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Informing the Design of Web Interfaces to Museum Collections

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Introduction

Developing attractive and resourceful web applications for museums is taking place in a fast growing and changing environment. Museums contain rich sources of material in their collections, and there is particular interest in making this material available to a wide audience (Fahy and Sudbury, 1995). This information must be accessible and usable for the public (Donovan, 1997).

The Rural History Centre at the University of Reading is currently working on a Designation Fund project to make their collections accessible and relevant to a wide range of public audiences, through the World Wide Web. The project involves cataloguing items into a database; creating digitised images of objects and photographs; authoring new text to promote new meanings and uses of the material; developing web interfaces to the database to meet the needs of different audiences: school children, general public, and experts; and evaluation of the access systems on samples of the target audiences. This paper focuses on a preparatory stage of the project which assessed the situation on the web with regard to access to collections in August 1999, including a review of literature on putting collections online and designing for different user groups and an evaluation of a small sample of web sites which share some features with the proposed site. The evaluation below describes the facilities offered by the sites and analyses their usability and presentation. The research has led to a set of recommendations and proposals based on the results of the evaluation and relevant literature. The guidance covers the information design of sites of this nature; how to integrate access to collections into the general site; ways of dealing with multiple users; the generation of story-based environments; and how the collections database might be searched and records returned.

Evaluation

The objectives of the evaluation of web sites were to identify other sites which do something similar to the plans for the Rural History Centre; observe how the functionality has been implemented; and consider which aspects of the interfaces may be adopted or adapted for this project. Sites other than museums were therefore considered (e.g. libraries, galleries, educational projects, photographic collections) to broaden the range of possible solutions. A sample of seven sites

was selected which included those with a searchable database of records, or those which had attempted to cater for more than one user type. These sites were:

1. Hampshire Museums (www.hants.gov.uk/museums/catalog.html)
2. The Tate (www.tate.org.uk/home/index.htm)
3. National Gallery of Art, Washington DC (www.nga.gov)
4. SCRAN (www.scran.ac.uk)
5. PhotoDisc (www.photodisc.com)
6. London Transport Museum (www.ltmuseum.co.uk)
7. The Library of Virginia (www.lva.lib.va.us)

General Methodology

Three approaches to evaluation were incorporated into the study, and a two-tier evaluation tool was created, consisting of a formal and informal level. This created a suitable structure, whilst also enabling additional elements to be added to provide the focus on databases and museums which are important features of this study. A method developed by Wallace (1995) and subsequently modified by Love and Feather (1998) for evaluating library special collections on the web was adapted for use as the formal approach. The less formal method, i.e. more descriptive, combined the Systematic Usability Evaluation (SUE) of Garzotto, Matera and Paolini (1998) with a framework proposed by Walker, Reynolds and Edwards (1999). A key feature of the SUE is that it considers the specific nature of the application to be evaluated, rather than addressing only general interface features. In so doing, such factors as learnability and efficiency are considered. This method takes into account the structure of the information, alongside the presentation, and allows for discussion and interpretation of sites. From a basic outline, defined by general prompts, criteria were modified to suit the purpose of the evaluation. The Walker et al. (1999) method was initially developed to provide criteria for teachers to guide their choice of CD-ROMs for classroom use. Issues related to learning, access and navigation, typography, use of images and text were included in the current evaluation.

Formal Evaluation

The framework for this evaluation is summarised in Table 1. General aspects of the whole site are considered (1a), before focusing on access to collections (1b). All of the main dimensions are broken down into further sub-dimensions and the outcome of the evaluation is a value assigned to each sub-dimension. In some cases, this will identify whether a feature is present or absent, while in others, the nature of the feature is described. The questions in the final column provide an interpretation of each of the sub-dimensions. The main dimensions can be summarised as:

- Institutional information providing general contextual information on the site
- Finding aids identifying whether or not the whole site can be searched and the means of searching

- User information identifying sites which target specific audiences
- Catalogues or collections describing the nature of searches of collections, where available
- Structural context locating the access to collections within the site
- Search mechanisms describing the methods available to search the collection
- Search return or records identifying the nature of the search outcomes

Results

The outcome of the formal evaluation is shown in Table 2. Some observations can be made from this summary:

- Only a little over half the sites provide information on accessing and copying the collection.
- In contrast, most of the sites allow users to submit feedback, and email queries are encouraged in relation to collections.
- Only two of the sites cater specifically for different user groups (SCRAN and London Transport Museum).
- Most of the sites provide access to the collections database (this was the main criterion for inclusion in the sample). Access is generally through searches using keywords or phrases. The sites vary as to whether the search can be

Table 1. Framework for formal evaluation

Dimension	Sub-dimension	Value	Meaning
(a) Generals aspects of site			
Institutional information	mission statement	y/n	Is there a mission statement available?
	acquisition policy	y/n	Is there an acquisition policy available?
	access information	y/n enquiries	Is there information on accessing the collection or a contact telephone number?
	copying information	y/n / n/a	Is there information on copying the special collection?
	general contact	y/n	Is there information on contact by post, telephone, facsimile, e-mail?
	location information	y/n maps	Are maps or directions provided?
Finding aids	availability	y/n	Can the site be searched?
	type	keyword/phrase index	Does the search use keywords or phrases, or is there an index?
User information	user feedback	y/n	Does the site provide a way of submitting user information or feedback?
	target audience	y/n	Does the site target particular audiences?

(*continued*)

Table 1. (Continued)

Dimension	Sub-dimension	Value	Meaning
(b) Features of the catalogues or collections			
Catalogues or collections	availability	available/linked	Are on-line finding aids on or available via this site?
	type	static list/database	Are the finding aids a static list or a searchable database?
	list classification	category	If there is a static list, which fields of database are used for list?
	query	e-mail/form n/a	Can you submit a query through the site by e-mail or form?
Structural context	position within site	number	How many links have to be followed from the home page before getting to collections page?
	links to external collections	y/n	Are links to other collection databases given?
	currency	date	When was this collection last updated?
Search mechanisms	interface type	keyword/phrase menu	Do you search by entering a keyword, a phrase? Can search be delimited by menu choice?
	user type	novice/ intermediate/ expert	Do different search mechanisms get aimed at different levels of user experience?
Search return or records	format	records/lists	Does a successful search give you individual records to step through or lists of records to choose from?
	failed search	description n/a	What process occurs if your search fails?
	type	text/images/ video/sound	What kind of media are contained in the collection for viewing?
	quality	low/high	Is material available in low or high resolution?
	amount	number	How many records are held in the collection?

narrowed down, by choosing specific categories. An alternative approach is also used, which limits selection to a pre-defined set of alternatives (static list). These are presented in various different types of menus. The Tate uses only static lists.

- The majority of sites return search results as lists of records.
- One site uses a story-based approach (tours) to introduce items within collections (NGA, Washington).

Discussion

What can be seen from this formal evaluation are consistent approaches and types of information made available by the sites in very different domains and circumstances. There are few radical or innovative mechanisms to provide content and often the database is only used to return records from searches and does not appear to be integrated with the remainder of the site. The sites differ as to whether any word or phrase can be used as a search term, or the search is limited to specific fields (e.g. artist, subject), or specific items within fields. Whilst these limitations can support searching, by prompting the user as to the range of material covered in the collection, some material will not be accessible to users if the lists are not exhaustive, or are not dynamically updated from the database.

Informal Evaluation

Table 3 describes the framework for this evaluation with brief definitions of terms. Table 3a and 3b adopt the usability attributes of Garzotto et al. (1998) with learnability broken down into consistency and predictability. Efficiency is described in terms of accessibility and orientation. Evaluation of the presentation of sites (Table 3c) adapts dimensions from Walker et al. (1999) considering consistency, typography, images and text, and finally overall presentation. This analysis is a variation on the method of heuristic evaluation[1], which involves a systematic inspection of an interface. The heuristics are defined within the framework. This procedure is normally part of an iterative design process, and has been shown to be more successful with multiple evaluators. However, since the purpose of this evaluation was to identify strengths and weaknesses of existing sites to inform future designs, a single evaluator who was experienced in web design was considered appropriate.

Results

As this type of evaluation provides detailed descriptions within each dimension, the results of evaluating only one site—the National Gallery of Art in Washington DC—are described in detail. The outcomes of the evaluations of all sites are summarised in the form of recommendations in the next section.

National Gallery of Art

- Learnability: consistency

The structure of the pages and different groups of pages is generally consistent, but links to sections sometimes come before and sometimes after the main text. A key problem with the links is the use of two graphic treatments: links can be from 'live text' (i.e. words within the body of text used as a link) or gif images. A further problem is the lack of distinction between links which take you to a new page, off the site, and those which go to a position on the same page.

- Learnability: predictability

The order of items is coherent and this is most clearly illustrated on the page about the collection. A preliminary list of topics is given e.g. painting, sculpture,

Table 2. Outcome of formal evaluation

Dimension	Sub-dimension	Web sites						
		Hampshire	**Tate**	**National Gallery of Art**	**SCRAN**	**PhotoDisc**	**London Transport**	**Library of Virginia**
(a) Global aspects of site (e = e-mail, f = fax, t = telephone, p = postal address)								
Institutional information	mission statement	N	N	N	Y	Y	N	N
	acquisition policy	N	N	N	N	N	Y	N
	access information	n/a	Y	Y	N	n/a	Y	Y
	copying information	n/a	Y	Y	N	Y	n/a	Y
	general contact	Y: e,t	Y	Y	Y: p,t,f,e	Y: p,t,f	Y: p,t,e	Y: p,t,e
	location information	n/a	Y: maps	Y: maps	Y	n/a	Y	Y
Finding aids	available	Y	Y	Y	N	N	N	Y
	type	keyword/ phrase	site map/guide	keyword/ concept	n/a	n/a	n/a	keyword
User information	user feedback	Y: e, form	Y: e, form	Y	n/a	Y	Y	Y
	target audience	N	N	N	Y: education	N	Y: schools, corporate business	N
(b) Collection								
Catalogues or collections	availability	Y	Y	Y	Y	Y	N	Y
	type	database, static lists	static lists	database, tours, static lists	database, static lists	database	n/a	database
	list classification	subject	artists	artists	curricula	n/a	n/a	n/a
	query	t,e	e	Y	Y	Y: e	Y: e	Y: e

Dimension	Sub-dimension	Web sites						
		Hampshire	**Tate**	**National Gallery of Art**	**SCRAN**	**PhotoDisc**	**London Transport**	**Library of Virginia**
Structural context	position within site	2 or 3	1	1	1	1	1	1
	links to external collections	N	N	N	Y	Y	Y	Y
	currency	13 August 1999	n/a	n/a	n/a	n/a	n/a	n/a
Search mechanisms	interface type	enter keyword or phrase, menu (static list)	hierarchical menus	enter keyword menus (static lists and to delimit search)	enter keyword prompts of fields, hierarchical menus in static lists	enter keyword menu to delimit search	n/a	enter keyword menu to delimit search
	user type	n/a	n/a	n/a	N	N	n/a	n/a
Search return or records	format	list of records	list of records	list of records, biography	list of records	thumnbails of images	n/a	lists of records
	failed search	blank screen	n/a	try again	'no entries found'	search screen	n/a	'no records found'
	type	text	text, image	text, image	text, image, video, sounds	images	n/a	text, images
	quality	n/a	low	low & high	high & low	low, med, high	n/a	low
	amount	n/a	8000 +	100,000 +	n/a	n/a	n/a	n/a

Table 3. Framework for informal evaluation

Dimension	Question	Prompts
(a) Learnability		
Consistency	Are conceptually similar elements treated in a similar fashion?	Symmetry between parts—Is a picture associated with a record treated in the same manner as another picture associated with another record? Are the navigational links of sections within a group of pages treated in a similar manner?
Predictability	Can the user form a predictive model of how the content is organised and how the system behaves?	Regularity—Are similar pages structured the same way? Are sections structured the same way?
		Collection ordering coherency—If there is a list of linked items, does the order within the list correspond to the logical order within the site?
(b) Efficiency		
Accessibility	How easy is it for users to find information they are looking for?	Completeness—Does the overview of site content (e.g. on home page) contain all information? Navigational richness—Are there too many or too few links? Do they make sense? Is their meaning obvious?
Orientation	Can users identify their current location and predict the consequences of their movements?	Backtracking—Does the user need to use the browser's back button to access a previous page or are there ways built in to the application? If there are ways built in to the application, do they use abstracted language like 'back' and 'next' or are they context sensitive? Context observability—Are there verbal or graphic cues to tell users where they are in the application, e.g. in a sequence of pages '1/5' or 'intro > contact > telephonenumber'?

(*continued*)

decorative arts and so on. Clicking on painting takes the user down the page to the section on painting, which is then followed by sculpture. This consistency between the list and order of the sections is helpful in orienting the user.

- Efficiency: accessibility

A positive aspect of this site is the accessibility of the site map from every screen. Although more like an index than a map, this lists the sections and sub-

Table 3. (Continued)

Dimension	Question	Prompts
(c) Presentation		
Consistency	Is the presentation of members within a collection consistent?	Are things like colour, type, information similar within a collection while sufficiently distinct from other objects at the same level?
	Does the area of the screen used remain consistent throughout the application?	
Typography	Does the typography help users to find the information they are looking for?	Are the headings clearly differentiated from the text? Are chunks of text at different levels clearly differentiated from each other?
	Does the text look accessible and inviting?	Is there plenty of white space around the text and between the paragraphs?
	Is the text clearly legible?	Is the typeface legible, and is the type large enough? Are the lines short enough to be easily read?
Images and text	Is the relationship between pictures and text made clear?	
	Are the pictures large enough to be clearly visible?	Can the pictures be enlarged?
Overall	Is the overall presentation attractive and engaging?	

sections of the site. The list order maintains the structure and hierarchy of the site, rather than choosing to list alphabetically, which can lead to confusion. The facility to search the site is also always present. However, on accessing the search page, the option to search the collection appears before the option to search the site, which could confuse users who may not see the site search.

There are plenty of links always available to the user and most of them clearly inform the user of their purpose. Furthermore, the links are well organised and structured so as not to be the dominant element on screen. There is a disparity, however, between the colouring of links in the left hand navigation bar and how the linked element is displayed. Brown is used to identify links to functions of the overall site and green is used for sections within the site, but this colour scheme is not continued in the display of the sections, which would have made the distinction clearer.

- Efficiency: orientation

Often the browser back button must be used to make small navigation steps within a section. However, the user is able to jump to the top of main sections and sub-sections using the links within the site. Some of the lists and content

is split over numerous pages with links within the application labelled "next" and "back". Other information offered on these pages includes the total number of elements e.g. 430 and then the set of records currently shown e.g. 20-29 of 430.

- Presentation: consistency

The same typeface is used throughout for all live text, but this is different from the typeface used in text converted to images. Also there are few indications of separate sections (e.g. headings), so changes of structure or content can be easily missed. A positive aspect is that the screen does not need to be re-sized from the home page when browsing the site.

- Presentation: typographic

Headings are clearly marked by different sizes, weights and space. The body text remains the same typeface, size and weight throughout.

There is good space used around text and images, although there can be a conglomerating effect around the right hand edge of the navigation area and the left hand edge of the main content area as shown in Figure 1.

The typeface is clearly legible, but if the browser window is set too wide, the text is displayed in a long line length which can prove problematic when reading a lot of prose.

- Images and text

Images for information purposes are clearly labelled with dimensions, creators, dates, etc., and are positioned close to the relating text. Such informational images can often be enlarged and the same information is then displayed to accompany the image.

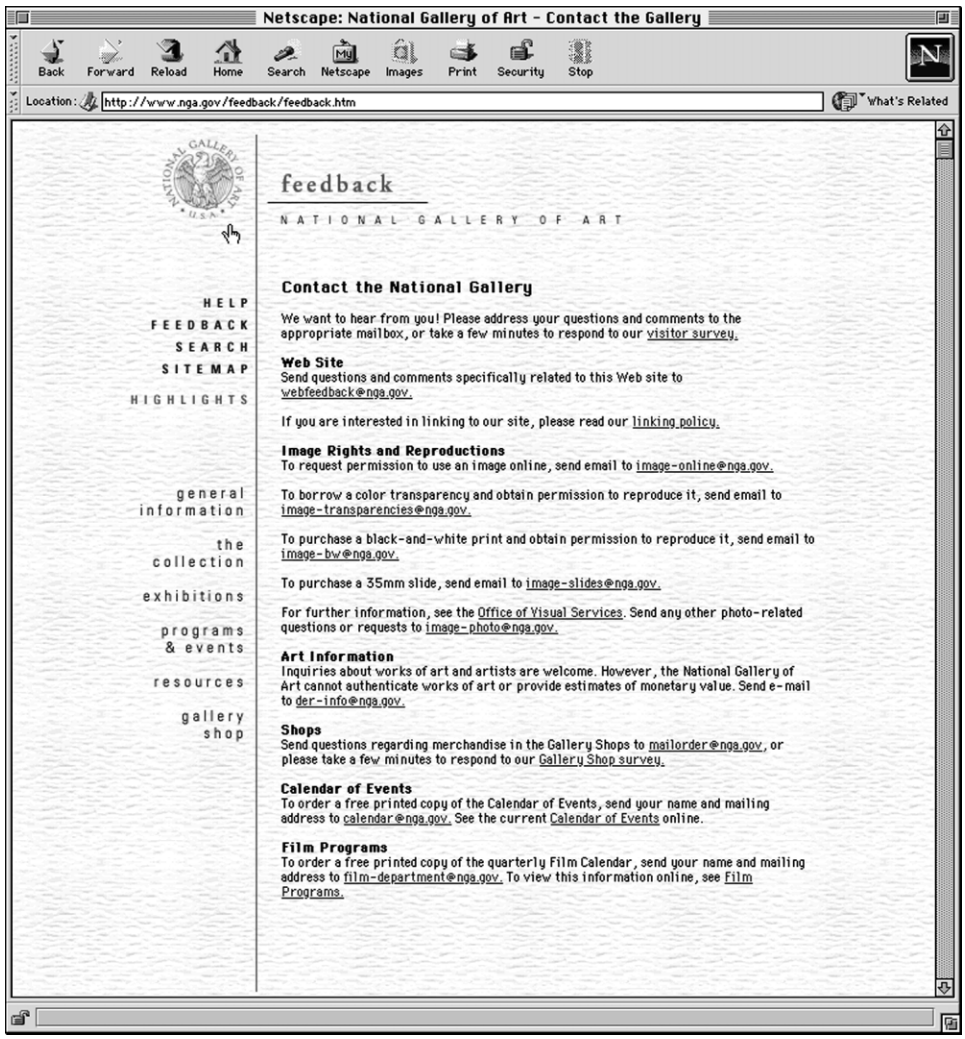
- Overall

The presentation has consistent features, but there are anomalies. Colour is limited to brown, green and black throughout which provides no aids to structure the site. The textured background can also affect the ease of reading in some circumstances.

Recommendations

In summarising the informal evaluations, good and bad practice can be identified, leading to a set of recommendations:

- It is important to ensure that links within sites can be easily identified. Various sites use both live text (i.e. words or phrases within a paragraph) and gif images (often in a sidebar) to indicate links. This division is appropriate if the two types of links are conceptually different. The different graphic treatments will thereby indicate the difference in nature between the links. However, if all links have a similar function, they should also be displayed in a similar manner.
- Conversely, the sites make no distinction between links to other sites, links to another page within the site, and links to another point on the same page. This inconsistency may be deliberate, but does not aid the user's orientation. This can be a particular problem when leaving a site. With a site such as the Tate, which currently encompasses three locations, it is important to be able to identify whether a link remains within a specific location, or refers to the main site. This differentiation can be achieved through graphic treatment, e.g. use of colour or location on the page.



1. The conglomerating effect around the vertical line in the National Gallery of Art (Washington) site.

- The use of colour to indicate different sections of sites is helpful, but these need to be carried through from links to sections. Similarly, whilst there is consistency within certain elements of sites, the examples illustrate that this is not always followed through to the whole site.
- A site map or index is a useful feature, particularly if it accurately reflects the structure of the site. An alphabetical ordering of items may be a useful list to scan, but it does not provide a mental model of the site. These features should also be accessible from most places within the site, and not just the home page.
- Headings should be clearly differentiated, which was the case in all sites except one (London Transport Museum). Good use is made of space to group similar items and separate these from other elements. Re-sizing of pages to cater for different content is unfortunate, but may be unavoidable. To ensure

that extremely long lines are avoided, some control of line length independent of the browser window width is advisable.

- It is important to make a distinction between functional or informative images and decorative images, particularly when collections include images. This has generally been achieved in these examples by structuring the results of searches and including captions with images. Where an image can be manipulated, e.g. enlarged, this should be made clear.
- A consistent and functional design is recommended, whilst also ensuring that interaction with the site is engaging. Thoughtful use of colour and space can clarify the organisation of the site and improve the presentation.

Proposals

These proposals are formulated from the evaluations of sample sites, supported by the views of other authors expressed in the literature, and incorporate the authors' knowledge of interface design.

General Site

- Integrate the collections database transparently into the make-up of the site, so that being able to search it is just another capability of the overall site. This integration is recommended by Besser (1997) who suggests that a key consideration in the overall plan for developing museums' on-line content should be bringing together collection management systems and exhibition information into one system. A similar approach to this is the integration of all the parts of the museum to provide a rich resource in the shape of a 'knowledge system' (Blackaby, 1997).
- Information to make available to all users:

- details of the user categories
- how to organise a trip to the museum, including maps, etc.
- contact details
- site map
- mission statement
- acquisition policy
- links to other sites of possible interest

Some of these features, e.g. site map, links to other sites, may benefit from being tailored to the category of user.

- If a user has a query do not just provide the phone, fax, e-mail, also provide an on-line form. This has the advantage that queries are received in a standard structure and there is a record of query types. These could be used to identify patterns. If, for example, there are frequent queries concerning a particular category of objects, this may be a candidate for a story (see below).
- Move toward a site which is dynamically generated as much as possible using scripts and databases so there is little manual HTML work involved (see, for example, searching the database, below).

Multiple Users

- Allow users to choose their category (e.g. general public or expert) which may determine what is presented and the form of presentation. The same information tailored to different user types can have many benefits. However, it is not necessary to be restricted to the same content across user type. Some users may be allowed access to additional distinct content which the other user groups do not. This is shown in the web site for the Marble Museum at Carrara in Italy[2], discussed by Paterno and Mancini (1999), with information included in the tours of the collection which other user groups do not get.
- Another approach to handling multiple users, described in the literature, is a multimodal style of interaction (Garzotto, Mainetti and Paolini, 1997). Modes are defined as different types of communications (e.g. text, sound; concise or extensive writing style) and interactions (e.g. navigation versus query). These authors suggest that the same set of commands or options can be available in each mode combination, but that their effects will vary according to specific modes. With different types of users, the presentation of the content can be modified accordingly, but the same functions can be available to each type of user.
- Choose between alternative methods of adapting to users
  identical options, but different responses depending on category of user (as above)
  different range of options
  The advantage of the first alternative is that one type of content can be reworked to suit different user types. An example of this approach is also found at the Marble Museum web site[2]. However, the second alternative avoids confusing the user if they explore more than one category, since the difference in meaning when choosing the same option could be disorienting.
- Track the user and respond with context sensitive information across the site. Paterno and Mancini (1999) focus on the implementation of a system to handle different user types and discuss 'adaptivity'. An adaptive system automatically adjusts what is presented to the user as a result of the user's actions.
- Although distinct user categories can be identified (in this project, school children, general public and experts), certain features are generally useful. For example, interactivity and two-way dialogues are recommended for all users. The benefits of interaction can be seen from the Natural History Museum's QUEST web site[3] where users can have dialogue via a message board.
- The distinctions between groups can also be made more subtle. For example, expert material could be embedded into the general public model and only shown when requested.
- For schoolchildren the material should reflect the national curriculum's aims and goals.
- Teacher support should be provided on-line, such as worksheets, lesson plans, guides and the like which the teacher downloads. An example of school material is the Odyssey site in Atlanta[4].

Access Methods

Stories

- Story-based environments can be generated for all user types, pulling information from the database. Blackaby (1997) has emphasised the importance of realising the relationships between objects accessed by users in order to integrate them with one another and the supporting material which contextualises them. The stories may begin by being generated 'by hand' as static pages, but the database could be used at any time to pull further information on objects or areas of interest. The database can be used to create dynamic stories where the 'who, where, why and how' is important to the user, rather than obtaining information on an isolated object record (Donovan, 1997; Freeman, 1999). People can learn from contextual information, provided in the form of engaging stories. Objects can be woven into stories, rather than having a focus on the objects (Donovan, 1997).
- Obtaining information from the database should be done without the user having to 'search the database' but just by clicking on a link which passes parameters to a script which does the searching. Any returned results should not replace the current information as the user may decide the further information is not useful. This could be achieved by introducing a new sub-window or using space set aside in a frame.
- For creating story environments it may be useful to develop an application where text can be entered and images referenced from the database. Using this application, pages could be generated ready to be embedded in the site.

Searching the Database (expert Users)

- When searching the database, rather than providing a blank screen or prompt, give the user choices via pull-down menus, check boxes or radio buttons. The option to search using keywords and phrases could also be given. A common misconception within the museum world is that providing access is enough either by letting users trawl through lists of records or by presenting them with a blank search engine (Donovan, 1997).
- Attention must be paid to the choices provided as when searching a museum database it is clear that "often what they [users] want to know and we've [museums] prepared for them are two different things" (Blackaby, 1997). The lists available to users to choose from need to be dependent on the fields within the database. So if there is a field such as 'vehicle', applicable to certain records, then that would be a choice on the list. If a user chooses vehicles, then a second list should be updated to reflect this choice. This would be presented as a list of the range of vehicles currently in the database. If the user then chose car, a further list should be updated to reflect this choice, gradually narrowing the search. The extent to which the search is refined could be determined by the user or the museum. By showing the user what is available from the database, there is a higher chance of successfully returning a desired record. This approach is a combination of static lists and database searches.
- Pull down menus (or other forms of lists) should (ideally) be dynamically

created or updated from the database. Thereby, if new categories are created, or new instances within categories, these are automatically generated within menus.
- If the user chooses to search by keyword, some instruction should be given not only on how to formulate the correct syntax for the search, but also some clues as to which words are likely to be successful.

Returning Records

- If a search fails, the user should benefit from some feedback which clearly states this. The feedback should explain why the search has failed i.e. nothing entered, a mis-spelling, no matching records. Also the search facility should appear on the same screen so that the users can try again while their failed search criteria should be displayed.
- A useful feature would be to keep the list of objects visible while viewing a record.
- When the user chooses to view an object record, related material should be highlighted with links which would open in new web-windows. This facility would invite users to explore related items in the collections database.

Conclusions

This work has served as a vehicle to conceptualise the development of the web interfaces to the collections database at the Rural History Centre. The team currently working on the project is multidisciplinary, which appears to be a necessary condition for projects of this nature. This project in particular requires subject knowledge of the collections, cataloguing skills, information and interface design skills, an appreciation of educational objectives, and technical web development skills, amongst others. The report on this preparatory research has been useful in contributing to the processes of induction of team members to the project.

It is hoped that the recommendations and proposals reported in this paper may also prove useful in suggesting directions for similar projects, with the objective of improving the design of web interfaces. However, in a broader context, the evaluation methods developed for this project provide a set of tools for analytical evaluation, that can be adapted to suit the particular needs of a project.

Acknowledgements

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Footnotes

1. Jakob Nielsen 'Heuristic evaluation' < http://www.useit.com/papers/heuristic/ >
2. http://giove.cnuce.cnr.it/
3. http://www.nhm.ac.uk/education/quest2/english/
4. http://www.cc.emory.edu/CARLOS/ODYSSEY/index.html

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