

# DevThis: HCI Education beyond Usability Evaluation

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## ABSTRACT

In this paper, we analyze a main future development in HCI in the direction of ubiquitous computing. Based on these considerations we describe the underpinnings, design and development of Develop This! (DevThis) as a set of educational modules to teach the theory and practice aspects of ubiquitous computing within the Bachelor curriculum of Media Technology at Rotterdam University. Finally, we conclude with ongoing developments and a future outlook.

## Keywords

Mobile applications, ubiquitous computing, ambient intelligence, pervasive computing, social media, sensor networks, education, curriculum development.

## INTRODUCTION

Each generation of ICT technology may be characterized by the questions it raised in the field of Human Computer Interaction (HCI): the mainframe technology with its expensive hardware asked for the selection of specially trained personnel for reliable data processing, the minicomputer era asked for software ergonomics using structured methods; the personal computer raised the question for usable applications and usability evaluation, and the home computer with its multimedia and web technology asked for the user experience of the application.

With the introduction of networked laptop and the smartphone starts a new generation of ICT technology known as Ubiquitous Computing, Pervasive Computing or Ambient Intelligence, depending on what one considers the main focus of the trend: either that the computer is everywhere, that the computer is takes part in almost all aspects of life, or that, eventually, the computer will provide us with a intelligent ecosystem.

In the current ICT generation, traditionally distinct IT functions such as data collection, processing and data access have converged communications into small mobile, networked devices which provide functions or services that are no longer tied to a specific time or (work) place. Ubiquitous Computing (UbiComp) shows how ICT can disappear and thus penetrate the entire habitat [12]. Thus far, only a small part of the development did become

reality: only the part that is supported by people who take their smartphones with them to communicate and to access information resources. Greenfield's "Everyware" [6] originally used to refer to utilizing information resources (Web 1.0) thereafter it referred to information and opinion sharing (Web 2.0) but in future, the "everywhere" will refer to the generation of information and data measurements that will take place with anyone, anytime, and anyplace (Web 3.0, The Internet of Things).

## HCI EDUCATION: USABILITY AND UCD

When software is developed for pre-specified functions and fixed workplaces, for HCI education it is sufficient to treat the ergonomic and usability standards for software engineering, user-oriented method for designing interactive software, and the methods and techniques for usability evaluation. In addition, education could be supplemented with modules (user) requirements analysis, users with special features, the use of prototypes and user tests, interactive web technologies, etc.

## Human Centered ICT

At Rotterdam University of Applied Sciences' Institute for Communication, Media and Information (CMI), we have investigated Ubiquitous Computing from an educational point of view in the department of Media Technology (MT) and from a research point of view in the research group Human Centered ICT (HCIct), motivated by the desire to adapt the curriculum to current developments in the professional market and the needs and wishes of the students.

The department of Media Technology developed a new profile in its teaching program which puts much more emphasis on the introduction of scientific research into the work scene; MT engineers should have the skills to acquire knowledge of relevant scientific developments and to translate that knowledge into the professional practice. Apart from being informed about the scientific developments, there is also more emphasis on the ability to design and implement research. Developments in media technology may evolve so fast that teaching modules become obsolete even before they are offered to students; as such, we expect that the knowledge of- and the skills to do research will have a more lasting value. Finally, from the desired educational profile follows that the training

provided to the students should put more emphasis on modern (read: Agile) development methodologies and the importance of being able to substantiate any design choices.

#### **FUTURE HCI EDUCATION: UBIQUITOUS COMPUTING**

When software is NOT developed for pre-specified functions and fixed workplaces, but, instead, software is developed that can be used by anyone, anytime, and anywhere, HCI education has to change in several respects. Given that ubiquitous software is a relatively new kind of application for which no uniform standards or best practices are available, it will be necessary to take into account that the wishes and requirements of users will only become clear at a relatively late stage in the design process. To redesign a telephone as a telephone, clear-cut and 'market-proven' requirements are readily available. However, to design a smartphone as a screen projector or a social media application, no such requirements do exist as such, and only when smartphones with such functionality are introduced to the market, best practices and required standards will start to evolve with the actual use of such applications. Within the design process, different types of prototyping research exist to investigate user requirements; nevertheless only relatively late in the process will working requirements be available.

The consequence of the late availability of requirements has two main implications: first, there is a need to employ highly flexible development methods allowing for partial designs and flexible iteration; secondly, it focuses on the need to do research within the context of use of the application. To evaluate yet-another-office-application, it will be clear that an office-like usability lab would suffice. To evaluate the usability or predict the marketing success of a social application it is far from clear how to turn the anyone, anytime and anywhere into a specification for a usability lab. In order to study evolving requirements and evolving use of (social) applications requires that everyday life should be used as a usability lab, corresponding to the idea of a living lab [11]. Finally, in addition to putting more stress on research skills, and to teach more advanced and more flexible design and evaluation methods, it will be necessary to provide students with a good overview of the relatively new research field of Ubicomp.

#### **Human-Centered ICT**

The research in the Human-Centered Ict (HCIct) group is centered around a number of themes or research subjects. Several themes are relevant to the area of ubiquitous/pervasive/ambient; these include: the applicability of software development methods to humane requirements (cf. soft requirements, see: [4]) and to highly changeable and 'wicked' design requirements [7], opportunities for mobile, social and context-sensitive interfaces [8], intelligent sensory network [9], interactive installations in the public domain, and finally, the

employment of open data as extensions of our senses or, perhaps, our intelligence.

#### **UBIQUITOUS COMPUTING IN DEVTHIS**

Following the ideas, outlines above, we have created new educational modules entitled DevThis. The name is kindly hijacked from the DesignThis teaching modules at several design education curricula. Presently, DevThis modules have been used three times as part of the curriculum for third and fourth year Media Technology students at the School of Communication, Media and Information-technology (CMI). Within the curriculum, the DevThis modules provide a testbed for educating students after their third year internships; as such, it should provide students with an opportunity to extensively investigate subjects of their own choosing and, simultaneously, have them consider the future developments in the media area.

#### **DevThis Basic Design**

The basic design for DevThis was that the module consists on the one hand of theoretical instruction about Ubiquitous Computing, including learning to read, study and possibly write scientific papers, and on the other hand it consists of a practical component where students work on a Ubicomp project in which they have to develop a prototype or demonstrator and are obliged to motivate their choices considering software architecture, the frameworks used, the development methodology chosen, etc. etc. Students work together in teams of between 3 and 6 people.

One main definition of the project is to create a social, mobile and context-sensitive application (and possibly that the application can be used for improve the social cohesion in deprived urban areas - but this aside). As such, the application should derive its' usefulness from a user community, and furthermore, the application should involve a mobile platform (i.e. a smartphone) and it should adapt to features of the environment, such as the user's location, the hardware used, or the characteristics and needs of the user, etc. Finally, provide that software development involves programming languages and frameworks, hardware and operating system platforms, analysis and design methods, as well as plans, specifications, and progress reports, students are urged to justify and document all of their main choices to some external funding party. The requirement to justify choices in ICT projects directly follows from the HBO-i domain description of the Bachelor of ICT [2].

In this way, we try to acquire three different goals in one educational module: to introduce students to scientific literature as a preparation for their final thesis, to familiarize students with research and development projects for external parties, and to have students gain experience in applying scientific knowledge in practical applications. It may be noted that applying scientific knowledge in professional practice is a key competence for Higher Professional education [5].

## CONCLUSION

In various ways, it became clear that the DevThis modules, although still in an early stage, have succeeded in providing HCI education beyond the traditional HCI teaching of usability and User-Centered Design. Compared to a few years ago, students are better equipped to be professionally active in the mobile and ubiquitous computing area, and they are much more aware of the tools, techniques and frameworks for developing mobile and ubicomp applications [1][3]. Furthermore, within the graduate programme, it is apparent that students are better equipped with knowledge about mobile and ubiquitous computing area. Both methodologically, as well as in terms of the body of knowledge of the field of study, and in using scientific sources, the knowledge and competence of the students have significantly improved. In this respect, also the number of final theses about mobile and ubiquitous computing subjects has increased: many final theses are now about how to make web applications mobile, with topics such as: which mobile framework to choose, should we develop native or web-based mobile applications, and how to employ open data in ubiquitous computing. This change has not been solely caused by only a few DevThis modules, but they do substantiate the movement away from web-oriented media to ubiquitous computing; precisely the prediction that inspired the development of DevThis modules.

## Future Outlook

The content of DevThis is still evolving. As a follow-up to DevThis, modules are under development around business cases, which introduces students to develop ideas for the commercial market. Furthermore, the content of the DevThis module moves towards the use of sensors and interactive installations following the Thematic Impulse Sensornetworks [9], and will increasingly make use of open data. In relation to this, we note that all the requirements that Weisser formulated for Calm and Ubiquitous Computing [12] did become reality, even though ubiquitous computing is not.

We assume that it is not the hardware or technical possibilities which let us down but rather we assume that the main obstacle is our lack of creativity. To counter this last obstacle, we are working on creating the facilities to enable students (and staff) with easy and affordable ways to experiment with ubiquitous computer applications (beyond the smartphone). As such, work is in progress to create a sensor-lab to provide students and researchers with a platform for experimentation in the area of ubiquitous computing. At present the 'sensor-lab' is implemented as a loan facility with different types of sensor toolkits but shortly, we plan to establish a dedicated room for experiments, featured with servers, several networks, a video-wall and sets of fixed sensors and transmitters.

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