

Scenario-Based Design as an Approach to Enhance User Involvement and Innovation

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Abstract. Scenario-Based Design has been implemented widely to the concept and product development processes. Especially in the development of Information and Communication Technologies the Scenario-Based Design approach has been utilized widely though with different variations and modifications. In this paper I focus on experiences how Scenario-Based Design approach has enhanced better user experience of design and increased user involvement and user-driven innovation in product development processes.

Keywords: Scenario-Based Design, Information and Communication Technologies, Human-Centred Design, User Involvement, Innovation.

1 Introduction

As a design instrument scenarios are stories about people and their activities in a particular situations and environments (contexts). The value of scenarios is that they make ideas more concrete and describe complicated and rich situations and behaviours in meaningful and accessible terms. Scenarios can be textual, illustrated (for example picture books or comic strips), acted (for example dramatised usage situation) or filmed (for example videos) descriptions of usage situations. The users in these descriptions are usually fictional representatives of users (personas) but might also be the real ones.[1, 8, 17]

Scenario building is a way to describe current situation of humans in particular context or generate design ideas for new products and to identify potential user groups and contexts of use for the product. The design team with or without users can generate one or more ideas (or system concepts) for the new system. The most feasible concepts can then be selected for further elaboration toward user and application requirements specification. [1, 8, 9, 10, 17]

Scenarios have been used actively in system design in past decades. [1, 3, 4, 5, 8, 9, 11, 21] Recently Alexander and Maiden (2004) has edited a comprehensive book for using scenarios as an effective technique for discovering, communicating and organizing user and technical requirements at any stage in the system life-cycle. [1]. Besides using scenarios as a design tool for product development, scenario-based methods have also been used to enhance user involvement to design e.g. system, appliances or work. [2,13,19]. In addition the user involvement in product

development life cycle enables users both to give their feedback to the pre-designed solutions as well as innovating totally new designs for their purposes. [12, 20]

2 Scenario-Based Design Projects

2.1 mmHACS

The user and concept of elderly focused mobile services were completed as a part of the 3-year mmHACS (multimedia Home Aid Communication System) project which started in the summer of 1998 at the University of Oulu. Nokia Mobile Phones was a cooperative partner in the project. The idea of the project was to create and demonstrate new products, services and a complete system based on modern technology for the homes and service providers of elderly and disabled people. The main emphasis of the project was on developing a multimedia communication terminal called Home Assistant. This terminal allowed elderly and disabled people to keep in touch with relatives, friends and service providers. [14]

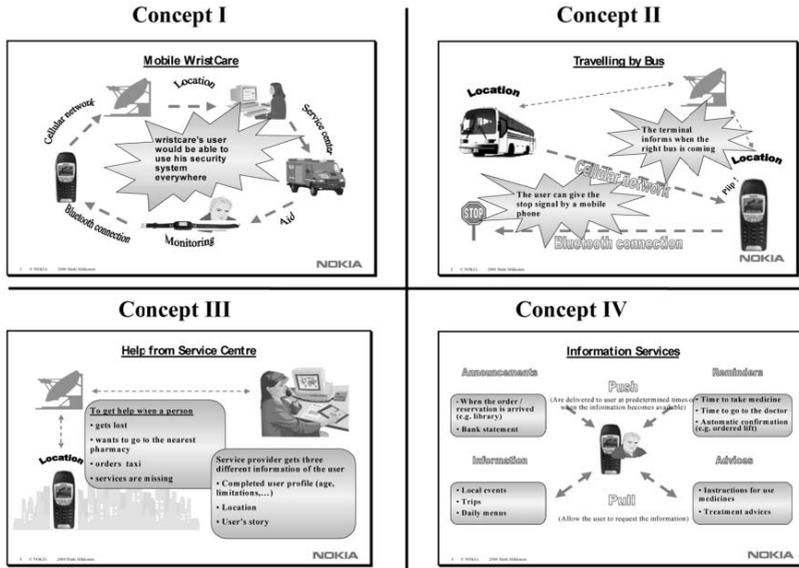


Fig. 1. Elderly-Driven design concepts of the mmHACS –project

The particular study of mmHACS surveyed product development and design in the field of mobile terminals and considered the suitability of mobile services, in particular, in facilitating the life of elderly and disabled people. The study concentrated on finding out the key service needs of elderly people. The service needs from the end users' as well as the experts' perspective were gathered by means of various group methods such as ideation sessions. Four mobile communication service concepts were created using these groups' opinions (Fig. 1). After diverse communication, these concepts were tested by the elderly. Forty-four elderly people

(average age: 74 years, range: 51–87 years, male = 27, female =17) evaluated the concepts. [14]

The concept study was used to ascertain what the elderly themselves thought of mobile services, and how important they felt the service concepts developed on the basis of the user study and the experts' statements were to them now and in the future. The example stories were implemented into the concepts for the concept study with the elderly. Based on the study, the main conclusion was that the elderly valued the freedom of travel brought by mobile terminals. They were ready to accept new forms of help made possible by mobile technology and were ready to begin to use the services as long as they truly facilitate independent living indoors and outdoors. Elderly people were also willing to pay for the use of the service concepts presented. [14]

2.2 KEN

One of the tasks of the KEN project (Key Usability and Ethical Issues in the NAVI programme 2000- 2002) was to examine the potential usage cultures of navigation services and devices. Fourteen different groups were selected for the study as potential users of personal navigation. The intention was to maximise the diversity of the customer groups. Groups at different stages of life were selected to include the various needs of persons from children to the oldest of the old. Also some special group, like hunters, were included in the study to determine the focused needs of personal navigation for these groups. It was intended that elderly persons suffering from memory disorders would make up one potential user group. However, it proved to be very difficult to assemble such a group for the scenario evaluations. For this reason we ended up gathering the opinions of this group by interviewing the relatives and care-giving personnel and in the group discussions we finally had thirteen different groups. [18]

The products and services for personal navigation were presented to the user groups in pictured scenarios (Figure 2). Every group evaluated 3-5 scenarios, which presented different perspectives of the products and services for personal navigation. The use of scenarios was intended to help people to understand the idea of personal navigation and then to elicit the ideas, attitudes, opinions and needs of different user groups with regard to navigation services and products. [18]

The purpose of these evaluations was to chart how much the user groups currently know about navigation services and devices and what kind of experiences they have had of navigation in general. The second goal was to study how credible and useful potential customers considered the scenarios. Third purpose was to identify needs of the user groups for navigation services and let the participators innovate new navigation services. The evaluations were carried out as group discussions. Beside the group discussions there have been interviews with experts of elderly care and rescue services to complement the information of some special groups. The scenario evaluations and interviews focused on consumer focused personal navigation. [18]

The user groups that we interviewed assumed that the first users for PNS (Personal Navigation Systems) would be found among different professionals and among the people that need extra guidance (including professionals caring for these people). Special interest groups like yachters and hunters already use GPS and VHF navigation devices. These kinds of groups will probably be among the early adopters

Lauri was waiting at the traffic lights when the phone alerted. Well, again commercial messages, this time from the shoe shop near by. Just after Lauri had put the phone into his pocket, another alert was coming. This time he was tempted to have a look at a brand new internet-connected toaster at the household appliance store on the other side of the street.



Fig. 2. Example page of the Junk Mail scenario

of the new services and products if they detect those as practical solutions for their use. In the interviews, young people were also generally mentioned as the first users of PNS even though some of the youngsters themselves did not see themselves as going on forefront in using PNS. Route guidance in unfamiliar places was generally seen extremely practical. Wilderness, hobbies related to nature, and cities were mentioned in all the user groups as places where the PNS could be usable. Commercial services and ads based on location were seen amazingly acceptable in the groups. People who did not want ads today did not want them either in future with another media. Most of the people considered location based ads useful since one could precisely define what kind of bargains one wants to receive and one could make exact search entries for needed items. Indoor navigation was seen rather useless for an ordinary user. In special situations and for special groups it was however mentioned as a practical application. Alongside with privacy the issues of safety and control were discussed widely in the interviews. Criticism towards new technology was brought up in many groups. Predestined and over-controlled environment was seen dubious. Participants in the user groups mainly wanted solutions to ease their life in some functions but they did not want their life to become totally controlled by the demand of super-efficiency. Fear of radical changes in human interaction, usability of systems and narrow use of new services and products were commented generally in the groups. [18]

Later on in Ken project the concept study of personal navigation in work contexts was carried out between May and August 2002 with Benefon Ltd. The objective of the study was to find out how different kinds of occupational groups could take advantage of the information technology and communication system that is based on personal navigation. In addition, the objective was to verify the upcoming product concept of Benefon and make sure that it would be appropriate for the planned purpose of use. During the work on the Benefon case, multidisciplinary group of researchers from Benefon and VTT Information Technology carried out two rounds of interviews. The researchers from Benefon interviewed representatives of different occupational groups in the US, the UK Sweden and Norway, whilst the researchers from VTT interviewed a number of representatives in Finland. There were 23 interviews in all (14 interviews were conducted abroad and 9 in Finland). Two of the Finnish interviews were pilot interviews. Each interview was divided into three sections:

Design of the Mobile Device, Usage Scenarios and The Feature Assembly method. There were two kinds of interviewees in the Benefon case: decision-makers at the selected target group companies and potential end users. The Design section was a structured interview, the Feature Assembly method was a game including interview and the Usage Scenario section was conducted as a thematic interview by using six different usage scenarios as a guide to visualising the context of use, functionality of the device and user's interaction with the system (Figure 3). [6]

In general the interviewees liked the scenarios presented to them. Using annotated cartoon panels was quite a useful and informative way to present the stories to the interviewees because we had to deal with difficult technical terms and functions during the interviews. In particular, the flow chart proved to be a very useful part in the scenarios because it helped to went through the one whole working day with problem scenarios and suggested solutions. According to the results of our study in the Benefon case, it seems that the end users and decision-makers of different occupational groups were quite interested in positioning devices as well as exploiting geographic information in their workplaces or working environment. However, the interviewees thought that the device should be quite simple, easy to use and easy to tailor to the needs of the company/organisation in question. Some of the users pointed out that it is important to them to know when they are being located and how accurate the positioning is. The set-up and controlling of the device should be able to be done remotely so that the end user does not have to do everything by her/himself. Many decision makers who were interviewed considered that the possibility to use new positioning technology could make the allocation of resources easier and more effective, which would also reduce costs. Of course, the price of the device should be reasonable so that the investment is profitable. [6]

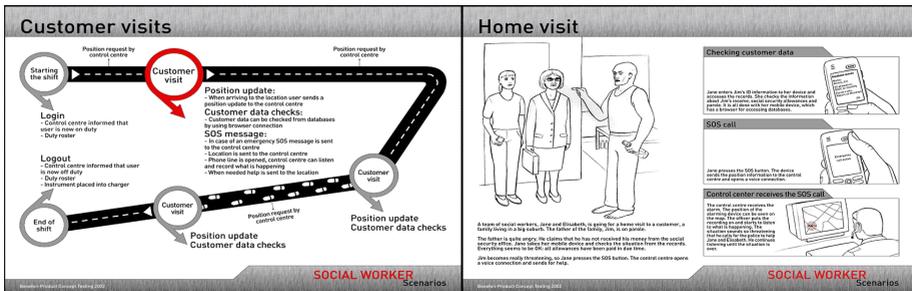


Fig. 3. Flow chart of the scenario and one page of the social worker scenario

2.3 Käykse

The goal of Käykse project has been to recognise the problems in designing and evaluating intelligent environments, and evolve the research frame. The intention was to increase the dialogue between technology developers, system designers and users. The project aimed to develop design methods that help in adjusting user needs and technical possibilities to each other. We have sought to understand user experience of tomorrow's services and products as early as possible, and to create an innovative,

inspiring, pleasurable and entertaining user experience and concept definition session to all stakeholders.[19]

We developed interactive scenario -method to increase the participation of the potential users in the early stages of the concept design process. We sought flexible methods, so that they can be utilized in various projects dealing with ubiquitous computing. We started with role-playing methods and found it very useful and rather light to take in to use. However, we wanted to evolve methods which involve physical participation. Improvised acting and scenario playing contain many of the elements we sought, so we decided to base our methods on them. [7, 19]

In testing the method we concentrated on case smart home, because at that moment there was a project going on that needed new ideas for designing a smart home concept. We found it is essential to know the theme of the development. The aim of the testing was to develop the methods further, find new ideas, discover the methodological problems and try to solve the found problems. According to observation, findings and feedback the upcoming sessions were prepared and the method was developed further. [19]

We staged three improvisation sessions, each with different participating groups. The first session consisted of experienced improvisation actors and our research team. Our aim was to test the method and improve it based on our results. Potential users attended the second session in the audience, influencing the acting, and in the last session the improvisation actors were left out and the users were encouraged to act out scenes with the research team. In order to gain results of first-time experiences, we had different actors and users present in each session. [19]

2.4 Nomadic Media and Mimosa

In Nomadic Media project [16] we aimed to develop innovative solutions that will allow consumers to use the devices that best suit them in respective time and place. The solutions should adapt more readily to people's personal preferences and needs, be enjoyable to use, and provide low-entry thresholds for all sections of society. In MIMOSA project [15] the main focus was the development of novel low-power microsystems to create the MIMOSA technology platform. MIMOSA achieves this by developing a personal mobile-device centric open technology platform to ambient intelligence. Microsystem technology is the key enabling technology for realising the MIMOSA platform due to its low-cost, low power consumption, and small size. The design approach of both projects was strongly human-centred.

In both projects scenarios were used as descriptions of usage situations in selected application areas, and they also described the common vision of the project: (1) What could different technologies provide to the end user and (2) how will the technology look and feel in different everyday situations. Scenarios were also used as a design instrument in the human-centred design (HCD) process of Nomadic Media and MIMOSA technology and applications. The initial scenarios were produced with the contribution of all partners, both technology and application developers. Second, the scenario ideas were analysed and refined and new scenarios created. These scenarios were later analysed to identify usage and application requirements, which lead to some refinements in the scenarios. The scenarios were updated throughout the projects, based on technology development and continuous user feedback. [10]

The main method of the early context requirement phase was scenario evaluations with application developers and end users. The scenario material including texts and visualizations (Fig. 4) was delivered to the focus group participants beforehand. One group included normally from 2 to 8 participants and two to three evaluators. The acceptance of the concepts described in the scenarios was evaluated and the users could present new ideas for improving the concepts or even invent new ones. The multiple-choice questionnaire was used to collect accurate and non-interpretative data in order to compare the evaluations carried out in different sessions. [10]

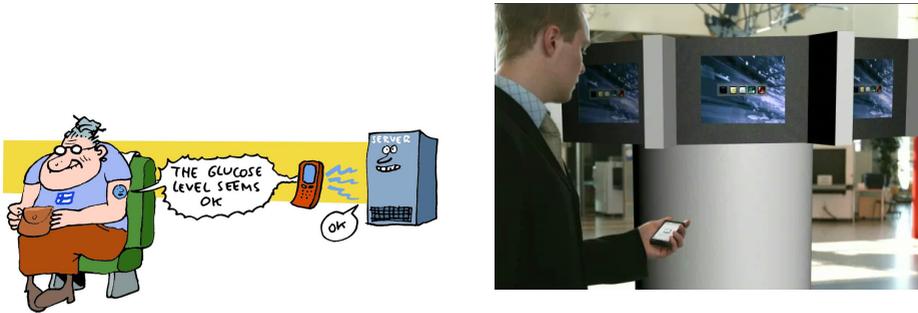


Fig. 4. Example scenario visualisations of Mimosa (left) and Nomadic Media (right)

3 User Involvement and Innovations

In mmHACS scenarios presented well defined service and technology concepts and potential users evaluated these scenarios. Scenarios were realistic and users could empathise well to the situations and characters presented in the scenarios. The user study of mmHACS was used as a tool to identify the needs of the users. It would have been good if more concrete and functional prototypes could have been used in the concept study to communicate and demonstrate the service concepts as the concepts had to be evaluated on the basis of the picture created by the researchers. Nevertheless, with the help of the example stories the elderly probably received the picture of the service concepts that was in the minds of the researchers. However, the elderly were often left with the understanding that the service is applicable only in the situation described in the story. To correct this misunderstanding, it was explained that the services were applicable in many situations. We believe the concept study gave most of the participants the intended picture of the service concepts. [14]

In Ken projects professional service part main result was that the three-stage method of the product concept interview seemed to be working well also in international studies (anyway in US, the UK Finland, Sweden and Norway). Evaluators (potential users and decision-makers) gave positive feedback of the interview and especially the Feature Assembly was commented by some users outside of Finland very competent way to collect user requirements for the concept. Researchers of the study were also happy with the developed methodology. The three-stage method made the concept study more understandable for the users and the interaction between researchers and interviewees was well organised but also flexible

when needed. Visualisation of the design, scenarios and the features helped communication between different nationalities in interview situation. Also the Feature Assembly played as a game made prioritising the features easier and more like a fun thing to be done. [6]

In mmHACS, KEN, Mimosa and Nomadic Media user involvement was mainly enabled by using scenarios as a design tool. Based on these experiences scenarios enhance the user involvement into the concept evaluation sessions. If the design concepts are well defined then the scenarios help potential users to evaluate concepts and subsequently evaluation results help developers and designers make their decisions for the further development of technologies, concepts and designs.

In projects like KEN, Käykse, Mimosa and Nomadic Media scenarios enable people to think devices, services and functions that were not experienced yet in real life. However, the stories presented in the scenarios were such that they could happen in real life to real persons. This is why people could identify themselves or probably other people in their community with the persons presented in the scenarios.

Our aim in scenario evaluations is not to present only so called neutral stories because our assumption is that critical scenarios could bring up some (e.g. ethical) questions related to personal navigation, which otherwise could be left out of the discussion. In scenario evaluation sessions the critical aspects presented in the scenarios actually makes it easier to bring up suspicions, e.g., questions about the rights of the authorities to locate persons. However, the critical scenarios were not only commented as undesirable concepts but in many cases the users are also innovating improvements to the scenarios. Illustrating the scenarios with pictures is a good method to clarify the concepts presented in the scenarios and to lighten up the stories to be easier to go through. Terminology of new technologies and services were in many evaluation sessions commented odd. Scenarios of course clarify the meaning of the concepts but still one has to be careful when launching new services and device – is it better to use existing and familiar terms or to create a brand new terminology?

The Interactive scenario method developed in Käykse project works at its best in the ideation phase when designing large complex entities, e.g. ubiquitous computing environments. The technical features cannot be gone through in detail using this technique. Improvisation is good in testing ideas, specifying existing scenarios and designing concepts. The method works also when illustrating ideas, concepts or usage situations for e.g. end users. Services, especially everyday life systems related to spaces, operating sequences and stages that differ from each other, can be designed by means of improvisation. In addition, improvising occupational services can be useful with professional users.

4 Conclusions

Scenario-Based Design fits well to all kind of projects. Scenarios have been used in Human Centred Design of computing applications and they seem to be especially useful and popular when designing smart environments and inventing new possibilities to utilise new technologies in our living environments. Complicated technological systems can be laid aside when using scenarios to describe the future possibilities from the user's perspective. Product development process is a cycle

where scenarios in general can be utilised in many ways. The strong user involvement already in the early concept definition phase shifts the user-centred design and innovation processes over the manufacturer-centric and technology-driven development and innovation that have been the ruling agenda for ages [20]. One of the outcomes of this process would be the opportunity to integrate the designer and the user again and give back to the user control over his computerised environment. If these kinds of user-innovation enabling (e.g. easily customised and personalised computing applications) tools and environments will come more common in the future I guess that then we are approaching the era of calmer computing.

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References

1. Alexander, I.F., Maiden, N. (eds.): *Scenarios, Stories, Use Cases. Through the System Development Life-Cycle*. John Wiley & Sons Ltd, Chichester (2004)
2. Bødker, S., Iversen, O.: Staging a Professional Participatory Design Practice-Moving PD beyond the Initial Fascination of User Involvement. In: *Proceedings of Second Nordic Conference on Human-Computer Interaction*, pp. 11–18 (2002)
3. Carroll, J.M.: *Scenario-Based Design*. In: *Envisioning Work and Technology in System Development*, John Wiley and Sons, New York (1995)
4. Go, K., Carroll, J.M.: The Blind Men and The Elephant: Views of Scenario-Based System Design. *ACM Interactions* 6, 44–53 (2004)
5. Hertzum, M.: Making use of scenarios: a field study of conceptual design. *International Journal of Human-Computer Studies* 58, 215–239 (2003)
6. Ikonen, V., Suihkonen, R., Jalonen, K., Laitakari, I.: *Developing Personal Navigation Products for Professionals - A Methodological Perspective*. Fifth Annual International Workshop on Internationalisation of Products and Systems IWIPS 2003. Berlin, Germany (2003)
7. Ikonen, V.: Experiences in using role-playing, computer game and physical action to enhance user involvement in design of future applications. *Workshop on HCI Issues in Proactive Computing at NordiCHI'04*. Tampere, Finland (2004)
8. Ikonen, V.: *Scenarios in Ubiquitous Computing System Design: User-driven vs. The 11th International Conference on Human-Computer Interaction (HCII 2005)* (Las Vegas, Nevada, 2005), Lawrence Erlbaum Associates. Lawrence Erlbaum, Mahwah (2005)
9. Ikonen, V., Niemelä, M., Kaasinen, E.: *Scenario-Based Design of Ambient Intelligence*. In: Youn, H.Y., Kim, M., Morikawa, H. (eds.) *UCS 2006*. LNCS, vol. 4239, Springer, Heidelberg (2006)

10. Ikonen, V., Leikas, J., Strömberg, H.: Elderly driven innovation for nomadic computing. The 1st Nordic Innovation Research Conference- Finnkampen. Acta Universitatis Ouluensis. Oulu 2007. C266 (2007)
11. Jarke, M.: Scenarios for Modelling. Communications of the ACM 42(1), 47–48 (1999)
12. Kelley, T.: The Ten Faces Of Innovation. Doubleday. New York (2005)
13. Löwgren, J.: Animated Use Sketches as Design Representations. ACM Interactions 6, 22–27 (2004)
14. Mikkonen, M., Väyrynen, S., Ikonen, V., Heikkilä, M.: User and concept studies as tools in developing mobile communication services for the elderly. Personal and Ubiquitous Computing 6 (2002) 2, 113–124 (2002)
15. Mimosa project (2006) (Accessed November 24, 2006), <http://www.mimosa-fp6.com>
16. Nomadic Media project (2006) (Accessed November 24, 2006), <http://www.extra.research.philips.com/euprojects/nomadic-media>
17. Rosson, M.B., Carroll, J.M.: Usability Engineering. In: Scenario-Based Development of Human-Computer Interaction, Morgan Kaufmann, San Diego (2002)
18. Sotamaa, O., Ikonen, V.: Picturing the Future Personal Navigation Products and Services by Means of Scenarios. In: Chen, M.-S., Chrysanthis, P.K., Sloman, M., Zaslavsky, A. (eds.) MDM 2003. LNCS, vol. 2574, Springer, Heidelberg (2003)
19. Strömberg, H., Pirttilä, V., Ikonen, V.: Interactive scenarios – building ubiquitous computing concepts in the spirit of participatory design. Personal and Ubiquitous Computing. 2004(3-4), 200–207 (2004)
20. von Hippel, E.: Democratising Innovation. MIT Press, Cambridge (2005)
21. Weidenhaupt, K., Pohl, K., Jarke, M., Haumer, P.: Scenarios in system development: Current practice. IEEE Software 15(2), 34–45 (1998)