

Re-Conceptualizing the E-Textbook for Ubiquitous Interactions

Ilya Shmorgun
Institute of Informatics
Tallinn University
Narva Rd. 29
10120 Tallinn, Estonia
ilja.shmorgun@tlu.ee

David Lamas
Institute of Informatics
Tallinn University
Narva Rd. 29
10120 Tallinn, Estonia
david.lamas@tlu.ee

ABSTRACT

The publishing industry is involved in an effort of converting school textbooks to electronic form, which often takes shape of static PDF documents. We propose to re-conceptualize the e-textbook as an aggregation of both professionally developed and user-contributed content, which is made available on a wide range of digital artifacts.

Author Keywords

E-textbook; ubiquitous interaction; artifact ecology.

ACM Classification Keywords

H.5.m Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Information Interfaces; Presentation.

INTRODUCTION

In recent years academic publishers began to engage in extensive digitalization of learning materials by converting school textbooks into e-textbooks (sometimes with a few extra interaction options) [11], mainly in PDF format as a logically ordered teaching and learning resource that matches the course requirements as far as possible and provides a synthesis of knowledge [4]. Both traditional textbooks and new e-textbooks are designed for reading them from beginning to end [3] by forming a coherent predefined whole for learners and teachers to follow. This does not leave much room for learners to interact with the vast amounts of digital artifacts (which form an individual's artifact ecology [9]), people, and environments while building their knowledge. We refer to this interaction as ubiquitous interaction, which builds on the assumption that information is expected to be able to move freely among the different digital artifacts people use [5], making it accessible right there and right now [6], when it is required to support a certain activity [8].

Research related to ubiquitous interactions and ecologies of artifacts includes works by Jung et al. [9], Ryan et al. [13], Bødker et al. [2], Forlizzi [7], as well as Oulasvirta and Sumari [12].

UBIQUITOUS E-TEXTBOOK

As using many different devices becomes commonplace, so do the expectations of being able to access necessary information from any device, which is close to hand. The same

changes begin to permeate schools, where students are doing more of their class work on laptops or tablets, while in some cases schools are also experimenting with bring your own device (BYOD) strategies. Although the issue of designing support for configuring and dynamically reconfiguring various technological resources depending on the needs of an ongoing activity has received some attention in recent HCI research, there are still many unresolved problems. For example, existing design strategies, such as mobile first and responsive design, do not fully satisfy the needs of ubiquitous interaction design. Mobile first focuses on prioritizing content to be shown to the user by initially creating mobile interfaces and only then focusing on other devices, such as laptops and desktops. Responsive design enables graceful scaling of content, where a website's layout is modified depending on the size of the screen of the device used to view that website. Both of these strategies focus mainly on the look of the user interfaces and do not necessarily take into account the different ways people interact with their devices (such as smartphones being used for content consumption, laptops and desktops for content creation) and do not facilitate different types of interactions.

Purpose of Research

The purpose of this research is to produce outcomes that will be distributed across 3 levels:

- Explanatory - an understanding of what ubiquitous interactions are;
- Descriptive - an updated frame of reference to analyze ubiquitous interactions based on an overview and comparison of selected analytical tools;
- Predictive - a theoretically informed framework for designing ubiquitous interactions.

Examples of analytical tools to be used in this research include the ecology of artifacts [9] and the Human-Artifact Model [1], which is based on the Activity Theoretical HCI [10].

Goals

The main goal of this project is to enhance learning experiences through the use of new technological solutions. An additional goal is to design and evaluate a proof-of-concept e-textbook solution, created for the ubiquitous interaction context. Further, the aim is to advance interaction design and

evaluation approaches by addressing the challenges of designing for ubiquitous interaction by understanding how humans interact with and through ecologies of artifacts when pursuing their activities.

Research Questions

Our main research question is “How to design ubiquitous interactions in the context of educational activities at schools?” Additional questions are:

- How can the educational activity be described with the help of the selected analytical tools?
- Is there something that needs to be modified in the selected tools?
- Does the proposed proof-of-concept e-textbook solution work in a real-world school context?

Activities

In order to achieve the goal of re-conceptualizing e-textbooks as aggregations of both professionally developed and user-contributed content accessible through one’s ecology of artifacts the following activities will be carried out:

- Discovery by pursuing an initial ethnographic study to uncover how learners, teachers and authors currently relate to their artifact ecologies; what activities are pursued; what actions take place and how they are operationalized, primarily by looking into how learners exploit and manipulate the available mediators to support their knowledge building process. The initial ethnographic study will also map the dynamics of the artifact configurations of learners, teachers and content authors while exploring the challenges and contradictions they face while using their artifact ecologies for knowledge building.
- Design to address the initial ethnographic study issues as well as to iterate the emerging e-textbook concept. This approach is coupled with field tests conceived to iterate the enabling digital artifacts by evaluating and exploring the general concepts of the proposed artifacts.
- Development by giving form to the range of digital artifacts to be used by learners, teachers and content authors facilitating the re-conceptualized e-textbook.

CONCLUSION

The continued adoption of various digital artifacts by users and the ongoing effort of digitizing existing textbooks by publishers triggers a need for rethinking what an e-textbook is and how it can be used in the classrooms of the future. Our work should provide a better understanding of how ubiquitous interactions are already taking place in schools and how a new e-textbook could be designed to be accessible through a wide range of devices and could function as an aggregation of both professional and user-contributed content. This research is aimed to further ubiquitous interaction design practices as well as propose a theoretical framework to support those practices.

ACKNOWLEDGEMENTS

This work is supported by the Estonian Higher Education and Research- and Development Activities in the Information and Communications Technology State Program 2011 – 2015.

REFERENCES

1. Bødker, S., and Klokmoose, C. N. The Human–Artifact Model: An Activity Theoretical Approach to Artifact Ecologies. *Human–Computer Interaction* 26, 4 (2011), 315–371.
2. Bødker, S., and Klokmoose, C. N. Dynamics in artifact ecologies. In *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design*, ACM (New York, NY, USA, 2012), 448–457.
3. Butler, D. Technology: The textbook of the future. *Nature* 458, 7238 (2009), 568–570.
4. Davy, T. E-textbooks: opportunities, innovations, distractions and dilemmas. *Serials: The Journal for the Serials Community* 20, 2 (2007), 98–102.
5. Dourish, P. *Where the Action Is: The Foundations of Embodied Interaction*, new ed. The MIT Press, Oct. 2001.
6. Dourish, P., and Bell, G. *Divining a Digital Future: Mess and Mythology in Ubiquitous Computing*. The MIT Press, Apr. 2011.
7. Forlizzi, J. The Product Ecology: Understanding Social Product Use and Supporting Design Culture. *International Journal of Design; Vol 2, No 1 (2008)* (2008).
8. Greenfield, A. *Everyware: The Dawning Age of Ubiquitous Computing*, 1 ed. New Riders Publishing, Mar. 2010.
9. Jung, H., Stolterman, E., Ryan, W., Thompson, T., and Siegel, M. Toward a framework for ecologies of artifacts: how are digital artifacts interconnected within a personal life? In *NordiCHI '08: Proceedings of the 5th Nordic conference on Human-computer interaction: building bridges*, ACM Request Permissions (Oct. 2008).
10. Kaptelinin, V., and Nardi, B. Activity Theory in HCI: Fundamentals and Reflections. *Synthesis Lectures on Human-Centered Informatics* 5, 1 (2012), 1–105.
11. Nelson, M. R. E-books in higher education: nearing the end of the era of hype? *Educause Review* 43, 2 (2008), 40.
12. Oulasvirta, A., and Sumari, L. Mobile kits and laptop trays: managing multiple devices in mobile information work. 1127–1136.
13. Ryan, W., Stolterman, E., Jung, H., Siegel, M., Thompson, T., and Hazlewood, W. R. Device ecology mapper: a tool for studying users’ ecosystems of interactive artifacts. In *CHI '09 Extended Abstracts on Human Factors in Computing Systems*, ACM (New York, NY, USA, 2009), 4327–4332.