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The Art Collection Ecosystem: Discovering Art using Formal Concept Analysis

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The Art Collection Ecosystem: Discovering Art using Formal Concept Analysis

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Abstract. We describe an application and case study in the design and evaluation of the Art Collection Ecosystem (ACE) — a Rich Internet Application that supports the ability of users to browse and explore art collections using Formal Concept Analysis. With a view of a system that allows browsing of tagged content, 25 participants conducted a usability study within the context of a popular social media website - Flickr. We describe key design elements within its user interface and incorporate revisions of its design based on user feedback. We incorporate these results into a framework called CollectionWeb - a set of software, services and processes that allows associative and explorative browsing of any kind of collection content over the Web.

1 The Art Collection Ecosystem and Formal Concept Analysis

Formal Concept Analysis [5] is a well-known technique for data analysis that involves the description of a formal concept as a set of objects that exhibit a common set of attributes. In this case, the objects are represented by individual artworks from the University of Wollongong's Art Collection and their attributes are described by keywords or 'tags' that denote their materials, provenance, location and themes. The ACE adopts a conceptual neighbourhood navigation paradigm from its predecessor application, ImageSleuth [2] - allowing users to specialise and generalise their view on the collection by providing links for navigation to lower and upper neighbours respectively. Additionally, conceptual scales [4], or 'perspectives' as they are called within the UI, allow users to effectively render and partition views on the collection content.

While ACE represents another application of Formal Concept Analysis to browse and query collection content, it differs from past implementations [2], [1] in that it is the first application of its type to use a tag cloud as a means of representing conceptual navigation choices. The screenshot in Fig. 1 represents a rendering of a formal concept described by the attributes 'print' and 'building 25' and a thumbnail display of its objects. The list of lower navigations are displayed at the bottom of the screen as a series of weighted links. When a user

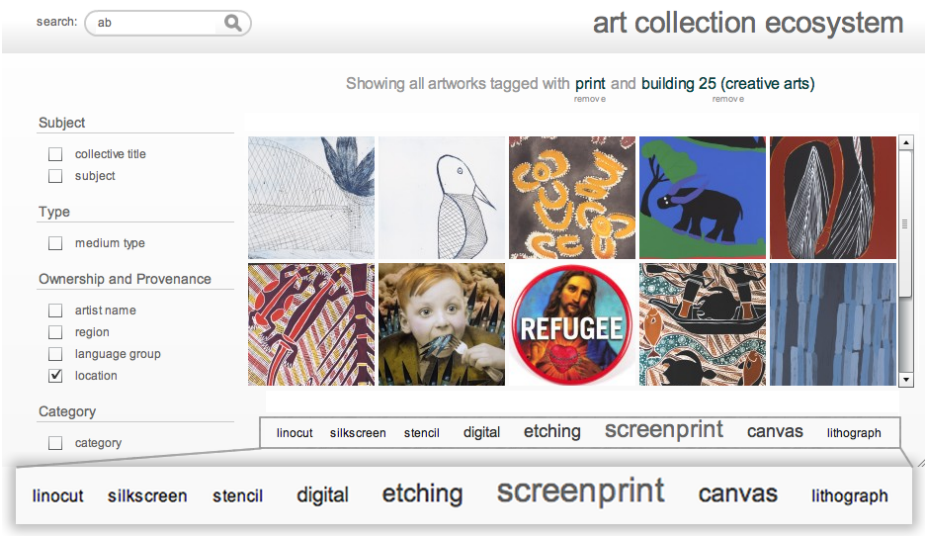

Fig. 1. The user interface of ACE, where the tag cloud metaphor is employed as a means of representing navigation choices within ACE

clicks on one of these links, its associated attribute is included within the current search and its associated sub-concept is rendered and displayed. The font sizes of these links correlate directly with the extent size of the formal concept's lower neighbour. Consequently this rendering also describes the attribute composition of the current formal concept in view, indicating that in our example, the inclusion of the attribute 'screenprint' represents the lower neighbour navigation with the largest extent size and therefore the highest prominence within the current view.

The software platform of ACE was ported from the design of the Virtual Museum of the Pacific [3]. The inception and evaluation of ACE was both to test the generality of the software platform to different collection content and to evaluate its design as a tool for browsing and navigating a collection of tagged images.

2 Design and Evaluation Methodology

The evaluation was undertaken as an assessment of ACE as a Web based platform for browsing tagged images. To contextualise the design in a broader context, all participants were required to familiarise themselves with Flickr, a popular Web based application that allows users to browse and upload tagged images.

25 students and staff from the University of Wollongong were selected to participate in a usability study. 14 of the 25 participants stated that they were

familiar with the social tagging application Flickr. To normalise this, all users were required to perform a series of search and navigation tasks within Flickr.

Users were required to use the controls provided within the user interface of ACE to search, refine and generalise their query across single and multiple dimensions. In doing so, users assessed the effectiveness and usefulness of the upper neighbour, lower neighbour and perspectives controls (shown on the left in Fig. 1) to navigate a collection of 45 artworks with 178 attributes or 'tags' spanning across 10 perspectives. An initial round of 20 participants were used to highlight key design issues within the user interface. The interface was subsequently revised where a further round of 5 participants were used to validate it.

3 Key Findings and Design Changes

Among the initial round of participants, the findings of the study demonstrate a moderate to strong consensus among users that they understood the effect of the user interface controls of ACE as they navigate the collection. In a response to the question "The user interface of ACE was clear in terms of how you were navigating the collection" where a score of -1 indicated "strongly disagree" and a score of 1 indicated "strongly agree", an average response of 0.4 was recorded. Many users commented on the learnability of the interface, stating that, unlike Flickr, novice users may require some time before they can fully understand the effect of the interface controls on altering the conceptual view of the collection. This result was reflected in the average score of 0.5 for the question "It may require some explanation to a novice user on how to use or understand the interface within ACE."

18 out of 20 users immediately understood the purpose and effect of the lower neighbours control as shown in Fig. 1, although many users thought that the size of the tag denoted popularity, rather than extent size. However, only 6 out of the 20 users correctly interpreted the purpose and the function of the upper neighbours control. The upper neighbours control, as shown in Fig. 2, inherits its design from ImageSleuth. The remaining 14 users suggested that, rather than removing the attribute of '- print' and '- northern territory' from a search, clicking one of those links simply navigated to all objects that were described by attributes 'print' and 'northern territory' respectively. This interface control was revised in Fig. 3 where it presented a more natural visual interaction of upper neighbour navigation. Subsequently, all 5 of the remaining users within the second evaluation round correctly interpreted the function of this control.

4 out of the 20 users also noted that, unlike Flickr, users could not click the web browser's 'Back' button to navigate to the previous page within ACE. These users commented that, as a familiar activity in using a Web application, a backwards navigation button is essential, even where the facility exists for upper and lower conceptual navigation. In the revised design prototype, a 'Back' button was implemented which allows users to traverse through their history of conceptual navigations and perspective changes.

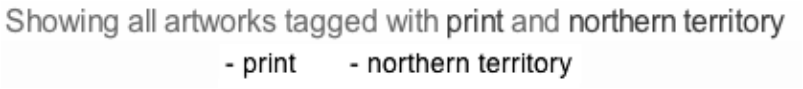

Fig. 2. Upper neighbours control, before design revision

Fig. 3. Demonstration of direct manipulation on revised upper neighbours control

4 Conclusion

The outcome of ACE was to assess the portability of the browsing platform based on ImageSleuth and The Virtual Museum of the Pacific along with its design validation and revision following a user evaluation. As a Web based application for semantically browsing collection content, key design elements of the interface have been revised. These design revisions will influence current and future implementations of its underlying software platform, called CollectionWeb. We therefore conclude that the research represents an important step in the interface design of web applications that allow the browsing of collections using Formal Concept Analysis.

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