

DIVISION OF COMPUTER SCIENCE

**Designing a Public Access Information System in a New
Domain**

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INTRODUCTION

The development of a public access information system, or 'information kiosk', presents the designer with many challenges (Leventhal et al 94). Amongst other things, such a system must be:

- accessible to a wide range of users with different competencies, experience and expectations in regard to both the use of computer technology, and the information domain itself;
- easy to use without training or access to specialised support staff; and, commonly,
- implementable using relatively unsophisticated interface technology such as a screen for output and a keyboard and point and click device for input.

The designer's challenge is even greater when the domain about which the system is to provide information is itself a new one, so that existing approaches to the provision of information are not co-ordinated in any way, and information to be included in the system must be obtained from many different individuals and organisations, each with a different view of the domain.

This paper describes an approach used in the design and development of a public access information system in a new domain such as that described above. The SPIRE system (System for the Provision of Information about Rehabilitation in Education) was intended to be used by students, lecturers and support staff in higher education institutions to obtain information about computer-based technology and other facilities available to support students with disabilities.

DESIGN PROBLEMS IN THE SPIRE PROJECT

All of the challenges described above were encountered in developing the SPIRE system.

The fact that the different types of users (students - current and potential, disabled and able-bodied; lecturers and

support staff) would have considerably different requirements in relation to the system was identified at quite an early stage in the project. For example, lecturers might typically use the system to find out how to teach or set exams for students with particular disabilities, whereas disabled students may require information about student union facilities or university based self-help groups.

It was important that SPIRE should be easy to use without training and with commonly available hardware, so that the system would be freely and widely used, and would tend to draw its users in to finding out more about the domain, rather than acting in any way as a barrier to information.

It was also realised at quite an early stage that there was no single existing system, computer-based or otherwise, on which SPIRE could be based, as issues relating to the provision of support for students with disabilities have only recently become important in UK universities, and much of the computer-based technology which can assist such students has only recently become available. Information in this domain was found to be provided by many different organisations, such as Skill (National Bureau for Students with Disabilities) and the RNIB (the Royal National Association for the Blind) at a national level, and, at the university level, by student accommodation and finance services or by specialised disability support staff. Each of these had a different perspective on the domain: for example, the RNIB provided information on support of various different kinds and for various different activities for blind students. Accommodation services were, on the other hand, able to assist students with all kinds of disabilities, but provided no assistance with obtaining financial support, or obtaining appropriate learning materials from lecturers. It was thus impossible to identify any existing, coherent view of the domain as a whole which could be used as the basis for our system.

In addition to the above, the nature of the development organisation imposed extra constraints on the project as follows. SPIRE was developed by staff of the Human Factors Consultancy at the University of Hertfordshire (UH), more recently known as Software Development Services (SDS). SDS is a small commercial organisation based within the Faculty of Information Sciences at UH. Over the past three or four years, the number of staff

working for SDS on a full-time basis has varied between one and three, with management and consultancy for particular projects being provided by various members of staff within the Faculty.

Because SDS is based within a university, it is effectively working within the general domain about which SPIRE was to provide information. This meant that access to potential system users and some university-based sources of information was relatively easy. However, because of the small size of the organisation and small scale of the project (funding for the SPIRE project was enough to cover the cost of one developer for a period of 1 year), access to other sources of information, such as national disability organisations, was limited. Furthermore, while SDS had free access to advice on approaches to user-centred design and usability evaluation (the design team for SPIRE consisted of a total of four individuals including two lecturers and one researcher with experience in the field of human-computer interaction, as well as the developer himself), it had little in the way of equipment for carrying out such evaluations - it did not have access to a formal usability lab.

DESIGN-RELATED ACTIVITIES IN THE SPIRE PROJECT

The approach taken to design and development of the SPIRE system was roughly that shown in figure 1.

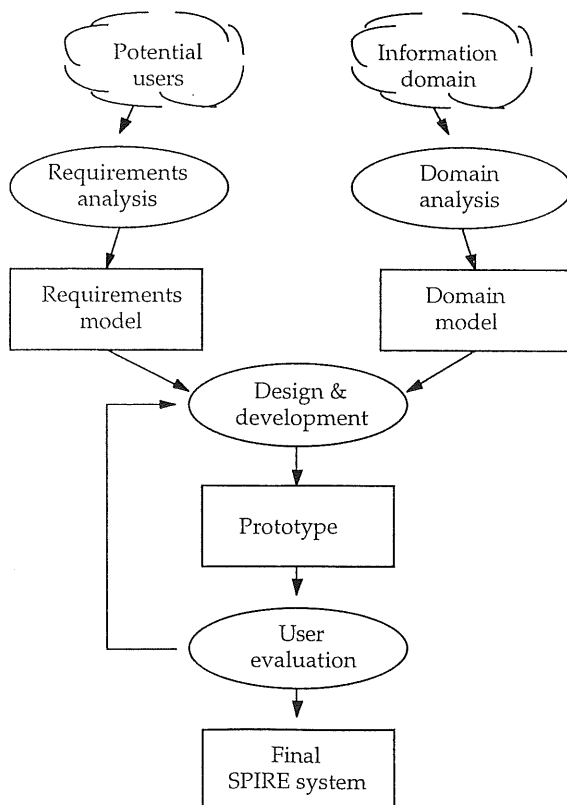


Figure 1: The development of the SPIRE system

Our initially vague understanding of the needs of potential system users, and of the information domain itself was refined by processes of requirements and domain analysis. The resulting requirements and domain models were used to inform the design and development of the system which was then prototyped a number of times with the second prototype being incrementally developed into the final system. Prototypes were evaluated by potential system users in a number of different ways. The following paragraphs describe in some detail what was done at each stage.

Requirements Analysis

As existing approaches to providing the sort of information to be presented by SPIRE were piecemeal and fragmented, there was no one system which we could observe and model as a basis for designing our new computer-based system. Our ideas regarding the tasks which should be supported by SPIRE therefore had to be developed from scratch.

Our initial approach was to gather the project team together for a brainstorming meeting. This proved quite productive as the design team included both lecturers and individuals who had recently been students in higher education so that two of the main groups of potential users were represented. The brainstorming meeting produced a list of 'scenarios' or situations in which it was envisaged that the SPIRE system might be used. These scenarios were then presented to a group of around 7 lecturers and 8 students to generate further suggestions for the kinds of facilities which the system might be expected to provide under the circumstances described.

As an example, a lecturer acting out a scenario in which a partially sighted student would be joining their class suggested that the system should provide information and advice on how to recognise the student, whether the student would be able to take notes and how to enlarge handouts quickly. A researcher role-playing a new student in a wheelchair who has just started at the university suggested that the system should provide a map showing ramps, lifts and disabled toilets and information about grants for modifying his accommodation.

This exercise led to a number of new design ideas. For example, it became clear that a commonly used first step towards obtaining information in the domain of interest was simply to ask a human expert. This finding influenced the overall design of the system as described below.

Domain Analysis

Since there was apparently no existing model of the domain of information to be provided by SPIRE, the project also needed to design a conceptual structure within which information could be provided. Paper documents relating to the domain were collected from all the existing sources of information the project was able to identify. These

documents were reviewed, and one giving an overview of policy in relation to students with disabilities was chosen to be used as the basis of a card sort.

The aim of the card sort was to identify high level concepts which a majority of potential system users shared in relation to the domain of information. These concepts, and the relations between them, could then be represented in the system's interface where they would help to guide users to related information. Around 90 key terms from the overview document were written on separate slips of paper and a complete set of terms was presented to each of the 7 lecturers and 8 students who were asked simply to put the slips into piles, then name the piles, and identify any relations between them.

Examples of terms used were: personal assistance for help with reading, volunteer helpers from community services and financial support from the Social Services. Groupings and concepts generated in this way included Help from People and Finance. The first two of the key terms above were categorised under Help from People, along with 17 other terms, and the third went under Finance, with 9 others.

After the sorting exercise, members of the design team reviewed the list of concepts generated to identify instances where, for example, slightly different terms (for example Help from People, Available Helpers, People Support and Support Personnel) had been used to name very similar clusters of objects. In this way, a unified view of the structure of the domain was developed.

Design and Development

Once a reasonably clear view of the requirements and domain models for SPIRE had been established, the design team met to consider the overall design of the system. The overall architecture of the system is described in some detail in Bearne et al 96, but significant design decisions which lead to the choice of that architecture were as follows.

Owing to the obvious complexity of the domain, and the fact that different types of users would come to the system with different knowledge of the domain and different needs for information, it was decided that information to be provided to the user should be filtered through a 'user profile' mechanism. This meant that the user's first task on entering the system would be to define his or her profile in terms of whether information sought was for a student, a potential student, a lecturer or a member of support staff, what disability it related to, and what subject of study. (These variables had emerged during requirements and domain analysis as 'first cut' dimensions along which information in the domain could be categorised.)

In order to further direct the search for information, it was decided that users should be able to select from a menu of activities in the domain (such as 'attend a lecture', 'do field

work', and 'use careers service') which would include all activities for which support for disabled students would be available in some shape or form. The list of possible activities was too long to present as a single whole, and also contained activities of different granularity (for example, 'attend lecture', 'get to a place on campus', 'use lift' and 'read text displayed on an overhead projector') and was therefore presented as a hierarchy of domain tasks. A section of the task hierarchy was as follows:

Attend lecture

- Get to lecture theatre
 - Get to place on campus
 - Find location
 - Use lift
- Listen to lecturer
- Read large display
- Read handouts

(More accurately speaking, the tasks formed a tree structure rather than a hierarchy, as low level tasks such as 'read printed text' appeared as a sub-task for a number of higher level tasks and often took the user to the same information.)

After having worked his or her way through the hierarchy of domain tasks, the user would then be able to ask for expert advice relating to the support available for the task in question. An attempt was also made to contextualise the advice which was presented. For example, a student asking for advice on how to find a location in the context of a query about attending lectures might be shown a different map from that shown to a student asking about locations in the context of a query about student union facilities.

As well as this route into the system, it was decided that users should also be given direct access to a database of information structured according to the results of the card sort carried out in domain analysis. This was provided as a more efficient means of accessing information for frequent system users who had a precise idea of what information they were looking for and confident in the use of computerised databases. A number of other specialised interfaces were also designed for accessing small subsets of the information held: for example, information about the university admissions procedure was available by accessing the database, selecting the Admissions category and clicking on the appropriate part of a flowchart representation of the admissions process.

User evaluation

Because only limited time and resources were available for carrying out user evaluations on the SPIRE project, the emphasis was on efficient procedures which would allow plenty of user feedback to be obtained relatively cheaply.

The first prototype for the system, developed in HyperCard, was first assessed by members of the design team and selected domain experts (including university disability officers) using structured evaluation sessions in which

subjects were asked to carry out a number of representative tasks and their reactions were recorded on a questionnaire. It was then subjected to a 'hallway and storefront' evaluation, in which the system was simply installed in a public place at UH (outside the student canteen) and members of the design team asked passers-by to spend approximately 15 minutes attempting to do various tasks using the system and recorded their reactions. Around 12 people were asked to evaluate the system in this way.

The second prototype was developed in FoxPro and was intended to be developed into the final system. Evaluation continued on an ad hoc basis throughout the rest of the development period, but was mainly carried out by members of the design team as lecturers and support staff were often too busy to devote long periods of time to evaluating the system.

LESSONS LEARNT

The SPIRE system is now used by the university disability officer at UH and is also in use at Oxford Brookes University. The development of a Web-based version of the system has also been funded and recently completed. We feel that the SPIRE system has therefore achieved at least a measure of success. Our feelings regarding the experience of developing the system are as follows:

- in the absence of any existing approach to the provision of information which could have acted as a basis for designing a computer-based system, discussing possible uses of the system in the context of a series of loosely defined scenarios was useful, and lead to a number of new design ideas for the system being identified;
- in the absence of an existing domain model, card sorts provided a useful way of identifying a conceptual structure for the system's interface, although we felt that the process should be used only to identify a rough outline for the structure - time spent analysing the results in detail in an attempt to produce a more precise picture would, we felt, have been wasted;
- the idea of filtering information for different types of users using the notion of a 'user profile' has apparently been relatively successful, however,
- the task hierarchy used as the second mechanism for filtering information was found to be far too complex and our attempts to contextualise information presented on the basis of this were not understood;
- specialised interfaces (such as that provided for accessing information about the university's admissions procedure) which were designed to suit the structure of particular kinds of information, rather than being intended to conform exactly to a consistent system style, appeared to work well for staff who used the system mainly to obtain information in a fairly restricted part of the domain;
- the 'hallway and storefront' form of evaluation is a relatively efficient one which can be carried out in a

short space of time without too much effort from the development team. It was, we felt, also an appropriate method to use in the development of a public information system which people will be expected to use without training or reference to support staff. However, it proved difficult to evaluate SPIRE in this way at the beginning of the project as the system contained little information at that time, and most of the users' criticisms were directed at the quality of information in the system, rather than its overall structure or interface. Experience suggests that this is commonly the case in early evaluations of information systems.

SUMMARY

In this paper, we have described the way in which a small design team tackled the problems associated with developing SPIRE, an information system aimed at providing a broad user population with information about a new domain. Design-related activities carried out in the project have been briefly described and some of the important lessons learnt during the project have been summarised. We believe that a number of the techniques used in the SPIRE project could usefully be applied in other design projects sharing the particular characteristics set out at the beginning of the paper, and that the lessons we learnt in developing SPIRE might be equally applicable in a range of similar projects.

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