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**Tomasz Niedziółka\***

Warsaw School of Economics  
Collegium of Business Administration

## USER EXPERIENCE RESEARCH AND DEVELOPMENT OF KNOWLEDGE IN THE FIELD OF HUMAN-COMPUTER INTERACTION

### Abstract

The aim of the article is to present the impact of User Experience Research on the development of knowledge in the area of Human-Computer Interaction (HCI). The article uses the Narrative Literature Review Method. The article uses literature and scientific articles on the subjects analyzed in its issues. Based on the analysis, it was found that User Experience Research influences the development of knowledge in the area of Human-Computer Interaction by: providing results of the research related to the issues that are of a significant interest to the HCI; the applicative character of the UX research results, allowing to improve the interaction between a human and a computer; providing new research methods to the HCI discipline.

**Keywords:** Human-Computer Interaction, User Experience, UX, HCI

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\* Adres e-mail: [d11n2562@sgh.waw.pl](mailto:d11n2562@sgh.waw.pl)

## Introduction

First computer devices and programs were constructed in such a way that they could perform designated tasks. However, they often proved to be too complicated and not user-friendly, and furthermore, their operators required previous trainings (Booth, 2014, p. 2).

The reason behind it was that the first designers of computer devices focused more on the device itself and less on its users, their needs, and circumstances in which they will be using the devices. A user was merely an addition to the system. The way in which first devices and computer systems were designed is referred to as technology oriented designing (Jaskuła, 2014, p. 28).

## 1. Methods

The article uses the Narrative Literature Review Method (Baumeister, Leary, 1997, p. 311).

It included a review of literature and scientific articles on the development of User Experience Research and Human Computer Interaction. The article integrates and interprets the previous results of original scientific research on this subject.

## 2. Results

User Experience Research contribute to the development of knowledge in the HCI discipline through:

- Providing results of the research related to the issues that are of a significant interest to the HCI,
- The applicative character of the UX research results, allowing to improve the interaction between a human and a computer,
- Providing new research methods to the HCI discipline.

User Experience Research is a crucial source of knowledge about the HCI, contributing to the development of this discipline.

### 3. Discussion

In the course of time, computer designers increasing focus on the users resulted in the research and knowledge development in the field of Human-Computer Interaction (HCI). This field can be defined as “(...) the study of people, computer technology, and the ways these influence each other. We study HCI to determine how we can make this computer technology more usable for people” (Dix, Finlay, Abowd, Beale, 1993, p. XIII).

Tasks which comprise matter of concern in HCI field are as following:

- Cooperative performance of tasks by people and machines,
- Human possibilities of operating the devices, including their interface,
- Designing, programming, and creating the interface,
- The communicative structure between people and machines (ACM SIGCHI, p. 7).

One of the first research in the field of HCI was a research conducted by Ivan Sutherland from the USA. As the first scholar, he created a pointing tool, a light pen, which enabled to manipulate objects on the screen: catching them, moving, and changing their sizes. Light pen facilitated work with early computers to a great degree (Sutherland, 1963, p. 329).

Sutherland's research were financed by the US Air Force and the National Science Foundation (Mayers, 2001, p. 45). Financial contribution from the national budget had an important influence on the development of the first research in the field of HCI. It allowed building an intellectual capital and creating a pioneering research team (Card, 1996, p. 162). Later research were funded by a private sector and organizations such as The European Association of Cognitive Science, The Computer Systems Technical Group, The British Computer Society Specialist Group on HCI and other.

Research conducted by Douglas Engelbart's team should also be taken into consideration. In 1968, the team presented software called On-line System (NLS), which enabled the users to cooperate remotely, sharing files and information. The real breakthrough though was using a computer mouse for the first time to operate the system (Goldberg, 1988, p. 68). This device entered the market after few years, in 1981, and it facilitated greatly the interaction between a human and a computer (Myers, 1984, p. 13).

Increasing interdisciplinarity of HCI was crucial for its development.

Since the 70s, programming began to be analyzed through psychology, as a problem-solving tool (Weinberg, 1971). In 1983, a book titled “The Psychology of Human-Computer Interaction” was released (Card, Moran, Newell, 1983). Its authors noticed the importance of psychological aspects of using computer devices by the users, such as:

- The perception time of visual stimulus,
- Decision-making time,
- Motoric reaction time of a user.

In the following years, HCI research were conducted through the prism of other disciplines: anthropology, psychology, philosophy, IT and linguistics.

Looking at development of HCI, the research conducted by David Canfield Smith needs to be considered, as he was the first one to introduce the term “icon” (Smith, 1977). In the following years, he implemented this solution in practice, working for Xerox (Smith, 1982, p. 515). Icons significantly facilitated human interaction with computer devices, and today they constitute its inseparable element.

Discussion between theorists and practitioners of HCI was mainly focused on terms such as functionality, usability and User Experience.

Functionality is defined as “(...) broad discipline, based on using rational rules of science observation, measuring, and designing during the process of creating and modifying websites, in order to increase using ease, cognitive advantages, usefulness, and decreasing discomfort connected to operating them” (Perrow, 2000, p. 20).

Usability is defined as “the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use” (ISO/IEC 9241-11).

In recent years, HCI researchers have been focusing on the term “User Experience”.

User Experience (UX) is defined in literature as “(...) the overall feeling or experience that a person has when using a product, such as a website, a mobile device, or a software application. It includes how easy it is to use, how pleasant and satisfying the experience is, whether it’s useful or not, and how well it meets the person’s needs” (Ross, 2014, p. 2).

The subject of interest of UX researchers is the influence of a given product or service on the customers' senses, for example their interest, enthusiasm, or irritation (Abrahão et al., 2017, p. 2).

Feelings and emotions play fundamental role in the case of UX. "Emotion is at the heart of any human experience and an essential component of user-product interaction and User Experience" (Forlizzi, Battarbee, 2004, p. 264).

User Experience can be shaped on different stages of user's contact with the product or service, i.e.:

- Before its use – e.g. based on advertisement, shopping process, installation of software,
- During its using – e.g. use of apps, support from help desk,
- After its use – e.g. de-installation process, return process (Riikka-Sundberg, 2015, p. 34).

Therefore, it is possible to talk about different types of UX:

- Anticipated UX – concerns the issue of how the users imagine the experience of using the product before exploiting it,
- Momentary UX – is the experience the users get when using the product,
- Episodic UX – is what users think about their experience after using the product,
- Cumulative UX – is a comprehensive User Experience based on numerous periods of using the product (Roto, Law, Vermeeren, Hoonhout, 2011, p. 15–18).

An important feature of UX is that it can be consciously created. This process is called the UX design. The goal of the UX design is to improve user satisfaction by enhancing usability, ease of use, and pleasure of interacting with the product (Kujala, 2011, p. 473).

The UX design process should be based on the analyses of the needs, opinions and experiences of the users due to the fact that "understanding the user's needs and the tasks performed by the user is basic to the system development process" (Bannon, 1991, p. 40).

This is the purpose of various User Experience Research methods.

The UX research analyze user behavior in specific circumstances in which they use a product or a service (Vermeren, 2010, p. 523). The following elements are taken into consideration:

- Feature of a product or a service such as: usability, functions, size, weight, language, symbols, aesthetic characteristics, usefulness, reputation, adaptivity, mobility.
- The user and their values, emotions, prior experiences, expectations, physical characteristics, motor functions, personality, motivation, skills, age, etc.
- Context of use, among others: time, place, temperature, accompanying persons, etc.
- Social factors – time pressure, pressure of success and fail, explicit and implicit requirements, etc.
- Cultural factors – sex, fashion, norms, habits, language, symbols, religion, etc. (Arhipainen, Tahti, 2003, p. 28).

So far approximately 100 of UX research methods have been classified (Web. 1). It is indicated that such a great number of UX research methods can be perceived as their weakness. There is a need to consolidate the existing methods in order to meet scientific requirements, including the ability to replicate them (Greiffenhagen, Reeves, 2013, p. 1). Nowadays, a significant problem exists. It is related to the fact that the researchers often instead of using the existing methods develop the new ones, which are then used only on a local scale, for instance, only at a one academic center or company. This situation significantly hinders the consolidation of previously developed research methods on a global scale (Hornbæk, 2006).

Despite so many UX research methods existing, the most well-known ones can be indicated.

They include (Alves, Valente, Nunes, 2014, p. 96):

- Observation,
- Think Aloud,
- Contextual Interviews/Inquiry,
- Interviews,
- Experience Prototyping,
- Task Analysis,
- Cognitive walkthrough,
- Questionnaires.

All of the existing UX research methods can be divided into several categories, i.e.:

- Lab research with individuals,
- Lab research with groups,

- Field research (short, e.g. observation),
- Field research (longitudinal),
- Surveys (e.g. online),
- Expert evaluations,
- Mixed methods (Roto, Obrist, Väänänen, 2018, p. 3).

Slightly different research methods are used at different stages of product and service development. The issue is presented in the table.

Table. The UX researches applied at various stages of a product or service creation

The stage of creating a service or product	The methods employed
Analysis of the needs	In-depth interview Questionnaire-based research Focus group research Ethnographic research Journal research Content analysis Cards sorting
Evaluation	Usability tests Eyetracking
Optimization	Statistics analysis Mouse movements tracking A/B tests

Source: Own elaboration on the basis of Mościchowska, Rogoś-Turek (2015, p. 34).

The results of the UX research are of applicative nature. By providing information on the users’ positive and negative experiences, the researches enable the creation of further products and services that increasingly satisfy users’ needs and expectations.

The results of UX research contribute to (ACM SIGCHI, p. 7):

- Improving the human interaction with the computer and the services it offers,
- Increase in the ability of people and machines to perform tasks together,
- Improvement of machine operation and interface capabilities,
- Designing, programming and creating interfaces more useful to the user,
- Improvement of the overall communication between people and machines.

The aforementioned UX research results are identical with the objectives that have guided researchers within the HCI discipline from the very beginning.

By increasing the state of knowledge in the above-mentioned areas, the UX research directly contribute to the development of the Human-Computer Interaction discipline. It is worth noting that the growing role of the UX research indicates a possible further development of the HCI discipline.

Initially, the researches in the area of HCI concerned primarily the usability and functionality of products and services. They focused on increasing people's ability to achieve goals with the use of computer devices. One of the result of these research was the invention of a computer mouse and icons on the screen, which significantly facilitated the interaction with computers (Goldberg, 1988, p. 68).

Due to the development of research in the HCI field the developers of computer devices ceased to pay attention solely to the generally understood human factors, and they noticed specific human actors (Bannon, 1986, p. 25), their emotions (Norman, 2002, p. 36) and experience (McCarthy, Wright, 2004).

The developers will continue to focus on the user in the process of developing products and services.

It is also worth noting that the UX research provides new research methods in the field of HCI. As it is indicated earlier, approximately 100 UX research methods are now classified. These methods have largely expanded the catalog of methods previously used by the researchers representing the field of HCI. In the following years, however, consolidation of the existing methods should be expected. It is important to build accumulated knowledge capital in the area of the UX with the use of research methods, the truthfulness and effectiveness of which have been repeatedly confirmed by the UX research community around the world.

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## **BADANIA USER EXPERIENCE A ROZWÓJ WIEDZY W OBSZARZE HUMAN-COMPUTER INTERACTION**

### **Streszczenie**

Celem artykułu jest zaprezentowanie wpływu badań User Experience na rozwój wiedzy w obszarze Human-Computer Interaction (HCI). W artykule wykorzystano literaturę oraz artykuły naukowe na temat analizowanych zagadnień. Na podstawie dokonanej analizy wykazano, że badania User Experience wpływają na rozwój wiedzy w obszarze Human-Computer Interaction poprzez: dostarczanie wyników badań dotyczących zagadnień będących przedmiotem zainteresowania dyscypliny HCI; aplikacyjny charakter wyników badań UX, pozwalających na usprawnianie interakcji pomiędzy człowiekiem a komputerem; dostarczanie nowych metod badawczych dyscyplinie HCI.

**Słowa kluczowe:** Human-Computer Interaction, User Experience, UX, HCI

**JEL code:** O3

### **Cytowanie**

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