Jisc

Spotlight on the Digital

Recent trends and research in scholarly discovery behaviour

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Executive summary

This report provides an update on the literature relating to the academic library role in discovery for both students and scholars since the earlier literature review published by the Spotlight project in late 2013.

It highlights five themes from the recent literature:

i. **Trends in user behaviour**: Increasing confirmation that the 'digital natives' idea differentiating generational behaviour is outdated, with online activity pervasive across all categories of users and age ranges. In addition, distinctions between different educational stages are less marked than earlier research indicated. Meanwhile expectations have become higher, with the norm fast becoming to expect to access resources anywhere from any device. Library tools sit in an eco-system alongside other tools from which users make strategic selections according to purpose. There is evidence that library staff tend to over-estimate the extent that users use library services, including discovery layers, as opposed to other services to discover resources

ii. **Debate on the library role in discovery**: While many respond to evidence about users tending to bypass the library by looking for ways to make library services more effective, others are challenging the idea that libraries should aim to play a primary role in discovery at all. Although the evidence for the effectiveness of new discovery tools is still coming in, some argue that libraries should accept that their role in discovery is no longer to be the single starting point – if indeed it ever was, which is disputed – and develop services to support specific aspects of discovery in which it can help, or even, if the evidence shows that the

investment being made in the tools is not reaping a return, cede discovery to Google and focus on other activities

iii. **Barriers to effectiveness**: At the same time as debating the library role in discovery, researchers are identifying ways in which library services are presented in ways that hinder their effectiveness. More could be done to ensure seamless access across services, multiple locations and different devices. More just-in-time information and support could be given. There is evidence that libraries over-estimate the extent to which users understand library concepts, tools and even basic bibliographic formats and relationships. There is the beginning of detailed, localised ethnographic studies which can help library staff understand user behaviour not just in general, global terms but more specifically what their own users actually do

iv. **Evaluating effectiveness**: With the completion from other discovery services and new developments such as open access and semantic data there is a developing focus on understanding what library and alternative discovery tools each do well. New library discovery tools can be convenient and flexible, but other services such as Google Scholar still out-perform libraries on factors such as speed of updates, covering non-standard sources, relevancy of results and complementary services such as citations and related articles

v. **Emerging trends**: new trends beginning to emerge that will impact on discovery are identified, including:

› The development of specialised apps for discovery rather than websites

› The growth of streaming services in music discovery, paralleled by early developments towards integrated online library services such as the Digital Public Library of America and talk in the UK of a digital public space (now being proposed by the BBC as an "Ideas Service")

› The huge challenge still posed to library services by the pervasiveness of mobile devices

› Lessons to be learnt from the hidden economy of scholarly e-book piracy viewed as user-curated communities of interest for scholarly discovery

› First-hand accounts of the rapidly changing landscape of online trends and behaviour among current students, which can challenge popular preconceptions (e.g. Instagram is more popular than Facebook) and signal significant developments (e.g. the easy-to-use interface design of Tinder)

› The beginning of knowledge about the online behaviour of the next generation of young people who will enter universities 2020-2025, for whom all interfaces will be touch or gesture based and mouse navigation unknown, for whom online and offline experience is seamlessly blended and who seem to have high visual preferences, want to be able to personalise the services they use, and have a ruthlessly instrumental approach to search

Introduction

The November 2013 Spotlight on the Digital literature review summarised and analysed the research and discovery behaviours of students, researchers, and teachers in higher education (although evidence on the behaviour of staff as teachers was scant).

It identified fourteen typical discovery behaviours and traced how these evolved across different phases of the journey from fresher to established faculty. Some behaviours that were widespread in the early stages of the journey, such as discovering resources from family and friends, faded and were replaced by reliance on more scholarly tools as part of becoming more mature academically. Other behaviours, however, remained part of the approach to resource discovery through all educational stages, notably use of general search engines as a starting point, discovering resources through the online library interface, and personal contact with peers (from fellow students through to fellow professional scholars). Using a general search engine, notably Google (or Google Scholar), as the starting point both for discovery of both known items and for more exploratory searches was identified as being already the well-established preferred route to discovery for most students and increasingly becoming so for career researchers. However, using e-journal databases was also widespread, and for students in particular (and especially in the arts and humanities) so too was use of the library catalogue, although the library discovery layer was too recent a development to emerge as a factor in the literature. Pre-print databases were becoming increasingly more important for researchers, more so in some disciplines than others, while discovering resources through educational and social interaction was important for all groups.

In the digital world both services and user behaviours are fast changing and so the current report attempts to survey the literature relevant to discovery behaviour two years on. The literature on discovery tools is voluminous: the online bibliography maintained by François Renaville (Renaville, 2015) catalogued 122 items in 2014 and had reached 60 items for 2015 by mid-August. The focus of this report is narrower than this resource, though, looking at what is known about user behaviour rather than details of the tools being used.

However, there is a shift in the concerns being addressed in the literature compared to the earlier report. While, of course, research continues to take place into the research and discovery behaviours of students and researchers, the era of large-scale studies of the impact of the internet on these behaviours seems to be past; while some of this work has carried over, Previously it was a question of assessing the impact of a novelty, now the attention is on tracking the evolution of behaviour against a backdrop of the internet being a well-established part of the scene, and in some cases trying to obtain more detailed close-up knowledge. In addition, library services as they have evolved in the internet era, in particular the development of new discovery services, are themselves part of the eco-system in which discovery behaviour takes place and affect that behaviour. How libraries conceive of their role in discovery, and the services they offer as a result, will have an impact on the behaviour of students and researchers as it defines the opportunities that are on offer and the advice and encouragement that is given. While the balance sheet on library web-scale discovery services is only beginning to be drawn up, we can trace in the literature concerns with the interaction between how the library seeks to respond to the new world of discovery and the behaviour of users,

and whether library interventions can change behaviour. Discussions of what the library should be doing, what are the barriers to its success, and how library services stack up against discovery services provided through other routes, can all be found and shed light on the current discovery behaviour scene.

We have therefore organised this report around five themes. After first looking at the latest updates focusing directly on user discovery behaviour in general, we turn to the debate over the library role in discovery in the contemporary world. This leads to a look at some of the internal barriers that have been identified to library services achieving their mission as fully as they would like, in the way these services are presented to users and in the ability of users to make good use of them. Some evaluations of library services against other discovery routes are then summarised. Finally, we look at new and emerging developments, both in new discovery services and evidence on the emerging online behaviours of those who will be the freshers of 2020-2025. Overall, we hope that this review provides a basis for taking on the debate over the library role in discovery and how library services and resources can be best positioned to be found and exploited by users.

As an aside, the role of resource discovery for teachers is no more well covered in the literature now than it was in 2013. There is some evidence that the emergence of MOOCs is providing a valuable resource for school teachers (Newton, 2015) but less that it is being used for resource discovery and pedagogical modelling in higher education. There is, though, a literature emerging on the role that librarians can play in the development and presentation of MOOCs, including learner information literacy skills as well as in handling the copyright and content access issues that MOOCs can raise (e.g. Gore, 2014. More references can be found at Dartmouth College, 2015). While there is much talk among some policy makers (more in the EU than the UK perhaps) and some educational technologists about the potential of open educational resources, and some well-resourced initiatives

especially but not exclusively aimed at schools, there is little hard evidence of their use in higher education (or indeed in schools). This remains a gap to be filled.

1. User discovery behaviour

The state of knowledge on user behaviour up to early 2014 (shortly after our earlier report) was summarised by Lynn Connaway of OCLC (Connaway, 2014).

She highlighted three headline findings:

» Users have many information options

» Library resources are not the first choice

» 'Convenience rules'.

Using many of the sources also surveyed in the earlier Spotlight report, including the Jisc-funded Visitors and Residents research in which she was a partner, she identified the importance of convenience as a factor and the goal-focused strategic approach taken by both students and researchers to discovery based around 'satisficing' – getting enough information to achieve the desired purpose and no more. Browsing and scanning resources, combined with squirreling away resources for possible future use, are typical behaviours, rather than detailed reading as resources are found. Both students and researchers tend to be confident in their information finding skills (we'll note further on some research that indicates this confidence may be misplaced) although understanding of copyright issues is low.

Connaway argued for the need to "develop *effective* library systems and services, to understand users' engagement with [the] digital environment" [her italics]. She suggested that students find libraries hard to navigate, inconvenient, and too associated with books (presumably physical books). She suggested that in response libraries need to improve their online presence, promote themselves better, provide more just-in-time support and become more user-centred in how they design their services and interfaces. The Visitors and Residents research Connaway cites, in

which Jisc and OCLC were two of the partners has published a fuller set of reports (Jisc, 2014). It distinguishes between two types of online behaviour: Visitor mode, in which people go online to carry out a particular focused task and then leave, and Resident mode, where people go online to connect with other people as part of having an online social presence. These distinctions refer to two types of behaviour which a single individual may exhibit at different times. In Resident mode discovery is not about search but about asking questions and finding resources from peers and trusted human sources. In developing their services libraries need to take account of and serve this Resident mode as well as the more goal-focused Visitor behaviour.

A more recent survey of users at seven UK academic libraries (Innovative Interfaces, 2015) supports the claim that older concept such as 'digital natives', which the Visitors and Residents typology aimed to overcome, is indeed outdated and that online activity has become pervasive across all categories of library users, with distinctions between educational stages perhaps becoming less marked than earlier research indicated. It also shows how expectations are quickly moving on, claiming that the norm now is to expect access to resources from anywhere and on any device. It suggests that library discovery tools now sit in an eco-system alongside other tools, from which users make strategic selections about which to use for specific purposes. One consequence of this is that library discovery tools are compared by users with others, especially Google Scholar, and not always favourably. The survey also reveals a great demand for easy access to user-friendly full text downloads of all resources on course reading lists. Again the report argues

for more just-in-time support from libraries and for a better response to the social aspect of resource discovery (the 'Resident' mode). Although this report is based on a relatively small sample of libraries, and focuses on library users not those who bypass the library (although it embraces users at all educational stages), it picks up themes which are reflected in other literature covered below, and in a field where evidence is often biased towards the US experience shows that the difference with UK users is not marked.

Some of the findings from users in this research (Innovative 2015, p.8) can be compared with data from a survey of some 80 UK academic library staff (Jisc, 2015) which included a question on which resources staff think users deployed for different purposes. While the match is not exact, some comparative results for different activities are illustrated in the table below.

	U=User survey S=Staff survey	Find known item	Carry out initial subject search	Get the feel for a topic	Pursue a line of enquiry	Find recommendations	Make chance discoveries
General library search (note 1)	U	70%	55%	31%	28%	17%	25%
	S	93%	89%	77%	79%	45%	82%
Union catalogues (note 2)	U	7%	9%	8%	6%	3%	4%
	S	49% (33%)	11% (5%)	6% (3%)	18% (14%)	12% (8%)	15% (10%)
Consult abstract databases	U	29%	28%	21%	18%	9%	11%
	S	47%	56%	41%	60%	15%	45%
Learning environment or reading lists (note3)	U	37%	23%	21%	15%	21%	6%
	S	47%	5%	8%	4%	34%	3%

Notes to table:

1. This was the wording in the user survey. In the staff survey the question was specifically about use of the Discovery Layer

2. The user survey referred to Copac, SALSER and Suncat as examples. The figures for the staff survey result from adding the responses for Copac, Suncat and WorldCat. Figures in brackets are the totals for Copac and Suncat only, excluding WorldCat

3. This was the wording in the user survey. In the staff survey the question was specifically about use of the Reading List system

The striking finding from this comparison is that in most cases staff over-estimate the extent to which users use different library services, in some cases very greatly. The exception is that users report greater use of the learning environment and reading lists than staff estimate for most activities, although this may be explained by the question for staff being asked more narrowly about reading list systems. It should be noted that staff do believe, correctly, that students also make very high use of Google Scholar and Wikipedia, but overall they think, it seems mistakenly, that the library discovery layer attracts very similar usage to Google Scholar in particular (and slightly more when it comes to finding known items).

These general studies of user discovery behaviour have been supplemented with narrower reports, in two dimensions. Some surveys look at discovery papers in specific disciplines; Ithaka S+R, 2012, 2013, 2014; DeGroote, 2014. Disciplinary differences can be marked, even allowing for the pace of change when surveys are conducted at different times. Chemists are reported as being generally satisfied with the discovery tools they need, though needing more help with keeping up to date and with serendipitous discovery. Health science researchers (albeit in a study covering just one, albeit very large, American university) are reported as being overwhelmed by library resources and relying heavily on just one database, and under-using the library's own website and link resolver. Historians are frustrated by the dispersal of information and see a need for more comprehensive and collaborative discovery tools, supported by expert library staff. Art historians are also frustrated by siloed collection records, with limited use of aggregators, especially in a discipline where small specialist collections can play a vital role in research, and need better search tools for images. Specialist art libraries, collections of ephemera, the continuing importance of print books with high quality images that can't be replicated digitally (or on the screens most researchers possess), and the need for specialised training of researchers in image management and specialised finding skills all point to a need in this discipline to swim against the tide of the mainstream. Without detailed examination of other disciplines, and indeed in some cases surveys with a broader base of respondents, it is impossible to know what are the special needs of each individual discipline and thus how the library can best serve them.

The other category of recent user studies to be mentioned is the first emergence of studies of scholarly use of social media tools, and in particular Twitter. One continuing ethnographic study (Stewart, 2015) is studying the Resident-mode scholarly behaviour of 14 postgraduate and faculty researchers across the world, in various disciplines, focusing on their formation and participation in research networks in Twitter throughout the scholarly cycle from discovery through to application and teaching. Findings indicate that these researchers mostly find that "the circulation of ideas and resources" in their Twitter networks "not only helped them build new knowledge and become aware of new literature in their fields, but also broadened their understanding of alternate viewpoints in their area of expertise". Being part of such a network and sharing resources through them is seen not merely as an instrumental activity to discover new resources, but as part of the creation of their scholarly identity in a community of interest. In respect of teaching, as this is a rare study where this activity of scholarly activity is explicitly mentioned, Twitter is used to share syllabi and resources, and for conversations about what teaching is and should be, as well as more explicitly in class as part of enrolling students into scholarly communities. The library role within such networks, if any, is not explicitly addressed. Another study (Gross, 2014) finds that Twitter use is growing, especially among early career academics, and that there is evidence that papers mentioned on Twitter are more downloaded and cited than others – in one reported case by a factor of eleven. While Twitter users are more predominant in the natural sciences those in the humanities and social sciences tend to be the more active users. It is probably fair to say that there is a lot more work to be done in understanding how academics make use of Twitter and other social media tools.

In summary, the recent work on user discovery behaviour shows that the differences between different educational stages that we could partially discern in 2013 have tended to fade into insignificance. Discovery as part of maintaining an online social presence has become more significant a part of the behaviour of many, and identified by many researchers as an issue for libraries to address along with such needs as that for just-in-time support and more unified and streamlined access. Library attempts to address such issues, for example through the deployment of discovery layers, have gained some traction but now all library services sit in a complex eco-system of discovery and research tools and services alongside those from other sources, and there is some evidence that library staff can tend to over-estimate the extent to which their tools are the ones users prefer.

2. The library role in discovery

When reports on user behaviour seek to draw out the implications of their findings for library services it is natural for the emphasis to be placed, as Lynn Connaway suggested, on making the services more effective – better known, easier to navigate, more comprehensive and less fragmented.

When reports on user behaviour seek to draw out the implications of their findings for library services it is natural for the emphasis to be placed, as Lynn Connaway suggested, on making the services more effective – better known, easier to navigate, more comprehensive and less fragmented.

This response addresses the shortcomings that users report and aims to improve how well library services are situated against comparative offerings. However, this line of response begs a more fundamental question which some of the recent literature discusses: is the response that libraries should make to issues arising from evidence on user discovery behaviour in the digital environment that it should do things better, or that it should do something different – perhaps radically different?

Roger Schonfeld (2014) sets out the issues with a view to encouraging libraries to at least question the assumption that libraries should set as their goal to be the starting point for users wanting to discover scholarly content. Discovery, he says, can be of three types: known-item search, exploratory search, and monitoring (maintaining current awareness, keeping up to date). Traditionally, libraries have been vital for the first two of these, although other sources such as peer networks for discovery through monitoring, and recommendations via reading lists to students, have always played an important role. Increasingly, though, discovery has moved to the network level, and, even though libraries have innovated in response, still "whether it is through Google's Search, Scholar, or Books services, Wikipedia, or a

variety of other tools, a higher share of academic discovery than ever before is routed around, rather than through, the library" (p. 5). Even many library directors now concede that libraries are not always the best starting point for discovery, and some initially argued that the library focus should shift to exposing their assets more effectively through network-level tools (e.g. Dempsey, 2012).

This view has influenced the investment in 'discovery layer' tools. While the impact of these has still to be fully seen, evidence (e.g. UKSG, 2013) is that while they may improve searches, especially exploratory searches, compared to what libraries offered before, they do not attract more users to use the library as the starting point for discovery. Moreover, while more evidence is needed, what evidence there is indicates that there is significant variation in user needs and behaviours between disciplines, between students and faculty, and even between institutions. Furthermore, while the 'single search box' approach of discovery layer services seeks to mimic the Google approach, what it misses is the highly developed and complex personalisation and range of services that underpin the apparent simplicity of Google.

The question Schonfeld poses, therefore, is what would follow if libraries were to accept that there can be no single starting point for scholarly discovery that meets the full range of user needs, preferences and practices. The discovery layer is no help with discovery through monitoring for current awareness and the library could possibly do more in this respect, given the fragmentation and incompleteness

of current awareness services, although there are already other players such as Google tackling the problem. Another possibility is a service to seamlessly search personal collections alongside institutional ones. Again, perhaps libraries should seek to think less in terms of institutionally-focused services and aim to connect discovery across platforms and the scholarly career life- cycle, which perhaps is where Google's biggest advantage lies. Or, most radically, perhaps libraries should cede discovery to Google and focus on other activities entirely.

Ultimately, Schonfeld argues for an evidence-based approach. If the metrics show that the investment in discovery layers and the like has increased library usage and provided a more well-used gateway to content, then the strategy of being the single starting point for discovery, or at least having a major share of the discovery market, can be vindicated. If, however, the figures do not demonstrate such an impact, then the right response may not be just to try harder. It might be that the strategic vision is wrong.

Schonfeld thus poses a challenge to the prevalent view that the automatic response to evidence on user discovery behaviour is that libraries should do the same sort of thing more effectively, and with greater awareness of the user preferences revealed in the discovery behaviour they exhibit. At some point, if greater effort does not yield the desired results, then rational consideration should be given to doing something different.

The most radical response – giving up on discovery – had already been suggested by one Canadian librarian (Askey, 2013). He argued that the discovery layer approach solved a problem that the library, not users, had defined, and didn't lead to greater use for a fundamental reason, that users find greater power and personalisation in Google services which a library-defined solution can never combat. Instead, Askey argues that alongside minimal search services his library should focus on digitising all their special collections and in better indexing of them to make them visible in Google and other network search tools, possibly using linked data.

Askey's approach is reinforced by the paradox highlighted by an established South African scholar Johannes Cronje who comments:

> *"As we gain more information about our users, so we design better solutions for them, and, as 45,500 Google results tell us, "Good design is invisible". Thus, even though we know the users it would seem that our aim is ultimately to ensure that the users don't know us. As librarians get better at solving problems for users even before they appear, so users' need to approach librarians is diminishing. I am such a user. I have lost completely the need to visit a library – either physically or virtually. I don't even have a username and password for my University library"*
> **Cronje, 2013**

And this is the approach he is passing on to the doctoral students he is training – showing them how they can conduct most, perhaps all, of their research using free tools and resources and never using, at least directly and visibly, the formal library services.

One library has actually taken the radical step of giving up on discovery. Utrecht University decided that as others can do a better job on discovery, the library should instead focus more of its resources on delivery (Kortekaas, 2014). They based this decision on evidence that while use of licensed resources – journals and databases - was increasing, use of library search tools to find these resources remained stable. Meanwhile searches through Google Scholar that led to the resources via a link resolver were increasing enormously. So Utrecht turned off its own e-journal discovery tool, although the OPAC has been retained for a period but without any investment in its further development as a search tool or extending it beyond the library catalogue, and with a view to turning it off in due course once the quality of their listings in WorldCat and the Dutch national catalogue have been improved. The focus on delivery has, they say, helped them to identify and put effort into resolving issues with

accessing resources, such as broken links, material that is not findable, and user discovery skills. In addition they have been able to invest in improved support to users on how to find resources using general search engines and specialist databases, and on supporting other aspects of the scholarly research cycle including data management and publishing.

Support for rethinking the library role in discovery, away from the ambition of being the starting point for most, comes from other sources as well. Barbara Fister (Fister, 2014), responding to Schonfeld's report, argues that libraries tend to overstate the extent to which discovery ever happened through library services, and training in research skills which focus on tools such as catalogues, indexes and abstracts misses out how scholars have long typically found the resources they need through "the citation network, recommendations from fellow scholars, their own libraries and files, and other non-library avenues such as the exhibits hall of their annual conference, where it was easier to discover new scholarly books in their field than any other place". She points to an article from as long ago as 1984 (Stoan, 1984) making this point:

> "In particular he chided librarians for overlooking the powerful way in which the literature indexes itself through citations. He also argued that for a beginner, getting a recommendation from an expert for a good place to start (a solid book with a good bibliography) was a better entry point than the library's less discriminate tools that provided stuff but no context or relevance ranking."

The library role, Fister says, is to aid discovery of known items, but it has only ever played a supplementary role in exploratory discovery and monitoring. Moreover, she argues, we need to realise the great difference between what discovery means for undergraduate students, where identifying and finding a small range of resources normally suffices, and for scholars for whom "Discovery is more personal, and its time frame is lengthy", meaning that "If our tools and instruction are based on the notion

that we should be like Google, or as close to it as we can be, we're using the wrong definition of "discovery.""

Fister concludes: "Discovery never was exclusively a library responsibility, and there's no reason why it should be today." Libraries should focus on opening up their collections and promoting open access, but in discovery their role should be on understanding better how discovery actually happens and promoting the information literacy skills which underpin it – which is less a matter of tools and services and more a matter of attitudes and practices:

> "As Sloan pointed out in 1984, discovery isn't really a technology, an algorithm, or a set of tools, and it certainly isn't something that the library does. It's a combination of developing personal curiosity and opportunities to join conversations being held by communities exploring the world in a variety of ways. Can librarians help with that? I would argue that's one of our most important jobs."

A related suggestion is made by Stephen Bell (Bell, 2014) who is concerned that in an online environment the serendipitous discoveries scholars traditionally made in the library stacks are being missed, as few students now roam the stacks even if print books are still being purchased. Looking outside education he notes that there is evidence for the value of chance encounters in the workplace, and that hence many organisations design their spaces to engineer serendipity. Libraries and academics, he argues, need to become smarter about how to do something similar especially in digital spaces. Recommendation algorithms and use of AI is one path, but how about, he suggests, if "instead of providing links to specific articles, … students were only supplied with librarian-constructed search strategies that lead them to relevant sets of literature requiring student-driven browsing, evaluation, and selection?" Again the point is that libraries need to develop a smarter approach to supporting discovery that looks beyond the traditional focus on tools and services.

3. Barriers to effectiveness

As well as encouraging libraries to think more widely and creatively about the nature of discovery and their role in it, some recent literature addresses how libraries could set about their task more effectively.

Roger Schonfeld addresses this in a recent report (Schonfeld, 2015) which argues that:

"Instead of the rich and seamless digital library for scholarship that they need, researchers today encounter archipelagos of content bridged by infrastructure that is insufficient and often outdated. These interconnections could afford opportunities to improve discovery and access. But in point of fact, the researcher's discovery-to-access workflow is much more difficult than it should be."

He makes a range of points about how library services can lag behind the experience users now expect of seamless access across services and effortless switching between devices:

» Because much discovery starts from outside the library, libraries need to ensure that access to licensed e-resources must work effectively no matter the route users have taken to their discovery

» Authentication needs to be as invisible off-campus as it is on-campus

» Proxies don't help and only contribute to lengthy and confused workflows

» Indexes are not updated quickly enough

» An increasing proportion of scholarly research is carried out on mobile devices. The biggest issue here is that PDFs and many websites don't work while on small screens. But in addition libraries have not even begun to take advantage of the other capabilities of mobile devices such as location services, cameras and voice-based tools

» User accounts are not well-implemented, and should be portable across institutions and platforms.

Overall, Schonfeld concludes, libraries and also providers and intermediaries are failing to meet the needs of users:

"On finding an article one would like to read that is available online and licensed by one's library, a researcher should never have to click seven, ten, or a dozen times, as is completely common today when working off-campus, to gain access to an article that, even so, cannot be read comfortably on a small screen. Let alone to click so many times only to find the article is not available through one's university library!"

The direction in which libraries need to move, Schonfeld argues, is towards developing an understanding of researcher practices that is holistic and based on ethnographic research. Libraries should take the lead with content providers in driving interface design and the user experience to better match actual research workflows, eliminate blockages and jargon, and move towards a single user-controlled and portable user account.

That libraries can do more to improve the user experience is supported by a meta-analysis of library usability studies undertaken by Emily Singley (Singley, 2014). She highlighted the top problems that crop up repeatedly:

» Jargon – even terms such as catalogue, database, serial, periodical and collections are not reliably understood

» Users not understanding the scope of search tools so using the wrong tool for the job, not understanding the role of the discovery layer, and not knowing the difference between what libraries hold and what needs to be requested

» Users getting lost when being transferred to external sites, and being confused or put off by the need for multiple authentications

» Users misunderstanding bibliographic formats and relationships such as article/journal, book/book review

» Users unable to navigate links to full text, and not knowing how to request ILLs

» Navigating with tabs – users often don't see tabs or don't click on them

Laura Wilkinson (2014) usefully outlines one strategy of how to reach the hard-to-reach users who she segments according to their issues and their tractability. However, one recent ethnographic study of student research behaviour (Dalal et al, 2015) highlights the low levels of information literacy skills displayed by many undergraduates even after library training in research skills, in particular:

» Lack of understanding of the purpose and relationships between tools and services, especially of the discovery layer, and often of the nature of scholarship itself

» Very basic search techniques and poor search strategies

» Failure to locate the full text of articles.

This continuing research has led the authors to develop new information literacy instruction that is slower, includes more repetition and takes more care to explain basic concepts. However, perhaps the most important finding is that the work is based upon using "videos of our students using our own library", as well as use of keylogging and voice recordings (Bloom and Deyrup, 2012), so that the problems and barriers can be identified very specifically. This may lead to better focused actions meeting the specific needs of the particular institution and its users rather than relying on general surveys of user behaviour.

4. Evaluating effectiveness

In the 2015 NMC Library Horizon Report (Johnson, 2015), improving digital literacy is identified as one of the headline, but solvable challenges.

Another challenge, but one regarded in the report as more difficult, is that of competition from alternative avenues of discovery. The report highlights the development of open access, semantic data and open data hubs as new developments that will transform the discovery landscape and which librarians must embrace. Librarians must evaluate the effectiveness of their own services and learn what alternative discovery tools do better.

In this vein, Aaron Tay (Tay, 2015) identifies five things that Google Scholar does better than a library discovery layer:

» It updates more quickly

» It covers scholarly materials not from the usual sources, e.g. free PDFs on author websites

» It has better coverage of open access

» It offers better relevancy of results

» It has a nice set of features such as citations and related articles.

On the other side of the balance sheet, though, Tay suggests that library discovery tools tend to be more versatile and so meet the convenience factor that looms large in many users' preferences. Convenience is also argued for as the best argument in favour of library discovery tools by Helen Edwards (Edwards, 2015). But these tools, she suggests, have their limitations: "many libraries are finding that, while useful, discovery tools have not reached the inflated expectations of early adopters and replaced all other methods of searching for information", and hence this leads back to the strategic discussion of the range of options on the future of library discovery services discussed above.

5. Emerging trends

Even while libraries assess their role in scholarly discovery in the changing service and user landscape, and the effectiveness of their own interventions which are helping to shape the territory, still the pace of change moves on relentlessly. We highlight here four themes which are emerging and will loom large over the next few years.

(i) New apps and services

Most of the discussion about library discovery tools versus other avenues for discovery focuses around Google Scholar and the like. However, the broader internet discovery scene is changing and we can expect new services and new demands to emerge. The use of specialised apps rather than websites is of course already well established and indeed used by some libraries. The potential of apps for promoting discovery across institutions, and for fostering serendipitous discovery – both ideas mentioned above – has been demonstrated by the recent development of an art discovery app based around the Boston area (MIT, 2015 and Andrew et al, 2015). This is more than a listings app as it also responds to user preferences and makes personalised recommendations.

More broadly, reference is sometimes made in the literature to changes in how users discover their music in order to foreshadow changes in expectations regarding their discovery habits and preferences in the academic domain. Here the growth of streaming services, perhaps capped now by the launch in 2015 of Apple Music, is worth referencing. The latter in particular now offers, for a monthly subscription, access to a massive range of recorded music in all genres, the ability to download music offline, curated playlists that respond to personal preferences, extensive recommender systems and a lot more. Why not, then, a single online library service that offers similarly access and personalised services for discovering the full range of the world's literature and scholarly output? With

developments such as the Digital Public Library of America, and talk about developing a Digital Public Space in the UK (see, for example, Strategic Content Alliance, 2014, Warwick Commission, 2015, and recent BBC thinking about the 'Ideas Service' BBC, 2015), we can expect such thinking to come more to the fore in the coming years.

(ii) Mobile technologies

Mobile technologies and the demand for anytime, anywhere and from any device access is not a new theme, but it continues to provide a challenge for library services. Prioritisation of mobile content and delivery was highlighted in both the 2014 and 2105 NMC Horizon Reports (Johnson, 2014 and Johnson, 2015) as a short-term challenge. Optimising catalogues and indexes for mobiles, as well as file formats for small screens, making websites mobile-friendly and exploiting the use of apps not only for discovery but also for other parts of the scholarly workflow such as annotating and sharing resources, all remain high on the agenda as work that by and large still needs to be done.

(iii) Piracy

Research in the UK on e-book piracy (Flood, 2015) shows that it is at a low level and lags far behind the level of theft in films and music. One reason suggested is that e-books are anyway easy to purchase and not expensive, but these reasons do not apply to the realm of expensive scholarly books and large pirate e-books sites aimed at academic users have been identified. While publishers lead the charge to close these down, the attitudes of academics towards

them can be more ambivalent, based on ideals of free access to knowledge and admiration for the grass-roots collaborative efforts such sites can sometimes represent (Tenen, 2014). The reason why they are worth mentioning in this context is that they can represent an alternative, but hidden, route to resource discovery as well as access – a way of finding books on a topic and downloading them for free or a for a small fee (depending on whether the method of piracy is illegal sharing of copyright materials or, in effect, collective purchasing of e-books). They can also indicate the possibility of user-curated communities of interest focused on discovering and sharing books in particular niches. It is perhaps a shame there is not more research on these book-sharing sites which focus on them not just as a threat but as a source for understanding user behaviour and motivation, not withstanding their illegality. Certainly the hugely popular music streaming sites such as Spotify and Apple Music mentioned above have been built on the basis of understanding why illegal download sites such as Napster became popular, looking beyond the attraction of being free, which turns out not to have been the whole story, to try to understand what these sites have to tell us about what users want from the services they use. Perhaps, for example, it is about the ability to personalise, self-curate and build personal collections as much as the economics that attracts users, but without the research being done we cannot know.

(iv) Future users

With new apps constantly appearing and fashions changing it is hard to keep track of where the users now are, what they are doing online and what they are using to do it with, let alone assess the implications for discovery and other services. Reports from the front can help to build a picture, though published research is rare and rapidly goes out of date. Watts (2015) provides one snapshot, from a student in Austin, Texas. He goes into extensive detail about the then-current state of app usage among his peers, claiming, for example, that Facebook use takes second place to Instagram, that Twitter is only used by some niche groups, Snapchat is popular, YikYak and GroupMe are well used, Tumblr, Pinterest, WhatsApp, Reddit and Quora are used by specific communities of interest, You Tube is heavily used but Google+ hardly at all and LinkedIn only as preparation for post-college life. There have been notable new developments even since the article was published, for example Periscope seems to have rapidly gathered a following for short live video sharing. Most interestingly, perhaps, is Watts mention of Tinder not so much for its very widespread use for romantic encounters but for its easy-to-use functionality which other apps are beginning to mimic in their interface design (on Tinder, swipe right for yes and swipe left for no for each potential match presented). It is already the case that undergraduate students now at university have never been aware of a world without the internet, but there is no reason to think that this is a watershed change that fixes for the foreseeable future the typical online habits of students. One commercial company in the USA has conducted focus groups to look at the online behaviours of young people aged between 7 and 12 – the university freshers of 2020 to 2025 (Vuong, 2014 and Lefelt et al, 2014). Caveats are necessary: these are small focus groups, they took place in the US, and some of the behaviour users show at these ages may change with greater cognitive maturity. Nevertheless the messages are instructive, including:

» Users from age 10 and even earlier are very comfortable with online shopping

» Google is used for finding known resources as well as for more exploratory search

» Search terms tend to be highly specific, using natural language queries, and other navigational tools are ignored

» Search is highly visual, universally preferring images to text. All users at all ages begin searches on Google but toggled immediately to the images tab to browse the results

» They are functional and task-orientated browsers, not bothered by aesthetics. Non-intuitive navigation is accepted and they prefer cluttered interfaces

» They like to customise, construct and personalise their own experiences

» Sharing takes place more in face to face exchanges, by word of mouth, rather than online

» Half of screen time is still on the TV

» They don't really distinguish between their online and offline experience

» The very youngest users have never used a mouse, only touch and gesture interfaces, and often don't understand the idea of a camera other than as part of a smartphone, or the concept of landline phones

» They learn very young how to leap over technological hurdles to reaching the content they want, making access barriers and gateways harder to maintain

» When it comes to music, streaming is winning out over pay-per-song (this was prior to the launch of Apple Music)

» Voice search is becoming more used (e.g. Siri on iPhones)

» They like to create and self-create using playlists, photo manipulation, remixing videos

Of course, what is as yet unknown is to what extent these preferences and approaches will modify as the users get older. Perhaps the visual preference in browsing and in interface design is no more than one would expect from young people, but the finding is so strong that it is certainly not to be assumed that it will leave no trace in later preferences as they become young adults. And the natural way that the digital is integrated seamlessly into everyday life, and the reporting of adroit problem-solving skills where institutional barriers are seen as part of the problem, may surely have a long-term impact. When designing future services libraries may be wise not to wait to know their users until they arrive on their doorstep.

Conclusion

It will hardly be news to most readers that the landscape for library discovery services continues to be challenging.

While the effectiveness of new library discovery services is still uncertain, however, more is known about some of the barriers which may hinder effectiveness both in their design and in user information literacy. At the same time a debate is maturing about what the role of the academic library in scholarly discovery can and should be, with a more nuanced understanding of different types of discovery and exploration of how libraries can best support them – without the automatic assumption that the best role is to be the starting point. Meanwhile the landscape of other discovery services continues to move on at a fast pace, as do the online habits and behaviours of new entrants to university bringing with them new challenges for inculcating scholarly routines. It may be that those universities who, while keeping abreast of the bigger picture, also make the effort to stay very close to their users and try to understand what they actually do in their discovery and overall scholarly workflows, in a very detailed way through ethnographic studies, are best placed to make the big decisions that will determine the future of library services.

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