Informing Intelligent Environments: Creating Profiled User Interfaces

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ABSTRACT

Designing user interfaces for broad user populations often means average user interfaces that do not take individual differences into consideration. The PROSKIN project is researching whether subsets of users can be identified and grouped by distinguishing interactive behaviours so that a more personally optimised interaction can be designed. This paper discusses the design and development of a research environment to support this research.

Keywords

User profiling, profiles, interface skins, log file recording, logging, interactive profiles

INTRODUCTION

The main aim of the PROSKIN project is to create interaction-based user profiles that help to create effective user interfaces for specific user groups. This paper describes a research platform which will help to establish and validate an interaction-based profiling tool, which designers can use when developing user interface skins. User profiling has already been established using psychometric measures but this is inappropriate for Ambient Intelligence (AmI) because it is too intrusive. One of the visions for AmI is to create a system that is able to learn from users, as users use the system (i.e. without explicit teaching or providing information via questionnaires).

In order for AmI to become a reality and provide truly anticipatory and responsive environments there will need to be pervasive computing and network coverage. One of the benefits that this brings is the infrastructure to capture and transmit interaction data within the actual context of use, and the subsequent ability to create user profiles based on sampled interaction data. These user profiles can be used to produce user interfaces that provide a more personally optimised interactive experience than those designed for typical or average users. Ideally user interfaces will be designed and personalised for the individual. However designing user interfaces for individuals is often impractical due to resource constraints (lack of user and usage information, design guidelines) but yet designing for broad user populations often produces a functional yet average interface with little personalisation [1].

The ability to change the user interface using skins has provided the user with the means to personalize their own user interfaces, but without a return path for interaction data there is limited understanding of how user interface personalization occurs in the actual context of use. The PROSKIN project is investigating ways in which subsets of user groups can be differentiated from a general user population by interactive behaviour profiling, through the construction of profiled skins (PROSKINs). Rather than attempting to design for the individual, it is envisioned that by identifying and designing user interface skins for profiled user groups that more personally relevant interactions may be designed. This will allow interfaces to be designed for types of user rather than all users or individual users, providing a more personally optimised interaction. To this end a research platform is being developed to allow the distribution and monitoring of profiled user interface skins within the actual context of use.

PERSONALISATION OF THE USER INTERFACE

The ability to personalise user interfaces through the use of interface skins is a feature of many operating systems and applications. This feature allows for the customisation of all user interface widgets, including colour and sound palettes, iconography and fontography as well as animations and other state transition effects. The customisation of these interface skins is generally made possible by one of two means: firstly by user selection of any or all of the available widgets for modification (e.g. icons, colours, fonts) from a library of choices (widget/component modification), or secondly by the

selection of an entire user interface skin that replaces the existing one (skin replacement). Changes to the user interface may be purely cosmetic, where the active interaction components are unaffected in shape, location or function and a themed skin is applied, for example a 'Lord Of The Rings' themed skin. However, changes to the user interface, whether by component modification or by skin replacement, have the potential to affect the quality of the interaction itself.

QUANTITATIVE PROFILING AND USAGE FEEDBACK

One of the key features of the PROSKIN approach is that it provides a feedback path to interface designers, providing interaction metrics that relate directly to individual interactive behaviours for a specific interface skin. This feedback loop is of benefit to interaction designers who are now able to observe and monitor changes to interface skins used in the actual context of use. By redeveloping user interface skins based upon quantitative behavioural data as opposed to qualitative feedback (e.g. feedback e-mails, bulletin boards, user group satisfaction surveys, popularity metrics) or demographic usage data (e.g. number of downloads) it is hoped that more precise and more personally intuitive user interfaces can be defined. The questionnaire data collected is used for research purposes to validate the interaction profiles.

RESEARCH QUESTIONS

The main research questions being addressed at this stage are; "Can subsets of user populations be identified by differentiating interactive behaviours" and "If subsets can be identified, can improvements to the quality of interaction be made as a function of individual difference. An additional research question, "Do users choose skins that provide the most effective interaction, or that appeal aesthetically the most?" is also being investigated.

APPROACH

We have built an Internet Radio application (Fig. 1) featuring the technologies described above. It is our intention to record interactive behaviours as they relate to individual user interface skins. In order to validate the logged data, it will be correlated against user profiles based on questionnaire data to produce interaction profiles. Each interaction profile will describe a subset of users by typical interactive behaviour and form the basis for the development and redevelopment of profiled skins by designers who will be provided with the profiles. The infrastructure to record behaviour allows for behavioural change as a function of interface skin to be captured. When the skins are redesigned by designers and redistributed to users, the resulting usage data provides a next level of validation if interaction is selectively improved for the targeted user groups.

A development platform is being constructed to facilitate this approach and consists of a number of technologies that combined allow quantitative hypothesis testing. These technologies include: user interface skins, log file recording, User Interface Markup Languages (UIML), online questionnaire administration and recording, client-server communications and a data repository. These technologies are all being applied in the construction of an Internet radio client (WebRadio). This client allows users to select and listen to radio stations streamed via the Internet and provides a client application from which to gather experimental data.

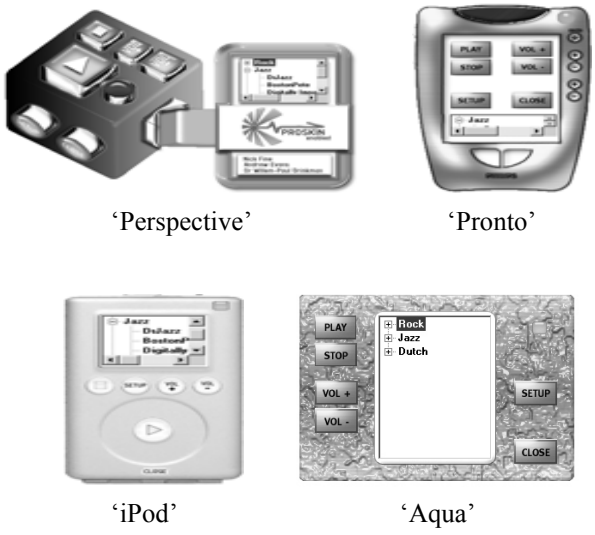


Fig. 1. Sample WebRadio User Interface Skins

RESEARCH ENVIRONMENT

The WebRadio features the ability to change the user interface (reskin) during operation. This is an entire skin replacement as opposed to modification of individual widgets and affords far greater control over experimental conditions. This is because entire skins can be varied (or mutated) over different conditions to control for individual interface widget changes. The WebRadio client also features an ability to receive and install new experimental skins automatically, pulled from the server at predetermined times. This is a critical feature of the PROSKIN platform as modified skins can be distributed to users and behavioural changes as a function of user interface skin change recorded.

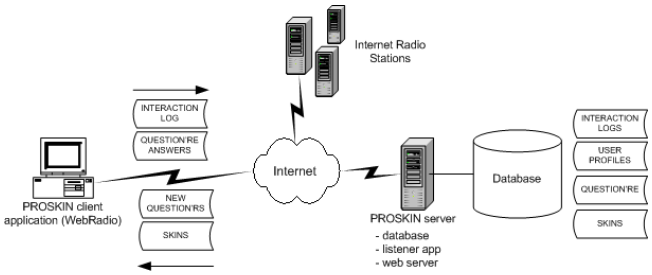
The WebRadio client features a logging component that records all user interaction with the application to a local session-based log. The log file records all keystrokes, mouse clicks, mouse movement and hover timings to provide quantitative interface-specific interactive behaviour metrics. The log files are encrypted locally before being uploaded to the PROSKIN server where they form the main source of data in constructing interaction profiles.

Each skin is defined by an XML file that describes the user interface, including background image, button position and behaviour (including mouseover and click-based events)

and any featured components, for example status indicator lights and radio station directory.

Questionnaires form the main source of data in constructing user profiles. These are administered via a secure web server running on the PROSKIN Server and stored with the interaction profiles derived from the recorded log files.

All communication is handled via TCP/IP to the PROSKIN Server, which runs a database that acts as a data repository and component library. All log files and questionnaires are stored in the database as well as the skins library and updated radio station directories.



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