as an example, such a keyword as 'recognizing accurate color' expressed by the GT or ECA participants is sorted into the functional value according to the experience value definition and then represented by the value theme as 'visibility'. Another example comes from the keywords 'flexible' and 'variable' sorted into functional and epistemic values respectively and then represented the theme words as 'flexibility' and 'variety'. The same interpretation goes on from the native statements of the participants (the first column in Table 1) up to the representative experience value theme words (the last column in Table 1) as it illustrates how the sorting process under the experience value structure take place.

When the sorting process is completed and thus experience value theme words are collected, it is the time to go for the user survey during which the theme words are offered to target users to select or rate according to their preference under a specific context. At this point, either of all the value theme words or carefully guided ones by experts can be cast to the target users. In the case of the office lighting environment study, 17 theme words were chosen by lighting experts and thus chosen for the subsequent user survey. The chosen value themes are presented in Table 2 as an example.

Table 2. Selected experience value themes for ES

Functional	Social	Active Emotion	Reactive Emotion	Epistemic
Clearness Task Concentration Work efficiency Control Convenient	Privacy	Comfortable Energetic Fun	Vivid Colorful Soft Warm Plain Natural	Novelty Diversity

Experience Extraction

Survey: Value Theme Extraction

In this step under the framework, the experience value themes are now evaluated by target users through survey. Each experience value theme is asked to be rated or selected according to the participant's preference or needs as for a specific context – the lighting environment of individual workstation in the present example. The themes can be evaluated by "yes" or "no" choice or preferential scale (e.g. 1 – 5 Liker scale).

In Figure 5, a survey result from 105 participants via emails at various office settings is presented as an example of the experience theme extraction process. A final set of experience value themes from the surveyed data can be decided through statistical process such as frequency examination or one-sample t test which produces three groups of themes along the statistical significance – 1) themes with significantly high frequencies or scores (red box in Figure 5), 2) themes with non-significance (orange box in Figure 5), 3) themes with significantly low frequencies or scores (gray box in Figure 5).
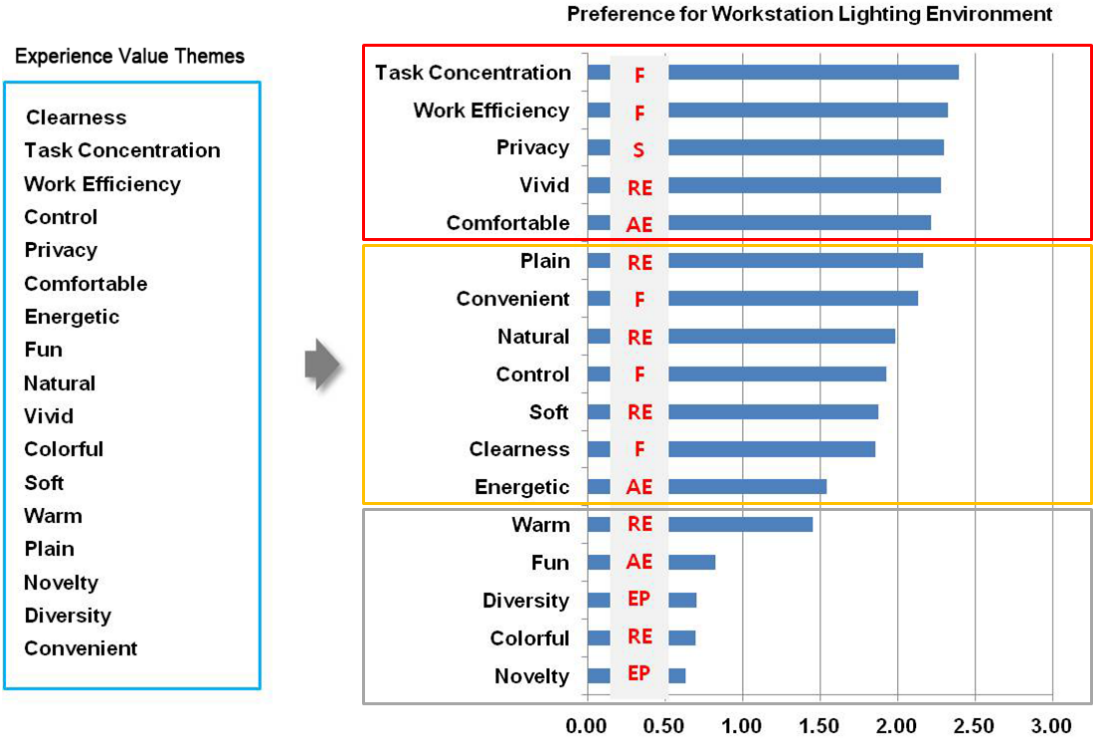

Figure 5. Survey – experience theme evaluation

Detailed statistical information of each theme may provide a further guide for a researcher to finalize the theme sets for design ideation. In the present survey, out of 17 experience value themes, top 12 theme words were chosen based on the statistical results for the final set of measures for the subsequent experience sampling. This means that the bottom five themes such as warm, fun, diversity, colorful, and novelty were cast out.

2.2 Experience Sampling (ES)

The purpose of experience sampling is to evaluate the experience value themes which were generated in Experience Processing. Since detailed introduction of ES was provided in the beginning of this paper, this section describes briefly about how it was conducted. Figure 6 shows example photos of the way it was carried out for the lighting environment study for individual workstations in an office setting.

Figure 6. Example photos for experience sampling

One or two video recorders were set towards each workstation and voice was also recorded. Five office workers participated in the ES for 5 working days from 9am to 10pm. The 12 experience value themes selected from the preceding survey were loaded to a tablet PC in the form of a wheel as shown in Figure 6. The tablet PC was programmed to signal every hour a 'ding-dong' sound while getting the screen bright so to invite the participant to check his current experience of the lighting environment according to the 12 experience value themes in a wheel form. When 'save' button is touched at the end of the answers, the PC displays a short message informing the data is saved. The data was stored into the PC which was retrieved later for experience analysis.

2.3 Experience Analysis

Experience analysis is primarily a quantitative statistical process of the experience evaluation data together with the contextual information collected from the video recordings stored in PC. It is also a preparation for an eventual application to the experience evaluation of the office lighting environment, in the case of the present example, when the lighting measures are combined. At this stage, it is to integrate the experience ratings from the ES results and the corresponding contextual information from the video recordings such as type, time and duration of the activity at the time of ES as well as various environmental factors which can be quantified if necessary. Outputs of experience analysis can be diagrams or tables combining both the contextual and the experience evaluation data as exemplified in Table 3.

In the table, ES results are equated with the observed contextual information and the recorded time. As for the value ratings, empty cells in the table indicate that the participant put no score as to the specific value theme while +2 and -2 represent 'most agreeing' and 'most disagreeing' respectively as they represent the two end sides on the rating scale while the score zero implies 'neutral' to the value theme. Reading the line in the example table, the participant got an ES signal from the tablet pc at 14:30 while having a nap at the desk. Upon the call, he got awake and then rated his experience of the lighting environ into the tablet pc that the environment was least energetic (energetic: -2) and least supportive for task concentration (task concentration: -2). The participant gave the score of -1 to both the experience values of 'clear' and 'vivid' whereas +1 to 'comfortable'. He gave neutral scores to 'natural' and 'soft' by leaving no reply to the rest. These data present the participant's 'then' experience of the lighting environment at his workstation at the time of the ES call and the related contextual information.

Experience Analysis-ES	Time	Activity	Preceding Event	Setting Presence	Task Concentration	Work Efficiency	Privacy	Clearness	Comfortable	Plain	Convenient	Natural	Control	Soft	Vivid	Energetic
	14:30	Having a nap		Sitting	-2			-1	+1			0		0	-1	-2
	15:30	Sending Text	Receiving Text	Sitting	+2	0		0	+1	-1		-1	0	-1	-1	0
	16:30	Reading	Typing	Sitting	-1	-1		0	+1	-1		0	0	0	0	-1
	17:30	Watering plants	Away from the desk	Sitting	+2	-1	-1	-2	0	-1		0		+1	0	-1

Table 3. Experience analysis – contextual information with the results of ES

Although the present table contains only several contextual factors as an example, various data from the video recordings can be used since they provide contextual clues for the experience value ratings. When gathered from an adequate number of participants, the accumulated experience ratings together with the contextual data may enter statistical procedures.

3 CONCLUSION

This paper has introduced an adapted experience sampling framework, entitled 'Context-Specific Experience Sampling'. For the explanation of the steps and procedures, case examples from a small scale lighting environment study in a regular office setting were presented. A key benefit of the proposed ES model is believed to be the context-based and context-specific experience value themes - from the pooling, sorting and extracting phases, for ES in relation to the target environment or product under investigation. The information process comprising divergent to convergent approaches to user experiences enables a researcher to generate pertinent and efficient evaluative experience value themes for effective ES. Another key contribution comes from the use of experience value structure from E3 value concept for a theory-guided experience keyword sorting processes and then for further theme extractions. As the final step in the model, experience analysis can help to integrate the video-recorded contextual information and the ES results in preparation for statistical applications in relation to the subject matter. Integrating qualitative and quantitative techniques to conventional ES, the present study proposes 'Context-Specific Experience Sampling Method' to be a tool for experience design research.

REFERENCES
[1] Hektner, J. M., Schimidt, J. A. and Csikszenimihalyi, M., *Experience Sampling Method: Measuring the Quality of Everyday Life*, 2007 (SAGE Publications, Thousand Oaks, London and New Delhi)
[2] Scollon, C. N., Kim-Pieto, C. and Diener, E., Experience Sampling: Promises and Pitfalls, Strengths and Weaknesses, in *Journal of happiness Studies Vol 4,* 2003, pp5-34,
[3] Cardelo, A. V., and Wise, P. M., *Taste, Smell and Chemesthesis in Product Experience*, Product Experience, 2008, pp91-13 (Elsevier, Oxford)
[4] Demir, E., Desmet, P. M. A. and Hekkert, P., Appraisal patterns of Emotions in Human-Product Interaction, in *International Journal of Design, Vol 3, No 2*, 2009

[5] Meschtscherjakov, A., Weiss, A. and Scherndl, T., Utilizing Emoticons on Mobile Devices within ESM studies to Measure Emoticons in the Field, in *MobileHCI'09*, Bonn, Germany, September, 2009, pp15-18

[6] Kim, K.O., An Application of a New Method, 'the Generative Technique' in Consumer Science, in *Journal of ARAHE, vol.16,* 2009, pp90-97

[7] Visser, S. F., Stappers, P. J., van der Lugt, R. and Sanders, E. B. –N., Contextmapping: Experiences from Practice, in *CoDesign, Vol 1, No 2,* 2005, pp119-149

[8] Graffney G. *Cultural Probes*, 2006 http://www.infodesign.com.au/ftp/CulturalProbes.pdf

[9] Cho, C.K, Kim, Y.S. and Lee, W.J., Economical, Ecological and Experience Values for Product-Service Systems, in *Design & Emotion,* Chicago, 2010

[10] Holbrook, M.B., *Consumer Value: A framework for analysis and research*, 1999 (Routledge, London)

[11] Sheth, J.N., Newman, B.I. and Gross, B.L., Why we buy what we buy: A theory of consumption values, in *Journal of Business Research*, *Vol 22*, March 1991, pp159-170

[12] Goedkoop, M. J., van Halen, C. J. G., te Riele, H. R. M., and Rommens, P. J. M., *Product Service Systems: Ecological and Economic Basics*, Report for Dutch Ministries of Environment (VROM) and Economic Affairs (EZ) 1999

[13] Scherer, Klaus R., Which Emotions Can be Induced by Music? What Are the Underlying Mechanisms? And How Can We Measure Them?", in *Journal of New Music Research*, *Vol 33, No 3*, 2004, pp 239-51

[14] Scherer, Klaus R., What are emotions? and How can they be measured?", in *Social Science Information, Vol 44, No 4,* 2005, pp 695-729

[15] Desmet, P. M. A., *Product Emotion, Product Experience* , 2008, pp379-422 (Elsevier, Oxford)

[16] Kröper, M., Fay, D., Lindberg, T. and Meinel, C., Interrelations between Motivation, Creativity and Emotions in Design Thinking Processes- An Empirical Study Based on Regulatory Focus Theory, *The First International Conference on Design Creativity (ICDC2010)*, Kobe, Japan, November 2010

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