Co-Designing for Life: three examples of human-driven design practices for sustainable services


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ABSTRACT
In this paper, we describe experiences of various projects when exploiting a collaborative design approach for the development of new services or products. Early user involvement in the product development process is nowadays generally accepted and standardised [7]. Also broad stakeholder involvement, ecosystem and living lab approaches are introduced for more contextual, need-driven and holistic development of service system. [6] However, the methods and techniques for accomplishing this may vary widely. Various methods naturally fit for certain special purposes but also customizing of methods for special needs and particular contexts is very important. Broad stakeholder involvement and commitment for lengthy development process needs to be taken into account when planning design process. In addition co-design and authentic, active user participation to design, calls for the new approaches, methods and tools and even renewal of the traditional model of user centered design.

Keywords
Human-Driven Design, Ubiquitous Computing, Co-Design, Innovation Showrooms, open innovation, stakeholder-based design.

INTRODUCTION
Today, human-centred design is quite an established practice for designing products and services so that forthcoming users are represented in the design process [7]. Human-centred design starts once the decision to design a certain kind of service has been made. To increase the users’ role in design and innovation, we should increasingly involve them in deciding what is needed and what kinds of services should be designed for them and with them. Kanstrup and Christiansen [12] describe this change as changing the user’s role in design from a victim who needs support to a valuable source of inspiration. But it is still uncertain whether a product or service development team will actually commit themselves to employing potential users in designing the forthcoming product or service as early as possible.

Reasons to this arise from the increasing cost of the early product development phase and the difficulties in finding and understanding correctly the available methods. The most often used methods for early design phases have been interviewing or focus groups. In addition methods for design sessions or for user requirement capturing have been adapted from other disciplines (e.g. ethnography, applied anthropology and participatory design) to better understand the actual usage situation of potential users with a new technological application [e.g. 1, 4, 8, 13].

The foundations of HCI-related participatory design can be traced to 1970s Scandinavia, from where it spread to other parts of the western world. User-centred design (UCD) and participatory design have shared many ideas, techniques and methods, but, in a way, UCD has in the past been more technology-driven, focussing on laboratory testing and finding so-called interface-related usability problems. Participatory design, on the other hand, has emphasised some ideological arguments (e.g. democracy) and given a more holistic view to system development [2,5]. For the past twenty years, and partly because of the launching of Ambient Intelligence and living lab approach, the HCI community and UCD methodology have shifted towards a more holistic view of involving users in the product development process. Besides so called traditional methods of design sessions and user involvement, innovative participation methods have been introduced.

One reason for updating methods and approach has been previously mentioned changing role of users in service design [11,12]. Instead of passive research subjects, they are seen as active co-designers and content creators. Users are acknowledged as best experts in their everyday lives and therefore have great potential as sources of innovation. User participation can affect the success of services directly by better quality, fit to needs and faster innovation speed.
The effects can also be indirect such as more customer-centred image, customer-driven organizational culture and increased motivation of employees or other stakeholders.[9,11]

In traditional human-centred design, only small numbers of users have been involved in the design activities. New methods are needed to reach the masses of potential innovators. Computer-supported methods for co-creation with users are one solution [10, 11]. New kinds of face-to-face collaboration methods are also needed. In the following we describe our experiences from methodological perspective in various projects.

CO-DESIGN WITH EXPERTS: DESIGN PROCESS FOR P4WELL

A novel service concept for pervasive and personal psychophysiological wellbeing and recovery management for working age-citizens based on stress, sleep, and exercise (P4Well) was aimed to be designed and tested in this reported project. The concept was intended for personal and independent use, and it combined psychological mini-intervention, physiological knowledge, and up-to-date wellness technologies. The project was launched at the beginning of 2008 and finished by the end of year 2009.

The project objectives were defined as:

1. Development of new innovative service concepts which utilize efficiently novel technologies in a multidisciplinary team with experts from many different organizations and backgrounds.
2. Integration of technologies and information from different methods to allow its utilization in interventions as a feedback to an ordinary citizen – either supported by a coach or managing independently his/her health.
3. Design and implementation of field studies to demonstrate the validity of the concept.

Design Process for service concepts

In the design process of the P4Well concept, cross disciplinary working methods were used to design the concept requirements and to discuss usage scenarios of the service. The design process was carried out in a series of expert group (EG) meetings. The EG consisted of experts with various backgrounds (e.g., in engineering, physiology, psychology, and business) from participating organizations.

The goal of the EG meetings was to design and develop requirements and a general description of the functionalities and elements of the concept. The approach for the concept creation was need-driven. The primary assumption was that the necessary personal health system (PHS) technologies are mainly available, but the immature applications, services and business models are the main hindrances for the wide spread utilization of PHS.

Efficient yet inspiring working group atmosphere with the experts from the different fields was targeted to be created in the EG meetings. In order to achieve this, collaborative working group methods were emphasized to collect opinions from all the stakeholders to create genuine cross-disciplinary discussions. Most of the organized meetings lasted one working day. During the design process, the EG met six times, with varying themes from the general requirements of the concept to scenario building, ethical and juridical issues, technical functionalities, and related business models.

List of Seminars

[Seminar 1] 20.2.2008, Helsinki, first expert group (EG) meeting: brainstorming for new ideas, examining potential target groups, ethical issues, and identifying basic elements for the service concept. A dialogue workshop method was used: punctilious manuscripted group discussions under predefined themes and groups. The goal was to get different perspectives from the various stakeholders for the concept development in a deliberative manner. 15 EG members participated in the meeting.

[Seminar 2] 11.3.2008, Helsinki, second EG meeting: user stories, use cases, and their analyses, as well as pathways of usage. A preliminary task and scenario-pair writing methods were performed. We organized one hour writing
sessions as a pair work for P4Well user scenario creation. 13 EG members participated in the meeting.

[Seminar 3] 31.3.2008, Helsinki, third EG meeting: legal and ethical issues. In this meeting, we applied a conventional team work method. The aim of the meeting was to find out the most critical ethical as well as juridical issues related to the service concept. 16 EG members participated in the meeting.

[Seminar 4] 22.4.2008, Helsinki, fourth EG meeting: an intermediate summary report of the concept work was launched, and we revised the results of our previous meetings. The goal was to investigate the material gathered for the concept and (re)direct the remaining concept development work according to the made conclusions. 16 EG members participated in the meeting.

[Seminar 5] 13.5.2008, Tampere, fifth EG meeting: technology concept, functions, and critical requirements. In this meeting, a so-called card-sorting game was "played" in pairs. The aim of the meeting was to prioritize and categorize most relevant features for the concept in different usage phases using the collaborative, as well as entertaining, approach. 16 EG members participated in the meeting.

[Seminar 6] 2.-3.6.2008, Summassaari, sixth EG meeting: business models, value chains, and concept review. This meeting consisted of pair and group works with the stakeholder cards from the previous meeting with the potential business platform. The goal was to identify potential business models for the P4Well service concept and also study potential opportunities and threats related to the analyzed models. 19 EG members participated in the meeting.

Expert group meetings succeeded well, with high commitment and active participation from partners. The beginning of the project is critical phase: you have to convince partners that the participation to the design sessions is useful. We took very seriously planning of the workshops and conducting of them: we exploited quite much resource to the actual planning but even more to the analysis and follow-up of the workshops. We took very seriously also participation to the workshops: we e.g. prohibited the use of computer or mobile phone during sessions. This was something extraordinary for participants who were used to check and send emails during meetings. However participants accepted this rule and due this everyone could really concentrate on meeting and enjoy fully of participation.

Outcome of design process was commented to be very useful for further development of the concept. The actual user participation to concept development was done in next phase. Users join in the design process in the form of scenario evaluations, design sessions and field trials. In the end, project itself was very successful and partners of the project were happy with the work done in the project. The concept is still under development while partly it has been already implemented to the some service portfolios of the partners. However, was there something missing from early concept definition phase? Maybe stronger interaction with actual users in first phase could have helped to make concept even better and boosted the development of concept to implemented service faster?

CO-DESIGNING WITH USERS- IHME

IHME research project takes place during 1.1.2009 - 31.10.2010 and it was segmented into three minor subprojects that offer distinct perspectives to examine methods and applications of ubiquitous computing from human-driven perspective: Developing and deploying new deliberative methods for designing services and environments (DELLU); conceiving, developing and introducing environments for open co-design of new services and products (UBIT); and developing services and products by paying attention to the preferences and needs of consumers with novel kinds of profiling solutions (TASSUA).

The main objective of UBIT subproject was to evaluate and develop further the concept of the new innovative experimental environments that work as a platform for testing and demonstrating new ubiquitous computing ideas, as well as, to enable possibilities for users to participate in both designing and executing new environments and services. Creating interactive and experimental concepts of co-design in an entertaining way aims at generating additional information and understanding on producing experimental services and applications that benefit the everyday life of people. In next chapter we’ll describe in more details the IHME –environment, main result of UBIT –subproject.

IHME –space

Launching Ihme environment was globally the first trial to test and develop further the idea of an open public co-design environment. Ihme was created to enable an open, low threshold environment where users can freely visit and with guidance experience and test new ubiquitous technology application and share their opinions.

The idea of the IHME -space was to develop experimental environment based on the strong interaction and participation of the users. The users were given the opportunity to affect, and to take part in the innovation process as co-designers for new technology and services.

VTT Ihme environment was located in the Ideapark shopping centre (Lempäälä, Finland) in a 61-square-metre facility. In the facility users were able to try out applications based on ubiquitous technology. Applications in the show room included virtual games on the pressure-sensing floor (Pompaa!), as well as games utilizing augmented reality (Dibitassut and Mobiililogot). Users
were also able to visit travel destinations virtually (VirtualTravel) and get acquainted with 3D autostereoscopic display and SmartBoard interactive whiteboard.

Figure 1. Front view to the IHME -space.

The staff included two employees dedicated to guide on learning the main principles and usage of the applications in the show room. After a guided tour the users were asked to fill out a short questionnaire concerning their preferences and ideas of further developing of the applications; and, as well, on how they experienced both visiting the show room and participating on designing future technologies in the offered shared environment.

After being accustomed and having experimented the applications visitors were asked to fill out a short questionnaire concerning their opinions and experiences on participating in co-designing process. Besides the written feedback collected on PCs, the users also gave direct oral feedback and developmental ideas to the staff. Actual notes were not written by the employees but the users were encouraged to write down their propositions on the questionnaire form.

Questionnaires used in the survey included two multiple choice questions which utilized a Likert scale for measuring users opinions and experiences about the user-friendliness and simplicity of new technological applications and services. These questions were created to map out a technological background and basic knowledge of the typical user visiting the IHME environment. Users were also asked to point out the most appealing applications.

Questionnaires section for open questions was designed to create an overview of user-experiences of visiting an open co-design environment and participating on ideating new services and products. The users were also asked to ideate new ways of applying technology presented in the show room; and to describe the features of the applications that made them either interesting, or not appealing. The users were, as well, asked to describe their stance on participating on developmental ideating of future technologies.

RESULTS

IHME space reached a great number of visitors (c.a. 2500), 355 users filled out the questionnaire. Majority of the visitors in the show room were children aged approximately from 7 to 12 years who, however, were only partially represented in participating in the questionnaire. According to questionnaires answered the average age of users visiting the show room was 35 years and the distinctive majority, 65%, of the visitors were men.

The VirtualTravel developed in IHME -project (presented and developed during the summer in Ihme environment) was the most appealing application (figure 1). Interactivity, entertaining factor, novelty, innovative visual representation, presence of a sound feedback, possibilities for further development and for a broad applicability were mentioned as the reasons making certain applications more appealing than the others (VirtualTravel, Smartboard). As a common reason, why other applications didn’t make an impression, users stated that they couldn’t see the practical benefits or the applicability was not easily noticeable (Dibitassut, Mobiililogot). Other commonly listed reasons were lack of novelty (Pomppaa!) and a game-like appearance of the applications (Pomppaa!, Dibitassut, Mobiililogot).

Figure 2. Distribution of the applications by their attractiveness.

Tech-savviness of the users visiting Ihme environment was measured on a five-level scale mapping out if users found new technology rather complicated and difficult (5) or easy and simple (1) to use. The distribution shows that 12 users (n=277) found new technology difficult and complicated (value 5), 63 users stated it to be rather more difficult than simple (value 4), 64 users didn’t find it either difficult or simple (value 3), 81 users said it to be rather more simple than difficult (value 2) and 59 users experienced new technology to be simple and easy to use (value 1).

New innovative ideas of applying technology in other contexts, as well as the ideas for the further development of the applications were expressed in 120 feedbacks. Majority of the feedback given in this section included innovative and creative ideas of applying technology in new context improving peoples everyday life.

VirtualTravel application gathered the most feedback. Users invented numerous ways to utilize the application. Utilization as a tool for visiting museums, concerts or and for virtual shopping were mentioned frequently. Users figured possible benefits also for informational and
commercial purposes in public environments and for usage as stimulating equipment for elders, invalids and sick people in hospitals or old people’s homes. Also the idea of using the application as an implement for lecturing and other educational purposes (for example teaching biology or geography) was pointed out. For further development of the VirtualTravel application users brought up ideas to have live material, a touch screen and 3D -features (both visual and audio) included to the application, a possibility to use the application online was also commonly expressed.

Visitors were also asked to state their stance on how they would feel about participating in designing new technologies and services. Out of the 175 answers given to the question 120 (69%) showed a positive response. Participating was seen as a useful and important, not to mention fun and interesting, way for stating an average users point of view, and also, necessary to developing user-friendly products and services. Convenient ways of participating listed by the users were short group interviews and conversations, online questionnaires, entering a publicly open show room and participating as a test user of new products and services. The main reasons why users were negative about taking part in the development process were not having enough time or interest, or users saw themselves not tech-savvy enough.

Visiting IHME space was reported as a positive experience by all the users answering the questionnaire. Positive user feedback was given concerning the opportunity to participate and experience new trends of ubiquitous technology which visitors found useful, public appearance of the VTT, easily approachable location and low threshold to enter the environment and to take part, expert knowledge and friendliness of the staff, and the children-friendliness of the Ihme environment. Negative user feedback concerned complains about presented technology being outdated, applications experienced as either too simple or not easily applicable in any useful way.

This human-driven design method supplied a contrast to the predominant trend of device-driven design IHME environment presented a globally unique trial for new kind of co-design approach: showroom and living lab in same context. It proved ability to enable a low threshold user research environment, obtaining feedback on innovative technology from ordinary people and other stakeholders in an open public environment. VTT IHME environment’ reached a great number of visitors and enabled a large amount of direct involvement and feedback from users in designing products and services. Direct contacts and interest to co-operation with potential partners/companies were obtained and great visibility in media for innovative research results was provided. Not only did the users find it informative and important to participate on the evaluation - every single one of the visitors found it entertaining and fun to participate. The trial provides indispensable knowledge for the future projects of designing co-design environments.

**CO-DESIGNING IN CONTEXT: SHAPING MARKETS FOR SUSTAINABILITY – SHAPE**

In Shape –project we take further steps in developing and implementing of co-creation methods and approach. Our cases with companies are focusing on travelling, furniture industry, local food in supermarket, sustainable amusement park in big shopping centre. We have utilized expert meetings, user interviews and questionnaires to get basic knowledge of these particular cases in context. The next steps of the study are focusing on real co-creation either in virtual or physical co-creation platforms or spaces. One example of our own development in tools for co-design is Visual -IHME. Another example is our co-design activities arranged in conjunction of travel and housing fairs.

![Figure 3. General approach of SHAPE](image)

**Co-designing in Fair environment and in Train**

Our aim was to involve various stakeholders to the designing of sustainable services in context where participants are already tuned in to the right mood: looking for travelling experience.

Domestic Travel Fair was held on 13-15 April in Tampere Exhibition and Sports Centre at the same time with four other fairs We participated in Domestic travel fair with Tampere Region Economic Development Agency Tredea at the Tampere stand

Main purpose was to study: 1) fair visitors’ opinions on sustainable travelling and factors important to them while travelling; 2) Fair as an environment for ad hoc short interviews.

The study sessions consisted of an open question: what sustainable travelling means to you and what comes to your mind on the words “sustainable travelling” and a short questionnaire (1xA4) for the participants to fill. The study sessions took appr. 5-10 minutes. Participants were selected randomly among visitors, mainly from the main entrance hall (110 participants). The questionnaire was also available on the internet (61 participants, but the questionnaire on the internet didn't include the open question on sustainable travelling due to technical reasons.

It is fair to say that the context (travelling fair) made it easier to people to think and give their opinions. Also to the designers, researchers and other involved doing research in context was enjoyable experience: it was easy to ask people
to participate for a shorter or a longer discussion depending on time of the people could spend. We focused this spring on “slow travel” – experience which was identified as a one of the potential features for sustainable travelling. One of our experiments in this focus area was to conduct innovation sessions and user interviews on train while travelling from Helsinki to Rovaniemi (so called Design Train). The experience was encouraging: expert sessions in their own cabin were successful, feedback was very positive from this group. Also user interviews were mainly commented as very inspiring experience: people were willing to spend a few moments during their travelling for interview and discussion was also easily related to the design issues – slow travelling.

Visual-IHME

The Visual IHME end-user interface shows a “window” to a spherical panorama picture that covers an environment in all directions from the point the picture is taken. The window can be turned around with a mouse, or with finger if a touch screen is in use. The user can move from one panorama picture to another by clicking an arrow button (Fig. 1 down left). Sound can be added to the panorama to increase realism. Also other types of files such as images, photographs, and texts can be attached to the panorama picture.

Figure 4. Distribution of the applications by their attractiveness.

The current set of co-creation tools include comment/discussion boards (either pinned to a location or positioned aside the image) with a “thumb up/down” voting function, questionnaires and polls. Within the current system, any user is able to start a new discussion topic but only users with editor rights can create questionnaires. The gathered data is stored in a database in the Visual IHME software. The data can be exported and analysed in Microsoft Excel format. In the future, more co-creation tools with an elaborated user right system and tools for data analysis will be developed.

We carried out a small scale end-user evaluation of Visual IHME with 10 adult volunteers of different ages (seven female, three male) on February 2013. The participants were individually given a brief demonstration of the platform and its co-design features, then filled a questionnaire and were shortly interviewed.

Visual IHME got positive feedback from all of the participants. Nine participants said that would use this kind of tool to share and develop ideas with others. The most valued features were “thumb up/down” (eight participants of the ten thought that this function is necessary in the interface), discussions (7/10), ability to create new discussion topics (6/10) and questionnaires (6/10).

In general, the participants thought that the role of the platform is to support collecting ideas from consumers and elaborating them together with designers. We received some ideas how and where Visual IHME could be applied to, for instance: when designing usage of land, traffic or telecommunications network, and when designing for equality and accessibility (e.g., accessibility of a city with the disabled inhabitants as one stakeholder group in the co-design process).

Each participant found social media services and internet as overall good tools for involving users in design and development, especially when developing new services or technology. However, half of the participants had a conception that with (current) social media services they are not able to influence issues that are important to them. In line with Dourish (2010), we take this as a hint that even in the modern world penetrated with communication technologies, there is still plenty of space to develop virtual or technology mediated platforms that really can empower people to influence the conditions they live in.

DISCUSSION

Design of future ICT and sustainable services and products that are mainly based on ICT, calls for new design methodologies for the greater acceptance among presumable user groups and justification among all relevant stakeholders. Furthermore the factors affecting to the design decisions of future services and applications are numerous, various and in many cases frequently in conflict. Today user experience studies are conducted in order to get better effectiveness, efficiency, and user satisfaction and user acceptance for new products and services. Even though the design approach is called human-centred or user-centred the design of new products and services has been quite technology or market driven in Information and Communication Technology (ICT) business. Instead of putting technology or market to the core of design process and product development the human needs and values should form the fundamental basis of design.

Human Driven Design (HDD) refers to the design approach which broadens the perspective from focused product or service development process model to the more holistic design perspective. Co-design as a lower level methodology furthermore broadens the scope and role of involved participant groups in the actual design process. Authentic co-design aims to give voice and influence to all...
relevant stakeholders and in that sense it links closely to the deliberative design approach. HDD includes assessment of critical issues (i.e. social, ethical) of design process and artifacts while tradeoffs in design have to be well justified. The ultimate goal of HDD approach is to accomplish design framework which will empower all stakeholders when designing their everyday service environment or context of work.

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