Usability Evaluation of Digital Libraries: A Tutorial

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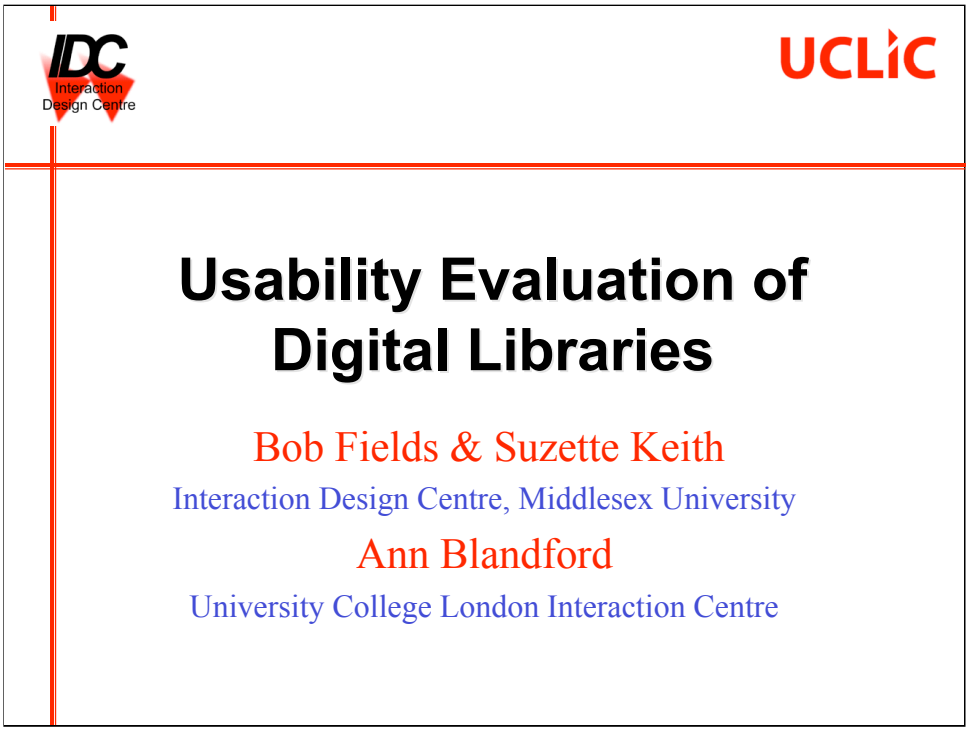
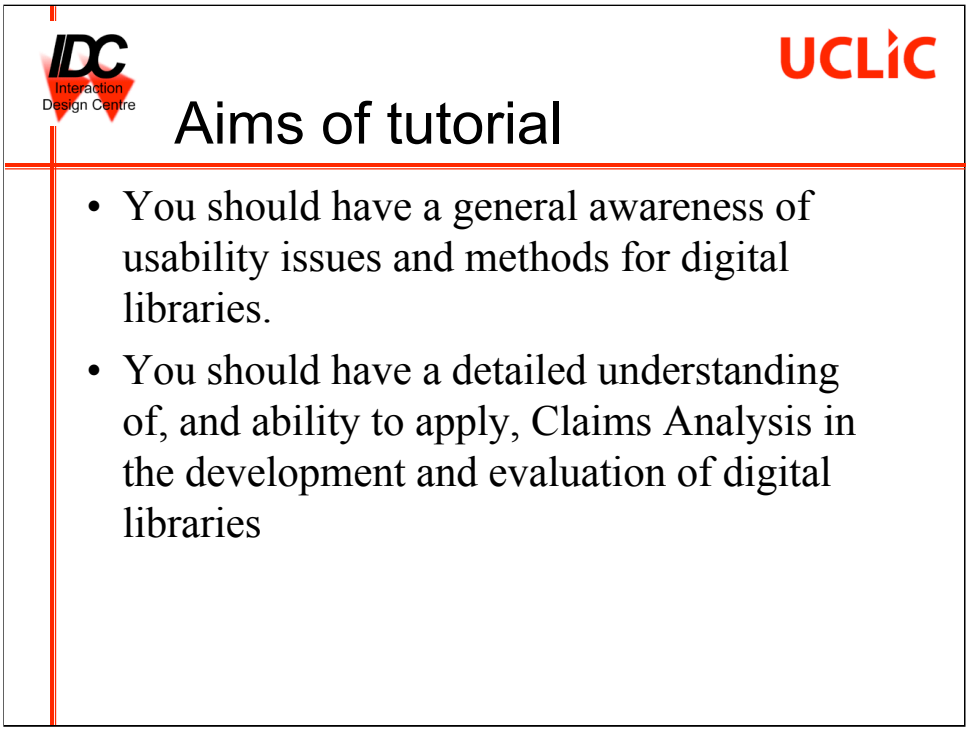


Acknowledgements

This tutorial has been developed and tested in collaboration with library staff at British Telecommunications plc, and has also been tested with Dr. David Bainbridge of the Greenstone Digital Library project, and Dr. Richard Butterworth, as he has developed features of the Vaughan Williams Music Library. This work is funded by EPSRC (GR/N37858).



This one-day tutorial is an introduction to usability evaluation for Digital Libraries. In particular, we will introduce Claims Analysis. This approach focuses on the designers' motivations and reasons for making particular design decisions and examines the effect on the user's interaction with the system. The general approach, as presented by Carroll and Rosson(1992), has been tailored specifically to the design of digital libraries.

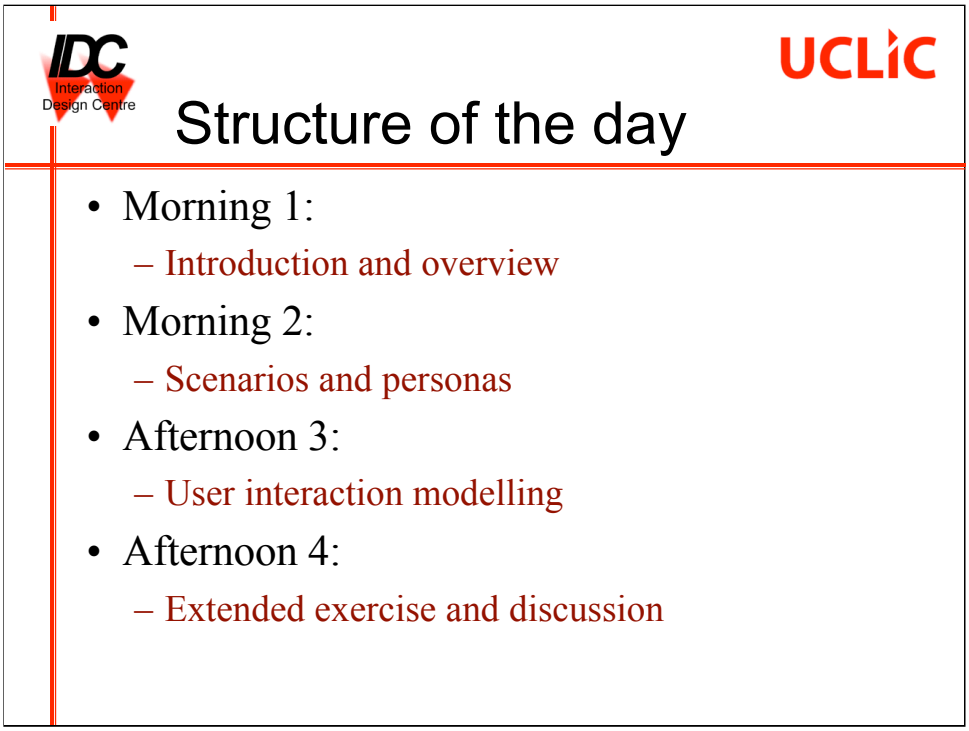
Digital libraries are notoriously difficult to design well in terms of their eventual usability. In this tutorial, we will present an overview of usability issues and techniques for digital libraries, and a more detailed account of claims analysis, including two supporting techniques – simple cognitive analysis based on Norman's 'action cycle' and Scenarios and personas. Through a graduated series of worked examples, participants will get hands-on experience of applying this approach to developing more usable digital libraries. This tutorial assumes no prior knowledge of usability evaluation, and is aimed at all those involved in the development and deployment of digital libraries.

Bates M The cascade of interactions in the digital library interface. *Information Processing and Management* 38 (2002):381-400

Cooper, A. (1999) *The Inmates are Running the Asylum*. Indianapolis: Sams Publishing.

Norman, D. (1986) Cognitive Engineering. in Norman, D.A. and Draper, S.W., Eds. *User Centered System Design,* 31-62 Hillsdale NJ: Lawrence Erlbaum.

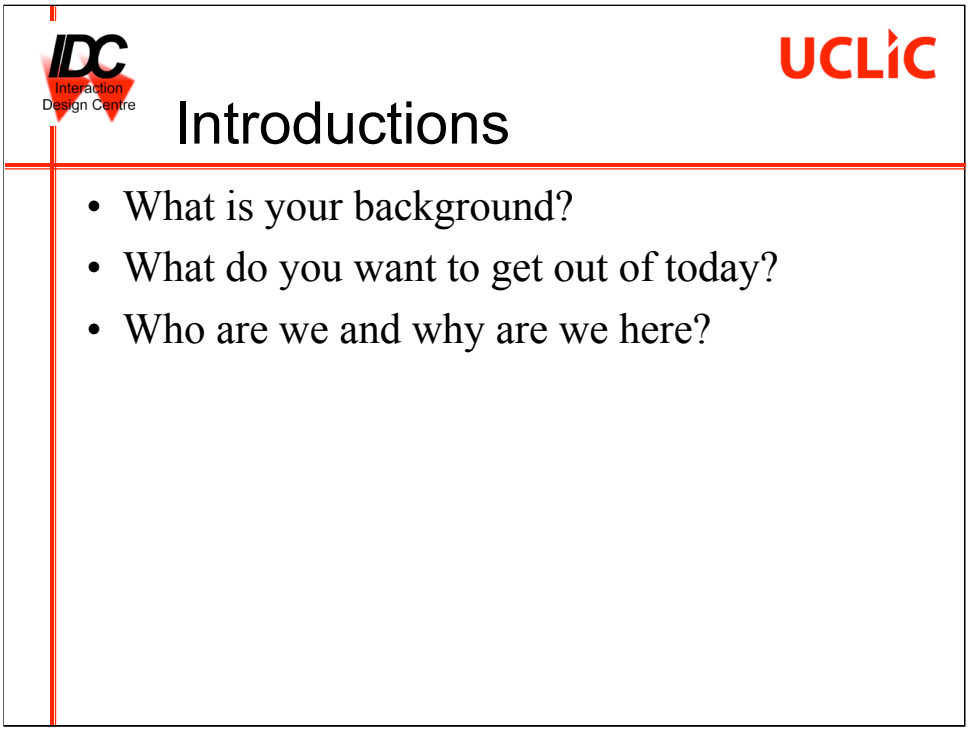
Carroll J M, Rosson M B (1992) Getting around the task-artifact cycle: how to make claims and design by scenario. *ACM Transactions on information systems*. Vol 10 No 2 April 1992 181-212



The tutorial will lead participants through the stages of evaluation using claims analysis, enhanced with supporting techniques. The early stages of the tutorial will present key design and practice issues and present illustrative examples of the use of claims analysis from our own experience. Through the day, personas, and the practicalities of creating plausible and powerful personas, will be presented, and participants will be given an exercise on persona generation. The more complex ideas that underpin the action cycle approach (as tailored to use with Claims Analysis) will be presented, with worked examples and class exercises. The final session of the day will be devoted to a substantial class exercise, in which participants will be expected to apply all elements of the approach to a realistic design problem.

All exercises will be paper-based. Participants will be expected to work in pairs or small groups for most exercises, and will engage in some role-playing activities as they work through the various exercises. The emphasis will be on presenting key theory and techniques, but with plenty of time for participants to practice skills, facing and overcoming some of the difficulties that are inherent in any approach to deep usability analysis.

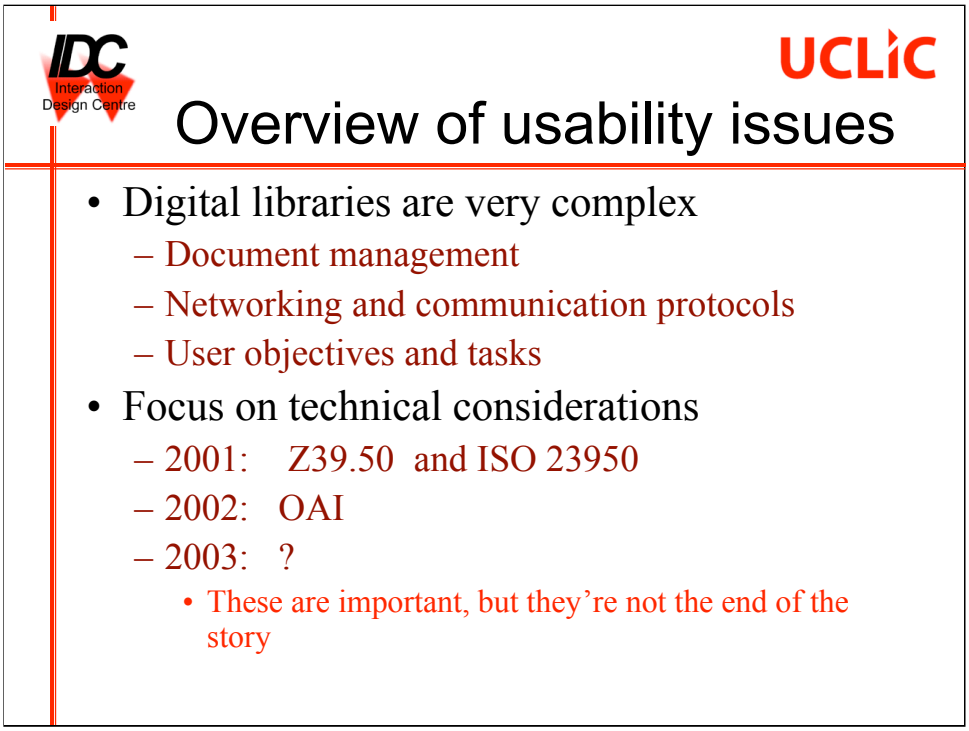
At the end of the tutorial we expect participants to have gained sufficient experience of applying Claims Analysis to be able to apply it to other systems. We also hope you will have enjoyed yourselves!



Suzette Keith has previous experience of working on user interface design issues with software developers in a number of commercial organisations. She is the researcher on the project that has developed and tested the approach being presented in this tutorial. She has worked closely with library and other staff at BT in the process of developing and testing the Claims Analysis approach.

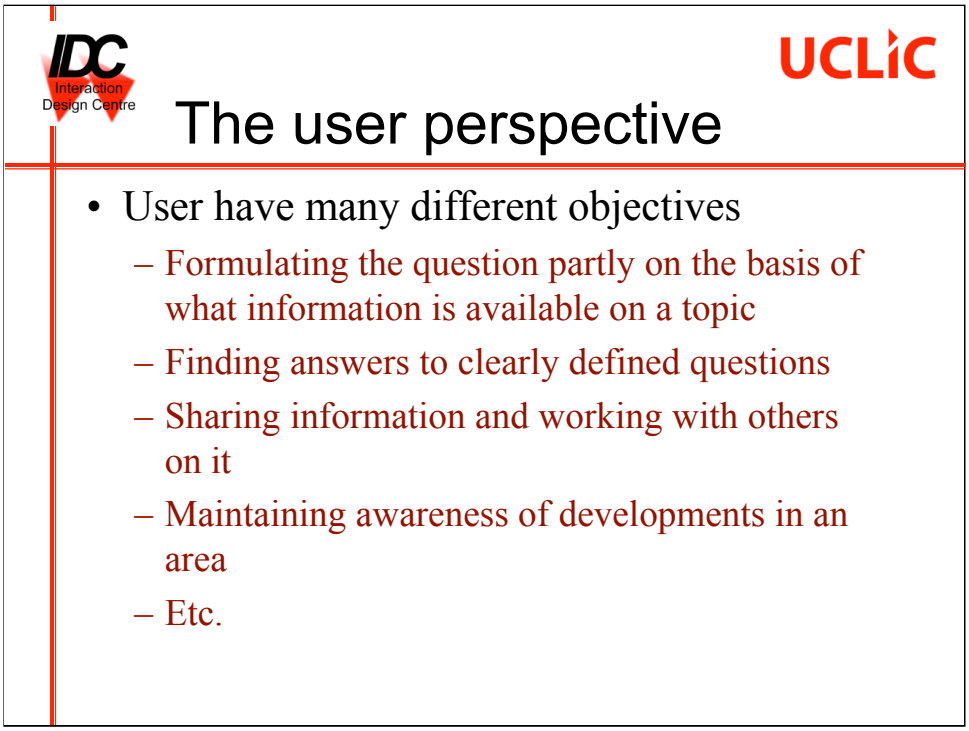
Dr. Bob Fields is a Senior Lecturer in the School of Computing Science at Middlesex University. He has extensive experience of HCI evaluation methods, and of teaching HCI. He is Principal Investigator on the project that has developed and tested the approach being presented in this tutorial.

Dr. Ann Blandford is a Senior Lecturer in UCL Interaction Centre, where she teaches cognitive and social aspects of HCI and usability evaluation methods on the MSc in HCI with Ergonomics. Previously, she was Director of Research in Computing Science at Middlesex University, where she taught various courses on HCI. She has presented tutorials on HCI topics at HCI'98, CHI'99, and EUPA 2002. She leads several projects investigating usability of digital libraries, covering social and technical aspects of usability and user acceptance as well as the approaches being presented in this tutorial. She co-chaired a successful workshop on usability of digital libraries at JCDL'02, and subsequently co-edited a special issue of the Journal of Digital Libraries on this topic.



There are widely recognised difficulties for end-users finding information in digital libraries. These range from difficulties in formulating queries to broader challenges of digital library use in the broader work context. The technical challenges of developing reliable libraries that perform correctly and standards such as *ISO 23950:1998, Information and documentation — Information retrieval (Z39.50) — Application service definition and protocol specification* can obscure more distant concerns such as how such libraries will actually be used. Designers and the librarians who typically have responsibility for making digital information available to end users lack strategies to examine the design problem from the end users' perspective. At a workshop on usability at JCDL'02, many participants – particularly librarians who have direct responsibility for delivering digital library resources – expressed a need for clearer direction and techniques for evaluating digital libraries and of thinking about the design and deployment of new digital resources.

Blandford, A & Buchanan, G. (2002) (Eds.) *Proceedings of workshop on Usability of Digital Libraries* at JCDL'02. Available from www.uclic.ucl.ac.uk/annb/DLUsability/JCDL02.html



Whereas much work in digital libraries and information retrieval has focused on technical issues, work within information seeking has had a much stronger focus on users and their behaviour when working with information. See for example, most of the references listed on this page. Unfortunately, little of the work has explicitly studied how the detailed design of a particular system influences and guides user behaviour. Later in this tutorial, we will discuss these matters in more detail.

Attfield, S., Blandford, A. & Dowell, J. (forthcoming) Information seeking in the context of writing: a design psychology interpretation of the 'problematic situation'. To appear in *Journal of Documentation*.

Bates M J (1989) The design of browsing and berrypicking techniques for the on-line interface. *On-line Review* 13 (5) 407-424

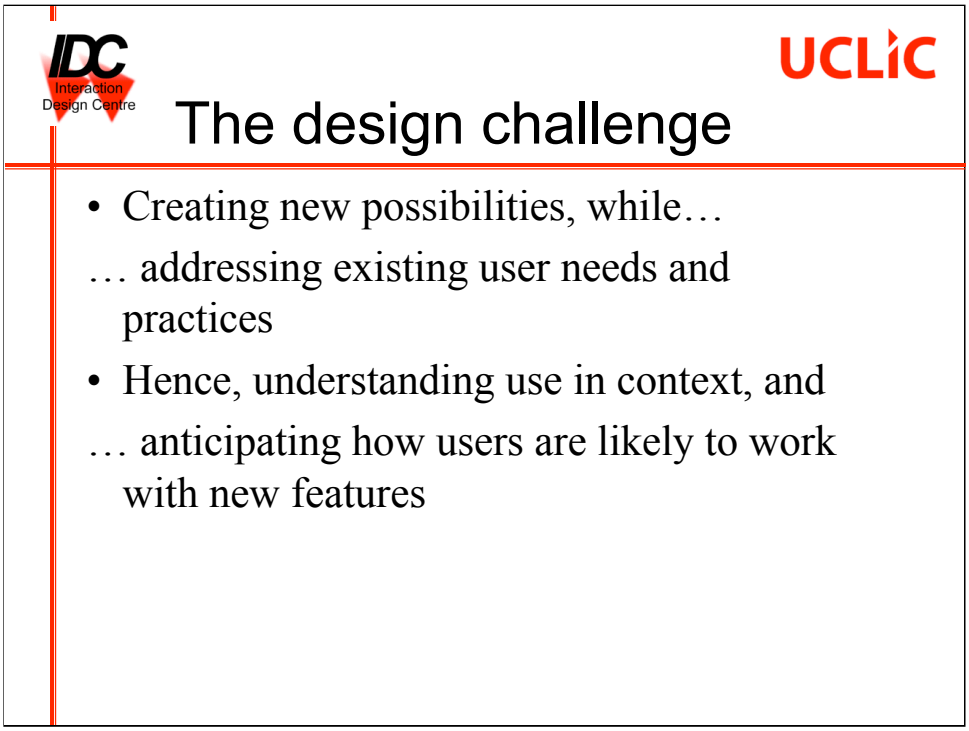
Belkin N J (1980) Anomalous states of knowledge as a basis for information retrieval. *Canadian Journal of Information Science*. 5. 133-134

Ellis, D. & Haugan, M (1997) Modelling the information seeking patterns of engineers and research scientists in an industrial environment. *J Documentation* 53 (4) 384-403

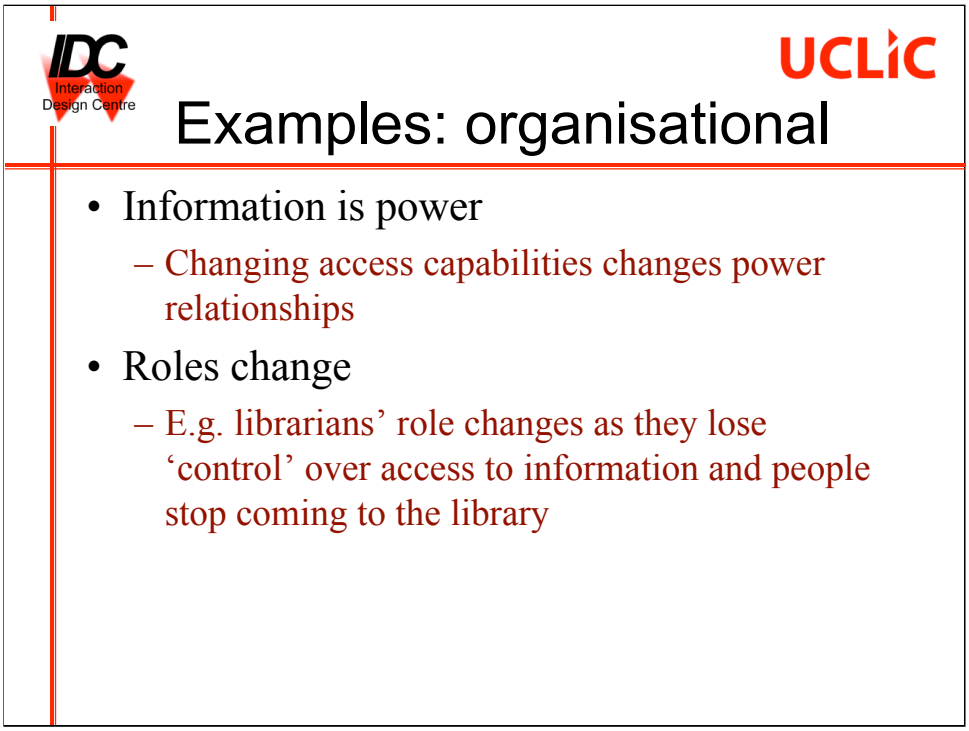
Ingwersen, P. (1996) Cognitive perspectives of information retrieval interaction: elements of a cognitive IR theory. *J Documentation* 52 (1) 3-50

Kuhlthau, C.(1988) Longitudinal case studies of the information search process of users in libraries. *Library and information science research* 10 (3) 257-30

Marchionini, G (1995) *Information seeking in electronic environments*. Cambridge University Press



There is a constant tension in design between design evolution – starting from an existing design and making small adaptations in response to identified needs (whether user needs or technical ones) – and design revolution, in which radically new systems are developed, thereby creating new interaction possibilities.



In our studies of the introduction of digital information sources in hospitals and academia, we have found many examples of ways in which they change roles are responsibilities, many of which are perceived as threatening by the user groups. For example, in a medical setting, traditional top-down information dissemination, which reflects established power relationships, is overturned, as senior staff often do not have the time or skills to access online information quickly, but junior staff who have recent academic training have better information accessing skills, and an increasing expectation that they should have access to clinical information to support their work. Information hoarding (e.g. password protecting computers or moving them to private offices) cause tensions within the organisation.

In an academic setting, the roles of librarians are changing, as publishers change interfaces and access without direct communication with library staff whose role clearly includes information provision. Also, end users come to the library less frequently, so that librarian–user interactions happen less naturally. Some librarians are dealing with this by finding new ways of interacting with users; others feel very threatened by the changes.

Adams, A. & Blandford, A. (2002) Acceptability of Medical Digital Libraries. *Health Informatics Journal*. 8(2), 58-66. Sheffield Academic Press. ISSN 1460-4582.

Adams, A. & Blandford, A. (forthcoming) The Unseen and Unacceptable Face of Digital Libraries. To appear in *Journal of Digital Libraries*.

Examples: interactional

- While the usability of individual libraries may (!) be tested, the interactions between systems don't seem to be
  - Access rights – e.g. Athens passwords
  - Recognising transitions from one library to another
  - Multiple tasks can interfere

Users are often expected to understand access rights with minimal explanation, and may be expected to go to the physical library to arrange access, which interrupts an ongoing search task. Similarly, many libraries interconnect in ways that are unexpected by users, so that users suddenly find themselves in an unfamiliar environment, with new interaction possibilities and new restrictions that are poorly signposted.

Blandford, A., Stelmaszewska, H. & Bryan-Kinns, N. (2001) Use of multiple digital libraries: a case study. In *Proc. JCDL 2001*. 179-188. ACM Press.

Examples: detailed

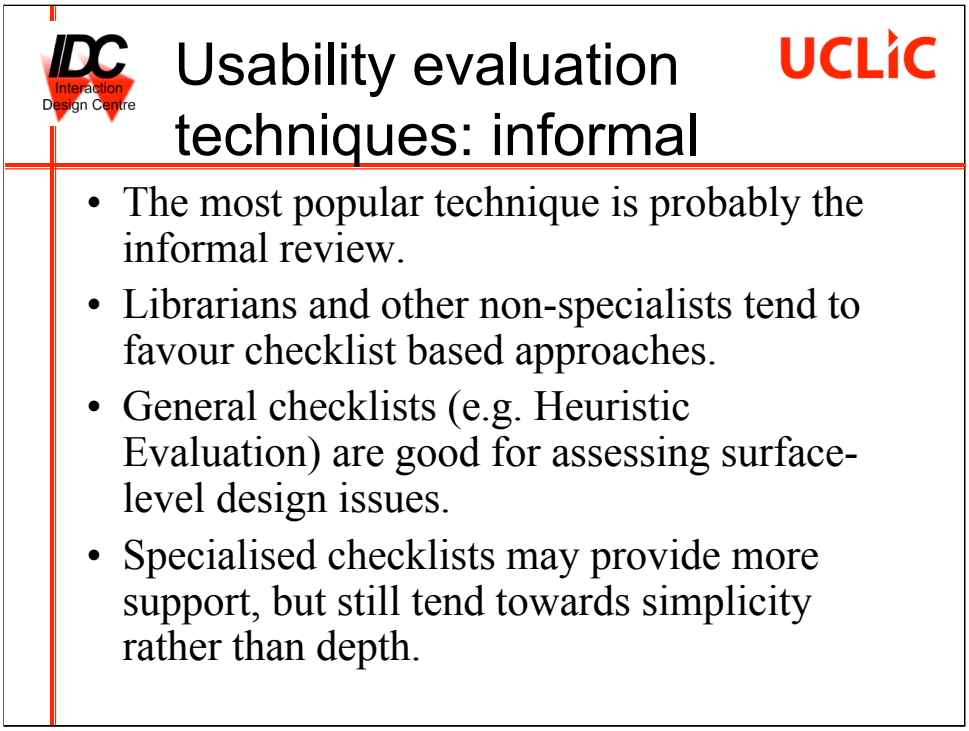
- Many users have poor searching skills, and libraries provide insufficient help in context
- Novel features, and who can use them, are hard for users to quickly assimilate
- The number of items returned from a search and the ordering of those items can be unclear to users
- The precise format of information is very important to some – e.g. media specialists

In laboratory tests, users are typically given search tasks by the investigators to study usability of features of a library. In practice, getting information is rarely a task in its own right: it's a supporting task for something else (such as writing a term paper, preparing a legal case, deciding how to treat a patient, etc.). As libraries become accessible in the work context (rather than by a special trip to the library building), users tend to continue to focus on their main tasks, expecting the library to 'deliver' to order without them having to learn new skills and new features. There is a mismatch between expectation and reality. Librarians often provide training courses on searching but these aren't universally well received because they are removed from users' real tasks and working environment.

There aren't ready answers to these issues – the first step is to understand the difficulty of the challenge.

Summary

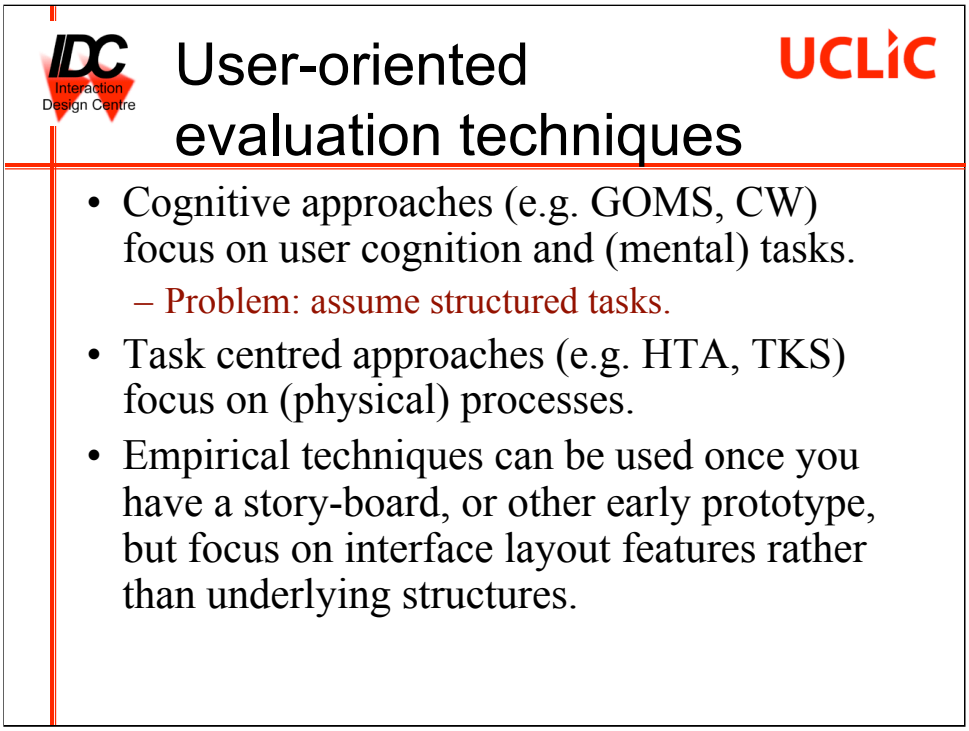
- It's no wonder libraries can be hard to use:
  - There are many different issues, from organisational through to detailed interface design, to think about
  - There a different stakeholders: developers, networking specialists, librarians, users, with different priorities and needs
- There are different approaches that can help with aspects of user experience…



Heuristic approaches, such as Nielsen's Heuristic Evaluation, provide a kind of check-list against which the design can be assessed – e.g. asking questions like whether users get appropriate feedback at every step. Sandusky proposed a framework for generating questions on a broader range of issues that are pertinent to DLs in particular.

Nielsen, J. (1994) Heuristic Evaluation. In J. Nielsen & R. Mack (Eds.), *Usability Inspection Methods* (pp. 25-62) New York: John Wiley.

Sandusky, R. J. (2002) Digital Library Attributes: Framing usability research. In A. Blandford & G. Buchanan (Eds.) Proc. Workshop on Usability of Digital Libraries at JCDL'02. 35-38 Available from http://www.uclic.ucl.ac.uk/annb/DLUsability/JCDL02.html



GOMS stands for Goals Operators Methods and Selection rules. The approach assumes that users' tasks are hierarchically structured and that the key issues revolve around how long each mental process or physical action takes. Users are assumed to be experts, and to know how to work with the device.

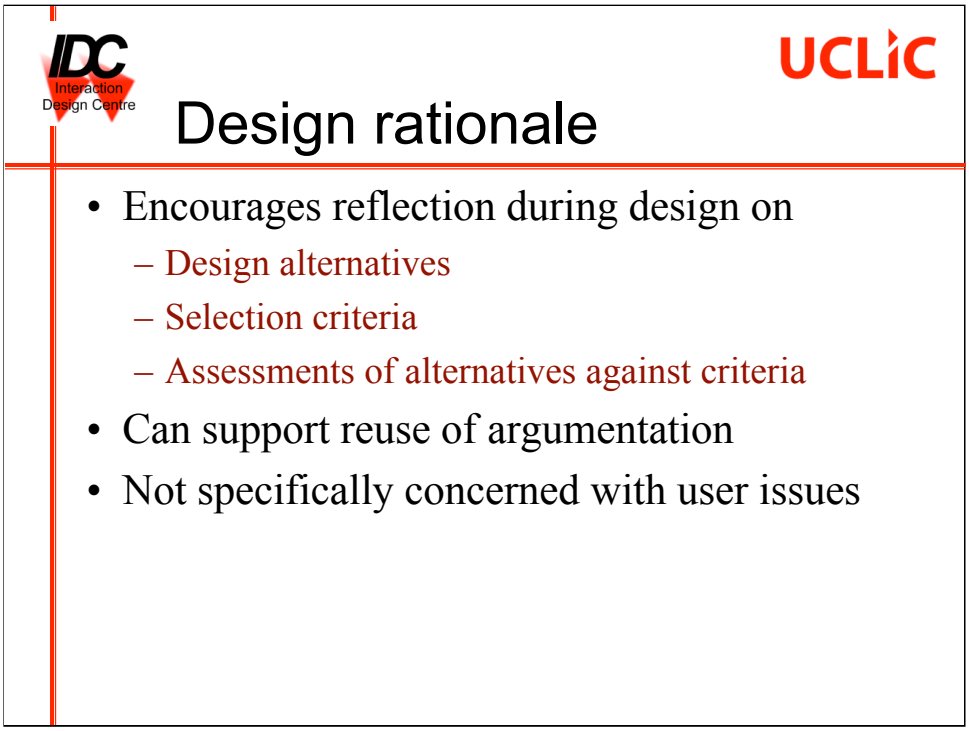
CW, or Cognitive Walkthrough, is based on a similar kind of theory, but makes contrasting assumptions about users – namely that they are novices with clearly articulated goals but who are exploring the device, so that they have to work out what to do next at every step. See:

Wharton, C., Rieman, J., Lewis, C. & Polson, P. (1994) The cognitive walkthrough method: A practitioner's guide. In J. Nielsen & R. Mack (Eds.), *Usability inspection methods* (pp. 105-140) New York: John Wiley.

HTA (Hierarchical Task Analysis) and TKS (Task Knowledge Structures) are task-based approaches that consider the physical actions users have to perform and (to some extent) the knowledge users have to have to perform those tasks. See:

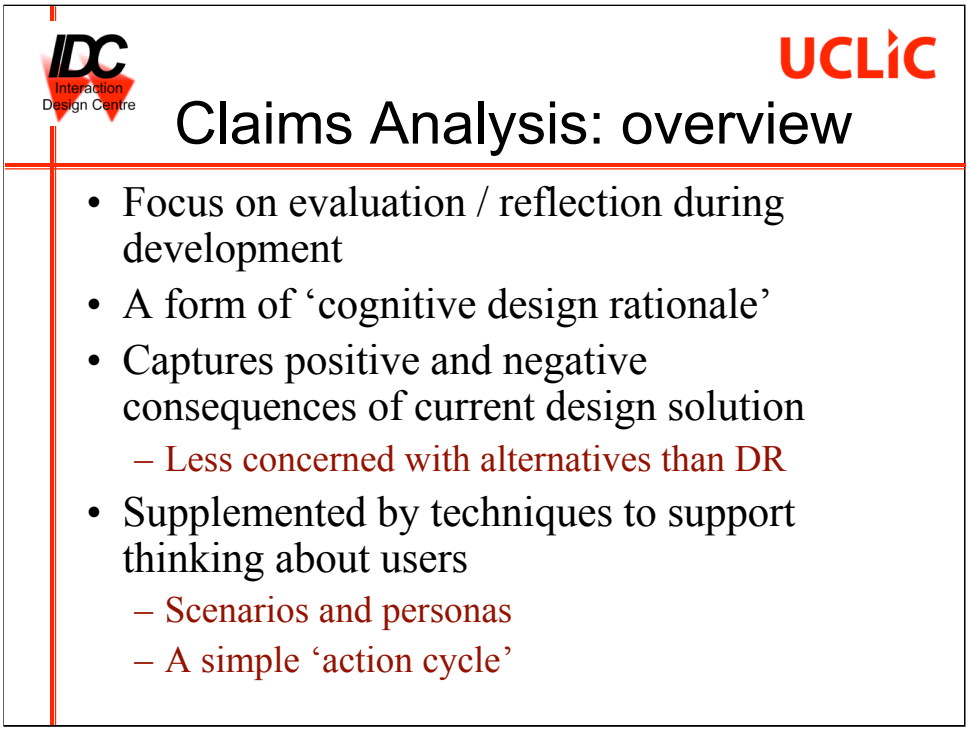
Johnson, P. (1992) *Human-Computer Interaction: Psychology, Task Analysis and Software Engineering*. London: McGraw-Hill.

All of these approaches have things to commend them, and all have a potential place to play in design and evaluation. In practice, the limited evidence there is indicates that few techniques have been taken up widely in industry – the exceptions probably being HTA and HE. Also, as we'll discuss later, these techniques are not generally well suited to evaluation of DLs.



DR techniques have developed in design domains such as architecture and systems design. Two example approaches that share much in common are the Issue Based Information System (IBIS) and Questions Options and Criteria (QOC).

MacLean, A., Young, R.M., Bellotti, V. & Moran, T. (1991) *Questions, Options, and Criteria: Elements of Design Space Analysis*. Human-Computer Interaction, 6 (3 & 4), 201-250. Special Issue on Design Rationale, (Eds.) Carroll J.M. and Moran T.P.



Claims analysis is an approach to thinking about design in terms of the 'claims' that the design team are making through their design decisions and their effect on the user. Claims analysis captures both positive and negative effects of the current design solution, allowing trade-offs to be considered. Thus, a claims analysis, like other approaches to design rationale, provides a structure for developers to be reflective and to think critically about their design. However, we found that claims analysis needs supporting techniques. Developers could readily provide positive claims – good reasons for the design being the way it is – but did not have strategies to identify and reason about negative effects. Therefore, complementary approaches are also needed.

The first of these is the use of scenarios, advocated by Carroll, but developed further – for example, by Cooper – into detailed personas. This involves developing detailed descriptions of individuals who might use the digital library, and developing detailed, plausible stories (scenarios) of how these individuals are expected to use the library.

Carroll J M, Rosson M B (1992) Getting around the task-artifact cycle: how to make claims and design by scenario. *ACM Transactions on information systems*. Vol 10 No 2 April 1992 181-212

Carroll J M (2000) *Making use: scenario based design of human computer interaction*. MIT Press

Cooper, A. (1999) *The Inmates are Running the Asylum*. Indianapolis: Sams Publishing.

Rosson, M. B. & Carroll, J. M. (2002) *Usability Engineering*. San Francisco: Morgan Kaufmann.

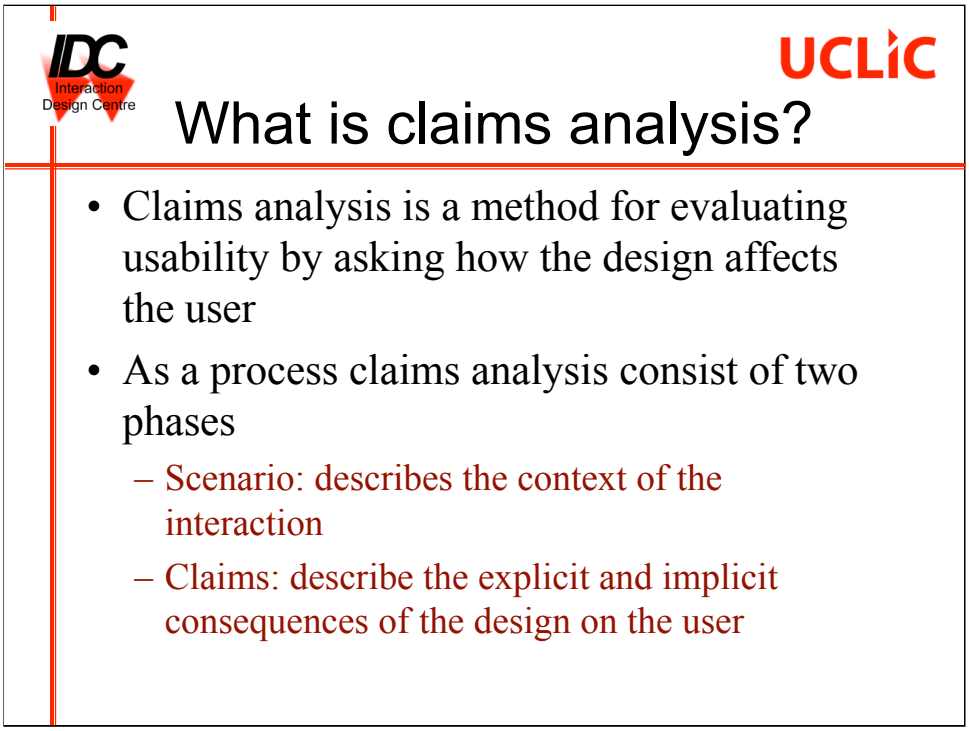
So why Claims Analysis?

- Designers are often developing systems speculatively, unsure of exactly how they will be used.
- There are a range of issues that need to be considered:
  - Formal approaches too ‘blinkered’
  - Heuristic approaches provide too little support
- Claims analysis seems to provide a balance between ease of use and level of guidance

Who needs to do evaluation?

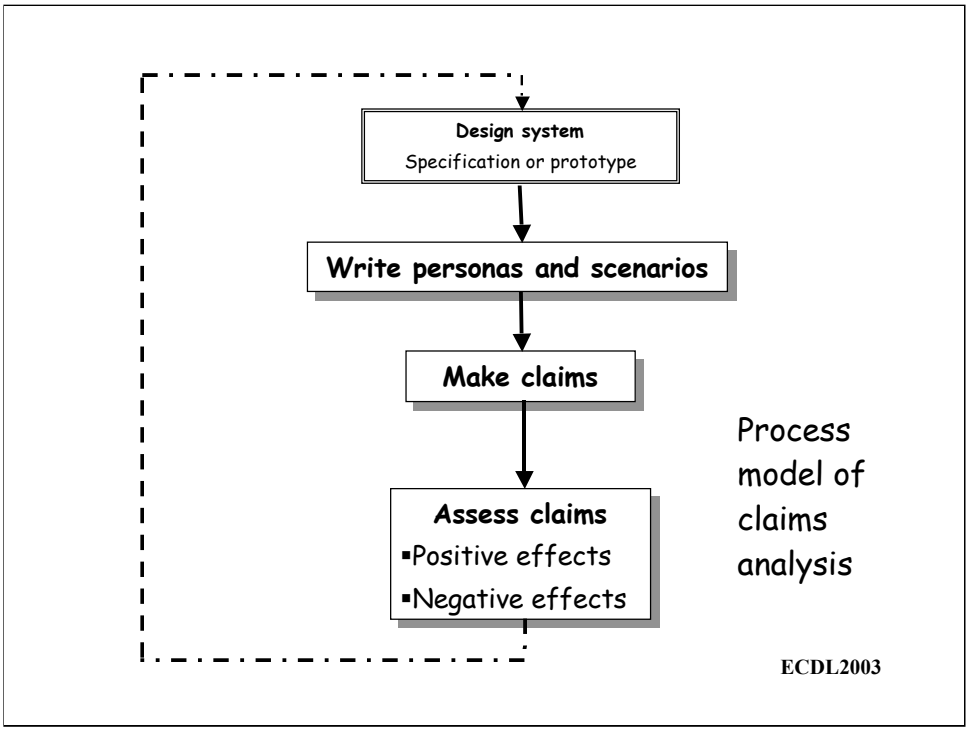
- Developers
- Purchasers
- Claims analysis focuses more on developers, as it can be used during ongoing design process
- Other evaluators (e.g. purchasers) need to probe what 'claims' are built in to the library and assess those

We have used Claims Analysis both retrospectively and concurrently with developers. Of the two, we find concurrent use more productive, as it is still possible for developers to reconsider and change design decisions at this point. However, for those who are involved in purchase and local implementation of DL systems, the same questions can be used retrospectively to assess the quality of design, or the appropriateness of the design for the intended user population.



Unlike the other expert inspection methods, claims does not produce a list of problems. Instead it provides an analysis of possible effects. These effects are identified by considering the interaction described in a scenario and by considering the results of research in the humanities and cognitive science disciplines.

The process of generating the scenarios supports both design and evaluative device identifying the user requirements as well as reaction to using the system. The claims generating stage offers the chance to be more systematic, to draw out implicit assumptions about the design and to reason about the effects.



Lets consider a visual representation of the key stages of the process of applying claims analysis. As this is an evaluation exercise within a design process we start with a model or description or prototype of the system – and we can expect to end with making modifications and refinement to that design.

We build up the context of use by creating stories that capture the essence of the users and their information seeking activities.From the stories and the description of the system we identify and create claims which describe the anticipated effect on the user.

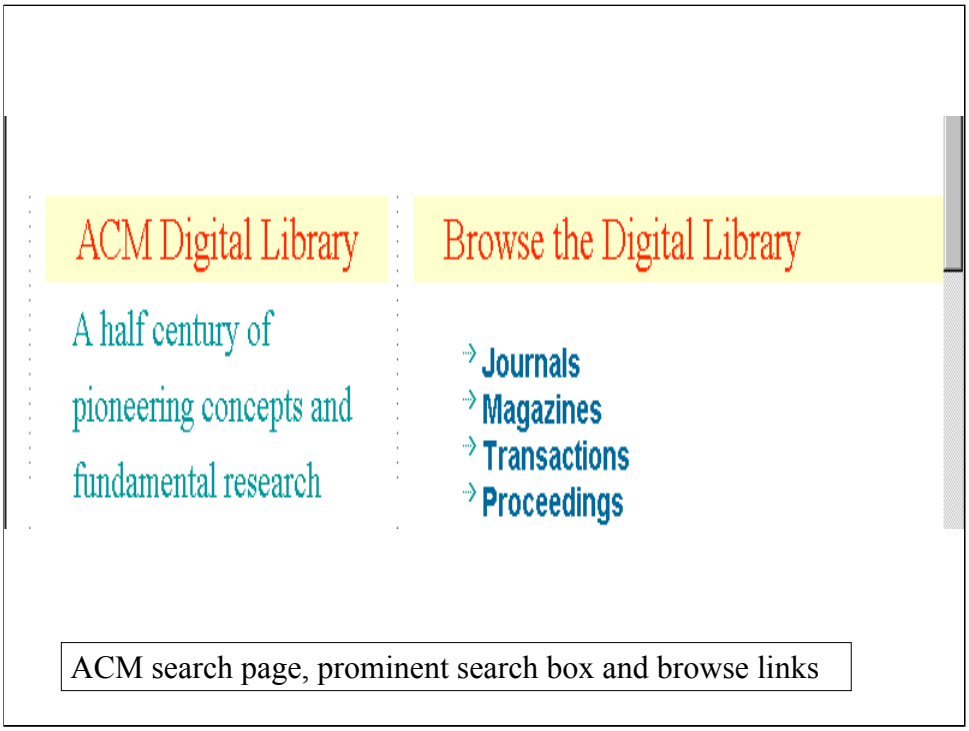
We finally assess the claims determining which are positive and if necessary digging deeper to find the negative ones.

We are assuming here that in a complex design, there is no one perfect solution to the design requirements. However we are assuming that we can optimise the design by maximising positive aspects of the design, resolving most negative effects and minimising the effect of any that remain insoluble. The design review team can discuss trade-offs between different design solutions, their effects on the users and the consequences for other parts of the design

Lets walk through a simple example with a well known digital library:

Sample persona

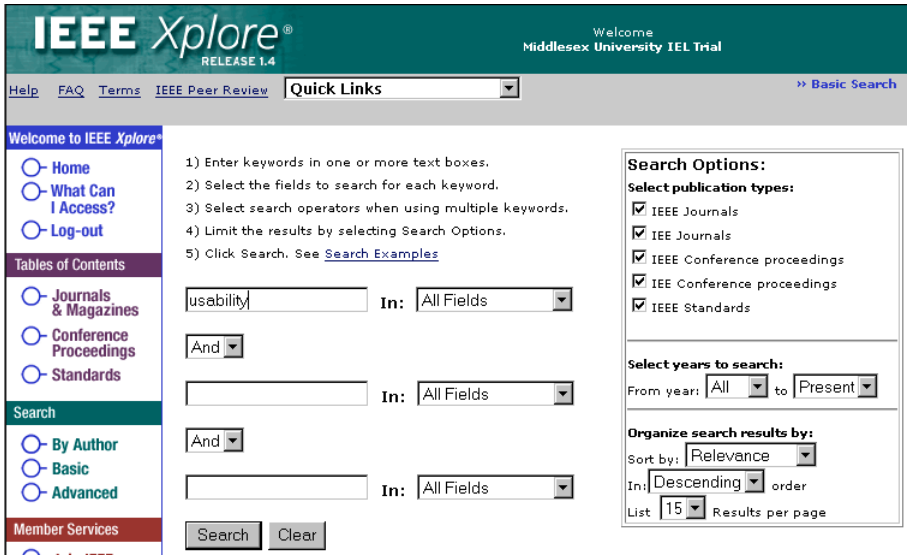
- Alice is a new member of the research team working on usability of digital libraries. She is a graduate software engineer who has recently joined the company. She is unfamiliar with the information resources available and the details of digital libraries...



ACM search page, prominent search box and browse links

Here, having overcome administrative difficulties about access and navigated her way to the search page is the home page of the ACM digital library:

One of the most striking features is the search box, as well as a description of the library and some alternative access browse links. Alice keys the phrase digital library



IEEE basic search, form filling search fields

Search box claims (1)

- The search box will encourage Alice to look for information by entering a keyword or phrase

Positive claim

We can make a claim about the search box – it is after all quite explicit. It assumes the user wants to make a free text entry search, it is prominent on the page without being overstated.

The effect on the user, although there is a choice, is to enter some terms

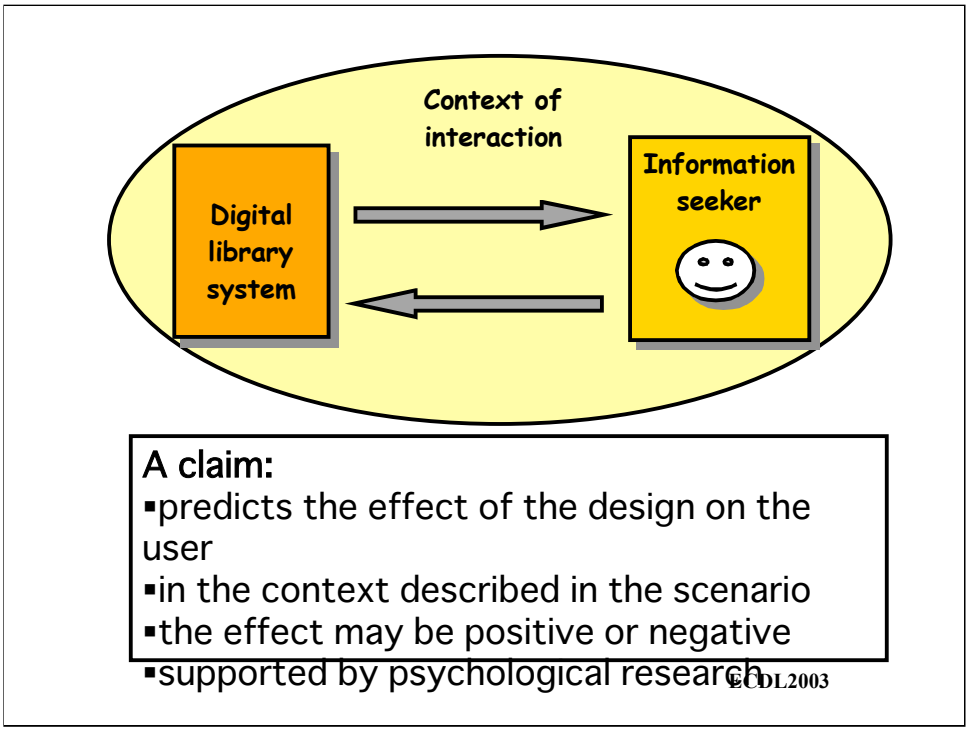
Search box claims (2)

- Alice may not know what syntax to use or understand about fields

Negative claim

If we push for a negative claim it is that the user may make a syntax error – Alice entered a phrase – this is now ACM's default, but what about digital libraries – is there automatic stemming? If the terms are not a phrase eg digital library interface design, but a pair of phrase concepts?

ACM gets around this one by offering adjacent links to help and advanced search. IEEE assumes you are clever - but not clever enough for the Boolean syntax of the advanced search!



So, to confirm the concept of claims:

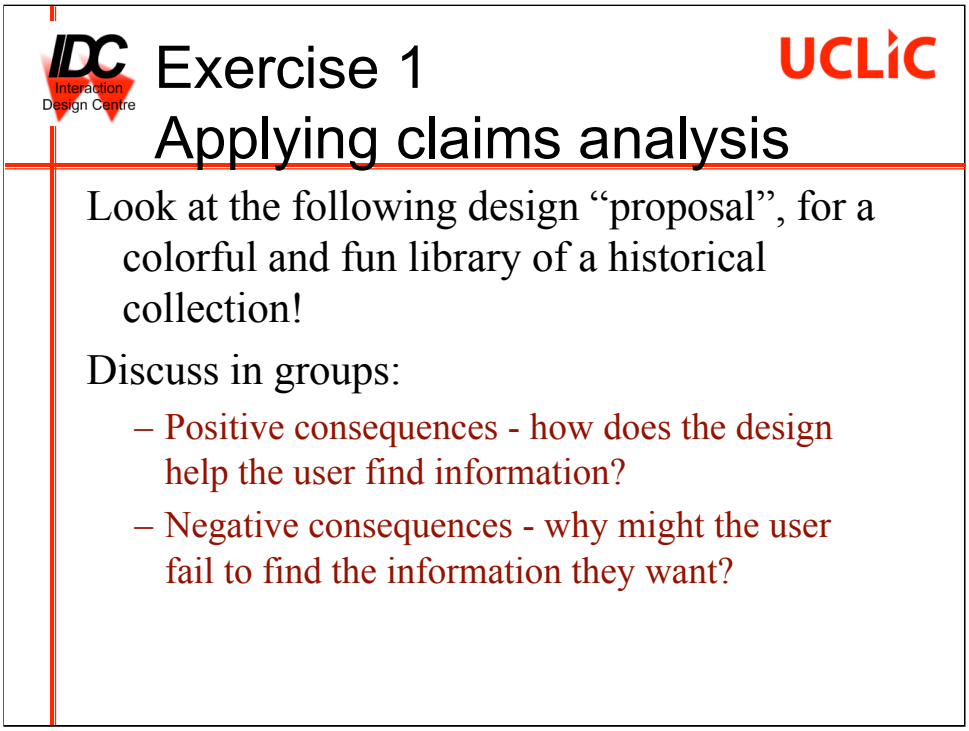
The claim exists only within the context of describing the user – Alice - and the interaction between our information seeker and the digital library system – ACM. That context is described by a scenario.

A set of claims express the relationship between the design and the user which is defined in the scenario.

That relationship may be helpful. It may support and encourage, guide and explain or simply anticipate users needs. Positive claims are usually design intentions – like putting the search box on the home page, but occasionally may be serendipitous.The claims also express any negative effect on the user – probably unintentional rather than as a deliberate act by the designer. An aspect of the design may lead the user to make an error, or leave the user stranded and confused, not knowing what to do next. It may lead the user to abandon the search despite the fact that the collection contains the information required. No search syntax or suggestions about how to formulate a query were provided.

Most often the claim can be and should be validated from psychological research and we are relying heavily on information seeking models. Sometimes further study may be needed – then the results of subsequent user trials can be captured and reused next time.

Finally the trade-off - The designers of the ACM interface perhaps chose to have an uncluttered layout for regular users, but with access to help for novices or advanced features.

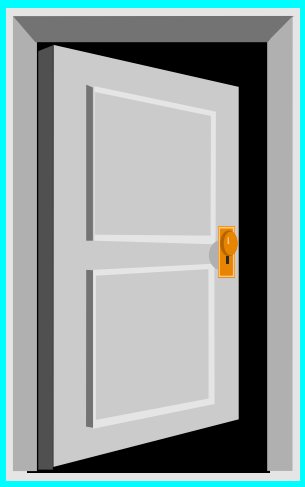


The purpose of this exercise is to find out how easy it is to generate claims from a simple prototype of an interface.

Please organise yourselves into small groups with your near neighbours to discuss how this design helps the user to find information and what might cause the user to fail.

Home page – click anywhere in the big history library. Ben is following up an interest in medical practise in ancient times.

BIG HISTORY



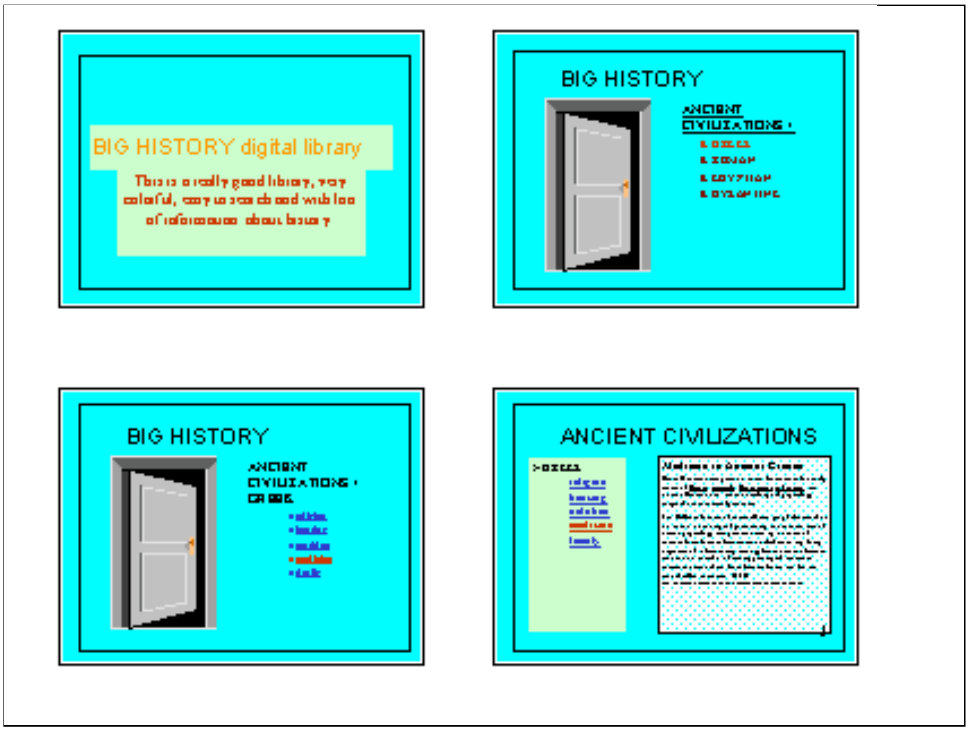
ANCIENT CIVILIZATIONS >

- GREEK
- ROMAN
- EGYPTIAN
- BYZANTINE

He choses a civilization

He choses a topic

He views the text-document



Consider the sequence of actions and events.

What is ***your*** reaction to this design?

Reflection: usability problems

- Presentation
  - Color, graphics
- Concept
  - Simple link following browsing
- Guidance
  - Better search support
- Categorization
  - Scale to 10,000+ documents and artifacts

DO THE EXERCISE FIRST!

In order to go deeper into the usability issues we need to define more about the user and what they are trying to do.

IDC Interaction Design Centre

UCLIC

2 Personas and scenarios

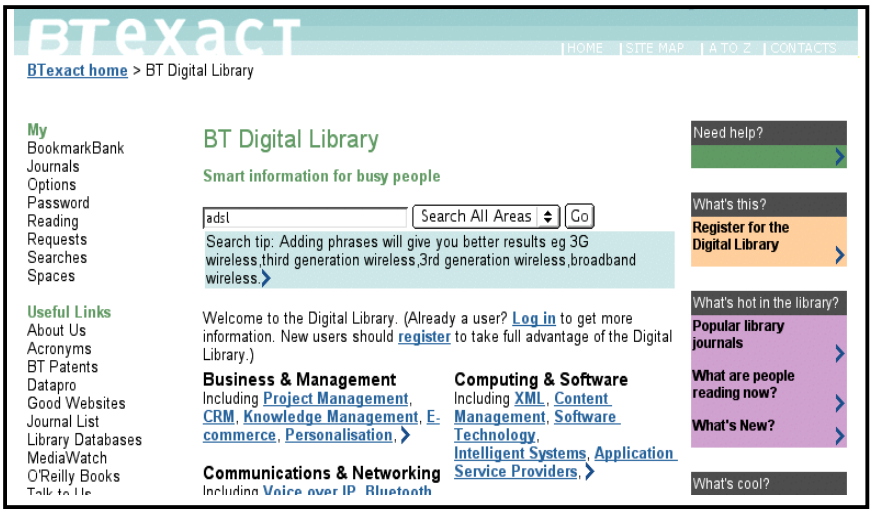
….telling the story

Chopin Manuscript collection run by Greenstone software

Digital libraries take many provide access to many different kinds of collections for different types of audience.

This on-going project to digitise a collection of music manuscripts uses Greenstone software to drive the library.

We at IDC Middlesex and UCLIC UCL have a number of projects running with the developers of Greenstone software from Waikato, New Zealand. The software is necessarily general purpose while the collections include books, papers, pictures, video and sound archives for a number of different organisations, with different cultural needs.

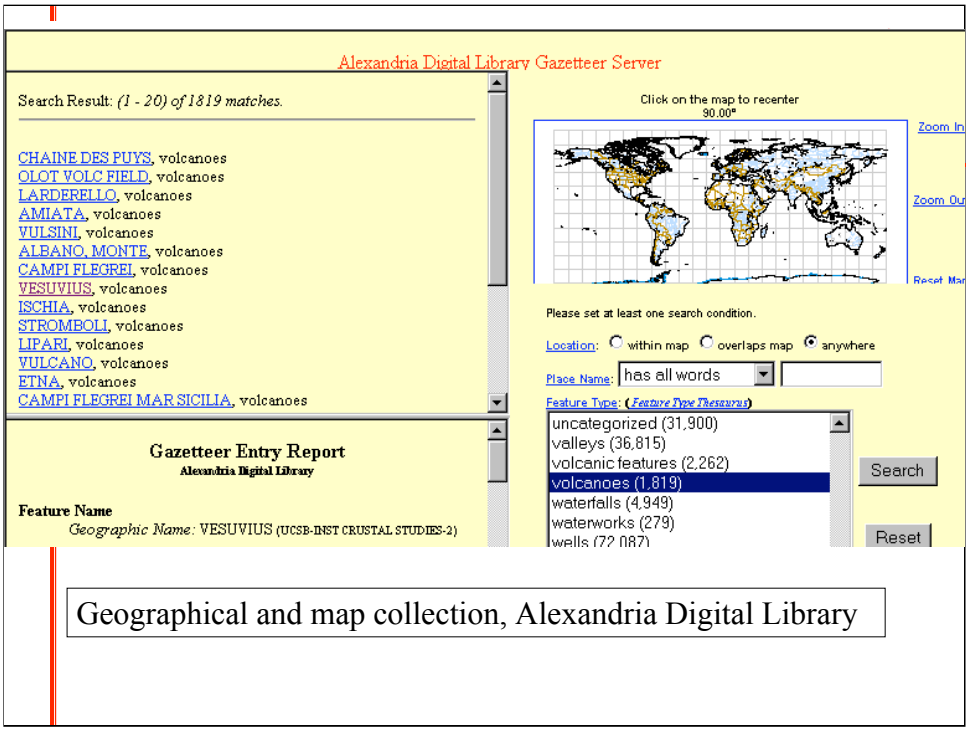


Commercial technical resource library

This commercial organisation library is accessible only to the engineers and market researchers of British Telecommunications plc.

The face of the library meets house style requirements, while the search engine was developed in-house. The search engine offers a common search to at least 10 different databases. These include two large abstract and index services, with licence agreements that give extensive full-text access to business relevant journal and business publications. There are multiple entry points and search support features.

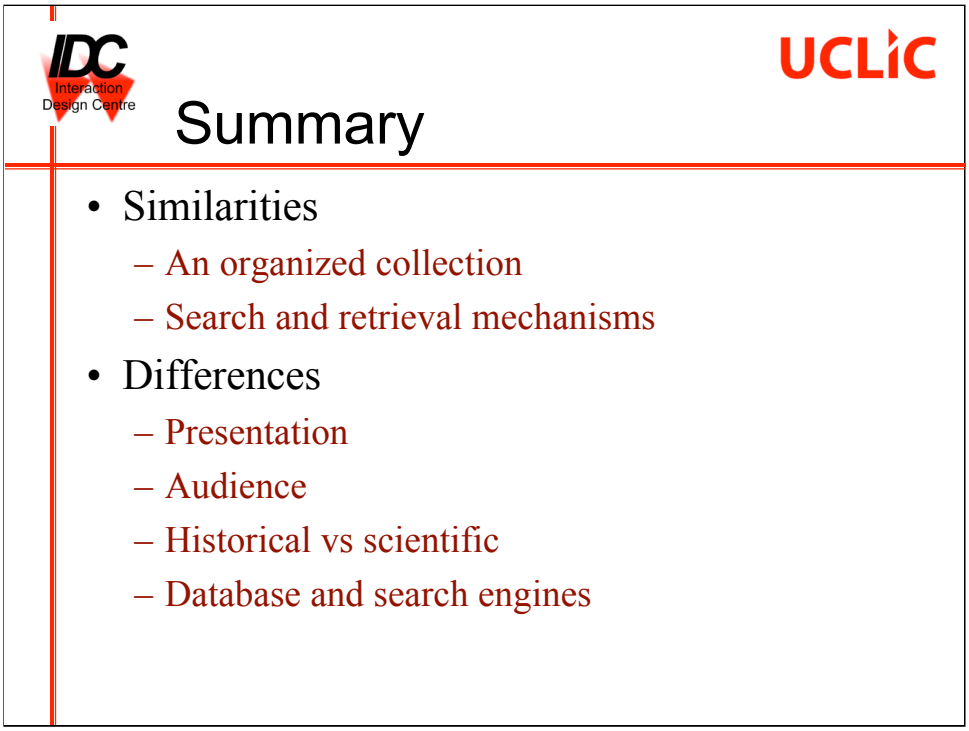
Typical of many institutional libraries, see also ACM and IEEE we saw earlier.



Geographical and map collection, Alexandria Digital Library

This is part of a results page from the Alexandria Digital library project.

The developers of this collection of maps and geographical data took usability seriously and have published their findings. Graphical information in general is more challenging to the developers and users – no full text searching, much greater dependence on indexing and browsing structures



Definitions of a digital library: variously emphasise the organisation of the collection, and the retrieval mechanisms, and their accessibility to digitised material.

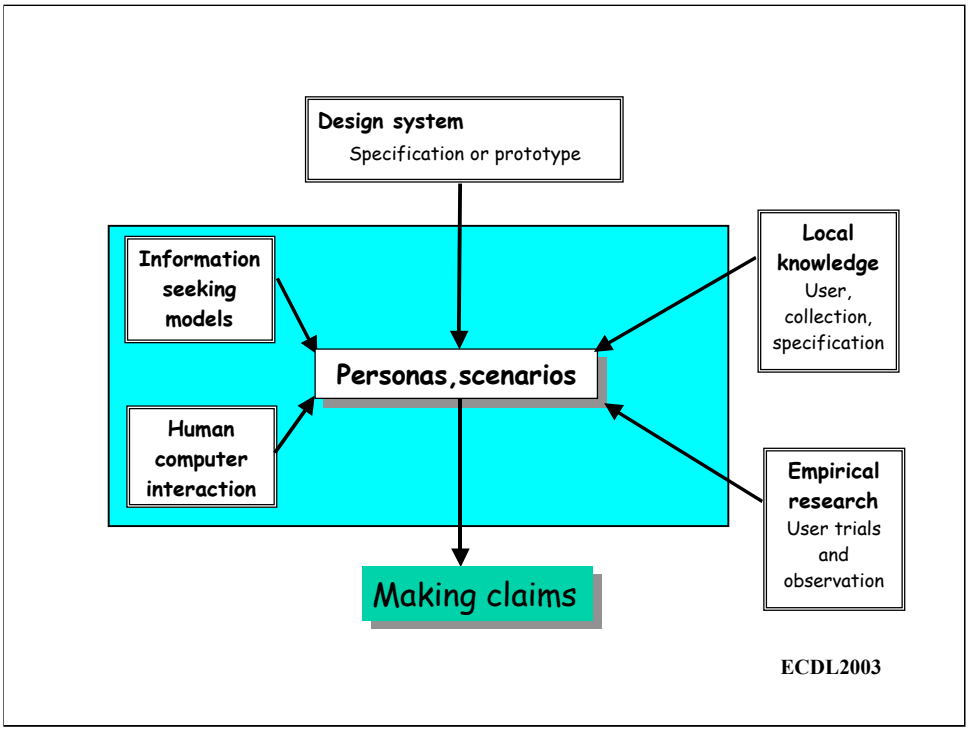
Presentational issues are obvious, but the important distinctions lies with character of the collection, the audience and the design of the search systems.

Differences reflect the uniqueness and innovativeness of each collection – the function of historical collections to preserve for the future creates different priorities to scientific collections which perhaps have to prioritise dissemination and quality control. The roles of the collector and the needs of audience differ.

Choices made about the search engine design and the management of the database, the rigorousness of the indexing or metadata are all going to have an effect on the design and through the design on the the user.

So how do we capture this diversity through one evaluation method

Bates M The cascade of interactions in the digital library interface. *Information Processing and Management* 38 (2002):381-400



Claims analysis uses scenarios to capture the context and uniqueness of the design and the user. This gives the flexibility needed to take account of the differing characteristics of the collection and the audience. Unlike methods such as heuristics and cognitive walk-through which try to be independent of the context. The quality of claims analysis as an evaluation tool is dependent on the quality of the scenario to represent the essential features of the user – to simulate a trial by real users.

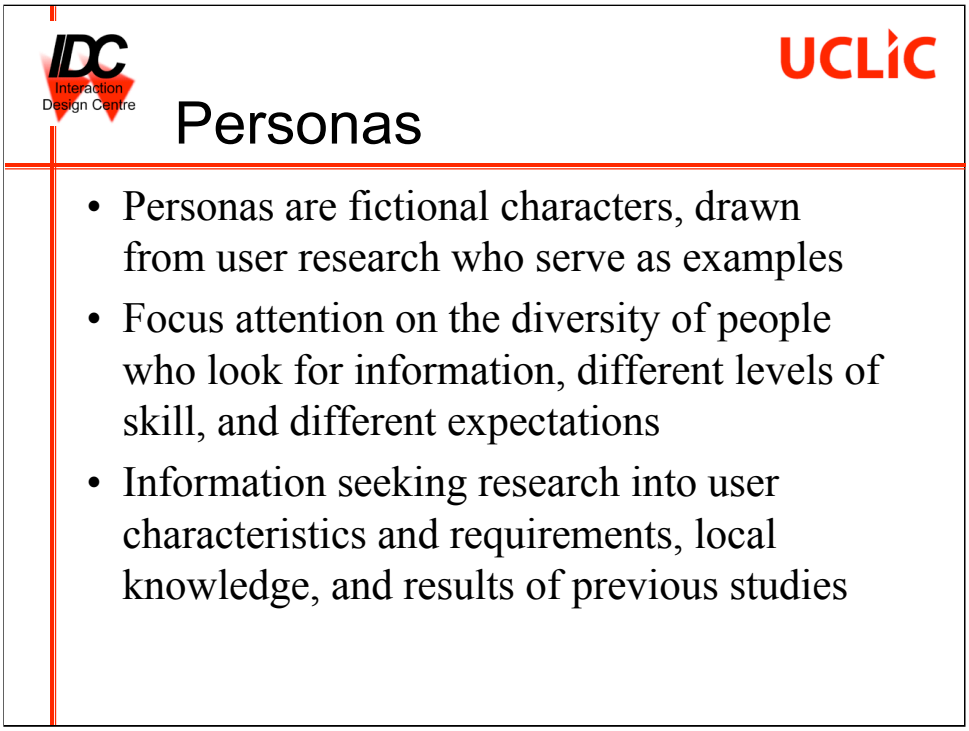
In this section we are concentrating on the development of scenarios using information seeking models. Other sources of information that feed into the stories is derived from:

•the description of the system which accounts for the actions and interaction

•local knowledge of the users – perhaps already built up as part of the development program, logs or collaboration with user groups

•empirical research – especially specific results from user trials, feedback, observation of users

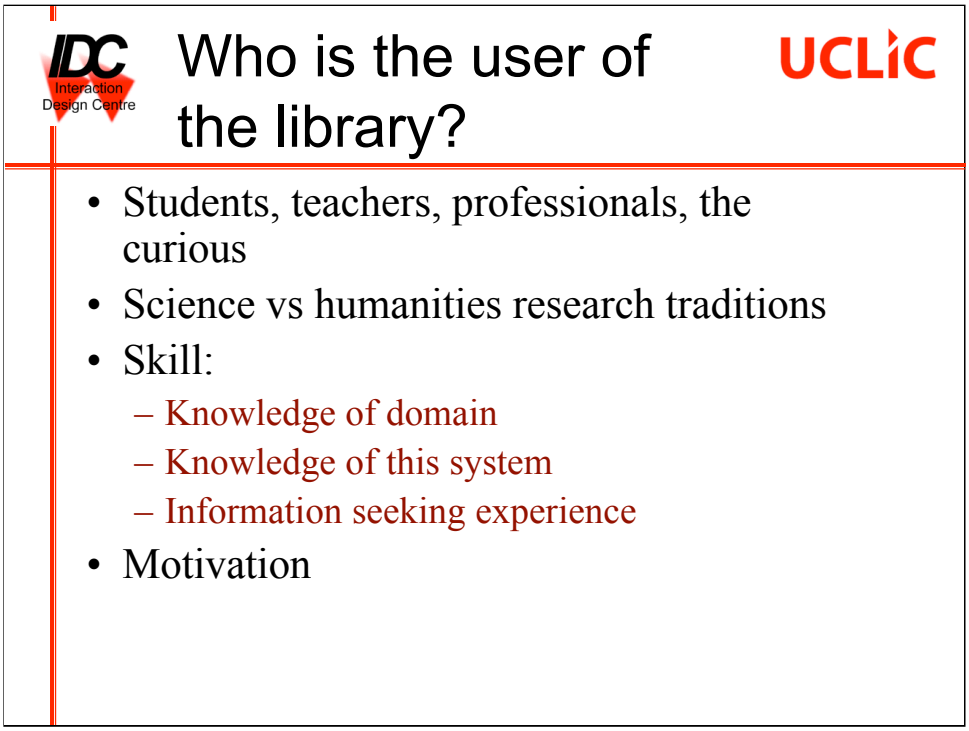
This information is used to create a set of possible stories about the users and the interaction which is then used to generate claims.



Personas are described by Cooper as fictional abstractions of real people, and offered as a strategy to support better, more usable software development. Some industrial designers go as far as to role play different types of users.

Designers often make reference to the user or to ad-hoc stories about users. However one general purpose user is insufficient as a model of who uses the library. A real life user would probably offer too much details. Instead the personas are abstractions which represent types of user. In general the less able, less skilled users provide more challenges when examining ease of use and ease of learning a new system. However in digital libraries we are also often dealing with people who are experts in their field and making complex enquiries.

For the purposes of evaluation (rather than design), we can expect to have to create several personas. This could be done ahead of the design review, but with the review team being given the opportunity to select the most critical ones



For a user group of a captive audience like the BT library it is relatively easy to identify the main characteristics and the developers were knowledgeable about them because they also ran a physical library and an enquiry service. The engineers and market researchers are highly skilled, qualified and motivated. But according to the developers looking at the log data, they lacked skilled search strategies

For the users of a collection of music under current development we can identify the expert users – but not be sure who might just find their way in through web-links.

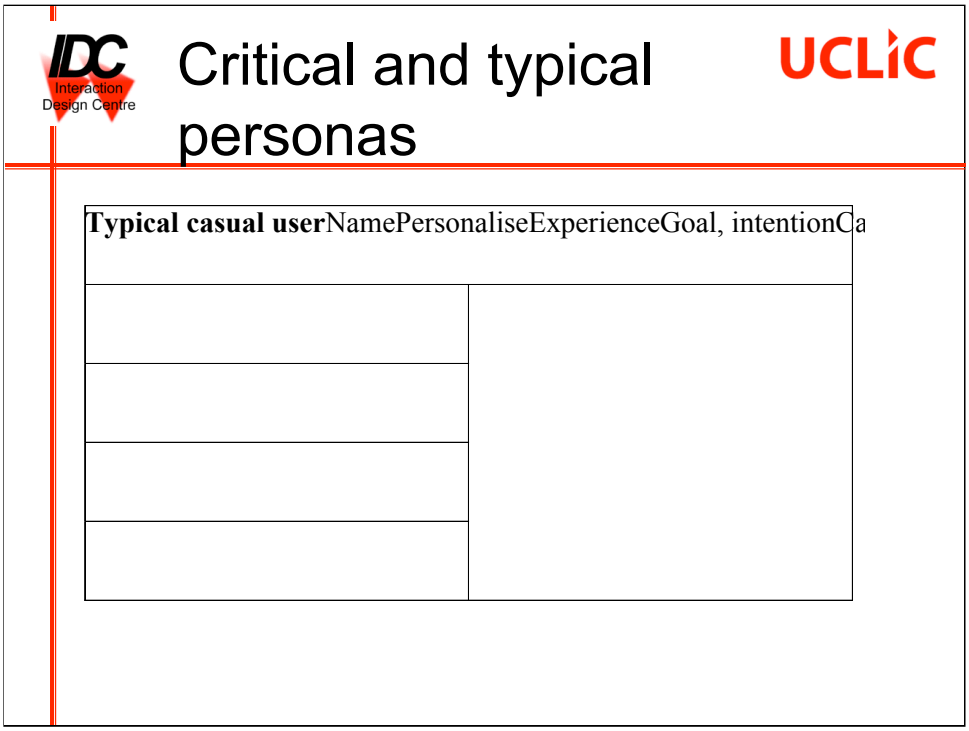
However we can use evidence from information seeking research such as Kulthau's students, and lawyers, Ellis's work with academics and engineers, and Bates work with humanities scholars to fill in some of the more general gaps. Kulthau identified the emotional uncertainty of users embarking on a new search. Bates identified how different were the humanities style of searching and the problem of lack of understanding of Boolean search syntax.

Sutcliffe summarized the knowledge and skills needed for a successful search – those lacking in search skills and knowledge of the domain and resource he predicted were likely to give up early.Of course motivation is a key issue and how much time you have to spend 'playing'.

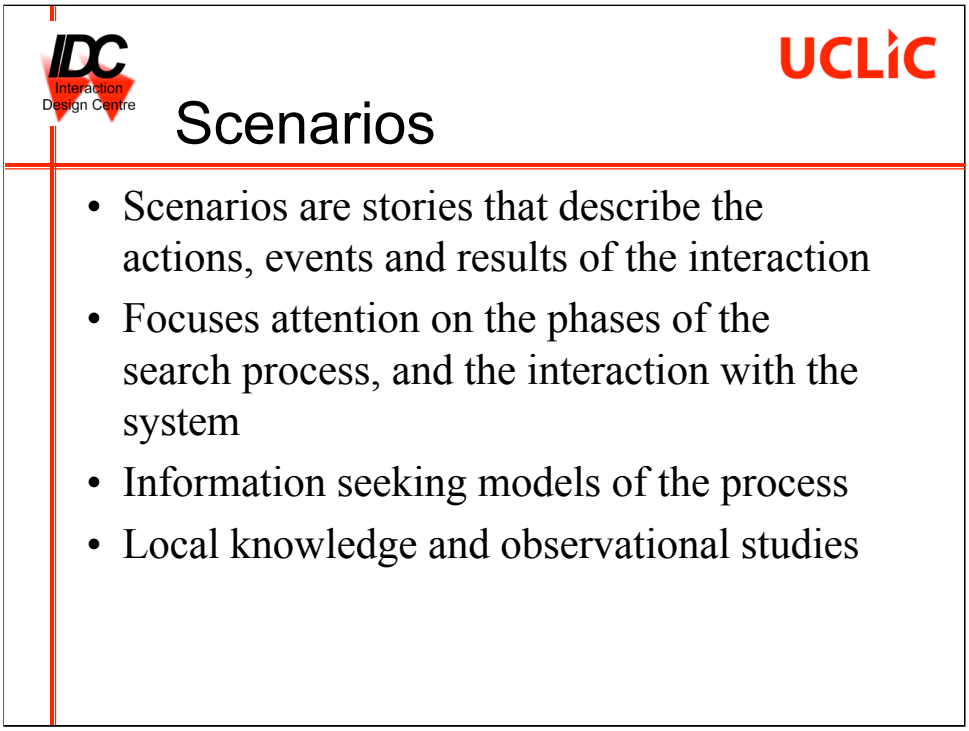
There are a number of key variables to be considered in identifying novice and casual users and more frequent and expert users. So we can use a template to remember them:

Bates M (1994) The design of databases and other information resources for humanities scholars: The Getty Online searching project report No 4. *On-line and CD ROM review* 18: 331-340

Sutcliffe, A. & Ennis, M. (1998) Towards a cognitive theory of information retrieval. *Interacting with Computers*. 10: 321-351.



For the purposes of learning about claims we are only going to describe one user. However if you need to evaluate a feature involving collaborative searching you may need to develop ‘a family’.

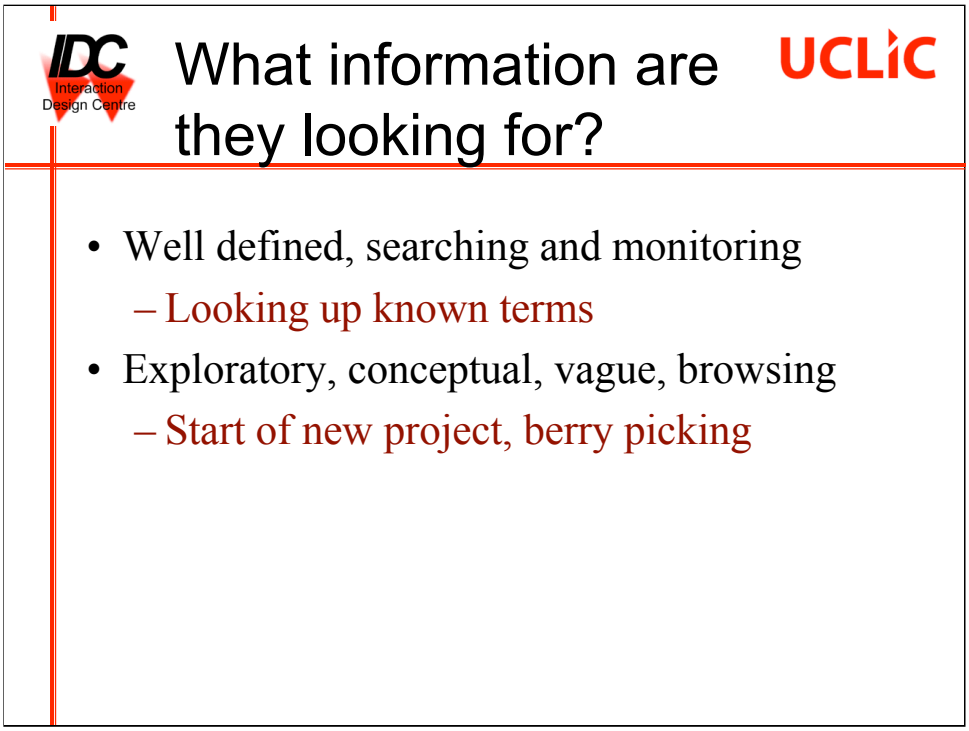


Scenarios and use cases are widely used in software development especially in support of object orientated design.

We are using scenarios to tell the story of the interaction at a level of detail that seems reasonable to the user described in the persona, and the current state of the design. In the examples we use we are assuming a prototype – or sample page is available. However it is possible to create a meaningful model of the system from within the story, prior to any development work.

It is important that the scenario does not just describe how the system works. Independence is achieved by using information seeking models to describe the sort things the user may want to do – their goals and plans – as well as their actions.

Real life stories – like real life personas probably contain too much information to be useful. However one of our students spent some hours observing visitors to a museum using the digital library and gained valuable insight into the users problems with the existing system.



There are two distinct views of the search process.

The long standing and accepted view describes a keyword search, having the assumption that the user has a reasonable idea of what they are looking for and can phrase it in a way the system understands. Even natural language queries assume that what is needed is to translate your query terms into something the system understands.

The other view is more conceptual – not that the user is aimlessly exploring. It is typical of the start of a new project or more sophisticated research style enquiries. Various navigational metaphors have been used which take advantage of the use of hyperlinks within the digital library to move around the information space.

For further details see:

Belkin N J (1980) Anomalous states of knowledge as a basis for information retrieval. *Canadian Journal of Information Science*. 5. 133-134

Ingwersen, P. (1996) Cognitive perspectives of information retrieval interaction: elements of a cognitive IR theory. *J Documentation* 52 (1) 3-50

Information seeking process

- Define problem
- Select source
- Formulate query
- Execute query
- Examine results
- Extract information
- Reflect stop

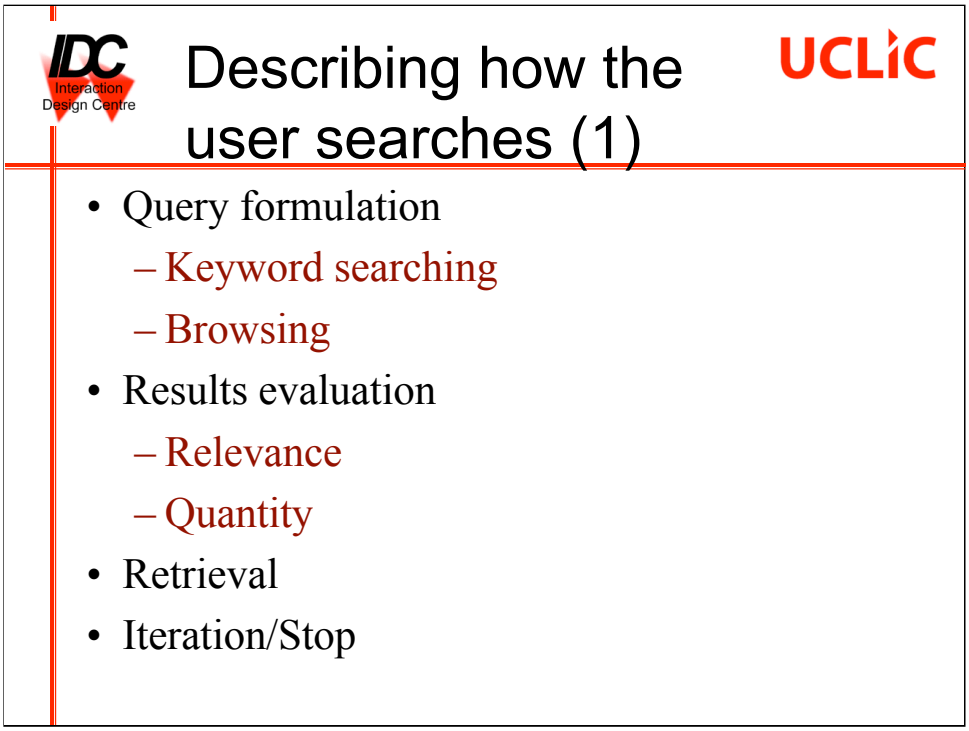
The more well defined search goes through a number of key stages. If we group them together we have the pre-search stages of defining the search problem and choosing the right database. Then we have the core activities of interacting with the library and finally the decision to repeat or complete.

For further detail see:

Kuhlthau, C.(1988) Longitudinal case studies of the information search process of users in libraries. *Library and information science research* 10 (3) 257-30

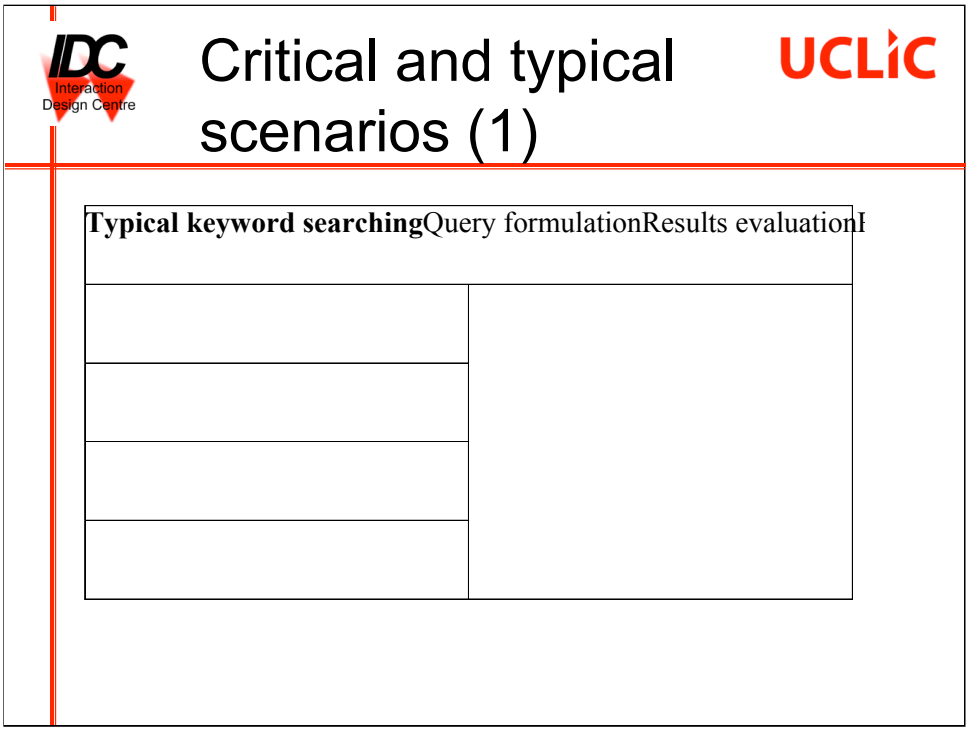
Marchionini, G (1995) *Information seeking in electronic environments*. Cambridge University Press

For our purposes I take only the core activities into the scenario



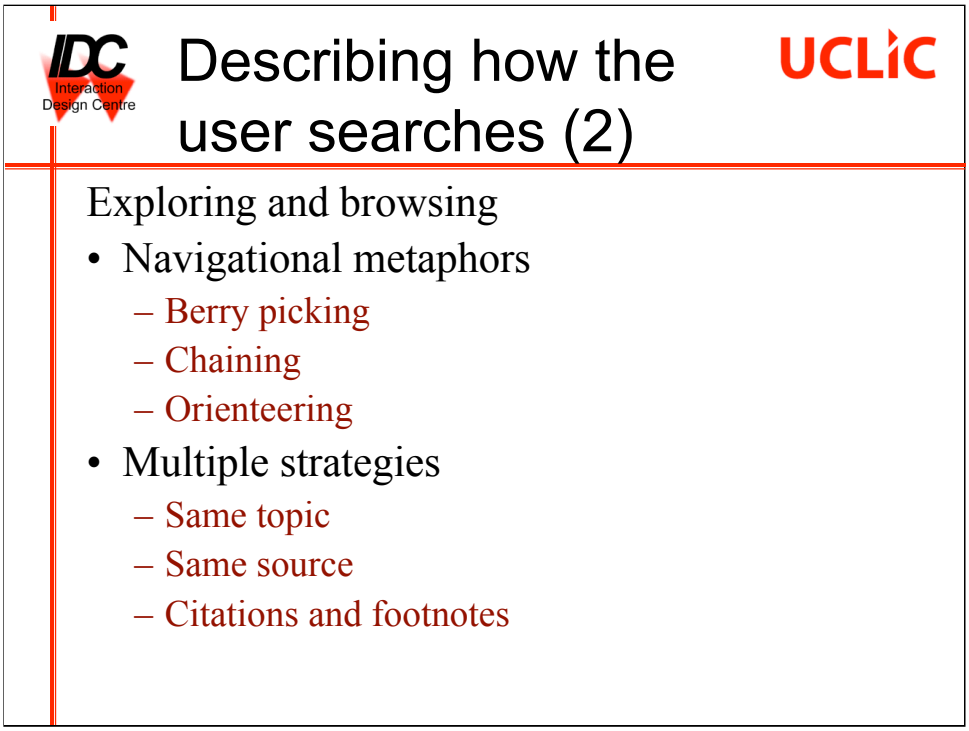
These core activities describe the minimum sequence necessary to search and retrieve a document. They tell a positive story of the interaction between the user and system leading to a relevant document. To make the scenario more challenging you can consider what happens if the user wants to look for more material or to otherwise improve the quality of the search results.

This lets us examine some of the significant stumbling blocks for the user – getting the query formulated appropriately, evaluating the results and deciding how to handle the problem of too few and too many results and of course what to do next



We can build up Catherine's story in which she has already decided she wants to know specifically about Vitamin C and particularly in relation to children.

We can use this template as a reminder of the stages, or to set a feature about any one of these stages into its context eg a feature that supports keyword selection

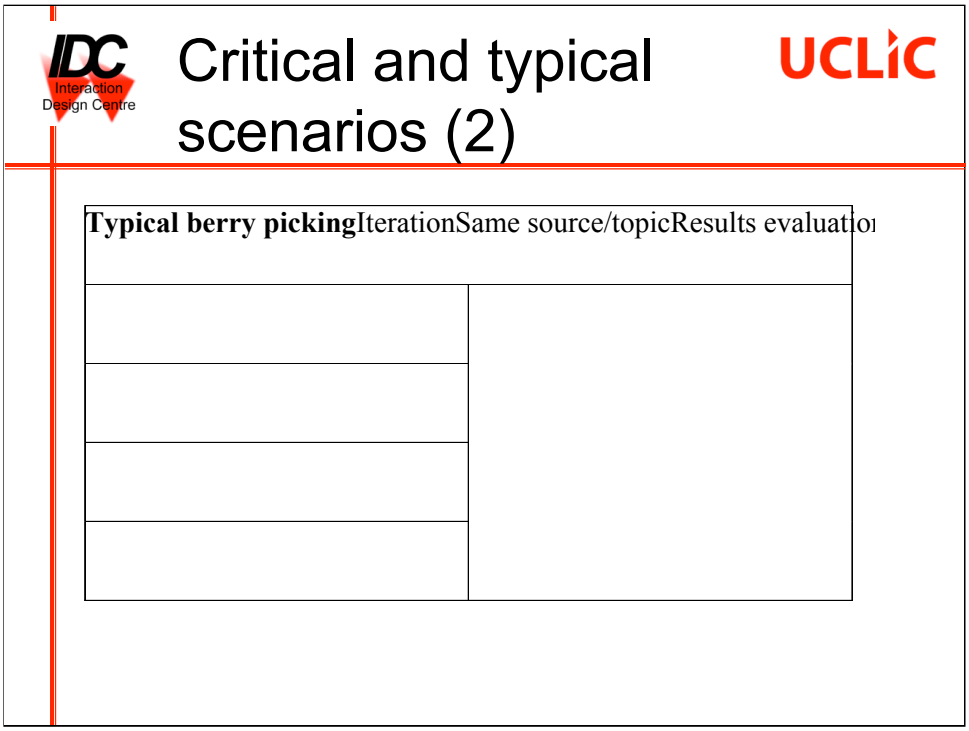


The navigational issues are not new but are not fully supported by all digital library designs. There has also been less design on navigation than on keyword searching. The navigational structures also depend more heavily on information organization rather than search engines and algorithms.

However – there is evidence that they are useful to the information seekers and much easier to use – providing that the categories match the users needs!

Various navigational metaphors have been used to describe how the users progress in a meaningful way between related material. Taking Bates berry-picking model as an example allows the user to apply strategies of 'sameness' from a document that is in the useful category. In particular to find things organized on the same topic – eg category or using the same index term. Information from the same source such as the same author or same publisher –especially useful if you find a core journal. And then there is the academic standby – chasing references either from a document being read, or who has cited that document.

Supporting these strategies improve the 'usefulness' of the library, by offering strategies that do not put such a high cognitive load on the user as keyword searching



It is possible that the features of the library support these activities but no guidance or strategy is offered so they are there but only if you are experienced enough to find them.

This template is a reminder of the alternative strategies and entry points

Bates M J (1989) The design of browsing and berrypicking techniques for the on-line interface. *On-line Review* 13 (5) 407-424

Blandford, A. & Stelmaszewska, H. (2001b) Shooting the information rapids. In Vanderdonckt, Blandford & Derycke (Eds.) *IHM-HCI2001* Vol. II (short paper). 51-54.

Ellis, D. & Haugan, M (1997) Modelling the information seeking patterns of engineers and research scientists in an industrial environment. *J Documentation* 53 (4) 384-403

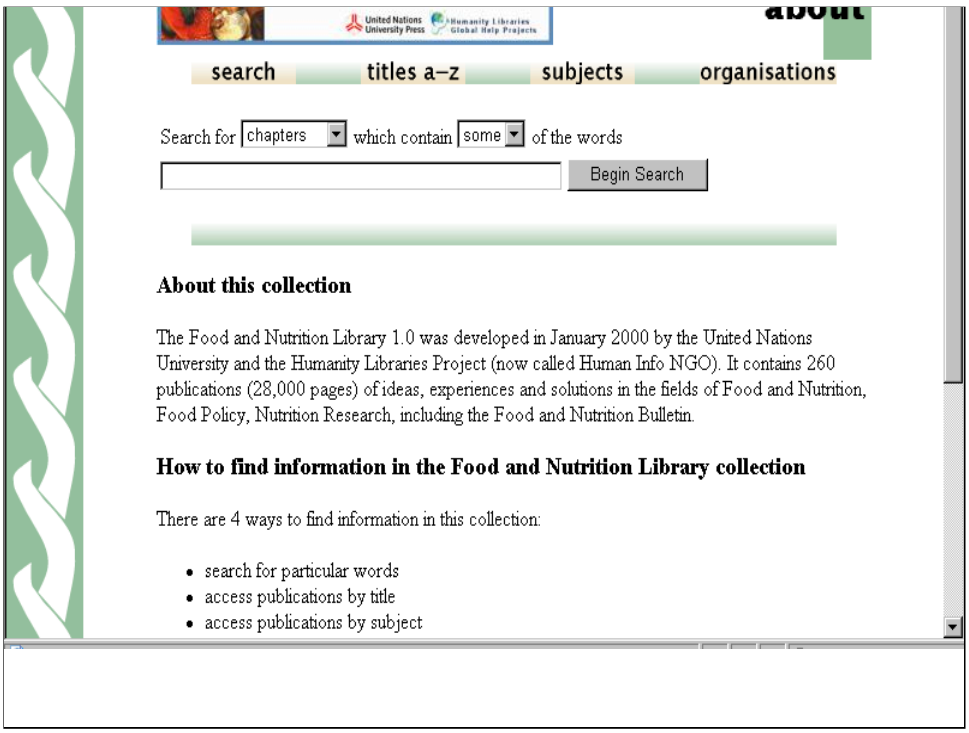
O'Day V L and Jeffries R 1993 Orienteering in an information landscape: How information seekers get from here to there. In *Proceedings of CHI 93*

Example

- ...Catherine is a student dietician working for a food supplier. She wants to know more about the diet and vitamin deficiencies of children. She identifies the world health collection from NZDL and enters some terms. She view the results and selects one. She looks to see if there are any other similar documents...

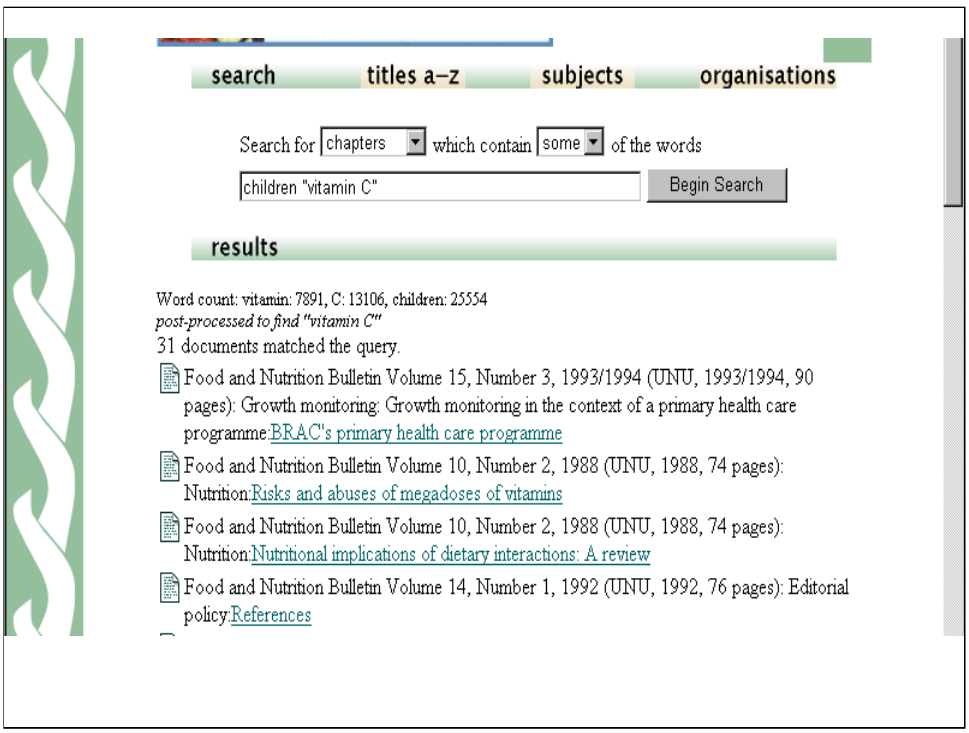
Here is an example which we will work through:

Persona, describing a person and scenario, describing the search activity and interaction with the system



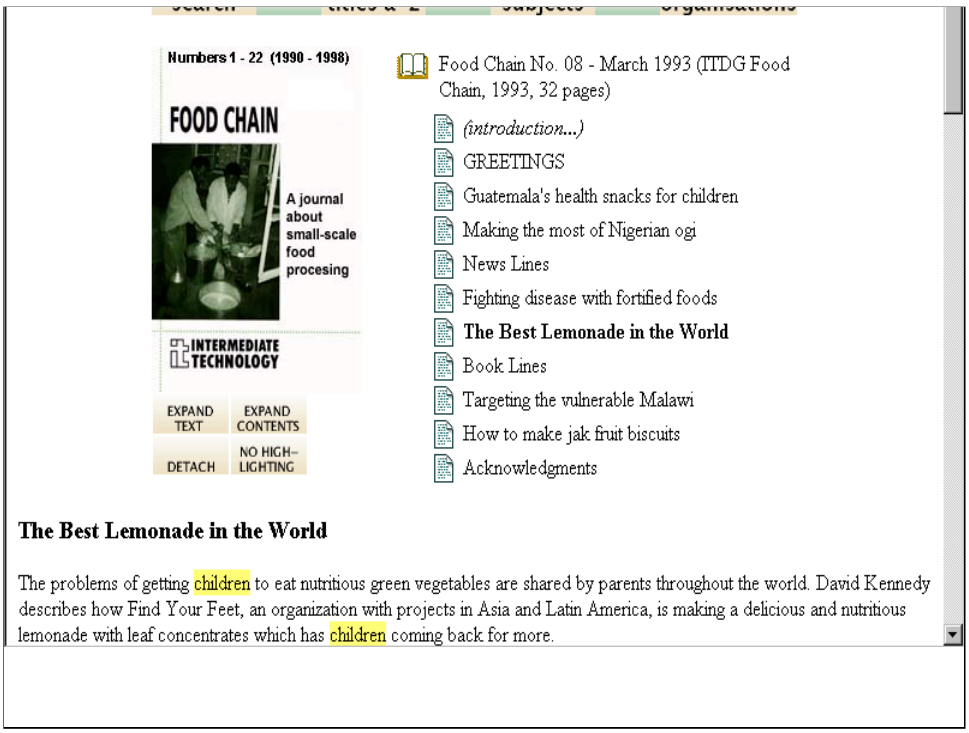
Home page for the Food and Nutrition digital library developed using Greenstone software.

The search box suggests a good starting point for an information seeking scenario using keywords.



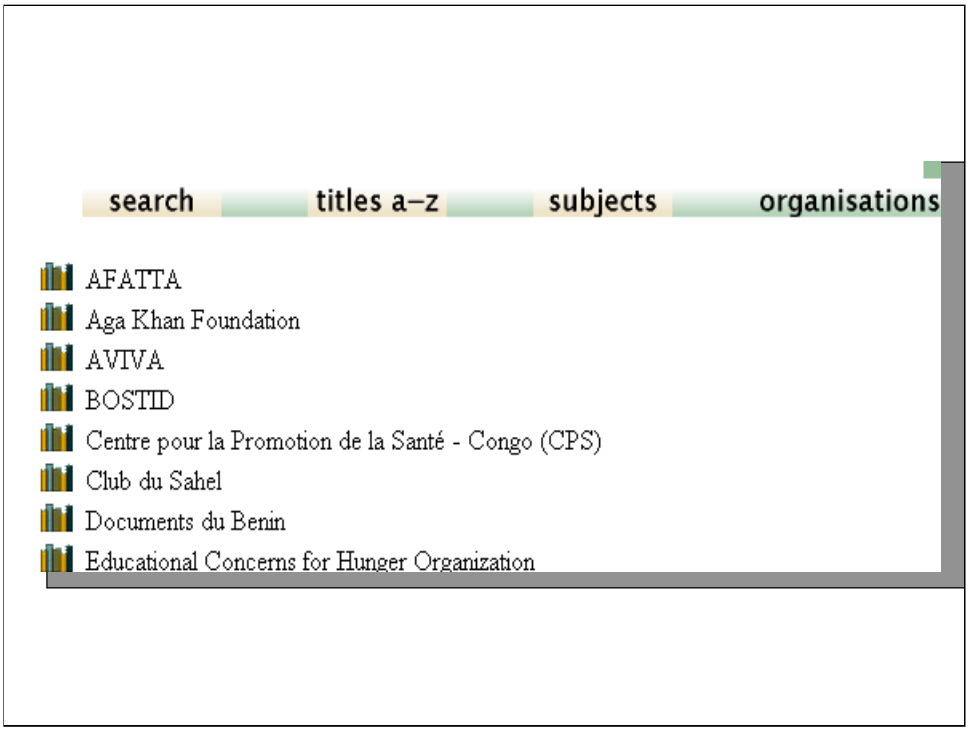
So in this scenario Catherine has entered the keyterms for vitamin C and children to represent her interests and views the results.

The results indicate quantity of results and terms found, but the main focus is on the content of the summaries and links to full documents



Catherine follows up a link to a document that look interesting and relevant. This library has some important features for navigating the stored documents.Catherine can read through this and then think about what to do next.

Remember she is not familiar with this library interface, but if she looks to the task bar she finds it points toward some alternative navigational opportunities. She could adopt a ‘berry picking’ strategy to look for other information from the same source - following the link to organisations.



The organisations link leads to a list of document suppliers – where Catherine could look for other articles or papers from the same source

Here is a list of documents from the same source.

A simple positive claim from this storyline is that the navigation story is supported by the features.

A serious negative claim is that it would be difficult for Catherine to access these opportunities.

The effect is that she is likely to abandon the search not realising that a much richer source of information is available.

Justification from the persona and scenario is that she is not experienced enough with this resource and its features, and may not think to adopt a navigational strategy.

Proposed design action is to offer more guidance to support browsing and investigate how the summaries are generated and whether more content could be added to encourage selection.

Exercise 2

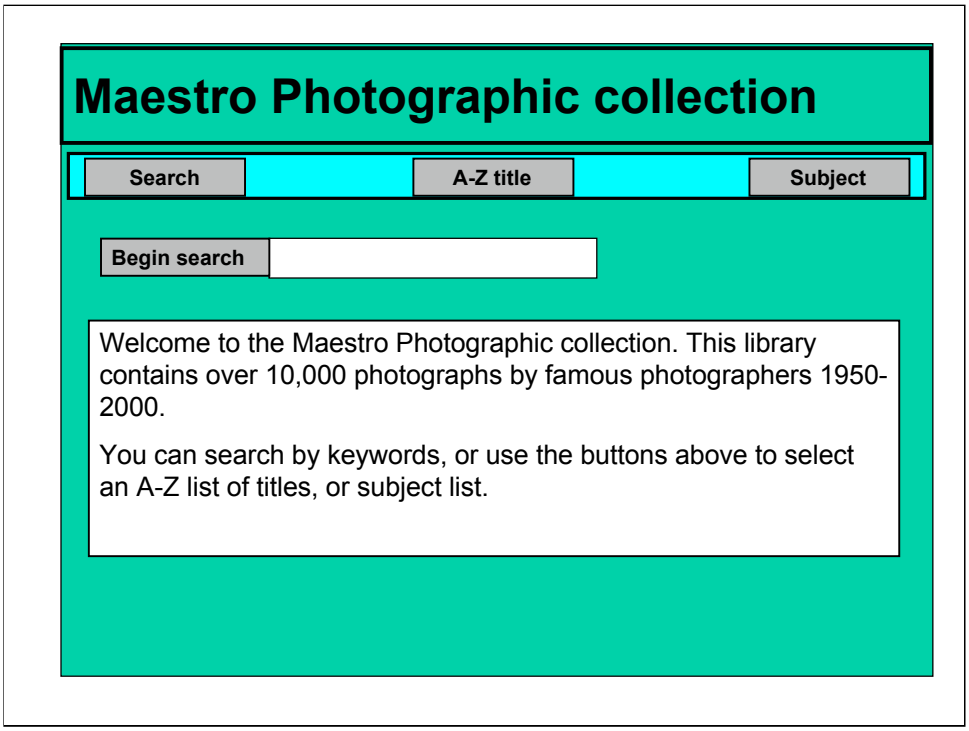
- Prepare 4-6 personas and scenarios for the Maestro Photographic collection
  - different types of user
  - successful and unsuccessful search attempts
  - keyword search process
  - browsing, navigating

We could try writing some personas for a real library but would need more information than we have available.

Instead here are some prototype pages, having a similar style to the Greenstone format, constructed very simply using Powerpoint tools.

The underlying story is that having discovered 4 filing cabinets of photographs in the Maestro Museum. Can you describe a variety of users – school student, teachers, art students and retired photographer and their search behavior.

We would ask you to devise several personas and scenarios, and at the end of the session we will ask you to describe one of them.

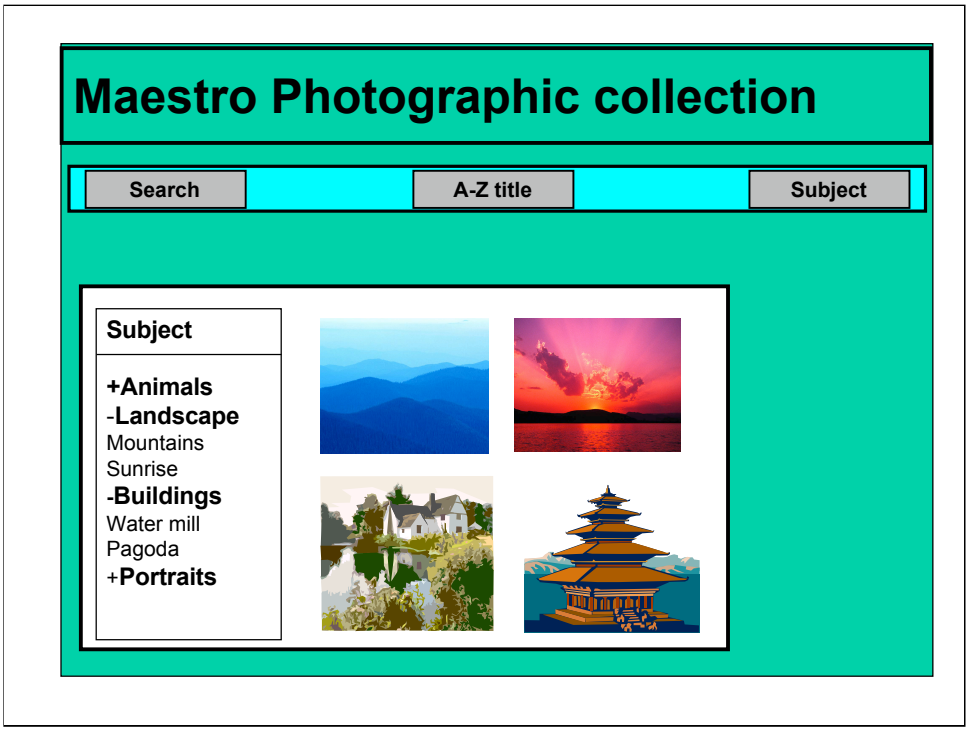


Who is the user?

What are they looking for?

How are they going to start the search?

What is the effect of this design on the user?



Who is the user?

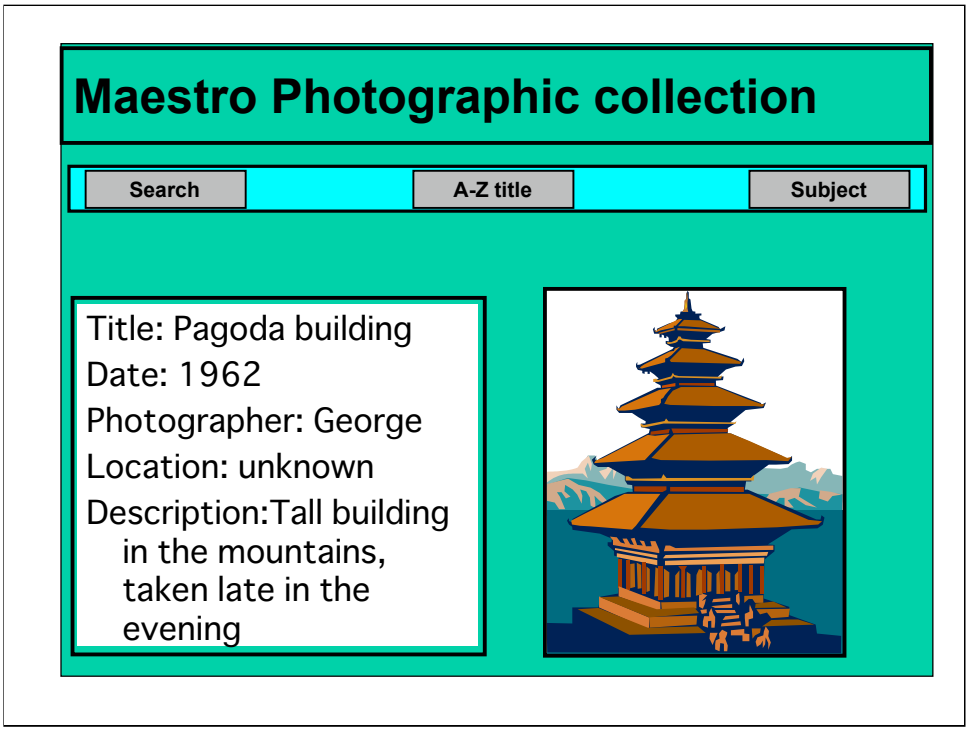
What are they looking for?

How are they searching for it?

If the results look relevant what do they do next?

If the results are **not** relevant what do they do next?

What is the effect of this design on the user?



Who is the user?

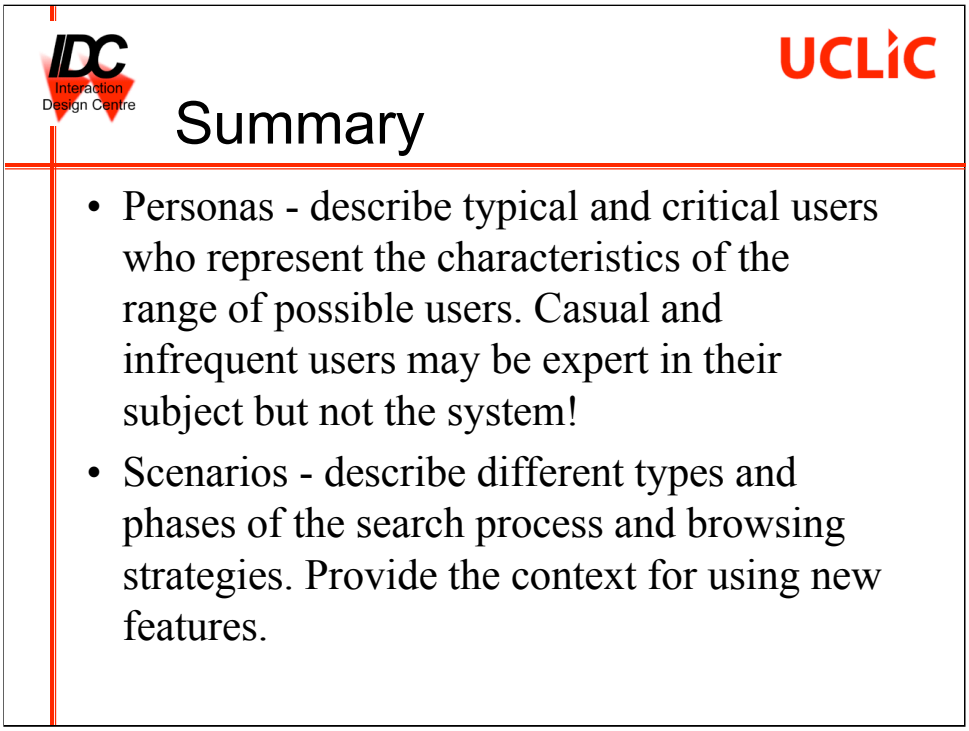
What are they looking for?

What can the user do next with this result?

If this result is relevant can the user use them to find related content?

If this result is not relevant, what else can the user do?

What is the effect of this design on the user?



Summarize the main features of the personas and scenarios developed in the exercise.

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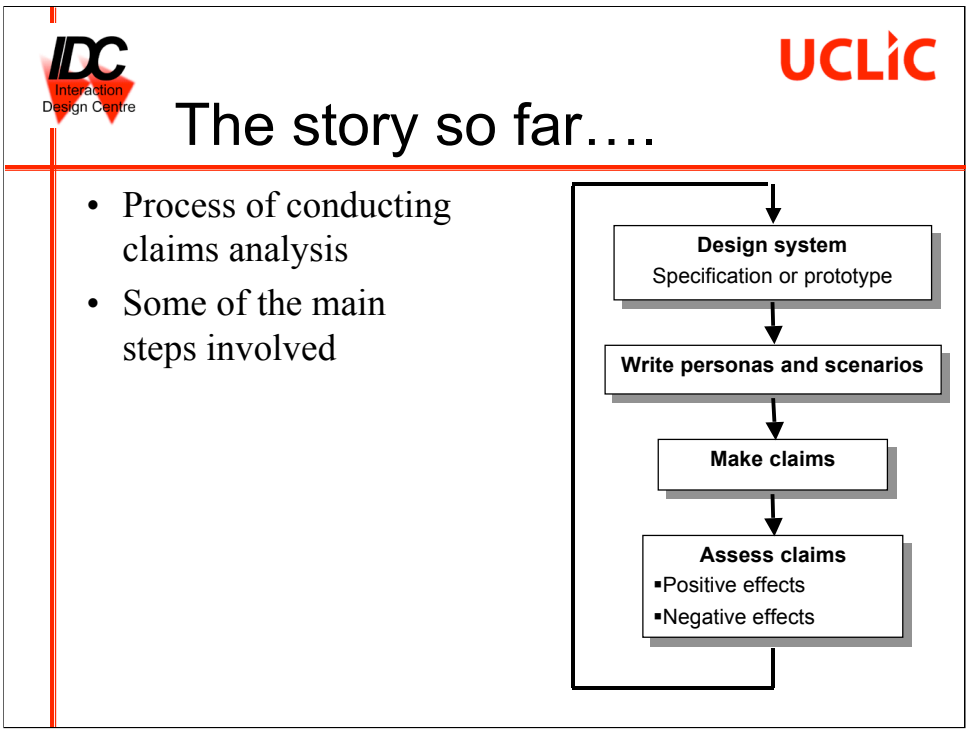
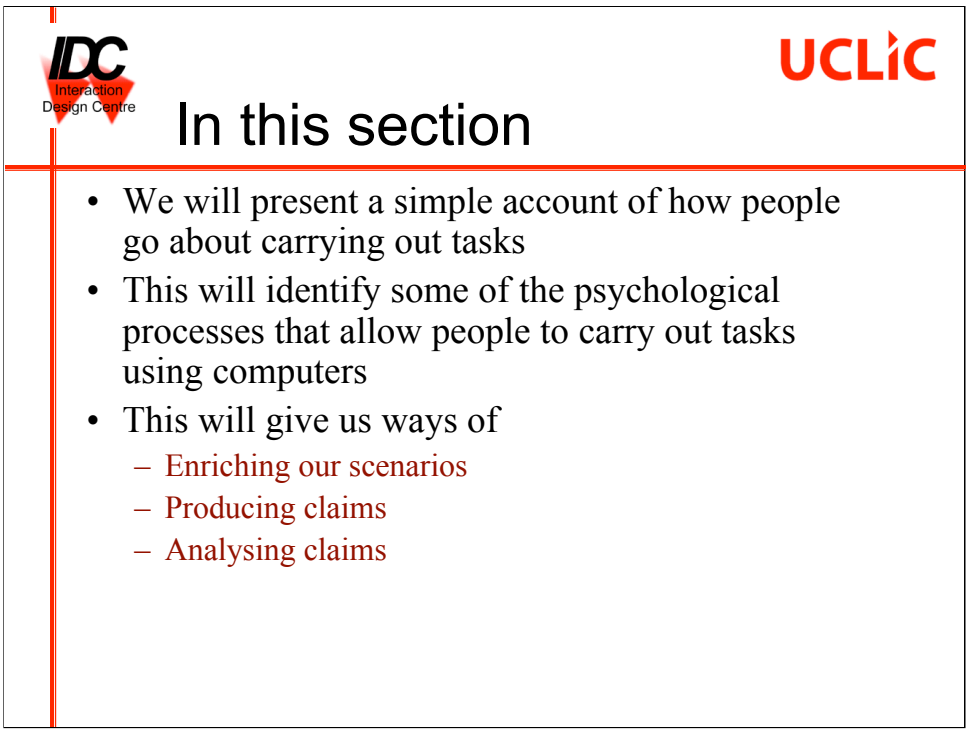
3 User Interaction Modelling



So far, we have looked at the overall process of carrying out a claims analysis. The main elements of this process are Representations of system designs, possibly embodied in prototype systems; Personas that represent typical users of the system in a very concrete way; Scenarios that capture instances of the designed system being used by the users described as personas.

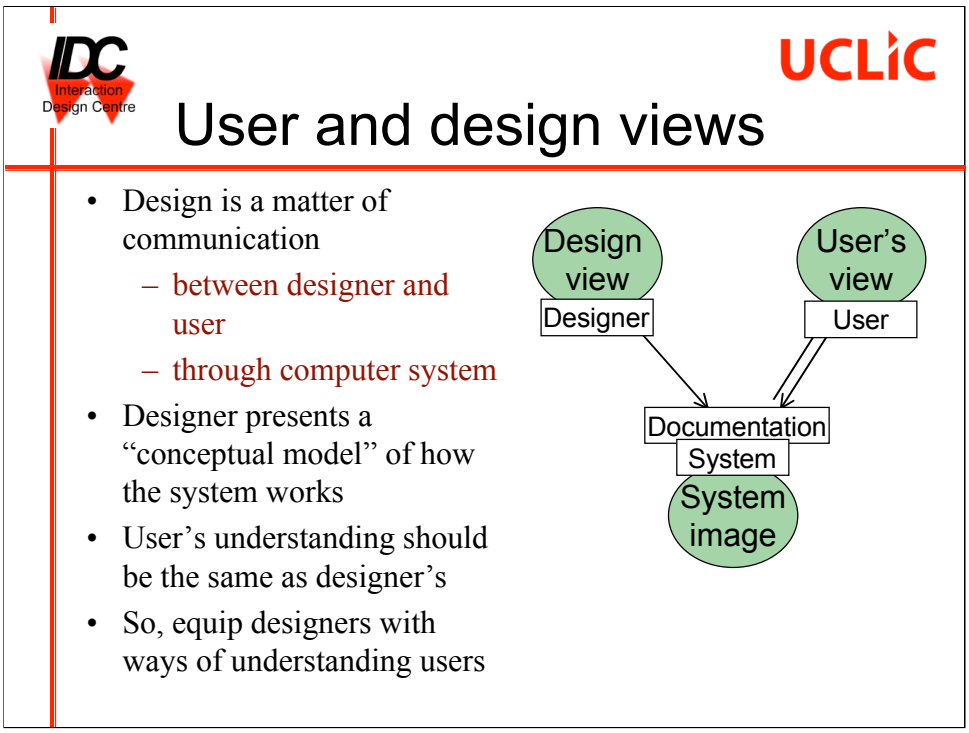


In this section of the tutorial, we will add some theoretical support to the practical techniques we have already discussed, in the shape of a conceptual model that gives us a vocabulary for thinking about some of the psychological processes that go on when someone carries out a task using a computer system.

This will give us a more systematic basis for producing and assessing claims as part of out analysis, and will also allow us to be more rigorous in the way we write out scenarios.

The model we described has been quite influential in the HCI world, and has informed a number of practical techniques and theoretical developments. You can find more in the following book by one of the central figures in the field of HCI.

Norman, D. (1988) *The Psychology of Everyday Things.* Basic Books.

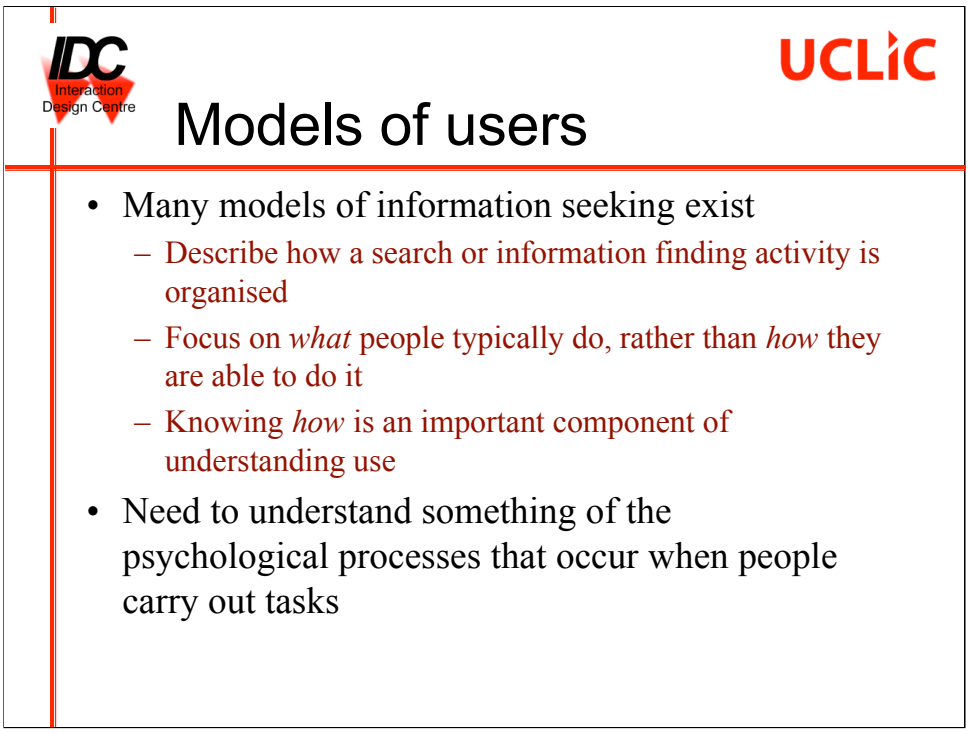


The design of interactive systems can usefully be seen a a communication between the designer or design team and the user. The communication does not involve any direct contact, but is conveyed through the designed user interface.

From this point of view, what is communicated? The content of this "message" should be the designers' understanding and conceptualisation of the system: that is the understanding of what the system does and how it works and is used. The user's view or conceptual is developed as a result of interaction with the system (or other material such as documentation) and should be the same as (or at least consistent with) the designers' intentions. And all communication takes place through the system image.

One part of achieving this is to give the designer ways of understanding how the user will act, and what cognitive processes need to occur in order for the user to be able to act. The model described in this section, together with the Personas, Scenarios and other parts of the Claims Analysis approach are tools to help do this.

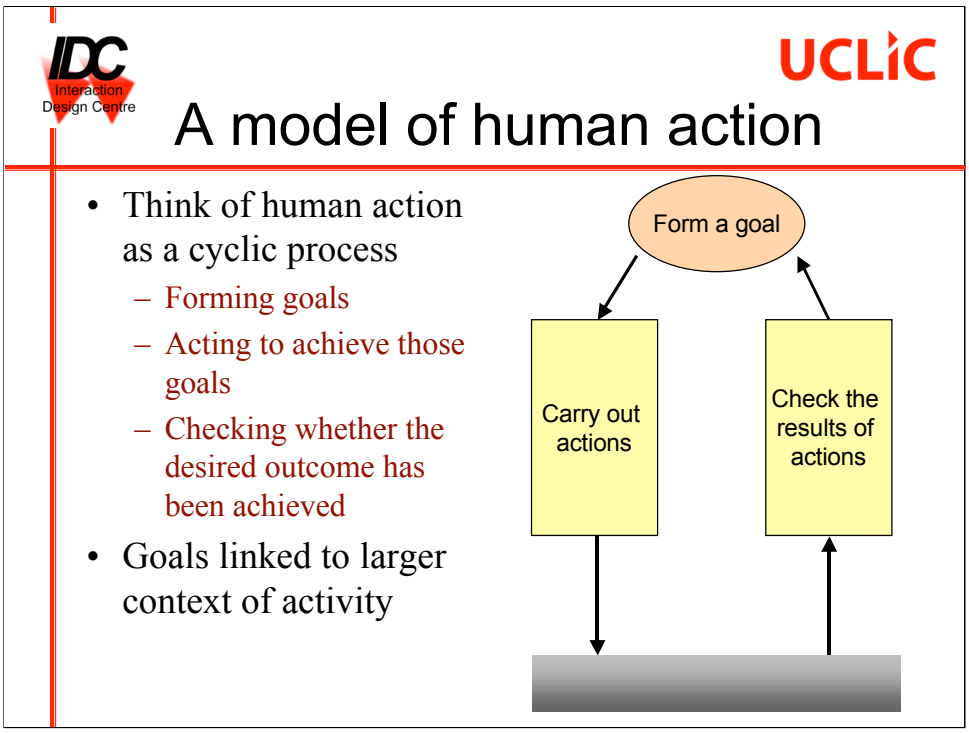
Norman, D. (1988). *The Psychology of Everyday Things*, Basic Books.
Preece, J., Y. Rogers, et al. (1994). *Human-Computer Interaction*, Addison Wesley.



In the information science community, there have been many attempts to produce descriptions of how people go about finding information.Such descriptions or models tend to identify the main phases or stages that are observed when people look for information. Steps such as “understanding the problem, “query formulation” , executing a search”, “examine results” and so on figure in such models. In other words, such models tend to focus on the things that people do in order to find information.

However, such models do not give a good understanding of how the search is carried, or of the cognitive processes that are necessary if a person enacts some form of information finding strategy.

The model we discuss below gives, albeit in a rather approximate way, some of this kind of understanding in a way that can inform design and evaluation.



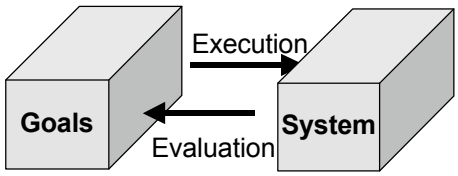
The model of human action that we will be working with assumes that peoples' actions are motivated by *goals*. In other words, we assume that people act in order to achieve some desired end-result. This goal will relate closely to, and be motivated by the larger activity in which they are engaged, and which is represented in a Scenario and Persona.

If a person has some goal, they may carry out a sequence of actions in order to work towards its achievement. The actions act upon the world and objects within it (computer systems, as well as other material objects), bringing about some change. The 'loop' is closed when the person notices the changes in the world and, checking to see if their goal has been achieved. The person may continue the cycle by revising or refining their goal, acting further to achieve as-yet-unresolved goals, and so on.

So far, the model has identified some key components of human activities: goals, actions taken in the service of achieving foals, and processes of checking whether the effects of actions do indeed satisfy the requirements of the goal. We can now go further and ass some more detail to the processes of acting and checking the effects of actions.

Ease of use

- The work of performing a task characterised as bridging ‘gulfs’:
- Gulf of execution:
  - How does the user translate goals into action?
- Gulf of execution:
  - How does the user understand the effects and tell when goals satisfied?



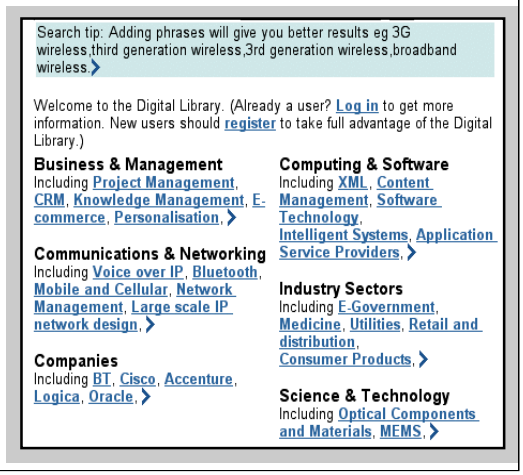
Given the model presented so far, we can start to unpack the concept of “ease of use”. The cognitive work of a user can be thought of as bridging two gaps. These gaps or gulfs are the difference or distance between the user’s goals and the system image.

The “gulf of execution” is the difference or degree of mismatch between what the user wants to achieve and the things that the user interface forces them to do in order to achieve it. If the user issues commands and carries out actions that make sense in terms of their goals, then the gulf is easier to bridge than in the user interface involves complex syntax and command sequences.

The “gulf of evaluation” refers to the difference between the information provided by the system and the user’s goals. If the system gives feedback that the user finds difficult to relate to their goals, then the gulf is harder to bridge.

Example: execution

- Goal:
  - Find up to date information about ADSL security
- Actions:
  - Select a category?
  - Which one?

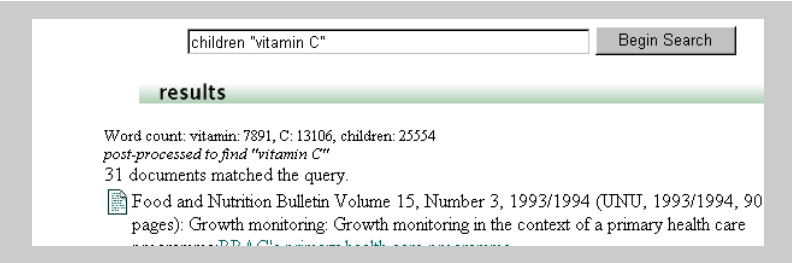


Suppose a user, unfamiliar with this library giving access to several collections of technical and commercial material, seeks information on a particular technical topic. They must select a category in which to browse. They may also need to select a collection to use too.

Making selections in a categorization scheme is often problematic as the user may think of the world in terms of different categories than the person who set up the library. Picking a category here is further complicated by the fact that only some of the categories under each heading are shown, with others being available by clicking on the “>” symbol.

Example: evaluation

- Goal:
  - find information about Vitamin C in children's diets
- Feedback:

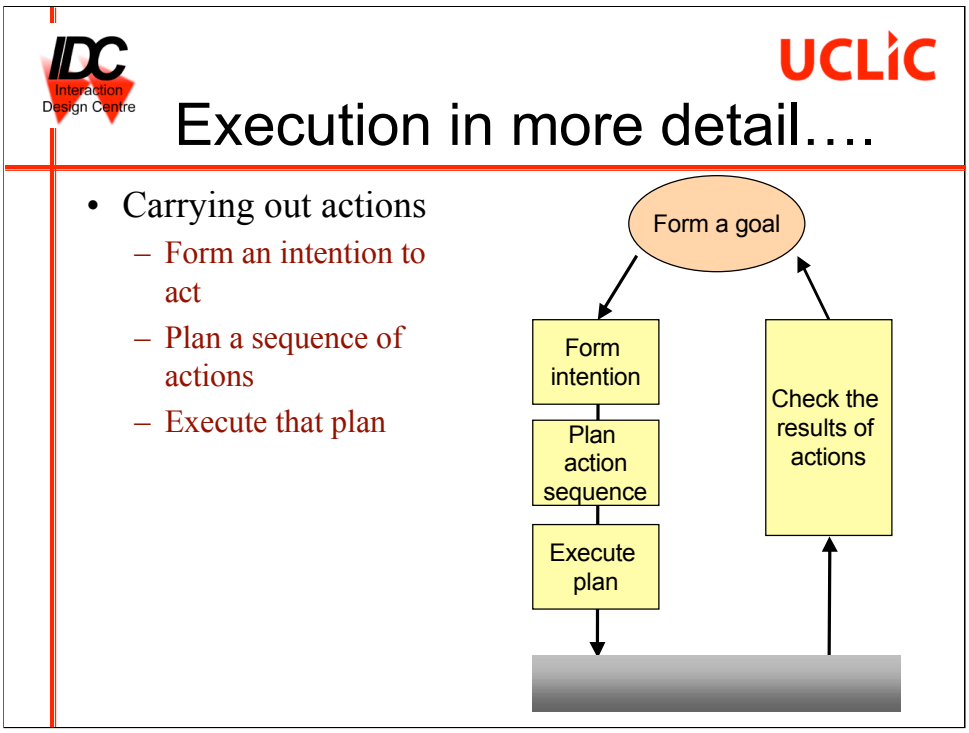


Suppose a user who is not especially familiar with a particular library of medical information is trying to find the answer to a specific question about Vitamin C and its importance in children's diets.

If after issuing a query we get feedback that, inter alia, says

> "Word count: vitamin 7891, c: 13106, children: 25554
>
> Post processed to find "vitamin c"
>
> 31 documents matched the query"

What will the user make of this feedback? While they could potentially read it, will they be able to make any sense of it? Even if they are, will the information help them to know whether they are making progress towards their goal?



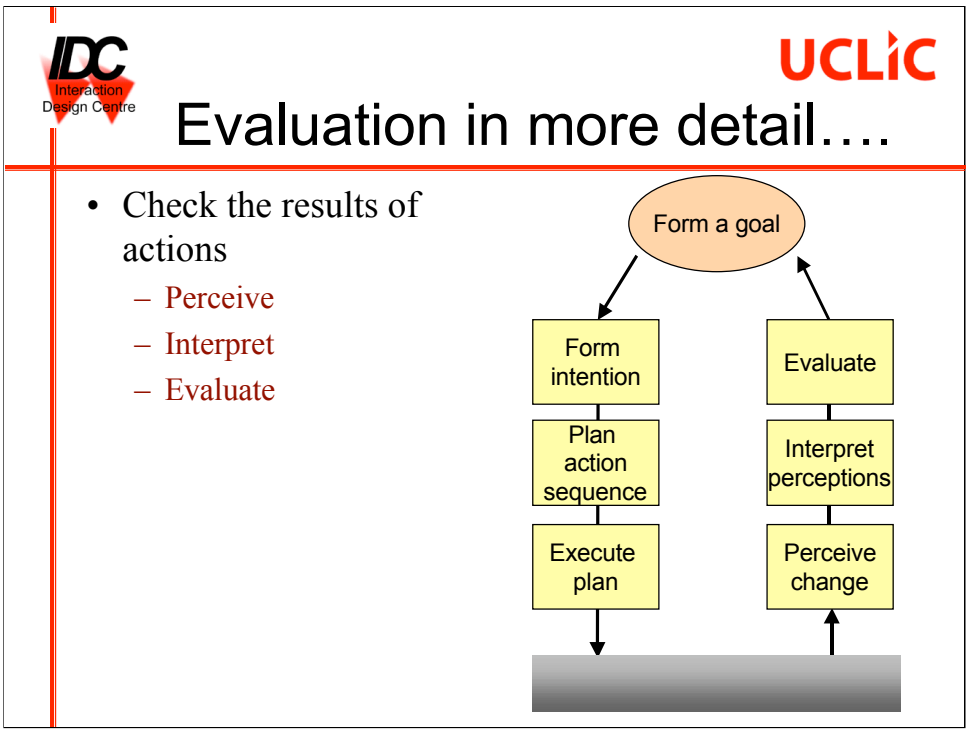
The model as presented so far gives us a way of talking about two components of what the a user must to in order to achieve a goal by interacting with a system: *execute* a series of actions and *evaluate* the effects of those actions with respect to the goal.

We are now in a position to describe these two facets of action in a little more detail. The execution phase of the cycle can be decomposed into three further processes"

Intention: The person must decide that they are going to act in order to achieve a particular goal, and that they're going to go about it in a particular way.

Planning: After having decided that they intent to achieve the goal, the person must figure out how. In other words that formulate a plan. If the task is already known, this could be a pre-prepared plan, or it could be constructed opportunistically on the basis of possibilities the system offers. The plan may be complete or partial.

Execution: The planned actions are carried out.



The second phase of the cycle can also be elaborated. After carrying out some actions, the state of the system will have changed. The process of checking the results of action can now be decomposed:

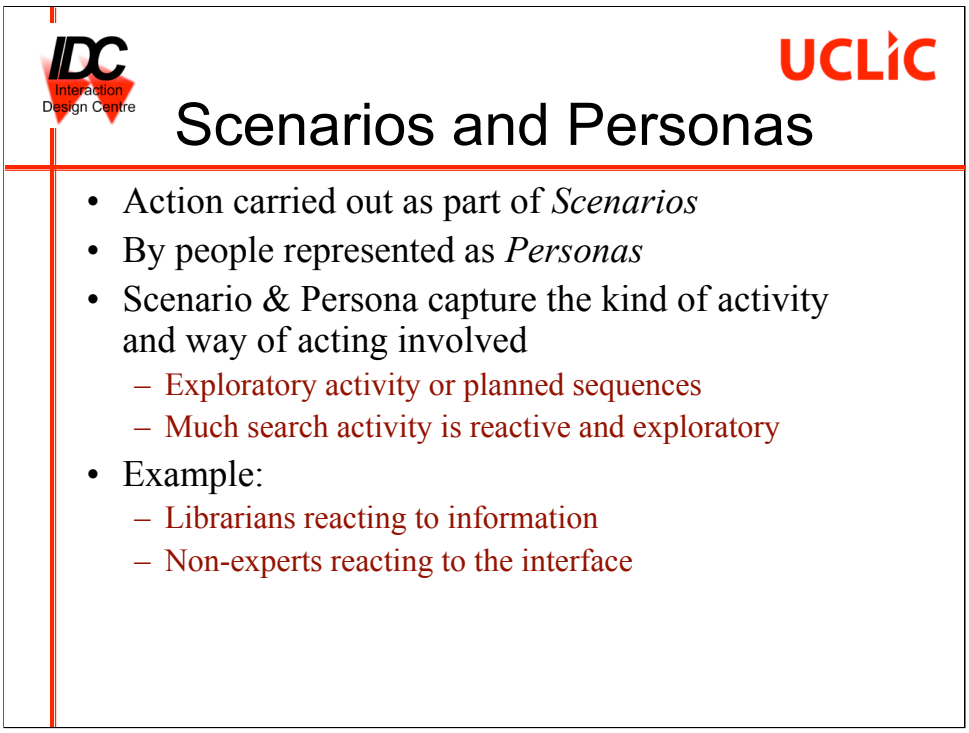
Perception of change: the user becomes aware that a change in the state of the system has occurred

Interpretation: the user determines the meaning of those observed changes, becoming aware of the state of the system

Evaluation: the user relates the state of the system to their goal, in order to decide whether or not the goal has been successfully achieved.

7-stage model of action

- Human actions decomposed into 7-stage process
- "Approximate model" of psychological processes involved in task performance
- Flexible:
  - Process can start anywhere
  - Steps can be omitted
  - Can "cycle round" many times



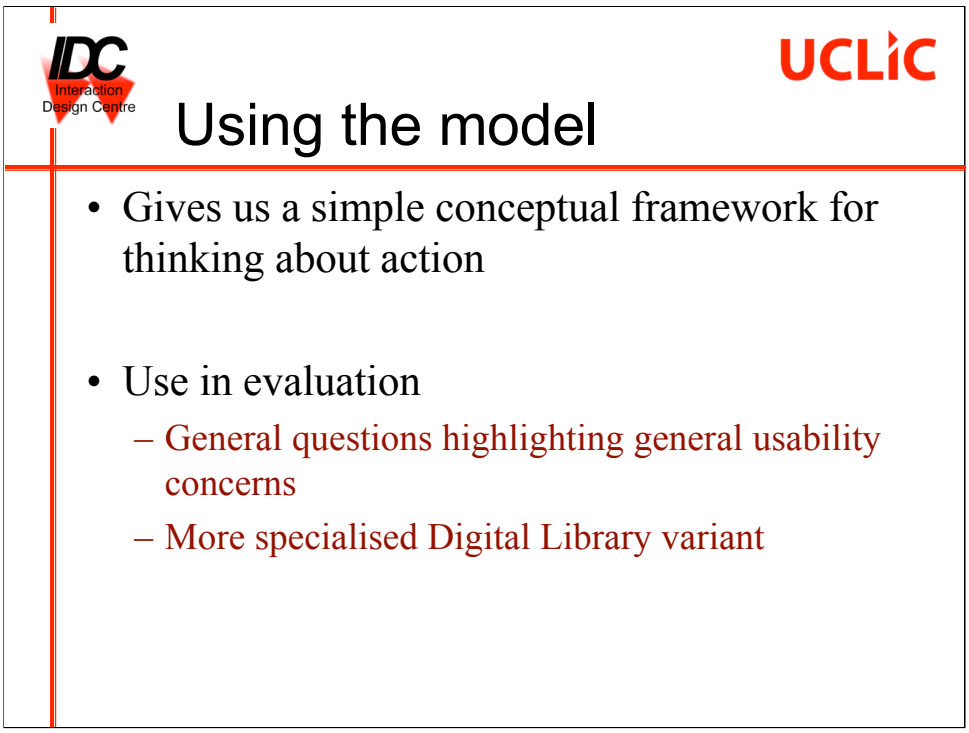
Any discussion of user action should reflect what we already know about the context in which the action takes place, as captured in the scenario and persona descriptions. Embodied in a persona and scenario will be a description of how the person organises their activity, to what extent they pre-plan what they are going to do, and so on. In terms of out model, a user who is has a good knowledge of the system and the actions it affords is likely to be able to plan some of their activity in advance of executing it, whereas a user with less understanding may only be able to plan one step ahead at each stage.

Our studies in digital library use suggest that both kinds of user could be said to be acting in a reactive way, but each is reacting to different features of the information presented to them. The more 'expert' users in our study (librarians) acted in a highly reactive way, responding opportunistically to information presented by the system. Non-expert casual users, on the other hand, reacted instead to features of the user interface

Fields, B., S. Keith, et al. (2003). *Designing for Expert Information Finding Strategies*. London, Middlesex University.

Exercise: scenarios

- Take your earlier scenario as a starting point
- Retell story of the scenario using terminology of the model:
  - Goals, Plans, Perception
  - Evaluation, Interpretation



In the book where the seven-stage model was introduced (the Psychology of Everyday Things), Donald Norman suggests that, as well as providing a useful conceptual model, it may have some value in evaluating designs. He suggests a checklist of questions, corresponding to the stages of the model, that can serve to highlight important issues to the designer.

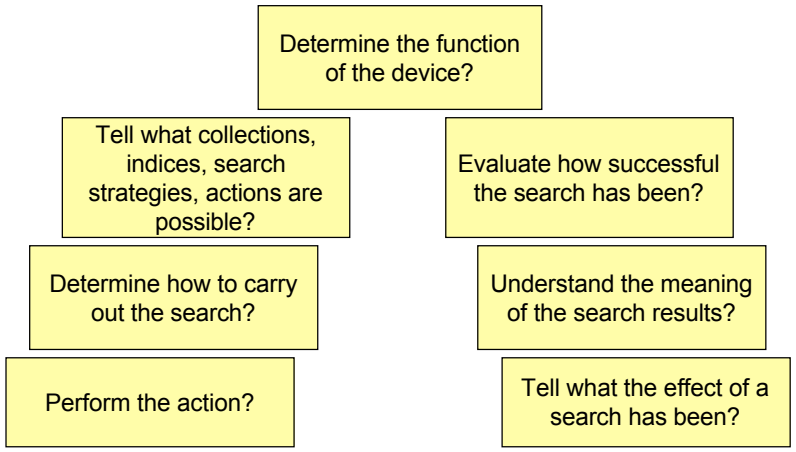
The questions encourage the designer to consider how easily a user can:

- Determine the function of the device?
- Tell what actions are possible?
- Determine mapping from intention to action?
- Perform the action?
- Tell what state the system is in?
- Determine mapping from state to interpretation?
- Tell if system in desired state?

This a very general checklist that could apply to any kind of system. A more specialized list can be constructed that applies to Digital Libraries and similar systems specifically.

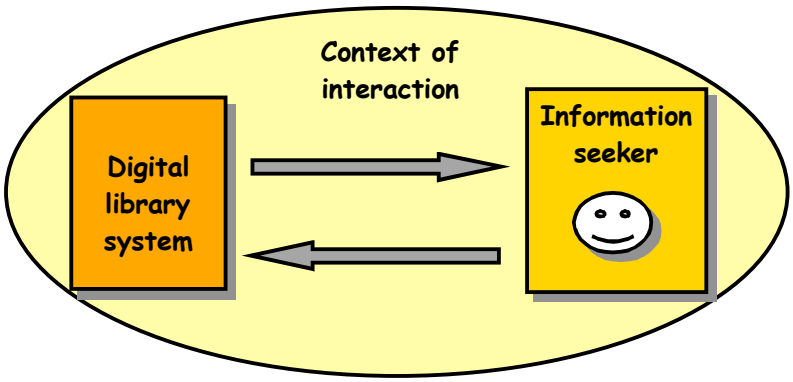
The model as a design aid

- How easy is it for the user to:



Identifying problems

- The checklist type approach can help us to spot situations where:
  - Where goal/subgoal not clear
  - Where actions not “visible”
  - Where effect of actions isn’t predictable so plan can’t easily be formulated
  - Where feedback not present, hard to interpret or phrased in terms that don’t match the user’s goal



A claim:

- predicts the effect of the design on the user
- in the context described in the scenario
- the effect may be positive or negative
- supported by psychological research

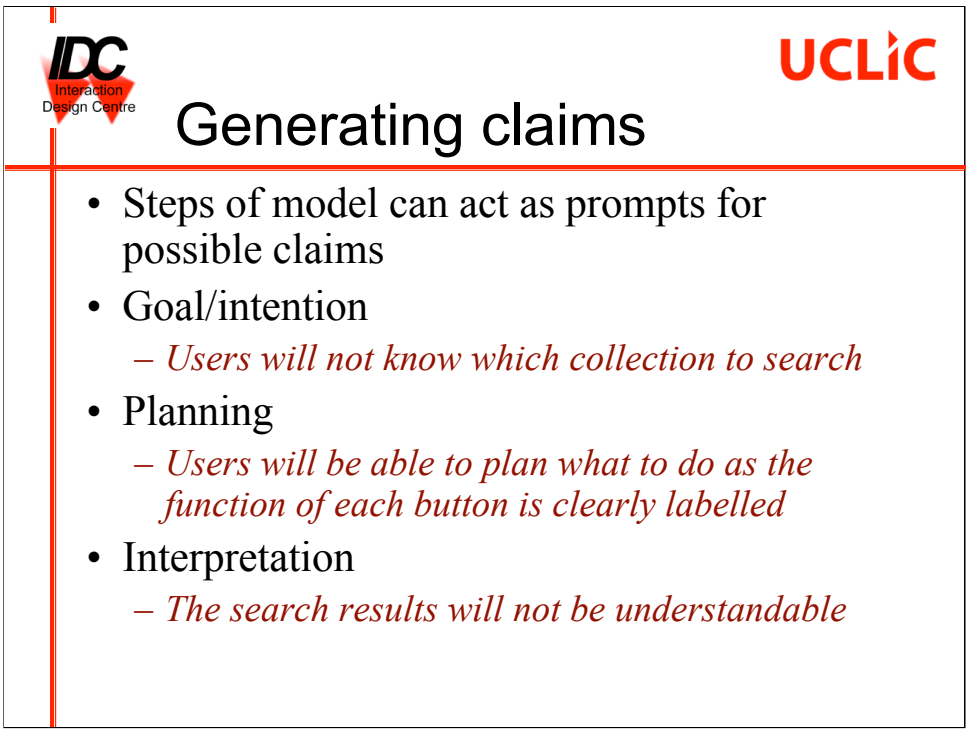
So, to confirm the concept of claims:

Claims express the relationship between the design and the user – that relationship may be helpful. It may support and encourage, guide and explain or simply anticipate users needs. Positive claims are usually design intentions – like putting the search box on the home page, but occasionally may be serendipitous.

The claims also express any negative effect on the user – probably unintentional rather than as a deliberate act by the designer. An aspect of the design may lead the user to make an error, or leave the user stranded and confused, not knowing what to do next. It may lead the user to abandon the search despite the fact that the collection contains the information required. No search syntax or suggestions about how to formulate a query were provided.

Claims can be validated from psychological research on interaction and specifically on information seeking models.

The claims help the designers to reflect on their design decisions and to consider trade-offs between different options and different constraints.



Earlier in the tutorial we have talked about claims, but didn't give much help in generating them. Experience has shown us that producing claims - that is envisaging the effects of our design decisions on the users - is an aspect of this approach that designers find hard. It is sometimes especially hard to produce negative claims, or claims that embody possibly problems with a design.

The stages of the action cycle model can be of some use here. In order to generate claims, systematically consider the seven stages of the model: First attempt to write down positive or negative claims that relate to the user's ability to formulate goals and intentions that can be achieved using the system. Then produce claims that relate to the support given to the user in planning what to do in order to reach the goal. And so on.

Remember that claims are statements made in the context of a given *system*, *scenario* and *persona*. So when we say something like "Users will not know which collection to search in", this is claiming that a particular user engaged in a specific activity using a system we have identified, will have a problem with the collections.

A different user (possibly one of the other personas we've described) may not have the same trouble.

Assessing claims

- If we already have claims, model can suggest ways of thinking about their validity
- Example
  - *"Users will be able to carry out searches easily"*
  - *"Users won't be able to understand the output"*
- How? In relation to which parts of the process?

Another way that the model can be applied to the production of claims is to reflect on claims that have already been produced. If a positive or negative claim has been asserted, we can consider what parts of the process the claim relates to and gain a more detailed understanding of how the claim may or may not be valid.

This use of the action cycle model to help refine and assess claims can be done in a design review-type meeting. The purpose of such a meeting can be to come to a collective understanding of the claims a designer has made about a part or feature of a design, and any further design action that may be needed.

The reason for considering such issues in the assessment of claims is explore some of the reasons why people may act in particular ways: knowing what problems might occur is important, but knowing why things might be a problem helps us to take more appropriate design action

Exercise: generating claims

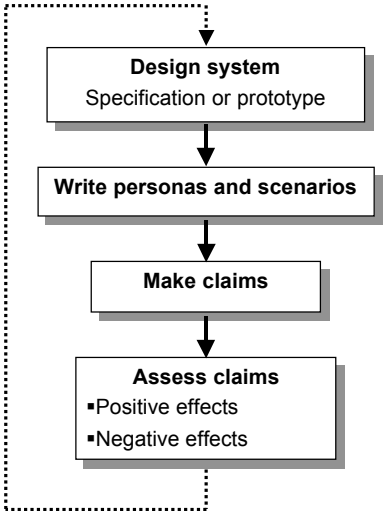
- Take a scenario from earlier as a starting point
- Generate claims using the stages of the model
  - How does the system support the user in forming Goals, Intentions, Plans, and in taking actions
  - How is the system's output perceivable, interpretable and comparable with the user's goal?

Summary

- In this section we have described an approximate model of human action
- Considers how users form goals, execute actions in pursuit of a goal, evaluate the resulting system states
- In the context of a scenario in which a persona carries out some activity
- The model can help us to produce and assess claims about the positive and negative claims about the effects our design may have on its users

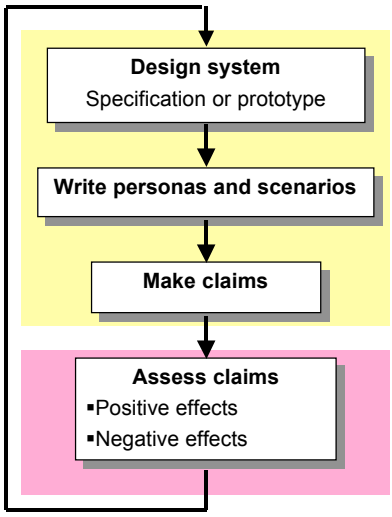
Process and practicalities

- We have talked about the overall process and its components
- However, we haven't talked about how to implement it in practice
- Many ways to do this
- What is likely to be successful depends on the rest of the development process



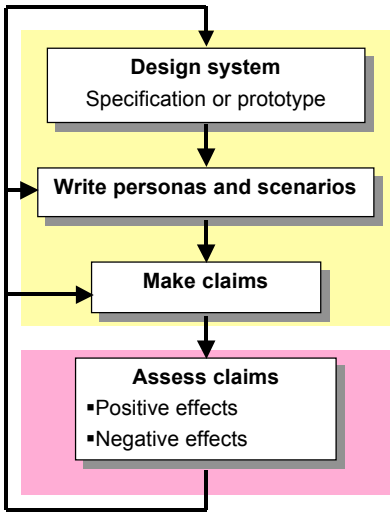
One way

- One way is to see earlier parts of the process as preparation for the later analysis part
- Preparation could be done by an individual designer
- Analysis carried out in a team design review meeting



Iterative analysis

- Consequences of analysis can be to re-work or change
  - Design
  - Scenarios
  - Personas
  - Claims
- And subsequently "re-run" the analysis to see what the effect has been



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4 Application and practical

Exercise 4

- Evaluating and reviewing a design:
  - current design in progress
  - existing live design
  - comparative trade-off of features of existing designs
- Prepare a persona and scenario, and make claims about the design:
  - effect on the information seeking process
  - effect on the interaction activity

Towards closure…

- What do *you* think are the strengths and limitations of Claims Analysis as you have heard about it and experienced it today?
  - Can you envisage finding it useful in your own work, or not? Why (not)?
  - What are its strong points?
  - What are its limitations, and which parts do you find hardest to apply?

Key take-home messages

- Really taking account of the user is *hard*
- Claims analysis involves generating positive *and negative* claims about features of a design
- By using Norman's action cycle, we have focused on claims that relate to the user's goal formation, action execution and evaluation of the next state.
  - The action cycle provides support for thinking about users at that level of detail
  - Claims Analysis can accommodate many other kinds of claims about the system – e.g. about how it will fit in the broader context of working.

Key take-home messages (2)

- Personas and scenarios can help with distancing 'the user' from yourself. Generate and test a few
- Personas are detailed descriptions of individuals who might use the DL
- A scenario describes the context of use, the information seeking process and the interaction with the DL
- A claim describes the relationship of the design to the user, asks what the effect is and why

Claims analysis is a process for carrying out an evaluation.

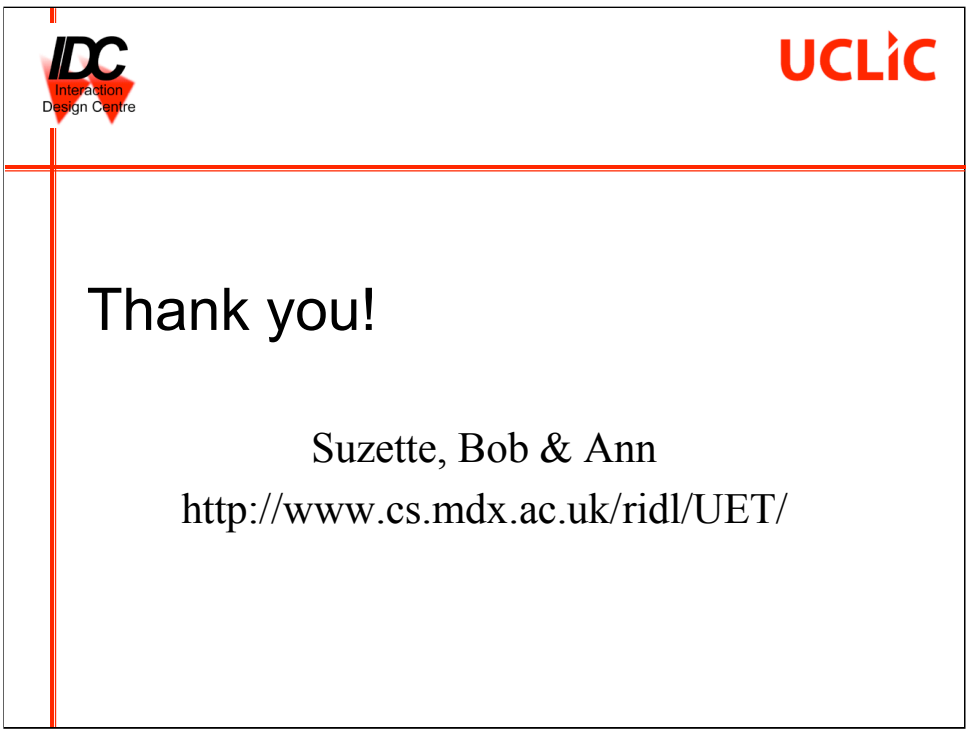
We have used:

• personas to describe different types of user and information needs

•scenarios drawn from information seeking research to describe the process of searching for information.

•an interaction model to describe the detailed experience of the interaction within the scenario and to develop claims

The personas and scenarios are used to support claims analysis by describing the context of the interaction and by encouraging reflective thinking about the effect of the design on the user activity described. Where usability problems are detected the personas and scenarios support further analysis of the problems by defining the context, and the cause of the breakdown in the interaction.



As well as the main project web site, there is more information at http://www.uclic.ucl.ac.uk/annb/DLUsability/DLindex.html . We're also reachable by email:

{S.Keith,B.Fields}@mdx.ac.uk;

A.Blandford@ucl.ac.uk.

We'd particularly like to hear of your experiences (positive or negative) of applying this approach in practice.

But above all, we hope you've enjoyed today and found it useful.