Participatory Design of Information Visualisation Interfaces for Digital Libraries

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Abstract: This paper presents the findings from a Participatory Design study actively involved users in the development of low-fidelity prototypes of digital library services that incorporate information visualization techniques. The methodology employed, key findings and overall conclusions are presented and discussed.

Introduction

The key objective of this project was to actively involve users (through the use Participatory Design) in the development of low fidelity prototypes that illustrate the use of information visualisation for web-based, end-user oriented Digital Library (DL) services.

Participatory Design

Participatory design (PD) (often termed the "Scandinavian Challenge" (Bjerknes, et al., 1987)) refers to a design approach that focuses on the intended user of the service or product, and advocates the active involvement of users throughout the design process. User involvement is seen as critical both because users are the experts in the work practices supported by these technologies and because users ultimately will be the ones creating new practices in response to new technologies (Blomberg & Henderson, 1990).

Blomberg and Henderson (1990) characterise the PD approach as advocating three tenets: (a) The goal is to improve the quality of life; (b) The orientation is collaborative; (c) The process is iterative.

The study reported in this paper looked at four categories of JISC's (Joint Information Systems Committee) Information Environment services; Portals, Images, Geospatial and Bibliographical.

Methodology

Representative users were recruited to participate in the PD sessions. In total 22 individuals were recruited to take part in the study. Six were present for the Portal, Images and Bibliographical service and four for Geospatial. Care was taken so that users participated in the

design of prototypes for categories of services for which they had good expertise (e.g. Librarians participated in the Bibliographical session).

All sessions were fully equipped with the necessary stationery i.e. coloured pens, pencils, felt tips, scissors, card, paper, acetates, overhead projector, post-it notes etc to help the participants in getting their thoughts on paper. The sessions were also video recorded and photographed.

The participatory design session

The structure applied to each of the four sessions was the same throughout. All sessions were scheduled for three hours and were held at City University, London. The structure for each session was as follows:

1. *Welcome and introduction*

Participants were welcomed and asked to read and sign a consent form.

2. *Introduction to information visualization*

A high-level introduction to information visualisation was presented. The introduction also outlined the misconceptions of information visualisation.

3. Introduction to the service

An introduction to the service was provided (for instance what is a portal along with specific examples of portal sites).

4. Activity 1: Requirements gathering

The first activity focused on getting the users to start thinking about the service that they were looking at. The technique used here was that of affinity diagramming (Kuniavsky, 2003). Affinity diagramming is a simple and effective method to gather a number of ideas that are then organised by grouping related items together.

A specific scenario was given for each service and the users were required to individually brainstorm ideas on post-it notes in terms of what information and/or functional requirements users have. The participants were asked to restrict one idea per post-it note.

The participants were then asked to select three of their post-it notes and place them on the whiteboard/flipchart and group any similar requirements together. The participants were asked to discard any ideas that had already been placed on the board. This was repeated until all of their ideas were put on the board.

The facilitator then led the participants in naming the groupings by reading out all the requirements per category and the participants were given the opportunity to reshuffle the

requirements to other categories if needed. Participants also highlighted any relationships that existed among the categories.

Thirty minutes were allocated to this activity.

5. *Documentation on information visualisation techniques*

Samples of information visualisation techniques were given to the participants to browse over for five minutes. The techniques were not discussed with the participants to prevent any bias.

6. *Activity 2: Paper-based prototypes in pairs*

The participants were asked to work in pairs to sketch design ideas using some form of information visualisation for the given scenario using the ideas that had been generated in the previous activity. They were asked to restrict their designs to one of the categories and not design a whole interface for the entire web site (for example concentrating on the search function).

The participants were allowed to refer to the documentation provided and use any or none of the techniques illustrated.

Thirty-five minutes were allocated to this activity but depending on the stage reached by the users an additional ten minutes were granted.

7. *Activity 3: Presentation of initial designs*

Each pair presented their design explaining how it worked and where information visualisation techniques were applied.

8. *Activity 4: Final prototype*

To develop the final prototype each group was asked to choose one of three options: (a) Work in existing pairs on the same prototype; (b) Work together as a whole group developing one prototype to the next level; (c) Work together as a whole group starting afresh and developing a new prototype.

All groups chose to work together either developing an existing idea and taking characteristics from other prototypes on board or developing a new prototype combining methods/techniques or thinking of new ways to present the information. The groups were given forty minutes to design their prototype.

Results

As an illustration of our overall results we present in this section only the findings from the participatory design session for the portal category of services.

Activity 1: Requirements gathering

The hypothetical scenario setting for the portal service given to the participants was:

"JISC is a public organisation that supports further and higher education. JISC has released a tender to develop a new portal site aimed at students in further and higher education to provide information and resources on Music. The tender requires you to: Identify the requirements of the site i.e. what users want in terms of information and functionality"

Figure 1 shows the findings from the affinity diagram exercise. The participants proposed twelve main categories of functionality/content for this service (namely: Setting, Classifieds/second hand instruments, Concerts and tickets, Online music, Intercultural music, Communications, News, Further information and outside links, Learning music, Information about artists, Musical genres, Search) with a number of elements under each category.

The participants also established some relationships among the categories/items between News (charts), Intercultural Music (charts across the world) and Online Music (download music and audio samples)

Figure 1: Portals affinity diagram

Figure 2: Portals Group 1

Portals Activity 2: Paper-based prototypes

The participants worked in pairs taking the findings of the requirement gathering into consideration to design an idea by applying some form of information visualisation.

Group 1:

The purpose of this design (Figure 2) was to track specific music journals across the world.

- The red dots on the world map represent cities

- The selection criteria is presented below the map. The user can select the country they wish to find music journals for, the timeframe (1960 -1970), the chart level (e.g. top ten), and the Genre (e.g. pop, jazz, folk etc).

- The results are displayed in a colour-coded format and symbols on the map

- It is possible to filter out information and have the information presented in different views. The user can zoom in and zoom out at a continent and country level.

- Data between countries can be compared, and viewed using the other visualisation methods such as histograms, bar charts, pie charts etc by manipulating the criteria

- A pop-up window appears to view details of selection i.e. top ten charts in New York.

The design was inspired by the following information visualisation techniques: Dynamaps (Dang, North & Shneiderman, 2001) and Zooming

Group 2:

The purpose of this design (Figure 3) is to demonstrate the sales of albums and concerts worldwide.

- The user can search for sales or concerts worldwide by selecting the appropriate tab/link at the top of the page.

- Can zoom in to continent, country, city, town via the worldwide map.

- The search settings on the right helps refine the criteria, as once the user has selected the desired location they can search by period (1990-1994), number of sales, genre and similar music. The combo boxes expand to allow the user to select/refine the search criteria.

- The results are immediately displayed in the bottom left hand box. The squares, triangles and circles represent albums, singles and DVD sales respectively. The Y axis shows the number of sales and the X axis show the year it was published. (The triangles etc are not grouped together because they are similar but because they have similar number of sales.)

- The labels represent the different groups (genres) and are placed on the display for easier selection.

- On selecting a label further information is provided on the right beneath the search settings.

The design was inspired by the following information visualisation techniques: Dynamaps (Dang, North & Shneiderman, 2001), Zooming, Exentric labeling (Fekete & Plaisant, 1999), and Shneiderman's FilmFinder (Shneiderman, 1994) application.

Group 3

The purpose of this design (Figure 4) was to learn about music from different cultures.

- Selecting a location zooms in to select a city, town

- Information can also be searched using the search on the top right. If search is used the map will zoom in to the selected city.

- Details on the right hand side of the screen are empty until a user selects a location

- When a user selects a location e.g. Egypt the Associated Genres appear in the top right hand side of the screen.

- On selecting one of the options provided in the Associated Genres window further details are provided in the pop-up window shown below.

The design was inspired by the following information visualisation techniques: Dynamaps and Zooming

Portals Activity 4: Final Prototype

The participants worked in a group of six to design the final prototype (Figures 5 and 6) and developed two versions:

The first prototype was an enhancement of Group 2's prototype comparing the number of charts reaching number one.

- The globe presents an overview of the information; the selection of an area will zoom in to country, city, and/or town. A user selects two areas e.g. Australia and U.K to compare the song and the place it appeared in the chart. The results are displayed in the bar chart.

- If the user enters the interface via the globe, the user can further refine their search using the timeframe on top of the bar chart.

- Alternatively the user may enter their criteria using the search settings which are presented in the top right hand corner.

- On selecting a particular entry from the bar chart specific information about that song is presented under the search settings e.g. singer, email, lyrics, number of weeks in top ten.

- Changing the criteria immediately updates the bar chart.

- The problem outlined by the participants was that too much information is presented for small screens.
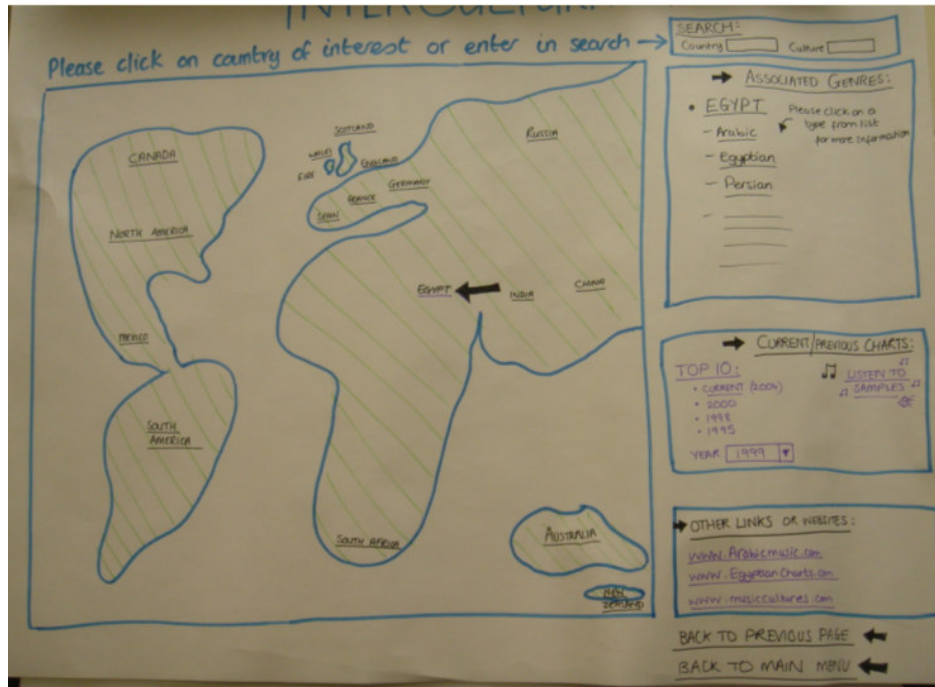
Figure 3: Portals Group 2

Figure 4: Portals Group 3

The design was inspired by the following information visualisation technique: Dynamaps and Zooming

The second version was an enhancement of Group 3's concept attempting to show information on music from different cultures.

- The globe presents an overview of the information; the selection of an area will zoom in to country, city, and/or town.

- On selecting a particular area the pie chart will show music from that culture and will illustrate where in the world that music is listened to/produced. The legend will show the percentage.

- The search settings allow a user to further refine the criteria. E.g. by selecting Egypt as the country, Arabic as the culture and music produced in 2000, the pie chart will depict all Arabic music across the world.

- Changing the criteria immediately updates the pie chart.

The design was inspired by the following information visualisation technique: Dynamaps (Dang, North & Shneiderman, 2001) and Zooming.
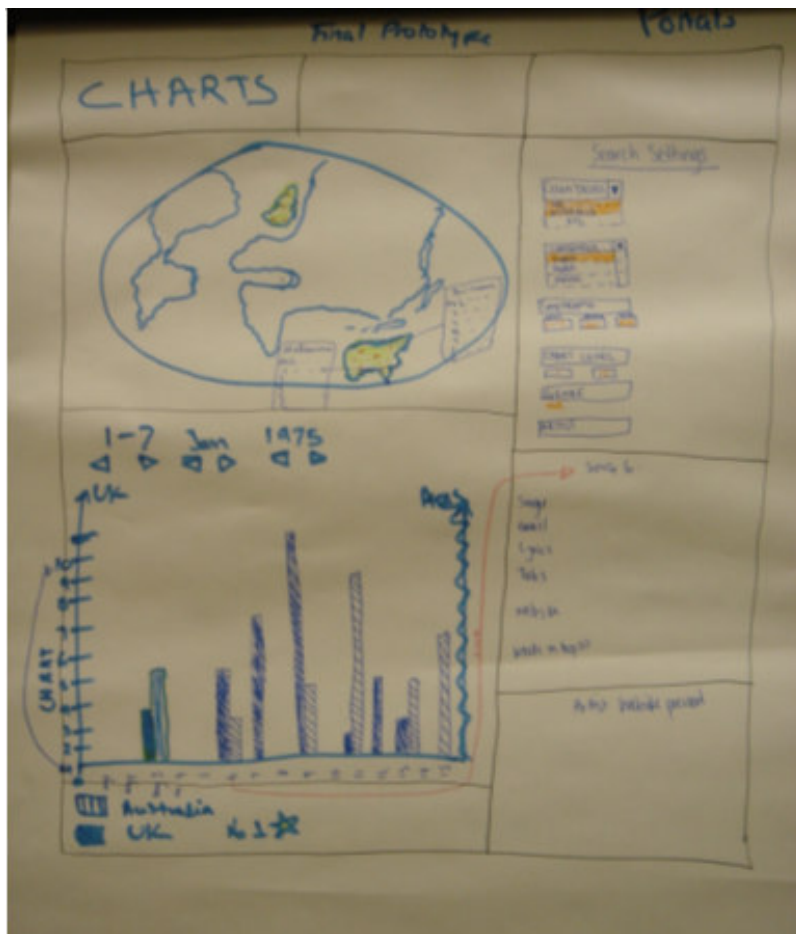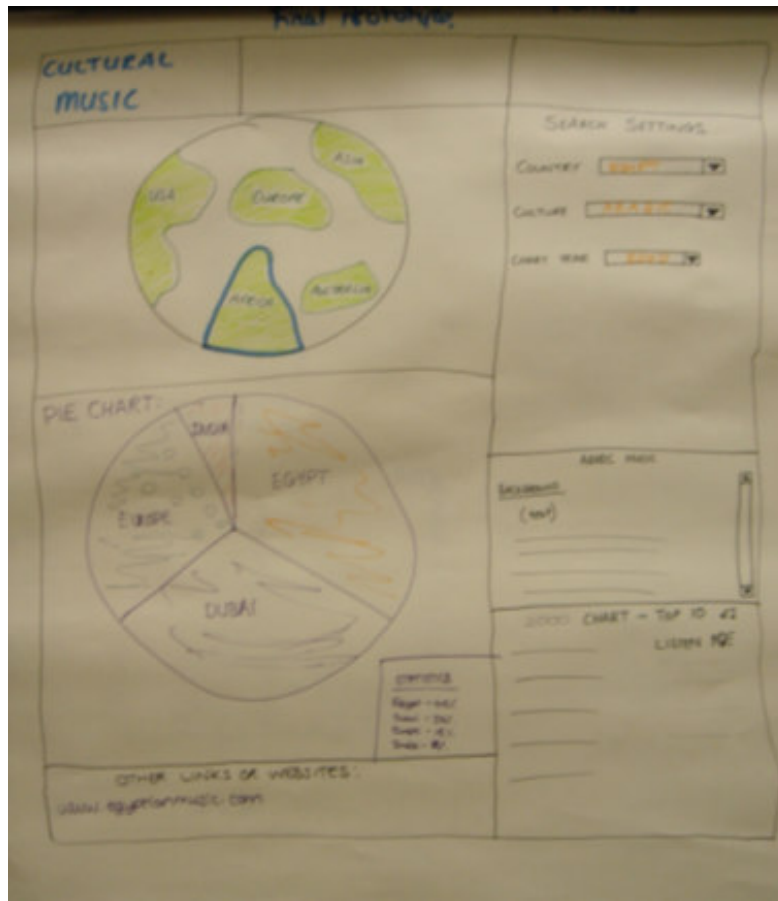
Figure 5: Portals Combined Prototype 1

Figure 6: Portals Combined Prototype 2

Conclusions

The participatory design method was an effective approach to get feedback on how information visualisation can be applied to web services.

The participatory design sessions for all four categories of services enabled the development of low-fidelity prototypes using existing information visualisation techniques.

The participants were provided with information on 15 different types of techniques which represented a good cross section of what has been developed so far. 12 of those techniques were used. Generally the participants did not restrict the design to just one technique they tended to combine a set of two or more techniques to define the interaction. Two of the final designs (Geospatial and Bibliographical service) made use of the History concept where users are presented with a log of what the user has visited (pathways) so that users can easily retrace their steps (Shneiderman, 1996).

One main problem that was highlighted with the use of information visualisation is information overload, too much information presented on one screen.

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