RePAH:

Reseach Portals in the Arts and Humanities

A user analysis project

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Dr Michael Fraser – *Humbul, University of Oxford*
Jayne Burgess – *Artifact, Manchester Metropolitan University*
Dr Claire Warwick – *LAIRAH, University College, London*
Alastair Dunning – *AHDS, King's College, London*
Alun Edwards – *Humbul, University of Oxford*

2. Executive Summary

2.1 The Work of the Project

In July 2005, the RePAH Project was commissioned to carry out a survey of user-needs for information portals in the Arts and Humanities by the AHRC ICT in Arts and Humanities Programme. It began its work in September, conducted its first round of focus groups in December, also launching its online questionnaire that same month. By May 2006, the Project had analysed the 128 questionnaire responses, completed the report on the first round of focus groups and conducted a Delphi exercise among selected respondents. At the same time, deep-log analysis was conducted on the extant web-log information, mainly based on information from the calendar year 2005, furnished by the AHDS and two constituent elements of the RDN, Humbul and Artifact. This information formed the platform for a second set of focus groups, focusing on a 'demonstrator' of possible information portal developments. The responses to this second set of focus groups enabled the project to provide the fine-grained analysis of user-need which constitutes the basis of its recommendations. This report was compiled in August 2006 and submitted in September 2006.

2.2 Project Aims and Objectives

This was an **information-gathering** project. Our brief was to discover **user-behaviour** and **user-needs** of researchers in the Arts and Humanities in respect of portals. We set out to discover four kinds of information:

1. Information about users' information discovery strategies and internet usage.
2. Information about users' awareness and attitudes with respect to currently available online services and tools, including such gateways and portals as currently exist.
3. Information about patterns of recent user-activity in relation to the RDN subject hubs and AHDS.
4. Information about users' responses to what future portal developments can deliver.

2.3 Conclusions

Our initial analysis of the Arts and Humanities Research Community's research behaviour was substantially confirmed. This is a community which is **non-homogeneous**, **institutionally diverse** and **variegated** in its research patterns. We estimate it as around **50-60,000 active practitioners**, composed of the 'stakeholders' identified in our report – Postgraduate [PG], Postdoctoral [PD], Research Assistants [RA], Faculty and Independent Researchers [RI]. Our 'road-map' of their research activities indicated a **core** and **penumbra** of activities, which are both **individual** and

group-based [**A3**]. Not all these activities are currently universally served by the current information resource-discovery channels.

2.3.1 Users' information discovery strategies and internet usage

We emphasise the following features underlying Arts and Humanities research behaviour as regards their digital resource-discovery and information needs:

- Digital resources are now **ubiquitous** for Arts and Humanities research. They are used **extensively**. Researchers believe that they have **fundamentally altered** the way in which they undertake research – i.e. the formulation of their research questions as well as gathering materials for answering those questions. At almost every stage of the research process, digital resources have changed the way in which Arts and Humanities research is now conducted. It has not yet, however, affected the way in which Arts and Humanities **publication** is conceived (although many journal papers end up on the Web). It has not fed through to the habits and procedures for **personal data archiving** nor has it had a substantial impact on the **means of scholarly communication** in the Arts and Humanities.
- Our researchers emphasised that their agendas were **flexible**, **open-ended**, established on a predominantly **personal** basis, and **multiple**. They did not regard themselves as working in hermetically-sealed specialist areas. Rather, they saw themselves as researching overlapping domains, in which there were a series of core issues which could be tackled from a variety of differing angles.
- Our researchers are **practical-minded** and **instrumental** in their resource-discovery strategies. The patterns were quite **discipline-specific**. Their needs are **extensive** and **broad-ranging**, reflecting their agendas. They expect their research methodology to involve a high degree of proficiency in resource-discovery. Our users are not promiscuous, but they have formed views on the perceived cost-benefits of using particular resource-discovery tools and strategies. These views are necessarily based on a sometimes less than perfect appreciation of the possibilities and range of a particular tool or digital library and of the possibilities of ICT generally. Both the questionnaires and focus groups highlighted a demographic within the arts and humanities community. There is a clear minority of scholars who are fluent in the use of digital applications and a sizable majority who find little need and/or time to use such tools.
- All machine-accessible resource discovery depends upon implied taxonomies of knowledge. **Pre-structured knowledge** is not always greatly appreciated, however, by Arts and Humanities scholars. Their need for **assurance** about the authority and trustworthiness of a particular digital resource is in tension with the assumption that the **individual researcher has specialist skills** with which to assess its authority, by a **suspicion about who is undertaking the authentication**, and by an **awareness of the complexity that such a process entails**. They want to know about who has undertaken the authentication, and how often it is updated. They learn about the reliability of digital resources mostly from other practitioners, using established and informal lateral means of

communication within specialist fields. Arts and Humanities researchers are as likely to want to develop their own resource discovery trajectories as to follow those dictated by others.

- Categorised information is often not ideal when one is interested, as Arts and Humanities scholars often are, in the particular, or the anomalous. Resource discovery can provide pointers in the right direction, but Arts and Humanities researchers readily accept that **individual resource discovery** is fundamental to their research. The reiterative processes that this involves are a key constituent in the pursuit of, and definition of, their research agendas. Since Arts and Humanities research is still mainly defined at an individual level, information resource tools have therefore to be based upon these individual needs.
- There seems to be a significant relationship between the relative **lack of 'mutual dependence'** among Arts and Humanities researchers, their **'task uncertainty'** and the ways in which digital resources are **produced and utilised**. The arrangements for collaborative research and for disseminating research results are **personalised, localised and decentralised**. Informal communication depends on individual groups and specific social networks. Digital resources, where they exist, tend to be field-based and similarly localised. Likewise, there is a corresponding reliance on commercially produced generalist digital resources. We could produce no reliable estimate of what proportion of resources were in proprietary (i.e. commercially-provided, subscription-based or purchased information) as opposed to public-domain (i.e. free to access, generally publicly-funded information) information. Our users were often not aware of the contractual basis on which the information was provided to them. Nor could we estimate how frequently, and for how long, they consulted these resources – the patterns were too varied.
- There is a perception among arts and humanities scholars that within their fields there is little or no collaboration. The reality is substantially different, because while **strong collaborative cultures may not exist**, however, weak ones do and take the form of citations of colleagues' works, routine email correspondence, interaction through conferences and professional society meetings.
- Arts and Humanities **'e-infrastructure'**, apart from the AHDS and RDN subject-portals, tends therefore to be determined at the level of the **employing institution** rather than the field or discipline, or higher.
- We have to take into account a **'counter-culture'** (which we encountered most noticeably in our investigation of some of the disciplines in the Arts, where information resource needs and research agendas are often articulated in terms of 'diametrical difference' to prevailing trends).
- Arts and Humanities researchers want access to information, irrespective of the medium in which it is available. They are used to working in fields where there is a very **mixed economy of resources**, electronic and physical. Journal articles are important, but so are printed books. E-prints (pre- and post-) are markedly less significant than in the physical sciences and engineering. Electronic bibliographical information is therefore of critical importance to Arts and Humanities researchers.

- There is less emphasis on communicating work-in-progress and more emphasis on **formal ways of disseminating information**. There is consequentially less emphasis on lead-times for accessing research-sensitive information and results.

2.3.2 Information about users' awareness and attitudes with respect to currently available online services and tools, including such gateways and portals as current exist.

In general, we encountered a **high and growing level of expectation** as to the availability of materials in digital form. These expectations have been fed by the **exponential growth in the content of Arts and Humanities digital libraries** by the wide variety of different content-creators and contractors.

Generally users were largely **unaware of the possibilities** for data analysis and multimedia data presentation that digitisation offers and were equally **unaware of the extent to which their use of digital resources is tracked and analysed** by content and service providers and employers.

The **internet search engine** emerges from this study as an immensely useful digital resource-discovery tool. Users deployed a variety of proprietary search-engines. Their simplicity and speed appealed to our users, for whom a key determinant in their cost-benefit analysis of resource-discovery tools was whether it saved, rather than cost them time. At the same time, our users were also aware of the limitations of their internet search-engine of choice. Our users told us of their **frustration at its lack of sophistication**. They were **suspicious of its ranking of hits** returned. They were **overwhelmed by the information redundancy** which often accompanies its results. They were, above all, concerned about the fact that search-engines do not search a great deal of digital content that is relevant to their needs; and, equally, they are frustrated by the lack of interoperability between different libraries of digital content.

The issue of **'access'** runs throughout our report. Access to online journals was most often raised; but it frequently occurred also in respect of proprietary digital content of various kinds, specific to particular disciplines. The issue was sometimes presented in terms of a trade-off in resource terms, with our users wanting to see the investment of scarce resources in widening the local access to digital content through licence and content purchase rather than increased investment in resource discovery. At the same time, our research practitioners were aware that 'access' was only fully beneficial when it was linked to enhanced resource discovery, and, in particular, interoperability.

Interoperability was another major theme running through our enquiries. It tended to affect some disciplines more than others. As digital content becomes richer and more diverse, so the independent platforms on which it is consulted multiply. As interoperability becomes more important, so the potential for a next-generation resource-discovery portal grows. While the AHDS and Intute allow their resources to be harvested by other services, **they do not themselves comprehensively harvest available**

metadata. For the AHDS this is due to their remit of collecting 'from' not 'for' the research community, while Intute-Arts and Humanities has indicated a general lack of useful metadata available. Intute offers Really Simple Syndication (RSS) news feeds that aggregate news and new collections. This is a form of service that is already appreciated by individual users. This would appear to be a more advantageous route for making data available to commercial harvesters than that provided by the Open Archives Initiative (OAI) metadata-harvesting. The latter has currently received only limited take-up within institutions and none to our knowledge by individuals.

2.3.3 Information about patterns of recent user-activity in relation to the RDN subject hubs and AHDS.

From the wide-range of resource-discovery services and tools used by Arts and Humanities scholars, we investigated user familiarity with and use of these two services in particular. The key feature of the **RDN subject-portals** is their **resource descriptions**. Although our users were clear about the potential importance of **authenticating** digital resources, they were not so sure about the **significance** of the resource descriptions provided by the RDN portals. In particular, they had no sense as to how often they were **up-dated**, the **status** of who had written them, and what **range** of resources they covered. Those that had used the subject portals, took the view that they tended to be useful at the beginning of a research enquiry, but to become rapidly less relevant the more one advanced into a subject. Those that had not used the RDN subject-portals but knew of their existence had evidently formed a view about whether they were **likely** to find anything of relevance to them within it. We conclude from our evidence that the RDN portals are insignificant for most research purposes for the Arts and Humanities practitioner.

AHDS has a similarly low profile among the majority of arts and humanities researchers, although the evidence from AHDS web-logs may well be deceptive. Overall they may under-record some aspects of its usage despite some inflation of usage figures resulting from the inclusion of internal traffic between different servers within the AHDS network as a whole, including network administration calls. Although the number of **resources downloaded** seems to be increasing, none of the participants in our focus groups or questionnaire admitted to having downloaded such collections. Where the AHDS **harvested** data, generally in collaboration with outside partners (as in e.g. Heirport the Historical Environment Information Resources Portal), it plays a significant, perhaps pivotal, role in Arts and Humanities research.

Neither service has a published strategy for consulting users and discovering their needs, although there are examples of good practice in some parts of the AHDS. There are some good collaborative links with other information service-providers in place, but these need to be strengthened. The two services are not currently interacting very well. The RDN subject-portal does not harvest the metadata on AHDS resources comprehensively. While references to each other can be found on their respective sites, neither service

promotes the other particularly actively, explains their relationship/differences or provides a quick and easy link to the other.

2.3.4 Information about users' responses to what future portal developments can deliver

Users generally found the current resource-discovery arrangements and services adequate, but were confused about their roles. The evidence is that researchers are more concerned with access to content than functionality.

At the same time, they recognize that the current situation with regard to functionality is not sustainable in the longer term. The importance of interoperability in users' minds was a measure of that realization. The exponential growth in data volume, combined with increasingly complex multilayered information, will make it more necessary to use resources in a complementary way, and simultaneously harder to do so.

Our users responded positively to the possibilities of a **personally-managed** research environment. There were specific, realizable functionalities that they identified as being of direct use to them in carrying forward their research agendas: **workflow management tools** and **resource discovery tools**. Researchers wanted greater personal control over digital resources. They readily perceived the advantages of tools which enabled them to integrate searching the web with searching their own hard-drive. They saw benefits to more developed **bookmarking** features, **personal editing** features, and an **automated copyright management system**. They wanted to be able to **filter** the quality of hit returns, **search distributed databases.** They responded positively to a **web-based news feed feature**, and liked the idea of **RSS feeds** that by-passed personal email accounts.

They were less excited about tools to enable communication and collaboration. The picture that emerged is of researchers who find asynchronous and largely mono-media communication channels such as email, web pages and telephone quite satisfactory. Real-time communications media such as instant relay chat and Grid videoconferencing with integrated computer applications sharing were less appealing. However most respondents declared themselves **happy to collaborate at the basic level of sharing the sources they used.**

Many of the features presented in the demonstrator imply a more sophisticated portal tool than the current gateways provide, and that requires a development in the ICT skills-base of the user-community which it is clearly reluctant to make. The investments made in the ICT skills-base through the Methods Network, ICTguides and training/awareness programmes organised by the AHDS cannot be expected to uplift the skills-base of researchers who do not currently see the need to do so. Whilst this skills-base is likely to improve over time, the potential functionality of portal tools will probably always outstrip it.

2.4 Ways Forward

We see a number of ways forward.

1. An awareness of the **distinctive research culture** with its fears and predilections must be taken into account.

2. The Arts and Humanities research community is not very assertive. Its digital resource-discovery needs have not been very well-voiced. As digital data expands exponentially in our field, and becomes increasingly complex and multi-layered, it is going to become harder to find, and use what we need. The arts and humanities need **strong pan-institutional organisations** that can champion the disciplines nationally and internationally. This is a role that AHDS is beginning to play in relation to standards (Brown et al 2006) but it applies also to information resource-discovery needs, including issues of access to content. The AHDS has a singular focus on arts and humanities. Intute offers a more integrated service of resource discovery within which Intute: Arts and Humanities has been established to function as a distinct service for the arts and humanities. The case for a single and coherent resource discovery service for arts and humanities is from the point of view of the user, clear.

3. The increasing provision of **metadata-harvesting** among the information service-providers is an immediate and short-term objective, dominating the agenda of resource-discovery over the next five years. Users are coming to expect much better **linkage** between **online bibliographical resources**, and the **online content** itself. They also want to search across **distributed digital data**. This objective implies:
    - **common metadata standards** [substantially in place]
    - agreed **authentication systems** [emerging, but more work needed]
    - much greater degree of **collaboration** among a wider group of information service-providers than is currently in place (research libraries: archives: museums: government/commercial information-providers, etc) [not in place]

    It is beyond our remit to recommend where such collaboration should come from. But we are convinced that the AHDS has a more important role to play in participating in, and facilitating, such collaborations than it has played in the past.

4. In the medium and longer term (in a five-ten year perspective), it is likely that the **semantic web**, especially when combined with harvesting agents, will provide the easy-to-use tools that many researchers need, at least to some degree. However, for some areas of the Arts and Humanities where "knowledge" is more the result of heuristics and associative thinking, it may be that a more folksonomic approach

as exemplified by **Web 2.0** services such as Flickr and steve.museum will be more effective. We are therefore more persuaded in the shorter-term of the possibilities of **Web 2.0** offering a way forward in the form of community-contributed and mediated content. Users do not seem averse to contributing in that way, but the nature of 'mediation' should be recognized. We can see the possibility of the RDN subject-portals evolving towards **a different mediation role**, with resource-discovery content coming instead from the community itself. In the longer term, there may be a possibility for combining the semantic-web and Web 2.0 approaches, especially if and where discipline-based ontologies emerge as commonly accepted.

5. We can begin to discern the determining characteristics of the resulting information environment as it emerges over the coming decade. It will be:

    - inclusive
    - aggregative
    - personalisable
    - locally managed
    - quality-assured
    - easy to use
    - community-based
    - internationally developed

    At various points in this report we have referred to this as a **'managed research environment'**. The use of the term "environment" rather than "portal" is significant here because it does not necessarily entail a single provider. It could comprise a selection of Web portal services, or "portlets", that users draw down to their desk top and configure personally or it may take the form of a pre-configured set embedded within a trusted supplier such as an institutional or professional society web site. Moving towards such an environment should be regarded as a medium-term objective (i.e. three to five years). The current portal providers in the Arts and Humanities do not look like this. But, of course, there are already individual services in the public domain that have some or all of these features and there are recent precedents for the kind of environment we have described. For example, the JISC/LTSN Learning and Teaching Portal Project resulted in a set of web portal services that are embedded in the HE Academy website as a suite of 'Finder' services that could be adopted by other organisations (http://www.heacademy.ac.uk/48.htm).

    We know that Arts and Humanities researchers are prepared to seek out and employ unusual, and 'unauthorised' sources for their information. We also know that they are willing to share useful sources they have discovered themselves. It seems likely that, if researchers come to recognize the existence and utility of such tools and services as these, they will employ them in greater numbers, further undermining the viability of established and 'authorised' services.

6. In the development of such a 'managed research environment' in the Arts and Humanities, there is also scope for collaboration with information system developers, including commercial and international providers. We do not exclude the possibility of UK collaboration in this area with developments currently under Beta-test in 'Google Scholar' to share the costs and manage the delivery. Many of these tools will need to conform to the international standards that are encouraging British developments to be compatible with a much larger range of applications.

   We therefore recommend a scoping study to ascertain the feasibility of such collaboration and the costs of developing a research-directed community-driven subject portal that offers:

   - **Workflow Management tools** that give the researcher greater personal control over digital project resources, especially more evolved **bookmarking features** and some form of automated **copyright management system** to facilitate the growing concern with usage permission and intellectual property rights was also highly valued.
   - **Resource Discovery tools** that provide greater control over web-based resources including the ability to **filter** the quality of hit returns, **search** multiple databases
   - **News feed features** that by-pass personal email accounts, but notify users of conferences, funding, jobs and new research publications.
   - **Collaborative research tools** for social bookmarking, uploading and sharing resources, annotating digital resources, shared document editing, attaching metadata to personally-created digital resources, and contributing to the authentication of digital content.

7. We recommend in the **short term** (one-two years) a much greater collaboration through data-harvesting of the current AHDS and former RDN subject-portals in resource discovery provision and though cross promotion of each others' services.

8. In the **medium term** (three-five years) we recommend that the AHDS and Intute develop a more Web 2.0 compatible profile to enable greater community involvement in resource recommendation, evaluation, creation, selection, sharing and annotation. We also recommend that funding bodies such as JISC and AHRC positively encourage and facilitate the development of interoperable portlets that can be used to embed portal type functionality in institutional and community web sites. An example of this may already be seen in the use of RSS news feeds offered by both services in order to announce news and collections.

9. In the **medium to long term** (five-ten years) we recommend that the AHDS and Intute: Arts and Humanities consider integrating their databases and user interfaces to provide the nucleus of a new, seamless, more comprehensive service in this particular area, one that combines and integrates the core functions of data-archiving, and digital resource harvesting/indexing.

3. Introduction

3.1 Background

How does the arts and humanities research community find and exploit the internet resources it needs? The question has no simple answer in terms of service provider. It is currently served by **complementary services**, each offering to act in some measure as resource discovery agents:

- RDN subject 'gateways'. Their mission statement of 1999 was to construct a 'collaborative network which enriches learning, research and cultural engagement by providing a new level of access to high quality Internet resources'. The Arts and Humanities 'gateways' (Humbul and Artifact) – were merged into a single entity (Intute) in the course of our investigations.
- The AHDS. The AHDS mission statement includes as one of its three planks: 'providing rich, deep access to the intellectual content of arts and humanities digital resources created by or for Higher Education.

These services offer **different resource discovery possibilities** to the user. Humbul/Artifact (now Intute) furnish collection-level descriptions about online resources and various 'value-added services' including online tutorials, alerting services, and customisable resource finders. The AHDS archives significant collections of electronic texts, databases, images and mixed media resources, and provides access to information about them, and about similar resources, located and managed elsewhere. However, the AHDS does not generally supply access to resources beyond those collected from within the research community.

They each **presuppose knowledge** of what the user requires. There is equally an assumption that the user clearly understands the differences between what they each offer. The elaboration of the services offered is based on limited user-requirements analysis which is out-of date, specific to one provider, and generally not based on research into user-needs in the light of recent technological developments. User-requirements analysis is a fundamental part of HCI [human and computer interaction] informatics. It seeks to design the specification of ICT-ware with a real understanding of the people who use the technology, resulting in more effective tools, work practices and more successful outcomes. Its techniques are developed from social-science methodologies and vary in the amount and depth of information to be obtained and the level of intrusiveness to the user. That analysis was not available for this service area. The RePAH Project was established to provide it.

Alongside the elaboration of these complementary service-providers there has also been a rapid development in **new 'pervasive' technologies** that refine, personalise and render interactive subject gateways and portals (through tool-bar type tools or portlet developments). An essential part of the background to the RePAH Project was therefore to examine current information search/access strategies and patterns among research practitioners and develop 'demonstrators' to investigate future user requirements for advanced information services that will serve to facilitate greater take and up use of these resources.

3.2 Aims and Objectives

RePAH has the following aims:

1. To **analyse** what user-requirements analysis has been undertaken in the past to define the strategic development of portals in this area, specifically with reference to the RDN and AHDS.

2. To **survey** current user-needs, as defined by their information search and access strategies and patterns by arts.

3. To **identify** the future needs in the UK arts and humanities research communities for the development of more refined, personalisable, interactive, integrated portal services ['portlets'].

RePAH's overall objective is to make recommendations on the basis of the above for the **further development and possible cross-linking** of these services, based on a sound understanding of user-behaviour, requirements and preferences.

3.3 Definitions used in this Report

There is no agreement in the literature on what the term 'portal' means. That has not, however, stopped its being frequently used in the context of environments of networked information. In reality, the term is used within a **spectrum of meanings** that reflect one or more of the following distinct, but complementary functionalities:

- An IL [information location] that **links** distributed sites of information [manually-harvested ↔ mechanically-harvested LINKS]
- An IL that **evaluates** sites of information [searchable resource descriptors ↔ customised resource descriptors to particular individuals/needs]
- An IL that **federates** distributed sites of information, encoded with metadata [structured metadata in forms and search-results that are readily understood by the user ↔ structured metadata where the user needs to be assisted in understanding the origin, form and results of the data]
- An IL that **orchestrates** network search environments and applications to provide additional or personalised information for the user [multiple functionalities based on cross-searching or metasearch ↔ portlet applications, personalised access, processing and delivery of such information]
- An IL that **manages** access to networked information on a predetermined basis [managed access within an organization/institution ↔ managed access to information outside an organization/institution that has been commercialised or otherwise protected]

On the basis of these functional spectra, which are not exclusive to one another, we propose to assign the following meaning to the terminology we adopt in this report:

a) **Gateway:** A gateway places the emphasis on providing **links** to distributed sites of information. A gateway service may also evaluate the resources enumerated. Within the RDN context the services provided by a hub, an organisational entity comparable to a subject centre.

b) **Portal:** a portal places the emphasis on **federating** distributed sites of information. This conforms to the JISC definition:

> *Technically, a portal is a network service that brings together content from diverse distributed resources using technologies such as cross searching, harvesting, and alerting, and collate this into an amalgamated form for presentation to the user. This presentation is usually via a web browser, though other means are also possible. For users, a portal is a, possibly personalised, common point of access where searching can be carried out across one or more than one resource and the amalgamated results viewed. Information may also be presented via other means, for example, alerting services and conference listings or links to e-prints and learning materials.* (JISC 2003e)

c) **Managed Information Environment:** a managed information environment places the emphasis on **managing access** to information, structured for the use of those within that environment. These employ 'portlet'-style technology to provide additional or personalised information services for the user.

3.4 Methodology

3.4.1 Stakeholder analysis

Our research process began with discussion and definition of the stakeholder groups for this study [Appendix A2]. We identify these as:

- Researchers
- Service providers
- Funding bodies

The main target user group, 'Researchers' was further refined as:

- Postgraduate [PG]
- Postdoctoral [PD]
- Research Assistant [RA]
- Faculty
- Independent researchers [IR]

3.4.2 Research questions

The project aimed to collect four different kinds of data related to research portal needs:

1. Information about users' awareness and attitudes with respect to currently available online services and tools including such gateways and portals as currently exist.
2. Information about user's information discovery strategies and internet usage.
3. Information about patterns of recent user-activity in relation to the RDN subject hubs and AHDS.
4. Information about users' responses to what future portal developments can deliver.

3.4.3 Research methods

The research methodology adopted draws on two complementary paradigms. Firstly, the main thrust of our investigation was historical and evaluative, that is to say it aimed to

'discern patterns of use and to collect qualitative statements regarding the use and improvement of the various [….] components'. In broad terms this approach can be situated within the **design-based research paradigm**. Design-based research is carried out in a continuing cycle of design, enactment, analysis and redesign. Within this study we have picked up the cycle at the enactment stage, conducted an analysis of the current picture and used the redesign stage to explore user-reactions to possible future functionality through prototype demonstrators. Secondly, however, the focus on primarily qualitative data about peoples' behaviour and attitudes situates this study also within the domain of **applied social-science research**. Within these two broad frameworks a **mixed-method approach** was adopted, combing quantitative and qualitative techniques to achieve the best results in terms of addressing the information types required and allowing the possibility of triangulation of different data types.

3.5 Data Sources

Data was provided as follows:

- Published Reports and Evaluations of Service Providers
- Questionnaire survey
- Focus Groups
- Delphi
- Server log analysis
- User trials

3.5.1 Published Reports and Evaluations [see Appendix A3]

We examined all available Annual Reports of the AHDS and its constituent branches, as well as the two RDN 'hubs'/'portals' in the period since their creation. We paid particular attention to any user-evaluation work that was undertaken. The more detailed evaluation of this evidence is considered in **Appendix A3.**

3.5.2 The Questionnaire [see Appendix A4]

Survey research aims to measure certain attitudes and/or behaviours of a population or a sample, most often by asking respondents for information. The survey instrument used was an online questionnaire on the project website, linked to from a number of related sites, in particular AHDS and Humbul. Potential respondents were alerted to the questionnaire through links embedded in these websites, plus email lists, newsletters of professional associations, online community websites and journals.

3.5.3 Focus Groups [see Appendix A6]

Focus groups combine elements of two other social-science research methods: interviewing and participant observation. The advantage of focus groups over interviewing is the explicit use of the group interaction to generate data and insights that would be unlikely to emerge without the interaction found in a group. An important aspect of conducting focus groups is the topic guide. The topic guide, a list of topics or question areas, serves as a summary

statement of the issues and objectives to be covered by the focus group. It also provides the initial outline for the report of findings. The topic guides and evidence from the focus groups is presented in detail in **Appendix A6**. To conform with data protection legislation, the transcripts of the focus groups will not be archived with the rest of the project. The first round of focus groups addressed research questions 1 and 2. The second round was used as part of the iterative process to gauge user-reactions to different future scenarios of portal development by discussing a prototype 'demonstrator' portal, discussed in detail in **Appendix A8.**

3.5.4 Delphi [see Appendix A7]

The Delphi technique is a systematic, iterative, predictive research method based on independent inputs from a panel of experts. The objective of most Delphi applications is the reliable and creative exploration of ideas or the production of suitable information for decision making. Delphi is based on a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback. It measures the degree of consensus among the panel regarding future events where the decisive factors are subjective, and not knowledge-based. The technique reaps the benefits of group decision making while insulating the process from the limitations of group or peer pressure and overly dominant individuals. The technique involves iterative rounds of questionnaires where responses are re-circulated so individuals can reconsider their opinions in the light of the responses of the panel as a whole. Our Delphi Exercise on Portals is further examined in **Appendix A7.**

3.5.5 Web server log analysis [see Appendix A5]

Web server logs record simple traffic statistics and data such as the numbers of page requests per month and originating addresses of page requests. Deep log analysis (DLA) uses web logs from a server and after the normal process of analysis links the information with site user profiles, or demographics, to produce a 'deeper, more meaningful data' picture of overall site usage. It is a four stage process:

- **Data definition** where recording the procedure and statistical significances are agreed.
- A series of **pre-defined metrics** are used to ensure the data is analysed in line with organisational goals and policies.
- Enrichment of usage data with **demographic data**.
- Identification of **questions concerning information-seeking behaviour** that need to be clarified by other user investigation.

An example of working metric definitions are:

- **User**. A user is effectively a computer; sometimes that computer represents an individual, in other cases a number of people. User identification can be based on a combination of 'IP' number and browser details, or by use of cookies.
- **Sessions**. They are identified in the logs by a session identification number. Logs include a session beginning tag and a session ending tag, which enables time calculations as well.
- **Items viewed/requests made**. The key usage sub-metrics are: type of items viewed, number of items viewed in a session and return visits. These sub-metrics offer good

platforms for characterising and comparing the information-seeking behaviour of sub-groups of users.

A more powerful way of examining the number of items viewed is to categorise search sessions by the number of items viewed. This is called **'site penetration'**. Research on the subject has shown that many web users graze lightly, examining just a few items/pages before they leave with no substantial content consumed, although knowledge might have been gained. High levels of penetration can be assumed when there is evidence of:

- 'natural movement' through the site
- the investigative nature of information-seeking
- the presence of an embedded search engine and other retrieval aids
- return visits to a site.

3.6 Problems with the Data

We have taken into account the following deficiencies in our data:

- **Incompleteness.** Annual reports are not available for all the services since their creation. Some user-evaluation undertaken in-house was not published. The evidence from web-logs was not archived for one of our services (Artifact) for the period of a full year.
- **Unrepresentativity.** The target population for our population was too large for us to survey comprehensively. We adopted a sampling approach in our focus groups. A non-probability sampling approach was used (self-selected sampling) in which the respondents chose whether to be included in the survey. Although less reliable than simple random sampling, stratified random sampling, or proportionate sampling, where care is taken to ensure that the sample is not biased in some way, this was the only option available to the project. The responses may not, therefore, be fully representative of the population as a whole. In particular, it is reasonable to suppose that the respondents are biased to some degree *in favour* of ICT since (a) the subject of the survey was the use of ICT in research and (b) the survey questionnaire itself was itself available only via the Web.
- **Comparability.** Our evidence was not always comparable. The methods of presenting usage data in published Annual Reports are not comparable with one another, and often on unclear bases.
- **Disaggregation.** Because of the complexities of the server-structure within the AHDS, we do not believe that our web-log analysis covered all the site activity at all the sites. It proved impossible to strip out the 'internal' AHDS log referrals in a way that satisfactorily disaggregated site consultation from other traffic.
- **Interpretation.** Deep-log analysis, in particular, poses problems of interpretation of the evidence it affords. Although it is based on what can seem very impressive samples, these can camouflage substantial differences between individual user groups. It enables us to map the digital environment of the service providers more accurately but it cannot, on its own, provide much by way of explanation, levels of satisfaction recorded, and the impact of the consultation upon the user.

For these reasons, this report is based on a triangulation approach, looking for the reinforcement of the evidence from one set of data in another before drawing strong conclusions on the basis of it.

4. The Arts and Humanities Research Community

4.1. Subject-Domain Analysis

What is the profile of the 'arts and humanities research community'? Our analysis is limited to an answer to the question that is sufficient to understanding its resource discovery needs. We understand it as **non-homogeneous, institutionally diverse,** and **variegated** in its research patterns. In comparison with other scientific disciplines, however, it has some **distinctive cultural approaches** that affect the way in which it approaches its resource discovery needs.

4.1.1 How many disciplines make up the 'arts and humanities research community'?

We have taken the eight panel profile of the AHRC, and mapped onto it the RAE subject panels. We have then compared these with the subject coverage of the RDN portals and AHDS service providers **[A2.1]**. The **subject breadth** of the community needs to be emphasised, since it underlines all the difficulties of subject-specific resource discovery in this area. Twenty-five of the 69 2001 RAE Panels fall within this area. Many of the subject areas are small and discreet. Many research practitioners would probably not regard themselves as part of anything as coherent as an 'arts and humanities research community'. The current electronic resource-discovery aids do not provide an 'even provision' to the disciplines in question. The least well-served area is Panel 8 [Philosophy, Law, and Religious Studies]. It is no coincidence that this was the area where we had the greatest difficulty in establishing a reliable user-requirement response. Other areas are clearly only partially served by the current providers. At no stage in our investigation, however, was any comment made to us about this unevenness of provision. **We registered no strong sense of perceived comparable inadequacy from practitioners in any particular disciplinary area.**

4.1.2 How many are involved in 'arts and humanities research'?

We do not know the answer to this question. Working on the basis of our initial stakeholder analysis (**3.4.1**) we used the RAE2001 returns to provide us with an overall pattern of **research population** by AHRC Subject Panel [**A2.2**]. Just over 12,750 practitioners were recorded as research-active in that review. Although the statistics are now five years out of date, we do not believe that the overall pattern will have greatly changed.

Of course, these figures do not take into account the other stakeholders that we have identified. In the case of Arts and Humanities **PGT and PGR**, we have used the statistics for HE qualifications obtained in the UK for 2004-5. These are broken down into very broad categories. Just over 27,000 individuals successfully completed their degrees in the Arts and Humanities during that period. Applying appropriate year-cohort multipliers, this would indicate a **PGT and PGR** demographic of 35-40,000 [**A2.4**].

Arts and Humanities **RA** [Research Assistants] and **IR** [Independent Researchers] are categories that elude us. There is likely to be a varying penumbra of users according to the discipline in question. The Archaeology portals, for example, will be used by UK archaeologists from a variety of backgrounds, of which only a small proportion (perhaps around 15%) are within HEI [**A2.5**]. This is probably an exceptional case. We imagine that a multiplier in the range 10/50% of HEI established posts is a reasonable working hypothesis (i.e. between 1,275 and 6,375). According to Abbott and Beer (2006) there are some 30,000 employed in the music, visual and performing arts sector.

Of course, the RDN portals were designed to be used for both teaching and research purposes. They have a wider remit than simply for conducting research. Our effort has not been to calculate the overall demand for portal services, simply that part of it which we might define as (at least in part) driven by a research agenda. For the purposes of this report, our assumption is that a reasonable estimate of the per-annum demographic cohort for Arts and Humanities portal services is of the order of **c.50,000-60,000**.

4.1.3 How are they scattered?

We further categorised the HEI return for each subject area in the RAE2001 exercise by size in order to achieve a picture of the subject distribution. It confirms what is generally known. Research-active Arts and Humanities units are generally small (under 10) to medium-sized (under 30). Only a small minority of units were recorded as large (over 30) or very large (over 50) [**A2.2**]. This pattern necessarily has an impact on the research information needs of users, making distributed information generally more significant as a way of keeping abreast in particular research fields.

4.1.4 Mapping Arts and Humanities Research Activities

Arts and Humanities research is variegated in nature. In pursuing the research for this project, we needed a **road-map** to understand it better [**A2.4**]. The diagram emphasizes that:

- Arts and Humanities researchers have, in addition to their **core** research activities, a **penumbra** of research-related activities, for which there are significant information resource-discovery needs.
- Arts and Humanities researchers have both **individual** and **group-based** research activities
- Arts and Humanities researchers are not universally served by the current information resource-discovery channels in all these areas

4.2 The Characteristics of Arts and Humanities Research

How should we characterize the fundamental characteristics of Arts and Humanities research? The question takes us well outside the brief of this project. But some appreciation of **disciplinary difference** is important because there is a risk that models of scientific

activity derived from the pure or applied sciences are applied inappropriately and that, as a consequence, information-discovery tools are not fit for purpose.

We have understood the differences between disciplines in terms of their **knowledge structures** and their **cultural characteristics**. The resulting model, outlined in a classic formulation by Becher (1989) and summarised by Fry (2004), emphasizes the following fundamental characteristics of Arts and Humanities [**A2.7**]:

- **Reiterative knowledge-gathering processes**. These are typically **open-ended**. They do not depend on **clearly-defined taxonomies**. They are suspicious of **categorised information**, preferring often to deal with particulars, qualities and complication. They often prefer to undertake their own **ontological evaluation** of knowledge.
- **Individualistic and pluralistic cultures**. The research agendas are defined at an individual level and the communication networks are localised, extensive and informal. The research agendas are often not well-understood beyond the particular individual in question. The research is loosely structured. There is sometimes an underlying 'counter-culture' which is suspicious of conformism and authority.

It should be emphasised that these are models, and not stereotypes. All patterns have exceptions, and these descriptors can readily be challenged with counter-examples. That said, these are models that we have found useful in our analysis, because they have led us to some **fundamental features** underlying Arts and Humanities research behaviour as regards resource discovery and information needs:

- All machine-accessible resource discovery depends upon implied taxonomies of knowledge. Pre-structured knowledge is not always greatly appreciated. The need to be assured about the authority of a particular digital resource is balanced by the assumption that the individual researcher has specialist skills with which to assess its authority. Arts and Humanities researchers are as likely to want to develop their own resource discovery trajectories as to follow those dictated by others.
- Categorised information is often not ideal when one is interested in the particular, or the anomalous. Resource discovery can provide pointers in the right direction, but Arts and Humanities researchers readily accept that individual resource discovery is fundamental to their research. The reiterative processes that this involves are a key constituent in the pursuit and definition, of their research agendas.
- Arts and Humanities research is still mainly defined at an individual level. Information resource development has to be based upon these individual needs.
- There is likely to be a significant relationship between the relative lack of 'mutual dependence' among Arts and Humanities researchers, their 'task uncertainty' and the ways in which digital resources are produced and utilised. Although the documented evidence for this is based on exemplar fields that are not specifically within the Arts and Humanities, the trajectories are applicable [**A2.8**]. The arrangements for collaborative research and disseminating research results are personalised, localised and decentralised. Informal communication depends on individual groups and specific social networks. Digital resources, where they exist, tend to be field-based and similarly localised. Alternatively, there is a reliance on commercially produced generalist digital resources.

- Arts and Humanities 'e-infrastructure', apart from the service-providers that we are investigating, tends therefore to be determined at the level of the employing institution rather than the field or discipline, or higher.
- We have to take into account a 'counter-culture' (which we encountered most noticeably in our investigation of some of the disciplines in the Arts, where information resource needs and research agendas are often articulated in terms of 'diametrical difference' to prevailing trends. Artists predominantly wish to be known for distinctive differences and not part of the crowd, and any associations with an established authority risked being influenced too much by dominant trends.'
- Arts and Humanities researchers want access to information, irrespective of the medium in which it is available. They are used to working in fields where there is a very mixed economy of resources, electronic and physical. Journal articles are important, but so are printed books. E-prints (pre- and post-) are markedly less significant than in the physical sciences and engineering. Electronic bibliographical information is therefore of critical importance to Arts and Humanities researchers. Within the UK's Higher Education Institutions there is a growing movement to develop institutional repositories. Those being established are within the sciences and social sciences, but as of yet they have not developed as vigorously within the arts and humanities.
- There is less emphasis on communicating work-in-progress and more emphasis on formal ways of disseminating information. There is consequentially less emphasis on lead-times for accessing research-sensitive information and results.

4.3 Conclusion: Arts and Humanities Information-Seeking Behaviour

Arts and Humanities scholars want access to information irrespective of the media in which it is available. They expect a good deal of that information to be available digitally, and to incorporate that into all area of their research work. There are **high and growing levels of expectation** as to the availability of materials in digital form. Those expectations are being fed by the **exponential growth** in the content of Arts and Humanities digital libraries by a wide variety of different content creators and contractors. We have no estimates of the current scale of digital libraries and content in the Arts and Humanities but it is clear that much of it is being generated outside established scholarly and research channels. The **need** for **quality resource discovery tools** is, therefore, higher than it has ever been before. Equally, the **need** for **quality assurance** of what is provided is, also, higher than it has ever been before.

Our research has reinforced the conclusions of an earlier, broader survey in 2005 as to the information-seeking behaviour of Arts and Humanities scholars [**A2.8**]:

- The **resources** that they most seek access to are: books, articles and non-textual materials, in particular digital image collections.
- The **search tools** that they most use to find these resources are: search-engines, bibliographic resources; and, subject-specific abstracts and indexes. Subject-specific portals are not currently a way by which many Arts and Humanities scholars find their resources. They use works of reference more frequently than they consult such gateways.
- The **informal resources** that they use include: emailing colleagues, asking colleagues, reading email newsletters and posting enquiries on email lists and bulletin boards.

- The **problems** that they encounter in accessing resources are dominated by the following: the particular HEI does not take the books/journals/subscribe to the databases the individual researcher needs; the need to travel to access resources which are either not available in digital forms, or not distributed digitally.
- Key research information is only available in proprietary digital media. This is a particularly significant problem in some areas of the Arts and Humanities research domain, especially in the Visual Arts (film, photography, art) and some large historical datasets.
- Overall the **perception of problems** in accessing resources do not appear to be significantly greater (overall) from those in other disciplines.
- **Habit and familiarity** play a large part in information-seeking behaviour. There is a recognised trade-off between the amount of time a user is prepared to spend in learning about an information resource tool, and their choice to use it. Arts and Humanities Scholars make the equivalent of a personal cost-benefit analysis when it comes to being prepared to use a particular resource-discovery tool, reflecting a differential sum of the following elements:
  - speed and proficiency
  - transparency of results
  - perceived relevance, density and completeness of the resources discovered
  - authority of the results recovered
  - ability to manipulate (download; transfer) the results
  - recommendation from others as to its utility
- Because of the dispersed nature of the disciplines involved, formal programmes for training and familiarization in the Arts and Humanities are difficult to deliver and rarely cost-effective. On-line tutorials for resource discovery have been extensively developed by the RDN network. Our users have not, however, made significant use of them. In reality, most users concentrate around a limited number of frequently-consulted resource discovery tools – sometimes as few as 4-5.
- The relative agility of the informal networks of communication in the Arts and Humanities means that there is a good deal of lateral ‘shared knowledge’ within disciplines about what resource discovery tools are most fit for purpose.

5 User-Requirement Analysis for Portals in the Arts and Humanities

5.1 The Documentation

The bulk of the Project's work involved the undertaking of this user-requirement analysis. This involved:

- a thorough understanding of the evolution of the current service provision on the basis of their published literature [**A3**].
- a triangulation of user-needs analyses, using the established techniques of the applied social sciences. These included a first round of 'focus groups' and interviews [**A6**], an online questionnaire [**A4**], and an analysis of the web-log data of the current service providers [**A5]**.
- an iterative process, enabling users to articulate their needs. This involved a Delphi exercise [**A7**], the development of a set of mock-up demonstrators of potential portal developments [**A8**] and a final set of user-trials of these developments [**A9**].

This part of our report provides an overview of the detailed findings in these individual work-packages and reports.

5.2 The Arts and Humanities Portal Problem

It will be helpful here, before entering into the more detailed issues which emerge from these reports, to outline what the underlying 'Arts and Humanities Portal Problem' appears from this evidence to be. At the risk of over-simplification, we present it as a series of propositions:

- Arts and Humanities scholars need access to a very wide diversity of research materials in digital media, growing very rapidly, furnished by a variety of commercial and non-commercial providers, in different formats and standards, often addressing different disciplinary needs and agendas, maintained by different bodies, only some of which are UK-based.
- The current subject portal and digital archive repositories do not provide access to the majority of these materials. They do not harvest the metadata from them. They do not provide interoperability. Nor do the other institutional portals.
- There is therefore a mismatch; users have diverse resource-discovery needs, which the resource discoverers do not, in the main, satisfy.
- There are understandable reasons for this mismatch. They include the following
  - the RDN subject portals are locked into an out-dated methodology of manual harvesting and resource authentication.
  - the AHDS concentrates on the archiving of digital materials, but does not archive their functionality. They thus become fossilised deposits for the user, relatively inaccessible. Again this is partly due to the mission of the AHDS to simply collect from the research community and not for it.

  - the providers have not developed a coherent strategy for understanding evolving user-needs
  - rapid technical evolution has meant the swift emergence of new technologies for individually managed information resources within more collaborative frameworks.
- The 'portal problem' has been 'latent' in the Arts and Humanities because more sophisticated commercial internet search engines have answered some of the immediate needs. But these search engines are relatively inflexible. Users are not convinced by their ranking systems. They are unsure of the authenticity of the information they provide and overwhelmed by its inherent redundancy. Increasingly, Arts and Humanities users are becoming aware of the problems that these internet search engines do not address: access to online digital resources which have not been opened to harvesting by search engines; and the related lack of interoperability between digital libraries, each hermetically sealed from one another.
- Yet emerging technologies do provide potential solutions to this mismatch problem. With emerging metadata standards, there are greater possibilities for automatic harvesting techniques. With better desk-top tools, there is more opportunity for the personal management of resource discovery. With different management of digital resources, functionality can be maintained along with datasets. The research communities can themselves be more involved in the provision of metadata for digital resources, and in authenticating them.
- This depends on a mediated environment through the widespread adoption of a common authentication system.
- The overall objective is to create a managed digital research environment in which access to resources is increased, alongside a greater interactive functionality in relation to them. The possibility for a greater array of scholarly communication needs to remain under active consideration.

5.3 Patterns of Arts and Humanities Digital Research

Our investigation confirms the ubiquity of digital resources for Arts and Humanities research. Over 60% of respondents to our online questionnaire regarded digital resources as 'essential' to their research [**A4**]. These resources were used 'extensively' by a majority of our respondents. Digital resources were emphatically not restricted to teaching delivery. In fact, whereas only a minority of our online questionnaire respondents thought it had changed the way that they taught, a clear majority thought that it had altered the way that they undertook their research. The first set of focus groups reinforced that sense – emphasizing that the existence of digital resources had changed the way that their agendas for Arts and Humanities research had been formulated, as well as transforming the way in which the material for answering those research questions was discovered and analysed [**A6.2.1**]. At almost every stage of the research process, digital resources have changed the way that Arts and Humanities research is now conducted.

We should nuance that conclusion in three important respects:

1) Our first focus group and our questionnaire evidence suggests that it has not yet profoundly influenced the way in which Arts and Humanities **publication** is conceived, where digital publication is not yet perceived as a logical consequence of the changes to research processes [**A6.2.1**].

2) This change in research process has not fed through to the habits and procedures for **personal digital data archiving**, where (according to the evidence from our online questionnaire) our respondents are not particularly engaged by the issues [**A4.3**].
3) This change has not yet had a substantial impact on the means **of scholarly communication** in the Arts and Humanities. The evidence from our first set of focus groups and questionnaire responses was here confirmed by the lukewarm reactions to the possibilities for more elaborate forms of online scholarly communication that we discussed with them. The sophisticated, lateral research networks in the Arts and Humanities seem adequately served by the current range of email, bulletin boards, and blogs (only occasionally used for research purposes, according to our research) [**A4.5; A6.2.3**].

Our respondents emphasised that their research agendas were flexible, open-ended, established on a predominantly personal basis, and multiple. Thirty-one percent of our online questionnaire respondents regarded themselves as not having one single research domain. Eighteen percent said that they had several. General scholarship was regarded as central to over 60% of our respondents' work. They did not regard themselves as working in hermetically-sealed specialist areas. Rather, they saw themselves as researching overlapping domains, in which there were a series of core issues which could be tackled from a variety of differing angles. They accepted that there was a distinction between 'core' and 'penumbra' research, although they wanted to keep many aspects of the 'penumbra' of research (e.g. refereeing articles for a journal; refereeing research proposals, etc) at arms' length wherever possible [**A2.9**].

What digital resources did our users find most useful? How did they find them? Here, we were impressed with the very broad range of digital libraries, bibliographical tools, encyclopaedia, dictionaries, and other online materials indicated to us by the respondents to our online questionnaire [**A4**]. Our focus-group participants were anxious to reinforce the message that they were practical-minded and instrumental in what they used, concerned about access to them, and resourceful in the way in which they searched for more materials of relevance to their work [**A6.2.2**]. The patterns were quite discipline-specific. Their needs were extensive, and often indeed broad-ranging. The range of research questions was very wide. Our questionnaire respondents referred to their extensive online bookmarked resources. Our focus groups reflected researchers who expected their research methodology to involve a high degree of proficiency in resource discovery. They learnt about resources from other practitioners by lateral means of communication. Their levels of formal initiation or training in the digital resources that they used varied from little to none.

The range of service-providers for resource discovery was correspondingly varied. University Library services and catalogues (OPACs: COPAC) are evidently significant. Internet search engines are regularly used. Users are not promiscuous, but they have formed their views on the perceived cost-benefits of using particular resource-discovery strategies for their purposes. Those views are necessarily framed on sometimes a less-than-perfect appreciation of the possibilities and range of a particular resource discovery tool or digital library.

We were particularly interested to discover the impact of the RDN subject portals and the AHDS as resource discovery tools in this pluralist environment. We first studied the evolution of these two services since their inception about a decade ago [**A3**]. We noted a

degree of patchiness in the coverage of the Arts and Humanities disciplines [**A3**]. The services themselves had evolved independently of one another, although they had complementary missions in the resource discovery area. Although the pattern varied across the services, there is no coherent strategy for consulting users and discovering their needs. After a decade of development, the services are not interacting well with one another at the resource-discovery level. So, while the AHDS and the RDN (Intute) have their collection metadata in OAI (Open Archive Initiative) formats, available for harvesting, it is not picked up comprehensively by the either of them. Equally, although Intute was launched in July 2006, at the time of writing [September 2006], there is almost no mention of its existence on the AHDS site. Because of the breadth of Arts and Humanities digital resource needs, and the diversity of their information providers, resource discovery services, tools and mechanisms need to be based on a strong collaborative framework, engaging with the major research libraries, archives and other creators and holders of digital content. The AHDS has developed important links in individual subject domains. The RDN, however, appears to be more limited in its collaborative frameworks.

Our users were clear about the potential importance of authenticating digital resources, although they were not so sure about the resource descriptions in the RDN subject-portals. In particular, they had no sense as to how often they were up-dated, and what range they covered. Those that had used the subject portals, took the view that they tended to be useful at the beginning of a research enquiry, but to become progressively less relevant as it deepened. As for the AHDS, although the number of its resources downloaded seems to be increasing, none of the participants in our focus groups or questionnaire admitted to having downloaded such collections. Where the AHDS harvested data, generally in collaboration with outside partners (as in e.g. Heirport the Historical Environment Information Resources Portal), it plays a significant, perhaps pivotal, role in particular agendas of Arts and Humanities research.

So our evidence is unambiguous about the relative insignificance of the RDN portals and AHDS for most research purposes for the Arts and Humanities practitioner. Only 4% singled them out as relevant to their digital resource needs and resources on our online questionnaire. Our web-log analysis tends to confirm that order of percentage for UK researchers as regards the site usage for Humbul and AHDS [**A5**]. (For Artifact, we had only fragmentary statistics to rely on, and the service has been in existence for a shorter period, with less time to build up its collections.) The evidence for Humbul 'site penetration' by users is more ambiguous. Academic users certainly tended to spend more time at the site than other users, and be more determined in their browse strategies. But users in general tended to come to RDN resources from external search engines than from an internal search of the site. This may reflect the fact, noted in our appendix that Humbul's OAI metadata was offered for harvesting by Yahoo where its hits rank high in search returns. It might also, however, suggest that users were consulting Humbul as part of a broader online search for materials. Although a significant proportion of those we have identified as these academic users went on to consult the summary description of a digital resource, only a small minority of the users tended to go through to link to it.

The AHDS was equally classified by our online questionnaire respondents as one of several resource discovery channels, alongside 'news and media' and the 'Web of Knowledge', of about equivalent relevance to their resource discovery needs as the RDN portals (4% of our online questionnaire respondents)[**A4.3**]. The web-log data for the AHDS suggested a rather smaller percentage of site-usage for UK researchers than for Humbul. But there are some

serious potential problems with these statistics. We are not sure of the extent to which individual AHDS sites were visited separately from the AHDS server, and whether this is recorded in its web-logs. Equally, we are not convinced that the internal traffic of the AHDS within its distributed hub-structure, has been adequately stripped out from our web-log data. Our focus groups, and associated analysis undertaken for a separate review of the AHDS service [Brown et al, 2006], emphasised that the users of the AHDS included several disparate groups, with different and non-complementary needs. Users reported that the resources they found via the AHDS were often not relevant to their needs, being either too niche or too generalised, the result of collecting small, disparate data sets, with large gaps within and between subjects. As with the RDN, there is a problem of 'critical mass', an essential prerequisite to the success of a resource-discovery tool. Our users retained, however, a positive view of the AHDS, even if they do not use it much. They appreciate its role in other areas, but simply have alternative ways of meeting their digital resource discovery needs that suit them better, or which they know better.

The internet search engine emerges from this study as an immensely useful digital resource discovery tool. In certain disciplines (Classics, Ancient History, Visual Arts and Media), Google was cited by our questionnaire respondents as their central tool for acquiring digital information. And, even though our web-log data revealed that our users deployed a variety of proprietary search engines, their simplicity and speed appealed to our users, for whom a key determinant in their cost-benefit analysis of resource discovery tools was whether it saved, rather than cost them time. That said, our users were also often aware of the limitations of their internet search engine of choice. Our users told us of their frustration at its lack of sophistication (a frustration that is, we concede, often a function of their lack of familiarity, or perhaps understanding, of Boolean search parameters permitted in Google's advanced search facilities). They were suspicious of the ranking of the hits returned, but were equally overwhelmed by the information redundancy which accompanies search-engine retrieval on internet materials. They were, above all, concerned about the fact that search engines do not search a great deal of digital content that is relevant to their needs; and, equally, they are frustrated by the lack of interoperability between different libraries of digital content.

The issue of 'access' runs through all our enquiries. Access to online journals was emphasised in the first focus groups, and reinforced in the online questionnaire and in our Delphi analysis, where it consistently came top of the list of user-needs [**A4.3; A5.7; A6.2.5**]. But the issue of access was also raised in respect of proprietary digital content of various kinds, specific to particular disciplines. The issue was sometimes presented in terms of an implied trade-off in resource terms, with our users wanting to see the investment of scarce resources in widening the local access to digital content through licence and content purchase rather than increased investment in resource discovery. At the same time, our focus group research practitioners were also aware that 'access' to digital content was not a simple matter of 'Oliver asks for more'. Access was only fully beneficial to the user when it was linked to enhanced resource discovery, and particularly interoperability.

Interoperability was another major theme running through our enquiries. It tended to affect some disciplines more than others; but it was present at some level for them all. The problem is evident to many practitioners. As digital content becomes richer and more diverse, so the independent platforms on which it is consulted multiply. As interoperability becomes more important, so the potential for a next-generation resource-discovery portal grows. But the current providers do not harvest a great deal of content. Our users, in so far as they were

familiar with the RDN subject portals, were very unclear about what data, if any, they harvested. By contrast, they understood very clearly the scope and range of the COPAC catalogue and other metadata harvesters in their particular subject-domain.

Another important issue raised in the course of our investigations was that of resource authority and quality control. Our users wanted to have assurances of quality. This emerged in the first focus groups [A6.2.4]. It was reinforced in the cycle of Delphi forecasting. But they also remained suspicious about who was undertaking the quality assurance. They wanted to have a role in the process, rather than have it mediated to them.

There were a number of other issues that our users raised. In Music and the Performing Arts, there were specific technical issues about retrieving and downloading very large files, and having the software with which to consult and manipulate them. In the Visual Arts, there were specific issues around digital images, many of which echoed the recent report on the subject from AHDS Visual Arts [AHDS Visual Arts, 2005a], where issues of access and interoperability are particularly acute. The question of digitally archiving functionality with content was raised in several of our enquiries, even if our users were not fully aware of the costs and difficulties of doing so. Questions of copyright and the use of digital content, and how to cite it, were also touched on as among the issues in our users' minds.

5.4 Portal Futures

The main thrust of the second half of our study was to investigate what features of the emerging ICT technologies for advanced resource discovery and communication would be most likely to meet the research strategies of the Arts and Humanities practitioner. In the most general terms, we identified these emerging technologies as providing tools for resource discovery, workflow management and communication. We concentrated on the greater possibilities for desktop interoperability, for more personalised management of resource discovery needs, and for the involvement of the research community in the provision of metadata for digital resources and for their authentication. The methodology in this second phase was adjusted to obtain formative evaluation feedback. It is now standard practice in product design and development that user-testing involves an iterative process of refinement and modification to adjust product development to meet user needs. The design of the Arts and Humanities research tools of the future should be no different. This was the purpose of our Delphi exercise and our final phase of user trials of portal demonstrators [**A7; A8**].

The results of the Delphi exercise [**A7**] were combined with the outcomes of the interviews, focus groups and questionnaire results to generate a list of desiderata. From these, a series of wireframe graphical mock-ups were created for evaluation purposes.

The shortlist of requirements that emerged from the earlier engagements with users was:

1. Ability to conduct simple searches across disparate data collections.
2. Ability to share ongoing research work, notes and ideas with research collaborators.
3. Ability to publicise and disseminate completed work, and comment upon other such work completed by peers.
4. Ability for comments / reviews / peer-moderation to influence searches by flagging up content that has been deemed legitimate.
5. Ability to browse through disparate resources as well as search.

6. Moderation, submission and creation of content by community as opposed to central authority.
7. Inclusion of news feeds and current event information.
8. Ability to create new searches within the context of existing searches.
9. Inclusion of background information about the creator of a piece of content, which would allow the user to assess their 'point of view'.
10. Inclusion of IPR and copyright information about resources.
11. Tracking of the user's use of resources discovered via the portal.

NB the requirement to access a wider range/all online journal content was not explicitly included in our requirement analysis, since the issue is one of content rather than functionality. But access to journals is subsumed within requirements 5, 6, and 8 above.

The demonstrators were designed to be modular in nature to allow for their extension and personalisation. They do not cover all the potential functionality, but they provide a mock-up of what a managed, customizable, portal research environment might look like. Our mock-ups focused upon the following features:

- **The system homepage:** what the researcher would see when they logged on using their Shibboleth or other user authenticated account.
- A typical **set of search results** that the user would see after conducting a Google Scholar search from within the system framework.
- An example of an **annotated web page** that a researcher has visited.
- An example of the **usage history** for a resource: in this case a paper in an online repository, though it could be a website, an online article, an entire journal, a dataset or a book from the library.
- The researcher's **bookmark** management system. Again, all types of resources could be bookmarked, not just web pages.
- The researcher's **online CV**. This would contain a short biography, their current job title and location and information about their projects (current and previous), their professional associations and a record of their publications.
- A **project management** page showing details of the project team and linking to all shared documents generated by the project, as well as email and shared bookmarks that team members had collected.
- A list of the researcher's collaborators or **research partners**. This page would also provide access to all the documents shared by research partners, all the email sent by and to them, and all the bookmarks they have shared, as well as links to their online CVs.

The resulting mock-ups are included in **A8**.

Which of these various potential features did our practitioners like most, and which did they find least attractive? Our final phase of user trials, detailed in **A9**, nuanced our conclusions significantly.

They were positive about the potential that the proposed resource management tools offered. But they wanted simple tools that required little or no input of time or personal engagement. They did not want tools that duplicated existing systems. They were wary of over-elaborate resource-discovery frameworks.

Workflow Management tools that give the researcher greater personal control over digital project resources, especially more evolved **bookmarking features** were identified as the most valuable. Some form of automated **copyright management system** to facilitate the growing concern with usage permission and intellectual property rights was also highly valued [**A9.3.2**].

Resource Discovery tools that provided greater control over web-based resources were highly valued by researchers [**A9.3.1**]. The ability to **filter** the quality of hit returns, **search** multiple databases was at the top of all responses. Journal articles and online bibliographical resources are consistently seen as the most important and regularly consulted online resource by most arts and humanities researchers. The option to have comprehensive access to these was consistently the top request of capabilities that were proposed. However, respondents also consistently wanted these features on their terms, gaining greater control over the searching process and reticent towards the notion of contributing personal time and information to learning a new system. A **web-based news feed feature** appealed to most respondents. Respondents liked the idea of a Really Simple Syndication (RSS) style system which by-passed personal email accounts, but notified users of conferences, funding, jobs and new research publications. But they wanted these features readily customizable, so that they could be switched on and off at will, and adapted to their own specific needs and requirements.

Communication tools were not valued highly [**A9.3.3**]. Users are satisfied with existing communication systems, particularly email. Real-time 'chat' and desktop video-conferencing ranked consistently among the lowest of all tools proposed. However, **collaborative research tools** such as social bookmarking, annotating digital resources, shared document editing, attaching metadata to personally-created digital resources, and contributing to the authentication of digital content online ranked towards the middle of most responses.

Automatic information-harvesting tools were highly valued when applied to digital content to which users wanted access [**A9.3.1**]. The application of these tools to their own 'content', however, was regarded as problematic. Two automatic-harvesting tools were proposed in the demonstrator mock-ups. They proved, as we expected, to be the most challenging elements of our vision of a managed research environment. These were:

a) an automated monitoring of electronic resource usage by research practitioners (to assist in shaping user-needs for the future)

b) an automated harvesting of individual practitioner CV details to provide the basis for a national register of research practitioners and to underpin an authority system in relation to individually supplied rankings and comments on resources.

These both raised issues for our users of the potential infringement of personal privacy. They challenged the predominantly individualistic scholarly culture. There was a concern, particularly marked among early-career academics, about the possible abuse of such information.

It is worth noting that in practice it is already not difficult to create a profile of an individual from the tracks they have left in the web, nor to form a judgement about their relative standing in their field, so the concerns raised here suggest a lack of awareness about the extent to which actions are already monitored and recorded.

5.5 Summary

Our research practitioners did not want to disassociate the development of functionality from broadening access to content. Indeed, given the choice, they would prefer investment in the latter to the former. However, they accepted that the two were intimately related, and that there was scope for additional functionality, so long as it was simple, adapted to their needs, did not replicate functionality available elsewhere, was not monolithic, was capable of being managed by them, and requiring no significant investment of time to understand and use. These are strong design constraints; and there is an implicit, but understandable incompatibility between wanting increased functionality, but not wanting to invest time and effort in understanding how it works.

Our practitioners had elaborate research resource discovery needs, and were resourceful in finding the means to meet them. The key constraint that they expressed to us was the limited interoperability. This was expressed in terms of the very limited metadata harvesting of digital resources in the Arts and Humanities, and the equally limited interoperability as between bibliographical tools and the digital resources that they catalogue.

Our users responded positively to the possibilities of a **personally-managed** research environment. There were specific, realizable functionalities that they identified as being of direct use to them in carrying forward their research agendas. These were in particular, some specific **workflow management tools** and **resource discovery tools**. Researchers wanted greater personal control over digital resources. They readily perceived the advantages of tools which enabled them to integrate searching the web with searching their own hard-drive. They saw benefits to more evolved **bookmarking** features, **personal editing** features, and an **automated copyright management system**. They wanted to be able to **filter** the quality of hit returns, **search distributed databases.** They responded positively to a **web-based news feed feature**, and liked the idea of **RSS feeds** that by-passed personal email accounts.

Our users were not sufficiently familiar with technological developments to be aware that they could play a role in adding metadata to digital content which they created so that it could be automatically harvested. Nor were they cognisant of the possible impact that their contribution could make to the authentication of online digital resources.

It is possible that, with increased IT awareness future researchers will be more tolerant of the various ways in which their online behaviour is tracked, in exchange for the enhanced resource discovery this can afford.

The tools that were intended to foster collaboration and harvest new data required that the users contribute personal data and allow monitoring from among the participating community. However there was great reticence among respondents for this degree of interaction. Anonymity and personal privacy outweighed the benefits of resource access or workflow efficiency.

They did not want additional communication tools. Automatic harvesting of their own digital content, even when it was focused on providing materials for tools that would enable them to access more readily the publications and activities of colleagues, was regarded as problematic.

6. Conclusions and Recommendations

6.1 Conclusions

This was an **information-gathering** project. Our brief was to discover **user-behaviour** and **user-needs** of researchers in the Arts and Humanities in respect of portals. We set out to discover four kinds of information:

1. Information about users' information discovery strategies and internet usage.
2. Information about users' awareness and attitudes with respect to currently available online services and tools, including such gateways and portals as current exist.
3. Information about patterns of recent user-activity in relation to the RDN subject hubs and AHDS.
4. Information about users' responses to what future portal developments can deliver.

Throughout our report, we have interpreted the concept of 'portal' within **parameters of different kinds of functionality**. They all relate, however, to **'resource discovery'**: i.e. what resource-discovery tools did researchers use most? What, in a period of rapidly-changing technical possibilities, will they want in the future?

We have gathered information from a range of sources and, applying methodologies derived from applied social-science and design-based research, allowed one element of the evidence to support and reinforce another, 'triangulating' between different data types, and being aware of the deficiencies in the relevant evidence at each stage.

Our initial analysis of the Arts and Humanities Research Community's research behaviour was substantially confirmed. This is a community which is **non-homogeneous**, **institutionally diverse** and **variegated** in its research patterns. We estimate it as around **50-60,000 active practitioners**, composed of the 'stakeholders' identified in our report – Postgraduate [PG], Postdoctoral [PD], Research Assistance [RA], Faculty and Independent Researchers [RI]. Our 'road-map' of their research activities indicated a **core** and **penumbra** of activities, which are both **individual** and **group-based** [**A3**]. Not all these activities are universally served by the current information resource-discovery channels.

6.1.1 Users' information discovery strategies and internet usage

We emphasise the following features underlying Arts and Humanities research behaviour as regards their digital resource-discovery and information needs:

- Digital resources are now **ubiquitous** for Arts and Humanities research. They are used **extensively**. Researchers believe that they have **fundamentally altered** the way in which they undertake research – i.e. the formulation of their research questions as well as gathering materials for answering those questions. At almost every stage of the research process, digital resources have changed the way in which Arts and Humanities research is now conducted. It has not yet, however, affected the way in which Arts and Humanities **publication** is conceived (although many journal papers end up on the Web). It has not fed through to the habits and procedures for **personal**

data archiving nor has it had a substantial impact on the **means of scholarly communication** in the Arts and Humanities.

- Our researchers emphasised that their agendas were **flexible**, **open-ended**, established on a predominantly **personal** basis, and **multiple**. They did not regard themselves as working in hermetically-sealed specialist areas. Rather, they saw themselves as researching overlapping domains, in which there were a series of core issues which could be tackled from a variety of differing angles.
- Our researchers are **practical-minded** and **instrumental** in their resource-discovery strategies. The patterns were quite **discipline-specific**. Their needs are **extensive** and **broad-ranging**, reflecting their agendas. They expect their research methodology to involve a high degree of proficiency in resource-discovery. Our users are not promiscuous, but they have formed views on the perceived cost-benefits of using particular resource-discovery tools and strategies. These views are necessarily based on a sometimes less than perfect appreciation of the possibilities and range of a particular tool or digital library and of the possibilities of ICTT generally. Both the questionnaires and focus groups highlighted a demographic within the arts and humanities community. There is a clear minority of scholars who are fluent in the use of digital applications and a sizable majority who find little need and/or time to use such tools. This finding is supported by the LAIRAH project's research which noted that there exists,

  > *…a divide between the enthusiastically digital (who appear to be a minority) and the majority of the academic profession. This is worrying, since there is a danger that digital humanities may therefore become ghettoised rather than further integrated into scholarship* [Warwick, et al 2006]

- All machine-accessible resource discovery depends upon implied taxonomies of knowledge. **Pre-structured knowledge** is not always greatly appreciated, however, by Arts and Humanities scholars. Their need for **assurance** about the authority and trustworthiness of a particular digital resource is in tension with the assumption that the **individual researcher has specialist skills** with which to assess its authority, by a **suspicion about who is undertaking the authentication**, and by an **awareness of the complexity that such a process entails**. They want to know about who has undertaken the authentication, and how often it is updated. They learn about the reliability of digital resources mostly from other practitioners, using established and informal lateral means of communication within specialist fields. Arts and Humanities researchers are as likely to want to develop their own resource discovery trajectories as to follow those dictated by others.
- Categorised information is often not ideal when one is interested, as Arts and Humanities scholars often are, in the particular, or the anomalous. Resource discovery can provide pointers in the right direction, but Arts and Humanities researchers readily accept that **individual resource discovery** is fundamental to their research. The reiterative processes that this involves are a key constituent in the pursuit of, and definition of, their research agendas. Since Arts and Humanities research is still mainly defined at an individual level, information resource tools have therefore to be based upon these individual needs.
- There seems to be a significant relationship between the relative **lack of 'mutual dependence'** among Arts and Humanities researchers, their **'task uncertainty'** and the ways in which digital resources are **produced and utilised**. The arrangements for collaborative research and for disseminating research results are **personalised, localised and decentralised**. Informal communication depends on individual groups and specific social networks. Digital resources, where they exist, tend to be field-

based and similarly localised. Likewise, there is a corresponding reliance on commercially produced generalist digital resources. We could produce no reliable estimate of what proportion of resources were in proprietary (i.e. commercially-provided, subscription-based or purchased information) as opposed to public-domain (i.e. free to access, generally publicly-funded information) information. Our users were often not aware of the contractual basis on which the information was provided to them. Nor could we estimate how frequently, and for how long, they consulted these resources – the patterns were too varied.

- There is a perception among arts and humanities scholars that within their fields there is little or no collaboration. The reality is substantially different, because while **strong collaborative cultures may not exist**, however, weak ones do and take the form of citations of colleagues' works, routine email correspondence, interaction through conferences and professional society meetings.
- Arts and Humanities **'e-infrastructure'**, apart from the AHDS and RDN subject-portals, tends therefore to be determined at the level of the **employing institution** rather than the field or discipline, or higher.
- We have to take into account a **'counter-culture'** (which we encountered most noticeably in our investigation of some of the disciplines in the Arts, where information resource needs and research agendas are often articulated in terms of 'diametrical difference' to prevailing trends).
- Arts and Humanities researchers want access to information, irrespective of the medium in which it is available. They are used to working in fields where there is a very **mixed economy of resources**, electronic and physical. Journal articles are important, but so are printed books. E-prints (pre- and post-) are markedly less significant than in the physical sciences and engineering. Electronic bibliographical information is therefore of critical importance to Arts and Humanities researchers.
- There is less emphasis on communicating work-in-progress and more emphasis on **formal ways of disseminating information**. There is consequentially less emphasis on lead-times for accessing research-sensitive information and results.

6.1.2 Information about users' awareness and attitudes with respect to currently available online services and tools, including such gateways and portals as current exist.

In general, we encountered a **high and growing level of expectation** as to the availability of materials in digital form. These expectations have been fed by the **exponential growth in the content of Arts and Humanities digital libraries** by the wide variety of different content-creators and contractors.

Generally users were largely **unaware of the possibilities** for data analysis and multimedia data presentation that digitisation offers and were equally **unaware of the extent to which their use of digital resources is tracked and analysed** by content and service providers and employers.

The **internet search engine** emerges from this study as an immensely useful digital resource-discovery tool. Users deployed a variety of proprietary search-engines. Their simplicity and speed appealed to our users, for whom a key determinant in their cost-benefit analysis of resource-discovery tools was whether it saved, rather than cost them time. At the same time, our users were also aware of the limitations of their internet search-engine of choice. Our

users told us of their **frustration at its lack of sophistication**. They were **suspicious of its ranking of hits** returned. They were **overwhelmed by the information redundancy** which often accompanies its results. They were, above all, concerned about the fact that search-engines do not search a great deal of digital content that is relevant to their needs; and, equally, they are frustrated by the lack of interoperability between different libraries of digital content.

The issue of **'access'** runs throughout our report. Access to online journals was most often raised; but it frequently occurred also in respect of proprietary digital content of various kinds, specific to particular disciplines. The issue was sometimes presented in terms of a trade-off in resource terms, with our users wanting to see the investment of scarce resources in widening the local access to digital content through licence and content purchase rather than increased investment in resource discovery. At the same time, our research practitioners were aware that 'access' was only fully beneficial when it was linked to enhanced resource discovery, and, in particular, interoperability.

Interoperability was another major theme running through our enquiries. It tended to affect some disciplines more than others. As digital content becomes richer and more diverse, so the independent platforms on which it is consulted multiply. As interoperability becomes more important, so the potential for a next-generation resource-discovery portal grows. While the AHDS and Intute allow their resources to be harvested by other services, **they do not themselves comprehensively harvest available metadata**. For the AHDS this is due to their remit of collecting 'from' not 'for' the research community, while Intute-Arts and Humanities has indicated a general lack of useful metadata available. Intute has RSS news feeds that aggregate news and new collections. End users appear to find this easier to use than Open Archives Initiative (OAI) metadata-harvesting. This is a form of service that is already appreciated by individual users. This would appear to be a more advantageous route for making data available to commercial harvesters than that provided by the Open Archives Initiative (OAI) metadata-harvesting. The latter has currently received only limited take-up within institutions and none to our knowledge by individuals.

6.1.3 Information about patterns of recent user-activity in relation to the RDN subject hubs and AHDS.

From the wide-range of resource-discovery services and tools used by Arts and Humanities scholars, we investigated user familiarity with and use of these two services in particular. The key feature of the **RDN subject-portals** is their **resource descriptions**. Although our users were clear about the potential importance of **authenticating** digital resources, they were not so sure about the **significance** of the resource descriptions provided by the RDN portals. In particular, they had no sense as to how often they were **up-dated**, the **status** of who had written them, and what **range** of resources they covered. Those that had used the subject portals, took the view that they tended to be useful at the beginning of a research enquiry, but to become rapidly less relevant the more one advanced into a subject. Those that had not used the RDN subject-portals but knew of their existence had evidently formed a view about whether they were **likely** to find anything of relevance to them within it. We conclude from our evidence that the RDN portals are insignificant for most research purposes for the Arts and Humanities practitioner.

AHDS has a similarly low profile among the majority of arts and humanities researchers, although the evidence from AHDS web-logs may well be deceptive. Overall they may under-record some aspects of its usage despite some inflation of usage figures resulting from the inclusion of internal traffic between different servers within the AHDS network as a whole, including network administration calls. Although the number of **resources downloaded** seems to be increasing, none of the participants in our focus groups or questionnaire admitted to having downloaded such collections. Where the AHDS **harvested** data, generally in collaboration with outside partners (as in e.g. Heirport the Historical Environment Information Resources Portal), it plays a significant, perhaps pivotal, role in Arts and Humanities research.

Neither service has a published strategy for consulting users and discovering their needs, although there are examples of good practice in some parts of the AHDS. There are some good collaborative links with other information service-providers in place, but these need to be strengthened. The two services are not currently interacting very well. The RDN subject-portal does not harvest the metadata on AHDS resources comprehensively. While references to each other can be found on their respective sites, neither service promotes the other particularly actively, explains their relationship/differences or provides a quick and easy link to the other.

6.1.4 Information about users' responses to what future portal developments can deliver

Users generally found the current resource-discovery arrangements and services adequate, but were confused about the roles. The evidence is that researchers are more concerned with access to content than functionality.

At the same time, they recognize that the current situation with regard to functionality is not sustainable in the longer term. The importance of interoperability in users' minds was a measure of that realization. The exponential growth in data volume, combined with increasingly complex multilayered information, will make it more necessary to use resources in a complementary way, and simultaneously harder to do so.

Our users responded positively to the possibilities of a **personally-managed** research environment. There were specific, realizable functionalities that they identified as being of direct use to them in carrying forward their research agendas: **workflow management tools** and **resource discovery tools**. Researchers wanted greater personal control over digital resources. They readily perceived the advantages of tools which enabled them to integrate searching the web with searching their own hard-drive. They saw benefits to more developed **bookmarking** features, **personal editing** features, and an **automated copyright management system**. They wanted to be able to **filter** the quality of hit returns, **search distributed databases.** They responded positively to a **web-based news feed feature**, and liked the idea of **RSS feeds** that by-passed personal email accounts.

They were less excited about tools to enable communication and collaboration. The picture that emerged is of researchers who find asynchronous and largely mono-media communication channels such as email, web pages and telephone quite satisfactory. Real-

time communications media such as instant relay chat and Grid videoconferencing with integrated computer applications sharing were less appealing. However most respondents declared themselves **happy to collaborate at the basic level of sharing the sources they used.**

Many of the features presented in the demonstrator imply a more sophisticated portal tool than the current gateways provide, and that requires a development in the ICT skills-base of the user-community which it is clearly reluctant to make. The investments made in the ICT skills-base through the Methods Network, ICTguides and training/awareness programmes organised by the AHDS cannot be expected to uplift the skills-base of researchers who do not currently see the need to do so. Whilst this skills-base is likely to improve over time, the potential functionality of portal tools will probably always outstrip it.

6.2 Ways Forward

We see a number of ways forward.

1. An awareness of the **distinctive research culture** with its fears and predilections must be taken into account.

2. The Arts and Humanities research community is not very assertive. Its digital resource-discovery needs have not been very well-voiced. As digital data expands exponentially in our field, and becomes increasingly complex and multi-layered, it is going to become harder to find, and use what we need. The arts and humanities need **strong pan-institutional organisations** that can champion them nationally and internationally. This is a role that AHDS is beginning to play in relation to standards (Brown et al 2006) but it applies also to information resource-discovery needs, including issues of access to content. The AHDS' has a singular focus on arts and humanities. Intute-Arts and Humanities has been established to function as a distinct service for the arts and humanities. The case for a single and coherent resource discovery service for arts and humanities is from the point of view of the user, clear.

3. The increasing provision of **metadata-harvesting** among the information service-providers is an immediate and short-term objective, dominating the agenda of resource-discovery over the next five years. Users are coming to expect much better **linkage** between **online bibliographical resources**, and the **online content** itself. They also want to search across **distributed digital data**. This objective implies:
    - **common metadata standards** [substantially in place]
    - agreed **authentication systems** [emerging, but more work needed]
    - much greater degree of **collaboration** among a wider group of information service-providers than is currently in place (research libraries: archives: museums: government/commercial information-providers, etc) [not in place]

    It is beyond our remit to recommend where such collaboration should come from. But we are convinced that the AHDS has a more important role to play in participating in, and facilitating, such collaborations than it has played in the past.

4. In the medium and longer term (in a five-ten year perspective), it is likely that the **semantic web**, especially when combined with harvesting agents, will provide the easy-to-use tools that many researchers need, at least to some degree. However, for some areas of the Arts and Humanities where "knowledge" is more the result of heuristics and associative thinking, it may be that a more folksonomic approach as exemplified by **Web 2.0** services such as Flickr and steve.museum will be more effective. We are therefore more persuaded in the shorter-term of the possibilities of **Web 2.0** offering a way forward in the form of community-contributed and mediated content. Users do not seem averse to contributing in that way, but the nature of 'mediation' should be recognized. We can see the possibility of the RDN subject-portals evolving towards **a different mediation role**, with resource-discovery content coming instead from the community itself. In the longer term, there may be a possibility for combining the semantic-web and Web 2.0 approaches, especially if and where discipline-based ontologies emerge as commonly accepted.

5. We can begin to discern the determining characteristics of the resulting information environment as it emerges over the coming decade. It will be:

    - inclusive
    - aggregative
    - personalisable
    - locally managed
    - quality-assured
    - easy to use
    - community-based
    - internationally developed

    At various points in this report we have referred to this as a **'managed research environment'**. The use of the term "environment" rather than "portal" is significant here because it does not necessarily entail a single provider. It could comprise a selection of Web portal services, or "portlets", that users draw down to their desk top and configure personally or it may take the form of a pre-configured set embedded within a trusted supplier such as an institutional or professional society web site. Moving towards such an environment should be regarded as a medium-term objective (i.e. three to five years). The current portal providers in the Arts and Humanities do not look like this. But, of course, there are already individual services in the public domain that have some or all of these features and there are recent precedents for the kind of environment we have described. For example, the JISC/LTSN Learning and Teaching Portal Project resulted in a set of web portal services that are embedded in the HE Academy website as a suite of 'Finder' services that could be adopted by other organisations (http://www.heacademy.ac.uk/48.htm).

    We know that Arts and Humanities researchers are prepared to seek out and employ unusual, and 'unauthorised' sources for their information. We also know that they are willing to share useful sources they have discovered themselves. It seems likely that, if researchers come to recognize the existence and utility of such tools and services as these, they will employ them in greater numbers, further undermining the viability of established and 'authorised' services.

6. In the development of such a 'managed research environment' in the Arts and Humanities, there is also scope for collaboration with information system developers, including commercial and international providers. We do not exclude the possibility of UK collaboration in this area with developments currently under Beta-test in 'Google Scholar' to share the costs and manage the delivery. Many of these tools will need to conform to the international standards that are encouraging British developments to be compatible with a much larger range of applications.

   We therefore recommend a scoping study to ascertain the feasibility of such collaboration and the costs of developing a research-directed community-driven subject portal that offers:

   - **Workflow Management tools** that give the researcher greater personal control over digital project resources, especially more evolved **bookmarking features** and some form of automated **copyright management system** to facilitate the growing concern with usage permission and intellectual property rights was also highly valued.
   - **Resource Discovery tools** that provide greater control over web-based resources including the ability to **filter** the quality of hit returns, **search** multiple databases
   - **News feed features** that by-pass personal email accounts, but notify users of conferences, funding, jobs and new research publications.
   - **Collaborative research tools** for social bookmarking, uploading and sharing resources, annotating digital resources, shared document editing, attaching metadata to personally-created digital resources, and contributing to the authentication of digital content.

7. We recommend in the **short term** (one-two years) a much greater collaboration through data-harvesting of the current AHDS and former RDN subject-portals in resource discovery provision and though cross promotion of each others' services.

8. In the **medium term** (three-five years) we recommend that the AHDS and Intute develop a more Web 2.0 compatible profile to enable greater community involvement in resource recommendation, evaluation, creation, selection, sharing and annotation. We also recommend that funding bodies such as JISC and AHRC positively encourage and facilitate the development of interoperable portlets that can be used to embed portal type functionality in institutional and community web sites. An example of this may already be seen in the use of RSS news feeds offered by both services in order to announce news and collections.

9. In the **medium to long term** (five-ten years) we recommend that the AHDS and Intute-Arts and Humanities consider integrating their databases and user interfaces to provide the nucleus of a new, seamless, more comprehensive service in this particular area, one that combines and integrates the core functions of data-archiving, and digital resource harvesting/indexing. This would mean a harmonisation of Web portal services, as opposed to a merging of the two organisations.

List of Tables and Figures

References Cited and Resources Consulted

(AHDS Archaeology Data Service), Arts and Humanities Data Service (1997), 'AHDS Archaeology Annual Report 1996-1997.'
http://ads.ahds.ac.uk/project/annrpts/1997rpt.html.
--- (1998), 'AHDS Archaeology Annual Report 1997-1998.'
http://ads.ahds.ac.uk/project/annrpts/1998.html.
--- (1999), 'AHDS Archaeology Annual Report 1998-1999.'
http://ads.ahds.ac.uk/project/annrpts/1999.html.
--- (2000), 'AHDS Archaeology Annual Report 1999-2000.'
http://ads.ahds.ac.uk/project/annrpts/2000.html.
--- (2001), 'AHDS Archaeology Annual Report 2000-2001.'
http://ads.ahds.ac.uk/project/annrpts/2001.html.
--- (2002), 'AHDS Archaeology Annual Report 2001-2002.'
http://ads.ahds.ac.uk/project/annrpts/2002.html.
--- (2003), 'AHDS Archaeology Annual Report 2002-2003.'
http://ads.ahds.ac.uk/project/annrpts/2003.html.
--- (2004a), 'AHDS Archaeology Annual Report 2003-2003.'
http://ads.ahds.ac.uk/project/annrpts/2004.html.
--- (2004b), 'AHDS Archaeology Annual Report 2003-2004.'
http://ads.ahds.ac.uk/project/annrpts/2004.html.
--- (2005), 'AHDS Archaeology Annual Report 2004-2005.'
http://ads.ahds.ac.uk/project/annrpts/2005.html.
(AHDS-History), Arts and Humanities Data Service (1997), 'AHDS History Annual Report 1996-1997.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual1996-97.htm.
--- (1998), 'AHDS History Annual Report 1997-1998.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual1997-98.htm.
--- (1999), 'AHDS History Annual Report 1998-1999.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual1998-99.htm.
--- (2000), 'AHDS History Annual Report 1999-2000.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual1999-2000.htm.
--- (2001), 'AHDS History Annual Report 2000-2001.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual2000-01.htm.
--- (2003), 'AHDS History Annual Report 2002-2003.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual2002-03.htm.
--- (2004), 'AHDS History Annual Report 2003-2004.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual2003-04.htm.
--- (2005), 'AHDS History Annual Report 2004-2005.'
http://ahds.ac.uk/history/about/reports-and-policies/annual/annual2004-05.htm.
(AHDS-Literature Language and Linguistics), 'Arts and Humanities Data Service 'Oxford Text Archive Annual Report – 1st August 2000-31st July 2001.'
http://ahds.ac.uk/litlangling/about/reports/AHDSLLL_Annual%20Report_2000-01.pdf.
--- (2002), 'AHDS Oxford Text Archive Annual Report – 1st August 2001 - 31st July 2002.'
http://ahds.ac.uk/litlangling/about/reports/AHDSLLL_Annual%20Report_2001-02.pdf.
--- (2003), 'AHDS Literature Language and Linguistics Annual Report - August 2002 – July 2003.'
http://ahds.ac.uk/litlangling/about/reports/AHDSLLL_Annual%20Report_2002-03.pdf
--- (2004), 'AHDS Literature Language and Linguistics Annual Report - August 2003 – July 2004'
http://ahds.ac.uk/litlangling/about/reports/AHDSLLL_Annual%20Report_2003-04.pdf.
--- (2005), 'AHDS Literature Language and Linguistics Annual Report August - 2004 – July 2005.'
http://ahds.ac.uk/litlangling/about/reports/AHDSLLL_Annual%20Report_2004-05.pdf.
(AHDS Performing Arts), 'Arts and Humanities Data Service Performing Arts (2003), Arts and Humanities Data Service Performing Arts Annual Report 2003.'
http://ahds.ac.uk/performingarts/about/reports-and-policies/annual.htm.
(AHDS Visual Arts) (2005a), 'The Digital Picture: a future for digital images in UK arts education (AHDS Visual Arts).'
http://thedigitalpicture.ac.uk/home.html.
(AHDS Visual Arts), Arts and Humanities Data Service (1998a), 'AHDS Visual Arts Annual Report 1997-1998.'

http://ahds.ac.uk/visualarts/about/reports/pr_97-98.htm.
--- (1998b), 'VADS User Needs Survey 1998.'
http://vads.ahds.ac.uk/reports/user_survey/user_survey.html.
--- (1999), 'AHDS Visual Arts Annual Report 1998-1999.'
http://ahds.ac.uk/visualarts/about/reports/pr_98-99.htm.
--- (2000), 'AHDS Visual Arts Annual Report 1999-2000.'
http://ahds.ac.uk/visualarts/about/reports/pr_99-00.htm.
--- (2001), 'AHDS Visual Arts Annual Report 2000-2001.'
http://ahds.ac.uk/visualarts/about/reports/pr_00-01.htm.
--- (2002), 'AHDS Visual Arts Annual Report 2001-2002.'
http://ahds.ac.uk/visualarts/about/reports/pr_01-02.htm.
--- (2003), 'AHDS Visual Arts Annual Report 2002-2003.'
http://ahds.ac.uk/visualarts/about/reports/pr_02-03.htm.
--- (2004), 'AHDS Visual Arts Annual Report 2003-2004.'
http://ahds.ac.uk/visualarts/about/reports/pr_03_04.htm.
--- (2005b), 'AHDS Visual Arts Annual Report 2004-200.'
http://ahds.ac.uk/visualarts/about/reports/Visual%20Arts%20Annual%20Report%202004-2005.pdf.
(AHDS Visual Arts), 'Arts and Humanities Data Service: Visual Arts 'Image Portal Demonstrator'
http://ahds.ac.uk/__print__/visualarts/projects/image-portal/index.htm.
(AHDS) Arts and Humanities Data Service (2003), 'Arts and Humanities Data Service (AHDS) Annual Report 2002-2003.'
http://www.ahds.ac.uk/history/about/reports-and-policies/index.htm.
--- (2003), 'Image Portal Demonstrator.'
http://ahds.ac.uk/visualarts/projects/image-portal/index.htm.
--- (2004a), 'The Arts and Humanities Data Service Strategic Plan 2002-2005'(2004).
http://ahds.ac.uk/about/reports-and-policies/index.htm. http://ahds.ac.uk/documents/exec-strategy-02to05-v1.pdf.
--- (2004b), 'Arts and Humanities Data Service (AHDS) Annual Report 2003-2004'
http://www.ahds.ac.uk/history/about/reports-and-policies/ahds-annual-report-2003-04.pdf.
--- (2004c), 'AHDS Strategic Plan 2005-2007.'
http://ahds.ac.uk/documents/exec-strategy-05to07.pdf
--- (2005), 'Arts and Humanities Data Service (AHDS) Annual Report 2004-2005.'
http://www.ahds.ac.uk/history/about/reports-and-policies/ahds-annual-report-2004-05.pdf.
(AHRC), 'Arts and Humanities Research Council 'The Bright Path: Strategy for the Arts and Humanities Research in the UK.'
http://www.ahrc.ac.uk/ahrb/website/news/publications.asp.
http://www.ahrb.ac.uk/ahrb/website/images/4_94380.pdf.
--- (2005), 'Annual Report 2004-05.'
http://www.ahrc.ac.uk/ahrb/website/images/4_96568.pdf.
--- (2006), 'ICT in the Arts and Humanities.'
www.ahrcict.rdg.ac.uk/index.htm.
(ANIR) Working Group on Access to Networked Information Resources (1994), 'Report of the Working Group on Access to Networked Information Resources', *Journal of Information Networking*, 2 (3).
(HERA) Humanities in the European Research Area 'Homepage of the Humanities in the European Research Area (HERA).'
http://www.heranet.info/Default.aspx?ID=102
http://www.nwo.nl/nwohome.nsf/pages/NWOP_6D4C8L_Eng.
(HESA) Higher Education Statistics Agency 'Staff Tables 2003-2004'
http://www.hesa.ac.uk/holisdocs/pubinfo/staff.htm.
--- (2004b), 'Student Tables 2003-2004.'
http://www.hesa.ac.uk/holisdocs/pubinfo/stud.htm.
--- 'HESA On-line Information Service.'
http://www.hesa.ac.uk/holisdocs/home.htm.
(IATH), Institute for Advanced Technology in the Humanities (2005), 'Summit on Digital Tools for the Humanities', paper given at Summit on Digital Tools for the Humanities. Charlottesville, Virginia.
http://www.iath.virginia.edu/dtsummit/SummitText.pdf.
(JISC) Joint Information Systems Committee (1999a), 'Adding value to the UK's learning, teaching and research resources: the Distributed National Electronic Resource (DNER).
http://www.computing.dundee.ac.uk/projects/dmag/bobby/jisc/194b.html
--- (1999b), 'Description of the DNER' http://www.jisc.ac.uk/index.cfm?name=dner_description.

--- (2002a), Adding Value to the UK's Learning, Teaching and Research Resources: the Distributed National Electronic Resource (DNER).'
http://www.jisc.ac.uk/index.cfm?name=dner_adding_value.
--- (2002b), 'JISC Five Year Strategy, 2001-2005'
http://www.jisc.ac.uk/index.cfm?name=strategy0105_summary.
--- (2003a) 'A Brief History of JISC.'
http://www.jisc.ac.uk/index.cfm?name=about_history.
--- (2003b), 'Description of the Distributed National Electronic Resource (DNER).'
http://www.jisc.ac.uk/index.cfm?name=dner_description.
--- (2003c)'JISC Information Environment: Portals.'
www.portal.ac.uk.
--- (2003d), 'JISC Information Environment Portals: Investigations into User Requirements and Sustainability: INVITATION TO TENDER.'
http://www.jisc.ac.uk/uploaded_documents/PortalsITTOct03.doc
http://www.jisc.ac.uk/index.cfm?name=funding_portals.
--- (2003e), 'Portals: Frequently Asked Questions.'
http://www.jisc.ac.uk/index.cfm?name=ie_portalsfaq.
--- (2006a), 'Automating the Selection of Resources for eLearners', Cross-Institutional Use of E-Learning to Support Lifelong Learners Programme
http://www.jisc.ac.uk/index.cfm?name=funding_circular03_06.
--- (2006b), 'Invitation to Tender: The Arts and Humanities Data Service (AHDS) Review and User Survey'
http://www.jisc.ac.uk/index.cfm?name=funding_ahds_review_and_user_survey
http://www.jisc.ac.uk/uploaded_documents/ITT%20AHDS%20Review%20and%20User%20Survey%20April%202006.DOC.
--- (2006c), 'Notes from a Consultation Workshop on the Virtual Research Environments Programme', paper given at London, February 2006.
http://www.jisc.ac.uk/uploaded_documents/VRE_Workshop_28Nov_notes.doc.
-- (2006d),'Virtual Research Environments Programme.'
http://www.jisc.ac.uk/index.cfm?name=programme_vre.
(JISC MU) Joint Information Services Committee Monitoring Unit (2005), 'Workflow Solution to the Preservation of Digital Media', 'Survey Report: Content Services 2004-05.'
http://www.mu.jisc.ac.uk/reports/surveys/.
http://www.mu.jisc.ac.uk/reports/surveys/ncs2004/ncs2004-05-survey-report.pdf.
(MIMETIC) Meeting Memory Technology Informing Collaboration 'Project Homepage.'
http://www.memetic-vre.net/.
(SOSIG) Social Science Information Gateway (2002), 'Evaluation and Feedback from User Communities.' Personal Communication.
Aarseth, E. (2003), 'The Field of Humanistic Informatics and its Relation to the Humanities.'
http://www.hf.uib.no/hi/espen/HI.html.
Abbott, D. and Beer, E. (2006), 'Getting to Know Our Audience. AHDS Performing Arts Scoping Study.'
http://www.hatii.arts.gla.ac.uk/ahds-pa/.
Accenture (2003), 'University Portals: Opening Doors to Better Service.'
http://www.gre.ac.uk/ils/cis/portalproject/universityportals.pdf.
Adler, M., and Ziglio, E. (1996), 'Gazing into the oracle' (Bristol, PA: Jessica Kingsley).
Agarwal, S. and Browning, P. (2004), 'Focusing on users: case study of portal user requirements analysis and user-testing sessions at the University of Bristol' *Online Information* 2004 Proceedings.
http://www.online-information.co.uk/2004proceedings/wedpm/agarwal_browning.pdf.
Allan, R., Awre, C. Baker, M., Fish, A (2003), 'Portals and Portlets 2003', *Technical Report UKeS-2004-06.*
http://www.nesc.ac.uk/technical_papers/UKeS-2004-06.pdf.
American Council of Learned Societies (1997), 'The Transformation of Humanistic Studies in the Twenty-first Century: Opportunities and Perils', Occasional Paper No. 40.
http://www.acls.org/op40.htm.
--- (2005), 'Our Cultural Commonwealth.'
http://www.acls.org/cyberinfrastructure/cyber_report.htm.
Anderson, I.G. (2004), 'Are you Being Served? Historians and the Search for Primary Sources.' *Archivaria* 58 (Fall).
http://archivists.ca/downloads/documentloader.aspx?id=3661.
Anderson, S. (2004), E-Science (E-Research Expert Seminar: Report on Proceedings. Senate House London.
www.ahds.ac.uk.

http://www.ahds.ac.uk/e-science/e-science-seminar-2004.pdf#search=%22%20%22E-Science%20(E-Research%20%20Expert%20Seminar%3A%20Report%20on%20Proceedings%22%22.

Anderson, S., Dunn, S., Hughes, L. (2005), 'VREs In the Arts and Humanities', paper given at All Hands Meeting.
http://www.ahrcict.rdg.ac.uk/info/vre/AHM05_paper.pdf.

Armstrong, CJ; Lonsdale, R., Stoker, D., and Urquhart, C. (2000), JUSTEIS Project as detailed below:
--- (2000), 'JISC Usage Surveys: Trends in Electronic Information Services.'
--- (2000) 'Strand A: A general survey of end users of all electronic information services.'
--- (2000), 'Strand C: A general survey of electronic information services provision.'
--- (2000), 'Final Report - 1999/2000 Cycle.'
http://www.dil.aber.ac.uk/dils/research/justeis/cyc1rep0.htm.

Asensio, M. (2003), 'Final Study Report JISC User Requirement Study for a Moving Pictures and Sound Portal.'
http://www.jisc.ac.uk/uploaded_documents/MPSportaluserreqs.doc.

Austin, T., Pinto, F., Richards, J. and Ryan, N. (2001), 'Joined up writing: an internet portal for research into the historic environment', paper given at Forthcoming paper in CAA 2001: Proceedings of Computer Applications and Quantitative Methods in Archaeology Conference., Gotland University, Visby, Gotland - Sweden, April 2001.
http://www.cs.kent.ac.uk/pubs/2001/1261/
http://www.cs.kent.ac.uk/pubs/2001/1261/content.pdf.

Awre, C., Hanganu, G., Ingram, C., Brett, T., and Dolphin, I. (2005), 'The CREE Project: Investigating User Requirements for Searching within Institutional Environments ', *D-Lib Magazine,* 11 (10)

Barab, S. A., and Krishner, D. (2001), 'Guest editors' introduction: 'Rethinking methodology in the learning sciences', *Journal of the Learning Sciences,* 10 (1&2), 5-15.

Becher, T. (1987), 'Disciplinary Discourse', *Studies in Higher Education,* 12 (3), 261-74.
http://taylorandfrancis.metapress.com/(hgezqt55un1kpa553ajmx045)/app/home/contribution.asp?referrer=parent&backto=issue,3,10;journal,67,91;linkingpublicationresults,1:104673,1.
http://taylorandfrancis.metapress.com/media/p3dgtpwwwg62076klqfw/contributions/k/0/k/l/k0kl85421441277x.pdf.

--- (1994), 'The Significance of Disciplinary Differences', *Studies in Higher Education,* 19 (2), 151-61.
http://taylorandfrancis.metapress.com/(ukbale45kiwotsyajxedb2vb)/app/home/contribution.asp?referrer=parent&backto=issue,4,12;journal,47,91;linkingpublicationresults,1:104673,1.
http://taylorandfrancis.metapress.com/media/h83augyqqjdufcxwhkdr/contributions/n/k/0/0/nk00303x8328m446.pdf.

Becher, T. and Trowler, P. (2001), *Academic Tribes and Territories: Intellectual Enquiry and the Culture of Disciplines* 2nd ed., Buckingham: Open University.
http://mcgraw-hill.co.uk/openup/chapters/0335206271.pdf.

Beckels, B., Brostoff, S., and Ballard, S. (2004), 'A First Attempt: Initial Steps Toward Determining Scientific Users' Requirements and Appropriate Security Paradigms for Computational Grids.' Proceedings of the Workshop on Requirements Capture for Collaboration in e-Science. Edinburgh, UK.
http://www.escience.cam.ac.uk/papers/req_analysis/first_attempt.pdf.

Beckles, B. (2004), 'User requirements for UK e-Science grid environments.'
http://www.allhands.org.uk/2004/proceedings/papers/251.pdf.

Berman F., Fox G.C., Hey A.J.G. (eds.) (2003a), *Grid Computing: Making the Global Infrastructure a Reality*. John Wiley & Sons.

Berman F., Fox G.C., Hey A.J.G. (2003b), 'The Grid: past, present, future' in Berman et al 2003a pp 9-50

Berners-Lee, T., Hendler, J. and Lassila, O. (2001), 'The Semantic Web: A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities'. In *Scientific American*, 17 May 2001.
http://www.sciam.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21

Beyer, H. and Holtzblatt, K (1998), *Contextual Design: Defining Customer-Centered Systems* London: Morgan Kaufmann.

Biblio-Tech Review 'Z39.50 Overview.'
http://www.biblio-tech.com/html/z39_50.html.

Bowman, A., Crowther, C., Kirkham, R., and Pybus, J. (2005), 'Building a Virtual Research Environment for the Humanities: PROJECT PLAN.'
http://bvreh.humanities.ox.ac.uk/BVREH-ProjectPlan-web.pdf.

Brewer, J. and Kilbride, W.G. (2005), 'HEIRNET User Survey 2005 Report and analysis (Council of British Archaeology).'

British Library (1993), 'Information Technology in Humanities Scholarship' British Library R & D Report 6097.

Brockman, W.S., Neumann, L., Palmer, C.L. and Tidline, T. (2001), 'Scholarly Work in the Humanities and the Evolving Information Environment.'
http://www.clir.org/
http://www.clir.org/pubs/reports/pub104/pub104.pdf.

Brown, A. L. (1992), 'Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings', *The Journal of the Learning Sciences,* 2, 141-78.

Brown, S and Liang, V. (2005), 'Work Package 3 User Needs: Report'.
http://aria.dmu.ac.uk/documents/WorkPackage3.pdf.

Brown, S., Bryson, J., Greengrass, M. and Ross, R. (2006), 'Arts and Humanities Data Service (AHDS) Review and Final Report', unpublished report to Joint Information Systems Committee and Arts and Humanities Research Council.

Burnard, L.and Short, H. (1994), 'An Arts and Humanities Data Service. Report of a Feasibility Study' Commissioned by the Information Services Sub-Committee of the Joint Information Systems Committee of the Higher Education Funding Councils (Oxford).

Burnard, L. (1999), 'Is Humanities Computing an Academic Discipline? or Why Humanities Computing Matters.'
http://www.iath.virginia.edu/hcs/burnard.html.

Butters, G. (2003), 'What Features in a Portal?' *Ariadne* (35).
http://www.ariadne.ac.uk/issue35/butters/.

Currier, S. and Campbell, L. (2002), 'Evaluating Learning Resources for Reusability: The DNER & Learning Objects Study', Australasian Society for Computers in Learning in Tertiary Education conference proceedings. Aukland 2002.
http://ascilite.org.au/conferences/auckland02/proceedings/papers/059.pdf

Case, D. (2002), 'Looking for Information: A Survey of Research on Information Seeking Needs and Behaviour', ed. Harold Borko (Library and Information Science; London: Academic Press).

Chae, B. and Poole, M (2005), 'Mandates and Technology Acceptance: A Tale of Two Enterprise Technologies', *Journal of Strategic Information Systems,* 14, 147-66.
http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B6VG3-4G54HJ6-1-1&_cdi=6027&_user=128590&_orig=search&_coverDate=06%2F30%2F2005&_qd=1&_sk=999859997&view=c&_alid=442604047&_rdoc=1&wchp=dGLbVlz-zSkWb&md5=16225d99f0402dca64c9906fcd303ce2&ie=/sdarticle.pdf.

Chambers, S. and Tiedau, U. (2002), 'Research goes virtual', *Library and Information UPDATE.*
http://www.cilip.org.uk/publications/updatemagazine/archive/archive2002/july/update0207c.htm.

Chappell, D.A and Jewell, T. (2002), *Java Web Services*. O'Reilly and Associates.

Christiansen, L.(2004), 'Blueprint for the European Research Observatory for the Humanities and Social Sciences (EROHS).'
http://www.heranet.info/Admin/Public/DWSDownload.aspx?File=Files%2fFiler%2fERCH%2fRISSH_-_ESFRIJUNE2004-version.doc.

Clark, J. (2003), 'Overview and Requirements Analysis: General Portals Functionality for SAD I', Subject Portals Project Phase I Documents.'
http://www.portal.ac.uk/spp/documents/phase1/projectplan/spdpoverview.doc
http://www.portal.ac.uk/spp/documents/phase1/.

--- (2001b) 'Subject Portals', *Ariadne,* (29)
http://www.ariadne.ac.uk/issue29/clark/intro.html

Cliffe, P. and Powell , A. (no date) 'UK Z39.50 Directory'
http://www.ukoln.ac.uk/distributed-systems/zdir/.

Cloiser, A. (2003), 'Interim User Requirements Report for the JISC Information Environment Service Registry.'
http://iesr.ac.uk/inerimreqs.html.

Collins, A. (ed.), (1992), *Toward a design science of education*. E. Scanlon & T.

Committee on a KNAW Research Institute for e-Science, (2003), 'Building the KNAW International Research Institute on e-Science Studies in the Humanities and Social Sciences (IRISS).'
http://www.knaw.nl.
www.knaw.nl/publicaties/pdf/90000111.pdf

Condron, F., Richards, J., Robinson, D., Wise, A. (1999), 'Strategies for Digital Data - A Survey of User Needs.'
http://www.eng-h.gov.uk/archcom/projects/.
http://www.eng-h.gov.uk/archcom/projects/summarys/html98_9/2178main.pdf.

Cooper, Ian (2004), 'Survey of the JISC Network Content Services 2004/05.'
http://www.mu.jisc.ac.uk/reports/surveys/ncs2004/.

Cox, A. (2004), 'Building Collaborative eResearch Environments.'
http://www.jisc.ac.uk/index.cfm?name=event_report_eresearch.

--- (ed.), (2006), *Portals: People, Processes and Technology*. Oxford: Facet.
Creswell, J. (2002), *Research Design: Qualitative, Quantitative and Mixed Method Approaches.* London: Sage.
Crouchley, R and Fish, A. (2004a), 'Roadmap for a UK Virtual Research Environment: Report of the JCSR VRE Working Group.'
http://tyne.dl.ac.uk/Sakai/sakai_doc/node11.html.
http://www.jisc.ac.uk/uploaded_documents/VRE%20roadmap%20v4.pdf.
--- (2004b), 'SAKAI Evaluation Exercise: A Report to JISC--Role of Portals in a Virtual Research Environment.'
http://tyne.dl.ac.uk/Sakai/sakai_doc/node11.html.
Cultural Heritage Consortium (2002), 'Heirnet: Historic Environment Information Resources Network. Users and their Uses of Heirs.'
http://www.britarch.ac.uk/HEIRNET/publications.html.
http://www.britarch.ac.uk/HEIRNET/users.PDF.
De Rosa, C. Dempsey, L. and Wilson, A. (2004), '2003 Environmental Scan: Research and Learning Landscape.'
http://www.oclc.org/reports/escan/toc.htm.
http://www.oclc.org/reports/escan/downloads/research.pdf.
Debus, M. (1995), *Methodological Review: A Handbook for Excellence in Focus Group Research* Washington, DC: Academy for Educational Development.
Denzin, N.K., and Lincoln, Y.S. (ed.), (1994), *Handbook of Qualitative Research.* Thousand Oaks, CA: Sage.
De Roure, D., Baker, M.A., Jennings, N. R. and Shadbolt N.R. (2003a), 'The evolution of the Grid.' in Berman, et al 2003a 65 – 100.
De Roure D., Jennings N. R., Shadbolt N.R. (2003b), The Semantic Grid: a future e-Science infrastructure. In Berman et al 2003a pp 438 – 470.
Design-Based Research Collective (2003), 'Design-Based Research: An Emerging Paradigm for Educational Inquiry'. *Educational Researcher*, Vol. 32.1, pp. 5-8.
Dimitrova, Maia 'Virtual Research Environments Programme.'
http://www.jisc.ac.uk/index.cfm?name=programme_vre.
Dolphin, I.; Miller, P. and Sherratt, R. (2002), 'Portals, PORTALs Everywhere', *Ariadne,* (33).
http://www.ariadne.ac.uk/issue33/portals/.
Duffy, C. and Kemp, S. (2004), 'What are the ICT needs of practice-based researchers in the visual and performing arts?' paper given at AHRC ICT Expert Seminars, London.
http://www.ahrcict.rdg.ac.uk/activities/expert_seminars/.
http://www.ahrcict.rdg.ac.uk/activities/expert_seminars/creative_and_performing_arts.pdf.
Dunn, S. (2005), 'Gated gardens? Virtual Research Environments and cross-disciplinary challenges for e-Research', paper given at Digital Resources for the Humanities 2005, Lancaster University.
http://ahds.ac.uk/drh2005/viewabstract.php?id=46&cf=1.
Dunn, S. and Dunning, A. (2005b), 'AHRC Research Centres and the Use of ICT.'
http://www.ahrcict.rdg.ac.uk/info/centres_projects/phase1.pdf.
Dunning, A. (2004), 'The AHDS is Evolving: Changes at the Arts and Humanities Data Service', *Ariadne,* 38.
http://www.ariadne.ac.uk/issue38/ahds/.
ESRC (2005), 'Review of International Data Resources and Needs '
http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre/opportunities/Commissioning_updates/index86.aspx.
http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre/Images/IRDRN_Brief_tcm6-8040.pdf.
Fernie, K. (2003a), 'Revealing collections: discovery, access and interoperability.'
--- (2003b), 'SMRs, Users and the Web and Users and their Uses of HEIRs', *Historic Environment Record News,* 1.
Ferry, A. (1997), '1996 Survey of User Information Needs and Search Methods Results: Art, Design, Architecture & Media Information Gateway.'
http://adam.ac.uk/adam/reports/survey/.
Finke, A. (1995), *How to sample in surveys.* London: Sage.
Follett, B. (1993), 'Joint Funding Councils' Libraries Review Group (The Follett Report).'
http://www.ukoln.ac.uk/services/papers/follett/report/
Foster I., Kesselman C. and Tuecke S. (2001), 'The anatomy of the Grid.' *International Journal of High Performance Computing Applications* Sage– reprinted in Berman et al 2003a 171 – 197,
Foster I., Kesselman C., Nick J.M.and Tuecke S. (2002), 'The physiology of the Grid.' The Global Grid Forum – reprinted in Berman et al 2003a 217 – 249.
Franklin, T. (2004), 'Portals in Higher Education: concepts and models.'
http://www.obhe.ac.uk/products/reports/publicaccesspdf/February2004.pdf.

Fraser, M. (2005), 'Virtual Research Environments: Overview and Activity', *Ariadne*, (44). http://www.ariadne.ac.uk/issue44/fraser/.

--- (2006), '20.112 Humbul: The final regeneration.' Humanist Discussion Group, Vol. 20, No. 112. http://www3.iath.virginia.edu/lists_archive/Humanist/v20/0111.html

Frechtling, J. and Sharp Westat, L. (1997), 'User-Friendly Handbook for Mixed Method Evaluations' http://www.ehr.nsf.gov/EHR/REC/pubs/NSF97-153/START.HTM

Fry, Jenny (2004), 'The Cultural Shaping of ICTs within Academic Fields: Corpus-based Linguistics as a Case Study', *Literary and Linguistic Computing*, 3. http://www.swetswise.com/swetsfo/swproxy?url=http%3A%2F%2Fwww.oxfordjournals.org%2FViewPDF%2Flitlin%2Fhdb%2FVolume_19%2FIssue_03%2Fabstracts%2F190303.sgm&ts=1141311512924&cs=3536757245.

--- (2006), 'Scholarly Research and Information Practices: A Domain Analytic Approach', *Information Processing and Management*, 42 (1), 299-316. http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B6VC8-4DVVXJY-1-1&_cdi=5948&_user=128590&_orig=search&_coverDate=01%2F31%2F2006&_qd=1&_sk=999579998&view=c&_alid=443570996&_rdoc=1&wchp=dGLbVzb-zSkWW&md5=505f16844e9e1106d89c6056e2fd6637&ie=/sdarticle.pdf.

Gannon, D. ;G. Fox, M. Pierce, B. Plale, G. von Laszewski, RG C. Severance, J. Hardin, J. Alameda, M. Thomas, J. Boisseau (2003), 'Grid Portals: A Scientist's Access Point for Grid Services (DRAFT 1).' http://forge.gridforum.org/projects/ggf-editor/document/GCE-Portal-working-draft/en/1/GCE-Portal-working-draft.pdf>.

Gardener, M. (2001), 'Portals--their role in the emerging networked economy.' http://www.essex.ac.uk/chimera/content/Pubs/pubs/EURESCOM-Gardner-portals.pdf.

Gerrard, D. (2005), 'Investigating the Application of a Grid Computing "Workflow" to standalone photo-historical data sources', (DeMontfort University).

Goldfisher, K (1993), 'Modified Delphi: A Concept for Product Forecasting', *Journal of Business Forecasting*, Winter.

Goodman, L. and Milton, K. (ed.), (2004), 'A Guide to Good Practice in Collaborative Working Methods and New Media Tools Creation' Catherine Owen (AHDS Guides To Good Practice). http://www.ahds.ac.uk/creating/guides/new-media-tools/index.htm.

Goodwin, C., Schwartz, M., Nielsen, J. (2005), 'Usability of Intranet Portals: A Report from the Trenches: Experiences from Real-Life Portal Projects. Usability of Intranet Portals: Executive Summary.' http://www.nngroup.com/reports/intranet/portals/summary.html.

Grout and Rymer, (1998), 'VADS User Needs Survey 1998: Report.' http://vads.ahds.ac.uk/reports/user_survey/user_survey.html

Greenbaum, T.L. (1993), *The Handbook of Focus Group Research.* New York: Lexington Books.

Greenstein, D. (1998a), 'The Arts and Humanities Data Service Three Years' On', *D-Lib Magazine***,** 12. http://www.dlib.org/dlib/december98/greenstein/12greenstein.html.

--- (1998b), 'The Arts and Humanities Data Service Three Years' On', *D-Lib Magazine*. http://www.dlib.org/dlib/december98/greenstein/.

Greenstein, D. and Trant J. (1996), 'AHDS: Arts and Humanities Data Service', *Ariadne*, (4). http://www.ariadne.ac.uk/issue4/ahds/.

Guy, M. (2003) 'User Testing Report**.'** Subject Access to the DNER (SAD I).' http://www.portal.ac.uk/spp/documents/testing/phase1/usertestingreportv3.doc.

Harely, Diane, Jonathan Henke, Ian Miller, Alison Head, David Nasatir, Jing Guo and Xi Sheng (2004), 'The Use of Digital Resources in Humanities and Social Science Undergraduate education.' http://digitalresourcestudy.berkely.edu/. http://digitalresourcestudy.berkeley.edu/pdf/digitalresourcestudy_final_report_exec_summ.pdf.

Harley, D. (2006), 'Use and Users of Digital Resources: A Focus on Undergraduate Education in the Humanities and Social Sciences.' http://cshe.berkeley.edu/research/digitalresourcestudy/report/digitalresourcestudy_final_report.pdf

Helmer, O. (1977), 'Problems in futures research: Delphi and causal cross-impact analysis', *Futures*, 17-31.

Hepworth, M (1998), 'Investigating methods for understanding user requirements for information products', *Information Research*, 4 (2). http://www.informationr.net/ir/4-2/isic/hepworth.html.

Howcroft, D., Newell, S. and Wagner, E. (2004), 'Understanding the Contextual Influences on Enterprise System Design, Implementation, Use and Evaluation', *Journal of Strategic Information Systems* 13, 271-77.

Katz, S. (2003), 'Why Technology Matters: the Humanities in the 21st Century', paper given at the Wisbey Lectures, King's College, University of London, 16 October 2003.

http://www.princeton.edu/~artspol/occaspap/Occasional%20Paper-Katz-10-16-03.pdf.
Kirkham, R.and Pybus, J. (2005), 'Building a Virtual Research Environment for the Humanities Interim Results of the User Survey.'
http://bvreh.humanities.ox.ac.uk/BVREH_Interim_Results_of_User_Survey_Report_web.pdf.
Kling, R., Spector, L. and McKim, G. (2002), 'Locally Controlled Scholarly Publishing Via the Internet: The Guild Model', *Journal of Electronic Publishing,* 8 (1).
http://www.press.umich.edu/jep/08-01/kling.html.
Klyne G., Carroll J.J., McBride B. (eds) (2004), 'Resource Description Framework (RDF): Concepts and Abstract Syntax.' *W3C.*
http://www.w3.org/TR/rdf-concepts/
Krueger, R.A. (1988), *Focus Groups: A Practical Guide for Applied Research*. Newbury Park, CA: Sage.
Lamb, A. (2004) 'Web Portals: Rabbit Holes to Grand Gateways.'
http://www.eduscapes.com/sessions/portals/.
Li, S. and Wood, W. (2005), 'Use of Portals in the Academic World.'
http://www.educause.edu
http://www.educause.edu/ir/library/pdf/CSD3738.pdf.
Lindstone, H., and Turoff, M (ed.), (1975), *The Delphi Method.* Addison Wesley.
Lonsdale, R E, D A Stoker and C J Urquhart (2001), 'JISC Usage Surveys: Trends in Electronic Information Services.'
http://www.dil.aber.ac.uk/dils/research/justeis/jisctop.htm.
McCarty, W. (1989), 'Humbul.' Humanist Mailing List, Vol. 2, No. 552.
http://lists.village.virginia.edu/lists_archive/Humanist/v02/0077.html.
McCarty, W. and Short, H (2002), 'A Roadmap for Humanities Computing.'
http://www.allc.org/reports/map/.
McCarty, W. and Kirschenbaum,,M (2003), 'Institutional models for humanities computing.'
http://www.allc.org/imhc/.
McCarty, W. (1999), 'Humanities Computing as Inter-discipline', paper given at Is Humanities Computing an Academic Discipline?' An Interdisciplinary Seminar, Institute for Advanced Technology in the Humanities Charlottesville, Virginia, USA.
http://www.kcl.ac.uk/humanities/cch/wlm/essays/inter/.
McLeod, M. (2004), 'User-Centered Product Creation in Electronic Publishing: Good Practice Models ', in Lizbeth Goodman and Katherine Milton (ed.), A Guide to Good Practice in Collaborative Working Methods and New Media Tools Creation (Glasgow: AHDS Performing Arts).
Metcalfe, R. and Manning, P. 'The Requirements for User Profiling to support Portal functionality.'
http://www.portal.ac.uk/spp/documents/testing/phase1/userscenarios/profiling.doc.
Miller, P. and Greenstein, D. (1997), 'Discovering Online Resources Across the Humanities: A Practical Implementation of the Dublin Core.'
http://ahds.ac.uk/public/metadata/discovery.html.
Mitchell, V (1992), 'Using Delphi to Forecast New Technology Industries', *Marketing Intelligence and Planning,* 10 (2).
Moffat, M. (2003), 'Summary of Portal Features Survey and Portal Consultancy Groups.'
http://www.eevl.ac.uk/public/ASP/info/.
--- (2003b), 'Humbul user testing – tested by 3 undergraduates; 3 postgraduates; three library staff; and 1 lecturer.'
http://www.portal.ac.uk/spp/documents/testing/phase1/user/Collated_results_of_Humbul_user_testing.doc
http://www.portal.ac.uk/spp/documents/testing/phase2/SPP_Testing_Round3_V1.doc.
Morgan, D.L. (ed.), (1993), *Successful Focus Groups: Advancing the State of the Art.* Newbury Park, California: Sage.
Network, Research Information 'Discovery Services: User behaviour, Perceptions and Needs.'
http://www.rin.ac.uk/?q=user-behaviour-perceptions-and-needs.
Nicholas, D., Huntington, P. & Williams, P. (2002), 'Evaluating metrics for comparing the use of web sites: a case study for two consumer health web sites', *Journal of Information Science,* 28, 63-75.
Nicholas, D., Huntington, P. & Williams, P. (2004), 'Digital consumer health information and advisory services in the UK: a user-evaluation and sourcebook'
http://ciber.soi.city.ac.uk/dhrgreports.php.
Nicholas, D., Huntington, P. and Watkinson, A. (2003a), 'Digital journals, big deals and online searching behaviour: a pilot study', *Aslib Proceedings,* 55, 84-109.
Nicholas, D., Huntington, P., Lievesley, N. & Wasti, A. (2000), 'Evaluating consumer Web site logs: case study The Times/Sunday Times Web site', *Journal of Information Science,* 26, 399-411.

Nicholas, D., Huntington, P., Rowlands, I., Russell, B. & Cousins, J. (2003b), 'Opening the digital box: what deep log analysis can tell us about our digital journal users.' Conference in Charleston, SC.

Nicholas, D., Huntington, P., Williams, P. & Dobrowolski, T. (2004b), 'Re-appraising information seeking behaviour in a digital environment: bouncers, checkers, returnees and the like', *Journal of Documentation,* 60, 24-39.

Notay, B. (no date), 'JISC Presentation Programme.' http://www.jisc.ac.uk/index.cfm?name=programme_presentation.

Palmer, C.and Neumann, L. (2002), 'The Information Work of Interdisciplinary Humanities Scholars: Exploration and Translation', *Library Quarterly,* 72 (1), 85-117.

Pearce, L. (2003a), 'Apart from the weather, I think it's a good idea: Stakeholder Requirements for Institutional Portals', *Ariadne* (35). http://www.ariadne.ac.uk/issue35/pearce/.

--- (2003b), 'Defining users and their needs: the PORTAL project work in progress', *SCONUL Newsletter* Summer/Autumn. http://www.sconul.ac.uk/pubs_stats/newsletter/29/6.RTF.

--- (2003c), 'Institutional Portals: A Review of Outputs.' http://www.fair-portal.hull.ac.uk/downloads/iportaloutputs.pdf.

Pearce, L., Carpenter, L., Martin, R. (2003d), 'Stakeholder Requirements for Institutional Portals.' http://www.fair-portal.hull.ac.uk/ http://www.fair-portal.hull.ac.uk/downloads/stakereq.pdf.

Peterson, E. and York, V. (2003), 'User-Evaluation of the Montana Natural Resource Information System (NRIS)', *D-Lib Magazine* 7/8. http://www.dlib.org/dlib/luly03/peterson/07peterson.html.

Phelps, T. and Watry, P.B. (2005), 'A No-Compromises Architecture for Digital Document Preservation.' 9th European Conference on Research and Advanced Technology for Digital Libraries (ECDL 2005) Vienna, Austria. http://multivalent.sourceforge.net/Research/Live.pdf#search=%22%20%22a%20no%20compromises%20architecture%20for%20digital%20document%20preservation%22%22.

Pinfield, S. and Dempsey, L. (2001), 'The Distributed National Electronic Resource (DNER) and the hybrid library', *Ariadne,* 26. http://www.ariadne.ac.uk/issue26/dner/.

Pinto, F. and Fraser, M. (2003), 'The SPP and its Functionality ', paper given at Investigations into Portals seminar, Oxford University Computing Services' May 2003. http://www.portal.ac.uk/spp/documents/phase1/presentations/oucs/TheSPP_functionality_files/frame.htm.

Powell, A (2001), 'RSLP (Research Support Libraries Programme) Collection Description.' http://www.ukoln.ac.uk/metadata/rslp/.

--- (2006), 'JISC Information Environment Architecture.' http://www.ukoln.ac.uk/distributed-systems/jisc-ie/arch/.

Powers, S. (2003), *Practical RDF*. O'Reilly and Associates.

Rogers, E. (1995), *Diffusion of Innovations*. 4th ed., London: Free Press.

Rosensweig, R. (2006), 'Can History Be Open Source? Wikipedia and the Future of the Past', *The Journal of American History,* 93 (1), 117-46. http://chnm.gmu.edu/resources/essays/d/42.

Ross, S. (2004), 'The Role of ERPANET in Supporting Digital Curation and Preservation in Europe', *D-Lib Magazine*, 7/8. dlib.org/dlib/july04/ross/07ross.html.

Ross, S., Anderson, I., Green, D., Albrecht, K. (2003), 'The NINCH Guide to Good Practice in the Digital Representation and Management of Cultural Heritage Materials.' http://www.nyu.edu/its/humanities/ninchguide/XII/ http://www.ninch.org/guide.pdf#search=%22%20%22the%20NINCH%20Guide%20to%20Good%20Practice%20in%20the%20Digital%20Representation%20and%20Management%20of%20Cultural%20Heritage%20Materials%22%22.

Rowley, J. (2001), 'JISC User Behaviour Monitoring and Evaluation Framework', *Ariadne*, 30. www.ariadne.ac.uk/issue30/jisc.

Sandoval, W. A., and Bell, P. (2004), 'Design-based research methods for studying learning in context: Introduction', *Educational Psychologist,* 39, 199-201.

Schopf, J. and Newhouse, S. (2005), 'Real Users –Real Requirements: 25 Conversations with UK eScience Projects', paper given at UK eScience All Hands Meeting, Nottingham, September. http://www-unix.mcs.anl.gov/~schopf/Talks/25proj-ahm-sept05.pdf.

Schreibman, S., Siemens, R. and Unsworth, J (ed.), (2004), *A Companion to Digital Humanities.* Oxford: Blackwell Publishing.

Sergeant, D M, S Andrews, A Farquhar (2005), 'EVIE Project: User Requirements Analysis Report.' http://www.leeds.ac.uk/evie/workpackages/wp2/evieWP2_UserRequirementsAnalysis_v1_0.pdf.

Shavelson, R. J., Phillips, D. C., Towne, L., & Feuer, M. J. (2003), 'On the science of education design studies', Educational Researcher, 32 (1), 25-28.

Shaw, Wendy (2001), 'The use of the Internet by academics in the discipline of English literature: a quantitative and qualitative approach', Information Research, 6 (2). http://informationr.net/ir/6-2/ws8.html.

Short, Harold and Marilyn Deegan (2004), 'Expert Seminar: What do Humanities Researchers need from ICT?,' Arts and Humanities Research Council ICT Strategy Review. http://www.ahrcict.rdg.ac.uk/activities/expert_seminars/. http://www.ahrcict.rdg.ac.uk/activities/expert_seminars/humanities_needs.pdf.

Silverman, D. (2004), *Doing Qualitative Research: A Practical Handbook*. London: Sage.

Smith, N., Ferguson, N. and Schmoller, S. (2004), 'Personalisation in Presentation Service.' www.therightplace.net/jp/.

Spärck-Jones, K. (2005), 'E-resources for Research in the Humanities and Social Sciences - A British Academy Policy Review.' http://www.britac.ac.uk/reports/eresources/index.html. http://www.britac.ac.uk/reports/eresources/report/eresources-pdf.pdf.

Sparks, S. (2005), 'JISC Disciplinary Differences Report.' http://www.jisc.ac.uk/uploaded_documents/Disciplinary%20Differences%20and%20Needs.doc.

Stephen, T. and Harrison, T. (2002), 'Building Systems Responsive to Intellectual Tradition and Scholarly Culture ', *The Journal of Electronic Publishing* 1. http://www.press.umich.edu/jep/08-01/stephen.html.

Stewart, D.W., and Shamdasani, P.N. (1990), *Focus Groups: Theory and Practice.* Newbury Park, CA: Sage.

Stone, S. (ed.), (1980), 'Humanities Information Research: Proceedings of a Seminar: Sheffield 1980' (Centre for Research on User Studies, 4; Sheffield: British Library Board).

Talja, S. (2002), 'Information sharing in academic communities: Types and levels of collaboration in information seeking and use', *New Review of Information Behaviour Research,* 3, 143-59. http://www.uta.fi/~lisaka/. http://www.uta.fi/~lisaka/Taljaisic2002_konv.pdf.

Unsworth, J. (2003), 'The Humanist: "Dances with Wolves" or "Bowls Alone"?' paper given at Scholarly Tribes and Tribulations: How Tradition and Technology Are Driving Disciplinary Change, October 17. http://www.arl.org/scomm/disciplines/Unsworth.doc http://www.arl.org/scomm/disciplines_program.html.

University of Bristol Information Services (2004), 'Portals and Portal Frameworks.' www.bris.ac.uk/is/projects/portal/portalbytes/.

Wagner, E. and Newell, S. (2004), "Best' for Whom?': the tension between 'best practice' ERP packages and diverse epistemic cultures in a university context', *Journal of Strategic Information Systems*, www.elsevier.co/loacate/jcis.

Waloszek, G. (2001), 'Portal Usability – Is There Such A Thing?' *SAP Design Guild,* Edition 3. http://www.sapdesignguild.org/editions/edition3/overview_edition3.asp.

Warwick, C., Terras, M., Huntington, P. and Pappa, N. (2006) 'If you build it will they come? The LAIRAH Study: Quantifying the use of online resources in the Arts and humanities through statistical analysis of user log data'. School of Library, Archive and Information Studies, University College London

Watry, P. and Larson, R. (ed.), (2005), 'Cheshire 3 Framework White Paper: Implementing Support for Digital Repositories in a Data Grid Environment, Local to Global Data Interoperability - Challenges and Technologies, 2005.' http://cheshire.berkeley.edu/Cheshire_Sardinia.pdf#search=%22%20%22cheshire%203%20framework%20white%20paper%22%22.

Watson P. (2003), 'Databases and the grid' In Berman et al 2003a pp 363 – 384.

Weymouth, T., Hardin, J., Golden, G., Severance, C. and Leasia, J. (2003), 'CHEF at the University of Michigan-and Onward', paper given at CIC Workshop. http://www.cic.uiuc.edu/groups/CIOTechForumPlanningCommittee/archive/ConferencePresentation/TechForum2003/Topics/CollaborationTools_Weymouth.pdf#search=%22chef%20and%20the%20university%20of%20michigan%20and%20onward%22.

White, C. (2003), 'Is the Portal Dead?' *DM Review*. http://www.dmreview.com/editorial/dmreview/print_action.cfm?articleId=6959.

Wilson, A. (ed.), (2004), '2003 OCLC Environmental Scan: Pattern Recognition' Dublin, Ohio: Online Computer Library Center.
http://www.oclc.org/membership/escan/downloads/research.pdf.

Wilson, A. (1987), 'Libraries In Support of Scholarly Communications in the Humanities', Occasional Publication of the University of London Library Resources Coordinating Committee, 7.

Working Group on Research Infrastructure in the Humanities and Social Sciences (2004), 'Blueprint for the European Resource Observatory for the Humanities (EROHS).'
http://www.erch.info/Default.aspx?ID=3.

Wouters, P. (2004), 'The Virtual Knowledge Studio for the Humanities and Social Sciences @ the Royal Netherlands Academy of Arts and Sciences',
http://www.virtualknowledgestudio.nl/en/
http://www.niwi.knaw.nl/nl/initiatieven/digitalisering/vks/C%3A%5CDocuments+and+Settings%5CElly%5CMy+Documents%5CThe+Virtual+Knowledge+Studio+for+the+Humanities+and+Social+Sciences.pdf.

Wright, C. (2006), 'AHRC ICT Strategy Project: Peer Review and Evaluation of Digital Resources for the Arts and Humanities.'

Wynne, M. (2002), 'Linguistics and the Arts and Humanities Data Service.'
http://www.llas.ac.uk/resources/conferenceitem.aspx?resourceid=1314.

--- (2002), 'Setting the Agenda: Languages, Linguistics and Area Studies in Higher Education: 24-26 June 2002, Manchester Conference Centre, UMIST.'
http://www.ilas.ac.uk.

--- (2004), 'Evaluation in the Arts and Humanities Data Service', Journal of Information and Knowledge Management Systems, 4.
http://eprints.ouls.ox.ac.uk/archive/00000826/.
http://eprints.ouls.ox.ac.uk/archive/00000826/01/eprint.pdf.

Young, R. (2004), 'Findings of the Altis Survey 2003-2004.'
http://www.portal.ac.uk/spp/documents/testing/phase2/altis/AltisSurvey20032004.doc

Zaphiris, P. (2004), 'Usability Studies -JISC Services and Information Environment.'
http://www.jisc.ac.uk/uploaded_documents/JISC-Usability-Studies-Final.doc.

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RePAH Project Activities and Outputs

Greengrass: presentation to Arts and Humanities Research Council ICT Strategy Review Projects Meeting	December 2005
Bryson: RePAH Poster Presentation to Director of the AHRC, Professor Philip Esler	May 2006
Bryson(2006) "Managing Web-based Information in an Arts and Humanities Research Environment," in *Portals: People, Processes and Technology*, ed. Andrew Cox. Oxford: Facet	June 2006
Brown, S, Bryson, J, Greengrass, M, and Ross, R (2006) 'AHDS Review and User Survey' A report to the Joint Information Systems Committee (JISC) and the Arts and Humanities Research Council (AHRC)	July 2006
Brown, Greengrass, Ross, Gerrard: Digital Resources in the Humanities and Arts Conference, Devon, UK	September 2006