Stereotype or Spectrum: Designing for a User Continuum

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ABSTRACT
This paper presents work carried out on developing a methodology for identifying and characterising a spectrum of users for a corpus agnostic environment designed to facilitate research into cultural heritage collections. It outlines the approach taken to the design of the CULTURA environment, and addresses the challenges and opportunities presented by this broadly-based user engagement. It also outlines how adaptive strategies have been used within the CULTURA environment to ensure that it effectively addresses the needs of its different user communities.

Categories and Subject Descriptors
H.3.7 [**Information Storage and Retrieval**]: Digital Libraries - *collection, dissemination, systems issues, user issues.* H.3.5 [**Information Storage and Retrieval**]: Online Information Services - *data sharing, Web-based services.*

General Terms
Management, Design, Experimentation, Human Factors.

Keywords
Cultural heritage, cultural heritage collections, digital cultural heritage collections, digital humanities, different user communities, user studies, adaptivity.

1. INTRODUCTION
The drive to digitize material of historical and cultural significance has largely been underpinned by the twin concerns of conservation and access. The imperative to preserve unique and delicate resources by producing digital surrogates has been, and continues to be, an important driving force for digitisation projects. Important though preservation undoubtedly is, access is more important still. Indeed, the act of conservation implies a need for access – we may access material that we do not bother to preserve, but we do not, in a world of limited and diminishing resources, preserve what we do not wish to access.

To date, the need for access tends to have been handled at institutional or collection level. This access is most often facilitated through online web interfaces, that allow the collection to be searched and records and resources to be viewed.

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These interfaces are limited in a number of significant ways. They tend to be specialised, search-based, superficial, and stereotyped. They are specialised because they, most commonly, handle material from one collection, or from one kind of collection. Typically, they require the user to rely on some – more or less complicated – variety of Boolean search to find the results they need. These results are presented in a superficial way – typically as a list of items, without any opportunity for deeper exploration or discovery. And these interfaces are stereotyped in terms of the sort of user they expect and assist. They are designed to address the needs of a monolithic user, whose expectations, experience, and interests are rigidly and unalterably defined.

2. THE CULTURA PROJECT
The CULTURA project[1] has been designed to address each of these limitations (Hampson *et al,* 2012a; Hampson *et al,* 2012b; Bailey *et al*, 2013). The research environment that is being developed by the project is not specialised for a specific collection, but it has been developed using two very different core collections. The 1641 Depositions, which record witness accounts of atrocities committed in Ireland during the 1641 Rebellion, constitute a textual corpus, which has been augmented by manually generated metadata[2]. The Depositions are marked by highly challenging linguistic content, with wide variation in orthography, syntax, and punctuation. The IPSA collection of illuminated medieval manuscripts, a virtual collection of scientific works, including herbals and astrological codices, is a purely visual collection, with extensive metadata[3]. The CULTURA environment has been designed to address the needs of users of both these collections, but also to generalise beyond these specific corpora to a wide range of cultural heritage collections.

In supporting exploration of this range of material, CULTURA supports traditional search-based exploration, but also moves well beyond it. It harnesses a range of innovative normalisation (Lawless *et al,* 2013) and natural language processing technologies that allow entities and relationships to be extracted from the collection and visualised using a range of specially designed visualisations. It also provides for entity-oriented search (Carmel *et al*, 2012), and allows users to crosswalk from one tool to another, ensuring that their exploration of the collection is flexibly supported. The environment also provides a comprehensive set of logging, bookmarking, and

[1] http://www.cultura-strep.eu/

[2] http://1641.tcd.ie/about.php

[3] http://ipsa.dei.unipd.it/en_GB/home

annotating tools that make it a powerful aid to both extensive and intensive work on content collections.

CULTURA, then, makes it possible to work on a range of material. It allows a variety of different investigations and explorations to be undertaken by users. The richness of this functionality is both an opportunity and a challenge. It is an opportunity, because CULTURA has the power and potential to empower a wide range of user types, and a challenge because there is the ever-present danger of the interface buckling under the weight of its own complexity, overwhelming the user with options, and frustrating all but the most devoted and fanatical investigator. The CULTURA project addresses this challenge through its implementation of adaptivity, and its emphasis on addressing a spectrum of users, rather than a single stereotyped user.

3. CHARACTERISING THE USER CONTINUUM

From its inception, CULTURA was conceived as a project that would be driven by the requirements of humanities users, rather than by the pursuit of technological novelty. Thus, sustained interaction with potential users before, during, and after the process of development were a crucial part of the project.

Equally essential to the project was the need to stimulate and support the communities of interest, which form around digital humanities and cultural heritage collections. These communities include a diverse mixture of professional researchers, apprentice investigators (e.g. students of history and art history), informed users (e.g. users belonging to relevant societies or interest groups, cultural or authorities) and members of the general public (both adults and children) with diverse interests and motivations.

Correctly characterising users is an essential element of ensuring that the interface with which they are presented addresses the needs of the user, and so accurate and rigorous user characterisation is a *condicio sine qua non* for the successful implementation of the CULTURA environment. In order to achieve this aim, humanities researchers from the Department of History at Trinity College Dublin – Ireland (TCDH) and the University of Padua – Italy (UNIPD) developed the following taxonomy that is exploited to guide their interactions with users and to inform the design and evaluation of the CULTURA environment:

- **Professional researchers** – established academics, experienced in the general area covered by the resource, *but not necessarily with the specific content of the resource*.
- **Apprentice investigators** – students at advanced undergraduate and post-graduate level. Some knowledge of the historical period and/or cultural context addressed by the resource.
- **Informed users** – researchers who are not professional academics but have knowledge of some aspect addressed by the resource.
- **General public** – adults and children.

Detailed interactions with these users groups, using a range of methodologies including surveys, focus groups, and one-to-one interviews, laid the basis for the design of the CULTURA environment. This approach involved interaction with users at a number of different levels.

For users of all types, focus groups and interviews were of fundamental importance. This was true at the beginning of the design process, when potential users were asked to reflect on their needs, wishes, and preferences for a research environment. Existing users of the 1641 Depositions and of the IPSA material were surveyed to provide their input.

In the case of apprentice researchers, CULTURA researchers have been able to take advantage of the opportunity to work closely with groups of under- and postgraduate students who are involved in the sustained use of the system. In the case of the 1641 Depositions, students in an M.Phil. module based on the Depositions were required to use the CULTURA environment for collaborative and solo research projects. This has been carried out over two years, and a third repetition of the exercise is planned for next year. In the case of IPSA, undergraduate students carried out a number of retrieval tasks on the collection as part of their class assignments (Agosti *et al*, 2012).

In addition to carrying out detailed interviews with professional researchers in a variety of related disciplines, humanities researchers involved in the CULTURA project have undertaken a number of research projects using the research environment. These have resulted in a number of humanities-focused publications (Ó Siochrú and Sweetnam, 2012; Orio and Ponchia, 2013; Sweetnam, 2013a; Sweetnam 2013b), and have been an invaluable means of validating the real life usefulness of the CULTIRA environment.

The experience of project researchers working alongside 'real life' users of the resources has proved tremendously valuable. Where possible, CULTURA has made use of sustained interaction with users. Manifestly, this sort of in-depth interaction is possible only with small cohorts of users. Therefore, where possible, this deep and narrow interaction has been supplemented with broader interactions, typically based around a number of clearly defined tasks. These exercises have particular value in terms of evaluating usability, and are a useful supplement to the sort of detailed engagement described above.

Online surveys play an important role in gathering the input required from users and evaluators. They provide a reliable means of systematically collecting comparable evaluation data, and allow responses to be gathered from users who may be spread over a wide geographical area. The focus of evaluation was on usability and usefulness, and for this reason our starting model has been the triptych model (Tsakonas and Papatheodoru 2006), although a number of interesting measures have been introduced in the literature. such as navigability, searchability, coverage and, in particular, retrievability (Azzopardi and Vinay, 2008).

In addition, because surveys can be partially completed, left, and then completed, this approach allows users to record their impressions at a time and pace that suits their needs. This is a vital feature when unpaid evaluators are used, as it prevents excessive trespass upon their good will.

On the basis of these interactions, use cases were developed and user requirements elicited and refined (Sweetnam *et al*, 2012). One of the key results of this process was a catalogue of user requirements which, in addition to outlining the features required, also recorded the user groups for which each feature was important, and how important each feature was in the case of each group. One of the findings to emerge very clearly from this exercise was the fact that less experienced users ranked more highly tools that allowed them to explore the content collections

in a relatively undirected way. By contrast, apprentice and professional researchers were far more likely to require tools that took they directly to specific artefacts, or sets of artefacts that were relevant to their interest.

Engagement with users has been an on-going and iterative process, and user input has guided the development of the environment as a whole, and the individual tools that it comprises. So the development of the environment was and it is user-driven as it is depicted in Figure 1.

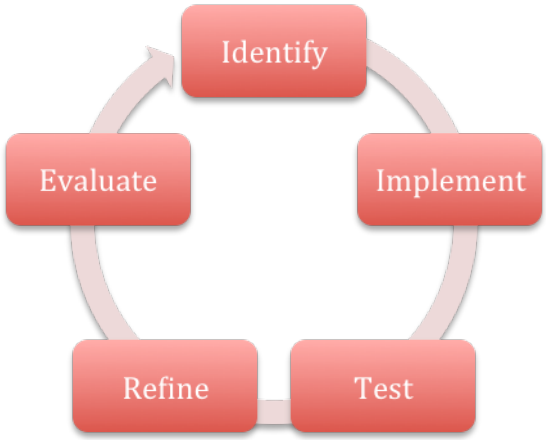

Figure 1. User-driven development.

4. THE CHALLENGES OF THE USER CONTINUUM

The decision to abandon the convenient fiction of a single stereotypical user and embrace the messy, muddled, and demanding heterogeneity of real world users presented real challenges, which had to be overcome or circumvented in the execution of CULTURA's intended approach.

4.1 User Availability

The most basic challenge faced by the humanities researchers was that of locating sufficiently large cohorts of users in each of the categories. These challenges were not uniform across the user spectrum. For example, apprentice investigators – essentially undergraduate and Masters level students – proved relatively easy to recruit, being both plentiful and easily compelled. At TCDH a Masters course on the 1641 Depositions was used throughout the project's lifecycle, as a forum for detailed student interactions with the CULTURA environment, while at UNIPD students in humanities taking classes in computer science used the CULTURA environment as case study for experiencing the interaction with digital collections. These students are a captive audience, but they are also an interested and motivated group of users, who typically valued the opportunity to contribute to the development of a new tool.

In a university context, professional researchers, too, are relatively easily recruited. A number of professional researchers were directly involved in CULTURA, and their insights were crucially important. However, it would be unwise to treat any small group of researchers as though they embodied the Platonic ideal of the humanities researcher, and so it was essential to seek wider input. In an era of spiraling workloads, however, researchers seeking input from expert researchers make heavy demands on the goodwill of their colleagues. In the case of those researchers who work directly on the collections, the promise of exclusive advance access to the interface constitutes something of a *quid pro quo*. This becomes a less compelling argument in the case of non-domain professional researchers. Encouraging involvement from users of this type involves an appeal to their goodwill. Researchers seeking this sort of input require considerable charm, and excellent powers of persuasion. A brass neck, too, does not go amiss.

Informed users are typically not found in a university setting. For both of the CULTURA collections, cultural institutions were an important element of this group. Both TCDH and UNIPD are fortunate to enjoy close relationships with cultural institutions – aided, in Trinity's case, by the close geographical proximity of most of the major Irish cultural institutions to the College. Other interested users differed – for TCDH local historians and genealogists were important, while UNIPD looked to local botanical and astronomical societies, and to members of *Salvalarte,* a voluntary association of individuals who share a great interest in History of Art and Cultural Heritage in general, and which is devoted to the preservation of Paduan culture (Agosti *et al*, 2013). Achieving coherent interaction with these groups required considerable effort. In addition, some unexpected hurdles were encountered. In the context of 1641, for example, TCDH researchers discovered that some professional genealogists were only willing to contribute to the project if they received financial remuneration. While this may be feasible in some projects, in some special circumstances, it is unlikely that many project budgets will allow for user groups to be rewarded in this way.

The reaction of these genealogists does highlight the importance of planning user interactions carefully, in order to ensure that benefit is shared as equally as possible between the project and the participants. While it may not be appropriate to offer financial incentives, it is vital that evaluators feel that they are benefitting from their involvement in the project. That benefit may be defined in terms of advance access to new functionality, or – more vicariously – as an opportunity to contribute to an important advance for scholars in their field, but if high quality feedback is to be obtained, it is essential that users feel a degree of investment in the success of the project.

The need for coherent feedback from informed users led researchers at TCDH to establish a user panel. This group was made up of three representatives each from historical societies, cultural institutions, and genealogists. This small group meant that it was possible to gather consistent, sustained feedback on the developing versions of the CULTURA environment and its tools.

The fourth segment of the user continuum proved, by a considerable margin, the most difficult to address. "General Public" is something of a catch-all category and, by its nature, is heterogeneous and poorly defined. Nonetheless, it is important that the views of these users are captured. In many ways, these are the most demanding users to design for. Their interaction with the system is likely to be casual, and they are easily deterred by obstacles to access. Thus, they provide an acid test for functionality and usability. The CULTURA project has addressed the challenges of interacting with this constituency in a number of ways. Working with schoolchildren was identified as a priority for the project, and researchers were able to develop links with schools in order to provide a number of workshops, which introduced students to CULTURA. These were followed by feedback and evaluation sessions. In addition, the CULTURA environment was offered in a limited public release. User

response was gathered using logging, on-page evaluation, and surveys, enabling a holistic picture of the users' experience to be captured.

This sort of broad-based, intensive interaction with users is far more demanding than the sorts of limited user testing of a near complete product that are typical of many digital humanities projects. However, the effort is abundantly justified by the results. The value of user input throughout design and implementation cannot be overstated if the aim is to provide these users with genuinely useful tools that meaningfully assist in investigating and understanding digital cultural heritage collections.

4.2 User Modeling

One of the key challenges addressed by this project is the task of constructing an accurate picture of the characteristics of each user constituency. Beyond this, however, is the challenge of translating those characteristics into a set of technological approaches to address the needs of these users. Both these tasks are complicated by the fact that users do not fall neatly into carefully gradated compartments. Rather, they occupy a continuum, and drawing the line dividing one category of users from another is necessarily and inevitably a somewhat arbitrary exercise.

In addition, there is no reason to suppose that users will only ever occupy one position on that user continuum. Indeed, it is a key aspiration of the CULTURA project to cultivate knowledge and understanding – in other words, to move users along – and up – that continuum. This progression is a feature of the sort of content collections that CULTURA will support. Many, if not most, professional researchers will have encountered material first of all as apprentice researchers, if not as members of the general public. Even if the user who traverses the whole continuum is something of an exception, the CULTURA interface must support their experience at each point.

It is also worth stressing that the humanities user continuum is not hierarchical. No one category of user is more important than any other. The users targeted by CULTURA are not Russian dolls, ranging in significance from the general public up to professional researchers. And if this is true of their significance, it is also true of the complexity of addressing their requirements. Supporting professional researchers is a demanding enterprise, but, then, so too is providing assistance to members of the general public. Indeed, the complexity of supporting the broad heterogeneity of the requirements of the general public is equal to, if different from, supporting the well-defined requirements of professional researchers.

For these reasons, we have chosen not to take what might have seemed an obvious approach to tailoring the CULTURA interface to different types of user. One possible approach to this would have been to define a rich feature set for the professional researchers, and then systematically deplete these features in order to offer a progressively simpler and more streamlined experience to others types of user.

Instead, it has become apparent that CULTURA needs to follow the inverse of this approach. The imperative to support and enable user development means that all users must have access to the full feature set. In addition, some user groups require additional support, and this support is most needed at the general public/interested user end of the user continuum. Users in these categories have consistently highlighted the value of "background briefing" type material to contextualise and illuminate the material in the collection.

4.3 User Support

The results of a great deal of user research – and perhaps of the best sort of user research – are often striking but, at the same time, entirely unsurprising. One of the findings from the user research carried out by CULTURA humanities partners falls firmly into this category. Our interactions with researchers have provided overwhelming confirmation of the – admittedly fairly obvious – fact that researchers are different. Even when working with a small and apparently homogeneous group of researchers who share similar methodological and subject interests, the variety of working and research styles adopted is striking.

To succeed as a research environment, CULTURA needs to accommodate as wide a range of working styles as possible. Too many research interfaces seem to operate as a methodological Procrustean bed, forcing users to conform to the tool, rather than the tool responding to and supporting the individual needs of the user. Thus, the CULTURA interface needs to offer the flexibility to support researcher's work styles. Users from all categories have consistently stressed the necessity to be able not just to locate and annotate the material that is relevant to their research, but to organize it within the interface.

And these users have also provided a comprehensive list of suggestions for achieving this customizability. Most commonly, they have requested the ability to create different workspaces for individual research projects, and a folder functionality that will allow bookmarks and annotations to be categorized and organized. They have requested a high level of control over these folders and projects. They require the ability to copy and move bookmarks and annotations, to allow projects to inherit earlier annotations, but also to start a new project from scratch, or to integrate only some of their existing annotations.

Users have also highlighted the usefulness of being able to export data from the environment. This feature means that CULTURA can be more than a self-contained reservoir – it can become part of a pipeline, a link in a longer chain of analysis, and a cog in a larger research machine. As the tools that contribute to CULTURA are developed, it will be important to ensure that they, make themselves available to wider interoperability and "mashing up". These requirements are important, because researchers are much more likely to make use of an interface that adapts to their requirements, and that allows them to carry out their research as efficiently as possible, without forcing them to change or compromise their preferred approach to research.

5. DEPLOYMENT OF THE COLLECTIONS IN THE ENVIRONMENT

Both of the content collections that are featured in the CULTURA environment have previously been made available by means of more traditional web interfaces and applications.

In the case of the 1641 Depositions, the transcribed text and high resolution page images were made freely available for public access at http://www.1641.tcd.ie/. This site allowed for browsing of the collection, for full-text searching, and for searching across the manually generated metadata. Limited bookmarking was also provided. In the pilot stage of CULTURA, a subset of the depositions data, comprising depositions relating to a single county, was incorporated into the CULTURA environment. Once initial testing had been completed, this coverage was expanded to include the Depositions in their entirety.

Similarly, in the case of the IPSA material, the illuminations were made available through a traditional web interface and application, with search functions and the possibility to link different images. Following the commencement of CULTURA, an analysis of the IPSA content was made between May and October 2012 to choose a significant subset of metadata to be imported and represented in the CULTURA environment for use as a case study to test the new environment and its functions.

The 1641 Depositions and the IPSA collection provide two very different corpora, on which the development of CULTURA can be carried out. As already discussed, this is crucial to the corpus-agnostic principle that underlies the design of CULTURA. In addition, the existence of two pre-existing applications provided a very valuable context for the sort of enhancement being carried out in the CULTURA project. The initial implementations of both 1641 and IPSA provided valuable baseline data on user needs and requirements. Even more crucially, the fact that established user communities had developed around each collection meant that researchers had ready access to experienced users of both collections who were clearly aware of the strengths and weaknesses of the existing modes of interacting with the collections.

6. ADDRESSING USERS WITH ADAPTIVITY

Characterising a diverse range of users, capturing their requirements, and modeling their work process are all vitally important steps in CULTURA's user-driven design. This work would count for little, however, if the resulting environment failed to satisfy these users, to address their requirements, to support their workflows, and to enable them to view culturally significant collection in new and rewarding ways. In order to achieve these ends, the CULTURA environment adopts an adaptive architecture that presents the user with both the content and the tools that are relevant to their investigation at any given time. Adaptivity is an essential part of CULTURA's design, but in the context of this paper there are two aspects especially concerned with supporting the range of users at either end of the spectrum, and we will confine our consideration to these.

6.1 Narratives

Narratives are a central part of the way in which adaptivity is implemented within the CULTURA environment. The term narrative is used 'to represent the adaptive flow of concepts that are woven together to make a coherent offering to a user. Individual concepts may be grounded with either content or services, or may be further refined with the execution of a sub-strategy' (Conlan *et al*, 2013). These narratives are threads through the collection, linking artifacts and tools related to a particular topic. Expert researchers, guided by the use cases and user requirements outlined during user consultations, designed narratives. They used their specialist knowledge of the collections to create a series of threads through the content. Each narrative has a number of levels. Less expert users are offered a relatively high level narrative, but as users interact with the resources that are presented to them, the system dynamically exposes additional material, resulting in a more complex user experience. These narratives allow for an open-ended and developing engagement with the resource collections, and support the development of users from members of the general public, up to apprentice investigators, or professional researchers.

An example of a high level narrative designed for less expert users are "lessons". These describe the different steps of a short course on a specific topic that is dealt within the collection. Typically, the relevant material will be spread across the diverse parts of the different components of a collection. Adaptive lessons provide structured routes through the collection, exposing the user to artifacts that are relevant to their topic of interest.

These narrative lessons have been implemented for both collections in CULTURA, and the user experience of these narratives has validated their usefulness for both types of content collection. In the case of 1641, a series of lessons were developed for use with schoolchildren who were encountering the 1641 Depositions for the first time. These users were presented with a sidebar containing a brief explanation of the context of the individual deposition being viewed, along with prompts for further research (see Figure 2). Users are able to move backwards or forwards within the lesson, or to branch off into further narratives, covering particular areas that especially pique their interest. At any point, the user can leave the narrative pathway to carry out their own detailed investigations. They are able to resume the lesson when desired.

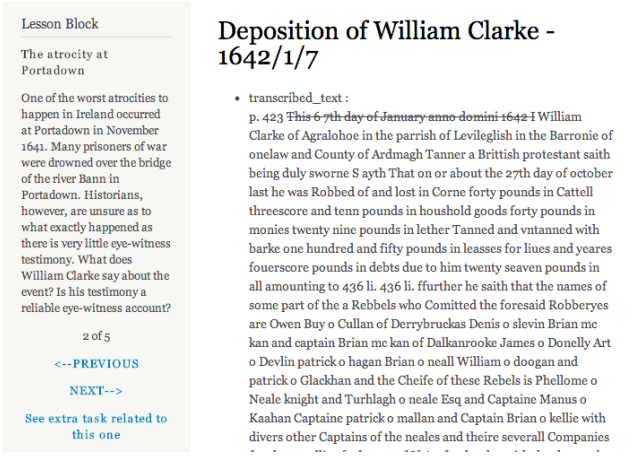

Figure 2. 1641 Lesson plan.

In addition to tying together chains of documents, these narrative lessons can include the other tools that contribute to the CULTURA environment. So, for instance, a user of the 1641 Depositions who is following a lesson based on a particular individual or location can be presented with the results of a free text search carried out over normalised or unnormalised data (see Figure 3) or of an entity-oriented search displaying the relationship of the entity in question to other entities within the collection (See Figure 4).

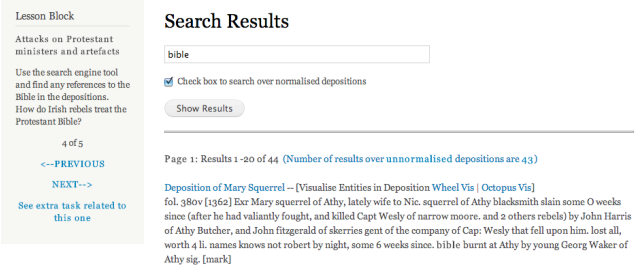

Figure 3. Exploration of search results.

The visualization features outlined below are also available to users of the 1641 Depositions, and, in a similar way, allow the collection to be explored on the basis of the links and relationships between people, places, and events. Individually, these tools offer a range of exciting new ways of looking at the Depositions. The lesson narratives add a further layer of richness, integrating these views within a coherent narrative structure.

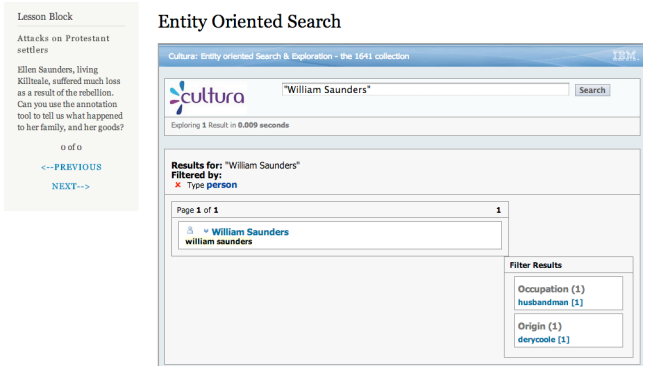

Figure 4. Entity-orientated search.

For users of the IPSA collection, one of the lessons provided examines the development of botanical illustrations in Italy and allows the user to learn about the specific features of the software environment. To show the development of botanical illustrations over the centuries, the plant rosemary was selected. Rosemary has been illustrated in different illuminated manuscripts and allows the user to appreciate the chain of derivation in the illustration over time. Since it is not easy to show the user the different illustrations of the same plant that are present in different manuscripts on the same screen without the user having a disorientation problem (Conklin, 1987), a new type of visualisation has been designed. This "wheel visualisation" of the rosemary's entity network, is shown in Figure 5.

Figure 5. "Wheel visualisation" of rosemary's entity network.

With this type of visualisation the user can appreciate that this plant has been represented in at least four manuscripts produced in different areas of Italy.

Figure 6. The four illustrations of the rosemary in the different manuscripts.

If the user continues to follow the sequence of the lesson, he can see a specific illustration of the plant, otherwise he can use the "dots" of the wheel to follow new routes. For example the user can ask to see the illustrations of the rosemary that are present in the four different manuscripts and the result is that of Figure 6.

If the user clicks on one of the authors, as for example, Pseudo Apuleio, the system displays a callout specifying the type of entity (see Figure 7) and allows the user to see the entity network of the author.

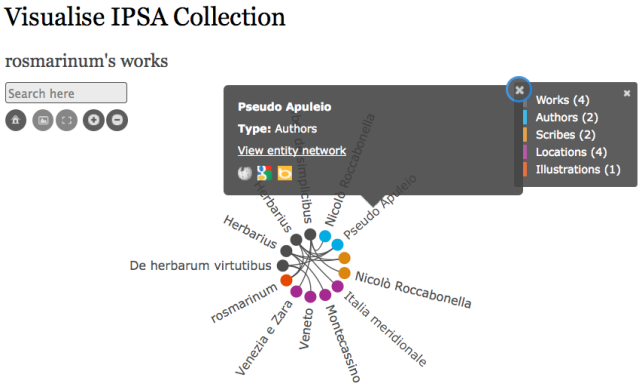

Figure 7. The screen showing that "Pseudo Apuleio" is an author and that is possible to see his network.

The entity network of the author is prepared by the system on the fly to answer this specific request of the user. In this way the user is adapting the interaction of the system to his interests, and he leaves the structure of the lesson and he uses the environment to adapt it to his interests.

The entity network of Pseudo Apuleio is very rich, since his herbal was widely copied in the Middle Ages (Figure 8).

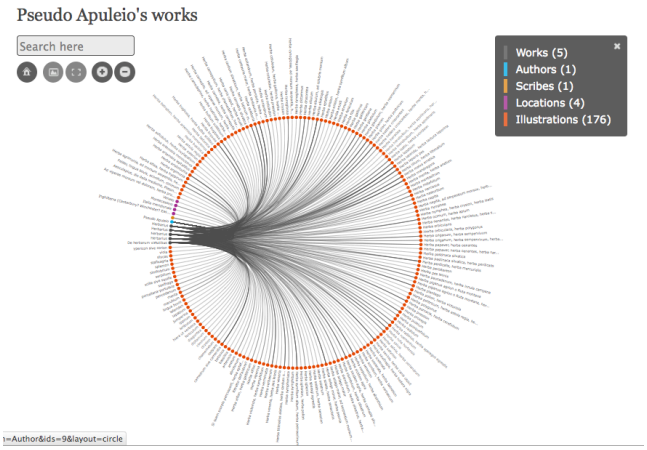

Figure 8. Pseudo Apuleio's works.

By clicking on each of the Pseudo Apuleio's works (a red dot for each work), the user is presented with a contextual square containing the essential information on the work together with an illustration if the dot refers to an illustration of a plant. From that square the user can navigate in the "wheel" of that specific plant and he can continue to explore into the digital cultural heritage collection.

As these examples demonstrate, these narratives are a powerful tool. They allow the diverse affordances of the CULTURA system to be brought together in a way that greatly enhances the user's understanding of the collection. They guide users without limiting them, by providing relevant guidance when necessary, and allowing the user to follow additional sub-paths in order to delve deeper into a particular topic, or to leave the narrative path entirely in order to undertake independent exploration, secure in the knowledge that a single click will return them to the narrative. The content in both of these collections is notable for its complexity, and the tools that the CULTURA environment provides add further layers of richness. Such a wealth of material is challenging for users, and adaptive narratives provide important support, guidance, and direction, without the need to conceal or throttle any of the complexity and the opportunities for discovery what this complexity brings.

In addition, it is clear from the examples considered above that the ability to create dynamic pathways through a collection, that can respond to the needs and interests of the user is entirely independent from the specific type of digital cultural heritage collection that the system is managing. The system can handle non-pictorial material, or illustrations relevant to any possible subject of interest or medium – ranging from illustrations of an ancient manuscript to photographs of a modern book.

These adaptive narratives are a powerful and generalised tool of interaction and navigation with any sort of digital collection related to cultural heritage.

6.2 Recommendations

While the adaptive narratives provided by the CULTURA environment allow users to be flexibly supported as they interact with a wide range of material in a variety of ways, they are essentially pre-packaged ways of looking at the material in the collections. A more dynamic form of support is provided by the recommender element of the user model. This system tracks the artifacts that a user interacts with, and the level of that interaction. So, for instance, viewing an item gives it a low weight, but bookmarking a record or annotating material within it result in a higher rating. These weightings are used to present the user with items that are related to their previous use of the collection.

Figure 9. The CULTURA Recommender.

6.3 User Model

Not all users are equally accepting of adaptivity. Professional researchers, especially, do not seem to like the idea of an automated system controlling – however benignly, and with however good an intention – their access to the material on which they are carrying out research. For these users, transparency and scrutability are irreducibly essential. The CULTURA environment supports this requirement in a number of ways. Firstly, when the adaptive recommender system offers content recommendations to the user, it makes it clear why the material is being suggested. Secondly, the environment offers the user extensive control over their user model, allowing them to see what terms are influencing their recommendations, and to alter the relative weights given to each of these terms; so the user can control the "user model" as it is depicted in Figure 9 where it is shown that the user can interact with the weight has been associated to a word or a concept, modifying it in relation to specific requirements. In line with the results presented in (Ruthven *et al*, 2003) on the involvment of users manually weighting their interest, it is likely that only motivated users (e.g. researchers) will exploit the user model control. Yet it is part of our approach to provide the continuum of users with similar tools.

Figure 10. User model control.

7. CONCLUSIONS AND FUTURE WORK

From its inception, the CULTURA project set itself some ambitious goals. The adaptive research environment which it aspired to create went well beyond the existing state of the art. In

moving beyond the specialised, search-based, and stereotyped norm, CULTURA offers a new model for access to and interaction with cultural heritage collections. It demonstrates the value of an adaptive interface, that responds dynamically to support the user, whatever his or her level of experience with the environment, or familiarity with the content. This flexibility has been both required and facilitated by CULTURA's attempt to address the needs not of a single stereotyped of user, but of a broad spectrum of user constituencies.

The design of this adaptive environment has been based firmly on input from users. CULTURA researchers have invested considerable effort in developing contacts with users from a broad range of user communities, and in working closely with those users to provide authentic and detailed user input plays its proper role in shaping CULTURA. This engagement has been both sustained and broad-based. This level of engagement is demanding, but essential in helping to underwrite the real-world usefulness and thus the long-term sustainability of the resultant environment.

User engagement as modeled by CULTURA is ongoing and iterative. Thus far, it has informed each phase of the project's development. The user input feedback loop will continue to play a vital role in the ongoing implementation and evaluation of the CULTURA system.

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