

3. STUDY OF CURRENT PRACTICES

3.1. Objectives and Methodology

As indicated in the introduction, this work applied a series of query techniques to investigate current information visualisation practices (both nationally and internationally). More specifically, we interviewed domain experts from the UK and aboard to establish Information Visualisation criteria and best practices for services and resources similar in nature to those offered by the JISC Information Environment. The specific query techniques employed were interviews, focus groups and questionnaires.

A representative from our team also attended two Information Visualisation tutorials, the first at the HCI International Conference 2003 (delivered by Prof. Ben Shneiderman) and the second at the British HCI conference (delivered by Prof. Bob Spence) where we had the opportunity to be exposed to a series of views and opinions on the domain of Information Visualisation and its link to Human Computer Interaction.

3.2. Interviews

The participants:

Interviews were conducted to collect the views and opinions from domain experts in the UK and aboard. Those interviewed are experts in the area of Information Visualisation, Digital Libraries, as well as specialists with extensive knowledge of the JISC Information Environment.

Two UK domain experts and two domain experts from aboard were invited for interviews. Three of them agreed to be interviewed.

The Interviewing Sessions

Interviews with UK experts (two face-to-face interviews)

Interviews with UK experts were held at the project team's offices. They were semi-structured interviews and were scheduled for one and a half hours. A list of interview questions was emailed to them in advance.

Interviewee 1: Professor Robert Spence

Background: Professor of Information Engineering, Imperial College, London, UK (specialising in Information Visualisation)

Interviewee 2: Dr Mike Pringle

Background: Head of AHDS Visual Arts (<http://vads.ahds.ac.uk/>). Specialist in Information Visualisation and familiar with the JISC Information Environment.

Interviews with International experts (one email interview)

Interviewee 3: Professor Ben Shneiderman

Background: Professor of Computer Science, University of Maryland at College Park, USA. A world specialist in Human Computer Interaction and Information Visualisation.

3.3. Focus Groups

Focus Groups were conducted to elicit user requirements (from stakeholders and end users) of digital libraries and to share views on how information visualisation can be incorporate into the design of digital libraries.

We organised six focus groups with participants from representative JISC services. Services representing the area of geo-spatial, images, multimedia images, portals and bibliographic domains participated.

The Participants

A representative sample of users and stakeholders were recruited to participate in these sessions. Project mangers, researchers, staff and end users of the services participated.

The Geo-Spatial Focus Group

Two geo-spatial sessions were conducted. The first was held at City University with two domain experts in the use of information visualization for geo-spatial systems and two graduate research students specializing in geo-special systems. The second focus group was conducted at one of the JISC funded services. Six participants were in this session (including the project manager, developers and designers).

The Portal Focus Group

The focus group for portal services was conducted at the premises of one of the JISC funded portal services. There were eight participants in this session and included the service manager, developers, designers and usability experts of an institute providing technologies for education (including portal services). They are all extensive users of all kinds of portal services (both JISC and non-JISC services).

The Image Library Focus Group

The image library focus group was conducted at one of the JISC image service providers. There were ten participants in this session. Two of the participants were stakeholders in one of the image library services funded by JISC, three of them were librarians who are experts in both online and offline image libraries. The rest were art and design students attending a degree course at an art and design university in the UK and are advanced users of image libraries.

The Multimedia Focus Group

The multimedia session was conducted at one of the JISC funded multimedia library service providers. Three participants were in this session and they were all stakeholders of the multimedia service. Amongst them, one was is a usability/accessibility specialist and one of them is a content specialist.

The Bibliographic Focus Group

The bibliographic session was conducted at one of the JISC funded bibliographic/archiving service providers. Five participants attended this session, all stakeholders in the services including researchers, developers, and user support officers; they were all bibliographic/archiving specialists and also end users of bibliographic and archiving services.

Structure of the Focus Group sessions

The same structure was used for all six sessions. Each session was scheduled for 1 hour and the following structure was followed:

1. Welcome and Introduction
2. Introduction to Information Visualisation (Part 1)

3. Focus group discussion (Part 1)
4. Introduction to Information Visualisation (Part 2)
5. Focus group discussion (Part 2)
6. Example of Information Visualisation

Welcome and Introduction

Participant were welcomed and briefed about the structure of the focus group session.

Introduction to Information Visualisation (Part 1)

An introduction to information visualisation in general was given. The aim being to give them a general overview of what information visualisation is and to provide the participants some initial ideas of information visualisation and thus initiate discussions.

Focus Group Discussion Part 1

The scope of this first part of the focus group discussion was to collect participants' views and opinions regarding the current issues of the specific area (e.g. geo-special) of digital libraries.

Introduction to Information Visualisation Part 2

This introduction acted as a supplement to the introduction in Part 1. In Part 2, we gave more details to the participants on the benefits of information visualisation and on how information visualisation can be incorporate into computer based applications in general.

Focus Group Discussion Part 2

In this part, we gathered the views and opinions from the participants on their suggestions towards the implementation of information visualisation and their ideas about the future design of digital libraries taking IV into consideration.

Example of Information Visualisation

A video showing a current application of information visualisation was shown to participants at the end of the session. We selected the DataLens PDA calendar video from the Human-Computer Interaction Lab at the University of Maryland at College Park as the demonstration video (<http://www.cs.umd.edu/hcil/datelens/>).

3.4. Questionnaires

Two sets of questionnaires were developed and sent out to two target groups.

Questionnaire Set 1

The first set of questionnaires was sent out (through e-mail) to a selection of representing JISC funded and supporting services.

The aim of this questionnaire was to gain some insights into each selected JISC service that their institute is/will be providing. Also, to obtain a better understanding of the service they provide and to share their views and opinions about the possibility of incorporating Information Visualisation into the service they are/will be providing.

Due to the nature of the medium used for distributing this questionnaire (e-mail) only three quick questions were used:

Question 1: Who do you consider to be the target audience of your service?

Question 2: Are there any plans to incorporate information visualisation techniques into the current/future design of your service? If so, could you provide us with further information on this?

Question 3: Can you suggest volunteers to participate in a future focus group/participatory design sessions? Any existing users of your service?

Questionnaire Set 2

The second set of questionnaires was sent (by email) to the delegates who attended the Libraries Without Walls 5 Conference; the delegates were experts in both online and offline libraries and some of them were working on JISC developments and projects.

The aim of this questionnaire was to collect their views and opinions towards the incorporation of information visualisation into the services they are/will be providing.

Again due to the nature of the distribution medium used the questionnaire consisted of 3 short questions:

Question 1: Can you point us to websites that demonstrate the use of Information Visualisation in Digital Libraries?

Question 2: What is the name(s) of the service that your institute is currently providing or planning to develop in the forthcoming future? Who do you consider to be the target audience of this service(s)?

Question 3: Are there any information visualisation techniques applied in the current design of your service? Are there any plans to incorporate information visualisation techniques into the current/future design of your service(s)? If so, can you provide us with further information on this?

3.5. Results (see Appendices for full details)

Summary of the Interviews

This is a collective summary of the interviews conducted:

Question 1: What do you think is the role of IV for digital information resources, in particular in terms of i) user interface for digital libraries, ii) learning and teaching, iii) e-learning, and iv) in enhancing the usability?

In terms of the role of IV for digital information resources, Professor Spence gave suggestions to a break-down list of tasks that he thought IV will benefit digital information resources. His suggestions were:

1. to support the many sub-tasks involved in a huge variety of tasks
2. give overview
3. support exploration to form a mental model (discovery, trade-offs etc)
4. support navigation, partly based on mental, either to enhance the model or to move to a target
5. support the formulation of a problem
6. support zooming/drilling down into parts of the information space
7. allow interpretation of data, comparisons etc.

Dr Pringle thought that IV would provide function applications for digital libraries in terms of being able to:

1. be a comparison to books
2. ordering with results
3. bridging gap between user and information

Professor Shneiderman suggested a number of his papers for reference one of which was about previews and overviews in digital libraries, to design surrogates to support visual information seeking (Greens et al, 2000).

Question 2: Are there any specific IV techniques/tools that you would recommend for digital libraries applications (such as portals, digital image databases, geo special, multimedia, bibliographic tools) among all the existing techniques developed? Which do you think are not that suitable for digital libraries? How successful are these techniques? And are there any reported studies that evaluated them?

Professor Spence suggested the following IV techniques for digital libraries:

1. Browsing is an important task: RSVP or mixed mode
 2. Hierarchical exploration tools (hyperbolic browser)
 3. Qualitative encoding
 4. IV for modifiable queries
 5. IV Query, presentation: focus + context
 6. Zoom + panning
 7. Suggested using information visualization for specifying a query, to explore the space and time
- For portals
 - Visual, graphical way of specifying a query, present graphically, for example, bio-medical information
 - For Geo-spatial,
 - Zoom & pane, panning the automatic zooming
 - Distortion (map distortion)

- Magic lens
- RSVP
- Bibliographic database
 - Images
 - Tile bars
- Image libraries/Multimedia (recommendations from Dr. Pringle)
 - Similar to Google, simple word in simple search
 - Relationship link similar to Amazon

In terms of applying the RSVP techniques that Professor Spence has developed, he suggested that there is still a need to explore which RSVP mode will be most applicable to DL

- Floating RSVP
- Eye-gaze is crucial

Dr Pringle thought that zooming in/out and use of icons/images to express information are techniques that are applicable not only to image libraries where he specialises at but also to digital libraries in general.

However, Dr Pringle did not think that hyperbolic tools (as opposed to Spence's view) are applicable as they are too complex for novice/general users. Whilst Professor Spence thought that co-ordinate plots do not suit the nature of digital libraries.

In terms of reported studies evaluated, Professor Spence stressed that currently there are not many comparative studies because IV is a relatively complex field with multi-techniques being used and the applications themselves are often not designed by domain experts.

We discussed the relevance of the International Children Digital Library by Dr. Druin from HCIL at the University of Maryland at College Park and Dr Pringle thought this is a good example of reported studies in applying IV.

Question 3: Are there any existing taxonomies of IV that could guide the design process of new application that use IV techniques/tools? Are there any special sets of

rules or guidelines that can assist designers in the selection of suitable techniques and tools for a particular domain or presentation medium (e.g. images, multimedia, text)?

Professor Spence referenced to Dr. Chi's taxonomy: A taxonomy of visualization techniques using the Data State Reference Model (Chi, 2000).

Professor Shneiderman gave references to the taxonomy that he proposed for IV in 1996 – The eyes have it: A task by data type taxonomy of information visualizations. (Shneiderman, 1996).

Question 4: Nowadays, most digital libraries tend to move towards web-based applications making them more easily accessible by the general public, and as the DDA legislature will become effective in the UK in 2004, how can we accommodate IV so that people with disabilities (e.g visually impaired, people with different spatial abilities) in particular could also enjoy and share the benefits and experience of visualisation.

In Professor Spence's view, visualisation is not limited by vision, it can be visualising by sound. As for the blind, he raised the issue of understanding how the blind people could form a mental model. And for colour blind people, he suggested designers could apply the colour blind rules into the design. For people with disabilities in spatial abilities, he pointed out that there is not much knowledge about this yet.

Professor Shneiderman suggested his principles on universal usability whilst Dr. Pringle thought that the idea is simply to keep the interface simple in order to be accessible to users.

Question 5: What do you see as the future directions of IV and especially when it comes to DL (and JISC services)?

Professor Spence's suggestions are:

- to investigate improvement in navigation
- human guidance of autonomous processes (i.e. automated search) (see chapter 9 in Spence book)
- opportunistic browsing
- frameworks for design
- agent support

Dr. Pringle stressed that the design should be focused on user centred design principles and to keep the design simple. He also talked about the effect of information fashionism to represent the notion that users only go to image banks if he/she knows that other people are using it too.

As to JISC, Dr. Pringle stressed that the key issue for digital libraries is not about which IV techniques to apply towards digital libraries, but rather finding shortcuts for the developer that enable the online information to be presented in a better way. He insisted that it is important to apply information visualisation techniques to the design when that is beneficial to users but not in a fancy way.

Furthermore, Dr. Pringle also pointed out that JISC development should focus on users.

Summary of the Focus Group Findings

We noticed that the majority of participants of our focus groups, although involved in the majority with the development and maintenance of JISC services, were not familiar with information visualisation. Participants in the geo-spatial focus groups were more familiar with information visualisation as the area is considered to be closely related to the discipline of geospatial information.

Background knowledge of information visualisation

There were misconceptions with participants thinking that IV is simply about maps, 3D games and virtual reality. Some participants were amazed that IV could be applied to applications that they didn't consider it to be feasible to use IV for.

KartOO (<http://www.kartoo.com>) was the most familiar IV related service to the participants and this was the most popular example of Information Visualisation application that the participants gave when asked whether they ever came across any information visualisations.

However, the comments given about KartOO were divided into two directions. Those who liked it said that the ability to link the related items together was good. Those who did not

like it commented that the hyperbolic trees (the IV technique used) was too sophisticated and might be too complex for general users; it could take users some time to learn and adapt to.

Issues in applying information visualisation techniques in digital library applications:

The majority of participants thought that visual presentations (for example maps) are useful in assisting their search when using digital libraries. Both stakeholders and end users were interested in exploring how the relationships between results could be displayed – i.e. how the results generated correlate between each other and how users could compare the results at a glance. They thought that information visualisation might be helpful in contributing towards this issue.

For geo-spatial libraries, experts in geo-spatial information (GI) systems stressed that the ideal geo-spatial libraries do not only show the GI data but make it able to link and correlate the GI data with non-GI data – national service/data (e.g. economic and social data, census data) in order to assist them in their research. But in order to do this, it will take an extensive amount of effort by all relevant agencies (especially owners of the data sets).

Participants of the portal, images and bibliographic focus groups also raised the issue of designing applications that show relationships among data, and these relationships need to be obvious and represented visually.

How IV could be incorporated into digital libraries and the ideal digital library applications

For geo-spatial information, the information visualisation techniques that the participants thought were useful are treemaps, timelines, density maps, and any IV techniques that could present many hundred of pictures to represent thematically similar information.

For bibliographic services, query previews, zoom in/out, and maps are techniques that the developers had in mind and they were interested in starting to incorporate these ideas into their design.

For portals, suggestions of using semantic maps and techniques that will help visualising hidden search results were mentioned.

For images and multimedia, thumbnails were considered useful for presenting images or snapshots of videos, timelines, use of icons and graphs, being able to flick through images and reflect image catalogues with rows of names, and flick through like a book; the ability to filter and relate would also be useful. Participants from the image focus groups also liked a feature where users could scroll in one direction to show a particular image/information.

Last but not least, participants also pointed out that there were a number of technical limitations that might make the incorporation of IV in their services difficult:

- data limitations – the constraints of metadata
- resources
- the ability to identify information
- bandwidth, streaming
- data licensing issues

Summary of Questionnaires

Those that answered our questionnaires pointed out that their main target audience was academics, researchers, teachers, learners, and students (undergraduates and postgraduates)

The majority of the current and prospective JISC services do not have any plans to incorporate information visualisation into their design in the immediate future.

Only three out of the thirteen respondents had developed or have plans to incorporate information visualisation into their design.