

## 4.2. Accessibility evaluation of IV techniques

The primary objective of accessibility testing was to determine whether accessibility is affected by the use of information visualisation.

As the project concentrated around four of JISC's Information Environment services, Portals, Images, Geospatial and Bibliographic, web services within those groups were identified that used some form of information visualisation to a varying degree. Only three services were evaluated in the end because one site was categorised as offering two services.

The methodology utilised was the 'think aloud' protocol where the users were asked to vocalise their thoughts whilst exploring the site and carrying out one predetermined task. Users were initially given five minutes of free exploration prior to commencing the task.

The accessibility of the whole site was not assessed; the users were guided to the areas where information visualisation had been applied. Three quantitative measures were recorded:

1. Ease – users were asked to rate how easy the site made it for them to do the task (between 1 = difficult and 7 = easy)
2. Navigation – users were asked to rate how easy it was to navigate their way around the site (between 1= difficult and 7 = easy)
3. Impairment – the users were asked to rate if their impairment had been taken into consideration (between 1 = not at all and 7 = completely)

Two other metrics were recorded for when the users carried out the task:

1. Time taken to complete task
2. Success or failure of the task

All users tested all services.

## **The Participants**

People with disabilities were considered to be the representative audience for testing for accessibility; three users were recruited from visually and cognitively impaired groups. The participants who took part consisted of:

- 1 blind user - an experienced web and Jaws (screen reader technology) user
- 1 partially sighted user – an experienced user, who sets the screen resolution to 800 by 600, changes the browser options to ignore font sizes and selects the largest font size available.
- 1 dyslexic user – an experienced user of the web

## **Accessibility Evaluation Results**

Overall the users completed 6 of the tasks successfully and failed in 3. Overall, the blind user experienced more difficulty in using the web sites in comparison to the other user groups; this user only succeeded in completing one task out of three for all services.

Users were asked to rate how easy it was to navigate their way around the site after exploration and again after they completed the task. The mean rating was 4 in both instances. However, the median rating provided by the blind user was 2 after exploration and 1 (the lowest rating out of 7) after completing the task. This is again reflected when users rated how easy it was to do the task, the overall score was 4 for all sites and the blind user gave an average of 1. The users were also asked to rate the degree to which their impairment was considered; the common rating was 3 for all user groups. The blind user found it the most difficult in using the services and gave an overall impairment rating of 1 (the lowest rating out of 7). In comparison the dyslexic user found the sites easier to use for the specific tasks giving a mean rating of 6 and in terms of impairment 5. The dyslexic user found it easier to use the sites because there was less information presented on the screen, in a textual format. The use of graphical representation assisted the user in understanding the information, “use of pictures and diagrams....less writing” was what the user liked.

The disabled users faced problems in finding the information, not knowing how to use the service, lack of feedback through assistive technology and the general slowness of pages loading further disoriented the users.

The main accessibility problems that each user experienced are described below:

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Key problems experienced by blind user:

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- Incompatible with screen reader software (Jaws)
- Insufficient feedback– information in list boxes not read, alt text not meaningful
- Missing alt text

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Key problems experienced by partially sighted user:

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- Links not obvious
- Small text
- Poor colour contrast (*2 instances*)
- Steep learning curve
- Use of text in graphics (*2 instances*)
- Images could be bigger

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Key problems experienced by dyslexic user:

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- Small icons/images (*2 instances*)
  - Navigation not clear
  - Screen real estate not used effectively
  - Links not obvious
  - Insufficient amount of information
  - Steep learning curve (*2 instances*)
  - No key/legend on map
  - Too much information just listed
  - No explanation for the use of colours
  - Poor colour contrast
  - Lack of association between images and text
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Information visualisation relies heavily on the use of graphical representation of the data. It is unlike average web sites, which provide textual information on the pages for users to

comprehend. Certain services used a number of visualisation techniques such as dynamic queries and zooming and the user was required to manipulate the data which was hidden behind the use of menus to gain an insight into the information available. However, the blind user had great difficulty interacting with the data because the software component used (Java) was not compatible with the screen reader.

The partially sighted user also experienced problems with using the Zooming technique because of the large fonts and high resolution as the image was not scalable. The zoom functionality prevented the blind user in accessing the data. The blind user did not expect to be able to use it because it is a 'predominantly visual navigation' but expected to complete the task using a different method, i.e. search.

To summarise the key findings are:

- The dyslexic user group was the least affected with the use of information visualisation. Having less information available on the screen and it being graphically conveyed was an advantage.
- The blind user group was the most affected because the sites were not compatible with the screen reader, alternative text was not marked up properly and information relied heavily on the use of visual perception.

### 4.3. Usability Evaluation

The aim of usability testing was to test the extent to which JISC services using information visualisation were considered to be usable by experts in the field of Human Computer Interaction.

As in the accessibility evaluations the same JISC Information Environment services were tested within Portals, Images, Geospatial and Bibliographical groups to maintain consistency.

Only three sites were evaluated because one site was categorised as two offering two services.

The method employed to test the usability of the services was expert evaluation. A usability checklist was designed that focused on evaluating information visualisation aspects of the site. This checklist was constructed using limited literature available on usability of information visualisation interfaces, the specific services and our existing knowledge in the field.

The checklist was divided into four distinct categories and research by Nielsen (1994), Freitas et al (2004), Pierotti (1995), Brath (1997a, 1997b) and Brath (1999) was used in the definition of the groupings and statements. The four categories that were identified were:

1. Visual representation
2. Navigation and interaction
3. User control and freedom
4. Content quality

Within these categories specific statements were defined such as 'colour is effectively used to represent different variables of data' and 'zooming into the data set shows more graphical details'.

For each statement a one to five scale was applied, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. Where the evaluator gave a rating of 3 or less they were asked to explain the reasoning behind this. A not applicable scale was also

included for statements that did not apply to the specific service. Please refer to Appendices to view the IV usability evaluation guidelines.

The evaluation was restricted to the areas of the sites that used information visualisation to portray the data; any steps taken to initially get to the specific area were not evaluated.

The sites were randomised; each evaluator was given a specific order to assess the site. This was to eliminate any bias that the evaluators may have generated whilst conducting the test. The evaluators tested the services individually and were not observed. After completion the evaluators were briefly asked to show the parts of the site that they visited to conduct the test. This provided the opportunity to observe exactly what parts of the site the user had evaluated and exposed themselves to.

A maximum time limit of three hours was set to complete the testing of all three sites.

### **Usability Evaluation Participants**

Five usability experts were recruited from the Centre for Human Computer Interaction Design. Four of which were PhD students and one researcher.

The participants were not subject matter experts for the services they were evaluating.

### **Usability Evaluation Results**

This section summarises the main findings from the expert testing which collated both quantitative and qualitative data.

Table 1 illustrates the average result for all services, taking into consideration all areas of the checklist were between 3.3-3.8 on the five point scale. This does not show significant differences in terms of usability between the services. However, it does indicate that usability of the services is bordering on being usable (Images) and unusable (Bibliographical and Portal/Geospatial).

Table 1:Table with Aggregated Ratings

Service	Aggregated rating
Portal/Geospatial	3.3
Images	3.8
Bibliographical	3.4

Table 2 breaks down the results further by showing how each service scored per category. Again there is not considerable difference between the services, but the Images service fairs better in visual representation, navigation and interaction and content quality. One reason for this is because the Image site used a lesser degree of information visualisation than the other two services and users were generally more familiar with using such a site.

Table 2:Average Ratings per Category of Service

Category	Bibliographical	Portal/ Geospatial	Images	All services
Visual representation	3.5	3.4	3.9	3.6
Navigation and interaction	3.5	3.1	3.8	3.5
User control and freedom	3.4	3.1	3.2	3.3
Content quality	3.1	3.5	3.9	3.5

The main usability problems the evaluators confronted whilst using the sites within the four categories are outlined below.

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**Key problems experienced with visual representation:**

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- The size of the display was considered to be too small for the visualisations, screen real estate was not used effectively, and there was too much wastage of space. (5 instances)
- The use of colour was not apparent or explained, so the users could not derive the relationship between the colour and the data (2 instances)
- It was not clear as to what the visualisation was trying represent, the evaluators found it difficult in understanding the information especially as the visualisation lacked in providing

explanations. Hence they felt the service was only useful for domain experts and did not cater for first time users. (9 instances)

- Too much information on the interface resulted in “cognitive overload”. (2 instance)
- The best form of information visualisation may not have been used, For example more than one form of visualisation could be applied to the interface to group the information. (2 instances)

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**Key problems experienced with navigation and interaction:**

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- Zooming in to view data was not always appropriate and appeared to be “pointless” because it just made “size changes” and did not provide meaningful feedback to the user, “...what is the point of having zoom that just makes a country name bigger.” (4 instances)
- The context was lost with too much zooming, “zoom in too much and can get lost.” (3 instances)
- Zooming in and out of data was not always considered to be easy because each time the user tried to zoom in, the pages took a long time load and with the screen being “blank” the evaluator felt lost. (1 instance)
- The key/legends used are meaningless and do not assist in helping to understand the information presented. (3 instances)
- Navigating around the sites is problematic, in terms of selecting data items, searching for data and inconsistent menus. (5 instances)
- Clickable items not obvious, tool tips/alt text missing from these elements which can also aid visual users. (3 instances)
- Pop-up windows used that do not have navigation options, including standard navigation browser buttons. (1 instance)
- Navigation is not intuitive the user is forced to read the instructions. (2 instance)

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**Key problems experienced with user control and freedom:**

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- No history available. (1 instance)
- No functionality was available to cancel, undo or redo, the user was forced to start from the beginning each time. (6 instances)

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**Key problems experienced with quality of content:**

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- An overview of the data collection was not available. (2 instances)
- Understanding the data is very difficult; the visualisations used are not effective in helping

to reveal insight into the data so making a decision is not possible. One user stated “I found it alien, perhaps easier for a domain expert.” (6 instances)

- Not easy to understand all of the visualisations presented. (2 instance)
- Ambiguous terminology used. (3 instances)

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**Other key problems:**

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- Slowness of the site in loading the pages. (2 instances)
  - Java applets problematic causing the site to crash. (4 instances)
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The above indicates that there are a number of usability problems associated with the use of information visualisation, mainly with the users in understanding the data and successfully using the service. The evaluators on this occasion were not subject matter experts for the services they were asked to look at, therefore struggled with interpreting the data.

Services applying information visualisation should aim to make the site as simplistic as possible, though this may not always be the case due to the nature of the information.

It is recommended that the criteria represented in the IV usability evaluation guidelines be used as basic guideline for the development of such services.