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Graspable Work Modeling

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Abstract

Structure placement techniques have been successfully used to facilitate individual articulation and communication in organizational settings. Recent research provides evidence that tangible interfaces might further improve these processes. A tool to capture knowledge about human work has been developed based on these findings. Graspable Work Modeling allows people not trained in modeling to create representations of their work that facilitate reflection and communication. Users physically build their models using a tangible interface. The modeling process is supported by a set of tools that exploit the synchronous availability of physical and virtual representations of the model.

1 Introduction

Graspable Work Modeling has been developed for people not trained in modeling. It enables everybody involved in a work process to externalize his or her individual view on the work process. In becoming aware of own work practices and interfaces to co-workers, communication in and about the work process is enabled (Suchman 1995). Reflection of the mental models that provide the foundation of one's activities is the first step to discover potential for improvements and optimizations (individual learning). The skill to articulate one's view onto work is necessary for participation in inter-personal improvement processes (organizational learning) (Kim 1993). The GWMD aims at facilitating and training these activities on all organizational levels from top management to operative staff.

2 Concepts

The scientific foundations of the GWMD are provided by Anselm Strauss' concept of Articulation Work (Strauss 1985). Articulation Work is an individual and organizational process that enables interaction between people working together. It covers all activities necessary to communicate *what* has to be done, *how* it is done and in *which context* it is done.

Modeling of work can facilitate articulation of complex work settings but is not a trivial task itself (Herrmann 2002). People are not naturally trained in the skills necessary for modeling, including the ability to abstract and to overlook the whole context of work. Structure Placement Techniques help to externalize individual concepts and mental models without prior training in modeling techniques (Dann 1992). When working with the GWMD, workers use a variant of structure placement techniques that is implemented with graspable modeling blocks. The person engaged in modeling physically puts together and connects these blocks to form the model.

The hands-on-experience of building an abstract model of work physically facilitates modeling (Zuckerman et al. 2005) and provides anchors for reflection of the modeled work process (Hornecker 2004). The articulated knowledge is made persistent by synchronously capturing a digital version of the model and is available for later processing or communication (cf. Figure 1).

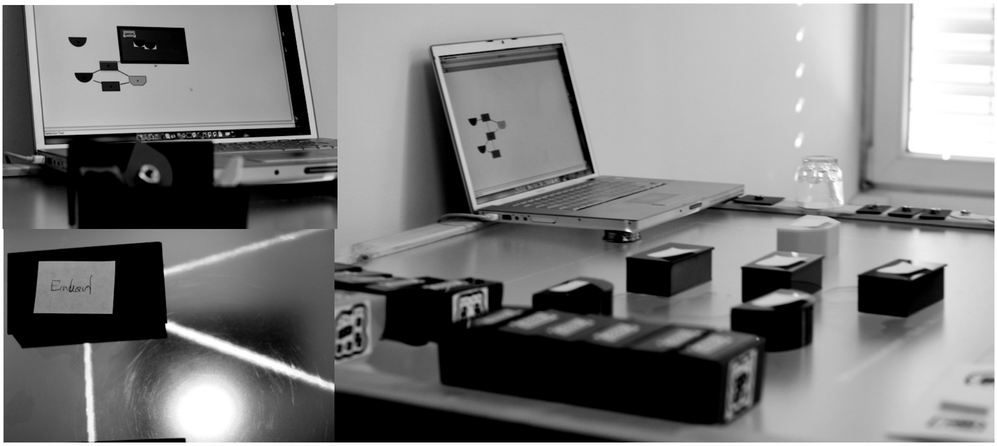

Figure 1: The Graspable Work Modeling Demonstrator

Supporting Flexibility & Openness in Modeling

Traditionally, users are forced to adapt their individual mental models to the expressiveness of the modeling tool by using a predefined modeling notation. We take a different approach by allowing users to define modeling elements themselves (cf. Jørgensen 2004). Users specify the semantics of the modeling elements and even can introduce new elements.

Facilitating Abstraction & Detailing

The GWMD supports users to find a proper level of abstraction by restricting the model size (using a rather small modeling surface). Any modeling element can be augmented with additional sub-models or any other type of information to allow for detailing. Physically, this is realized by binding information to artifacts and putting them into modeling elements (which serve as a container). In this way, users can augment their models with additional context information. This information can be accessed and hidden at any time by opening and closing blocks.

Capturing the Modeling Process

Modeling is a complex task that often requires iterative refinement. Users can capture the status of the model at any point in time using a snapshot mechanism. Whenever necessary, they can navigate through the modeling process and use reconstruction support to restore a previously captured model state. The model snapshots are also made persistent to allow for later recapitulation of the modeling process.

Standardized and Flexible Data Representation

The GWMD relies on ISO Topic Maps (ISO 2006) for data representation. Topic Maps are a standard data format to represent semantic networks. They capture any type of networked structures (such as models of work) and also contain semantic meta-information. Every model saved by the system not only contains the model itself but also the semantics of all modeling elements used and their relationships. A common meta-meta-model enables semantic mapping of modeling concepts during model transfer and communication.

3 Implementation

The system presented here utilizes the reacTIVision-Framework (Kaltenbrunner & Bencina 2007), a vision-based open-source tool for rapid prototyping of tangible user interfaces. The table and the tangible building blocks were specifically designed and produced for the prototype system. The vision-based approach of reacTIVision requires only a camera, a video-beamer and one computer to run the system – no additional IT-augmentation of any parts of the system is required. The visualization application is based upon the JHotDraw-Framework (Gamma & Eggenschwiler 1996), an open-source tool for building platform-independent graphical editors. JHotDraw enables flexible deployment of the visualizer, either on platforms supporting Java or web-based as an applet running in a browser.

A camera located in base plate of the table senses the positions of the objects put onto the semi-transparent modeling surface. The system seamlessly integrates physical and virtual models; it extracts positions and labels of the blocks by applying image recognition and processing algorithms and synchronously displays the model in a visualizer application ('virtual surface'). A video-beamer projects connectors between blocks and additional meta-information onto the modeling surface (e.g. directions for model state reconstruction). The user can accomplish the modeling process using tangible elements only. By default, the virtual surface provides additional information available for the current model state. When the user activates history mode, this surface is used to display stored snapshots.

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