Chapter XXV
Ubiquitous Access to Adaptive Hypermedia

Chris Stary
University of Linz, Austria

ABSTRACT

Although mobile interactivity is becoming quite common, for content-rich applications, such as educational hypermedia systems, user-centered design is still a development challenge. Content has to be accessible for different users in various settings, thus, to be presented in a situation-dependent way to learners and coaches. For browser- or GUI-like access facilities the drivers of design are rarely learning tasks or transfer activities coupling content to communication, but rather standard access facilities of hypermedia systems, eventually driven by domain-independent user profiles. Taking into account learning tasks and transfer activities requires adaptation of navigation and content elements of hypermedia to various front ends. In this chapter conceptual mappings of stationary to mobile access facilities ensuring coherence and consistency are presented. Context-sensitive coupling communication facilities to didactically relevant content elements enables focused work. Navigation is either based on (filtered) domain structures or on user views generated through annotations. For mobile access, additional visual encodings are used to facilitate the navigation procedure given the limited space of non-stationary devices. In this way ubiquitous access facilitates self-directed learning.

INTRODUCTION

As mobile hypermedia become increasingly common in educational settings (cf. Becking, Betermieux, Bomsdorf, Feldmann, Heuel, Langer & Schlageter, 2005), learning and knowledge transfer activities have to be supported through applications enabling ubiquitous access. The distinct consideration of content, presentation, and navigation (Duval, 2004) identifies hypermedia design categories that can be handled in a mutually tuned way for ubiquitous access to

educational hypermedia. With respect to content, being the most prominent element of educational hypermedia, the concept of learning objects allows coaches to form modular and self-contained units of learning (Kurzel & Slay, 2002; Farmer & Hughes, 2005). Although this concept facilitates the challenging task of adapting non-stationary devices (Zhang, & Adipat, 2005), the structuring of hypermedia content for self-directed and learner-centred knowledge transfer is not primarily an engineering task, as for example, identified by Vrasidas, & Glass, (2003). It is rather a matter of didactically sound arrangement of domain elements for learning and effective knowledge transfer (Dijkstra, Jonassen & Sembill, 2001). As those elements should represent the entities e-learning environments are built on (Schluep, 2005) their identification and adjustment from a didactical perspective are crucial (Auinger & Stary, 2005a, 2005b; Schulmeister, 2003). From a user perspective meeting didactic objectives has already become a decisive factor of educational support systems (Leidig, 2001).

Besides content management navigation is essential, since it makes up most of the user's experience when interacting with hypermedia systems (Lazar, 2003). Navigation features should facilitate the access to domain- and user-relevant information including content and its manipulation features. When using those features users should be able to build up and maintain a coherent mental representation of the traversed environment, the so-called cognitive map (Chase, 1986). This representation serves as a baseline for users when interacting with the software system (cf. Rovine & Weisman, 1989). Educational software developments do rarely address navigational issues conceptually (Boyle, 2002), they typically aim for minimizing the time used for navigation, such as xTask (Ketamo, 2003) for PC and PDA navigational panels: 'The navigation system is simple and systematic. The navigation panel fulfils Nielsen's ideas about good navigation: "A user recognizes where to go and where s/he has been" (Neilsen, p. 367) Inputs for conceptual considerations stem from various modeling techniques, for example, RMM (Isakowitz, Stohr & Balasubramanian, 1995) or UML (Sauer & Engels, 2001). However, they remain at a domain-independent level, although empirical evidence reveals that domain-sensitive access might facilitate interaction for users significantly (MacGregor, 1999).

In the following we review the results from several domain- and user-centered developments in the field of adaptive learning hypermedia utilizing the platform Scholion (scholion.ce.jku.at). It provides ubiquitous access facilities, as we demonstrate for mobiLearn (www.nml.at, www.mobiLearn.at) and ELIE (E-Learning in Engineering funded by the EU in the Interreg IIIc REGINS programme) (Auinger, Fürlinger & Stary, 2004; Auinger, Auinger, Derndorfer, Hallewell & Stary, 2007; Stary & Auinger, 2005). The reviewed cases target towards the transfer of media-informatics and electric engineering knowledge, respectively.

In the section Generating Adaptive Content, the procedure for content engineering is introduced. It is based on the CoDEx method comprising document analysis and reflective interviews. It helps to elicit didactically relevant information from experts. In the section Enacting Consistent and Coherence Ubiquitous, we review self-directed knowledge transfer based on the intertwining content elements with communication facilities. It includes domain- and user-specific navigation. We detail the mapping of stationary facilities to mobile devices preserving consistency in structure and behavior.

GENERATING ADAPTIVE CONTENT

The production of content requires a structured procedure. As Kerres, de Witt and Stratmann (2003) and Euler (1992) point out effective content production based on didactic knowledge has to go beyond structuring of content using