Information journeys in digital archives

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EngD

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Computer Science

September 2017

Abstract

Archival collections have particular properties that make physical and intellectual access difficult for researchers. This generates feelings of uncertainty in the researchers leading to a large burden of enquiries to the archive, many routine. In this thesis I investigate the information seeking behaviours of archival researchers and the distinct properties of the archive first through the respective literatures and then through a series of five studies. Using systems, data and researchers from the National Archives, these studies examine the nature of the enquiries archives receive across many channels, the in-person interactions between archivists and researchers in the reading rooms and the unmediated search behaviours of archival researchers. I proceed to outline the barriers inhibiting research progress and the techniques or 'regulators' used by researchers to surmount or mitigate these barriers. In the final two studies I develop and attempt to validate an instrument for measuring uncertainty in information seeking in large digital collections. This three factor (disorientation, prospect and preparedness) scale of archival uncertainty allows improvements to online archival systems to be effectively tested before implementation. I also propose system properties which seem likely to assist researchers to make progress given these factors and which could be tested using this instrument.

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Acknowledgements

Firstly, thank you to the archivists and researchers who kindly consented to participate in these studies. Many were extremely generous with their time and ideas. The Web Team at the National Archives have put up with me for really quite a long time and responded kindly to requests for advice or data but countless other colleagues at Kew have provided support and encouragement.

I'd like to thank Lizzy Baker and Peter Davies for many years of friendship but more pertinently for a roof over my head for fairly extended parts of the process.

This work would have been impossible to complete without the stalwart support of (over five years) five supervisors: Guy Grannum and Emma Allen at the National Archives and Helen Petrie, Sarah Rees-Jones and Chris Power at York. I owe all of you a huge debt of thanks (Emma you've been such a hugely kind and generous colleague for more years than I care to think about). But above all my experience working with Chris has taught me that academia isn't so hard if someone has your back. May the Credible Hulk of HCI smash forever. I am very, very fortunate to have worked with such a heroically supportive supervisor and perpetually enthusiastic colleague.

On that subject my fellow EngDs Sam Simpson and James Keal ('late' of this parish) are the best findings I've made during my research at York. See you in the bar afterwards.

But the Twitter crew, foremost amongst them Lucie Dutton (the redoubtable @Miss Elvey) and Steven Morgan (@Stemorgs) have virtually always been around when I wanted to sound off and this is for them as well.

I'm profoundly grateful to Dr Alec Patton for telling me right at the start that I could do it and to Dr Ollie Blaiklock for the best single piece of advice on how it should be done.

This thesis, like its author, is dedicated to Helen Cox. There is very little romance in a study of information seeking in digital collections but I can at least say that you taught me the value of search persistence, for which I am both exceedingly lucky and forever grateful.

Author’s declaration

I, Joseph Jonathan Pugh, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Chapter four of this thesis has been published in a modified/preliminary form as:

Pugh, Joseph, and Christopher Power. "Swimming the Channels: An Analysis of Online Archival Reference Enquiries." In *Human-Computer Interaction*, pp. 99-115. Springer International Publishing, 2015.

Ethical approval

Experimental work in this study has been approved by the departmental ethics panel for Computer Science at the University of York.

Funding

This work has been supported by the Engineering and Physical Sciences Research Council (EPSRC).

Chapter 1: Introduction

"Book have led some to knowledge and some to madness, who drew from them more than they could hold. Like our stomachs, our minds are hurt more often by overeating than by hunger…"

- Petrarch, 'De remedius utriusque fortunae' (1353).[1]

1.1 The best place to hide a book

Information seeking arises in many contexts. The Name of the Rose, Umberto Eco's 14th century set novel of monasticism and murder is not, in the end, about finding a book. Nevertheless, Eco's sleuth William of Baskerville finds himself preoccupied with a variety of information seeking problems connected with a library. William is tasked with finding not only a killer but also a solution to a growing political rift between the Roman Church and German Emperor and a specific text which he gradually comes to understand is the lost portion of Aristotle's Poetics. William's access to the monastery's library is limited by its guardians and even his ability to break in avails him very little: he has only a sketchy idea of the text he is looking for and cannot search methodically through every item in the labyrinthine collection. Indeed both William and his tyro, Adso of Melk, fail to recognise the volume itself as their goal when they first see it because it confounds their expectations by appearing to be in Arabic. Later it becomes clear from the library's catalogue that the book contains four texts in at least three languages and in their hurry they have only looked at the first. Yet even in the catalogue, the text's description does not mention Aristotle or the Poetics but describes the text as "Liber acephalus de stupris virginum et meretricum amoribus" (A book, with the beginning missing, on the dishonouring of virgins and the loves of harlots).[2] The catalogue entry has been contrived by the librarian to conceal the text from those who might be trying to locate it.

Outside the bounds of fiction, information systems, whether paper catalogues, OPACs,[3] digital libraries or search engines, do not intentionally conceal what they purport to describe. Research in archives and libraries is a race against time only insofar as there is generally a train to be caught or a publishing deadline to be met. But the problems devised by Eco to frustrate his fictional protagonist are real ones familiar to researchers. How do we find what we are looking for when we have only a half formed idea of what that is? How do we locate items when only the archivists are allowed to consult the shelves? What do we do when the concepts we are seeking to find material on are a poor match for terms used in a text or a catalogue? How do we interpret texts when we locate them? These information seeking problems are venerable and difficult. They can be explored through the creation and use of models and attempts to validate those models; by observing and analysing the information behaviour of ordinary users and those of domain experts in particular collections. And finally, just as systems can be devised to obscure texts and conceal

[1] Conrad Rawski, *Petrarch's Remedies for Fortune Fair and Foul* (Bloomington: Indiana University Press, 1991), p.138

[2] Eco, Umberto. *The Name of the Rose* (Picador, 1983), p.439

[3] Online Public Access Catalogues, developed for libraries in the 1960s and commonplace by the 1980s.

meaning, they can be constructed to serve, in some way, as paths through the labyrinth.

Information management is a consuming preoccupation of the 21st century. Do we have the right data? Are we sharing too much? Is our data secure? Can we access old data? Can we find the information we need at the point at which we need it? As information professionals, librarians and archivists are particularly interested in all these questions. The reason for them is the exponential growth of information produced by digital systems and platforms. To give an example in just one medium, the British Film Institute holds about 1m films and television programmes collected over 80 years; a considerable quantity of footage. But still less video than is uploaded to YouTube every 48 hours.[4] In 2010, the comedian Charlie Brooker joked about a "past mountain, which grows 24 hours in size every single day…There simply isn't room".[5] But for libraries, archives and their users, Brooker's joke is more like a simple statement of fact. In 2017, the National Archives and Records Administration (NARA) in the United States announced that they believed the nascent Obama Presidential Library would contain about 300m emails.[6] The arithmetic is straightforward: if a researcher spent just ninety seconds reading each email, they would be reading for 24 hours a day for the next 856 years. The fact that the Clinton Presidential Library holds a mere 40m emails shows the direction of travel but it does nothing to soothe the anxiety of the researcher.[7]

Interest in how researchers might manage information at scale is conventionally dated back to 1945 when Vannevar Bush published his seminal article in Atlantic Monthly 'As We May Think' outlining Memex, a searchable information store for the lab or office.[8] And it's very understandable to place this desire for information management and information retrieval in the 1940s which is – entirely un-coincidentally – the beginning of the digital age. But this is not correct for two reasons. The first is that Bush is not concerned with the problem of managing plenty but that of an earlier era, in which the central question for information management was how to get more information beneath the researcher's eye faster:

"If the user inserted 5000 pages of material a day it would take him hundreds of years to fill the repository, so he can be profligate and enter material freely."[9]

It is precisely this profligacy with which we must now contend. Bush's memex is not the forefather of the information systems we require today but the great-great grandchild of earlier, mechanical devices for improving the researcher's ability to increase their facility to absorb data. The reading wheel designed by the Swiss-Italian engineer Agostino Ramelli, appears his book of 1588. He never built it but it

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[4] Luke McKernan, "Audiovisual Archives and the Web," *Luke McKernan*, January 29, 2016, http://lukemckernan.com/2016/01/29/audiovisual-archives-and-the-web/.

[5] Charlie Brooker, "How to Cut Tuition Fees," *The Guardian*, December 20, 2010, sec. Opinion, http://www.theguardian.com/commentisfree/2010/dec/20/charlie-brooker-how-cut-tuition-fees.

[6] National Archives and Records Administration, "National Archives Announces a New Model for the Preservation and Accessibility of Presidential Records", January 29, 2016, https://www.archives.gov/press/press-releases/2017/nr17-54

[7] Dan Cohen, "When Machines are the Audience"', *Dan Cohen*, January 29, 2016, http://www.dancohen.org/2006/03/02/when-machines-are-the-audience/

[8] Vannevar Bush, "As We May Think," *The Atlantic*, July 1945, http://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/.

[9] Ibid, p.42

has been built in real life at least twice: by students working for Daniel Libeskind[10] and by the French artist Lea Lagasse.[11]

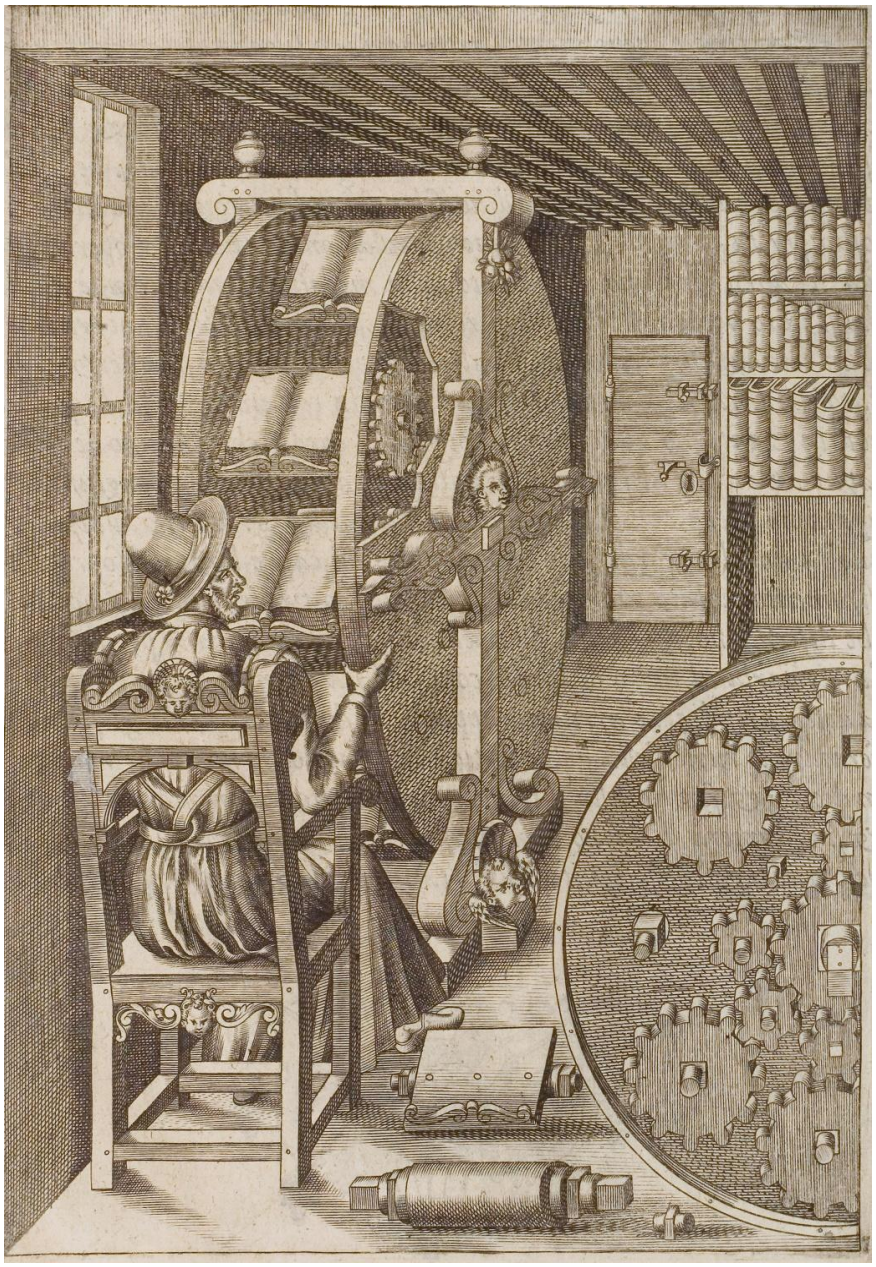

Figure 1.1: Figure 188 in *Le diverse et artificiose machine del Capitano Agostino Ramelli*, 1587

Ramelli writes:

"This is a beautiful and ingenious machine, which is very useful and convenient for every person who delights in study, especially to those who are feeling unwell and

[10] Greg Allen, "On The Making Of The Lost Biennale Machines Of Daniel Libeskind," Blog, *Greg.org*, (2010), http://greg.org/archive/2010/09/20/on_the_making_of_the_lost_biennale_machines_of_daniel_libeskind.html.

[11] Lea Legasse, "The Awaken Dreamer," *Lealegasse.com*, 2012, https://lealagasse.com/2012/08/30/the-awaken-dreamer-5/.

troubled by gout, being that, with this strong machine, a man will see and can turn a great quantity of books without moving from one spot."[12]

Ramelli is dealing with a problem of scarcity: books are big and heavy and working with more than one information source at a time is hard. The e-reader, whether it's made out of wood or something else, doesn't help us with this problem of too much. In fact the development of mobile technology means that the excess of data is much harder to avoid. Previous infamous hoarders (say, eccentric Victorian book collector and self-declared 'vello-maniac' Sir Thomas Philipps) spent years amassing their vast collections.[13] Today, in contrast, we can be overwhelmed by being presented with too much data in a matter of seconds. There are about 2,500 archives in the UK collectively containing billions of documents.[14] Extend this around the world and the amount of information becomes, even by contemporary standards, quite large. These collections are growing all the time and the amount of data about those collections is also growing: digital scans, newly published works, large scale cataloguing projects, websites built by digital humanists to allow the exploration of records[15], APIs provided by archives themselves.[16] Where do users fit into all of this?

For prospective users, the experience of visiting an archive can be relatively forbidding on a number of levels, from an imposing building to a laundry list of reading room rules.[17] There is no need for this to be the case when we are discussing archival information systems: the technologies, whether online or at a terminal in a research room, which researchers use to locate items of interest within an archival collection. Unfortunately many factors combine to ensure that these systems may be the most alarming part of an archival visit. Despite centuries of cataloguing, many records are inadequately described so that volumes containing hundreds of pages may simply be labelled "correspondence", preventing any detailed online search of their contents. The vaunted systemisation of archives, propounded by leading 20th century archivists such as Sir Hilary Jenkinson is a sham: archives have been called a "crazy quilt" of inconsistent arrangement and unfamiliar terminology.[18] The classification of archives by the origin of documents (the principle of provenance) renders many tasks non-trivial. Even very seasoned professionals may find social history research, which by its nature touches many

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[12] Agostino Ramelli, *Le Diverse et Artificiose Machine Del Capitano Agostino Ramelli* (ECHO Cultural Heritage Online, 1587), http://echo.mpiwg-berlin.mpg.de/MPIWG:XAY0CN5D.
[13] Sir Thomas' library of 60,000 books – 10,000 more than Project Gutenberg – cost him his health and his family's fortune. After his death in 1872, his descendants were still selling the books in 1977.
[14] The National Archives, "ARCHON Directory," *The National Archives*, 2010, http://nationalarchives.gov.uk/archon.
[15] Tim Hitchcock et al., "Old Bailey Online - The Proceedings of the Old Bailey, 1674-1913," accessed September 24, 2017, https://www.oldbaileyonline.org/.
[16] The National Archives, "The Discovery Service," Text, accessed September 26, 2017, http://discovery.nationalarchives.gov.uk/.
[17] The National Archives, "Before You Visit," *The National Archives*, accessed September 15, 2013, http://www.nationalarchives.gov.uk/visit/before-you-visit.htm.
[18] W. M. Duff and P. Stoyanova, "Transforming the Crazy Quilt: Archival Displays from a User's Point of View," *Archivaria*, vol. 1, no. 45, Jan. 1998, p.60

areas of a collection, difficult.[19] For genealogists with their focus on name searching, if a name is typed into a search field, results will come back if and only if that collection has been adequately catalogued.[20] This leads many to assume nothing relevant is present in a collection when in reality it is. The result is an "anxiety attack"[21], a sense that things are "overwhelming"[22] and sheer "fear".[23] And these are professional researchers so the feelings of novice users can only be imagined.

There are 32 million descriptions in Discovery, the system the National Archives uses to describe its collections - and that's big enough to get lost in. Data doesn't have to be 'big' in the Google or GCHQ sense to be unmanageable. It can just be too big for comfort. Indeed, the more we look at the literature the more we can find other pathologies of information: library anxiety, information overload or infobesity – the last a horrid dizzy bloated feeling caused by reading too much online.[24] Even this phenomenon was known in the early modern period: Miguel de Cervantes satirises the perceived risks of reading in Don Quixote, who turns Knight Errant after reading too many books about chivalry which cause his brain to dry out.[25] Our problem in the 21st century is not how to amass information, it's generally the opposite: how do we restrict our own exposure to information to just what we need and want. We know we have limited attention and it can consequently be squandered.[26] So our task is often to "cut back content" and cognitively we have a number of strategies for doing that, as we will discuss in the next chapter.[27] Technologically, powerful tools are available to help us locate content and with the availability of public catalogues (OPACs) and search engines it seems obvious that we have these tools. And yet users continue to struggle against a tide of data. There would appear to be mismatch between the sense that we are living in an "Age of Google" in which information seeking is regarded as a solved problem and the ability of researchers to make efficient use of enterprise search systems.[28] It may be that thus far, Computer Science has over promised and under delivered in this area. Assessing, with a view to managing, the problems caused by this abundance in the sphere of cultural heritage and more specifically archival collections will be the subject of this thesis.

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[19] Marta Lomza, "Trainee Tuesday: Bad Idea!", The National Archives blog, 3rd September 2013, http://blog.nationalarchives.gov.uk/blog/trainee-tuesday-bad-idea/

[20] Duff and C. Johnson, "Where Is the List with All the Names? Information-Seeking Behavior of Genealogists," *American Archivist*, vol. 66, no. 1, pp. 79–95, Jan. 2003, p.79

[21] W. M. Duff and C. A. Johnson, "Accidentally Found on Purpose: Information-Seeking Behavior of Historians in Archives.," *Library Quarterly*, vol. 72, no. 4, pp. 472–96, Jan. 2002, p.480

[22] Ibid, p.481

[23] Ibid, p.482

[24] David Bawden and Lyn Robinson, "The Dark Side of Information: Overload, Anxiety and Other Paradoxes and Pathologies," *Journal of Information Science* 35, no. 2 (April 1, 2009): 180–91

[25] Miguel de Cervantes, *Don Quixote*, trans. John Ormsby (Wikisource, 1885), https://en.wikisource.org/wiki/Don_Quixote.

[26] Robert Desimone and John Duncan, "Neural Mechanisms of Selective Visual Attention," *Annual Review of Neuroscience* 18, no. 1 (March 1, 1995): 193–222, doi:10.1146/annurev.ne.18.030195.001205.

[27] Susan Sontag, *Against Interpretation and Other Essays* (London: Penguin Classics, 2009), p.13

[28] Steven J. Bell, "Submit or Resist: Librarianship in the Age of Google," *American Libraries* 36, no. 9 (2005): 68–71.

1.2 Defining the archive

1.2.1 What is an archive?

To Hilary Jenkinson, the formative and for decades the preeminent figure of British archival scholarship, an archive was a collection of documents of a particular kind: those produced in the course of a public or private transaction and kept by the parties responsible for that transaction or their successors.[29] This somewhat fussy and over narrow definition will not now serve us - today Jenkinson has been called "stunningly reactionary", though he is hardly to blame for not being a postmodernist in 1922 or for the length of time it took others to challenge his view.[30] Today, the International Council on Archives (ICA) takes a much broader view defining archives as:

"[T]he documentary by-product of human activity retained for their long-term value."[31]

The key word is "retained" because it implies choices have been made. An archive is a product of purposeful selection. An archive, by its nature, cannot contain 'everything'. Documents ("including written, photographic, moving image, sound, digital and analogue") are chosen for long-term preservation. Archivists take this seriously and intend 'long-term' to mean a period measured in thousands of years. On the other hand, many other documents are not chosen and may consequently be lost or destroyed. This is also inherent to archival preservation. It is inevitable that not everything from the past will survive to be accessed by present day researchers.

1.2.2 Digital archive or digital library?

In the digital age, the idea that an archive is a "by-product" is a little more contentious. Let us take the example of the Rossetti Archive, a website which describes itself as "The Complete Writings and Pictures of Dante Gabriel Rossetti: A Hypermedia Archive". [32] The site collects a range of prose, poetry and visual art by Rossetti with contextual works by other authors and artists and some contemporary periodicals. Conventionally, this is not an archive. The ICA are uncompromising: archives "are not created consciously as a historical record".[33] Rosetti's 'archive' is in actuality held, according to data from the National Register of Archives, in 54 collections in 28 institutions.[34] On inspection these are across the UK (from London

[29] Hilary Jenkinson, *A Manual of Archive Administration* (London : P. Lund, Humphries & Co. Ltd., 1937), http://archive.org/details/manualofarchivea00iljenk, p.11.

[30] Elisabeth Kaplan, "'Many Paths to Partial Truths': Archives, Anthropology, and the Power of Representation," *Archival Science* 2, no. 3–4 (September 1, 2002), p.215

[31] International Council on Archives, "What Are Archives?," accessed September 26, 2017, https://www.ica.org/en/what-archive.

[32] Jerome McGann, "Rossetti Archive," accessed September 26, 2017, http://www.rossettiarchive.org/.

[33] International Council on Archives, op. cit.

[34] The National Archives, "Rossetti, Dante Gabriel (1828-1882), Painter and Poet," Text, accessed September 26, 2017, http://discovery.nationalarchives.gov.uk/details/c/F39625.

to Scotland via the Isle of Man) and in at least four other countries. Yet, if I systematically digitised these sets of documents and published them online – quite different to what the Rossetti archive has done – it is still not entirely clear that the result would be a digital archive. This is at least partly because there is no accepted definition of what constitutes a digital archive.

Kate Theimer has made a very cogent attempt to consider this question and demonstrates what a difficult problem it is by concluding that the phrase is now used to mean “virtually anything” – presumably no pun intended.[35] A term used both more regularly and perhaps more consistently is digital library. Although ‘digital library’ can convey several meanings the term has become, in Christine Borgman's words, "a convenient and familiar shorthand to refer to electronic collections".[36] Borgman makes it clear that one of the key properties of a digital library is that it must contain data.[37] This allows us to make a slightly artificial but useful distinction between online catalogues (OPACs) and digital libraries. An OPAC is not a digital library because it does not contain documents (data), only metadata about documents. This means that the system is not, for example, full text searchable. However, many systems, including the National Archives' Discovery system[38] are a hybrid: a catalogue for the most part but also containing many thousands of digitised documents. The result is a digital library but of a particular kind: namely one that is not completely full text searchable and where many documents cannot be delivered to the casual surfer but can only be physically delivered in person to a specific location. There are many other kinds of system dubbed 'digital archives' as Theimer pointed out but it is this particular kind of system, this hybrid digital library/catalogue that we are most concerned with because it reflects the reality for many real world collections projected into cyberspace. In this thesis when we speak of digital libraries or digital archives this is the kind of system we are describing.

1.2.3 Information seeking or information retrieval?

The study of information retrieval (IR) parallels the development of increasingly sophisticated mechanical and then digital computing devices in the first half of the 20th century.[39] By the 1980s, authorities were writing of ‘modern’ information retrieval,[40] an approach best summarised as “given a query return a ranked list of relevant documents” and celebrated at the annual TREC (Text Retrieval) conference.[41] Following on from experiments at Cranfield University in the 1960s, TREC crystallised an evaluation methodology based on:

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[35] Theimer, Kate. “The Role of ‘the Professional Discipline’ in Archives and Digital Archives.” *ArchivesNext*, February 17, 2014. http://www.archivesnext.com/?p=3683.

[36] Borgman, Christine L. “What Are Digital Libraries? Competing Visions.” *Inf. Process. Manage.* 35, no. 3 (May 1999), p.231

[37] Ibid, p.234

[38] The National Archives, "Discovery", Accessed 1st March 2014, http://www.nationalarchives.gov.uk/discovery

[39] Buckland, Michael K. "Emanuel Goldberg, electronic document retrieval, and Vannevar Bush's Memex." *Journal of the American Society for Information Science (1986-1998)* 43, no. 4 (1992): 284.

[40] Salton, Gerard, and Michael J. McGill. "Introduction to modern information retrieval." (1986).

[41] Voorhees, Ellen M., and Donna K. Harman, eds. *TREC: Experiment and evaluation in information retrieval*. Vol. 1. Cambridge: MIT press, 2005.

"the idea that live users could be removed from the evaluation loop, thus simplifying the evaluation and allowing researchers to run in vitro–style experiments in a laboratory with just their retrieval engine, a set of queries, a test collection, and a set of [relevance] judgments."[42]

The result was to add legitimacy to a cornucopia of studies of a topic such as automatic query expansion in which the effectiveness of the technique is strongly asserted,[43] or methods to improve it yet further are proposed without a single human being ever apparently being asked whether the results thus returned were of better or worse quality than without the intervention or indeed if they were relevant at all.[44] Since relevance was a purely mathematical function (permitting the calculation of similarity coefficients or term-frequency weights) performance was best measured using a shared TREC dataset for which corresponding 'relevance' was known.[45] Such results are at best unproven and at worst unprovable. With hindsight we should perhaps not be surprised that many decades of this work were superseded very quickly by two 25-year old graduate students.[46] Nor that the resultant company moved to put user data at the centre of its activities.

This sterile and flawed Cranfield approach is by no means the be all and end all of information retrieval research and many writers use the term interchangeably with or comfortably alongside that of information seeking (IS).[47] But for decades these fields appear to have proceeded with minimal contact with each other. Information seeking research is human centred. It focuses on attempting to understand the ways and means by which individuals attempt to meet or resolve information needs and gaps. Librarians have been thinking about the problem of how people locate information since at least the 3rd century BC when Callimachus wrote his 120 volume 'Pinakes' for the Great Library of Alexandria.[48] Information seeking as a topic of study for psychologists as well as librarians seems to have taken off, like Cranfield, in the 1960s. By the 1990s, the subject was also of interest to students of management, partly keen to reduce the costly period of orientation (or confusion!) experienced by new members of staff.[49] Information seeking researchers construct models and consider strategies and tactics deployed by information seekers. Yet in the 1990s it was still possible for digital researchers not only to explore the topic with

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[42] Ibid.

[43] Xu, Jinxi, and W. Bruce Croft. "Query expansion using local and global document analysis." In *Proceedings of the 19th annual international ACM SIGIR conference on Research and development in information retrieval*, pp. 4-11. ACM, 1996.

[44] Mitra, Mandar, Amit Singhal, and Chris Buckley. "Improving automatic query expansion." In Proceedings of the 21st annual international ACM SIGIR conference on Research and development in information retrieval, pp. 206-214. ACM, 1998.

[45] Salton, Gerard, Anita Wong, and Chung-Shu Yang. "A vector space model for automatic indexing." *Communications of the ACM* 18, no. 11 (1975): 613-620.

[46] Brin, Sergey and Larry Page (1998). *"The anatomy of a large-scale hypertextual Web search engine"* (PDF). *Computer Networks and ISDN Systems. **30**: 107–117.*

[47] Belkin, Nicholas J. "Interaction with texts: Information retrieval as information seeking behavior." *Information retrieval* 93 (1993): 55-66.

[48] Witty, Francis J. "The Pinakes of Callimachus." *The Library Quarterly* (1958): 132-136.

[49] Miller, Vernon D., and Fredric M. Jablin. "Information seeking during organizational entry: Influences, tactics, and a model of the process." *Academy of Management Review* 16, no. 1 (1991): 92-120.

no reference to library literature but even to claim as novel terms which had been defined twenty years before by other researchers.[50]

A historical view of these fields exaggerates their differences today. Most current IR researchers see some role for users in their work and as more and more information seeking has encompassed electronic and digital systems, IS researchers have expanded their interest into the behaviour of such systems as well as their users. Nevertheless, because of the avowedly less holistic nature of information retrieval in the past, this thesis will prefer the term information seeking and it is this topic that we will introduce in the next chapter.

1.4 Research goals

There are two really significant challenges for 21st century archival practice and both stem either directly or indirectly from the new abundance of digital material. The first is to ensure the preservation of these abundant digital records of modern life with the same robustness as the techniques that enable us to read thousand year old parchment or vellum records.[51] The second is how we help researchers locate, access and understand these and every other kind of record collected by archival institutions over the centuries. This thesis is concerned with the latter question. Its aims are to:

- understand how users negotiate and make sense of large collections of information in the course of their research
- examine how professional archivists, as expert users, work to support researchers and whether they employ research methods or behaviours which could be deployed for the benefit of novices
- investigate barriers to research progress encountered by archive users and understand their causes and constituents
- develop a way of measuring the success of interventions to support digital archival research and suggest what such interventions might be like.

In the course of this work it will be become clear how vital an understanding is of the felt uncertainty experienced by researchers. This is the critical quality which we will seek to understand in terms of its effects, constituents and possible mitigation. In the course of the next seven chapters we will not find a cure for the negative affect which archival researchers can experience in the course of their work but we will understand the problem better, be able to measure its extent and at least be able to describe the broad outline of possible remedies.

[50] Russell, Daniel M., Mark J. Stefik, Peter Pirolli, and Stuart K. Card. “The Cost Structure of Sensemaking.” In *Proceedings of the INTERACT ’93 and CHI ’93 Conference on Human Factors in Computing Systems*, ACM, 1993

[51] Pallab Ghosh, ‘Google's Vint Cerf warns of 'digital Dark Age', http://www.bbc.co.uk/news/science-environment-31450389

1.5 Research context

This research has been undertaken in an industrial context. The Engineering Doctorate (EngD) was developed in the 1990s on the basis of a report by the mechanical engineer John Parnaby. Parnaby claimed that not only were PhD's "too narrow and academic" for the needs of industry but that the standard of the PhD was "declining".[52]The suspicion must exist that every generation regards the new students they encounter as pale imitations of themselves and their own work as students. Nevertheless, it is implied that work carried out in an industrial context is different to work carried out outside one and it seems worth briefly reflecting on whether that is substantively true. For Bourner et al, the key difference between academic and professional doctorates is that the latter aim to provide a "contribution of knowledge to professional practice…rather than perceiving research as an end in itself."[53] This is a difference of intent and in practice it is wholly artificial. It is interesting to imagine what the research landscape would look like if academia did not produce anything of interest or use to professional practice (assuming Jonathan Swift hasn't cornered that market) but it would not be the landscape we currently occupy. Conversely, across many, many fields, academia is interested in professional practice. There is movement in both directions between universities and industry – even in the humanities – and insights of interest to academic researchers can be produced by industrial work. Nevertheless, some difference of emphasis probably does exist, driven by the active participation of the third wheel not present in a PhD, the industrial sponsor.

1.5.1 The National Archives as industrial sponsor

The National Archives was founded in the 19th century as the Public Record Office, with a responsibility for safeguarding the records of the British Government. Prior to the construction of its first purpose built repository on Chancery Lane (dubbed "the strongbox of the Empire" by its first Deputy Keeper[54]) records were kept in various buildings across central London. Conditions there ranged from bad at the Tower of London ("rust, cankers, moths, worms") to worse at the King's Mews Charing Cross ("a mass of putrid filth, stench, dirt and decomposition").[55] The Archives' present Kew site first opened in 1978 and contains two purpose built reading rooms, office and conservation space, a library, exhibition gallery, café, shop and 185km of repository shelving.[56] The archive additionally keeps records which are seldom accessed in a

[52] Godfrey, Patrick. "The engineering doctorate (EngD): Developing leaders for tomorrow with industry." In *CLAIU-EU Conference 2012: The Engineering Doctorate*. 2012, p.2
[53] Bourner, Tom, Rachel Bowden, and Stuart Laing. "Professional doctorates in England." Studies in Higher Education 26, no. 1 (2001): 65-83.
[54] Lawes, Aidan. *Chancery Lane 1377-1977:"The Strong Box of the Empire"*. PRO Publications, 1996, p.19
[55] Ibid, p.5 and p.16
[56] The National Archives, http://www.nationalarchives.gov.uk/help-with-your-research/start-here/what-we-have/

salt mine in Cheshire. Many of its modern responsibilities are enshrined in the 1958 Public Records Act.[57] Though some (like the maintenance of the public, open, online statute book just cited) would have been hard for the framers of that Act to anticipate. The archive is collecting an increasing quantity of born digital records and also maintains the UK Government web archive.[58] It is staffed by civil servants and is a non-ministerial government department reporting to the Department for Digital, Culture, Media and Sport.[59] For decades the archive saw itself as a site where research took place as opposed to being an active research organisation in its own right but this changed with the appointment of a Head of Research (later Director of Research) in 2008 with a growing number of staff, a now extensive programme of academic collaboration and recognition by the UK Research Councils as an Independent Research Organisation.[60]

In support of the piece of research you are currently reading, the UK's National Archives (TNA) provided, amongst other things access to data, facilities, their users and the Archive's staff were generous with their time. Though a member of National Archives staff took on a supervisory role in the project – and was an invaluable sounding board - they did not directly guide the direction of research beside an insistence that it should be 'practical' and this is the very high, abstract level at which I experienced the distinction between professional and academic doctorates. Indirectly, of course, many research decisions have been taken on the basis of the data available from the archives in terms of website log files, correspondence with readers and the expert advice of archivists at Kew. Although this research is based largely (though by no means exclusively) on the interactions and collections within a specific archive, these share many commonalities with archives across the UK and indeed internationally.

Although uniquely (in the UK) large – both in terms of its architecture above ground and holdings below – the National Archives is in many respects a typical archive. Like all accredited archives in the UK,[61] the National Archives collects records according to its collecting policy, preserves them to an internationally recognised standard (ISO 11799) and makes them available to researchers in its reading rooms.[62] Its digital functions are replicated across many UK both within universities and in county record offices. Archives use an international common cataloguing standard known as ISAD(G) which builds on principles of arrangement developed throughout the 20th century.[63] This ensures a broad interoperability

[57] Legislation.gov.uk, Public Records Act 1958, https://www.legislation.gov.uk/ukpga/Eliz2/6-7/51
[58] The National Archives, UK Government Web Archive, http://www.nationalarchives.gov.uk/webarchive/
[59] Gov.uk, https://www.gov.uk/government/organisations#non-ministerial-departments
[60] The National Archives, 'Our research and academic collaboration', http://www.nationalarchives.gov.uk/about/our-research-and-academic-collaboration/
[61] The National Archives, http://www.nationalarchives.gov.uk/archives-sector/archive-service-accreditation/
[62] ISO 11799, 2015, https://www.iso.org/standard/63810.html
[63] International Council on Archives, ISAD(G): General International Standard Archival Description - Second edition, 2011, https://www.ica.org/en/isadg-general-international-standard-archival-description-second-edition

between collections of archival information.[64] Indeed municipal archives are not substantially more different from each other than municipal swimming pools: the route to the water may vary a little but the basic pattern is consistent and in the end you will definitely get wet. There are small special or private archives which do not have digital catalogues, offer a limited service and consequently for who some of what follows does not apply but the basic archival functions of the National Archives are replicated across the UK and internationally.

1.6 Thesis structure and contributions

The thesis is divided into eight chapters, first examining archival and information seeking literature (chapters 2-3) and then presenting the results of five studies; three examining evidence allowing information behaviours in archival search to be characterised (chapters 4-6) and two based on the development of a scale strongly informed by the data from the earlier studies (chapter 7).

Chapter 2

This chapter contains a review of key information seeking literature, particularly focusing on models of information seeking, sensemaking and common information behaviours such as satisficing and browsing. The purpose of this analysis is to understand the constituent tasks and accompanying cognitive and affective processes of information seeking.

Contribution 1: Models of information seeking can be classified into five principal types: classic, behavioural, contextual, cognitive path and macro models.

Chapter 3

This chapter will explain and motivate the particular focus on the archival domain. The experience of archival research will be described and the chapter will discuss reference interviews, the process by which users negotiate enquiries with archivists and we will discuss the concept of uncertainty in the archival domain.
The chapter also presents a brief study analysing keyword searches using Discovery though the limits of this method quickly become apparent.

Contribution 2: Users rarely fail to generate result sets through their searching in archives. Their problems relate to a lack of *relevant* results. Guidance written by archivists intersects relatively poorly with users actual search terms.

Chapter 4

This chapter presents an analysis of a sample of electronic enquiries received by the National Archives in an attempt to understand how and why users make - or fail to make - progress in archival search.

[64] Very broad. But nonetheless real.

Contribution 3: Almost half of enquiries in a dataset received by the National Archives appeared to have failed at the point at which users attempted to locate the correct entry point for their research (‘where do I look?’)

Contribution 4: Judging by this dataset, the specificity of enquiries received by archives appears to have increased since the mid-1990s.

Chapter 5

This chapter presents an analysis of recorded reference interactions between archivists and researchers in order to understand how the behaviours of expert users differ from those of novices, how archivists provide research assistance and the nature of that assistance.

Contribution 5: Archivists assistive behaviours in course of reference interviews with researchers include screensharing, bookwork and query formulation advice. Overall they teach research strategies to researchers. Archival systems do not support this ability at the point of search.

Chapter 6

This chapter presents an analysis of unmediated online search by archival researchers with the aim of understanding the strategies they employ to negotiate barriers to search progress. These strategies could be reified into systems.

Contribution 6: Researchers frequently employ their own regulators (strategies) to address barriers to research progress. Barriers are sources of uncertainty and can be artifactual, environmental or personal. Regulators act to mitigate these barriers and can be based on knowledge, skills or tools.

Contribution 7: Archival researchers are relatively search persistent compared to typical accounts of search system users but many are “journeymen” researchers, unable to deploy a number of expert behaviours, despite years of experience.

Chapter 7

This chapter presents the development and validation of an instrument for measuring uncertainty in digital archival environments. The aim of the study was to further understand the causes and constituents of the felt uncertainty experienced by archival researchers and to allow proposed user experience changes in the information seeking domain to be compared and measured for efficacy prior to deployment.

Contribution 8: Information seeking uncertainty (ISU) is comprised of three factors: disorientation, prospect and preparedness. Too much uncertainty can cause sensemaking to break down and leave researchers unable to progress.

Contribution 9: Interventions within the search system itself will be the most effective. Generally improving a user's awareness of a subset of archival records is helpful but may not significantly reduce their uncertainty.

Chapter 8

This chapter summarises findings from the thesis and presents a critical review of the research as well as some future directions.

Chapter 2: Information seeking, an overview

"A few words on looking for things. When you go looking for something specific, your chances of finding it are very bad. Because of all the things in the world, you're only looking for one of them. When you go looking for anything at all, your chances of finding it are very good. Because of all the things in the world, you're sure to find some of them."

– Jake Kasdan, 'The Zero Effect' (1998).[65]

2.1 Introduction

The search for answers to information problems is a fundamental human activity that we all undertake. Information behaviour has been extensively studied by researchers and we are in a position to classify its constituent activities and processes. In this chapter we will continue the process of defining what we mean by an information journey. We will discuss single episodes of search and typical information behaviours such as browsing that we recognise from daily life. From here we will proceed to more complex models of information seeking. We will also consider some of the processes and cues that seem to underpin information seeking including sensemaking and information scent. None of these behaviours are unique or distinct to the archival domain. Archives have their special properties but our basic understanding of their use by researchers can be grounded in this more general science of information.

There are several reasons for carrying out this survey. The first is to introduce common language and terms used in the information seeking domain so that this research shares concepts long established in information seeking and avoids the pitfall of 'rediscovering' long understood phenomena and coining unnecessary neologisms. Building on the work of other scholars means that the set of studies presented here can focus on specific aspects of or gaps in prior work and so this survey provides guidance in setting research questions and in formulating hypotheses. Models in particular can help to establish sites of intervention. They can help us consider how to facilitate the completion of particular tasks or transitions in the models, identify zones or causes of negative affect and generally serve as reference models for the domain. In subsequent chapters we will make use of these models to contextualise behaviours observed in the course of studies involving users and their data. Where models have been constructed based on evidence, validated by research and show clear applicability to the domain, they can act as powerful explanatory frameworks.

[65] Jake Kasdan, *The Zero Effect* (Columbia Pictures, 1998).

2.2 The search for relevance

Let us begin at the level of the system and then consider information seeking in a more holistic environment. Even before Cranfield and TREC, *relevance* was considered a key concept in information retrieval.[66] Today we generally understand information systems to be those which, in receipt of a query from a user, return, or retrieve, a set of results which match (in some sense) the query terms. This has been called the "query-response paradigm".[67] Cranfield researchers were deeply interested in the relationship between two properties of the retrieved results, namely their *precision* and *recall* and investigated whether these properties were invariably inversely proportional to each other.[68] Precision being the proportion of returned results in a set which are relevant and recall being the proportion of all possible relevant results which are being returned. The utility of these terms is dependent on a specific definition of relevance – namely, as a property being measured against a ground truth. This requires a bounded information space. Imagine a library card catalogue. Each book is assigned a number of subject headings. We could digitise these cards and ask the system to return all the books relating to a given subject heading. By one measure, we would now have a list of all the books in the system relating to the topic we specified. This would appear to be high recall, perhaps moderate precision. What we can't know is how many other books in the library – not catalogued under the subject heading – also have some relevance to the topic. So how high is our recall?

The subject headings promise some sense of *aboutness*, they purport to tell us at a high level what a particular text covers.[69] But aboutness is itself a difficult concept.[70] To take a simple example, consider C.S. Lewis' 1950 children's book *The Lion, the Witch and the Wardrobe*. This book is obviously about the fictional adventures of four children in a magical kingdom reached through a wardrobe.[71] If we examined it as a text corpus we would find the children's names appear many times in the book along with Narnia, the name of the kingdom. What would appear nowhere in the corpus are terms such as Jesus, resurrection or Christianity. Yet, it is well understood (from a combination of close reading and other textual sources) that the book is, in another sense, about precisely these things.[72] Conversely, the Narnia books are not *about* gender politics in postwar Britain, yet they could be *relevant* to this topic because of the use that may be made of the portrayals of female characters within them. This relevance is only partly intrinsic to the text (unlike aboutness) but is substantially supplied by the interest of the researcher.

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[66] Maron, Melvin Earl, and John L. Kuhns. "On relevance, probabilistic indexing and information retrieval." *Journal of the ACM (JACM)* 7, no. 3 (1960): 216-244.

[67] White, Ryen W., and Resa A. Roth. "Exploratory search: beyond the query-response paradigm (Synthesis lectures on information concepts, retrieval & services)." *Morgan and Claypool Publishers* 3 (2009).

[68] Cleverdon, Cyril W. "On the inverse relationship of recall and precision." *Journal of documentation* 28, no. 3 (1972): 195-201.

[69] Saracevic, Tefko. "Why is relevance still the basic notion in information science." *Re: inventing Information Science in the Networked Society. Proceedings of the 14th International Symposium on Information Science (ISI 2015)*

[70] Hutchins, William John. "The concept of 'aboutness' in subject indexing." *Aslib proceedings*. Vol. 30. No. 5. MCB UP Ltd, 1978.

[71] Lewis, C.S. 'The Lion, the Witch and the Wardrobe', Geoffrey Bles, 1950

[72] Sibley, Brian, 'The Land of Narnia', Collins Lions, 1989

Relevance then is a judgement about what is relevant to a specific person at a specific moment in time. This may appear a circular definition but from the earliest days of IR it was implicitly understood (even if periodically dodged) that what was being matched was an idea in a user's head not a term typed as a surrogate for that idea. When, as far back as 1955, Kent and Berry describe "brainless machines" accomplishing "selection of documents of pertinent interest", it is clear their goal was not mere query matching.[73] Tefko Saracevic has described relevance as "entering unannounced" into the field of information science and vividly describes the collapse of one of the earliest large scale attempts to obtain objective relevance judgements from large groups due to high rates of disagreement.[74] In the 1970s this was perhaps not so problematic: M. E. Maron, for example, makes it fairly clear that he regards documents as being 'about' whatever the librarian indexing them says they are about.[75] But in the context of today's information systems (not to mention the advent of postmodernism) this will not really serve us.

2.3 Information needs and behaviours

If items cannot be matched against some objective notion of relevance then to what should they be compared? The answer is to a researcher's *information need*, put simply, the question they are attempting to resolve. This might be a straightforwardly factual one, such as trying to remember which Brontë sister wrote Wuthering Heights.[76] Or it might be something more conceptual like trying to understand the principle causes and consequences of, say, stagflation in the global economy of the 1970s. Even the simpler of these examples isn't a search query: any resultant query is a mere surrogate for an information need in the user's mind. For Belkin et al such needs arise from an "anomalous state of knowledge" which an individual first recognises and then acts to resolve.[77] The process required to do this may be far from obvious to them - or to anyone if the need is a particularly difficult one. Let us consider some of the techniques and skills that we, consciously or otherwise tend to employ in these situations.

2.3.1 Satisficing

One important characteristic of an information need is how powerful it is which in turn has an important regulatory effect on information seeking, namely how persistent we are in attempting to track down what we want know. Satisficing is the process by which we decide that we have found 'enough' in a search. [78] The term is a

[73] Kent, Allen, Madeline M. Berry, Fred U. Luehrs, and James W. Perry. "Machine literature searching VIII. Operational criteria for designing information retrieval systems." *American documentation* 6, no. 2 (1955): 93-101.

[74] Saracevic, Tefko. "Why is relevance still the basic notion in information science." In Re: inventing Information Science in the Networked Society. Proceedings of the 14th International Symposium on Information Science (ISI 2015), pp. 26-35. 2015.

[75] Maron, M. E. "On indexing, retrieval and the meaning of about." Journal of the American Society for Information Science 28, no. 1 (1977): 38-43.

[76] Emily.

[77] Belkin, Nicholas J., Robert N. Oddy, and Helen M. Brooks. "ASK for information retrieval: Part I. Background and theory." *Journal of documentation* 38, no. 2 (1982): 61-71.

[78] Sternberg, 'Cognitive Psychology', Wadsworth 5th edition, 2009, p.483

portmanteau of suffice and satisfying coined by the economist and father of bounded rationality Herbert Simon.[79] Satisficing is our inbuilt mechanism to protect us from the problem of too much. It is what stops us from becoming a Don Quixote or Sir Thomas Philipps. In considering satisficing it is tempting to rather flippantly recall Zipf's "principal of least effort"[80] or to evoke "Mooers' law", formulated in 1959 stating that any IR system would not be used "whenever it is more troublesome for a customer to have information than for him not to have it".[81] In fact it is clear that decisions around satisficing are affected by a variety of factors – beyond whether a system is awkward to interrogate. Jannica Heinström examined the impact of personality, proposing three main types of information seekers: fast surfers, broad scanners and deep divers. These types were distinguished by their approach to search but also by factors such as their conscientiousness or their "openness to experience".[82]

For Mansourian and Ford (examining, like Heinström, a sample of research students but also academic and research staff) satisficing was often based on a judgement of risk. "Perfunctory" searches were acceptable to these researchers for information they felt was "inconsequential" but not where they fretted missing a source might prove "disastrous".[83] This suggests that satisficing is very much an affective process and this seems to reflect our lived experience: we are much more likely to persist in locating information that we really want to find and not likely to search exhaustively for an answer in which we are not especially invested. As we will see, archival researchers fall strongly into the latter category and are correspondingly search persistent. But we all give up sometimes (even if only temporarily), a strategy Savolainen refers to as withdrawing.[84] Those who persist might turn to browsing.

2.3.2 Browsing

For obvious reasons, librarians have long been interested in browsing, a concept which was set in a new context by the invention of the World Wide Web. Browsing is sometimes talked about as if it was something strongly distinct or different from searching. Olston and Chi call these the "two predominant paradigms for finding information", before making it clear that they understand browsing to be a form of searching (and vice versa).[85] Marcia Bates has illustrated compellingly that browsing is a kind of search essentially divided into four phases: glimpsing, sampling,

[79] Simon, Herbert A. "Rational choice and the structure of the environment." *Psychological Review* 63, no. 2 (1956): 129.
[80] George Kingsley Zipf, *Human Behavior and the Principle of Least Effort*, vol. xi (Oxford, England: Addison-Wesley Press, 1949)
[81] Calvin N. Mooers, "Mooers' Law or Why Some Retrieval Systems Are Used and Others Are Not," *Bulletin of the American Society for Information Science and Technology* 23, no. 1 (1996), p.22
[82] Jannica Heinström, 'Fast surfing, broad scanning and deep diving', Journal of Documentation vol.61, no,2, 2005, p.228-247
[83] Mansourian, Yazdan, and Nigel Ford. "Search persistence and failure on the web: a "bounded rationality" and "satisficing" analysis." *Journal of Documentation* 63, no. 5 (2007): 680-701.
[84] Savolainen, R., 2007. Filtering and withdrawing: strategies for coping with information overload in everyday contexts. *Journal of Information Science*, *33*(5), pp.611-621.
[85] Olston, Christopher, and Ed H. Chi. "ScentTrails: Integrating browsing and searching on the Web." *ACM Transactions on Computer-Human Interaction (TOCHI)* 10, no. 3 (2003), p.177

examining and acquiring.[86] To use, again, a library example, these represent glancing at a shelf (glimpsing) and alighting upon an item of interest (sampling), reaching for the item and flicking through it (examining) and then taking it to the desk to be issued (acquiring). At each stage we may pull back – perhaps there is nothing of interest on the shelf or on examination the book proves less interesting that at first glimpse. Bates prefers to talk in terms of glimpses rather than scanning, a word which she says has mutually exclusive connotations of both superficiality and thoroughness and furthermore is a behaviour which "can occur in non-browsing situations as well".[87]

Through this process of browsing a shelf of books has been reduced to one item. It has been browsed but it has also been *filtered*, in a manner analogous to the examination of search results. Savolainen characterises filtering as the way in which our eyes "automatically skip" or "jump" items of low interest when studying an information source. [88] This is clearly a kind of 'glimpsing' and it applies to search results where, no matter how good the algorithm, a mix of items of varying relevance are presented. Having obtained a large results set of mixed relevance, a user must attempt to reduce this to a smaller subset of items of high relevance. Faceted search may or may not support this filtering effort.[89] Some authors maintain a clear separation between browsing and searching, others explore this complexity. Olston and Chi, for instance, lean on Jul and Furnas to develop their own terminology, referring to web browsing as "search by navigation" and web search as "search by query". Interestingly this is not quite what Jul and Furnas say.[90] They assert that these concepts are discrete: that querying and navigation are tactics while browse and search are tasks, so a user may "search by navigation" and "search by query" but also "browse by navigation" and "browse by query". Browsing by query seems a good description of filtering. Browsing is then one aspect of search behaviour, let us now discuss searching more widely.

2.3.3 Searching

There has been much work attempting to classify the types of search behaviours that information seekers engage in. Browsing aside, generally two main types of search dominate library and information science literature, namely *known item search* and *topic search*, the latter sometimes called recall or subject search. Known item search is used by some authors to mean something quite specific: a search in which "the user is looking for a title s/he already knows or a book by a specific author"[91]. But Lee et al have called this definition "inappropriately restrictive" in the context of the

[86] Bates, Marcia J., "What is browsing – really? A model drawing from behavioural science research." *Information Research, 12, no. 4* (2007)

[87] Ibid.

[88] Savolainen, R., 2007. Filtering and withdrawing: strategies for coping with information overload in everyday contexts. *Journal of Information Science*, *33*(5), pp.611-621.

[89] Dash, Debabrata, Jun Rao, Nimrod Megiddo, Anastasia Ailamaki, and Guy Lohman. "Dynamic faceted search for discovery-driven analysis." In *Proceedings of the 17th ACM conference on Information and knowledge management*, pp. 3-12. ACM, 2008.

[90] Jul, Sussane, and George W. Furnas. "Navigation in electronic worlds: a CHI 97 workshop." *Sigchi Bulletin* 29 (1997), p.3

[91] Slone, D. J. (2000) Encounters with the OPAC: on-line searching in public libraries *Journal of the American Society for Information Science* 51(8), p.763

common use of the term in the context of digital search systems.[92] In the general context of a set of queries to such systems, the difference between a topic search and a known item search can only be defined by the degree of specificity of the information made available by the user. Lee and her colleagues point out that this distinction is one characterised by "blurriness".[93]

William Buckland defines topic search as "a search for information regardless of, or in ignorance of, any particular documentary source".[94] But while the pairing of topic and known item search is very firmly established in information science[95] Buckland criticises it, preferring a two dimensional model of document specificity (high to low) and information specificity (likewise) with the former pertaining to interest in specific texts and the latter to well formulated and precise queries ("What was the population of Klagenfurt in 1900?").[96] This is a significant point because it is easy – given they are described as forms of search – to think of topic and known item searches as search strategies when applying them as terms actually serves to define the user's information need. An expert user may deliberately use a broad term as part of a strategy to produce terms which they can later use to narrow their search. But mostly people simply attempt to express their information need in terms of a query.

That the unclear distinction between known item and topic searches makes it hard to categorise certain kinds of search made possible by emerging systems becomes very obvious if we consider the cultural heritage domain. If a user searches a museum collection by colour[97], is this a known item search ('I'm looking for paintings containing a specific pigment') or a topic search ('show me everything blue')? Tackling these complexities leads to further blurriness. Even in library science, some authors declare that there are three main types of search - adding "factual search". [98] Buckland is dismissive of this, insisting that both subject and factual searches are "searches for information albeit differing in the degree to which the information can be specified as a fact".[99] A further type of search is the collocation search where all items directly related to a known item (for example sharing the same author) are returned.[100] This might cover our museum example.

A relatively early attempt to produce a taxonomy of web search was published by Andrei Broder in 2002. Using data compiled by the search engine Alta Vista, Broder divided search into three "classes": navigational, informational and transactional.[101] Navigational searches were explicitly declared by Broder to be examples of known item search. They were said to occur when users entered a

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[92] Lee, Jin Ha, Allen Renear, and Linda C. Smith. "Known-Item Search: Variations on a Concept." *Proceedings of the American Society for Information Science and Technology* 43.1 (2006), p.3

[93] Ibid, p.13

[94] Buckland, M. K. (1979) On types of search and the allocation of library resources *Journal of the American Society for Information Science* 30(3), p.143

[95] Lee et al, op. cit, p.2

[96] Buckland, op. cit, p.144

[97] On for instance the Rijkmuseum's website, e.g. for a certain shade of blue: https://www.rijksmuseum.nl/en/search?p=1&ps=12&f.normalized32Colors.hex=%234279DB

[98] Rowley, Jennifer E. *Organizing knowledge: an introduction to managing access to information*. Ashgate Publishing, Ltd., 2008, p.114

[99] Buckland, op. cit, p.143

[100] B. Eversburg. "*On the Theory of Library Catalogs and Search Engines",* last modified 29 November 2007, http://www.allegro-c.de/formate/tlcse.htm

[101] Broder, Andrei. "A taxonomy of web search." In *ACM Sigir forum*, vol. 36, no. 2. ACM, 2002, p.5

keyword relating directly to “a particular site that the user has in mind” – consequently, Broder’s examples are mostly brand names (Compaq, American Airlines, Haaretz). A key point is that Broder clarifies that the user’s “immediate intent” is to locate the particular site.[102] We cannot, of course, know from the record of such a query, what the user’s actual information need – to be fulfilled in some way presumably from the target site in question - actually is. However, this does demonstrate that participants often associate their information need with a particular information source and this ability has been called “critical” for reaching information goals.[103]

Broder’s informational queries locate “static” information and are characterised by their broadness. This is in direct opposition to transactional searches which are said to aim “to reach a site where further interaction will happen”, such as shopping, downloading and other “web mediated services”.[104] Family history websites and cultural heritage collections websites (though not other site content on, say, museum websites) would both fall into this category. However Broder notes, “We could not find a simple question to distinguish between transactional and informational queries”.[105] A cynical observer might suggest that this may imply that the distinction is not especially meaningful or useful and indeed Rose and Levinson have redefined transactional queries as “resource queries”, where the user’s aim is “simply to get access to an online resource”.[106] Nevertheless, Broder’s categories are still very much in use.[107]

These classifiers all represent attempts by researchers to characterise the forms of the queries produced by users. But there has also been significant work to characterise the higher level approaches behind sequences of queries employed by information seekers. Marcia Bates carefully distinguishes between a search strategy (a plan for a whole search) and search tactics (“a move made to further a search”).[108] An example of a search strategy might be a “building block search” which is a reflective method used to help students construct and refine Boolean queries.[109] Another example of a search strategy would be *negative searching,* a term used by Stielow and Tibbo to describe the desire of humanities researchers to “discover that nothing else has been published on a particular research topic”.[110] Researchers may make use of the same tactic to rule out particular information sources or repositories from serious investigation and some degree of negative search seems important to help bound research tasks.

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[102] Ibid.

[103] Teevan, Jaime, Christine Alvarado, Mark S. Ackerman, and David R. Karger. "The perfect search engine is not enough: a study of orienteering behavior in directed search." In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM, 2004, p.417

[104] Broder, op. cit, p.6

[105] Ibid, p.7

[106] Rose, Daniel E., and Danny Levinson. "Understanding user goals in web search." In *Proceedings of the 13th international conference on World Wide Web*. ACM, 2004, p.14

[107] Elisa Gabbert, “The 3 Types of Search Queries & How You Should Target Them”, Wordstream Blog, accessed 16 May 2013, http://www.wordstream.com/blog/ws/2012/12/10/three-types-of-search-queries

[108] Bates, Marcia J. "Information search tactics." *Journal of the American Society for information Science* 30, no. 4 (1979), p.207

[109] Zorana Ercegovac, *Information Literacy: Search Strategies, Tools & Resources for High School Students and College Freshmen* (ABC-Clio, 2008), http://eric.ed.gov/?id=ED414975, p.42

[110] Frederick Stielow and Helen Tibbo, “The Negative Search, Online Reference, and the Humanities: A Critical Essay in Library Literature.,” *RQ* 27, no. 3 (January 1988), p.358

2.3.4 Exploratory search

A particular kind of sequence of queries has proved particularly interesting for researchers. For Debra Slone these are “unknown item searches” which she calls the “most complex” search type.[111] These are searches in which users attempt to communicate to a system “a problem they are…unable to express in system language” or to put it another way, participants who were “never sure of what they wanted until they found it”.[112] Slone’s work demonstrates very elegantly the thorny nature of these searches which can resist simple data-based analysis in that users performing them can appear successful in generating search terms and finding reasonable items but still fail to satisfy their information need. Slone warns that failure is particularly likely in unknown item searches for “narrow topics”. This raises an important point: namely the difference between an unknown item search and a subject search. Slone uses the example of “go karts” which appears to be a topic or subject search. But we must presume in this example that it is where the item in question is not present or understood by the system and returns no hits that the search can be called an unknown item search – it is a function of both the confusion of the user and the confusion of the system working together.

For O’Day and Jefferies this kind of complex search (or a kind hard to distinguish from it) is “progressive” or “interconnected” search.[113] These searches are characterised by the participants’ shifting information needs and their interest in an “accumulation” of search results “not the final result set”. O’Day and Jefferies liken this to the berrypicking described by the ubiquitous Marcia Bates. Bates pointed out that many user queries are not “single unitary, one time conception[s]” of a problem and often seek to “move through a variety of sources”.[114] She instead outlined an iterative process of search, where new information encountered by users “gives them new ideas and directions to follow”, which she dubbed “evolving search”. Berrypicking is defined as the satisfaction of the original query “by a series of selections of individual references and bits of information at each stage of the ever-modifying search”. The focus is not on query matching but on “the sequence of searcher behaviours” as a researcher “follows up various leads” using a variety of techniques. In the academic domain these might include footnote chaining, area scanning[115] or a range of other tactics.

O’Day and Jefferies go on to use the metaphor of orienteering to describe search behaviour. In the eponymous outdoor sport players move through generally unfamiliar terrain from pre-planned point to point and only in this way reach their final goal. For O’Day and Jefferies the similarity to research behaviour arose from the way in which information searchers “used data from their present situation to determine where to go next”. In a subsequent (2004) paper Teevan et al have defined orienteering very succinctly as “a search behaviour in which people reach a

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[111] Slone, op.cit, p.758

[112] Ibid, p.761

[113] O'Day, Vicki L., and Robin Jeffries. "Orienteering in an information landscape: how information seekers get from here to there." In *Proceedings of the INTERACT'93 and CHI'93 conference on Human factors in computing systems*, ACM, 1993, p.439

[114] Marcia J. Bates, “The Design of Browsing and Berrypicking Techniques for the Online Search Interface,” *Online Information Review* 13, no. 5 (December 31, 1989): 407–24, doi:10.1108/eb024320.

[115] Sometimes called ‘area searching’: the practice of looking at library materials located physically near already identified material – i.e. with the same or similar shelfmark.

particular information need through a series of small steps".[116] O'Day and Jefferies earlier work is specifically credited in this paper but the definition is similar rather than the same – actually the two studies are constituted very differently, both in terms of their tasks and their participants. Teevan stresses the importance of using "both prior and contextual information…without specifying the entire information need up front". Participants in her study often knew "how to get into the vicinity of the information in question and made a large step to get to the correct area", they then used "local exploration" to find the information target.[117] This tactic is strikingly similar to that employed by participants playing the game Wikispeedia in a 2012 study by West and Leskovec. The game requires participants to find the shortest path between two random Wikipedia articles and in a study of 30,000 games, the authors found the same pattern of "big leaps first, followed by smaller steps".[118]

Teevan and her colleagues contrast orienteering with a strategy they call "teleporting", where information seekers attempt to "jump directly to their information target". The most obvious example of this on the web is probably Google's "I'm feeling lucky" button.[119] Teleporting, it almost goes without saying, is not always successful and this might explain why the study found its use to be "surprisingly rare". The fact is that merely travelling successfully to a (believed) relevant website is seldom the end of an information journey. Indeed Teevan et al highlight three ways in which orienteering is better than teleporting, saying that the former decreases cognitive load on researchers by assisting recall, gives them a sense of direction, confidence and progress and also provides greater context to help fully comprehend their search results.[120]

These studies would appear to be describing very similar information behaviour. We could call it unknown item search, progressive search, berrypicking or orienteering. But these behaviours seem to be most coherently labelled with the phenomenon of exploratory search. For White and Roth exploratory searches "transcend multiple query iterations and potentially multiple search sessions".[121] For Marchionini, exploratory searches return "sets of objects that require cognitive processing and interpretation".[122] The goal of the search is likely to extend "beyond simply locating information toward activities associated with learning and understanding".[123] These are the kinds of searches that are very frequently carried out in archives, as we will see. These are searches in which it is not possible to teleport to a final destination because this destination is not yet known to the researcher. This chapter is an example of the output of an exploratory search task. In attempting to understand the processes constituting exploratory search we are moving beyond an examination of search as question answering (the query-response paradigm) into an examination of the process of *re*search. In order to explore this process of extended information seeking, we will now turn to models

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[116] Teevan, Jaime, Christine Alvarado, Mark S. Ackerman, and David R. Karger. "The perfect search engine is not enough: a study of orienteering behavior in directed search." In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM, 2004, p.415

[117] Ibid, p.417

[118] West, Robert, and Jure Leskovec. "Human wayfinding in information networks." In *Proceedings of the 21st international conference on World Wide Web*, ACM, 2012, p.624

[119] Google, http://www.google.co.uk

[120] Teevan et al, op. cit., p.419

[121] White and Roth, op. cit., p.21

[122] Marchionini, op. cit., p.43

[123] White and Roth, op. cit., p.21

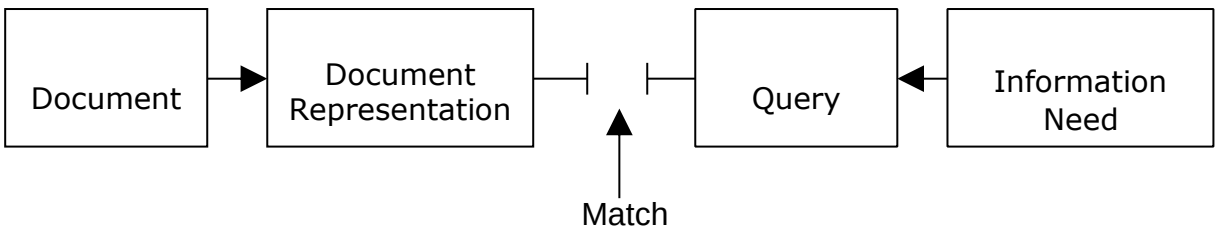
which present this journey not as a category amongst other categories but as the series of steps directly experienced by users.

2.4 Modelling information behaviour

"For any complex system", writes Duncan Watts, "there are many simple models we can invent to understand its behaviour. The trick is to pick the right one."[124] In the area of information behaviour Watts' trick appears particularly difficult. There is an embarrassment of riches, with dozens of models available, all attempting to answer the questions "what makes us search?" and "how do we find things?". In order to reduce this complexity, a number of writers have attempted to group such models. Dinet et al, divide what they call "information search models" into two sets: "information science oriented" and "cognitive" oriented.[125] However there are a number of models that appear to exhibit both sets of properties, as we shall see. In this overview of information models we will attempt to gain a deep understanding of what both systems and users are doing. In an attempt to make sense of the large number of published models, I have divided them into five groups based on shared characteristics. We will first examine models which appear to be 'flat' and show a clear linear 'path' and then move on to more complex models. Some examples of this first type of single layer model are now described as "simple" or "traditional", nevertheless they still contain some useful insights or model effectively small elements of larger processes. No model can ever be a complete representation of a system[126] but by grouping models with distinct traits we can hopefully gain a greater understanding of the system they represent. Some authors have attempted to synthesise this large collection into macro models and we will briefly consider some of these towards the end of this survey. Because these models grapple with varying success with the problem of abstracting the complex function of information seeking (or operate at different levels of abstraction) we will return to some of them in later chapters as the 'right tool for the job' of illustrating specific aspects of information seeking journeys.

2.4.1 Classic models

The simplest model of information seeking is that expressed by Marcia Bates. [127] It is possible to imagine a more parsimonious model but not by much:



[124] Duncan J Watts, *Six Degrees: The Science of a Connected Age* (London: Vintage, 2004), p.304

[125] J. Dinet, A. Chevalier, and A. Tricot, "Information Search Activity: An Overview," *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology* 62, no. 2 (April 2012), p.6

[126] If it was it would *be* the system.

[127] Marcia J. Bates, "The Design of Browsing and Berrypicking Techniques for the Online Search Interface," *Online Information Review* 13, no. 5 (December 31, 1989), p.408

Figure 2.1. Bates' Classic model (1989)

Bates called this the "classic" model of information retrieval and declared (in 1989) that it had been used in information science for 25 years, in other words since the mid-sixties and had proved "very productive" – although her paper aimed to supplant it. The model shows how a system, populated with representations of documents attempts to match a representation to a query generated by a user need and is a simplified version of earlier models such as those produced by S.E. Robertson.[128] This is virtually a pure system model, certainly no user is represented directly. They are implied only insofar as an information need must originate from a user. This putative user can only be imagined and seems to exist primarily to generate a query for the IR system. Nevertheless what is going on in the user's head cannot be completed omitted, even from a model as simple as this

Over a decade later. Andrei Broder formulated a very similar model, showing how a system responds to a query - also understanding it as a "classic" model: [129]

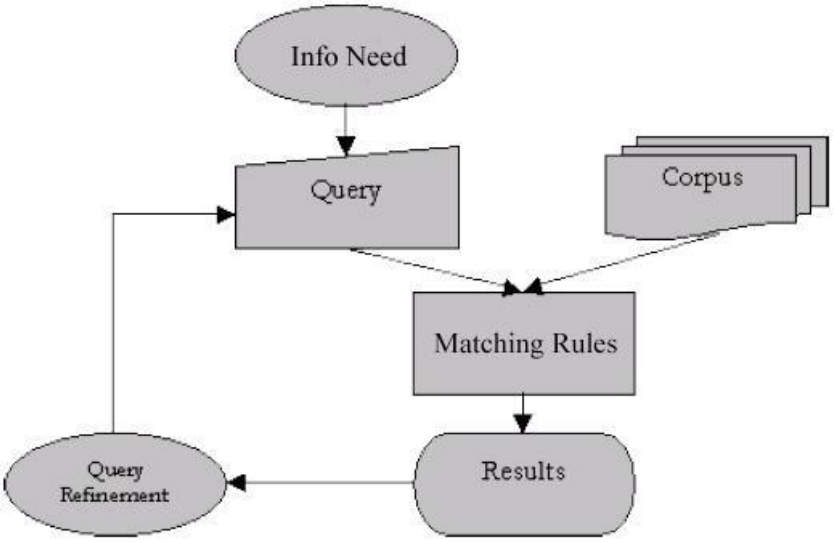


Figure. 2.2. Broder's Classic model (2002)

The only substantive difference between the two models is Broder's inclusion of the concept of refining and rerunning queries. If Bates was attempting to make a point with the aridity of her classic model it was not immediately recognised within IR. Broder further contended that the "classic" model could be augmented for the web without particularly significant modification:[130]

[128] Ibid.

[129] Andrei Broder, "A Taxonomy of Web Search," *SIGIR Forum* 36, no. 2 (September 2002), p.4

[130] Ibid.

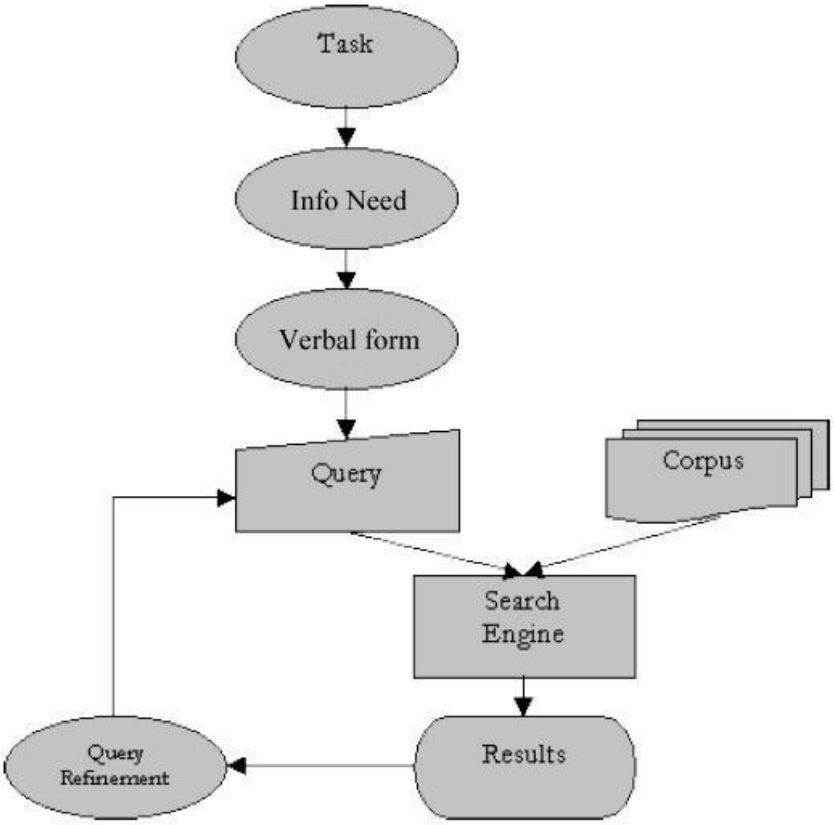


Figure 2.3. Broder's augmented classic model (2002)

Such an approach had already been effectively endorsed by Ben Shneiderman and colleagues in their 1997 four phase framework of search:[131]

Formulation → Action → Review of results → Refinement

Figure 2.4. Shneiderman, Byrd and Croft (1997)

We can see that all of these stages exist in Broder, though the concept of reviewing results prior to refinement is not explicit. Shneiderman et al call formulation – where a query is formed by a user - "the most complex phase", and Broder accommodates this somewhat in his second model by showing that an information need must be actualised in some meaningful way ("verbal form") before it can be expressed as a query. In these days of Siri, the idea that queries are expressed verbally before being run seems a little less silly than in 2002.

Another "traditional" model of information retrieval is provided by Saracevic:[132]

[131] Ben Shneiderman, Don Byrd, and W. B Croft, *Clarifying Search: A User-Interface Framework for Text Searches* (Corporation for National Research Initiatives, 1997), p3

[132] Tefko Saracevic, "Modeling Interaction in Information Retrieval (IR): A Review and Proposal.," *Proceedings of the ASIS Annual Meeting* 33 (January 1996), p.9

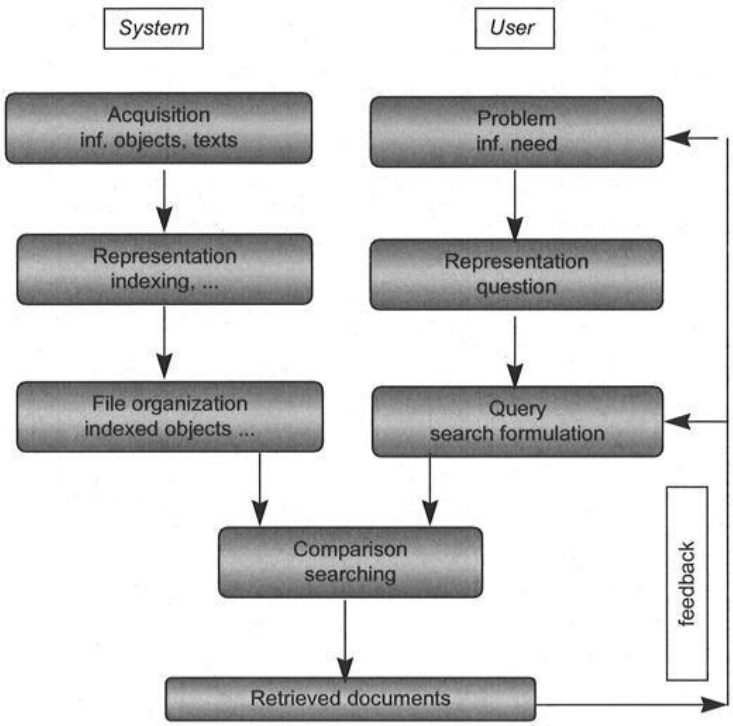


Figure 2.5. Saracevic's Traditional model (1996)

While superficially this model appears more complex, it is really only a slightly more nuanced version of Bates, with user needs meeting document representations. However, in this model the concept of reformulation is present in the form of feedback which can inform either a problem/information need or a query. The user gets another roll of the dice: the chance to reformulate their query based on the new information and have another go. In this sense the model is also slightly more sophisticated than Broder. This "traditional" model is perhaps a little unhelpful in implying that the level of complexity involved within the system is as great as that contained by the user, which is very unlikely to be the case. Other models of this type include Wilson's 1981 model of information behaviour.[133] Wilson subsequently criticised his own early effort saying that this kind of model "does little more than provide a map of the area"[134] and "does not directly suggest hypotheses to be tested".[135]

As a group we can thus see considerable agreement as to what constitutes classic or traditional information retrieval. This is the query-response paradigm in model form. The user is largely absent and any suggestion that there might be a context to their use can consequently not be represented. The tenacious survival of such models into the 21st century is impressive.

[133] T. D. Wilson, "Models in Information Behaviour Research," *Journal of Documentation* 55, no. 3 (August 1, 1999), p.251

[134] Wilson, op. cit, p.252

[135] Wilson, op. cit, p.253

2.4.2 Behavioural models

A second family of models is based on collecting the distinct behaviours exhibited by information seekers as they carry out research. David Ellis has conducted and inspired much work in this area. His behavioural model (fig. 7) was derived from interviews with 47 social scientists.[136] Although Ellis cautioned against stating the relationships between the features of the model "categorically" except in the case of an individual information seeking pattern – in other words suggesting that the order of the steps was not generalisable - the model is typically expressed in this way:[137]

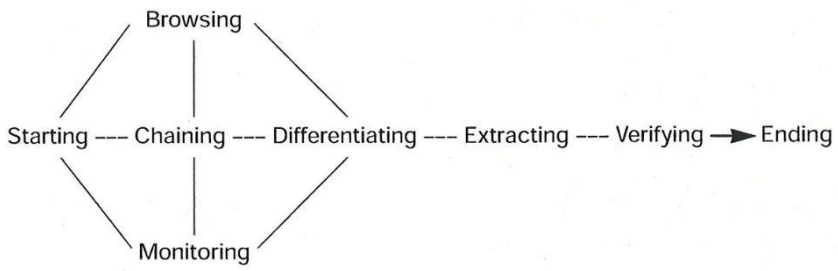


Figure 2.6. Ellis' Behavioural Model of information retrieval after Wilson (1989, 1999)

This model is not concerned with information retrieval and so lacks many of the features of the classic IR models. Ellis' model instead seems to fit Bates' definition of a search strategy as a sequence of tactics.[138] Chaining (moving through a sequence of citations) and monitoring (maintaining an eye on search progress and watching for resources not available at the start) are both clearly tactics, as is browsing. But this means we could add many other search tactics to the model before we reach the 'extracting' phase, for example the tactic of asking a colleague or particular specialist for their search suggestions.

Other researchers have evidently recognised this. In 2003, Lokman Meho and Helen Tibbo published a further study on the patterns of work of 60 social scientists. While confirming many features of Ellis' work, they added four new features to his model (including "networking") and altered its shape:[139]

[136] David Ellis, "A Behavioural Approach to Information Retrieval System Design," *Journal of Documentation* 45, no. 3 (December 31, 1989), p.174
[137] Donald O. Case, *Looking for Information: A Survey of Research on Information Seeking, Needs and Behavior* (Emerald Group Publishing, 2012), p.144
[138] Marcia J. Bates, "Information Search Tactics," *Journal of the American Society for Information Science* 30, no. 4 (1979), p.207
[139] Lokman I. Meho and Helen R. Tibbo, "Modeling the Information-seeking Behavior of Social Scientists: Ellis's Study Revisited," *Journal of the American Society for Information Science and Technology* 54, no. 6 (2003), p.584

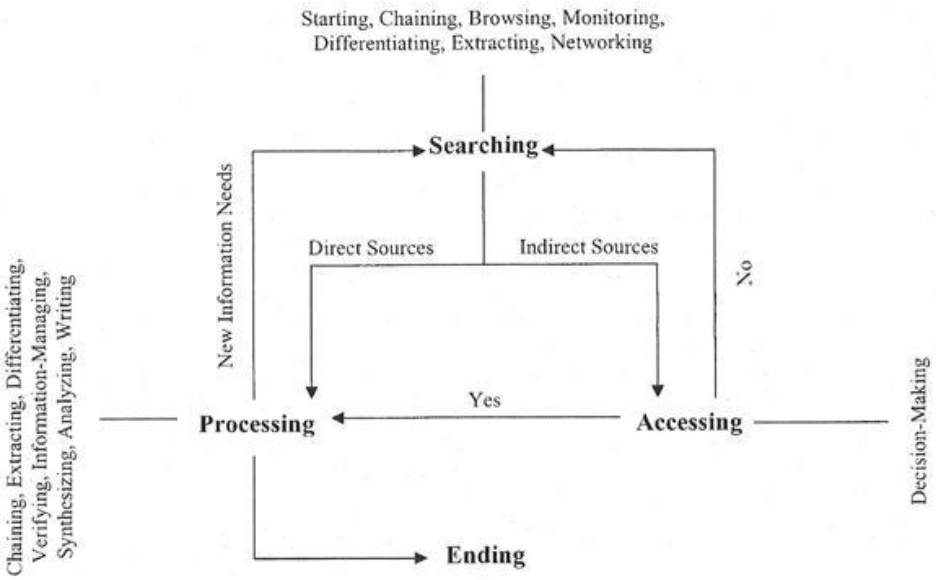


Figure 2.7. Ellis after Meho and Tibbo (2003)

The focus of this new model on access is extremely interesting. Many other models assume that there is no gulf between selecting a source and querying it. In truth, as all researchers realise quickly, determining that a source likely contains information of use may be far more straightforward than gaining access to it. Barriers to search will be discussed in more detail later. For now it is enough to note that these two models caution us to understand that searching is not a process of constant forward momentum.

So far we have discussed models in which the user follows a single, point-to-point path, albeit that some of those journey are convoluted or may be implied by the model to be stochastic. Some of the models we will now discuss are linear but all are representing multiple spaces simultaneously. Returning to Ellis, a model heavily indebted to his work is that of Choo et al:[140]

[140] Chun Wei Choo, Brian Detlor, and Dan Turnbull, "Information Seeking on the Web: An Integrated Model of Browsing and Searching," *First Monday* 5, no. 2 (February 7, 2000), p.8

	Starting	Chaining	Browsing	Differentiating	Monitoring	Extracting
Undirected Viewing	Identifying selecting starting pages, sites	Following links on initial pages				
Conditioned Viewing			Browsing entry pages, headings, site maps	Bookmarking, printing, copying Going directly to known site	Revisiting 'favorite' or bookmarkedsi tes for new information	
Informal Search				Bookmarking, printing, copying Going directly to known site	Revisiting 'favorite' or bookmarkedsi tes for new information	Using (local) search engines to extract information
Formal Search					Revisiting 'favorite' or bookmarkedsi tes for new information	Using search engines to extract information

Figure 2.8. Choo's behavioural model of information seeking on the web (1999)

Here we see that an extra dimension has been added to Ellis' model, drawn from Francis Aguilar's modes of scanning and shown on the left of the model. These modes were developed in the 1960s and are preferred by the authors to other more recent (and web-based) categorisations of browsing behaviour for reasons they do not elaborate.[141] There appear to be a number of problems with the resulting work.

Choo et al's study made use of 34 participants working in the private sector and categorised their web behaviours according to where they appeared to fit the proposed model.[142] This may appear a little methodologically curious. The results are also odd. For example, Choo et al define "formal search" as "a deliberate or planned effort to obtain specific information…about a particular issue".[143] Yet they claim only to have found evidence of this behaviour in the "extracting" phase of information seeking.[144] This seems implausible: how do such searches start? Can searches using footnotes ("chaining") not be formal? The strong implication is that some of Choo's "episodes" of search may be miscategorised within the model. Similarly many cases of "undirected viewing" occurred where participants visited news websites to "keep up with what's happening in the world".[145] This appears to be a very fine example of "monitoring", yet Choo and her colleagues maintain that undirected viewing was only observed in the starting and chaining phases.[146] These distortions seem to have come about because Choo et al present Ellis' model as steps in sequence but, as we have already seen, this is not how either Ellis himself or Meho and Tibbo understand the model and consequently it seems reasonable to suspect that it does not work in this way.

[141] Ibid, p.5
[142] Ibid, p.9
[143] Ibid, p.5
[144] Ibid, p.13
[145] Ibid, p.11
[146] Ibid, p.13

The preceding models are systems blind. But some behaviourist models exist showing responses to running queries within a system. Marchionini's model of information shows in detail what the user is doing at each stage in an interaction with a search system.[147] Like Ellis' model it is also not linear: Marchionini's model can be experienced in a default state as a straightforward journey from the acceptance and definition of an information problem to a query and results phase that seems to fit comfortably with some of our classic models. However, other ways of navigating through the model are possible:

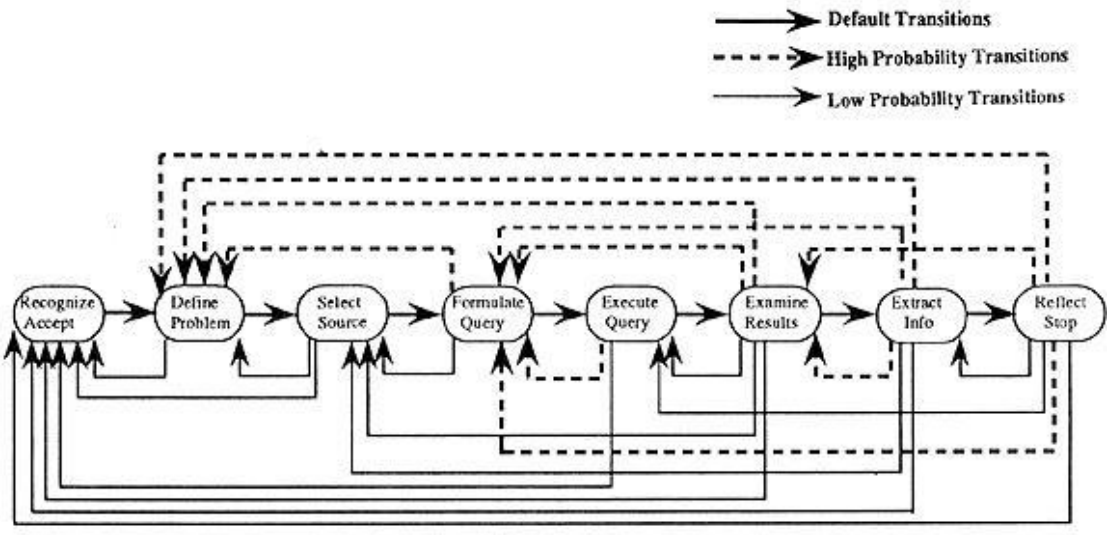


Figure 2.9. Marchionini's Model of information seeking (1995)

The low probability route, for instance shows that both queries and problems may need to be redefined just about any time a user is exposed to new information. This model is usefully granular and incorporates some crude but useful representations of decision making on the part of the user who must choose where to carry out a search and not just generate results, as in a classic model, but examine them, extract information and then decide what do next.

To these models it is possible to add others which examine the steps which constitute the work of historians[148] and those of engineers[149] and no doubt many others. What these models have in common is considerably more interest in nodes than in edges, by which I mean there is very little consideration of why or how transitions happen and emphasis is reserved for understanding what differentiates, say, extracting from verifying. Behavioural models show us what the user is doing but they do not show us what the user is thinking. That is the province of the next two groups of models.

[147] Gary Marchionini, *Information Seeking in Electronic Environments* (Cambridge University Press, 1997). p.50

[148] Uva, Peter A. "Information-Gathering Habits of Academic Historians: Report of the Pilot Study.", State Univ. of New York, Syracuse (1977).

[149] Ellis, David, and Merete Haugan. "Modelling the information seeking patterns of engineers and research scientists in an industrial environment." Journal of documentation 53, no. 4 (1997): 384-403.

2.4.3 Contextual models

Contextual models are those which appears to focus less on process (though some process may be present) and more on information seekers themselves, their mentalities and their environment or situation. Wilson's model of information seeking behaviour (fig. 10 below) is such a model and, like Choo et al, incorporates Ellis (fig. 7). But here the emphasis in the left and centre portions of the model is on barriers to progress, which relate to various aspects of the user's situation or context. We will examine these barriers in more detail in subsequent chapters. But it is perhaps worth remarking at this point that the model does not suggest how these barriers are overcome by users. This appears to be an example of what Tefko Saracevic has called "a situational framework"[150] and a number of other models also appear to fall into this category.

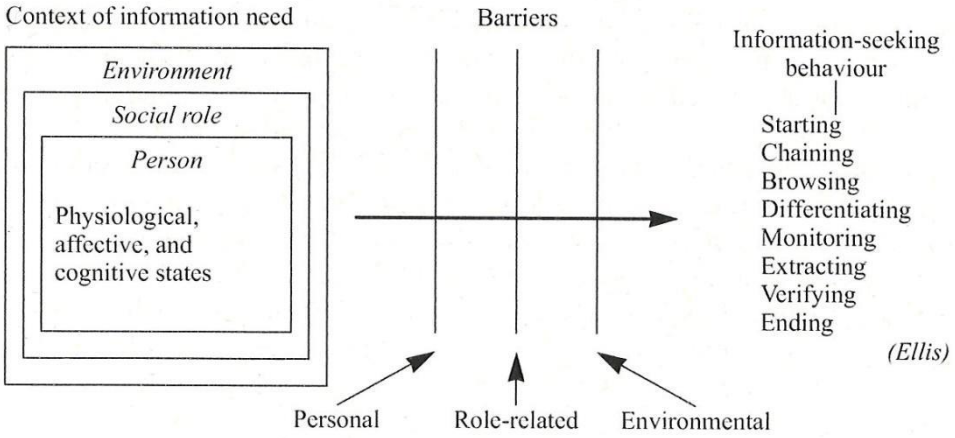


Figure 2.10. Wilson's model of information-seeking behaviour (1981)

There is no IR system at all shown here and Saracevic has called such situated models "systems blind".[151]

Fifteen years later, Wilson revised his model (fig. 22) to take account of new research, particularly research outside the immediate discipline of information science.[152] The model is in some respects similar but is much expanded:[153]

[150] Saracevic, 'Relevance reconsidered', p.9
[151] Saracevic, 'Relevance reconsidered', p.7
[152] Wilson, 'Information behaviour', p.551
[153] Wilson, 'Models in information research', p.257

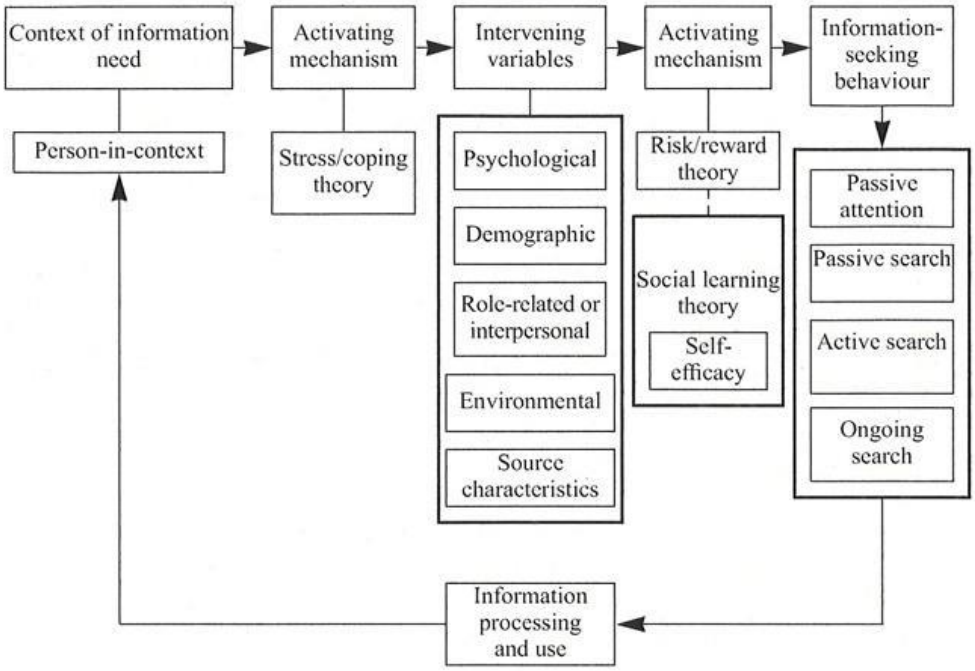


Figure 2.11. Wilson's model of information behaviour (1996)

We can see that "search" of various kinds is now represented on the right hand side. "Intervening variables" replace barriers and there are rather more of them – "source characteristics" is an interesting one. Wilson breaks this down as problems of "access" (which he relates to cost) and "credibility".[154] Issues about intellectual access (or problems connected with language or palaeography) are not explicitly addressed but perhaps fall into the environmental category. Wilson offers "stress/coping theory" as "an alternative to seeking to define and gain evidence of the elusive information need".[155] This seems a rather gloomy suggestion. Wilson's second "activating mechanism" reminds us that sometimes information needs can be recognised without any strong desire to fulfil them. Once again though, this model appears to have little to tell us about systems per se - though it has been redeveloped to say a little more by Barbara Niedzwiedzka.[156] It is overwhelmingly focused on the individual user and their environment.

A model with a little more to say about systems (but not all that much) is that of Ingwersen and Järvelin:

[154] Wilson, 'Information behaviour', p.561

[155] Ibid, p.554

[156] Barbara Niedźwiedzka, "A Proposed General Model of Information Behaviour," *Information Research* 9, no. 1 (2003), http://informationr.net/ir/9-1/paper164.html

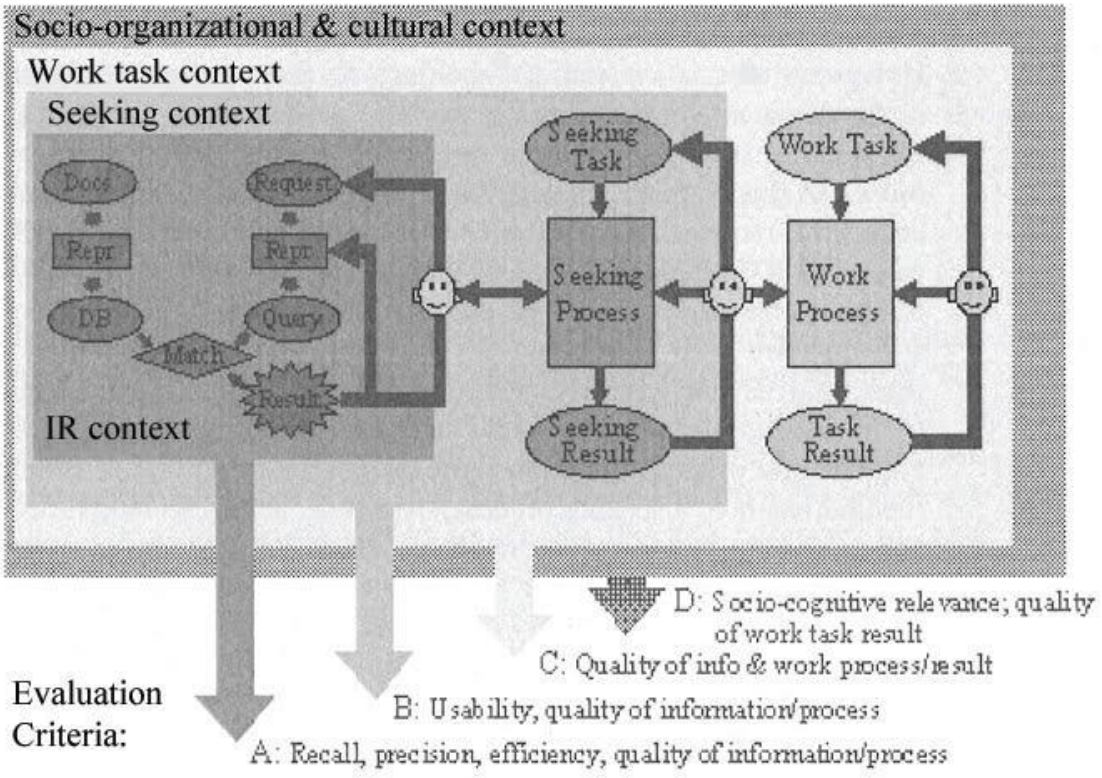


Figure. 2.12. Ingwersen and Järvelin's model of information seeking (2004)

This model, proposed in 2004 was adopted by Wilson et al to support their 2010 monograph on search interfaces.[157] The group selected the model on the basis of its "holistic perspective" and its ability to simultaneously include "important finite concepts such as topical relevance".[158] The principal purpose of Ingwersen and Järvelin's model seems to be to place a single information retrieval iteration within a social context of work. Ingwersen and Järvelin are situating the process as a socio-technical system.

The innermost IR context layer is perhaps the weakest part of the model. It is extremely simplified, being not much more sophisticated than one of our 'classic' models. The next two layers seem to focus on what Wilson calls "person-in-context". We have a "seeking task" and a "practice of information seeking"[159]. The authors make the point that at this level there are "a variety of information sources and systems" available[160] – though these are not shown. This is all encapsulated in a "work task" with process factors such as "effort and time"[161] which exists within a real world, cultural context. The model also suggests possible evaluation criteria at each

[157] Max L. Wilson et al., "From Keyword Search to Exploration: Designing Future Search Interfaces for the Web," *Found. Trends Web Sci.* 2, no. 1 (January 2010), p.15

[158] Ibid, p.14

[159] Kalervo Järvelin and Peter Ingwersen, "Information Seeking Research Needs Extension Towards Tasks and Technology," *Information Research* 10, no. 1 (October 2004), http://informationr.net/ir/10-1/paper212.html

[160] Ibid.

[161] Ibid.

stage: this is important because defining and measuring success in information seeking can be difficult, particularly with more complex retrieval systems.[162]

A corollary to Ingwersen and Järvelin model would seem to that of Leckie et al – though the latter actually predates the former:[163]

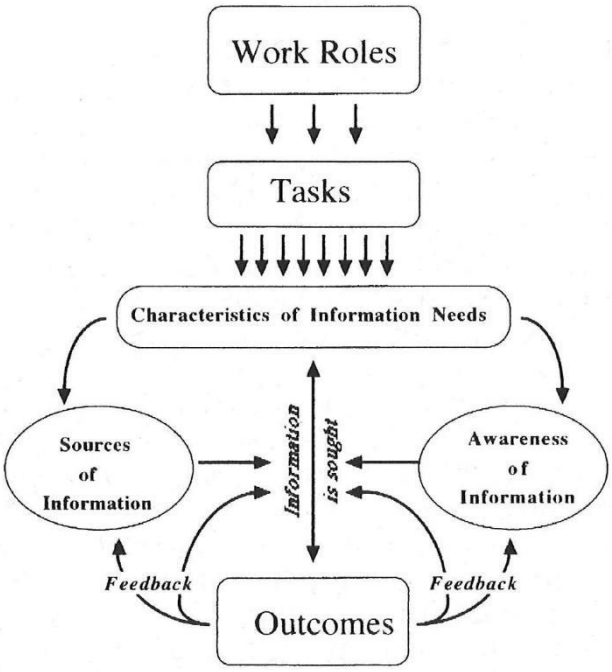


Figure. 2.13. Leckie et al, "a model of the information seeking of professionals" (1996)

We can see once again a strong focus on task situated in a work context but with a much greater concentration on an information need than in the previous example. This model also serves as a salutary reminder that we cannot access an information source of which we are not aware; a key barrier not obviously present in some of the other situational models. Leckie's model is intended to be "generalizable across the professions" but is based upon literature examination not empirical study.[164]

In the same paper in which their information seeking model is outlined, Ingwersen and Järvelin outlined a simple model of the relationships between the various actors (people, machines and information objects) involved in information seeking, and their environment.[165] Curiously, this is clearly a simplified representation of Ingwersen's 1996 model of information retrieval[166].

[162] Marc Bron et al., "A Subjunctive Exploratory Search Interface to Support Media Studies Researchers," in *Proceedings of the 35th International ACM SIGIR Conference on Research and Development in Information Retrieval*, SIGIR '12 (New York, NY, USA: ACM, 2012), p.6

[163] Gloria J. Leckie and And Others, "Modeling the Information Seeking of Professionals: A General Model Derived from Research on Engineers, Health Care Professionals, and Lawyers.," *Library Quarterly* 66, no. 2, p.180

[164] Ibid.

[165] Jarvelin and Ingwersen, op. cit, p.3

[166] Wilson, 'Models in Information Behaviour Research' p.259

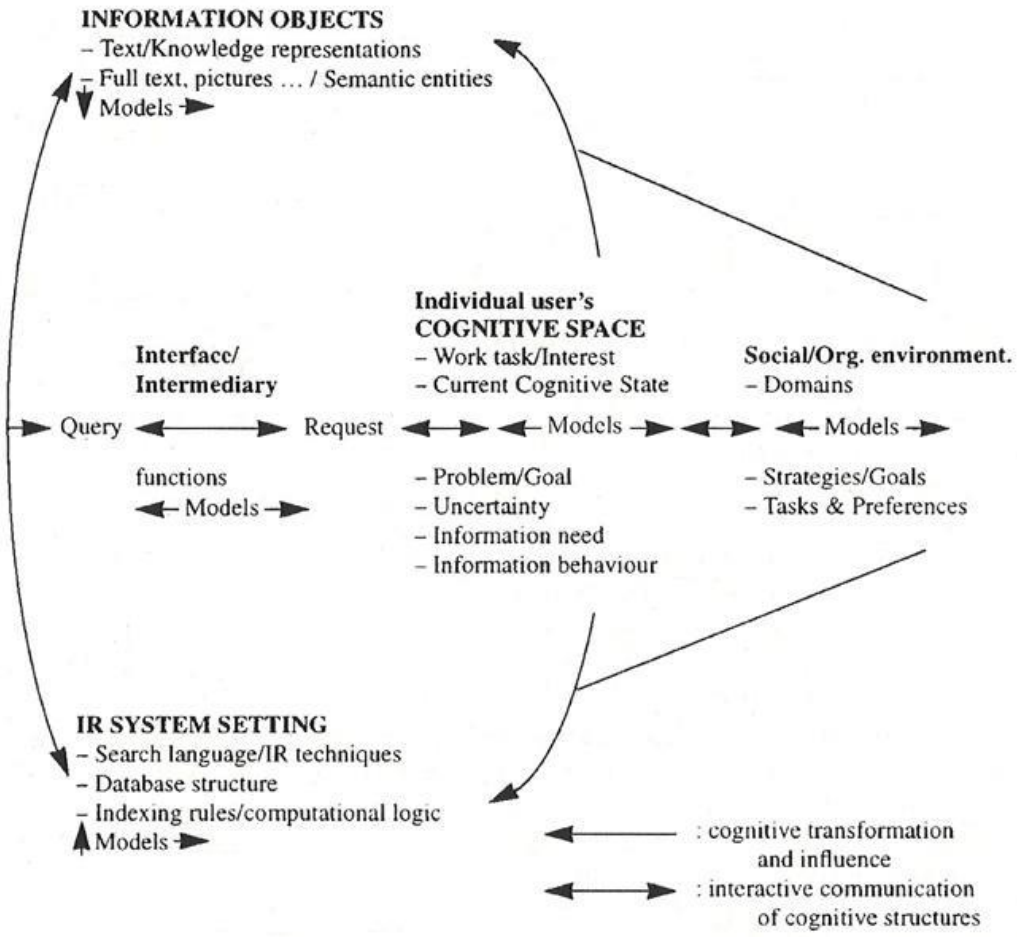


Figure 2.14. Ingwersen's cognitive model of the IR process (1996)

We see here not a search taking place within an environment, but a complicated network of interacting entities. The model is similar to that of the model of information seeking but is more fluid. It is concerned with the different spaces that are operating – inside our heads, the environment, the information objects and how they interact. This model is considerably more sophisticated than the previous example but it is also more abstract. "Work tasks" are present in the user's cognitive space but they having nothing like the centrality of the previous model – other than the user being at the heart of this model, rather than the system. As if to make up for this, system objects get three mentions, with the interface, settings and data all represented separately. This appears to be a situated model that is not systems blind. In fact we can add more actors even than these: [167]

[167] Belkin, Nicholas J., Robert N. Oddy, and Helen M. Brooks. "ASK for information retrieval: Part I. Background and theory." *Journal of documentation* 38, no. 2 (1982), p.65

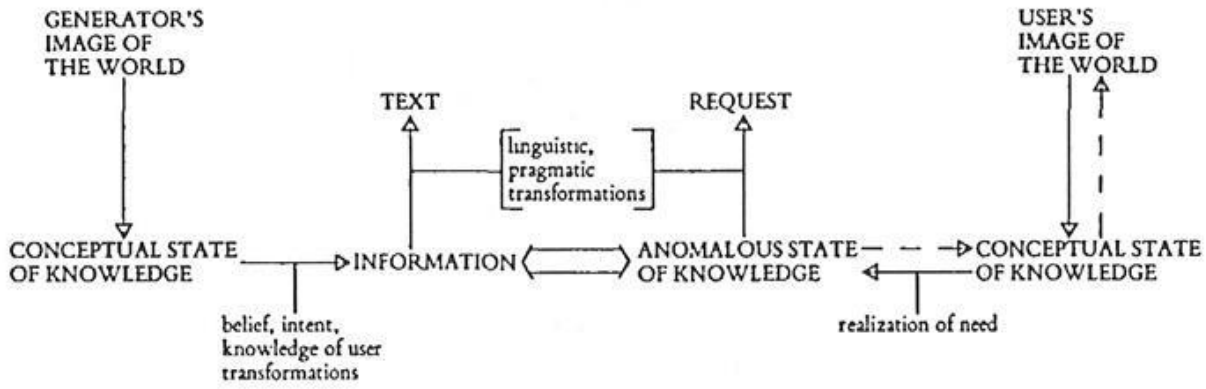


Figure 2.15 Belkin's model of "A Cognitive Communication system for information retrieval" (1980)

Belkin's model of information retrieval handles interactions very simply (perhaps simply enough for us to call it traditional[168] or classic) but reminds us that every information object is the product of an author. In the archival context this may be a writer who has been dead for an extended period of time, with a worldview very profoundly different to that of the information seeker. There is also, almost inevitably a very large gap between the reason for the generator's production of a document and the user's need. Unfortunately exactly the same effect applies to metadata creators as data creators. They may be similarly ignorant of the intent of their users and may also be separated from them in time – some sets of records remain primarily indexed by Victorians. As we encounter more 'situated' models which place the user in their environment it is helpful to have a model that reminds us that documents and their creators are also situated – "information is people in disguise" as Jaron Lanier has it.[169]

The models of Johnson and Meischke[170] and that of Byström and Järvelin[171] with their interest in "beliefs", "direct experience" and "personal style of [information] seeking" add further nuances to the human-centred view. But the desire to concentrate on both sides of the information seeking process equally – with both the situated user and the situated system is a key preoccupation of Saracevic's stratified interaction model. This model is generally expressed in quite a complicated looking way:[172]

[168] Saracevic calls a very similar Belkin and Croft model traditional in 'Relevance reconsidered', p.6

[169] Laurence Scott, "Who Owns the Future? by Jaron Lanier – Review," *The Guardian*, February 27, 2013, http://www.theguardian.com/books/2013/feb/27/who-owns-future-lanier-review.

[170] Knight, S. A. and A.H. Spink. *Toward a Web search information behavior model* in Spink and M. Zimmer (eds.) Web Search: Multidisciplinary Perspectives. Springer Berlin Heidelberg, 2008, p.216

[171] Katriina Bystr"om and Kalervo Järvelin, "Task Complexity Affects Information Seeking and Use," *Inf. Process. Manage.* 31, no. 2 (1995), p.197

[172] Saracevic, 'Modeling interaction', p.13

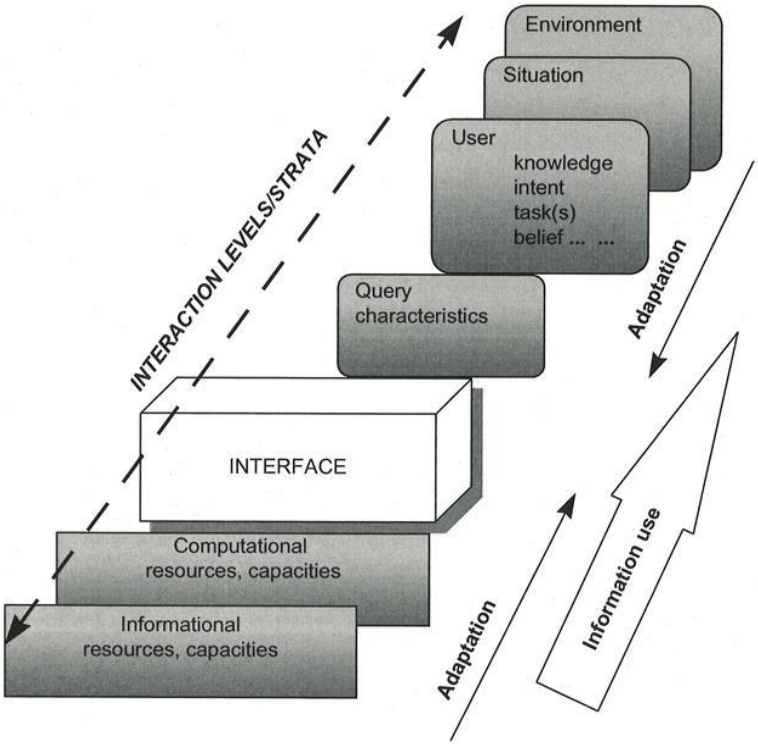


Figure 2.16. Saracevic's "stratified model of IR interaction" (1996)

However, it is fairly easy to explain. A situated user produces a query that is partly a product of that environment. This is handled by an interface that is also situated because it is operating within a specific set of computational resources handling information which is arranged in a particular way. Saracevic confusingly names his 'strata' levels and gives them different titles to the illustration. So we have the cognitive level (user), situational and affective levels (the latter is presumably 'environment') and a "surface" level where the interface sits.[173] To some extent then Saracevic's levels recall Kuhlthau's. But his description of the model appears not to exactly correspond to his own diagram. For example, on the cognitive level users are said to "interact with the 'texts'"[174]. Texts are not explicitly included in the depiction of the model. They exist, presumably, as part of the "informational resources".

The weakness of this model is that the user appears extremely distant from the resources being worked with. In a sense this is true: information seeking through an interface is a little like threading a needle whilst wearing oven gloves. However, once results are generated Saracevic conceives of an Acquisition-Cognition-Application sequence where the user interprets and uses those results.[175] We see a direction of travel through the levels ("information use") but Ingwersen's more complicated interactions (where, for example both information objects and users cognitive spaces are influenced by the environment) seem perhaps more realistic and persuasive. The model's strength lies in its buttressing of Saracevic's conception of information retrieval as a "dynamic interdependent system of relevances"[176], showing that conceptions of what is relevant to a given query will likely be different across the

[173] Saracevic, 'Relevance reconsidered', p.10
[174] Saracevic, 'Modeling interaction' p.6
[175] Saracevic, 'Modeling interaction' p.5
[176] Saracevic, 'Relevance reconsidered', p.10

different strata and that “THE major issue of information science” is to increase the interaction between the strata with the aim of aligning this system.[177]

Other examples of contextual models include Johnson and Meischke’s comprehensive model of information-seeking,[178] the “non-linear” model of Allen Foster[179] and Savolainen’s model of everyday life information seeking.[180]

2.4.4 Cognitive path models

Cognitive path models are those which appear to represent an information journey or path and also involve thoughts and decisions about that path. These models can be highly abstract or contain significant low level detail. A highly abstracted cognitive path model is that of Amanda Spink,[181] developed from evaluating the search patterns of 40 academic users:[182]

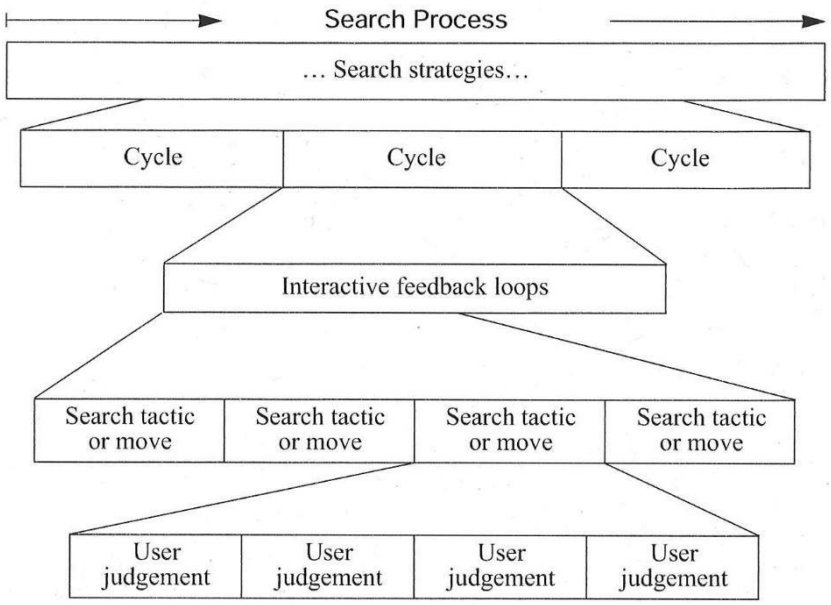


Figure 2.17. Spink’s model of IR interaction (1997)

Here the emphasis is on some (unspecified) constructive action by the user, instigated crucially by a judgement that the search will be advanced. At a similarly high level of abstraction Bates’ berrypicking model illustrates how a sequence of queries (in the manner of Shneiderman or Broder) each producing documents, are

[177] Ibid, p.11
[178] Johnson, J. David, and Hendrika Meischke. "A comprehensive model of cancer-related information seeking applied to magazines." *Human Communication Research* 19, no. 3 (1993): 343-367.
[179] Allen Foster, “A Nonlinear Model of Information-seeking Behavior,” *Journal of the American Society for Information Science and Technology* 55, no. 3 (2004), p.232
[180] Reijo Savolainen, “Everyday Life Information Seeking: Approaching Information Seeking in the Context of ‘way of Life’,” *Library & Information Science Research* 17, no. 3 (1995), p.268
[181] Amanda Spink, “Study of Interactive Feedback During Mediated Information Retrieval.,” *Journal of the American Society for Information Science* 48, no. 5 (January 1997), p.391
[182] Ibid, p.385

strung together by information seekers with more complex needs than can be satisfied by a single query.[183]

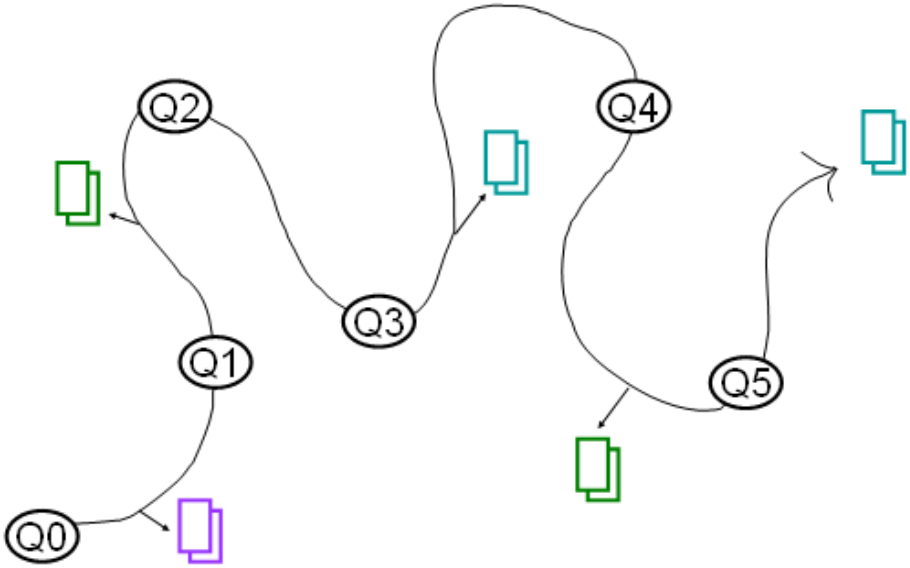


Figure 2.18. Bates' Berrypicking model (1989)

While a number of the classic models incorporate reformulation, Marcia Bates believed that the accumulation of information at each stage of a search to be greater than the sum of its parts (see 2.3.4). This is a simple visual representation of exploratory search. But other authorities have also produced models which appear to be based around this notion of a pattern of repeated sequences in which meaning (not merely documents) is accumulated to take users closer to a resolution of their information problem. For example, Wilson's problem solving modelacts as a kind of game of snakes and ladders.[184] At each linear stage of resolving some problem some uncertainty may be resolved or the user may fall back and progress may not be made:

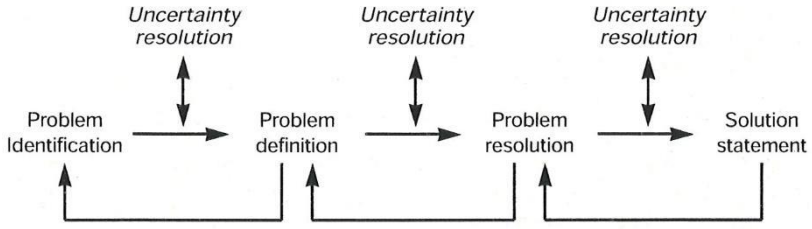


Figure 2.19. Wilson's problem solving model of "information seeking and searching" (1999)

[183] Marcia J. Bates, "The Design of Browsing and Berrypicking Techniques for the Online Search Interface," *Online Information Review* 13, no. 5 (December 31, 1989): 407–424

[184] Wilson, op. cit., p.266

Uncertainty reduction is happening alongside the process of moving towards a solution. What is very unclear is what drives this process. Does a reduction in uncertainty allow a problem to be defined or does the process of problem definition (whatever that might consist of) lead to reduced uncertainty? The low level tasks undertaken by the user are not explored.

Nevetheless, Wilson's model suggests that berrypicking may, perhaps, be a more haphazard process than might be immediately apparent. However this model also has some differences to the previous ones in that it appears formulated in such a way that it could take place in its entirety prior to actual searching taking place, since it is possible for the fourth stage to be framed as "this is how we are going to deal with the problem".[185] The decreasing uncertainty is paralleled in Bates and may lead us to wonder if despite its apparent simplicity we should understand berrypicking in two dimensions: movement through a series of searches and movement from uncertainty to greater certainty. We will return to the role of uncertainty in the information seeking process in subsequent chapters.

A more complex but clearly related example is Cole's model of problem solving via interaction with an IR system:[186]

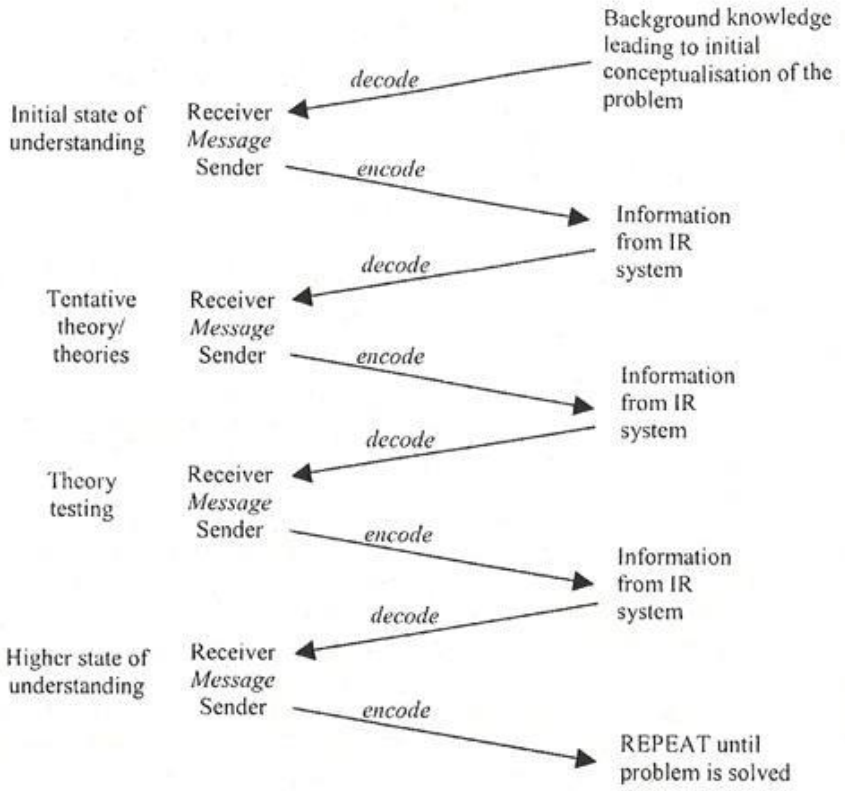


Figure. 2.20. Cole's model of problem solving via interaction with an IR system, after Ford (1999, 2004)

Here we can see more explicitly how a series of interactions with a system resolves uncertainty and promotes understanding, with decoding (perhaps a form of sensemaking, which we will shortly discuss) or decoding occurring at each step. This model helpfully reminds us that interpreting results from the system needs to be

[185] Ibid.

[186] Nigel Ford, "Modeling Cognitive Processes in Information Seeking: From Popper to Pask," *Journal of the American Society for Information Science and Technology* 55, no. 9 (2004), p.772

paired with encoding, as the user must then manifest their new understanding in some way, for example by reformulating search terms. If the user can't do this they cannot deploy their new knowledge. The process is a dialogue[187] where both user and system attempt to understand one another better. In archival systems the reality is a little more complex since the user must often make sense not only of results but of the organising principles behind the collection in order to improve their searches.

A model focused on representing the thoughts and feelings alongside their behaviours is that of Carol Kuhlthau. Some model creators leave the basis for their design vague or provide a short list of papers by others whose findings their model represents – Bates, for instance, takes this approach.[188] In contrast, Kuhlthau provides thorough details of the development work for her model. Beginning with a "small-scale study in a naturalistic setting augmented by case studies", her model was "tested in two longitudinal studies and further verified in two large-scale field studies using more quantitative methds and statistical analysis."[189] The last of these involved almost 400 high school students working in 21 public libraries in the United States and was first published in 1991.[190] Kuhlthau's model has subsequently experienced some adjustment, such that the seven phases are now said to be task initiation, prefocus exploration, focus formulation, information collection, search closure and writing.[191] Nevertheless, this representation highlights the model's ability to capture user experiences on a variety of levels at each stage:[192]

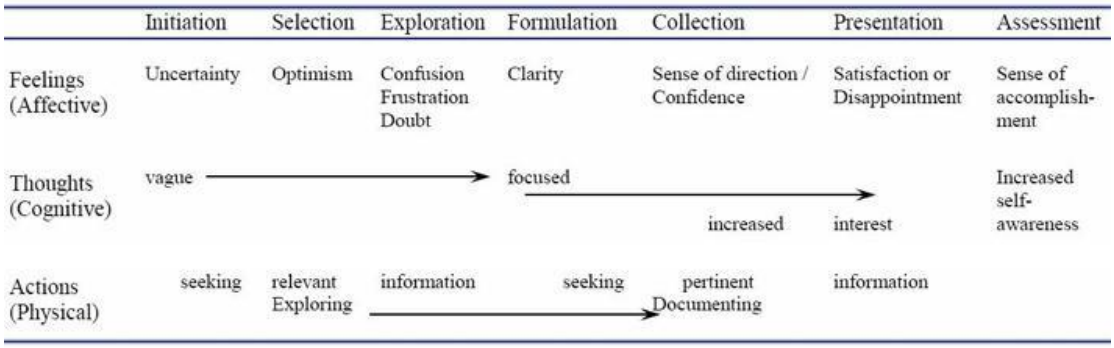


Figure 2.21. Kuhlthau's model of "the information search process" (2004)

On the one hand this model was developed based upon observation of a specific group (high school students) generally engaged on the specific task of writing a research paper for their teacher. The forward momentum in this model is no doubt a function of the fact that students are working to a deadline![193] This is a very linear model but it has three layers and manages to encompass both the detail of searching and higher level information behaviour. In this specific sense, the model

[187] Saracevic, Modeling interaction, p.5
[188] Bates, op. cit.
[189] Kuhlthau, Carol C. "Inside the search process: Information seeking from the user's perspective." *Journal of the American society for information science* 42, no. 5 (1991), p.364
[190] M. Hearst, *Search User Interfaces*. Cambridge; New York: Cambridge University Press, 2009, p.69
[191] Carol Collier Kuhlthau, *Seeking Meaning: a Process Approach to Library and Information Services* (Westport, Conn.: Libraries Unlimited, 2004), p.44
[192] Ibid, p.82
[193] Though most research tasks are, of course, bounded in some respects.

resembles Sharit et al's model of search engine information seeking behaviour. [194] In both models we are given insight into the user's thinking at each step but while Sharit provides greater detail (problem initiation or orientation has nine points attached to it), Kuhlthau offers an affective as well as a cognitive layer.

Wilson has suggested that Kuhlthau's work "complements" that of Ellis and declares her perspective as "phenomenological rather than cognitive"[195], in spite of the above representation, which manifestly includes a cognition layer. For Wilson the greatest contrast between Ellis and Kuhthau is that the latter is sequential while the order of many of the stages of the former may vary: that one has stages, the other features.[196] In reality, as expressed above, the multilayered nature of Kuhlthau's model seems to render it considerably richer than that of Ellis. The differences seem to come from a greater degree of simplification of the stages by Kuhlthau (obviously the neatness is a function of the model rather than reality) and the fact that Ellis is modelling the work of university social scientists and Kuhlthau that of high school students. One other commonality between the models is that both Ellis and Kuhlthau's work was carried out in advance of the arrival of widespread internet use in the 1990s.

A further model with a strong interest in the behaviour of students is that of Brand-Gruwel et al:[197]

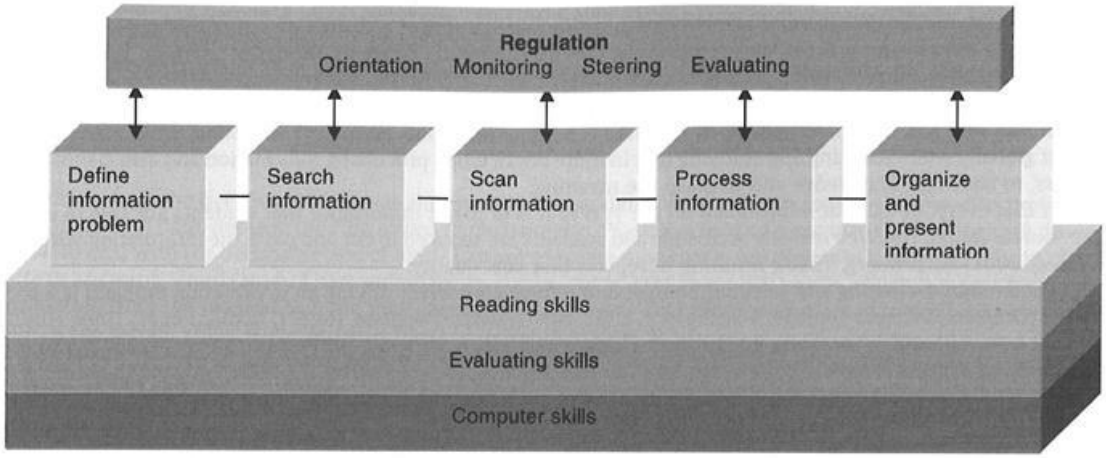


Figure 2.22. Brand-Gruwel et al, the "information problem solving using internet" model (2009)

This model is explicitly a problem solving model and was developed with the stated purpose of assisting in the development of resources to teach students information skills.[198] It consequently has a strong focus on the knowledge requirements necessary to complete a task and, unlike Kuhlthau, is as much about behaviours which *should* be exhibited as it is about behaviours which really are. In the model's

[194] Joseph Sharit et al., "Investigating the Roles of Knowledge and Cognitive Abilities in Older Adult Information Seeking on the Web," *ACM Trans. Comput.-Hum. Interact.* 15, no. 1 (May 2008), p.4
[195] T. D. Wilson, "Models in Information Behaviour Research," *Journal of Documentation* 55, no. 3 (August 1, 1999), p.255
[196] Ibid, p.266
[197] Saskia Brand-Gruwel, Iwan Wopereis, and Amber Walraven, "A Descriptive Model of Information Problem Solving While Using Internet," *Computers & Education* 53, no. 4 (December 2009), p.1209
[198] Ibid, p.1207

"five constituent skills" we can see echoes of Marchionini: "define information problem" is shared, scanning and processing seem reminiscent of examining results and extracting information. But like Kuhlthau's students, these students must organise/collect information and "present" it. The three skills underpinning the model are dubbed "conditional" with the implication that they are a necessary predicate for carrying out the constituent skills or process. The "regulation activities" surmounting the model are to be carried out throughout the process because "the students need to make a plan…they have to check whether the proposed plan is still the right one, or decide if changes…are needed"[199] and thus represent a form of 'best practice'. However after running three studies, involving 48 students in total, the authors concluded that not only were the five skills "performed by all students" but also that "all students do to some extent regulate the process".[200] The study was a relatively taxing one for the participants who had to research and write a magazine article while simultaneously adopting a think aloud protocol. The use of such a protocol, which demands participants engage their metacognition, in a study that is itself about metacognition may be considered problematic. Nevertheless, for the systems developer this model seems to suggest some useful points for intervention. If, for example, regulation is so important, an information system should perhaps explicitly support it. In fact, the whole model somewhat resembles an abstract machine model, familiar from the systems engineering domain. It is an interesting thought experiment to consider what such a system might be like.

Other examples of cognitive path models include Krikelas[201] and Sutcliffe and Ennis,[202] the latter emphasising different kinds of user knowledge (domain and device) in a manner that we will see later.

2.4.5 Macro models

We have seen already examples of models incorporating other models: Ellis (fig. 15) in particular is reused by both Wilson and Choo. Natalya Godbold has attempted to combine Wilson (fig. 7), Ellis and Kuhlthau (fig. 18) amid discussion of a knowledge 'gap'.[203] For Godbold, the activating mechanism of a chance discovery, monitoring or active information seeking leads to a wheel of information behaviours in which users can respond very actively by searching or spreading information or with some indifference, by avoiding or merely "taking note" of new information.[204] T.D. Wilson offers a nested three layer model, with information search behaviour the innermost layer, information-seeking behaviour in the middle and information behaviour the outer layer.[205] Unfortunately Wilson does not give examples of which models fall into which layer and some models very obviously set out to operate across these boundaries while some are content to explore a single 'layer'.

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[199] Ibid, p.1209

[200] Ibid, p.1215

[201] James Krikelas, "Information-Seeking Behavior: Patterns and Concepts.," *Drexel Library Quarterly* 19, no. 2 (January 1983): 5–20.

[202] Sutcliffe, Alistair, and Mark Ennis. "Towards a cognitive theory of information retrieval." *Interacting with computers* 10, no. 3 (1998): 321-351.

[203] Natalya Godbold, "Beyond Information Seeking: a General Model of Information Behaviour.," *Information Research* 11, no. 4 (2006), http://informationr.net/ir/11-4/paper269

[204] Ibid.

[205] T. D. Wilson, "Models in Information Behaviour Research," *Journal of Documentation* 55, no. 3 (August 1, 1999), p.263

However Knight and Spink's 2008 macro model represents a more thorough attempt to combine a wide range of existing models:[206]

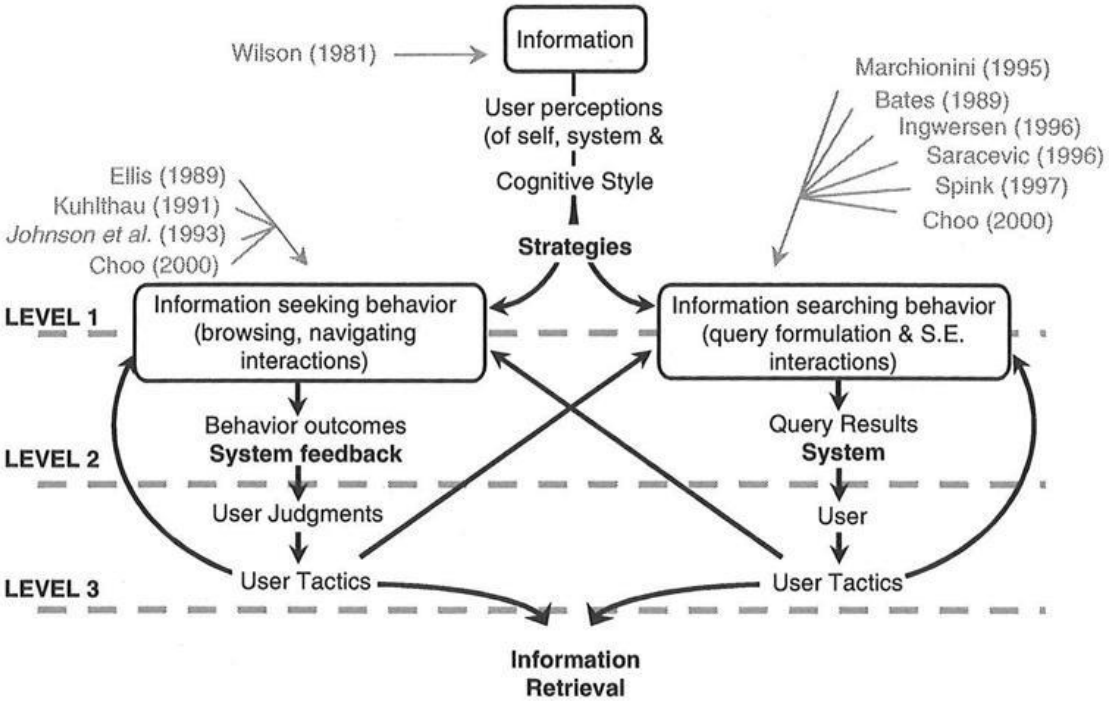

Figure 2.23. Knight and Spink's "Macro model of human IR behaviour on the web" (2008)

For Knight and Spink, there are three types of model: models of information behaviour, exemplified by Wilson (fig. 7) at the top, information seeking models which are concerned with browsing and navigating and information searching models which are concerned with queries and search engines. What is confusing is that this seems like a bridging of the divide between system centred models and user centred ones but user and system are represented on both sides of the model. This occurs because of the authors' belief in the importance of the user's "cognitive style" which apparently will lead them to make a choice to either browse or search.[207] In this seems just as likely to be determined by the user's specific information need, not present in this model – except in so far as it exists within Wilson's 1981 model (fig. 7).[208] Nevertheless, the user is free to "periodically swap" between different types of strategy.[209] Unfortunately rather than providing clarity this model is more of a Frankenstein's monster, a chimera which represents neither a user's journey through an information universe (of different web sites, queries, systems and offline resources) nor a model of what is going through their mind.

In contrast Bhuvaneshwari Lakshminarayanan's unified process model is an invaluable collation of "every information behaviour and every element and variable

[206] Knight and Spink, op. cit., p.230
[207] Knight and Spink, op. cit., p.229
[208] And does this really make any sense attached to the top in its entirety?
[209] Knight and Spink, op. cit., p229

mentioned in the literature", including those "unobservable" in his own user research.[210]

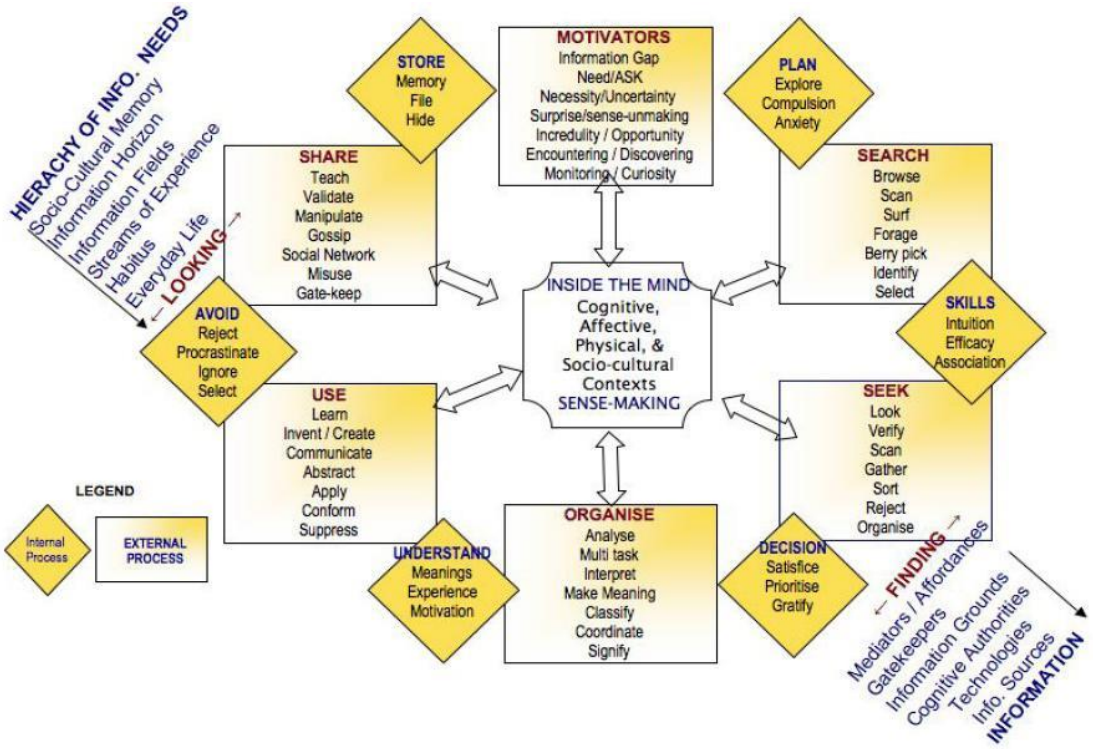

Figure 2.24. Lakshminarayanan's "conceptual unified process model of human interaction behaviours" (2010)

The sheer scale of this model reminds us how much complexity is jettisoned in a simplified representation like that of Ellis. The result is a spotter's guide to information behaviour - more an encyclopaedia than a roadmap. However, Lakshminarayanan also provides a directed model of information behaviours where users move from perception (where an information need is either acknowledged or rejected) to looking, finding and checking before finishing with using, saving and sifting.[211] By moving beyond "understanding" and use, to the 'afterlife' of an information search, Lakshminarayanan extends most of the models already discussed and provides a strong narrative for how information is located and consumed.

2.4.6 Do we need better models?

Taking the models we have considered as a whole, one inescapable conclusion is that we don't need any more models![212] While the idea of producing just one more 'complete' or general model is very seductive we already have whole families of models and the rather unwieldy work of Knight and Spink suggests that we might

[210] Bhuvaneshwari Lakshminarayanan, "Towards Developing an Integrated Model of Information Behaviour" (Thesis, Queensland University of Technology, 2010), http://eprints.qut.edu.au/33252/, p.307

[211] Lakshminarayanan, op. cit., p.310

[212] This survey of models is by no means comprehensive.

well be better off working with what we have. Perhaps some need refinement but we are demonstrably in possession of models which a very great deal of ground and which are, in at least some cases, backed by either substantial body of formative analysis or by subsequent validation by other researchers. We would hope that the same ground is not being constantly chewed over and by and large this hope seems justified. We need to select the most appropriate model for the particular area we are discussing: systems strong models where we are primarily discussing systems and user strong models where we are discussing users. That one type of model may only contain vestigial parts of the other types is not a problem.

Of course in reality both user and system are represented in many models. As we have seen, Ingwersen and Saracevic, for example, are not wholly concerned with queries and systems (though these are represented in their model) they are also concerned with users and their cognition. Thus the binary division (posited by Dinet et al) that there are essentially two types of model is not really sustainable. In reality, the user is represented in even the most basic of "system" models: in Bates, for example, the user's information need is represented. In what follows we will make use of several of the models we have introduced but it is to the Marchionini model (fig. 2.9) that I will most frequently refer because of its useful ability to reflect the phases of search as a set of tasks performed by user, because it has some empirical validation from, for example, Joseph et al. and for archival reasons we will discuss in the next chapter.[213]

Another key observation is that there would appear to be many points across the models where a systems developer could intervene and these are not necessarily where systems are traditionally located: the placement of the IR system in, for example, the model of Ingwersen and Järvelin, is arguably utterly arbitrary. Technology could intervene at the task or work level to help (say) manage the progress of an enquiry, rather than simply providing a text box into which phrases can be typed. It is one thing to model user behaviour but these models don't tell us is what interventions are most appropriate to modify or augment the abilities of users carrying out the patterns of behaviour being modelled. How can we best affect these 'information externalities'?[214] In subsequent chapters we will attempt to validate certain properties of these models through analysis of various kinds of user data. However information seeking and its models are not the only paradigm through which the way in which users find things in digital collections has been explored or understood. We will now consider two further approaches: sensemaking and information foraging.

2.5 Sensemaking

Sensemaking is a complex area with many overlapping definitions which can be hard to untangle. Sensemaking sounds like it means "making sense of stuff" or, more formally, in the words of Furnas and Russell "what people do to make sense of the information in their world".[215] Standard models of information seeking and information retrieval do not devote much of their attention to this process. In Wilson's

[213] Joseph, Pauline, Shelda Debowski, and Peter Goldschmidt. "Models of information search: A comparative analysis." *Information Research* 18, no. 3 (2013): 18-1.

[214] Watts, op. cit., p.212

[215] Furnas, George W., and Daniel M. Russell. "Making Sense of Sensemaking." In *CHI '05 Extended Abstracts on Human Factors in Computing Systems*, New York, ACM 2005, p. 2115

model of information behaviour (fig. 12), for example, this 'making sense' appears to be tackled in one "information processing and use" step.[216] In Marchionini's model (fig. 10), what we actually do with information after we've found seems largely confined to the penultimate "extract information" stage with perhaps a little space reserved in "reflect/iterate/stop".[217] On the other hand a number of what I termed cognitive path models (such as berrypicking, with its sense of an accumulation of information gradually leading to an emergence of meaning) seem to capture this process in a little more detail. But what exactly is being accumulated/emerging? Pinning down a single precise meaning of sensemaking in the literature is difficult. Blandford and Attfield, for example, define sensemaking slightly differently as “why people are seeking information and what is being done with that information”.[218] So for them, motivation and use are both key parts of the process, which may not be obvious from a 'common sense' definition.

In order to tease out the different dimensions to sensemaking it is necessary to compare and contrast some of the varying approaches that have been proposed and some of the efforts that have already been carried out to synthesise them.

2.5.1 Brenda Dervin

Beginning in the 1970s, Brenda Dervin developed an approach ("a set of theoretic premises and methodologies"[219]) she carefully referred to as “Sense making” - to distinguish it from the phenomenon she was trying to study.[220] Dervin was interested in the blocks or gaps which inhibited movement through the process of information seeking and information use and how these could be 'bridged'. Dervin often represented Sense making as a triangular process but Wilson produced a linear diagram based on her accounts[221]:

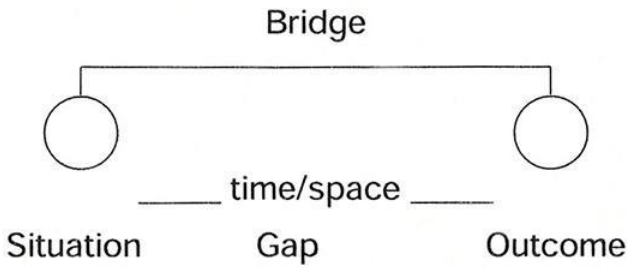

Figure 2.25. Dervin, "Sense-making framework", as represented by Wilson (1999)

What today is likely to strike the HCI researcher about Dervin's model is its clear

[216] Wilson, T. D. “Information Behaviour: An Interdisciplinary Perspective.” *Information Processing & Management 33*, no. 4 (July 1997), p.561

[217] Marchionini, Gary*. Information seeking in electronic environments* (Cambridge University Press, 1997). p.50

[218] Blandford, Ann, and Simon Attfield. “Interacting with Information.” *Synthesis Lectures on Human-Centered Informatics 3*, no. 1 (January 1, 2010), p.7

[219] Dervin, Brenda, and Patricia Dewdney. “Neutral Questioning: A New Approach to the Reference Interview.” *RQ 25*, no. 4 (1986), p.2

[220] Dervin, Brenda. “Sense-making Theory and Practice: An Overview of User Interests in Knowledge Seeking and Use.” Journal of Knowledge Management 2, no. 2 (December 1, 1998), p.36

[221] Wilson, T.D. “Models in Information Behaviour Research.” *Journal of Documentation 55*, no. 3 (August 1, 1999), p.254

resemblance to Norman's gulf of evaluation.[222]

Context (or what Dervin called 'situation') played a fundamental part in this process: Dervin strongly believed that information should not be conceptualised "as an autonomous object that can be stored, accessed and transferred" - it had no independent existence but was entirely "a construct of the user".[223] This directly informed her view of how of how information seeking ("better described as sense-making"[224]) problems should be solved in practice. If ten users were left facing the same apparent information gap:

"those who see it as a decision involve themselves in knowledge creation and use in markedly different ways from those who see it as a spin-out [no clear direction is present]*, or wash-out* [a previously clear path has apparently vanished]*".*[225]

Consequently, her phrases to conceptualise steps on information journeys often revolve around how we feel about them ("avoided a bad place", "arrived where I wanted to") because these feelings are likely to affect our subsequent behaviour.[226] This might appear a little abstract yet Dervin was adamant that "the creating of helpful interfaces is a major mandate of Sense making".[227] Her work with users in both on- and offline situations suggested some clear practical avenues which could be explored. For example, experiments with adding author metadata to journal articles which focused on (among other things) what the authors felt were the strengths and weaknesses of their own work "produced a marked improvement in user ability to decide what would be useful".[228] Admittedly, this study is not fully reported in the paper.

2.5.2 Russell, Pirolli and Card

When Daniel Russell and his Xerox colleagues wrote their paper on "the cost structure of sensemaking" in the early 1990s, they made no reference to Dervin's work. They presented their own take on the term, defining it as "the process of searching for a representation and encoding data in that representation to answer task-specific questions"[229] or even more narrowly as "finding a representation that organises information to reduce the cost of an operation in an information task". [230] In other words, not 'how do we make sense of things' but 'what is the most efficient way to represent a body of information'. The problem they were interested in solving, for Xerox, related to training people in the differences and similarities between different kinds of laser printer. Xerox had large quantities of documentation and Russell and his colleagues were interested in automatically generating key concepts

[222] Norman, Donald A., and Stephen W. Draper. "*User centered system design; new perspectives on human-computer interaction*". L. Erlbaum Associates Inc., 1986, p.40

[223] Dervin and Dewdney, op. cit., p.3

[224] Ibid.

[225] Dervin, op. cit.,p.40

[226] Ibid.

[227] Dervin, p.41

[228] Dervin, p.44

[229] Russell, Daniel M., Mark J. Stefik, Peter Pirolli, and Stuart K. Card. "The Cost Structure of Sensemaking." In *Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems*, ACM, 1993, p.269

[230] Ibid.

(e.g. 'toner', 'leaking') from this collection of text, looking for clusters and building schemas from ‘encodons’, the entities within a representation. They saw this as a "cyclic process" of gradual improvement, whereby the schemas and clusters of schemas would get better and better in a "learning loop", until "good representations" cover all the information and no "residue" (items that do not fit available representations) remains to be encoded.[231]

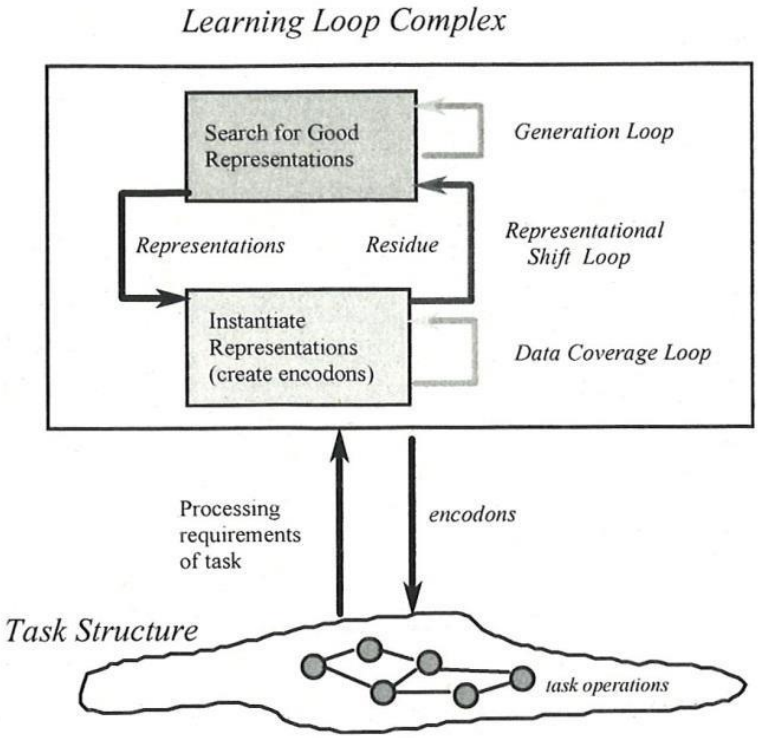

Figure 2.26. Russell et al, "Learning Loop" (1993)

Russell and his colleagues claimed that such learning loops were "widespread" and they reported that they had seen the same behaviour in a group designing a new algebra curriculum, in a business analyst writing a newsletter and in a Xerox group writing a report on OCR.[232] They do not give extensive information about these three groups and the last may be the researchers themselves. There is also the matter that the paper's own illustration of these four workflows shows very considerable differences in the order and form of the steps depicted – and none refer to data extraction which the authors state is the "main cost" in the whole process[233]:

[231] Ibid, p.3
[232] Ibid, p.4.
[233] Ibid, p.5

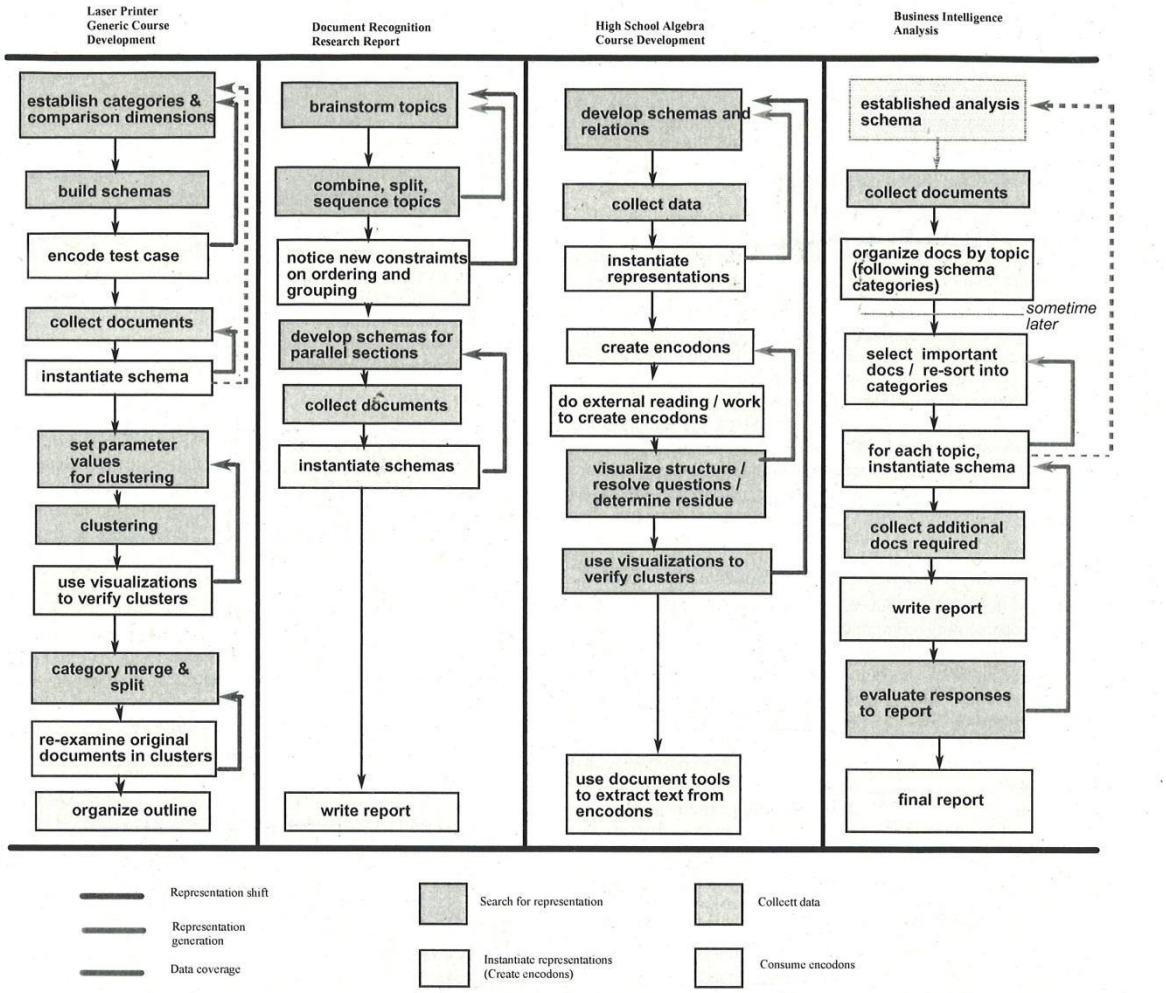

Figure 2.27. Russell et al, "Sensemaking in four different information rich tasks" (1993)

As if realising the rather complicated and perhaps contradictory nature of this evidence, in their 2005 paper Pirolli and Card reduced the process to four steps, which they called *information*, *schema*, *insight* and *product*.[234] To try to unpack these steps a little, it appears that in Pirolli and Card's view an analyst gathers *information*, represents that information in a *schema* because that “aids analysis”, develops their *insight* “through the manipulation of [the schema] representation" and the result is some "knowledge product" - a report, a presentation, based on that insight.[235] If we think of a schema as a mental model or working explanation which is then refined to produce some novel understanding we start getting closer to how sensemakers (or people as we usually call them) actually work. To use a concrete archival example, a historian might find some, on the face of it, rather dry documents such as parish accounts (*information*) but might attempt to conceptualise them (in a schema?) to understand the changes that are going on in that parish over a period of time. If the period of time is the 16th century in England they might be able to redeploy these

[234] Pirolli, Peter and Stuart Card. "The sensemaking process and leverage points for analyst technology as identified through cognitive task analysis", *Proceedings of International Conference on Intelligence Analysis*, vol. 5, 2005, p.2
[235] Ibid.

insights to generalise about the English Reformation. This is in fact a very approximate and high level description of how the historian Eamon Duffy produced his highly regarded work 'The Voices of Morebath'.[236] But this is clearly a very, very impoverished model of most historians work most of the time. It is also not altogether clear how this 2005 work relates to Russell, Pirolli and Card's earlier definitions of sensemaking.

Pirolli and Card attempt to provide strong empirical justification for this 2005 understanding of sensemaking by presenting the results of "interviews and protocols" (not described further in the paper[237]) with intelligence analysts from which they derive the following "sensemaking loop":

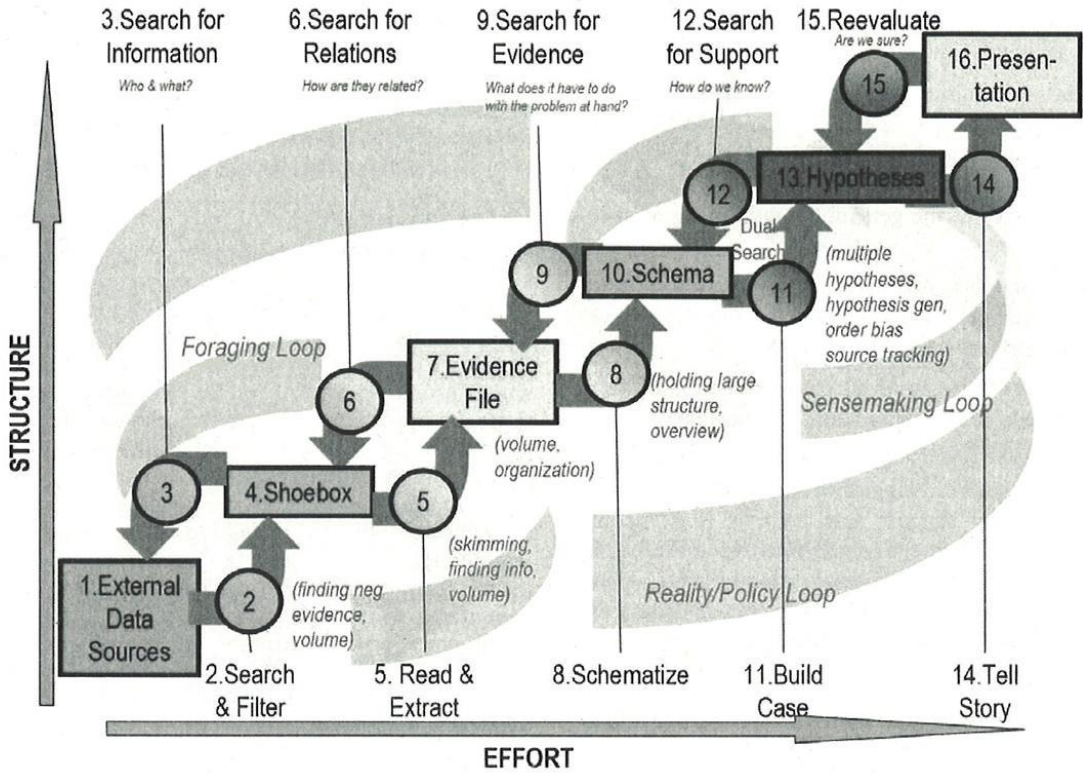

Figure 2.28. Pirolli & Card, "notional model of sensemaking loop for intelligence analysis" (2005)

There are still loops (lots of them) but we are no longer in a world of encodons and residue. Sources are searched and filtered (twice, apparently) with relevant documents being added to a store ("shoebox") for "further processing".[238] "Relevant snippets" from these collections of documents make it to evidence files which are then "represented in some schematic way"[239] – such that schemas still sit at the centre of this model. These schemas may be formalised or simply exist "in the mind of the analyst" but they are marshalled to build a case and "support or disconfirm

[236] Duffy, Eamon. *The Voices of Morebath: Reformation and Rebellion in an English Village*. New Haven: Yale University Press, 2003.
[237] Pirolli and Card, op. cit., p.2
[238] Ibid, p.3
[239] Ibid.

hypotheses" which is finally presented in some fashion.[240]

Unfortunately, this model has some odd features which may limit its generalisability. The idea that a hypothesis is the last thing to be developed is a very strange one – this is either a poor word to choose for this phase, a misunderstanding of how intelligence analysts work or an indication that they employ a very flawed methodology. Fundamentally, the idea that evidence can be collected and sifted from no specific viewpoint (awaiting one to be supplied later) is incorrect and if Pirolli and Card were misled by their interviewees into thinking that these judgements were not being applied then they should have questioned their own analysis more rigorously. The filtering, extracting and searching steps are all taking place with a "schema" already in place – one comprised of the analysts' domain knowledge and initial assumptions they already have in mind. Pirolli and Card do discuss confirmation bias in the context of the sensemaking loop[241] but not in the context of the foraging loop. (Russell, incidentally has denied that foraging is part of sensemaking).[242] Instead the upward spiralling of their analysis model recalls the relentless improvement of their learning loop towards an optimally efficient state – "the best gain for time spent".[243] This seems unjustifiably Panglossian: are the neatest and most efficient set of categories the best? What and who are they the best for? In the context of Russell et al's task of designing the best laser printer training, it might be that the schema required by a set of students to promote swift and thorough learning is very different from the 'best' schema. Certainly the team presented no evidence that the structure of their new course was better received by Xerox trainees. This context-free sensemaking is very different to that advocated by Dervin who writes slightingly of "retreating to the safety of certainty" and reproduces Fahey and Prusak's assertion that "disentangling knowledge from its uses" is a "deadly sin of knowledge management".[244] For Dervin, if sensemaking is applied properly in the context of system building, the resulting design "never focusses on arriving at right answers or best knowledge".[245] Russell sometimes gives the impression that he believes organising thoughts is not sensemaking but that organising data is.[246] This is incorrect.

In any case, an overly deterministic approach may be unprofitable in this area because information systems are socio-technical systems par excellence in that their contents are as frequently misleading as their operation. It is one thing to mistrust your sensor data but if it was literally incapable of returning up-to-date, accurate and relatively easily understood data you would probably think it was time to procure a new system. Yet information systems work in precisely this way: they are collections of past data, often compiled for a different reason to their current use, or as Dervin cautions: "knowledge made today is rarely perfectly suited to application tomorrow."[247] This maxim is very clearly demonstrated in the archival sphere where virtually no document is being put to the use its creator intended – almost by

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[240] Ibid.

[241] Pirolli and Card, op. cit, p.5

[242] Russell, Daniel M., Robin Jeffries, and Lilly Irani. "Sensemaking for the rest of us." In *Sensemaking Workshop at CHI*. 2008, p.2

[243] Ibid, p.7

[244] Dervin, p.38

[245] Dervin, p.44

[246] Russell et al, "Sensemaking for the rest of us", p.3

[247] Dervin, p.41

definition.

2.5.3 Klein, Moon and Hoffman

Scepticism towards certain kinds of intelligent systems capable of creating meaning from data is a hallmark of a third key group of researchers into sensemaking: Gary Klein and Brian Moon of Applied Research Associates and their collaborator Robert Hoffman. In two 2006 papers, Klein, Moon and Hoffman first considered the ways in which sensemaking was distinct from other phenomena well explored in the literature (creativity, curiosity, comprehension, mental modelling and situation awareness). They declared that mental modelling came "closest to what people seem to mean today by sensemaking" but offered their own definition, calling sensemaking "a motivated, continuous effort to understand connections (which can be among people, places and events) in order to anticipate their trajectories and act effectively."[248] This definition may again appear a little restrictive, particularly in the context of their model of sensemaking, which they called the data/frame theory.[249]

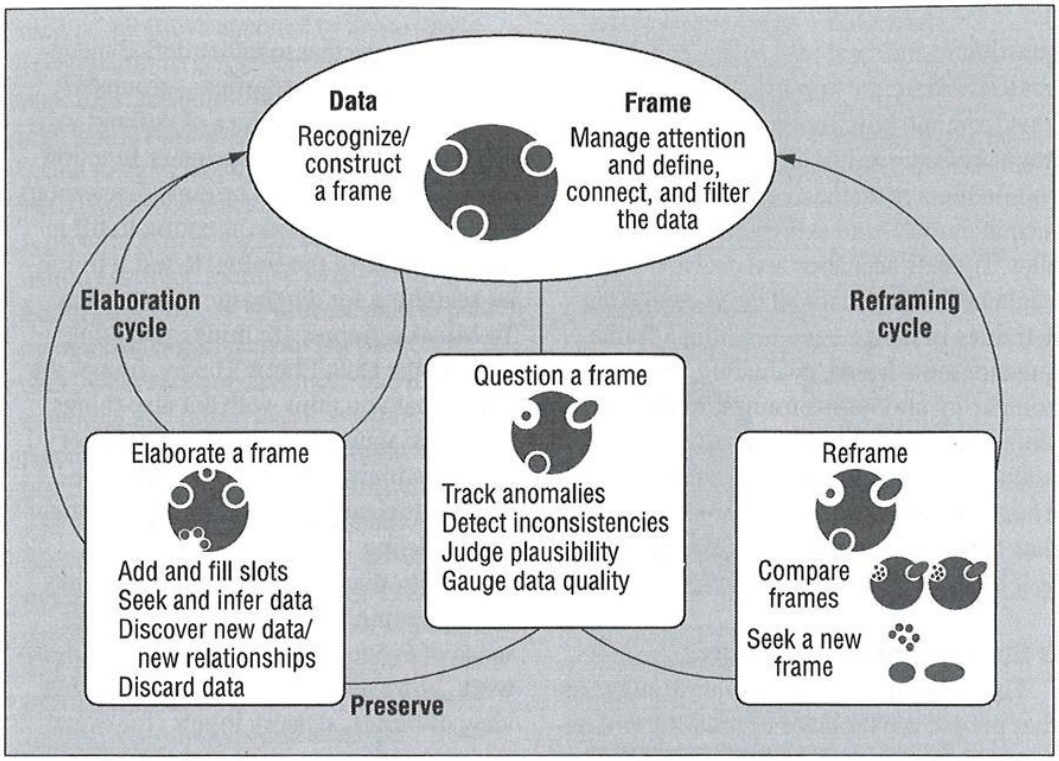

Figure 2.29. Klein, Moon and Hoffman, "The Data/Frame Theory of sensemaking" (2006)

In this wide ranging model, a frame is a metaphor for "some perspective, viewpoint or framework".[250] This means that frames "shape the data…a house fire will be perceived differently by the homeowner [and] the firefighter".[251] When we encounter

[248] Klein, G., B. Moon, and R.R. Hoffman. "Making Sense of Sensemaking 1: Alternative Perspectives." *IEEE Intelligent Systems 21*, no. 4 (July 2006), p.71
[249] Klein, G., B. Moon, and R.R. Hoffman. "Making Sense of Sensemaking 2: A Macrocognitive Model." *IEEE Intelligent Systems 21*, no. 5 (September 2006), p.89
[250] Ibid, p.88
[251] Ibid.

new information we choose how to assimilate it by altering the frame or by abandoning it altogether – or perhaps it is the aberrant data we choose to mentally discard. For Klein and his colleagues, sensemaking differed from mental modelling because it was about "achieving…outcomes" and "the strategies and barriers encountered".[252] The model was presumably based on research carried out by Klein and colleagues on behalf of the United States army.[253] This research involved observation and analysis of serving army officers in the course of artificial scenarios and interview work. Klein et al took care to highlight testable aspects of their theory.[254] It is not clear that these specific aspects have been followed up by researchers.

Pirolli and Card's first reaction was to claim that Klein et al had come to "similar conclusions" to their own and that "a data/frame…plays a similar role to schema".[255] But this is clearly a far more sophisticated analysis than the blunt instrument of the learning loop. One key difference between the two models is that Russell et al's original loop considered a finite body of material. A system (or person in their real world examples) would keep grouping until all data had been clustered and no more "residue" was present. When the optimum arrangement of information was reached, the task would be completed. Klein's model and definition of sensemaking is continous. We're always interpreting and reinterpreting so that this definition of sensemaking I would call "interpretation building" and it seems a compelling model of how we do actually handle new information when we first encounter it. It appears a little less helpful as a guide to how we process wider collections of information in order to come to more complex conclusions, which we will consider shortly.

Five years after their intelligence analysis paper, Pirolli and Russell changed their opinion of Klein's research. In their introduction to a special issue of the journal Human-Computer Interaction on sensemaking, they laid out their view of the current state of sensemaking research, which they divided into three main strands: their own "representation construction model" of sensemaking, research into collaborative sensemaking within teams of people (by Karl Weick and others) and the data/frame perspective of sensemaking.[256] They appeared to have decided that the approaches were no longer similar. Their perception of the differences between the two appear to partly reflect an evolution in their ideas about their own work. They refer to their intelligence analysis model as representing "the transformation of information from its raw state into a form where expertise can apply" and emphasise creating new knowledge or rather "changing the knowledge available to humans".[257] Klein and his collaborators are cautious of this process going too far. They use the example of a weather forecaster – an expert needs more than an attractive visualisation of the weather produced for a TV audience to make accurate predictions, they "must be

[252] Klein et al, "Making sense of sensemaking 1", p.71

[253] Sieck, Winston R., Gary Klein, Deborah A. Peluso, Jennifer L. Smith, and Danyele Harris-Thompson. "FOCUS: A model of sensemaking." *Fairborn, OH: Klein Associates* (2007).

[254] Klein, Gary, Jennifer K. Phillips, Erica L. Rall, and Deborah A. Peluso. "A data-frame theory of sensemaking." In *Expertise out of context: Proceedings of the sixth international conference on naturalistic decision making*, pp. 113-155. New York, NY, USA: Lawrence Erlbaum, 2007.

[255] Pirolli and Card, op. cit, p.4

[256] Pirolli, Peter, and Daniel M. Russell. "Introduction to This Special Issue on Sensemaking." *Human–Computer Interaction 26*, no. 1–2 (2011), p.3

[257] Ibid, p.4

able to explore data".[258] Remove an artefact from its archaeological context and much of its evidential value is destroyed. It is unsurprising that Russell, Pirolli and Card are not overly concerned about this because their data becomes more refined as it travels through their model but Klein et al see early adoption of a hypothesis as "advantageous and inevitable"[259] and place more emphasis on the benefits and pitfalls of questioning frames noting that "spoon-feeding interpretations to the human…can be counterproductive."[260] Checking mechanisms are built into Pirolli and Card's sensemaking loop (figure 2.29) but these appear very late in the process.

Latterly, Pirolli and Russell have lumped together Dervin and Klein et al, as if their perspectives were the same.[261] This is to do Dervin a disservice. It is true that Klein's 2007 description of sensemaking as "typically triggered by unexpected changes or other surprises that make us doubt our prior understanding"[262] seem to recall Dervin's spin-outs, wash-outs and general sense of suddenly encountering obstacles to movement. But Dervin seems more concerned with the context of knowledge than Klein and his collaborators. Where do we see in the data/frame model the triggers for questioning and reframing? There is no situated user as there is at the heart of Dervin's work. How we feel about the information we receive is also absent from Klein's model, as it is in the more system-focused work of Russell and his former Xerox colleagues.

2.5.4 Limitations of sensemaking

Blandford and Attfield have very usefully characterised the "signature phenomenon" of sensemaking as "an interplay that occurs between top down and bottom up processing…a bi-directional process under the influence of data on the one hand and the generation of representations that account for data on the other".[263] Unfortunately this definition very neatly encapsulates the biggest challenge of sensemaking research, namely understanding the precise nature of these processes in real world situations and problems.

This can be illustrated with a very trivial example. In the 1990s, the broadcaster Loyd Grossman became famous for his Masterchef catchphrase that he and his fellow cookery judges had "deliberated, cogitated and masticated" – or some variation.[264] In this way Grossman used to helpfully break down the judge's information journey on Masterchef into three stages. But if we consider this process from a sensemaking perspective, how does a Masterchef judge proceed? Does Loyd sample the first set of dishes and test the others against the resulting frame? Does he think of his favourite type of food (a different frame) and see which dish comes closest to it? Is he testing a salmon mousse against some sort of platonic ideal of a

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[258] Klein et al, 'Making sense of sensemaking 1', p.71

[259] Klein et al, 'Making sense of sensemaking 2', p.89

[260] Ibid.

[261] Pirolli and Russell, op. cit., p.4

[262] Klein, Gary, Jennifer K. Phillips, Erica L. Rall, and Deborah A. Peluso. "A data-frame theory of sensemaking." Expertise out of context: Proceedings of the sixth international conference on naturalistic decision making. Mahwah, NJ: Lawrence Erlbaum Associates, 2007, p.117

[263] Blandford and Attfield, op. cit., p.7

[264] Hogan, Michael. "Gregg Wallace and John Torode on the Return of MasterChef,". *Daily Telegraph*. February 12, 2010. Accessed 29th March 2014, http://www.telegraph.co.uk/culture/tvandradio/7220921/Gregg-Wallace-and-John-Torode-on-the-return-of-MasterChef.html

salmon mousse (yet another frame)? We have no idea – and indeed the question brings to mind fiercely fought transatlantic debates in psychology around top down and bottom up processing from which it seems best to steer clear. All this means it is not obvious it is possible to use the data/frame model to predict or to map the solution to an information problem without considerably more knowledge about the user's thinking than we normally possess. It can lay out for us the sort of process that judges are carrying out but the order and nature of the steps along it are even less clear than in Grossman's catchphrase. Russell has rather trivialised the study of "everyday sensemaking tasks" calling them "fairly simple…one collects a bunch of data…and then…lightly re-organise[s] it" and uses very commercial examples like buying a holiday or a car.[265] If instead we consider the example of voting in an election – a very common, if not everyday, sensemaking task - we can see immediately how complex such decision making really is, involving all kinds of long and short term factors. Directly equating sensemaking with organisation is to oversimplify.

Klein has called sensemaking "the deliberate attempt to understand events".[266] But many of these processes are unconscious or scarcely conscious making them difficult to capture. Only some form of contextual enquiry or careful examination of the products of external cognition activities can give us meaningful insight into the thought processes by which judgements are made within specific domains. This would appear to severely limit the usefulness of the data/frame in action research and systems development. Klein has proposed a form of taxonomy which lays out the practical situations in which sensemaking is used[267] (problem detection, connecting the dots, forming explanations, anticipatory thinking, project future states, find the levers, see relationships, problem identification) but we are all interpreting information all the time – at a high level, not mere sensory input – making this list seem particularly redundant.

Some claims for the practical utility of sensemaking have been made. In their discussion of Klein et al's model Blandford and Attfield say that a frame "sets up expectations of further data that might be available".[268] This is not entirely true. Having a particular interpretation of some information does not – unfortunately - automatically mean that a user will understand where to go to get more information. If a user spends time looking at a dataset, they may well come to be familiar with the terms within it and indeed learn of many new terms and entities that they could use to improve their search somewhere else. But they don't perforce gain any insight into where 'somewhere else' might be. However, it is absolutely true that a frame "can direct" information seeking.[269] Many lost and confused users may be labouring under misapprehensions about the systems and data they are using and these misapprehensions are driving their behaviour. The data/frame model is a useful reminder to designers that the assumptions of users may need to be challenged hard and early by a system if there is good evidence that they are misleading. It also

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[265] Daniel M. Russell, Robin Jeffries, and Lilly Irani, "Sensemaking for the Rest of Us," 2008, https://www.researchgate.net/profile/Lilly_Irani/publication/228641117_Sensemaking_for_the_rest_of_us/links/00b4951e864beeec8f000000.pdf.

[266] Gary Klein et al., "A Data-Frame Theory of Sensemaking," in *Expertise out of Context: Proceedings of the 6th International Conference on Naturalistic Decision Making* (New York: Lawrence Erlbaum, 2007), p.117

[267] Ibid.

[268] Blandford and Attfield, op. cit., p.7

[269] Ibid.

offers us hope that, if this is done properly, these assumptions can be changed. But none of these sensemaking models will tell us how best to make our challenge and understanding how the misapprehensions of users are formed and destroyed will only take us so far on the path to resolving them. Instead of becoming too preoccupied with the precise nature of sensemaking, it may be more productive to consider other approaches, for example, to explore the behaviour of experts and novices in information seeking and in their contrasting strategies identify techniques which would help the latter become more like the former.[270]

In the end it may be Dervin's reflections that are of most value to us: to simply be mindful, when we design information systems, that individual users perceive them and their content differently both to system designers and to each other and that users must be supported to find answers appropriate for them, which may appear neither "right" nor "best" to the first glance of an outside observer. In this area archivists, like librarians, must tread carefully. Information products are not self-explanatory. That is one of their features and users may need help to understand them and assimilate them into whatever narrative of the past they are constructing. But information professionals can only go so far in telling a user what a document 'means'. This is what we might call the ethics of sensemaking. It would be profoundly wrong for an archive to insist on a particular reading of any given document. While archives provide context for the documents in their collections and can assist users with the complexities of palaeography, dating and many other properties of a document, users must come to their own conclusions about what they are reading.

2.6 Information foraging and scent

A further framework for understanding information journeys is that proposed by Daniel Russell's colleagues Peter Pirolli and Stuart Card. In 1995, the pair suggested that the use of information access technologies by humans could be likened to the "browsing for sustenance" of other organisms.[271] They claimed that "classic information retrieval" (so presumably something along the lines of section 2.4.1 above) was reminiscent of the way that a wolf hunts. Whereas filtering (which we discussed in 2.3.1) was "like a spider building a web and waiting for prey to come to it." This foraging was a metaphor but its use allowed them to propose that information seeking could be modelled using the biological approach of optimal foraging theory. This model they argued would permit assumptions to be made about users' decisions (what to search for, where to search, how much time to spend), currency (the value of a piece of information to a user. Users may seek to maximise, minimise or "stabilise" returns and constraints (of the task, the available technology, the user's abilities). These seem perfectly reasonable things to ask of a model.

Unfortunately, this metaphor doesn't really work. As we have seen, our approach to information is contextual and changes throughout the information seeking process. We are interested in a piece of information one day and not the next and vice versa. In contrast food (although given time it can go bad) does not

[270] Tabatabai, Diana, and Bruce M. Shore. "How experts and novices search the Web." Library & information science research 27, no. 2 (2005): 222-248.

[271] Pirolli, Peter, and Stuart Card. "Information foraging in information access environments." In Proceedings of the SIGCHI conference on Human factors in computing systems, pp. 51-58. ACM Press/Addison-Wesley Publishing Co., 1995.

suddenly cease to be food. Relevance is not so accommodating. Furthermore, finding information, as we have seen, can lead to urgent demands for new information. Finding food has generally the reverse effect. In fact, Pirolli and Card do not offer significant evidence that information seeking genuinely does share characteristics with food foraging. We may choose to regard their metaphor as merely the window dressing for their model. If we examine the assumptions that underpin the analyses they present we find fairly conventional similarity matching which they attempt to optimise using characteristics such as "profitability" which they define as the "expected net [information] gain divided by the amount of time it takes to handle the item".[272] Unfortunately there is no practical way to measure the 'information gain' a user would obtain from a given text. They also offer a "zero-one rule", where they state that items below a certain level of profitability are eliminated wholesale on the principle that "the rate of junk mail" has no bearing on whether we would like to receive it – junk is junk. This is not quite correct, even on its own terms. I do not want to ignore junk mail I am receiving at an extremely high rate: I want to make sure the flow stops because it is indicative of a problem. And in information seeking terms, these sorts of definite judgements may not hold. If I am searching for information about Bluetooth technology it is obvious that items about Viking ruler Harald Bluetooth should be excluded. But if they are included I may be sufficiently interested to take a look at them, particularly if my results set contains a large number of them. I would then find that the technology was named after the King who, according to some accounts, united and Christianised Denmark.[273] Is this profitable? Again, this would appear to be a very difficult question to answer. In moving on to dynamic foraging Pirolli and Card retreat to the certainties of Cranfield and TREC even though they accept that relevance judgements procured by experts are not objective.[274]

Nevertheless, this work spurred Pirolli and Card to develop the concept of information scent.[275] This is the principal that "proximal cues" presented to a user (such as a link or document preview) acts a kind of lure for information foraging by indicating to the user that relevant content exists elsewhere from their current location within a website or system.[276] Users then follow the 'scent' of information across web links as a result of these "proximal cues" which imply the content at the other end.[277] The idea that digital content can proliferate in this way, that this is desirable and is something that designers should consider and encourage is a useful and important principle. Pirolli proposed spreading activation as a mechanism for

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[272] Ibid.

[273] Adam Clark Estes, "Bluetooth is named after a medieval king who may have had a blue tooth", Gizmodo, http://gizmodo.com/bluetooth-is-named-after-a-medieval-king-who-may-have-h-1671450657

[274] Pirolli, Peter, and Stuart Card. "Information foraging in information access environments." In Proceedings of the SIGCHI conference on Human factors in computing systems. ACM Press/Addison-Wesley Publishing Co., 1995, p.52

[275] Pirolli, Peter. "Computational models of information scent-following in a very large browsable text collection." In Proceedings of the ACM SIGCHI Conference on Human factors in computing systems, pp. 3-10. ACM, 1997.

[276] Pirolli, Peter, Stuart K. Card, and Mija M. Van Der Wege. "The effect of information scent on searching information: visualizations of large tree structures." In Proceedings of the working conference on Advanced visual interfaces, pp. 161-172. ACM, 2000.

[277] Chi, Ed H., Peter Pirolli, Kim Chen, and James Pitkow. "Using information scent to model user information needs and actions and the Web." In *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM, 2001, p.491

understanding how “clusters” (data) relate to each other and to “cluster summaries” (metadata). Overlap and correlation between words (the word ‘soup’ might correlate highly with ‘stew’ and less highly with ‘hydrofoil’) allow the information space to be connected to further improve the quality of results presented.
Pirolli, Card and their collaborators have developed a large number of algorithms (partly as a result of two small studies of users) but these are strongly based on the idea of information value and cost.[278] This latter is less relevant in a non-commercial research environment and of arguably no value at all when research is a leisure pursuit, as in family history. Pirolli and Card further make it clear that information value and relevance “often changes dynamically over time”.[279] It is not clear how information scent encompasses this change. It is also a fact that in some digital collections, as we have discussed, metadata is a poor guide to relevance. Imagine a box containing 500 letters. This might be catalogued as “correspondence” and so it is. But these letters will be rich in names, places and other high information scent terms. But these terms are not present in the metadata so the information scent for the box is misleadingly low. Archival researchers have to contend with many of these false scents as we shall see in the next chapter.

2.7 Conclusion

In this chapter we have examined fundamental information behaviours, such as satisficing. We have understood browsing as a form of search and exploratory search as a chain of searches in which each link is performing a vital function. We have looked at a range of approaches to sensemaking, a key information process but one hard to predict in action. Finally, we considered information foraging and scent and why they appear to have limited explanatory power in the archival domain. We have also examined a large number of models of information behaviour and divided them into five groups: behavioural, contextual, cognitive path and macro models. We will repeatedly return to these models in the following chapters, using them to try to understand what we are seeing in a range of studies and to try and judge their applicability to the domain of archives. These models are at varying levels of abstraction and we must look carefully at data and artifacts capturing user behaviour to see if we can observe aspects of these models in them, as well as in the existing accounts and studies of information seeking (or research) in archives. In the next chapter we will not only turn to specific discussion of archives and archival behaviour, we will take our first look at the evidence of how researchers make use of archival systems in the form of analysis of queries submitted to Discovery, the National Archives’ catalogue system. Formulating queries, requests or searches is crucial to many of the models we have considered and a sample of these queries will form our first unit of analysis.

[278] One study of one user and a second study of five users.
[279] Pirolli and Card, 1995, p.52

Chapter 3: The Trouble with Archives

“The history that fell was numerous and weighty. It crashed down on Detective Phillips and buried him completely.

'Help!' Detective Philips called, but no one heard him. The history was piled too high. It covered the windows. It was dark underneath it and hard to move. What little air remained was thick and stifling.”

- Andrew Kaufman, 'The Tiny Wife' (2014).[1]

3.1 Introduction

Back in the introductory chapter, we discussed briefly some of the properties of archives and archival systems and their complexity. In the previous chapter I have generally avoided domain specifics or used examples related to libraries, the workings of which are familiar to most of us. Archives are not libraries. The role of this chapter is to introduce archives and the archival setting: the ways in which archives are not like libraries both in terms of the experience of visiting and interacting with them for users and also in terms of their comparative disinterest in user studies from library science. The widespread unfamiliarity of archives will be discussed and this naturally leads to the topic of uncertainty in the archival context as researchers venture into this confusing and complex domain. We will attempt to begin to understand what makes archival research difficult and how these difficulties affect researchers. Historically, archivists have not been interested in the answers to these questions, leading to a neglect of user studies in archives verging on the systematic. But today there is a small but growing body of research about which it is possible to generalise. Having discussed archives generally, the chapter will then introduce a specific archival information system in the form of Discovery, the National Archives’ federated catalogue for UK archival records, arguably one of the world’s most significant archival information systems. The results of a small study based on Discovery will then be presented. This study uses query logs to give us our first practical indications of how archival systems are used and supported. Such analyses are good are good at the 'what' and 'how' of search but for the 'why' we will turn to other methods in later chapters.

3.2 Lost in the stacks

In town centres, perhaps in handsome Victorian buildings paid for by robber baron industrialists, or idling at the kerbside in more rural areas, in schools, in colleges, in certain kinds of workplaces, there are few of us (lucky enough to live in the ‘first world’) who will not have encountered a library and many of us who can relate happy childhood experiences of afternoons spent freely browsing, exploring new authors and taking advantage of works’ proximities to each other to move freely through authors, genres or topics. This immediacy is not possible for the archival visitor as Frank Burke attempted to summarise in the 1970s:

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[1] Andrew Kaufman, *The Tiny Wife* (Toronto, Ontario: Cormorant Books, 2014), p.54

"The one essential difference between libraries and archives is the concept of open versus closed stacks…One can enter a public library anywhere in the country; take a few minutes to get oriented…go to the stacks…and begin to read and take notes. It is not necessary to say a word to a librarian."[2]

Unlike browsers in public libraries, archival researchers will never become familiar with the physical layout of the repository in which documents are kept or the arrangement of the material on the repository shelves. And this physical arrangement may in any case be haphazard: the absence of visitors removes the need to match physical arrangement to sense. Documents are produced with a magician's flourish for researchers from invisible and inaccessible repositories. In a digital world it may be felt that this distinction is no longer relevant. Users after all may freely search and browse records online. Digitised collections of cultural and historical material are increasingly prevalent and increasingly popular. 97% of special collections and archives surveyed by the Online Computer and Library Centre (OCLC) in 2013 had completed at least one digitisation project.[3] Even in relatively tough times for local authorities in the UK, 72% have a digital catalogue and 54% have digitised at least part of their collection.[4] Collaborations between commercial providers, academic institutions and repositories of records have resulted in a huge number of large and small scale websites with the stated ambition of widening access to specific archival collections. This trend shows no sign of abating and in spite of decades of digitisation there remains no shortage of unprocessed material: the stereotype of the dusty archive, boxes piled high like a scene from Raiders of the Lost Ark, is not entirely fanciful; 95% of records at the UK National Archives at Kew remain undigitised and for many UK archives this is an enviable rate.[5]

This lack of comprehensive digitisation is the first clue as to why the distinction between 'open' and 'closed' access still matters. When users search and browse an archival catalogue, what are seeing is quite different from a library OPAC and indeed from a conventional search engine. Users are not browsing or searching the full text of documents and they are not able to read the majority of documents online – but this is also the case with a library catalogue. It is the other missing elements in those accustomed to the library which are more striking. Books and journals in (digital) libraries are arranged under subject headings, they have recognised and recognisable titles, authors and their catalogue entries incorporate controlled vocabulary. There is the sense that every item is described and to roughly the same level of detail. Most archival documents have none of these metadata properties. All compass points familiar to the academic researcher (or indeed

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[2] Burke, Frank. "Similarities and differences". In Clark, Robert L. *Archive-library relations*. Bowker, 1976, p.57

[3] OCLC, 'Survey of Special Collections in Archives in the United Kingdom and Ireland', 2013, http://www.oclc.org/research/publications/library/2013/2013-01r.html, p.18

[4] The National Archives, 'Digital services and archive audiences: local authority archives', 2014, http://www.nationalarchives.gov.uk/documents/archives/Digital_Services_and_Archive_Audiences_2014.pdf

[5] The National Archives, 'Online collections', http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/?research-category=online

frequenter of Waterstones) are absent. Crucially there is also no way of really knowing whether a series of records is unusually well or poorly described so users cannot tell what sort of (highly variable) metadata they are really searching.

It is also the case that libraries contain relatively homogenous collections. Public libraries will contain many of the same authors, academic libraries will subscribe to many of the same journals. Archives may have record types in common (court records, business records, school records) but the documents themselves exist generally in one place and can be found nowhere else. [6] This means that becoming familiar with the holdings of one archive does not prepare a researcher particularly well for when they move on to the next repository. Much of the learning they have acquired (relating specifically to holdings at any rate) no longer applies. Even within a repository, it is difficult to transfer knowledge because of the "crazy quilt" mentioned in chapter 1: archival arrangement will vary collection by collection.[7] In a library these distinctions could be eliminated by physically and intellectually grouping like material together but archives use a provenance based system of arrangement and description.[8] This means that material from different originators is kept separated and that its original order is maintained.[9] But within these rules physical (into different boxes or 'pieces') and intellectual (into 'series') arrangement of the collections is possible. This helps archivists because they come to understand where documents on specific topics are likely to be intellectually located but researchers are largely unaware of all aspects of this system.[10] Archival information systems make the hierarchical structure of collections visible but it is not clear that this sufficient to make up for the other shortcomings of archival metadata – and keyword search in any case cuts across this arrangement.

To update Fred Burke for the 21st century, the one essential difference between libraries and archives is the stark contrast in professional practice. It seems likely that the resulting metadata produces distinct forms of interaction. The difference may no longer be about shelving but it is fundamentally the same: while archival researchers may be able to browse across metadata records this is only the most distant of kissing cousins of the physical browsing of a public library because what is being browsed is almost invariably the sketchiest of facsimiles of a document, one indeed which may describe none of the essential properties looked for by the researcher. As a well known television character certainly never said, it's browsing but not as we know it. The world of standardised and familiar book metadata is light years away. The effect of this is to make work in archives slow and haphazard. Apple's "unboxing room" for iPods may once have attracted the attention of many technology writers but the experience of opening "hundreds of different types of box" without knowing the precise contents is just another day for the

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[6] Malbin, Susan L. "The Reference Interview in Archival Literature." *College & Research Libraries* 58, no. 1 (January 1, 1997), p.76

[7] W. M. Duff and P. Stoyanova, "Transforming the Crazy Quilt: Archival Displays from a User's Point of View," *Archivaria*, vol. 1, no. 45, Jan. 1998, p.60

[8] Duff, Wendy, and Allyson Fox. "'You're a guide rather than an expert': Archival reference from an archivist's point of view." *Journal of the Society of Archivists 27*, no. 2 (2006), p.131

[9] King's College Archive Centre, 'Provenance and original order', http://www.kings.cam.ac.uk/archive-centre/introduction-archives/principles/provenance.html

[10] Kate Theimer, "Debate: The majority of users don't care about provenance. They just want access to information", ArchivesNext, http://archivesnext.com/?p=2771

experienced archival researcher.[11] Through these repeated 'unboxing experiences', these researchers may come to develop a knowledge of the collection distinct from the finding aids that are available but only this extended and time consuming ordering and examining of the material will permit this. Frequently a catalogue will not answer the only question which appears to be really relevant: what's in the box? The only alternative to relatively speculative ordering and physical exploration is to lean heavily on the expertise of the archivist, whose job it is (amongst other things) to amass collections knowledge.

3.3 Archives and usability

Crudely, archivists have two principal roles: to preserve records from the past for the benefit of the future and to provide access to them in the present. Worldwide we have ample evidence of their ability to deliver on the former but the record of archivists on the latter is not perhaps so impressive.

3.3.1 Guardians and gatekeepers

In the New England fall of 1982, Elsie Freeman, then in charge of education at the National Archives in Washington (NARA) gave a speech in Boston in which she proposed to turn the world of archives "upside down".[12] Freeman told the assembled audience that the "identity and the research habits" of the users of archives needed to become as much a part of archival theory as the rules governing records and she told the room flatly that if they thought they "put the user first" they were kidding themselves. She pointed out that her own organisation not only hadn't carried out any form of user survey since 1976 but had in fact "never examined systematically who our users are".[13] But for Freeman, the problem was one of attitude as well as lack of information. "We tend to be cool", she declared, "to the user who is not professionally trained to do research...if the researcher speaks our language, we favour him; if he does not, we tend to be less sympathetic".[14] She claimed that archivists' relationships with family historians ("one of our largest clienteles") could "most kindly be called adversar[ial]...That one can do research for fun seems not to fall within our categories of acceptable use."[15] Freeman was one of the first advocates for user centred research in archives.[16] Archivists were perfectly capable of describing some of the problems encountered in the course of the research process:

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[11] Nate Lanxon, 'Book review: Inside Apple' by Adam Lashinsky, 2012, http://www.wired.co.uk/article/inside-apple-book-review [Lashinsky discusses this on the first page of chapter 3]

[12] Freeman, Elsie. "In the Eye of the Beholder: Archives Administration from the User's Point of View." *American Archivist* 47, no. 2 (April 1, 1984), p.112

[13] Ibid, p.117

[14] Ibid, p.113

[15] Ibid.

[16] Meyerson, Jessica, Patricia Galloway, and Randolph Bias. "Improving the User Experience of Professional Researchers: Applying a User-centered Design Framework in Archival Repositories." *Proceedings of the American Society for Information Science and Technology* 49, no. 1 (January 1, 2012), p.1

“The researcher using original documents in [visits to] several different repositories is likely to be confronted with a bewildering array of admissions requirements, rules and reference tools...In some cases there are no written sources of information about the holdings and the researcher is totally dependent on the curator's presence, knowledge, memory and goodwill.”[17]

But rather than being seen as problems to be solved by the profession, it appears that these were regarded as features in the archival landscape that it was simply researchers' jobs to negotiate – even as it was noted that archivists were spending “an increasing amount of time in assisting researchers”.[18] Even these observations were made in a library journal.[19]

Thirty years after Freeman's speech was published, some of the transformation she called for has taken place but key parts of the research she advocated have still not been undertaken. There are many reasons for this and critics inside and outside the profession have at times stated them very bluntly: "archivists are more interested in records than people", archivist Dana Bell Russell has said.[20] "Archivists have no…professional ethos of public service", argued Carolyn Heald.[21] These criticisms are outdated but not entirely unfair. The approach of archivists to public service does not match that of their colleagues in libraries, with which they are inevitably compared. Paul Conway has outlined this "gatekeeper approach" and says archivists are:

"expert intermediaries placing themselves between the user and both the primary access tools and the historical record or of allowing the user direct access to the tools but requiring them to pass through the gatekeeper, on some intellectual level, before they may consult the record".[22]

When archivists then use the word ‘gatekeeper’ they imagine a friendly helpmate who encourages researchers to be their best selves by keeping one eye on the preservation of the documentary heritage. But one person's gatekeeper is another person's roadblock. Without research into the experiences of their users – without indeed knowing who their users actually were, archivists were on very shaky ground when they discussed the service they provided. A residual disinterest in user studies amongst archives researchers still ensures the discipline knows far less about the behaviour and needs of its users than do librarians.[23] What progress has been made has been achieved by a relatively small group of investigators. Foremost amongst them are Wendy Duff and her collaborator Catherine Johnson who together carried

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[17] Kraft, Katherine and Anne Engelhart. “Remembering the women: manuscript reference at the Schlesinger Library.” In Whalen (ed.) *Reference Services for Archives*, The Haworth Press, 1986, p.15

[18] Mason, Philip P. “The challenge of contemporary records: reference service in a Labor and Urban archives.” In Whalen (ed.) *Reference Services for Archives*, The Haworth Press, 1986, p.126

[19] ‘Reference Services for Archives’ was first published as an issue of ‘The Reference Librarian’.

[20] Cross, James Edward. “Archival Reference.” *The Reference Librarian* 26, no. 56 (1997), p.11

[21] Malbin, Susan L. “The Reference Interview in Archival Literature.” *College & Research Libraries* 58, no. 1 (January 1, 1997), p.75

[22] Cross, op. cit., p.8

[23] Johnson, Andrea. "Users, use and context: supporting interaction between users and digital archives". in Craven *'What are archives?: Cultural and theoretical perspectives: a reader'*, Ashgate 2008,p.146

out seminal work in 2002 and 2003 when they examined the behaviour of two of the main user groups in archives, namely genealogists and historians. Close reading of these two papers reveals intriguing similarities as well as differences between the two groups.[24] Simply conducting interviews with a number of representatives of these groups and then subjecting them to analysis may not appear especially ground-breaking but no such collection of the views and strategies of these users had been available before. The same year, Elizabeth Yakel and Deborah Torres published their work on 'archival intelligence', for the first time seriously addressing the question of what skills an archival researcher needed to have.[25] Prior to this work archivists had little except their own experiences to guide them in trying to understand what support their users required.

Today, UK archives at least, can be more confident that they know who their users are. Since 1998[26], the UK's Public Service Quality Group for Archives and Local Studies has been publishing the results of sesquiennial surveys, focusing on high level user satisfaction data and audience profiling.[27] These surveys were an invaluable tool for archives when first published. They were not unhesitatingly embraced by the profession: in 2000, some archivists felt quite comfortable asking in print if the PSQG were in reality a "cuckoo in the nest".[28] The question then followed what was to be done with this new information. Archivists divided into two camps. Some were convinced by Freeman's arguments and began to consider how archival services could be redeveloped to better suit the needs of users. The other group saw the problem in reverse and wondered how users could somehow be re-educated in order to better understand the way archives were constructed.[29] That this second approach seemed not very realisable did not appear to bother them over much.

3.3.2 Mediators and machines

At roughly the same time as the user-centredness debate was unfolding in the pages of archival journals, both the 'fix the archive' and the 'fix the user' camps found they had to contend with a new question. With the emergence of personal computers, email and the internet how were archives to adapt to the new demands placed on them by technology? Susan Malbin pointed out very perceptively in 1997 that those advocating the user centred approach to archives were keen on technology but saw it almost as an end in itself. Her conclusion was that these archivists believed technology could make face to face discussions with users "obsolete".[30] It seems likely that such advocates never really considered the host of problems that

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[24] Duff, Wendy M., and Catherine A. Johnson. "Where Is the List with All the Names? Information-Seeking Behavior of Genealogists." American Archivist 66, no. 1 (January 1, 2003): 79–95.
Duff, Wendy M., and Catherine A. Johnson. "Accidentally Found on Purpose: Information-Seeking Behavior of Historians in Archives." Library Quarterly 72, no. 4 (January 2002): 472–96.

[25] Yakel, Elizabeth, and Deborah Torres. "AI: archival intelligence and user expertise." *The American Archivist* 66, no. 1 (2003): 51-78.

[26] Duff, Wendy, Jean Dryden, Carrie Limkilde, Joan Cherry, and Ellie Bogomazova. "Archivists' Views of User-based Evaluation: Benefits, Barriers, and Requirements." *American Archivist* 71, no. 1 (April 1, 2008), p.146

[27] Archives and Records Association, 'Other publications', retrieved 31st March 2014, http://www.archives.org.uk/publications/other-useful-publications.html

[28] Pickford, C. 'Cuckoo in the nest or welcome addition to the archival family? The UK Public Services Quality Group (PSQG) for archives and local studies'.*Archivum* 45 (2000): 219-232.

[29] Malbin, op. cit, p.72

[30] Malbin, op. cit, p.71

introducing novelties such as keyword search would bring: technology was the solution – how could it also be the problem? But in terms of their evidence, archivists were back to square one. The PSQG surveys, for example, apply to physical interactions with archives and consequently from their first days have never been a comprehensive survey of archival users, whose digital interactions now outnumber their real world counterparts by a large ratio: at the National Archives this is about 1:300 in terms of documents accessed.[31] What little user research had been carried out related to real world interactions. Who could say whether the digital world would be different or the same?

Some archivists became positively messianic about technology but Elsie Freeman again sounded a strong note of caution, telling her audience “we are well on the way to creating electronic systems that do not supply what users want".[32] The ways in which the resulting systems have failed to meet all of their users’ needs are various. Andrew Prescott has made crystal clear how the breadth of historical enquiry can be stymied by digitisation which does not reproduce the physical characteristics of the paper source sufficiently.[33] His laundry list of large scale projects whose products are not really fit for purpose illustrates very effectively that not much time was spent considering the uses to which these digital copies (surrogates) of records were actually going to be put. The internet was once hailed as the solution to all problem of access, both intellectual and physical. But more thoughtful researchers began to point out the inconvenient fact that digital archives had “not lived up to the overarching expectation of 'access for all'".[34] In fact, because the focus of archivists remained on collections and not their users, they risked repeating the same problems in a new space, except that here, users not only did not understand how the archives were arranged but no longer had a person on hand that they could ask for help. Computer Scientists working alongside archivists had been aware of this problem for some time. "Disintermediation", warned Richard Butterworth in 2006, "is where the roles the library and archive staff play in supporting users to make the best use of available resources are removed".[35] Figures from the PSQG (while high) seem to reflect this. It is noticeable that while 73% of users rated the quality of advice received in person as “very good” (the highest on a five point scale), only 38% were prepared to say the same thing about their web experience.[36] Though of course this does not tell us what it is about the web experience they thought was lacking – and less still what actually *is* lacking. Further research is needed in order to understand the problems users experience using archives – both in person and at a distance. Today, computer systems, not the archivist are the gatekeepers to collections.

In 2008, Wendy Duff, who has done as much as anyone to put Freeman's

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[31] The National Archives. "Annual Report and Accounts 2012-3", Accessed 20th March 2014, http://www.nationalarchives.gov.uk/documents/annual-report-12-13.pdf, p.12

[32] Freeman, op. cit., p.112

[33] Prescott, Andrew. “The Imaging of Historical Documents.” In *The Virtual Representation of the Past*, edited by Mark Greengrass and Lorna Hughes, 7–22. Aldershot: Ashgate, 2008. http://eprints.gla.ac.uk/44847/.

[34] Johnson, op. cit.,p.149,

[35] Butterworth, Richard."The Accessing of our Archival and Manuscript Heritage project and the development of the 'Helpers' website", Interaction Design Centre, 2006, p.21

[36] Archives and Records Association, "National Survey of Visitors 2012", Accessed 20th March 2014,http://www.archives.org.uk/images/documents/PSQG/Survey_of_visitors_to_uk_archives_2012_-_national_report.pdf, p.7

research agenda into practice, still felt able to say that “user-based evaluation research of archival services and systems remains limited”.[37] But subsequently Duff and her collaborators own approach has been criticised by Meyerson et al who have suggested it “privileges user-reported, subjective evaluations” through overuse (even exclusive use) of questionnaires and focus groups.[38] More innovative techniques (for example the use of 'mystery shoppers' by Archives New Zealand[39]) are only just beginning to emerge. Anneli Sundqvist has emphasised as recently as 2016 that not only is “academic research in archival science…still of limited proportions”[40] but user studies in archives represents “only a minor part of archival science research”.[41] Examining what experimental and non-experimental user research has been carried out in the past forty years, Sundqvist goes further and suggests that “the most salient feature of [the experimental] studies, however, is that none actually qualifies as a true experiment.”[42] I hope the same will not be said of the work presented here but Sundqvist makes this claim in part because of a lack of prior hypotheses and the absence of “randomly assigned participants and control groups” and complains of limited populations comprised of students and academics.[43] Some of these criticisms seem justified but some are not: a between subjects experimental design is not invalid just because it does not involve a control group. Likewise an experimental study does not cease to be an experimental study just because the participants are students.[44] This unfamiliarity with the field suggests that a proportion of even those archivists most keenly interested in user research are still not entirely aware of how such research should be carried out.

In fact, it would be grossly misleading to say that invaluable work in this area has not been undertaken. Andrea Johnson examined the information seeking behaviour of over 500 archival users in the course of her doctoral work.[45] Johnson summed up the three main problems encountered by these users as “where shall I look?”, “what shall I say?” and “what is that?”.[46] We shouldn't be surprised by these problems. They could have been predicted from models of information seeking, most noticeably that of Gary Marchionini that we encountered in the previous chapter (fig. 2.9) Marchionini's "choose a search system" ("select source" on the diagram) is clearly analogous to Johnson's "where shall I look". "Formulate query" is "what shall I say" and "what is that" is "extract information", which is the phase relating to the use of the information products located in information seeking.[47] That archival problems are information seeking problems is clear. For family and other historians, it is impossible for their work to progress if they cannot find what they are looking for – indeed, to a great extent, the products of such exploratory searches *are* their work.

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[37] Duff et al, op. cit., p.145

[38] Meyerson, op. cit., p.1

[39] Battley, Belinda, and Alicia Wright. “Finding and Addressing the Gaps: Two Evaluations of Archival Reference Services.” *Journal of Archival Organization* 10, no. 2 (2012): 107–36.

[40] Sundqvist, Anneli. “Archival Mediation.” In *Research in the Archival Multiverse*, edited by Anne Gilliland, Monash University Publishing, 2017, p.559

[41] Ibid, p.562

[42] Ibid, p.568

[43] Ibid, p.569

[44] Not even if they are undergraduates, as Douglas Adams might have joked.

[45] Johnson, op. cit., p.145

[46] Ibid, p.151

[47] Marchionini, Gary. *Information Seeking in Electronic Environments*. Cambridge University Press, 1997, p.45

3.3.3 There are no jokes about archives[48]

Archives and archival research are unfamiliar to the general public. While not everyone visits libraries, museums and art galleries most people are aware of what they are and roughly what happens inside them. Most people have never visited an archive and don't spend much time thinking about what might go on in one. Even academic interest is less than might be expected. In a 2013 survey of about 300 humanities scholars in Belgium and the Netherlands, the most popular answer to a question about how often the cohort had used the website of the Dutch National Archives was "never".[49] The Royal Library (Koninklijke Bibliotheek) fared even worse with the mode answer being, essentially, 'never heard of it'.[50] Scholars do not necessarily expect an archive to be 'walk up and use' but, since the explosion of interest in genealogy fostered by shows such as *Who Do You Think You Are,* freshly minted researchers may do. [51] Archives are perforce unfamiliar because they are outside most people's ordinary experience. Once encountered they have unique properties which make them hard to use: they are large and fine grained, they are consequently organised in ways that are not immediately transparent and they are frequently difficult to interpret.

These properties are not magicked away by the move to digital and in fact there is evidence they are worsened. In 2004, Tefko Saracevic looked at eighty studies of digital libraries, which as we discussed in chapter 1, we could consider a kind of digital archive (and vice versa). He reported "users have many difficulties with digital libraries…they usually do not fully understand them, they hold a different conception of a digital library from operators and designers, they lack familiarity with the range of capabilities, content and digital provided…they often engage in blind alley interactions".[52] Saracevic claimed that a "firewall" existed between digital libraries and their users and he hypothesised that "in use more often than not, digital libraries' users and digital libraries are in an adversarial position".[53] Saracevic's use of the word 'adversarial' unconsciously echoes Elsie Freeman and seems to embody her worst fears: that the most negative qualities of real world archival interaction would be transplanted online. Coupled with the disintermediation created by the removal of the archivist we have a perfect storm for confusion and error.[54] And storm it is because researchers do not proceed by bushwhacking through an individual repository. In order to complete their information journey they will likely visit large collections of digital libraries. Since many repositories are not indexed by Google, users must work quite hard to move between them, navigating what Kirchhoff et al have called "digitisation islands in the vast sea of the internet".[55] This is a hostile

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[48] My thanks to my colleague Andrew Payne at The National Archives for originating this aphorism on the lack of popular engagement with archives.

[49] Kemman, Max, Martijn Kleppe, and Stef Scagliola. "Just Google It - Digital Research Practices of Humanities Scholars." *arXiv:1309.2434 [cs]*, September 10, 2013. http://arxiv.org/abs/1309.2434, p.8

[50] Ibid.

[51] *Who Do You Think You Are*, BBC / Wall to Wall, 2004

[52] Saracevic, Tefko. "Evaluation of digital libraries: an overview". *Notes of the Delos WP7 workshop on the evaluation of Digital Libraries*, Padua, 2004, p.8

[53] Ibid, p.9

[54] Butterworth, Richard.*"The Accessing of our Archival and Manuscript Heritage project and the development of the 'Helpers' website"*, Interaction Design Centre, 2006, p.21

[55] Kirchhoff, Thomas, Werner Schweibenz, and Jörn Sieglerschmidt. "Archives, Libraries, Museums and the Spell of Ubiquitous Knowledge." *Archival Science* 8, no. 4 (December 1, 2008), p.255

environment in which users can (fortunately metaphorically) drown.

And yet some people are at home in this environment. In 2003, Yakel and Torres published work on what qualities they codified in analysis of interviews conducted with 28 primary source researchers.[56] Their aim was to unpick the constituents of user expertise in archives and they emphasised three: domain knowledge (that is knowledge of the researcher's own research domain; Georgian England, say), artefactual literacy (that is, the researcher's familiarity with archival documents and their properties) and a third constituent they called archival intelligence.

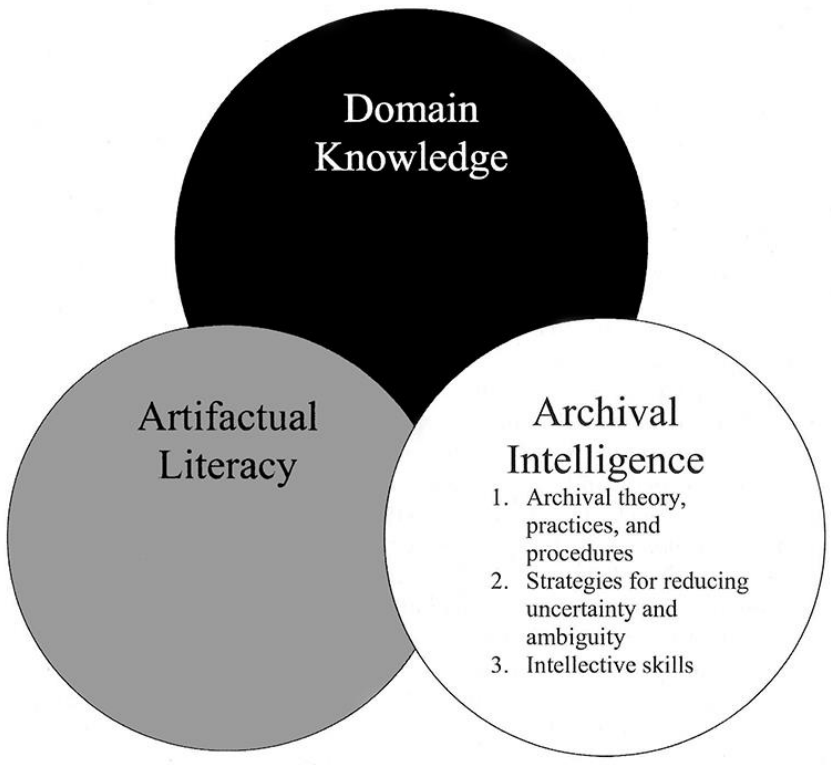

Figure 3.1: User Expertise in Archives (Yakel and Torres)

This third aspect they believed to consist of intellective skills, archival theory and practice and strategies for reducing uncertainty and ambiguity – we will discuss some definitions and properties of uncertainty shortly. What they meant by archival theory was less clear since it encompassed a knowledge of "archival jargon" (fonds, series, provenance – many examples could be provided) but also "interpretation of primary sources" (which sounds rather like artefactual literacy) and "an awareness of one's own and others' level of domain knowledge".[57] This last is a metacognitive approach to domain knowledge, not distinctly archival but ample evidence exists that metacognition is an important determinant in search success.[58]

The blurriness between archival intelligence and the other two properties is illustrated by the overlapping circles in their diagram. Yakel and Torres' work

[56] Yakel and Torres, 2003

[57] Yakel and Torres, op. cit., p.58

[58] Diana Tabatabai and Bruce M. Shore, "How Experts and Novices Search the Web," *Library & Information Science Research* 27, no. 2 (2005): 222–48

remains the standard explanation for the difference in search success between expert archivists, navigating expertly through the archival environment and the novices, struggling to find their way.

3.4 Uncertainty

What is the nature of this struggle? Users appear to be *uncertain* how to progress their enquiries through the stages of information seeking represented in the models discussed in the previous chapter. Some of the cognitive path models go as far as to describe the affective experience of users in the midst of this uncertainty. We have seen in Carol Kuhlthau's model (fig. 2.21), for instance, the feelings of “confusion, frustration and doubt” that can beset users in the course of information seeking. These feelings are duly found in the archive by Duff and Johnson[59] and we will see many more such examples in the next chapter. In the meantime, a number of disciplines have become interested in classifying uncertainty, from engineering to economics. These examinations tend to focus on the locus or site of uncertainty. In a number of cases, what emerges is a suggestion that there are two principal types of uncertainty that should be explored. The more difficult problem then becomes deciding what precisely distinguishes these two types from each other.

For example, in the context of system and product design, De Weck and Eckert distinguish between endogenous (internal) and exogenous (external) uncertainty. For them the distinction between these two types of uncertainty is one of control. Endogenous uncertainties can be “influenced by the system designer...to a greater extent” than those exogenous uncertainties that are outside the system boundary.[60] But in practice, this is a very difficult distinction to make. De Weck and Eckert themselves make clear that they regard the “use context” of a system as crossing the boundary between what they call a product context, with properties such as technology and reliability (the latter a system property we can specify and measure) into what they call a market context, encompassing environment and operator skill and even shading into a political and cultural context.[61] So the idea that some uncertainty is somehow 'within' the system and some is present but 'outside' it does not seem to be an especially useful way of understanding what is, after all, an *interaction* between a user and a system, taking place in some context or other. And it is after all, the user's uncertainty we are interested in reducing not that of the designer.[62]

Rather than attempting to distinguish sites of uncertainty within a system, John Maynard Keynes sought to draw a distinction between systems in which uncertainty was present. In his 1937 paper on a general theory of employment, he distinguishes between uncertainty in a game like roulette (“not subject...to uncertainty”) and that in assessing “the prospect of a European war...or the price of copper and the rate of interest twenty years hence”, with weather somewhere in the

[59] See Chapter 1, p.11
[60] De Weck, Olivier L., and Claudia Eckert. "A classification of uncertainty for early product and system design." (2007), p.4
[61] Ibid.
[62] The designer can read this thesis!

middle ("only moderately uncertain").[63] For Keynes then, uncertainty was linked to the number of possible states. We are uncertain what the precise outcome of a spin on a roulette wheel is, but we know it is one of 37 possible numbers.[64] We are not uncertain about whether the ball will land on 85 or yellow or be replaced by a shuttlecock: our uncertainty is bounded and calculable. But on complex questions looking ahead considerable distances in time, Keynes argued "there is no scientific basis on which to form any calculable probability whatever."[65] The uncertainty in some systems is not bounded and we are at a loss to predict the outcome except through guesswork. Information seeking may range across this spectrum. We may well be using a bounded system and searching a bounded collection but the nature of exploratory search may just as well mean that we move across multiple systems and multiple collections with the number of possible states growing accordingly.

Keynes' distinction remains of interest but subsequent economists, from Herbert Simon onwards, began to wonder whether, say, roulette and future interest rates really were the same class of problem or whether their uncertainty differed in some fundamental aspect. Derived from Herbert Simon's substantive and procedural rationality, Dosi and Egidi proposed the existence of substantive and procedural uncertainty, the former related to "some lack of information about environmental events" and the latter person-centred, being "the competence gap in problem solving".[66] There might, in this way of thinking be a large amount of substantive uncertainty surrounding future interest rates but this is compounded, should I speculate about them, by the procedural uncertainty generated by my own comparative ignorance of macroeconomics compared to an economist. In other words, one type of uncertainty (procedural) is affected by expertise where the other (substantive) is not.

This distinction is similar but not precisely identical to that between aleatory (or ontological) uncertainty and epistemic uncertainty. Aleatory uncertainty in generally understood to mean the irreducible uncertainty within a reasonably well understood set of parameters.[67] This is the uncertainty inherently present in the roulette wheel: even a careful mathematical model would struggle with the flick of the dealer's wrist as she set the wheel in motion, small imperfections with the wheel, table, ball and casino airflow which could affect where the ball is likely to end up. However carefully we studied these things we would still be in some doubt as to the outcome. Peter Fishburn has described this, only slightly tautologically, as the "chance that affects stochastic phenomena".[68] On the other hand we have epistemic uncertainty, which Daniel Dequech has carefully explained is by some regarded as "limitations in people's mental abilities" and by others as the inherent "unpredictability

[63] Keynes, John Maynard. "The General Theory of Employment." *Quarterly Journal of Economics* 51, no. 2 (1937), p.213
[64] 38 in the United States.
[65] Keynes, op. cit., p.214
[66] Dosi, G., and M. Egidi. "Substantive and Procedural Uncertainty." *Journal of Evolutionary Economics* 1, no. 2 (June 1, 1991), p.2
[67] Thunnissen, Daniel P. "Uncertainty Classification for the Design and Development of Complex Systems." In *Proceedings of the 3rd Annual Predictive Methods Conference,* Veros Software, 2003, p.14
[68] Fishburn, Peter. "A Variational Model of Preference Under Uncertainty." *Journal of Risk and Uncertainty* 8, no. 2 (1994), p.137

of future knowledge".[69] Whichever of these definitions we prefer we can see that the key difference between aleatory (Dequech prefers ontological[70]) and epistemic uncertainty is whether the uncertainty is situated in reality or merely in our understanding of reality. The awkward point about this distinction is that our knowledge might change: Thunnissen suggests that epistemic uncertainty relates to properties that we could fully understand but for some practical reason the information is not available.[71] Sources of this kind of uncertainty might be behavioural or "phenomenological" but Thunnissen claims phenomenological uncertainties could be "unknown unknowns" - some relevant information cannot be known "even in principle". This now sounds awfully like aleatory uncertainty.

These distinctions are complex and possibly even a little self-referential, nevertheless they do begin to illustrate that while it is possible that some uncertainty is inherent and irreducible in our system, there is uncertainty that we can definitely(!) act upon in the minds of our users and there would also appear to be a region in between where uncertainty which is non-inherent in the system and not in the mind of the user – a particular kind of epistemic uncertainty (perhaps procedural uncertainty) can be acted upon. It is in this region that system barriers may operate. We will consider this further in chapter 7.

3.5 Properties of the Discovery system

Many of the studies I will outline in the next four chapters make use of the Discovery catalogue system. This is a large and complicated system containing over 30 million descriptions of records held not only at the National Archives but also in other UK repositories and also internationally. Tens of millions of searches are carried out each year using the system by researchers from all over the world with an interest in the records of the UK government held at Kew or in UK history in its widest sense.

[69] Dequech, David. "Uncertainty: Individuals, Institutions and Technology." *Cambridge Journal of Economics* 28, no. 3 (May 1, 2004), p.368

[70] Aleatory uncertainty seems to be more common and I will prefer it here.

[71] Thunnissen, Daniel P. "Uncertainty Classification for the Design and Development of Complex Systems." In *Proceedings of the 3rd Annual Predictive Methods Conference,* Veros Software, 2003, p.14

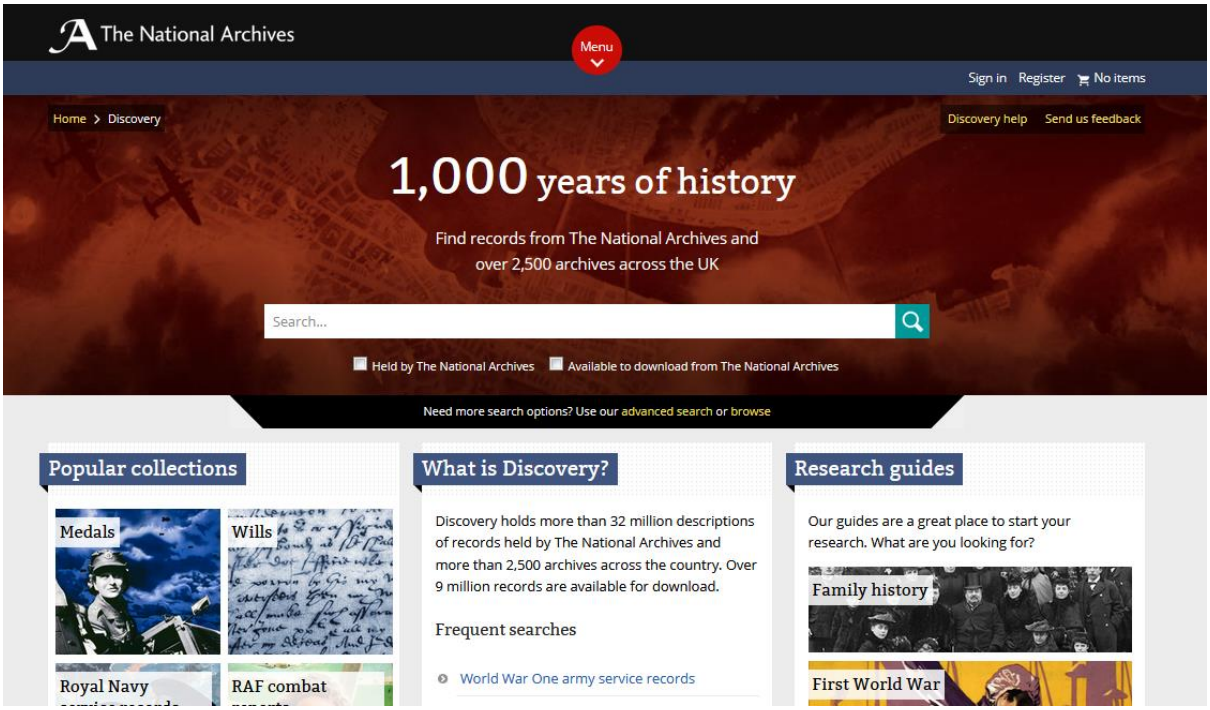

Figure 3.2 The front page of Discovery (http://discovery.nationalarchives.gov.uk)

This is a search system based around a Google style single search box. The main page contains links to guidance on key record types. Some search systems provide some initial query terms as prompts.[72] This is not the case here and the user must treat the search box as an invitation. Rather like a command line prompt, the system is predicated on the idea that the user knows what they want. The system also permits advanced search and incorporates Boolean logic, faceted search, relevance ranking of results and the ability to stem and lemmatise search terms in order to widen result sets. These are potentially quite powerful but may not be fully used or understood by users. Boolean logic in particular has been revealed by Dinet et al to be the subject of quite fierce resistance by users. Even systems designed specifically to promote its use fail dismally.[73] 9 million records in Discovery are available for download. This may suggest an impressive digitisation rate of 30% but since this is generally estimated at 5% of only the records held at Kew what it actually demonstrates is the enormous quantity of records not individually described at all.

The metadata within the system is based on the principles of provenance and original order discussed in 3.2 above. For the National Archives this means a large number of top level collections ('fonds') based on the originating government department: ADM (Admiralty), DEFE (Ministry of Defence), RAIL (nationalised railway companies), COAL and so on. Other archives have much more diverse depositors than government departments and these originating bodies could be local businesses and institutions, prominent families and estates or indeed the local fetish

[72] Bodleian Library, "Early Modern Letters Online," accessed September 30, 2017, http://emlo.bodleian.ox.ac.uk/.

[73] Jérôme Dinet, Monik Favart, and Jean-Michel Passerault, "Searching for Information in an Online Public Access Catalogue (OPAC): The Impacts of Information Search Expertise on the Use of Boolean Operators," *Journal of Computer Assisted Learning* 20, no. 5 (2004): 338–46

club.[74] Beneath these are ‘series’ representing smaller groupings of records which are often organisationally discrete.

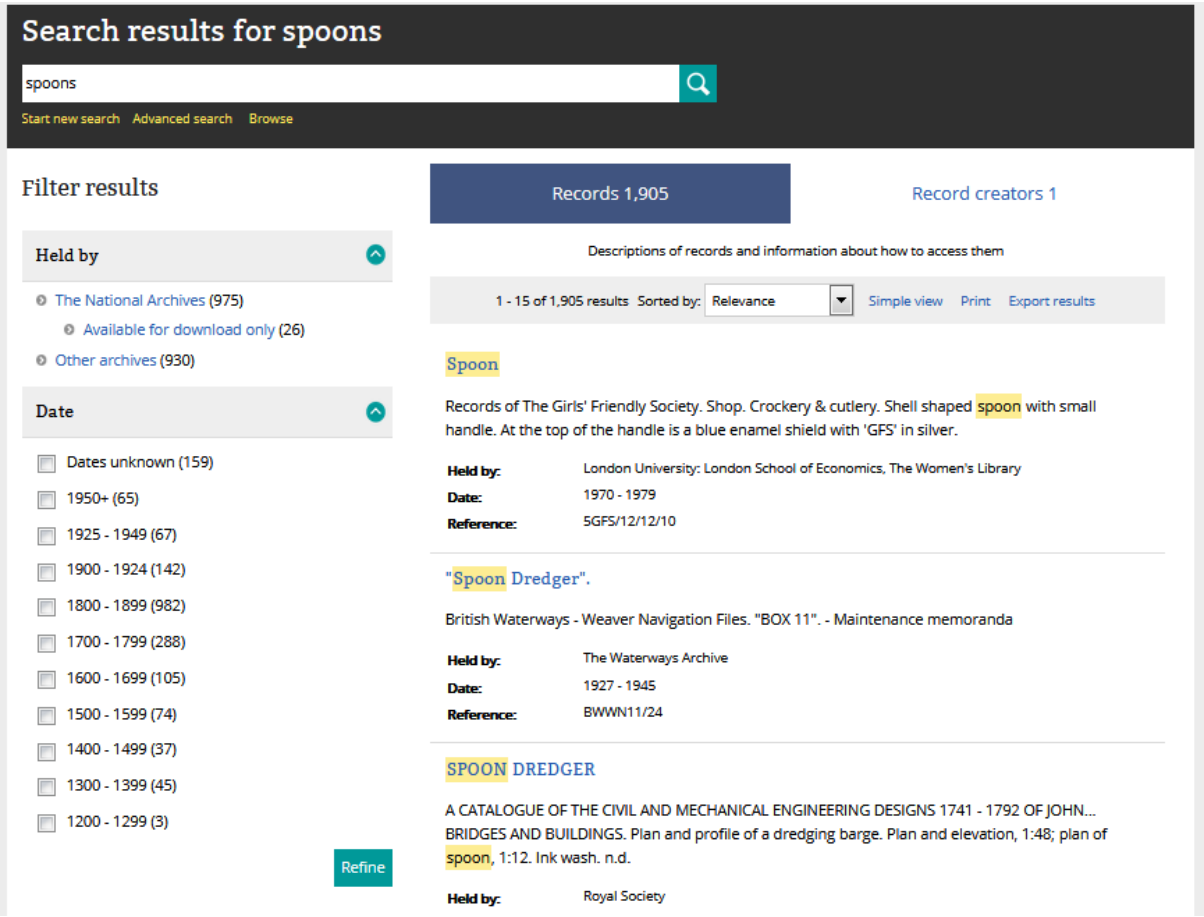

Figure 3.3 Search results in Discovery

For example COAL 44 is the records of the Statistics Department of the National Coal Board and COAL 28 are the records of its marketing department. A researcher interested in the effect of marketing on coal sales will likely need to consult records in both places. Discovery reports COAL 28 consists of 377 files and boxes.[75] The good news is that these are individually described. The bad news is that a typical description is ‘Opencast coal: general’ and this must stand for a box or file which will likely contain dozens if not hundreds of documents.[76]

[74] Discovery, ‘London Leathermen’, Bishopsgate Institute, http://discovery.nationalarchives.gov.uk/details/c/F275963
[75] Discovery, ‘National Coal Board and British Coal Corporation: Marketing Department‘, COAL 28, http://discovery.nationalarchives.gov.uk/details/r/C5276
[76] Discovery, ‘Opencast coal: general’, COAL 28/7, http://discovery.nationalarchives.gov.uk/details/r/C328508

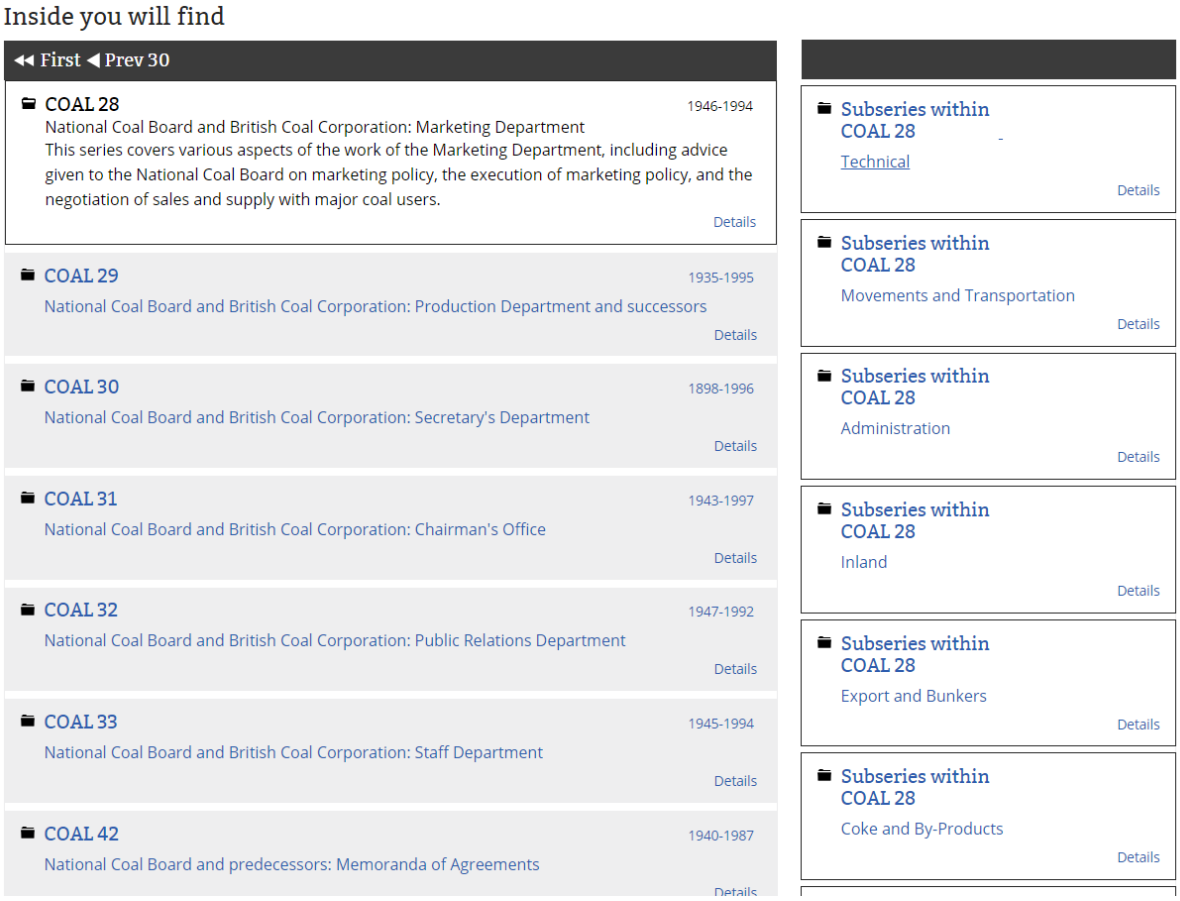

Figure 3.4 Browsing COAL in Discovery

The system also permits users to browse through the archival structure from any item and see where it is positioned in the archival hierarchy. It is not possible to browse from the Discovery home page but from a series such as COAL 28 it is possible to see neighbouring series (COAL 29 etc.) and COAL 28's constituent sub-series (Technical, Administration, Export and Bunkers and so on). This view is 'browse by hierarchy'. Clicking on 'browse by reference' from COAL 28 will skip these sub-series and permit browsing of COAL 28/1, COAL 28/2 and so on. These sub-series are meant to serve as helpful groupings of boxes and files so it is unfortunate these views are not terribly well integrated.

3.6 A short study of Discovery queries

For many millions of researchers, their first chance to express their information need to an archival system which might offer some chance of resolving that need comes when they type a search query into Discovery. For some users this may open a door to a crucial clue to a family mystery or appear to offer a key document to complete a research project. For others frustration awaits. As we will see in the next chapter, National Archives' users frequently state in correspondence that they have looked for a document but are unable to locate it. Some of these documents are genuinely hard to locate but some seem very straightforward. I initially proposed three explanations

for the difficulty experienced by users, the overwhelming majority of whom can clearly express their information need in a form that would seem to facilitate searching:

1. The users are searching for information in the wrong place (e.g. confusing site search with records search).
2. Users are making excessively narrow relevance judgements and ignoring relevant records guidance because it is not the known item they are searching for. (i.e. a document about service records is not a service record.)
3. Users are formulating excessively detailed queries and generating no results in response.

The purpose of this study was to examine query logs in order to see if any light could be shed on these explanations for research failure or whether other factors seemed more prominent in the data. Using data from the National Archives we can illustrate the volume of queries and their general character. This data is interesting but its shortcomings will quickly become obvious.

3.6.1 Method

This study involved quantitative and some qualitative analysis of three discrete sets of data.

Materials

The National Archives kindly provided log files representing 61,853 Discovery queries, which constitute every request sent to the system on 24th February 2015, a date chosen entirely at random. The also provided access to the instance of the Webtrends system which allowed the top 300 search terms for 2013-2015 to be captured and analysed. A third dataset was the set of keywords used by the National Archives to characterise its research guides.

The Archives produces resources called research guides to assist researchers in locating particular types of records. The existence of these guides is further circumstantial evidence that archivists recognise that locating many kinds of records using existing system is difficult but they also show an active willingness to try to assist. These guides specifically focus on information which will increase the chance of successful search, emphasises which records are available online, at Kew or elsewhere and may include a search box to carry out a filtered search within Discovery.

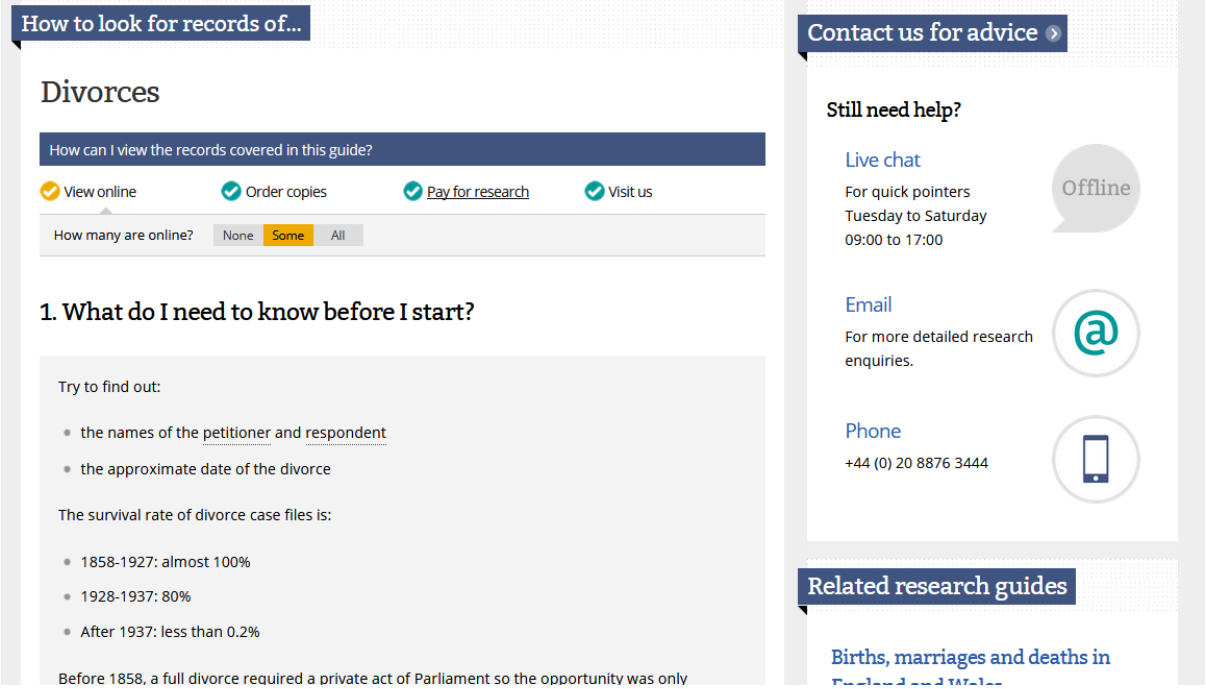

Figure 3.5 National Archives' research guide on divorce records

These guides are arranged in alphabetical order and associated with a set of keywords. This comprises 310 terms used to facilitate access to research guides on bespoke topics. The guides are grouped in various ways on the National Archives site but an A to Z index of terms is the only way to navigate every guide in one place.[77] A term such as “Boer War” offers links to three different research guides: Boer War, British Army operations up to 1913 and Prisoners of war in British hands. This is an attempt to cover different information needs which might be expressed by the same term; whether the user is interested in the military, political or personal aspects of the conflict, for example.

Procedure

WebTrends data was analysed using Excel to produce figures for the total volume of searches and to assess the representativeness of the top 300 query term data. Two month snapshots of the data were used rather than look at 30 days of data to smooth out peaks caused by specific events either in the media or by promotion by the Archives’. The top 300 terms for March/April 2013 and for comparison March/April 2015 where then examined and grouped into emergent high level categories. In both cases a handful of results defied easy categorisation and were called ‘other’. Having originated these categories based on the query data an attempt was then made to categorise the keywords used by the National Archives to describe its own research guides into the same groups in order to make a comparison between the research interests of users and the Archives’ ability to meet those interests with their guidance.

[77] The National Archives, http://nationalarchives.gov.uk/records/atoz/

Finally a simple Python script was written to examine the lengths of each of the queries submitted to Discovery in the 24th February dataset, to check whether they contained Boolean logic and finally to attempt to test hypothesis 3 by resubmitting each query to the Discovery system and recording the number of results generated.

3.6.2 Results

The Webtrends data produced the following totals of queries:

Period	Total number of searches	Number of searches in top 300 terms	Proportion of total searches in top 300 terms
March-April 2013	2,297,810	94,995	4.15%
March-April 2014	2,854,754	153,233	5.37%
March-April 2015	3,514,791	238,303	14.75%

Table 3.1: Discovery searches March/April 2013-5

These top 300 terms could be placed in high level categories. For March/April 2015 the results were:

Category	Number	%	Example searches
Reference	79	26.3	WO 363, WO 97, HO 198, WO 372, WO 100, BT 26, WO 69
Personal Name	61	20.3	smith, jones, taylor, brown, williams, Johnson, Thomas
Place	77	25.7	Northampton, India, Palestine, Sheffield, Singapore, Ireland, Liverpool
Organisation	30	10.0	Poor Law Union, Royal Engineers, Royal Field Artillery, Merchant Navy
Topic	25	8.3	naturalisation, births, parish, murder, death, marriages, tank, evacuees
Type of Record	17	5.7	service records, ship passenger list, muster books, war diary, wills, census
Event	2	0.7	ww1, Boer War
Groups (of people)	1	0.3	German
Other	8	2.7	*, Grannum, Part 1: European Origin Mainly, Name
Total	300		

Table 3.2: Top 300 Discovery search terms 2015, arranged by category

The 2013 data is, helpfully, not dissimilar:

Category	Number	%	Example searches
Reference	101	33.7	WO 363, WO 12, WO 95, WO 339, FO 371, AIR, BT 113, PREM 19/878
Personal Name	59	19.7	Smith, Roberts, Nelson, Williams, Margaret Thatcher

Place	62	20.7	London, Philippines, China, Worcestershire, Hampshire, Iran
Organisation	31	10.33	Royal Navy, Royal Engineers, Machine Gun Corps, RAMC, Metropolitan Police
Topic	20	6.7	Intelligence, Divorce, Military, Deaf AND School, Murder, Bigamy
Type of Record	15	5	Wills, War Diaries, Census, Silver War Badge, Bronze Star
Event	3	1	Boer War, Spanish Civil War, ww1
Groups (of people)	3	1	Prisoners of War, German, wheelwright
Other	6	2	*,Websites Division, 50, Part One
Total	300		

Table 3.3 Top 300 Discovery search terms 2013, arranged by category

Applying the same categories to the National Archives keywording of their own research guides produced the following results:

Category	**Number**	**%**	**Example term**
Reference	0	0	
Personal Name	1	0.3	Henry VIII
Place	7	2.3	America, Australia (transportation to), Nazi Germany, Caribbean, France (English lands in), Ireland, Scotland
Organisation	77	24.8	Army, Central Criminal Court, Cities, Colonies, Fleet Air Arm, Parliament, Women's Land Army, Workhouses
Topic	103	33.2	Agriculture, Church lands, Film, Medieval period, Pensions, Slavery, Tithes, Wars
Type of Record	47	15.2	Bomb census, Crew lists, Online records, Medals, Press, Wills
Event	11	3.6	Boer War, Civil War (English), Crimean War, First World War, Second World War
Groups (of people)	54	17.4	Actors, Casualties of war, Conscientious objectors, Land girls, Missing people, refugees, warrant officers
Other	10	3.2	Citing records, Caring for records, Latin, Ordering documents, Reading old documents
Total	310		

Table 3.4: Research guide keywords arranged by category

Finally, upon analysis, the 24 hour set of queries had the following properties:

- A mean length of 2.46 terms
- A median length of 2 terms

- 27.9% of the queries consisted of one term, 38.1% of two, 18.0% of three and 16% of more than three.
- Only 3.5% of the queries used any form of Boolean logic.[78]

Archivists tend to recommend broad searches so queries with more than three terms were examined in order to test hypothesis 3 as these seemed the most likely to generate no results. This is because the default logic of a Discovery search query is to add Boolean AND to terms, so that spoon generates almost 2000 results, spoon cheese generates 13 results and spoon cheese walnut generates 2 results and so on. (Unfortunately it does this silently: when the query is shown on the results page the Boolean logic the system has added is not shown.)

Of the 9,910 queries incorporating three or more terms:

- The average term length is 5.46
- 37.1% contain Boolean logic

When these queries were resubmitted to Discovery 7,386 of the queries returned results out of the 9,910. 25% did not return any results; this is less than 4.1% of the original sample. Few users therefore seem to be producing excessively detailed queries and generating no results in response.

3.6.3 Discussion

In the course of the 2013-5 period a number of additional databases were added to Discovery.[79] We would consequently expect a growth in use but we might expect queries to become more diverse. We do indeed see an appreciable growth in searches but these searches appear to have become, if anything, more homogenous over the period. This seems to be in part the result of successful promotion of common topics by the National Archives ("service records" is not present in the top 300 terms in 2013, it is the second most common term in 2015), increased use of wildcard searches by users (from 0.12% of searches to 1.14%) and some automated testing of terms by the archives.[80] It is interesting to see that the Archives' do seem to be able to influence searches to some extent, through the sheer scale of publicity campaigns around big topics such as the Great War.

The differences between the search terms of users and the archives own guidance is stark. In both the 2013 and 2015 sets of top terms, references, personal names and places constitute in excess of 70% of searches (74.0% in 2013 and 72.3% in 2015). Whereas for the research guides references, personal names and places now constitute less than 3% of terms. Organisations, groups of people, topics and types of record make up over 90% of terms. This mismatch is rather unfortunate

[78] That is contained AND, OR, NOT as distinct terms in upper or lowercase.
[79] Records from the National Register of Archives, Manorial Documents Register and A2A database were added to the system over the course of the period under discussion.
[80] 'Grannum' is a very common search term. It is also the surname of Discovery's product manager at the National Archives and has obviously been used for load testing or similar.

but the reasons for it are to some extent understandable: it would be impossible to produce a useful guide to ‘Smith’ or ‘Brown’, nor is it possible to produce a guide for every place.[81] Instead the Archives groups sets of research guides on pages such as “looking for a person”[82], or “looking for a place”.[83] These pages are somewhat unwieldy, the former containing well in excess of 100 links. Tracking down this assistance seems a lot to ask of users.

The effect of the analysis of the sample of 24 hours of queries was to largely disprove hypothesis 3. This does not mean that the results sets generated were relevant. A cursory inspection reveals that many were very likely totally irrelevant but it does mean that obtaining no results is in fact a relatively unusual scenario now that Discovery has expanded to include legacy databases such as the National Register of Archives that was once separate. When users say they cannot find what they are looking for, they likely mean not that they found nothing but that they were unable to locate items of interest amidst irrelevant results sets and then unable to formulate a new query which would prove more profitable. And yet this simple analysis immediately exposes the limits of this data.

While we can explore my third hypothesis with relative ease and disprove the suggestion that excessively lengthy queries are causing large numbers of users to return null results sets, we cannot tell whether users are making narrow relevance judgements or confirm whether they are carrying out results in the wrong place. Indeed, we cannot confirm whether any of these users found anything relevant at all no matter how relevant-looking their results sets may appear to an analyst. This sort of log evidence is simply not rich enough to tell us what users are thinking and this is crucial because relevance is personal and evolving. A document that appears relevant late in the information seeking process, that mentions, for instance, entities which the researcher has only recently encountered, may not appear relevant near the start. It is no use an information system insisting a document is relevant if the user cannot perceive it. They will instead seek out more obviously and presently useful material. Only real users can explain the reasons behind their relevance judgements and declare definitively whether a set of results has advanced their research.

Consequently in the next chapters, we will turn to different sources in order to theorise about impediments and uncertainties to users' search progress by examining the enquiries which the modern archive receives in substantial volumes across an ever more diverse set of channels.

[81] Though at the country or city level the archives has much metadata it could lean on. Part of the problem is that the guides are ‘human written’ when many more could be generated by sets of rules.
[82] The National Archives, ‘Looking for a person’,http://nationalarchives.gov.uk/records/looking-for-person/default.htm, accessed 20th February 2015
[83] The National Archives, ‘Looking for a place’, http://nationalarchives.gov.uk/records/looking-for-place/default.htm, accessed 20th February 2015

Chapter 4: Swimming the Channels

"What is all this boring, and probing, and sounding, and scrutinizing...but an exaggeration of the one principle or set of principles of search, which are based upon the one set of notions regarding human ingenuity, to which the Prefect, in the long routine of his duty, has been accustomed?"

- Edgar Allen Poe, 'The Purloined Letter' (1844).[84]

4.1 Introduction

In earlier chapters, I have repeatedly claimed or repeated the claims of others that archives are difficult to use and navigate. In this chapter we will explore empirical evidence for this view. Digitisation has put archival documents into the hands (or rather into the home computers) of millions of active users. Whether it is students and professional researchers investigating the history of a nation, or members of the curious public mapping their family trees, each of them comes to archival collections with a need to find information. In order to find it they will have tackle multiple systems or arrangement within the collections and multiple systems for exploring the record within the archive – or indeed on the web. Kirchhoff et al have described the increasing profusion of archival information systems, digital libraries and other cultural databases as "digitisation islands".[85] As a result of this complexity, patrons of archives often have to contact archives directly for assistance. Just as interaction with the resources has changed in the digital era, the interactions with archives as organisations have changed. Rather than coming into the archive, remote users try to access documents online, and will often put enquiries to staff through a variety of different digital channels from telephone to email and onward into social networking.

The purpose of this chapter is to examine a set of these enquiries as surrogates of the information needs of archival researchers on a reasonably large scale. What kinds of problems are they encountering and what appears to be causing them? Collecting this information and analysing the language in which they describe these issues (which may in some cases give us valuable additional information about how they feel about these problems as well as reason about them) should provide insights into how these users can be better supported to be more confident and self-sufficient researchers. Fitting, if possible, these enquiries into existing models of information seeking may help us narrow further our view of where these problems occur and imply more targeted interventions and solutions. In the previous chapter (3.3.2) I used the work of Andrea Johnson to suggest that the Marchionini model could be used to 'place' archival information seeking problems.

[84] Edgar Allan Poe, *The Fall of the House of Usher and Other Writings*, ed. Peter Ackroyd and David Galloway, Rev Ed edition (London ; New York: Penguin Classics, 2003), p.292
[85] Kirchhoff, T., Schweibenz, W., Sieglerschmidt, J.: Archives, libraries, museums and the spell of ubiquitous knowledge. Arch Sci. 8, 251–266 (2008).

This will be attempted in the course of the study in order to see if there is a concentration of issues in any one phase.

4.2 Archival enquiries

The National Archives fields over 100,000 research enquiries annually, with the majority of those enquiries now coming from remote users.[86] But fielding such enquiries is part of the public function of all archives and has been the subject of a small number of studies by researchers.

The move from paper correspondence to enquiries received by email encouraged, almost simultaneously, Kristin Martin[87] and Wendy Duff and Catherine Johnson to examine and categorise these enquiries. [88] In Martin's case, her aim was assess the impact of email on the content of these enquiries within a single repository. In Duff and Johnson's case the aim was to inform the development of future digital archival information systems. The pair hoped that by categorising enquiries across a group of archives and examining the types of information supplied by users, they would uncover "clues as to how patrons seek information". Martin predicted that as more information about holdings became available online, users would form more specific enquiries relating to those holdings – though she also warned this could be counterbalanced by an increase in a rise in "broad" enquiries from novices. Valuable contributions as Martin and Duff and Johnson's work are, quite some time has passed since their papers were published and the modern archive communicates across the full range of digital channels, not just email. But in spite of extensive library literature on offering digital services, the archival literature on topics such as answering enquiries via IM or "livechat" is virtually non-existent with Gary Brannan's paper discussing such sessions at West Yorkshire Archive Service a rare exception.[89] Archivists might argue that libraries and archives are similar, and thus lessons from the library literature would carry forward to archives.[90] Instead there is insistence from authorities in the archival sphereof the opposite, as we will discuss in the next chapter.[91] For these reasons, the study reported here examines enquiries to the National Archives to address these gaps in the literature. Through this study we will consider where and when users are encountering problems, through what

[86] Information provided by the National Archives.
[87] Martin, K.: Analysis of Remote Reference Correspondence at a Large Academic Manuscripts Collection. American Archivist. 64, 17–42 (2001).
[88] Duff, W., Johnson, C.: A Virtual Expression of Need: An Analysis of E-mail Reference Questions. American Archivist. 64, 43–60 (2001).
[89] Brannan, G.: Talking in the night: exploring webchats at the West Yorkshire Archive Service. In: Theimer, K.: Reference and Access: Innovative Practices for Archives and Special Collections. Rowman & Littlefield (2014).
[90] Lee, Ian J. "Do virtual reference librarians dream of digital reference questions?: A qualitative and quantitative analysis of email and chat reference." *Australian Academic & Research Libraries* 35, no. 2 (2004): 95-110.
[91] An unexpected coincidence but as far as I know no relation.

channels they pose what kinds of questions to archivists, and what are the drivers of those requests.

This chapter therefore presents a qualitative study involving a content analysis of the enquiries that come to a large national archive that offers multiple channels for user engagement. Alongside this is included an analysis of a popular online genealogy forum, Rootschat, for comparison. This latter dataset is intended to improve the external validity of the analysis of the archive based enquiries, and help identify if the data collected is representative of more general problems in information seeking in archives.

4.2 Method

This mixed method qualitative study consisted of a combination of content analysis[92] and a grounded theory analysis[93] of a variety of different sources of existing user-generated data stored at the National Archives in the UK and a selection of forum posts on the popular genealogy community forum Rootschat.

The content analysis used two existing coding schemes to answer the following two questions:

- What are the differences in the types of enquiries users make through different online channels?
- When users have information seeking enquiries, at what stage of information seeking behaviour are they in?

Further, the grounded theory analysis of the content was conducted using an open coding scheme, with the aim to understand what the drivers were behind information seeking enquiries.

4.2.1 Data collection

The research team, in cooperation with TNA, identified four main channels through which remote enquiries are received and handled: email, telephone, livechat and Twitter. In addition, a sample of enquiries to the Rootschat family history forums was also taken for comparison to the TNA channels. Each channel had data sampled from different time periods. This was to avoid the skewing of the data towards particular events or announcements from the National Archives - for example, the announcement of new records relating to the centenary of World War I would likely skew all channels towards requests for data from that era. Data was sampled in an incremental way with researchers coding data as it was retrieved. For each channel, when coding of the enquiries stabilised such that proportion of posts allocated to each code in the coding schemes did not change, sampling was ended for the channel. At TNA, there is a Contact Centre which provides an email and

[92] Krippendorff, K., and Bock, M. A. (eds): *The Content Analysis Reader.* Thousand Oaks, CA: Sage (2008).

[93] Strauss, A, Corbin, J.: Basics of qualitative research: Grounded theory procedures and techniques. Thousand Oaks, CA, US: Sage Publications, Inc. (1990).

telephone service. The purpose of this Contact Centre is to provide a positive advice service for callers, to enable them to pursue their research and to point users in the right direction with some suggestion but not to carry out their research for them, which is a service carrying a charge. The Contact Centre is staffed by a mix of administrative workers and records specialists.

TNA receives 1,000 – 2,000 emails per week to the enquiries inbox. These are responded to by staff working in shifts in the Contact Centre with a total of 37,613 responses logged in 2012/13. In order to manage this volume, the Contact Centre staff make heavy use of a collection of email templates maintained on the Archives' intranet. For example, in 2012 roughly 4,800 enquirers (nearly one in six) received a form response personalised by a link to a page on the National Archives website deemed relevant by the member of staff responding.[94]

For this study, 150 emails received by the National Archives Contact Centre were examined. This comprised a sample from 31st May 2013 and another sample from January 15th and 16th 2014. In each case the Contact Centre were requested to send whatever had been received on a given date up to the number requested after filtering for spam messages. Requests for naturalisation records are handled via a separate web form containing structured fields and were therefore omitted from this study.

For the telephone channel, TNA collected a quantity of logs of telephone enquiries in 2008 as part of their own internal auditing procedures. 51 telephone enquiries were analysed from four samples taken from between 27th February and 10th April 2008.

In 2014, TNA staff were running four hours of live chat sessions four days a week. Transcripts from fifty live chat sessions were analysed with twenty-two livechat sessions from 20th February 2014, three additional sessions from 21st February 2014, twenty three session from 3rd April 2014 and two session from 4th April 2014. The transcripts were anonymised to remove the names of the both the archives interlocutor and the user.

TNA has been using Twitter since July 2009 and has over 115,000 followers @uknatarchives. Fifty-five Twitter conversations were collected, covering the period from 3rd January to 24th May 2014. These conversation were collected by selecting every tweet where TNA participated in a discussion with the expectation that these would be have the highest likelihood of being in response to questions

Rootschat is one of the world's largest freely accessible family history forums and the largest in the UK. It contains about 5.6m posts, has around a quarter of a million registered members and claims about a quarter of a million unique visitors a month.[95] The site comprises a large number of different forums. The sample examined here was generated by collecting the top two posts from the most recently edited threads on 12th January 2014 and 2015 from a random selection of twenty-

[94] Information provided by the National Archives.
[95] Rootschat, “Advertising with Rootschat”, http://www.rootschat.com/advertise/

five (of forty) different English county boards to represent a snapshot of enquiry activity on this site.

For each data sample, each unit of communication (e.g. 1 email, 1 livechat session, 1 tweet conversation, 1 telephone session, 1 forum post) may contain more than 1 enquiry. Hereafter, for purposes of clarity and comparison, each channel is discussed in terms of the number of enquiries present within them as opposed to these units of communication. Further, not all enquiries are considered to be information seeking enquiries. For example, a copy request is not indicative of an information seeking activity. Accordingly, when talking about information seeking enquiries we see an expected dip in numbers. The total number of enquiries encountered for each channel is presented

	Email	**Telephone**	**Livechat**	**Twitter**	**Rootschat**
Enquiries	153	51	63	57	71
Information Seeking Enquiries	115	36	56	21	64

Table 4.1. Final numbers of *enquiries* and *information seeking enquiries* identified in samples.

4.2.2 Content Analysis

A content analysis was carried out on all of the above data with two researchers coding samples of the data and checking for reliable application of the codes. There were three different ways that the data was coded in order to answer the research questions.

The data was first coded using a version of the codes of the Duff and Johnson study. This coding scheme allows us to characterize the types of enquiries that came in through each channel. The following are the codes used with a brief summary of what each means:

- **Administrative/Directional:** Enquiry asks about administrative information. Examples include costs of photocopying, opening hours or directions.
- **Fact-finding:** An enquiry requiring a specific factual answer.
- **Material-finding:** An enquiry about where to find sources about a particular person, place or event.
- **Specific form:** An enquiry about if a particular source type is available (e.g. census, military service records).
- **Known item:** An enquiry to know if a specific item known by the individual is held at the archive.
- **Service request:** An enquiry for a specific service provided by the organisation (e.g. copying).
- **Consultation:** An enquiry asking for advice that calls on the archivists' specific knowledge of resources. For example, whether a specific series of records contain material relevant to the researcher.

- **User education:** An enquiry where the user has “vague sense” of the record they want or wants to know “how to get started”. These may be statements that start with “how do I?”

In some instances, the enquiries did not fit into this classification scheme. These enquiries were subsequently labelled as *New*, with their contents analysed for possible common themes. In most cases these sets were quite small, but where there were patterns more information about these *New* types of enquiries are provided in the results.

While the Duff and Johnson coding scheme provides a view of the type of enquiry in relation to the services offered by the archive, it does not provide insight into what users submitting the enquiries are really trying to achieve and in particular gives no view of progress in situations where users were in the process of information seeking.

An appropriate methodology appeared to be to attempt to map the enquiries to a model of information seeking and in this way to examine the progress of enquirers. The Marchionini model was selected. Being a behavioural model (see 2.4.2) it has a strong focus on the tasks carried out by users. Andrea Johnson’s work (see 3.2.2) makes it appear the best fit for the domain and it has been validated by, among others, Joseph et al.[96]

Using this model, a second coding was devised that characterises the stage of information seeking the user was at when the enquiry was made. The following were the codes used from the Marchionini model:

- **Define Problem**: An enquiry where the user cannot (or does not) define clearly what they are looking for.
- **Choose a search system / select source**: An enquiry where the user seeks direction as to where to begin a search. What types of information/source are available?
- **Formulate query**: An enquiry where the user has a clear sense of what they are looking for but is unable to generate the query terms required to meet their information need.
- **Execute query:** An enquiry where the user requests search be undertaken for them as they are unable to unwilling to do so.
- **Examine results:** An enquiry where the user is trying to understand the result set. Users may seek clarification or reassurance of their own understanding of the results, or the relevance of the results.
- **Extract information:** An enquiry about specific records where the user is trying to make sense of the record. This could include technical problems with document access (e.g. failed downloads).

[96] Joseph, Pauline, Shelda Debowski, and Peter Goldschmidt. "Models of information search: a comparative analysis." *Information Research* 18, no. 1 (2013).

4.2.3 Grounded Theory

A grounded theory method was used to identify key categories, themes and patterns that were within the data. This method was undertaken without a pre-conceived hypothesis or theory regarding what the drivers were behind the enquiries. An open coding scheme, grounded in the data, identified key features of the enquiries and the attendant problems being experienced by users and solutions proposed by archivists.

4.3 Results

4.3.1 Content Analysis

The results of the application of the Duff and Johnson coding scheme are presented in Table 4.2. Further, in Figure 4.1 the percentages of each enquiry type are presented by channel alongside the results from Duff and Johnson for purposes of comparison.

Category	Email	Telephone	Livechat	Twitter	Rootschat
Service Requests	15	6	10	10	0
Administrative	8	10	2	8	0
Fact-finding	19	2	12	6	24
Material-finding	28	14	14	4	13
Specific form	18	4	1	3	8
Known item	42	9	16	2	13
User education	8	6	6	3	8
Consultation	7	0	1	0	3
New	8	0	1	21	2
Total	**153**	**51**	**63**	**57**	**71**

Table 4.2. Coding of enquiry types for each enquiry channel using the Duff and Johnson coding scheme

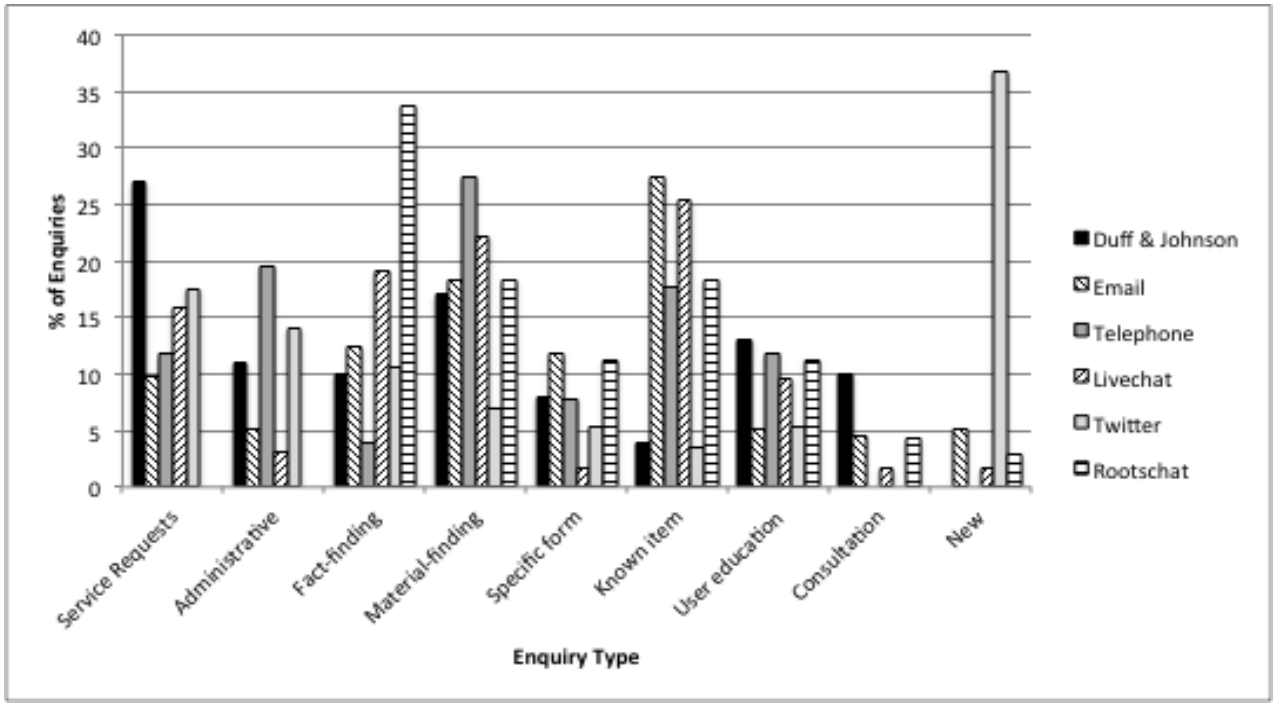

Figure 4.1. Percentage of enquiry types for each enquiry channel. Results from Duff and Johnson included for comparison.

Applying Duff and Johnson's coding to TNA emails produced some similarities between our data set and theirs. For example 10% of Duff and Johnson's enquiries were considered to be fact finding and the proportion is 12% in the TNA sample. 17% were deemed to be material finding and the proportion is 18% in the TNA sample. However some categories are very different. TNA received many fewer administrative and service enquiries and its largest block of enquiries were known item requests (27.5%). In Duff & Johnson's sample only 4% of requests were known item. It must be emphasised that it is not required that a user should be able to reel off a catalogue reference (COPY 1/400/254, say) in order to "know" an item. If they are accurately describing a discrete record that really exists (the will of Tobias Box, the log of HMS Brilliant) or should exist but perhaps has not survived, then it has been classed as a known item.

For the telephone-based enquiries, we see spikes of activity in the areas of administrative requests and material finding. In contrast to more modern channels, the telephone was the only channel in which material finding exceeded known item requests. It is possible these users are older than those using digital channels but this is pure speculation.

While the main intention of the livechat sessions is to support research enquiries, we see that they in fact cover a much broader range of topics. Their profile actually looks very similar to the email sample with, for instance, similar proportions of known item requests (27% to 25.4%). We do see an increased proportion of service requests and fact-finding requests. This is not unexpected in a real-time medium: people are looking for quick answers to immediate queries that they have.

Twitter appears qualitatively different from any of the other media, and in particular highlights the *New* category introduced into the Duff and Johnson coding. Whereas in the other channels it is generally possible to code within the Duff and Johnson coding scheme, Twitter deviated strongly from this trend. In other channels, there were very few outlying enquiries, but with Twitter nearly 37% of enquiries to which TNA responded could not be categorised in this more traditional model. Many of these messages proved to be observations not questions, corrections to other users misconceptions (referring to the archive as an authority) or consisted of positive comments about TNA. These exchanges seem very distant from Mary Jo Pugh's characterisation of archival interactions as "substantive, obligatory and continuing."[97]

Turning to the coding using the Marchionini model of information seeking, the results are presented in Table 4.3. Figure 4.2 shows the relative percentages of each code for each sample.

Information Seeking Stage	Email	Telephone	Livechat	Twitter	Rootschat
Define Problem	2	9	5	3	11
Choose a search system	55	18	20	10	32
Formulate query	19	1	9	1	13
Execute query	9	1	4	1	1
Examine results	11	4	13	4	7
Extract information	19	3	5	2	0
Total	**115**	**36**	**56**	**21**	**64**

Table 4.3. Coding of the information seeking stage for each enquiry channel using the Marchionini model based coding scheme.

[97] Mary Jo Pugh, op. cit.

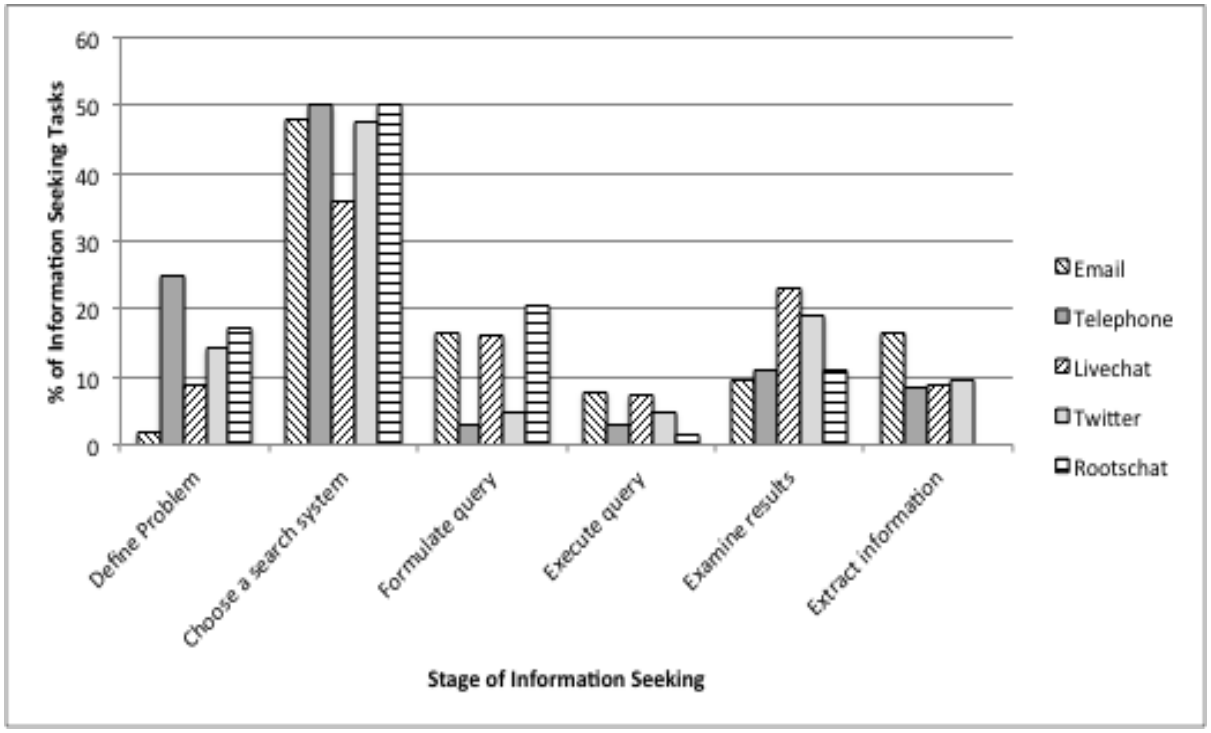

Figure 4.2. Percentage of enquiries in each information seeking stage for each channel.

Using the Marchionini coding, in the majority of channels almost half of enquiries seemed to relate to the choose a search system phase; that is to say they were primarily concerned with asking “where do I look” type questions. Even in the livechat channel, where it is at its lowest percentage, we see that over a third of the sample are in this stage. Due to the dominance of that stage of information seeking, it is perhaps unsurprising that later stages have much lower percentages. There are relatively small numbers of issues in the “examine results” and "execute query" phase. If most enquiries indicate people do not know where to look, then the chances of them every reaching the point where they can execute and examine their queries is much lower.

4.3.2 Grounded Theory

A variety of different features in the enquiries were coded in the open coding scheme. On the enquirers’ side, the codes encapsulated facts about why they conducted their queries, such as the users overall research question or reasons for their search. The actions users had taken in the system, such as previous searches tried, result sets checked, or sometimes reporting null results (e.g. “nothing comes up”) or expectations of content not present (e.g. “there must be thousands of other files”). We also observed instances where users did not appear to understand how the archive was organised, such as advising the archivist, incorrectly, that documents belonged somewhere else. The codes also captured misunderstandings about the archives’ services, such as requesting downloads of very large (sometimes non-digitised) volumes of material. We also captured any indicators of the overall

user experience or emotional content as described by the enquirer. This often included feelings of frustration and expressions of anxiety.

On the side of the archivist interlocutors, the solutions proffered were coded by the mechanism by which they were resolved and associated information. These mechanisms included redirection of enquirers to prepared research guides on a web page, or a specific part of the archive, or a different archival catalogue or even an external organisation. In some cases, in particular when things could not be resolved, referrals to other colleagues were also observed and coded. As the codes were developed, they were compared to each other for their content in an attempt to identify overall patterns of behaviour and subsequent impacts of that behaviour. These patterns of statements and enquiries were grouped together to form higher-level themes that were subsequently compared to the literature and each other to identify what the central theme(s) were within the data.

After conducting the grounded theory analysis, a number of key themes could indeed be identified alongside one formal theory about what was driving the enquiries.

4.3.3 Archivist as Google

The first theme that seemed to represent a recurrent issue in the data is the large number of the enquiries across the channels which were handled by directing the enquirer to existing online record guidance. For example, two different livechat enquirers are both looking for unit war diaries relating to battalions of the Durham Light Infantry:

> *"I cannot find anything on your website....do you keep these please?"* (Livechat Enquirer 14)

> *"...have been trying to locate it but without success"* (Livechat Enquirer 3)

The war diaries are available at the archive, and through the primary Discovery search portal but more importantly, information on how to find unit war diaries is prominently displayed in a number of different places on the National Archives website. As a result, the archivist is easily able to direct the enquirers to the correct guidance. But the purpose of that guidance is to support users in finding the documents themselves and to free up archivists to focus on more difficult information seeking problems.

This suggests that the abundance of search engines and their related systems (e.g. websites), guides, manuals and other help mechanisms constructed by the archive appear to not be sufficiently integrated to help users in their information seeking. While each of these different mechanisms for finding information are in themselves valuable, there is no mechanism to prompt users to go to particular pieces of help within the system. The absolute divide between searching the collections and searching guidance about those collections is immensely problematic.

Situations where the archivist was ‘acting as Google’ in directing people to known resources was present in all channels. This type of interaction has an impact on archive resources in two ways. First, it impacts their ability to undertake more complex data seeking tasks, where individuals have hard to find or hard to access materials. Secondly, the resources that people are being directed to have been invested in to address specifically these types of requests.

4.3.4 Ability to survey the terrain

When we look at the Marchionini model coding in combination with the grounded theory analysis, an interesting theme begins to emerge. The vast majority of enquiries that are coming from users fall squarely in the category of “where do I look?” This is a somewhat surprising result: given the availability of search technology we might assume that knowing where to look is a problem already solved. One possible interpretation is this is all idiosyncratic to the National Archives. However, when we look at Rootschat, we see similar types of enquiries being made. Fact-finding, material finding or known item searches, users are predominantly getting stuck knowing where to look. This indicates to us that this is not unique to TNA.

A further possible explanation is a general laziness of the user base in trying to find out where to search. We all know that it is easier to ask someone else to undertake a task than to put in the effort ourselves. Within the dataset, such seeming lack of effort by users does occasionally appear:

> *"I am new to family research, please advise if it is possible to search the records online from Australia and what is required to help me do this."* (Email Enquirer 60)

> *"How do I get info on my grandad in Ww1 please? I have a name, DoB? Is there an email or tel number."* (Twitter Enquirer 33)

However, only a very small number of the enquiries across the channels appear to display this lack of effort. So, while this idea has face validity, we would expect a lot more of this type of interaction if it were the key reason for the enquiries. Further, when looking at the user base this explanation seems unlikely. People who are investigating their family histories, one of the largest groups now using archives, are doing so because they want to, not because they have to do so, and it seems unlikely they would hand over the task without making reasonably strenuous efforts. Trained professional historians also seem unlikely to ‘outsource’ their research in this way.

Other users seem to have all the information they need to conduct a search, yet still seem uncertain even as to how to begin:

"Trying to trace my Grandfather …who served in the Sherwood Foresters. Notts & Derby.Regt. in the Great War. How do I use the web site to get any information on him?? Got his Reg no [xxxxx]." (Email Enquirer 42)

With a service number in hand, many relevant records are easily available to this user. Similarly, an email enquiry about passage to Australia:

"*My dad was in the Merchant Navy from 1948 - 1955. The only info. I have was that he was in Townsville, Australia in 1953 and he settled in South Africa in 1955.*

Is there any way of finding his record of service...His name was [xxxxx], DOB 30.11.1927." (Email Enquirer 45)

We must ask ourselves, why, with an abundance of search systems to choose from, are these users contacting someone for instructions in place of trying to search for themselves?

The answer to this question perhaps lies in situations where users have tried to find information, but have ended up back near the start of the Marchionini model. There were several enquiries throughout the channels that indicate that users are seeking reassurance that what they have found is correct:

"Hi, was wondering if you could help find my Grandad's naval records and medals on here, I found him on your website ADM [yyyyy], the name [xxxxx]. I find it very confusing. Can you help me?" (Livechat Enquirer 30)

Furthermore, other users indicate that they do not trust their own findings:

"I am searching for records of my father's s service in WW1, he received his RAC pilots licence, aged 16, in 1916 and his wings from the Royal Flying Corps later that year. Despite flying for over 600 hours there is no record of his war service with the RFC. I presume that this is because there are no RFC records for the period late 1916 - to early 1918, but would be grateful if you could confirm this?" (Email Enquirer 97)

"When I was young I was told that my Grandfather ([xxxxx]) fought in WW1 with the Irish Guards. I found this person and army number [yyyyy] in the Irish Guards the information I paid for has not helped me in my quest to find if this is in fact my Grandfather, it tells me the same name but not where he lived or other useful information which indeed would confirm if this is the same person am looking for." (Email Enquirer 89)

Consider the case of Email Enquirer 97 above. This user is in fact correct to be suspicious of their lack of search progress (the documents are available); but they have no mechanism to know that a path has already been laid out for them in the research guides provided by TNA. To return to Kirchhoff's metaphor of digitisation islands, the enquirer suspects he has passed his island by but there are no signposts to tell him if he is right or wrong - just as there were no signposts on any part of his journey.

Compare this to Email Enquirer 89 who is unable find information to confirm which individual is his grandfather. In this case, the information may be contained in a different part of the archive, but there is no way for the enquirer to know this is the case. If the enquirer understood the archive's structure, that might help their situation, but there are few mechanisms within existing search systems at TNA or at other archives that help teach users about the structure of archives as part of their ongoing search. This leads to frustration and uncertainty on the part of the searcher. They are on one digitised island, and cannot even see the other islands in the distance they need to reach.

In the case of Email Enquirer 45, we have an even worse situation in that the individual finds the overabundance of choice so daunting that they are unable to even know where to begin their journey even though they appear to have all the information needed to successfully navigate to the end. In all of these situations, the archival information systems have removed the archivist from the traditional assistive role they play in the physical reading room environment. This *disintermediation*[98] means that where systems fail to assist users in understanding the next step, the user must fall back on contacting the archivists through the channels available to them, even if it means trying to determine where to start.

4.3.5 Seeking reassurance

There are a large number of enquiries where users indicate they have uncertainty, doubts or anxieties, often caused by a lack confidence either in what they have found or of what to do next. They then appear to seek reassurance from the archivist.

The disintermediation between user and archivist means that there is no opportunity for the user to seek reassurance that they have done the right thing and the archive's systems, primarily focused on finding materials, are not designed to fulfil this role. This, in turn, prompts users to try to engage with archivists through the various remote channels. At times, this is in regards to records, as seen in previous examples. In other cases, people seek to confirm facts they suspect but do not know:

> *"I am aware that some libraries and archives require letters of recommendation to access certain resources, and was wondering if the National Archives follows any*

[98] Butterworth, R.: The Accessing our Archival and Manuscript Heritage project and the development of the "Helpers" website. Middlesex University, Interaction Design Centre (2006).

similar practices….My time in London is limited, and (as I'm sure you'll understand) I am anxious to have everything necessary (including letters) before I arrive."
(Email Enquirer 6)

Interestingly, this theme fits with prior research. We discussed in Chapter 1 how Duff and Johnson's work with mid-career historians exposed the stressful nature of negotiating an unfamiliar archival collection.[99] They referred to the "fear" they felt at having missed something in the course of their work. We can discern these same fears within this data.

Considering all of these themes, we can draw out a formal theory of what drives enquiries to the archives: the disintermediation of the archivist prevents ready resolution of users' uncertainties regarding their search progress. To be clear, this is not to say that these uncertainties did not exist in some halcyon day before technology was introduced to the process but help was unquestionably at hand when archival reference required a visit to the reading room. What support current systems can provide does not appear, from this data and from the sheer volume of enquiries generally, to be sufficient.

4.4 Discussion

From the results of content analysis using the Duff and Johnson coding, we see that there is definite variability in how different channels are used for enquiries. This indicates, at least in the case of TNA, there are distinct benefits to running these different channels. Users are opportunistically using the channels in different ways, and sometimes in ways that would not be predicted.

Looking at the content of the messages, the channels shape the enquiries in some way: either by drawing in users with certain forms of problem or by encouraging the framing of enquiries in certain ways. For example, livechat users can explore problems in a more naturalistic, conversational way than the Twitter users but these users lack the more casual, unplanned and spontaneous opportunities for interaction afforded by social networking.

Kristen Martin predicted that there would be shifts in the types of questions that would be asked over time due to the availability of online archive tools, and this does seem to have happened, at least when comparing our data to the 11 archives studied by Duff and Johnson. We do indeed see that the proportion of known item enquiries appears to have increased substantially, with users providing much more specific enquiries. This increase appears in email, livechat and telephone. Twitter users appear concerned with other topics than individual collections items.

In one sense this is good news for archives because it means they are in a better position to accommodate user needs than they have ever been. They are receiving, across a spectrum of channels, large numbers of detailed and specific

[99] W. M. Duff and C. A. Johnson, "Accidentally Found on Purpose: Information-Seeking Behavior of Historians in Archives.," Library Quarterly, vol. 72, no. 4, pp. 472–96, Jan. 2002, p.482

enquiries, sufficient to identify the most significant issues faced by the main body of their users and attempt to resolve them. The bad news is that plotting these enquiries against the Marchionini model, tells us that users need more support within the archival interactive systems to improve their ability to choose a search system and navigate between digitised islands of archive data. Knowing ‘where to look’ remains a major problem for users, and they fall back on human support to solve this problem instead being able to rely on the system to aid them in being more effective or efficient in their information seeking tasks. The replacement of the archivist mediator with the machine leads to equivalent diversion of enquiries: digital users take to digital channels to get questions answered they would once have been able to ask in person. Is this a problem? The questions, after all, get answered. But this does not seem to fulfil the promise of information systems. It does not seem unreasonable to expect catalogues to be able to provide near-equivalent support to archivists. The volume and character of enquiries does not suggest this is the case.

4.5 Limitations

This study has a number of limitations. In all channels except livechat (where separation would make no sense) only the user’s side of the correspondence was considered – and only their initial statement of the problem. This allowed for a large number of user problems to be examined but it inevitably also means that the archivists elicitation, actions and the richness of user’s further explanations of their problem and indeed whether they regarded their problem as being resolved was not captured. Some of this will be considered in following chapters but it is still unfortunate that insight was sacrificed for volume here.

At the same time, even after examining hundreds of items of correspondence I am not convinced saturation was achieved in terms of the emergent coding. Duff and Johnson and Marchionini’s frameworks performed well in allowing enquiries to be categorised but the hugely varied nature of archival correspondence meant that I was continuing to find small nuggets of interest in new items, despite boosting some of the samples. Ultimately looking at a wide variety of channels prevented any one channel from being completed coded to exhaustion. At the same time considerable repetition was being achieved so although I suspect that more coconuts may conceivably have been on the tree most were displaced.

A further limitation of the study is the date range of some of the collected data. The majority of data collected comes from the first half of 2014, with some preliminary email data from 2013 and some supplementary Rootschat data from January 2015. However the telephone data made available by the National Archives was from 2008. The Archives’ were generous in their provision of data for this study but it was not possible for this researcher to listen or record telephone calls directly, instead working from transcripts prepared by the Archives for a previous project. This was the best available data for analysis but it does not meet the same standard as the other data collected.

It may also be argued that a study looking principally at electronic channels (telephony is arguably an analogue medium) does not allow us to make claims about non-electronic channels. That is true as far as it goes but the fact is that for the majority of national and municipal archives today there are really no non-electronic channels. Digital cataloguing and ordering permeates modern reading rooms to such an extent that the only time readers are briefly away from archival information systems is when they are taking photographs of documents with their digital cameras. The question is the support they have to work with these systems, not some sort of control condition in which technology is available in one setting and not the other. Researchers are on their own until they speak to someone – walking into a reading room does not automatically provide them with answers.

4.6 Conclusion

Kirchhoff et al. advocate creating portals linking digitisation islands together to solve this pervasive problem of users not knowing where to go.[100] TNA now provides a form of portal, or federated search, through its Discovery search system that indexes archives across the UK and a number of other formally separate databases, as we discussed in the previous chapter. But Discovery remains only one of a cluster of databases with which the historian or genealogist is likely to need to engage and in the data collected from TNA users it is clear that they still have difficulty knowing where to look. The lesson for online archives is that portals in and of themselves will not necessarily improve the users' ability to know where to start or where to go next in their search activities. In fact, creating such portals could conceivably exacerbate the problem further by offering so much choice in one place as well as adding another 'island'. This is a variation on the well known (in Computer Science and many other disciplines) "competing standards" problem – you had fourteen and now you have another.[101] As digitisation efforts continue (even accelerate) and further archival collections appear online, this profusion of options will only worsen for users and they seem confused enough as it is.

These results indicate that it is inadequate for support to exist somewhere separate from search systems; it must be proximal to and integrated within the system supporting the users' current task(s). This support might take the form of contextual help based on recognising broad types of queries ("looking for a person?"). It might make use of dynamic term suggestion, more thoroughly scoped search, result clustering (beyond the faceted browsing already available), wizards or relevance feedback. However, what these results do not provide is the means by which to choose which of these design interventions, if any, are appropriate in specific contexts of use. We will return to this problem of weighing up the impact of possible design interventions in chapter 7.

[100] Kirchhoff et al, op. cit.
[101] Randall Munroe, 'How standards proliferate', XKCD, https://xkcd.com/927/

For now, we have seen very clearly the confusion and uncertainty which dogs users in their attempts to conduct research relying solely on the search systems and help documentation online without an archivist to assist them. Many users feel unable to act amidst an abundance of choice; lost in a sea of islands of digitised data not knowing where their journey began, where they are now, or whether they have reached their destination. This lack of awareness leads to uncertainty in the users, which manifests in them reaching out to real world archivists for direction and reassurance when they have found something, that they have proceeded correctly. This is the general information environment in which users find themselves. It is not that any one system is causing this uncertainty. What individual systems, such as Discovery, are instead failing to do is offer any signposts or life raft for the adrift user at the point of search. It could be argued that all the correspondence we have seen shows that this is not really a problem because the archivist remains available virtually to answer the enquiries that they would once have addressed in person – or indeed any other. This is surely to offer a free pass to search systems. They could offer more support and they should. Even where support is available, as we saw in the previous chapter, it is outside search systems and in many cases a poor match to user's information needs.

In the next chapter, we will examine the in-person interactions between archivists and researchers in the reading room and see what similarities and differences can be observed. This will indicate what support human interlocutors provide to users and allow us to understand some of the expert strategies employed by professional archivists.

Chapter 5: “The question everybody wants to know”

"He therefore that shall think immediately to fly and to transport himself over these Walls, and set himself in the very middle and inmost Recess of it, and thence think himself able to show all the Meanders and Turnings, and passages back again to get out, will find himself hugely mistaken and puzled [sic] *in finding his way out again."*

- Robert Hooke, ‘The Posthumous Works’ (1680).[1]

5.1 Introduction

Perceiving a gap between researchers’ enthusiasm and their ability, the Shelbourne Hotel in Dublin offers guests, for a price, the services of a genealogy butler.[2] But in general, few researchers can afford such bespoke services. They must make use of the tools which are available. In the previous chapter we discussed the disintermediation of archival interactions. This is not the removal of any mediator but more precisely the exchange of an archivist mediator for a digital system. In order to understand what this exchange might mean it seems important to understand what mediated interactions between researchers and records are like. That is to say to understand what happens in reference interviews; the conversations between archivists and researchers. Despite explicit calls for such studies by Elsie Freeman and Mary Jo Pugh as early as 1982,[3] it is not clear that previous studies have examined these interactions in detail and existing systems do not, therefore, appear to be based on them. We will compare these behaviours to those observed in other communication channels and begin to consider what a digital service would have to provide in order to more closely resemble the interactions possible within the reading room.

The purpose of this study is to examine the expert strategies used by archivists to help researchers in order to understand some of the differences between professional and amateur researchers, consider whether of their strategies are appropriate for integration into digital systems and finally, considering the other side of the exchange, to analyse the problems being encountered by the researchers in a further effort to understand why they occur. How does sickness break out and how does the skilled physician cure the patient?

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[1] Stephen Inwood, The Man Who Knew Too Much: The Strange and Inventive Life of Robert Hooke, 1635 - 1703 (Pan, 2003), p.309

[2] The Shelbourne Hotel, “Genealogy Butler Service at The Shelbourne Hotel,” accessed September 30, 2017, http://www.shelbournedining.ie/genealogy-butler.

[3] Pugh, Mary Jo. "The illusion of omniscience: subject access and the reference archivist." *The American Archivist* 45, no. 1 (1982): 33-44.

5.2 The Reference Interview

We discussed in chapter 3, the comparative lack of focus on users in archives when compared with libraries. This is nowhere more obvious than in the sphere of reference. As early as 1876, Samuel Green in the United States was able to write in an entirely heart-warming way about the many and varied users of library reference services (the “artisan…school-girl…businessman…small boy”) with their different enquiries (patents, birds eggs, lightning rods) and the different sources that the skilled reference librarian would reach for in order to assist them.[4] Green’s work is entirely without parallel in the world of archives. Over the following century and a half librarians’ interest in reference interactions has only deepened. In America in the 1880s larger libraries began to offer formal training in research assistance. By the 1950s it was possible to write whole histories of library reference services.[5] Robert Taylor’s work on question negotiation in the 1960s contains extensive transcripts of reference conversations between readers and librarians and models of these patrons information seeking.[6] In the early 1980s, an article by William Miller called 'What's wrong with reference' was the trigger for libraries to enter a period of “rethinking reference”, in the words of Linda Smith “that included alternative staffing models, experimentation with newer technologies, and a focus on patron-centred service”.[7] As we saw in Chapter 3, the 1980s saw archivists raising some similar questions – but these changes were not made. The result is that a very great deal is known about reference interactions in libraries and many research papers and helpful books on the topic are available. The same is not true of archives. This begs two related questions: can we simply bring the results of these studies into archives? How similar do reference interactions in libraries and archives seem to be?

Ironically, of course, the evidence to answer this question is not readily available since few studies of archival reference have been conducted. There are two principal studies of reference enquiries in archives. Duff and Fox's 2006 study analyses 13 interviews with archivists from two US institutions talking about their reference work.[8] Its counterpart is a 2013 study also by Wendy Duff and her collaborators, studying interviews by the researchers on the other side of the desk.[9] In addition in 2006, Ciaran Trace carried out an ethnographic analysis of archival reference work but unfortunately this study relates to only one researcher at a small university collection with no digital catalogue and so is not readily generalisable. No investigator that I am aware of has published analysis of archival reference interviews directly from observation and transcript. What do these studies (and non-fieldwork based work from archivists such as Mary Jo Pugh) have to tell us about the differences between library and archival reference interviews?

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[4] Green, Samuel S and David Pena. "Personal relations between librarians and readers." *Journal of Access Services 4*, no.1-2 (1876/2007), p.159

[5] Still, Julie M. “A history of reference” in Anderson, Katie Elson, and Vibiana Bowman Cvetkovic. *Reinventing Reference: How Libraries Deliver Value in the Age of Google*. American Library Association, 2014, p.9

[6] Taylor, Robert S. *Question-Negotiation and information seeking in libraries.* No. 3. Lehigh University, Bethlehem PA Centre for Information Science, 1967.

[7] Smith, Linda, ‘Reference’ in Bates, M. (Ed.), Maack, M. (Ed.). (2009). *Encyclopedia of Library and Information Sciences*, 3rd edition. Boca Raton: CRC Press. vol. 6, p.4486

[8] Duff, Wendy, and Allyson Fox. "'You're a guide rather than an expert': Archival reference from an archivist's point of view." *Journal of the Society of Archivists* 27, no. 2 (2006): 129-153.

[9] Duff, Wendy, Elizabeth Yakel, and Helen Tibbo. "Archival reference knowledge." *The American Archivist* 76, no. 1 (2013): 68-94.

Based on a 1986 study carried out by NARA in the United States to design an expert system for information retrieval, Mary Jo Pugh says that reference interaction or question negotiation consists of three parts: query abstraction, resolution and refinement.[10]

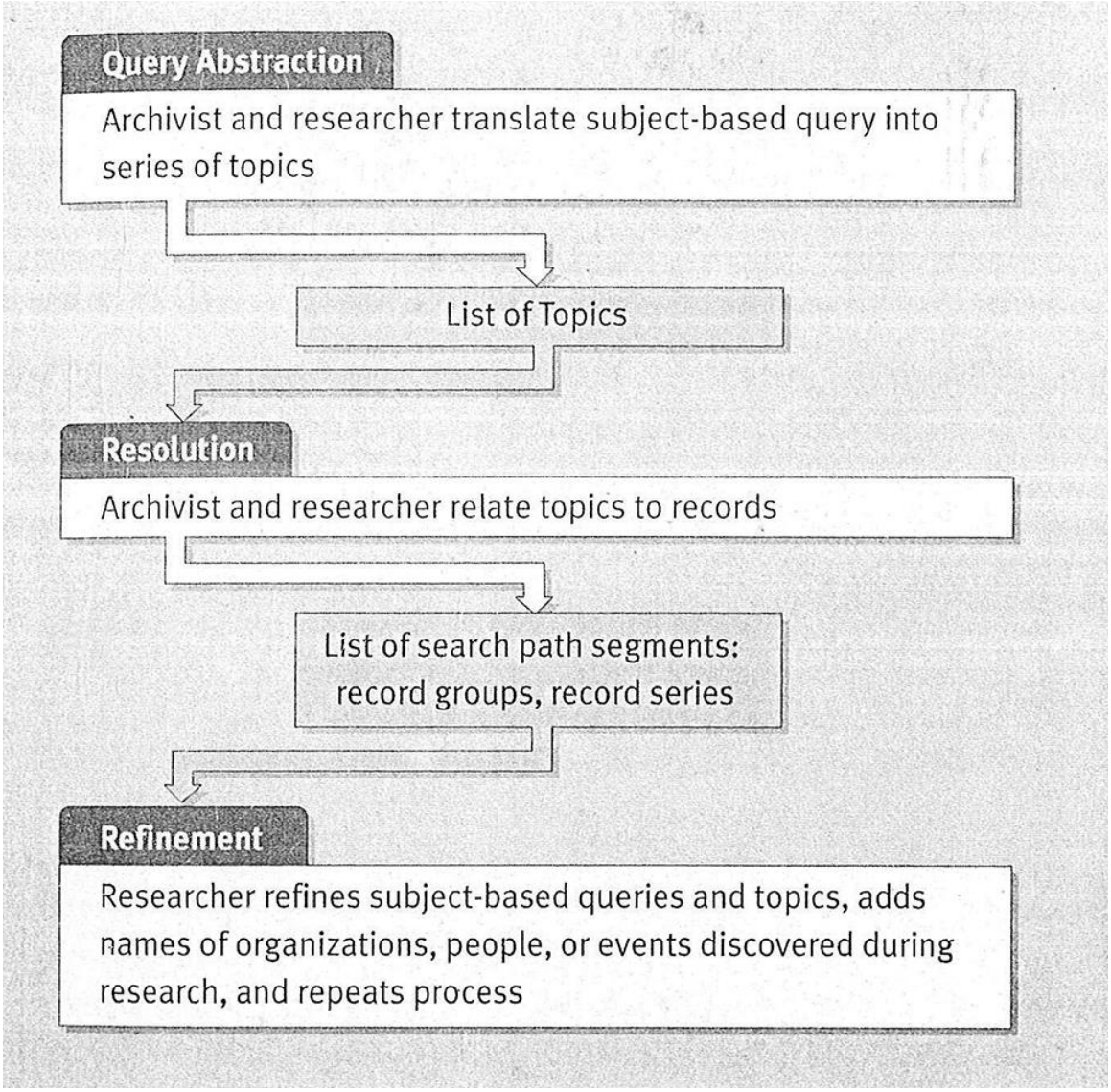

Figure 5.1: Mary Jo Pugh's model of question negotiation in archives

This is about transforming questions into groups of records that the researcher can turn to. Compare this model with the advice of Susan Knoer to reference librarians: "the correct answer is the one that's most useful for this patron…you are a personal shopper for information…your job is to match the patron with what he needs in the form he needs or wants…You're the matchmaker...give him his options and let him decide".[11] This seems a considerably more flexible approach in which a reader's question can be tackled in many different ways. Knoer continues: "Now that you've found the answer...ask the patron if you've answered his question and answered it

[10] Pugh, Mary Jo. *Providing reference services for archives and manuscripts*, Society of American Archivists (1992), p.112

[11] Knoer, Susan. *The reference interview today*. ABC-CLIO, 2011, p.10-11

completely".[12] Clearly both librarians and archivists are sometimes in the business of recommending information sources and not answering questions. But what we know about both archives and archivists suggests that differences between their practice are significant and real. The homogenous nature of libraries makes general knowledge (of fiction or reference) useful. In archives many questions don't have answers or the answers involve breaking bad news that records have been destroyed. But how significant these differences really are in practice is still very unclear. "Most information about the dynamics of reference interaction in archives is anecdotal", notes Mary Jo Pugh.[13] Her best guess at the differences between the interactions is "that reference encounters in libraries are usually short and voluntary, each devoted to a single question. In contrast, reference transactions in archives are more likely to be substantive, obligatory and continuing."[14] Duff and Fox pick up this theme, quoting one of their participants as saying "archival reference is not like library research, it takes time. You might look for weeks and not find anything."[15] This suggests that part of the archivist's role is to manage expectations. Only further gathering of evidence from archives will permit an assessment of whether the issues of time, level of challenge and expectation really are the most salient differences between these two forms of reference interaction – and indeed whether these constitute differences significant enough to cause us to set aside some or all of the library literature. Writing on active listening, on question negotiation and many other topics seems surely of use to archives. The purpose of this study is not to consciously contrast the behaviours of archivists and librarians but I hope that the evidence presented will make it easier for such contrasts to be made.

5.3 Methodology

In order to understand the components and character of interactions between archivists and the researchers using their collections it was decided to record and analyse a set of such interactions. It was hoped in this way to identify the most important behaviours exhibited by the archivists and also gain further insight into researcher behaviours. Researchers approach archivists in the reading room in order to resolve a problem they have encountered. How do the archivists go about solving them?

5.3.1 Data collection

At the time this study was conducted there were four kinds of reference desk at the National Archives: a desk in the large document and map reading room (LDMRR) with a particular focus on academic research and medieval and early modern enquries, a 'start here' desk, aimed at briefly directing brand new researchers and the blue and red desks in the main reading room aimed at modern researchers and family historians respectively. With the permission of the National Archives, over the

[12] Ibid, p.12

[13] Pugh, Mary Jo. *Providing reference services for archives and manuscripts*, Society of American Archivists (1992), p.120

[14] Ibid

[15] Duff and Fox, op. cit., p.144

course of two weeks (15th – 30th July 2014) six archivists were recorded during interactions with 56 readers on the blue and red desks in the first floor reading room at the National Archives at Kew. This reading room and these two enquiry desks are focused on genealogical (red) and modern records (blue).[16] Recording was carried out in a series of two hour shifts at different times and days of the week across both desks in order to ensure a broadly representative snapshot of enquiries. Some of the sessions contained a very small number of enquiries, some took place at much busier times. In the reading rooms interactions ranged from a few seconds ('where are the microfilm printers?') to approaching 20 minutes in length. Time spent is not a reasonable metric for the way in which an enquiry is handled and it will not be significantly discussed here except to note that archivists' time is limited and so efficient treatment of enquiries is clearly desirable.

Recording was carried out by the investigator using a smartphone. The investigator wore a badge indicating their status as an observer and prominent signage informed researchers that interactions at a specific enquiry point would be recorded for research purposes, giving them the opportunity to speak to an alternative member of staff. At the conclusion of the interactions, researchers were offered the opportunity to have records of the exchange deleted. No researchers asked that their exchanges not be retained. In this way a balance was sought between permitting interactions to commence in a natural and unforced way and ensuring researchers were comfortable with and informed about participation. The investigator took brief written notes of more physical or contextual aspects of the interaction while recording was in progress and noted the outcome of the consultation if it was unclear from the recording.

5.3.2 Method of analysis

Exchanges were transcribed for content analysis in MAXQDA. The 56 interactions were found to consist of 63 enquiries. As in the previous study, these enquiries were first encoded according to Duff and Johnson's enquiry types.[17] In this case all of the enquiries could be assigned to categories within Duff and Johnson's framework but the new/unknown category has been retained in result presentation for the purposes of comparison. The enquiries were then assigned to a phase within Marchionini's model of information seeking.[18] Because some of the enquiries were very brief and lacking context (for example asking directions to a room within the building) they were not assigned to a phase. Discounting such enquiries left 44 available for this second form of analysis.

[16] The latter considered to be post-1782 at the National Archives.
[17] Duff, W., Johnson, C.: A Virtual Expression of Need: An Analysis of E-mail Reference Questions. American Archivist. 64, 43–60 (2001).
[18] Marchionini, G.: Information Seeking in Electronic Environments. Cambridge University Press (1997).

A grounded theory analysis of the entries was then carried out.[19] The purpose of this analysis was to identify major qualitative themes in the transcripts and synthesise these into a view of the archivist's approach to reference interviews and the strategies they employ to handle reader enquiries.

5.4 Results

The following results were obtained from the content and grounded theory analyses.

5.4.1 Content analysis

The results of the application of the Duff and Johnson coding scheme are presented in Table 1. These are then shown in Figure 1 as percentages alongside the channels examined in the previous chapter.

Category	**Enquiries (n)**
Service Requests	16
Administrative	3
Fact-finding	6
Material-finding	7
Specific form	11
Known item	14
User education	1
Consultation	5
New/Unknown	0
Total	63

Table 5.1: Coding of enquiry types using the Duff and Johnson coding scheme

[19] Strauss, A, Corbin, J.: Basics of qualitative research: Grounded theory procedures and techniques. Thousand Oaks, CA, US: Sage Publications, Inc. (1990).

The reading room data appears here as the first of the seven channels and is presented in royal blue:

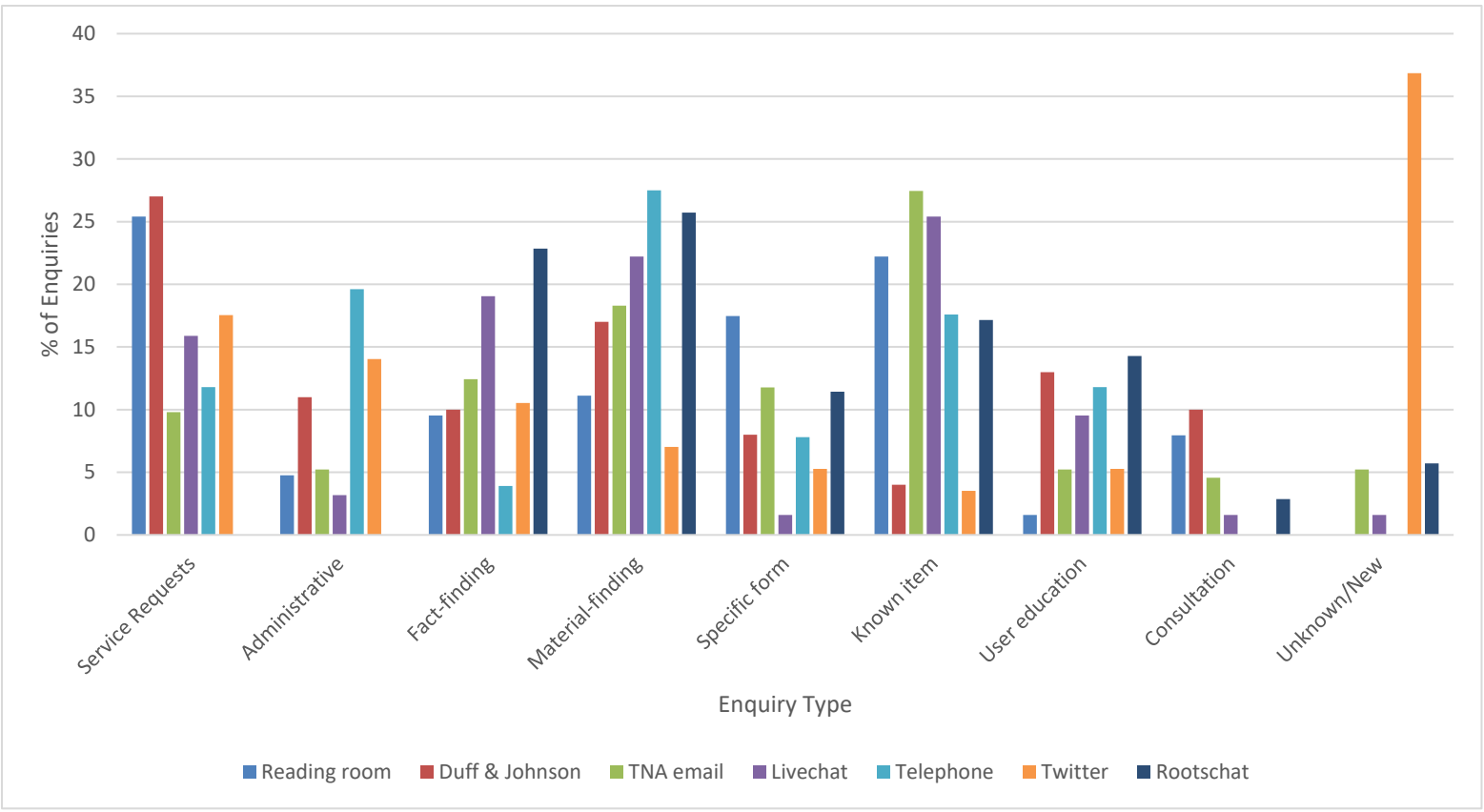

Figure 5.1: Enquiries assigned to Duff and Johnson's types

We see that service requests are the most common kinds of enquiries, followed by known item queries. The reading room is a complex environment containing PCs, microfilm readers, printers and card machines to enable use of them and various other technologies of mixed vintage so the significant proportion of service requests (only a little lower than that reported by Duff and Johnson) should not entirely surprise us. Known item enquiries appear in similar numbers to other channels we have looked at and significantly more than in Duff and Johnson adding further weight to the contention in the previous chapter that user enquiries have substantively altered in favour of known items as a result of digitisation. Specific form enquiries ("An enquiry about if a particular source type is available (e.g. census, military service records") are more prevalent in this channel than they are in any other. This may be because of the proximate availability not only of the originals of these documents but significant written guidance about them. In person visitors are perhaps also more likely to have encountered these document types before.

Moving again to the coding based on the Marchionini model of information seeking, the results are presented in Table 2. Fig. 2 again shows the relative percentages in each of the phases alongside the other five channels.

Model Phase	Enquiries (n)
Define Problem	1
Choose a search system	20
Formulate query	4
Execute query	3
Examine results	4
Extract information	12
Total	44

Table 5.2: Coding of the information seeking stage for each enquiry using the Marchionini model based coding scheme

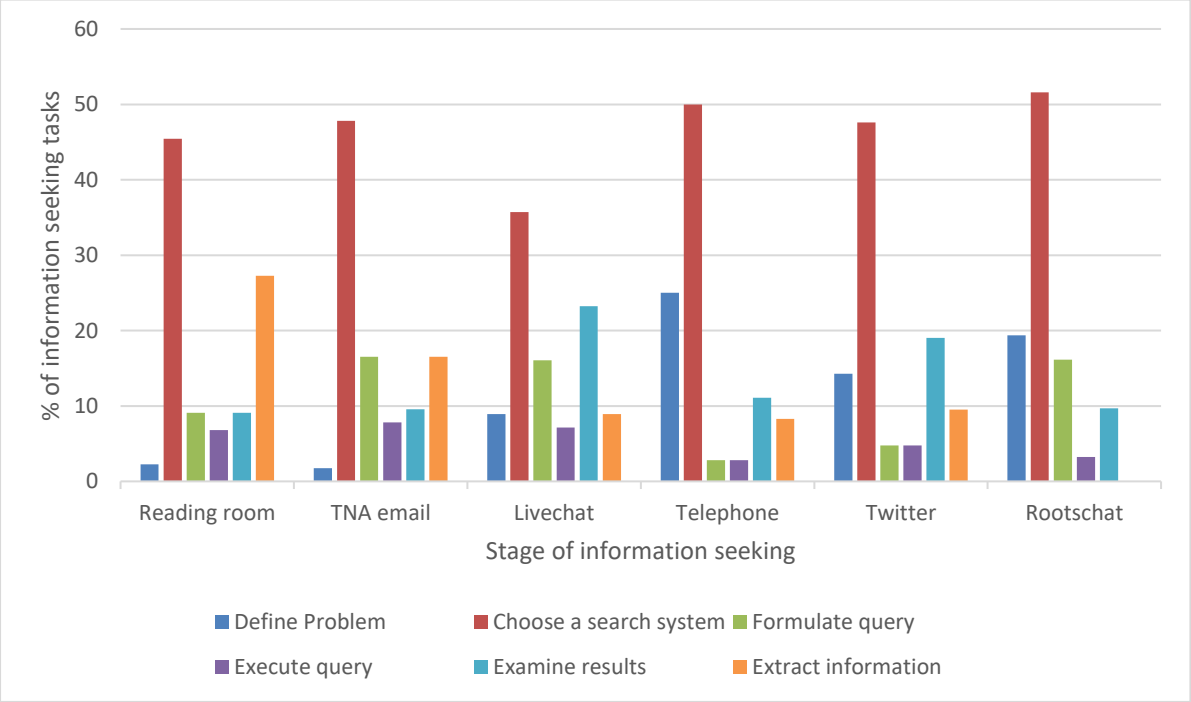

Figure 5.2: Percentage of enquiries in Marchionini's information seeking stages for each channel

Once again we see a high proportion of information seeking enquiries, more than 45%, falling into the 'choose a search system' phase, suggesting researchers here have no better grasp of where to look than those using other channels. This might be considered to be a surprising finding but just as with the Livechat channel, although archivists are present, the main resources available for users to locate information in the first instance remain a digital catalogue and information provided online. They do not have the benefit of a mediator until they initiate a discussion with the archivist. There are also a high proportion of 'extract information' type enquiries in the reading

room. This is because of the physical proximity of unfamiliar documents, leading readers to ask the available experts 'what does this mean?'

It might seem curious to examine this data alongside the other channels on the basis that the focus on the previous chapter was on disintermediation and here the archival mediator is present. However this is to misunderstand the nature of the evidence. The enquiries represent the user's state of knowledge at the point of interaction. Through an encounter with a mediator-archivist, researchers attempt to progress their enquiry but at the point of enquiry statement they have only used the same digital services as the users represented in the other channels. They are different in the sense that they have entered the building and they can formulate enquiries based on the expertise and documents in front of them but nevertheless they are in many ways facing the same constraints (catalogue systems, research guides) as researchers working via email, until they are offered assistance by the expert.

5.4.2 Analysis of archivists' assistive strategies

The transcripts of the conversations were examined specifically in order to try and understand the key strategies employed by archivists to assist readers. By the iterative addition and refining of coding it was determined that seven principal kinds of behaviours seemed to occur frequently: screensharing, direction to research guidance, redirection, bookwork, query formulation advice, elicitation and reader appraisal. In this analysis comparisons were made to the data collected from the other channels of communication with the Archives, examined in the previous chapter.

Screensharing

A key interaction in the reading rooms sees archivists turning their monitors at 90 degrees ("I'll just tilt the screen"[20]) so the VDU can be seen by both themselves and by the enquirer. The archivist then provides a walkthrough of the user's journey through the site:

> *Archivist: So, from the homepage, [she demonstrates] if you click on 'looking for a person' – a direct link on the screen – then at the top, there's 'British army soldiers after 1913'. This describes all the records that survive and there's a link to Ancestry [a third party website].*[21]

In the archived Livechats from the previous chapter, this intermediate 'looking for a person' page, for example, was never mentioned because of a preference for direct linking exhibited by the archivists using this medium. This might seem efficient but it denies the user the chance to see a journey they can repeat and a chance to look over the range of research guidance which exists.

[20] To Reader #19
[21] To Reader #17

Archivists tilted their screens in response to about one in six enquiries but in many more cases (across all channels) they ran searches or otherwise attempted to explore records information in order to assist users. The interaction required to resolve the enquirer's information need is in this way modelled for them to see, in the hope it can be reproduced later.

Direction to research guidance

A research guide is a particular form of online guidance produced by the National Archives (see 3.4.1). It describes particular suggested research avenues and often includes in-line search boxes which allow delineated portions of the Archives' catalogue to be searched in order to ensure that the most relevant results are returned to users. In almost exactly one in four reading room enquiries observed, Archivists recommended research guides:

> *Archivist: We've got a number of different guides about migrants – you know, migrants in and migrants out, naturalisations, registers of aliens, that sort of thing. If you look at those guides they will point you in the right direction.*[22]

In Livechats analysed this rises to almost 45%. In 2012, Archivists accessed the email template providing a link to a research guide 4,790 times. All of this represents a very large number of referrals to these key pieces of digital content.

Archivists match a user's information need as expressed in their enquiry, with the guide (there are over 350 of them) which will help them resolve it. As can be seen from the above figures, it is unclear what proportion of enquiries across the board can be resolved in this way – and by resolved is meant, permitting the reader to move to another stage in their research – but it is clearly a significant proportion. Shifting these readers to making use of online guidance frees the archivists to give their time to enquiries too 'bespoke' to be generalised in such resources and which benefit from more specialised expertise.

However, when viewed in isolation online, these guides lack the detailed commentary provided on them by archivists in the reading room:

> *Archivist: Now if you click on that link, it gives you an overview of the sort of records that we might have. And the question everybody wants to know: what have you got that's online. And the records, they're actually on Ancestry. If you click on that link, it takes you through to Ancestry, to the right page where you can search by name. Now, with someone who's got a common name, obviously, you're always going to have problems...* [23]

[22] To Reader #42
[23] To Reader #34

But archivists also use the research guides to model interactions, so even if they are explicitly told by readers that they have already consulted the relevant guide, they may still use it as a way of monitoring the progress of their search:

> *Reader #21: We've done all that.*
>
> *Archivist: Good. I want to just show you this because I think it always helps to focus the mind, looking at these. Because it basically tells you the research strategy.*

In this case the archivist then sequentially investigated the different groups of records highlighted in the guide until the most likely series of records was located.

Redirection

Conversely, the National Archives – either as a website or as a collection – is not the best place to resolve every enquiry that it receives. Furthermore, a very considerable quantity of National Archives content is hosted on external websites and readers and archivists alike must make use of these. Sites recommended in the course of this study included Ancestry, Findmypast, FreeBMD, Scotland's People and other parts of government:

> *Archivist: Military service records from the 1920s onwards are still held by the Ministry of Defence. Check the Veterans UK website to find out how to request access to these records.*[24]

Users are happy to be redirected in this way and indeed in email correspondence often explicitly reference redirection saying things like "I hope this is in your remit or you can point me in the right direction".[25] However they may struggle to manage information from the range of sites they must use. We will examine this later.

What should be minimised is referring enquiries to other parts of the organisation, because of the obvious inefficiencies this creates. A certain amount of this occurs through every channel: in the reading room, it was observed that users at the blue (modern) desk were recommended to speak to the red (genealogical) desk and vice versa:

> *Archivist: "Well, I reckon you would be well advised to probably go to what we call the red desk over there."*[26]

In the data from the previous chapter we can see that non-archival queries (regarding say record copying, to whose systems the archivists have no access) in the livechat are redirected. Some email enquiries are dealt with by more junior staff, others are escalated to more experienced records specialists.

[24] Livechat #43
[25] Email Enquirer #56
[26] To Reader #19

Bookwork

In the reading room, archivists often consult and frequently recommend books. In the 55 discussions with users analysed, archivists actively recommended books on seven occasions:

> *Archivist: What you could do is borrow this book from me because it's got a chapter on 'Records of Seamen before 1835'…but notice the rather dismal first sentence.*[27]

They also often openly consulted books or even read directly from them to assist users. Returning to the data from Chapter 4, in 50 livechats examined only once was a book recommended to a user. To some extent these differences are about proximity: archivists in the reading rooms sit in front of a large shelf full of relevant books, archivists working on Livechat prefer Google and links. This is entirely understandable. But the reading room archivists are recommending books not merely because they are nearby but because (as when they recommend websites) they consider they are the right source to resolve the reader's enquiry.

It should be noted that aspects of bookwork, redirection and direction to research guidance would appear to be methods used by the archivist to solve 'where do I look' type problems.

Query formulation advice

It is common for archivists to provide guidance on query formulation. Users are surprisingly reluctant to make use of query formulation tactics, even if they have some reason to suspect they might be useful:

> *Archivist: What was his name by the way?*
>
> *Reader #21: Wily, Henry William.*
>
> *Archivist: Yeah. Did you try it without the middle name just in case?*
>
> *Reader #21: No.*
>
> *Archivist: It's always worth- you know, sometimes less is more.*
>
> *Reader #21: And sometimes they spelled the name incorrectly as well.*
>
> *Archivist: Right. Did you try those kind of spelling variants?*
>
> *Reader #21: No.*

[27] To Reader #24

We see in this case that the user, in spite of having encountered and noted name variants in his research, has not considered trying these in his search queries. Expert researchers are able to widen their pool of search terms as their work progresses – the sight of new documents produces new terms. Here we see this user has not made use of their new knowledge to undertake new queries.

In other cases, users do attempt to use variants but do not think to widen their queries by simplifying them:

> *Archivist: Have you tried variant spellings and things like that?*
>
> *Reader # 11: Yeah. Because we use Ancestry.co.uk at home and I've tried all sorts of different spellings.*
>
> *…*
>
> *Archivist: Have you tried- I mean, all I can really suggest is you sort of try every variation. You try L Wisbey or E Wisbey.*
>
> *Reader #11: Oh, just try- put the 'e' without the name?*
>
> *Archivist: Often it's best to get lots and lots of results and sort of sift through them.*

Here we see the archivist promoting recall over precision. This ability to widen or narrow results sets at will comprises part of Marcia Bates' suite of information search tactics and is one of the hallmarks of an information professional.[28]

These tips are sometimes presented in livechat discussions:

> *Archivist: If you put phrases in inverted commas it will search for the whole phrase, as opposed to individual words in the phrase, i.e. search for "special branch" rather than special branch.*
>
> *Enquirer #27: Great. Will do. Thanks for the advice.*

However, the query formation advice provided in livechat can be limited in comparison with that of the reading room:

> *Archivist: Address search can be tricky on the censuses…if you're coming in to the office we can show you some ways of getting around the limitations.*[29]

A final valuable piece of user education in this area is the one that provides this paper with its title. Some users assume that, because some portions of the Archive's

[28] Bates, Marcia J. "Information search tactics." *Journal of the American Society for information Science 30.4* (1979): 205-214.
[29] Livechat #2

holdings are name searchable (that is, are accompanied with metadata that has been produced to give primacy to personal names) they all must be:

> *Reader #42: But if there is a record, the name will appear, won't it?*
>
> *Archivist: Not necessarily.*

In fact, collections are catalogued piecemeal over a period of centuries and the method of cataloguing is extremely various. Researchers need always to be aware of what is being searched and what is not being searched. In this case an obvious keyword is not always the key.

Elicitation

Some users will attempt to transform their information need into enquiries for documents or particular types of documents but do it wrongly. If they do this clearly, there is no problem:

> *"I'm looking for a unit war diary for the Buffs regiment in Kenya in 1953."*[30]

Unit war diaries do not exist after 1950, when they are replaced by quarterly reports which are held at Kew in the archival series WO 305.[31] This sort of misapprehension is very easily corrected by an archivist and the user can be sent off in the right direction, though it is worth noting that misusing this sort of terminology will stymie keyword searching – a search for "war diary" in 1953 in Discovery produces very few hits, none of them relevant.[32]

For the archivist, more difficult is what we might call the "concealed enquiry", described by Mary Jo Pugh, where the user's expression of their information need differs reasonably strongly from their actual information need.[33] In some cases, a query is stated in such broad terms that it isn't (quite) a query:

> *Reader #25: I've got a stepfather, who I don't know who he is…and I've got a funny feeling he was born in Scotland….that's all I know.*
>
> *…*
>
> *Archivist: What are you trying to do? To try and find that [birth] record are you? I don't think we can help you with that.*

---

[30] #193 in Jay, Selman and Chow's 2008 collection of TNA enquiries

[31] The National Archives, 'Army operations after 1945', Accessed 7th October 2014, http://nationalarchives.gov.uk/records/research-guides/army-operations-after-1945.htm

[32] The National Archives, 'Search results for "war diary"', accessed 7th October 2014, http://discovery.nationalarchives.gov.uk/results/r?_aq=%22war%20diary%22&_dss=date&_sd=1953&_ro=any&_hb=tna

[33] Pugh, Mary Jo. *Providing reference services for archives and manuscripts*, Society of American Archivists (1992), p.122

Here, the archivist suggests the notion of a document which appears to fit what the reader appears to need, even though he does not ask a question. Archivists have to help users transform information needs into records enquiries, should users be unable to carry out this transformation themselves. This is a key skill which genealogists and historians alike work to acquire.[34] However, in the process of acquiring this skill, users can make the mistake of asking for the wrong document in a way which is misleading. That is to say, rather than telling the archivist what it is they wish to find out (their genuine information need), they ask how to obtain a document they believe they require in order to fulfil the need. Requests for a certain type of record (specific form) may fall into this category. For example, Reader 5 asks about company registrations. In fact, he is interested in a specific aviation company run by an ancestor. It may be there are other records of interest pertaining to his relative's aviation career but because he asks about a specific record type, the archivist must probe to find out more. Or they may fail to do so and simply take the request at face value (the National Archives does not hold systematic company registrations) and refer the enquirer elsewhere.

Unless they probe carefully, the archivist is denied the opportunity to genuinely assist the reader in their research and focuses solely on the document they are asked to locate, whether or not it will genuinely help. The archivist's friend here is the simple question 'what are you trying to find out'. This acts as a very effective check as to whether the documents the user is asking for are actually germane (or optimal) for the investigation being undertaken. If the archivist does not ask this question, she can seldom be completely certain that she is genuinely helping the reader as far as possible. Current digital archival systems do not attempt to elicit this.

Researcher appraisal

Through discussions with users, archivists can gauge their level of familiarity with the records and tailor their responses accordingly:

> *Archivist: The best thing, rather than just starting with the catalogue is to start with the- public screens all start with this. If you start for- say, 'looking for a'... No, actually, because we know exactly what you want - you're interested in logbooks. If you skip straight to 'research guidance A to Z' and it's actually A to Z by keyword-*[35]

[34] See Duff, Wendy M., and Catherine A. Johnson. "Where is the list with all the names? Information-seeking behavior of genealogists." *American Archivist* 66.1 (2003): 79-95. and their "Accidentally found on purpose: information-seeking behavior of historians in archives." *The Library Quarterly* (2002): 472-496.

[35] To Reader #42

Or understand that a query relates more to an online system than to record arrangement:

> *Reader #35: You see, normally I find a service record and I then can go to [WO] 117, Chelsea records and find a brief resume of his career. I've been doing this for years.*
>
> *Archivist: Oh right, so you know the records, it's just the online-*
>
> *Reader #35: But I can't find it…I looked in the file and it tells me that [WO] 118 is now on the screen. Where is it!?*

It is possible to make these judgements with purely textual enquiries – Duff and Johnson's methodology insists on it, in fact, by labelling some queries as "user education". The way in which an enquiry is expressed may give us some insight into the familiarity of the user with the records. Certainly there are some trigger phrases ("I don't know how to start"[36]) which signal confusion but it is considerably easier to 'get the measure' of a user in a limited time in person than it is remotely.

5.4.3 Analysis of researcher problems

In the course of discussions with archivists, researchers were able in some cases to be explicit about problems they were encountering on their research journeys that seemed to cause or be manifestations of uncertainty. These problems could be characterised as source recall, source unfamiliarity, reference conversion and the switch from paper records to digital.

Source recall

One of the problems of the profusion of websites containing archival sources is that users may no longer be aware of where they found a particular piece of information. There is some evidence that researchers conducting archival research at home have tabs to many of such sites open at the same time.[37] It is possible this exacerbates the problem. This family historian was at an early stage in their research:

> *Reader #53: I don't know if you can help me. I'm researching a family tree. I've got a boy being on the 28th of October 1883 and his sister being born July '83. Well one of them is wrong! How can I found out what the correct dates are?*
>
> *Archivist: Where did you see this information?*
>
> *Reader #53: Um. Pfff. We sort of-*

[36] #82 in Jay, Selman and Chow's 2008 collection of TNA enquiries
[37] How, Chris and Kreiter, Lynn. *"Diary study analysis and evaluation of Discovery and catalogue search*", cogapp, Unpublished report for the National Archives, 2012, p.4

Archivist: From various sources?

Reader #36: Yes.

Without being sure of the documentary sources being used, the only way to resolve this enquiry is by directing the researcher to essentially 're-find' the original information rather than to attempt to corroborate whichever of the two sources appeared least reliable – a subtly different but more productive exercise. In this case the archivist probably added to the confusion by recommending the user consult the census which does not give dates of birth only ages and often contains errors. Indeed it is possible this may have been a source contributing to the reader's confusion.

Many of the archivists observed took notes while users where outlining their problem. Fewer users did the same in response to the archivists' answers in spite of the emphasis on robust data collection in some consultations:

> *Archivist: It would be good to bring with you, some time, all the concrete facts you've got. That old expression 'marshall your facts'. Even construct a rough and ready tree. You need to start thinking, 'Well, where are the gaps? What do I need to fill in?'*[38]

Here the archivist is describing the next research behaviour we will address.

Source unfamiliarity

Users do not always have good mental models of what will be in a record and this runs the risk of wasting considerable quantities of both their time and the archivists'. Research guides give some vague sense of what might be found but do not give examples. This seems not to unduly bother readers but if the archivist has to invest considerable time in explaining how a piece of research is to be undertaken, some readers do begin to make certain mental calculations. In this example, the reader asked how to locate documents associated with a will in the late 18th century. Eventually, the archivist explained what the document was likely to contain:

> *Archivist: [reading from reference book] "-a valuation of the deceased's personal estate is given in the margin."*
>
> *Reader #55: And that's it? Well I know how much it was for.*
>
> *Archivist: Okay. So what are you trying to find out?*
>
> *Reader #55: Well. Other information about the family. But there wouldn't be anything on there. It'd only give his wife's name.*

[38] To Reader #20

…

**Reader #55: Nah. That's not going to give me any information. More than what I've got…I don't think I'll even bother with that.*

This was the culmination of an interaction of over eleven minutes. The longest interaction recorded (over 18 minutes) was with a couple researching the military career of an 18th century forebear, which included this exchange:

Reader #21: Can I ask just one question?

Archivist: Yeah.

Reader #21: On his actual- Okay, if you haven't got his military record but for a military record of another person about the same time, is it, basically, just the same sort of information?

[The reader is referring to the notes they have gathered which constituted an extensive record of the ancestor's career]

…

Reader #21: There wouldn't be a great deal more information on it? From personal-

Archivist: You can't generalise really.

The last point may be technically true but it is clear that the reader was attempting to make a judgement about what could be gained from the specific form of record under discussion. This can only be judged if the categories of information likely to be present in it are made known to the reader and this is within the archivist's competence and purview.

Reference conversion

The conversion of old reference codes, used either in published volumes or internal to a collection, to 'modern' references which can be used to retrieve a document is a not uncommon archival information need:

"I'm trying to replace old references with new ones."[39]

It can be observed inside and outside of the reading room.[40] In some cases it is possible to build automated tools which can convert from one system of categorisation to another. Discovery supports searching by former reference but (naturally) not every series is catalogued with former references attached, nor can every permutation of reference ever produced by a user of the collection be

[39] Reader #1
[40] Livechat #32

converted so there will always have to be a degree of judgement and knowledge employed.

These enquiries have been categorised as “consultations” under Duff and Johnson because they appear to call upon the archivist’s specialist knowledge. Readers must either consult or be taught the underlying technique such that they can apply it and not have to keep coming back. Research guides can explain some of these techniques but, like automated tools, cannot cover every eventuality and if they are too complex, readers will continue to ask for help rather than attempt to master the process themselves. Both readers observed consulting about conversion (Reader 7 and Reader 1) showed resistance to tackling reference conversion unaided and the latter employed the strategy of ‘shopping around for a better answer’ by going to another desk and asking them same question of another archivist before returning for more support.

Switch from paper

For veteran users, a cause of confusion (and some annoyance) is the removal of paper finding aids or microfilm resources of various kinds and their absorption into existing online systems:

> *Reader #22: I spent an hour earlier on, looking for something that would have taken me two minutes on the [micro]film…I had to scroll through every damn page to get where I wanted to go – because I wasn’t sure if they were in order to start with.*

Confidence in the old system is replaced by hesitancy and caution with the new system. The digital system provides new affordances and with time, experienced users will gain in confidence. However, it may be considered that nothing is lost when these (increasingly outdated and inaccurate records) are removed. In fact, paper indexes have a number of affordances which digitised records lack. They are considerably easier to browse, for example (by which, in this context, I mean, read in a linear fashion) and they provide a clearer overview of the records than disconnected single catalogue entries. Slow download times for often large PDFs (PCs in the reading room – even for staff – appear particularly sluggish) make what may be imagined to be a seamless digital experience, feel considerably more troublesome than previous paper based systems. At the same time, novice users would probably not even have known of the existence of the old resources so while the digitised resources may be regarded as less accessible by some experts, they are undoubtedly both more visible and more accessible to novices.

5.4.4 What do archivists do?

Synthesising the key themes from the above analysis gives a broad view of archivists’ approach to reference interviews. Archivists do not answer researchers’ questions. Archivists promote self-help by providing strategies which will, when applied by researchers, likely result in answers to their questions. The National

Archives own written guidance confirms this view. One of the best practice guidelines for contact centre staff at the National Archives is “encourage callers to help themselves”.[41] This guideline is applied at the individual level in resolving an enquiry.

This means that the prevalent interaction mode of archivists in reference interviews is a teaching mode. Archivists in reading rooms at Kew are teaching individual users the skills of archival research. They are very seldom merely answering their enquiries (unless of course they are administrative, directional or service related – ‘how do I print’) they are providing significant tutelage in research skills of a range of types. They are called ‘advisers’ but they are not proffering mere advice. They are educating, with the apparent aim of permanently raising the abilities of those carrying out research.

5.5 Conclusions

This study provides valuable insights into the strategies employed by archivists to help researchers make progress. They do not answer questions, instead they are tasked with helping the user understand how they can progress their research journey to the next stage themselves. This would seem to have certain implications for system design – a need for systems operating within a ‘teaching’ interaction framework rather than merely a ‘searching’ (or even a ‘string matching’) one. These would presumably be systems which have learning outcomes alongside (or instead of) providing “the answer”. In a sense, this is a welcome outcome, since most research journeys don’t have a single answer but in another sense, it requires a fundamental repositioning of archival service provision online because very few such tools have these outcomes in mind. It is also noticeable that archivists are employing a range of resources which are outside the digital system. Their advice may sometimes operate at the query and result level but they work to appraise users and elicit more information from them. Crucially, they also appear to know almost as much about what is *not* in the archive as what is in it. Search engines are poor at knowing what they do not know. The archivist bringing many more resources to bear.

However, this study provides relatively vague information about the problems of users. The study design gave no opportunity for the investigator to elicit more information from the enquirers or ask consistent questions which would facilitate comparison of their problems. Very little about the context of their research was clear and we can see features of their uncertainty but not the trigger. The result is that we still do not have a strong or systematic understanding of the classes of problems encountered by users and the mitigation provided by archivists is, though welcome, unavailable to most users most of the time since so many now work remotely. There remains a need to understand more systematically how researchers make progress ‘under their own steam’ – in spite of some of the problems we have observed - and

[41] The National Archives, ‘Best practice guidelines for the contact centre’, Unpublished.

to understand these problems in the disintermediated context and this will be the subject of the next chapter.

Chapter 6: Finishing the jigsaw

"In a strange way the very ease of accessing the data caused Bernice the most problems…There was hardly a gap between Bernice finishing a request and the terminal saying - ready. She realized that it had become her habit to use those little moments of impatience to collect her thoughts. She found herself suffering from information meltdown - like turning on a shower and getting a face full of scalding water."

- Ben Aaronovitch, 'The Also People' (1995).[1]

6.1 Introduction

In the previous chapter, we looked at the techniques used by archivists to facilitate research progress and we also collected examples of some of the problems inhibiting researchers from locating material of interest to them. The accumulated evidence of the past two chapters suggests that many archival researchers are deeply uncertain about how to make progress. Having established the fact of this uncertainty, in this chapter we will aim to discover its source – or more likely sources - through a qualitative study of the search strategies of a group of archival researchers. Through the analysis of interviews with and observations of researchers, we will consider the barriers they face, the strategies the most expert users employ to reduce their uncertainty and how future systems could incorporate these strategies to enable more users to make confident forward progress in their research journeys. Amidst the many models which attempt to conceptualise information seeking there are some which see the process principally in terms of barriers:[2]

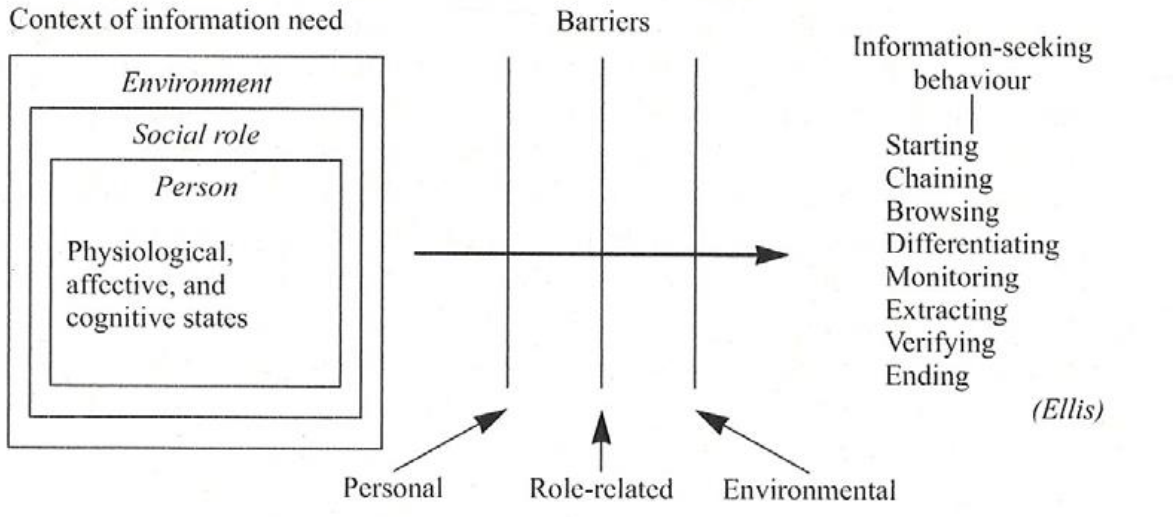

Fig. 6.1 A general model of information-seeking behaviour (Wilson, 1981, revised).

[1] Ben Aaronovitch, *The Also People* (London: Virgin Books, 1995), p.68
[2] Wilson, Tom D. "Information behaviour: an interdisciplinary perspective." *Information processing & management* 33.4 (1997), p.552

Wilson's model of information-seeking behaviour is a contextual model we discussed briefly in chapter 2. It situates a user amidst a physical and social context which constitutes a sort of obstacle course that they must negotiate if they wish to carry out ordinary information behaviours (drawn from the work of David Ellis[3]) such as browsing. The model does not describe how these barriers are to be surmounted but Wilson mentions "coping" in the context of stress reduction to "master, reduce or tolerate" the negative feelings that might be experienced in the case of a frustrated searcher.[4] These negative feelings have been most powerfully summed up, as we have already discussed, by Saracevic and his claims of a "firewall" between digital collections systems and their users.[5] This is presumably what we see illustrated in Figure 6.1.

The constituents of this firewall have been investigated by Savolainen.[6] His literature review, covering papers from 1965 onwards, identified six main information seeking barriers. These were firstly an unwillingness to see one's needs as information needs and secondly an inability to articulate one's information needs. In the archival domain the sheer scale of enquiries received by archival institutions suggests users do not significantly suffer from these problems. Savolainen's third barrier was an unawareness of relevant information sources which we have also identified as a significant barrier for archival researchers in chapter 4. We have already seen that the proliferation of digital collections has created a serious resource discovery problem, Kirchhoff et al's "digitisation islands in the vast sea of the internet".[7] A given research problem may require use of a range of databases, some containing primary sources and others secondary literature.[8]

Savolainen's fourth, fifth and sixth barriers are low self-efficacy, poor search skills and an inability to deal with information overload. This last seems, at least in part, connected with sensemaking. This is a phenomenon which has also been conceptualised in several ways but has been approached primarily in terms of barriers by Brenda Dervin (see 2.5.1).[9] For Dervin, as for Wilson, the affective aspects of these barriers were just as important as the cognitive aspects and this especially true of satisficing, as we have discussed (see 2.3.1). Mansourian and Ford's "nervous searching" has previously been observed by Duff and Johnson in interviews of historians and captures the affective anxiety accompanying the cognitive uncertainty.[10] Cognitive uncertainty in this context represents an inability to make research judgements - is this document relevant? Where do I look next? What do I type? These are the sorts of questions raised in information seeking models and

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[3] Ellis, David. 'A behavioural approach to information retrieval system design', *Journal of Documentation 45*, no.3 (1989), p.174

[4] Ibid, p.554

[5] Ibid, p,9

[6] Reijo Savolainen, 'Cognitive barriers to information seeking: a conceptual analysis', Journal of Information Science, 2015

[7] Kirchhoff, Thomas, Werner Schweibenz, and Jörn Sieglerschmidt. "Archives, Libraries, Museums and the Spell of Ubiquitous Knowledge." *Archival Science* 8, no. 4 (December 1, 2008), p.255

[8] Buchanan et al, 'Information seeking by Humanities Scholars', Proc. ECDL 2005, p.6

[9] Dervin, Brenda, and Patricia Dewdney. "Neutral Questioning: A New Approach to the Reference Interview." *RQ 25*, no. 4 (1986), p.2

[10] Duff and Johnson, 'Accidentally found on purpose: information seeking behaviour of historians in archives', 2002

literature which researchers in a state of high cognitive uncertainty cannot answer. Affective uncertainty consists of the negative feelings that may be associated with being unable to answer these questions - anxiety, frustration, lowered self-esteem. These distinct 'layers' of uncertainty are most clearly depicted in Kuhlthau's model of information seeking (figure 2.21). We will discuss this idea in more detail in the next chapter.

On the fourth and fifth barriers of low self-efficacy and search skills, a clearer judgement can be formed after the observation of researchers at work described shortly. The group of archival users who seem comparatively unaffected by research barriers are the archivists themselves, the expert users in this domain. Focusing on expert archival users, considering what constitutes their expertise and how this might be transferred to novices – and in turn what constitute their characteristics – has been the subject of analysis by researchers such as Tabatabai and Shore who stressed the importance of metacognitive strategies by experts.[11] The more specific problem of the constituents of archival expertise was examined by Yakel and Torres (see 3.2.3) who proposed that such expertise consisted of three elements: artifactual literacy (issues around analysis of written texts), domain knowledge (the domain being the subject the user is researching) and archival intelligence.[12] This third property they further described as consisting of archival theory, strategies for reducing uncertainty and ambiguity and intellective skills (with an emphasis on preparation and planning). This would appear to be an exacting person specification and perhaps focuses insufficiently on what the archive will do to help users meet these demands in terms of training and systems.

In investigating how users carry out online archival search and how they conceptualise their own online information seeking we can usefully supplement Yakel and Torres' work by directly observing the efforts of ordinary users to make research progress in digital collections. In the past these users would have received material assistance from an archivist but as Butterworth has pointed out, in digital catalogues "the roles the library and archive staff play in supporting users to make the best use of available resources are removed."[13] Without the support of these intermediaries, researchers must devise what strategies they can to surmount the barriers to their research. These strategies seem fertile ground for guidance on how best to extend systems to meet their needs.

6.2 Method

In order to gain a more detailed picture of the barriers encountered by users when working with online archival collections and their responses to them, I conducted a qualitative study consisting of a content analysis of two sets of interviews with archival researchers and a further analysis of their intervening search sessions.

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[11] Diana Tabatabai and Bruce Shore, 'How experts and novices search the web', Library and Information Science Research 27, 2005: 222-248

[12] Elizabeth Yakel and Deborah Torres, 'AI: Archival Intelligence and User Expertise', The American Archivist, Vol. 66 (Spring/Summer 2003) : 51–7

[13] Richard Butterworth, 'The accessing of our archival and manuscript heritage project…', 2006, p.21

6.2.1 Participants

An opportunity sample of 16 participants was recruited. Most participants were approached to take part in the study whilst amidst online research at Kew, a few approached staff offering to participate. There were 6 female participants and 10 male participants. 2 were under 25, 4 were over 65 with the remaining 10 in between. They ranged widely in their experience with archival documents: 4 participants had been working with archival documents for fewer than 3 years (of these, 2 were visiting the National Archives for the first time) but at the other end of the scale 6 had been working with such documents for more than 10 years. 4 participants were under- or postgraduate students, 3 were university academics, 6 were genealogists, 1 was a professional researcher and 2 were amateur historians.

6.2.2 Materials

Sessions were all carried out at the National Archives in Kew over the course of June 2015. Participants worked on a PC with the screen capture software Snagit installed and this was used to record their session for later analysis. Participants were permitted to nominate a start point (e.g. Ancestry or the National Archives home page or reader screen) and were then permitted to search and browse as they wished. The PC was located within the first floor reading room at the National Archives in Kew and this gave researchers free access to popular (and otherwise paywalled) family history and other search tools. The resulting setup was intended to mimic as closely as possible the conventional setup for reading room users, within the limits imposed by the nature of the study. The investigator sat alongside participants while they worked and took written notes. Participant interviews were recorded on an Android smartphone for later transcription.

6.2.3 Procedure

Participants were given a short questionnaire and asked a series of semi-structured interview questions to elicit information about their research backgrounds and goals. They then engaged in a 20 minute session carrying out their own research tasks (in many cases these were the tasks they had been working on before they were approached to participate in the study). This mix of methods was used in order to compare researchers stated conception of their own information behaviour with direct observation of their actual strategies and tactics. After the search session, participants were asked to comment on aspects of their observed search behaviour and to discuss what (if anything) they had found which progressed their information journey. A retrospective protocol was used because it was felt that a concurrent verbal protocol could encourage more reflective searching by participants who might otherwise have exhibited relatively poor metacognitive performance.

6.2.4 Data coding and analysis

The video capture of the participants search sessions was examined to understand the sequence of the searchers queries, reformulations and moves from one term or database to another. Timecoded notes were taken of the queries entered, result set sizes achieved, filters applied and the pages of results examined before a search was abandoned or acted upon. Ancillary behaviours such as notetaking were also recorded.

A content analysis of the 32 interviews (16 from prior to the search session

and 16 from immediately after it) was conducted. The interviews were transcribed and the transcripts coded in MAXQDA to identify examples of where the users highlighted challenges to their research progress of whatever kind, either in the past or in their current session.[14] The strategies they used to make progress or solve problems in their research were also coded and analysed as were mentions of affect by participants and the metaphors they used (e.g. mountains, jigsaws). Preliminary codes in these areas were extended as more of the documents were examined. Some early concepts which appeared of interest (e.g. Google) never appeared again. Analysis continued until all the documents had been examined and saturation reached. At this point, the number of incidences of identified barriers were counted in an attempt to gain a very rough sense of their prevalence in the sample. A second round of analysis permitted high level groupings of barriers and solutions to be created which are described below.

6.3 Results

We will consider first the interview analysis and then the features of the results of the recorded search sessions. Examination of the latter yielded some core search behaviours and afforded the opportunity but only in combination with the former can we assess the effectiveness of the users' search strategies.

6.3.1 Barriers to search progress

As described above, the interview transcripts were examined to locate discussion relating to barriers to research experienced by users that appear to be sources of cognitive and affective uncertainty. On further analysis and with an eye to Wilson's model (figure 6.1) and Yakel and Torres' archival intelligence (figure 3.1), these barriers were able to be categorised into three main types: artifactual, environmental, and personal.

Barrier Description	Mentions	Barrier Type
Record description a poor guide to relevance	13	Artifactual
Dispersal of records across many systems	11	Environmental
Negotiating name or spelling variants	10	Artifactual
Record loss or destruction	9	Artifactual
Sheer quantity of material	9	Artifactual
Faulty hypothesising about archival arrangement	7	Personal
Writing hard to decipher	5	Artifactual
Name disambiguation	5	Artifactual
Paywalls and charging	5	Environmental

[14] Krippendorff, K., and Bock, M. A. (eds): *The Content Analysis Reader.* Thousand Oaks, CA: Sage (2008).

Limited search strategies	5	Personal
Struggle to recall previously used resources	4	Personal
Closed material	3	Environmental
Unfamiliar hardware	2	Environmental
Unpredictable system behaviour	2	Environmental
Hard to stay on task	2	Personal
Lack of awareness of key system functionality	2	Personal

Table 6.1: Barriers reported most frequently by participants

Artifactual barriers are those which are intrinsic to the process of working with archival documents and collections. These include the fact that such collections are large and that the metadata for an individual document may well be a poor guide to relevance for an individual user. Archival documents and their metadata contain large quantities of personal names but the difficulties of distinguishing the 'right' John Smith from amongst many others and in working with names which have not been written consistently by record creators or record subjects (Smith, Smyth, Smythe etc.) or where names are used repeatedly along maternal or paternal lines represent barriers to locating and identifying relevant information. Documents can be hard to decipher or, once read, understood in their proper historical context. Finally, even amidst the feast of documents, it is possible that a particular item that is sought has not survived, which can in some cases represent a fundamental barrier to research progress:

"Either the names are spelled incorrectly, which is a possibility, or the records of those particular parishes have disappeared." (Participant 2)

Environmental barriers are those which are extrinsic to the user but are not an inherent part of the process of working with archival documents but are instead essentially situational. These include the fact that documents may be paywalled or closed to public access for reasons of privacy, sensitivity or official secrecy. References and referrers change over time ('link rot'[15] is by no means a modern phenomenon and archival references from a previous century may not work in this one) and collections and the means for searching them may become dispersed:

"Can I do that here? Can I look at things like war records here?" (Participant 4)

This means that users must look in different places to search different parts of the same collection and may mean that a starting point for a search is not obvious.

Finally personal barriers are intrinsic to the user's thinking or feeling and may encompass a lack of experience or knowledge in a novice user when compared to that of an expert. Artifactual and environmental barriers apply equally to novice and expert users though the later may have more sophisticated strategies for surmounting them, as we will discuss shortly. Personal barriers include the fact that it

[15] Tyler, David C., and Beth McNeil. "Librarians and link rot: A comparative analysis with some methodological considerations." *portal: Libraries and the Academy* 3.4 (2003): 615-632.

is very easy to become distracted amidst archival collections, that there may be a lack of trust in search results or a low level of knowledge about the functionality provided by a search system or that researchers may be able to conceive of only a limited range of search strategies. It is finally the case that users sometimes develop inaccurate hypotheses about the way in which records are arranged which can also serve as a barrier to understanding collections of interest and making search progress. In some cases users even assert that understanding how the collections are arranged is not useful:

"I don't know if the average user would be able to understand this hierarchy they have here. I don't know if that's really necessary for us to see." (Participant 15)

This is in spite of the fact that such understanding is essential for locating documents which are not well described and thus essentially unavailable to keyword search.

6.3.2 Search strategies and tactics

Archival researchers have to navigate as best they can between dispersed collections. Between them the sixteen participants examined seven different databases. The National Archives' own online catalogue Discovery was the most used and ten of the participants carried out at least one search on it. Ancestry was the next most popular and was used by four of the participants. Ten participants made use of a single database in their search but five participants used two different databases over the twenty minute search session and one participant used three databases. There was wide variation in the number of search queries executed by each user. Two academic participants were content to run a single query and spend the remainder of the session methodically examining the result set generated. Other users made dozens of queries in the time available; the highest number in the course of the study being 29 (including constraints applied to existing queries).

It is tempting to consider one or other of these styles of searching – which we might call 'rapid reformulators' and 'linear examiners' – superior to the other. However they are both reasonable attempts to deal with the same challenge, namely to gain some overview or prospect of the collections relating to the domain in which the researcher is operating.[16] By looking in detail at a body of results derived from a single relatively wide query, a skilled researcher can build up considerable collections knowledge. For example, Participant 3 looked for "maps Hong Kong" and was able to begin to understand the scope and arrangement of these holdings even though examining 150 results in detail was both time consuming and cognitively taxing. Conversely Participant 12, the most rapid of the 'rapid reformulators' instead expended cognitive effort on term generation and used the results of multiple queries to build up a picture of the records available on her topic. This might be criticised as unsystematic but the two strategies are strongly linked to the early part of a user's research journey, what Wilson calls problem definition.[17]

Both strategies aim to give the user some grasp of the problem space. They are not of themselves indicative of Heinström's definitions of fast surfing or deep diving.[18] Which is to say that there is no indication in the data that rapid reformulators

[16] Stan Ruecker, Milena Radzikowska, and Stéfan Sinclair, *Visual Interface Design for Digital Cultural Heritage : A Guide to Rich-Prospect Browsing* (Farnham: Ashgate, 2011).
[17] Wilson, op. cit.
[18] Heinström, op. cit.

are worse or shallower searchers than the linear examiners. Researcher 12, for example, made extensive use of date filters, was the was one of only two participants to make use of Discovery's subject facets and covered considerable but bounded ground: from prostitution, sexual health and so called white slavery in the Great War period to New Zealand's General Freyberg and the Hornchurch convalescent depot. These are not scattergun query sets but represent a sustained attempt to understand what records are available across the researcher's topic. The researcher further specifically acted to overcome quirks of Discovery's search – removing abundant medal roll entries and fuzzy matches including the word 'venerable' cluttering search for 'venereal'. Participant 3 and Participant 12 were both successfully applying different approaches to the same problem.

13 of 16 researchers located material that they asserted in interview assisted them in solving their research problem. This included researchers who stated known item type problems (that they were looking for something specific) and failed to locate the known item but declared that they had found other relevant material. Two researchers did not locate material they deemed relevant. The remaining researcher used the time to demonstrate her research strategy rather than strongly attempting to locate new information. It must be noted that relevance judgements based on archival metadata will likely not absolutely correlate to the relevance of the resulting documents when ordered and examined. These are provisional relevance judgements based on metadata not data: only when the researcher has examined the physical document itself will they know for certain if it is relevant to their research.

6.3.3 Advanced search and Boolean logic

A problem which some users clearly exhibited and did not raise in their interviews (suggesting they may not have been aware of it) was a poor ability to perform advanced searches. Discovery supports Boolean logic but users are not required to use it. The advanced search page facilitates the construction of Boolean queries using language like 'any of these words' rather than OR, 'none of these words' rather than NOT:

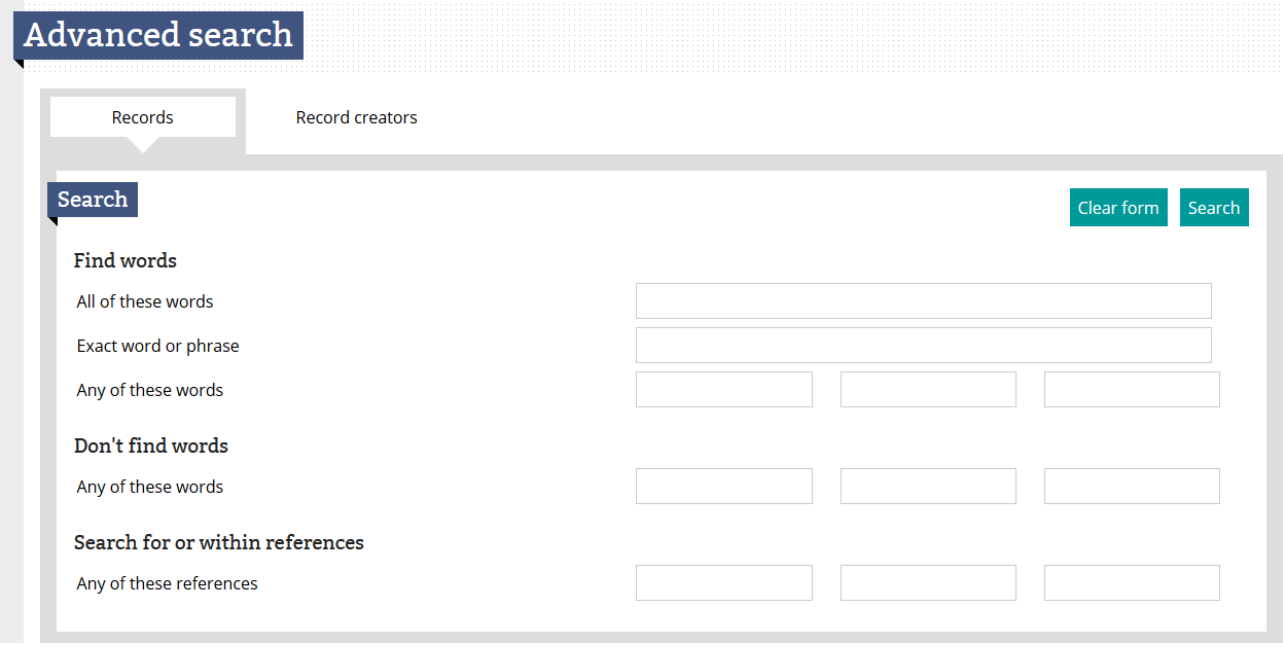

Fig. 6.2 Discovery Advanced search page (The National Archives, 2015)

Unfortunately, the problems and confusion associated with Boolean logic reported in previous studies were still exhibited by some users of the advanced search.[19] Both participants 1 and 14 used successive combinations of broad and narrow terms in such a way as to fail to narrow down unwieldy results sets. For example, using the fields to generate the query *Crewe OR House* generated 929 results, Participant 1 attempted to reduce these results by adding the term *propaganda* but the query *Crewe OR House OR Propaganda* generates a wider not a narrower set of results. Participant 14 had similar difficulties and used broad terms like *American* in OR queries alongside narrow ones such as *activist* or *student*. But varying the narrow terms has virtually no impact on the composition of the results generated. At times the participant attempted more complex logic such as *(draft AND resisters) OR Vietnam* but again, varying the terms in brackets is a poor strategy as the results are swamped by the large number of *Vietnam* hits. Both users were attempting to use the additional terms to manage large results sets and both failed. The evidence would appear to be that masking Boolean logic through a superficially usable interface does not necessarily mean that users can construct useful sequences of Boolean queries.

Some functionality was used very sparsely by users. Only one participant sorted their results in Discovery; this is in spite of the fact that the 'relevance' ranking is rendered very unreliable by limited metadata: it is often not clear what documents are 'about' let alone if they are directly relevant to a user. One participant (an experienced academic) requested the ability to filter results by government department, despite the fact this is possible through not only advanced search but in the left hand navigation of search results. Only two users made use of the subject filters in the same left hand navigation. In Ancestry, users preferred extensive use of the browser's back button to return to a new query page rather than refining (or 'editing' in Ancestry's parlance) their existing queries.

6.3.4 Persistence of searchers

In many respects archival researchers are typical researchers. They must think hard about query formulation and attempt to analyse results sets to determine whether the items are relevant to them. But the information behaviours of archival researchers are by no means typical in all respects. This point is nowhere more obvious than in the treatment of search results by archival researchers. It is a tenet of search interface design that users will not look beyond the first page of results and may only glance at the first few items.[20] Archival researchers occasionally exhibit this behaviour but in general, far from examining the top handful of results, it is commonplace for users of archival systems to examine dozens of results across multiple pages. This was true not merely of the methodical examiners but also the rapid reformulators. Examining up to 150 results carefully is a highly cognitively intensive form of filtering (see 2.3.2), in which the researcher is making very large numbers of relevance judgements. The rapid reformulators slice these large results

[19] Dinet et al, 'Searching for information in an online public access catalogue (OPAC): the impacts of information search expertise on the use of Boolean operators', Journal of Computer Assisted Learning 20, pp338–346, 2004

[20] Thorsten Joachims et al., "Accurately Interpreting Clickthrough Data As Implicit Feedback," in *Proceedings of the 28th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, SIGIR '05 (New York, NY, USA: ACM, 2005), 154–61

sets into more digestible sizes. The initial broad query provides an overview and subsequent modified queries bring smaller portions of the collections into focus. Even so, while it is very tempting to perceive users as sinking excessive costs into a single search, in practice it is very difficult to determine objectively within the domain at what point these costs truly do become excessive when a single 'find' will justify the effort. Fu and Gray suggested that searchers were highly sensitive to information-seeking costs.[21] This does not appear to be the case in the archival domain.

6.3.5 Regulating barriers to search

The interplay of artifactual, environmental and personal barriers is what makes research in digital archival collections difficult but users, archives and archival system designers use many strategies in order to remove or reduce the impact of either the barrier itself or the uncertainty associated with it. Let's refer to such strategies and techniques as *regulators*. Regulators can be grouped into the categories of knowledge based, skills based and tool based. Knowledge based regulators include aspects of records knowledge, such as a familiarity with the key holdings that constitute a collection, common (or obscure) types of record, a thorough understanding of archival arrangement or the use of secondary literature to gain prospect on the archival space being searched:

"[My dissertation supervisor] recommended an academic source that's already been written from 2002. Basically, I looked at the sources that this guy used when he wrote his book." (Participant 1)

Skills based regulators include a wide variety of strategies and tactics employed by users throughout the information seeking process. These include research preparation and monitoring (through external cognition such as written notes or family trees), query formulation techniques, time management and the ability to detect and explain discrepancies in the documentary record:

"I find a lot of the research that is published is incorrect and I'm trying to go back to the sources and clarify details" (Participant 14)

Tool based regulators are those which users can call on or operate to facilitate progress; they can ask an archivist for help or make use of online records guidance, they can search and browse records, print copies and manipulate digital document images by, say, zooming and brightening:

"This one's wrote very clearly. Some of them aren't…I can't make out what that word says and I've forgotten my magnifying glass today." (Participant 5)

These last are good examples of how barriers and regulators correspond: zooming and brightening are tool based regulators for the artifactual barrier of a document being hard to read. The user manipulates the tool and (all being well) their improved view of the document makes some piece of difficult handwriting easier to read and their uncertainty as to its meaning is correspondingly reduced.

[21] Wai-Tat Fu and Wayne D. Gray, "Suboptimal Tradeoffs in Information Seeking," *Cognitive Psychology* 52, no. 3 (May 1, 2006), p.198

However, there are a few regulators which do not seem to fit easily in to these categories. The first and most important is that of positive affect or strong self-efficacy. Experienced researchers are not only motivated but express high levels of positivity and optimism. They are philosophical in the event of failure and modify their relevance criteria to encompass any useful information located in the event they fail to locate a specific known item that was their original intent:

"I just enjoy coming and if I find anything it's like a bonus. That's how I look at it. I just enjoy coming and just looking." (Participant 5)

Some researchers did express frustration at the slow pace of their research or that their topic was not seen as a priority to receive cataloguing attention. But passing references to irritation or boredom were far outnumbered by references to lucky or "amazing" finds (serendipity), aspects of research they enjoyed, curiosity, fascination even love:

"I could stay here all week. I love it." (Participant 4)

In these cases, the barrier is not surmounted but people either feel content with the outcome or have found new avenues to explore which lessens the significance of the barrier. The repetition of these powerful regulators of serendipity and self-efficacy in statements from users combined with the persistence of their search behaviours suggest that Savolainen's fourth barrier of low self-efficacy may not be of strong relevance in the archival domain.

Regulators appear commonly to act on a single barrier at a time – use of freedom of information requests (FOI) for example, is an appropriate regulator for the environmental barrier of documents which are closed to public access. Using Discovery, the FOI process can be set in motion at the touch of a button – it has been reified as a tool, to borrow the language of Michel Beaudouin-Lafon.[22] The barrier of a document being hard to read may be regulated by use of zooming or improving the contrast. These are common controls in interfaces for viewing archival documents. The coupling of barriers and regulators provides a framework within which we can consider further tool based regulators which could be applied to specific barriers, so as to place less heavy reliance on regulators derived from the users' own knowledge and skill. Where for example is the tool based regulator for name or spelling variants or to manage changing references?

If all else fails, researchers' self-efficacy permits them to console themselves that not everything survives from the past and that is part of the nature of research:

"[T]he sources just dried up. You're talking a hundred and fifty years ago so they're not always there. So sometimes your research finds things, sometimes you don't. That's what research is like." (Participant 13)

This would seem an insurmountable barrier in the context of a known item search but archive users are often primarily engaging in a far wider process of exploratory search, where success is not counted in the ability to locate any one specific piece of information but in the building of a larger picture. Participants were strongly united in

[22] Michel Beaudouin-Lafon, "Instrumental Interaction: An Interaction Model for Designing Post-WIMP User Interfaces," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '00 (New York, NY, USA: ACM, 2000), 446–53

describing this process, whether they found it easy or difficult:

“This is why it's all been so difficult for me and so confusing. Because it's like having a jigsaw puzzle, you've got Big Ben but you haven't got the clock bit!” (Participant 2)

“Last time I was here I couldn't find two or three angles. It's a bit like a big jigsaw puzzle, if you like, found all these others pieces, put them all in and there are a few holes in the middle of it.” (Participant 3)

“The joy of working here is putting the jigsaw puzzle together. And [these files] will help put that jigsaw together in a completely different way. And that's the excitement for me.” (Participant 9)

While, gaps can appear in some places that are more frustrating than others, the picture is more important than any one piece. This conviction forms an important role in knowing when to halt searches (satisficing). Satisficing is itself a regulator since it helps users to trade off search persistence for a specific item or term against general forward progress. The urge to resolve the picture promotes barely suppressed impatience in some users:

“I've only been here once before a month ago, I really had the bug - oh gosh, I'm going to go, I'll subscribe because I just want to keep looking. But I thought, oh no, it's ridiculous. Because there's so much to look up and it kept flashing up 'dah dah dah', I thought oh no I'll wait, I've got to wait.” (Participant 4)

While others are more sanguine:

“We have got one [individual we are researching]. We don’t know what’s happened to him after the First World War. So we’re patiently waiting for the 1921 census…we’re hoping that might throw a bit more light on him.” (Participant 8)

Release of the 1921 census was five years away at the time of the interview.

An aspect of the enthusiasm (mixed or unmixed with patience) of archival users appears to be the reluctance of at least some of them to criticise discrete aspects of digital systems because, whatever their specific features, the level of access they provide in general represents such a significant improvement on the information seeking environment prior to their launch.

“It’s difficult to criticise any of it because when I started none of this was available.” (Participant 6)

This reminds us that archival research remains a hybrid on- and offline activity. Unlike for metadata,[23] there is no single 'move to digital' for a repository, the transfer happens collection by collection. The transfer can be unwelcome to some users experienced with an old system:

“…for reasons best known to…people here, they withdrew it…They’ve got no concept of what they’re doing.” (Participant 13)

[23] And scarcely even there.

Although it may seem counterintuitive, the archival landscape for even the remote past is not static because new cataloguing and digitisation take place and terms of access evolve. So a search carried out in one year may return different results a year later. To those looking to resolve an immediate information need this is of little help but for exploratory searchers this is a source of optimism concerning future progress. This would appear to explain why users report repeating searches and tend to record files they have looked at but not search terms they have used. The strategy of returning to previously tried terms may appear wasteful but not only is this a way of checking whether new documents have been cataloged since the search was last carried out but it permits users to refresh their memories regarding tasks that have been temporarily set aside. Negative searching (the strategy of noting what is not present) was reported by several users but can never be regarded as being definitive. Again it is possible to imagine how the skills based regulators of rerunning searches and negative searches could be supplemented or supplanted by a tool based regulator. At present while it is technically possible to see records which have been recently opened, the National Archives makes hundreds of thousands of amendments to its catalogue metadata every year and there is no obvious way to get a sense of these outside of a few large scale projects.[24] An interface which made what are continual improvements in catalogue metadata more visible to users would help them produce new research insights.

6.3.5 Experts, novices and journeymen

Not all regulators are born equal. Let us consider the artifactual barrier of documents which contain contradictory information. Some of the participants were inclined to insist that some documents were right ("definitely factual") and others were "wrong". Conventionally, rather than focusing on 'facts' a historian would see a document as providing a particular perspective – this is part of Yakel and Torres' artifactual literacy.[25] Nevertheless in managing conflicting information researchers must employ a series of regulators. They must first detect the discrepancy. Having detected it, they may then create a hierarchy of accuracy in which, for whatever reason, one information source is preferred over another. More difficult still is to generate a hypothesis which encompasses (or makes sense of) the discrepant information:

"There's something wrong there…Because they were both born in the same period – I thought 'why are they both born in 1949'? But they were twins.

[Researcher: How did you know?]

Because the mother and the father. Because the mother's maiden name was Janes, like the yearbooks – well that's not very usual is it?" (Participant 2)

This would appear to be very strongly related to Klein, Moon and Hoffman's conception of sensemaking.[26] Barriers act against sensemaking but regulators

[24] The National Archives, 'Cataloguing projects', http://www.nationalarchives.gov.uk/about/our-role/plans-policies-performance-and-projects/our-projects/cataloguing-projects/
[25] Elizabeth Yakel and Deborah Torres, "AI: Archival Intelligence and User Expertise," *American Archivist* 66, no. 1 (January 1, 2003): 51–78.
[26] G. Klein, B. Moon, and R.R. Hoffman, "Making Sense of Sensemaking 2: A Macrocognitive Model," *IEEE Intelligent Systems* 21, no. 5 (September 2006): 88–92, doi:10.1109/MIS.2006.100.

facilitate the reframing and elaboration cycles which would otherwise grind to a halt of indecision and uncertainty.

It is possible to observe certain regulators, such as robust query formulation techniques and learning through search which are exhibited by some users and not others. Traditionally we would call users exhibiting few of these expert techniques novices. However, it is clear that there are veteran researchers who do not display the robust range of search strategies exhibited by expert users. They may be able to make progress - though it will require more time and effort than an expert would expend – or they may lack sufficient regulators to overcome the barriers between them and their information goal. Alan Cooper refers to such users as perpetual intermediates.[27] Taking a more optimistic view, I have dubbed them journeymen.

Some of the contrast between experienced users can be seen in the different approaches of Participant 8 and Participant 13. Both were looking at First World War medal rolls and both investigated about half a dozen different individuals over their 20 minute search session but participant 8 had time to consider multiple types of medal and search multiple databases. Participant 13 used only one website and looked for only one type of medal. He also abandoned more searches and looped repetitiously. Yet both participants had more than ten years of experience working with archival documents. In another example, Participant 10 had a clearly expressed information need, seeking to learn the precise circumstances for which an ancestor had been awarded the OBE. He ran 17 queries over the course of his session and failed to find relevant records:

“I suppose it’s a bit frustrating really because I feel certain that there is something there but what I can’t do is find it.” (Participant 10)

And yet relevant records were indeed present in the database he selected to carry out his search. Participant 10 failed to locate them because he was not able to simultaneously broaden his query terms and limit their application to specific archival series or departments gleaned from his existing results sets. Participant 10 also had more than 10 years of experience working with archival documents. He was not a novice searcher and would doubtless have had no trouble locating an everyday document such as a marriage certificate. But faced with a less familiar research task he was revealed as a journeyman researcher not able to apply expert search strategies and build up the necessary knowledge through searching to resolve his research question. We might theorise that these journeyman users are the most likely to be negatively affected by changes to systems or their withdrawal as they lack the resilience of expert users.

This reminds us that, in the context of exploratory search, relevance is not a binary property either. An item in a result set is not either relevant or irrelevant. Users may have a range of research tasks underway at any one time. Some will be actively being pursued but at the same time others will be being conducted passively. Researchers are able to use knowledge built in one search task to subsequent search tasks:

“I'll park that for the moment and see what comes up in South Africa first. And then as I go through other series I'll kind of keep an eye open for it. And in reading published material I'll see if they come up with any other sources or references that

[27] Alan Cooper, *The Inmates Are Running the Asylum* (Indianapolis, IN: Sams, 2004), p.182

might lead to where it is. And also then go back to the documents I've got..." (Participant 9)

Expert searchers are not labelling each search result merely as relevant or irrelevant, they are learning through search by reading and considering the results they have retrieved.

We also perhaps see the Dunning-Kruger effect at work here.[28] Information seeking, after all, is an activity we all carry out all the time and the same is true of online information seeking. It's easy to regard ourselves as expert even though most of us have never observed an expert searcher, seldom take the time to investigate thoroughly the properties of the search tools we use and may not have been taught information literacy as part of our formal education. As system developers we must consider how we can alter the properties of results interfaces to achieve the more reflective expert searching observed in this study and by investigators such as Tabatabai and Shore.[29] We may need to send stronger signals to both novice and journeyman users to allow and encourage them to better regulate the search barriers they will inevitably encounter.

6.4 Conclusion

In analysing the search behaviours of users of online archives, we have argued for the distinctness of such behaviours, particularly in respect of the common assumption that users look at few search results. We have presented the concepts of barriers and regulators as a framework for understanding uncertainty and progress in online archival search. We have observed that self-efficacy is a powerful regulator and facilitates a dogged search persistence not commonly found in studies of other domains. The pervasiveness of the jigsaw metaphor illustrates a key aspect of exploratory search, namely that overall progress is more important than locating any particular item or the result of any discrete topic search. This may be what separates archival researchers from the users studied by Fu and Gray[30] or Joachims et al.[31]

We have further observed that even experienced users do not necessarily act as experts and proposed the concept of journeyman searchers; information seekers who are neither novices nor able to act as experts. Of Savolainen's six barriers[32] we have discounted three (low self-efficacy, weak information needs and inability to recognise information problems) as being of weak relevance to the archival domain and considered how another (information overload) is currently regulated by some users. The remaining two barriers - poor search skills and an unawareness of relevant information sources - are also subject to regulation. Consolidating disparate resources into aggregators such as Discovery can regulate the environmental barrier of dispersed collections information. But novice or journeyman searchers who lack key skills require access to tool based regulators which reify precisely those same skills. More of the load needs to be passed from the user to the system. As

[28] Kruger and Dunning, 'Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments', Journal of Personality and Social Psychology, vol 77, no.6 (1999): 1121-1134
[29] Tabatabai and Shore, op. cit.
[30] Fu and Gray, op. cit.
[31] Joachims et al., op cit.
[32] Savolainen, op. cit.

designers we must consider how best to carry out this process. New tool based regulators constitute the missing pieces in the jigsaws of online collections systems currently in use.

In the next chapter we will use this body of knowledge regarding the causes of uncertainty in information seeking to examine the constituents of the uncertainty itself.

Chapter 7: The certain path

'Who was it who said that beyond a certain point all dangers are equal?'
'I think it was Walter Bagehot. He was talking about a steeplejack.'

- Raymond Chandler, 'The Long Goodbye' (1953).[1]

7.1 Introduction

We have already seen how undesirable it is for users to experience the negative affect which accompanies cognitive uncertainty in information seeking; how uncertainty impedes or stymies their research progress and how it creates an additional burden of resources on archives and archivists. Several implications for design have be raised by the previous three studies such as integrating research guidance with search results and the concept of tool based regulators. This implies a process of development whose success it would be useful to test. In this chapter we will explore the dimensions of the uncertainty inherent in information seeking. We will outline the development and validation of a 32 item scale to measure this uncertainty with the intention that this will aid the development of systems which create less uncertainty in their users.

7.1.1 Measurement and information seeking

Traditionally, information retrieval research measured properties such as "retrieval quality" based on common sets of queries known as the TREC collection.[2] Such studies were preoccupied with how interventions affected the precision and recall of searches.[3] (see 2.2.) These properties are not easy to assess because, as we have seen, relevance is subjective and determined by all sorts of environmental and psychological factors.[4] The Cranfield approach discounts these factors in favour of an entirely artificial approach to relevance which relies on a ground truth. In reality the job of definitively identifying all possible relevant results in a large collection is an extremely challenging one and in the context of a substantial digital library or archive may not be possible. Existing research carried out by the National Archives seems to suggest that it is recall that is most important to archival users because they "look to maximise the number of results" in case they miss something important.[5] But a prior

[1] Chandler, Raymond. *The Big Sleep and Other Novels*, New Ed edition (London: Penguin Classics, 2000), p.438
[2] Mitra, Mandar, Amit Singhal, and Chris Buckley. "Improving Automatic Query Expansion." In *Proceedings of the 21st Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, SIGIR '98. New York, 1998
[3] Xu, Jinxi, and W. Bruce Croft. "Query Expansion Using Local and Global Document Analysis." In *Proceedings of the 19th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, p.9
[4] Saracevic, Tefko. "Relevance Reconsidered." In *Proceedings of the Second Conference on Conceptions of Library and Information Science*, 201–18. Copenhagen, 1996.
[5] How, Chris and Lynn Kreiter. "*Diary study analysis & evaluation of Discovery and Catalogue search*", Cogapp, 2012, p.24

piece of research also commissioned by the Archives was more cautious and asserted that a desire for high recall searches was found more in certain types of users than others.[6] All this does is emphasise empirically that the only way to find out whether information seeking interfaces and the results they provide meet the needs of users is to ask them. Such studies need to be constructed carefully because many, if not most, judgements about users' performance are subjective even if they are based on rigorous measurement. Time on task, for example is a difficult metric. In the archival domain, if online users spend a lot of time looking at documents is this good or bad? The answer is that this cannot easily be determined without some further contribution from the user.

Another example can be seen in a 2002 study by Stelmaszewska and Blandford in which the two observed users interacting with multiple digital libraries.[7] In their subsequent analysis they pointed out that when confronted with “no matches” in response to a query, users had “low persistence” and that “the maximum number of no matches ever obtained was three”.[8] This is an interesting finding (from a small study) but it begs a question that is not obviously answerable: how many “no matches” is an appropriate number to receive from a database before moving on? Is the behaviour identified by Stelmaszewska and Blandford really “low” persistence, or is it 'appropriate' or even 'optimum' persistence? Only an expert in the particular collection being investigated could adjudicate and perhaps not definitively. One way of answering this would be to compare the results of experts to those of novices but even here we are being very trusting that the optimum behaviour is on display. Aula and Kaki have collected some of the errors “experts” can make.[9] Experts are not experts in everything! Self-certification can also be unreliable. In Kemman et al's 2013 survey of Benelux humanities scholars, PhD students rated themselves significantly higher as information retrieval experts than Professors and senior researchers.[10] Unfortunately, the authors take this finding at face value (is this just ageism?) and don't consider that students might be indifferent judges of their own research ability.

If measures which focus directly on the performance of users or results sets present difficult challenges then shifting the focus to aspects of a user’s experience with a system seems appropriate. Uncertainty is the property we are interested in reducing so it is the property which will be measured and systems causing less of it will be preferred.

7.1.2. What is information seeking uncertainty?

Information seeking uncertainty (ISU) occurs when information seekers encounter barriers they cannot adequately regulate. They do not know how to proceed. This cognitive impediment gives rise to negative affective feelings such as anxiety or

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[6] Martin, Emma and Amanda Bergknut. "*User research for the Online Strategy: final report, records site*", Amberlight, 2008, p.18

[7] Stelmaszewska, H., and A. Blandford. “Patterns of Interactions: User Behaviour in Response to Search Results.” In *Proceedings of the JCDL Workshop on Usability of Digital Libraries*, 2002. http://www.uclic.ucl.ac.uk/annb/DLUsability/JCDL02.html, p.2

[8] Ibid, p.7

[9] Aula, Anne, and Mika Käki. “Understanding Expert Search Strategies for Designing User Friendly Search Interfaces.” In Isaías, P. & Karmakar, N. (Eds.) *Proc. IADIS International Conference WWW/Internet 2003*, Volume II, 759–62. IADIS Press, 2003., p.1

[10] Kemman, Max, Martijn Kleppe, and Stef Scagliola. “Just Google It - Digital Research Practices of Humanities Scholars.” *arXiv*:1309.2434 [cs], September 10, 2013. http://arxiv.org/abs/1309.2434, p.11

frustration. In 3.3 we discussed various dimensions of uncertainty. What many of the authors assessing these dimensions have in common is that their focus is on uncertainty as a property of information. Epistemic and aleatory uncertainty are distinguished not by what an observer knows but what is knowable. We will return to this idea but it is of limited use in a practical measurement of ISU since few information seekers are in a position to make a judgement about it.

ISU is not primarily existential, it is a state. It must also have a locus, that is to say we must have uncertainty *about* something. The locus of uncertainty is some aspect of the user's information journey, which is to say their attempt to resolve a gap or otherwise anomalous state in their knowledge.[11] This as yet unfulfilled desire for information is the root cause of the user's uncertainty but it is overwhelmingly not the proximal cause. This can be located more specifically both in terms of the user's progress in their journey (or lack of progress) and in their feelings about this progress.

7.1.3 What isn't information seeking uncertainty?

Monat et al define uncertainty as "a period of anticipation prior to confrontation with a potentially harmful event" and this is the definition adopted by Greco and Roger for their Uncertainty Response Scale.[12] This scale measures personality traits linked to qualities such as "desire for change". Greco and Roger's uncertainty is the kind experienced shortly before "the onset of an electric shock"; an immensely stressful experience culminating in actual physical pain. [13] No matter how complicated a search interface, an encounter with it is not, by and large, a harmful event and this scale is not appropriate for measuring ISU. Paul Silvia uses a definition of uncertainty derived from Fred Attneave but Attneave's equation is based on the premise that uncertainty can be calculated from the probability that a given event can occur.[14] This is a definition of intrinsic unpredictability or unexpectedness, rather than something relating to the felt experience of an individual. But regardless neither a domain expert nor a systems designer has any real idea in advance of the probability of any complex search ending in success and so Silvia and Attneave's uncertainty cannot be calculated here, rendering the formula of limited use. This is not to say that measuring perceptions of unpredictability or anxiety may not be of interest in ISU but they are not the most salient aspects of the form of uncertainty experienced in information seeking.

7.1.4 Uncertainty in exploratory search

We have seen in Chapter 2 that some models of information seeking incorporate uncertainty in ways which envisage the process primarily as a progressive reduction in that uncertainty:[15]

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[11] N.J. Belkin, R.N. Oddy, and H.M. Brooks, "Ask for Information Retrieval: Part I. Background and Theory," *Journal of Documentation* 38, no. 2 (February 1, 1982): 61–71, doi:10.1108/eb026722.
[12] Veronica Greco and Derek Roger, "Coping with Uncertainty: The Construction and Validation of a New Measure," *Personality and Individual Differences* 31, no. 4 (September 5, 2001): 519–34, p.519
[13] Ibid.
[14] Silvia, Paul J. *Exploring the psychology of interest*. Oxford University Press, 2006, p.35
[15] Tom Wilson, "Exploring Models of Information Behaviour: The 'uncertainty' Project," *Information Processing & Management* 35, no. 6 (November 1, 1999), p.841

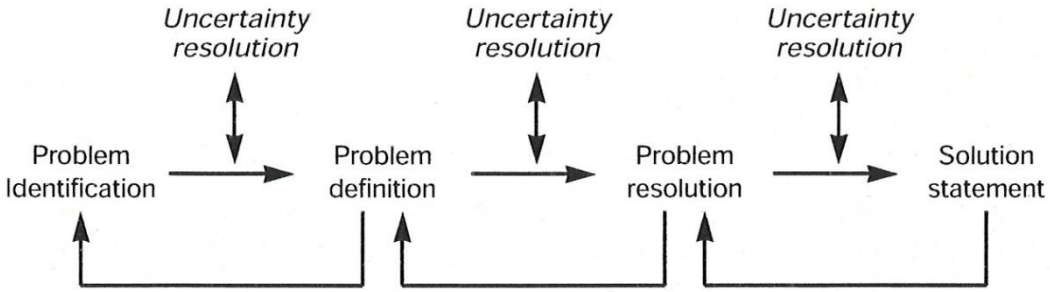

Fig. 7.1 Wilson's problem resolution chain (Wilson, 1999)

Each stage in Wilson's model "sees the successive resolution of more and more uncertainty".[16] This has two implications. The first is that ISU is a unified scalar concept which can vary throughout the search process but is a single property such that uncertainty experienced in, say, the problem identification phase, is essentially identical to that experienced in the problem resolution phase. The second is that there is a finite amount of uncertainty in the system which can be removed by finding a positivistic solution to the problem at hand. This may be appropriate for simple fact finding ('how many dollars can I get for £100?'[17]) but it is likely not appropriate for complex exploratory search tasks. Models for search over multiple sessions do exist (such as Lin and Belkin's MISE framework[18]) but they do not consider uncertainty.[19] Nevertheless, it seems possible to take any reasonably fine grained information seeking model, for example that of Marchionini and consider that uncertainty may be generated and indeed characterised by any phase or transition between phases:

[16] Ibid.
[17] Not as many as I could when this chapter was first being drafted.
[18] Shin-jeng Lin and Nick Belkin, "Validation of a Model of Information Seeking over Multiple Search Sessions," *Journal of the American Society for Information Science and Technology* 56, no. 4 (February 15, 2005): 393–415, doi:10.1002/asi.20127.
1.[19] Shin-jeng Lin and Iris Xie, "Behavioral Changes in Transmuting Multisession Successive Searches over the Web," *Journal of the American Society for Information Science and Technology* 64, no. 6 (June 1, 2013): 1259–83, doi:10.1002/asi.22839.

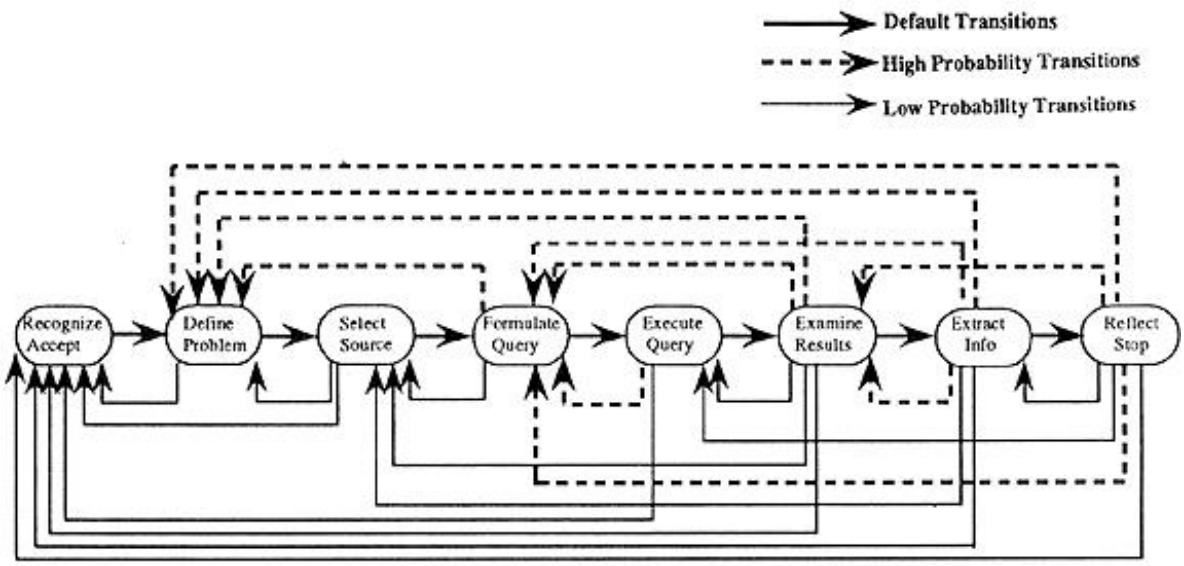

Fig 7.2. Marchionini's model of information seeking (1995)

So we may experience source selection uncertainty ('where do I look?'), query formulation uncertainty, result examination uncertainty and so on – in each case this is information seeking uncertainty caused by a barrier encountered in this phase

Some models, however, do not require such augmentation and indeed attempt some decomposition of ISU into component parts. Carol Kuhlthau's model of information search[20] which has received some validation from Wilson et al[21] is multidimensional:

	Initiation	Selection	Exploration	Formulation	Collection	Presentation	Assessment
Feelings (Affective)	Uncertainty	Optimism	Confusion Frustration Doubt	Clarity	Sense of direction / Confidence	Satisfaction or Disappointment	Sense of accomplish-ment
Thoughts (Cognitive)	vague →			focused →	increased	interest	Increased self-awareness
Actions (Physical)	seeking	relevant Exploring	information →	seeking	pertinent Documenting	information	

Fig. 7.3 Kuhlthau's model of the information search process (Kuhlthau, 1993)

As in the work of Diane Nahl,[22] who sees every information behaviour as being

[20] Carol Kuhlthau, 'A principle of uncertainty for information seeking', Journal of Documentation, vol. 49, no.4, 1993, p.343

[21] Wilson et al. 'Information Seeking and Mediated Searching. Part 2. Uncertainty and Its Correlates', Journal of the American Society for Information Science and Technology, vol 53, no.9, 2002, p.704-715

[22] Nahl, A conceptual framework for explaining information behaviour, *Studies in Media & Information Literacy Education*, Volume 1, Issue 2 (May 2001)

constituted of triples of affective, cognitive and sensori-motor behaviours, Kuhlthau's model has three layers. Users may conduct many searches in each phase. Rather than uncertainty steadily reducing as in Wilson, here a phase of high uncertainty is succeeded by a feeling of optimism which is succeeded by further uncertainty to be replaced by clarity and confidence: the searcher experiences a whirlwind of emotions. Yet like Wilson, there is a neat conclusion to the process which ends in a "sense of accomplishment".

The causes and progress of cognitive uncertainty are not manifest in this model but have been usefully explored in the library and archival literature. For librarians, users' uncertainty around research and information use, particularly amongst students, was refined into the concept of library anxiety by Constance Mellon.[23] Mellon found that many students felt "lost" in the library and that these feelings stemmed from the size of the collection, not knowing where items were located, not knowing where to start and not knowing "what to do".[24] It is striking how similar these concerns are to the work of Andrea Johnson, more than 20 years later, even though her users were archival researchers working with a digital system.[25] But Kuhlthau's model illustrates the ways in which these cognitive sources of uncertainty are tightly bound up with affective uncertainty so as to render them inseparable.

If as Kuhlthau work seems to suggest ISU is a property with more than one component it seems appropriate to consider what these components might consist of. For Otter and Johnson disorientation or 'lostness' is a "fundamental difficulty" experienced by users in hypertext systems.[26] But their measurements of lostness (like those of Pauline Smith[27]) are suitable only for bounded tasks. In exploratory search tasks we lack information on critical quantities such as the number of documents or nodes which need to be visited to complete a task. The focus on hyperlinks by both Smith and Otter and Johnson also makes their work difficult to apply to search tasks – where new links are effectively formed by whatever search term the user can dream up – and impossible to apply to exploratory search tasks where a "perfectly efficient" search simply does not exist. Ahuja and Webster's work on disorientation, although strongly focused on web site navigation includes a metric with items that seem apposite to information seeking uncertainty ("I felt lost") and takes a user centred rather than task centred approach.[28]

We might also consider properties which could possibly be negatively correlated with ISU. Yakel and Torres archival uncertainty consists of artifactual literacy (issues around analysis of written texts), domain knowledge (the domain being the subject the user is researching) and archival intelligence, consisting of archival theory, strategies for reducing uncertainty and ambiguity and intellective

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[23] Constance A. Mellon, "Library Anxiety: A Grounded Theory and Its Development," *College and Research Libraries* 47, no. 2 (January 1986): 160–65.

[24] Ibid, p.162

[25] Andrea Johnson, "Users, Use and Context: Supporting Interaction between Users and Digital Archives," in *What Are Archives?: Cultural and Theoretical Perspectives: A Reader*, ed. Louise Craven (Ashgate, 2008).

[26] M. Otter and H. Johnson, "Lost in Hyperspace: Metrics and Mental Models," *Interacting with Computers* 13, no. 1 (September 1, 2000): 1–40, doi:10.1016/S0953-5438(00)00030-8.

[27] Pauline A. Smith, "Towards a Practical Measure of Hypertext Usability," *Interacting with Computers* 8, no. 4 (December 1, 1996): 365–81, doi:10.1016/S0953-5438(97)83779-4.

[28] Jaspreet S. Ahuja and Jane Webster, "Perceived Disorientation: An Examination of a New Measure to Assess Web Design Effectiveness," *Interacting with Computers* 14, no. 1 (December 1, 2001): 15–29, doi:10.1016/S0953-5438(01)00048-0.

skills (with an emphasis on preparation and planning). [29] It may be observed that these factors map relatively neatly to Marchionini's "types of expertise" relating to information seeking: cognitive facility, domain expertise, system expertise (lacking from Yakel and Torres), information seeking expertise and techniques ("patterns, strategies, tactics and moves").[30] Additionally, Ruecker et al have argued for the importance of "prospect" when working with large scale collections.[31] Derived from the work of Jay Appleton, Ruecker and his colleagues define prospect as "a view of the world where enough information is available for the perceiver to understand the terrain and have a sense of what it affords, without seeing all the details".[32] Interfaces which provide such a view permit "rich prospect browsing".[33] In the archival sphere, Mitchell Whitelaw has referred to these as "generous" interfaces because content is shown in some quantity up front rather than being concealed behind a search box.[34]

But in general, aside from Andrea Johnson's work, archival practitioners have not expressed much interest in uncertainty. Yet it is clear that the process of locating desired items amidst large digitised collections is by no means a trivial one and so an instrument which can characterise the uncertainty inherent in such a process is highly desirable. Library anxiety has seen first the development by Sharon Bostick of the 43 item Library Anxiety Scale[35] and then the development of the Multidimensional Library Anxiety Scale by Doris Van Kempen.[36] But many of the items on these scales are not generalisable beyond the library building ("the staff are never too busy to come and help me") and at 53 questions, the latter is a little unwieldy.[37] Subsequent efforts such as those of Erfanmanesh et al[38] or Chowdhury and Gibb[39] remain insufficiently generalisable or are hampered by items of indifferent quality ("When seeking information resources in the university library, I feel anxious because of the library's furniture") or statements which the information seeker cannot adequately answer (being invited, for example to rate how "unaware" they are). The need for a reliable measure of uncertainty in information seeking, formulated for the archival environment in the first instance, appears to remain pressing.

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[29] Elizabeth Yakel and Deborah Torres, 'AI: Archival Intelligence and User Expertise', The American Archivist, Vol. 66 (Spring/Summer 2003) : 51–7

[30] Gary Marchionini, *Information Seeking in Electronic Environments* (Cambridge University Press, 1997), p.61

[31] Stan Ruecker, Milena Radzikowska, and Stéfan Sinclair, *Visual Interface Design for Digital Cultural Heritage : A Guide to Rich-Prospect Browsing* (Farnham: Ashgate, 2011), p.26

[32] Jay Appleton, *The Experience of Landscape.* (London: Wiley, 1975).

[33] Ruecker, op. cit., p.3

[34] Mitchell Whitelaw, "Generous Interfaces for Digital Cultural Collections", *Digital Humanities Quarterly*, vol. 9, no. 1 (2015), http://www.digitalhumanities.org/dhq/vol/9/1/000205/000205.html.

[35] Jeanne Nikolaison, "The Effect of Library Instruction on Library Anxiety in the Public Library Setting," *Current Studies in Librarianship* 37, no. 1 (2011), p.18

[36] Doris J. Van Kampen, "Development and Validation of the Multidimensional Library Anxiety Scale," *College & Research Libraries* 65, no. 1 (2004): 28–34.

[37] Jessica Platt and Tyson L. Platt, "Library Anxiety Among Undergraduates Enrolled in a Research Methods in Psychology Course," *Behavioral & Social Sciences Librarian* 32, no. 4 (October 1, 2013), p.247

[38] Mohammadamin Erfanmanesh, A Abrizah, and Noor Harun Abdul Karim, "Development and Validation of the Information Seeking Anxiety Scale," *Malaysian Journal of Library & Information Science* 17, no. 1 (2012),p.38

[39] Chowdhury, Sudatta, Forbes Gibb, and Monica Landoni. "A model of uncertainty and its relation to information seeking and retrieval (IS&R)." *Journal of Documentation* 70, no. 4 (2014), p.598

7.2 Methodology

Our aim is to meet this need by constructing a multidimensional instrument which can measure the information seeking uncertainty experienced by users of digital archival collections.

7.2.1 Scale construction

An initial pool of 142 items was generated. Many of the statements were taken (occasionally verbatim) from statements from users collected in the three previous studies outlined in this thesis. In an attempt to mirror some of the users' language, a statement used in the scale such as:

"I found the search system intimidating."

Was derived from a user describing the experience of working at the Archives and saying:

"I felt a little intimidated by it."

In other cases, the relationship was less direct. A number of users referred to the scale of material held by the Archives (e.g. "there's so much to look up") and these comments were turned into statements such as:

"I found it difficult to cope with the sheer volume of material I was looking through."

Statements were generated to reflect all the barriers and regulators that had been firmly identified, the different kinds of affect reported (anxiety, joy, frustration) and the phases of the Marchionini model. These statements were augmented by items adapted or inspired by concepts from a literature review: Sauro's SUPR-Q,[40] Chowdhury et al,[41] Hearst et al,[42] Duff and Johnson,[43] O'Brien and Toms,[44] Nahl,[45] and Marchionini's model of information seeking were all consulted.[46] These sources were selected either because they related directly to affective aspects of information seeking or because they contained items that seemed to relate to previously identified barriers, regulators or transitional emotional states encountered by archival researchers – particularly if these had been expressed very broadly or vaguely by the subjects. Jeff Sauro's work was particularly useful as archival researchers have tended to talk in terms of the research problems they are having, rather than

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[40] Jeff Sauro, "SUPR-Q: A Comprehensive Measure of the Quality of the Website User Experience," *J. Usability Studies* 10, no. 2 (February 2015): 68–86.
[41] Chowdhury et al, op. cit.
[42] Marti Hearst et al., "Finding the Flow in Web Site Search," *Commun. ACM* 45, no. 9 (September 2002): 42–49, doi:10.1145/567498.567525.
[43] Wendy M. Duff and Catherine A. Johnson, "Accidentally Found on Purpose: Information-Seeking Behavior of Historians in Archives.," *Library Quarterly* 72, no. 4 (January 2002): 472–96.
[44] Heather L. O'Brien and Elaine G. Toms, "The Development and Evaluation of a Survey to Measure User Engagement," *Journal of the American Society for Information Science and Technology* 61, no. 1 (January 1, 2010): 50–69, doi:10.1002/asi.21229.
[45] Diane Nahl, "Measuring the Affective Information Environment of Web Searchers," *Proceedings of the American Society for Information Science and Technology* 41, no. 1 (January 1, 2004): 191–97, doi:10.1002/meet.1450410122.
[46] Marchionini, op. cit.

discussing specific systems problems they are experiencing. Examining the concepts embedded in this scale allowed us to consider items based on usability, system terminology and feedback and customer centredness. Statements were not included from these scales if they could not be linked back to the concept of uncertainty. For example, time pressure is a regulator for the barrier of being easily distracted by how varied and interesting archival material can be and it is also a property explored by Diane Nahl. On this basis statements such as:

"Having a time limit helps me work efficiently."

were initially generated. While such statements clearly relate to time pressure and efficiency it is also clear that they do not relate materially to the concept of cognitive or affective uncertainty.

The initial list of 142 statements were examined by two rounds of experts; three archivists and two computer scientists. This examination eliminated a range of statements which were considered to be poorly phrased, not fully appropriate to the domain – either to archives or uncertainty ('the search system was attractively designed') or were in other ways ambiguous. This resulted in a trial set of 67 statements (see Appendix A) to be tested with a sizeable sample of users carrying out an exploratory search task. These statements were used in conjunction with a five point likert scale, moving from "strongly disagree" to "strongly agree" with "neither agree nor disagree" at the midpoint.[47]

7.2.2 Data collection

Designing exploratory search tasks which are realistic and representative but can still be accomplished under laboratory or other bounded conditions is relatively challenging.[48] For the purposes of testing the instrument a study was designed in which participants were invited to imagine they were assisting a historian carry out research into the 17th century. They were to use the National Archives catalogue system Discovery to try and identify the types of goods imported and exported into England during the period. They were not given any examples of such goods but were required to devise their own search queries. They were then shown a 1654 High Court of Admiralty document relating to the silver trade, digitised by the MarineLives project.[49] Participants were not shown a transcript and the document is written in a hand very difficult for a non-expert reader to decipher. They were asked if the document was relevant to their search, what goods they had found in their prior search and whether they felt they had found the most significant goods traded in the period. The purpose of the document task was to replicate the final steps of the

[47] Royce Singleton, Bruce C. Straits, and Margaret Miller Straits, *Approaches to Social Research*, 2nd ed. (New York ; Oxford: Oxford University Press, 1993).
[48] Bill Kules and Robert Capra, "Designing Exploratory Search Tasks for User Studies of Information Seeking Support Systems," in *Proceedings of the 9th ACM/IEEE-CS Joint Conference on Digital Libraries*, JCDL '09 (New York, NY, USA: ACM, 2009), 419–20, doi:10.1145/1555400.1555492.
[49] High Court of Admiralty, "HCA 13/69 f.41r," *MarineLives*, 1654, http://marinelives.org/wiki/HCA_13/69_Silver_1_f.41r_Annotate.

archival information journey when the researcher actually has the document in their hands, as opposed to users working only with metadata as in the previous chapter.

The survey tool Qualtrics was used to collect to collect responses from participants. Collection was in four phases:

1. A pilot phase in which 15 responses were collected.
2. A wider phase in which 178 responses were collected. Respondents were recruited via email and Twitter, mainly via mailing lists such as student history societies and the Friends of the National Archives.

Respondents were incentivised by being entered into a drawer to win sets of Amazon vouchers. This constituted *sample one*. This was followed by a second survey comprising:

3. A test phase in which 40 responses were collected from a panel convened by Qualtrics itself. 10 of these responses were deleted as low quality and this data was used to set a floor of 6 minutes for the study. Responses were not collected from users who completed the task in fewer than 6 minutes.
4. A final phase in which 139 responses were collected from Qualtrics panel representatives, making 179 in total.

This constituted *sample two*. These respondents were recruited and remunerated by Qualtrics. The two Qualtrics surveys were structurally identical except that three demographic questions were moved ahead of the task and an email field removed from the second version. The order of the instrument statements was randomised to prevent context or other ordering effects.

7.2.3 Participants

Participants were roughly gender balanced but with slightly more responses from women being recorded:

Sample	Male	Female	Preferred not to say / not recorded	Total
One	66	77	35	178
Two	85	88	0	173

Table 7.1. Gender of participants

In both cases, a relatively high proportion of participants were under 35:

Sample	18-24	25-35	36-45	46-55	56-65	65+	Did not say	Total
One	42	53	12	21	15	3	32	178
Two	48	51	27	26	21	0	0	173

Table 7.2. Age of participants

Neither group claimed much experience in archival research but, composed largely of university students, the first sample is more experienced and less representative than sample two which was partly commissioned in order to balance it:

Sample	First time	Less than a year	1-5 years	5-10 years	10-20 years	20 years +	Did not say	Total
One	75	18	34	11	4	5	31	178
Two	118	11	27	10	6	1	0	173

Table 7.3. Experience working with archival documents of participants

68% of users in sample two stated that they had never worked with archival material before, compared to 51% of users who responded to the question in sample 1.

7.3 Data Analysis

7.3.1 Data Preparation and Cleaning

Incomplete, blank or otherwise nonsensical responses were removed. This produced 172 responses from sample one and 173 from sample two, making 345 responses available for analysis.

7.3.2 Principal Components Analysis

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (KMO=0.94) suggested that factor analysis should result in robust and clear factors. (Indeed Kaiser enthusiastically refers to values above 0.90 as “marvelous”).[50] (See Appendix B for item based MSAs). Bartlett's Test of Sphericity verified that relationships existed between items ($\chi 2=12618.5$, df=2211, $p<0.001$).

PCA was used to examine the number and scope of the factors present in the data. An initial scree plot suggested the characteristic ‘elbow’ at 2-5 factors.

[50] Kaiser, Henry F., and John Rice. "Little jiffy, mark IV." *Educational and Psychological Measurement* 34, no. 1 (1974), p.112

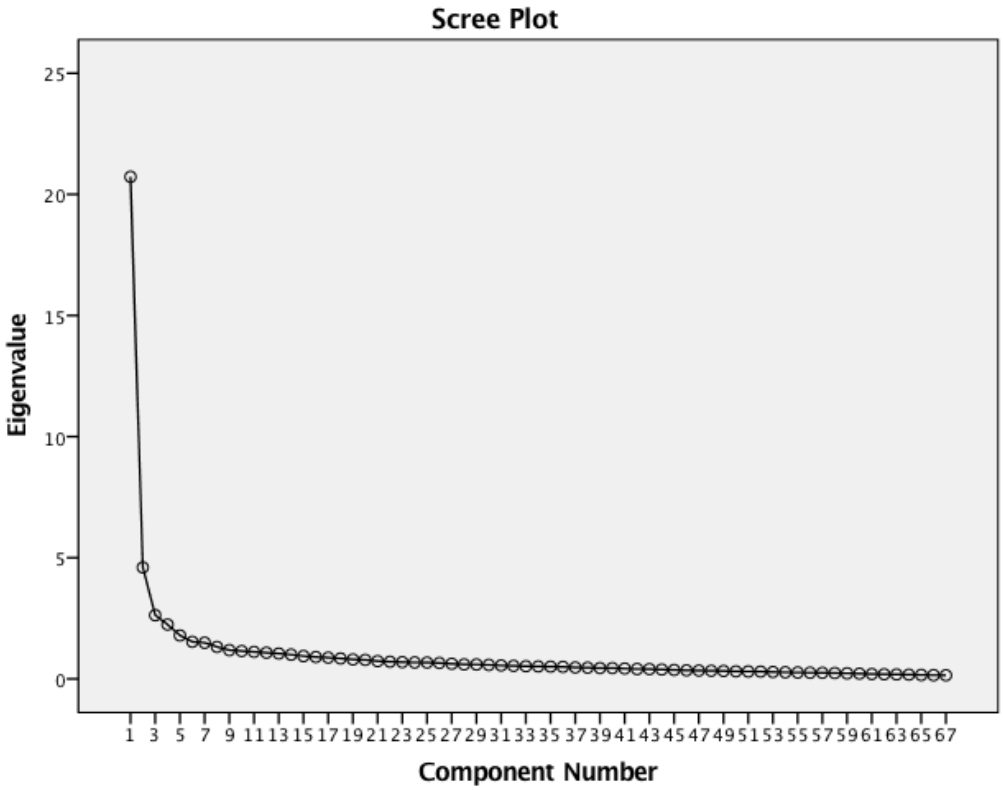

Figure 7.4. Eigenvalues of the 67 tested items

Oblimin rotation with Kaiser normalisation was adoped in an attempt to simplify the factors. The 2 factor solution accounted for too little variance to be considered optimal (37.8%).

The three factor solution produces two moderately correlated factors and a third, clearly orthogonal factor.

Component	Factor 1	Factor 2	Factor 3
Factor 1	1	-0.374	0.004
Factor 2	-0.374	1	0.027
Factor 3	0.004	0.027	1

Table 7.4. Component Correlation Matrix (67 items)

The four and five factor solutions produced factors very considerably correlated with each other, producing highly complex cross-loadings. In pursuit of simple structure these solutions offer little explanatory power and these two factors together only account for 6.0% of the variance. Consequently, the three factor solution was preferred. (see Appendix C).

7.3.3. Reduction

In order to reduce the scale to a more manageable length, items in factors 1 and 2 with loadings of 0.61 and above were considered, on the basis that Tabachnick and

Fidell (following Comrey and Lee), regard 0.55 or greater as "good".[51] Accordingly, above 0.6 seemed (informally) a 'strong good'. These 31 items were reduced to 28 once strongly cross-correlating items were removed. The 4 items in the third factor were clearly orthogonal to the other two factors. Only these were retained to produce a scale of 32 statements (see Appendix D).

In order to confirm the validity of this selection half the data was taken at random (across both samples) and compared the remaining 35 questions with the second half of the data. For factor 1, the correlation between the 14 selected statements and the remainder was 0.897. For factor 2 it was 0.861. The 32 statement subscale was tested as a whole against the full scale and found to correlate at r=0.90.

But with this test, a somewhat cross loading item from factor 3 (Q42 – "At the start of the research task I had a clear plan.") heavily loads with factor 1. So for further tests Q42 was moved to this factor.

7.3.4 Interpreting the Factors

To complete the principal component analysis, the factors were examined and labelled according to their constituent elements. (see Appendix C)

Factor 1: Disorientation

14 items comprise this factor which accounted for 30.1% of the rotated variance. The calculated alpha value was 0.912. These statements relate to confusion, a sense of being lost or overwhelmed by the scale of the task at hand and a desire for outside help. Following Ahuja and Webster this factor has been named *disorientation*.[52]

Factor 2: Prospect

14 items comprise this factor which accounted for 6.9% of the rotated variance. The calculated alpha value was 0.927. These much more positive statements seem to reflect a kind of groundedness: that users can look ahead to future search sessions, understand where material of interest is located and felt they had made forward progress. Because so many of the statements seem to contain Ruecker et al's sense of "I see what I can do", this factor has been named *prospect*.[53]

Some statements in factor 2 may appear similar. For example, Q38 and Q39 both relate to the user's understanding of the arrangement of the archive. But Q39 asks a wider question about the user's mental model of the entire collection where Q38 only about the specific records being sought during a task. Q25 and Q60 are intensified forms of Q35 and Q61 respectively. (See Appendix A).

Factor 3: Preparedness

[51] Tabachnick, Barbara G., and Linda S. Fidell. *Using multivariate statistics*. Allyn & Bacon/Pearson Education, 2007.
[52] Ahuja and Webster, op. cit.
[53] Ruecker, op. cit.

With Q42 moving into factor 1, just three items comprise this factor which accounted for 3.9% of the rotated variance. The calculated alpha value was correspondingly lower at 0.547. These statements refer to preparation, planning and trust and consequently this factor has been named preparedness. Preparation is one of two constituents making up “intellective skills” in the dimensions of archival intelligence identified by Yakel and Torres.[54]

A 20 question version of the instrument was also examined and had relatively similar alpha values for the three factors (0.883, 0.88 and 0.547 respectively). However, reducing the instrument to 20 questions means that not all steps in the information journey are represented and ultimately the 32 question instrument was preferred as possessing more discriminatory power and still being relatively easy to deliver.

7.4 Limitations

This was a single task firmly based in a single domain: that of historical research. But it was formulated to try and imitate as closely as was practical the key phases of information seeking. The participants’ information source was selected for them but they had to formulate queries, examine results sets and decide when they had found ‘enough’. They also had to examine a document and attempt to extract information from it. These constitute the main phases of exploratory search as it is conventionally understood.[55] There seemed to be plenty of scope for uncertainty. On the other hand, the task was one devised for them. It did not emerge from their own information needs and their commitment to it would be correspondingly weak. There was also no scope for preparation such reading of secondary literature as would conventionally be employed by a professional researcher, or much time to plan a search strategy.

It may be argued that this study did not take place over a “very long” period of time and thus cannot accurately replicate the conditions of exploratory search. Doubtless a longitudinal study of exploratory search would reveal many features of interest, however a study taking three, six or 18 months would still cover only a small fraction of the information journey of a family historian and would be concerned with less fine grained cognitive and affective experiences. While the task represents a tiny fraction of an information journey, it is of these fractions that the journey is constructed and it is appropriate to analyse them.

7.5 Discussion

These factors of uncertainty seem plausible and reassuringly present in the literature. Prospect has been championed by Stan Ruecker and his colleagues. The ability to appreciate and understand the archival landscape is invaluable for research success. Disorientation (or lostness) as discussed in 7.1.4 has been examined by a range of authors and this form of confusion is familiar to anyone who has observed online archival research in progress. Preparedness is considered important by Yakel and Torres, a key part of archival intelligence. Taking time to prepare for archival research by, for instance, locating references to documents in or amassing concepts

[54] Yakel and Torres, op. cit., p.73
[55] Marchionini, op cit.

from secondary reading is bound to lead to surer progress. At the same it makes sense that preparedness alone cannot guarantee success. Planning and preparation (rather like confidence) are obviously helpful in making progress but they are a supplement to domain knowledge and artifactual literacy not a substitute for them.

Two frameworks may help us understand the relationship between these factors. Firstly, if we consider prospect and disorientation in the context of Norman's action cycle there does appear to be some similarity between these properties of mind and Norman's gulfs of evaluation and execution.[56] Disorientation is not identical with falling into this latter gulf but it is more closely associated with a kind of paralysis of action than prospect. Users in this state wish someone would solve their problem for them (Q33), cannot manage the information they are collecting (Q19, Q20) and experience loss of control – either going in circles (Q27) or feeling they have a destination or goal in mind that something is preventing them from reaching (Q28). This does seem to capture the helplessness we saw in chapter 4. Prospect is similarly more than just a running jump over the gulf of evaluation. Norman's action cycle is about formulating goals and evaluating the results of executing them. Prospect can resemble this ("I see what I can do") but appears broader. Users with strong prospect are planning their next actions or even next search sessions (Q45, Q46) and feel they have a good overall understanding of the whole archival system (Q38, Q39). This is more than not falling into a hole. Nevertheless, a rise in prospect will clearly help with goal formation just as a rise in disorientation would appear to make it harder to take action – or rather to reflect encounters with barriers producing a state in which it is harder to take action.

The second useful framework here is Klein, Moon and Hoffman's data/frame model of sensemaking (Fig. 2.29 and discussed at 2.5.3). In conditions of high uncertainty this elaborate interplay between data and frame simply grinds to a halt. Users cannot understand the feedback they are receiving from the system (Q12), cannot frame new queries (Q23) and cannot make judgements about their progress or likely chance of success (Q9, Q42). Elaboration, questioning and reframing are all failing. There is simply data (too much of it) and confusion. Sensemaking is a fundamental process of cognition and for it to break down in this way is bound to be accompanied by negative affect. Low prospect and high disorientation reflect the glue poured into this delicate clockwork in the course of bad interactions with information systems and data.

There is still more that can be teased out regarding the interplay between prospect and disorientation and whether this has implications for design. Prospect and disorientation are correlated and indeed the contention at this stage cannot be entirely refuted that one is the mirror of the other. The relationship between all three factors is more plainly illustrated in a final study.

7.6 Follow up study: Sussing the ISUS

Having developed the instrument, the next step was to run a study attempting to validate it empirically in conditions that themselves possessed a reasonable degree of ecological validity.

[56] Norman, Donald A. "Cognitive artifacts." *Designing interaction: Psychology at the human-computer interface* 1 (1991): 17-38.

7.6.1 Methodology

In this experiment the aim was to measure differences in levels of uncertainty using the ISUS. The hypothesis was that users who received more support to complete a task should feel less uncertain, as measured by the scale, than users that did not receive such support.

Participants

The study was piloted with three participants and some task text was clarified as a result of these initial tests.

31 participants were then recruited; an opportunity sample of students and academics from the University of York with the addition of some older adults. 16 of the participants were in the 26-35 age category with 6 under 25. No participants were over 65.

The participants were not generally familiar with the National Archives or its systems. When asked how long they had been using archival documents, 19 participants recorded that this was their "first time". 9 said they had been working with such documents for less than a year. Only 3 participants had been working with documents for longer than a year.

Design

This study used a between subjects design and participants were randomly assigned to one of two groups where the independent variable was the level of research support they were given. As this was the instrument's first real outing the study did not compare two systems (how would we know for sure which 'better' at supporting the user?) but the same system: Discovery. Users were given paper support in the form of the research guide produced by the National Archives to assist in locating specific record types. The dependent variable was uncertainty as measured by the ISUS but the experiment also measured the time taken to complete the task and whether the document located was the correct one, the wrong one or whether the user was unable to locate what they believed to be a relevant document.

Materials

Participants were asked to locate a specific First World War unit war diary in the National Archives Discovery catalogue system. This is one of the more straightforward tasks carried out by amateur researchers and it makes use of records which have been digitised as a result of their considerable popularity.[57] The centenary in 2014 of the start of the Great War was the catalyst for an upsurge in activity and commemoration of the period across many countries. The National Archives holds records of over 5m servicemen and women who fought in the conflict. Medal index cards, service records (though much damaged) and unit war diaries held at Kew are the three principal record types for those wishing to investigate an

[57] BBC News, "WW1 Soldier Diaries Placed Online by National Archives," *BBC*, 2014, http://www.bbc.co.uk/news/uk-25716569.

individual's role in the war, especially if that individual was fortunate enough not be represented in the records of the Commonwealth War Graves Commission.

While both groups of participants undertook the same task, they did not receive equal support. Participants in condition one began the experiment on the main page of Discovery. Participants in condition two (the 'helped' condition) undertook the same task but were given two key pieces of assistance. The first was a paper copy of the research guide 'British Army war diaries 1914-1922', produced by the National Archives.[58] They were invited to read this carefully in advance of their search. These participants did not start on the homepage of Discovery but on an advanced search page in which some filters had been pre-populated for them. This mimics the bespoke search provided by the digital version of the war diaries research guide. These users were thus searching about 23,000 records rather than the 32m in Discovery. On the face the face of it, these two additions should provide a significant advantage for condition two participants.

Procedure

In both conditions participants were asked to sign a form giving their informed consent, given a short demographic questionnaire and then given a known item search task. They were invited to use the Discovery search system on their own computer (as most amateur genealogists would do) to find a specific First World War unit war diary (that of the 17th Battalion of the Lancashire Fusiliers) on behalf of a relative. Participants were given 10 minutes to locate the document and note its catalogue reference. They were timed by the investigator. The clock was stopped if the participant announced they had located the document and written down the reference. At the end of the ten minutes or after they had requested the clock be stopped, participants completed the ISUS. They were not told until after they had completed the instrument if they document they had located was the correct one.

7.6.2 Results

At the end of the experiment, participants could find themselves in one of three states: they had either successfully identified the correct document (WO 95/2484/1) and stopped the clock, run out of time at 10 minutes or stopped the clock having identified a document other than the one they had been directed to find. 20 participants across the two conditions succeeded in locating the correct document. 53% of participants in condition one successfully located the document but 80% managed this in condition two.

Condition	Correct doc found	Wrong doc found	No doc found
1	8	2	5
2	12	1	2

Table 7.5. Ability to locate document

[58] The National Archives, "British Army War Diaries 1914-1922," accessed August 6, 2016, http://nationalarchives.gov.uk/records/research-guides/british-army-war-diaries-1914-1922/.

The three documents incorrectly presented as the war diary of the 17th battalion were all war diaries. Two were diaries for the 11th battalion of the Lancashire Fusiliers. The system uses a serif font which it is possible caused users to mistakenly take 11 to be 17. The remaining diary was that of the 51st Battalion of the King's Liverpool Regiment which is less explicable but this was found in the shortest time in the study (two minutes and five seconds) perhaps suggesting an over-hasty relevance judgement.

The mean time to complete the experiment was 5 minutes and 46.5 seconds. The mean time in condition one was 7 minutes 7 seconds and in condition two 4 minutes and 26 seconds. The fastest time recorded to correctly locate the document was 2 minutes 8 seconds (in condition two).

In a known item task (as opposed to an exploratory search task) it is obviously desirable that participants find what they are looking for quickly. The helped condition participants were effectively given extra 'thinking time' by being given the research guide to study in advance of the task so it may be considered that they used their time differently rather than genuinely completing the task faster.

Statistical analysis of the ISUS results was performed in R. Preparedness, disorientation and prospect were calculated by adding up their respective scores. Uncertainty was calculated by reverse scoring prospect and preparedness (all statements correlate negative uncertainty) and adding the reverse scored results to those from disorientation (where all statements correlate positively to uncertainty).

The mean scores and standard deviations were as follows:

Condition	Stat	Preparedness	Prospect	Disorientation	Uncertainty
1	M	9.60	37.33	48.73	104.67
1	SD	1.70	8.63	11.90	18.63
2	M	11.53	45.60	43.07	89.93
2	SD	1.15	9.01	12.86	19.92

Table 7.6. Descriptive statistics across three factors

So in the helped condition (2), participants seem to feel more prepared, have more prospect over their information journey and feel less disorientation. They are consequently less uncertain.

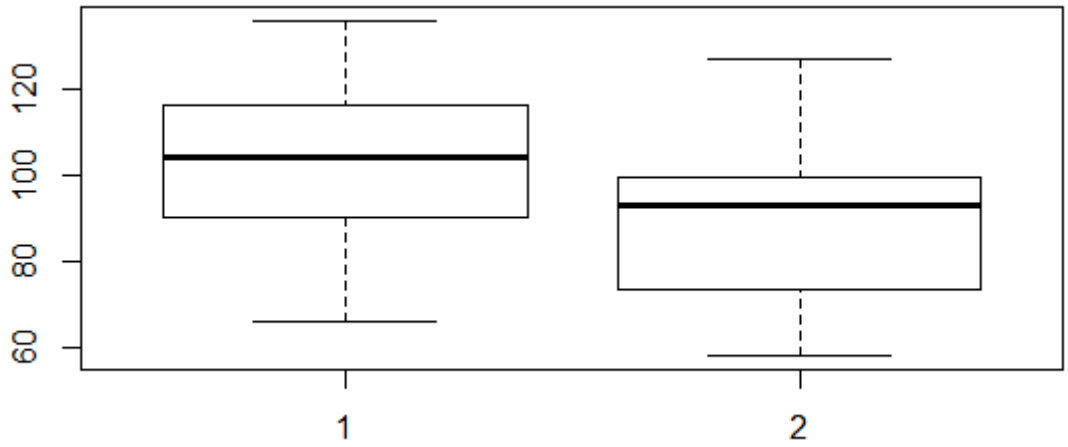

Figure 7.5 Box plot of mean uncertainty in the unhelped (1) and helped (2) conditions

Mann-Whitney tests shed a little more light on the differences in mean preparedness, prospect and disorientation between the two conditions. There was a significant difference in preparedness, with a p-value of 0.0034 and with an effect size W = 42.5. There was also a significant difference in prospect with a p-value of 0.0127 and W = 52. Participants felt significantly more prepared and experienced significantly improved prospect. But disorientation did not show a significant difference across the two conditions. The Mann-Whitney test produced a p-value of 0.221 for disorientation (W = 142.5) with the result that the p-value for uncertainty was 0.0650. (W = 157.5). This means participants' disorientation and uncertainty were not significantly reduced in the helped condition.

7.6.3 Discussion

This is an excellent result and shows the instrument acting with discrimination. Close examination of the results shows next to no difference between key disorientation items such as Q26 ("The document descriptions didn't tell me enough to know if what I was seeing was really relevant") or Q4 ("I was frustrated because I knew what I wanted but I couldn't get to it") between the two conditions. This should have been anticipated: we have clearly not made any system changes that should cause radically different responses to these sorts of questions across the two conditions. This serves as a fine 'sense check' for the instrument. It also appears to vindicate the importance of the three factors - that is to say their importance as independent properties in their own right.

Research guides make researchers feel significantly more prepared and they do give them significantly more prospect but they don't diminish disorientation (which partly explains why even participants who have read them can't invariably find their documents). Research guides do not significantly reduce their users' uncertainty. And we should not expect them to because really successful interventions will be those which act on sites of disorientation (queries, result sets etc.) as well as providing prospect over collections.

It may appear that a simple known item search may appear to be a very imperfect test for an instrument designed to measure uncertainty in exploratory search. In fact preliminary testing, piloting and observation of the participants made

clear several aspects of the Discovery system which made this superficially quite straightforward task challenging. For example, although the document in question has been digitised it cannot be viewed. The National Archives charges for digital downloads of war diaries and although the document viewer appears to function, users see the following:

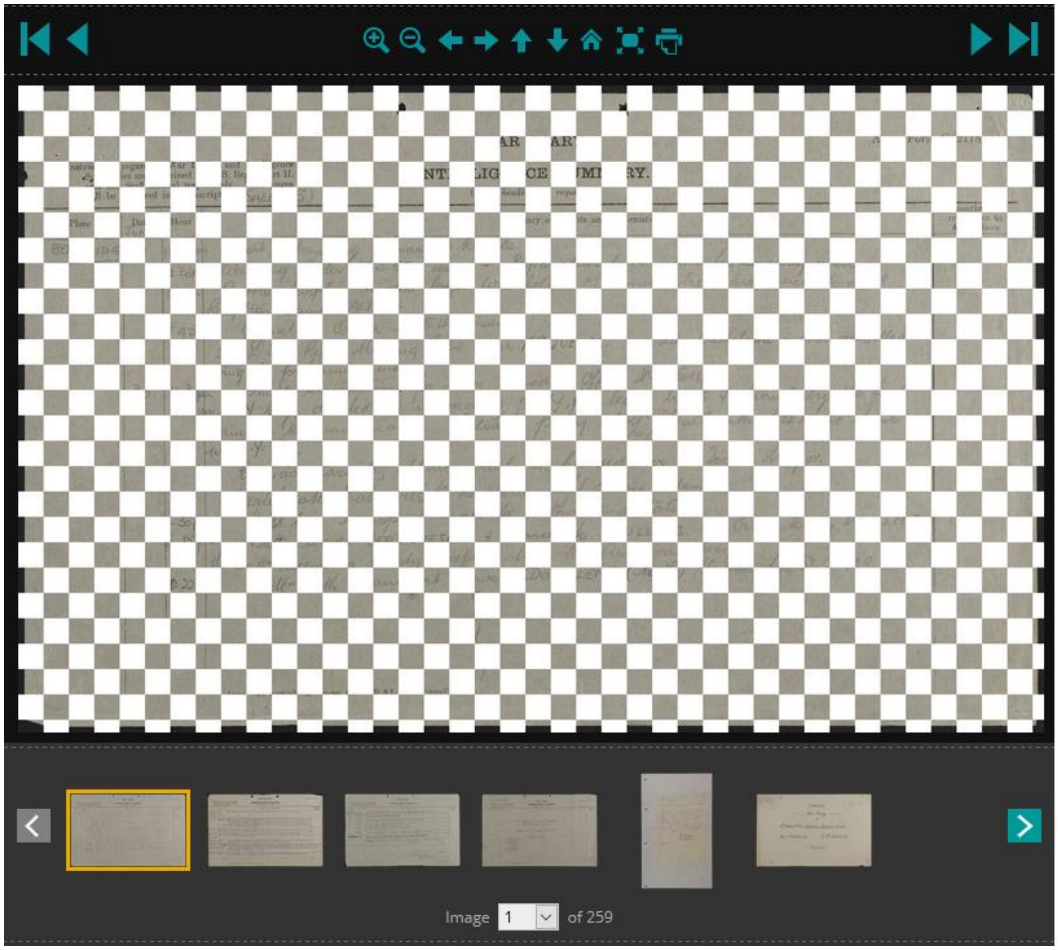

Figure 7.6: WO 95/2484/1 using the Discovery image viewer

The checkerboarding renders the document image useless for the purposes of 'previewing' content to aid a judgement about its relevance. In terms of locating the document, it might as well not have been digitised. Since this is the case for at least 95% of the documents in the archive it may be argued that this makes the study more representative but this is of little comfort to the user.

Vague metadata also hampers relevance judgements and renders certain obvious queries more difficult. At item level the description field of the document reads, in its entirety: "17 Battalion Lancashire Fusiliers". The system's search logic means that using "17th" in a query will exclude this document from results as will the terms "war" and "diary". These words occur instead amidst the record's "context" showing its place in the hierarchy. This is located right at the bottom of the page in a separate pane from the description and may not be examined by all users. There are also large numbers of items of tangential relevance: many war diaries relating to similar regiments in similar conflicts. These factors all connive to ensure that the task in fact affords a reasonable level of challenge, such to ensure a reasonable amount of uncertainty in both conditions. This is also a good example of the principle that

data doesn't have to be 'big' (in the sense meant by data scientists or companies such as IBM) to be confusing. The results suggest that 23,000 records are not significantly less confusing than 32m. But this is a very useful finding because it may mean that the reverse is true: that 32m records may not be significantly more confusing than 23,000 and that a few orders of magnitude are likely irrelevant once we have reached 'too big to handle' – wherever that point might be. The positive implication of this may just be that solutions that work well for thousands of records can be scaled up. Certainly this is something which merits further investigation.

A final observation and the one which continues to motivate this work is how dispirited some users feel when they find nothing. Hearing a rueful participant greet the end of their allotted time by exclaiming "I feel very useless" (P17) illustrates a classic negative interaction that simply shouldn't be occurring in a system that purports to be based on user centred principles.[59] Information uncertainty may be different from Greco and Roger's electric shocks but that doesn't mean that it has no effect on researchers and perhaps in some cases a stronger effect than we might expect.

7.6.4 Limitations

This is a single study of a small sample of users and suffers from some of the same limitations discussed above (see 7.4). The task was a realistic one but not one the participants had an intrinsic motivation to solve and was technically a known item search task – albeit one of a specialised and particular kind. Nevertheless, the challenge participants experienced was real and so was their cognitive uncertainty with affective frustration following in many cases as the scale demonstrates.

7.7 Conclusion

This result is highly encouraging for the ISUS. Uncertainty appears to be able to be measured and in a way that permits some discrimination. Users can remain disoriented even after being prepared and experiencing greater prospect. Research guides intended to explain the arrangement and scope of collections can succeed in their task and convey important and useful collections information yet still leave their users none the wiser in terms of the system they must grapple with.

For the National Archives this study appears to expose some issues. The fact that a 'preview' of a document does not function as one is a serious usability issue. If the archive must deliberately obscure its holdings for reasons of commercial expedience then a generating a genuine preview showing, say, 5% of a document (consisting of 20 pages or more) would be a far more sensible compromise and allow users to make improved relevance judgements. The difficulty of these judgements and the consequent relatively high failure rate - a third - in what should be a relatively straightforward known item task suggests that whatever else uncertainty might be it is here too high. Locating a service record for a specific Great War veteran, for

[59] Jonathan Cates, 'More comprehensive Discovery', 2015, http://blog.nationalarchives.gov.uk/blog/comprehensive-discovery/

instance, is a much more difficult task and we might predict even higher failure rates and uncertainty scores.

Over the course of this chapter, a scale for measuring information seeking uncertainty has been developed and evaluated. This is a multidimensional state comprising two interrelated factors, namely disorientation and prospect and a third orthogonal factor of preparedness. Where previous scales were perhaps of limited use outside the library environment, the information seeking uncertainty scale (ISUS) should be of use in the development of archival and other cultural heritage search systems. The statements are relatively open and may have value in enterprise search more widely. Developers now have a tool they can to measure the results of changes to search interfaces such as modifying facets, altering search fields, changes to relevance ranking or the impact of deploying technologies such as dynamic term suggestion. Successive phases of search system development can be assessed using the ISUS and better results for users achieved. Above all it may be hoped use of the instrument will result in systems that cause less uncertainty for users and result in more successful search outcomes.

Chapter 8: Conclusion

“You don't want a forest, a leaf will do.”

- P.L. Travers, 'What the bee knows' (1967).[1]

8.1 Chasing certainty

Information journeys in digital archives are challenging. These journeys are varied and various but there are some general things we can say about them. They are comprised largely of episodes of exploratory search in which the questions asked are evolving and the final ‘answer’ may not even be imaginable at the start. Researchers are explorers who must chart a course between digitisation islands and explore dense and exhausting jungles once they land. They must generally work without signposts or where these exist they will be written in a language they barely understand. They will face numerous obstacles and barriers and they may never know whether they walked right past the treasure they searched for or whether it was destroyed centuries ago. They will be uncertain, they will face setbacks and mere preparedness may not be sufficient to see them through to the end of the journey. They may satisfice or withdraw early. But sometimes they will make progress and that, perhaps strangely, will be enough. In the future these journeys may become easier or they may, as digital collections become comprised less of volumes of memoranda and boxes of correspondence and more of emails, intranets and VR models, become yet more complex and labyrinthine. “There will never be an app for digital preservation”, argues Trevor Owens and it’s tempting to suggest that there won’t be one for information seeking either, in the sense that an intellectual journey entirely undertaken by a machine isn’t obviously an intellectual journey at all.[2]

On the Ancestry family history website, having identified an ancestor in your own tree, the system will attempt to locate the individual in the family tree of another user. By this means it was possible at the touch of a button to add this tree to your own and watch generations of your family suddenly fall into place. This is both momentarily satisfying and by far the most boring way to conduct research. Indeed the functionality (what Ancestry now calls 'hints'[3]) has been rather carefully managed since its first days as the “shakey leaf” - a reference to the animation signalling a likely match in the database.[4] The fact is that some uncertainty is enjoyable. Without it we couldn’t enjoy what Richard Feynman called “the pleasure of finding the thing

[1] P. L. Travers, *What the Bee Knows* (New Paltz, New York: Codhill Press, 2010).

[2] Trevor Owens, “The Theory and Craft of Digital Preservation”, accessed August 15, 2017, http://www.trevorowens.org/2017/06/full-draft-of-theory-craft-of-digital-preservation/

[3] Ancestry, “When a Leaf Appears More of Your History Could Appear Too,” accessed September 30, 2017, http://www.ancestry.com/hints.

[4] Ancestry, “Ancestry.com Commercial - Shakey Leaf,” *YouTube*, 2009, https://www.youtube.com/watch?v=ORmxCXmiIy4.

out."[5] Indeed Ancestry's functionality is reminiscent of Daniel Cook's "rescue princess button", his analogy for the difference between design in games and other forms of design work.[6] The simplest system is not always the most desirable one. For many amateurs (and professionals if they're being honest) archival research is ergodic. This is clear not simply because of the comments some users make about the process but because they voluntarily undertake it at all. Genealogists are overwhelmingly leisure researchers: no one is making them uncover their family history. It is a pastime they engage in because they find it rewarding. But this does not mean that all uncertainty associated with information seeking is desirable. The amount of data in archival systems is large and growing. Users will need tools which are able to hold back the tides of data as well as summon them or they will drown in their own returned results.

Over the previous four chapters this work has first tried to understand and categorise the problems experienced by archival researchers, looked at how archivists resolve these problems or barriers and then, by introducing the concept of regulators, considered how users attempt to resolve these problems themselves. Finally, through the process of scale development the factors comprising the felt uncertainty of information seekers have been distinguished and named as disorientation, prospect and preparedness. Along the way the following principal findings or claims have been made:

- The very considerable number of models of information seeking appear to be able to be divided into five principal types: classic, behavioural, contextual, cognitive path and macro. (see 2.4)

- Almost 50% of information seeking enquiries in a dataset of enquiries sent to the National Archives appeared to have failed at the 'select source' phase and were 'where do I look' type questions. (see 4.3)

- Judging by this dataset, the specificity of enquiries appears to have increased since 1995-9, as was predicted by Kristen Martin. But her fears that this would be counterbalanced by a rise in "broad" enquiries from novices do not appear to have been realised. (see 4.3)

- Archivists engage in a range of complex assistive behaviours in course of reference interviews with researchers including screensharing, bookwork and query formulation advice. But above all they teach research strategies to researchers. Archival systems do not generally support this ability at the point of search. (see 5.3)

- Researchers are forced to employ their own regulators (strategies) to address

[5] Christopher Sykes, "The Pleasure of Finding Things out," *Horizon* (BBC, 1981), http://www.bbc.co.uk/iplayer/episode/p018dvyg/horizon-19811982-the-pleasure-of-finding-things-out.
[6] Daniel Cook, "The Princess Rescuing Application," *LostGarden*, 2008, http://www.lostgarden.com/2008/10/princess-rescuing-application-slides.html.

barriers to research progress. Barriers are sources of uncertainty and can be artifactual, environmental or personal. Regulators act to mitigate these barriers and can be knowledge based, skills based or tool based. Reification of regulators into system functionality is highly desirable. (see 6.4)

- Archival researchers are search persistent compared to typical accounts of search system user but despite many years of experience many are journeyman researchers, unable to deploy a number of expert behaviours (see 6.4)

- Uncertainty is comprised of three factors: disorientation, prospect and preparedness and can be measured in a way that makes distinctions between these factors clear. Too much uncertainty can cause sensemaking to break down and leave researchers unable to make progress. (see 7.5)

- Interventions at the site of uncertainty will be the most effective. Generally improving a user's awareness of the portion of the archival landscape they are currently 'occupying' is helpful but may not significantly reduce their uncertainty (see 7.6)

Archival users require more support from digital archival systems than they currently receive. Through this research the outline of solutions to some of their woes has become clearer and I have presented a tool to test the effectiveness of such solutions.

8.2 The many faces of uncertainty

An important question to consider, as we arrive at the end of our own information journey is whether we find someone waiting ahead of us. Disorientation and prospect seem rather strongly related to Don Norman's gulfs of evaluation and execution.[7] Has the designer of everyday things already trodden this path and said everything that needs to be said? Fortunately, not entirely! It would be a fine thing to be measuring the effect of these directly on users but that is not what is happening here. Norman's two gulfs may be a little like the Nidus in the 1980s television series 'Into the Labyrinth' in that they need to be found anew in each place we visit - located in the design problem that is under discussion. But prospect and disorientation are more than simply sidestepping a gulf or tripping into one. They may be kissing cousins of the action cycle but they represent broader concerns.

Not only do the factors comprising the ISUS also have an affective as well as a cognitive dimension (so we are able to supply much flesh to the bare bones of a Norman understanding of archival journeys) but, partly as a result of their exploratory nature, these journeys require many iterations of the cycle. Users must think beyond immediate goals and actions and carry out complex planning and evaluation. High

[7] Donald A. Norman, "Cognitive Engineering," in *User Centered System Design: New Perspectives on Human-Computer Interaction*, ed. Donald A. Norman and Stephen W. Draper (Hillsdale, N.J.: CRC Press, 1986).

prospect states imply the ability to see far ahead in the search process and gain an overview of the elements of the information landscape from the system to the material represented within it. Norman was thinking in terms in terms of failure or error but highly disoriented individuals appear to suffer a kind of paralysis of action and withdraw or call for help rather than press on. What is being reflected is a breakdown in the process of sensemaking. In Klein, Moon and Hoffman's terms, users can no longer construct frames from the data they are encountering.[8] Rather than additional data adding meaning, the user's level of understanding remains unchanged – or may even reduce as they question previously held assumptions (am I even in the right place?).

This would also seem to definitively nail the outstanding question as to whether, as it were, disorientation and prospect are two sides of the same coin: that prospect is just a sort of reverse disorientation and vice versa. Certainly the two are correlated. But this does not seem to accord with Norman and close examination of the ISUS statements and the data presented in the previous chapter makes clear that the two properties are genuinely distinct. In our study, not only could prospect fall without any significant change in disorientation but the felt experience of the two is different. This difference (between all three of our factors) is easily teased out by analogy:

Imagine you are a deep sea diver exploring the remains of sunken city.

Over many years, prior to this exploration you have studied texts describing aspects of the ruins you are about to explore. You are prepared. You have never been in this part of the ocean before but the visibility is good and as you slowly descend you see the layout of the city below you. You can see the layout of streets and the remains of houses. Mentally you start labelling buildings as potential temples, palaces and public buildings. You have prospect over the terrain below you. You head towards a building which caught your eye on your descent and pause to examine a row of hieroglyphics on the outside.

Now imagine you are descending not with an oxygen tank strapped to your back but in a cramped submersible. This city is much deeper. Visibility is still good, you are prepared. But the controls on your submarine are extremely difficult to operate. The vessel's movement is slow and unpredictable. You find it much more difficult to examine objects of interest to you. Lights flash on panels in front of you. You're not entirely sure what they mean. A warning sounds briefly. Was it important? You're unclear. After 30 minutes, the temple feels as distant as ever. After several more hours you realise that, through the toughened glass, you have confused a building with a rock formation.

This is the disorientation that comes from exploring using a digital catalogue. If archival systems really were driving vehicles, historical research would be a highly dangerous activity. Serious mismatches exist between the barriers to research and the existing tool based regulators within systems. The old archival paradigm with archivist as mediator was constricted but it has been replaced with mere lookup systems not those that can provide the support of an archivist. Landmarks may be

[8] G. Klein, B. Moon, and R.R. Hoffman, "Making Sense of Sensemaking 2: A Macrocognitive Model," *IEEE Intelligent Systems* 21, no. 5 (September 2006): 88–92, doi:10.1109/MIS.2006.100.

familiar and visible but users' ability to reach them is severely curtailed. The ocean can be unforgiving and it has its perils but the most pressing problem is to understand what the buttons in front of you do. Without this, users become frustrated and confused. And this analogy also allows us to move beyond the source of the uncertainty (intrinsic to the archival landscape or extrinsic in the form of the systems we are using to navigate that landscape) to the very nature of the uncertainty itself. Which kinds of information seeking uncertainty are aleatory and which kinds are epistemic?

The answer to this question takes us back to our barriers. Environmental and personal barriers give rise to epistemic uncertainty, which it is well understood can be of both kinds.[9] Tentatively, following Herbert Simon, we might go further and say that personal barriers give rise to procedural uncertainty and environmental ones to substantive uncertainty. Artifactual barriers may give rise to substantive uncertainty but many of them crucially have aleatory uncertainty at their core. It may on the face of it seem impossible for aleatory uncertainty about the past to exist on the basis that past events are intrinsically more retrievable than future ones. We are, after all, moving towards the future and the kinds of complex questions we would like to know about it (such as those proposed by Keynes discussed in chapter 3) we will be able to answer with patience, even if we don't have access to the information now. Our uncertainty about the future should progressively reduce with the passage of time. This is not the case for the past. The past is unrecoverable and what we call history, beyond living memory, consists of the partial and incomplete documentary and archaeological record. One does not have to completely buy into the arguments of those postmodernist historians who argued, in for instance the words of Keith Jenkins, “we can never really know the past...the gap between the past and history...is such that no amount of epistemological effort can bridge it”, to believe there are some things about the past we can’t know.[10] Any suggestion by postmodernists that we cannot “know” the historical “fact” of what interest rates were twenty years ago (to turn Keynes on his head) is patently daft.

But there are clearly historical facts that are not knowable. Domesday Book, for example, is a text giving us an immense amount of information about England in the 11th century. But it does not include, for example, any information on London or Winchester so (in the absence of other evidence) we cannot know about landholdings in these cities.[11] More fundamentally, we cannot be sure about other aspects concerning Domesday Book, such as precisely how it was used. This is historical aleatoric uncertainty: irreducible unless some new information is introduced into the system. Aleatoric uncertainty is thus both bounded and irreducible in historical research as it is in other disciplines. It is artefactual, intrinsic to the study of the documentary record and this means that to some extent we can set aside concerns that a ‘shakey leaf’ or some other system will do away with it altogether. Uncertainty in archival information seeking is here to stay. But it can be changed. Fox and Ülkümen have made it clear they do not regard aleatory and epistemic uncertainty as mutually exclusive.[12] This seems correct in an archival sense at the

[9] Kahneman, Daniel, and Amos Tversky. "Variants of uncertainty." *Cognition* 11, no. 2 (1982): 143-157.

[10] Keith Jenkins and Alun Munslow, *Re-Thinking History* (London: Routledge, 2003), p.23

[11] The National Archives, “Life in Towns and Villages,” accessed September 30, 2017, http://nationalarchives.gov.uk/domesday/world-of-domesday/towns.htm.

[12] Fox, Craig R., and Gülden Ülkümen. "Distinguishing two dimensions of uncertainty." *Perspectives on thinking, judging, and decision making* (2011): 1-14.

document level. Let us return to Umberto Eco where we began. A text could be partly destroyed by a villainous monk – we would be irreducibly uncertain about the missing content but a clear and accurate catalogue would reduce epistemic uncertainty concerning the text's location, just as an obscure and misleading one would increase it. And just as, in Klein, Moon and Hoffman's words "a house fire will be perceived differently by the homeowner [and] the firefighter", so will our book be perceived differently, with a different frame and with differing proportions and quantities of uncertainty by librarian and investigator.[13] Crudely, archivists and librarians know where to expect things. They may not know where a document is but they know where it should be. They know where to look. Our systems do not make use of such reduced epistemic uncertainty. All searches are equal to the machine.

It is users' epistemic uncertainty upon which we must redouble our efforts to produce archival information systems which can be both straightforwardly operated and easily understood (in terms of both their function and the information space they are navigating) by users. This research offers new evidence, a new tool and fresh understanding to help us design these future systems.

8.3 Critical review

This work contains two types of claims supported by evidence; both are about data but the nature of the data varies across the studies. The difference between a qualitative assessment – an interpretation – of interview data and the statistical analysis of numerical data may appear large but since factor analysis also includes a substantial interpretive phase (crudely, the mathematics tells you what the factors consist of not what they 'are') this difference is not as large as it might seem. The result is that these analyses are not and cannot be objective and the reader must consider the evidence carefully and make a judgement about the case presented. The experiments that form part of this work have been carried out carefully to prevent confound but there are clearly many factors at play in the tasks users carried out (unmediated searching for instance) and although many aspects of the setup in such studies was controlled a tradeoff clearly exists between environmental validity and the rigidity – with enhanced control – of a laboratory study. Conversely, some of the studies used artificial tasks adopted for their repeatability and their potential to be completed in a manageable timeframe but this was at the cost of being able to study participants own intrinsic information needs and goals.

These goals are themselves problematic. Because archival information seekers generally have a clear information goal, some of the conclusions of this study (perhaps including the ISUS itself) may offer less explanatory power for the very earliest phases of information seeking, before any information goal has been firmly established.

The cry of every researcher is 'more data, more data'; all of the studies presented use an appropriate amount of data for the conclusions drawn but larger samples are often to be wished for and would no doubt have revealed further results of interest. Finally, it would have been extremely interesting to have been able to carry out further testing of the scale on novel prototypes but that will have to be work

[13] Klein, G., B. Moon, and R.R. Hoffman. "Making Sense of Sensemaking 2: A Macrocognitive Model." *IEEE Intelligent Systems 21*, no. 5 (September 2006), p.88

for another day.

8.4 Future research

Having been developed and tested, the ISUS instrument is capable of a number of uses. It has been designed for archival information systems but virtually all of the statements could be used (or minimally adapted) for use with other information environments and it would be interesting to test the instrument in other research disciplines. The relationship between this scale and a simple broad scale such as NASA Task Load Index (TLX) would be interesting to explore.[14] How does information seeking uncertainty correlate with properties such as frustration and mental demand? The relationship between information seeking and gaming is an interesting one. There are clear similarities between the two insofar as digital research is (or can be) an ergodic activity including challenge, feelings of progress and some sense of immersion. Yet there are clearly strong differences from games: information seeking is neither bounded nor guided in the manner of a designed or even procedural game. Feedback is comparatively poor and the level of interactivity is correspondingly low – the system returns documents but that's all it does. The ISUS allows us to ask, perhaps some similar questions about the richer interactive environments in gaming (what roles do preparedness, prospect and disorientation 'play' here?) and also to test the converse – if we import some characteristics of game environments into information seeking systems, do they have a positive effect on users' experience and ability to locate material of interest. Colleagues have already begun to consider these questions, building on some of the work presented here.[15]

For archives, the instrument could be used to measure the effectiveness of archival instruction as well as changes to systems. Further work could be done around barriers to archival research progress, identifying and reifying regulators, using the instrument to test the success of the proposed interventions. For example prospect, is generally understood to be enhanced by rich prospect browsing (or generous) interfaces.[16] In the past, archives have experimented tentatively with such interfaces (fig. 8.1) with the aim of helping users explore particular collections. Evaluating and comparing such interfaces is much easier with the aid of the ISUS.

[14] Hart, S.G., 2006, October. NASA-task load index (NASA-TLX); 20 years later. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 50, No. 9, pp. 904-908). Sage CA: Los Angeles, CA: Sage Publications.

[15] Power, Christopher, Alena Denisova, Themis Papaioannou, and Paul Cairns. "Measuring Uncertainty in Games: Design and Preliminary Validation." In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, pp. 2839-2845. ACM, 2017.

[16] Mitchell Whitelaw, "Generous Interfaces for Digital Cultural Collections", *Digital Humanities Quarterly*, vol. 9, no. 1 (2015), http://www.digitalhumanities.org/dhq/vol/9/1/000205/000205.html.

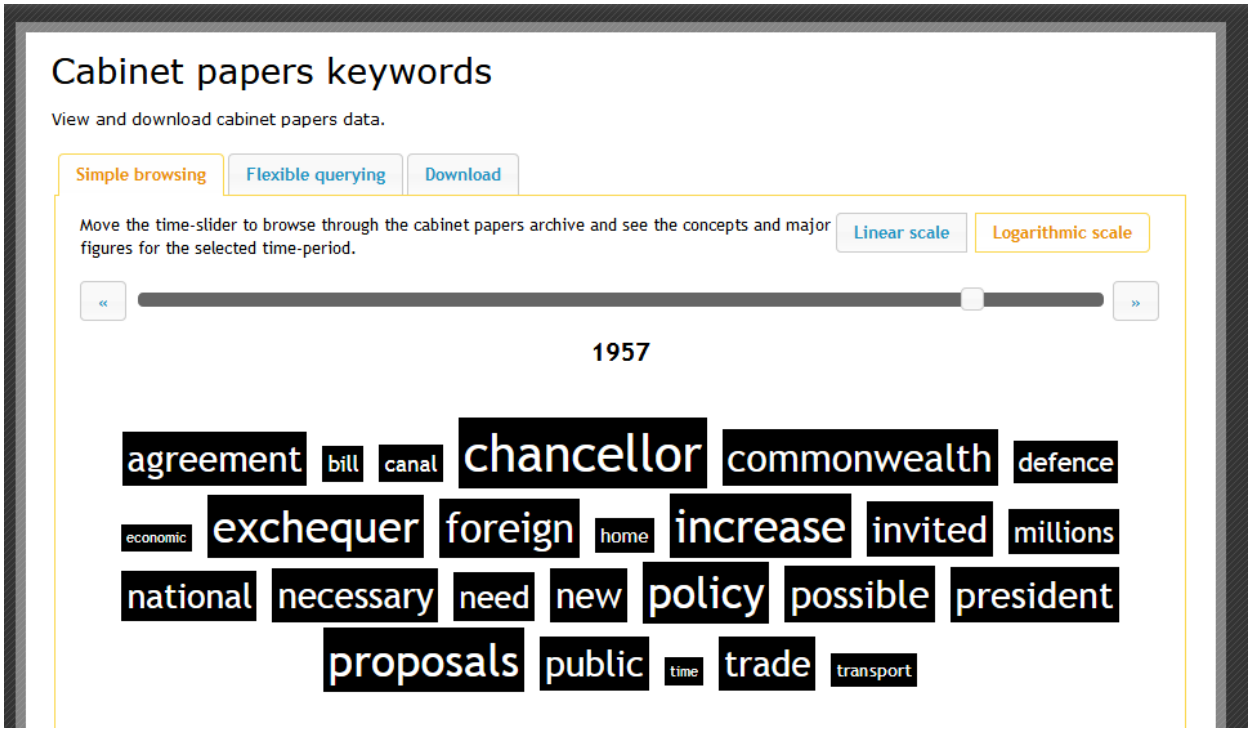

Figure 8.1 An experimental tool for visualising an archival collection (Hall and Pugh, 2011)[17]

Archivists can use a results set to learn about the distribution of collections. It is interesting to consider what interface changes could be made so that less experienced users were able to 'see' these relationships in the same way. Some of the statements may act as springboards for design work: what can we do to help users find "new avenues to explore" and make onward paths clearer so they "know where to go next". How can we make users more confident working with unfamiliar record types? How above all can users feel that system is an active partner in their research?

The National Archives is undertaking active redevelopment of Discovery and this work has served to inform some of the priorities for that process. Likely changes include, among others, making research guides present to users within the tool, so they can act at the site of uncertainty, and trying to make an object's position within the hierarchy of the collection more obvious. I hope very much that the result will be an improved experience for the archive's users.

[17] Hall and Pugh, Cabinet papers keywords, http://webarchive.nationalarchives.gov.uk/20121030090648/http://labs.nationalarchives.gov.uk/cabinetpaperskeywords/

Bibliography

Aaronovitch, Ben. *The Also People*. London: Virgin Books, 1995.

Ahuja, Jaspreet S., and Jane Webster. “Perceived Disorientation: An Examination of a New Measure to Assess Web Design Effectiveness.” *Interacting with Computers* 14, no. 1 (December 1, 2001): 15–29. doi:10.1016/S0953-5438(01)00048-0.

Allen, Greg. “On The Making Of The Lost Biennale Machines Of Daniel Libeskind.” Blog. *Greg.org*, 2010. http://greg.org/archive/2010/09/20/on_the_making_of_the_lost_biennale_machines_of_daniel_libeskind.html.

Alphabet. “Google.” Accessed September 30, 2017. https://www.google.co.uk/.

Ancestry. “Ancestry.com Commercial - Shakey Leaf.” *YouTube*, 2009. https://www.youtube.com/watch?v=ORmxCXmiIy4.

———. “When a Leaf Appears More of Your History Could Appear Too.” Accessed September 30, 2017. http://www.ancestry.com/hints.

Appleton, Jay. *The Experience of Landscape.* London: Wiley, 1975.

Archives and Records Association. “National Survey of Visitors 2012,” 2012. http://www.archives.org.uk/images/documents/PSQG/Survey_of_visitors_to_uk_archives_2012_-_national_report.pdf.

———. “Other Useful Publications.” Accessed September 30, 2017. http://www.archives.org.uk/publications/other-useful-publications.html.

Aula, Anne, and Mika Käki. “Understanding Expert Search Strategies for Designing UserFriendly Search Interfaces.” In *In Isaías, P. & Karmakar, N. (Eds.) Proc. IADIS International Conference WWW/Internet 2003, Volume II*, 759–62. IADIS Press, 2003.

Bates, Marcia J. “Information Search Tactics.” *Journal of the American Society for Information Science* 30, no. 4 (1979): 205–14. doi:10.1002/asi.4630300406.

———. “The Design of Browsing and Berrypicking Techniques for the Online Search Interface.” *Online Information Review* 13, no. 5 (December 31, 1989): 407–24. doi:10.1108/eb024320.

———. “What Is Browsing—really? A Model Drawing from Behavioural Science Research.” *Information Research* 12, no. 4. Accessed September 26, 2017. http://www.informationr.net/ir/12-4/paper330.html.

Battley, Belinda, and Alicia Wright. “Finding and Addressing the Gaps: Two Evaluations of Archival Reference Services.” *Journal of Archival Organization* 10, no. 2 (April 1, 2012): 107–36. doi:10.1080/15332748.2012.726899.

Bawden, David, and Lyn Robinson. “The Dark Side of Information: Overload, Anxiety and Other Paradoxes and Pathologies.” *Journal of Information Science* 35, no. 2 (April 1, 2009): 180–91. doi:10.1177/0165551508095781.

BBC News. “WW1 Soldier Diaries Placed Online by National Archives.” *BBC*, 2014. http://www.bbc.co.uk/news/uk-25716569.

Beaudouin-Lafon, Michel. “Instrumental Interaction: An Interaction Model for Designing Post-WIMP User Interfaces.” In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 446–53. CHI ’00. New York, NY, USA: ACM, 2000. doi:10.1145/332040.332473.

Belkin, Nicholas J. “Interaction with Texts: Information Retrieval as Information-Seeking Behavior.” *Information Retrieval* 93 (1993): 55–66.

Belkin, N.J., R.N. Oddy, and H.M. Brooks. “Ask for Information Retrieval: Part I. Background and Theory.” *Journal of Documentation* 38, no. 2 (February 1, 1982): 61–71. doi:10.1108/eb026722.

Bell, Steven J. “Submit or Resist: Librarianship in the Age of Google.” *American Libraries* 36, no. 9 (2005): 68–71.

Blandford, Ann, and Simon Attfield. “Interacting with Information.” *Synthesis Lectures on Human-Centered Informatics* 3, no. 1 (January 1, 2010): 1–99. doi:10.2200/S00227ED1V01Y200911HCI006.

Bodleian Library. “Early Modern Letters Online.” Accessed September 30, 2017. http://emlo.bodleian.ox.ac.uk/.

Borgman, Christine L. “What Are Digital Libraries? Competing Visions.” *Inf. Process. Manage.* 35, no. 3 (May 1999): 227–43. doi:10.1016/S0306-4573(98)00059-4.

Bourner, Tom, Rachel Bowden, and Stuart Laing. "Professional doctorates in England." *Studies in Higher Education* 26, no. 1 (2001): 65-83.

Brand-Gruwel, Saskia, Iwan Wopereis, and Amber Walraven. “A Descriptive Model of Information Problem Solving While Using Internet.” *Computers & Education* 53, no. 4 (December 2009): 1207–17. doi:10.1016/j.compedu.2009.06.004.

Brannan, Gary. “Talking in the Night: Exploring Webchats at the West Yorkshire Archive Service.” In *Reference and Access: Innovative Practices for Archives and Special Collections*, edited by Kate Theimer. Rowman & Littlefield, 2014.

Brin, Sergey, and Lawrence Page. “Reprint of: The Anatomy of a Large-Scale Hypertextual Web Search Engine.” *Computer Networks*, The WEB we live in, 56, no. 18 (December 17, 2012): 3825–33. doi:10.1016/j.comnet.2012.10.007.

Broder, Andrei. “A Taxonomy of Web Search.” *SIGIR Forum* 36, no. 2 (September 2002): 3–10. doi:10.1145/792550.792552.

Bron, Marc, Jasmijn van Gorp, Frank Nack, Maarten de Rijke, Andrei Vishneuski, and Sonja de Leeuw. “A Subjunctive Exploratory Search Interface to Support Media Studies Researchers.” In *Proceedings of the 35th International ACM SIGIR Conference on Research and Development in Information Retrieval*, 425–34. SIGIR ’12. New York, NY, USA: ACM, 2012. doi:10.1145/2348283.2348342.

Brooker, Charlie. “How to Cut Tuition Fees.” *The Guardian*, December 20, 2010, sec. Opinion. http://www.theguardian.com/commentisfree/2010/dec/20/charlie-brooker-how-cut-tuition-fees.

Buchanan, George, Sally Jo Cunningham, Ann Blandford, Jon Rimmer, and Claire Warwick. “Information Seeking by Humanities Scholars.” In *Research and Advanced Technology for Digital Libraries*, 218–29. Lecture Notes in Computer Science. Springer, Berlin, Heidelberg, 2005. doi:10.1007/11551362_20.

Buckland, Michael K. “Emanuel Goldberg, Electronic Document Retrieval, and Vannevar Bush’s Memex.” *Journal of the American Society for Information Science* 43, no. 4 (1992): 284–94.

———. “On Types of Search and the Allocation of Library Resources.” *Journal of the American Society for Information Science* 30, no. 3 (1979): 143–47. doi:10.1002/asi.4630300305.

Burke, Frank. “Similarities and differences”. In Clark, Robert L. *Archive-library relations*. Bowker, 1976.

Bush, Vannevar. “As We May Think.” *The Atlantic*, July 1945. http://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/.

Butterworth, Richard. “The Accessing Our Archival and Manuscript Heritage Project and the Development of the ‘Helpers’ Website.” Technical Report. Interaction Design Centre: Middlesex University, February 2006.

Byström, Katriina, and Kalervo Järvelin. “Task Complexity Affects Information Seeking and Use.” *Inf. Process. Manage.* 31, no. 2 (1995): 191–213.

Cairns, Paul. “A Commentary on Short Questionnaires for Assessing Usability.” *Interacting with Computers*, March 27, 2013, iwt019. doi:10.1093/iwc/iwt019.

Case, Donald O. *Looking for Information: A Survey of Research on Information Seeking, Needs, and Behavior*. Emerald Group Publishing, 2012.

Cates, Jonathan. “More Comprehensive Discovery.” *The National Archives Blog*, November 4, 2015. http://blog.nationalarchives.gov.uk/blog/comprehensive-discovery/.

Cervantes, Miguel de. *Don Quixote*. Translated by John Ormsby. Wikisource, 1885. https://en.wikisource.org/wiki/Don_Quixote.

Chandler, Raymond. *The Big Sleep and Other Novels*. New Ed edition. London: Penguin Classics, 2000.

Chi, Ed H., Peter Pirolli, Kim Chen, and James Pitkow. “Using Information Scent to Model User Information Needs and Actions and the Web.” In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 490–97. CHI ’01. New York, NY, USA: ACM, 2001. doi:10.1145/365024.365325.

Choo, Chun Wei, Brian Detlor, and Dan Turnbull. “Information Seeking on the Web: An Integrated Model of Browsing and Searching.” *First Monday* 5, no. 2 (February 7, 2000). doi:10.5210/fm.v5i2.729.

Chowdhury, Sudatta, and Forbes Gibb. “Relationship among Activities and Problems Causing Uncertainty in Information Seeking and Retrieval.” *Journal of Documentation* 65, no. 3 (April 24, 2009): 470–99. doi:10.1108/00220410910952438.

Chowdhury, Sudatta, Forbes Gibb, and Monica Landoni. "A model of uncertainty and its relation to information seeking and retrieval (IS&R)." *Journal of Documentation* 70, no. 4 (2014): 575-604.

Cleverdon, Cyril W. “On the Inverse Relationship of Recall and Precision.” *Journal of Documentation* 28, no. 3 (1972): 195–201.

Cohen, Dan. “When machines are the audience,” *Dan Cohen*, March 2, 2006, http://www.dancohen.org/2006/03/02/when-machines-are-the-audience/.

Cook, Daniel. “The Princess Rescuing Application.” *LostGarden*, 2008. http://www.lostgarden.com/2008/10/princess-rescuing-application-slides.html.

Cooper, Alan. *The Inmates Are Running the Asylum*. Indianapolis, IN: Sams, 2004.

Corbin, Juliet M., and Anselm L. Strauss. *Basics of Qualitative Research : Techniques and Procedures for Developing Grounded Theory*. 3rd ed. Los Angeles, Calif.: Sage Publications, 2008.

Cross, James Edward. “Archival Reference.” *The Reference Librarian* 26, no. 56 (1997): 5–25. doi:10.1300/J120v26n56_02.

Dequech, David. “Uncertainty: Individuals, Institutions and Technology.” *Cambridge Journal of Economics* 28, no. 3 (May 1, 2004): 365–78. doi:10.1093/cje/28.3.365.

Dervin, Brenda. “Sense-Making Theory and Practice: An Overview of User Interests in Knowledge Seeking and Use.” *Journal of Knowledge Management* 2, no. 2 (December 1, 1998): 36–46. doi:10.1108/13673279810249369.

Dervin, Brenda, and Patricia Dewdney. “Neutral Questioning: A New Approach to the Reference Interview.” *RQ* 25, no. 4 (1986).

Desimone, Robert, and John Duncan. “Neural Mechanisms of Selective Visual Attention.” *Annual Review of Neuroscience* 18, no. 1 (March 1, 1995): 193–222. doi:10.1146/annurev.ne.18.030195.001205.

DeVellis, Robert F. *Scale Development : Theory and Applications*. 2nd ed. Thousand Oaks, Calif. ; London: Sage, 2003.

De Weck, Olivier L., and Claudia Eckert. "A classification of uncertainty for early product and system design." *Massachusetts Institute of Technology Engineering Systems Division Working Paper Series*, ESD-WP-2007-10, 2007.

Dinet, J., A. Chevalier, and A. Tricot. “Information Search Activity: An Overview.” *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology* 62, no. 2 (April 2012): 49–62. doi:10.1016/j.erap.2012.03.004.

Dinet, Jérôme, Monik Favart, and Jean-Michel Passerault. “Searching for Information in an Online Public Access Catalogue (OPAC): The Impacts of Information Search Expertise on the Use of Boolean Operators.” *Journal of Computer Assisted Learning* 20, no. 5 (2004): 338–46. doi:10.1111/j.1365-2729.2004.00093.x.

Dooley, Jackie. “Survey of Special Collections and Archives in the United Kingdom and Ireland.” OCLC, 2013. http://www.oclc.org/research/publications/library/2013/2013-01r.html.

Dosi, G., and M. Egidi. “Substantive and Procedural Uncertainty.” *Journal of Evolutionary Economics* 1, no. 2 (June 1, 1991): 145–68. doi:10.1007/BF01224917.

Duff, Wendy, Jean Dryden, Carrie Limkilde, Joan Cherry, and Ellie Bogomazova. “Archivists’ Views of User-Based Evaluation: Benefits, Barriers, and Requirements.” *The American Archivist* 71, no. 1 (April 1, 2008): 144–66. doi:10.17723/aarc.71.1.y70837374478t146.

Duff, Wendy, and Allyson Fox. "‘You're a guide rather than an expert’: Archival reference from an archivist's point of view." *Journal of the Society of Archivists* 27, no. 2 (2006): 129-153.

Duff, Wendy, and Catherine Johnson. “A Virtual Expression of Need: An Analysis of E-Mail Reference Questions.” *American Archivist* 64, no. 1 (January 1, 2001): 43–60.

———. “Where Is the List with All the Names? Information-Seeking Behavior of Genealogists.” *American Archivist* 66, no. 1 (January 1, 2003): 79–95.

Duff, Wendy M., and Catherine A. Johnson. “Accidentally Found on Purpose: Information-Seeking Behavior of Historians in Archives.” *Library Quarterly* 72, no. 4 (January 2002): 472–96.

Duff, Wendy M., and Penka Stoyanova. “Transforming the Crazy Quilt: Archival Displays from a User’s Point of View.” *Archivaria* 1, no. 45 (January 1, 1998). http://journals.sfu.ca/archivar/index.php/archivaria/article/view/12224.

Duff, Wendy, Elizabeth Yakel, and Helen Tibbo. "Archival reference knowledge." *The American Archivist* 76, no. 1 (2013): 68-94.

Duffy, Eamon. *The Voices of Morebath: Reformation and Rebellion in an English Village*. New Haven: Yale University Press, 2003.

Eco, Umberto. *The Name of the Rose*. Picador, 1983.

Ellis, David. “A Behavioural Approach to Information Retrieval System Design.” *Journal of Documentation* 45, no. 3 (December 31, 1989): 171–212. doi:10.1108/eb026843.

Ellis, David, and Merete Haugan. “Modelling the Information Seeking Patterns of Engineers and Research Scientists in an Industrial Environment.” *Journal of Documentation* 53, no. 4 (October 1, 1997): 384–403. doi:10.1108/EUM0000000007204.

Ercegovac, Zorana. *Information Literacy: Search Strategies, Tools & Resources for High School Students and College Freshmen*. ABC-Clio, 2008. http://eric.ed.gov/?id=ED414975.

Erfanmanesh, Mohammadamin, A Abrizah, and Noor Harun Abdul Karim. “Development and Validation of the Information Seeking Anxiety Scale.” *Malaysian Journal of Library & Information Science* 17, no. 1 (n.d.): 2012.

Estes, Adam Clark. “Bluetooth Is Named after a Medieval King Who May Have Had a Blue Tooth.” *Gizmodo*, 2014. https://gizmodo.com/bluetooth-is-named-after-a-medieval-king-who-may-have-h-1671450657.

Eversberg, Bernhard. “On the Theory of Library Catalogs and Search Engines,” 2007. http://www.allegro-c.de/formate/tlcse.htm.

Fishburn, Peter. “A Variational Model of Preference Under Uncertainty.” *Journal of Risk and Uncertainty* 8, no. 2 (1994): 127–52.

Ford, Nigel. “Modeling Cognitive Processes in Information Seeking: From Popper to Pask.” *Journal of the American Society for Information Science and Technology* 55, no. 9 (2004): 769–82. doi:10.1002/asi.20021.

Foster, Allen. “A Nonlinear Model of Information-Seeking Behavior.” *Journal of the American Society for Information Science and Technology* 55, no. 3 (2004): 228–37. doi:10.1002/asi.10359.

Fox, Craig R., and Gulden Ülkümen. “Distinguishing Two Dimensions of Uncertainty.” In *Perspectives on Thinking, Judging and Decision Making*, edited by W Brun, G Keren, G Kirkebøen, and H Montgomery. Oslo Universitetsforlaget, 2011.

Freeman, Elsie. “In the Eye of the Beholder: Archives Administration from the User’s Point of View.” *American Archivist* 47, no. 2 (April 1, 1984): 111–23.

Furnas, George W., and Daniel M. Russell. “Making Sense of Sensemaking.” In *CHI ’05 Extended Abstracts on Human Factors in Computing Systems*, 2115–16. CHI EA ’05. New York, NY, USA: ACM, 2005. doi:10.1145/1056808.1057113.

Fu, Wai-Tat, and Wayne D. Gray. “Suboptimal Tradeoffs in Information Seeking.” *Cognitive Psychology* 52, no. 3 (May 1, 2006): 195–242. doi:10.1016/j.cogpsych.2005.08.002.

Gabbert, Elisa. “The 3 Types of Search Query & How to Target Them.” *Wordstream*. Accessed September 27, 2017. http://www.wordstream.com/blog/ws/2012/12/10/three-types-of-search-queries?dt=1.

Godbold, Natalya. “Beyond Information Seeking: A General Model of Information Behaviour.” *Information Research* 11, no. 4 (2006). http://informationr.net/ir/11-4/paper269.

Godfrey, Patrick. "The engineering doctorate (EngD): Developing leaders for tomorrow with industry." In *CLAIU-EU Conference 2012: The Engineering Doctorate*. 2012.

Gov.uk, “Departments, agencies and public bodies”, accessed 30 Febuary 2018, https://www.gov.uk/government/organisations#non-ministerial-departments

Greco, Veronica, and Derek Roger. “Coping with Uncertainty: The Construction and Validation of a New Measure.” *Personality and Individual Differences* 31, no. 4 (September 5, 2001): 519–34. doi:10.1016/S0191-8869(00)00156-2.

Green, Samuel S and David Pena. "Personal relations between librarians and readers." *Journal of Access Services 4*, no.1-2 (1876/2007): 157-167.

Hall, Mark, and Joseph Pugh. “Cabinet Papers Keywords.” *TNA Labs (archived)*, 2011. http://webarchive.nationalarchives.gov.uk/20121030090648/http://labs.nationalarchives.gov.uk/cabinetpaperskeywords/.

Hart, Sandra G. “Nasa-Task Load Index (NASA-TLX); 20 Years Later.” *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 50, no. 9 (October 1, 2006): 904–8. doi:10.1177/154193120605000909.

Hearst, Marti A. *Search User Interfaces*. 1st ed. Cambridge University Press, 2009.

Hearst, Marti, Ame Elliott, Jennifer English, Rashmi Sinha, Kirsten Swearingen, and Ka-Ping Yee. “Finding the Flow in Web Site Search.” *Commun. ACM* 45, no. 9 (September 2002): 42–49. doi:10.1145/567498.567525.

Heinström, Jannica. “Fast Surfing, Broad Scanning and Deep Diving: The Influence of Personality and Study Approach on Students’ Information-Seeking Behavior.” *Journal of Documentation* 61, no. 2 (2005): 228–47.

High Court of Admiralty. “HCA 13/69 f.41r.” *MarineLives*, 1654. http://marinelives.org/wiki/HCA_13/69_Silver_1_f.41r_Annotate.

Hitchcock, Tim, Robert Shoemaker, Clive Emsley, Sharon Howard, and Jamie McLaughlin. “Old Bailey Online - The Proceedings of the Old Bailey, 1674-1913.” Accessed September 24, 2017. https://www.oldbaileyonline.org/.

Hogan, Michael. “Gregg Wallace and John Torode on the Return of MasterChef,” February 12, 2010. http://www.telegraph.co.uk/culture/tvandradio/7220921/Gregg-Wallace-and-John-Torode-on-the-return-of-MasterChef.html.

How, Chris, and Lynn Kreiter. “Diary Study Analysis and Evaluation of Discovery and Catalogue Search.” Unpublished report for the National Archives. cogapp, 2012.

Hutchins, William John. “The Concept of ‘Aboutness’ in Subject Indexing.” In *Aslib Proceedings*, Vol. 30. MCB UP Ltd, 1978.

International Council on Archives. “What Are Archives?” Accessed September 26, 2017. https://www.ica.org/en/what-archive.

____. “ISAD(G): General International Standard Archival Description - Second edition, 2011” Accessed September 26, 2017. https://www.ica.org/en/isadg-general-international-standard-archival-description-second-edition

International Organization for Standardisation. “ISO 11799”, 2015, accessed September 30, 2017, https://www.iso.org/standard/63810.html

Inwood, Stephen. *The Man Who Knew Too Much: The Strange and Inventive Life of Robert Hooke, 1635 - 1703*. Pan, 2003.

Järvelin, Kalervo, and Peter Ingwersen. “Information Seeking Research Needs Extension towards Tasks and Technology.” *Information Research* 10, no. 1 (October 2004). http://informationr.net/ir/10-1/paper212.html.

Jenkins, Keith, and Alun Munslow. *Re-Thinking History*. London: Routledge, 2003.

Jenkinson, Hilary. *A Manual of Archive Administration*. London : P. Lund, Humphries & co., ltd., 1937. http://archive.org/details/manualofarchivea00iljenk.

Joachims, Thorsten, Laura Granka, Bing Pan, Helene Hembrooke, and Geri Gay. “Accurately Interpreting Clickthrough Data As Implicit Feedback.” In *Proceedings of the 28th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, 154–61. SIGIR ’05. New York, NY, USA: ACM, 2005. doi:10.1145/1076034.1076063.

Johnson, Andrea. “Users, Use and Context: Supporting Interaction between Users and Digital Archives.” In *What Are Archives?: Cultural and Theoretical Perspectives: A Reader*, edited by Louise Craven. Ashgate, 2008.

Johnson, David, and Hendrika Meischke. “A Comprehensive Model of Cancer-Related Information Seeking Applied to Magazines.” *Human Communication*

Research 19, no. 3 (March 1, 1993): 343–67. doi:10.1111/j.1468-2958.1993.tb00305.x.

Joseph, Pauline, Shelda Debowski, and Peter Goldschmidt. “Models of Information Search: A Comparative Analysis.” *Information Research* 18, no. 1 (2013). www.informationr.net/ir/18-1/paper562.html.

Jul, Susanne, and George W. Furnas. “Navigation in Electronic Worlds: A CHI 97 Workshop.” In *SIGCHI Bulletin*, Vol. 29, 1997. https://homepages.cwi.nl/~steven/sigchi/bulletin/1997.4/jul.html.

Kahneman, Daniel, and Amos Tversky. “Variants of Uncertainty.” *Cognition* 11, no. 2 (March 1, 1982): 143–57. doi:10.1016/0010-0277(82)90023-3.

Kaiser, Henry F., and John Rice. "Little jiffy, mark IV." *Educational and Psychological Measurement* 34, no. 1, 1974.

Kampen, Doris J. Van. “Development and Validation of the Multidimensional Library Anxiety Scale.” *College & Research Libraries* 65, no. 1 (2004): 28–34.

Kaplan, Elisabeth. “‘Many Paths to Partial Truths’: Archives, Anthropology, and the Power of Representation.” *Archival Science* 2, no. 3–4 (September 1, 2002): 209–20. doi:10.1007/BF02435622.

Kasdan, Jake. *The Zero Effect*. Columbia Pictures, 1998.

Kaufman, Andrew. *The Tiny Wife*. Toronto, Ontario: Cormorant Books, 2014.

Kemman, Max, Martijn Kleppe, and Stef Scagliola. “Just Google It - Digital Research Practices of Humanities Scholars.” *arXiv:1309.2434 [cs]*, September 10, 2013. http://arxiv.org/abs/1309.2434.

Kent, Allen, Madeline M. Berry, Fred U. Luehrs, and J. W. Perry. “Machine Literature Searching VIII. Operational Criteria for Designing Information Retrieval Systems.” *American Documentation* 6, no. 2 (April 1, 1955): 93–101. doi:10.1002/asi.5090060209.

Keynes, John Maynard. “The General Theory of Employment.” *Quarterly Journal of Economics* 51, no. 2 (1937).

Kirchhoff, Thomas, Werner Schweibenz, and Jörn Sieglerschmidt. “Archives, Libraries, Museums and the Spell of Ubiquitous Knowledge.” *Archival Science* 8, no. 4 (December 1, 2008): 251–66. doi:10.1007/s10502-009-9093-2.

Klein, Gary, Jennifer K. Phillips, Erica L. Rall, and Deborah A. Peluso. “A Data-Frame Theory of Sensemaking.” In *Expertise out of Context: Proceedings of the 6th International Conference on Naturalistic Decision Making*, 113–55. New York: Lawrence Erlbaum, 2007.

Klein, G., B. Moon, and R.R. Hoffman. “Making Sense of Sensemaking 1: Alternative Perspectives.” *IEEE Intelligent Systems* 21, no. 4 (July 2006): 70–73. doi:10.1109/MIS.2006.75.

———. “Making Sense of Sensemaking 2: A Macrocognitive Model.” *IEEE Intelligent Systems* 21, no. 5 (September 2006): 88–92. doi:10.1109/MIS.2006.100.

Kline, Paul. *A Psychometrics Primer*. Free Association Books, 2000.

Knight, S. A., and A. Spink. “Toward a Web Search Information Behavior Model.” In *Web Search, Information Science and Knowledge Management*, 209, 2008. http://adsabs.harvard.edu/abs/2008wsis.book..209K.

Knoer, Susan. *The reference interview today*. ABC-CLIO, 2011.

Kraft, Katherine Gray, and Anne Engelhart. “Remembering the Women.” *The Reference Librarian* 5, no. 13 (September 17, 1986): 11–22. doi:10.1300/J120v05n13_02.

Krikelas, James. “Information-Seeking Behavior: Patterns and Concepts.” *Drexel Library Quarterly* 19, no. 2 (January 1983): 5–20.

Krippendorff, Klaus, and Mary Angela Bock, eds. *The Content Analysis Reader*. Thousand Oaks, Calif: Sage Publications, 2009.

Kruger, Justin, and David Dunning. “Unskilled and Unaware of It: How Difficulties in Recognizing One’s Own Incompetence Lead to Inflated Self-Assessments.” *Journal of Personality and Social Psychology* 77 (1999): 1121–34.

Kuhlthau, Carol. “A Principle of Uncertainty for Information Seeking.” *Journal of Documentation* 49, no. 4 (April 1, 1993): 339–55. doi:10.1108/eb026918.

Kuhlthau, Carol C. “Inside the Search Process: Information Seeking from the User’s Perspective.” *Journal of the American Society for Information Science* 42, no. 5 (June 1, 1991): 361–71. doi:10.1002/(SICI)1097-4571(199106)42:5<361::AID-ASI6>3.0.CO;2-#.

Kuhlthau, Carol Collier. *Seeking Meaning: A Process Approach to Library and Information Services*. Westport, Conn.: Libraries Unlimited, 2004.

Kules, Bill, and Robert Capra. “Designing Exploratory Search Tasks for User Studies of Information Seeking Support Systems.” In *Proceedings of the 9th ACM/IEEE-CS Joint Conference on Digital Libraries*, 419–20. JCDL ’09. New York, NY, USA: ACM, 2009. doi:10.1145/1555400.1555492.

Lakshminarayanan, Bhuvaneshwari. “Towards Developing an Integrated Model of Information Behaviour.” Thesis, Queensland University of Technology, 2010. http://eprints.qut.edu.au/33252/.

Lanxon, Nate. “Book Review: ‘Inside Apple’ by Adam Lashinsky.” *Wired UK*, 2012. https://www.wired.co.uk/article/inside-apple-book-review.

Lawes, Aidan. *Chancery Lane 1377-1977:"The Strong Box of the Empire"*. PRO Publications, 1996.

Leckie, Gloria J., Karen E. Pettigrew, and Christian Sylvain. “Modeling the Information Seeking of Professionals: A General Model Derived from Research on Engineers, Health Care Professionals, and Lawyers.” *Library Quarterly* 66, no. 2 (January 1996): 161–93.

Legislation.gov.uk. “Public Records Act 1958”, accessed September 30, 2017, https://www.legislation.gov.uk/ukpga/Eliz2/6-7/51

Lee, Ian J. “Do Virtual Reference Librarians Dream of Digital Reference Questions?: A Qualitative and Quantitative Analysis of Email and Chat Reference.” *Australian Academic & Research Libraries* 35, no. 2 (January 1, 2004): 95–110. doi:10.1080/00048623.2004.10755262.

Lee, Jin Ha, Allen Renear, and Linda C. Smith. “Known-Item Search: Variations on a Concept.” *Proceedings of the American Society for Information Science and Technology* 43, no. 1 (2006): 1–17. doi:10.1002/meet.14504301126.

Legasse, Lea. “The Awaken Dreamer.” *Lealegasse.com*, 2012. https://lealagasse.com/2012/08/30/the-awaken-dreamer-5/.

Lewis, C.S., and Pauline Baynes. *The Lion, the Witch and the Wardrobe*. London: Geoffrey Bles, 1950.

Lin, Shin-jeng, and Nick Belkin. “Validation of a Model of Information Seeking over Multiple Search Sessions.” *Journal of the American Society for Information Science and Technology* 56, no. 4 (February 15, 2005): 393–415. doi:10.1002/asi.20127.

Lin, Shinjeng, and Iris Xie. “Behavioral Changes in Transmuting Multisession Successive Searches over the Web.” *Journal of the American Society for Information Science and Technology* 64, no. 6 (June 1, 2013): 1259–83. doi:10.1002/asi.22839.

Lomza, Marta. “Trainee Tuesday: Bad Idea!” *The National Archives Blog*, 2013. http://blog.nationalarchives.gov.uk/blog/trainee-tuesday-bad-idea/.

Malbin, Susan L. “The Reference Interview in Archival Literature.” *College & Research Libraries* 58, no. 1 (January 1, 1997): 69–80. doi:10.5860/crl.58.1.69.

Mansourian, Yazdan, and Nigel Ford. “Search Persistence and Failure on the Web: A ‘Bounded Rationality’ and ‘Satisficing’ Analysis.” *Journal of Documentation* 63 (September 11, 2007): 680–701. doi:10.1108/00220410710827754.

Marchionini, Gary. *Information Seeking in Electronic Environments*. Cambridge University Press, 1997.

Maron, M. E. “On Indexing, Retrieval and the Meaning of about.” *Journal of the American Society for Information Science* 28, no. 1 (January 1, 1977): 38–43. doi:10.1002/asi.4630280107.

Maron, M. E., and J. L. Kuhns. “On Relevance, Probabilistic Indexing and Information Retrieval.” *J. ACM* 7, no. 3 (July 1960): 216–44. doi:10.1145/321033.321035.

Martin, Emma, and Amanda Bergknut. “User Research for the Online Strategy: Final Report, Records Site.” Unpublished report for the National Archives. Amberlight, 2008.

Martin, Kristin. “Analysis of Remote Reference Correspondence at a Large Academic Manuscripts Collection.” *American Archivist* 64, no. 1 (January 1, 2001): 17–42.

Mason, Philip P. “The challenge of contemporary records: reference service in a Labor and Urban archives.” In Whalen (ed.) *Reference Services for Archives*, The Haworth Press, 1986

McGann, Jerome. “Rossetti Archive.” Accessed September 26, 2017. http://www.rossettiarchive.org/.

McKernan, Luke. “Audiovisual Archives and the Web.” *Luke McKernan*, January 29, 2016. http://lukemckernan.com/2016/01/29/audiovisual-archives-and-the-web/.

Meho, Lokman I., and Helen R. Tibbo. “Modeling the Information-Seeking Behavior of Social Scientists: Ellis’s Study Revisited.” *Journal of the American Society for Information Science and Technology* 54, no. 6 (2003): 570–87. doi:10.1002/asi.10244.

Mellon, Constance A. “Library Anxiety: A Grounded Theory and Its Development.” *College and Research Libraries* 47, no. 2 (January 1986): 160–65.

Meyerson, Jessica, Patricia Galloway, and Randolph Bias. “Improving the User Experience of Professional Researchers: Applying a User-Centered Design Framework in Archival Repositories.” *Proceedings of the American Society for Information Science and Technology* 49, no. 1 (January 1, 2012): 1–7. doi:10.1002/meet.14504901208.

Miller, Vernon D., and Fredric M. Jablin. “Information Seeking During Organizational Entry: Influences, Tactics, and a Model of the Process.” *Academy of Management Review* 16, no. 1 (January 1, 1991): 92–120. doi:10.5465/AMR.1991.4278997.

Mitra, Mandar, Amit Singhal, and Chris Buckley. “Improving Automatic Query Expansion.” In *Proceedings of the 21st Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, 206–14. SIGIR ’98. New York, NY, USA: ACM, 1998. doi:10.1145/290941.290995.

Mooers, Calvin N. “Mooers’ Law or Why Some Retrieval Systems Are Used and Others Are Not.” *Bulletin of the American Society for Information Science and Technology* 23, no. 1 (1996): 22–23. doi:10.1002/bult.37.

Munroe, Randall. “How Standards Proliferate.” *Xkcd*. Accessed September 30, 2017. https://xkcd.com/927/.

Nahl, Diane. “A Conceptual Framework for Explaining Information Behavior.” *Studies in Media & Information Literacy Education* 1, no. 2 (2001). http://www2.hawaii.edu/~donnab/lis610/nahl_2001.html.

———. “Measuring the Affective Information Environment of Web Searchers.” *Proceedings of the American Society for Information Science and Technology* 41, no. 1 (January 1, 2004): 191–97. doi:10.1002/meet.1450410122.

Niedźwiedzka, Barbara. “A Proposed General Model of Information Behaviour.” *Information Research* 9, no. 1 (2003). http://informationr.net/ir/9-1/paper164.html.

Nikolaison, Jeanne. “The Effect of Library Instruction on Library Anxiety in the Public Library Setting.” *Current Studies in Librarianship* 37, no. 1 (2011).

Norman, Donald A. “Cognitive Artifacts.” In *Designing Interaction: Psychology at the Human-Computer Interface*, 17–38. Cambridge Series on Human-Computer Interaction 4. Cambridge University Press, n.d.

———. “Cognitive Engineering.” In *User Centered System Design: New Perspectives on Human-Computer Interaction*, edited by Donald A. Norman and Stephen W. Draper. Hillsdale, N.J.: CRC Press, 1986.

Norman, Donald A., and Stephen W. Draper. *User Centered System Design: New Perspectives on Human-Computer Interaction*. Hillsdale, N.J.: CRC Press, 1986.

O’Brien, Heather L., and Elaine G. Toms. “The Development and Evaluation of a Survey to Measure User Engagement.” *Journal of the American Society for Information Science and Technology* 61, no. 1 (January 1, 2010): 50–69. doi:10.1002/asi.21229.

O’Day, Vicki L., and Robin Jeffries. “Orienteering in an Information Landscape: How Information Seekers Get from Here to There.” In *Proceedings of the INTERACT ’93 and CHI ’93 Conference on Human Factors in Computing Systems*, 438–45. CHI ’93. New York, NY, USA: ACM, 1993. doi:10.1145/169059.169365.

Olston, Christopher, and Ed H. Chi. “ScentTrails: Integrating Browsing and Searching on the Web.” *ACM Trans. Comput.-Hum. Interact.* 10, no. 3 (September 2003): 177–97. doi:10.1145/937549.937550.

Otter, M., and H. Johnson. “Lost in Hyperspace: Metrics and Mental Models.” *Interacting with Computers* 13, no. 1 (September 1, 2000): 1–40. doi:10.1016/S0953-5438(00)00030-8.

Owens, Trevor. “The Theory and Craft of Digital Preservation”, Accessed August 15, 2017. http://www.trevorowens.org/2017/06/full-draft-of-theory-craft-of-digital-preservation/

Pickford, C. “Cuckoo in the Nest or Welcome Addition to the Archival Family? The UK Public Services Quality Group (PSQG) for Archives and Local Studies.” *Archivum* 45 (2000): 219–32.

Pirolli, Peter. “Computational Models of Information Scent-Following in a Very Large Browsable Text Collection.” In *Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems*, 3–10. CHI ’97. New York, NY, USA: ACM, 1997. doi:10.1145/258549.258558.

Pirolli, Peter, and Stuart Card. “Information Foraging.” *Psychological Review* 106, no. 4 (1999): 643–75. doi:10.1037/0033-295X.106.4.643.

———. “Information Foraging in Information Access Environments.” In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 51–58. CHI ’95. New York, NY, USA: ACM Press/Addison-Wesley Publishing Co., 1995. doi:10.1145/223904.223911.

———. “The Sensemaking Process and Leverage Points for Analyst Technology as Identified Through Cognitive Task Analysis.” In *Proceedings of International Conference on Intelligence Analysis*, Vol. 5, 2005.

Pirolli, Peter, Stuart K. Card, and Mija M. Van Der Wege. “The Effect of Information Scent on Searching Information: Visualizations of Large Tree Structures.” In *Proceedings of the Working Conference on Advanced Visual Interfaces*, 161–72. AVI ’00. New York, NY, USA: ACM, 2000. doi:10.1145/345513.345304.

Pirolli, Peter, and Daniel M. Russell. “Introduction to This Special Issue on Sensemaking.” *Human–Computer Interaction* 26, no. 1–2 (March 10, 2011): 1–8. doi:10.1080/07370024.2011.556557.

Platt, Jessica, and Tyson L. Platt. “Library Anxiety Among Undergraduates Enrolled in a Research Methods in Psychology Course.” *Behavioral & Social Sciences Librarian* 32, no. 4 (October 1, 2013): 240–51. doi:10.1080/01639269.2013.841464.

Poe, Edgar Allan. *The Fall of the House of Usher and Other Writings*. Edited by Peter Ackroyd and David Galloway. Rev Ed edition. London ; New York: Penguin Classics, 2003.

Power, Christopher, Alena Denisova, Themis Papaioannou, and Paul Cairns. “Measuring Uncertainty in Games: Design and Preliminary Validation.” In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, 2839–45. CHI EA ’17. New York, NY, USA: ACM, 2017. doi:10.1145/3027063.3053215.

Prescott, Andrew. “The Imaging of Historical Documents.” In *The Virtual Representation of the Past*, edited by Mark Greengrass and Lorna Hughes, 7–22. Aldershot: Ashgate, 2008. http://eprints.gla.ac.uk/44847/.

Pugh, Mary Jo. *Providing Reference Services for Archives & Manuscripts*. Chicago: Society of American Archivists, 1992.

———. “The Illusion of Omniscience: Subject Access and the Reference Archivist.” *The American Archivist* 45, no. 1 (January 1, 1982): 33–44. doi:10.17723/aarc.45.1.2186l730132n24vx.

Ramelli, Agostino. *Le Diverse et Artificiose Machine Del Capitano Agostino Ramelli*. ECHO Cultural Heritage Online, 1587. http://echo.mpiwg-berlin.mpg.de/MPIWG:XAY0CN5D.

Rawski, Conrad. *Petrarch’s Remedies for Fortune Fair and Foul*. Bloomington: Indiana University Press, 1991.

Rootschat. “Advertising with RootsChat.” Accessed September 30, 2017. http://www.rootschat.com/advertise/.

Rose, Daniel E., and Danny Levinson. “Understanding User Goals in Web Search.” In *Proceedings of the 13th International Conference on World Wide Web*, 13–19. WWW ’04. New York, NY, USA: ACM, 2004. doi:10.1145/988672.988675.

Rowley, Jennifer E. *Organizing Knowledge: An Introduction to Managing Access to Information*. Ashgate, 2008.

Ruecker, Stan, Milena Radzikowska, and Stéfan Sinclair. *Visual Interface Design for Digital Cultural Heritage : A Guide to Rich-Prospect Browsing*. Farnham: Ashgate, 2011.

Russell, Daniel M., Robin Jeffries, and Lilly Irani. “Sensemaking for the Rest of Us,” 2008. https://www.researchgate.net/profile/Lilly_Irani/publication/228641117_Sensemaking_for_the_rest_of_us/links/00b4951e864beeec8f000000.pdf.

Russell, Daniel M., Mark J. Stefik, Peter Pirolli, and Stuart K. Card. “The Cost Structure of Sensemaking.” In *Proceedings of the INTERACT ’93 and CHI ’93 Conference on Human Factors in Computing Systems*, 269–76. CHI ’93. New York, NY, USA: ACM, 1993. doi:10.1145/169059.169209.

Russell-Rose, Tony, and Tyler Tate. *Designing the Search Experience : The Information Architecture of Discovery*. Amsterdam ; London: Elsevier, Morgan Kaufmann, 2013.

Salton, Gerard, and Michael J. McGill. *Introduction to Modern Information Retrieval*. McGraw-Hill, Inc., 1986.

Salton, G., A. Wong, and C. S. Yang. “A Vector Space Model for Automatic Indexing.” *Commun. ACM* 18, no. 11 (November 1975): 613–20. doi:10.1145/361219.361220.

Saracevic, Tefko. “Evaluation of Digital Libraries: An Overview.” In *Notes of the DELOS WP7 Workshop on the Evaluation of Digital Libraries*. Padua, Italy, 2004. https://www.researchgate.net/profile/Tefko_Saracevic/publication/228761950_Evaluation_of_digital_libraries_An_overview/links/0deec52615c303b113000000.pdf.

———. “Modeling Interaction in Information Retrieval (IR): A Review and Proposal.” *Proceedings of the ASIS Annual Meeting* 33 (January 1996): 3–9.

———. “Relevance Reconsidered.” In *Proceedings of the Second Conference on Conceptions of Library and Information Science*, 201–18. Copenhagen, 1996. http://cat.inist.fr/?aModele=afficheN&cpsidt=2725622.

———. “Why Is Relevance Still the Basic Notion in Information Science?” In *Proceedings of the 14th International Symposium on Information Science*, 26–35, 2015.

Sauro, Jeff. “SUPR-Q: A Comprehensive Measure of the Quality of the Website User Experience.” *J. Usability Studies* 10, no. 2 (February 2015): 68–86.

Savolainen, Reijo. “Cognitive Barriers to Information Seeking: A Conceptual Analysis.” *Journal of Information Science*, May 28, 2015, 0165551515587850. doi:10.1177/0165551515587850.

———. “Everyday Life Information Seeking: Approaching Information Seeking in the Context of ‘way of Life.’” *Library & Information Science Research* 17, no. 3 (1995): 259–94. doi:10.1016/0740-8188(95)90048-9.

———. “Filtering and Withdrawing: Strategies for Coping with Information Overload in Everyday Contexts.” *Journal of Information Science* 33, no. 5 (October 1, 2007): 611–21. doi:10.1177/0165551506077418.

Scott, Laurence. “Who Owns the Future? By Jaron Lanier – Review.” *The Guardian*, February 27, 2013. http://www.theguardian.com/books/2013/feb/27/who-owns-future-lanier-review.

Sharit, Joseph, Mario A. Hernández, Sara J. Czaja, and Peter Pirolli. “Investigating the Roles of Knowledge and Cognitive Abilities in Older Adult Information Seeking on the Web.” *ACM Trans. Comput.-Hum. Interact.* 15, no. 1 (May 2008): 3:1–3:25. doi:10.1145/1352782.1352785.

Shneiderman, Ben, Don Byrd, and W. B Croft. “Clarifying Search: A User-Interface Framework for Text Searches.” Corporation for National Research Initiatives, 1997.

Sibley, Brian. *The Land of Narnia*. Collins Lions, 1989.

Sieck, Winston R., Gary Klein, Deborah A. Peluso, Jennifer L. Smith, Danyele Harris-Thompson, and Paul A. Gade. “FOCUS: A Model of Sensemaking.” Klein Associates Inc, Fairborn OH, 2007. http://www.dtic.mil/docs/citations/ADA469770.

Simon, Herbert A. "Rational choice and the structure of the environment." *Psychological Review* 63, no. 2 (1956): 129.

Singleton, Royce, Bruce C. Straits, and Margaret Miller Straits. *Approaches to Social Research*. 2nd ed. New York ; Oxford: Oxford University Press, 1993.

Slone, Debra J. “Encounters with the OPAC: On-Line Searching in Public Libraries.” *Journal of the American Society for Information Science* 51, no. 8 (2000): 757–73. doi:10.1002/(SICI)1097-4571(2000)51:8<757::AID-ASI80>3.0.CO;2-T.

Smith, Linda, ‘Reference’ in Bates, M. (Ed.), Maack, M. (Ed.). *Encyclopedia of Library and Information Sciences*, 3rd edition. Boca Raton: CRC Press, 2009.

Smith, Pauline A. “Towards a Practical Measure of Hypertext Usability.” *Interacting with Computers* 8, no. 4 (December 1, 1996): 365–81. doi:10.1016/S0953-5438(97)83779-4.

Sontag, Susan. *Against Interpretation and Other Essays*. London: Penguin Classics, 2009.

Spink, Amanda. “Study of Interactive Feedback during Mediated Information Retrieval.” *Journal of the American Society for Information Science* 48, no. 5 (January 1997): 382–94.

Stelmaszewska, H., and A. Blandford. “Patterns of Interactions: User Behaviour in Response to Search Results.” In *Proceedings of the JCDL Workshop on Usability of Digital Libraries Usability of Digital Libraries 2002*, 2002. http://www.uclic.ucl.ac.uk/annb/DLUsability/JCDL02.html.

Sternberg, Robert J. *Cognitive Psychology*. 5th ed. (International student ed.). Belmont, CA: Cengage Learning/Wadsworth, 2009.

Stielow, Frederick, and Helen Tibbo. “The Negative Search, Online Reference, and the Humanities: A Critical Essay in Library Literature.” *RQ* 27, no. 3 (January 1988): 358–65.

Still, Julie M. ‘A history of reference’ in Anderson, Katie Elson, and Vibiana Bowman Cvetkovic. *Reinventing Reference: How Libraries Deliver Value in the Age of Google*. American Library Association, 2014

Sundqvist, Anneli. “Archival Mediation.” In *Research in the Archival Multiverse*, edited by Anne Gilliland, 558–80. Monash University Publishing, 2017.

Sutcliffe, Alistair, and Mark Ennis. “Towards a Cognitive Theory of Information Retrieval.” *Interacting with Computers*, HCI and Information Retrieval, 10, no. 3 (June 1998): 321–51. doi:10.1016/S0953-5438(98)00013-7.

Sykes, Christopher. “The Pleasure of Finding Things out.” *Horizon*. BBC, 1981. http://www.bbc.co.uk/iplayer/episode/p018dvyg/horizon-19811982-the-pleasure-of-finding-things-out.

Tabatabai, Diana, and Bruce M. Shore. “How Experts and Novices Search the Web.” *Library & Information Science Research* 27, no. 2 (2005): 222–48. doi:10.1016/j.lisr.2005.01.005.

Tabachnick, Barbara G., and Linda S. Fidell. *Using multivariate statistics*. Allyn & Bacon/Pearson Education, 2007.

Taylor, Robert S. *Question-Negotiation and information seeking in libraries.* No. 3. Lehigh University, Bethlehem PA Centre for Information Science, 1967.

Teevan, Jaime, Christine Alvarado, Mark S. Ackerman, and David R. Karger. “The Perfect Search Engine Is Not Enough: A Study of Orienteering Behavior in Directed Search.” In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 415–22. CHI ’04. New York, NY, USA: ACM, 2004. doi:10.1145/985692.985745.

Theimer, Kate. “The Role of ‘the Professional Discipline’ in Archives and Digital Archives.” *ArchivesNext*, February 17, 2014. http://www.archivesnext.com/?p=3683.

The National Archives. “Annual Report and Accounts 2012-3,” 2013. http://www.nationalarchives.gov.uk/documents/annual-report-12-13.pdf.

———. “ARCHON Directory.” *The National Archives*, 2010. http://nationalarchives.gov.uk/archon.

———. “Army Operations after 1945.” Accessed October 7, 2014. http://nationalarchives.gov.uk/records/research-guides/army-operations-after-1945.htm.

———. “Before You Visit.” *The National Archives*. Accessed September 15, 2013. http://www.nationalarchives.gov.uk/visit/before-you-visit.htm.

———. “Best Practice Guidelines for the Contact Centre.” Unpublished, 2012.

———. “British Army War Diaries 1914-1922.” Accessed August 6, 2016. http://nationalarchives.gov.uk/records/research-guides/british-army-war-diaries-1914-1922/.

———. “Cataloguing Projects.” Accessed September 30, 2017. http://nationalarchives.gov.uk/about/our-role/plans-policies-performance-and-projects/our-projects/cataloguing-projects/.

———. “Digital Services and Archive Audiences: Local Authority Archives 2014,” 2014. http://www.nationalarchives.gov.uk/documents/archives/Digital_Services_and_Archive_Audiences_2014.pdf.

———. “Discovery API.” *The National Archives*. Accessed September 15, 2013. http://discovery.nationalarchives.gov.uk/SearchUI/api.htm.

———. “Life in Towns and Villages.” Accessed September 30, 2017. http://nationalarchives.gov.uk/domesday/world-of-domesday/towns.htm.

———. “Research Guides - Online Collections.” Text. *The National Archives*. Accessed September 30, 2017. http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/.

———. “Rossetti, Dante Gabriel (1828-1882), Painter and Poet.” Text. Accessed September 26, 2017. http://discovery.nationalarchives.gov.uk/details/c/F39625.

———. “Search Results for ‘War Diary.’” Accessed July 10, 2014. http://discovery.nationalarchives.gov.uk/results/r?_aq=%22war%20%22&_dss=date&_sd=1953&_ro=any&_hb=tna.

———. “The Discovery Service.” Text. Accessed September 26, 2017. http://discovery.nationalarchives.gov.uk/.

_____. “UK Government Web Archive.” Text. Accessed September 26, 2017 http://www.nationalarchives.gov.uk/webarchive/

____. “Our research and academic collaboration.” Text. Accessed September 26, 2017. http://www.nationalarchives.gov.uk/about/our-research-and-academic-collaboration/

____. “Archive sector accreditation.” Text. Accessed September 26, 2017. http://www.nationalarchives.gov.uk/archives-sector/archive-service-accreditation/

____. “Discovery: London Leathermen, Bishopsgate Institute.” Text. Accessed September 26, 2017. http://discovery.nationalarchives.gov.uk/details/c/F275963

____. “National Coal Board and British Coal Corporation: Marketing Department, COAL 28” Text. Accessed September 26, 2017. http://discovery.nationalarchives.gov.uk/details/r/C5276

____. “Opencast coal: general - COAL 28/7.” Text. Accessed September 26, 2017. http://discovery.nationalarchives.gov.uk/details/r/C328508

The Shelbourne Hotel. “Genealogy Butler Service at The Shelbourne Hotel.” Accessed September 30, 2017. http://www.shelbournedining.ie/genealogy-butler.

Thunnissen, Daniel P. “Uncertainty Classification for the Design and Development of Complex Systems.” In *Proceedings of the 3rd Annual Predictive Methods Conference, Veros Software*, 2003.

Travers, P. L. *What the Bee Knows*. New Paltz, New York: Codhill Press, 2010.

Tyler, David C., and Beth McNeil. “Librarians and Link Rot: A Comparative Analysis with Some Methodological Considerations.” *Portal: Libraries and the Academy* 3, no. 4 (November 25, 2003): 615–32. doi:10.1353/pla.2003.0098.

Uva, Peter A. “Information-Gathering Habits of Academic Historians: Report of the Pilot Study,” 1977. https://eric.ed.gov/?id=ED142483.

Voorhees, Ellen M., and Donna K. Harman, eds. *TREC: Experiment and Evaluation in Information Retrieval*. Cambridge, Mass: MIT Press, 2005.

Watts, Duncan J. *Six Degrees: The Science of a Connected Age*. London: Vintage, 2004.

Weck, Olivier L. De, and Claudia Eckert. "A Classification of Uncertainty for Early Product and System Design." Working Paper. Massachusetts Institute of Technology. Engineering Systems Division, February 2007. http://dspace.mit.edu/handle/1721.1/102887.

West, Robert, and Jure Leskovec. "Human Wayfinding in Information Networks." In *Proceedings of the 21st International Conference on World Wide Web*, 619–28. WWW '12. New York, NY, USA: ACM, 2012. doi:10.1145/2187836.2187920.

Whitelaw, Mitchell. "Generous Interfaces for Digital Cultural Collections", *Digital Humanities Quarterly*, vol. 9, no. 1 (2015). http://www.digitalhumanities.org/dhq/vol/9/1/000205/000205.html.

White, Ryen W., and Resa A. Roth. "Exploratory Search: Beyond the Query-Response Paradigm." *Synthesis Lectures on Information Concepts, Retrieval, and Services* 1, no. 1 (January 2009): 1–98. doi:10.2200/S00174ED1V01Y200901ICR003.

Wilson, Max L., Bill Kules, m. c. schraefel, and Ben Shneiderman. "From Keyword Search to Exploration: Designing Future Search Interfaces for the Web." *Found. Trends Web Sci.* 2, no. 1 (January 2010): 1–97. doi:10.1561/1800000003.

Wilson, T.D. "Information Behaviour: An Interdisciplinary Perspective." *Information Processing & Management* 33, no. 4 (July 1997): 551–72. doi:10.1016/S0306-4573(97)00028-9.

Wilson, T. D. "Models in Information Behaviour Research." *Journal of Documentation* 55, no. 3 (August 1, 1999): 249–70. doi:10.1108/EUM0000000007145.

Wilson, T.d., N.j. Ford, D. Ellis, A.e. Foster, and A. Spink. "Information Seeking and Mediated Searching: Part 2. Uncertainty and Its Correlates." *Journal of the American Society for Information Science and Technology* 53, no. 9 (January 1, 2002): 704–15. doi:10.1002/asi.10082.

Wilson, Tom. "Exploring Models of Information Behaviour: The 'uncertainty' Project." *Information Processing & Management* 35, no. 6 (November 1, 1999): 839–49. doi:10.1016/S0306-4573(99)00029-1.

Witty, Francis J. "The Pínakes of Callimachus." *The Library Quarterly* 28, no. 2 (April 1, 1958): 132–36. doi:10.1086/618523.

Xu, Jinxi, and W. Bruce Croft. "Query Expansion Using Local and Global Document Analysis." In *Proceedings of the 19th Annual International ACM SIGIR Conference*

on Research and Development in Information Retrieval, 4–11. SIGIR '96. New York, NY, USA: ACM, 1996. doi:10.1145/243199.243202.

Yakel, Elizabeth, and Deborah Torres. "AI: Archival Intelligence and User Expertise." *American Archivist* 66, no. 1 (January 1, 2003): 51–78.

Zipf, George Kingsley. *Human Behavior and the Principle of Least Effort*. Oxford, England: Addison-Wesley Press, 1949.

Appendix A: 67 statements in testing order

Q1	I found using the search system intimidating.
Q2	I was not sure my searches were returning all of the relevant records.
Q3	At the start of the research task I had a clear plan.
Q4	I was frustrated because I knew what I wanted but I couldn't get to it.
Q5	I felt elated because I did not know what I would find.
Q6	I found it hard to read the documents I looked at.
Q7	I often felt I didn't know where to go next.
Q8	I found it difficult to keep track of all the places where I found records.
Q9	I wasn't sure whether what I was looking for was in the collection or not.
Q10	The system used words I didn't understand.
Q11	I felt confident locating a type of record I had not used before.
Q12	The search results were difficult to understand.
Q13	I often felt I didn't know what to do next.
Q14	I stuck to tried and tested techniques to carry out my research.
Q15	When I didn't find what I was looking for straight away I knew what to do.
Q16	I didn't understand what everything in the documents I found meant.
Q17	I found it confusing trying to work out which of the search results was the right one.
Q18	I found looking through all those results exhausting.
Q19	I found it difficult to cope with the sheer volume of material I was looking through.
Q20	I found it difficult to keep track of what I was finding.
Q21	I felt the system was helping me solve my research problem.
Q22	I was excited about venturing into the unknown.
Q23	By the end, I was running out of ideas for new queries.
Q24	I do not remember all the places I searched.
Q25	I knew exactly where to head to complete this task.
Q26	The document descriptions didn't tell me enough to know if what I was seeing was really relevant.
Q27	I found myself going round in circles.
Q28	I knew what I wanted but I couldn't see how to get there.
Q29	I found thinking about every possible way of searching for something very difficult.
Q30	I was sure the system would show me all the results I asked for.
Q31	I found the search system confusing.
Q32	At the start of the session I felt unsure about how to begin my research.
Q33	I felt I needed help.
Q34	I knew what information I wanted to find in my search session.
Q35	I knew where to search to find the information I needed
Q36	I struggled to think of the right words to put in the search box.
Q37	I found it hard to know what to type in the search box.
Q38	I knew where the records I needed were located.
Q39	I felt I understood how records are arranged in the archive.
Q40	The search system was easy to use.
Q41	I knew where to find help when I needed it.
Q42	I think what I was looking for might not even be here.
Q43	I recognised most of the government departments that came up in my searches.

Q44 I often felt lost during the session.
Q45 I know where to look in my next search session.
Q46 I recognised most of the types of documents in my search results.
Q47 I felt I knew how to resolve discrepancies among the documents I located.
Q48 I feel my search session produced results that have moved my research forward.
Q49 I have a clear plan for how I will continue my research after this session.
Q50 I'm no nearer to answering my question than I was at the start.
Q51 I think I know where to look next to find what I need.
Q52 Searches that returned no results helped me eliminate lines of enquiry.
Q53 I feel well prepared for my next search
Q54 I felt well prepared at the start of my search.
Q55 I couldn't make relevant results appear in my search.
Q56 I have found new avenues I want to explore.
Q57 I'm worried that I have missed a key source.
Q58 I was aware of the most important types of records for the research I was undertaking.
Q59 I recognised what I was looking for when I saw it.
Q60 I found significant numbers of highly relevant results in the course of my searching.
Q61 The results I looked at seemed relevant to my search topics.
Q62 I found enough on my topic.
Q63 At the start of the task I thought my searching was likely to meet with success.
Q64 I'm confident what I was looking for is in here somewhere.
Q65 I relied on luck to locate relevant items.
Q66 I worried about making mistakes in the course of my research.
Q67 At the end of the search session I felt uncertain.

Appendix B: Descriptive statistics and item based Measures of Sampling Adequacy

Item	Mean	SD	MSA
I found using the search system intimidating.	2.94	1.15	0.952
I was not sure my searches were returning all of the relevant records.	3.72	0.98	0.935
At the start of the research task I had a clear plan.	3.07	1.07	0.753
I was frustrated because I knew what I wanted but I couldn't get to it.	3.18	1.10	0.945
I felt elated because I did not know what I would find.	2.84	1.00	0.781
I found it hard to read the documents I looked at.	4.13	1.07	0.903
I often felt I didn't know where to go next.	3.34	1.06	0.968
I found it difficult to keep track of all the places where I found records.	3.32	1.01	0.914
I wasn't sure whether what I was looking for was in the collection or not.	3.48	1.00	0.949
The system used words I didn't understand.	2.78	1.14	0.943
I felt confident locating a type of record I had not used before.	2.95	1.07	0.953
The search results were difficult to understand.	3.22	1.09	0.957
I often felt I didn't know what to do next.	3.30	1.06	0.972
I stuck to tried and tested techniques to carry out my research.	3.34	0.88	0.639
When I didn't find what I was looking for straight away I knew what to do.	2.90	1.06	0.911
I didn't understand what everything in the documents I found meant.	3.83	1.02	0.902
I found it confusing trying to work out which of the search results was the right one.	3.40	1.03	0.969
I found looking through all those results exhausting.	3.27	1.04	0.882
I found it difficult to cope with the sheer volume of material I was looking through.	3.29	1.08	0.916
I found it difficult to keep track of what I was finding.	3.37	1.04	0.925
I felt the system was helping me solve my research problem.	2.93	0.99	0.947
I was excited about venturing into the unknown.	3.42	1.06	0.916
By the end, I was running out of ideas for new queries.	3.35	1.04	0.950
I do not remember all the places I searched.	3.36	1.07	0.925
I knew exactly where to head to complete this task.	2.62	1.05	0.969
The document descriptions didn't tell me enough to know if what I was seeing was really relevant.	3.58	1.03	0.946
I found myself going round in circles.	3.17	1.08	0.939
I knew what I wanted but I couldn't see how to get there.	3.21	1.04	0.931
I found thinking about every possible way of searching for something very difficult.	3.27	1.00	0.905
I was sure the system would show me all the results I asked for.	3.15	1.01	0.785
I found the search system confusing.	3.12	1.12	0.957
At the start of the session I felt unsure about how to begin my research.	3.35	1.12	0.931
I felt I needed help.	3.69	1.08	0.974
I knew what information I wanted to find in my search session.	3.40	1.05	0.916
I knew where to search to find the information I needed	3.03	1.08	0.952
I struggled to think of the right words to put in the search box.	3.14	1.16	0.891

I found it hard to know what to type in the search box.	3.17	1.14	0.894
I knew where the records I needed were located.	2.63	1.12	0.959
I felt I understood how records are arranged in the archive.	2.71	1.15	0.958
The search system was easy to use.	3.22	1.11	0.939
I knew where to find help when I needed it.	2.81	1.04	0.969
I think what I was looking for might not even be here.	3.06	1.04	0.851
I recognised most of the government departments that came up in my searches.	2.98	1.06	0.940
I often felt lost during the session.	3.24	1.13	0.967
I know where to look in my next search session.	3.04	1.04	0.971
I recognised most of the types of documents in my search results.	2.92	1.06	0.968
I felt I knew how to resolve discrepancies among the documents I located.	2.67	0.97	0.966
I feel my search session produced results that have moved my research forward.	3.11	1.10	0.950
I have a clear plan for how I will continue my research after this session.	2.90	1.04	0.965
I'm no nearer to answering my question than I was at the start.	3.16	1.24	0.948
I think I know where to look next to find what I need.	3.02	1.06	0.961
Searches that returned no results helped me eliminate lines of enquiry.	3.21	0.97	0.830
I feel well prepared for my next search	2.90	1.02	0.961
I felt well prepared at the start of my search.	2.78	1.04	0.901
I couldn't make relevant results appear in my search.	2.97	1.20	0.933
I have found new avenues I want to explore.	3.21	1.05	0.948
I'm worried that I have missed a key source.	3.70	1.00	0.897
I was aware of the most important types of records for the research I was undertaking.	2.75	1.05	0.933
I recognised what I was looking for when I saw it.	3.08	1.06	0.963
I found significant numbers of highly relevant results in the course of my searching.	2.94	1.13	0.955
The results I looked at seemed relevant to my search topics.	3.30	0.99	0.943
I found enough on my topic.	2.68	1.09	0.951
At the start of the task I thought my searching was likely to meet with success.	3.54	0.97	0.850
I'm confident what I was looking for is in here somewhere.	3.43	1.02	0.936
I relied on luck to locate relevant items.	3.13	1.02	0.887
I worried about making mistakes in the course of my research.	3.26	1.08	0.883
At the end of the search session I felt uncertain.	3.56	1.04	0.967

Appendix C: Structure Matrix of 67 items

Structure Matrix	1	2	3
The system used words I didn't understand.	0.577	-0.217	0
I often felt I didn't know what to do next.	0.735	-0.508	0.011
I found it confusing trying to work out which of the search results was the right one.	0.726	-0.422	-0.026
I often felt I didn't know where to go next.	0.761	-0.415	0.029
I worried about making mistakes in the course of my research.	0.415	-0.127	-0.032
By the end, I was running out of ideas for new queries.	0.627	-0.341	-0.033
I felt I needed help.	0.701	-0.463	0.048
At the start of the session I felt unsure about how to begin my research.	0.535	-0.232	0.061
The document descriptions didn't tell me enough to know if what I was seeing was really relevant.	0.638	-0.309	0.062
I found looking through all those results exhausting.	0.506	-0.099	0.067
At the end of the search session I felt uncertain.	0.64	-0.515	0.075
I wasn't sure whether what I was looking for was in the collection or not.	0.637	-0.362	-0.091
I found it difficult to cope with the sheer volume of material I was looking through.	0.607	-0.151	-0.114
The search results were difficult to understand.	0.698	-0.437	0.115
I relied on luck to locate relevant items.	0.438	-0.13	0.116
I often felt lost during the session.	0.669	-0.427	0.12
I found the search system confusing.	0.677	-0.503	0.131
I was frustrated because I knew what I wanted but I couldn't get to it.	0.623	-0.344	0.14
I found it difficult to keep track of what I was finding.	0.635	-0.214	-0.142
I found using the search system intimidating.	0.576	-0.341	0.143
I found myself going round in circles.	0.681	-0.353	0.166
I found thinking about every possible way of searching for something very difficult.	0.477	-0.132	0.167
I was not sure my searches were returning all of the relevant records.	0.533	-0.228	-0.205
I struggled to think of the right words to put in the search box.	0.457	-0.32	0.209
I do not remember all the places I searched.	0.527	-0.17	-0.215
I knew what I wanted but I couldn't see how to get there.	0.601	-0.208	0.236
I found it hard to read the documents I looked at.	0.507	-0.197	-0.274
I found it hard to know what to type in the search box.	0.499	-0.301	0.289
I didn't understand what everything in the documents I found meant.	0.557	-0.23	-0.303
I'm no nearer to answering my question than I was at the start.	0.554	-0.487	0.307
I'm worried that I have missed a key source.	0.568	-0.164	-0.327
I found it difficult to keep track of all the places where I found records.	0.568	-0.074	-0.374
I couldn't make relevant results appear in my search.	0.543	-0.451	0.432

Searches that returned no results helped me eliminate lines of enquiry.	-0.024	0.392	0.019
I think I know where to look next to find what I need.	-0.458	0.763	-0.02
The search system was easy to use.	-0.395	0.583	-0.021
I feel well prepared for my next search	-0.472	0.762	0.028
I have a clear plan for how I will continue my research after this session.	-0.423	0.772	0.032
I know where to look in my next search session.	-0.504	0.781	-0.033
I found enough on my topic.	-0.455	0.664	0.051
I stuck to tried and tested techniques to carry out my research.	0.107	0.244	-0.052
I was excited about venturing into the unknown.	-0.134	0.589	0.057
I felt the system was helping me solve my research problem.	-0.419	0.724	-0.071
When I didn't find what I was looking for straight away I knew what to do.	-0.171	0.542	-0.075
I felt elated because I did not know what I would find.	0.068	0.396	0.076
At the start of the task I thought my searching was likely to meet with success.	-0.045	0.407	0.079
I recognised what I was looking for when I saw it.	-0.459	0.671	-0.102
I recognised most of the types of documents in my search results.	-0.417	0.644	0.114
I felt confident locating a type of record I had not used before.	-0.42	0.688	0.115
I found significant numbers of highly relevant results in the course of my searching.	-0.36	0.646	-0.116
I have found new avenues I want to explore.	-0.303	0.692	-0.117
I knew where to search to find the information I needed	-0.455	0.608	0.146
I knew what information I wanted to find in my search session.	-0.22	0.407	0.146
I recognised most of the government departments that came up in my searches.	-0.285	0.547	0.157
I knew where the records I needed were located.	-0.444	0.677	0.189
I feel my search session produced results that have moved my research forward.	-0.44	0.704	-0.205
I'm confident what I was looking for is in here somewhere.	-0.28	0.516	-0.211
I knew where to find help when I needed it.	-0.455	0.597	0.27
I felt I knew how to resolve discrepancies among the documents I located.	-0.378	0.632	0.28
I knew exactly where to head to complete this task.	-0.497	0.616	0.293
I felt I understood how records are arranged in the archive.	-0.462	0.615	0.293
The results I looked at seemed relevant to my search topics.	-0.373	0.674	-0.293
I was aware of the most important types of records for the research I was undertaking.	-0.259	0.563	0.324
At the start of the research task I had a clear plan.	-0.084	0.268	0.38
I was sure the system would show me all the results I asked for.	-0.053	0.222	0.394
I think what I was looking for might not even be here.	0.351	-0.197	0.414
I felt well prepared at the start of my search.	-0.246	0.427	0.45

Appendix D: Information Seeking Uncertainty Survey (ISUS)

Your Search Experience

Based on the session you have just completed, please rate how far you would agree with the following statements:

SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree.

I often felt lost during the session.
SD *D* *N* *A* *SA*

The document descriptions didn't tell me enough to know if what I was seeing was really relevant.
SD *D* *N* *A* *SA*

I found enough on my topic.
SD *D* *N* *A* *SA*

By the end, I was running out of ideas for new queries.
SD *D* *N* *A* *SA*

I knew exactly where to head to complete this task.
SD *D* *N* *A* *SA*

I found the search system confusing.
SD *D* *N* *A* *SA*

At the start of the research task I had a clear plan.
SD *D* *N* *A* *SA*

I found it difficult to cope with the sheer volume of material I was looking through.
SD *D* *N* *A* *SA*

I felt the system was helping me solve my research problem.
SD *D* *N* *A* *SA*

I knew where the records I needed were located.
SD *D* *N* *A* *SA*

The results I looked at seemed relevant to my search topics.
SD D N A SA

I felt I needed help.
SD D N A SA

I recognised what I was looking for when I saw it.
SD D N A SA

I was sure the system would show me all the results I asked for.
SD D N A SA

I wasn't sure whether what I was looking for was in the collection or not.
SD D N A SA

I know where to look in my next search session.
SD D N A SA

I found significant numbers of highly relevant results in the course of my searching.
SD D N A SA

I think what I was looking for might not even be here.
SD D N A SA

I found it difficult to keep track of what I was finding.
SD D N A SA

I knew where to search to find the information I needed.
SD D N A SA

I was frustrated because I knew what I wanted but I couldn't get to it.
SD D N A SA

At the end of the search session I felt uncertain.
SD D N A SA

I found myself going round in circles.
SD D N A SA

I felt well prepared at the start of my search.
SD *D* *N* *A* *SA*

The search results were difficult to understand.
SD *D* *N* *A* *SA*

I felt I understood how records are arranged in the archive.
SD *D* *N* *A* *SA*

I often felt I didn't know where to go next.
SD *D* *N* *A* *SA*

I feel my search session produced results that have moved my research forward.
SD *D* *N* *A* *SA*

I felt confident locating a type of record I had not used before.
SD *D* *N* *A* *SA*

I have found new avenues I want to explore.
SD *D* *N* *A* *SA*

I knew what I wanted but I couldn't see how to get there.
SD *D* *N* *A* *SA*

I felt I knew how to resolve discrepancies among the documents I located.
SD *D* *N* *A* *SA*

Appendix E: ISUS statements by factor

Preparedness

- I felt well prepared at the start of my search.
- I was sure the system would show me all the results I asked for.
- At the start of the research task I had a clear plan.

Prospect

- I felt the system was helping me solve my research problem.
- I knew where the records I needed were located.
- The results I looked at seemed relevant to my search topics.
- I knew exactly where to head to complete this task.
- I knew where to search to find the information I needed.
- I recognised what I was looking for when I saw it.
- I found enough on my topic.
- I know where to look in my next search session.
- I found significant numbers of highly relevant results in the course of my searching.
- I feel my search session produced results that have moved my research forward.
- I felt confident locating a type of record I had not used before.
- I have found new avenues I want to explore.
- I felt I understood how records are arranged in the archive.
- I felt I knew how to resolve discrepancies among the documents I located.

Disorientation

- I often felt lost during the session.
- The document descriptions didn't tell me enough to know if what I was seeing was really relevant.
- I found it difficult to cope with the sheer volume of material I was looking through.
- By the end, I was running out of ideas for new queries.
- I felt I needed help.
- I found the search system confusing.
- I wasn't sure whether what I was looking for was in the collection or not.
- I think what I was looking for might not even be here.
- I found it difficult to keep track of what I was finding.
- I was frustrated because I knew what I wanted but I couldn't get to it.
- At the end of the search session I felt uncertain.
- I found myself going round in circles.
- I knew what I wanted but I couldn't see how to get there.
- The search results were difficult to understand.
- I often felt I didn't know where to go next.

Appendix F: Sample consent form

Information Sheet for War Diary study

The purpose of this form is to tell you about the study and highlight features of your participation.

1 Who is running this?

The study is being run by Jo Pugh who is a Research Engineer at the National Archives and the University of York.

2 What is the purpose of the study?

The purpose of this study is to see whether people can straightforwardly locate items (in this case First World War unit war diaries) via the National Archives website.

3 What will I have to do?

Undertake a ten minute search session and complete a questionnaire on the experience afterwards.

4 Who will see the data from this study?

Only I and my doctoral supervisor will work directly with the completed questionnaires which will not include any personally identifiable data.

The results of the study may be published in an academic journal or report to the National Archives but again you will not be identifiable in any way.

5 Do I have to do this?

Your participation is completely voluntary. You can therefore withdraw from the study at any point and if requested your data can be destroyed.

6 Can I ask a question?

You should feel free to ask questions during the study but I cannot advise you on your search as you work to complete the diary task.

Informed Consent

I, _____, voluntarily give my consent to participate in this search study using National Archives' systems. I have been informed about, and feel that I understand the basic nature of the project. I understand that I may withdraw from the session at any time without prejudice.

I also understand that my information is confidential.

Only Mr. Jo Pugh and Dr. Christopher Power will have access to the data collected today in its original format and it will only be shared beyond in an anonymous or aggregate format.

_____ _____

Signature of Research Participant Date

Section B: Post Interview Consent

Please initial each of the following statements when the study has been completed and you have been debriefed.

I have been adequately debriefed Your initials:

I was not forced to complete the study. Your initials:

All my questions have been answered Your initials:

Appendix G: Sample preliminary questionnaire

Preliminary Questionnaire

Please circle the relevant answer

1. **How long have you been working with documents from the National Archives?** (using Discovery, Ancestry, Find my Past etc.)

First time / Less than a year / 1-2 years / 3-5 years / 5 to 10 years / More than 10 years

2. Have you ever visited the National Archives?

Yes / No

3. Have you ever used Discovery (the National Archives search system) before?

Yes / No

4. How would you rate your confidence as a researcher?

Very confident / Pretty confident / Mildly confident / Rather unconfident / Very unconfident

4. **How would you rate your confidence with technology?**

Very confident / Pretty confident / Mildly confident / Rather unconfident / Very unconfident

5. **Are there any databases you use commonly for research?** (e.g. FreeBMD, Gazettes etc.) List as many as you wish.

6. Which of the following categories best describes your age?

Under 25 / 25-35 / 36-45 / 46-55 / 55-65 / Over 65

Appendix H: War diary research guide

British Army war diaries 1914-1922

What are these records?

These records are the unit war diaries of the British Army in the First World War. They are not personal diaries (try the Imperial War Museum or Local Record Offices for those). They are part of a large series of records, WO 95, which contains many more diaries scheduled for digitisation. We are now conserving, sorting, digitising and itemising thousands more diaries from the WO 95 series as part of our First World War 100 programme.

What information do the records contain?

Some diaries record little more than daily losses and map references whilst others are much more descriptive, with daily reports on operations, intelligence summaries and other material. The digitised diaries cover activity in France and Belgium.

The diaries sometimes contain information about particular people but they are unit diaries, not personal diaries. A few contain details about awards of the Military Medal and the Meritorious Service Medal.

Many maps and plans were included in the original diaries but some confidential material was removed before the files were made available. This accounts for the absence of some appendices referred to on the covers of many diaries.

How do I search the records?

You can search the records in Discovery, our catalogue, via http://discovery.nationalarchives.gov.uk/

Please note, your results will show all instances of the term(s) you searched for within the record descriptions, as this is currently a keyword search.

If you search only by regiment, your search results will include all the battalions in that regiment.

You do not need to include the word ‘regiment’, ‘battalion’ or ‘brigade’. For example, to search for a battalion in the Northumberland Fusiliers, you need only search using the words ‘Northumberland Fusiliers’.

Searching is free, but there may be a charge to download documents.

What do the records look like?

With each download, you will typically see a unit diary that may cover a period of several years. This may be divided into several PDF files, which you can save to your computer. You can then scroll through the PDF files to locate the battalion and dates that you are interested in. You can also use the image viewer in Discovery to preview the pages of the diary.

Many of the war diaries were scribbled hastily in pencil and use obscure abbreviations, whilst some are the second carbon copy of the original, so they may be difficult to read.

Why can’t I find what I’m looking for?

Not all the unit war diaries held by The National Archives have been digitised yet. More digitised diaries will be published online as part of First World War 100, our centenary programme.

The war diaries for Gallipoli and the Dardanelles campaign are available via Ancestry (£).

Those diaries that haven’t been digitised are available to view in their original form at The National Archives in Kew. They are in record series WO 95.

Appendix I: Marchionini in the Archives

Define Problem

‘‘I am new to the family research, please advise if it is possible to search the records, on line, from Australia and what is required to enable me to do this.”

- User cannot (or does not) define in any meaningful sense what they are looking for. Rare so far because it's hard to formulate - in written form - enquiries which are very nebulous.

Choose a search system / select source

[For Andrea Johnson this is “where shall I look”]

“Attempting to look into my father’s side of the family tree and found his grandad was listed on a census as Royal Marines Greenwich out pensioner...Can you point me in the right direction for any more information I may obtain.”

- User seeks direction as to where to begin a search. What types of information/source are available?

Formulate query

[For Andrea Johnson this is “what shall I say”]

“I would like to know whether your archive holds any documents about the British presence in West Berlin in 1960s...My browsing in the FCO files on the internet only revealed documents for the 1940s, 1950s and some for the 1980s, but there must be thousands of other files regarding encounters of the British with the population of West Berlin.”

- User has a clear sense of what they are looking for but is unable to generate the query terms required to meet their information need.

Execute query

“*Do you have any records for a Private William FISHER, said to be born about 1817/1818 in England...I look forward to your reply and, if you have any information, how I may obtain certified copies of any documents relating to this person.”*

- User appears unwilling to carry out research themselves or engage with an online research process. Often accompanied by a recognition that they will have to pay to have their research needs met.

Examine results

“I am enquiring about 10472 Patrick Nolan I have received his medal card from you and I am wondering if there is any diaries that he may have written I cannot locate them in the search on here”

- Can the user understand their result set? Can they judge the relevance of the results they are seeing successfully? Are they comfortable with null result sets? Can they effectively judge their search progress from result sets?

Extract information

[For Andrea Johnson this is “what is that”]

“I know my grandfather, Robert E Wallis, was a sapper in the Royal Engineers and his Regiment number was 58917, but other than finding his medal card, I cannot find out anything more about who he served with or where in France he was...Do you think any information on his medal roll index card would provide any help? I have attached a copy if you wouldn't mind having a look at it please, as I am not really sure what the numbers mean.”

- Can the user make sense of the record once they have found it? Can they use it as they wish/need to use it? Includes technical problems with document download etc.

Appendix J: Duff and Johnson in brief

- Administrative/Directional

Costs of photocopying, hours, location, phone numbers. Policies and procedures; permission to access/publish materials, how to cite.

- Fact-finding

A specific answer to a specific question – not a source where the answer might be found but the actual answer.

- Material-finding

“Whether the archives has any *sources* about a particular person, place or event”. User often able to give “specific dates, places and activities”

- Specific form

The user wants to know if a specific record *type* is available (e.g census, military service records)

- Known item

“User gives the name of a specific or known item and wants to know if it is located in that archive”

- Service request

Request for a specific service like record copying. Request “almost always” accompanied by document reference(s).

- Consultation

User asks for “advice…which calls on [the archivist’s] specific knowledge of the resources”. Do they contain the type of material looked for? Can the archivist make a recommendation?

- User education

User has “vague sense” of the record they want or wants to know “how to get started”. There is usually a “how statement” involved – “how do I find…”

Summarised from:
Wendy M, Duff and Catherine A. Johnson, 'A virtual expression of need: an analysis of e-mail reference questions', The American Archivist, vol. 64, Spring/Summer 2001: 43-60