Chapter 11
Teaching Design of Emerging Embodied Technologies

Gunver Majgaard
University of Southern Denmark, Denmark

ABSTRACT

How does design of emerging embodied technologies enrich the HCI learning processes? The authors introduce a model for embodied interaction and use it in the development of a painting app for children based on the motion sensor Asus Xtion Pro (similar to Kinect). The development of the app was part of a HCI course for engineering students. The motion sensor was interesting as a design tool, because it appealed to full body interaction. The development exemplified and unfolded the embodied elements: multiple modalities, physical, bodily, social, and symbolic interaction in a situated environment. Subsequently, the authors introduce a physical-digital toolbox, illustrating the span of parameters within the model for embodied interaction: robot technology, tangibles, wearables, interactive surroundings, and bigger objects.

INTRODUCTION

In this article, we explore how having a body affects interaction design (Pfeifer, 2007). Last autumn, my fifth semester engineering students used the motion sensing input device, Asus Xtion Pro (similar to Microsoft’s Kinect), for the design of embodied interaction tools for children. The platform was interesting as a design tool, because it appealed to full body interaction. In addition, it appealed to innovative and creative development projects (Borenstein, 2012).

The design was part of a course in physical-digital interaction design, where the students explored other interactive platforms than PCs and tablets. The students developed a painting application, where at the end, users painted in ten different colours by waving one of their hands.

Basically, we have several categories of physical-digital interactive devices for embodied interaction: Robots and Robot Technology, Touch and Tangibles, Interactive Wearables, Interactive Surroundings, and Bigger Objects. Interactive Surroundings are Sensor Networks, such as cam-
era tracking, hands-free speech recognition and motion sensor devices, such as Microsoft Kinect or Asus Xtion Pro.

For many years, it has been our desire to develop effective and easy to use handsfree user interfaces. Kinect was the first on the market and was launched in November 2010. It sold 8 million units in the first 60 days and entered the Guinness World Records as the fastest selling consumer electronic device in history (Melgar, 2012).

In this study, we want to investigate the relationship between emerging technologies, embodied and natural interaction, and learning activities. Our teaching and learning approaches are based on participatory, exploratory and reflective learning. The students are to participate actively in all the phases of the design: initial field study, prototyping and testing. This contrasts HCI courses focusing on theoretical studies and analyses of other people’s designs. This participatory and reflective learning philosophy is supported theoretically by Schön (1983), Papert, (1993) and Bateson (2000). The students basically learn, while they are exploring and designing new prototypes. In the classroom and in project work, the students reflect on their design ideas, concepts, programming, target groups, test results and academic knowledge. Active participation and reflection is the core of learning (Bateson, 2000; Wenger, 1998). The overall question explored in this paper is:

How does a design of emerging embodied technologies, such as Asus Xtion Pro, enrich the HCI learning processes in Engineering Education?

First, we discuss enriched learning processes in an embodied context and relate this to kinaesthetic, auditory and visual modalities. Then we introduce the concept of embodied interaction, as a combination of multiple modalities, physical, symbolic and social interaction, in a situated environment. As an illustration of this, we describe the students’ development of the painting prototype and the user test. In order to focus on the Asus Xtion as an educational tool in the HCI course, we discuss how the students’ learning unfolded.

The HCI learning loops are illustrated, focusing on the interplay between the students and children in real-life situations. The course is evaluated and the learning activities are pinned down. This is followed by a section on the physical-digital toolbox, which supports embodied interaction. The various categories of physical-digital platforms are: Robot technology, Touch and Tangibles, Interactive Wearables, Interactive Surroundings, and Bigger Objects. Finally, we summarize and conclude.

The research method used in this study is based on Design-based Research and Action Research (Majgaard, 2011; van den Akker 2006; Lewin, 1946). Design-based Research is a branch of educational research that uses the iterative design of educational interventions to exemplify and develop theories of learning. Action Research brings a change in the behaviour of the target group into focus and allows emerging goals. Experiments and critical reflections are at the core of this research method, allowing learning from and through practice. The interventions took place in the target group’s natural surroundings e.g. in the classroom.

**APPROACHES: EMBODIED INTERACTION AND LEARNING**

This study focuses on how embodied technologies theoretically may enrich learning processes. But first we need to describe what we mean by embodied interaction.

**The Embodied Interaction Model**

The rise of embedded computers helps us move around in the world, do household tasks and automates processes in industry. It also affects the way we learn, teach, experience and explore the world. Both the increase of computational power and embedded computing, provide new ways of interacting. Basically our computers become
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