Designing Interactive Music Systems: A Pattern Approach

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Extended Abstract

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Music is a very demanding and structurally complex type of multimedia information. Most computer systems today can easily play back musical data in high quality. Nevertheless, they hardly offer any new and media-appropriate interaction with the musical data.

This is an example of what we call the *Multimedia Semantics Problem:* Technically, current systems can handle multimedia data quite well, but the user cannot really access and use the contents and structure of this data in new, productive ways. We might well face a new software crisis: More and more non-textual data is amassed on computer systems, yet users have no way of working with this data in appropriate forms. This severely limits the possible increase in productivity and usefulness of such systems.

How should an ideal system support music, then? Certainly, users would not just select a piece using traditional mouse or keyboard input, and simply play it back. Instead, they would also be able to hum a melody to locate the tune they want, then conduct it using their hands, or play to it with the computer assisting them in their performance, alone or with somebody else via the Internet. This is what we would call an example of media-appropriate interaction with the media type music. It encourages human creativity, instead of stifling it through lack of interaction, and lets the user learn about musical concepts by playing with them.

We developed such a system, called *WorldBeat*, in the form of an interactive computer-based exhibit for public exhibition centers. Users control the entire system using just a pair of infrared batons, and can perform all the interactions described above, including improvising to a Blues band without having to fear wrong notes. *WorldBeat* has been

elected one of the top exhibits in the *Ars Electronica Center* in Linz, Austria, where it has become a permanent installation. As multimedia software title it received the *1998 Multimedia Transfer Award,* being chosen from among 160 contestants.

The real problem that stands in the way of developing such systems successfully, though, is communication: Software developers, interaction designers, and users as experts of the application domain are missing a common language to effectively communicate their respective expertise that is required in the course of such a project.

Our approach to this problem is pattern-oriented. It is a quite established method to express successful solutions to recurring problems in software engineering in the form of software design patterns. They range from architectural patterns describing overall guidelines for system structure and organization, via object design patterns indicating how sets of interacting software components can solve certain problems effectively and elegantly, to coding patterns that give help with concrete implementation issues.

HCI research is just now beginning to carry this pattern approach over to interaction design. Here, it can be a useful framework to put user interface design guidelines, from abstract task issues and general *golden rules,* via dialogue design, to concrete questions like physical interaction, into a unifying framework.

Furthermore, we show how this pattern approach can be followed even when structuring the knowledge of the application domain: User expertise and paradigms can be expressed as a similar hierarchy of patterns, from abstract tasks and concepts, via typical objects and relations, down to the building blocks of the user's world.

The crucial advantage of this approach is that all groups involved can use a unified form of expressing their goals, rules, and knowledge, making it easier for each group to understand the other's ideas and concerns. It becomes possible to find transitions between these hierarchies that show, for example, how musical domain concepts like the *groove* in Jazz need to be represented in the user interface, and how this could give hints to an appropriate internal structure of interacting software objects.

When these three pattern hierarchies are sufficiently interconnected and complete, they can even become a *pattern language* that captures the diverse interdisciplinary experience involved in the project — a *lingua franca*. Such a structured pool of experience may even be useful as a flexible, generative form of representation that early standardization efforts require.

We show how the *WorldBeat* system reflects this pattern approach, and how we used the resulting pattern language to help us develop subsequent interactive systems from a similar domain.