D-work innovation

Where, when and in which social context do good ideas evolve in the distributed work environment of knowledge workers?

By

Anastasios Dimas

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D-work innovation

Where, when and in which social context do good ideas evolve in the distributed work environment of knowledge workers?

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ABSTRACT

The nature of work is changing. Until recently, the majority of people worked in fixed, team-based collaborations in collocated settings for fixed periods of time. Currently we are experiencing a major shift towards distributed work. D-work is multi-tasking (workers participate in many projects and teams that often change), multi-locational (work is conducted by people located in different divisions, firms, organizations and time-zones) and mobile (people conduct work while transiting).

D-Work changes the definition of the traditional office and blurs the boundaries between home, workplace and the city. Homes will have to accommodate work, businesses must adapt their policies and office spaces to D-work and cities have to adapt to new patterns of mixed work-live units. At the moment, workers, managers and designers have become less aware of where, when, with whom and during which activities, does the most productive and creative work take place.

In an effort to tackle the abovementioned issue, we developed a methodology that combines Context–Aware Experience Sampling with traditional ethnographic tools. Our system is composed of a Bluetooth-based positioning system, a context-aware self-report survey administered on mobile phones and traditional questionnaires. The methodology was tested via a four week case study on innovation that was conducted in a marketing firm based in Helsinki. During the study we collected data from eleven participants about the occurrence of work-related ideas and barriers inside and outside the office space. All participants provided us with information about their work habits by filling out a questionnaire prior to the beginning of the study. By juxtaposing their answers to their actual work-life data that we collected, similarities and discrepancies between the two emerged that helped us to understand and assess their work behavior. General results as well as personal reports that were compiled for three subjects are presented and analyzed. An overall assessment of the system and suggested improvements based on results and participant feedback are also discussed.

Thesis Supervisor: Kent Larson
Title: Principal Research Scientist

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Facts on distributed work

The nature of work is changing. Until recently, the majority of people worked in fixed, team-based collaborations in collocated settings for fixed periods of time. However, we are currently experiencing a major shift towards distributed work. This shift is the result of changes taking place in the social context, location and execution time of work-related activities. In a distributed work environment knowledge workers[1] execute their tasks in more than one location, during variable times of the day and even while transiting. As we can see in Figure 1 below, knowledge workers spend on average one third of their time at their main workplace and another third at home, while the remaining work time is distributed across other office spaces and third places (such as hotels, public spaces, cafes, vehicles, etc). As far as American knowledge workers are concerned (estimated to be 134 millions), research has revealed that they work on average at 3.4 different locations (see Figure 2)[2]. As a result, collaborations are not confined within the main office space but occur across different teams, divisions, firms and organizations that are often distributed in different locations and time zones. The effect of this collaboration from afar leads to the emergence of new kinds of organizations, quite often virtual ones. Another important feature of distributed work is that of multi-tasking. The job content of knowledge workers is demanding both cognitively and socially as around 50% of their work includes thinking and creativity demands[3]. More specifically, 40% of total working time is solo work and involves tasks requiring concentration, while the remaining 60% is spent in social interactions within a complex network consisting of team members, other colleagues, managers, clients, family members, friends and others. To summarize, D-work is multi-locational (work is conducted by people located in different divisions, firms, organizations), mobile (people conduct work while transiting) and multi-tasking (workers participate in many projects and teams that often change).

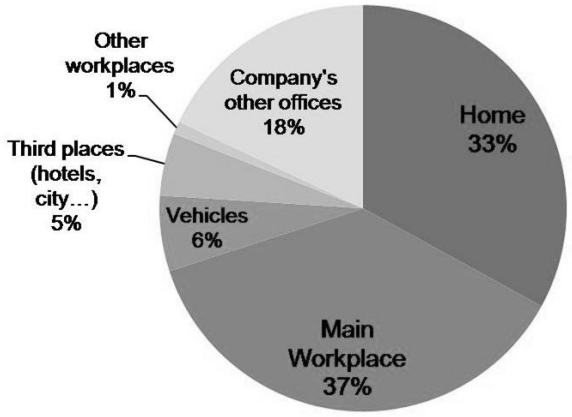


Figure 1 – Average distribution of knowledge workers' weekly work time across various spaces[4]

[1] A knowledge worker is a person employed due to his or her knowledge of a subject matter, rather than their ability to perform manual labor.
[2] Vartiainen and Hakonen and Koivisto, 2007
[3] Vartiainen and Hakonen and Koivisto, 2007
[4] Vartiainen and Hakonen and Koivisto, 2007

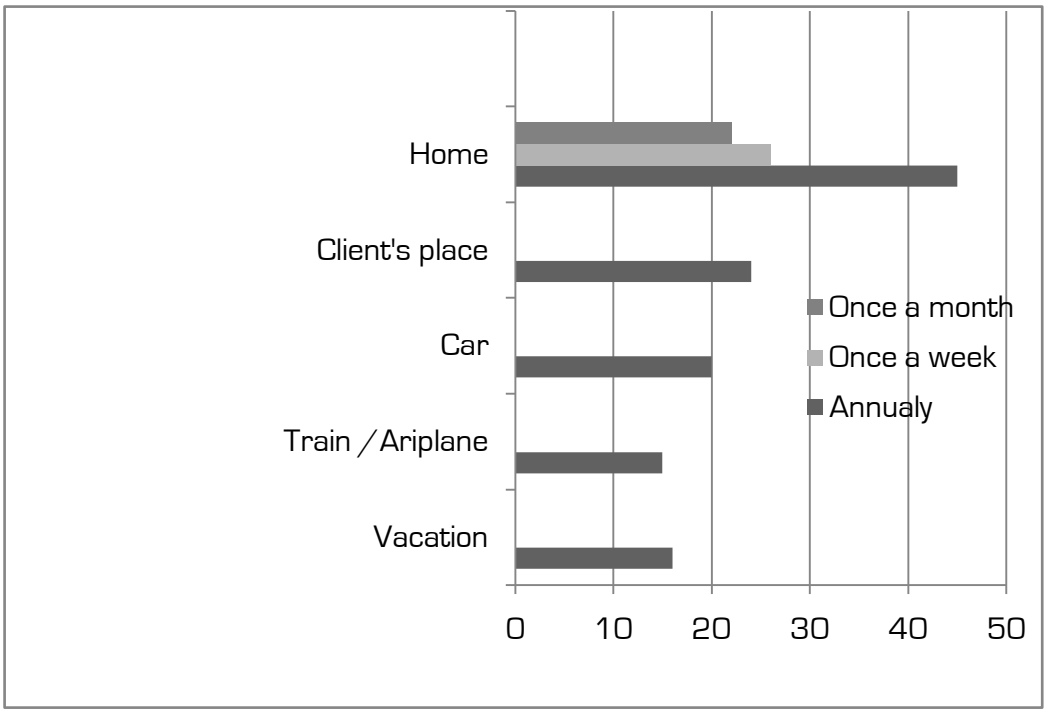


Figure 2 – Average distribution of work time across spaces for American knowledge workers

As location has become a minor constraint in the execution of work tasks, people are able to choose more freely where to work. As a result, the boundaries between home and workplace as well as between public and private spaces rapidly dissolve. As we mentioned, the physical environments that employees use for working are divided into five categories: home, the main workplace ("office"), moving places, e.g. cars, trains, planes and ships, a customer's or partner's premises (other workplaces") and hotels cafes etc ("third workplaces").[5] According to Cooper et al. (2002, p.295): "the decentralization of work activities and the practice of 'assembling the mobile office' on the part of 'nomadic workers' entail the simultaneous management of private activities, as when mobile teleworkers coordinate their work life from/at home. 'Public' work activities may be drawn into 'private' spaces, with a variety of effects on an individual's home and family life (both positive and negative)". This emerging distribution of activities across various space typologies forces knowledge workers to constantly search for places to concentrate and to share and socialize[6]. The overall effect of this search is an increasingly complex work-life that presents itself as a challenge to be recognized and dealt with.

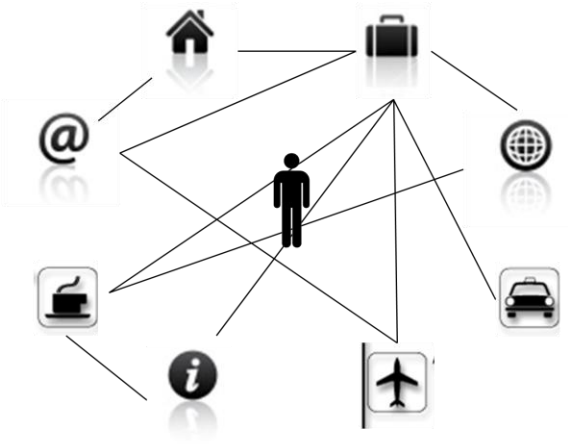
[5]Andriessen and Vartiainen, 2006

[6] Vartiainen and Hakonen and Koivisto, 2007

D-Work Implications and importance of study

Many studies have shown that the number of knowledge workers is rapidly growing[1]. Reducing operational and real estate costs, increasing economical outcomes, market globalization, social needs (of customers and employees), new business ideas as well as developments in mobile and wireless information and communication technologies (ICT), are some of the driving forces behind the constant growth of distributed work. Various methods have been employed to minimize the use of offices spaces in order to reduce cost, such as desk sharing (staff losing their right to exclusive use of personal workspace), hoteling (workspace has to be booked in advance), and the touchdown office (staff are allotted a workspace when they arrive at the facility on a "first come – first serve" basis)[2]. These methods, in addition to the ongoing globalization of businesses and their respective markets lead to the dispersion of workforce, thus increasing the mobility of employees. Moreover, as customers' demands constantly increase with regard to the quality and diversity of offered products and services, knowledge and knowhow have to be drawn from many different disciplines, in order to be combined into appropriate (and often novel) customer solutions.

On the other hand, mobile technology acts as an enabler of distributed work. Wireless LAN, Bluetooth piconets[3] and 3G networks, along with the sheer ubiquity of laptops, PDAs and most importantly mobile phones, allow knowledge workers to work anywhere and anytime they choose, thus minimizing "dead time" and increasing productivity and financial gain. Quite often, ideas become a driving force of D-Work. Strategic thoughts and theoretical constructs can act as the instigators for developing new technologies to support them. This in its turn creates new business opportunities[4]. Finally, social needs, as expressed by the needs and work habits of workers and customers, become a decisive factor in the development and implementation of mobile technologies and forms of business organizations.



[1]Andriessen and Vartiainen, 2006

[2] Lilischkis, 2003

[3]A piconet is an ad-hoc computer network linking a user group of devices using Bluetooth technology

[4]Andriessen and Vartiainen, 2006

The rapid growth of D-Work carries many implications with regard to the design of workplaces, business policies and the development of technology and work tools. As we have mentioned, distributed work changes the definition of the traditional office and blurs the boundaries between home, workplace and the city. In the imminent future, homes will have to accommodate work, businesses will have to adapt their office spaces to D-work and cities will have to adapt to new patterns of mixed work-live units. New business policies and models will have to be developed in order to deal with the challenges that D-Work brings up. Managers will need to be able to manage their subordinates remotely and rely more upon results than upon the supervision of employees' behavior[5]. The ability to monitor and control the activities of employees from afar raises concerns about the protection of their privacy that should be taken into consideration in the formulation of management policies. Moreover, motivation and co-ordination of employees as well as social bonding will have to be at least partly accomplished in ways other than face-to-face communication[6]. Finally, the quality and functionality of technological infrastructure and tools will become one of the most important features of future workplace.

One major implication of distributed work is that currently, workers, managers, and designers have become less aware of where, when, with whom, and during which activities does the most productive and creative work take place. This issue will be the main focus of our study. In order to pursue such an exploration, we must understand the real needs as well as the work content of distributed and mobile knowledge workers. This understanding can only be obtained by studies embedded in actual practice and not in a laboratory environment. However, designers currently lack the scalable tools to pursue a study of that kind. In his 2006 paper "Collaboration in mobile virtual work: a human factors view", Professor John R. Wilson stated the necessity for a new methodology that would track interactions and behavior of distributed and co-located office workers. One of his suggestions was based on direct observation; as he put it, "a richer study would possibly require a distributed research team in a kind of mapping onto the focus collaborating team studied, whereby each member of the work team is shadowed by a member of the research team so the same events, communications and decisions can be observed from the different points of view involved." To this proposal we juxtapose an alternative research methodology we developed, involving the use of Context-Aware Experience Sampling in parallel with traditional ethnographic tools. A detailed description is included in the methodology chapter.

[5] Lilischkis, 2003

[6] Vartiainen and Hakonen and Koivisto, 2007

Prior Work

Relevant research inferring location of human subjects via their proximity to distributed Bluetooth devices within spaces has been conducted before. Bluetooth scans on a mobile phone can identify other devices nearby, enabling the researcher to infer which people a particular subject encountered during the day[1]. It has been shown that this is a powerful technique to measure the social context of a mobile device.[2] A similar kind of research has looked at patterns of location of subjects over certain periods of time to deduce high-level contexts such as "work" and "home".[3] The most pertinent research, where Context-Aware Experience Sampling was first employed, was a pilot study conducted by the MIT House_n Research Group in collaboration with the WorkSpace Futures Group at Steelcase, Inc.[4]. Part of this study was the initial development of tools for CAES (i.e. Smartphone software collaborating with spatially distributed Bluetooth beacon devices). The work presented here is the first full scale study using CAES in order to measure not only patterns of occupancy and collaboration within office environments but their correlation to the process of ideation in knowledge workers as well.

[1] Raento et al. 2009
[2] Davis, King et al., 2004
[3] Eagle, 2005
[4] Cheung, 2007

Methodology

As we aforementioned, our research methodology combines Context-Aware Experience Sampling with traditional ethnographic tools (see Figure 1). Even though ethnographic tools are valuable in behavioral studies, in complex situations such as the study of ideation and innovation in distributed work environments, they are far from ideal. It has been shown that questionnaires are inaccurate as people often cannot recall situations accurately (the reconstruction of information from memory is not very reliable). Moreover, it is impossible to capture mundane activity patterns and complex associations through them. On the other hand, direct observation is capable to do that, however it is an expensive, invasive and time-consuming methodology. Moreover, it is not mobile (it would be hard and anti-economical to employ observers to track subjects outside the study environment), it is not scalable (it would be very expensive and most probably unrealistic to directly observe large numbers of subjects) and thus it can only be applied in a small sample. Finally, in-situ self-report procedures, such as the diary method and the experience sampling method (ESM)[1] are useful but are not aware of a subject's context (i.e. where and with whom the subject is, what kind of activities he is engaged with and at what time of the day). Overall, traditional tools for collecting behavioral data produce results that do not correlate well with real time empirical data regarding the same behavior or events.

Figure 1 – Traditional ethnographic tools used in behavioral studies

In an effort to tackle the abovementioned issue, MIT's House_n Consortium developed Context-Aware Experience Sampling (CAES). Context-aware experience sampling improves upon the experience sampling method by using sensor technologies to automatically detect events that can trigger sampling and thereby data collection[2]. There are many advantages in using CAES. First, compliance of participants can be assessed more accurately as researchers can know exactly when a self-report was completed, how long the completion time was and if answers were changed before survey completion[3]. Second, real-time collection of data enables

[1] See Larson and Csikszentmihalyi, 1983

[2] See http://web.mit.edu/caesproject/index.htm for more information

[3] See Barrett and Barrett, 2001

researchers to start analyzing data right after the study begins, thus allowing them to make adjustments to the survey's content or to the conditions that trigger sampling. Third, as CAES employs media capturing devices such as mobile phones, it allows study subjects to capture images, audio and video of their situation to further support their answers. Fourth, computerized self-reports have a more sophisticated structure than traditional questionnaires as questions can be conditional (i.e. can depend on the subject's answers to previous questions or to other conditions specified by the researcher), of specific frequency (i.e. questions can be asked a certain number of times per day or per event[4]), and randomized (in order to reduce response bias). Finally, the collected data are formatted in a way that allows for immediate computer-based analysis, thus eliminating the load of translating them into code.

In order to study productivity and the process of ideation in distributed work environments, we developed a methodology that combines Context–Aware Experience Sampling with traditional ethnographic tools (see Figure 2). Our system is composed of a Bluetooth-based positioning system, a context-aware self-report survey administered on mobile phones, traditional self-repot questionnaires and direct observation. The methodology was tested via a four week case study on innovation that was conducted in Taivas, a marketing firm based in Helsinki. During the study we collected data from eleven participants about the occurrence of work-related ideas and barriers inside and outside the office space. Participants were interrupted at specific times (according to their transitions across office spaces) and were asked to record their activities, feelings, ideas, problems, social context and experiences in real time. The mobile phone survey used psychometric scales, multiple-choice and open-ended questions as well as image capturing in order to capture (and later assess) subjects' conditions per place, time and social context. Participants were unaware of when they would be queried and thus acted "naturally". The validity of this methodology is based on repetition, as behavioral patterns are exposed over time. Moreover, participants provided us with information about their work habits by filling out a questionnaire prior to the beginning of the study. Our aim was to juxtapose their Pre-study questionnaire answers[5] to our findings from direct observation and the use of the CAES system, in order to expose similarities and discrepancies between their actual work-life data and self-proclaimed habits. Detailed descriptions of the survey's content and the Bluetooth positioning system are included in the following chapter.

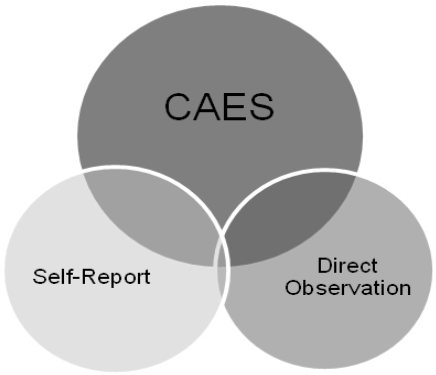


Figure 2 – Taivas case study research methodology

[4]See Raento and Oulasvirta and Eagle, 2009

[5]Please see Appendix B – Participants' Pre-study Questionnaire Answers

Case Study: TAIVAS, Helsinki, Finland

The aim of the Taivas case study was to study where, when and in which social context do good ideas evolve in the distributed work environment of knowledge workers. By being able to track work-related ideas and problems and by finding and measuring patterns of occupancy, mobility and collaboration within distributed work environments, we can gain a better understanding of the real needs of knowledge workers, the content of their work and the process of ideation and innovation within such environments. Moreover, by strategically exposing those findings to management and employees alike, we could possibly increase productivity levels as well as creativity in many ways. First, by providing employees with useful feedback about their work-lives, we could help them make adjustments to their work-behavior in order to improve their performance and work-life quality by helping them recognize areas of potential improvement as well as problems that need to be tackled so as to bring balance in their often entropic lifestyles. Second, by cross-referencing anonymized data of employees, managers are allowed to review group dynamics and track significant incidents and measures at various levels (i.e. across employees, teams or even larger business structures) in real time, thus gaining a "global view" of the workplace. This could help them make more informed decisions about business policies and personnel management. Finally, the results of the study could also help designers assess if and how technology-enabled collaboration environments encourage innovation, how ICT tools and new space typologies can support D-Work, as well as what the future challenges with regard to office space design are.

During the four week case study we collected data from eleven participants belonging in different disciplines. After signing a consent form[1] and filling out the Pre-study questionnaire[2], each participant received a 3G GPS-enabled Samsung SGH-i617 Blackjack II Smartphone running the Windows Mobile 6.0 operating system and the MyExperience application. Participants were prompted by their phones to answer surveys while transiting between office spaces under certain conditions (discussed later). Their phones (and thus movements) were tracked by fourteen Bluetooth beacons developed by BLIPsystems and eleven other mobile phones that were distributed across Taivas' spaces. Participants also had the chance to record ideas and barriers at their own initiative by pressing two buttons. The collected data were anonymized and sent over to the House_n server on a daily basis via data plans offered by Elisa Network.

Image 1 – Taivas Headquarters

[1]Please see Appendix C – Consent Form

[2]Please see Appendix A – Pre-study Questionnaire

Phone survey

In order to study the complex concepts of productivity, ideation and innovation within distributed work environments, we had to reduce them to simple quantitative components which were easier to measure. For this reason we decided to study work and creativity as an activity system[3]. In this view, work is a goal-driven system consisting of a subject using tools to process objects of work within a working context. The aim of the system is to fulfill given or self-set tasks. Image 2 below illustrates this concept. As a result, to understand the nature of work and the process of ideation within work environments, it is only sensible to analyze the following six perspectives: 1) what is done (type of task or activity); 2) by whom is it done (e.g. by a single person or by a team, by a manager or an employee etc); 3) how is it done (i.e. what kinds of tools used); 4) where is it done (e.g. at the office, at home, while transiting etc); 5) when is it done (i.e. at what time of the day); 6) and most importantly, the relationships between the variables (i.e. worker-task, worker-coworker, worker-environment etc). Our view is in concert with psychologist Mihaly Csikszentmihalyi's view that creativity is understood better if examined from a systemic perspective, including the social and cultural context[4]. Moreover, it is broadly believed that innovation is also by nature a systemic phenomenon[5].

At this point it is appropriate to make a clarification about the thesis title. In the Taivas case study our effort was concentrated in capturing data about ideas (which are inventions) and not specifically applied ideas (which are innovations). However, as most of the ideas that subjects recorded throughout the study were to be eventually transformed into products or services and since we monitored the advances and obstacles that appeared towards their realization within the D-Work environment, we can safely claim that we implicitly studied innovation. According to Osborn[6], the process of innovation has three distinct stages. The first is fact finding, i.e. the process of collecting data and information about whatever is needed to be done. The second is idea finding, which is the exploration of possibilities, a process which is free from as many constraints as possible. The last stage is solution finding, which is the development of promising ideas into applied solutions. Thus, our study covers the first and second stages of innovation.

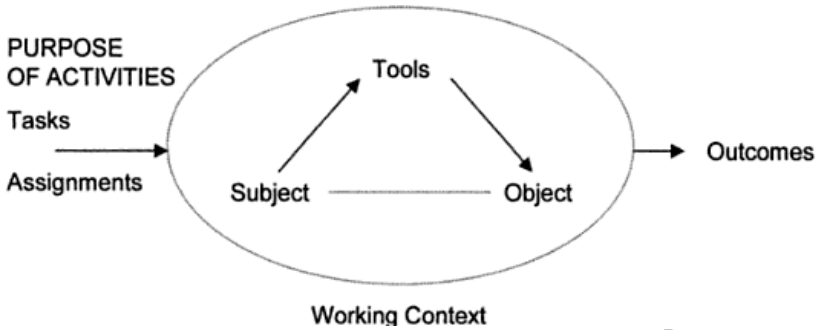


Image 2 – Work as a goal-driven system[7]

[3]See Andriessen and Vartiainen, 2006
[4]Bundy, 2002
[5]Fagerberg, 2004
[6]See Osborn, 1957
[7]Andriessen and Vartiainen, 2006

Before we move on to discuss the survey's design, we should briefly refer to the factors we chose to track by explicitly asking subjects questions related to them. Even though it is probably impossible to measure creativity, our research on the process of ideation, as well as our use of common sense, made us realize that the most important indicators of creativity are access to information, access to the right work tools, knowledge acquisition, social Interaction (i.e. collaboration and exchange of ideas between knowledge workers), the physical and ambient environment (i.e. comfort with regard to spaces, furniture, noise levels etc) and psychological factors (such as stress). Other factors, such as routine, are not included above as they can be inferred by answers to other questions that subjects were asked, as well as by examining sensor data (for example, by tracking frequency of occupancy of spaces and transitions, as well as repetitions in the detected social context of participants over long periods of time, routine patterns could be revealed).

Let us now move on to the design of the survey. As far as the content and phrasing of the questions were concerned, in many cases they were adapted to Finnish culture as well as to Taivas' internal business language. We have found that certain questions were thought to be offensive or unclear by certain Taivas employees, whereas the same questions were thought to be fine when asked during pilot studies conducted within House_n. Overall, the survey was designed to be short; questions were asked in the simplest and shortest possible way (in one short sentence). The vast majority of questions (25 out of 27) were either multiple or single choice and thus quick to answer. Moreover, subjects were asked between five and twelve questions per prompt (lasting between one and two minutes). Research has shown that the ideal number of daily prompts is around eight[8]. However, as we wanted to obtain as much data as possible, we did not explicitly set a maximum number of daily prompts. Finally, at any given point during the survey, participants were allowed to exit the survey by letting it time out.

As we have already mentioned, the phone survey was either triggered by the transitions of participants across office spaces, or was initiated by participants pressing either the "idea" or the "barrier" button. These buttons were always apparent in the phone's experience sampling software interface (i.e. MyExperience's interface) and allowed subjects to record ideas and problems whenever these occurred. Regardless of the triggering origin, the survey was structured in two parts. Between the first and the second part, a "continue" option was inserted. The first part would cover the basic questions (where subjects were when out of Taivas, if they were engaged in activities alone or not, with whom they were with and what were they doing). If the participant would choose to continue to the second part of the survey, then according to his answers in the first part and a sophisticated randomization technique, he would be directed to either the "social interaction" or the "spatial" branch. The spatial branch asked subjects questions with regard to their spatial transitions and preferences, whereas the social interaction branch about their collaboration and encounters with others. To enhance user participation, an incentive in the form of a small award was employed. Every time participants completed surveys, either self-initiated or Bluetooth-triggered, either partially or fully, they gained one point. At the end of each week, the participant with the highest score would receive a bottle of wine. Overall, we structured the phone survey in a way that meaning could be extracted by the participants' answers. To see the full survey please go to Appendix E.

[8]Mota, 2006

The process of formulating the mobile phone survey was one of the most difficult parts in the study. Given the constraints of time and the mobile phone's screen size, in order to ask subjects the right questions and in the right way and order, the survey passed through many iterations. The images below show snapshots of various survey versions. The first version was tested via paper prototyping (see Image 5) which proved to be a valuable method for gaining insight about what the survey's content and structure should be. To see some of the phone survey diagrams in order to visually compare their structures, please go to Appendix O.

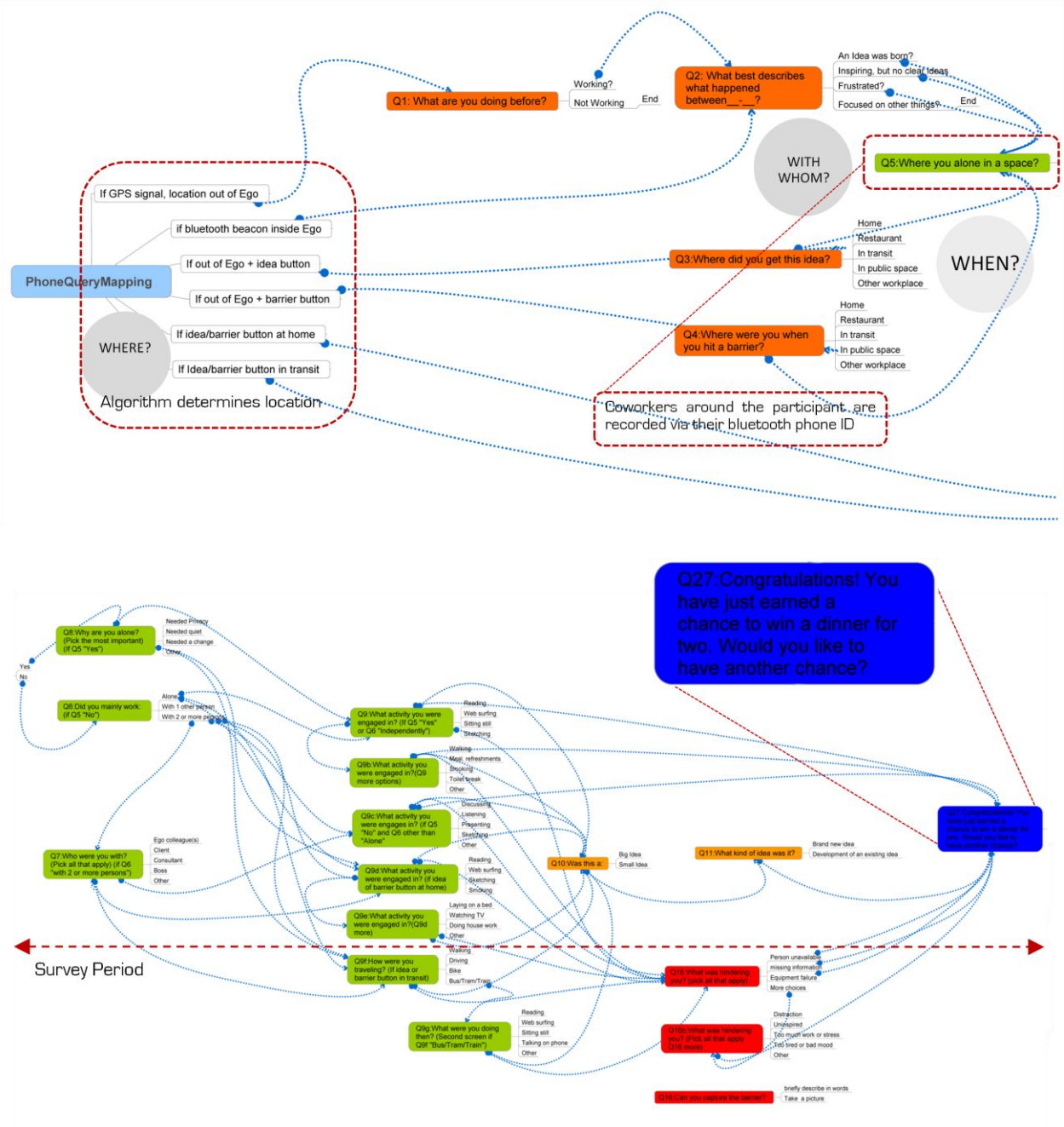
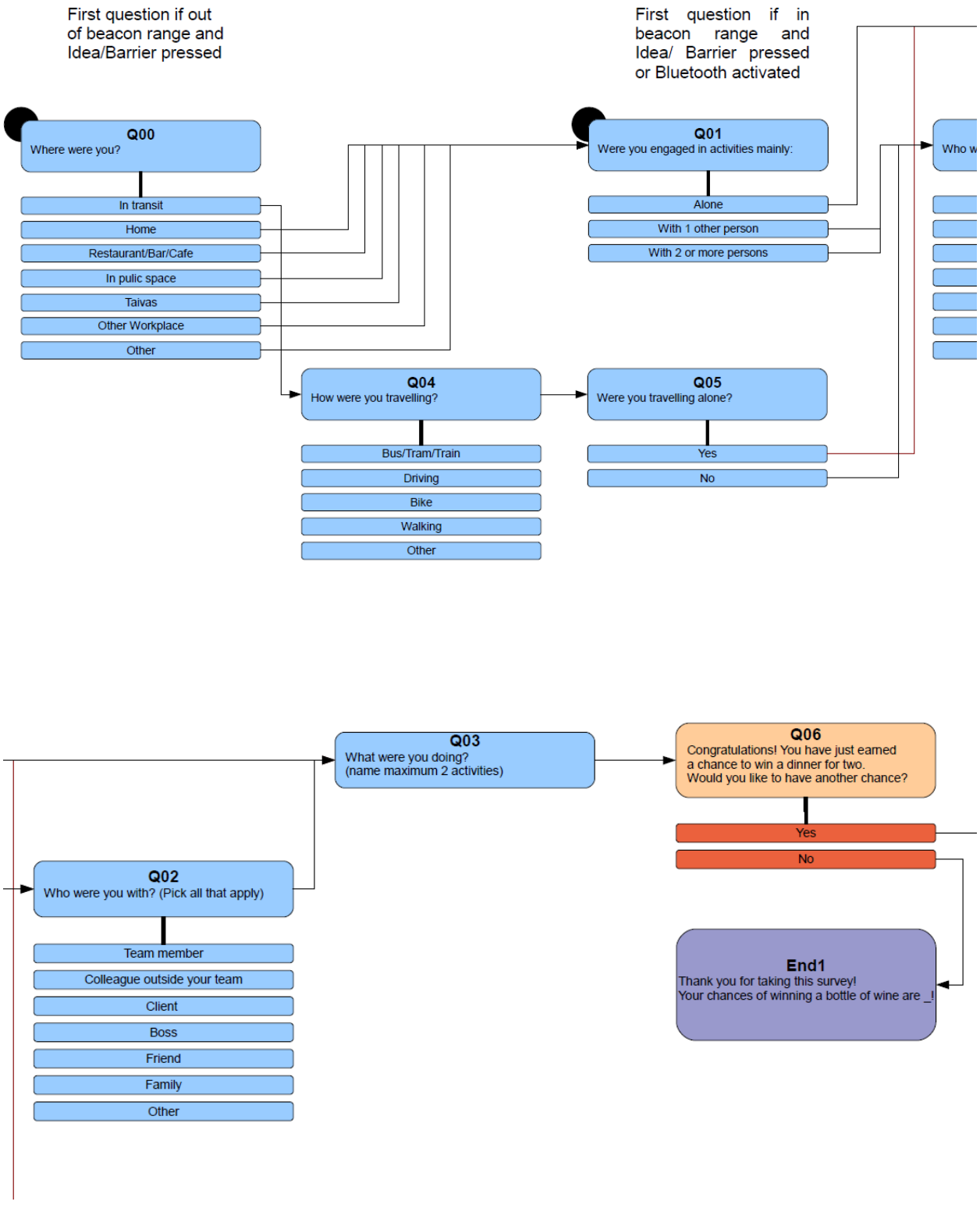


Image 3 – Phone survey diagram samples of version 1


First question if out of beacon range and Idea/Barrier pressed
First question if in beacon range and Idea/ Barrier pressed or Bluetooth activated
Q00
Where were you?
In transit
Home
Restaurant/Bar/Cafe
In pulic space
Taivas
Other Workplace
Other
Q01
Were you engaged in activities mainly:
Alone
With 1 other person
With 2 or more persons
Q04
How were you travelling?
Bus/Tram/Train
Driving
Bike
Walking
Other
Q05
Were you travelling alone?
Yes
No
Q02
Who were you with? (Pick all that apply)
Team member
Colleague outside your team
Client
Boss
Friend
Family
Other
Q03
What were you doing?
(name maximum 2 activities)
Q06
Congratulations! You have just earned a chance to win a dinner for two.
Would you like to have another chance?
Yes
No
End1
Thank you for taking this survey!
Your chances of winning a bottle of wine are _!

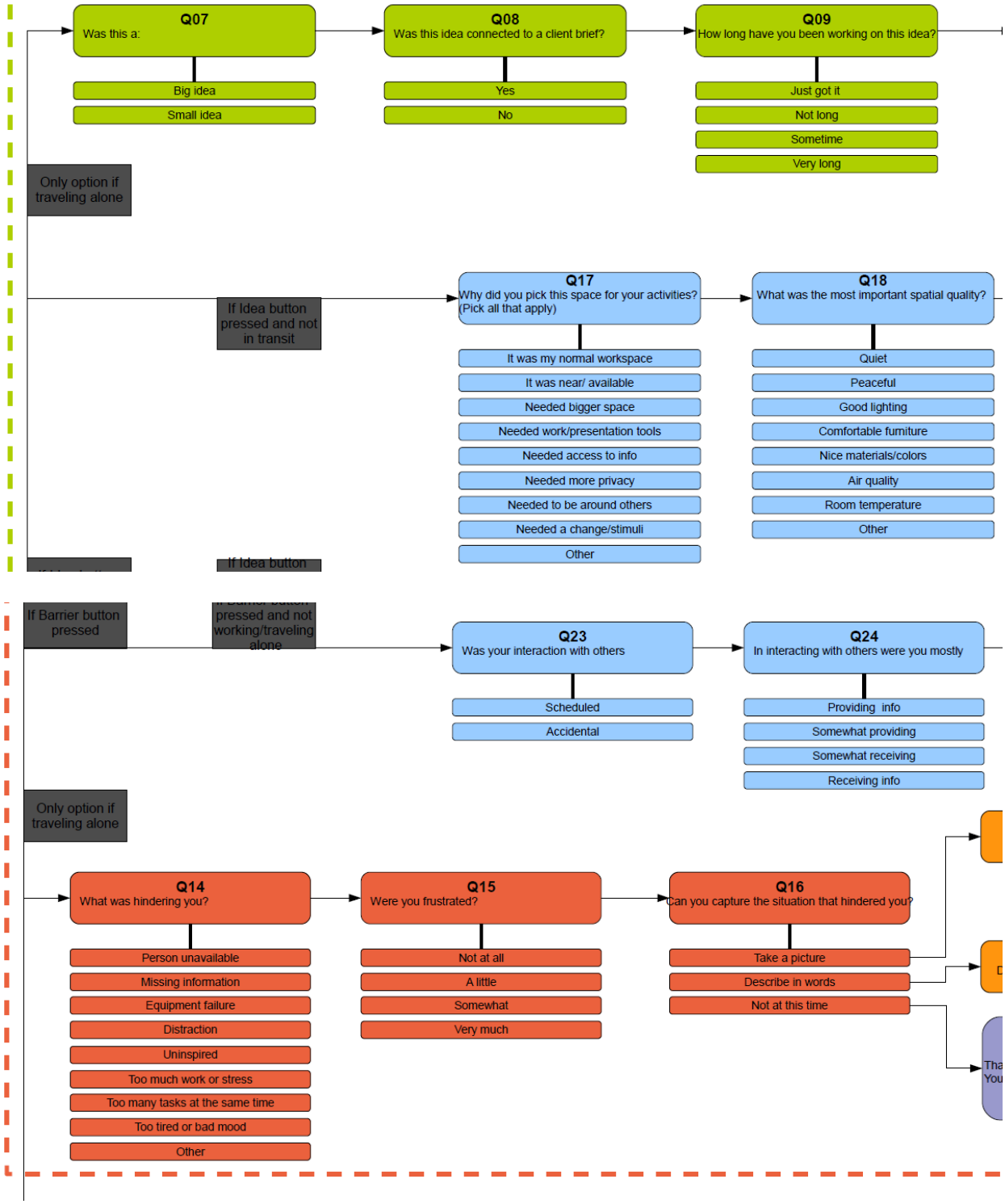


Image 4 – Phone survey diagram samples of version 4 (Final version)

Image 5 – Paper prototype of the phone survey

MyExperience software

MyExperience is an open source context-aware experience sampling application developed in C# for Windows Mobile devices using .NET CF 2 and Microsoft SQL Compact Edition. As a mobile data collection platform, MyExperience has been designed to record a wide range of data including sensors, images, video, audio and user surveys. MyExperience is based on a three-tier architecture of sensors, triggers and actions; triggers use sensor event data to conditionally launch actions. One novel aspect of MyExperience is that its behavior and user interface are specified via XML and a lightweight scripting language similar to the HTML/JavaScript paradigm on the web[9]. Image 6 (next page) illustrates the architecture of MyExperience as revealed in the structure of the XML protocol. Image 7 illustrates the overall data collection system architecture. Data were collected and time-stamped via MyExperience, recorded to an SQL database in the mobile phone and sent to the House_n Server. Even though MyExperience has many built-in sensors, we had to develop our own Bluetooth sensor[10].

[9] Please visit http://myexperience.sourceforge.net/ for more information

[10] Please see Appendix H – Bluetooth Sensor for MyExperience

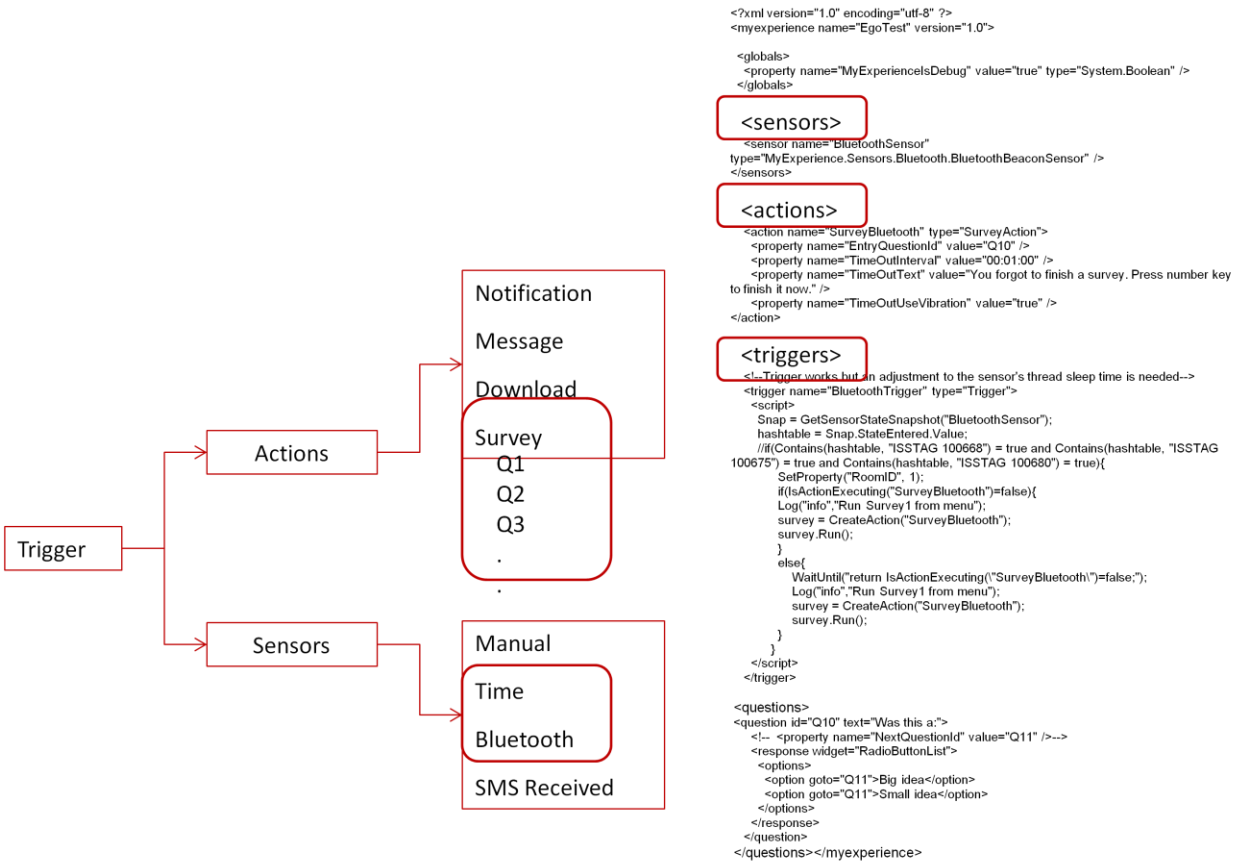


Image 6 – MyExperience XML protocol sample and structure

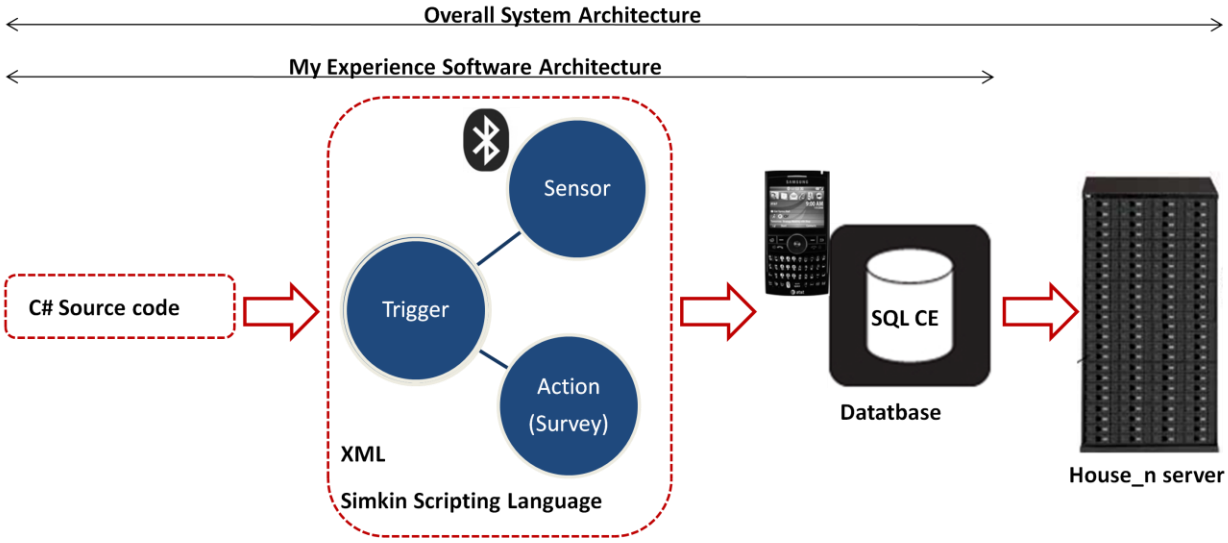


Image 7 – Data collection system architecture

Bluetootht positioning system

As we have mentioned, participants were prompted by their phones to answer surveys while transiting between office spaces. Fourteen Bluetooth beacons developed by BLIPsystems and eleven other mobile phones (Nokia and Samsung) that had their Bluetooth devices on (and thus acted as supplementary beacons) were distributed across Taivas' spaces. Images 8 and 9 show a BLIPSystem beacon as is and as was installed within Taivas. Each participant was carrying a Samsung SGH-i617 Blackjack II Smartphone that had its Bluetooth device on and was running our MyExperience protocol. In this way, participants' phones were detected by the beacons as soon as the participants were located within their range. In the Bluetooth trigger that we developed within MyExperience (which was based on the Bluetooth sensor that we also developed), we used the condition that participants would be prompted by their mobile phone to answer the survey every time they changed location within Taivas, as long as they spent a minimum time span of ten minutes in their previous location. In the case of the cafeteria space that was located on the third floor, the time span was adjusted to two minutes since our direct observation showed that most employees would only make brief visits to that space. Image 10 illustrates this trigger condition.

Image 8 – Class II Bluetooth beacon

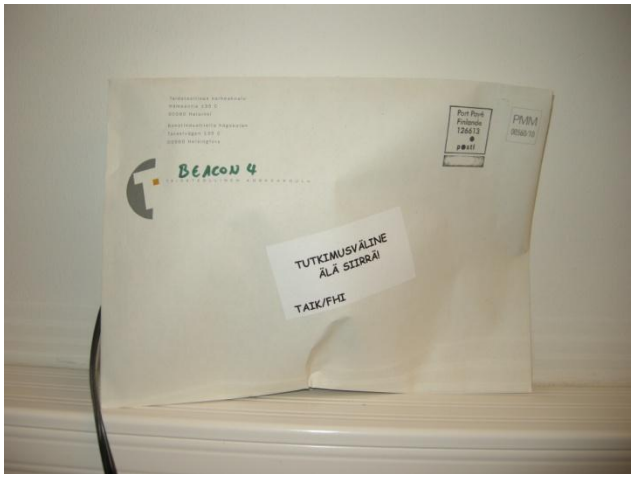


Image 9 – Bluetooth beacon placed in Taivas

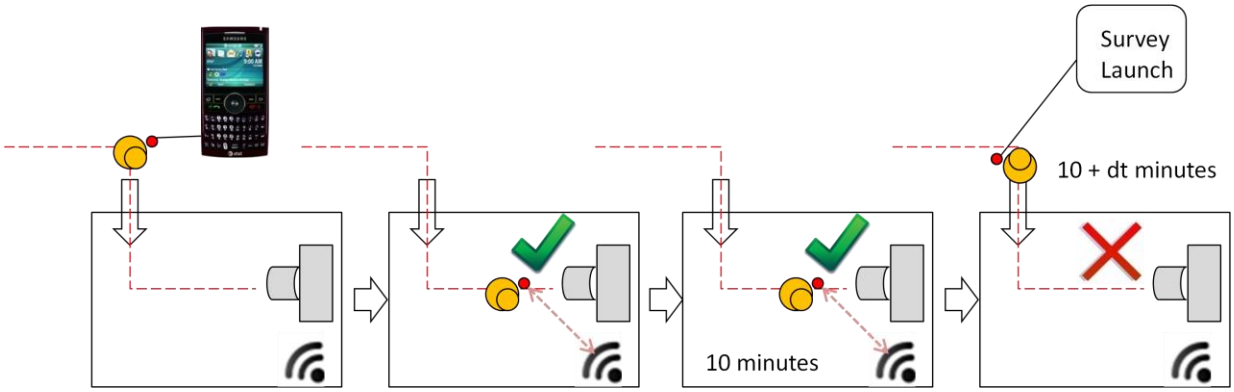


Image 10 – Trigger condition for prompts based on participants' transitions within Taivas

Both the BLIPsystem beacons and the mobile phones that we used as beacons are Class II Bluetooth devices, meaning that they have an effective range of approximately ten meters. Thus, if they are deployed within a small space, or at high density within larger spaces, significant signal overlap will occur. In this case, an accurate positioning of participants based on which Bluetooth beacons their mobile phones are able to "see" at that specific moment will be prevented. Research has shown that variation in Bluetooth networks is unpredictable due to environmental noise[11]. Noise is epressed as the appearance of non-study related Bluetooth devices that take up a large portion of the number of allowed detected devices per scan, as well as signal reflections from study related devices caused by the presence of metal surfaces within the study area, as well as signal absorption and distortion due to the presence and movement of people. Thus, Bluetooth-based detection of nearby devices (and thus subjects) is inherently stochastic[12]. In order to minimize the signal overlap we did the following: first, we placed the beacons in boxes wrapped in aluminum foil so that part of the signal would be forced to reflect inwards; second, we created a Bluetooth map of Taivas by scanning for Bluetooth devices at many different locations over a three day period. The recordings were analyzed and combinations of detected Bluetooth beacons per location were ranked according to the frequency of their occurrence. Then, we assigned each space a Room ID (for example desk 1 equals RoomID 1) and to each Room ID a number of specific Bluetooth beacon combinations, thus creating a location look-up table. Images 11 and 12 illustrate this process.

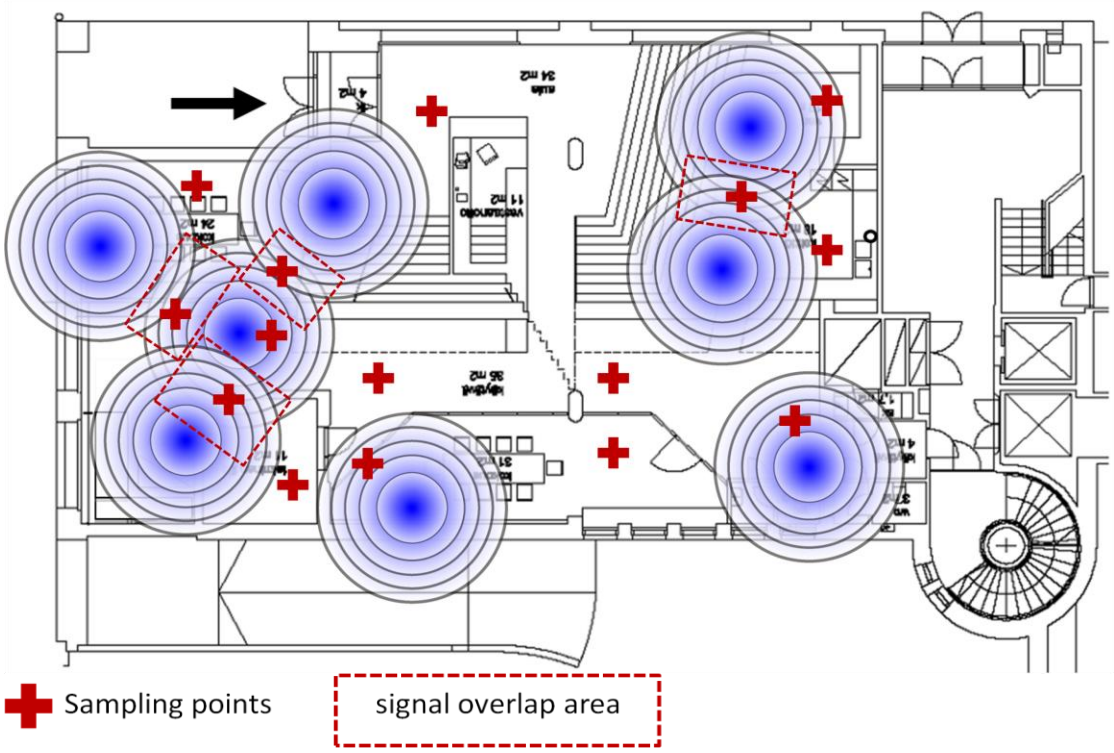
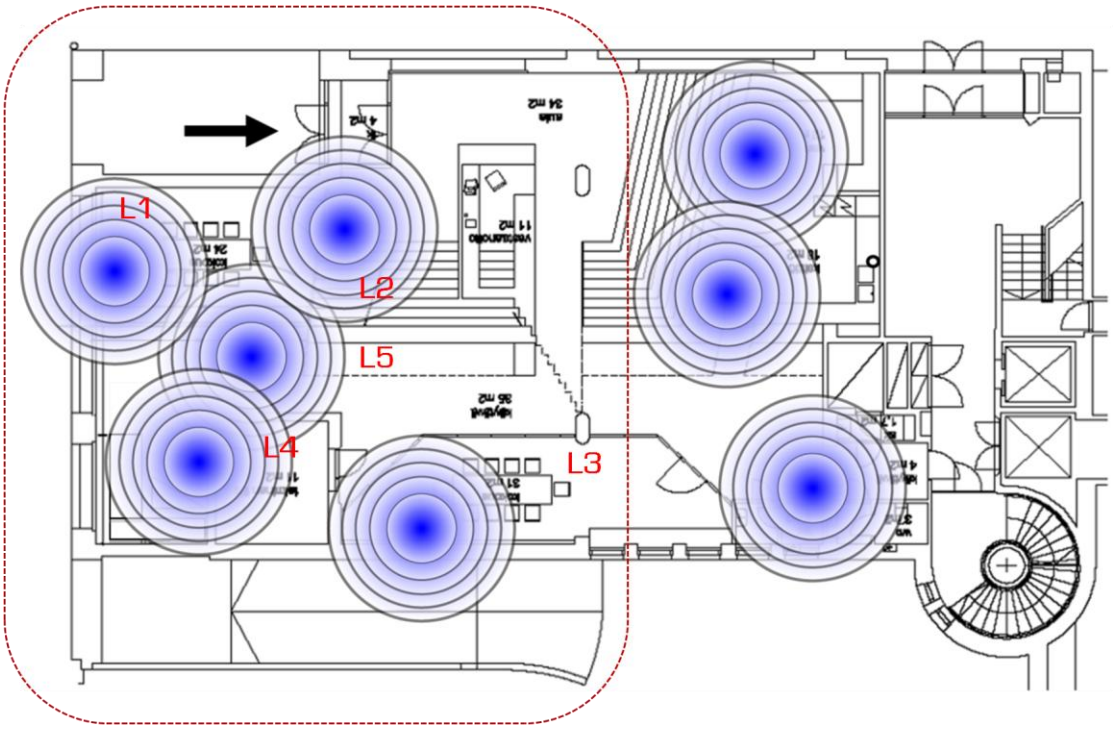


Image 11 – Bluetooth signal sampling over a three day period leads to a mapping of space required to formulate a look-up table

[11] See Cheung and Intille and Larson, 2007
[12] Raento and Oulasvirta and Eagle, 2009



Bluetooth beacons: B1, B2, B3, B4, B5 -Locations: L1=meeting room1, L2 = entrance, L3=meeting room, L4=desk space, L5=corridor

B/L MATRIX	L1	L1	L2	L2	L3	L4	L4	L5	L5
B1	0	0	0	1	0	0	1	1	1
B2	0	0	0	0	0	1	1	0	0
B3	0	0	0	0	1	0	0	1	0
B4	0	1	1	1	0	0	0	0	0
B5	1	1	0	0	0	0	0	0	0

BC*L Matrix: Number of unique beacon combinations detected per location

Image 12 – The process of formulating a look-up table.

As we can see from Image 13 (next page), Taivas headquarters are mainly located in a vast unified open-plan space. Given the lack of physical boundaries, in order to study the transitions of participants across spaces, we decided to divide the floor plan into rooms by strategically distributing the Bluetooth beacons. Open-plan spaces present a greater challenge for Bluetooth positioning systems than partially or fully enclosed spaces as signal overlap and reflection become more frequent and intense, thus lowering the chances of formulating a concrete look-up table. Image 13 shows the desk locations of the case study participants, the division of the floor plan into rooms, the ID that was assigned to each room, as well as the way we distributed Bluetooth beacons within Taivas. For more information about the formulation of the look-up table, please see Appendix I.

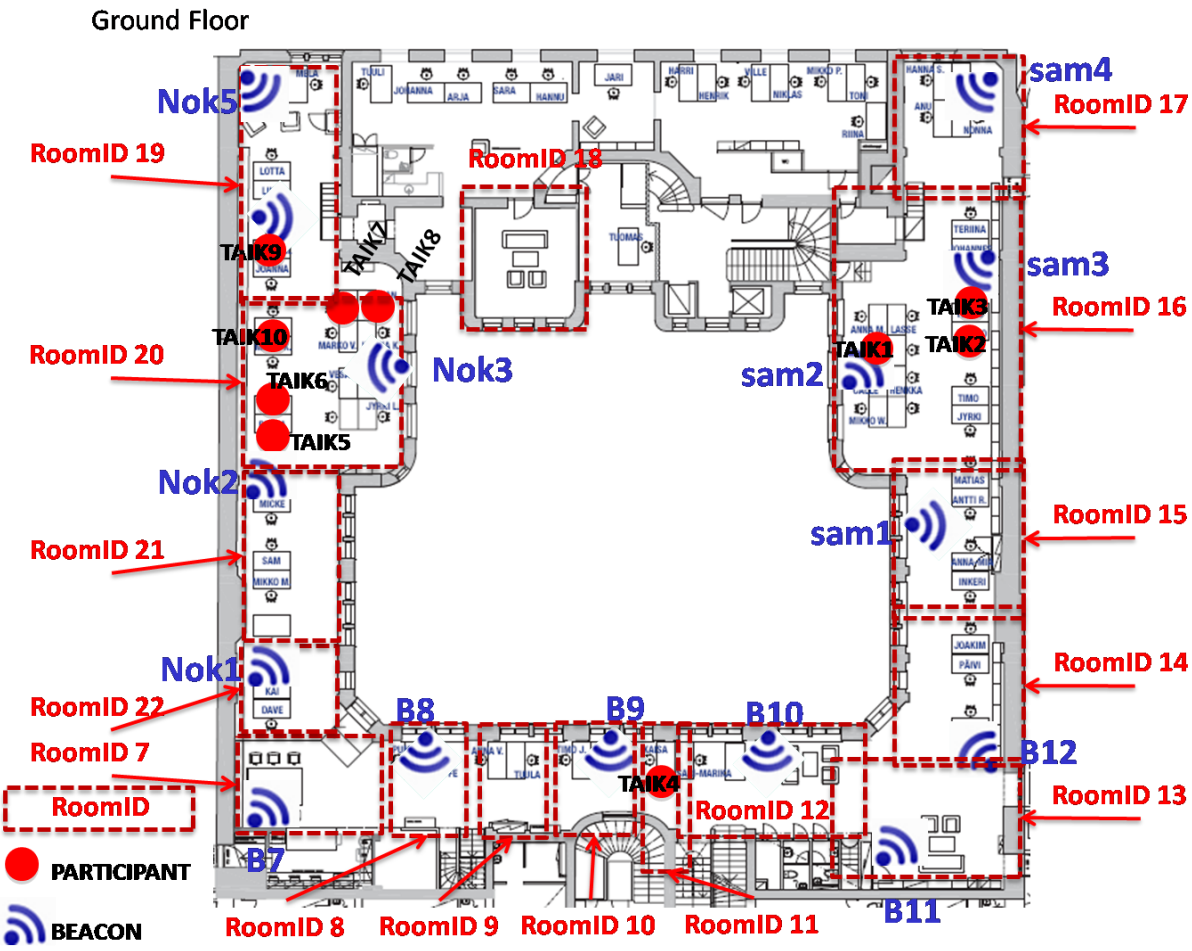


Image 13 – Division of spaces, location of participants and Bluetooth beacons

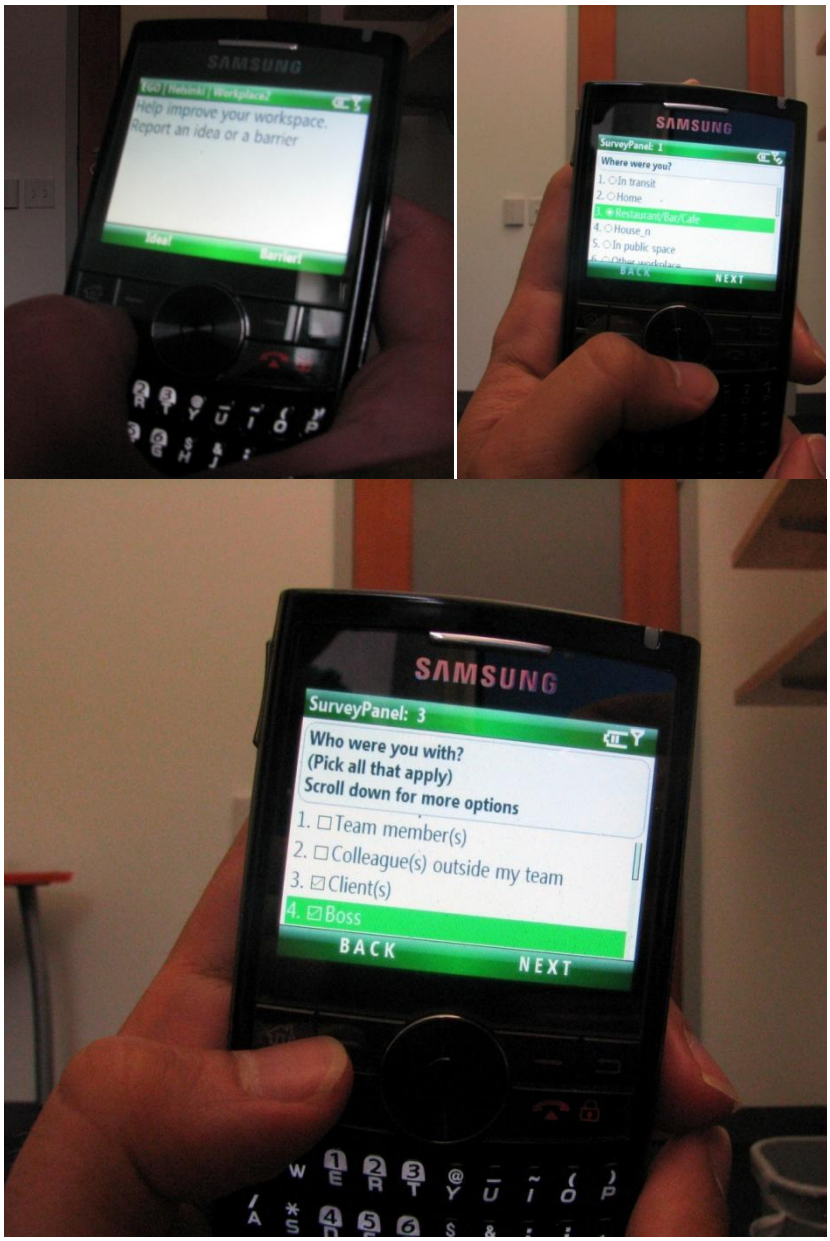


Image 14 – Captured images of the phone survey interface

Data Analysis

Data analysis is presented in three consecutive parts. In the first part, we go through the initial results of the case study, covering the compliance rate of subjects, survey completion time, conditions used for the triggering of surveys and adjustments that were made in our algorithms while reviewing participants' data sets during the first week of the study. In the second part we analyze in more detail the overall case study results, covering the occurrence of ideas and barriers with regard to location, time, social context and corresponding recorded activities for each participant as well as per occupation type. In the third and final part, we present personal reports for participants TAIK1, TAIK2 and TAIK3. Those three participants were selected because they worked close to each other, allowing us to study not only group dynamics (who interacts with whom and in what ways), but also test more exhaustively the validity of our employed methodology via the analysis of Bluetooth scan recordings. The reports cover in detail subjects' behavior and survey answers during their participation in the study which are then juxtaposed to their Pre-study Questionnaire responses in order to expose agreements and possible discrepancies between the two. Summarized results are provided in the end of parts two and three.

Initial Results

The Taivas case study was conducted in two consecutive phases. In both phases we used the same mobile phone survey and generic MyExperience configuration (i.e. sensors, triggers, and actions). In the first phase (May 25th – June 10th) we used the condition that participants would be prompted by their mobile phone to answer the survey every time they changed location within Taivas, as long as they spent a minimum time span of ten minutes in their previous location. In the case of the cafeteria space that was located on the third floor, the time span was adjusted to two minutes since our direct observation showed that most employees would only make brief visits to that space (lasting under five minutes on average). Given this configuration and a highly mobile participant (one who changes location every ten minutes), our protocol allowed for a maximum of five prompts per hour for most locations (not the cafe). Our direct observation for participants TAIK1 and TAIK2 showed that their average work day in Taivas would last between eight and twelve hours, thus bounding the maximum number of possible daily prompts between forty and sixty. By extrapolating this observation to the rest of the participant group we could expect to observe a maximum average of forty prompts per day. However, we did not expect participants to change location that frequently, simply because it would allow them no time for conducting most office related work tasks. Thus, we empirically estimated that daily prompts should appear to be between eight and twenty per day.

As was abovementioned, participants' data were sent over to the House_n server daily for monitoring purposes, in order to make sure that participants' interactions with MyExperience were as expected. Figure 1 shows the total number of survey prompts per subject for week 1.

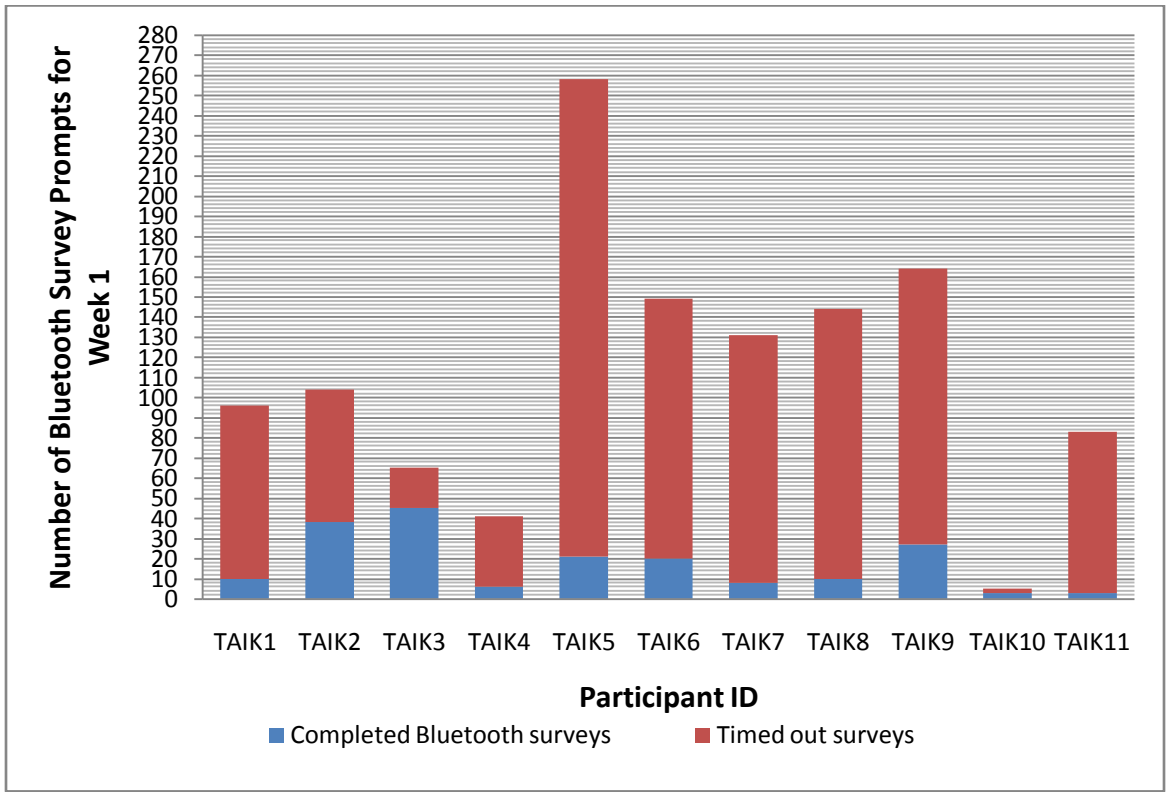


Figure 1 – Participants' survey compliance for week 1

Our review of the data recorded during the first five days of the study, as shown above, revealed that the average number of daily survey prompts was 22.5[1], a bit over our empirically established maximum. The high frequency of prompts made us look into the dataset more closely. Our review revealed that for certain participants, such as "TAIK5", the Bluetooth trigger algorithm was sometimes unable to detect the pre-defined combinations of Bluetooth beacons contained in the look-up table that assign a room ID to each space, thus erroneously mislocating the participant to being outside of Taivas for short periods of time (for two or three scan cycles or a minute on average). By detecting a known Bluetooth beacon combination after such an incident, the algorithm would assign a Room ID to the participant (that of his current location) and would erroneously prompt him to answer a survey, believing that the participant had returned to Taivas. As we have already said, Bluetooth based detection of nearby devices is innately stochastic due to signal overlap and environmental noise. However, through an analysis of the unique beacon combinations that were recorded in each space over the first week period, we were able to optimize our look up table and filter out most of these mislocations. In other cases where participants were situated in adjacent desk spaces, the algorithm would detect Bluetooth beacon combinations that were assigned to the spaces next to the participants' current location, forcing the algorithm to erroneously assume that a transition across desks had occurred and to thus prompt the participant. These cases of high participant proximity were impossible to resolve. Yet, by cross–checking the Room ID assigned to the participants' location by the Bluetooth algorithm to the participants' answers with regard to their location (i.e. being at their desk space or not), we were able to determine a frequency of occurrence for this incidents that should be taken into account in a statistical analysis.

Going back to Figure 1, the average percentage of answered Bluetooth surveys was 22%, meaning that in four out of five prompts the participant chose not to comply, either by not finishing answering the first part of the survey, or by letting the survey to time out without answering any question at all. Of course, had the participants been prompted less often, we would have seen a higher relative response rate. Still, in absolute measures, participants' response rates were quite good, providing us with four completed bluetooth surveys per day on average, one out of which (or 25%) covered the second part of the survey as well (see Figure 2). These answers do not include participant-initiated surveys (i.e. the recordings of ideas and barriers – discussed later). As expected though, participants' response rates dropped after the first week, reaching one response per day towards the end of the study. Figure 3 shows the average daily response rate for week1. There we see a peak forming in the middle of the week with regard to the number of survey prompts and completed surveys, followed by a significant drop on Friday. This makes sense as most employees leave earlier on Friday after the weekly wine session that takes place at 3pm.

Survey completion time (from survey notification sound to displaying the end message) was also examined. Surveys in which the subjects decided to stop after the continue option lasted one minute on average whereas the vast majority of fully-completed surveys (i.e. those covering either the spatial or the social interaction branch as well) lasted two minutes on average. However there were atypical occasions were the participants spent seven, ten or even twenty minutes to complete the full survey.

[1] Please see Appendix J: Participants' Response Rates for Week 1 for more information

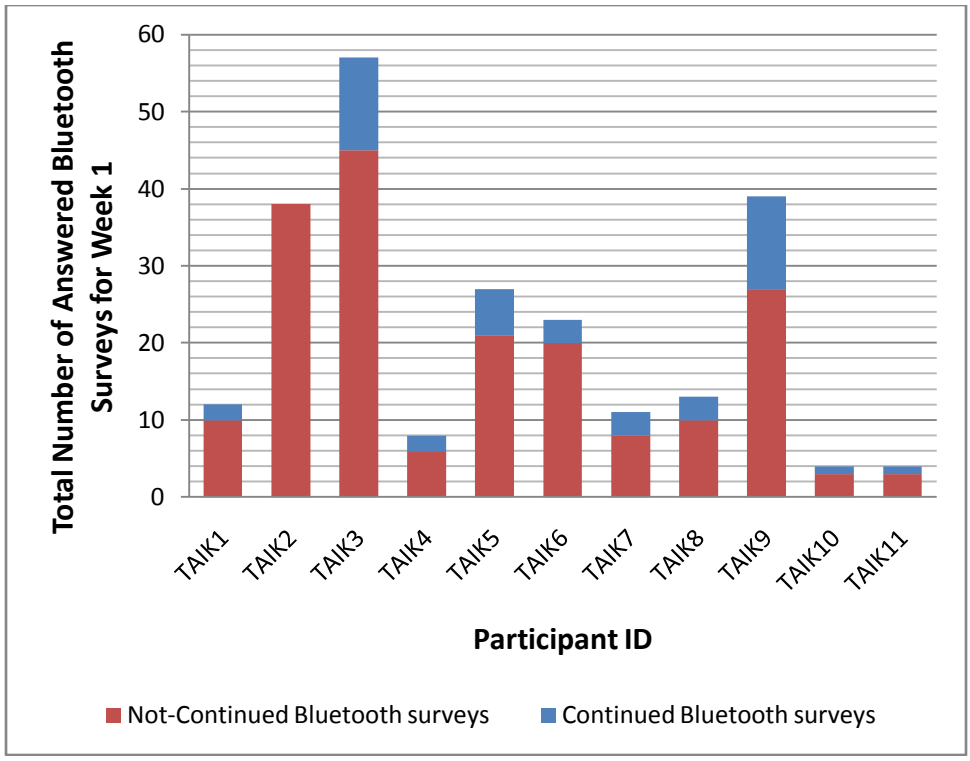


Figure 2 – Continued and not-Continued Bluetooth surveys per participant (week 1)

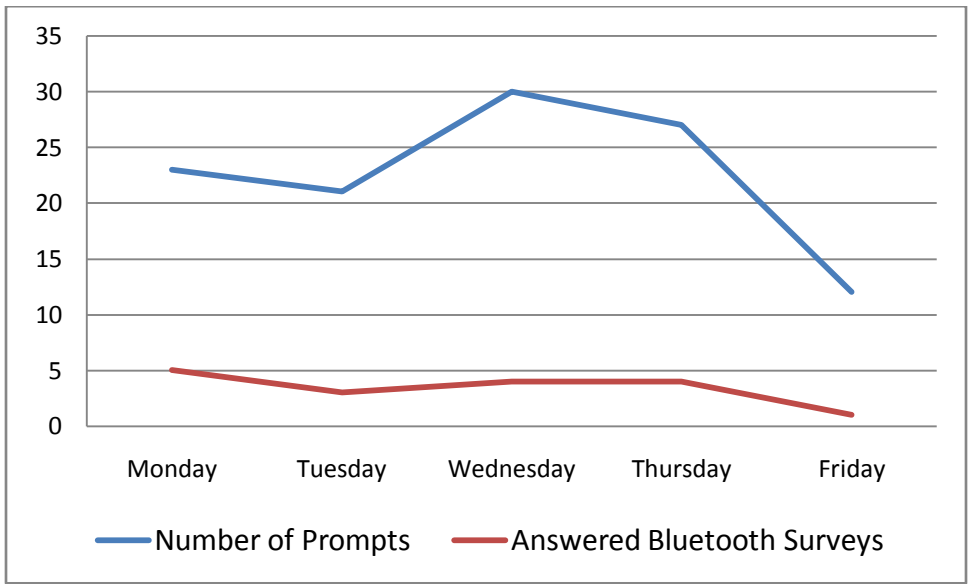


Figure 3 – Average daily response rate for week 1

In the second phase of the study (June 10th – June 18th) we decided to minimize the number of daily prompts significantly. Thus we added to our Bluetooth trigger algorithm the condition that once the participant answered a survey (either Bluetooth-triggered or participant-initiated) he wouldn't be prompted again for forty five minutes regardless of his transitions. This minimized the maximum number of daily prompts to eight and the daily response rate to one or two.

Overall Results

During the four week case study three hundred Bluetooth-triggered surveys were answered and fifty five ideas and forty two barriers were recorded, thus providing us with a total of three hundred and ninety seven completed surveys. In ninety nine surveys the participants chose to reply "yes" to the continue option, thus yielding a percentage of continued surveys of 25%. Figure 4 below shows the total number of completed surveys and the ratio of continued to not-continued surveys per participant. Participants TAIK2 and TAIK9 stand out as the first one never chose to continue to the second part of the mobile phone survey and the second one had a ratio of continued to not-continued surveys of 0.51, i.e. more than twice the average.

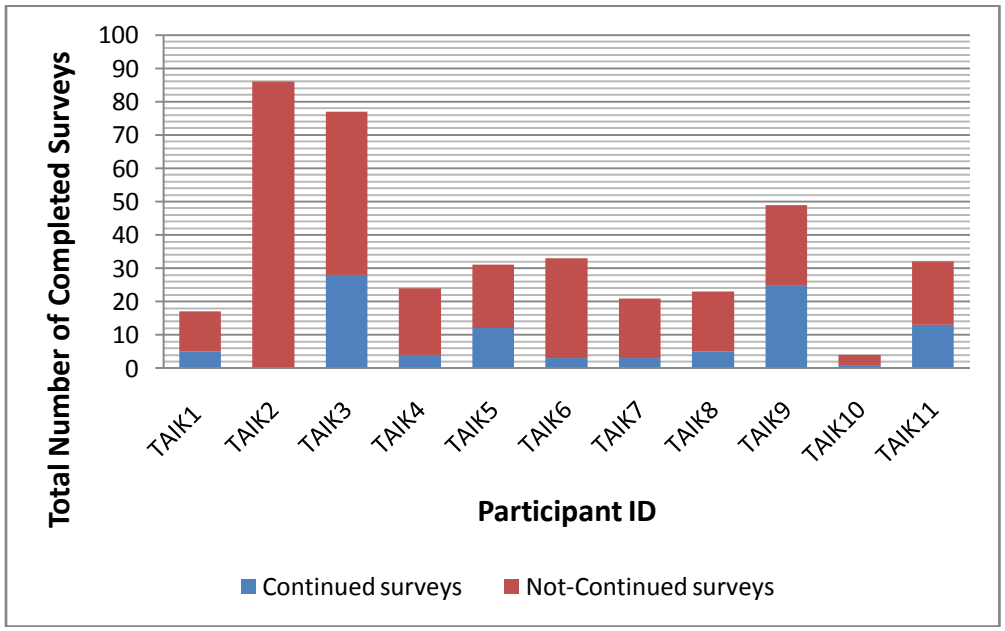


Figure 4 – Continued and not-Continued surveys per participant

Moving on, we will briefly juxtapose the number of unique activities recorded by each subject over the duration of the study. By choosing to include open-ended questions in the mobile phone survey, we ensured that we would get far richer data sets with regard to participants' activities than if we had used multiple choice questions. The extra amount of information proved quite helpful in the interpretation of answers to various other questions as we will see in the qualitative reports that are to follow. However, in order to make quantitative comparisons with regard to recorded activities across subjects, we had to translate each recorded activity to a more generic one.[2] For example, reported activities such as "drawing" or "visual designing" were translated simply to designing. In many cases however, the task of translating activities into more generic types was quite daunting. For example, activities such as "planning a pitch", **"**planning and briefing", **"**designing a website" and **"**planning and designing webpage" were translated to "designing" since some kind of design skill is required in order to conduct the tasks. However, this labeling process might occasionally lead to

[2] Please see Appendix K: Participants' data: Ideas, Barriers and Bluetooth Survey Results

misinterpretations of work situations as it strips off valuable qualitative information. However such a process was necessary in order to establish a common language with regard to reported activities so as to compare daily richness of activities across participants and juxtapose it to occurrences of ideas as well as to try and find structures on a daily and weekly level with regard to repetition and duration of activities. For reasons of economy, we will juxtapose daily distribution of activities in the qualitative reports that are to follow for participants TAIK1, TAIK2 AND TAIK3. Figure 5 below shows the number of unique recorded activities per participant. One interesting observation is that participants TAIK3 and TAIK11, who recorded the highest number of unique activities during the case study (after their translation), also recorded the highest numbers of ideas and barriers; still, no correlation can be made at this point.

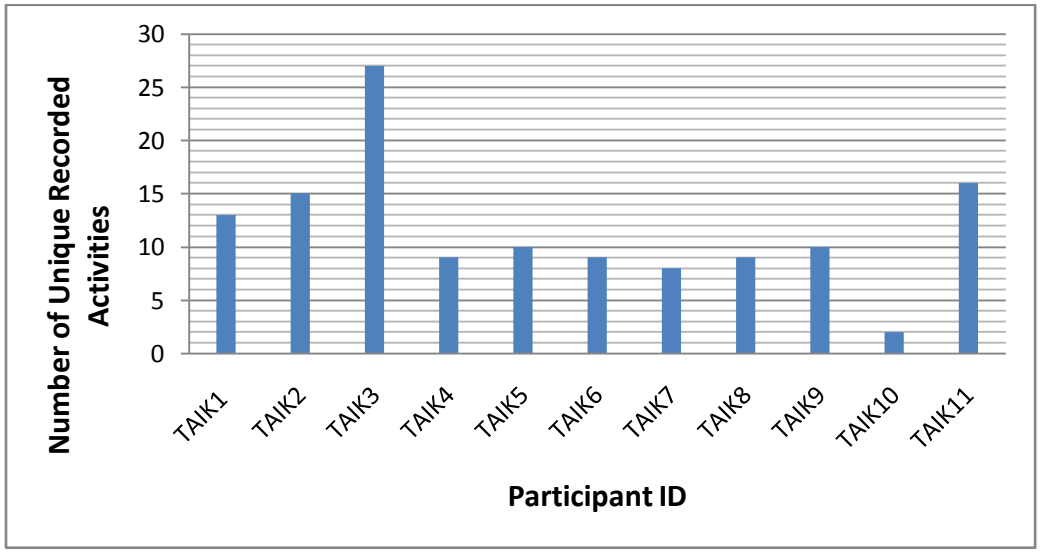


Figure 5 – Unique recorded activities per participant

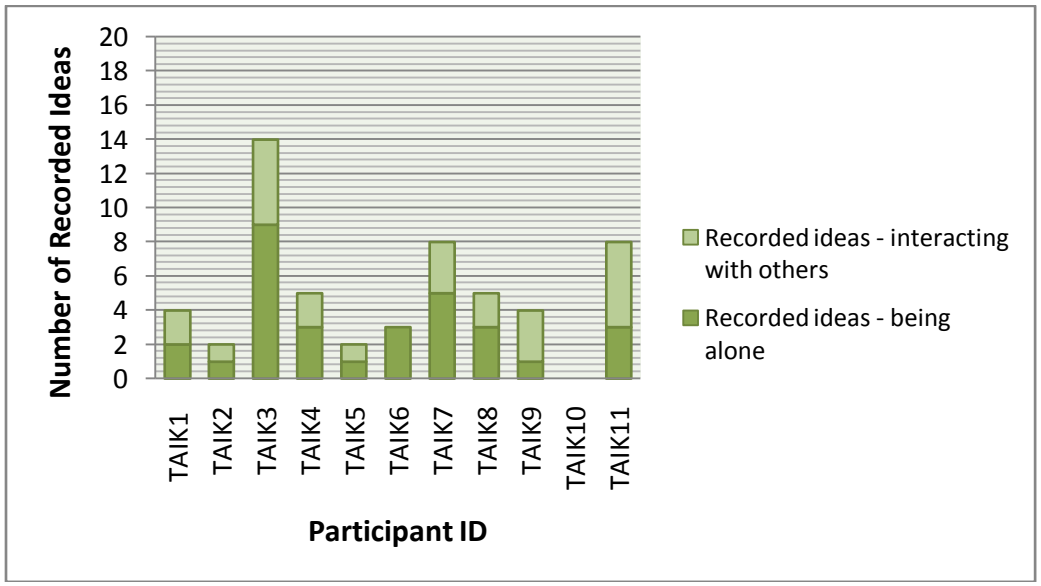


Figure 6 – Recorded ideas and social context

Let us now look into the occurrence of ideas with regard to social context. As we can see in Figure 6 (previous page) all participants apart from TAIK11 recorded having more ideas while being engaged in activities alone. A detailed break down of the participants' social context at the occurrences and recordings of ideas can be seen in Figure 7 below. As expected, in most cases where the participants reported having an idea while being engaged in activities with others, they were with team members. An interesting observation is that participant TAIK6 (who along with participants TAIK5 and TAIK9 form a team) reported having ideas only when being alone, whereas her team members reported having ideas mostly when working as a team. This implies a different degree and possibly type of collaboration between TAIK6 and her team members that could be further investigated by a juxtaposition of their activities during the case study, meaning that by comparing activity types across team members we could possibly check if TAIK6 has a role within the team that does not demand a lot of interaction with other team members. However, such a comparison is beyond the scope of our study. In the case of the team formed by participants TAIK7 and TAIK8 results where as expected, as both participants reported a strong interaction between them, as shown by their idea recordings, that was confirmed by their phones' Bluetooth scans (i.e. participant TAIK8 was often in proximity to TAIK 7 and vice versa). Finally, participant TAIK11 recorded most of her ideas when engaged in activities with clients.

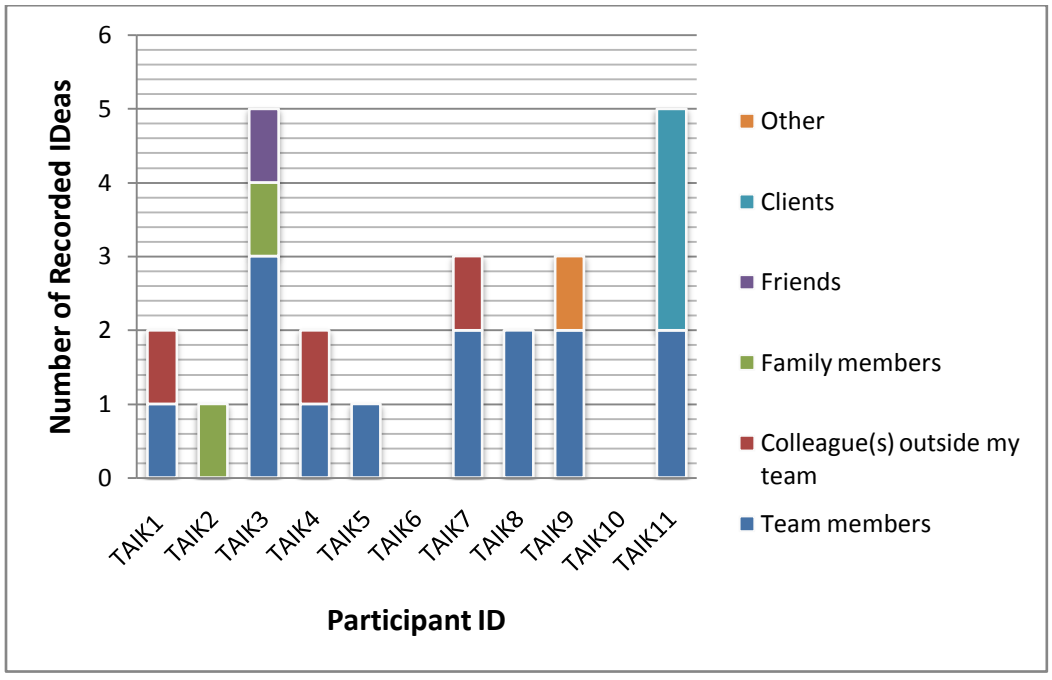


Figure 7 – Recorded ideas while engaged in activities with others

As far as the timing of ideas is concerned our data showed that the vast majority of ideas were reported to occur in the morning hours (see Figure 8). There were no recordings of ideas after 5pm. This shows that most participants were not using their phones to record ideas and barriers while they were at home, even though they had them switched on (as shown by their Bluetooth scans). The same goes for the use of the phones over the weekend. No participant recorded any event during weekends. Of course if the case study phones were given to

participants to use them as their primary phones, the results would be quite different as the chances of the participants forgetting to switch them on, or charge them or leaving them behind purposefully or by accident for both short and long periods of time would be minimized.

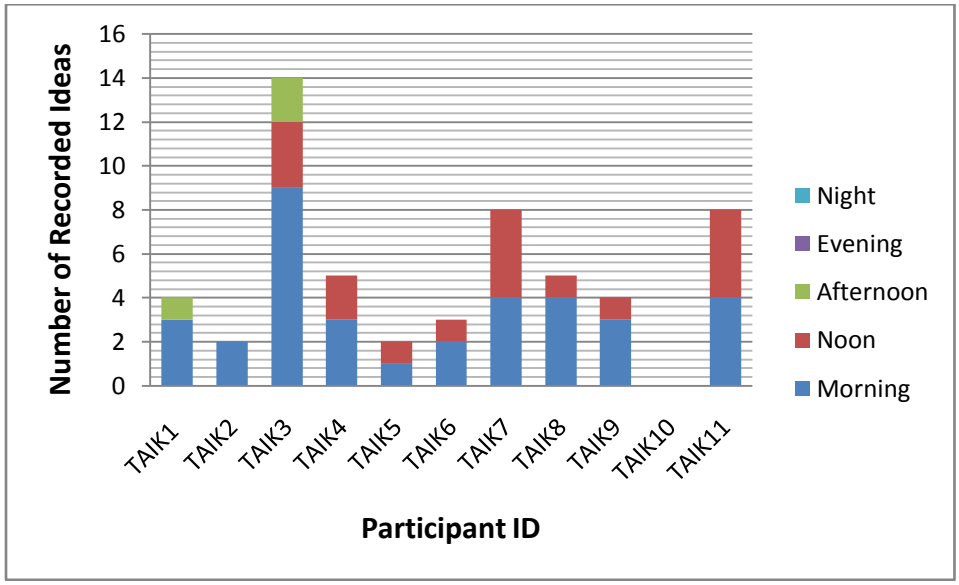


Figure 8 – Time of the day when ideas were recorded

Since most participants were not using their mobile phones while being out of the office, most ideas and barriers were recorded to arise within Taivas. Only participants TAIK2, TAIK3, TAIK4 and TAIK11 reported having ideas in locations other than Taivas (shown in Figure 9 below); out of those four, only subjects TAIK2 and TAIK3 had a significant percentage of recorded ideas occurring outside the office space. A detailed analysis of reported ideas in the spaces within Taivas is included in the participants' reports.

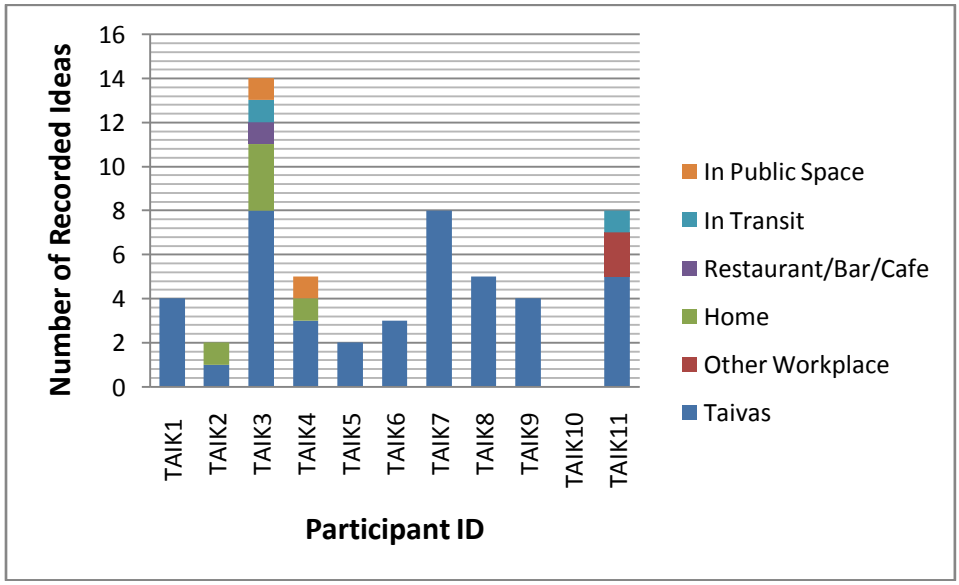


Figure 9 – Locations where ideas were recorded

An interesting part of the study would be to compare the amount of recorded ideas and barriers across professions. However, as the study group was quite diverse with regard to occupation, no significant groupings were able to be made. Figure 10 shows the number of recorded ideas juxtaposed to the occupation type of each participant. Because there are only three types of professions that have at least two representatives (designer, graphic designer and art director), we can only make comparisons among those. Apparently, designers reported the largest number of ideas, followed by art directors and graphic designers.

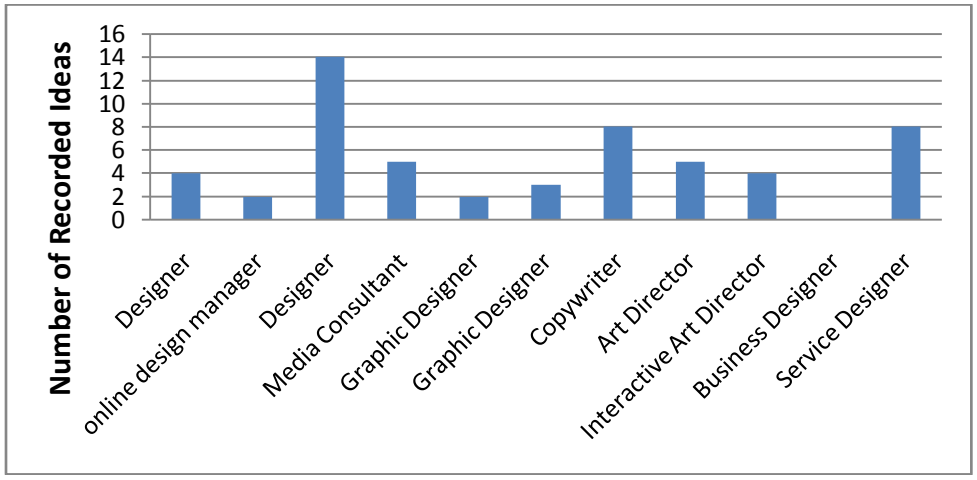


Figure 10 – Recorded ideas per participants' occupation type.

Before we conclude our analysis of idea-related data it would be necessary to examine how often participants were able to describe their ideas in detail. By deciding to continue to the second part of the survey after pressing the idea button, the participants would often be directed to describe their ideas in more detail. The chance of this happening was 50%, as the

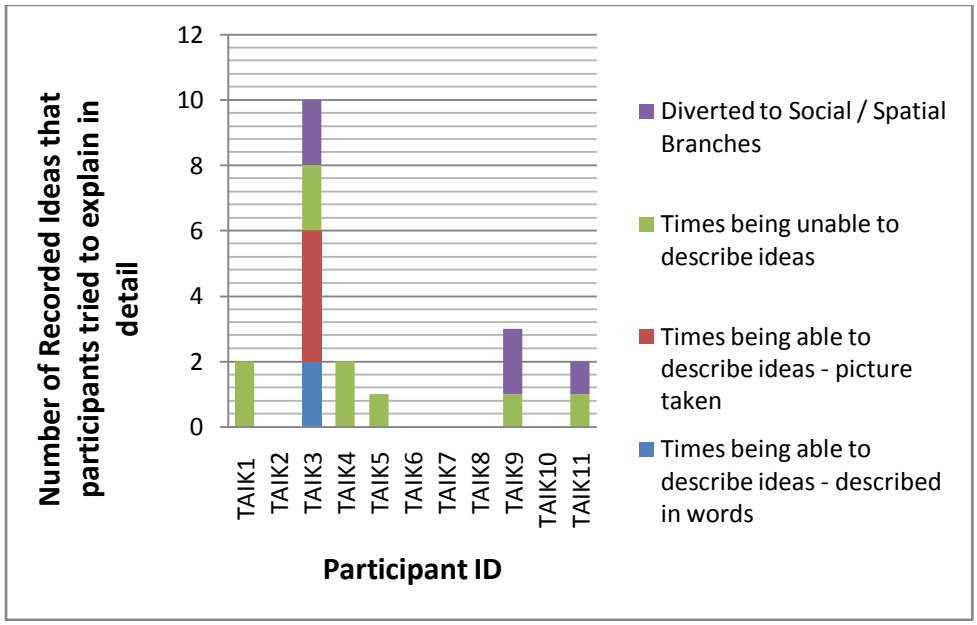


Figure 11 – Recorded ideas that participants tried to explain in detail

spatial and social interaction branches had a 25% chance each to show up due to randomization. As a result, when the participants were willing to provide us with more information about the situations that led to the creation of their ideas, they only had a 50% chance to do so. As we explained in the mobile phone survey subchapter, the randomization technique in the second part of the survey (i.e. after the continue option), was employed for reasons of economy and we were aware that some idea and barrier-related data would be missed. Figure 11 (previous page) shows the total number of recorded ideas per participant where the participant tried to explain the type of the idea as well as the circumstances that led to its generation. Out of the total eleven participants, only six chose to provide us with more information about these incidents. The diagram exposes the randomization effect as participants TAIK3, TAIK9 and TAIK11 were diverted twice to either the social interaction or spatial survey branch. Still, even in the cases where participants were directed to the idea branch, they were unable to describe ideas either in words or by taking a picture with the exception of participant TAIK3. We cannot deduct whether this inability to provide descriptions was due to participants' reluctance (as it would take up more of their time) or due to the elusive nature of the ideas that occurred to them.

Following, we will examine barrier-related data, again starting by looking at social context. By looking at Figure 12 It is obvious that most participants reported facing barriers in their work related tasks while being alone. Only subjects TAIK1 and TAIK9 reported having more problems with regard to their work activities while they where engaged in activities with others. Participant TAIK9 however also reported having more ideas when engaged in activities with others, thus we can assume that he was often engaged in activities with others. As TAIK9 is a director (Art Director), such an assumption is quite sensible since he would often be required to provide directions and resolve team-related issues and it was proved to be so by his phone's Bluetooth scans. Another valuable observation is that participants TAIK3 and TAIK11, who reported having the highest number of barriers, also reported having the highest number of ideas which is due to their overall excellent compliance rate (see TAIK3's compliance rate in his

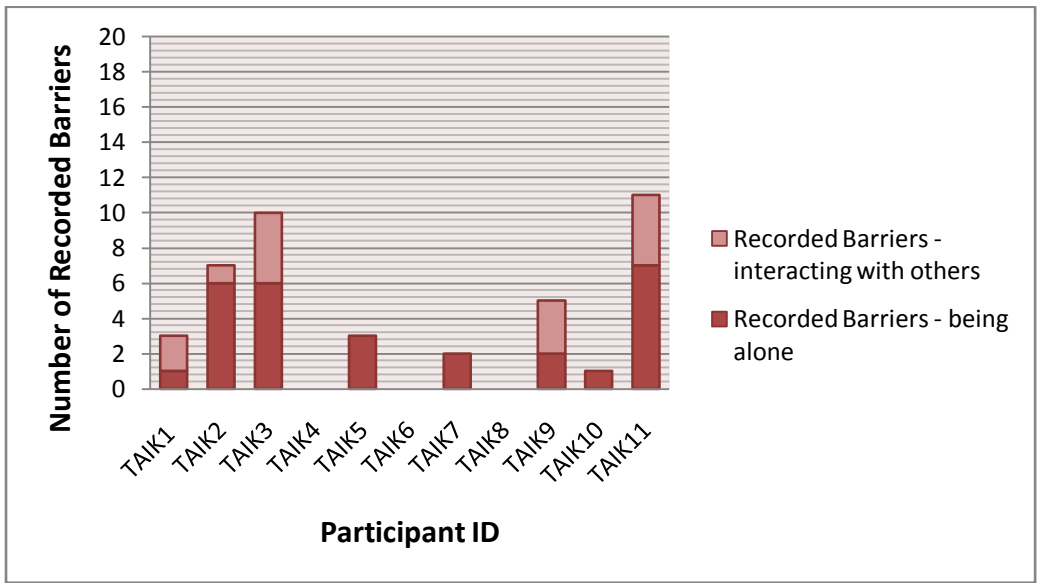


Figure 12 – Recorded barriers and social context

personal report). A noteworthy fact is that in most cases where participants reported facing a barrier while being engaged in activities with others, they were with colleagues outside their team, as shown in Figure 13. In the remaining cases they were with team members, while only two participants reported barriers while working with their boss. In general, fewer barriers than ideas were recorded during the course of the study while participants TAIK4, TAIK6 and TAIK8 recorded no barriers. A final significant finding was that quite often participants reported being productive when they recorded facing a barrier.

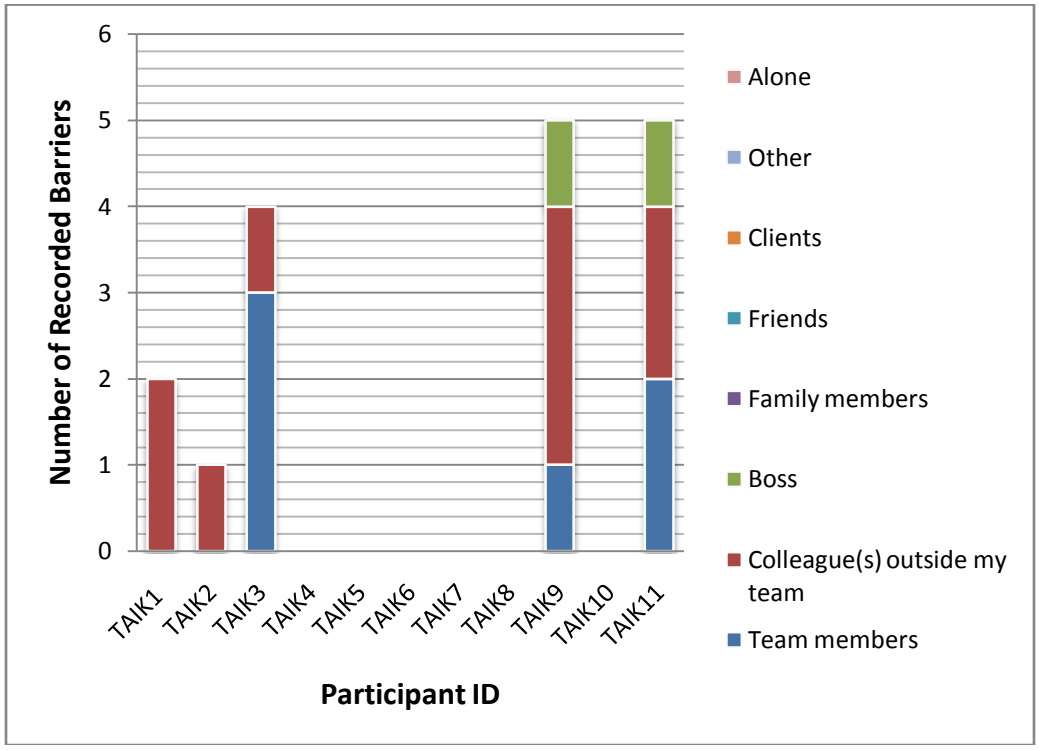


Figure 13 – Recorded barriers while engaged in activities with others

By examining the time when subjects reported facing barriers we saw that the vast majority of barriers were reported to arise in the morning hours (see Figure 14). There were no recordings of barriers after 5pm. Moreover, as in the case of the recorded ideas, no barriers were reported over the weekend. This fact should be taken into consideration in future studies as it would be preferable to give participants study phones to use as their primary phones in order to capture more work related activities while out of the office and during the weekend.

Our analysis of the locations where participants reported facing work–related problems shows that once more, these occurred within Taivas. Only participants TAIK2 and TAIK3 reported facing problems in locations other than Taivas (at home, in transit and in a cafe) as shown in Figure 15. Unlike the recordings of ideas, no subject had a significant percentage of recorded barriers occurring outside the office space. A detailed analysis of the barriers reported in the spaces within Taivas is included in the participants' reports that are to follow.

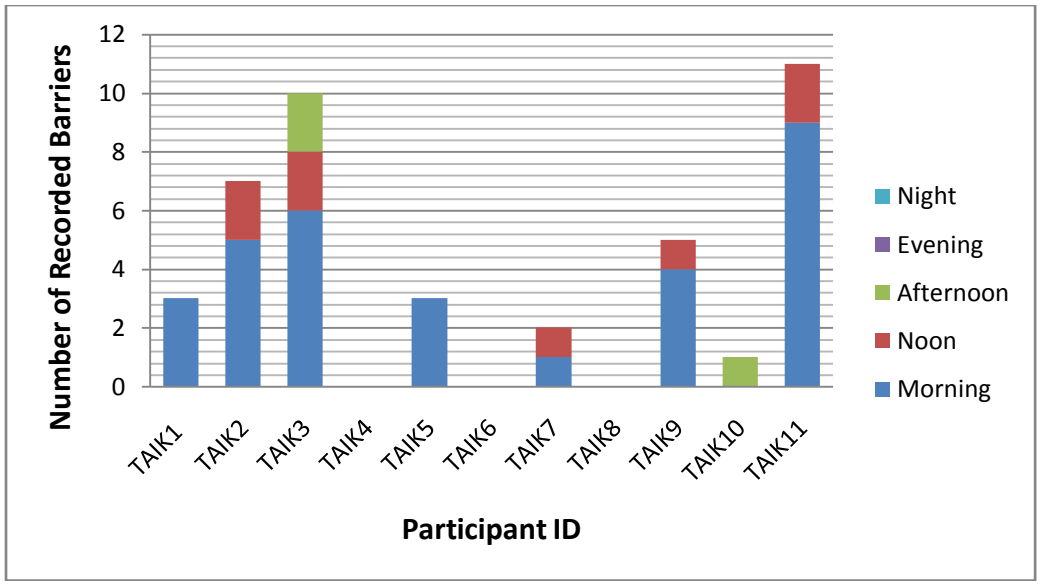


Figure 14 – Time of the day when barriers were recorded

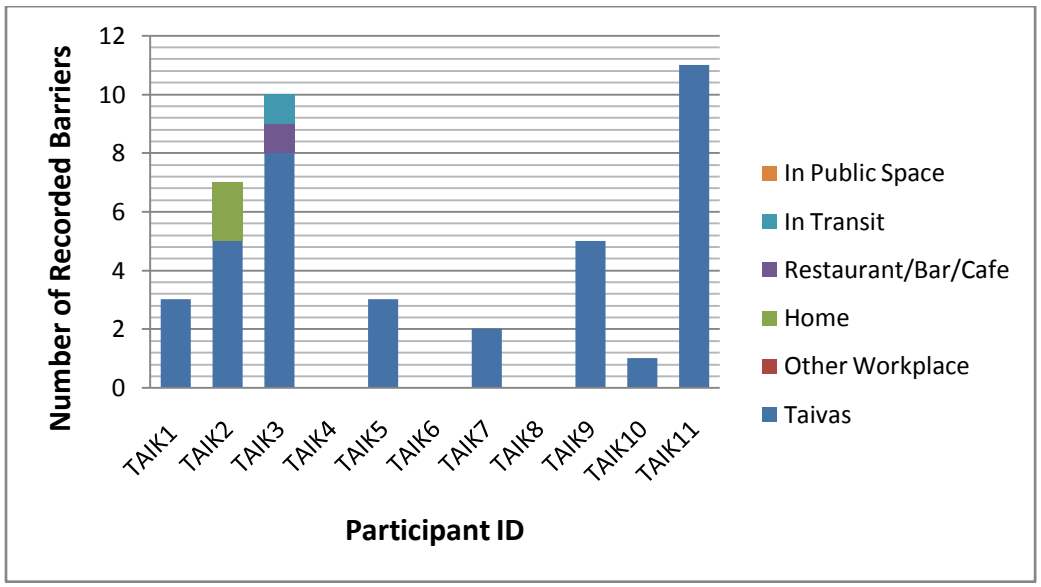


Figure 15 – Locations where barriers were recorded

At this point we should briefly refer to the types of barriers that participants reported facing during the four week case study. However, before we do that, it will be useful to review how often participants were able to describe the problems they faced in detail. By deciding to continue to the second part of the survey after pressing the barrier button, participants would often be directed to describe their barriers in more detail. Again, the chance of this happening was 50%, due to the aforementioned randomization that was inserted in the survey's structure. As we can see in Figure 16, participants were more often directed to the spatial and social interaction survey branches than when they tried to explain ideas in detail. This is certainly due to the less number of recorded barriers (than ideas), as randomization works out evenly (i.e. within the planned percentages) only after a significant amount of prompts. Even though the

recorded number of barriers for which subjects chose to provide us with more contextual information about is almost equal to that of ideas (twenty two and twenty respectively), subjects were more often able to describe the problems they faced. This is due to the structure of the survey[3], as subjects had to choose the type of the barrier out of a predefined multiple choice list. Unfortunately, such a list of predefined ideas is impossible to compile, that is why we had to use an open-ended question for their description.

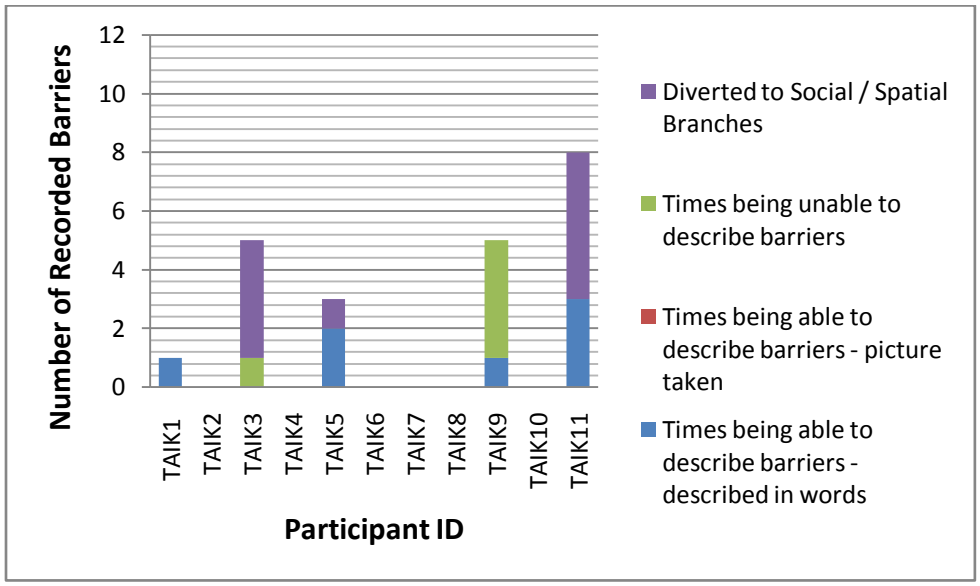


Figure 16 – Recorded barriers that participants tried to explain in detail

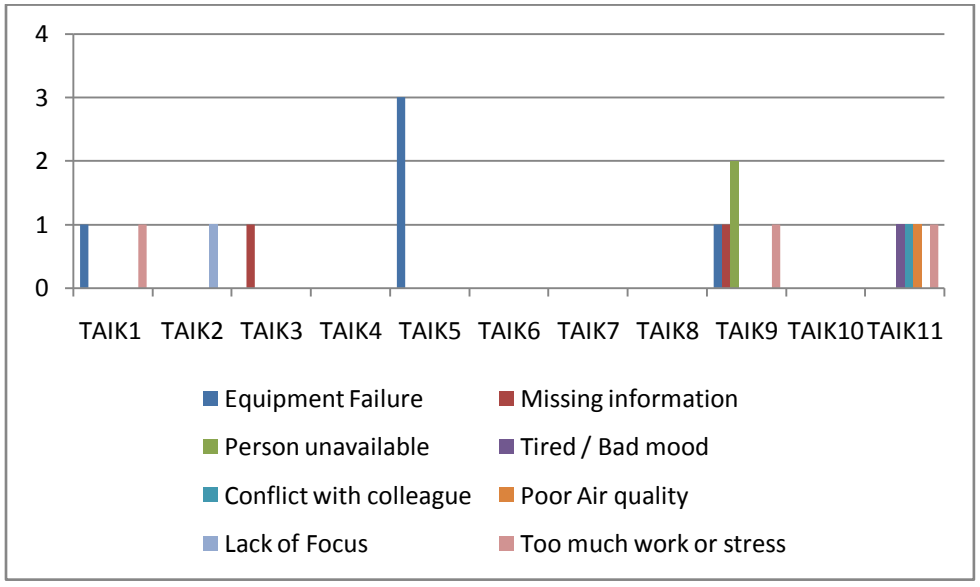


Figure 17 – Types of recorded barriers per participant

[3] Please see Appendix E: Mobile Phone Survey

As mentioned above, we will briefly refer to the reported types of barriers. Figure 17 shows what kind of problems each individual faced during the course of the study. Unfortunately, we were not able to retrieve any useful information about the problems that participants TAIK7 and TAIK9 have reported; still we were able to draw some conclusions. Subjects reported explicitly most of their problems by selecting them from the predefined barrier list. However, in the cases of "Conflict with colleague", "Lack of focus" and "Poor Air quality" which were not included in our list, (as such a list can never be all-inclusive), the nature of the barrier was defined implicitly via other answers the participants provided us with. As we can see, equipment failure and missing information were the most often reported problems. The only problem that was related to ambient spatial characteristics was that of poor air quality, reported by participant TAIK11 while working at her desk space on the second floor.

It would be useful now to juxtapose the types of barriers to profession. Such juxtaposition could reveal not only the kinds of activities that participants were often engaged with, but also provides us with insight about potential areas of improvement. As we can see from Figure 18 below, designers reported equipment failures and missing information, a fact that should be taken into consideration by Taivas management as an upgrade of work-related equipment and information services might be required. Reported conflicts with colleagues should also be considered by managers, as a restructuring of the teams might be needed. With regard to spatial characteristics, the issue of poor air quality should be tackled, especially if shown to be persistent.

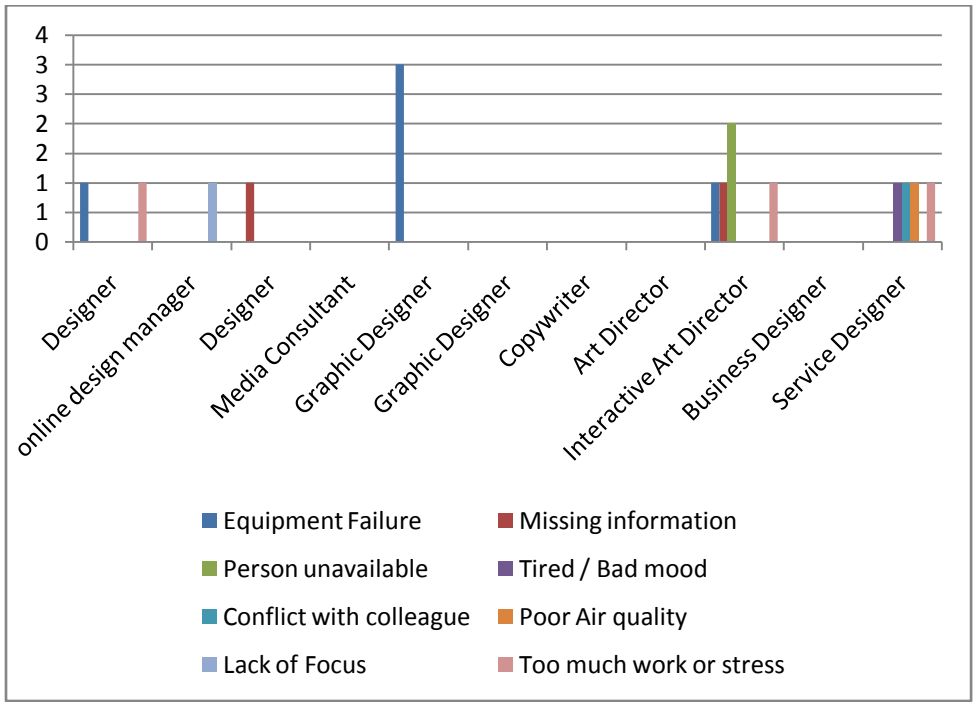


Figure 18 – Types of recorded barriers per participants' occupation type

So far we have examined ideas and barriers separately. In the following diagrams we jointly demonstrate the recordings of ideas and barriers with regard to location, time and social context. The conclusions that can be drawn by reviewing these diagrams have already been

mentioned; this juxtaposition is for illustrating our findings in a more clear way. Figure 19 shows the number or recorded ideas and barriers per participant. As we can see, the emergence of ideas and barriers across subjects follows no evident pattern as the ratio of ideas to barriers per participant is extremely variable. When we look at the aggregate number of ideas and barriers per location though, we see that most incidents were recorded within Taivas, while only a few were recorded at home, in other workplaces, in transit and in third places (see Figure 20). We have already mentioned that if participants were using the study phones as their primary mobile phones, we would probably see a more even distribution of recorded incidents across spaces. We should also keep this information in mind when reviewing the aggregate number of recorded ideas and barriers per social context, shown in Figure 21. Again, the office

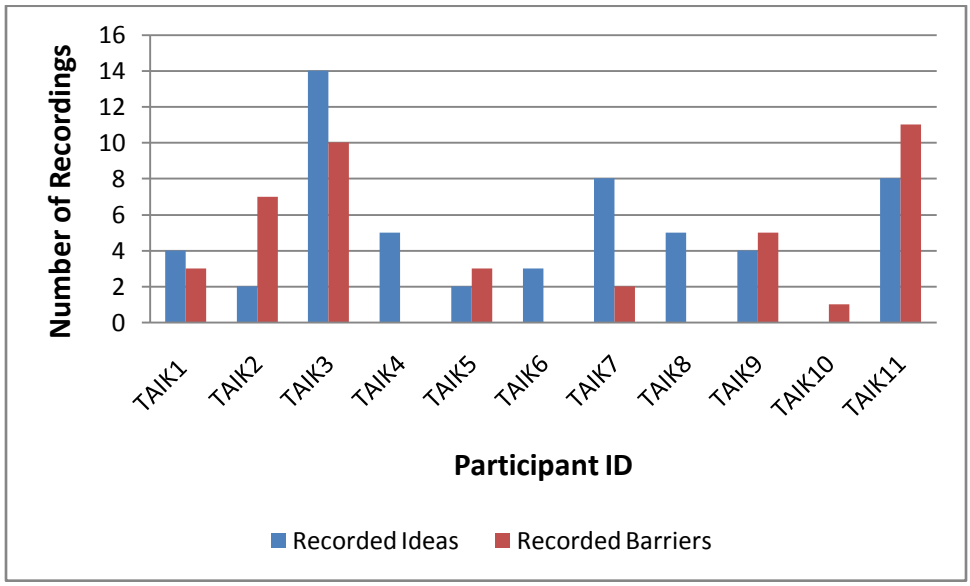


Figure 19 – Recorded ideas and barriers per participant

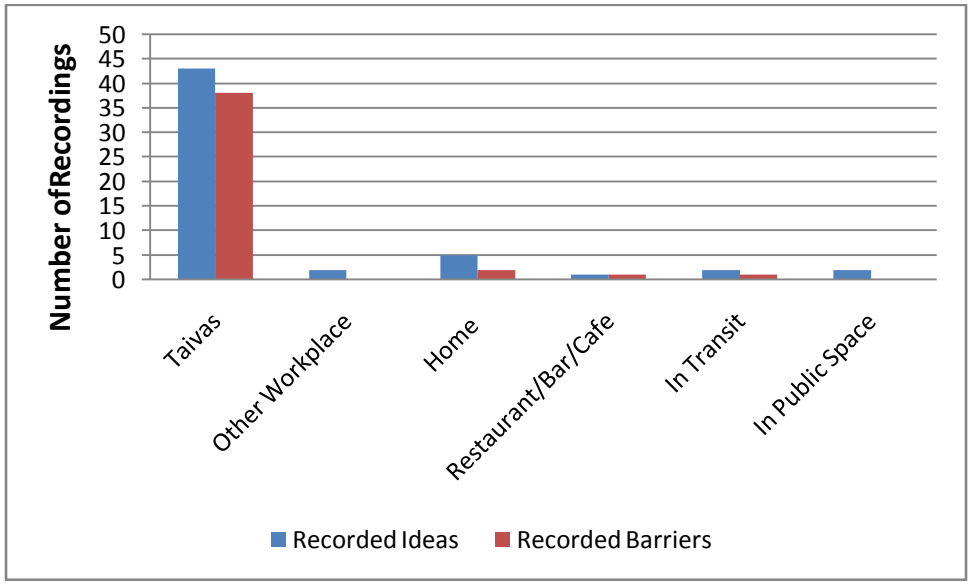


Figure 20 – Aggregate number of recorded ideas and barriers per location

environment is dominant, as we see that most ideas where recorded when participants were working with team members and most barriers when participants were working with colleagues who did not belong in their team (we have excluded that fact that the vast majority of ideas and barriers were recorded while subjects were working alone for comparative reasons). In Figure 22 another aforementioned pattern is revealed; recordings of ideas and barriers were at their peak in the morning (6am to 12pm), diminishing towards the evening. However, as the way we had divided the workday into time zones was too coarse, we decided to divide it at two hour intervals (starting at 4am and ending at 6pm). The results are visualized in Figure 23. The diagram clearly shows that the number of recorded ideas was higher from 6am to 8 am and from 12pm to 2pm, whereas the maximum number of barriers was recorded

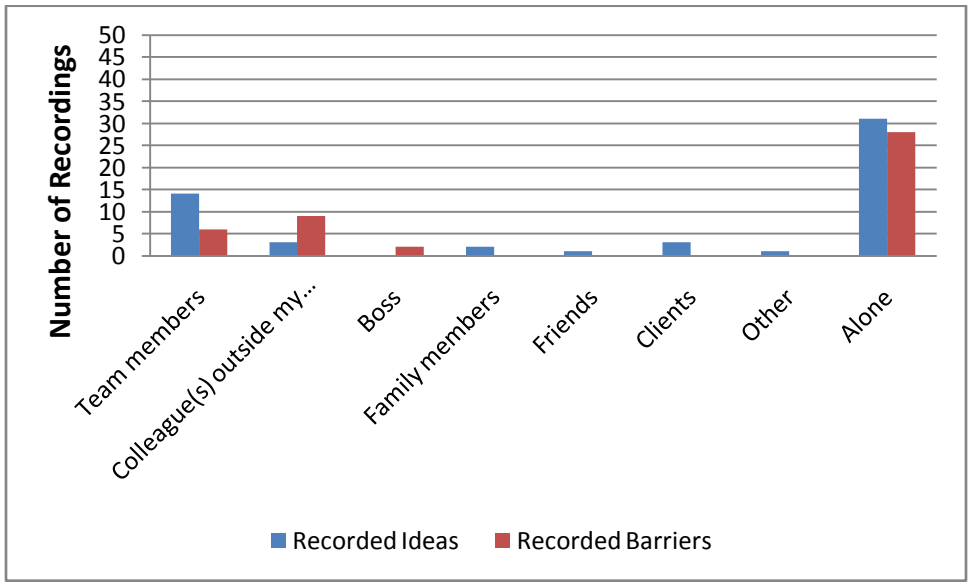


Figure 21 – Aggregate number of recorded ideas and barriers per social context

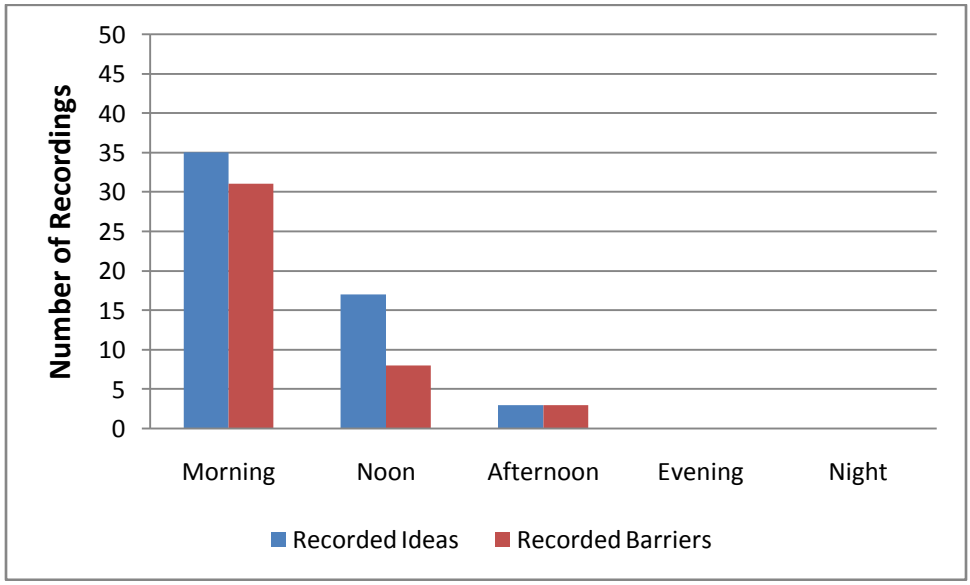


Figure 22 – Aggregate number of recorded ideas and barriers per time of day

between 8am and 10 am. By fitting polynomial curves of sixth degree to our data points we smoothed out the results, as shown in Figure 24. Of course, if we used polynomials of different degree (e.g. fifth or fourth) we would get slightly different fits, but since we are not interested in making predictions about the occurrence of ideas and barriers later on during the day (we should use a method other than polynomial fitting for such a task), the choice of polynomial degree is not that important.

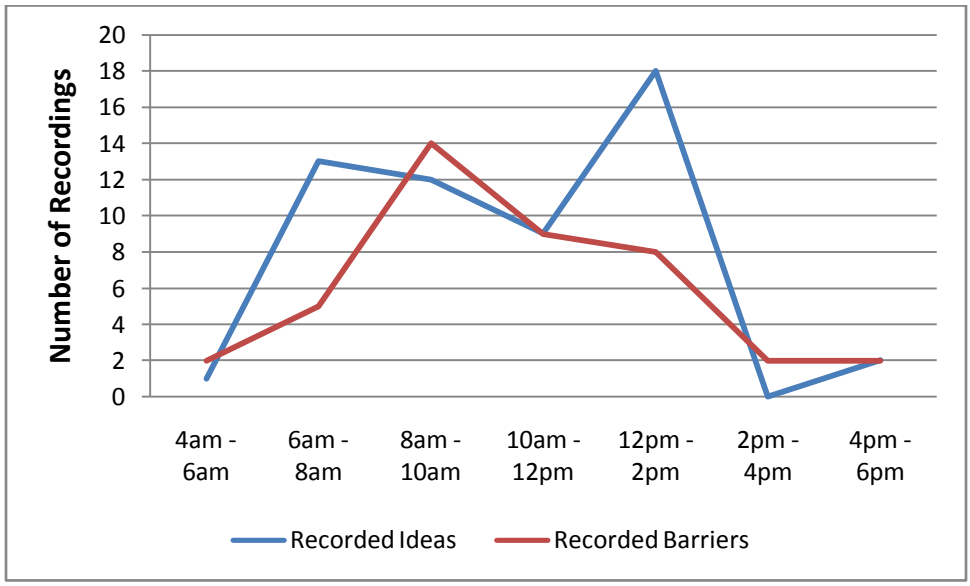


Figure 23 – Time of day when ideas and barriers were recorded

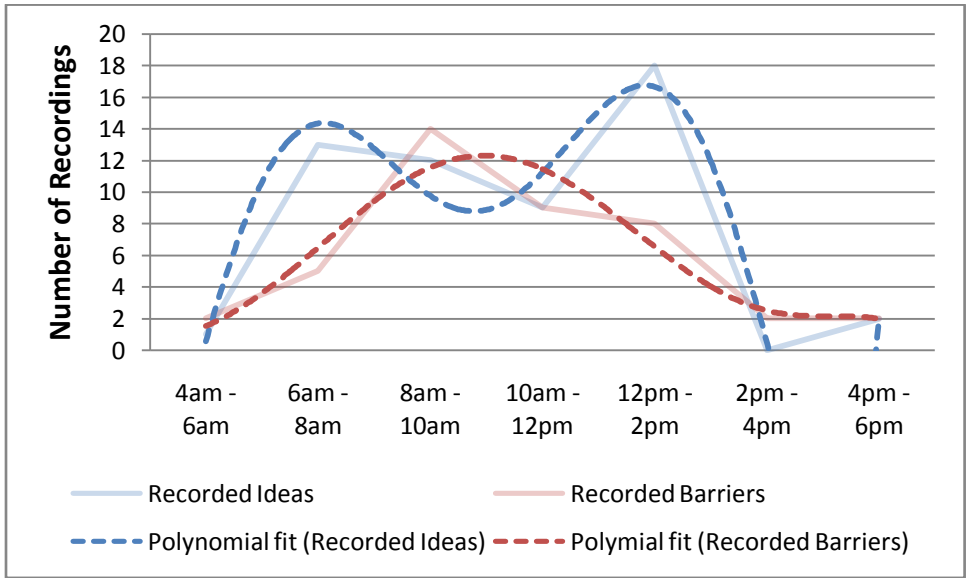


Figure 24 – Polynomial interpolation of the time of day when ideas and barriers were recorded

Before we conclude our analysis it is necessary to go over the reasons for which participants chose to be or work within specific spaces. Table 1 (next page) shows why participants changed locations within Taivas. A review of the table shows us explicitly participants' personal needs

with regard to work tools, social context and spatial characteristics and at the same time, in an implicit way, the diversity of tasks that each participant had to go through during the study. For example, subject TAIK3, who reported the highest number of ideas, the second highest number of barriers, the highest number of unique recorded activities and the highest number of social interactions at the occurrence of ideas and barriers, also reported the highest amount of work – related needs that resulted in a high number of transitions within the office space (discussed later). Of course, we have already mentioned that participant TAIK3 is a record holder due to his ideal compliance rate throughout the study, a fact that should be included as a factor in statistical inference. In order to learn more about participant's reasons for spatial transitions however, we should examine the transition patterns of each individual. For reasons of economy we will only do that in the qualitative reports for participants TAIK1, TAIK2 and TAIK3.

Participant ID / Spatial choice	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
It was my normal workspace	x		x	x	x	x	x	x	x		x
It was near/available								x			
Needed bigger space					x	x			x		x
Needed presentation/ work tools			x			x					
Needed access to info			x						x		
Needed more privacy			x		x	x			x		x
Needed to be around others			x								
Needed a change/stimuli	x		x								
Other			x								

Table 1 – Reasons for spatial transitions per participant

Summary

As we have seen, most ideas were recorded during the morning while participants were working alone in Taivas. Designers reported having the highest number of ideas as a group. Whenever participants reported ideas while engaged in activities with others they were most often with team members. In almost every recording of their coming up with an idea, participants were unable to describe it in words. As far as barriers are concerned, again their majority was recorded during morning hours while participants were working alone in Taivas. In most cases where the participants reported facing a barrier while being engaged in activities with others, they were with colleagues outside their team. A noteworthy observation was that subjects were able to describe barriers more often than ideas, due to the structure of the questions. Equipment failure and missing information were the most often recorded barriers. Another significant finding was that participants often reported being productive when they were facing barriers. Generally, less barriers than ideas were reported. No comparisons were made with regard to gender or age since the number of male participants was higher than that of female (seven and four respectively) and since nine out of eleven subjects belonged in the same age group (between thirty and forty years old).

Reports for Participants TAIK1, TAIK2 and TAIK3

Participant TAIK1

Participant "TAIK1" is a thirty four year old designer, holds a University Arts degree and has been working for Taivas for two years. "TAIK1" is not a member of a specific team, however he occasionally works with participants "TAIK2" and "TAIK3". During the four day period that he participated in the study, (he had to leave Taivas due to family matters after this period) he recorded four ideas, three barriers and answered ten Bluetooth-triggered surveys out of the total eighty eight prompts he received, thus providing us with seventeen complete surveys. Figure 25 below shows his daily compliance rate during week 1.

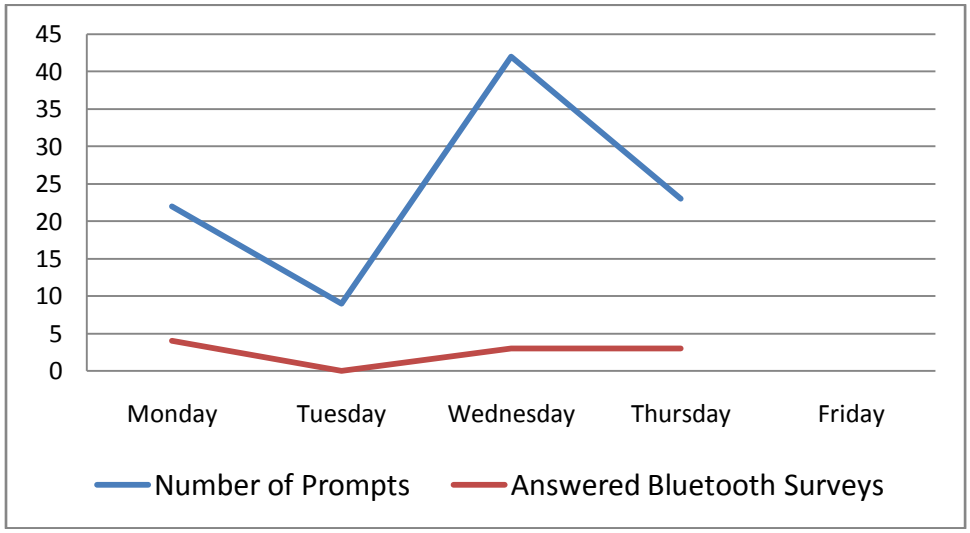


Figure 25 – Daily response rate for week 1

The first idea was reported by participant "TAIK1" on the second day of the study at 10:50 am, while having coffee alone in a small lounge area located near his desk, (RoomID 13 - see Image 13 Case Study Chapter) and his recorded activity was "thinking". His second idea was recorded on the third day of the study at 1:08 pm, while he was listening to a soundtrack at his desk space with one of his team members and his recorded activity was "listening to top gun soundtrack". His phone's Bluetooth scans show that participant "TAIK3" was within range and since they occasionally work together, we can assume that "TAIK1" was with "TAIK3" at the time. When we reviewed participant's "TAIK3" dataset we found that "TAIK3" reported the same activity at the same time and at the presence of "TAIK1", thus turning our assumption into a fact. His third and fourth ideas were recorded on the fourth day of the study at 8:36 am and 9:02 am respectively. His first idea for the day was recorded while he was searching the web at the presence of two of his colleagues who did not belong in his team in the desk space next to his (RoomID 14) and his recorded activity was "web search". Indeed, the Bluetooth scans of his mobile phone showed that participants "TAIK2" and "TAIK3" were not within range at that specific time. The participant chose to provide us with more information about his idea at this point. He stated that this idea was "small", not related to a client brief (and thus not part

of a work-related problem solving process), that he had just got the idea and that other people where “somewhat important” in helping him coming up with it. However, he stated that he was unable to capture the situation that led to this idea. His second idea for the day was recorded almost half an hour later, while he was drawing alone at his desk space and his recorded activity was “drawing”. Once again, the participant chose to provide us with more information about the generation of his idea. He stated that his idea was “big”, not related to a client brief (and thus not goal-driven), that he had he hasn’t been working on this idea for a long time and that other people where somewhat important in helping him coming up with it. However, he was still unable to capture the situation that led to this idea, neither in words nor by taking a picture.

The similarities in the participant’s answers for the third and fourth idea, as well as the short period of time that intervened between their recordings, suggest that there is a good probability that the participant was referring to the same idea, an idea that started as “small” and half an hour later developed to “big”. As his initial activity was web searching in the presence of others, we can assume that during this time an accumulation of information and possibly an informal brainstorming occurred, followed by a short incubation period. The second activity of “drawing”, during which the participant was potentially re-working his original small idea, could be part of a reflective thinking process, an act of re-evaluation that possibly led him to the development of his “big” idea. For this reason, we feel that the addition of a question in the survey’s “Idea branch”, along the lines of “was this idea related to your last recorded idea?”, or “Was this idea: a) development of an existing idea b) brand new idea”, would be quite useful to assess connectivity and propagation of ideas.

As was aforementioned, participant “TAIK1” recorded three barriers over a four day period. His first barrier was recorded on the first day of the study at 8:42 am, while being at his desk space, (RoomID 16) at the presence of two of his colleagues who did not belong in his team and his recorded activities were “trying to think” and “listening to advices”. The Bluetooth scans of his mobile phone showed that participants “TAIK2” and “TAIK3” were within range at that specific time, although we can not deduct that those were the colleagues the participant referred to. His activity of “listening to advices” in the presence of two colleagues, was also recorded by a Bluetooth survey that was triggered by a micro–transition across desks thirty minutes later.

The second barrier was recorded on the third day of the study at 7:14 am, while he was alone at his desk space and his recorded activities were “trying to find info” and “looking for an environment change”. The participant chose to provide us with more information about his barrier at this point. He stated that this barrier was related to “equipment failure”, that he was “somewhat” frustrated and when asked to capture the situation he wrote “what to do when you would need to have calm to do some research and you don't have proper equipment to work!”. In a Bluetooth survey that was triggered by his transition into an unknown space (meaning the participant was out of the beacons’ range) and then back to his desk space ten minutes later (7:24), the participant, when asked about his activities, stated “trying to work but no proper equipment!”. We can deduct from the facts above that indeed the participant changed location as he was “looking for an environment change”, possibly seeking to find information, however his search was not fruitful as he kept complaining about missing or failing equipment. Since the participant has been working in Taivas for around two years, we would

assume he would be well aware of the tools offered to him as well as their potential failures and thus we could claim that he would be able to bypass equipment failures and come up with solutions quickly; yet incidents such as the above challenge this claim.

The participant's third barrier was recorded on the fourth day of the study at 9:25 am at the presence of two of his colleagues who did not belong to his team, while being in a desk space next to his (RoomID 15) and his recorded activity was "too much hassle". In the Bluetooth-triggered survey that followed his transition back to his desk, six minutes after he recorded his barrier, the participant stated that he was alone and stressed. Even though the participant chose not to provide us with more information about this barrier, we can assume that whatever the reason that prevented him from carrying out his activities was, it had a lasting effect.

Following an analysis of the participant's transitions as recorded by his phone's Bluetooth scans, we saw that the participant spent most of his time in his desk space and in desk spaces nearby, yielding a high micro-mobility (desk-to-desk) to macro-mobility (floor-to-floor /space-to-space) ratio. There were no recordings of him in the second floor meeting rooms, or any visits to the third floor cafeteria and only in two occasions he was located at the lounge area nearby his desk. All of his ideas and barriers were recorded while he was at the office and according to his phone's Bluetooth scans we can safely assume that he never had the phone on while out of the office. This prevents us from drawing any conclusions with regard to his work-related activities while outside Taivas. In two occasions, his ideas occurred at the presence of others (one team member and two not-team members respectively), whereas in the other two he was alone. Most of his ideas were recorded during early morning hours while at his desk space or in spaces close by. Two out of his three recorded barriers occurred at the presence of others (not-team members), one while he was alone and all of them were recorded during early morning hours. His meetings with others involved team members (three times), his boss (once) and colleagues outside his team (four times). Only one of his meetings with a team member was "accidental" however it was recorded to be "essential" for carrying out his activities.

Overall, "TAIK1" recorded thirteen unique (translated) activities over his participation period (see sample in Figure 26). He often reported thinking or trying to think, as well as talking, listening and drawing. It is interesting that in two occasions, when asked about his activities he stated "too much hassle" and "stress", implicitly recording his feelings instead of his activities.

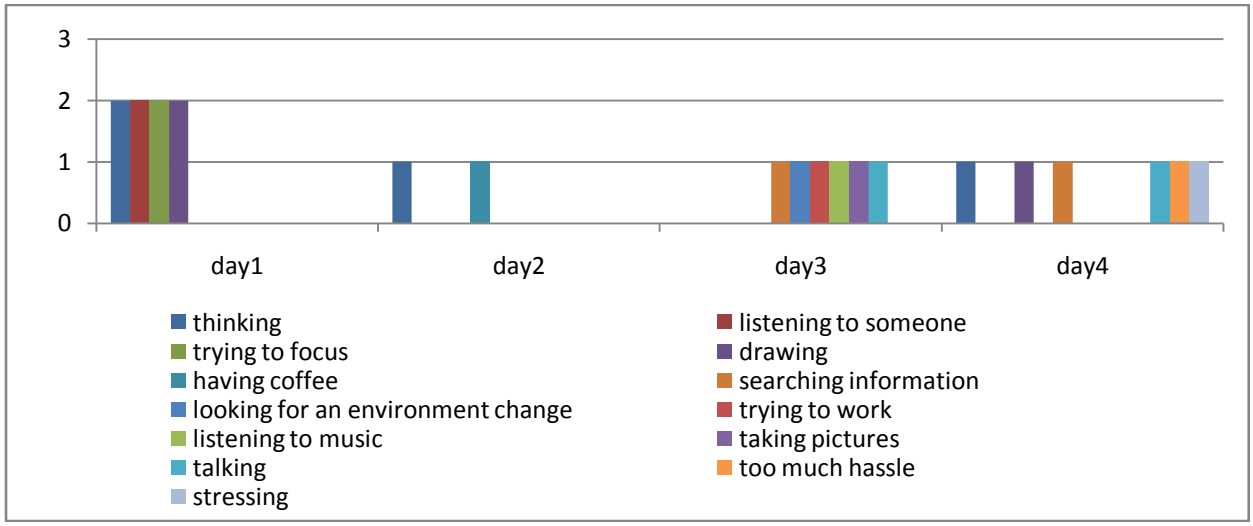


Figure 26 – Daily activities distribution for participant TAIK1 during week 1

Let us now juxtapose our findings to the data that participant "TAIK1" provided us with in the Pre-study Questionnaire (see Appendix A). In the question "Where do you prefer to work when you are trying to come up with ideas?" the participant answered "Taivas", which completely agrees with our findings. In the question "At Taivas, are there places that you prefer to use for creative thinking", the participant answered that he had "no specific preference as long as there is a sofa where you can sit and exchange ideas with people". His answer slightly agrees with our data since in three occasions out of four, he was either at his desk space or in desks near by and only once at the small lounge area near his desk, where he stated that he was "having coffee"(RoomID 13). His recorded activities of "drawing", "listening to top gun soundtrack" and "web-searching", during which he recorded having an idea, were most likely conducted at his desk space, since our direct observations showed that Taivas employees mostly use their desks and desktops for these types of activities and they use the lounge area (RoomID 11) either for relaxing, or for brief meetings. Still, all of his ideas were recorded in the area covered by rooms 13, 14, 15 and 16, showing that the subject has a preference towards this area.

In the question "When during the day do you think you usually get the best ideas?" the participant answered "Afternoon". This completely opposes our data, since all of his ideas where recorded before or around lunchtime (at 10:50 am, 1:08 pm, 8:36 am, and 9:02 am). Of course, had "TAIK1" participated in the study for the entire four week period, we might have detected a different pattern than the current one. In the following question, "When during the week do you think you usually get the best ideas?", the participant answered "The weekend". As we have no weekend data for the specific participant, we can not assess his claim. For the following question, "Do you think you have (more or) better ideas while working with others or alone?", "TAIK1" answered "With others". Our data mostly agree with this claim since in two out of four idea recordings the subject was in the presence of others and as we can assume that his fourth idea (where he recorded being alone) was the development of his third idea (where he recorded being with others) then in three out of four cases his ideas occurred while at the presence of others. In the next question, "With whom you usually work when trying to come up with ideas? (Pick all that apply.)", the participant chose all options. Indeed our data show that some of his ideas occurred in the presence of team members and colleagues outside his team.

In the following section the participant provided answers with regard to his choices. More specifically, in the question "If you prefer to work alone, what is the most important reason for this?", the participant replied "For a change". The subject explicitly stated once that he was looking for an environment change, but never for a change in his social context. As the subject never chose to answer any spatial-related questions, we can not assess his claim. In the next question "If you prefer to work with others, what is the most important reason for this?", the participant answered "To have the expertise of others available if needed". Indeed, we recorded two occasions (in the reporting of a barrier and a subsequent Bluetooth-triggered survey) where the participant stated that he was "listening to advice" and another two occasions where he was "talking". The participant recorded being in the presence of others eight times, six out of which we can safely assume that he was working with them. Out of those six, in four occasions he was either talking or listening, meaning that indeed he often discussed about his work and was seeking advice from his co-workers.

When “TAIK1” was asked “Are there some activities that you think are especially good for you to create ideas? Could you name a few?”, he answered “no special activity, just need to feel no pressure”. Even though we were not able to detect a pattern revealing a specific type of activity during which ideas occurred, his activities of “drawing”, “listening to top gun soundtrack”, “having coffee” and “thinking”, suggest that the participant was most probably in a relaxed state, even though he chose not to explicitly record his stress levels for these occasions. In the following question the subject was asked “Can you say what usually hinders you to get ideas? (Pick 3 most important ones.)”. His answers were “Missing information”, “Too much work or stress” and “Too little time to complete the task”. His answers totally agree with our data, as the barriers he recorded were related to “trying to find info”, an “equipment failure” that possibly prevented him from obtaining the information he was after and “too much hassle” followed by “stress”. In the following question “TAIK1” was asked “What do you think would contribute more to your having more or better ideas? (Rank them, 1 = most important)” the participant answered in ranked order “Better access to information”, “More time per project”, “More interaction with others”, “Different workspace configuration” and “Better equipment”. We can assume from the collected data that the participant indeed values access to information the most, as his barriers were related to missing information, or to equipment failure that prevented him from obtaining information. His recording of “too much hassle” as a barrier also certifies that he also values more time per project a lot.

The next set of questions covers participants’ preferences with regard to work-space. When asked “What is the most important spatial quality for you?”, “TAIK1” answered “Comfortable furniture”. Even though the participant chose not to provide us with spatial-related information, we can juxtapose his answer with his statement about idea-generation spaces, where he stated that he has “no specific preference as long as there is a sofa where you can sit and exchange ideas with people”, along with the fact that one of his ideas was recorded while sitting in the small lounge area close to his desk space. In the following question “Why might you choose another place than your work station to work in? (Rank them, 1 = most important)”, his ranked answers were “For privacy”, “For certain equipment”, “For a change”, “For company” and “For a larger working area”. Our data partially agree with his claims, since the participant’s micro mobility pattern reveals that he did not visit any of the more private work spaces during the study, however he spent a lot of time in his desk-space and in two occasions his transitions were due to his seeking equipment in order to obtain information. In the next part, the participant was asked “What kind of shared system do you use the most?”. His answer in this case was “Work table”. This agrees with our data since in the recorded occasions where he was not using his desktop pc (as when he was web-searching for example), his activity was “drawing”. There was no data of him using a projector, or a wall space or white board. In the following question, the subject was asked “What are the attributes of personal work space you would like to have? (Rank them, 1 = most important)”. His answers were “Privacy”, “Lots of room”, “Quiet”, “Everything at hand” and “People around”. Once again, judging by the participant’s answers we deduct that he values privacy the most and since he spent quite a bit of time at his desk space (three out of four of his ideas where recorded while at his desk space or desks near by), we assume that his personal work space satisfies his demands; this could be the reason why he did not visit any of the more private work spaces.

In the following question the participant was asked “What kind of shared space would you like to have? (Rank them, 1 = most important) and his reply was “Room for projects”, “Privacy for meetings” and “Equipment always at hand”. Since we have no spatial-related data with regard to use of shared spaces in the presence of others, we can not assess his claim. Moving on, the participant was asked “For what activities do you need a particular kind of space? (Rank them, 1 = most important)” and his ranked answers were “Brainstorming”, “Sketching”, “Relaxation”, “Socializing” and “Presenting”. Our data somewhat agree with the participant’s answers. As we aforementioned, the participant was in the presence of others eight times (out of the total seventeen surveys he completed) and we can safely assume that in six occasions he was working with them. In four out of those six occasions, he was either talking or listening to someone else talking (giving him advice). Additionally, he recorded one of his ideas while listening to music with one of his team members (TAIK3), so there is a good probability that an informal conversation / brainstorming took place at that time between the two participants. Thus, we have recorded five possible conversations occurring mostly at his desk space (RoomID 16) or in a desk space near by (RoomID 14). This implies that “TAIK1” indeed prefers to have work-related conversations and possibly brain-storming sessions in a relatively confined area. However, we would expect this area to be the small lounge close to his desk (RoomID 13), as the participant stated earlier that he would prefer a space where “…there is a sofa where you can sit and exchange ideas with people”. Still, there were no recordings of him interacting with others in the lounge area. There was only one occurrence of him being in the lounge alone, having coffee and thinking (where one of his ideas was recorded). We can assume that “TAIK1” uses this lounge as his relaxation space, but we would need more data to confirm. However, the phone survey data as well as our direct observation show that he prefers to sketch at his desk.

The following and last set of questions from the pre-study questionnaire that all participants had to fill in asks questions about the idea generation process, and the effects of routine and deadlines in their work-life. In the statement “Usually I follow a standard methodology to come up with ideas.”, the participant replied “disagree a lot”. It is true that in all four occasions where he recorded having an idea, his social context and activity combinations were unique. The participant reported having ideas while being alone, (two times), with one other person who was a team member (once) and with two or more persons that were not part of his team (once). His recorded activities when the ideas occurred to him where drawing, listening to music, thinking / having coffee and web-searching. Even though the size of his data set is too small to allow us to make assumptions, there is definitely no evident pattern implying a methodology.

The next statement that the subject had to assess was “Usually I get my best ideas when I have scheduled my activities in advance.”. To this statement the participant answered “Agree”. We are aware at this point that the participant does not feel comfortable or creative when under stress or when handling too many tasks at the same time, as was revealed in two of his recordings (of a barrier and a subsequent Bluetooth-triggered survey) and according to his own statement that he needs “to feel no pressure” in order to come up with ideas. Moreover, via the nature of the recorded activities he was involved with when he came up with his ideas, (e.g. having coffee, listening to music etc), we deducted earlier on that his ideas occurred while being in a relaxed state. Still, we have no explicit data with regard to the participant’s

scheduling and how well he manages to keep up with it. For this reason, we feel that the addition of a question in the phone survey that would provide us with feedback about a worker's workload management skills would be beneficial, as it could be correlated with recorded stress levels.

In the next question, the participant had to evaluate the role of routine in his performance. When presented with the statement "I perform better while following a daily office routine", "TAIK1" replied "Disagree a lot". Our data agree with his claim, at least as far as the idea generation process is concerned, since we were not able to detect a pattern within this process. We were only able to detect a pattern with regard to the time and place of the occurrence of ideas (early hours / area covered by rooms 13,14,15 and 16), however, when juxtaposed to the participant's overall mobility (the participant spent all of his time in the aforementioned rooms) as well as the hours when he was using the phone within the office, no routine pattern can safely be established. However, in a future study, we could perhaps learn more about a worker's daily routine by not only examining the time and frequency of occurrence of specific activities through out a day or a week, as we did in this study, but also by getting participants' feedback with regard to the scheduling of their daily activities and their degree of commitment to it. In the last question, "TAIK1" was asked to asses the effect of task deadlines. In the statement, "I perform better when I have some kind of deadline.", the participant's answer was "Agree". As we have no recordings of the participant facing a deadline during the case study period, we are unable to assess his answer.

Data Analysis Summary for participant "TAIK1"

During the four day study period, the participant recorded four ideas (see Figure 28), three barriers and answered ten Bluetooth-triggered surveys out of the total eighty eight prompts he received, thus providing us with seventeen complete surveys. He recorded being with others eight times and six out of those he was most probably working with them. His meetings with others involved team members (three times), his boss (once) and colleagues outside his team (four times). Only one of his meetings with a team member was "accidental" however it was recorded to be "essential" for carrying out his activities.

Thirteen unique (translated) activities were reported. He was often thinking or trying to think or focus, as well as talking, listening and drawing (see Figure 27). It is interesting that in two occasions, when asked about his activities he stated "too much hassle" and "stress", implicitly recording his feelings instead of work-related activities. The participant spent most of his time in his desk space and in desk spaces near by, yielding a high micro-mobility (desk-to-desk) to macro-mobility (floor-to-floor /space-to-space) ratio. There were no recordings of him in the second floor meeting rooms, or any visits to the third floor cafeteria and only in two occasions he was located at the lounge area near by his desk. All of his ideas and barriers were recorded while he was at the office and according to his phone's Bluetooth scans we can safely assume that he never had the phone on while out of the office.

Most of his ideas and barriers were recorded during early morning hours and not during the afternoon as he stated, while being at his desk space or spaces near by. Beyond that, no other pattern became apparent with regard to his work habits. The participant stated that most of his

ideas occur to him during the weekend, yet we have no data to assess this statement. He has more or better ideas while working with others, which somehow agrees with our data, and he relies on the advice and expertise of his co-workers. Access to information, feeling no stress, privacy and comfortable furniture are valuable to him and were confirmed to be so by the phone survey data. He prefers to work at Taivas and has no specific space or methodology, nor specific kinds of activities during which ideas occur to him. He dislikes routine and often changes his location, social context and his work tasks.

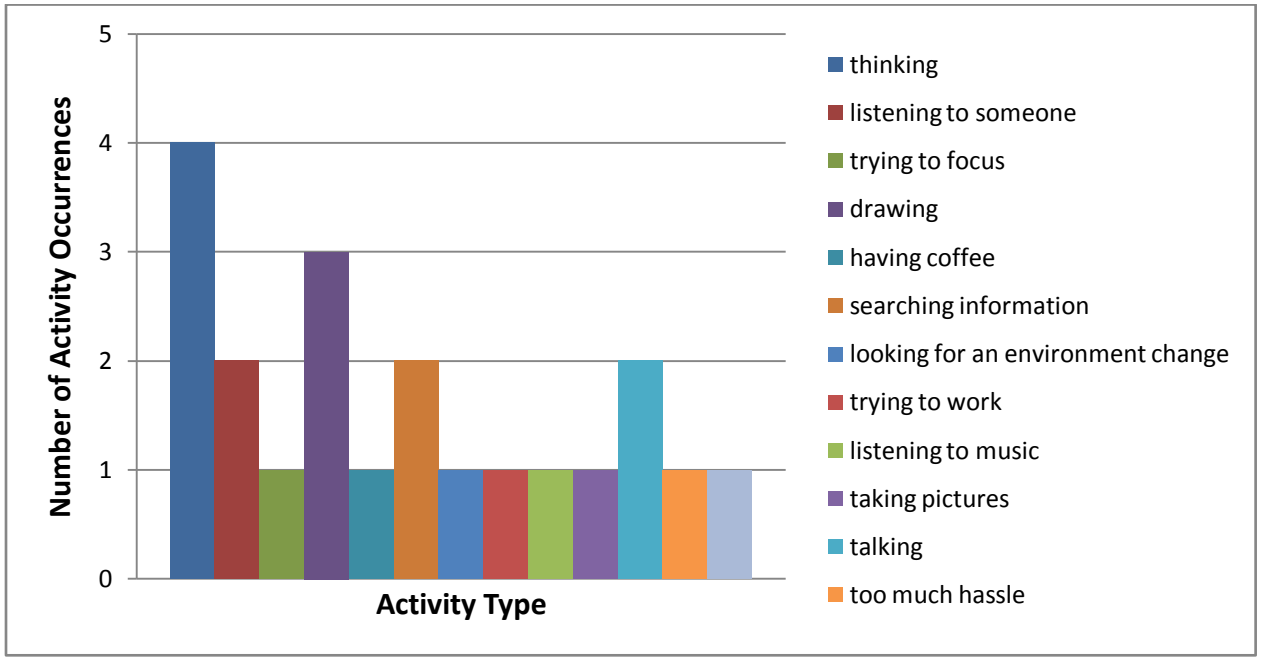


Figure 27 – Aggregate unique recorded activities for participant TAIK1 during week 1

		Personal Desk space		Other Desk space		Meeting room		Printer Room		Lounge		Taivas café		Other workplace		Home		Public Space		Restaurant /Bar/Cafe		In Transit	
Early Morning	alone		1																				
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						
Morning	alone	1								1													
	with team member(s)																						
	with other colleague(s)		1	1	1																		
	with boss																						
	with clients																						
	with friends																						
	with family																						
Noon	alone																						
	with team member(s)	1																					
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						
Afternoon	alone																						
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						

Figure 28 – Location, time and social context of ideas and barriers recorded by participant TAIK1

*Green cells represent ideas while red barriers

*Numbers within cells indicate the number of recordings for the specific combination

Participant TAIK2

Participant "TAIK2" is a forty year old male online design manager, holds vocational qualifications in business administration and information technology and has been working for Taivas for ten years. "TAIK2" works occasionally as a team with "TAIK3", and they both occasionally work with participant "TAIK1". During the case study period he recorded two ideas, seven barriers and answered seventy seven Bluetooth-triggered surveys, thus providing us with eighty six complete surveys. Figure 29 below shows his daily compliance rate during week 1. Even though we have analyzed the entire four-week datasets for participants TAIK2 and TAIK3, we have chosen to illustrate their compliance rate and daily activities distribution only for week 1 in order to be able to compare them to those of participant TAIK1.

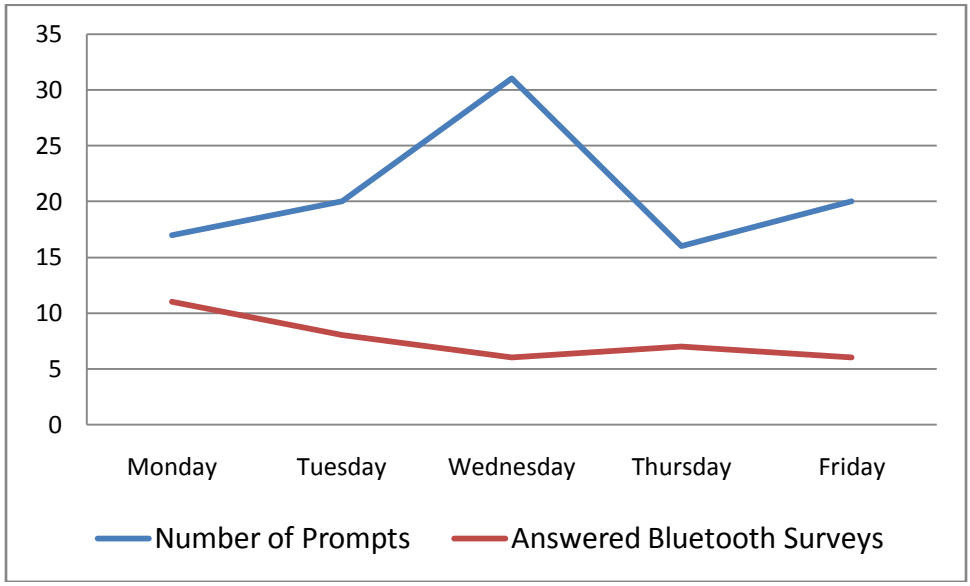


Figure 29 – Daily response rate for week 1

"TAIK2"'s first idea was recorded on the second day of the study at 4:07 am, while working at home with two or more of his family members present and his recorded activity was "planning site designs". Even though the participant chose not to provide us with more information about his idea, it is interesting that he recorded two barriers while working alone at home, thirty minutes before he pressed the idea button (at 3:42 am and 3:48 am respectively), so we can assume that his recording of the idea signifies his coming up with a solution to the problem that made him work so early in the morning. His second and last recorded idea occurred to him on the fourth day of the study at 7:29 am, while he was working alone at his desk space in Taivas (RoomID 16) and his recorded activity was "web optimizing". Once more, the participant did not provide us with any more information about his idea. It is noteworthy the fact that in all of his recordings, the participant never chose to continue to the second part of the phone survey, unlike any other case study participant. The effect of this behavior was that we ended up having a "poor" dataset for the specific participant and we feel that, for future studies, more consideration should be put in the strategic placement of the "continue" option within the phone survey, if such an option should be included at all.

Moving on to the participant's barrier recordings, it is noteworthy that his first two barrier surveys that were recorded on the first day of the study, were not completed. Our assumption is that the participant was trying to familiarize himself with the phone's interface. The third barrier was recorded on the first day of the study at 1:27 pm, while he was designing alone at his desk space and his recorded activity was "ui-designing" (i.e. designing a user-interface). His fourth and fifth barriers were recorded while working alone at home, as we aforementioned and his recorded activities were "configuring firmware" and "reading e-mails" respectively. The sixth barrier was recorded on the second day of the study at 6:56 am while the participant was working alone at his desk space and his activity was "trying to concentrate working". The last recorded barrier occurred fifteen days later (one week before the study was completed) at 12:55 pm while the participant was working with one of his colleagues who did not belong in his team and his recorded activity was "planning". His phone's Bluetooth scans show that participant "TAIK3" was within range at that specific time. However, as we know that "TAIK2" and "TAIK3" work occasionally as a team, we assume that the participant must had been working with a colleague other than "TAIK3", unless he considers "TAIK3" to be not one of his team members, something which we consider highly unlikely.

By analyzing the participant's transitions as recorded by his phone's Bluetooth scans, we saw that the participant spent most of his time in his desk space (RoomID 16) but unlike "TAIK1", he often visited other spaces within Taivas, yielding an average micro to macro mobility ratio. He often spent time in the desk space next to his (RoomID 17) where more table space is provided, both being alone and with his teammate (TAIK3), and he often paid visits to colleagues situated at RoomID 11 which is quite far away from his personal work space. He was often located in the small lounge area near to his desk (RoomID 13) both being alone and with "TAIK3" present, as well as in the meeting room placed above that lounge (RoomID 6), again sometimes being alone and in some other occasions with participant "TAIK3" being within his phone's scan radius. There were no recordings of him in the third floor cafeteria. One of his two reported ideas was recorded while he was at home, at the presence of family members and the other one while he was alone at his office space. Both of his ideas occurred during early morning hours. Out of his seven reported barriers, two were recorded while being at home working alone and the other five while at the office working alone, except for once when he was working with two colleagues. However, we found no pattern with regard to the time of their occurrence. According to his mobile phone's Bluetooth scans we know that he often had the phone on while out of the office. Still, apart from three incidents that were reported to have taken place at his home, we have no other explicit data with regard to his out-of-office work habits. Finally, the collected data show that the participant never used the phone during weekends.

Participant "TAIK2" reported being involved in activities with others only six times in the eighty six surveys he answered. His meetings involved team members (two times), family members (once) and colleagues outside his team (three times). Still, our data analysis shows that he was often attending meetings in one of the first floor meeting rooms (RoomID 6) along with "TAIK3". It is interesting that in two Bluetooth-triggered surveys the participant reported doing tasks alone and his recorded activity was "meeting". His phone's bluetooth scans show that during this time period, no other participants were within detection range. However, the participant recorded one more activity between those two meetings, that of "e-mailing". This fact made us assume that "TAIK2" must have been involved in some kind of virtual meeting

(most probably online), since he was physically alone. Such kind of activities, being alone and in a meeting at the same time, have been reported by other participants too. In order to better track knowledge acquisition and exchange of information in virtual environments, we feel that in future studies a question should be included in the "Social interaction" branch in order to capture these interactions. A sample question could be "Was your interaction with others: 1)physical (face to face) 2)virtual (email, chat etc).

Overall, "TAIK2" recorded fifteen unique (translated) activities over his participation period (see sample in Figure 30). He often recorded that he was emailing, downloading, guide lining, as well as lay outing, designing and planning. It is interesting that by reviewing his activities, we saw that during each work day, the participant would report dealing with specific tasks over long periods of time. Additionally, his daily schedule seems to be more "structured" (repetitive) than that of participant "TAIK1". During the four week period he reported only fifteen unique activities that are "normally" distributed on a weekly basis, whereas participant "TAIK1" reported thirteen unique activities in a period of four days (see Appendix L). Of course, had participant "TAIK1" been part of the study for the entire four week period, perhaps we would be able to detect a similar pattern to that of subject "TAIK2" and possibly an upper limit of unique recorded activities close to the number recorded during the first week (i.e. thirteen).

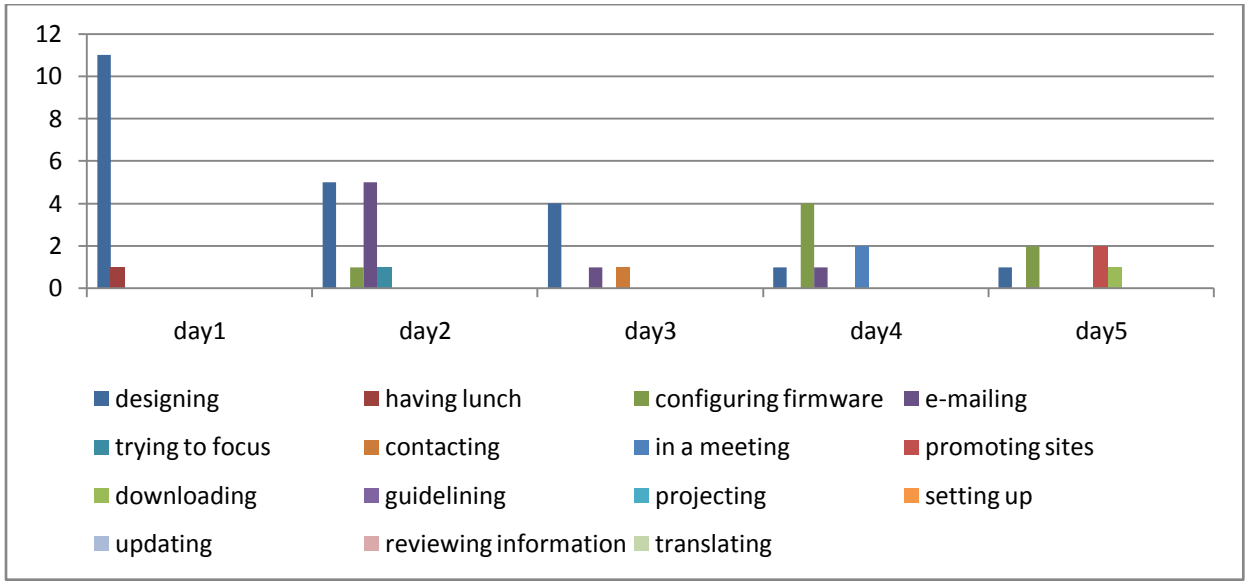


Figure 30 – Daily activities distribution for participant TAIK2 during week 1

We will now briefly juxtapose our findings with some of the answers that participant "TAIK2" gave in the Pre-study Questionnaire (see Appendix A). In the question "Where do you prefer to work when you are trying to come up with ideas?" the participant's first two answers were "In Taivas" and "At home" (the other two were "in public spaces" and in his "summer cottage"). Our data agree with his answers since his recorded ideas occurred to him while in Taivas and at home. When asked "When during the day do you think you usually get the best ideas?", the participant replied "Early morning". Again, his answer is in accordance with our data as his ideas occurred to him at 4:07 am and 6:27 am. However, when "TAIK2" was asked "When during the week do you think you usually get the best ideas?", he replied "At the end of the

week". His statement somewhat agrees with our data since his ideas occurred on a Tuesday and on a Thursday respectively. In the question "Do you think you have (more or) better ideas while working with others or alone?" the participant answered "With others". His answer does not really agree with our data since he was rarely working with others (only in six out of eighty six completed surveys or in 7% of his total recorded activities) and only once an idea occurred to him while he was working with family members. In the next question, "With whom you usually work when trying to come up with ideas? (Pick all that apply.)", the participant chose his "Working partner" and "A friend". As we aforementioned, the participant recorded working with his team member only twice, and his phone's scans show that in many occasions, when he was located in the small lounge area close to his desk and in a meeting room on the first floor, participant "TAIK3" was within range. In none of these occasions were any of the other case study participants present (e.g. "TAIK1"). This fact does not exclude the possibility of other Taivas employees being present, since not every employee participated in the study, and it does not certify that "TAIK2" and "TAIK3" were working together in these occasions (proximity does not necessarily mean interaction). We feel that this analysis could be provided as feedback to participant "TAIK2", in order to reconsider his statement of being more creative when working with others and especially with his team members.

In this section we will try to explain why the participant has recorded working mostly alone. In the question "If you prefer to work alone, what is the most important reason for this?", the participant answered "For quiet". The participant spent a lot of time in his personal workspace and at the desk space next to his (RoomID 16 and 17), in the quiet far corner of the ground floor, were more space and work tables are available. This, along with the facts that he considers distraction as one of the major factors that prevent him from coming up with ideas (along with missing information) and that he would choose a different workplace mainly for reasons of privacy, shows that "TAIK2" often needs to work in a quiet area and quite possibly alone. In the following question "TAIK2" was asked "What do you think would contribute more to your having more or better ideas? (Rank them, 1 = most important)" the participant answered in ranked order "Better access to information", "Different workspace configuration", "More time per project", "More interaction with others" and "Better equipment". From his answers we see that the participant feels that he already has enough social interaction within the office environment and he is not in need of more. However, more social interaction with his team member as well as with other co-workers could lead to more information exchange and thus a higher probability for creative behavior. Still, we can not certainly deduct that "TAIK2" is a "lonely" person, since he might be interacting a lot in ways that our methodology was not able to capture, i.e. with employees that did not participate in the case study (and thus were not recognizable in the participant's phone scans) as well as in virtual environments or even outside the office space.

Before we conclude, we will review the participant's statements with regard to the effects of routine and deadlines in his work-life. In the statement "Usually I get my best ideas when I have scheduled my activities in advance.", the participant replied "disagree a little". Since we have no data with regard to his schedule we can not assess this statement. However, when contrasted to his answer in the statement "I perform better while following a daily office routine", which was "Agree", we see a discrepancy. We already mentioned that the participant's work life activities seem to be more "structured" and evenly distributed than that

of “TAIK1” and this implies that he follows a routine (either imposed by job demands, or personal, or both). However, following a daily or weekly routine demands scheduling. It is our belief that either the participant does not believe that scheduling and creativity are related and thus scheduling has no effect on the ideation process, or that a better performance does not necessarily mean having more or better ideas.

Data Analysis Summary for participant “TAIK2”

During the case study period, the participant recorded two ideas (see Figure 32), seven barriers and answered seventy seven Bluetooth-triggered surveys, thus providing us with eighty six complete surveys. He recorded being involved in activities with others six times (7% of recorded activities). His meetings with others involved team members (two times), colleagues outside his team (three times) and family members (once). It is interesting that in two Bluetooth-triggered surveys the participant reported doing tasks alone and his recorded activity was “meeting”, implying some kind of virtual interaction took place.

Fifteen unique (translated) activities were reported (see Figure 31). “TAIK2” often recorded that he was emailing, downloading, guide lining, as well as lay outing, designing and planning. His work life activities seem to be more “structured” and evenly distributed than that of “TAIK1” and this implies that he follows a routine. The participant spent most of his time in his desk space but he often visited other spaces within Taivas, yielding an average micro to macro mobility ratio. One of his two reported ideas was recorded while he was at home, at the presence of family members and the other one while he was alone at his office space. Both of his ideas occurred during early morning hours. Out of his seven reported barriers, two were recorded while being at home working alone and the other five while at the office working alone, except for once when he was working with two colleagues. However, we found no pattern with regard to the time of their occurrence. According to his phone’s Bluetooth scans we know that he often had the phone on while out of the office, but apart from three incidents that were reported to have taken place at his home, we have no other explicit data with regard to his out-of-office work habits.

The participant stated that he prefers to work at Taivas and at home and that most of his ideas occur to him during early morning hours, which both are in accordance with our data. He also thinks that he gets more ideas towards the end of the week, which somewhat agrees with our findings. The participant believes that he has more and better ideas while working with others, and more specifically when working with team members and friends. However, his recordings show that he was rarely working with team members (only in two out of the eighty six completed surveys or in 2% of his total recorded activities). Still, he thinks that he has enough social interaction already. “TAIK2” values quiet spaces and privacy a lot, which is probably why he chose to spent a lot of time in his desk space and in the quiet spaces near by. Scheduling activities is not something he believes would help him come up with more ideas, yet he states he performs better when following a routine and our data show that he usually does.

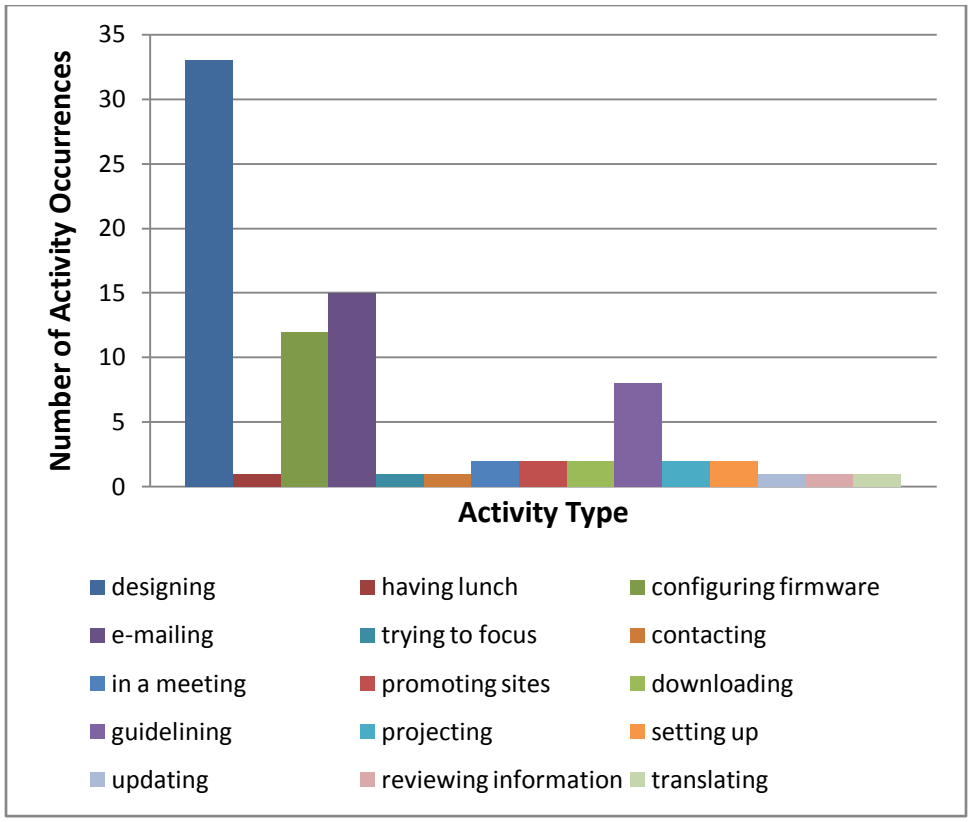


Figure 31 – Aggregate unique recorded activities for participant TAIK2 during week 1

		Personal Desk space		Other Desk space		Meeting room		Printer Room		Lounge		Taivas café		Other workplace		Home		Public Space		Restaurant /Bar/Cafe		In Transit	
Early Morning	alone	1	4														2						
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family															1							
Morning	alone																						
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						
Noon	alone	1																					
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						
Afternoon	alone																						
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						

Figure 32 – Location, time and social context of ideas and barriers recorded by participant TAIK2

*Green cells represent ideas while red barriers

**Numbers within cells indicate the number of recordings for the specific combination

Participant TAIK3

Participant "TAIK3" is a twenty seven year old designer, holds a BA degree and has been working for Taivas for around one and a half years. "TAIK3" works occasionally as a team with "TAIK2", and they both occasionally work with participant "TAIK1". During the case study period he recorded fourteen ideas, ten barriers and answered fifty three Bluetooth-triggered surveys, thus providing us with seventy seven complete surveys. Figure 33 below shows his daily compliance rate during week 1. We have already mentioned that his ratio of answered surveys to received prompts was ideal, as demonstrated by the matching curves below.

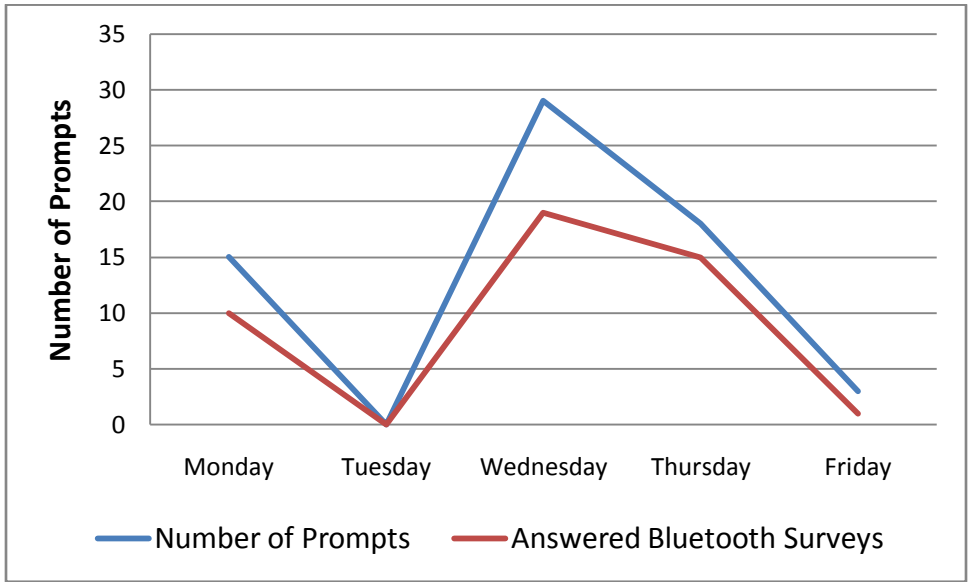


Figure 33 – Daily response rate for week 1

Participant "TAIK3" recorded the highest number of ideas, the second highest number of barriers and the highest number of unique recorded activities. In order to fully present our findings about this subject in the same manner as we did for participants "TAIK1" and "TAIK2",

Time	Location	Social Context	Activity Type
9:31	In transit	Alone	walking through a park while eating ice-cream
12:04	Taivas - Room16	Alone	modeling
12:35	Taivas - Room16	Alone	3D modeling a logo
6:19	Home	Alone	sleeping resting in bed
9:15	Taivas - Room13	2 team members	walking around the office. solving technical problems with team m
11:22	Taivas - Room16	Alone	surfing the internet
13:05	Taivas - Room16	2 team members	listening to top gun soundtrack
16:14	In transit	Alone	walking
16:27	Restaurant/Bar/Cafe	Alone	waiting for food as I understood how something works
6:22	Home	1 family member	brushing teeth whilst I got an idea about one brochure
10:51	Taivas - Room16	2 team members	going through stock video for a project
9:42	Taivas - Room16	Alone	video edit
7:27	Taivas - Room16	Alone	planning
9:05	In public space	1 friend	going through a webpage

Table 2 – Location, time and social context of ideas for participant TAIK3

a very lengthy report would be required; thus, for reasons of economy we have summarized his recordings of ideas and barriers with regard to location, time, social context and reported activities in Tables 1 and 2. With regard to location, eight out of the total fourteen ideas that occurred to him where recorded while he was working in Taivas, either alone (five times), or with team members (three times). In two occasions he recorded ideas when he was at home, while resting in bed alone and while brushing his teeth in the presence of one of his family members. In another two occasions he recorded ideas while walking on his own, whereas his other two ideas were recorded while waiting for food in a restaurant alone and while working with a friend in a public space. In most occasions, ideas occurred to him while he was working alone and their majority was recorded during the morning hours.

It is apparent that the situations during which the subject reported that an idea had occurred to him vary significantly from every aspect. An interesting observation was that "TAIK3" was the only subject who reported being visited by friends and family members while working in Taivas. Moreover, by analyzing the Bluetooth scans of his mobile phone we saw that other participants were within his range quite frequently, above the observed average number of social interactions. Finally we would like to mention that participant "TAIK3" was the only one who tried to capture some of his ideas by taking pictures of the situations that led to their occurrence. Unfortunately, due to a malfunction in his phone's storage card we were not able to retrieve them.

Let us now have a brief look at the recordings of the subject's barriers. As we can see from Table 2, the vast majority of barriers were recorded in the morning while the participant was working in his desk space or in desk spaces nearby. In four out of ten occasions "TAIK3" was working with either team members (twice), or colleagues who did not belong in his team (twice), whereas the remaining six barriers were recorded while he was engaged in activities alone. The subject quite often reported problems that were related to his mood and productivity levels and in some occasions to his social interactions (i.e. discussions in person and over the phone). The participant also recorded three barriers while he was designing. However, due to the aforementioned randomization issue, he was unable to provide us with more information about the nature of those barriers.

Time	Location	Social Context	Activity Type
11:43	Taivas - Room16	Alone	procrastinating (Not at all productive)
6:24	In transit	Alone	thinking about going to work
10:12	Taivas - Room16	1 other colleague	briefing subcontractor (using phone)
10:17	Taivas - Room16	Alone	working on a simple web application - Needed access to info
10:22	Taivas - Room16	2 team members	discussing about project - Too tired or bad mood
10:23	Taivas - Room16	Alone	photoshopping
13:38	Taivas - Room16	2 team members	web design
14:09	Taivas - Room13	2 other colleagues/te	discussing about web development
16:11	Taivas - Room14	Alone	thinking* (Not at all productive)
16:21	Restaurant/Bar/Cafe	Alone	waiting

Table 3 – Location, time and social context of barriers for participant TAIK3

By analyzing the participant's transitions as recorded by his phone's Bluetooth scans, we saw that the participant spent a lot of time in his desk space (RoomID 16) and in desk spaces nearby. Unlike participant "TAIK1" though, the subject visited spaces located in different floors and

areas very often, yielding a low micro-mobility (desk-to-desk) to macro-mobility (floor-to-floor /space-to-space) ratio. "TAIK3" often paid visits to participant's "TAIK4" desk space (RoomID 11) and was occasionally located to execute tasks in the work table area (RoomID 17). In many occasions the subject was in the second floor meeting rooms (RoomID 5 and RoomID6), either alone or with others. There were also recordings of him being in the cafeteria space (RoomID 1) as well as in the red couch lounge space (RoomID 23). The participant often had his phone on while being out of the office, as demonstrated by his idea and barrier recordings, but he would occasionally switch it off while being in Taivas' premises.

Overall, "TAIK3" recorded twenty seven unique (translated) activities over his participation period (see sample in Figure 34). He often recorded that he was 3D modeling, surfing the web, reviewing information, as well as editing videos and images. The daily schedule of the subject appears to be unstructured (unlike participant's "TAIK2"), as every work day accommodated different number and types of activities.

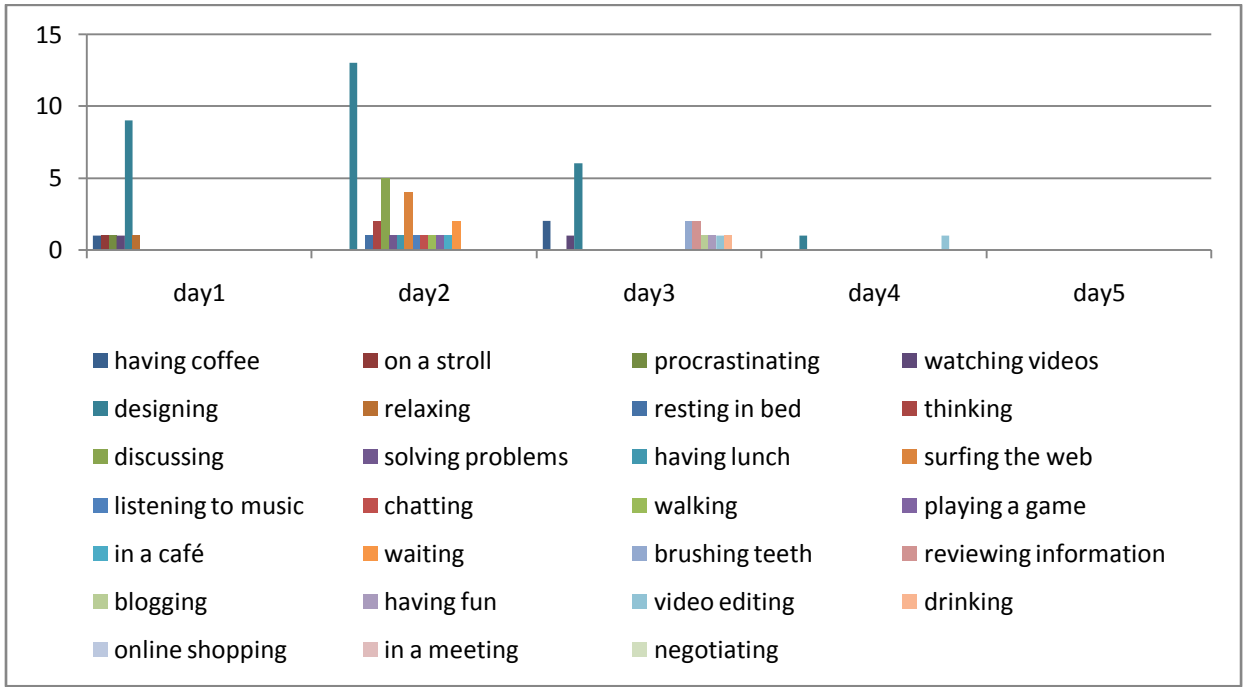


Figure 34 – Daily activities distribution for participant TAIK3 during week 1

We will now juxtapose our findings with the data that participant "TAIK3" provided us with in the Pre-study Questionnaire (see Appendix A). Once again, for reasons of economy, we will only demonstrate some of the findings that we though were significant. In the question "Where do you prefer to work when you are trying to come up with ideas?" the participant answered "In public places". The participant indeed recorded an idea while working in a public place with a friend; still, as such an incident took place only once, his self-proclaimed preference is not in accordance with our data. In the question "At Taivas, are there places that you prefer to use for creative thinking", the participant answered "sofas, the internet printer room". The recordings of his transitions indeed show that "TAIK3" often spent time web surfing in various lounge areas, thus his answer agrees with our data. When asked "When during the day do you

think you usually get the best ideas?", the participant replied "Not at a particular time" which completely opposes our findings since most of his ideas were reported to emerge during the morning hours. In the question, "Do you think you have (more or) better ideas while working with others or alone?" the participant answered "With others". Once again we see a discrepancy between his answers and our data, since the vast majority of his ideas were recorded while he was engaged in activities alone. In the next question, "With whom you usually work when trying to come up with ideas? (Pick all that apply.)", the participant chose his "Working partner" and "Team", which are both in accordance with our records. In the following question the subject was asked "Can you say what usually hinders you to get ideas? (Pick 3 most important ones.)". His answers were "Distraction", "Too much work or stress" and "Too little time to complete the task". His answers somewhat agree with our data, as the barriers he recorded were related to bad mood and low productivity levels.

When asked "What do you think would contribute more to your having more or better ideas? (Rank them, 1 = most important)", the participant ranked "Better access to information" first. We can assume from the collected information that the participant indeed values access to information the most, as his transitions were often due to his seeking information. Finally, in the statement "I perform better while following a daily office routine", the participant replied "Disagree a little". Our data agree with his claim as the number and types of activities he was engaged with on a daily basis varied a lot. Moreover, the subject recorded a very high number of unique activities and his activity recordings follow no evident pattern (see Figures 35 and 36).

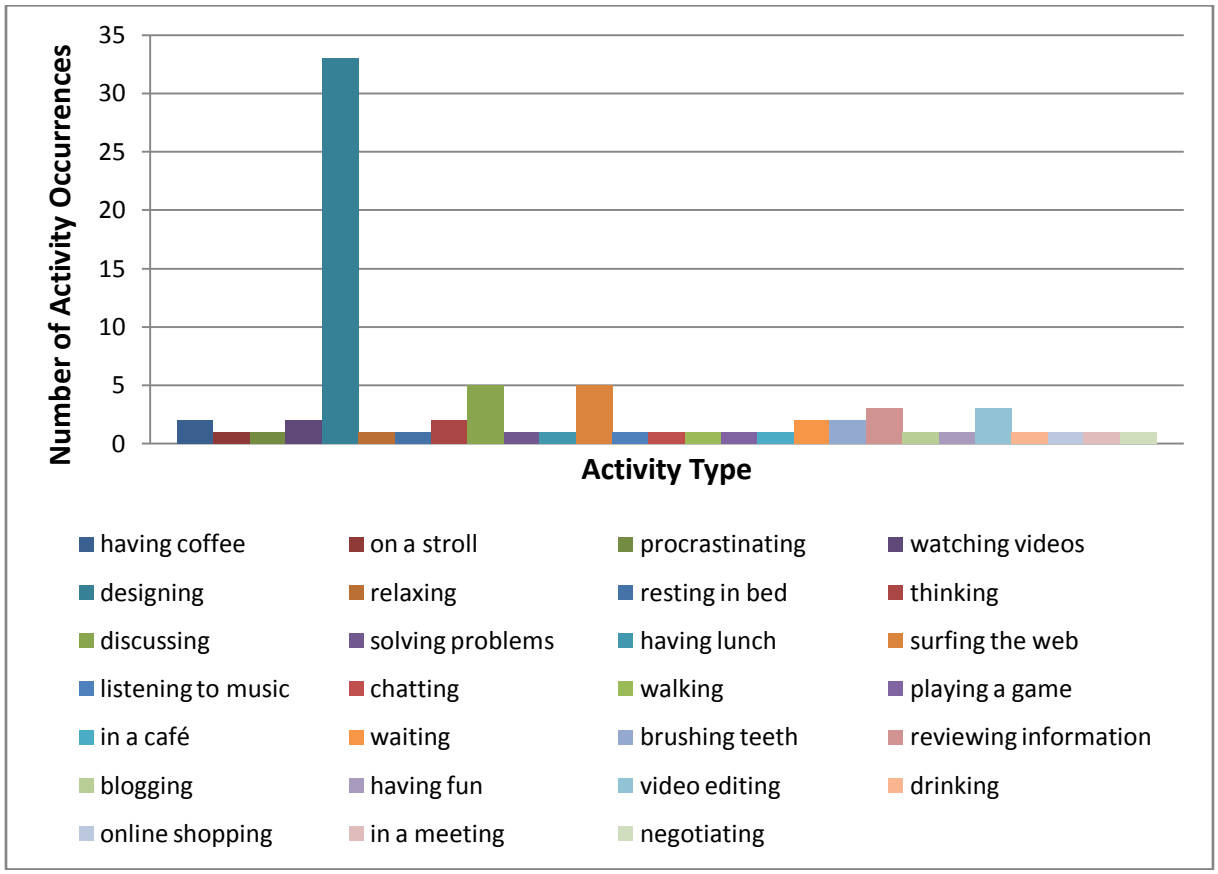


Figure 35 – Aggregate unique recorded activities for participant TAIK3 during week 1

		Personal Desk space		Other Desk space		Meeting room		Printer Room		Lounge		Taivas café		Other workplace		Home		Public Space		Restaurant /Bar/Cafe		In Transit	
Early Morning	alone	1														1							1
	with team member(s)																						
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family															1							
Morning	alone	2	3																			1	
	with team member(s)	1	1							1													
	with other colleague(s)		1																				
	with boss																						
	with clients																						
	with friends																	1					
	with family																						
Noon	alone	2																					
	with team member(s)		1	1																			
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						
Afternoon	alone				1															1	1	1	
	with team member(s)										1												
	with other colleague(s)																						
	with boss																						
	with clients																						
	with friends																						
	with family																						

Figure 36 – Location, time and social context of ideas and barriers recorded by participant TAIK3

*Green cells represent ideas while red barriers

**Numbers within cells indicate the number of recordings for the specific combination

Summary

The three qualitative reports we compiled allowed us to examine in detail the daily work lives of participants TAIK1, TAIK2 and TAIK3. By analyzing the subject's data we were able to find and measure patterns of occupancy, mobility and collaboration within their distributed work environments. In all occasions we tried to see if and how those patterns were correlated to the process of ideation. By juxtaposing our findings to the answers that the participants provided us with in the Pre-study Questionnaire, we were able to expose agreements and discrepancies between the self-proclaimed lifestyles and beliefs of subjects and their actual work-life data. For example, In the case of participant TAIK1, we have shown that the subject is probably more creative during the morning hours, contrary to his belief that ideas often occur to him in the afternoon. Moreover, we were able to confirm that access to information, feeling no stress, privacy and comfortable furniture are valuable to him, as he had stated prior to the beginning of the study. As far as participant TAIK2 is concerned, our analysis showed that indeed he prefers to work at Taivas and at home and that most of his ideas occur to him during early morning hours, as he had stated himself. However, his recordings show that he was rarely working with team members, contrary to his statement that he prefers working with others. The case of participant TAIK3 was similar, as both agreements and disparities emerged. Even though the participant had stated that he prefers to work in public spaces while trying to come up with ideas, our records show that most of his ideas occurred to him while he was working at Taivas. The subject also believes that ideas do not occur to him more often during a certain time of the day; still, most of his ideas were reported to emerge during the morning hours.

After reviewing the datasets of Taivas' employees we would like to make the following recommendations to the management. With regard to office design, it seems that most participants are happy with their environment (i.e., type of furniture and arrangement, materials and colors used, room temperature and noise levels). The only significant issue that we found was that of poor air quality, that was reported by certain participants. This issue should be tackled in order to provide workers with a comfortable ambient environment. Moreover, it seems that certain participants wish for, or should be interacting with other co-workers more often. For this reason Taivas should consider design strategies in order to provide more opportunities for informal social interactions between employees. As far as services and work tools are concerned, it became apparent to us that an upgrade of work-related equipment and offered information services might be required, since most recorded barriers were related to either equipment failures or missing information and because most participants ranked access to information as the most important precondition for having more ideas. As far as Taivas' business policies are concerned, we believe that management should provide more opportunities to certain employees (such as TAIK3) to work out of the office via the right choice and provision of ICT.

Participant Feedback

After the completion of the study participants were asked to provide feedback about their participation by filling out a Post-study Questionnaire[1]. During the session nine out of eleven participants were present and provided answers and recommendations with regard to the content and structure of the survey (i.e. phrasing, ordering and typology of the questions), easiness of survey completion (i.e. completion time and understanding the question), as well as technical limitations and problems they faced while carrying and using the survey phone[2]. Overall, their remarks were quite constructive and should be taken into consideration in the design of surveys with regard to their content and interface, as well as in choosing appropriate mobile phone devices in future studies. Below we summarize their most practical comments.

As far as the content of the survey is concerned, some useful additions were made. In the question "Where were you?", participants thought that the option "Friend's place" should be added. In the question "Were you engaged in activities alone/ with 1 other person/ with 2 or more persons?", the most interesting remark was to add the option "Physically or via chat/ e-mail", an addition that we recommended ourselves earlier on, as it would provide us with useful insight about information acquisition and diffusion via social interactions within virtual environments. In the question "Why did you pick this space for your activities?" an option we missed was "Because it is the habit"; this option would better allow us to juxtapose frequency of occupancy of certain office spaces by subjects to their self-proclaimed habits. In the question "What tools did you use?" an important choice we missed out was "Design books, magazines, etc.". Finally, when subjects were asked what would have been the most important question to ask had they designed the survey themselves, the most useful suggestion was "Was the day successful as a whole?". The answer to this query would expose a participant's overall sense and feelings for his/her work day and could be juxtaposed to the respective number of recorded ideas and barriers as well as stress levels.

During the feedback session it became apparent to us that in some cases participants were unable to understand that certain questions were designed as multiple-choice, even though they were explicitly stated to be so in the MyExperience interface (instructions "pick all that apply/ scroll down for more options" were displayed right next to or below the questions). For example in the questions "Who were you with?", "What was hindering you?" and "Why did you pick this space for your activities?" some options were missed out by certain subjects, as they informed us, because they hadn't realized that they could scroll down the phone's screen, even though a scroll bar had been inserted in the interface. Such misunderstandings can be easily overcome by spending some time training participants on how to use the phone's interface.

With regard to the type of questions used in the phone survey (i.e. single choice, multiple choice, open-ended), participants had many suggestions to make. In some cases they thought that certain open-ended questions (where subjects had to type in their answers) should be replaced by multiple-choice ones; this was the case for the question "What were you doing?" which was originally designed as multiple-choice, but was later changed to open-ended in order

[1] Please see Appendix M – Post-study questionnaire

[2] Please see Appendix N – Participants' Post-study Questionnaire Answers

to capture richer data. On the other hand, for the questions “In interacting with others were you mostly providing info/ receiving info” and “How important was this interaction for your current activities?”, certain participants felt that they should be allowed to provide more information about their social interactions by typing in a text field.

Even though we tried to ask questions in the shortest and simplest possible way, some subjects felt uncertain about the content and aim of the questions at times. For example, for the question “What were you doing?” some participants were not sure whether they should answer what they were actually doing at the moment (i.e. their actual acts) or what they were trying to do but had not yet done (i.e. their aim). In other cases, such in that of the question “Was this a big idea/ small idea?”, certain subjects felt it would be difficult to characterize ideas as “big” or “small”, even though this was a terminology borrowed from Taivas’ internal language and not extraneously imposed by us. Furthermore, some subjects felt they were executing their “creative” duties in a way that they did not fit in the general concept of what we call an “idea” and thus could not be characterized as such. One subject even stated that it is very hard to define what an idea is in general, hence characterizing ideas as big or small is an impossible (and perhaps absurd) task. Similar kinds of comments were provided for the questions “Can you capture the situation that led to this idea? / Can you capture the situation that hindered you?” since trying to describe the generative process of an idea is a challenging task.

When asked about the kinds of problems that emerged while carrying and using the phones, participants referred to both software and hardware issues. As we have aforementioned, certain participants were alarmed too often during the first part of the study due to their being mislocated by the Bluetooth algorithm (see Data Analysis – Initial results). This issue was mostly resolved (but not fully) by optimizing the algorithm’s location look-up table. However, subjects got accustomed to being prompted often, thus when we changed the conditions for triggering surveys and the maximum number of possible daily prompts, they reported that as an issue, as they were not prompted that often. Certain participants also reported that MyExperience would appear to be slow from time to time (especially towards the end of the study) and that it would cause the phone to switch off at night while it was recharging. Moreover, almost every subject was annoyed by the phone’s short battery life. As far as the phone’s actual design was concerned, participants reported that the size of the phone was too big to carry around and they were also dissatisfied about the design of the keyboard.

Overall, participants felt comfortable with the number of questions asked per prompt and they believe that by adding more variety to the queries along with customized questions for each participant, the study will become more pleasurable. Two out of nine participants present ranked technical improvements as the most important issue to be tackled, while another three believe that fewer surveys per day would substantially improve the study. Finally, when asked if they would participate in such kind of a study again, six participants replied “yes”, one replied “yes, if it would work properly”, one participant answered “maybe” and one participant answered “The idea is good but it is not possible to participate fully because of the lot of work.” No participant gave a negative answer, thus encouraging us to continue with the development of the methodology.

Conclusions

As we have seen, Context-Aware Experience Sampling is a useful and potentially powerful tool for studying the behavior of office space occupants when combined with traditional ethnographic tools. The ubiquity, increasing processing power and relatively low cost of mobile phones, makes them ideal candidates for context-aware experience sampling applications. The amount of data that can be collected per participant via a mobile phone is vast and quite rich in information content, allowing researchers to conduct both quantitative and qualitative analyses. By juxtaposing self-proclaimed habits and beliefs of knowledge workers to their actual work-life data we are able to make assessments and possibly predictions about their work behavior by exposing similarities and discrepancies between the two. These assessments could be compiled in the form of reports like the ones we have reviewed and could be provided to knowledge workers as feedback. Moreover, by cross-referencing data between participants we are allowed to review group dynamics and track significant incidents and measures at various levels (i.e. across employees, teams or even larger social structures), thus gaining a "global view" of the workplace. By developing the appropriate visualization tools we can offer managers and coordinators easy to understand, real-time, anonymized data that can help them make more informed decisions about the workplace.

Future Work

In the Taivas case study we tried to track the occurrence and diffusion of ideas and barriers in the distributed work environment of knowledge workers, a matter of such complexity that it could not have been analyzed in a cost effective, non-obtrusive way simply by using traditional ethnographic tools. As this was the first full scale study using Context-Aware Experience Sampling, it is sensible that there is a lot of room for improvement and a lot of work left to be done. Even though we have managed to analyze subjects' patterns of occupancy, mobility and collaboration and to correlate them to the process of ideation, our collection of data was more or less confined within the office space. As we know, distributed work is by nature multi-locational (work is conducted by people located in different divisions, firms, organizations and time-zones) and mobile (people conduct work while transiting (Micro-Macro Mobility). Thus, in order to obtain better data, it is necessary that in future studies subjects are tracked while being out of their main office. Our initial intention was to use the phone's built-in GPS device in order to learn more about the activities and interactions of knowledge workers, however, due to the battery consumption that such a configuration would cause (i.e. scanning for Bluetooth devices and for satellite signal concurrently), we decided not to employ such a system. Moreover, our findings were based on the juxtaposition of the subjects' Pre-Questionnaire answers to the responses they gave in the mobile phone survey. The next step would be to use body and mobile phone sensors (such as heart rate sensors and accelerometers) that can monitor the physical condition and movements of subjects in order to obtain additional, more objective data. These kinds of data can be checked against the participants' self-reports and could help resolve ambiguous situations. We say that because during the Taivas case study, there were occasions where participants were not sure how to assess their own stress levels, allowing for misinterpretations to occur in the analyses of their activities;[1] by employing the aforementioned system, such situations could be easily resolved.

Even though we were able to collect great amounts of data, their analyses and visualizations were made by using traditional statistical analysis tools and graphs. However, in order to be able to understand the complex associations between the variables that describe distributed work, we have to invent new types of visualization tools. The next step would be to determine which visualization type is most suitable for which type of work-life data and to develop visualizations that exploit the power of human visual intelligence to detect patterns (see Images 1, 2 at the chapter's end). Additionally, research efforts should be turned to the development of algorithms that can be trained to find patterns of work in order to inform the development of design tools for future office, home and urban design as well as work policies.

Before we conclude we would like to make certain recommendations for future studies. With regard to survey design we recommend the average number of daily prompts to be around eight. Moreover, rethinking of the strategic positioning and inclusion of the "continue" option within the mobile phone survey is required so as to minimize data loss. Our analysis showed that we would have gotten more complete data sets if we had allowed participants to either provide answers for the entire survey or to let the survey time-out than by allowing them

[1]Please see Appendix N – Participants' Post-study Questionnaire Answers

to exit the survey after the "continue" option. One more issue that should be reconsidered is the use of the option "other". We believe that it should either be removed or replaced by an open-ended question. Additionally, as randomizing between branches after the "continue" option causes a 50% data loss with regard to the occurrence of ideas and barriers, we suggest either an increase of the chance of the idea and barrier branches to show up (e.g. to 75%), or an alternative structuring of the survey. Finally, by reviewing participant feedback and the case study results, we think that certain questions and options should be incorporated in the phone survey. These include:

- The addition of the option "view" in the question "What was the most important spatial quality?"
- The addition of the option "Friends place" in the question "Where were you?"
- The addition of the question "Was your interaction with others: 1) physical (face to face) 2) virtual (email, chat etc)?"
- The addition of the question "Was this idea related to your last recorded idea?", or "Was this idea: 1) development of an existing idea 2) brand new idea."
- The addition of the question "Overall, was this a productive day?"
- The addition of a question in the phone survey that would provide us with feedback about a worker's workload management skills.
- The addition of customized questions for each participant.

With regard to the sensor technology to be employed in future studies we recommend the use of programmable beacons such as Wockets. The advantage of these beacons is that their power transmission can be controlled accurately and thus the signal strength of the sensor can be adjusted without too much hassle. Moreover, the following issues should be considered if the method of Bluetooth scans is employed:

- Variation in Bluetooth networks is unpredictable due to environmental noise (i.e. due to the appearance of non-study related devices that take up a large portion of the number of allowed detected devices, as well as due to signal reflections from study related devices caused by metal surfaces and movement of people).
- The higher the number of Bluetooth devices present in the study area is, the greater the detection time of devices per scan will be (it could reach a minute).
- The higher the frequency of Bluetooth scans is, the faster the phone's battery will drain.
- The Bluetooth protocol is heavy; Smartphones cannot be used for continuous processing in the same way as a desktop computer can.
- Reading Bluetooth signal strength by using the Received Signal Strength Indicator (RSSI) with each data packet received is not always possible due to the different bluetooth stacks implemented by different mobile phone brands, nor is it recommended due to the non-uniform Bluetooth signal field (the Samsung SGH-i617 Blackjack II uses the Microsoft Bluetooth stack).

As far as the choice of mobile phones to be used in future studies is concerned, three issues should be considered. First, the phone's size should not be too big so it can be easily carried

around by subjects. Second, the size of the keyboard should allow quick typing of text, so that participants won't feel discouraged to type their answers when presented with open-ended questions during the survey. Finally, battery life should be the most important criterion as it has been shown to be the main concern of most participants. In our case, battery power lasted up to eight hours when MyExperience was idle (i.e. when participants did not initiate surveys and were not prompted to answer Bluetooth-triggered surveys) and six hours during normal operation.

To conclude, with regard to the choice of experience sampling software to be run on the phones in future studies we recommend the use of MyExperience if the selected mobile phone runs the Windows Mobile operating system. A universal experience sampling software would be an ideal solution, as it could be run in the participants' personal mobile phones, thus eliminating the need for subjects to carry an extra phone. Such a solution is yet unrealistic as mobile phone manufacturers use different platforms for running and developing applications.

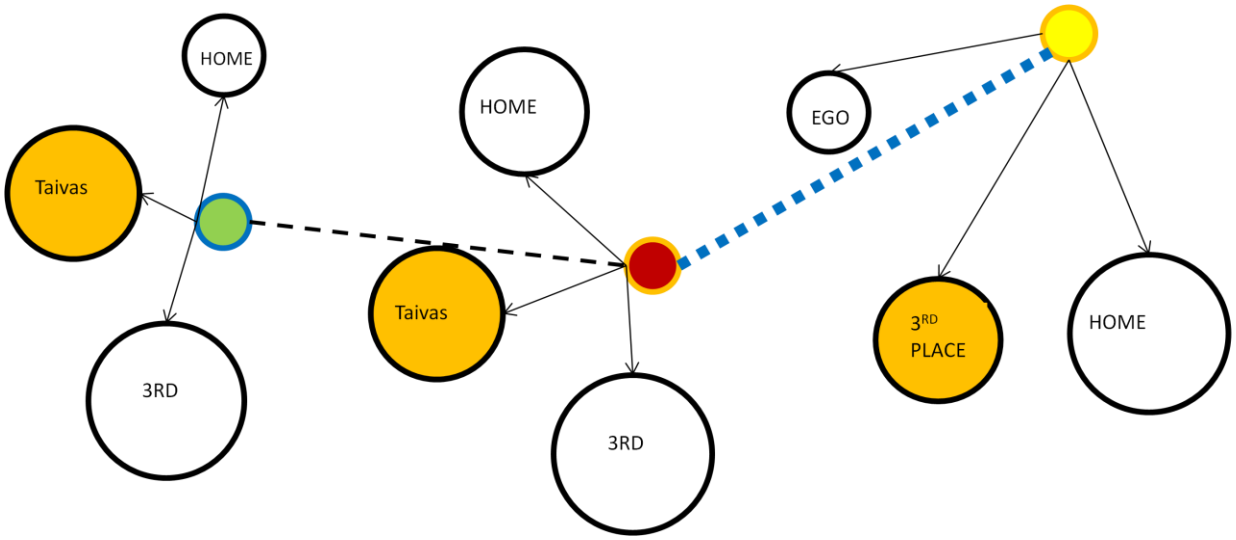


Image 1 – The image shows the states (red, yellow, green) of 3 Taivas employees belonging in 2 different teams at a specific time, juxtaposed to current location, collaborations and work habits.

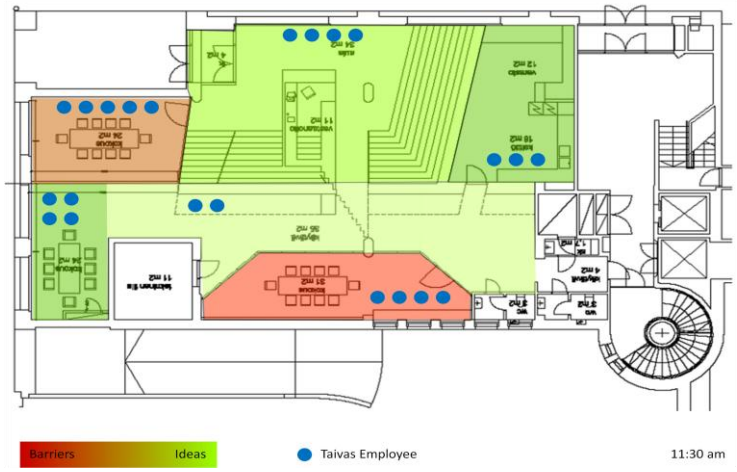


Image 2 – Ideas and Barriers Gradient

Appendix A – Pre-study Questionnaire

Name

Phone number

IMEI	ID

The year of birth

Education

Job description

How long have you worked in Taivas/ Ego?

How long have you worked in the field?

1. Where do you prefer to work when you are trying to come up with ideas?

   __ In Taivas
   __ At home
   __ In public places
   __ Other workplace outside Taivas
   __ Other, please specify

   _____

2. At Taivas, are there places that you prefer to use for creative thinking?

   __ No
   __Yes

   Could you name those places?

   _____

   _____

3. When during the day do you think you usually get the best ideas?

   __ Early morning
   __ Lunch break
   __ Afternoon
   __ Evening
   __ Night
   __ Not at the particular time // Not at a particular times

4. When during the week do you think you usually get the best ideas?

   __ At the beginning of the week
   __ At the end of the week
   __ At the weekend
   __ Not at the particular time

5. Do you think you have (more or) better ideas while working with others or alone?

   __ With others
   __ Alone

6. With whom you usually work when trying to come up with ideas? (Pick all that apply.)

__ Your working partner
__ Your team
__ A client
__ A friend
__ A colleague outside your team
__ Other, please specify

_____

7. If you prefer to work alone, what is the most important reason for this?

__ For privacy
__ For quiet
__ For a change
__ Other, please specify

_____

8. If you prefer to work with others, what is the most important reason for this?

__ To try out your ideas with others
__ To have the expertise of others available if needed
__ To keep up to date with what others are doing
__ To be in the presence of others
__ Other, please specify

_____

9. Are there some activities that you think are especially good for you to create ideas? Could you name a few?

_____

_____

_____

10. Can you say what usually hinders you to get ideas? (Pick 3 most important ones.)

__ Person unavailable
__ Missing information
__ Equipment failure
__ Distraction
__ Too much work or stress
__ Too little time to complete the task
__ Too many tasks at the same time
__ Other, please specify

---

11. What do you think would contribute more to your having more or better ideas? (Rank them, 1 = most important)

__ Different workspace configuration
__ More interaction with others
__ Better access to information
__ More time per project
__ Better equipment
__ Other, please specify

_____

12. What is the most important spatial quality for you?

__ Quiet
__ Peaceful
__ Good lighting
__ Comfortable furniture
__ Nice materials / colors
__ Air quality
__ Room temperature
__ Other, please specify

---

13. Why might you choose another place than your work station to work in? (Rank them, 1 = most important)

__ For a change
__ For privacy
__ For company
__ For a larger working area
__ For certain equipment
__ Other, please specify

---

14. What kind of shared system do you use the most?

__ Projector
__ White board
__ Wall space
__ Work table
__ Other, please specify

_____

15. What are the attributes of personal work space you would like to have? (Rank them, 1 = most important)

__ Lots of room
__ Privacy
__ Quiet
__ Everything at hand
__ People around
__ Other, please specify

_____

16. What kind of shared space would you like to have? (Rank them, 1 = most important)

__ Room for projects
__ Privacy for meetings
__ Equipment always at hand
__ Other, please specify

_____

17. For what activities do you need a particular kind of space? (Rank them, 1 = most important)

__ Presenting
__ Brainstorming / discussing
__ Sketching
__ Socializing
__ Relaxation
__ Other, please specify

_____

18. Usually I follow a standard methodology to come up with ideas.

__ Agree a lot
__ Agree
__ Disagree a little
__ Disagree a lot

19. Usually I get my best ideas when I have scheduled my activities in advance.

__ Agree a lot
__ Agree
__ Disagree a little
__ Disagree a lot

20. I perform better while following a daily office routine.

__ Agree a lot
__ Agree
__ Disagree a little
__ Disagree a lot

21. I perform better when I have some kind of deadline.

__ Agree a lot
__ Agree
__ Disagree a little
__ Disagree a lot

Appendix B – Participants' Pre-study Questionnaire Answers

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	Legend																							
2	Single choice					Multiple choices					Open-ended			Ranked						Comments				
3																								
4	Question/	1				2	3				4		5	6					7	8	9	10		
5	USER ID																							
6	TAIK1	1				2	3				3		1	1	2	3	4	5	3	2		2	5	6
7	TAIK2	1	2	3	8	1	1				2		1	1	4				2			2	4	5
8	TAIK3	3				2	6				4		1	1	2	4	5		8	1		4	5	6
9	TAIK4	2				2	4	5			4		1	1	2				1	1		2	4	6
10	TAIK5	1				1	4				4		2	1					1	1		5	6	7
11	TAIK6	1				2	1				4		2	1	2	5			8	0		4	6	7
12	TAIK7	2				1	6				4		2	1	2				8	0		4	5	6
13	TAIK8	1	3			2	3	4	5		4		1	1	2				1	1		2	5	6
14	TAIK9	1	3			1	1	3	4	5	4			1	2	3	4	5	1	1		2	6	7
15	TAIK10	2				2	3	4	5		4		2	1	2				1	2		2	4	7
16	TAIK11	1	2	8		1	4	5			1	3		1	2	3	8		2					
17																								

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
18	Question/	11					12	13						14	15					16				
19	USER ID	1.	2.	3.	4.	5.		1.	2.	3.	4.	5.	6.		1.	2.	3.	4.	5.	1.	2.	3.		
20	TAIK1	3	4	2	1	5	4	2	5	1	3	4		4	2	1	3	4	5	1	2	3		
21	TAIK2	3	1	4	2	5	2	2	1	5	4	3		2	4	1	2	3	5	1	2	3		
22	TAIK3	3	4	1	2	5	8	2	1	5	4	3		8	4	1	3	2	5	1	2	3		
23	TAIK4	2	4	1	3	5	2	2	3	1				4	2	3	4	5	1	8				
24	TAIK5	4	3	2	1	5	2	8	2	1	3	4	5	8	4	2	5	3	1	2	1	3		
25	TAIK6	2	3	4			4	2	3	4				8	8	3				8	2			
26	TAIK7	4	3	2	1	5	2	2	1	3	4	5		1	3	5	4	2	1	1	3	2		
27	TAIK8	1	2	4			8	1	2	8					2	4	3	5		1	3			
28	TAIK9	4	3	2			2	2	1	4				4	2	4	3			1	2	3		
29	TAIK10	1	2	3	4	5	4	4	2	1	5	3		1	1	3	2	4	5	2	1	3		
30	TAIK11							2	4	5	3	1												
31																								

	A	B	C	D	E	F	G	H	I	J
32	Question/	17					18	19	20	21
33	USER ID	1.	2.	3.	4.	5.				
34	TAIK1	2	3	5	4	1	4	2	4	2
35	TAIK2	2	3	5	4	1	3	3	2	3
36	TAIK3	2	5	1	3	4	4	3	3	3
37	TAIK4	2	5	4	1		2	3	2	1
38	TAIK5	2	1	3	4	5	3	3	3	1
39	TAIK6	2	4	1			3	3	2	2
40	TAIK7	2	4	5	3	1	4	4	4	2
41	TAIK8	1	2	5			3	4	3	2
42	TAIK9	1	2	4			3	2	2	2
43	TAIK10	3	5	1	2	4	3	4	2	3
44	TAIK11	3	2	1	4	5	4	3	3	2

Cell**:** B4

Comment: Where do you prefer to work when you are trying to come up with ideas?

1. In Taivas
2. At home
3. In public places
4. Other workplace outside Taivas

8. Other, please specify

Cell: F4 **Comment:**

At Taivas, are there places that you prefer to use for creative thinking?

1. No
2. Yes Could you name those places?

Cell: G4 **Comment:**

When during the day do you think you usually get the best ideas?

1. Early morning
2. Lunch break
3. Afternoon
4. Evening
5. Night
6. Not at the particular time

Cell: K4 **Comment:**

When during the week do you think you usually get the best ideas?

1. At the beginning of the week
2. At the end of the week
3. At the weekend
4. Not at the particular time

Cell: M4 **Comment:**

Do you think you have (more or) better ideas while working with others or alone?

1. With others
2. Alone

Cell: N4 **Comment:**

With whom you usually work when trying to come up with ideas? (Pick all that apply.)

1. Your working partner
2. Your team
3. A client
4. A friend
5. A colleague outside your team

8. Other, please specify

Cell: S4 **Comment:**

If you prefer to work alone, what is the most important reason for this?

1. For privacy
2. For quiet
3. For a change

8. Other, please specify

Cell: T4 **Comment:**

If you prefer to work with others, what is the most important reason for this?

1. To try out your ideas with others
2. To have the expertise of others available if needed
3. To keep up to date with what others are doing
4. To be in the presence of others

8. Other, please specify

Cell: U4 **Comment:**
Are there some activities that you think are especially good for you to create ideas? Could you name a few?

Cell: V4 **Comment:** Can you say what usually hinders you to get ideas? (Pick 3 most important ones.)

1. Person unavailable
2. Missing information
3. Equipment failure
4. Distraction
5. Too much work or stress
6. Too little time to complete the task
7. Too many tasks at the same time
8. Other, please specify

Cell: F6 **Comment:** No particular places, basically where there is a sofa where you can exchange with other people

Cell: U6 **Comment:**
No special activity, just need to feel no pressure.

Cell: E7 **Comment:**
Summer cottage

Cell: T7 **Comment:**
Picked two options: 1,2

Cell: U7 **Comment:**
Sports and outdoor activities

Cell: F8 **Comment:**
Sofas, the internet, printer room (has a flipper)

Cell: S8 **Comment:**
To concentrate on difficult tasks

Cell: U8 **Comment:** Sports retroactively help me to get out of my regular problem solving patterns -
thus helping me to be more open-minded. Sports & videogames.

Cell: F9 **Comment:**
Small meeting rooms such as [?] or sofas.

Cell: U9 **Comment:** Research, brainstorming, taking break and doing physical exercise when getting stuck with an idea

Cell: F11
Comment: Cozy rooms with sofas and stuff

Cell: S11 **Comment:**
Time to think and mull

Cell: U11 **Comment:**
Free writing, mind maps

Cell: S12 **Comment:**
I get more focused ideas, more unique ideas.

Cell: U12 **Comment:**
Walking around the city with no destination. Lunch time, eating.

Cell: F13 **Comment:**
Rooms with sofas or otherwise relaxed

Cell: U13
Comment: gym -
on the way home (tram) -
walking in the streets

Cell: M14 **Comment:**
Picked both options.

Cell: U14 **Comment:**
Working under pressure!

Cell: F15 **Comment:**
Cozy meeting rooms

Cell: U15 **Comment:**
Big piece of paper to draw

Cell: D16 **Comment:**
Field research (in different places with different users)

Cell: F16 **Comment:** Commented "no" option:
There are no one place above others

Cell: M16 **Comment:**
Picked both options.
Comment: Requires both!

Cell: Q16 **Comment:**
With users

Cell: S16 **Comment:** Commented option 2:
Peaceful (flow won't be disturbed!)

Cell: T16
Comment: Picked two options:
1,2

Cell: U16 **Comment:**
I use a lot different kinds of knowledge acquisition, analyzing, and ideation methods. Prototyping and testing are importa nt also.

Cell: X16 **Comment:** Picked 7 options:
2,3,4,5,6,7 and other: Not in the right mood or motivated

Cell: B18 **Comment:**
What do you think would contribute more to your having more or better ideas? (Rank them, 1 = most important)

1. Different workspace configuration
2. More interaction with others
3. Better access to information
4. More time per project
5. Better equipment

8. Other, please specify

Cell: G18 **Comment:**
What is the most important spatial quality for you?

1. Quiet
2. Peaceful
3. Good lighting
4. Comfortable furniture
5. Nice materials/ colors
6. Air quality
7. Room temperature
8. Other, please specify

Cell: H18 **Comment:**
Why might you choose another place than your work station to work in? (Rank them, 1 = most important)

1. For a change
2. For privacy
3. For company
4. For a larger working area
5. For certain equipment

8. Other, please specify

Cell: N18 **Comment:**
What kind of shared system do you use the most?

1. Projector
2. White board
3. Wall space
4. Work table

8. Other, please specify

Cell**:** O18 Comment**:**
What are the attributes of personal work space you would like to have? (Rank them, 1 = most

important)

1. Lots of room
2. Privacy
3. Quiet
4. Everything at hand
5. People around

8. Other, please specify

Cell: T18 **Comment:**
What kind of shared space would you like to have? (Rank them, 1 = most important)

1. Room for projects
2. Privacy for meetings
3. Equipment always at hand

8. Other, please specify

Cell: G22 **Comment:**
How furniture is placed

Cell: N22
Comment: Server

Cell: T23 **Comment:**
Nice, inspiring, comfortable environment/ space with comfy sofas and enough space.

Cell: H24 **Comment:**
For comfort

Cell: N24 **Comment:**
Notebook

Cell: N25 **Comment:**
Sketching paper

Cell: O25 **Comment:**
Creative atmosphere

Cell: T25 **Comment:**
Informal, inspiring space

Cell: G27 **Comment:**
The feel of the space including many of these things. Different than my desk.

Cell: J27 **Comment:**
Relaxation

Cell: N27
Comment: Picked two options: 1
8, sketch book

Cell: F30 **Comment:** Picked 4 options but didn't rank them:
1,4,5 and other: More skillful working partners

Cell: G30 **Comment:** Picked 4 options:
2,3,6 and other: Security

Cell: N30 **Comment:** Picked two options:
1 and other: Meeting rooms

Cell: S30 **Comment:**
Picked 4 options but didn't rank them: 2,3,4,5

Cell: V30
Comment: Picked two options but didn't rank them: 1,3
Commented option 1: Important

Cell: B32 **Comment:**
For what activities do you need a particular kind of space? (Rank them, 1 = most important)

1. Presenting
2. Brainstorming
3. Sketching
4. Socializing
5. Relaxation

8. Other, please specify

Cell: G32 **Comment:**
Usually I follow a standard methodology to come up with ideas.

1. Agree a lot
2. Agree
3. Disagree a little
4. Disagree a lot

Cell: H32 **Comment:**
Usually I get my best ideas when I have scheduled my activities in advance.

1. Agree a lot
2. Agree
3. Disagree a little
4. Disagree a lot

Cell: I32 **Comment:**
I perform better while following a daily office routine.

1. Agree a lot
2. Agree
3. Disagree a little
4. Disagree a lot

Cell: J32 **Comment:**
I perform better when I have some kind of deadline.

1. Agree a lot
2. Agree
3. Disagree a little

Appendix C – Consent Form

CONSENT TO PARTICIPATE IN RESEARCH

Situated Innovations: Workplace

You are asked to participate in a research study conducted by the following researchers from the Future Home Institute at the University of Art and Design Helsinki (TaiK).

Jarmo Suominen (Head of the Research Project)
Riikka Rahtola
Juha-Pekka Karinki
Johanna Lappi

This research will deploy tools developed by the House_n Research Consortium at the Massachusetts Institute of Technology (MIT). You were selected as a possible participant in this study because:

- You are at least 18 years of age.
- You work in the designated study area, Taivas, Inc. Taivas was considered to be a representative area to implement a study focusing on creativity in modern work.
- You may have specific intellectual interest in the goals of this study.
- You are not employed by the MIT Department of Architecture or TaiK Future Home Institute.

You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

- **PARTICIPATION AND WITHDRAWAL**

Your participation in this study is completely voluntary and you are free to choose whether to be in it or not. If you choose to be in this study, you may subsequently withdraw from it at any time without penalty or consequences of any kind. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

- **PURPOSE OF THE STUDY**

With mobile computing and global telecommunication, the nature of work is rapidly changing. Workers, managers, designers, and manufacturers of workplace products do not have a good understanding of where, when, with whom, and in what activity context does the most productive and creative work take place. In addition, designers currently lack the scalable tools to gain an empirical understanding of the effect of architectural design on user behavior.

Direct observation of the behavior of users in existing, occupied architecture, can be a powerful tool, but it is relatively costly, time consuming, invasive, and is difficult to deploy over many weeks or months. In addition, self-report tools such as questionnaires have been shown to inaccurately capture mundane activity patterns, and complex associations. Further, designers lack the tools to evaluate new designs in terms of user behavior after they are built.

The aim of this study is to better understand complex workplace behavior using three conventional ethnographic tools (direct observation, questionnaires, interviews) combined with a new tool developed by the MIT House_n Research Consortium (context aware experience sampling using mobile phones and Bluetooth beacons).

If proven successful, the software and hardware system we create might eventually enable a new type of occupancy performance evaluation system for any type of environment. The algorithms could also be used to enable new types of communication, entertainment, and educational devices for the workplace setting.

- **PROCEDURES**

If you volunteer to participate in this study, we would ask you to do the following things:

1. Carry a mobile phone with a position detecting application that is only operational in the workplace that is designated as part of the study. This workplace will also have commercial Bluetooth beacons installed throughout, as part of this positioning system. This positioning system will be operational for 30 days.
2. Answer questions presented to you on a mobile device that you carry with you (also known as doing "experience sampling") for 30 days during the experiment. This self-reported activity data will be compiled and only anonymized data will be utilized. Co-workers and management of Taivas will not have access to data about individual workers.

These procedures are described in more detail below.

Procedure 1: Mobile Positioning System

During the experiment period, you will be asked to carry a mobile phone running an application that simply senses whether or not a Bluetooth beacon is nearby. This data will enable us to see how many people are occupying small spaces, and when gatherings or meetings occur. The data itself will be stripped of participant identity and precautions are taken with the coding of the data to ensure that it cannot be used to track the whereabouts of an individual, with positive identity. If you agree to use one of these devices, you will be asked to carry the device throughout the study period as much as possible. The phone will not be used for telephone calls. The positioning system will only be functional in the designated study area. If mobile device becomes uncomfortable, you are free to not carry the device.

The Bluetooth beacons are 1 by 2 by 4 inches and encased in plastic. These will be placed in or taped to convenient locations around the designated study area. As commercial devices, being employed for their intended purpose, these will not disrupt any existing communications, etc.

Procedure 2: Experience Sampling

During the experiment period, we will ask you to carry a mobile phone with you, wherever you go. The device will frequently prompt with a "beep," or other standard device notification tone, at which time a brief set of questions will be presented – the frequency of prompting will depend upon your movement activities, but will range from approximately 10 minutes apart to a few hours apart. You can answer the questions by picking the most appropriate choice, or occasionally, typing in a short response. These mobile devices with experience sampling systems will be used to make anonymized reports of all of the participants' self-reported workplace activities.

Along with your participation in these procedures, you may be asked to complete two questionnaires (one at the beginning of the study, and the other at the end), and a debriefing interview at the end of the experiment. During these questionnaires and interviews, you may decline to answer any or all questions.

During the experiment period, there will also be one or two researchers present making observations about your activities and the use of spaces related to these activities. The researchers will conduct their observations in the way which will respect your privacy and cause a minimum amount of inconveniences to you.

- **POTENTIAL DISCOMFORTS**

When you are participating in experience sampling, there is a possibility that you may feel stressed by the mobile device interruptions. You are free to decline to answer any of the questions that the mobile device presents to you, and you may turn off or stop carrying the device should it become too stressful.

- **POTENTIAL BENEFITS**

By participating in this study, you may learn about novel technologies under development. You will be provided with personal data about your workplace activities (not available to Taivas co-workers or management) that may allow you to gain a deeper appreciation of the richness of your everyday activities and how they are supported by your workplace setting.

We anticipate that this study will help us to develop and measure the performance of computer algorithms that can automatically detect everyday activities. This work may eventually lead to the development of new devices for the workplace that help to maintain productivity.

- **CONFIDENTIALITY**

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission.

Your responses will be referenced by an ID number in order to protect your identity. A study enrollment log will be kept that will include participants' unique identification numbers, names, telephone numbers and enrollment data. This log will be stored the way that only the researchers have access to it.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. Your name will not in any way be associated your data. Once your data is anonymized, it may be shared with other researchers for future studies.

Investigators may take still photographs of your workplace environment. If you do not wish to have pictures taken of you or your workplace environment, you may still participate in this study without prejudice. The photographs will only be used by the investigators for the data analysis tasks of the study and to document that work in academic publications. The media will be under the sole control of the investigators and will be stored in a location accessible only to the investigators. After the investigators have analyzed the results, prior to showing any images in academic and peer-reviewed papers, or anywhere else, they will use standard methods to manipulate the media to protect your identity, such as blurring the face.

- **IDENTIFICATION OF INVESTIGATORS**

If you have any questions or concerns about the research, please feel free to contact

Riikka Rahtola
Project Researcher
044 333 4734, riikka.rahtola@taik.fi

Juha-Pekka Karinki
Project Researcher
040 852 0913, juha-pekka.karinki@taik.fi

Johanna Lappi
Project Researcher
040 593 4823, johanna.lappi@taik.fi

Appendix D – Participants' Information and Teams' Structure

USER ID	Gender	Year of birth	Age	Education	Job description	How long has worked in Taivas (years)	How long has worked in the field (years)
TAIK1	M	1975	34	University/ School of Arts	Designer	2	11
TAIK2	M	1969	40	Merkonomi, datanomi	Online design manager	10	11
TAIK3	M	1982	27	BA	Designer	≈1,5	6
TAIK4	F	1976	33	MA, M.Pol.Sci.	Media consultant, copy	2,5	≈3
TAIK5	F	1981	28	Medianomi	Graphic designer	≈2,5	≈2,5
TAIK6	F	1978	31	MA	Concept designer	≈2,5	5-Apr
TAIK7	M	1974	35	Medianomi	Copywriter	1,5	10
TAIK8	M	1976	33	Tradenomi	Art director	3	10
TAIK9	M	1977	32	University of applied sciences	Interactive art director	0,5	6
TAIK10	F	1968	41	Merkonomi, marketing	Business designer	2,5	3,5
TAIK11	M	1976	33	MA, Industrial designer	Service designer	≈3	≈4

merkonomi = vocational qualification in business and administration
datanomi = vocational qualification in business information technology
medianomi = a degree in media studies at a university of applied sciences
tradenomi = a degree in business, administration etc. at a university of applied sciences.

Teams' Structure

USER ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
TAIK1		1	1								
TAIK2	1		1								
TAIK3	1	1									
TAIK4											
TAIK5						1			1	1	1
TAIK6					1				1	1	1
TAIK7								1			
TAIK8							1				
TAIK9					1	1					1
TAIK10					1	1					1
TAIK11					1	1			1	1	

Team	No Team	
		TAIK2 and TAIK3 occasionally work together but they are not in the same team.
		TAIK1 occasionally works with TAIK2 and TAIK3.
		TAIK4 does not work with any other participants.
		TAIK5, TAIK6 and TAIK9 form a team. TAIK11 occasionally works with them but usually al
		TAIK7 and TAIK8 form a team.
		TAIK10 (located in the 3rd floor) works sometimes with TAIK5, TAIK6 and TAIK11.

Appendix E – Mobile Phone Survey

Interface: Help improve your workplace. Report an idea or a barrier.

- Idea button pressed → Q00 (If Out of Taivas) or Q01 (If in Taivas)
- Barrier button pressed → Q00 (If Out of Taivas) or Q01 (If in Taivas)

Q0: Where were you?

- In transit → Q4
- Home → Q1
- Restaurant/Bar/Café → Q1
- Taivas → Q1
- In public space→ Q1
- Other Workplace → Q1
- Other → Q1

Q1: Were you engaged in activities:

- Alone → Q3
- With 1 other person → Q2
- With 2 or more persons → Q2

[First question if in beacon range and Idea/Barrier button pressed]

Q2: Who were you with? (Pick all that apply) → Q3

- Team member
- Colleague outside your team
- Client
- Boss
- Friend
- Family
- Other

Q3: What were you doing? (Name maximum 2 activities)→ Q6

Q4: How were you travelling? → Q5

- Bus/Tram/Train
- Driving
- Bike
- Walking
- Other

[Idea/Barrier button pressed while participant is in transit]

Q5: Were you travelling alone?

- Yes → Q3
- No → Q2

Q6: Congratulations! You have just earned a chance to win a bottle of wine.
Would you like to have another chance?

- Yes → Q7 (If Idea Button Pressed) or Q14 (if Barrier Button Pressed) or Q17 or Q23 (Randomized between Spatial and Social Branches)
- No → End1

Q7: Was this a: → Q8 [Idea Branch | only option if participant is travelling alone]
- Big idea
- Small idea

Q8: Was this idea connected to a client brief? → Q9
- Yes
- No

Q9: How long have you been working on this idea? → Q10
- Just got it
- Not long
- Sometime
- Very long

Q10: How important were others in creating this idea? → Q11
- Essential
- Important
- Somewhat important
- Not that important

Q11: Can you capture the situation that led to this idea?
- Take a picture → Q12
- Briefly describe in words→ Q13
- Not at this time → End2

Q12: Take a picture → End2

Q13: Describe the situation in 20 words or less→ End2

Q14: What was hindering you? (Pick all that apply) → Q15 [Barrier Branch]
- Person unavailable
- Missing information
- Equipment failure
- Distraction
- Uninspired
- Too much work or stress
- Too many tasks at the same time
- Too tired or bad mood
- Other

Q15: Were you frustrated? → Q16
- Not at all
- A little

- Somewhat
- Very much

Q16: Can you capture the situation that hindered you?
- Take a picture → Q12
- Briefly describe in words→ Q13
- Not at this time → End2

Q17: Why did you pick this space for your activities? (Pick all that apply) → Q18 [Spatial Branch]
- It was my normal workspace
- It was near/available
- Needed bigger space
- Needed presentation/ work tools
- Needed access to info
- Needed more privacy
- Needed to be around others
- Needed a change/stimuli
- Other

Q18: What was the most important spatial quality? → Q19
- Quiet
- Peaceful
- Good lighting
- Comfortable furniture
- Nice materials/colors
- Air quality
- Room temperature
- Other

Q19: What tools did you use? (Pick all that apply) → Q20
- Projector
- White board
- Wall space
- Work table
- Computer
- Phone
- Pen and paper
- Other

Q20: How important was this space for your activities? → Q21
- Essential
- Important
- Somewhat important
- Not that important

Q21: How much was this a productive use of your time overall? → Q22

- Very productive
- Quite productive
- Not much productive
- Not at all productive

Q22: How much stress were you experiencing? → End2

- A lot
- Quite a bit
- Not much
- None

Q23: Was your interaction with others: → Q24 [Social Interaction Branch]

- Scheduled
- Accidental

Q24: In interacting with others were you mostly: → Q25

- Providing info
- Somewhat providing
- Somewhat receiving
- Receiving info

Q25: How important was this interaction for your current activities? → Q21

- Essential
- Important
- Somewhat important
- Not that important

End1: Thank you for taking this survey! Your chances of winning a bottle of wine are __!

End2: Thank you for taking this survey! Your chances of winning a bottle of wine are __!

Appendix F – MyExperience XML Mobile Phone Survey Protocol

```
<?xml version="1.0" encoding="utf-8" ?>

<myexperience name="EgoTest" version="1.0">
  <!--Author: Anastasios Dimas: MIT | House_n Consortium | Workplace2 | Helsinki | Taivas (Ego)-->


  <globals>
    <property name="MyExperienceIsDebug" value="true" type="System.Boolean"/>
    <property name="RoomID" value="-1" type="System.Int32" />
    <property name="PreviousRoom" value="-1" type="System.Int32" />
    <property name="tStart" value="00:00:00" type="System.TimeSpan" />
    <property name="Launch" value="false" type="System.Boolean" />
    <property name="CounterReport" value="0" type="System.Int32" />
    <property name="SurveyCompletedTime" value="00:00:00" type="System.TimeSpan" />
    <property name="Timer" value="-1" type="System.Int32" />
  </globals>


  <sensors>
    <sensor name="StartSensor" type="MyExperienceInitializedSensor" />
    <sensor name="BluetoothSensor" type="House_n.Sensors.BluetoothBeaconSensor" />
    <!--Data Upload Time Sensor-->
    <sensor name="TimeSensor" type="TimeSensor">
      <property name="Resolution" value="Minute"/>
    </sensor>
  </sensors>


  <actions>
    <action name="SurveyIdea1" type="SurveyAction">
      <!--If Idea button pressed while in Taivas-->
      <property name="EntryQuestionId" value="Q01" />
      <property name="TimeOutInterval" value="00:05:00" />
      <property name="TimeOutText" value="You forgot to finish a survey. Press any key to finish it
now." />
      <property name="TimeOutUseVibration" value="true" />
      <property name="TimeOutUseSound" value="false" />
      <property name="TimeOutUseLed" value="true" />
      <property name="AllowBack" value="true" />
    </action>

    <action name="SurveyIdea2" type="SurveyAction">
      <!--If Idea button pressed while out of Taivas-->
      <property name="EntryQuestionId" value="Q00" />
      <property name="TimeOutInterval" value="00:05:00" />
      <property name="TimeOutText" value="You forgot to finish a survey. Press any key to finish it
now." />
      <property name="TimeOutUseVibration" value="true" />
      <property name="TimeOutUseSound" value="false" />
      <property name="TimeOutUseLed" value="true" />
      <property name="AllowBack" value="true" />
    </action>

    <action name="SurveyBarrier1" type="SurveyAction">
      <!--If Barrier button pressed while in Taivas-->
      <property name="EntryQuestionId" value="Q01" />
      <property name="TimeOutInterval" value="00:05:00" />
      <property name="TimeOutText" value="You forgot to finish a survey. Press any number key to finish
it now." />
      <property name="TimeOutUseVibration" value="true" />
      <property name="TimeOutUseSound" value="false" />
      <property name="TimeOutUseLed" value="true" />
      <property name="AllowBack" value="true" />
    </action>

    <action name="SurveyBarrier2" type="SurveyAction">
      <!--If Barrier button pressed while out of Taivas-->
      <property name="EntryQuestionId" value="Q00" />
      <property name="TimeOutInterval" value="00:05:00" />
      <property name="TimeOutText" value="You forgot to finish a survey. Press any number key to finish
it now." />
      <property name="TimeOutUseVibration" value="true" />
```

```
      <property name="TimeOutUseSound" value="false" />
      <property name="TimeOutUseLed" value="true" />
      <property name="AllowBack" value="true" />
    </action>

    <action name="SurveyPrompt" type="MessageAction">
      <property name="Title" value="EGO | Helsinki | Workplace2" />
      <property name="Text" value="Help improve your workspace. Report an idea or a barrier" />
      <property name="FontTextSize" value="14.0" />
      <property name="AlwaysOnTop" value="false" />
      <property name="ShowTwoOptions" value="true" />
      <property name="LeftButtonText" value="Idea!" />
      <property name="RightButtonText" value="Barrier!" />
    </action>

    <action name="SurveyBluetooth" type="SurveyAction">
      <property name="EntryQuestionId" value="Q01" />
      <property name="TimeOutInterval" value="00:05:00" />
      <property name="TimeOutText" value="You forgot to finish a survey. Press any number key to finish
it now." />
      <property name="TimeOutUseVibration" value="true" />
      <property name="TimeOutUseSound" value="false" />
      <property name="TimeOutUseLed" value="true" />
      <property name="AllowBack" value="true" />
    </action>

    <action name="CounterReport" type="NotificationAction">
      <property name="Title" value="Counter Report" />
      <property name="FontTextSize" value="14.0" />
      <property name="DisplayInterval" value="00:00:30" />
      <property name="AutoAppendDisplayIntervalCountdown" value="false" />
      <property name="AutoAppendSnoozeCount" value="false" />
      <property name="MaximumReminders" value="0" />
      <property name="TurnOnScreen" value="false" />
      <!--<property name="UseLed" value="false" />-->
      <property name="UseSound" value="false" />
      <property name="UseVibration" value="false" />
    </action>

    <action name="Upload" type="House_n.Web.DataSendAction">
      <property name="UploadID" value="TAIK1"/>
    </action>

    <action name="PlaySoundAction" type="PlaySoundAction">
      <property name="SoundFile" value="\Storage Card\notify.wav"/>
    </action>
  </actions>


  <triggers>
    <trigger name="StartTrigger" type="Trigger">
      <script>
        startSensorSnapshot = GetSensorStateSnapshot("StartSensor");

        while (true){
                prompt = CreateAction("SurveyPrompt");
                location = GetGlobalProperty("RoomID");

                if(location = -1){
                   //user is out of the office
                   if (prompt.Run() = "Yes"){
                       survey = CreateAction("SurveyIdea2");
                       survey.Run();
                   }
                   else{
                        survey = CreateAction("SurveyBarrier2");
                        survey.Run();
                   }
                }

                if(location != -1){
                   //user is in the office
                   if (prompt.Run() = "Yes"){
                       survey = CreateAction("SurveyIdea1");
                       survey.Run();
                   }
```

```
                    else{
                         survey = CreateAction("SurveyBarrier1");
                         survey.Run();
                    }
                }
                Log("info","try again");
        }
      </script>
    </trigger>

    <trigger name="BluetoothTrigger" type="Trigger">
      <script>
        Snap = GetSensorStateSnapshot("BluetoothSensor");
        hashtable = Snap.StateEntered.Value;

        previousRoom = GetGlobalProperty("RoomID");
        SetGlobalProperty("PreviousRoom",previousRoom);

        //Assumed location: Out of Taivas - Room-1
        if((Contains(hashtable, "Beacon 1t") = false) and
           (Contains(hashtable, "Beacon 2t") = false) and
           (Contains(hashtable, "Beacon 3t") = false) and
           (Contains(hashtable, "Beacon 4t") = false) and
           (Contains(hashtable, "Beacon 5t") = false) and
           (Contains(hashtable, "Beacon 6t") = false) and
           (Contains(hashtable, "Beacon 7t") = false) and
           (Contains(hashtable, "Beacon 8t") = false) and
           (Contains(hashtable, "Beacon 9t") = false) and
           (Contains(hashtable, "Beacon 10t") = false) and
           (Contains(hashtable, "Beacon 11t") = false) and
           (Contains(hashtable, "Beacon 12t") = false) and
           (Contains(hashtable, "Beacon 13t") = false) and
           (Contains(hashtable, "Beacon 14t") = false) and
           (Contains(hashtable, "Nok 1t") = false) and
           (Contains(hashtable, "Nok 2t") = false) and
           (Contains(hashtable, "Nok 3t") = false) and
           (Contains(hashtable, "Nok 4t") = false) and
           (Contains(hashtable, "Nok 5t") = false) and
           (Contains(hashtable, "Sam 1t") = false) and
           (Contains(hashtable, "Sam 2t") = false) and
           (Contains(hashtable, "Sam 3t") = false) and
           (Contains(hashtable, "Sam 4t") = false) and
           (Contains(hashtable, "Sam 8t") = false) and
           (Contains(hashtable, "Sam 10t") = false))
        {SetGlobalProperty("RoomID", -1);}

        //Assumed location: Cafeteria - Room1
        if(Contains(hashtable, "Beacon 1t") = true){SetGlobalProperty("RoomID", 1);}

        if(Contains(hashtable, "Beacon 13t") = true){SetGlobalProperty("RoomID", 1);}

        //Assumed location: PhotoShoot space - Room2
        if((Contains(hashtable, "Beacon 2t") = true) and (Contains(hashtable, "Beacon 7t") = true) and
(Contains(hashtable, "Nok 1t") = true))
        {SetGlobalProperty("RoomID", 2);}

        //Assumed location: Lounge meeting1 - Room3
        if(Contains(hashtable, "Beacon 3t") = true){SetGlobalProperty("RoomID", 3);}

        //Assumed location: Lounge meeting2 - Room4
        if(Contains(hashtable, "Beacon 4t") = true){SetGlobalProperty("RoomID", 4);}

        //Assumed location: Meeting Room1 - Room5
        if(Contains(hashtable, "Beacon 5t") = true){SetGlobalProperty("RoomID", 5);}

        if(Contains(hashtable, "Beacon 14t") = true){SetGlobalProperty("RoomID", 5);}

        //Assumed location: Meeting Room2 - Room6
        if((Contains(hashtable, "Beacon 6t") = true) and (Contains(hashtable, "Beacon 12t") = true))
        {SetGlobalProperty("RoomID", 6);}

        if((Contains(hashtable, "Beacon 12t") = true) and (Contains(hashtable, "Sam 1t") = true))
        {SetGlobalProperty("RoomID", 6);}

        //Assumed location: Table lounge1 - Room7
        if((Contains(hashtable, "Beacon 7t") = true) and (Contains(hashtable, "Beacon 12t") = true))
```

```
        {SetGlobalProperty("RoomID", 7);}

        //Assumed location: Desk - Room8
        if((Contains(hashtable, "Beacon 7t") = true) and (Contains(hashtable, "Beacon 8t") = true))
        {SetGlobalProperty("RoomID", 8);}

        //Assumed location: Desk - Room9
        if((Contains(hashtable, "Beacon 7t") = true) and (Contains(hashtable, "Nok 1t") = true)
        and (Contains(hashtable, "Beacon 2t") = false))
        {SetGlobalProperty("RoomID", 9);}

        if((Contains(hashtable, "Beacon 12t") = true) and (Contains(hashtable, "Nok 1t") = true)
        and (Contains(hashtable, "Beacon 7t") = false) and (Contains(hashtable, "Beacon 9t") = false))
        {SetGlobalProperty("RoomID", 9);}

        //Assumed location: Desk - Room10
        if((Contains(hashtable, "Beacon 9t") = true) and (Contains(hashtable, "Beacon 12t") = true))
        {SetGlobalProperty("RoomID", 10);}

        //Assumed location: Desk - Room11
        if((Contains(hashtable, "Beacon 12t") = true) and (Contains(hashtable, "Beacon 9t") = false)
        and (Contains(hashtable, "Beacon 10t") = false) and (Contains(hashtable, "Nok 1t") = false)
        and (Contains(hashtable, "Beacon 11t") = false))
        {SetGlobalProperty("RoomID", 11);}

        //Assumed location: Desk - Room12
        if((Contains(hashtable, "Beacon 10t") = true) and (Contains(hashtable, "Beacon 12t") = true))
        {SetGlobalProperty("RoomID", 12);}

        //Assumed location: Table Lounge2 - Room13
        if((Contains(hashtable, "Beacon 11t") = true) and (Contains(hashtable, "Beacon 12t") = true))
        {SetGlobalProperty("RoomID", 13);}

        //Assumed location: Desk - Room14
        if((Contains(hashtable, "Beacon 12t") = true) and (Contains(hashtable, "Sam 1t") = true)
        and (Contains(hashtable, "Sam 2t") = true) and (Contains(hashtable, "Sam 3t") = false))
        {SetGlobalProperty("RoomID", 14);}

        //Assumed location: Desk - Room15
        if((Contains(hashtable, "Beacon 12t") = true) and (Contains(hashtable, "Sam 1t") = true)
        and (Contains(hashtable, "Sam 2t") = true) and (Contains(hashtable, "Sam 3t") = true)
        and (Contains(hashtable, "Sam 4t") = false))
        {SetGlobalProperty("RoomID", 15);}

        //Assumed location: Desk - Room16
        if((Contains(hashtable, "Beacon 12t") = true) and (Contains(hashtable, "Sam 1t") = true)
        and (Contains(hashtable, "Sam 2t") = true) and (Contains(hashtable, "Sam 3t") = true)
        and (Contains(hashtable, "Sam 4t") = true))
        {SetGlobalProperty("RoomID", 16);}

        //Assumed location: Desk - Room17
        if((Contains(hashtable, "Beacon 12t") = false) and (Contains(hashtable, "Sam 1t") = false)
        and (Contains(hashtable, "Sam 2t") = true) and (Contains(hashtable, "Sam 3t") = true)
        and (Contains(hashtable, "Sam 4t") = true))
        {SetGlobalProperty("RoomID", 17);}

        //Assumed location: Printer Lounge2 - Room18
        if(Contains(hashtable, "Sam 8t") = true and (Contains(hashtable, "Nok 3t") =
false)){SetGlobalProperty("RoomID", 18);}

        //Assumed location: Desk - Room19
        if((Contains(hashtable, "Nok 1t") = false) and (Contains(hashtable, "Nok 2t") = false)
        and (Contains(hashtable, "Nok 3t") = false) and (Contains(hashtable, "Nok 4t") = true)
        and (Contains(hashtable, "Nok 5t") = true))
        {SetGlobalProperty("RoomID", 19);}

        if((Contains(hashtable, "Nok 1t") = false) and (Contains(hashtable, "Nok 2t") = false)
        and (Contains(hashtable, "Nok 3t") = true) and (Contains(hashtable, "Nok 4t") = true)
        and (Contains(hashtable, "Nok 5t") = true))
        {SetGlobalProperty("RoomID", 19);}

        //Assumed location: Desk - Room20
        if((Contains(hashtable, "Nok 1t") = false) and (Contains(hashtable, "Nok 2t") = false)
        and (Contains(hashtable, "Nok 3t") = true) and (Contains(hashtable, "Nok 4t") = true)
        and (Contains(hashtable, "Nok 5t") = false))
        {SetGlobalProperty("RoomID", 20);}
```

```
if((Contains(hashtable, "Nok 1t") = false) and (Contains(hashtable, "Nok 2t") = true)
and (Contains(hashtable, "Nok 3t") = true) and (Contains(hashtable, "Nok 4t") = true)
and (Contains(hashtable, "Nok 5t") = false))
{SetGlobalProperty("RoomID", 20);}

if((Contains(hashtable, "Nok 1t") = false) and (Contains(hashtable, "Nok 2t") = true)
and (Contains(hashtable, "Nok 3t") = true) and (Contains(hashtable, "Nok 4t") = true)
and (Contains(hashtable, "Nok 5t") = true))
{SetGlobalProperty("RoomID", 20);}

//Assumed location: Desk - Room21
if((Contains(hashtable, "Nok 1t") = true) and (Contains(hashtable, "Nok 2t") = true)
and (Contains(hashtable, "Nok 3t") = true) and (Contains(hashtable, "Nok 4t") = false)
and (Contains(hashtable, "Nok 5t") = false))
{SetGlobalProperty("RoomID", 21);}

if((Contains(hashtable, "Nok 1t") = true) and (Contains(hashtable, "Nok 2t") = false)
and (Contains(hashtable, "Nok 3t") = true) and (Contains(hashtable, "Nok 4t") = true)
and (Contains(hashtable, "Nok 5t") = false))
{SetGlobalProperty("RoomID", 21);}

//Assumed location: Desk - Room22
if((Contains(hashtable, "Nok 1t") = true) and (Contains(hashtable, "Nok 2t") = false)
and (Contains(hashtable, "Nok 3t") = false) and (Contains(hashtable, "Nok 4t") = true)
and (Contains(hashtable, "Nok 5t") = false) and (Contains(hashtable, "Beacon 12t") = false))
{SetGlobalProperty("RoomID", 22);}

//Assumed location: Red couch - Room23
if(Contains(hashtable, "Sam 10t") = true){SetGlobalProperty("RoomID", 23);}


roomID = GetGlobalProperty("RoomID");
prevRoom = GetGlobalProperty("PreviousRoom");

if(prevRoom != roomID){
   timer = 0;
   SetGlobalProperty("Timer",timer);
   if(roomID!= -1){

      //Start timer
      timeStart = GetTime();
      SetGlobalProperty("tStart",timeStart);

      //Creates a 15 minute delay, once Q01 or End1 or End2 pops, between prompts
      //(no need to answer Q01 in order to work)
      timeLastSurveyCompleted = GetGlobalProperty("SurveyCompletedTime");
      timeCheck = GetTimeSpan("00:15:00");
      timeTrigger = timeStart - timeLastSurveyCompleted;
      if(timeTrigger > timeCheck){

         if(roomID = 1){
            timeLimit = 120;
         }
         else{
             timeLimit = 600;
         }

         for i=0 to timeLimit{
                timer = GetGlobalProperty("Timer");
                timer = timer+1;
                SetGlobalProperty("Timer",timer);
                if (timer >= timeLimit){
                    SetGlobalProperty("Launch",true);
                }
                Sleep(1000);
         }

         launch = GetGlobalProperty("Launch");
         if (launch = true){
             if((IsActionExecuting("SurveyIdea1")= false)     and
                (IsActionExecuting("SurveyIdea2")= false)     and
                (IsActionExecuting("SurveyBarrier1")= false)  and
                (IsActionExecuting("SurveyBarrier2")= false)  and
                (IsActionExecuting("SurveyBluetooth")= false)){
```

```
                        SetGlobalProperty("Launch",false);
                        playerAction = CreateAction("PlaySoundAction");
                        playerAction.RunAsync();

                        Log("info","Run Survey1 from menu");
                        survey = CreateAction("SurveyBluetooth");
                        survey.Run();
                    }
                }
            }
        }
    }
  </script>
</trigger>

<trigger name="TimeTrigger" type="Trigger">
  <script>
    timeSensorSnapshot = GetSensorStateSnapshot("TimeSensor");
    minuteValue = timeSensorSnapshot.StateEntered.Value.Minutes;

    if ((minuteValue % 15) = 0){
        //Sends sdf and lof files to House_n server
        upload = CreateAction("Upload");
        upload.Run();
        Log("info","try again");
    }
  </script>
</trigger>

<trigger name="TimeTrigger2" type="Trigger">
  <script>
    timeSensorSnapshot = GetSensorStateSnapshot("TimeSensor");
    timeValue = timeSensorSnapshot.StateEntered.Value;
    if(timeValue = "00:01:00"){

    //Sets SurveyCounter to zero every Thursday midnight
    cur_date = GetDateTime();
    if(cur_date.DayOfWeek = "Thursday"){
        counterValue = GetGlobalProperty("SurveyCounter");
        SetGlobalProperty("CounterReport", counterValue);
        SetGlobalProperty("SurveyCounter",0);
    }

    counterReport = GetGlobalProperty("CounterReport");
    msgString = "Thank you for participating. Your weekly score is: " # counterReport;
    report = CreateAction("CounterReport");
    report.Text = msgString;
    report.Run();
    Log("info","try again");
    }
  </script>
</trigger>
</triggers>


<questions>

  <!--Q00 | First question if out of beacon range and Idea/Barrier button pressed-->
  <question id="Q00" text="Where were you?">
    <response widget="RadioButtonList">
      <options>
        <option goto="Q04">In transit</option>
        <option goto="Q01">Home</option>
        <option goto="Q01">Restaurant/Bar/Cafe</option>
        <option goto="Q01">Taivas</option>
        <option goto="Q01">In public space</option>
        <option goto="Q01">Other workplace</option>
        <option goto="Q01">Other</option>
      </options>
    </response>
  </question>

  <!--Q01 | First question if in beacon range and Idea/Barrier button pressed-->
  <question id="Q01" text="Were you engaged in activities:">
    <response widget="RadioButtonList">
      <options>
```

```
        <option goto="Q03">Alone</option>
        <option goto="Q02">With 1 other person</option>
        <option goto="Q02">With 2 or more persons</option>
      </options>
    </response>
    <script event = "OnLoad">
      timeNow = GetTime();
      SetGlobalProperty("SurveyCompletedTime", timeNow);
    </script>
  </question>

  <!--Q02-->
  <question id="Q02" text="Who were you with?\n(Pick all that apply)\nScroll down for more options">
    <property name="NextQuestionId" value="Q03" />
    <response widget="CheckBoxList">
      <options>
        <option>Team member(s)</option>
        <option>Colleague(s) outside my team</option>
        <option>Client(s)</option>
        <option>Boss</option>
        <option>Friend</option>
        <option>Family</option>
        <option>Other</option>
      </options>
    </response>
  </question>

  <!--Q03-->
  <question id="Q03" text="What were you doing?\n(name maximum 2 activities)">
    <script event="OnComplete">
      if(IsActionExecuting("SurveyIdea1")= true){
         Goto("Q06a");
      }
      if(IsActionExecuting("SurveyBarrier1")= true){
         Goto("Q06b");
      }
      if(IsActionExecuting("SurveyIdea2")= true){
         Goto("Q06c");
      }
      if(IsActionExecuting("SurveyBarrier2")= true){
         Goto("Q06d");
      }
      if(IsActionExecuting("SurveyBluetooth")= true){
         Goto("Q06e");
      }
    </script>
    <response widget="MultilineTextBox" />
  </question>

  <!--Q04 | Idea/Barrier Button in transit-->
  <question id="Q04" text="How were you traveling?\nScroll down for more options">
    <property name="NextQuestionId" value="Q05" />
    <response widget="RadioButtonList">
      <options>
        <option>Bus/ Tram/ Train</option>
        <option>Driving</option>
        <option>Bike</option>
        <option>Walking</option>
        <option>Other</option>
      </options>
    </response>
  </question>

  <!--Q05-->
  <question id="Q05" text="Were you traveling alone?">
    <response widget="RadioButtonList">
      <options>
        <option goto="Q03">Yes</option>
        <option goto="Q02">No</option>
      </options>
    </response>
  </question>

  <!--Q06a | Idea button pressed within the office - SurveyIdea1-->
  <question id="Q06a" text="Congratulations! You have just earned a chance to win a bottle of wine.
Would you like to have another chance?">
```

```
      <script event="OnComplete">
        //Set or increment Global Variable Counter by 1
        if(ContainsGlobalProperty("SurveyCounter")=false){
           SetGlobalProperty("SurveyCounter", 1);
        }
        else{
             counterValue = GetGlobalProperty("SurveyCounter");
             counterValue = counterValue+1;
             SetGlobalProperty("SurveyCounter", counterValue);
        }

        answer = GetResponse();
        answer1 = GetResponse("Q01");

        if(answer = "No"){
           Goto("End1");
        }
        else{
            if(answer1 = "Alone"){
               GotoRandom("Group1a"); //goes to Q07a1 or Q17a1
            }
            if(answer1 != "Alone" ){
               GotoRandom("Group1b"); //goes to Q07a2 or Q07a3 or Q17a2 or Q23a
               //added another version of Q07 (Q07a3) so that I have a 50% chance of it popping up
            }
        }
      </script>
      <response widget="RadioButtonList">
        <options>
          <option>Yes</option>
          <option>No</option>
        </options>
      </response>
    </question>

    <!--Q06b | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q06b" text="Congratulations! You have just earned a chance to win a bottle of wine.
Would you like to have another chance?">
      <script event="OnComplete">
        //Set or increment Global Variable Counter by 1
        if(ContainsGlobalProperty("SurveyCounter")=false){
           SetGlobalProperty("SurveyCounter", 1);
        }
        else{
             counterValue = GetGlobalProperty("SurveyCounter");
             counterValue = counterValue+1;
             SetGlobalProperty("SurveyCounter", counterValue);
        }

        answer = GetResponse();
        answer1 = GetResponse("Q01");

        if(answer = "No"){
           Goto("End1");
        }
        else{
            if(answer1 = "Alone"){
               GotoRandom("Group2a"); //goes to Q14a1 or Q17b1
            }
            if(answer1 != "Alone" ){
               GotoRandom("Group2b"); //goes to Q14a2 or Q14a3 or Q17b2 or Q23b
               //added another version of Q14 (Q14a3) so that I have a 50% chance of it popping up
            }
        }
      </script>
      <response widget="RadioButtonList">
        <options>
          <option>Yes</option>
          <option>No</option>
        </options>
      </response>
    </question>

    <!--Q06c | Idea button pressed outside the office - SurveyIdea2-->
    <question id="Q06c" text="Congratulations! You have just earned a chance to win a bottle of wine.
Would you like to have another chance?">
```

```
      <script event="OnComplete">
        //Set or increment Global Variable Counter by 1
        if(ContainsGlobalProperty("SurveyCounter")=false){
           SetGlobalProperty("SurveyCounter", 1);
        }
        else{
             counterValue = GetGlobalProperty("SurveyCounter");
             counterValue = counterValue+1;
             SetGlobalProperty("SurveyCounter", counterValue);
        }

        answer = GetResponse();
        answer1 = GetResponse("Q00");
        answer2 = GetResponse("Q01");
        answer3 = GetResponse("Q05");

        if(answer = "No"){
           Goto("End1");
        }
        else{
            if((answer1 = "In transit") and (answer3 = "Yes")){
               Goto("Q07b1");
            }
            if((answer1 = "In transit") and (answer3 = "No")){
               GotoRandom("Group3a"); //goes to Q07b1 or Q23c1
            }
            if((answer1 != "In transit") and (answer2 = "Alone")){
               GotoRandom("Group3b"); //goes to Q07b2 or Q17c1
            }
            if((answer1 != "In transit") and (answer2 != "Alone")){
               GotoRandom("Group3c"); //goes to Q07b3 or Q07b4 or Q17c2 or Q23c2
               //added another version of Q07 (Q07b4) so that I have a 50% chance of it popping up
            }
        }
      </script>
      <response widget="RadioButtonList">
        <options>
          <option>Yes</option>
          <option>No</option>
        </options>
      </response>
    </question>

    <!--Q06d | Barrier button pressed outside the office - SurveyBarrier2-->
    <question id="Q06d" text="Congratulations! You have just earned a chance to win a bottle of wine.
Would you like to have another chance?">
      <script event="OnComplete">
        //Set or increment Global Variable Counter by 1
        if(ContainsGlobalProperty("SurveyCounter")=false){
           SetGlobalProperty("SurveyCounter", 1);
        }
        else{
             counterValue = GetGlobalProperty("SurveyCounter");
             counterValue = counterValue+1;
             SetGlobalProperty("SurveyCounter", counterValue);
        }

        answer = GetResponse();
        answer1 = GetResponse("Q00");
        answer2 = GetResponse("Q01");
        answer3 = GetResponse("Q05");

        if(answer = "No"){
           Goto("End1");
        }
        else{
            if((answer1 = "In transit") and (answer3 = "Yes")){
               Goto("Q14b1");
            }
            if((answer1 = "In transit") and (answer3 = "No")){
               GotoRandom("Group4a"); //goes to Q14b1 or Q23d1
            }
            if((answer1 != "In transit") and (answer2 = "Alone")){
               GotoRandom("Group4b"); //goes to Q14b2 or Q17d1
            }
            if((answer1 != "In transit") and (answer2 != "Alone")){
```

```
                GotoRandom("Group4c"); //goes to Q14b3 or Q14b4 or Q17d2 or Q23d2
                //added another version of Q14 (Q14b4) so that I have a 50% chance of it popping up
            }
        }
      </script>
      <response widget="RadioButtonList">
        <options>
          <option>Yes</option>
          <option>No</option>
        </options>
      </response>
    </question>

    <!--Q06e | Bluetooth - SurveyBluetooth-->
    <question id="Q06e" text="Congratulations! You have just earned a chance to win a bottle of wine.
Would you like to have another chance?">
      <script event="OnComplete">
        //Set or increment Global Variable Counter by 1
        if(ContainsGlobalProperty("SurveyCounter")=false){
           SetGlobalProperty("SurveyCounter", 1);
        }
        else{
             counterValue = GetGlobalProperty("SurveyCounter");
             counterValue = counterValue+1;
             SetGlobalProperty("SurveyCounter", counterValue);
        }

        answer = GetResponse();
        answer2 = GetResponse("Q01");

        if(answer = "No"){
           Goto("End1");
        }
        else{
            if(answer2 = "Alone"){
               Goto("Q17e");
            }
            if(answer2 != "Alone"){
               GotoRandom("Group5"); //goes to Q17e or Q23e
            }
        }
      </script>
      <response widget="RadioButtonList">
        <options>
          <option>Yes</option>
          <option>No</option>
        </options>
      </response>
    </question>

    <!--Q07a1 | Idea button pressed within the office - SurveyIdea1-->
    <question id="Q07a1" text="Was this a: ">
      <property name="NextQuestionId" value="Q08" />
      <property name="QuestionGroup" value="Group1a" />
      <response widget="RadioButtonList">
        <options>
          <option>Big idea</option>
          <option>Small idea</option>
        </options>
      </response>
    </question>

    <!--Q07a2 | Idea button pressed within the office - SurveyIdea1-->
    <question id="Q07a2" text="Was this a: ">
      <property name="NextQuestionId" value="Q08" />
      <property name="QuestionGroup" value="Group1b" />
      <response widget="RadioButtonList">
        <options>
          <option>Big idea</option>
          <option>Small idea</option>
        </options>
      </response>
    </question>

    <!--Q07a3 | Idea button pressed within the office - SurveyIdea1 - chance increase-->
    <question id="Q07a3" text="Was this a: ">
```

```
  <property name="NextQuestionId" value="Q08" />
  <property name="QuestionGroup" value="Group1b" />
  <response widget="RadioButtonList">
    <options>
      <option>Big idea</option>
      <option>Small idea</option>
    </options>
  </response>
</question>

<!--Q07b1 | Idea button pressed outside the office - SurveyIdea2-->
<question id="Q07b1" text="Was this a: ">
  <property name="NextQuestionId" value="Q08" />
  <property name="QuestionGroup" value="Group3a" />
  <response widget="RadioButtonList">
    <options>
      <option>Big idea</option>
      <option>Small idea</option>
    </options>
  </response>
</question>

<!--Q07b2 | Idea button pressed outside the office - SurveyIdea2-->
<question id="Q07b2" text="Was this a: ">
  <property name="NextQuestionId" value="Q08" />
  <property name="QuestionGroup" value="Group3b" />
  <response widget="RadioButtonList">
    <options>
      <option>Big idea</option>
      <option>Small idea</option>
    </options>
  </response>
</question>

<!--Q07b3 | Idea button pressed outside the office - SurveyIdea2-->
<question id="Q07b3" text="Was this a: ">
  <property name="NextQuestionId" value="Q08" />
  <property name="QuestionGroup" value="Group3c" />
  <response widget="RadioButtonList">
    <options>
      <option>Big idea</option>
      <option>Small idea</option>
    </options>
  </response>
</question>

<!--Q07b4 | Idea button pressed outside the office - SurveyIdea2 - chance increase-->
<question id="Q07b4" text="Was this a: ">
  <property name="NextQuestionId" value="Q08" />
  <property name="QuestionGroup" value="Group3c" />
  <response widget="RadioButtonList">
    <options>
      <option>Big idea</option>
      <option>Small idea</option>
    </options>
  </response>
</question>

<!--Q08-->
<question id="Q08" text="Was this idea connected to a client brief?">
  <property name="NextQuestionId" value="Q09" />
  <response widget="RadioButtonList">
    <options>
      <option>Yes</option>
      <option>No</option>
    </options>
  </response>
</question>

<!--Q09-->
<question id="Q09" text="How long have you been working on this idea?">
  <property name="NextQuestionId" value="Q10" />
  <response widget="RadioButtonList">
    <options>
      <option>Just got it</option>
      <option>Not long</option>
```

```
          <option>Sometime</option>
          <option>Very long</option>
        </options>
      </response>
    </question>

    <!--Q10-->
    <question id="Q10" text="How important were others \nin creating this idea?">
      <property name="NextQuestionId" value="Q11" />
      <response widget="RadioButtonList">
        <options>
          <option>Essential</option>
          <option>Important</option>
          <option>Somewhat important</option>
          <option>Not that important</option>
        </options>
      </response>
    </question>

    <!--Q11-->
    <question id="Q11" text="Can you capture the situation that led to this idea?">
      <response widget="RadioButtonList">
        <options>
          <option goto="Q12">Take a picture</option>
          <option goto="Q13">Briefly describe in words</option>
          <option goto="End2">Not at this time</option>
        </options>
      </response>
    </question>

    <!--Q12-->
    <question id="Q12" text="">
      <property name="NextQuestionId" value="End2" />
      <response widget="CameraWidget" />
    </question>

    <!--Q13-->
    <question id="Q13" text="Describe the situation in 20 words or less.">
      <property name="NextQuestionId" value="End2" />
      <response widget="MultilineTextBox" />
    </question>

    <!--Q14a1 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q14a1" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group2a" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q14a2 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q14a2" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group2b" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
```

```
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q14a3 | Barrier button pressed within the office - SurveyBarrier1 - chance increase-->
    <question id="Q14a3" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group2b" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q14b1 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q14b1" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group4a" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q14b2 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q14b2" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group4b" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q14b3 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q14b3" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group4c" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
```

```
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q14b4 | Barrier button pressed within the office - SurveyBarrier1 - chance increase-->
    <question id="Q14b4" text="What was hindering you?\n(Pick all that apply)\nScroll down for more
options">
      <property name="QuestionGroup" value="Group4c" />
      <property name="NextQuestionId" value="Q15" />
      <response widget="CheckBoxList">
        <options>
          <option>Person unavailable</option>
          <option>Missing information</option>
          <option>Equipment failure</option>
          <option>Distraction</option>
          <option>Uninspired</option>
          <option>Too much work or stress</option>
          <option>Too many tasks at the same time</option>
          <option>Too tired or bad mood</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q15-->
    <question id="Q15" text="Were you frustrated?">
      <property name="NextQuestionId" value="Q16" />
      <response widget="RadioButtonList">
        <options>
          <option>Not at all</option>
          <option>A little</option>
          <option>Somewhat</option>
          <option>Very much</option>
        </options>
      </response>
    </question>

    <!--Q16-->
    <question id="Q16" text="Can you capture the situation that hindered you?">
      <response widget="RadioButtonList">
        <options>
          <option goto="Q12">Take a picture</option>
          <option goto="Q13">Briefly describe in words</option>
          <option goto="End2">Not at this time</option>
        </options>
      </response>
    </question>

    <!--Q17a1 | Idea button pressed within the office - SurveyIdea1-->
    <question id="Q17a1" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group1a" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17a2 | Idea button pressed within the office - SurveyIdea1-->
```

```
    <question id="Q17a2" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group1b" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17b1 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q17b1" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group2a" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17b2 | Barrier button pressed within the office - SurveyBarrier1-->
    <question id="Q17b2" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group2b" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17c1 | Idea button pressed outside the office - SurveyIdea2-->
    <question id="Q17c1" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group3b" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
```

```
      </response>
    </question>

    <!--Q17c2 | Idea button pressed outside the office - SurveyIdea2-->
    <question id="Q17c2" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group3c" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17d1 | Barrier button pressed outside the office - SurveyBarrier2-->
    <question id="Q17d1" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group4b" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17d2 | Barrier button pressed outside the office - SurveyBarrier2-->
    <question id="Q17d2" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group4c" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q17e | Bluetooth - SurveyBluetooth-->
    <question id="Q17e" text="Why did you pick this space for your activities?\n(Pick all that
apply)\nScroll down for more options">
      <property name="NextQuestionId" value="Q18" />
      <property name="QuestionGroup" value="Group5" />
      <response widget="CheckBoxList">
        <options>
          <option>It was my normal workspace</option>
          <option>It was near/available</option>
          <option>Needed bigger space</option>
          <option>Needed presentation/ work tools</option>
          <option>Needed access to info</option>
          <option>Needed more privacy</option>
```

```
          <option>Needed to be around others</option>
          <option>Needed a change/stimuli</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q18-->
    <question id="Q18" text="What was the most important spatial quality?\nScroll down for more
options">
      <property name="NextQuestionId" value="Q19" />
      <response widget="RadioButtonList">
        <options>
          <option>Quiet</option>
          <option>Peaceful</option>
          <option>Good Lightning</option>
          <option>Comfortable furniture</option>
          <option>Nice materials/colors</option>
          <option>Air quality</option>
          <option>Room temperature</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q19-->
    <question id="Q19" text="What tools did you use?\n(Pick all that apply)\nScroll down for more
options">
      <property name="NextQuestionId" value="Q20" />
      <response widget="CheckBoxList">
        <options>
          <option>Projector</option>
          <option>White board</option>
          <option>Wall space</option>
          <option>Work table</option>
          <option>Computer</option>
          <option>Phone</option>
          <option>Pen and paper</option>
          <option>Other</option>
        </options>
      </response>
    </question>

    <!--Q20-->
    <question id="Q20" text="How important was this space for your activities?">
      <property name="NextQuestionId" value="Q21" />
      <response widget="RadioButtonList">
        <options>
          <option>Essential</option>
          <option>Important</option>
          <option>Somewhat important</option>
          <option>Not that important</option>
        </options>
      </response>
    </question>

    <!--Q21-->
    <question id="Q21" text="How much was this a productive use of your time overall?">
      <property name="NextQuestionId" value="Q22" />
      <response widget="RadioButtonList">
        <options>
          <option>Very productive</option>
          <option>Quite productive</option>
          <option>Not much productive</option>
          <option>Not at all productive</option>
        </options>
      </response>
    </question>

    <!--Q22-->
    <question id="Q22" text="How much stress were you experiencing?">
      <property name="NextQuestionId" value="End2" />
      <response widget="RadioButtonList">
        <options>
          <option>A lot</option>
          <option>Quite a bit</option>
```

```
      <option>Not much</option>
      <option>None</option>
    </options>
  </response>
</question>

<!--Q23a-->
<question id="Q23a" text="Was your interaction with others:">
  <property name="NextQuestionId" value="Q24" />
  <property name="QuestionGroup" value="Group1b" />
  <response widget="RadioButtonList">
    <options>
      <option>Scheduled</option>
      <option>Accidental</option>
    </options>
  </response>
</question>

<!--Q23b-->
<question id="Q23b" text="Was your interaction with others:">
  <property name="NextQuestionId" value="Q24" />
  <property name="QuestionGroup" value="Group2b" />
  <response widget="RadioButtonList">
    <options>
      <option>Scheduled</option>
      <option>Accidental</option>
    </options>
  </response>
</question>

<!--Q23c1-->
<question id="Q23c1" text="Was your interaction with others:">
  <property name="NextQuestionId" value="Q24" />
  <property name="QuestionGroup" value="Group3a" />
  <response widget="RadioButtonList">
    <options>
      <option>Scheduled</option>
      <option>Accidental</option>
    </options>
  </response>
</question>

<!--Q23c2-->
<question id="Q23c2" text="Was your interaction with others:">
  <property name="NextQuestionId" value="Q24" />
  <property name="QuestionGroup" value="Group3c" />
  <response widget="RadioButtonList">
    <options>
      <option>Scheduled</option>
      <option>Accidental</option>
    </options>
  </response>
</question>

<!--Q23d1-->
<question id="Q23d1" text="Was your interaction with others:">
  <property name="NextQuestionId" value="Q24" />
  <property name="QuestionGroup" value="Group4a" />
  <response widget="RadioButtonList">
    <options>
      <option>Scheduled</option>
      <option>Accidental</option>
    </options>
  </response>
</question>

<!--Q23d2-->
<question id="Q23d2" text="Was your interaction with others:">
  <property name="NextQuestionId" value="Q24" />
  <property name="QuestionGroup" value="Group4c" />
  <response widget="RadioButtonList">
    <options>
      <option>Scheduled</option>
      <option>Accidental</option>
    </options>
  </response>
```

```
    </question>

    <!--Q23e-->
    <question id="Q23e" text="Was your interaction with others:">
      <property name="NextQuestionId" value="Q24" />
      <property name="QuestionGroup" value="Group5" />
      <response widget="RadioButtonList">
        <options>
          <option>Scheduled</option>
          <option>Accidental</option>
        </options>
      </response>
    </question>

    <!--Q24-->
    <question id="Q24" text="In interacting with others were you mostly:">
      <property name="NextQuestionId" value="Q25" />
      <response widget="RadioButtonList">
        <options>
          <option>Proving info</option>
          <option>Somewhat providing</option>
          <option>Somewhat receiving</option>
          <option>Receiving info</option>
        </options>
      </response>
    </question>

    <!--Q25-->
    <question id="Q25" text="How important was this interaction for your current activities?">
      <property name="NextQuestionId" value="Q21" />
      <response widget="RadioButtonList">
        <options>
          <option>Essential</option>
          <option>Important</option>
          <option>Somewhat important</option>
          <option>Not that important</option>
        </options>
      </response>
    </question>

    <!--End1 Message-->
    <question id="End1" text="Thank you for taking this survey!\n\nYour chances of winning a bottle of
wine are @SurveyCounter!">
      <parameter name = "SurveyCounter">return GetGlobalProperty("SurveyCounter");</parameter>
      <response widget="EmptyWidget" />
      <script event = "OnLoad">
        timeNow = GetTime();
        SetGlobalProperty("SurveyCompletedTime", timeNow);
      </script>
    </question>

    <!--End2 Message-->
    <question id="End2" text="Thank you for taking this survey!\n\nYour chances of winning a bottle of
wine are @SurveyCounter!">
      <parameter name = "SurveyCounter">return GetGlobalProperty("SurveyCounter");</parameter>
      <response widget="EmptyWidget" />
      <script event = "OnLoad">
        counter=GetGlobalProperty("SurveyCounter");
        counter=counter+1;
        SetGlobalProperty("SurveyCounter", counter);
        timeNow = GetTime();
        SetGlobalProperty("SurveyCompletedTime", timeNow);
      </script>
    </question>
  </questions>

</myexperience>
```

Appendix G – Taivas Beacon Map

```
<?xml version="1.0"?>
<SerializableHashTable xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
_0012625CB6C5="Nok 1t"
_0017E5D1E03A="Nok 2t"
_00192D40102D="Nok 3t"
_0012D21B4C6C="Nok 4t"
_001979CC55D3="Nok 5t"
_0015DE00FC4C="Nok 6t"
_0021D2633806="Sam 1t"
_0021D2633804="Sam 2t"
_0021D2633872="Sam 3t"
_0021D263386D="Sam 4t"
_0021D2F417D1="Sam 5t"
_0021D227484F="Sam 6t"
_0021D263381A="Sam 7t"
_0023398DEF66="Sam 8t"
_0021D2F417C3="Sam 9t"
_0021D26338A3="Sam 10t"
_000EA5100645="Beacon 1t"
_000EA5100668="Beacon 2t"
_000EA5100669="Beacon 3t"
_000EA5100670="Beacon 4t"
_000EA5100671="Beacon 5t"
_000EA5100672="Beacon 6t"
_000EA5100675="Beacon 7t"
_000EA5100676="Beacon 8t"
_000EA5100677="Beacon 9t"
_000EA5100678="Beacon 10t"
_000EA5100679="Beacon 11t"
_000EA5100680="Beacon 12t"
_000EA5100644="Beacon 13t"
_000EA5100673="Beacon 14t"/>
```

Appendix H – Bluetooth Sensor for MyExperience (BeaconSensor.cs & BluetoothBeaconSensor.cs)

BeaconSensor.cs:

```
using System;
using System.Collections.Generic;
using System.Text;
using InTheHand.Net.Sockets;
using InTheHand.Net;
using System.Resources;
using System.Reflection;
using System.Xml.Serialization;
using System.Collections;
using System.Xml.Schema;
using System.Xml;
using System.Threading;
using System.IO;

namespace House_n.Sensors
{
	public class BeaconEventArgs : EventArgs
	{
		//private string _beaconID;
		private SerializableHashTable _beaconIDs;
		private object _sender;

		public object Sender
		{
			get
			{
				return _sender;
			}
		}

		public SerializableHashTable BeaconIDs
		{
			get
			{
				return _beaconIDs;
			}
		}

		public BeaconEventArgs(object sender, SerializableHashTable beaconIDs)
		{
			_sender = sender;
			_beaconIDs = beaconIDs;
		}
	}
```

```
public class BeaconSensor
{
        private BluetoothClient client;
        private ResourceManager manager;
        private BluetoothDeviceInfo currentDevice = null;
        private SerializableHashTable beaconPlaces;
        private static string MAPPING_FILENAME = "beaconMap.xml";
        public delegate void BeaconEventHandler(BeaconEventArgs data);
        public event BeaconEventHandler NearBeacons;
        private Thread sensorThread;
        private bool killThread = false;
        private int timer = 0;
        private int previousRoom = -1;
        private int roomID = -1;
        private bool launchSurvey = false;

        //Constructor
        public BeaconSensor()
        {
                client = new BluetoothClient();
                manager = new ResourceManager("beacons", Assembly.GetExecutingAssembly());
                beaconPlaces = new SerializableHashTable();
                readXML();
        }

        private BluetoothDeviceInfo[] discoverDevices()
        {
            return client.DiscoverDevices(8, false, false, true);
            //Max no. of devices,bool authenticated, bool remembered, bool unknown
        }

            //Returns condition for launching Survey
            public bool LaunchSurvey{
               get{
                  return this.launchSurvey;
               }
               set{
                  this.launchSurvey = value;
               }
            }

            //Returns the current location of the participant
            public int RoomID{
               get{
                  return this.roomID;
               }
               set{
                  this.roomID = value;
               } }
```

```
        //The loop that runs the asynchronous sensor
        //Sets boolean variable launchSurvey for MyExperience
        private void loop()
        {
                while (killThread == false)
                {
                        BluetoothDeviceInfo[] beacons = discoverDevices();
                        if (beacons.Length > 0 && killThread == false)
                        {
                                SerializableHashTable nearbyBeacons = new SerializableHashTable();
                                foreach (BluetoothDeviceInfo info in beacons) {
                                if (beaconPlaces.ContainsKey(info.DeviceAddress.ToString())){
        nearbyBeacons[info.DeviceAddress.ToString()] = beaconPlaces[info.DeviceAddress.ToString()];
                                        }
                                else{
        nearbyBeacons[info.DeviceAddress.ToString()] = "Unknown - " + info.DeviceName;
                                        }
                                }

                           previousRoom = roomID;
                           roomID = getRoomID(nearbyBeacons);

                           if (previousRoom != roomID)
                              timer = 0;
                           else if (roomID!=-1)
                              timer += 20;

                           if ((timer / 20) == 30)
                              launchSurvey = true;

                           if (killThread == false)
                              NearBeacons(new BeaconEventArgs(this, nearbyBeacons));
                        }

                //takes approx 10 seconds to discover. Sleeps for 20 seconds between each discovery
                for (int ii = 0; ii < 400; ii++){
                      if (killThread)     //set true if Stop() is called
                          break;
                      Thread.Sleep(50);
                 }
        }
}

        public void Start(){
                if (sensorThread != null)
                        return;
                lock (this)
                {
                        killThread = false;
                        sensorThread = new Thread(new ThreadStart(loop));
                        sensorThread.Start();
                }
        }
```

```
		public void SetName(string beacon, string name){
			beaconPlaces[beacon] = name;
			writeXML();//relatively cheap, since it will be quite rare.
		}

		public void Stop(){
			if (sensorThread == null)
				return;
			lock (this){
				killThread = true;
				sensorThread.Join();
				sensorThread = null;
			}
			writeXML();
		}

		private void readXML(){
		    try{
FileInfo mapFileInfo = new FileInfo(Assembly.GetCallingAssembly().GetName().CodeBase.Substring(0,
Assembly.GetCallingAssembly().GetName().CodeBase.LastIndexOf('\\')) + "\\" + MAPPING_FILENAME);
			if (!mapFileInfo.Exists)
			   return;
			XmlSerializer serializer = new XmlSerializer(typeof(SerializableHashTable));
			StreamReader reader = new StreamReader(
			Assembly.GetCallingAssembly().GetName().CodeBase.Substring(0,
Assembly.GetCallingAssembly().GetName().CodeBase.LastIndexOf('\\')) + "\\" + MAPPING_FILENAME);
			XmlReader xmlReader = XmlReader.Create(reader.BaseStream);
			if (serializer.CanDeserialize(xmlReader))
			{
			   beaconPlaces = (SerializableHashTable)serializer.Deserialize(xmlReader);
			   //remove extraneous xml stuff
			   beaconPlaces.Remove("xmlns:xsi");
			   beaconPlaces.Remove("xmlns:xsd");
			}
			xmlReader.Close();
			reader.Close();
		    }
			catch (Exception ex)
			{
			   throw new Exception("Mapping file " + MAPPING_FILENAME + " exists but couldn't be
		parsed. This usually means that the file is not well-formed XML");
			}
		}

		private void writeXML(){
			XmlSerializer serializer = new XmlSerializer(typeof(SerializableHashTable));
			StreamWriter writer = new
StreamWriter(Assembly.GetCallingAssembly().GetName().CodeBase.Substring(0,
Assembly.GetCallingAssembly().GetName().CodeBase.LastIndexOf('\\')) + "\\" + MAPPING_FILENAME);
			serializer.Serialize(writer.BaseStream, beaconPlaces);
			writer.Close();
		}
```

```
        // Determines user's position (room) based on detected beacons
            int getRoomID(SerializableHashTable nearbybeacons)
            {
               //roomID = -1 : Assumed location: out of Taivas

               //Assumed location: Cafeteria - Room1
               //000EA5100645="Beacon 1t", 000EA5100644="Beacon 13t"
               if (nearbybeacons.ContainsKey("000EA5100645") == true)
                  return 1;
               else if (nearbybeacons.ContainsKey("000EA5100644") == true)
                  return 1;

               //Assumed location: PhotoShoot space - Room2
               //000EA5100668="Beacon 2t", 000EA5100675="Beacon 7t", 0012625CB6C5="Nok 1t"
               else if ((nearbybeacons.ContainsKey("000EA5100668") == true) &&
        (nearbybeacons.ContainsKey("000EA5100675") == true)
                     && (nearbybeacons.ContainsKey("0012625CB6C5") == true))
                  return 2;

        //Sample Look-up table – Rooms 3-21 are omitted

               //Assumed location: Desk - Room22
               //000EA5100680="Beacon 12t", 0012625CB6C5="Nok 1t", 0017E5D1E03A="Nok 2t",
        00192D40102D="Nok 3t", 0012D21B4C6C="Nok 4t", 001979CC55D3="Nok 5t"
               else if ((nearbybeacons.ContainsKey("0012625CB6C5") == true) &&
        (nearbybeacons.ContainsKey("0017E5D1E03A") == false)
                     && (nearbybeacons.ContainsKey("00192D40102D") == false) &&
        (nearbybeacons.ContainsKey("0012D21B4C6C") == true)
                     && (nearbybeacons.ContainsKey("001979CC55D3") == false) &&
        (nearbybeacons.ContainsKey("000EA5100680") == false))
                  return 21;


               //Out of bluetooth range
               return -1;

            }
}
```

```
public class SerializableHashTable : IXmlSerializable
{
	Hashtable _hashtable;

	public SerializableHashTable()
	{
		_hashtable = new Hashtable();
	}

	public string this[string key]
	{
		get
		{
			return (string)_hashtable[key];
		}
		set
		{
			_hashtable[key] = value;
		}
	}

	public void Remove(string key)
	{
		_hashtable.Remove(key);
	}

	public XmlSchema GetSchema()
	{
		return null;
	}

	public void WriteXml(XmlWriter writer)
	{
		foreach (string key in _hashtable.Keys)
		{

			string writeKey = key;
			string writeValue = (string)_hashtable[key];

			if (Char.IsDigit(writeKey[0]))
				writeKey = "_" + writeKey;

			if (Char.IsDigit(writeValue[0]))
				writeValue = "_" + writeValue;

			writer.WriteAttributeString(writeKey, writeValue);
		}
	}
```

```
        public void ReadXml(XmlReader reader)
        {
            Hashtable newTable = new Hashtable();

            while (reader.MoveToNextAttribute())
            {
                string name = reader.Name;
                string value = reader.Value;
                if (name.Length >= 2 && name[0] == '_' && Char.IsDigit(name[1]))
                    name = name.Substring(1);
                if (value.Length >= 2 && name[0] == '_' && Char.IsDigit(value[1]))
                    value = value.Substring(1);

                newTable[name] = value;
            }

            _hashtable = newTable;
        }

        public bool ContainsKey(string key)
        {
            return _hashtable.ContainsKey(key);
        }

        public ICollection Keys
        {
            get
            {
                return _hashtable.Keys;
            }
        }

    public override string ToString()
    {
      StringBuilder sb = new StringBuilder();

      foreach (string key in _hashtable.Keys)
      {
        sb.Append(key).Append(":").Append(_hashtable[key]).Append(",");
      }
      if (sb.Length == 0)
        return "";
      else
        return sb.ToString(0, sb.Length -2);
    }
        }


}
```

BluetoothBeaconSensor.cs

```
using System;
using System.Collections.Generic;
using System.Text;
using MyExperience.Actions;
using MyExperience.Utils;

using MyExperience.Sensors;

namespace House_n.Sensors
{
    class BluetoothBeaconSensor : Sensor
    {
// MyExperience sets the Bluetooth sensor as a BluetoothBeaconSensor :
// <sensor name="BluetoothSensor" type="House_n.Sensors.BluetoothBeaconSensor" />
// and calls it within the Bluetooth Trigger :
// Snap = GetSensorStateSnapshot("BluetoothSensor");


        private BeaconSensor beaconSensor;
        private string Room;

        public override Type StateType{
            get { return typeof(string); }
        }

        public BluetoothBeaconSensor(){
            beaconSensor = new BeaconSensor();
            beaconSensor.NearBeacons += new
BeaconSensor.BeaconEventHandler(OnBeaconsDetected);
        }

        void OnBeaconsDetected(BeaconEventArgs eventArgs){
            Room = Convert.ToString(this.beaconSensor.RoomID);
            string state = eventArgs.BeaconIDs.ToString() + " Room " + Room;
            OnStateEntered(new State(state));
        }

        protected override State StartSensor(){
            beaconSensor.Start();
            return State.Initial;
        }

        protected override void StopSensor(){
            beaconSensor.Stop();
        }

        public bool getLaunchSurvey(){
            return this.beaconSensor.LaunchSurvey;
        }

        public void setLaunchSurvey(bool value){
            this.beaconSensor.LaunchSurvey = value;
        }
    }
}
```

Appendix I – Taivas Bluetooth Beacon Look-up table

ROOMID	SPACE DESCRIPTION	FLOOR	BLUETOOTH BEACON COMBINATIONS PER ROOM (Total: 40)		
			1 (Detection Probability >0.8)	2 (Detection Probability>0.5)	3 (Detection Probabilty>0.3)
ROOM 1	CAFETERIA	3	B1	B13	
ROOM2	PHOTOSHOOT SPACE	2	B2+B7+NOK1		
ROOM3	LOUNGE MEETING 1	2	B3		
ROOM4	LOUNGE MEETING 2	2	B4		
ROOM5	MEETING ROOM 1	2	B5	B14	
ROOM6	MEETING ROOM 2	2	B6+B12	B12+SAM1	
ROOM7	TABLE LOUNGE 1	1	B7+B12	B7+B12+NOK1	B7+B12+NOK1+NOK4
ROOM8	DESK1	1	B7+B8	B7+B8+B12	B7+B8+NOK1
ROOM9	DESK2	1	B7+NOK1	B12+NOK1	
ROOM10	DESK3	1	B9+B12	B9+B12+NOK1	
ROOM11	DESK4 - ON ITS OWN	1	B12		
ROOM12	DESK5	1	B10+B12	B10+B12+SAM1	
ROOM13	TABLE LOUNGE 2	1	B11+B12		
ROOM14	DESK6	1	B12+SAM1+SAM2		
ROOM15	DESKS	1	B12+SAM1+SAM2+SAM3		
ROOM16	DESKS	1	B12+SAM1+SAM2+SAM3+SAM4	SAM1+SAM2+SAM4	SAM1+SAM2 / SAM2+SAM4
ROOM17	DESKS	1	SAM2+SAM3+SAM4		
ROOM18	PRINTER LOUNGE	2	SAM8	SAM8+NOK4	
ROOM19	DESK	1	NOK4+NOK5	NOK3+NOK4+NOK5	
ROOM20	DESK	1	NOK3+NOK4	NOK2+NOK3+NOK4	NOK2+NOK3+NOK4+NOK5
ROOM21	DESK	1	NOK1+NOK2+NOK3	NOK1+NOK3+NOK4	
ROOM22	DESK	1		NOK1+NOK4	
ROOM23	RED COUCH AREA	2	SAM10		
Beacon 1 = B1, Beacon 2 = B2, etc | Samsung 1 = SAM1, Samsung 2 = SAM2, etc | Nokia 1 = NOK1, Nokia 2 = NOK2, etc					

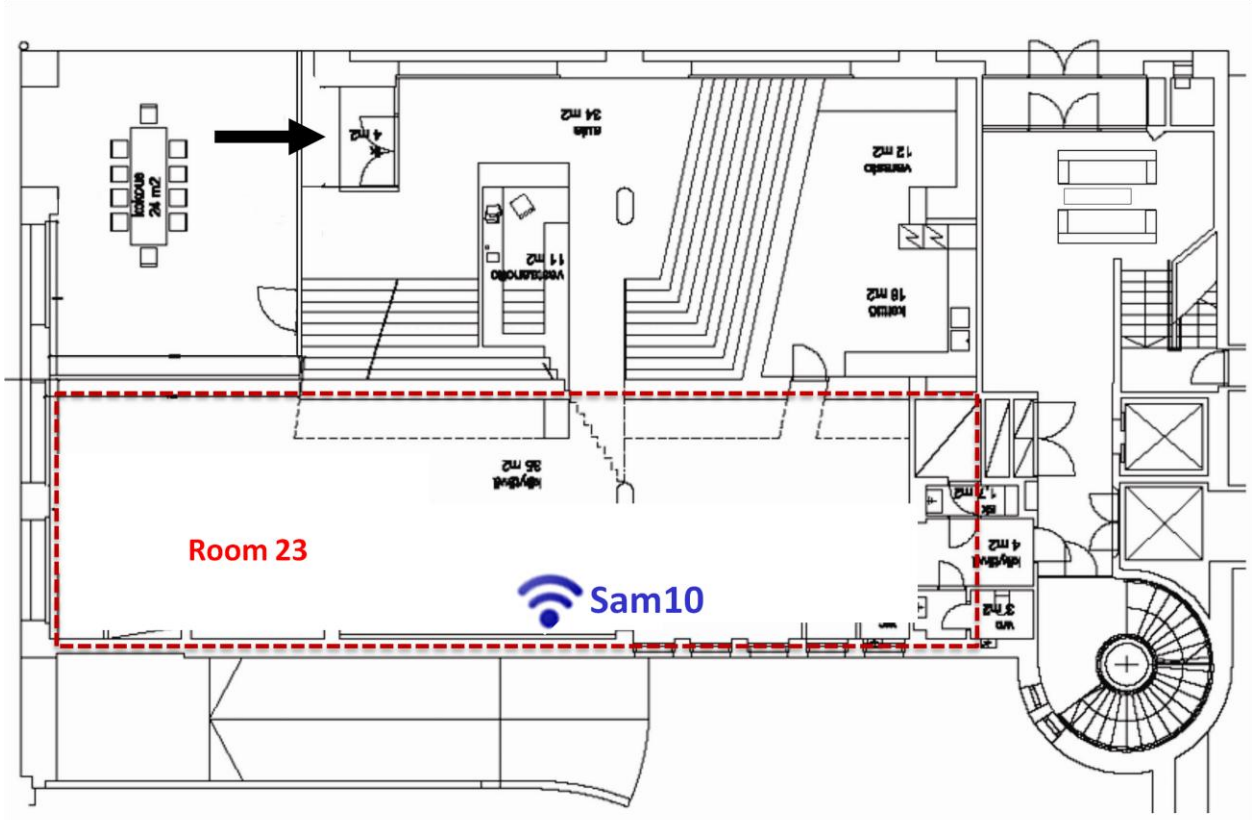
ROOM19	NOK1	NOK2	NOK3	NOK4	NOK5
	FALSE	FALSE	FALSE	TRUE	TRUE
	FALSE	FALSE	TRUE	TRUE	TRUE
revised	FALSE	FALSE	FALSE	FALSE	TRUE

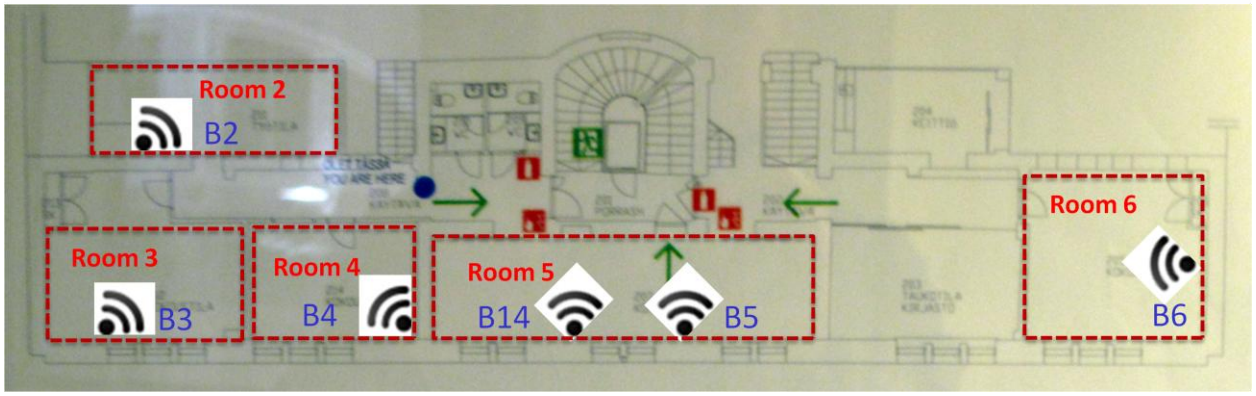
ROOM20	NOK1	NOK2	NOK3	NOK4	NOK5
	FALSE	FALSE	TRUE	TRUE	FALSE
	FALSE	TRUE	TRUE	TRUE	FALSE
	FALSE	TRUE	TRUE	TRUE	TRUE
revised	FALSE	FALSE	FALSE	TRUE	FALSE
revised	FALSE	FALSE	TRUE	FALSE	FALSE

ROOM21	NOK1	NOK2	NOK3	NOK4	NOK5
	TRUE	TRUE	TRUE	FALSE	FALSE
	TRUE	FALSE	TRUE	TRUE	FALSE

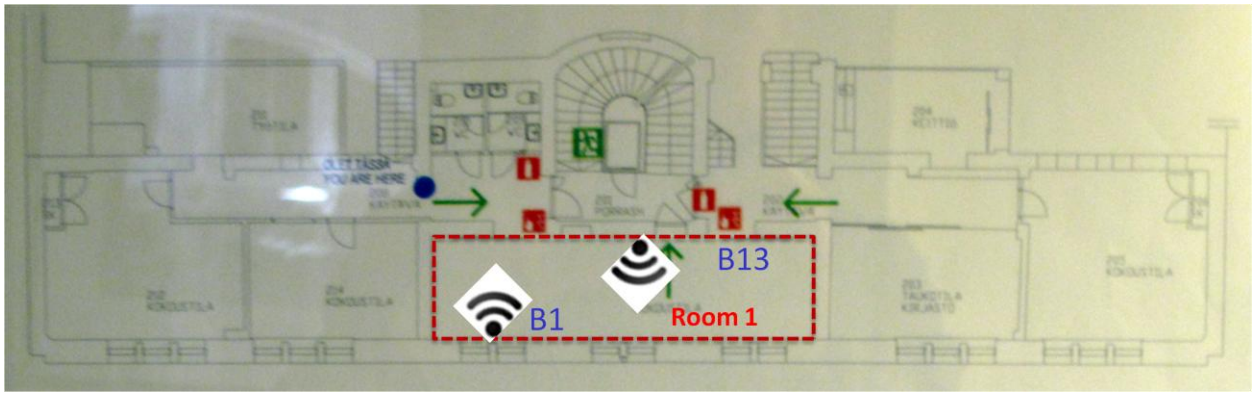
	NOK1	NOK2	NOK3	NOK4	NOK5
ROOM22	TRUE	FALSE	FALSE	TRUE	FALSE

LOOK-UP TABLE SAMPLE





Second Floor



Third Floor

Appendix J – Participants' Response Rates for Week 1

USER ID	Number of Prompts	Answered Bluetooth Surveys	Continued Bluetooth Surveys	Timed Out Bluetooth Surveys	Percentage of Answered Bluetooth Surveys	Percentage of Continued Bluetooth Surveys	Participant Start Date
TAIK1	96	10	2	86	10%	0.20	5/25/2009
TAIK2	104	38	0	66	37%	0.00	5/25/2009
TAIK3	65	45	12	20	69%	0.27	5/25/2009
TAIK4	41	6	2	35	15%	0.33	5/25/2009
TAIK5	258	21	6	237	8%	0.29	5/25/2009
TAIK6	149	20	3	129	13%	0.15	5/25/2009
TAIK7	131	8	3	123	6%	0.38	5/25/2009
TAIK8	144	10	3	134	7%	0.30	5/25/2009
TAIK9	164	27	12	137	16%	0.44	5/25/2009
TAIK10	5	3	1	2	60%	0.33	5/26/2009
TAIK11	80	3	1	80	4%	0.33	5/26/2009
WEEKLY AVERAGE	112.45	17.36	4.09	95.36	22%	0.27	
DAILY AVERAGE	22.49	3.47	0.82	19.07			
DAYS RUNNING:	5						

USER ID	Number of Prompts	Answered Bluetooth Surveys	Continued Bluetooth Surveys	Timed Out Bluetooth Surveys	Percentage of Answered Bluetooth Surveys	Percentage of Continued Bluetooth Surveys
TAIK1						
day1	22	4	1	18	0.18	0.25
day2	9	0	0	9	0.00	0.00
day3	42	3	1	39	0.07	0.33
day4	23	3	0	20	0.13	0.00
day5						
TOTAL	96	10	2	86		
DAILY AVERAGE	24.00	2.50	0.50	21.50	0.10	0.15
TAIK2						
day1	17	11	0	6	0.65	0
day2	20	8	0	12	0.40	0
day3	31	6	0	25	0.19	0
day4	16	7	0	9	0.44	0
day5	20	6	0	14	0.30	0
TOTAL	104	38	0	66		
DAILY AVERAGE	20.80	7.60	0.00	13.20	0.40	0.00
TAIK3						
day1	15	10	4	5	0.67	0.40
day2	0	0	0	0	0.00	0.00
day3	29	19	4	10	0.66	0.21
day4	18	15	4	3	0.83	0.27
day5	3	1	0	2	0.33	0.00
TOTAL	65	45	12	20		
DAILY AVERAGE	13.00	9.00	2.40	4.00	0.72	0.22

TAIK4						
day1	13	3	1	10	0.23	0.33
day2	22	2	1	20	0.09	0.50
day3	0	0	0	0		
day4	5	1	0	4	0.20	0.00
day5	1	0	0	1	0.00	
TOTAL	41	6	2	35		
DAILY AVERAGE	8.20	1.20	0.40	7.00	0.13	0.28
TAIK5						
day1	45	6	1	39	0.13	0.17
day2	50	4	1	46	0.08	0.25
day3	73	4	0	69	0.05	0.00
day4	50	6	3	44	0.12	0.50
day5	40	1	1	39	0.03	1.00
TOTAL	258	21	6	237		
DAILY AVERAGE	51.60	4.20	1.20	47.40	0.08	0.38
TAIK6						
day1	36	9	1	27	0.25	0.11
day2	61	4	0	57	0.07	0.00
day3	38	5	1	33	0.13	0.20
day4	14	2	1	12	0.14	0.50
day5	0	0	0	0		
TOTAL	149	20	3	129		
DAILY AVERAGE	29.80	4.00	0.60	25.80	0.15	0.20
TAIK7						
day1	30	3	2	27	0.10	0.67
day2	47	3	1	44	0.06	0.33
day3	18	1	0	17	0.06	0.00
day4	34	1	0	33	0.03	0.00
day5	2	0	0	2	0.00	
TOTAL	131	8	3	123		
DAILY AVERAGE	26.20	1.60	0.60	24.60	0.05	0.25
TAIK8						
day1	33	3	2	30	0.09	0.67
day2	0	0	0	0		
day3	31	3	1	28	0.10	0.33
day4	51	1	0	50	0.02	0.00
day5	29	3	0	26	0.10	0.00
TOTAL	144	10	3	134		

DAILY AVERAGE	28.80	2.00	0.60	26.80	0.08	0.33
TAIK9						
day1	47	9	4	38	0.19	0.44
day2	7	3	1	4	0.43	0.33
day3	63	8	5	55	0.13	0.63
day4	44	5	2	39	0.11	0.40
day5	3	2	0	1	0.67	0.00
TOTAL	164	27	12	137		
DAILY AVERAGE	32.80	5.40	2.40	27.40	0.31	0.36
TAIK10						
day1						
day2	3	3	1	0	1.00	0.33
day3	1	0	0	1	0.00	
day4	0	0	0	0		
day5	1	0	0	1	0.00	
TOTAL	5	3	1	2		
DAILY AVERAGE	1.25	0.75	0.25	0.50	1.00	0.33
TAIK11						
day1						
day2	9	2	1	7	0.22	0.50
day3	0	0	0	0		
day4	44	0	0	44	0.00	
day5	30	1	0	29	0.03	0.00
TOTAL	83	3	1	80		
DAILY AVERAGE	20.75	0.75	0.25	20.00	0.09	0.25

Appendix K – Participants' data: Ideas, Barriers and Bluetooth Survey Results

Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11	Total
No. of recorded ideas - being alone	2	1	9	3	1	3	5	3	1	0	3	
No. of recorded ideas - interacting with others	2	1	5	2	1	0	3	2	3	0	5	
Total No. of Recorded Ideas	4	2	14	5	2	3	8	5	4	0	8	55
No. of recorded Barriers - being alone	1	6	6	0	3	0	2	0	2	1	7	
No. of recorded Barriers - interacting with others	2	1	4	0	0	0	0	0	3	0	4	
Total No. of Recorded Barriers	3	7	10	0	3	0	2	0	5	1	11	42
No. of answered Bluetooth Surveys	10	77	53	19	26	30	11	18	40	3	13	300
No. of Total Surveys Completed	17	86	77	24	31	33	21	23	49	4	32	397
No. of Continued Surveys	5	0	28	4	12	3	3	5	25	1	13	99
Percentage of Continued Surveys	29%	0%	36%	17%	39%	9%	14%	22%	51%	25%	41%	25%
No. of Unique recorded activities	13	15	27	9	10	9	8	9	10	2	16	
Participant used phone over the weekend	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
No. of photos taken	2	0	4	0	0	0	0	0	0	0	0	6

Timing of Ideas												
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11	Total
Morning	3	2	9	3	1	2	4	4	3	0	4	35
Noon	0	0	3	2	1	1	4	1	1	0	4	17
Afternoon	1	0	2	0	0	0	0	0	0	0	0	3
Evening	0	0	0	0	0	0	0	0	0	0	0	0
Night	0	0	0	0	0	0	0	0	0	0	0	0
Location of Ideas												
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11	Total
Taivas	4	1	8	3	2	3	8	5	4	0	5	43
Other Workplace	0	1	0	0	0	0	0	0	0	0	2	3
Home	0	0	3	1	0	0	0	0	0	0	0	4
Restaurant/Bar/Cafe	0	0	1	0	0	0	0	0	0	0	0	1
In Transit	0	0	1	0	0	0	0	0	0	0	1	2
In Public Space	0	0	1	1	0	0	0	0	0	0	0	2
Timing of Barriers												
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11	Total
Morning	3	5	6	0	3	0	1	0	4	0	9	31
Noon	0	2	2	0	0	0	1	0	1	0	2	8
Afternoon	0	0	2	0	0	0	0	0	0	1	0	3
Evening	0	0	0	0	0	0	0	0	0	0	0	0
Night	0	0	0	0	0	0	0	0	0	0	0	0
Location of Barriers												
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11	Total
Taivas	3	5	8	0	3	0	2	0	5	1	11	38
Other Workplace	0	0	0	0	0	0	0	0	0	0	0	0
Home	0	2	0	0	0	0	0	0	0	0	0	2
Restaurant/Bar/Cafe	0	0	1	0	0	0	0	0	0	0	0	1
In Transit	0	0	1	0	0	0	0	0	0	0	0	1
In Public Space	0	0	0	0	0	0	0	0	0	0	0	0

Social Context - Recorded Ideas when engaged in activities with others and alone											
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
Team members	1	0	3	1	1	0	2	2	2	0	2
Colleague(s) outside my team	1	0	0	1	0	0	1	0	0	0	0
Family members	0	1	1	0	0	0	0	0	0	0	0
Friends	0	0	1	0	0	0	0	0	0	0	0
Clients	0	0	0	0	0	0	0	0	0	0	3
Other	0	0	0	0	0	0	0	0	1	0	0
Alone	2	1	9	3	1	3	5	3	1	0	3
Total	4	2	14	5	2	3	8	5	4	0	8

Social Context - Recorded Barriers when engaged in activities with others and alone											
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
Team members	0	0	3	0	0	0	0	0	1	0	2
Colleague(s) outside my team	2	1	1	0	0	0	0	0	3	0	2
Boss	0	0	0	0	0	0	0	0	1	0	1
Family members	0	0	0	0	0	0	0	0	0	0	0
Friends	0	0	0	0	0	0	0	0	0	0	0
Clients	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Alone	1	6	6	0	3	0	2	0	2	1	7
Total	3	7	10	0	3	0	2	0	7*	1	12*

Team1 Team2 No Team *7, 12 are actually 5 and 11 – this is because participants TAIK9 and TAIK11 reported being with team members and colleagues concurrently when facing a barrier in two occasions.

Idea Recordings for which the participant chose to provide more information by answering the second part of the survey											
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
Times being able to describe ideas - described in words	0	0	2	0	0	0	0	0	0	0	0
Times being able to describe ideas - picture taken	0	0	4	0	0	0	0	0	0	0	0
Times being unable to describe ideas	2	0	2	2	1	0	0	0	1	0	1
Diverted to Social / Spatial Branches	0	0	2	0	0	0	0	0	2	0	1

Barrier Recordings for which the participant chose to provide more information by answering the second part of the survey											
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
Times being able to describe barriers - described in words	1	0	0	0	2	0	0	0	1	0	3
Times being able to describe barriers - picture taken	0	0	0	0	0	0	0	0	0	0	0
Times being unable to describe barriers	0	0	1	0	0	0	0	0	4	0	0
Diverted to Social / Spatial Branches	0	0	4	0	1	0	0	0	0	0	5

Types of Recorded Barriers											
Recorded Barriers	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
Equipment Failure	1	0	0	0	3	0	0	0	1	0	0
Missing information	0	0	1	0	0	0	0	0	1	0	0
Person unavailable	0	0	0	0	0	0	0	0	2	0	0
Tired / Bad mood	0	0	0	0	0	0	0	0	0	0	1
Conflict with colleague	0	0	0	0	0	0	0	0	0	0	1
Poor Air quality	0	0	0	0	0	0	0	0	0	0	1
Lack of Focus	0	1	0	0	0	0	0	0	0	0	0
Too much work or stress	1	0	0	0	0	0	0	0	1	0	1

Break-down of idea-recording times												
	TAIK1		TAIK2		TAIK3		TAIK4		TAIK5		TAIK6	
Time of Ideas	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers
4am - 6am	0	0	1	2	0	0	0	0	0	0	0	0
6am - 8am	0	1	1	1	3	1	1	0	1	1	0	0
8am - 10am	2	2	0	1	4	0	1	0	0	2	0	0
10am - 12pm	1	0	0	1	2	5	1	0	0	0	2	0
12pm - 2pm	1	0	0	2	3	1	2	0	1	0	1	0
2pm - 4pm	0	0	0	0	0	1	0	0	0	0	0	0
4pm - 6pm	0	0	0	0	2	2	0	0	0	0	0	0
	4	3	2	7	14	10	5	0	2	3	3	0

Break-down of idea-recording times												
	TAIK6		TAIK7		TAIK8		TAIK9		TAIK10		TAIK11	
Time of Ideas	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers	Ideas	Barriers
4am - 6am	0	0	0	0	0	0	0	0	0	0	0	0
6am - 8am	0	0	0	0	3	0	0	0	0	0	4	1
8am - 10am	0	0	2	0	0	0	3	3	0	0	0	6
10am - 12pm	2	0	2	0	1	0	0	1	0	0	0	2
12pm - 2pm	1	0	4	2	1	0	1	1	0	0	4	2
2pm - 4pm	0	0	0	0	0	0	0	0	0	1	0	0
4pm - 6pm	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	8	2	5	0	4	5	0	1	8	11

Reasons for choosing spaces											
Participant ID	TAIK1	TAIK2	TAIK3	TAIK4	TAIK5	TAIK6	TAIK7	TAIK8	TAIK9	TAIK10	TAIK11
It was my normal workspace	x		x	x	x	x	x	x	x	x	
It was near/available								x			
Needed bigger space					x	x			x	x	
Needed presentation/ work tools			x			x					
Needed access to info			x						x		
Needed more privacy			x		x	x			x	x	
Needed to be around others			x								
Needed a change/stimuli	x		x								
Other			x								

Appendix L – Translation of Participant's Activities

Participant TAIK1

Recorded Activity	Translated Activity	Unique Activities	Occurrences
trying to think	thinking	thinking	4
listening to advices	listening to someone	listening to someone	2
thinking	thinking	trying to focus	1
listening	listening to someone	drawing	3
trying to focus	trying to focus	having coffee	1
drawing	drawing	searching information	2
drawing	drawing	looking for an environment change	1
trying to focus	trying to focus	trying to work	1
having coffee	having coffee	listening to music	1
thinking	thinking	taking pictures	1
trying to find info	searching information	talking	2
looking for an environment change	looking for an environment change	too much hassle	1
trying to work but no proper equipment!	trying to work	stressing	1
listening to top gun soundtrack	listening to music		
taking pictures	taking pictures		
talking	talking		
web search	trying to find info		
drawing	drawing		
talking	talking		
thinking	thinking		
too much hassle	too much hassle		
stress	stressing		

Participant TAIK2

Recorded Activity	Translated Activity	Unique Activities	Occurrences
visualizing layouts	designing	designing	33
lay outing	designing	having lunch	1
lay outing	designing	configuring firmware	12
lunch	having lunch	e-mailing	15
lay outing	designing	trying to focus	1
lay outing	designing	contacting	1
lay outing	designing	in a meeting	2
ui-designing	designing	promoting sites	2
ui-designing	designing	downloading	2
ui-designing	designing	guide lining	8
ui-designing	designing	projecting	2

ui-designing	designing
configuring firmware	configuring firmware
reading e-mails	e-mailing
planning site designs	designing
fine tuning a web site	designing
e-mailing	e-mailing
e-mailing	e-mailing
e-mailing	e-mailing
trying to concentrate working	trying to focus
e-mailing	e-mailing
lay outing	designing
lay outing	designing
lay outing	designing
tuning site	designing
lay outing	designing
lay outing	designing
contacting	contacting
e-mailing	e-mailing
arranging materials	designing
web optimizing	designing
configuring	configuring firmware
configuring	configuring firmware
in a meeting	in a meeting
e-mailing	e-mailing
meeting	in a meeting
configuring	configuring firmware
configuring	configuring firmware
promoting sites	promoting sites
planning	designing
downloading	downloading
configuring	configuring firmware
configuring	configuring firmware
promoting	promoting sites
planning	designing
configuring	configuring firmware
configuring	configuring firmware
configuring	configuring firmware
guide lining	guide lining
guide lining	guide lining
guide lining	guide lining
guide lining	guide lining

setting up	2
updating	1
reviewing information	1
translating	1

guidance	guide lining
guide lining	guide lining
guide lining	guide lining
e-mailing	e-mailing
projecting	projecting
setting up	setting up
projecting	projecting
e-mailing	e-mailing
e-mailing	e-mailing
downloading materials	downloading
e-mailing	e-mailing
setting up	setting up
planning	designing
planning	designing
e-mailing	e-mailing
planning	designing
configuring	configuring firmware
e-mailing	e-mailing
guide lining	guide lining
configuring	configuring firmware
planning	designing
lay outing	designing
e-mailing	e-mailing
lay outing	designing
lay outing	designing
updating	updating
internal info	reviewing information
e-mailing	e-mailing
lay outing	designing
translating	translating
planning	designing
planning	designing

Participant TAIK3

Recorded Activity	Translated Activity	Unique Activities	Occurrences
drinking coffee	having coffee	having coffee	2
walking through a park while eating ice-cream	on a stroll	on a stroll	1
procrastinating	procrastinating	procrastinating	1
youtube	watching videos	watching videos	2
3d modeling a logo	designing	designing	32

modeling	designing	relaxing	1
modeling	designing	resting in bed	1
modeling	designing	thinking	2
3d modeling a logo	designing	discussing	6
3d modeling	designing	solving problems	1
logo 3d modeling	designing	having lunch	1
modeling	designing	surfing the web	5
modeling a logo	designing	listening to music	1
relaxing	relaxing	chatting	1
sleeping, resting in bed.	resting in bed	walking	1
thinking about going to work	thinking	playing a game	1
i was briefing a flash designer and discussing about it with the project manager.	discussing	in a café	1
walking around the office. solving technical problems with team members.	solving problems	waiting	2
lunch	having lunch	brushing teeth	2
briefing subcontractor.	discussing	reviewing information	3
working on a simple web application.	designing	blogging	1
discussing about project.	discussing	having fun	1
photoshopping	designing	video editing	3
photoshopping a web layout.	designing	drinking	1
photoshopping	designing	online shopping	1
layout and design.	designing	in a meeting	1
lay outing	designing	negotiating	1
lay outing	designing		
layout, Photoshop	designing		
lay outing and reading mail	designing		
surfing the internet	surfing the web		
lay outing	designing		
using facebook to further my career	surfing the web		
surfing on the web	surfing the web		
surfing on the web	surfing the web		
listening to top gun soundtrack	listening to music		
positioning buttons to a webpage with a team member	designing		
web design	designing		
web design	designing		
discussing concept and layout	discussing		
discussing about web development.	discussing		
chatting	chatting		
thinking	thinking		
walking	walking		

waiting	waiting
playing a game	playing a game
sitting in cafe waiting	in a café
waiting for my food as I understood how something works	waiting
brushing teeth whilst I got an idea about one brochure	brushing teeth
brushing teeth whilst I got an idea about one brochure	brushing teeth
updating the Taivas blog.	reviewing information
blogging	blogging
going through stock video for a project	reviewing information
designing web	designing
web design	designing
getting coffee	having coffee
watching youtube	watching videos
designing web	designing
web design	designing
web design	designing
coffee	having coffee
web design	designing
having fun	having fun
video editing	video editing
drinking	drinking
video edit	video editing
waiting for render to complete	designing
shopping for groceries	online shopping
editing a video	video editing
illustrating	designing
discussing about the future	discussing
designing	designing
administrating Taivas blog	reviewing information
in a meeting	in a meeting
savings negotiations	negotiating
planning	designing
going through a webpage	surfing the web

Participant TAIK4

Activity	Translated Activity	Unique Activities	Occurrences
planning and writing an article	writing	writing	5
writing	writing	having lunch	2
eating lunch	having lunch	sending information	2
writing an article	writing	designing	6

sending a copy to a client	sending information	reviewing information	4
writing an another article	writing	looking for an expert	1
planning a campaign	designing	in a meeting	1
planning and copywriting	designing	having a cigarette	1
planning a campaign	designing	copywriting	2
editing an article	reviewing information		
looking for an expert	looking for an expert		
planning a presentation	designing		
planning a campaign	designing		
planning an article	designing		
planning and writing an article	writing		
lunch	having lunch		
meeting	in a meeting		
having a cigarette	having a cigarette		
copywriting	copywriting		
checking text and layout for a campaign	reviewing information		
wrote a press release and sent it	sending information		
copywriting	copywriting		
editing a copy text	reviewing information		
editing and proofreading text	reviewing information		

Participant TAIK5

Activity	Translated Activity	Unique Activities	Occurrences
searching pictures	searching information	searching information	5
We were looking for the lost material	searching information	designing	10
I'm doing the layout to the web page	designing	discussing	10
We were discussing about the layout to the web page	discussing	e-mailing	2
We were designing the layout to the web page	designing	chatting	1
I was looking for pictures from the net	searching information	passing information	1
I'm designing a model for direct-marketing mailing	designing	waiting	1
I was e-mailing about the logo issue	e-mailing	drawing	1
I was lay outing the direct-marketing add	designing	thinking	1
I was chatting	chatting	printing	1
We were talking about the day's agenda	discussing		
I was looking for the background info from the net	searching information		
Photoshop crashed, again	designing		
Photoshop crashed	designing		
I was giving technical instructions to my colleague	passing information		

I was editing the picture	designing
I had to restart my computer because of the malfunctioning Photoshop	waiting
I was looking for pictures	searching information
I was designing envelopes	designing
In the palaver	discussing
In the palaver	discussing
In another palaver	discussing
In the palaver	discussing
I was making up the direct-marketing add	designing
I was drawing the chart	drawing
In the palaver	discussing
The weekly palaver	discussing
An internal palaver	discussing
We were developing the concept for the mini brochure	thinking
In the planning palaver	discussing
I was writing an e-mail	e-mailing
I was designing the picture	designing
I was trying to print	printing

Participant TAIK6

Activity	Translated Activity	Unique Activities	Occurrences
I was discussing about the phases and the next steps of the project	discussing	discussing	14
I was designing and benchmarking contents of the web services	designing	designing	6
I had a lunch	having lunch	having lunch	1
We are going through the planned web service	reviewing information	reviewing information	3
I was designing	designing	benchmarking	2
We were talking about what we should do to the next client meeting, and also about the state of the company	discussing	in a meeting	2
Discussing	discussing	writing	3
A phone call from the customer who was not satisfied with the communication with a team member	discussing	analyzing	1
Benchmarking	benchmarking	doing nothing significant	1
I'm designing a web service and drawing wire frames	designing		
We were discussing about the progress of the project and layouts we are going to need	discussing		
Designing	designing		
A palaver and a brief	discussing		
A discussion about yesterday's client, and a short talk about a copy which another client has [I'm not sure what is	discussing		

meant here]	
A discussion about a pitch	discussing
In the client meeting in which we went through the work done to develop a web service	in a meeting
benchmarking	benchmarking
I'm writing the summary of the current state of the client's web services for the competition.	writing
A work related discussion	discussing
I'm making an analysis of the client's web service	analyzing
A discussion about the schedule of an attachment to the bill	discussing
A discussion about a pitch	discussing
I'm creating a concept for a competitive bidding, writing a memo	writing
I'm designing and searching ideas for layout type	designing
We were discussing about the alternatives for the cover of a direct-marketing add	discussing
We went through the user study on which we should base a extensive survey in order to develop a web service	reviewing information
Nothing significant	doing nothing significant
Fixing the element chart	reviewing information
A planning palaver for the direct-marketing add	discussing
I'm writing texts for the direct-marketing add	writing
A meeting with a client	in a meeting
We went through the technical implementation, and I commented the visualization and functionalities	discussing
We designed a concept for a campaign	designing

Participant TAIK7

Activity	Translated Activity	Unique Activities	Occurrences
Designing extensions to a web site	designing	designing	3
A bread text to the advertisement	writing	writing	6
Thinking	thinking	thinking	3
Net layout	designing	surfing the web	5
Writing	writing	presenting	1
Net surfing	surfing the web	talking	1
Thinking about the problem	thinking	discussion	1
In the net	surfing the web	having lunch	1
Writing	writing		
Designing	designing		

Presentation	presenting
In the net	surfing the web
In the net	surfing the web
In the net	surfing the web
We were talking	talking
A palaver	discussion
Eating	having lunch
Thinking	thinking
Writing	writing
Writing	writing
Writing	writing

Participant TAIK8

Activity	Translated Activity	Unique Activities	Occurrences
finishing a layout	designing	designing	7
going trough the layouts	designing	looking for inspiration	2
just gathering some inspiration	looking for inspiration	presenting	2
presenting layouts	presenting	reading	1
presenting and creating ideas	presenting | thinking	thinking	4
reading emails	reading	printing	1
designing a greeting card	designing	writing	1
creating	designing	searching information	1
looking for an inspiration	looking for inspiration	reviewing information	1
ideation	thinking		
creating a logo	designing		
designing a layout for a print	designing		
printing layouts	printing		
finishing layouts	designing		
filling hour report	writing		
going trough new work	reviewing information		
browsing photos	looking for information		

Participant TAIK9

Activity	Translated Activity	Unique Activities	Occurrences
Monday meeting and planning a pitch with a colleague	in a meeting	in a meeting	3
planning a project	designing	designing	36
planning and visual designing	designing	interacting	2
planning and visual design	designing	e-mailing	2
visual designing	designing	in a meeting	3

in interaction with a product company	interacting	researching	2
in interaction with production company	interacting	having lunch	2
planning a pitch	designing	receiving information	1
planning a pitch	designing	searching information	2
visual designing	designing	multitasking	1
planning and briefing	designing		
planning pitch	designing		
visual designing	designing		
visual designing	designing		
visual designing	designing		
visual design	designing		
reading emails	e-mailing		
planning a pitch	designing		
planning	designing		
planning	designing		
planning and making time schedules	designing		
planning a pitch	designing		
planning a pitch and eating my lunch	designing		
meeting regarding a project	in a meeting		
research for pitch	researching		
research and planning a pitch	researching		
planning a pitch	designing		
planning a pitch -presentation	designing		
planning a pitch	designing		
designing a website	designing		
planning a presentation	designing		
planning a pitch	designing		
working with too many projects at the same time	multitasking		
designing a website	designing		
having my lunch	having lunch		
planning a website	designing		
designing a website	designing		
designing and planning updates for a website	designing		
planning and designing updates for a website	designing		
planning and designing webpage	designing		
planning and designing webpage	designing		
designing a website	designing		
getting briefed into a new project	receiving information		
writing emails	e-mailing		
gathering information for a new project	searching information		

planning a website	designing
meeting	in a meeting
planning a website	designing
planning a website	designing

Participant TAIK10

Activity	Translated Activity	Unique Activities	Occurrences
I was planning a workshop about commercialization of innovation	designing	designing	3

Participant TAIK11

Activity	Translated Activity	Unique Activities	Occurrences
Outlining and analyzing knowledge	analyzing	analyzing	5
Same as previous	analyzing	observing	3
Observing the user	observing	interviewing	3
Observing and interviewing	observing	reading	3
An interview	interviewing	receiving information	1
Observing and interviewing	interviewing	e-mailing	1
I'm reading books and web sites for material	reading	talking	1
Analyzing	analyzing	discussing	5
A photograph for a pitch	taking pictures	reviewing information	1
Receiving briefs	receiving information	presenting	1
Writing an internal e-mail	e-mailing	multitasking	1
Trying to read a brief	reading	conflict	1
I was trying to read a brief but the noise and the phone disturbed me	reading	having lunch	1
I was talking about the brief	talking	taking pictures	1
I was discussing with a coder about finalizing the functionalities	discussing	writing	2
We went through the comments from the client and answers to them, we discussed also about internal problems	reviewing information	thinking	4
I was discussing about the solutions to the interfaces	discussing		
A presentation	presenting		
Analyzing	analyzing		
Analyzing alone	analyzing		
Making a summary	writing		
Too much work, has to work alone, no one to juggle ideas, back hurts.	multitasking		
Agreed a palaver	discussion		
Briefing	passing information		
An arrogant colleague, don't listen to	conflict		

me	
A lunch	having lunch
A call to discuss my career in the company, bad feeling	discussing
A discussion with a colleague	discussing
I'm writing	writing
Ideation	thinking
Preparing a questionnaire	thinking
Ideation of the ideation methods	thinking
Ideation	thinking

Appendix M – Post-study questionnaire

Below is a list of questions from the phone survey. If you have something on your mind concerning the questions, feel free to comment them. All kinds of comments would be appreciated. **Especially, in answering the particular question during the study:**

Did you feel that we had missed some answering option?
Did you think that the question should have been open-ended?
Did you have some difficulties in understanding the purpose of the question?
Did you think that the question should have been left out altogether or phrased differently?

Where were you?

- In transit
- Home
- Restaurant/ Bar/ Cafe
- Taivas
- In public space
- Other workplace
- Other

Were you engaged in activities:

- Alone
- With 1 other person
- With 2 or more persons

Who were you with?

- Team member(s)
- Colleague(s) outside my team
- Client(s)
- Boss
- Friend
- Family
- Other

What were you doing?

How were you traveling?

- Bus/ Tram/ Train
- Driving
- Bike
- Walking
- Other

Were you traveling alone?

- Yes
- No

Was this a:

- Big idea
- Small idea

Was this idea connected to a client brief?

- Yes
- No

How long have you been working on this idea?

- Just got it
- Not long
- Sometime
- Very long

How important were others in creating this idea?

- Essential
- Important
- Somewhat important
- Not that important

Can you capture the situation that led to this idea? /
Can you capture the situation that hindered you?

What was hindering you?

- Person unavailable
- Missing information
- Equipment failure
- Distraction
- Too much work or stress
- Too many tasks at the same time
- Too tired or bad mood
- Other

Were you frustrated?

- Not at all
- A little
- Somewhat
- Very much

Why did you pick this space for your activities?

- It was my normal workspace
- It was near/ available
- Needed bigger space
- Needed presentation/ work tools
- Needed access to information
- Needed more privacy
- Needed to be around others
- Needed a change/ stimuli

- Other

What was the most important spatial quality?

- Quiet
- Peaceful
- Good lighting
- Comfortable furniture
- Nice materials/ colors
- Air quality
- Room temperature
- Other

What tools did you use?

- Projector
- White board
- Wall space
- Work table
- Computer
- Phone
- Pen and paper
- Other

How important was this space for your activities?

- Essential
- Important
- Somewhat important
- Not that important

Was your interaction with others:

- Scheduled
- Accidental

In interacting with others were you mostly:

- Providing info
- Somewhat providing
- Somewhat receiving
- Receiving info

How important was this interaction for your current activities?

- Essential
- Important
- Somewhat important
- Not that important

How much was this a productive use of your time?

- Very productive
- Quite productive
- Not much productive
- Not at all productive

How much stress were you experiencing?

- A lot
- Quite a bit
- Not much
- None

If you had done the survey, what would have been the most important question for you to ask?

Did your study phone work properly during the study? If not, what kinds of problems did emerge?

Did you find the survey easy to answer? If not, what were the things you didn't like?

In what kind of situations you did find answering the survey the most distracting?

What kind of arrangements had made the study more pleasurable? Rank the options (1 = most important).

___ Less questions

___ More variety to the queries

___ Questions that had been customized for you

___ Technical improvements (better battery life, etc.)

___ Fewer surveys/ day

Do you feel you would participate in this kind of study again?

___ Yes

___ No

Appendix N – Participants' Post-study Questionnaire Answers

Situated Innovations: Workplace
The summary of the feedback from the participants / the questionnaire administered on June 18, 2009 / present 9 of the 11 participants

Below is a list of questions from the phone survey. If you have something on your mind concerning the questions, feel free to comment them. All kinds of comments would be appreciated. Especially, in answering the particular question during the study:
Did you feel that we had missed some answering option?
Did you think that the question should have been open-ended?
Did you have some difficulties in understanding the purpose of the question?
Did you think that the question should have been left out altogether or phrased differently?

Questions commented [the ID number of the participant in brackets (i.e. TAIK3 = [3])]

Q00: Where were you?

"Friend's place" (missing option, [3])

Q01: Were you engaged in activities alone/ with 1 other person/ with 2 or more persons?

"Physically or via chat/ e-mail (would've probably been useful knowledge)." [3]
"Were you engaged in activities doesn't really fit for my type of brainworker since during the work day I'm always engaged." [7]

Q02: Who were you with?

"Multiple choices would have worked better." [2] (**Comment by J-P Karinki: the interface in the mobile phone was designed in a way that first you'll notice the answering options, after that you'll maybe check what the question was… Somehow the instructions "pick all that apply/ scroll down for more options" had stayed unnoticed. See also in other comments below.**]

Q03: What were you doing?

"On this kind of question, I think that the answer is way too long to answer, to explain the context and everything. A [?] multiple choices could be needed." [1]
"At first it was unclear whether this question meant the purpose of the doing or the act of doing itself." [7]

Q07: Was this a big idea/ small idea?

“Quite difficult to tell…” [1]
“How to define big/ small idea? Or idea itself? I felt there were several duties (all creative) that didn’t fit into this concept/ question.” [4]

Q08: Was this idea connected to a client brief?

“Ideas are born constantly, and they are all generally connected to work.” [9]

Q11/ Q16: Can you capture the situation that led to this idea?/ Can you capture the situation that hindered you?

“Sometimes it is difficult to define how the idea/ solution was born, although it has been the important part of the process.” [9]

Q14: What was hindering you?

“More than one choice please!” [1]

Q17: Why did you pick this space for your activities?

“Same here, more choices to select!” [1]
“Because it is the habit, by happenstance, because it was a whimsy, it was there” [missing options, 6]

Q19: What tools did you use?

“Design books, magazines, etc.” [missing options, 6]

Q20: How important was this space for your activities?

“Quite difficult to define. We need the space to be in somewhere, but… It makes sense in some occasions.” [6]
“I think that this is not so important question.” [9]

Q23: Was your interaction with others scheduled/ accidental?

“There should be more options. Interaction with colleagues is going on all the time.” [9]

Q24: In interacting with others were you mostly providing info/ receiving info?

“Text box” [2]

“I didn’t feel that the question was important. Most of the time it popped up during the planning sessions.” [5]
“Often it is just a discussion with others.” [9]

Q25: How important was this interaction for your current activities?

“Text box” [2]

Q22: How much stress were you experiencing?

“I think this should always be the 2nd question to ask.” [1]
“This one was too abstract for me. Most of the time I answered none, though I think I was experiencing stress earlier.” [3]

If you had done the survey, what would have been the most important question for you to ask?

“How much stress were you experiencing?” [1]
“Sorry, nothing special comes to mind. How about ‘Was the day successful as a whole?’” [9]

Did your study phone work properly during the study? If not, what kinds of problems did emerge?

“It was always saying that I didn’t complete the survey to the end even when I did.” [1]
“The program slowed down a lot time to time.” [2]
“The program crashed down, keys were difficult/ impossible to lock, short battery life” [3]
“At first, the query popped up in every 5 or 10 minutes, even when I had not changed location and I had just answered to it. On the last week, I didn’t get any queries at all even though I changed from space to space.” [4]
“Once the phone got stuck and didn’t stop making the sound that signals the end of time to complete the survey. It stopped only when I removed the battery. The phone also shut off by itself even when it was currently recharging.” [5]
“At first it alarmed way too often, at the end it get shutting off. [The program] reacted slowly at the end.” [6]
“The phone shut off in the nights when it was recharging. At first it alarmed too often, every 5 minutes.” [7]
“The phone shut off by itself although it was recharging. The constant vibrating sound got to my nerves time to time.” [8]
“My phone has to be changed once.” [9]

Did you find the survey easy to answer? If not, what were the things you didn't like?

"Technical limitations. The short battery life made it very painful." [3]
"The constant peeping was annoying, especially when the queries didn't seem to have been connected to the change of location." [4]
"At first the survey didn't work well, the phone peeped although I didn't move. On the last week the situation was quite opposite, I didn't get queried even when I carried the phone with me:)" [5]
"[The questions popped up] too frequently and were too repetitive. They were also too limiting, the lack of possibilities to describe things was frustrating." [6]
"The size of the phone became challenging, it felt too big to carry around." [7]
"Not time [to answer]:)" [9]

In what kind of situations you did find answering the survey the most distracting?

"When in the "IDEA" situation." [1]
"When I had to concentrate." [2]
"I didn't felt that it was distracting." [3]
"When the phone peeped all the time, especially in the palavers." [4]
"At first the phone peeped very often during the palavers (about every 15 minutes)." [5]
"When with the clients" [6]
"During the thinking process. The sound of the vibration interrupted it unpleasantly." [7]
"In a hurry" [8]
"In a hurry:)" [9]

What kind of arrangements had made the study more pleasurable? Rank the options (1 = most important).

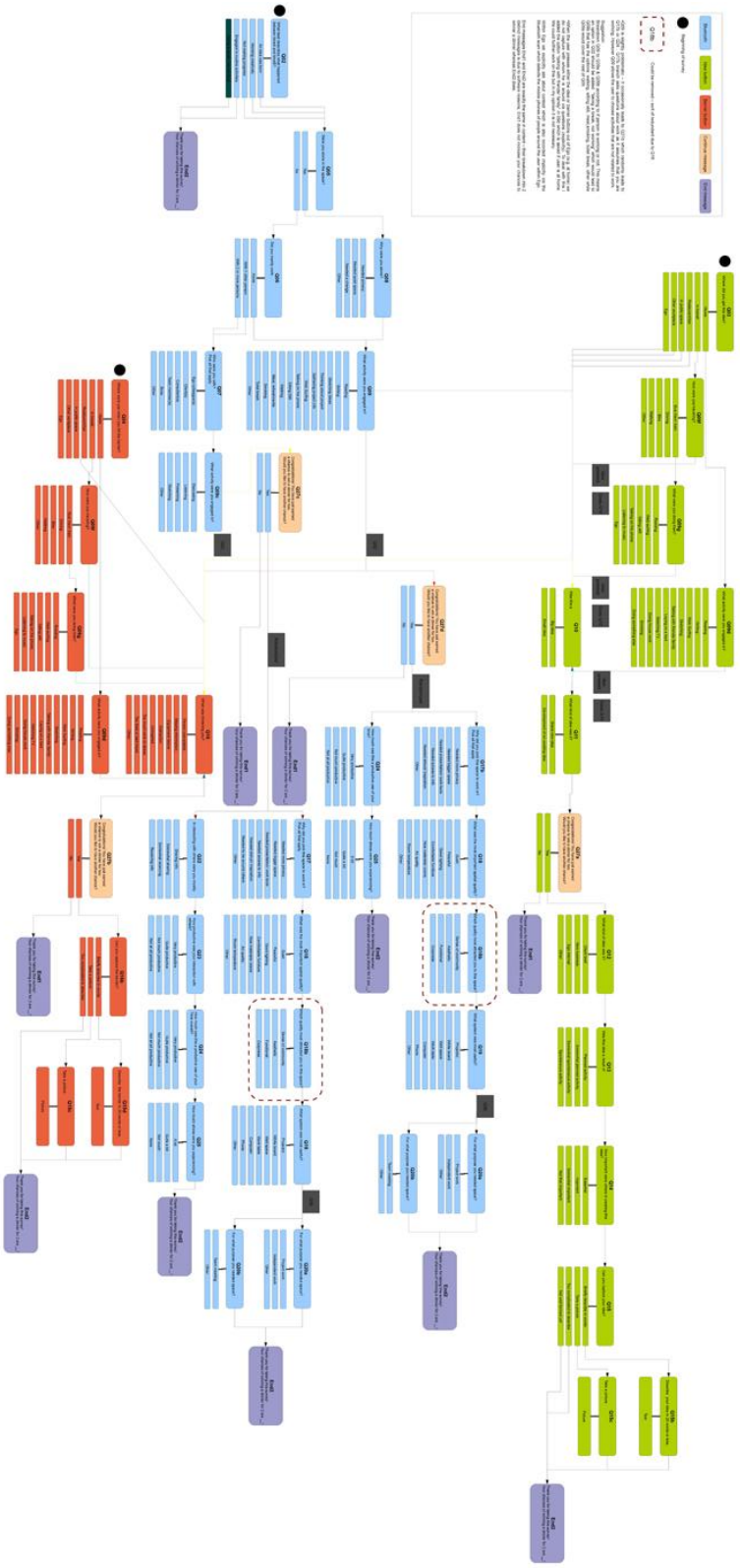
Less questions	5 5 4 2 4 5 4 5 3
More variety to the queries	1 1 2 3 2 2 1 1 2
Questions that had been customized for you	2 2 3 4 3 3 3 2 -
Technical improvements	3 3 1 1 5 4 2 4 -
Fewer surveys/ day	4 4 5 5 1 1 5 3 1

Do you feel you would participate in this kind of study again?

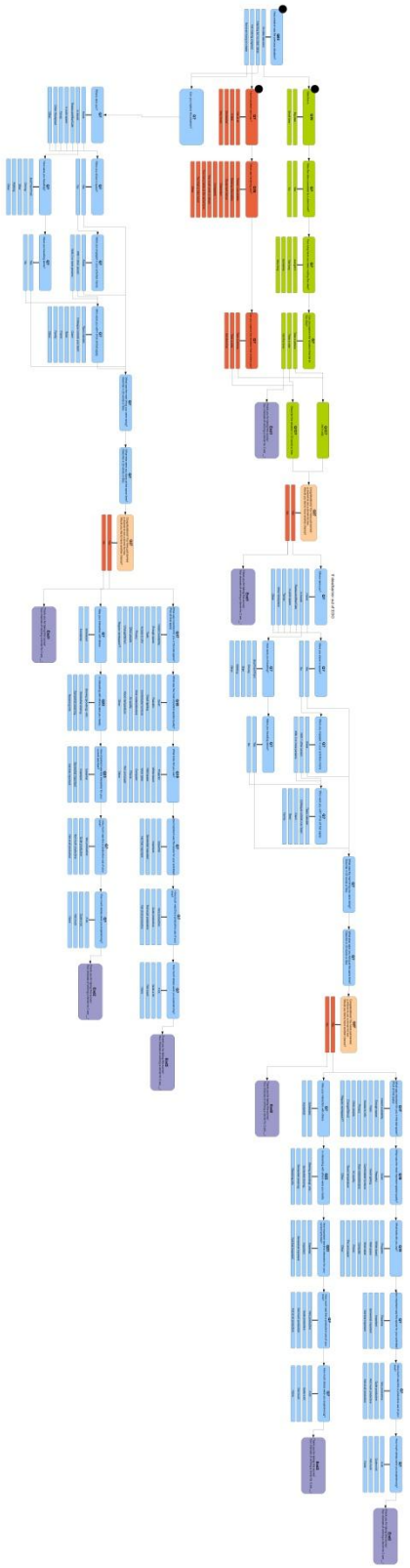
Yes	6
Yes [if it would work properly]	1
Maybe	1
?	1
No	-

[Comment, 6: "The idea is good but it is not possible to participate fully because of the lot of work."]

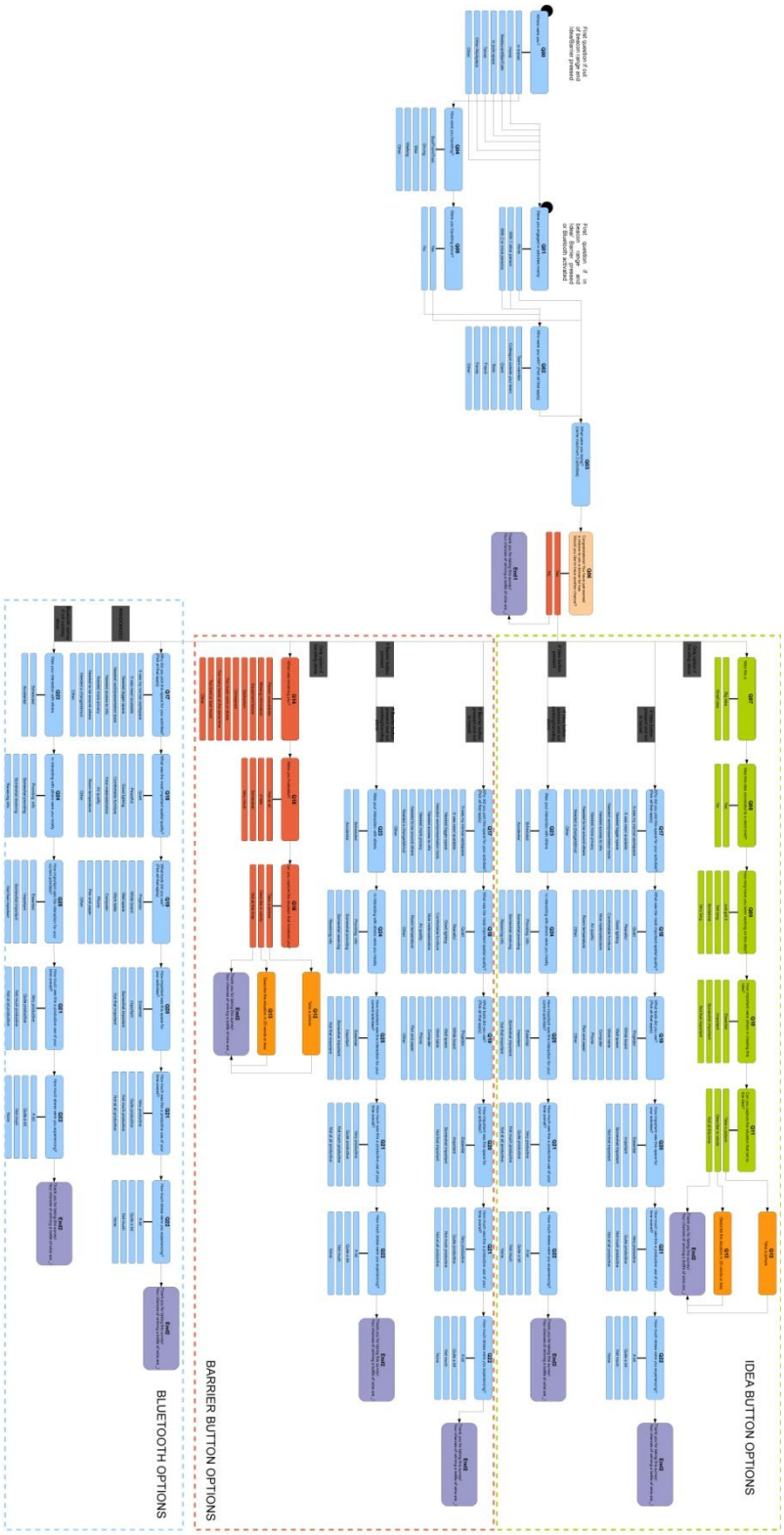
Appendix O – Phone Survey Diagrams



Survey Version 2



Survey Version 3



Survey Version 4 – Used in Taivas case study

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