
CROSSREF SEARCH

FEEDBACK FROM USERS AND PUBLISHERS

May 1, 2003



CONFIDENTIAL

Prepared by Carol A. Meyer
MAXWELL PUBLISHING CONSULTANTS
15 Maxwell Road
Winchester, MA 01890 USA
781 729 6271
Fax +1 781 729 2676
meyercarol@attbi.com

CROSSREF SEARCH
FEEDBACK FROM USERS AND PUBLISHERS

TABLE OF CONTENTS

| | |
|--|----|
| EXECUTIVE SUMMARY | 1 |
| INTRODUCTION | 3 |
| PUBLISHER SURVEYS | 5 |
| ISSUES SURVEY..... | 5 |
| FUNCTIONALITY SURVEY..... | 6 |
| END USER SURVEY | 8 |
| RESPONDENT PROFILE | 8 |
| SEARCH BEHAVIOR | 9 |
| SERVICE USEFULNESS..... | 10 |
| COMPETITION WITH EXISTING SERVICES | 11 |
| CRITICAL MASS | 12 |
| THE VALUE OF FULL-TEXT SEARCHING | 12 |
| RELEVANCE RANKING | 13 |
| FIELDDED SEARCHING | 14 |
| SUGGESTED FEATURES | 14 |
| CONCLUSION..... | 15 |

EXECUTIVE SUMMARY

INTRODUCTION

The CrossRef Search prototype was launched in September 2002, under authorization from the CrossRef Board of Directors. CrossRef members and affiliates were invited to respond to two surveys, one on business policy issues and the other on functionality and features. In January 2003, access to the prototype was expanded for end-user testing.

The results summarized in this report suggest that user demand exists for a robust full-text search service of this kind, and that users would most likely use this tool in conjunction with, rather than instead of, existing navigational tools. This report concentrates on the basic issues that the Board identified as being critical to evaluating the initiative. The actual user data, provided in full in the Appendix, covers issues not explicitly addressed in this report and will be subject to fuller analysis and interpretation in future.

PUBLISHER RESULTS

Publisher results indicated a favorable reaction to the functionality of the prototype. Publishers' opinions were spread out on the value of the service and whether CrossRef should pursue it. Some were enthusiastic, and others were concerned with the competitive impact on their own services. Some also wondered about whether launching CrossRef Search would interfere with other CrossRef priorities, such as member compliance with outbound reference linking and launching forward linking functionality.

END USER RESULTS

End-user reaction to the prototype was also positive. Two-thirds of the respondents indicated that they would always or often use the service if it were available.

A majority of respondents, 90%, thought that CrossRef Search would be an additional source for their research rather than as a replacement for existing tools.

The survey results underscored the importance of including the comprehensive literature and achieving a critical mass of publisher participation. A large group of users asked for more content, indicating that they thought functionality was very good, but that it would be of limited utility until it provided significant coverage in their own fields.

Seventy-eight percent (78%) of users said that if the CrossRef Search service were available, they would most likely use it because of the full-text search capability. Full-text searching was the most useful feature identified by the survey participants, with an average rating of 4.05 out of 5. Despite the importance of full-text searching, some respondents had reservations, in particular those researchers who self-identified as biomedical researchers (and thus were likely to be PubMed users).

The lowest-rated function was relevance ranking, although it still had a favorable response (average 3.32 out of a possible 5). Users expressed some skepticism about the impartiality of relevance ranking, and reported strange or irrelevant results due to the use of similar terms in different fields or disciplines. Respondents requested the addition of subject searching or subject refinement options as a way to compensate for this problem.

CONCLUSION

Both the Publisher and the End User Surveys provided suggestive evidence of the usefulness and demand for a good, comprehensive, cross-publisher, full-text search service to complement existing tools. The surveys also brought to the surface challenges to be overcome should such a project be undertaken and there is definite opposition from some publishers to CrossRef undertaking such a project.

The publishers who are most opposed to launching CrossRef search are those who believe it would compete with their existing businesses. The finding that 90% of respondents who would use CrossRef Search planned to use it in conjunction with, rather than in place of, their existing favorite services—such as library catalogs, secondary databases, and discipline-specific tools—provides a new perspective on those concerns. This result should be considered in the context of the prototype's limited coverage of the literature; that is, if the prototype had been more robust, it is possible that respondents would have been more likely to view it as a replacement for other available tools.

Publishers and users alike identified the issue of comprehensive content in order for the service to be of value. Publishers struggled with defining appropriate critical mass. Users were not asked to define it, but their complaints about coverage in their areas underscore this issue. This result indicates that widespread publisher participation will be a critical success factor if CrossRef Search goes forward.

The full-text feature of CrossRef Search was valued by both publishers and by users, and some pointed out that this characteristic is the key reason why the service would be beneficial. The responses that were more skeptical of full-text searching described precision problems, the difficulty in managing large results lists, and the anomalous outcomes possible when the same term is used in different ways across disciplines.

The user feedback on relevance underscored its importance and potential power and that the prototype did not make the relevance criteria obvious to users. Some distrusted relevance ranking, some wanted to be able to manipulate how relevance is ranked, and some wanted explicit relevance feedback in the form of percentages or visual clues.

Users suggested several approaches to solving the same problem: adding classification and providing a fielded search by subject; classifying journals by subject and being able to restrict or refine search to a group of related journals; or providing automated subject clustering (post processing the results). The results indicate that some kind of subject control would significantly improve users' search experiences, as was shown anecdotally in the Vivisimo version of the prototype.

INTRODUCTION

The CrossRef Search prototype was launched in September 2002, under authorization from the CrossRef Board of Directors, as a tool to explore the creation of a high quality, full-text, cross-publisher search index. The prototype anticipates a growing demand from scholars and librarians for broad, cross-disciplinary navigation of scholarly content that is limited to authoritative published literature, hence free from the results-quality problems of general web search.

When the prototype was initially launched, CrossRef members and affiliates were invited to respond to two surveys, one on business policy issues and the other on functionality and features. In February 2003, a follow-up email again requested responses to the surveys.

In January 2003, access to the prototype was expanded for end-user testing. Users in the research community received a 14-question survey (produced under the direction of the CrossRef Board) that was specifically designed to assess

- 1) how individuals would use this service in their current work environment,
- 2) how availability of this service would affect use of publishers' existing products, as well as other secondary services, and
- 3) how valuable users would find full-text search functionality.

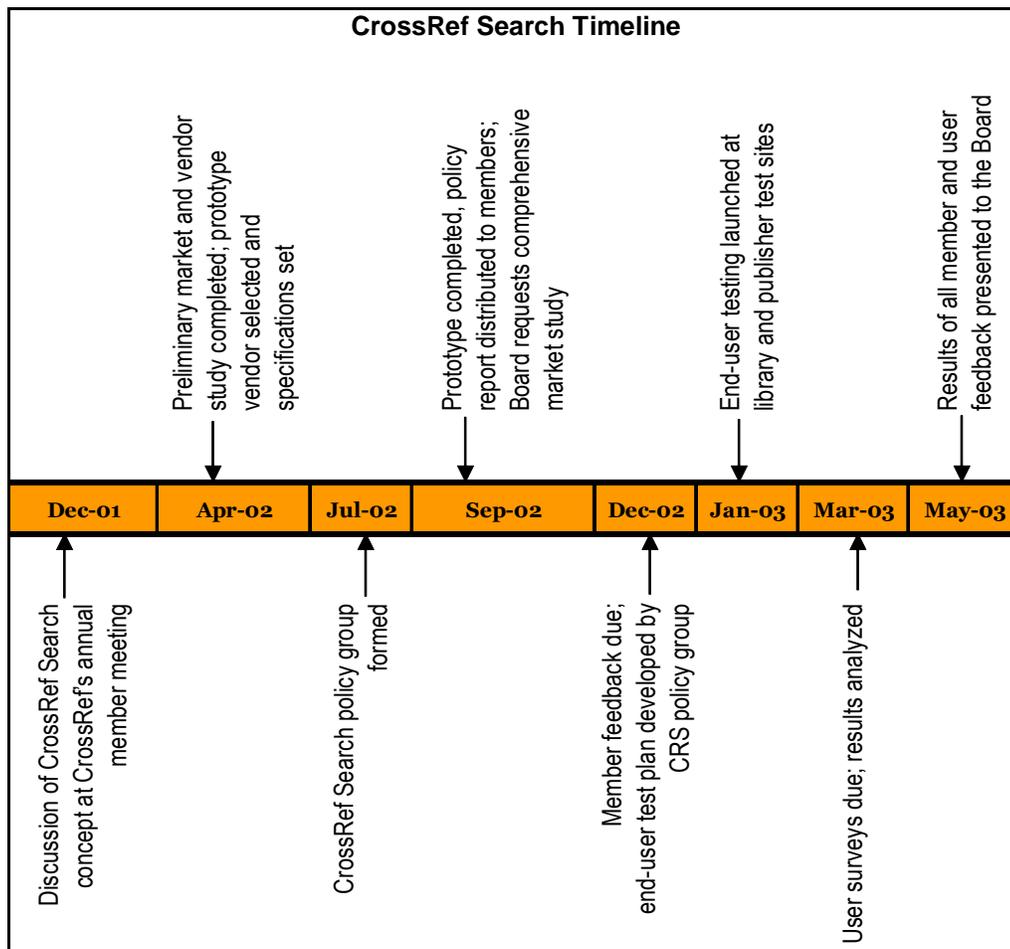
The End User Survey did not address any other business or competitive issues. Three publishers served as end-user test sites (ACM, Blackwell Publishing, and Nature), assisting in the distribution and collection of surveys. One hundred ten (110) responses were received. This report summarizes responses to the prototype from both publishers and end users.

BACKGROUND AND TIME-LINE

Since the CrossRef Search concept was first discussed among the CrossRef membership in December 2001, the reaction among publishers has been mixed, ranging from enthusiasm for the project to opposition to CrossRef undertaking this activity. There were concerns that the project would distract from CrossRef's core mission and concerns about the potential for competition with existing services, whether from outside the CrossRef community or with services offered by CrossRef members.

The results summarized below indicate that user demand exists for a robust full-text search service of this kind, and that users would most likely use this tool in conjunction with, rather than instead of, existing navigational tools.

This report concentrates on the basic issues that the Board identified as being critical to evaluating the initiative. The surveys also contain a wealth of data that could be used to make product development and business decisions should a decision be reached to go forward with the service. That data is not explored in depth in the present report. The actual user data, provided in full in the Appendix, will be subject to fuller analysis and interpretation in future. The publisher data is available upon request.



PROTOTYPE DESCRIPTION

Fast Search and Transfer was selected as a vendor to create the prototype. Six publishers agreed to participate in the prototype by providing data from their back files: Blackwell Publishing, Elsevier Science, Nature, Springer, University of Chicago Press, and Wiley. This data represented approximately 700,000 articles. CrossRef created a prototype front end for a generic site (a site where users could access all publishers' data) and Wiley created a front end that represents how CrossRef Search might be deployed on a publisher's site. The prototype functionality includes full-text search, metadata or fielded searching, relevance ranking, and links to publishers' web sites using the DOI. Inclusion of a particular feature is not an indication of whether it would appear if CrossRef Search were to be launched. Fast hosts the data centrally.

PUBLISHER SURVEYS

ISSUES SURVEY

All CrossRef members and affiliate members (approximately 150) received the Issues Survey after the release of the prototype in September 2002, and again in February 2003. A total of 15 surveys was received, a response rate of about 10%. The small number of responses makes it difficult to extrapolate to the entire membership, but the surveys do provide valuable qualitative feedback into the opinions of members on the proposed service. The survey did not attempt to quantify publisher's opinions, but asked them to provide open-ended responses. The questions were based on the issues identified in the *Report to Members* distributed in the fall of 2002.

SERVICE USEFULNESS AND PARTICIPATION

The Issues Survey addressed two fundamental questions. First, should CrossRef proceed with CrossRef Search? Second, would respondents' organizations participate if it did go forward? Slightly more respondents said the service is needed and CrossRef should proceed, than said it is not necessary and CrossRef should not proceed. When asked whether they themselves would participate, five said yes and three said no, and three said it depends on the cost. One participant clarified, "It is important that publishers can budget for participation. We are strongly against any fees based on results volume, unless these were capped in some way."

COMPETITION WITH EXISTING SERVICES

The major reason publishers gave for not wanting to participate was a concern that CrossRef Search would compete with their own services. Most of these respondents did not complete subsequent questions about how to make the service viable, but simply referred to their earlier assertion that CrossRef Search should not go forward. Publishers for whom competition with their own services was not a barrier did not express such concerns.

CROSSREF PRIORITIES

Of those who did not commit themselves one way or the other, the responses indicated that they thought it might be a good idea, but they have other priorities for CrossRef (for example, fully implementing referencing linking and forward linking). One respondent (who is not in favor of proceeding) called the prototype "a valiant effort".

CRITICAL MASS

Members and affiliates agreed that critical mass would be an important determinant in the success of CrossRef Search, but were not agreed on how to define it. Respondents suggested targets of 50% or 100% participation of CrossRef publishers or 75% of the major multi-subject publishers. Another used A&I databases as a benchmark and offered the data point that one well-known secondary database (in a single subject area) covers 7,500 journal titles. Several respondents pointed out that critical mass depends on the subject; for example, one publisher suggested critical mass would be "most of the major journals in a particular discipline."

SUBJECT CLASSIFICATION

More publishers thought that subject classification should be included than those who thought it should not. The open-ended answers talked about the difficulty of doing this in any level of detail.

One respondent articulated why subject searching should be included: “to provide the user the ability to search certain subject areas using a term (which could have a different meaning depending on the subject area).” Another countered: “No. This would require additional work for the publishers with no clear benefit.” Another thoughtful member mused: “Unless it can [be] automated with some sort of clustering, I think that uniform classification to any kind of thesaurus is unrealistic. Broad subject headings on the journal titles; e.g. BOTANY, CIVIL ENGINEERING, could be occasionally useful to resolve ambiguities among words which have different meanings in different disciplines.”

The survey asked publishers if CrossRef Search should have central site where users can search all participating publishers’ full text, or whether the service should be accessible only from members’ own sites. Again, the responses were fairly evenly spread with three publishers clearly in favor and two clearly against. Most respondents said affiliates should be able to incorporate the service into their own products and services.

TERMS AND FUNDING

In general, respondents did not express major objections to the Terms and Conditions as outlined, although members had a few suggestions and requests for clarifications. The business model didn’t fare as well; while a number of respondents had no problems with plan, a few mentioned that they thought it was unrealistic.

Most publishers thought that seeking external funding for the service would be a good idea. One respondent in favor put it this way: “It sounds reasonable. The benefits are more the scholarly community than the publishers.” Those who objected to outside funding did not think CrossRef should pursue the initiative at all.

FUNCTIONALITY SURVEY

At the same time that publishers were asked to respond to the business issues discussed above, they were asked to use the prototype to search and respond to a set of 16 questions about their search experience. The Functionality Survey differed from the previous survey in that respondents were asked to quantify their answers on a scale from 1 to 5, where 5 indicated the highest level of satisfaction.

Overall, the response to the prototype functionality from publishers was positive. Out of 13 publisher respondents, over 90% thought the simple and advanced search were easy to use and the results list was clear and well organized. Seventy-eight percent (78%) responded favorably to the full-text and fielded searching. The links to full text were appropriate according to 75% of respondents, although several reported that they encountered broken links. Sixty-seven percent (67%) thought the date sort was helpful (several mentioned this functionality should be assumed as a basic part of any search). Fewer, 56%, thought the relevance ranking and the refine by journal features were useful.

| Feature | Average 1 (lowest) to 5 (highest) |
|--|--|
| The simple search was intuitive | 4.40 |
| The results list was clear and well-organized | 4.40 |
| I was able to use the prototype to locate articles I already knew about | 4.40 |
| The results list contained the information I needed to choose which items to link to. | 4.20 |
| The links to the full text from the results list worked as I expected | 4.13 |
| The full-text searching helped me locate relevant information | 4.11 |
| The prototype was easy to search | 4.10 |
| The advanced search was easy to use | 4.10 |
| The fielded searching helped me locate relevant information. | 4.00 |
| The ability to sort the results list by date was useful | 4.00 |
| I was able to use the prototype to discover relevant articles I did not already know about | 4.00 |
| The ability to sort the results list by relevance was useful | 3.89 |
| The ability to limit the results list by journal title was useful | 3.22 |

Table 1. Publisher Rankings of Prototype Functions

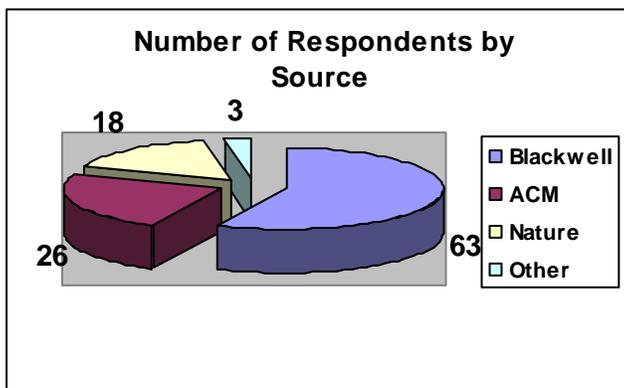
Additional features that publishers suggested included subject searching, language searching, searching by publisher (which was, in fact, available), content from additional publishers, relevance statistics, and the ability to use Boolean queries on simple searches. In responding to the question of what features should be eliminated, one respondent questioned the value of search by publisher, and two wondered about the utility of the journal refinement feature.

END USER SURVEY

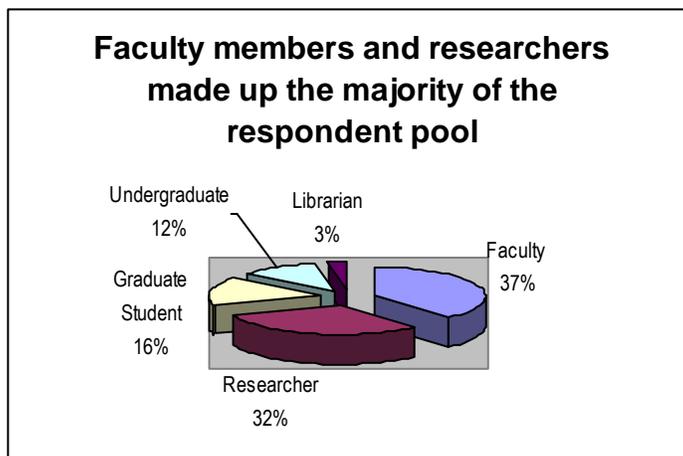
Three publishers, ACM, Blackwell Publishing, and Nature, agreed to recruit end users to try the prototype and answer 14 questions about the experience. The End User Survey concentrated on the user experience, searching behavior, and reaction to the functionality present in the prototype. The survey did not attempt to explore business issues such as the cost, who would pay, or how the service would be accessed by end users.

RESPONDENT PROFILE

One hundred ten (110) users responded to the End User survey. The three publishers above solicited participants, distributed the surveys, and collected results. A few additional responses came from users identified by a member of CrossRef's Library Advisory Board.



The majority of the respondents identified themselves as faculty members (37%) or researchers (32%).



The respondents were fairly evenly spread across academic disciplines, including social sciences, law, humanities, business, and science (Blackwell), biological sciences (Nature), and computer sciences (ACM).

| Field | % |
|----------------------------------|---------------|
| Social Science | 24.3% |
| Science & Medicine | 22.4% |
| Computer Science and Engineering | 18.7% |
| Humanities | 13.1% |
| Business | 5.6% |
| Law | 4.7% |
| Other | 3.7% |
| Unspecified | 7.5% |
| Total | 100.0% |

Table 2. Fields Represented by End-User Respondents

Although the survey did not specifically ask where the respondents lived and worked, their email addresses and fax numbers indicated that at least half were from outside the United States.

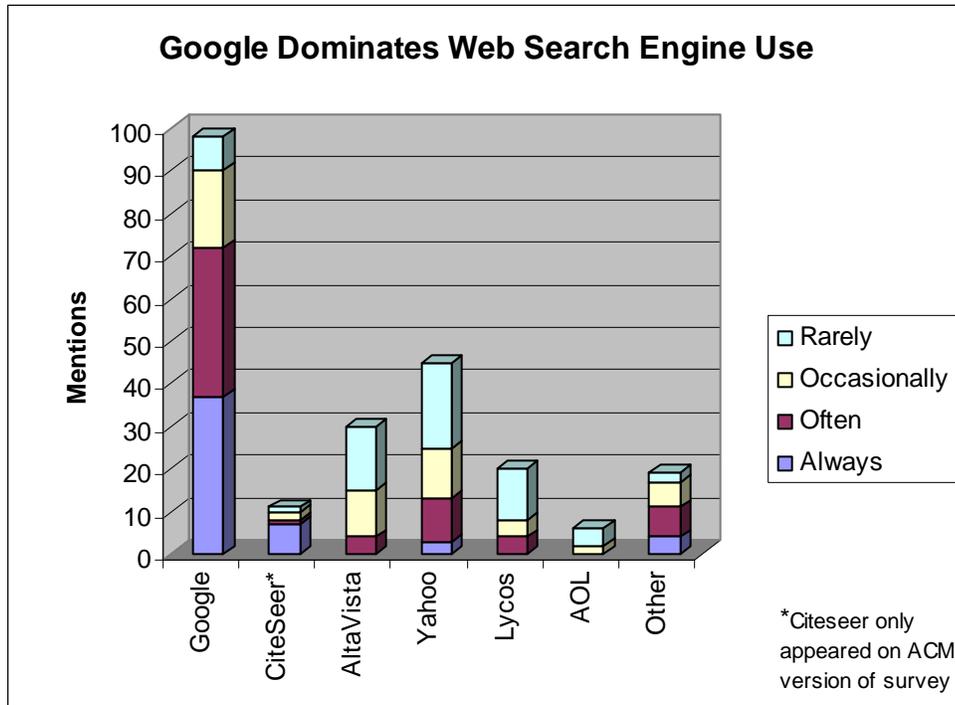
SEARCH BEHAVIOR

End users demonstrated their search behavior in two ways: by answering questions about it and by sharing three of their prototype searches.

Eighty-four percent (84%) of users reported that they always or often used simple search on their preferred search tool(s), while half that many, or 42%, reported they always or often used advanced search. Seventeen percent (17%) used the simple search occasionally or rarely, where 56% used the advanced search only occasionally or rarely. Three percent (3%) said they never used advanced search.

While a detailed study of the search terms reported by respondents is not included here, most users used simple one or two-word searches to test the prototype. Respondents also searched for author names (frequently their own names).

The survey questioned users on how frequently they used a variety of search tools, including web search engines, where Google (not surprisingly) dominated. Eighty-nine (89%) of respondents reported that they use Google, and two-thirds of them use it always or often.



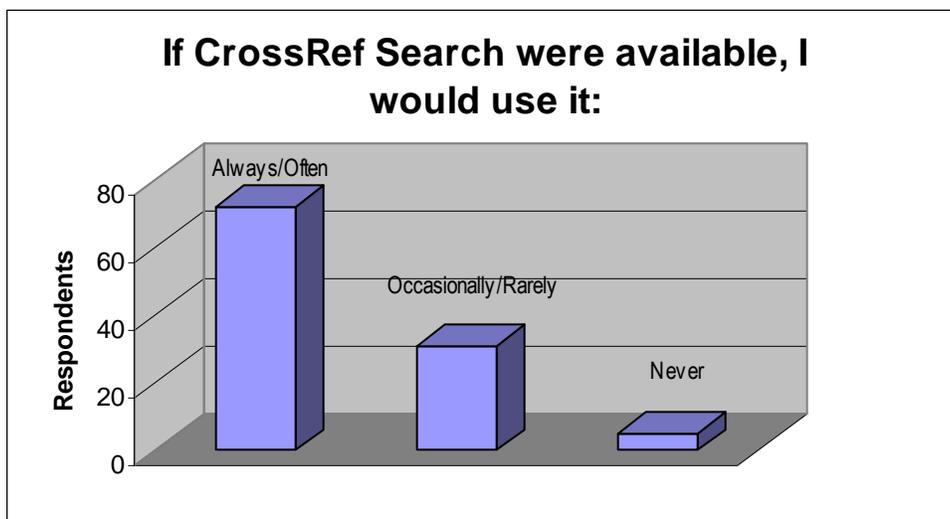
The most frequently used search tools (other than web search engines) were online library catalogs, A&I services, and discipline specific databases.

| When I go online to search scholarly or scientific publications, I usually search | Average (0 to 4 where 0 is never and 4 is always) |
|---|--|
| Online library Catalogue and Database | 2.43 |
| Abstracting and Indexing service e.g. ISI, PubMed | 2.13 |
| Discipline specific online collection/database/archive | 1.96 |
| Publishers search sites, e.g. Wiley, Elsevier | 1.50 |
| Author Websites | 1.29 |
| Online conference proceedings websites | 0.96 |
| Other | 0.74 |
| Pre-print services | 0.57 |

Table 3. Search Tool Use

SERVICE USEFULNESS

The respondents viewed the CrossRef Search prototype favorably. Sixty-six percent (66%) said they would use the service in online journal research always or often if it were available. As one user put it: “You have a brilliant idea.”



Respondents thought the service would be most useful for advanced researchers (50%) and graduate students (48%). Only 8% of the respondents thought the service would be most useful for undergraduate students. (Totals add to more than 100% because some respondents chose more than one answer.)

Users were asked how they would use CrossRef Search if it were available. Sixty-two percent (62%) said they would use it to search for papers by specific authors, and 60% as a way to begin their research. The fewest responses cited the ability to find known publications, although the percentage that said they would use it for that purpose was still substantial (43%).

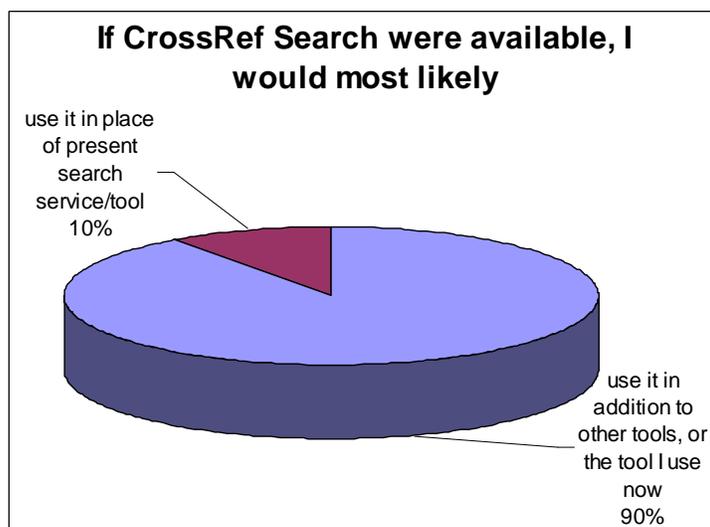
| If CrossRef Search were available, I would most often use it in my research | % |
|--|--------------|
| to search for papers by a specific author or authors | 61.8% |
| as a way to begin research on a particular topic | 60.9% |
| to find cited references | 53.6% |
| to find minor papers related to my topic | 53.6% |
| to search in fields I am less familiar with | 51.8% |
| to find known publications | 42.7% |

Table 4. How Respondents Would Use CrossRef Search

COMPETITION WITH EXISTING SERVICES

A majority of respondents, 90%, thought that CrossRef Search would be an additional source for their research, not a replacement for existing tools.

For the few who did think it could replace a search tool, each respondent specified a different product; it is interesting that only one of these nine respondents mentioned a discipline-specific tool. (These one-off responses were: “EBSCO”, “Google”, “Greenstone Digital Library”, “Ingenta”, “LawTel”, “publisher web sites”, “PubMed”, “those available at present at Aalborg University Library”, and “Web of Science”.)



CRITICAL MASS

The survey asked users to suggest additional features that should be included in CrossRef Search. The largest group of users, either in response to this question or to other questions throughout the survey, asked for more comprehensive coverage, indicating that they thought functionality was very good, but that it was of limited utility until it provided significant coverage in their own fields. Some said “more journals,” others “more publishers,” and one requested conference proceedings. Users wanted better coverage in social sciences, law, medicine, anthropology, psychology, database, computer science, and many other disciplines.

The survey instructions included this caveat: “Because the service is not yet comprehensive in its coverage of the literature, the prototype cannot be tested for content depth or completeness at this time,” but users were unable to separate the functionality from the end results of their searches. They wanted to see comprehensive, topical results relevant to their interests.

A typical comment on this subject was “coverage in my subject area is as yet too limited for me to manage a proper assessment.”

THE VALUE OF FULL-TEXT SEARCHING

Seventy-eight percent (78%) of users said that if the CrossRef Search service were available, they would most likely use it because of the full-text search capability. By contrast, 54% said they would use it for the cross-publisher search capability, 54% said they would use it for interdisciplinary search, and 45% because of the inclusion of published, largely peer-reviewed content.

Full-text searching was the most useful feature identified by the survey participants with an average rating of 4.06 out of 5. One user expressed the value this way: “The cross-journal full-text search is the best feature.” Another stated: “Clearly advantageous. Ability to turn on/off a big plus.” And finally, “Full-text searching gave me a sense of trust for the system.”

Other comments in response to the question of full text reflected the importance for users of not only identifying the relevant results through full-text search but of actually having immediate access to an appropriate copy of the full text of the article itself. For example, one user complained:

“The website did not recognize our library’s subscription to the journals/publishers.” Another researcher commented, “CrossRef’s choice of source of the full-text article must match the institution’s subscriptions, e.g. we may not subscribe to a journal directly, but another database may provide it such as EBSCO Host.” A third said simply, “Unable to access some full-text papers.”

Despite the popularity of full-text searching, a minority of respondents had reservations. One user observed that his full-text searches “gave very unexpected results.” Interestingly, most of the users in this category were Nature users, who assigned less value to full-text searching, an average of 3.65 compared to 4.06 in the total group. One of these respondents commented: “useful, but it can give so many results that it would beat the purpose of using a search engine to narrow results.” This discrepancy is probably explained by their familiarity and comfort with existing non-full text search, such as the highly robust discovery tools in PubMed. As one user explained, “I might not use it [CrossRef Search] anyway; I have specific needs and can generally find what I want easily on PubMed...”

| Please rate the usefulness of the prototype features listed below | Average 1 (lowest) to 5 (highest) |
|--|--|
| full-text searching | 4.06 |
| simple search interface | 3.98 |
| advanced search interface | 3.77 |
| field-limited searching | 3.75 |
| refine search options | 3.75 |
| narrow-by-journal feature | 3.71 |
| results list | 3.68 |
| Other | 3.44 |
| relevancy ranking | 3.31 |

Table 5. Usefulness of Prototype Features

RELEVANCE RANKING

The lowest-rated function was relevance ranking, although that still had a favorable response (Average 3.32 out of a possible 5). Users expressed some skepticism about the impartiality of relevance ranking, and reported strange or irrelevant results due to the use of similar terms in different fields or disciplines. Respondents requested the addition of subject searching or subject refinement options as a way to compensate for this problem.

Some users wanted a relevance calculation displayed, and one suggested that hits in the title and abstract should be more highly weighted than those in the full text. These comments indicate that users either did not notice, or did not value this relevance information presented in the prototype at the top of the search results screen:

RESULTS RANKED ACCORDING TO NUMBER OF QUERY TERM MATCHES AND THE FIELD(S) IN WHICH THE TERMS MATCHED. CORE FIELDS ARE RANKED AS FOLLOWS: TITLE > AUTHORS > KEYWORDS > JOURNAL NAME > ABSTRACT > AFFILIATION > FULL-TEXT.

RESULTS LIST

The results list was well rated (3.68), but toward the bottom of the list of features in rank order. Judging from the comments, end users answered the question about how useful the results list was

based not only on the elements contained in the results list, but also based on the order or relevance of the items received. For example, one user commented, “The lists generated for my search terms were very close matches to what I was looking for,” while another observed the list contained “a lot of irrelevant material.”

FIELDDED SEARCHING

Despite the popularity of full-text searching, fielded searching was also reported to be useful, with an average response of 3.75 out of 5. Some users pointed out problems with getting fielded searching in the prototype to work properly, especially the author name search, which was the most popular type of search reported in the trials.

Others had not noticed the fielded searching function. One even asked “where was that?” (It was on the advanced search screen under “refinement options,” which in itself may have caused some confusion as the term “refinement” is often used to indicate re-sorting or searching within an existing results list). Several users complained about the lack of ability to search on journal name or publication name, although that function was available in the prototype as a “publication” fielded search. These responses indicate an opportunity for improving the user interface or help systems should the service go forward.

SUGGESTED FEATURES

Additional features suggested by the survey participants were numerous and varied. The list below presents the most requested suggestions in order of their popularity:

- adding more content in participants’ particular disciplines (as discussed in [Critical Mass](#) above);
- improving relevance of results and ability to manipulate relevance ranking (also discussed in [Relevance Ranking](#) above);
- adding a “next results” link at the bottom of the results list;
- adding the ability to search on subjects or refine results based on subject areas or disciplines;
- providing an alert service or a way to notify users that new articles are available;
- improving the journal refinement list and allowing users to refine based on a predefined “basket” of journals
- adding an interface to citation manager software such as BibTex and EndNote.

CONCLUSION

DEMAND AND USEFULNESS

Both the Publisher and the End User Surveys provided suggestive evidence of the usefulness and demand for a good, comprehensive, cross-publisher, full-text search service to complement existing tools. The surveys also brought to the surface challenges to be overcome should such a project be undertaken.

Publisher and end-user responses both showed a high regard for the features demonstrated in the prototype. Every feature queried received an average response above the midline from end users (the lowest rated feature, relevance ranking, got an average score of 3.31 out of 5) and all but two received an average of 4 or 5, the two highest scores). The rankings from publishers were even higher, with 11 out of 13 features averaging well above 4.

The users were particularly enthusiastic about the prototype functionality, while publisher responses were less uniform. Some publishers opposed the idea because they thought the service would compete directly with their existing businesses, and some favored it because they believed their users were calling for such functionality.

The comments were as useful as the statistics in determining how valuable the service could potentially be. While the respondents were generally sophisticated in terms of their academic research experience (69% were faculty members or researchers), they exhibited fairly typical search behavior in that they prefer simple to advanced search interfaces, and most tested the prototype with basic two-word searches. This behavior underscores the importance of making the interface as simple as possible, and letting technology guide the user to the most relevant results without creating the need for sophisticated search learning behaviors. Even among this experienced group of researchers, the high penetration of Google indicates that simple search can sometimes be the most expedient.

COMPETITION

As we have seen, the publishers who are most opposed to launching CrossRef search are those who believe it would compete with their existing businesses. The finding that 90% of users who would use CrossRef Search planned to use it in conjunction with, and not in place of, their existing search services provides a new perspective on those concerns. This result should also be considered in the context of the prototype's limited coverage of the literature; that is, if the prototype had been more robust, it is possible that respondents would have been more likely to view it as a replacement for other available tools.

Only 10% of users thought they might use CrossRef search to replace an existing tool, but the tool that they would replace was different for each of these users. This tentatively suggests that no one service or type of service would lose significant market share to CrossRef Search. A possible conclusion is that CrossRef Search is unlikely to be a threat to existing search and discovery resources. One might argue that if this product would not take market share from existing services, then there is no point in launching it; but the favorable feedback and the high number of users who would find such a service valuable suggests that CrossRef Search could grow the market in research discovery tools.

CRITICAL MASS

Publishers and users alike identified the issue of comprehensive content in order for the service to be of value. Publishers struggled with defining appropriate critical mass. Users were not asked to define it, but their pleas for more coverage in their areas of interest make it clear that they know it when they don't see it. This result indicates that widespread publisher participation would be a critical success factor if CrossRef Search goes forward.

The survey results do not point to a formula that will define critical mass. Several publishers and users suggested trying to add content on a subject-by-subject basis. Doing so would create additional content acquisitions work and would increase the competitive risk for products in the targeted disciplines. This type of approach is much more appropriate for discipline specific tools where the value added is selection and coverage. A simple "more is better" approach may result in uneven coverage, especially during a ramp-up period, but it may be sufficient for an auxiliary tool. The result also shows that even though 700,000 articles (the number available in the prototype) sounds weighty, it hides the details of coverage in individual fields that make an impact on the individual researcher.

FULL-TEXT SEARCH

The full-text feature of CrossRef Search was valued by both publishers and by users, and some pointed out that this characteristic is the key reason why the service would be beneficial. The responses that were more skeptical of full-text searching described precision problems, the difficulty in managing large results lists, and the anomalous outcomes possible when the same term has is used in different ways across disciplines.

These criticisms of full-text searching are all well documented in the information science literature, and yet they have not interfered with Google's dominance in search of non-proprietary content. Full-text search providers must rise to the challenge to continually refine their service in order to decrease the annoyance factor and increase service utility. Improved relevance ranking can bring the best results to the top so that users will not be overwhelmed by large results sets; automated subject clustering can help control the multiple meanings problems; and new tools for approximate-style search will gradually move the search experience toward inexact, recognition-based query refinement.

Structured searching tools are valuable and well used by certain communities, as demonstrated by the comments from those users in the bio-medical area who were happy with PubMed-style functionality. Full-text search is a different approach, and if the responses to this survey are indicative, a niche for it exists, especially as used in conjunction with other tools.

APPROPRIATE COPY AND ACCESS

Another possible conclusion from the full-text feedback of the End User Survey is that article access through CrossRef Search would have to integrate readily with institutions' OpenURL-based local link servers, so that users can access appropriate copies and services in a convenient way. Such access improvements could become increasingly important as traffic to the articles multiplies through tools such as CrossRef Search. Users seldom understand their institutions' electronic subscriptions, but they still expect immediate access.

One user's response to the question of who would be the best audience for CrossRef Search was particularly telling. He chose researchers, "primarily because of the prohibitively high cost of single article purchases \$19—you're having a laugh!! No postgrad or dissertation student will be willing (never mind able) to fork out that much." This user clearly did not understand the distinction

between the full-text *search* service and the full-text *provider*, but this response underscores the need to facilitate access to full-text articles in tandem with facilitating full-text search.

RELEVANCE

Relevance and full text are intertwined. Full-text searching is by nature less precise than fielded searching in structured databases. In a traditional bibliographic database, an experienced user does not get extraneous results. In a full-text search, many results will be irrelevant, but if they are sorted to the bottom of a 2000-entry list, it will not matter because the user will never see them.

The user feedback on relevance underscored its importance and potential power and that the prototype did not make it obvious enough to users what the relevance criteria were. Some distrusted relevance ranking; some wanted to be able to manipulate how relevance is ranked, and some wanted explicit relevance feedback in the form of percentages or visual clues.

SUBJECT CLASSIFICATION AND CLUSTERING

Users' desires for subject control were also closely related to the issue of relevance. Users suggested several approaches to solving the same problem: adding classification and providing a fielded search by subject; classifying journals by subject and being able to restrict or refine search to a group of related journals; or providing automated subject clustering (post processing the results). The prototype had none of these functions for reasons of time, cost, the recognition that this issue was important, and a desire not to provide a sloppy solution. Since the prototype was released, clustering vendor Vivisimo and prototype developer Fast have demonstrated subject clustering of CrossRef Search results. The results from the user test show that some kind of subject control would significantly improve users' search experience.