USER-EXPERIENCE ECOSYSTEMS:
A TOOL FOR UNDERSTANDING USER EXPERIENCES FROM THE USER'S VIEWPOINT

Petri Mannonen,
Aalto University School of Science
petri.mannonen@aalto.fi

ABSTRACT

User experience has been established as a valid concept when the user's viewpoint of interactive products and services is considered. However, the definitions of user experience are currently linked only to the designed product or service. From the user's perspective, the usage of a product usually includes the use of other resources as well, and all these resources have an effect on the experience of using the product.
This article defines the concept of user-experience ecosystems as a network of products, services and information resources the user is experiencing when using a product. The user-experience ecosystem concept takes into account the technology-filled world we are currently living in. The power of the user-experience ecosystem concept is demonstrated via a case study of university students' e-book reader user experience.

Keywords: user experience, user-centered design, ecosystems

INTRODUCTION

During last few years, user experience has grown into a popular concept in many fields relating to product or service design. In fields of user-centered design (UCD) and human-computer interaction (HCI) user experience has become almost as central as usability and user needs (Hassenzahl & Tractinsky, 2006; Kuutti, 2010; Wright, Blythe & McCarthy, 2006) and in, for example, business literature experience has been recognized as a central concept in companies' customer relationships (Meyer & Schwager, 2007) and even envisioned to be the key economic offering of the companies (Pine & Gilmore, 1998).

Despite of the popularity of the concept, few are agreed on definitions of it (Law et al., 2009). As a result, many different meanings and viewpoints toward user experience have been developed (Forlizzi & Battarbee, 2004; Roto et al., 2011).

Regardless of the differences, the definitions of user experience also have similarities. The most common factor is naturally product or service and the usage of it. For example ISO 9241-210 (2010) standard defines user experience as: *"person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service"*

Hassenzahl and Tractinsky (2006), in contrast, define user experience as: *"a consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g., complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g., organizational/social setting, meaningfulness of the activity, voluntariness of use, etc.)."*

In addition to usage, the ISO's definition emphasizes time span. We can experience product or service before we have a change to actually use them and we can also think back and, in a way, re-live or re-experience the usage situations.

In contrast, Hassenzahl (2010) and Law et al. (2009) emphasize dynamic, context-dependant, and subjective nature of user experiences. *Dynamic* means that experience is a continuous process that is undergoing changes all the time. This aspect

highlights the same temporal aspects as the ISO standard. Context-dependency means that single experiences are always strictly situated and, in a way, unique. Subjectivity means that the user experience is part of the user and not part of the product or service. Experiences emerge in relationships between people, situations and products, but they are created in the mind of the user.

The relation between user experience and usability is complicated. However, the common understanding is that the user-experience research builds on human-computer interaction and usability research and tries to widen the focus of HCI studies by, for example, emphasizing hedonic aspects of product usage and aesthetics (Bargas-Avila & Hornbaek, 2011).

Interestingly, the current user-experience research speaks about users and their experiences in very product- and service-centric ways. The subjective nature of user experience is recognized in the literature (e.g., Battarbee & Koskinen, 2005), but the designed product or service, and the users interaction with it, is usually thought to be enough to trigger a meaningful experience in the user. Undoubtedly, any event can be seen as a source of experience, and people can even describe, for example, the emotions the event somehow elicited. However, understanding every product-interaction event as a meaningful experience for the user can result in undervaluing the user's tasks, motivations, and goals (i.e., underrating the user and his or her point of view).

Since users' goals and tasks are in the core of usability and UCD (e.g., ISO, 2010; Lewis & Rieman, 1994; Hackos & Redish, 1998; Beyer & Holtzblatt, 1998) forgetting them in user-experience research means forgetting one's background. In addition, forgetting the key factors of usability and UCD means also forgetting the user.

This article analyzes the user experience from the users' viewpoint and, based on that, builds a user-centered framework of user experience, namely user-experience ecosystem. The user-experience ecosystem framework is further explained and tested in an in-depth analysis of the e-book reader user-experience of university students. Finally, in conclusions, the user-experience ecosystem framework's key characteristics are summarized and future research directions to further develop the framework are suggested.

USER-CENTERED VIEW OF USER EXPERIENCE

From the users' perspective the current definitions of user experience are very restricted. The main problem of the user-experience research seems to lie in one of its key dimensions, in the context of use. The definitions of user experience name numerous factors of context, namely physical, organizational, social environment, meaningfulness of the task, and voluntariness of use (Hassenzahl & Tractinsky, 2006; Law et al., 2009; Roto et al., 2011). Despite being aware of the highly situational (i.e., context-dependent) nature of user experience, the current research is systematically missing one of the key aspects of the modern world, pervasiveness of technologies and other human-made artifacts.

The majority of environments we act in are technology filled (Hughes, 2005). In addition, most of our everyday tasks are deeply linked to different technologies. For example, a simple task of having a cup of coffee at the corner cafeteria includes using many kinds of technologies and by many different people. The individualistic bias (i.e., focusing only on single users) has been noticed in user-experience literature (Battarbee & Koskinen, 2005). However, even the co-experience approach suggested by Battarbee and Koskinen (2005) focuses on single products and services that mediate communication or experience sharing. In addition to individualistic bias, there seems to be a bias toward seeing only one product or service at a time.

During the last few decades, information and communication technologies (ICT) have infiltrated almost every part of (Western) societies. Also the majority of user-experience design has been conducted in the field of ICT (Bargas-Avila & Hornbaek, 2011). Castells (2000), in his seminal work on network society, lists four key characteristics of the information technology paradigm: 1) information

technologies act on information, 2) effects of information technologies are pervasive, 3) information technologies utilizes networked logic in inside the systems and between systems, 4) information technologies are flexible, and 5) different information technologies tend to converge into highly integrated systems. These key characteristics are the force that has pushed the information technology evolution forward and information technologies to new domains of life.

As a result, we live in an environment where there are only a few products or services that are or can be used separately from other products and services. Usually things are used in an environment inhabited by tens, hundreds and sometimes thousands of other man-made things. As a result, the using of a single product or service is strongly affected by other products and services. Thus, focusing on a single product or service and its interaction with users is not enough when user experience is considered.

As the definitions state, user experience is related to a person's perceptions and responses resulting from the use or anticipated use of a product or service (ISO, 2010). The subjective nature of user experience (Battarbee & Koskinen 2005; Hassenzahl, 2010) means that the dimensions and processes of user experience need to be understood in very user-centered ways during the design process as well. If we look at the ICT products and services from a user's point of view, we can see that in order to use a certain product or service the user also needs access to certain other products and services that in addition to being available to the user also provide services to the new product. ICT solutions and their usage are related to infrastructures (electricity, connectivity, etc.), contents (different media, content providers, etc.), other users (communication, collaboration, competition, etc.) and so on. As a matter of fact, a lot of work in ICT development has been and is focused on ensuring that the products and services are interoperable and can be interconnected (e.g., standardization and open interfaces).

The combination of different ICT products and services can be seen as a complex system, which as a whole enables the user to accomplish his or her goals. In this system, there is from the user's perspective a lot of interconnected products and services with different roles and functionalities.

Understanding the connections the to-be-designed product or service has to other products and services already populating the users' environment is just the first step toward a user-centered view of user experience. The second step can be taken by recognizing the giants whose shoulders we the user-experience researchers and designers are standing on. In HCI and UCD the principles suggested by Gould and Lewis (1985)—that is, early focus on users and their tasks, empirical measurements, and iterative design—are nowadays generally accepted cornerstones for taking the users of products and services into account during the design process (Mao et al., 2005).

The fit between the user and his or her tasks and the new product or service, that is the usability of the product or service, is the main goal and design driver of UCD (ISO, 2010; Hackos & Redish, 1998). One of the most important notions about people's tasks is that using a certain system or solution is not necessarily a meaningful task itself. Tools are used to make tasks less laborious or time consuming, or to minimize errors. A task is usually larger than a single tool. This means that from the users' perspective, using of a product or service is just a part of accomplishing something bigger.

Since from the users' perspective a single product or service seldom covers a whole task or activity, it is reasonable to assume that, also, meaningful experiences from the users' perspective are not related to just using a system but to accomplishing something bigger. Naturally understanding these meaningful wholes as a designer of new products and services requires one to understand the role of the new product or service in users' perception of these experiences and events.

As a result of taking a user-centered view toward product or service usage and experiences related to it, the designed product or service can be seen as a part of a network of multiple products, services and

other actors (people, organizations, etc.). In addition to having many different kinds of members, the network can also change while the user is reaching for the goal. In a way, this complex and evolving network resembles an ecosystem.

USER-EXPERIENCE ECOSYSTEMS FRAMEWORK

An ecosystem analogy has been widely used in business and management analysis (e.g., Moore, 1993; Nachira et al., 2007). In these analyses, the ecosystem concept is used to give a very complex and dynamic group of actors, in a business ecosystem's case—customers, collaborators, subcontractors and competitors—a form. The power of ecosystem metaphor lies in its ways of explaining diversity and complexity as well as change (Briscoe & Sadedin, 2007).

Holling and Gunderson (2002) have defined four key features of ecosystems: 1) ecosystems change, but the change is neither continuous and gradual nor consistently chaotic, 2) ecosystems include members and subsystems of different scales, and scaling from one range of scales to another is a nonlinear process, 3) ecosystems do not have a single equilibrium, and 4) introducing fixed policies and management cause the ecosystems to lose resilience and break.

The key features of ecosystems make the concept interesting from business and management perspectives as they hint on ways of understanding and coping with unpredictable events and partners of different sizes and significance. Similarly, an ecosystem analogy can be used to allow a wider perspective toward a user experience of a service or a product.

A good starting point to a user-experience ecosystem is the identification of its members. As mentioned above, from the user's perspective a meaningful experience usually includes several independent factors. In ecosystem terminology, these are the members of the ecosystem. In some special cases, (e.g., in games and new media installations) the experience can indeed emerge out of interacting with just one system or device. However, these cases are infrequent, since there usually are co-participants and many contextual factors, such as lighting or network connections, that play a role in the event. With ICT solutions the probability of a user-experience ecosystem of just one actor is even lower. Since one of the key characteristics of ICT is acting on information (i.e., ICT systems mediate, transform, store and restore information) at least two members, the product and the information, can usually be identified in the user experience ecosystem of ICT solutions. Like Holling's and Gunderson's second ecosystem characteristic state, the user-experience ecosystems also can include members that are not easily comparable with each other (e.g., resources such as time and energy or attribute-like objects such as information transferring limits).

The main theme in Holling's and Gunderson's ecosystem-feature list is change. User-experience ecosystems can also be seen to follow this theme. A user's viewpoint toward his or her activities changes from one situation to another. These changes reflect directly onto the user-experience ecosystem. For example, in one moment, the user can be calm and focused on his or her objectives and very aware of all things available and needed in achieving the objective. During another moment, he or she can become aware of other duties and become hurried and sloppy, and his or her perception of the available possibilities, tools and resources shrinks. These changes are also examples of changes that are very difficult to predict from inside the ecosystem. However, studying users' experience ecosystems does not require one to limit the information gathering inside a single experience ecosystem.

As with other ecosystems, user-experience ecosystems do not have a single state of balance. People can accomplish their goals in different ways and nonequal experiences can be equally valuable for them. In some ways, modern mobile phones already acknowledge this fact. One can communicate with one's friends and colleagues with multiple different ways with a single phone. The decision of whether to use e-mail, SMS, MMS, voice or some other communication method is left to the user. Obviously, the design of the phone has an effect on which methods the user prefers.

Resilience is a key attribute of natural ecosystems (Holling & Gunderson, 2002). User-experience ecosystems can be seen as naturally resilient, unless rigidity is introduced through unsuccessful designs of products and services. From the users' perspective, designs that are too rigid do not allow users to appropriate the products and services to suit their changing needs and desires.

The key tasks in understanding user-experience ecosystems during product and service design are: 1) identifying the key user-experience ecosystems, 2) identifying the members of the ecosystems, 3) understanding the dynamics of the ecosystems, and 4) mapping the potential external forces that can cause dramatic changes to ecosystems.

Identifying the key user-experience ecosystems means understanding the users, and their needs, desires and activities, deeply enough to be able to determine, from the user's perspective, the meaningful events and ensembles. Identifying the members of the selected user-experience ecosystems refers to defining, from the user's perspective, the entities that affect what he or she is able to do and what kinds of results can be obtained. Understanding the dynamics of the ecosystems means studying the roles and attributes of the members of the ecosystems and the interactions between them, as well as finding out the possible states of the ecosystem (i.e., how the meaningful experiences emerge and what is needed for the ecosystem to produce a desired experience for the user. The last task is to map the external forces that can somehow transform the ecosystem. Examples of these kinds of forces are things and events that can change the user's priorities and desires.

The following chapter uses a study of university students' e-book reader user-experience to develop the user-experience ecosystem concept further and to present a more concrete example of how the framework can be used and what kinds of insights it offers.

CASE: E-BOOK READERS IN STUDY USAGE

The e-book reader study was conducted during spring 2010 with a co-design approach. The study consisted of the testing of five different e-book readers by students, an experience-sharing group interview of the participating students, and three co-design sessions during which a larger student group brainstormed product and service concepts relating to e-books.

RESEARCH SET-UP

The device testing period lasted two and half months (one study period). During it, five different e-book readers were given to five student-volunteers to use in their studies. The Amazon Kindle device turned out to be too cumbersome, especially in how the materials needed to be transformed and transferred to the device, and, as a consequence, the student stopped using the device after just one week. In addition to the devices, support for using them was also provided to the students. In practice, the support meant converting study materials to suitable formats for the e-book readers and helping the students to use all of the available features of the devices. Table 1 presents the tested devices, their compatibility with the study materials and whether the device supported note taking and other study activities.

During the experiment, the students were asked to keep a diary of their experiences with the devices. In order to help the researchers follow the evolution of user experiences and to identify students who required help with their device, a blogging service was used for the diaries. In practice, only one student managed to blog actively about his e-book reader usage through the whole testing period. He was also the most active and satisfied user of the devices. With other students, the amount of blog entries decreased from an average of one entry per two days to one entry per one to three weeks during the testing.

After the testing period, a group interview and experience-sharing session was organized. In the session the students were asked to introduce their devices to each other. In the introductions the students were asked to explain the main features and usage logic of the devices, their own experiences of using them, and to give a recommendation to buy or not to buy the device as

Device	Bookeen CyBook Opus	Foxit eSlick	BeBook	Amazon Kindle	Sony Reader Touch Edition PRS-600
Technical specifications	Screen: 5” Weight: 150g Battery life: 8 000 pages	Screen: 6” Weight: 180g Battery life: 8 000 pages	Screen: 6” Weight: 220g Battery life: 7 000 pages	Screen: 6” Weight: 289g Battery life: Two weeks	Screen: 6” Weight: 285g Battery life: 7 500 pages
Note taking / highlighting / underlining	No	No	No	Yes, highlighting and bookmarking	Yes, highlighting, bookmarking and drawing
Compatibility with study materials and services	PDF: yes TXT and HTML: yes PPT and DOC: no File transfer from a computer via USB cable	PDF: yes TXT and HTML: partly PPT and DOC: no File transfer from a computer via USB cable	PDF: yes TXT and HTML: yes PPT and DOC: some File transfer from a computer via USB cable	PDF: through Amazon’s converting service TXT and HTML: some PPT and DOC: no File transfer from a computer via USB cable *	PDF: yes TXT and HTML: some PPT and DOC: no File transfer from a computer via USB cable **

Table 1 *The devices that were selected for the study. Selection was based on availability (in Finland) and on device’s pricing and user focus. Some expensive devices that were aimed at more professional usage were excluded from the study, since their extremely high pricing makes them unsuitable for consumers (and students).*
** Amazon’s whispernet service was not yet available in Finland.*
*** The device required manufacturer’s special software to transfer the documents in a controlled way.*

well as their approximation of a suitable price for the device.

The research setup resembled cultural probes (Gaver et al., 1998). The e-book readers and diary assignments were the probe, and the research tried to dig deeper into the studying experiences instead of just evaluating the usability of the devices. The probes method was selected, since studying is an activity that has irregular events (i.e., it is hard to predict when exactly a student learns something or has some other kind of experience). Probes have been reported to be a useful approach when the studied phenomena are irregular and hard to predict (Nieminen & Mannonen, 2005). A group interview was selected instead of individual interviews, since interviewing multiple people simultaneously has been reported to facilitate richer conversations, because the interviewees not only answer questions but also comment on the other interviewees opinions (e.g., Nieminen & Mannonen, 2005; Höysniemi, Hämäläinen & Turkki, 2004).

In addition to the probe research and group interview, three co-design sessions, during which students brainstormed and developed studying and e-book reader related product and service concepts, were arranged. One of the students that participated in the probe research also participated to the co-design sessions. A total number of 14 students were present in the co-design sessions. The same group of students participated in all of the sessions. The first session focused on brainstorming; the second one on evaluating and further developing the ideas; and the last one on finalizing the concepts.

RESULTS

The analysis revealed that almost all aspects of e-book reader user-experience were related to the ways the e-book readers either fitted or did not fit in the larger network of products, services and information the students were handling at the time. Generally the devices were very different from the students’ expectations. The e-book readers’ main selling point, that is, combining the good sides of digital text and traditional books, did not seem to match with the students’ needs and desires. User experience viewpoint can be used to explain many of the problems the students experienced with the devices.

During the research, five main user-experience ecosystems were identified, namely home, library, lecture hall, cafeteria, and bus. The names of the ecosystems refer to places but the identified ecosystems were not restricted to named places. For example the ecosystem named cafeteria did not require the user to be in a cafeteria. Instead the name describes the mode of operation of the students.

Key members of the user-experience ecosystems were quite the same in every ecosystem. They included different kinds of study materials; media the study materials could be accessed through; friends taking the same course(s); teachers of the course(s); homework and other compulsory parts of the course(s); university's study portal and other related services; and course events such as lectures and exercises. In addition, services such as telecommunication networks and physical properties, such as a place to spread one's backpack's contents were identified as main actors in certain ecosystems. The e-book readers were one medium to access the study materials. Although the members of the different ecosystems were partly the same, their roles varied. For example in the home ecosystem, friends were a resource that could be used only in problem situations, while in the cafeteria ecosystem, friends were collaborators and major contributors.

Similar to the roles of the ecosystems' members, the dynamics of the different ecosystems also varied a lot. In the library ecosystem, the interaction between the members seemed to be rare, while in the cafeteria or home ecosystems there was much more interaction and also more frequently external forces affecting to the ecosystems. Main external forces affecting to almost every identified ecosystem were students' leisure time activities, friends and members of their families. Once in a while, local, national or international events such as a neighbor's housewarming party, noisy maintenance work on the nearby street, electricity or telecommunication network breaks, and events that produced national or international pieces of news also affected the ecosystems. Table 2 presents an abridged version of the lecture-hall ecosystem of one of the participating students.

As stated above, the e-book readers were one medium through which the students could access the study materials. In all of the ecosystems there were competitors to the e-book readers. The main competitors were usually books and other printed materials, laptop computers, smart phones and local media, such as computers at a computer classroom. Also resources for the e-book readers existed in the ecosystems, for example, electricity outlets where a charger could be plugged in, open Wi-Fi networks to access additional information resources, computers to transfer more material into the devices, etc.

UX Ecosystem	Lecture Hall
User's needs, aims and desires	*"The goal is to survive the lecture,"* actively participating in a lecture requires one to follow the lecture from both the teacher's presentation and from other study material. This means going through the course book and selected articles while the teacher is speaking. A successful lecture or learning experience can occur if, for example, the teacher manages to give a very good presentation, the interaction in the lecture succeeds, or the student understands some previously misunderstood subject matters.
Key members	Teacher(s), friend(s) taking the course, students belonging to same assignment group, course book, lecture slides, other information resources (library's services, Google), electricity outlet (available in some lecture halls), university's WI-FI network, course irc channel, student's own laptop computer, students' own mobile phone, a clock in the wall of the lecture hall, e-book reader.
Dynamics and interaction	The lecture ecosystem is somewhat hierarchical. The teacher is a key actor who connects pieces of information together. All the interaction and members of the ecosystem should support the connecting of information, since describing the facts and their connections is the core of the lecture.
External forces and their impacts	Time—Lectures last between 45 and 90 minutes. When the time runs out (and already before that) the concentration and motivation suffers. Friends outside the lecture hall (e.g., friends asking for lunch company can cause changes of agenda). Fire alarms, network shutdowns, electricity outages, etc.

Table 2 *Abridged presentation of one of the participating student's lecture-hall ecosystem*

The user-experience ecosystems explained many usability and user-experience phenomena relating to the e-book readers that could not be anticipated based on just the devices and their planned usage. For example, the page-turning delay of the devices, although perfectly acceptable for reading a book or an article from start to finish proved to be much too slow to be usable in the lecture hall, cafeteria or

sometimes even in the home ecosystems. In contrast, in many ecosystems the fiercest competition came from laptop computers and not from traditional books, since the studying was a very dynamic process during which the study materials were used in a nonlinear order, and much of the activities included active participation from the students' part (e.g., answering homework questions and doing group work) and the traditional books were not as good in these activities as a laptop computer.

Interestingly, during the co-design sessions, the students almost exclusively created concepts for services and solutions that gathered and integrated currently separated information sources and communication and collaboration solutions. The ideas were directed toward computer usage, and the role of an e-book reader in students' visions and scenarios was small or nonexistent. However, a tablet computer, such as the iPad, fits quite nicely in the imagined ecosystems. During the research the tablet computers were not yet available in Finland.

CONCLUSION

Current definitions of user experience as well as approaches to user experience design seem to embody a bias toward product-centric thinking. This results in incomplete understanding of the roles of the designed products and services in users' activities. Focusing on the user experience through single products and services leads to forgetting the importance of social contacts and processes (Battarbee & Koskinen, 2005). In addition, it distorts the user appreciation approach that exists in the background of user-experience research and design (i.e., in UCD and human–computer interaction research. In extreme cases the current approach and aim toward user-experience design can lead to designing the users instead of designing for them (Redström, 2006).

The roots of user-experience design and research lie in satisfying the users' fundamental needs (Keinonen, 2010). Fulfilling this goal requires the designers and researchers to acknowledge the users' viewpoint toward the product and service usage and experiences related to them. First, a user-centered view of user experience needs to change the time scale of user experience definitions from "anticipated use," to "use," to "recalling the using," to "meaningful time periods for the user" (i.e., completing a task, accomplishing a goal, obtaining an experience). Second, it needs to widen the scope of user experience to take into account all actors who affect the experience and not just the interaction with the designed product or service.

One strategy to obtain this information is to understand the designed products and services as members of ecosystems that produce the experiences for the users. A user-experience ecosystem framework depicts the complex network of interlinked people, products, services, and resources from the user's point of view. The ecosystem analogy can help the designers and researchers to better understand the role of the designed product or service; the dynamics and interaction between the user and the different available systems and solutions, as well as the designed product or service and other members of the ecosystem; and to predict and adapt to different kinds of changes that can occur in the ecosystem. As a result, the products and services can be more easily designed to help the users to obtain positive or otherwise desired experiences.

The presented user-experience ecosystem framework and the study of university students' user experiences with e-book readers is just a starting point. Further research is needed to clarify, for example, the typical member types and roles in user-experience ecosystems. Likewise, the evolution and changes in user-experience ecosystems need to be studied more in order to make the framework truly usable for designers.

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REFERENCES

Bargas-Avila, J. A. Hornbæk, K. (2011). Old Wine in New Bottles. In *Proceedings of CHI 2011, May 7–12, 2011, Vancouver, BC, Canada, 2689–2698.*

Battarbee, K., Koskinen, I. (2005) co-experiece: user experience as interaction. *CoDesign*, Vol. 1, No. 1, 5-18.

Beyer, H., Holtzblatt, K. (1998). *Contextual Design: Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann Publishers.

Briscoe, G., Sadedin, S. (2007) Natural Science Paradigms. In F. Nachira, A. Nicolai, P. Dini, M.L. Louarn and L. R. Leon (eds.) *Digital Business Ecosystems*, European Comission, 48-55.

Castells, M. (2000) *The Rise Of The Network Society* (2nd ed.) Oxford, UK: Blackwell Publishers.

Forlizzi, J., Battarbee, K. (2004) Understanding experience in interactive systems. In *Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques* (DIS '04). ACM, New York, NY, USA, 261-268.

Gaver, B., Dunne, T., Pacenti, E. (1999) Design: Cultural probes. *Interactions*, Vol. 6, No. 1 (January 1999), 21-29.

Gould, J.D., Lewis, C. (1985). Designing for Usability: Key Principples and What Designers Think. *Communications of the ACM*, Vol. 28, No. 3, 300–311.

Hackos, J.T., Redish, J.C. (1998) *User and Task Analysis for Interface Design*. New York, NY: Wiley Computer Publishing.

Hassenzahl, M., Tractinsky, N. (2006) User experience – a research agenda. *Behaviour & Information Technology*, Vol. 25, No. 2, 91-97.

Hassenzahl, M. (2010) *Experience Design: Technology for All the Right Reasons*. Morgan & Claypool Publishers.

Holling, C.S., Gunderson, L.H. (2002) Resilience and Adaptive Cycles. In: L.H. Gunderson, C.S. Holling (eds.) Panarchy: Understanding transformations in human and natural systems, Washington: Island Press, 25-62.

Hughes, T.P. (2005) Human-Built World: How to think about technology and culture. Chicago and London: The University of Chicago Press.

Höysniemi, J., Hämäläinen, P., Turkki, L. (2004) Wizard of Oz prototyping of computer vision based action games for children. In *Proceedings of the 2004 Conference on Interaction Design and Children: building a community (IDC'04)*. ACM, New York, NY, USA, 27-34.

ISO - International Organization for Standardization (2010) *International Standard 9241-210 Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems*. International Organization for Standardization.

Keinonen, T. (2010) Protect and Appreciate: Notes on the Justification of User-Centered Design. *International Journal of Design*, Vol. 4, No. 1, 17-27.

Kuutti, K. (2010) Where are the Ionians of user experience research?. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries* (NordiCHI '10). ACM, New York, NY, USA, 715-718.

Law, E. L-C., Roto, V., Hassenzahl, M., Arnold P.O.S. Vermeeren, A. P.O.S., Kort, J. (2009) Understanding, scoping and defining user experience: a survey approach. In Proceedings of the 27th international conference on Human factors in computing systems (CHI '09). ACM, New York, NY, USA, 719-728.

Lewis, C., Rieman, J. (1994) Task-Centered User Interface Design: A Practical Introduction. Available at: http://hcibib.org/tcuid/ (Referred May 20th 2011)

Mao, J–Y., Vredenburg, K., Smith, P.W., Carey, T. (2005). The State of User–Centered Design Practice. *Communications of the ACM*, Vol. 48, No. 3, 105–109.

Meyer, C., Schwager, A. (2007) Understanding Customer Experience. *Harvard Business* Review, February 2007, 116-126.

Moore, J.F. (1993) Predators and Prey: A New Ecology of Competition. *Harvard Business* Review, May-June 1993, 75-86.

Nachira, F., Dini, P. and Nicolai, A. A Network of Digital Business Ecosystems for Europe: Roots, Processes and Perspectives, In: F. Nachira, A. Nicolai, P. Dini, M.L. Louarn and L. R. Leon (eds.) *Digital Business Ecosystems*, European Comission, 2007, 1-20.

Nieminen, M.P., Mannonen, P. (2005) Capturing the mobile and distributed work for concept development using photograph probes. In *Proceedings of International Conference on Human-Computer Interaction IASTED-HCI 2005*. Phoenix USA, Nov. 2005, 191-196.

Pine, B.J., Gilmore, J.H. (1998) Welcome to the Experience Economy. *Harvard Business* Review, July-August 1998, 97-105.

Redström, J. (2006) Towards user design? On the shift from object to user as the subject of design. *Design Studies*, Vol 27, No. 2, 123-139.Roto, V., Law, E., Vermeeren, A., Hoonhout, J. (eds). 2011. User Experience White Paper. Outcome of the Dagstuhl Seminar on Demarcating User Experience, Germany. Available at: http://www.allaboutux.org/uxwhitepaper (Referred May 20th 2011)

Wright, P., Blythe, M., McCarthy, J. (2006) User Experience and the Idea of Design in HCI. In: S. Gilroy, M. Harrison (eds.) *Interactive Systems. Design, Specification, and Verification, Lecture Notes in Computer Science*. Berlin, Heidelber: Springer, 1-14.