User experience design during OpenSHAPA development

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ABSTRACT
During the development of an open-source exploratory sequential data analysis tool, broad control theory principles have guided user experience design. Closed-loop development practices guide the implementation discussion, which broadly comprises two parts. Firstly, there is a design discussion in which users propose and comment on user interface mock-ups. Secondly, there is a development discussion in which users actively participate in guiding development. The approach used in this case study effectively manages the dynamic nature of open-source software production and use.

Author Keywords
Open-source, user experience design, control theory, open-loop, closed-loop, exploratory sequential data analysis.

ACM Classification Keywords
H.5.2. User Interfaces: User-centered design, D.2.3. Coding Tools and Techniques: Evolutionary prototyping.

INTRODUCTION
OpenSHAPA [1] is a research tool for exploratory sequential data analysis [2]. It integrates and presents multiple types of data (such as sound, video, etc), and assists with analysis by allowing users to build and organise interpretations. OpenSHAPA is currently used by a small community of human psychology researchers, with scope for a much broader audience.

OpenSHAPA is a natural extension and conversion of MacSHAPA [3], a pre-existing exploratory sequential data analysis tool. OpenSHAPA is currently in what is known as the bootstrapping phase of development, where the source code has been made available to a small group of developers and selected advanced users of MacSHAPA. The bootstrapping phase includes the implementation of core functionality, and is occurring prior to wider dissemination under the GPLv3 license [4].

User experience design is practised within the development of OpenSHAPA by engaging users according to broad principles borrowed from control theory. In its fullest form, control theory is a coupling of mathematics and engineering that is applied to dynamic systems [5]. Examples include climate control systems where constant temperature is maintained, regardless of variability in the surrounding environment. Similarly, the process of software creation and utilisation occurs in a dynamic environment, where underlying technology and toolkits continually evolve and change; products inevitably improve and interact with each other in new and varied ways. The dynamic nature of the environment in which software exists is the key motivator for considering human-computer interaction in the OpenSHAPA development process.

Control theory principles—the inspiration for user experience design processes in OpenSHAPA—describe controllers that act to regulate systems in dynamic environments. Controllers may be open-loop or closed-loop [6]. Open-loop controllers act on a system without considering any subsequent feedback. In contrast, closed-loop controllers continually gather feedback from the impact of their actions, enabling more appropriate adjustments in the future.

Traditionally, proprietary software is developed with open-loop control processes, where the future use of a product is anticipated, designed for, developed, and released. Accordingly, the process lacks mechanisms to measure actual user experience in a timely manner.

Conversely, OpenSHAPA development is directed by closed-loop control concepts; ensuring that user experience informs and drives development, and is also used as a benchmark for every incremental change.

METHOD
User input is encouraged by the creation of a culture in which users are treated as co-developers whose feedback is regarded as vital. Currently feedback is gathered by engaging users and developers in an implementation discussion. The implementation discussion comprises two components: the design discussion, and the development discussion.

The design discussion
Since OpenSHAPA is derived from MacSHAPA, this serves as a natural starting point for the ongoing design discussion. OpenSHAPA developers continually meet with MacSHAPA users in an ad-hoc manner to discuss strengths...
and weaknesses of the existing tool. Along with a list of explicit desires, design discussions provide a list of high-level requirements. These are often ambiguous and difficult to understand, for example:

“We need the ability to open multiple videos; specifying offsets for each, so that they start playing at different times but with time synchronised.”

Such high-level statements seldom lead to an immediate user-interface solution. Instead, a closed-loop system is created which involves users as co-developers. Potential solutions are proposed in the form of mock-up sketches, which are posted on a wiki alongside written descriptions of envisaged interface functionality. Users and developers actively engage in design discussions through a process which encourages reviewing, commenting and modifying the sketches in order to identify potential problems, or to propose alterations which address these.

Once most users and developers involved with a design are satisfied with the proposed user interface, the actual development of a design can begin. This marks the beginning of the development discussion.

The development discussion

The OpenSHAPA development discussion is the next phase, where user feedback is no less critical to user experience design. Continual feedback is stimulated by releasing early, releasing often, and listening to the users [7]. The development discussion is maintained by following a disciplined release schedule. Fixed release dates can be adhered to by remaining flexible with the scope of features to be included in any release, and with the result that a new version of OpenSHAPA is shipped every month.

The discussion with the users during development manifests in three forms:

1. Users are encouraged to inform developers of exactly what issues are occurring by logging bug reports. The reports come in two forms - explicit desires or high-level statements. These reports close the loop and are used to begin another iteration of the design discussion.

2. In the case of explicit desires outlined via bug reports, the user who raised the issue is responsible for verifying that their explicit desire has been satisfied. Once fulfilled, developers create a user-interface test that is automatically executed on every subsequent build of the software. This automated regression testing from the user’s perspective ensures that once developers have included a fix, it remains fixed for future releases.

3. Developers actively engage users in prioritising problems to be solved by asking questions such as, “What is the problem that frustrates you most?” In this manner, the most frustrating problems are given highest priority.

RECOMMENDATIONS FOR FUTURE WORK

A development process fostered by a community culture such as the one described above requires a degree of caution, as not every user of an open-source project will actively engage in the implementation discussion. When moving into the wider release of OpenSHAPA under the GPLv3 licence, a conscious effort will be made to democratise the design process further, and close the development loop by automatically gathering usage information and software errors. Such information will be used to target development efforts more efficiently, according to actual usage data.

As soon as automated mechanisms for gathering usage patterns and software errors have been created, these issues can be prioritised on the basis of their frequency of occurrence in real-world situations. Design issues with the highest priority will be examined further with the help of OpenSHAPA itself: OpenSHAPA will be used to perform video analysis of users actually using OpenSHAPA. Such an exercise will provide empirical usage data to inform the design discussion further and close our development loop.

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REFERENCES

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