Chapter 2

Pattern-Based Tool Design for Shared Knowledge Construction

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ABSTRACT

Shared knowledge construction aims at supporting the creation and gathering of new knowledge. It relies on tools for computer-mediated interaction. The design and development of these tools is difficult, as not only the interaction of one user with the tool but also the interaction among the users themselves has to be taken into account. For designing and developing successful tools, it is crucial to involve end-users in the development process and to create shared understanding of the requirements as well as the solutions among the end-users and developers. In this chapter, the author analyzes the problems when developing tools for computer-mediated interaction in general and present a novel pattern-based approach for supporting developers as well as integrating end-users in the development process. The author shows the applicability of this approach by introducing tools for shared knowledge construction and describing their pattern-based design. The author concludes by giving an outlook on future research directions.

INTRODUCTION

The rapid evolution and development of computing systems and networking technologies resulted in the use of the Internet as a global communication infrastructure. Every day new computers or local area networks are connected via gateways and Internet service providers to the Internet and contributes to its exponential growth. The popularity of the Internet is largely due to the influence of the World Wide Web (WWW). The WWW is the fastest growing segment of the Internet and is now accepted as the standard information support system in many important sectors of life activities such as finance, education, travel, business, science, health care, art etc. Nowadays, the WWW is the platform for all kinds of information sharing and cooperation as well as communication forms. Furthermore, the WWW is currently performing a shift from the single-user-centered usage to support
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multi-user needs covering many social aspects and collaboration forms.

Our current knowledge and information society considers knowledge as intellectual capital. Knowledge is an important resource for companies, organizations, and individuals. Knowledge is often defined as information of which a person, organization, or a group is aware. Implicit knowledge cannot be formalized and is based on personal experiences, skills, or a combination of both. Compared to this, explicit knowledge is more comprehensible as it is often formalized, e.g. in mathematical expressions. For constructing knowledge, individuals reflect on their experiences and organize these experiences. Thus, knowledge is a cognitive learning process which uses and converts external forces to structure the environment. Shared knowledge construction goes a step further as it requires a group to interact and create a shared understanding of knowledge. Shared knowledge construction is a process in social sciences as well as pedagogy. It enhances traditional knowledge construction by using tools for computer-mediated interaction. Due to the popularity of the Web, these tools are often web-based.

The development of tools for computer-mediated interaction is difficult as not only the interaction of one user with the tool but also the interaction among a number of users has to be taken into account when designing these tools. For designing and developing successful tools, it is crucial to involve end-users in the development process (Schümmer, Lukosch, & Slagter, 2006). Involving end-users in the development process requires that end-users and developers can communicate using a common language. This language has to allow end-users and developers to identify and specify requirements as well as solution. Often this language does not exist. Furthermore, the necessary background knowledge for developing tools for computer-mediated interaction is often not part of the professional training for software engineers. These issues make it difficult to develop successful tools for computer-mediated interaction in general and particularly for shared knowledge construction. We propose to overcome these issues by providing developers and end-users with a pattern language for communicating with each other and a development process which involves the end-users.

In this chapter, we first analyze the problems when developing tools for computer-mediated interaction in general. Then, we present a novel pattern-based approach for supporting developers as well integrating end-users in the development process. We report on our experiences when using the pattern language to design and specify tools for shared knowledge construction. We conclude the chapter by giving an outlook on future research directions.

BACKGROUND

The development of tools for computer-mediated interaction is a challenging task. Apart from the actual task of the application, e.g. editing texts or spreadsheets, developers have to consider various aspects ranging from low-level technical issues up to high-level application usage. Among others, network connections between the collaborating users have to be established to enable communication, parallel input from the collaborating users has to be handled, specific group functions have to be included to provide group awareness, and the data has to be shared and kept consistent to allow users to work on common task at all (Ellis, Gibbs, & Rein, 1991). These issues are often not part of the professional training of software engineers. Instead, software engineers learn the basic principles that empower them to create any kind of software.

Development frameworks, like e.g. NSTP (Patterson, Day, & Kucan, 1996), GroupKit (Rosenman & Greenberg, 1996), COAST (Schuckmann, Kirchner, Schümmer, & Haake, 1996), Habanero (Chabert, Grossman, Jackson, Pietrovicz, &