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# Report of the Link Resolver Investigation Team

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# Report of the Link Resolver Investigation Team

29 January 2016

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# Executive Summary

This report was commissioned to explore whether the University Library should improve and update its ProQuest-provided link resolver interface, 360 Link Legacy. To develop a recommendation and propose an implementation plan, an investigation team:

- evaluated the existing interface
- researched how users encounter and interact with the existing interface
- identified essential and desired requirements for interface improvements
- reviewed three link resolver tools
  - 360 Link Legacy (current solution)
  - 360 Link 2.0 (updated version of current solution)
  - Umlaut (open-source software)

After considering the above research, as well as the feedback of many library stakeholders, the investigation team recommends that **the library should update its link resolver interface, using the Umlaut open-source software.**

Justifications for this recommendation include:

- the current solution is out of date, and vendor support may be rescinded
- the current solution does not meet accessibility requirements
- the current solution does not provide detailed analytic data on user behavior
- the current solution appears to most users as an error page
- the current solution causes users cognitive strain and information overload
- of considered alternatives, Umlaut is the most customizable and accessible
- of considered alternatives, Umlaut met the most functional requirements
- of considered alternatives, Umlaut was preferred by library stakeholders (e.g., PARC)

In addition to research and recommendations, this report also includes a risk/benefit analysis of the reviewed tools, a proposed Umlaut implementation plan, and supplementary diagrams of user flows and screenshots of link resolver interfaces.

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# Introduction

In September 2015, the Technology Alignment and Stewardship Committee (TASC) charged a Link Resolver Investigation Team to consider whether the Library should improve and update the Link Resolver interface. The Link Resolver menu appears when users click on an MGet It link in a citation database or full text source. The charge was the result of a Trello Front Door request placed by Ken Varnum.

The Library has been using the same ProQuest-provided link resolver interface since the rollout of ArticlesPlus and 360 Link in 2009. In 2014, ProQuest began offering “360 Link 2.0,” an updated form of the menu. At the time, LIT’s Library Web Systems and User Experience departments brought the new interface to the Public Access Resources Committee (PARC), who evaluated the updated form and decided not to implement it because of accessibility issues and inconsistencies in the way full text was displayed. At the same time, the problems in the current “Legacy” interface were acknowledged to be worth resolving. Further investigation into options resulted in the submission of an LIT Front Door Request for Fall 2015 to update the link resolver interface. This investigation team was created to review the current interface, survey the landscape of alternative solutions, and recommend a course of action.

The Front Door request noted a number of issues with the current 360 Link menu interface:

- The old version of the menu that we use is now out of date and support for it may be rescinded by ProQuest at any time in favor of the updated version.
- Neither the current nor the updated menus meet the University Library’s accessibility standards.
- The current menu does not provide detailed analytic data on user behavior and thus does not support the Library’s new emphasis on learning analytics and behavior-based improvement of the user experience.
- Open-source middleware (“Umlaut”) is now available and being used by a number of libraries to customize views of data from the 360 Link resolver API.

Given those conditions, now is a good time to review the functional requirements of the menu and decide on what among the available options best meets the Library’s needs. In this report, we will:

- document the results of user studies and accessibility reviews the Team initiated;
- describe how the Investigation Team developed a set of functional requirements for the menu based on our own experience as well as user interviews;

- provide a complete review of the tools we evaluated for replacing the current menu;
- review costs and benefits of each of three courses of action; and
- recommend a preferred tool and outline an implementation plan.

## User-Driven Needs & Research

The Investigation Team started with a review of how users come to the the current link resolver menu in general (“user flows”), and continued with a user study to understand the specifics of interactions (“user research”). These studies are detailed here.

### User Flows

Our team wanted to better understand how users encounter the link resolver page on their path to accessing full-text items. Our team identified how users arrive at the link resolver page and charted the destinations where it would lead them in searching for full-text resources.

The user flows we explored stemmed from search scenarios beginning with the Library Home Page, ArticlesPlus, MGet It Citation Search, Ask a Librarian, and Google Scholar. These four flows are listed in order of increasing complexity; the most straightforward path to full text is first. Illustrations of the four flows can be found in Appendix C.

- **Library Home Page/Citation Linker Page** - Users on the library home page select the MGet It Citation Linker, enter item information and are led to the full text, 360 Link or a proxy server error page.
- **ArticlesPlus** - User searches with the ArticlesPlus box in the library header, from the search results the user selects the available MGet It Link (either link to full text or Citation Only-no full text available). The MGet It link then brings up one of the following: 360 Link Page, 1-Click Full Text, IEDL Full Text, Error Message In Database, or a Wrong Link Page.
- **Ask a Librarian** - User initiates conversation with librarian via chat, phone or in person. The librarian searches via MGet It Citation Linker page, ArticlesPlus Search, Mirlyn Search or Google Scholar and sends one of the following to the patron: PDF, Stable-URL to e-version, ArticlesPlus Record-Item Record, Mirlyn Record, 360 Link
- **Google Scholar** - This flow had the most variation in how students arrived at the link resolver page due to location of the student on/off campus and whether they

were logged in. Once the student was authenticated the flow closely modeled the Citation Linker Page but with less accurate results.

This exercise revealed the complexity users experience when navigating to full-text articles through the proxy server and authenticating access to vendor supplied resources. Encountering the current link resolver page is relatively uncommon because the page is bypassed when full-text is available directly from one of the library's licensed content providers. When the link resolver page does appear after a user clicks the MGet It button, it is frequently perceived--as user research confirms--as a system error to retreat from rather than as a tool leading forward to full-text.

Key strategies in implementing a solution would include providing a consistent set of interactions/data that reveal full text availability to users as early as possible in the search process (even in search results). We highly recommend customization of content and layout related to the link resolver page and related interactions along ever changing user workflows and vendor resources.

### User Driven Features

Consolidating the feedback derived from user research, the team derived five broad features and functions that the replacement tool should include. These are reflected in the reviews of the three products and in the charge for the future implementation team.

- A universal call for a distinct link/button leading user to full-text (highest importance) on the link resolver page.
- Improved clarity of content and associated actions on the page. We noticed that the more scannable and action-oriented the text on the link resolver menu, the more likely the user was to find and click on the best full-text link.
- Findability. All students tested showed signs of cognitive strain and information overload. Future iterations of this page should use the principle "less is more."
- Link resolver pages that only provide links to volume or journal levels should use action oriented and clear language in links to direct user to the full text within the vendor database.
- When full text is not directly available, that fact should be prominently displayed in the interface along with options for obtaining it from other sources (via document delivery, Ask a Librarian, print copies in Mirlyn, etc.).

# Functional Requirements

The team identified the important features and functions of the desired link resolver, and prioritized each as being of high, medium or low importance. We developed the initial list keeping only in mind what we considered essential and desirable features, without regard for whether or not each feature is currently available using a particular tool.

## Features/functions of high importance

<b>Link to full text</b>	<i>Ability to link directly to the full text of the article, book chapter, etc.</i>
<b>Clear language for various options</b>	<i>Interface allows for customization of labels for various content fields. Journal title field might be identified as “journal name” or preceded by “published in journal” xxxx, for example.</i>
<b>Usable interface</b>	<i>Interface is easy to use and meets minimum usability standards, as assessed by UX specialists</i>
<b>Accessible interface</b>	<i>Interface meets minimum accessibility standards, as assessed by UX and accessibility specialists</i>
<b>Catalog record information available on screen</b>	<i>Ability to display catalog holdings within the link resolver interface, when appropriate</i>
<b>Header and footer consistent with the rest of the library website</b>	<i>Interface allows for easily including web “wrapper” - i.e., allows for branding consistent with other library web pages</i>
<b>Article citation information included</b>	<i>Bibliographic fields such as author, article title, volume number, date, etc., are displayed (and easily identified) in the link resolver interface</i>
<b>Document delivery options available</b>	<i>Link resolver includes links to delivery services, such as ILL and library-to-library delivery, and facilitates automatic population of bibliographic information fields</i>
<b>Enables learning analytics</b>	<i>Capable of logging patron information to enable research into how different types of users use and interact with our various content and features</i>



## Features/functions of medium importance

<b>Export or save to citation manager</b>	<i>Capability of exporting bibliographic information to citation management software such as Endnote, Refworks, etc.</i>
<b>Save to “favorites”</b>	<i>Capability of exporting bibliographic information to a user’s individual “favorites” list</i>
<b>Stable URL</b>	<i>A stable URL is provided by which the user can bookmark the link resolver screen for an individual item</i>
<b>Ask a Librarian direct contact option</b>	<i>Link to local help options - i.e., our Ask a Librarian service</i>
<b>Email/text a citation</b>	<i>Bibliographic information can be emailed or sent via text message</i>

## Features/functions of low importance

<b>Format a citation</b>	<i>Formats bibliographic information in the user’s choice of citation styles (APA, MLA, etc.)</i>
<b>Find similar items (cited by)</b>	<i>Provides related items based on materials which cite the original item (the item for which the user was originally searching)</i>
<b>Find similar items (cited in)</b>	<i>Provides (or links to) list of resources cited by the original item (the item for which the user was originally searching)</i>
<b>Find similar items (author)</b>	<i>Provides other items written by the same author(s)</i>
<b>Purchase suggestion</b>	<i>Link to suggest purchase of items not owned by the library</i>
<b>“Cited by” metrics</b>	<i>Provides number of items within a certain database that cite the original item (the item for which the user was originally searching)</i>

# Tools Reviewed

After creating the list and ranking each function by importance, we then looked to see if each one was supported by 360 Link in our current iteration (“360 Link Legacy”), the 360 Link sidebar (“360 Link 2.0”), and in Umlaut.

## 360 Link Legacy (Current Tool)

This is the link resolver tool we currently use with the local brand “MGet It.” The link resolver menu appears if the University Library has not configured “one click” full text access for the full text service, or if there is not a reliable full-text service available (see Appendix B, Figure 1, for a screenshot of the current interface). The Electronic Access Unit (EAU) in Technical Services activates one click access for individual publishers when it is confident the OpenURL will be regularly resolved into an article. Not all publishers reliably provide access at the article level; some provide access only at the issue, volume, or journal level. And for other items, the library does not license a full-text source. In all of these cases, the user sees the MGet It menu.

## User Research

We conducted seven user studies involving six undergraduate and one doctoral student. Accessibility testing is a high priority, and four of the students tested are registered with the Office of Services for Students with Disabilities.

Each interview lasted approximately a half hour and involved two main tasks: a search for a full-text article starting from the Library homepage and a scenario where the link resolver page was shown directly to the participant for page specific feedback. Feedback was recorded in written notes and screen captures and audio recordings. Our findings were:

- Five of seven users stated “this page looks like an error page and I would look for another way to get to full text.”
- The doctoral student stated “I think it would take too much time to find full text using this page, there must be an easier way.”
- Two users with visual disabilities relied on alternative tools like in-page “find” tools to discover a link to full text or other bibliographic information.
- All users felt the page was too busy and saw no obvious way to full text within the current page. They had to slow down and read through the entire page to discover the full text link labeled “get article.”

If no full text article was available the students were unaware of why. Clear and actionable alternatives to a full text link were either not seen or not taken. Two students discovered the Ask a Librarian link but were hesitant to click because they were uncertain of the librarian's availability.

## Accessibility

360 Link Legacy has major accessibility issues that cannot be easily fixed without a significant amount of development effort. This is not recommended partly because any such fixes will be patches of the vendor's current interface (and subject to failure should the vendor change the interface), but mostly because the Legacy interface will soon be discontinued by the vendor.

## 360 Link 2.0

360 Link 2.0 is an updated interface to the same OpenURL knowledge base as our current solution. There are two significant differences from the user perspective. The first is that the options menu appears in a sidebar on the right-hand side of the screen (see Appendix B, Figure 2, for a screenshot). The second is that a new (and even more reliable) kind of direct-to-full-text linking is available, "Index-Enhanced Direct Links" (IEDL). An IEDL is a custom link provided by a content provider to the Summon index, which is the underlying database that powers ArticlesPlus. It is not an OpenURL, but rather a permanent link to a particular item. These IEDLs are far more reliable than OpenURLs (approaching 95% success rates, compared to 65% for OpenURLs).<sup>1</sup>

## Usability

The sidebar presents some usability challenges. The sidebar and vendor content are presented using HTML "iframes," in which several distinct web pages are displayed in panels within a single browser window. Some vendors (e.g., Sage) prevent their content from being displayed in this way, leaving the content portion of such a screen empty or with a generic error message. The EAU, through the administrative interface, can deactivate the sidebar and provide custom error text on a vendor-by-vendor basis. This is not efficient for staff, nor consistent for users.

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<sup>1</sup> See Stuart, Kenyon, Ken Varnum, and Judith Ahronheim. "Measuring Journal Linking Success from a Discovery Service." *Information Technology and Libraries* 34, no. 1 (March 2015). doi:10.6017/ital.v34i1.5607

## Accessibility

360 Link 2.0 also fails our accessibility requirements. We shared our accessibility review of the 360 Link 2.0 beta in fall 2014 with ProQuest; they addressed some of these concerns, but some of the most significant still remain.

The Library's Front-end Architect and Accessibility Specialist, conducted a review in 2014 and sent a report with a list of suggested Improvements to ProQuest to improve 360 Link 2.0's accessibility. A summary of the findings is in Appendix D.

## Umlaut

Umlaut is open-source software that interacts with the 360 Link knowledge base via the provided API. It therefore has access to all the metadata about an article that either the 360 Link Legacy or 360 Link 2.0 interfaces have, but enables a library to build a custom interface for displaying the data. Universities using this tool include [New York University](#), [Johns Hopkins University](#), and the [Royal University of Denmark](#) (which offers its interface in Danish and English). See Appendix B, Figure 3, for a sample screenshot.

## Usability

The interfaces provided by other universities are fairly similar; they are marked by much cleaner design, visual prioritization of delivery options, and the offering of additional services and assistance. Being completely customizable, the interface can be easily tailored to fit the library's overall web design and can enable the specific features we wish to offer.

## Accessibility

Umlaut has a fully customizable interface. This option would allow us to create an interface that meets or exceeds our accessibility requirements some development effort.

## Summary of Features Available

Table 1: High Importance Features / Functions

<b>HIGH Importance Features / Functions</b>	<b>Feature Availability in....</b>		
	<b>360 Legacy</b>	<b>360 2.0</b>	<b>Umlaut</b>
<b>Link to full text (or closest possible)</b>	Yes	Yes	Yes
<b>Clear language for various options</b>	No	No	Yes
<b>Usable interface</b>	No	No	Yes
<b>Accessible interface</b>	No	No	Yes
<b>Catalog record on screen (where applicable)</b>	No	No	Yes
<b>Consistent header/footer with library website</b>	No	Unknown	Yes
<b>Article citation information (author, title, pub, date, etc.)</b>	Yes	Yes	Yes
<b>Document delivery options</b>	Yes	Yes	Yes
<b>Enables learning analytics project</b>	No	No	Yes

Table 2: Medium Importance Features / Functions

<b>MEDIUM Importance Features / Functions</b>	<b>Feature Availability in....</b>		
	<b>360 Legacy</b>	<b>360 2.0</b>	<b>Umlaut</b>
<b>Export to citation manager (e.g, RefWorks)</b>	Yes	Yes	Yes
<b>Stable URL</b>	No	No	Yes
<b>Ask a Librarian - direct contact option</b>	Yes	Yes	Yes
<b>Email/text a citation</b>	Yes	Yes	Yes

Table 3: Low Importance Features / Functions

<b>LOW Importance Features / Functions</b>	<b>Feature Availability in....</b>		
	Yes	No	No
<b>Find similar items: cited by</b>	No	No	Yes
<b>Find similar items: cited in</b>	No	No	Unknown
<b>Find similar items: authors</b>	No	No	Yes
<b>Purchase suggestion (for books)</b>	No	No	Yes
<b>Cited by metrics</b>	No	Yes	Yes

# Discussion of Options

This section will discuss the benefits and risks of each of the three options the team investigated.

## Option 1: Stay with 360 Link Legacy

### Benefits

Not replacing the legacy interface would reduce demands on LIT's Design & Discovery unit (the combination of the Library Web Systems and User Experience departments) and, to a lesser degree, Technical Services' EAU.

### Risks

Staying with the current solution would simply delay implementation until it became necessary on the vendor's schedule. The current interface has significant usability and accessibility issues and, according to the vendor, is currently scheduled to be decommissioned in September 2016. According to the 360 Link project manager, the recent merger of ProQuest and Ex Libris may delay that date until early 2017.<sup>2</sup> Still, the current interface is not going to be available for more than a year.

We have no access to user interactions with the site for service improvement or campuswide learning analytics processes with the Legacy version.

### User Impact

Users would see no improvement in a poorly-understood interface.

## Option 2: Upgrade to 360 Link 2.0

### Benefits

Upgrading to 360 Link version 2.0 would be straightforward from the library's perspective and would involve activating the new interface through the existing administrative dashboard managed by EAU. Because both the 2.0 and Legacy interfaces rely on the same knowledge base and back-end infrastructure hosted by ProQuest, none of them will directly result in significantly more work for EAU.

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<sup>2</sup> From conversation with Eddie Neuwirth, 360 Link's project manager.

## Risks

While the 360 Link 2.0 interface resolves some usability issues present in the Legacy interface, it introduces several new challenges. The first affects all users in some cases, due to the the technology used to generate the sidebar. As noted in the “Tools Reviewed” section above, some vendors prevent their content from appearing within an iframe, leaving the content portion of such a screen empty, or showing an error message, leaving the user with no obvious path to the document they sought.

Since PARC previously reviewed 360 Link 2.0, the vendor has resolved some issues, but has not resolved all of them. (See Appendix D, below.)

We have no access to user interactions with the site for service improvement or campuswide learning analytics processes with the 2.0 version.

## User Impact

Most users would experience an improved linking experience because of the availability of Summon-based IEDL links to full text. Some users would face accessibility problems with the sidebar, and while most content would simply appear in the main frame, some vendors’ content would not.

## Option 3: Implement Umlaut

### Benefits

Adopting our own front-end to the 360 Link API would give the library the ability to meet all the high and medium importance functional specifications, and most of the low importance items that we considered, as well as meet the user needs we described above. Several high-importance items available only through Umlaut are worth highlighting:

- Having a fully accessible interface.
- The ability to customize all the language on the page to make it related specifically to services, tools, and options available to U-M affiliates.
- Being able to offer differentiated services depending on the particular user. For example, document delivery services could be prominently offered to faculty and graduate students (who receive them for free), but less “forcefully” for undergraduates (who must pay).
- Offering Ask a Librarian and trouble reporting tools within the interface that are aware of the user’s context.



- Gathering transactional data at the item level for the library and campus learning analytics projects.

## Risks

The University of Michigan Library would be the first institution to adopt Umlaut for use with 360 Link (it was originally built and is most used with SFX, owned by Ex Libris, and at least one institution is using it with Innovative's WebBridge). Being the first 360 Link API user will mean that we will bear more burden for maintaining the code for ourselves. We have the skills to do so, however, and it is not expected to be a complicated effort.

To the degree that we customize the existing default Umlaut interface, we may generate a larger amount of effort when Umlaut itself is updated through the open-source community. Running the software locally also means that we will be responsible for maintaining uptime and performance of the tool in our environment, much as we do for our discovery, website, catalog, and digital library tools. This is an incremental effort, but one that needs to be considered as new projects we take on now will have support costs down the road.

## User Impact

Users would have a well-designed full text delivery options page that met the library's accessibility standards and that is well integrated into the library website's user experience.

# Recommendation & Implementation Plan

The investigation team recommends hosting the link resolver interface locally using the 360 Link API and the Umlaut open-source software. This recommendation is based on the functional specifications we developed, a review of the usability and accessibility of the two options we considered, and a desire to provide a consistent, supportable interface for our users that could be useful for the campuswide learning analytics project.

The team brought a preliminary outline of our thinking to PARC on January 13, 2016, for feedback. PARC discussed our approach, in particular the functional and user requirements and the tools under review. The consensus of the group was that our investigation team was on the correct path and that we were considering the right factors in conducting our review.

## Proposed Implementation Plan

This section details the work needed to fulfill this request if the recommended option, developing our own front-end interface using the existing Umlaut open-source software as the front-end to the 360 Link API, is adopted.

This development effort would be covered by the “[Implement New Link Resolver](#)” LIT Front-Door request submitted in December 2015 and preliminarily reviewed by TASC, with a final approval pending receipt and acceptance of this report.

Design & Discovery estimates that this project will span approximately 12 weeks calendar time, divided across individuals in the unit with expertise in user experience, interface design, accessibility, and front- and back-end development. Preliminary thinking is to include link resolution within the framework of the new search interface; assuming this is the selected path, higher-level design work is already well underway on the larger project, although work on the details of this interface, and confirmation of this approach, are still needed. Testing of the new interface could begin in a limited way from one selected service on the current website (for example, ArticlesPlus).

### Issues for the Implementation Team to Consider

Several issues were raised during the course of the investigation that were deemed out of scope at this stage of the process, but will need to be explored and resolved as part of the implementation process:

1. Selection and prioritization of added services in the link resolver menu interface. There will be many services that could be added (cited-by counts, cited-in lists, catalog links, get a citation service, save for later, report a problem, etc.). Care will need to be taken to keep the interface usable for the majority of users the majority of the time, while selecting specific services that make sense for classes of users.
2. If a report-a-problem link is going to be included, the Ask a Librarian and EAU staff will need to have workflows to handle a larger volume of reports than are currently received through ArticlesPlus.
3. Whether the menu page should appear for all users, all the time, or should only appear when a full text link is not available via the API. Weighing a frequently streamlined interaction flow against the need to provide options when the direct-to-full-text link fails will need consideration.

## Draft Charge

The Umlaut Link Resolver Implementation Team is charged with implementing Umlaut as the library's main link resolution service, as recommended in the Link Resolver Investigation Team report's "Recommendation & Implementation Plan" section.

## Deliverables

1. Interface designs for the link resolver interface
2. Implementation of Umlaut and the 360 Link API
3. Appropriate sources to direct to the new link resolver interface during the beta testing (ArticlesPlus may be a reasonable test bed)
4. Identify individuals or groups that will need to update documentation and training materials to reflect the new link resolver interface.

## Timeline

The Implementation Team should complete its list of deliverables by [3 months of start date].

# Appendices

## Appendix A. Committee Charge

### Team Name:

Article Search Link Resolver Investigation Team

### Parent Committee:

TASC

### Background / Purpose ([Trello card](#)):

The library currently uses the hosted interface of Serials' Solutions 360 Link OpenURL resolver to direct patrons to available copies of online materials. The hosted interface does not allow us to mediate requests or to provide appropriate assistance to patrons when they need help, beyond a "Need Help" link.

### Charge:

- 1) Investigate the options that are in place or could be activated on the 360 Link menu pages and evaluate each for value to our users;
- 2) Identify functions we would like to have available in the link resolver menu;
- 3) Identify a tool or tools that would allow us to provide the required functions from (1) and the desired functions from (2).

The answer to (3) could be 360 Link's new sidebar interface, it could be the Umlaut middleware (which relies on the 360 Link knowledgeable via an API), or it could be a completely different tool. This recommendation should also take into account the likely needs of Learning Analytics processes to have detailed, user-level access to transactions conducted through the link resolver.

### Deliverables:

- A completed charter for the investigation (we have a sample charter in LIT that we'll pass along)
- An assessment of at least two options, and the pros and cons of each
- A recommendation of which tool to use, based on a UX analysis and assessment of what will best meet defined user needs

- A final report with functional requirements (if needed) and advice for moving forward with an implementation plan and schedule
- If needed, a future Front Door request

## Timeline:

TASC suggests: October 2015 (8 weeks)

## Membership:

- TASC Sponsor: Kathleen Folger
- Technical Lead: Ken Varnum
- Service Lead: Lisa Campbell

## Division Stakeholders:

- Collections:
  - Judy Ahronheim
- Research:
  - Shevon Desai
- Taubman:
  - Kate Saylor
- LIT:
  - Jon Earley
  - Ben Howell

## Appendix B. Screenshots

Figure 1. Current Interface

**M LIBRARY** UNIVERSITY OF MICHIGAN [Mirlyn](#) [Search Tools](#) [MGet It](#) [Ask a Librarian](#)

### MGet It

**Source:** [Refine or alter criteria](#)

Article: B lymphocytes are essential for the initiation of T cell-mediated autoimmune diabetes: analysis of a new "speed congenic" stock of NOD.Ig mu null mice.  
Author: Serreze, D V  
Journal: The Journal of experimental medicine  
ISSN: 0022-1007 Date: 11/1996  
Volume: 184 Issue: 5 Page: 2049  
PMID: 8920894

Citation: [Email](#) or [Export/Save](#)  
[Always check the citation for accuracy. Click this link for more information.](#)

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Figure 2. Sample Sidebar Interface

The screenshot displays the NCBI PubMed sidebar interface for a search result. At the top, the NCBI logo and navigation links are visible. The search bar contains the query '8920894[pmid]'. The main content area shows the article title: 'B lymphocytes are essential for the initiation of T cell-mediated autoimmune diabetes: analysis of a new "speed congenic" stock of NOD.Ig mu null mice'. Below the title, the author 'Serreze, D V' and journal information 'The Journal of experimental medicine' are listed. The sidebar features several sections: 'Filter your results' showing 'All (1)' and 'NIH grants (1)'; 'Related information' with links to 'Cited Articles', 'MedGen', and 'PubMed'; 'Search details' showing the PMID '8920894 [pmid]'; and 'Recent activity' showing the search query '8920894[pmid] (1)'. At the bottom, there are 'Email' and 'Export' buttons, and a link to 'Additional Options'. The footer contains the NCBI address and various logos.

Figure 3. Sample Umlaut Interface

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Article  
IL-7-dependent B lymphocytes are essential for the anti-polysaccharide response and protective immunity to *Streptococcus pneumoniae*  
Shriner, Anne K • 2010 Jul 01  
Published in Journal *The Journal of Immunology*. Volume 185. Issue 1. Page 525 - 31.  
ISSN: 0022-1767

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[Highwire Press American Association of Immunologists](#)  
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Digital copies of most articles and selections are available through the Libraries Service Center at [lsc@jhu.edu](mailto:lsc@jhu.edu).  
v.52(1946)-v.133(1984)

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More info  
Print canceled 2006. Supplements bound separately from main title circulate one week.  
Supplements: vol. 135 suppl. 1 1985  
Supplements: vol. 141 1988


**Welch Journals - Stack Level 2, Welch Library**  
More info  
Print canceled 2006.  
vol. 1-175 1916-2005

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## Appendix C. User Flows

Our team created user flows to better understand and visualize the various paths users navigate in order to arrive at the link resolver page and full-text. The user flows were helpful in understanding ways to improve clarity in the link resolver page as well as full-text search strategies as a whole, as well as to illustrate the complexities users can face in getting to full text from a citation.

Figure 1. Library Home Page/Citation Linker Page

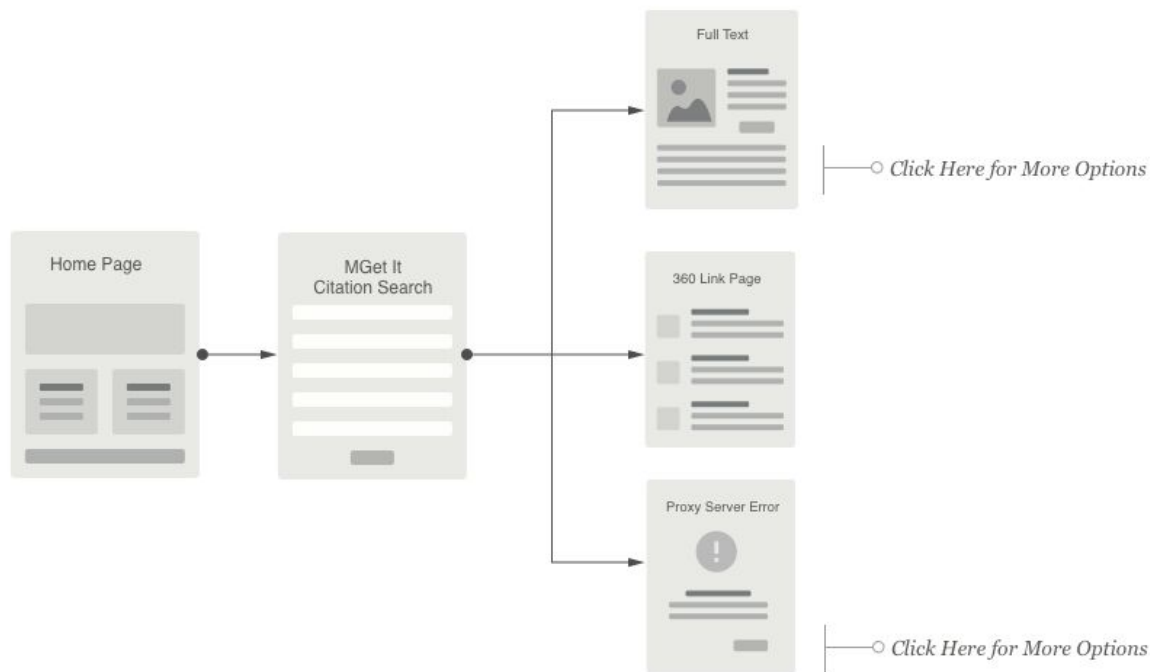


Figure 2. ArticlesPlus

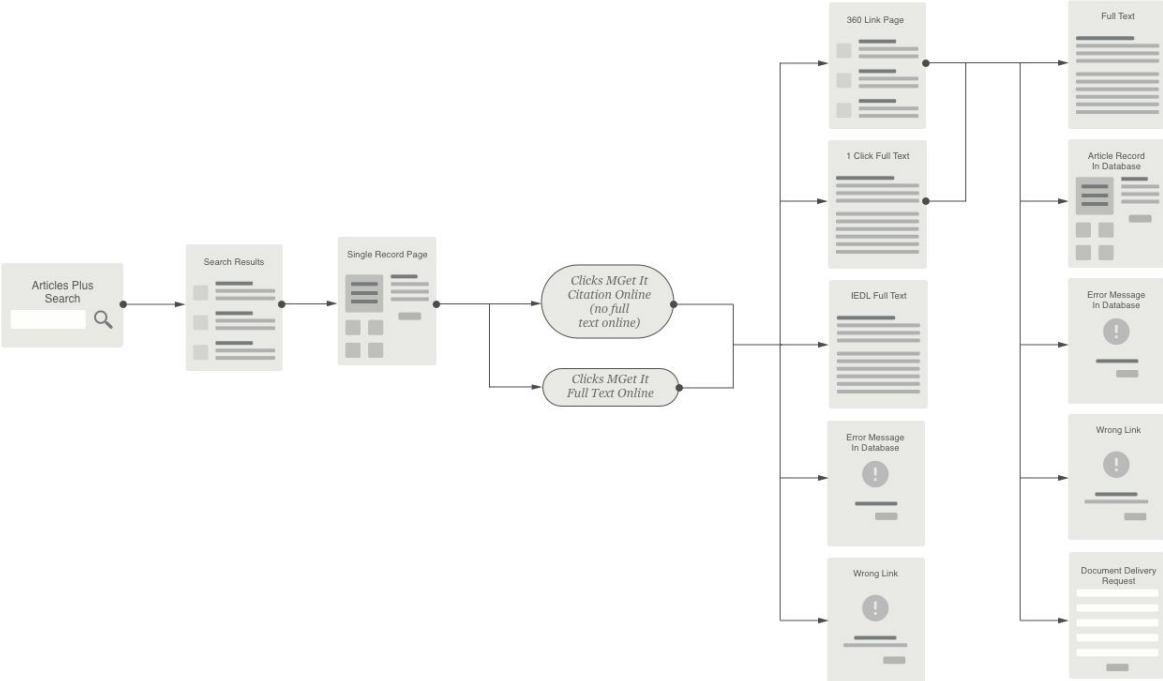


Figure 3. Ask a Librarian

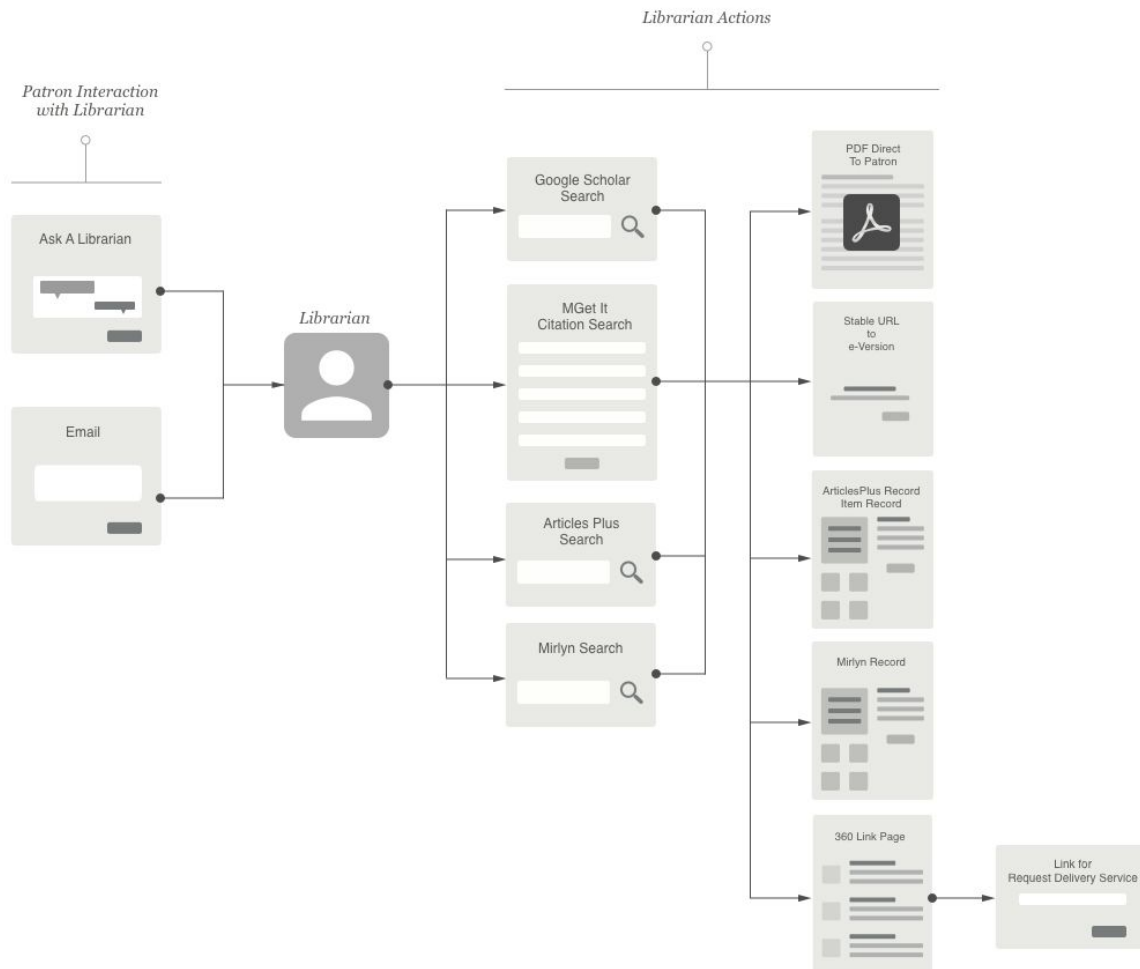


Figure 4. Google Scholar - Path 1

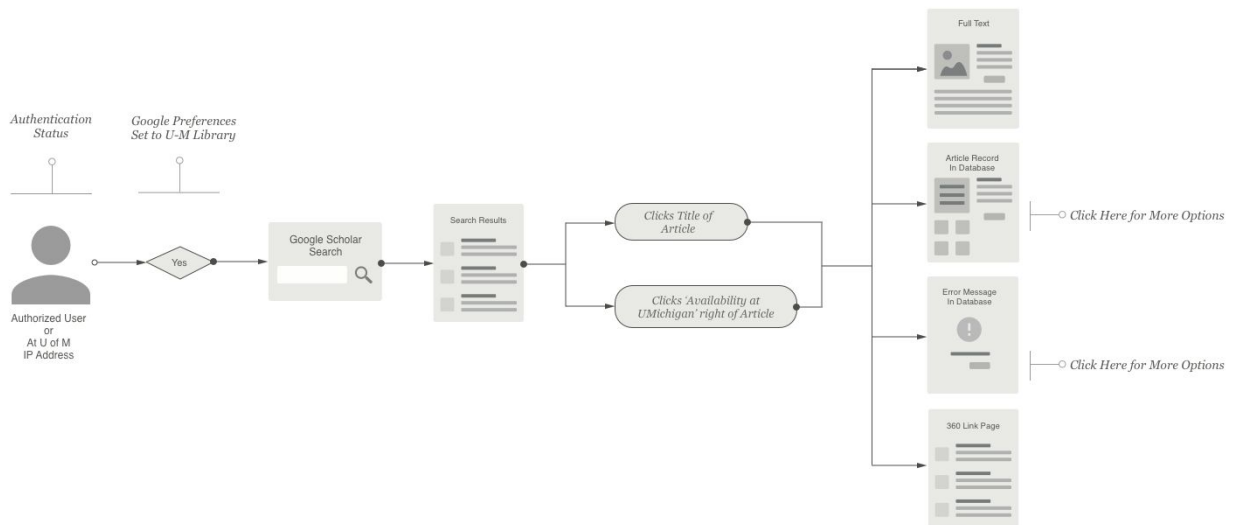


Figure 5. Google Scholar - Path 2

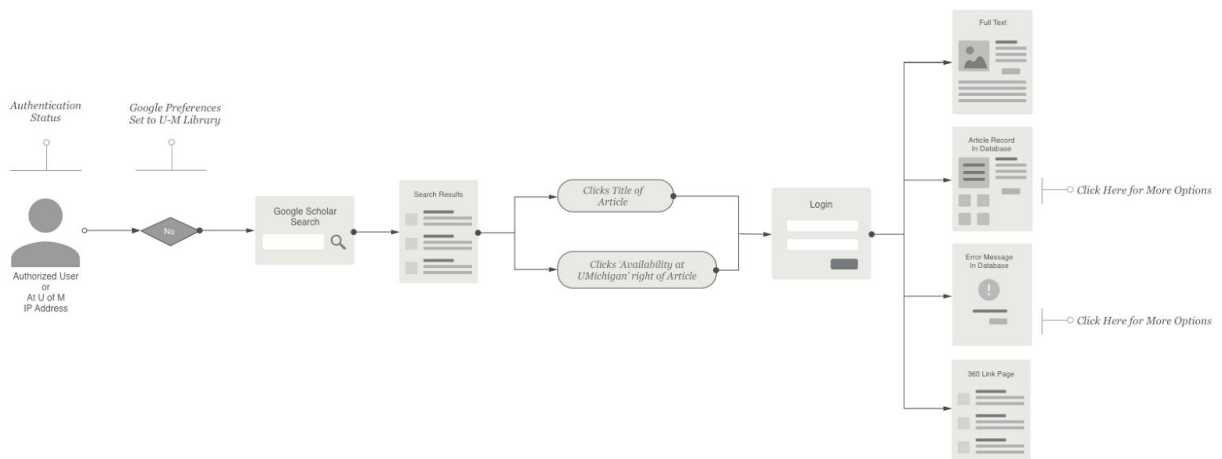


Figure 6. Google Scholar - Path 3

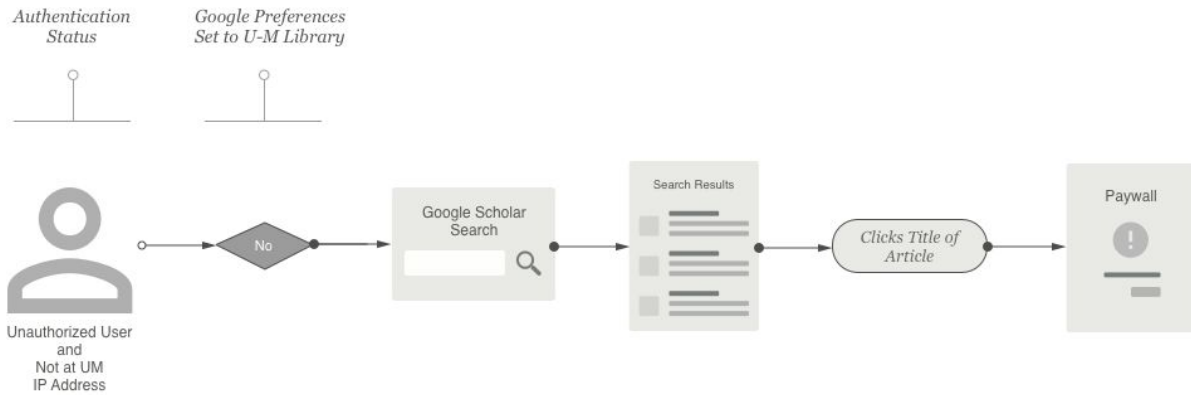
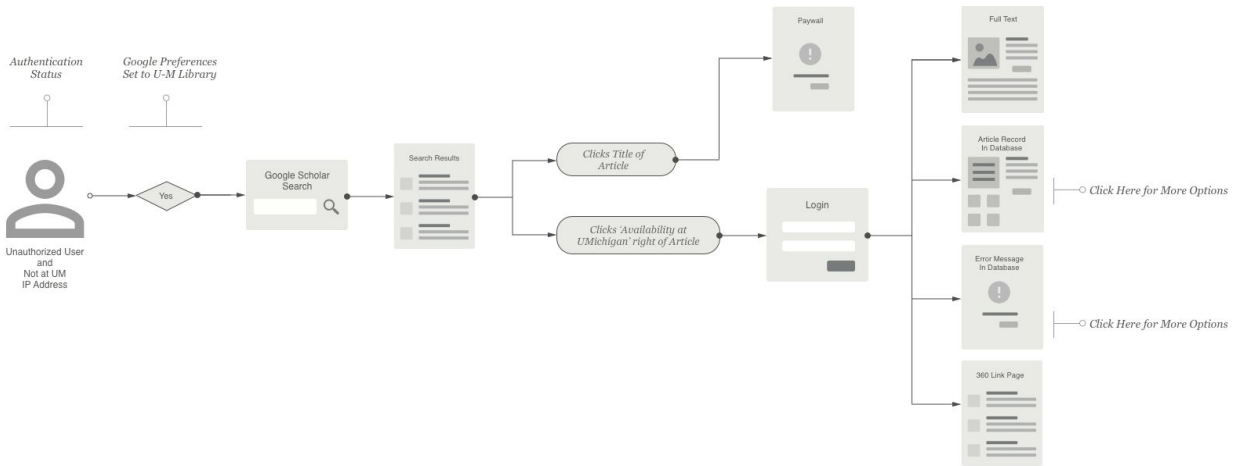


Figure 7. Google Scholar - Path 4



## Appendix D. Accessibility Review of 360 Link 2.0

These are the findings of an accessibility review of 360 Link 2.0 conducted by the library's Front-end Architect and Accessibility Specialist, conducted in 2014. Some of these issues have been addressed through subsequent updates to 360 Link 2.0.

- Critical Errors
  - The `<i>` tag is a deprecated tag for italic text, therefore it isn't valid HTML5 & isn't semantic HTML4, is not a clickable element semantically, and thus currently it doesn't get keyboard focus for many if not all users who don't have access to a mouse (some screen readers are saying it is clickable, but screen reader users are the minority of users who don't use a mouse and some screen readers don't announce that these are clickable).
    - Do not solve this by adding `role="button"` or `tabindex="0"` as both of these not solve the problem for all users and do not solve the semantic problem.
    - Do use a `<button>` (or, less preferably, an `<a>`) wrapping an `<img>` or with a `background-image`.
  - Icon fonts are very problematic since they read as gibberish with screen readers and similar assistive technologies.
  - Form elements (like the `<select>` under "Didn't get full text?") need labels with proper for attributes.
  - If an item inside the sidebar receives focus when that section is closed, it should automatically open.
- Needs Improvements
  - The `<iframe>` should have a title attribute set so it is clear to users that can't see the page that the `<iframe>` contains the main content
    - You could also duplicate the page's `<title>` in the `<iframe>`'s title attribute).
  - There should be a heading for each section of the sidebar (the `<div class="section">` elements), and those headings should be text wrapped in an `<h#>`.
    - Putting links, buttons or images inside an `<h#>` can cause problems, so put those outside the `<h#>`.
    - The whole sidebar should have a header to describe what the sidebar is.
  - The logo at the top of the page has an alt text of "logo image" which could be improved. It would probably need to be altered per user base (for example, if we use the sidebar it should probably say "University of

Michigan", "Provided by the University of Michigan Library", "University of Michigan Library logo", or something in that vein depending on which image we put there).