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Using Web Analytics for Mobile Interface Development

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Abstract:

Libraries are developing mobile Web sites to keep up with the dynamic landscape of emerging technologies. However, the development of a mobile Web site is not as simple as serving the existing desktop Web site on a handheld device. Library developers can use analytics software to better understand users and to develop a user-centered mobile Web site. This case study explores the use of a library's traditional desktop Web site's analytics information in creating a mobile interface.

Although Web analytics can provide a great amount of information about users, data should be used as supplementary information. Usability testing, focus groups, and surveys are other methods that can be conducted to understand users. Analytics cannot be a substitute for these types of user input, yet it may be useful for the initial development of mobile Web sites.

Keywords: mobile, Web site, library, usability, analytics, Google Analytics, Piwik, ClickHeat, user-centered, Drupal

Introduction

Web analytics are an effective tool that can be used to inform library Web site development. In recent years, technologies such as smartphones, computer tablets, and Wi-Fi-enabled eReaders have been used to connect users to libraries' online resources. Institutions must respond in order to meet the needs of these mobile device users.

When developing a mobile Web site, there are a number of considerations to make. In most cases, the traditional desktop library Web site may not be appropriate for mobile consumption. Mobile Web sites need to account for the limitations of smaller screen sizes, lower resolution, and slower network speeds. How can library Web developers create a more optimized mobile site using analytics? This article examines how Web metrics of a library's desktop site can be used to develop its mobile counterpart's interface.

Literature Review

Recently, the rise of handheld device usage and ownership has prompted libraries to provide optimized, mobile-friendly access to online resources and content. According to the Pew Internet Research Center, mobile device usage skyrocketed after the 2011-2012 holiday season, with ownership nearly doubling among adult users (Rainey 2012). Thirty-five percent of Americans are taking advantage of mobile technologies, and state they would use mobile apps and GPS-enabled devices for library services (Zickuhr, et al. 2013). Libraries are responding either through in-house mobile Web site development or vendor-based solutions (Chan 2012). Institutions are also making specific resources, such as subject guides, mobile accessible (Boruff & Bilodeau 2012). Database publishers and vendors are also making subscription-based electronic resources more mobile-friendly.

The development of mobile Web sites requires not only understanding user behaviors, but also the limitations of their devices. A research study of over 80 different academic libraries' mobile site interfaces advocates for assessing user needs to improve services (Han & Jeong 2012). The very definition of the mobile user implies those users who are looking for quickly accessible information, and that library sites should be catered to such (Kim 2010). This includes information that should be readily available on mobile sites, because it is sought "on the go." A focus group on Kent State University's mobile Web site found that students may want to seek research articles on their handheld device, but not necessarily read them (Seeholzer & Salem 2011). This implies that when using mobile devices, users may want to seek information for its availability and not necessarily for its consumption.

Web analytics are useful for supporting user-centered design because they provide a variety of information about visitors that can improve a library's Web site. Site content, user hardware demographics, and network information can be collected passively. These data have

been useful for a wide spectrum of libraries to learn more about online users, including the effectiveness of digital libraries (Hess 2011), understanding users of academic library Web sites (Black 2009), and improving academic library Web site design (Fang 2007).

The metrics recorded through analytics can provide further insight on the path users take to visit a Web site. Content usage, the date and time information is accessed, and how users access a site, are just some pieces of data that can be collected through analytics. One example that Kirk Hess notes is that metrics show users are not using sites' internal search engines to find inventory within a digital library, but instead discovering digital library content from external links, such as Wikipedia (2011). Elizabeth Black states that analytics can provide the most highly accessed information on a site and their peak times of usage (2009). Analytics can be used to distinguish how users enter a site, be it organically, such as typing the site's URL, or selecting a link after a search engine query.

In addition to what content is seen on a site, hardware and network information can also be collected through analytics. User connection speed, operating systems, browser types, and screen resolutions have been harvested since the early days of the Web, through server log files. The collection of this type of information continues today, assisting Web specialists with design decisions. For instance, Wei Fang has used analytics for justification not to use high-resolution images due to users' lower connection speeds (2007). These hardware-specific considerations are more critical for mobile devices, relying on Wi-Fi speeds and lower screen resolutions.

Web Analytics

This section examines the use of three Web analytics tracking programs: the widely used Google Analytics, its open source alternative, Piwik, and a "mouse click" aggregate logging tool

called ClickHeat. These programs generally operate the same way: a tracking code is added to the header or footer section of each page of a Web site and user information is reported back to a centralized server. From there, data is rendered and displayed to administrators through a Web browser. Analytics can alternatively generate reports and send data via email.

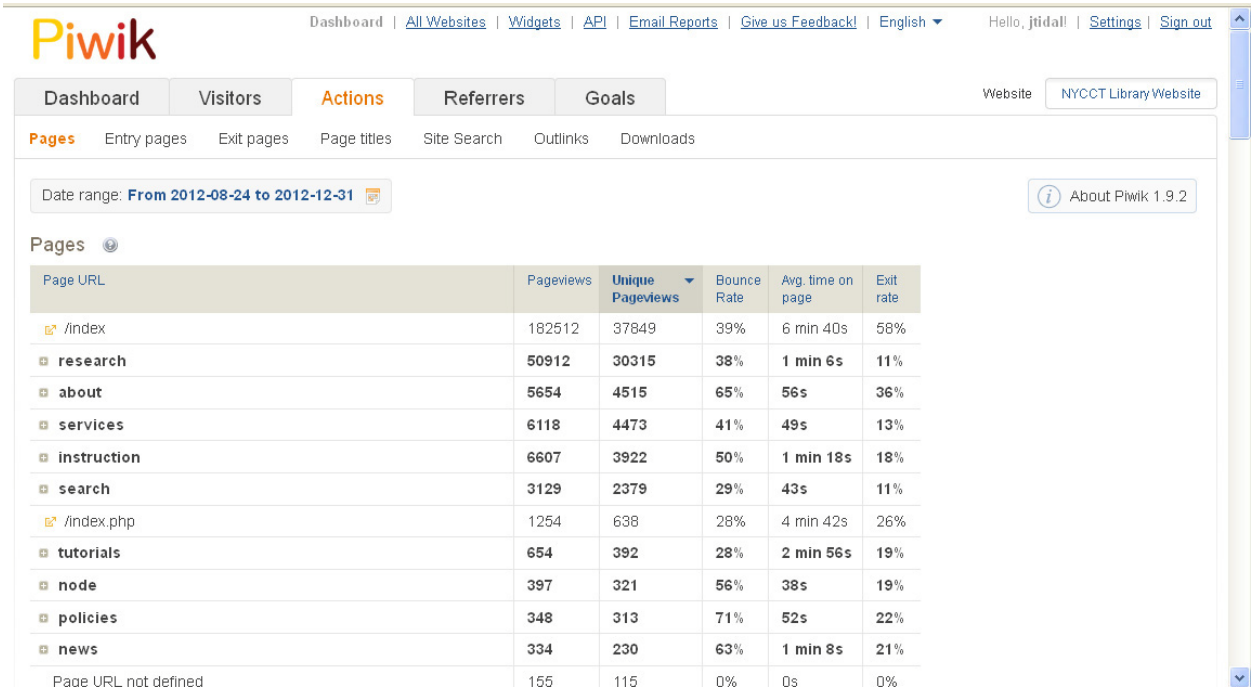
Google Analytics

Probably one of the most popular Web tracking systems is Google Analytics (GA). It is freely available (http://www.google.com/analytics) and relatively easy to incorporate into an existing Web site. GA uses JavaScript to track visitors to Web sites. A "page tag," also known as a Web beacon, is inserted into every page of a Web site. When a page is accessed, it sends visitor information back to Google's servers. Cookies are left on users' machines, so returning activities are tracked. GA provides a wide range of data on users; hardware configurations, such as operating system, browser, browser version, and screen resolution are collected. Visitor data such as the network provider's IP address, network speed, geographic location (IP-based), and popular site content are also gathered through GA. However, this tracking program has come under scrutiny for privacy concerns. Not only is this data about visitors tracked, but so is the site structure of Web sites using GA. This information can potentially be used by Google for other purposes than Web traffic statistics.

Piwik

Piwik (see Figure 1) is an open-source, PHP/MySQL-based analytics engine, marketed as an alternative to Google Analytics. The tool can be downloaded directly from the Piwik Web site (http://piwik.org) and installed on the Web server hosting the site. This analytics software allows

the use of alternate tracking methods as specified by the local server administration, including JavaScript Web beacons, PHP-based code, or imported server log files. The options are an asset, because some mobile devices and browsers may not necessarily support JavaScript. Unlike Google Analytics, data collected through Piwik is stored on the host Web server so access is restricted to administrators, where they have full control of visitor data. Conversely, it does not have the large support community that GA has access to.



Page URL	Pageviews	Unique Pageviews	Bounce Rate	Avg. time on page	Exit rate
/index	182512	37849	39%	6 min 40s	58%
research	50912	30315	38%	1 min 6s	11%
about	5654	4515	65%	56s	36%
services	6118	4473	41%	49s	13%
instruction	6607	3922	50%	1 min 18s	18%
search	3129	2379	29%	43s	11%
/index.php	1254	638	28%	4 min 42s	26%
tutorials	654	392	28%	2 min 56s	19%
node	397	321	56%	38s	19%
policies	348	313	71%	52s	22%
news	334	230	63%	1 min 8s	21%
Page URL not defined	155	115	0%	0s	0%

ClickHeat

ClickHeat (http://www.labsmedia.com/ClickHeat/index.html) is a freely available Web analytics program that tracks mouse clicks on a page. Individual pages can be viewed through a ClickHeat overlay, where administrators can see the “hotspots,” or most clicked areas of a Web page. Similar to Google Analytics, ClickHeat collects visitor information through JavaScript code. This is useful because it shows what sections of a library Web page that users utilize or ignore (Farney 2011).

Mobile Web site Development

The Ursula C. Schwerin library's mobile Web site has gone through numerous iterations. The initial mobile version began in early 2010 and was a stand-alone HTML page with a minimalist CSS style sheet and no background or images. This page only provided mobile-friendly links to electronic databases and other resources, and was soon abandoned after analytics showed a lack of traffic.

A year later in 2011, the library's traditional desktop Web site migrated from a static HTML Web site to the Drupal 6 (D6) content management software (CMS). Drupal CMS has optional, community-developed custom modules that can easily incorporate analytics programs into a site. These modules automatically amend the tracking code for Google Analytics, Piwik, and ClickHeat to pages managed by Drupal. Pages outside of the scope of the CMS, however, will not be tracked unless specifically edited to do so. These modules allow back-end administrative pages to be exempt or included from tracking. It is not necessary to use Drupal to use these programs, but is advantageous if a Web site contains hundreds of pages. A custom Drupal module was used to serve pages to mobile devices; these could have been considered as a second version of the library's mobile Web site. This custom mobile module would encode existing pages of the desktop Web site into a mobile-friendly Web framework. This framework, known as jQuery Mobile, is touch-optimized and specifically designed for cross-browser and cross-system support. However, this module was ultimately problematic and unusable with our desktop site.

Content such as images, tables, and application-specific files (PDFs, Excel, and Word documents) embedded within pages were not compatible with mobile devices. The “home page” was a touch index listing of all existing pages on the site. Customized standalone pages outside of Drupal’s content system, designed to use the mobile module, appeared “scrambled” or did not load at all.

In re-evaluating the site with these problems in mind, it was found best to install a mobile version of the library’s Web site in a separate installation using Drupal 7(D7). D7 was chosen, despite the traditional desktop Web site’s D6 installation, because of the greater number of mobile and responsive modules and themes available at the time. Responsive modules refer to extensions that utilize responsive web design, where a website is resized and optimized depending on the end user’s device. This includes an optimized jQuery Mobile D7 module and theme. The previous mobile Web site used only a customized module.

Even though this version of the Web site was more optimal than serving a desktop Web site through a mobile module, it was still important to consider what content should be added to the Web site. Two criteria were used to determine what this content should be. Firstly, noted usability guru Jakob Nielsen states that mobile Web site development should be designed for the small screen, and ”must limit the number of features to those that matter the most” (2011). Having a small number of links, or features, assisted the user reaching their specific needs. If these needs were not met, or went beyond the limitations of a mobile Web site, they were provided with the option to use the desktop version of the site. Secondly, analytics data were used to restructure the mobile Web site to have a user-centered design based on the most-used pages within the traditional Web site.

Analytics Evaluation

Metrics recorded from the visitors of the desktop Web site were used to develop the interface of the library's mobile site. These statistics were collected during the fall 2012 semester, prior to the mobile Web site's redesign launch. Even though the multiple analytics tools described above (GA, Piwik, and ClickHeat), collect, store, and present data differently, common themes among them can still be used to make generalizations about users.

GA provided helpful and varied metrics on library users. Five percent of users entering the library's desktop Web site arrived via a mobile device. The most popular devices, listed by rank, include the Apple iPhone, iPad, iPod, and iPod Touch. Additionally, there were a significant number of users that were unknown or not reported, which may be attributed to search engine bots, crawlers, older mobile phones, users who don't use JavaScript, or users who refused to be tracked. Google Analytics also provided the most visited sources of content on the library's Web site. Other than the main index page, the library's catalog, electronic databases, e-books, library hours, and citation subject guides were the most-visited pages throughout the semester. Users also prefered to use iOS based devices over Blackberry or Android based devices (Figure 2).

Figure 2. Google Analytics

Mobile Device Info

Visits	**Pages / Visit**		**Avg. Visit Duration**	**% New Visits**	**Bounce Rate**
1. Apple iPhone	1,228	1.85	00:01:40	60.99%	57.74%
2. Apple iPad	1,152	2.35	00:04:06	48.61%	46.35%
3. (not set)	221	2.44	00:02:21	66.97%	51.58%
4. Apple iPod Touch	92	1.84	00:01:25	70.65%	63.04%

5. SonyEricsson LT15i Xperia Arc	91	2.07	00:02:53	61.54%	50.55%
6. Apple iPod	89	2.34	00:05:26	62.92%	34.83%
7. Samsung SGH-T989	51	1.88	00:01:12	54.90%	60.78%
8. Samsung SGH-T989 Galaxy SII	49	3.14	00:02:36	48.98%	36.73%
9. Samsung GT-I9000 Galaxy S	48	2.50	00:02:29	41.67%	41.67%
10. Samsung SGH-I997 Infuse	38	1.42	00:09:4	17.89%	21.05%

Google Analytics visitor device information from August 24th, 2012 – December 31st, 2012

Piwik noted similar findings. The majority of mobile visitors to the library's desktop site included iOS based devices. Piwik reported a significant number of unknown users as well (see Figure 3). Despite Piwik's report of Android devices outnumbering individual iOS devices, the collective number of iPhone, iPad, iPod, and iPod Touch devices greatly outnumber Android users. iOS based technology is the most widely used mobile devices used when visiting the library's desktop site. Piwik's most visited pages listed the library's catalog, database page, library hours, and citation subject guides, reflecting the same information collected by Google Analytics.

Figure 3. Operating systems	**Visits**
Windows 7 Windows 7	19080
Mac OS Mac OS	9030
Windows XP Windows XP	8777
Windows Vista Windows Vista	2580
Android	1120
iPad	1091

iPhone	976
Windows 8 Windows 8	424
Unknown Unknown	236
iPod iPod	154
Linux Linux	131
BlackBerry BlackBerry	49

Library visitor statistics by operating system from Piwik, August 24th , 2012 – December 31st, 2012.

ClickHeat provided information about the most clicked on links on the library's home page. Only the home page (Figure 4) was considered for ClickHeat statistics, since it serves as a nexus of the library's Web site. The top pages on the site can be directly accessed through the home page unlike other pages deeper within the site. The library's catalog was part of a tabbed navigation system, placed in the middle of the library's home page. Other tabs included links to research databases, e-books, journals, and subject guides (Figure 5). This form was the "hottest" area, or most clicked, consistent with the findings of the data collected by Piwik and GA (Figure 6 and Figure 7). In order of ranking, the most visited links according to ClickHeat included the library's catalog, research databases, and links to our electronic book collections. Research databases and e-books were the most popular pages on the library Web site, according to these two different services.

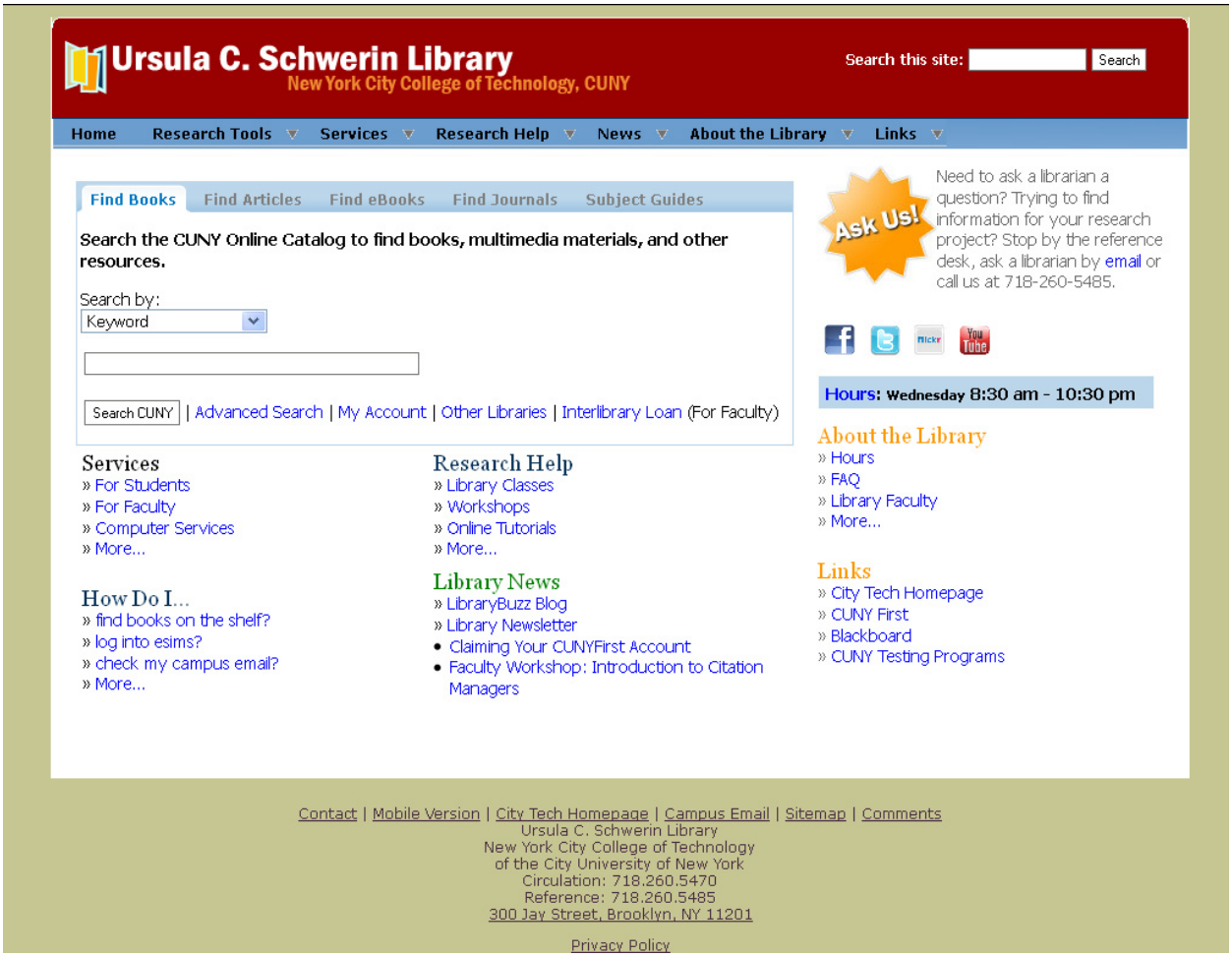
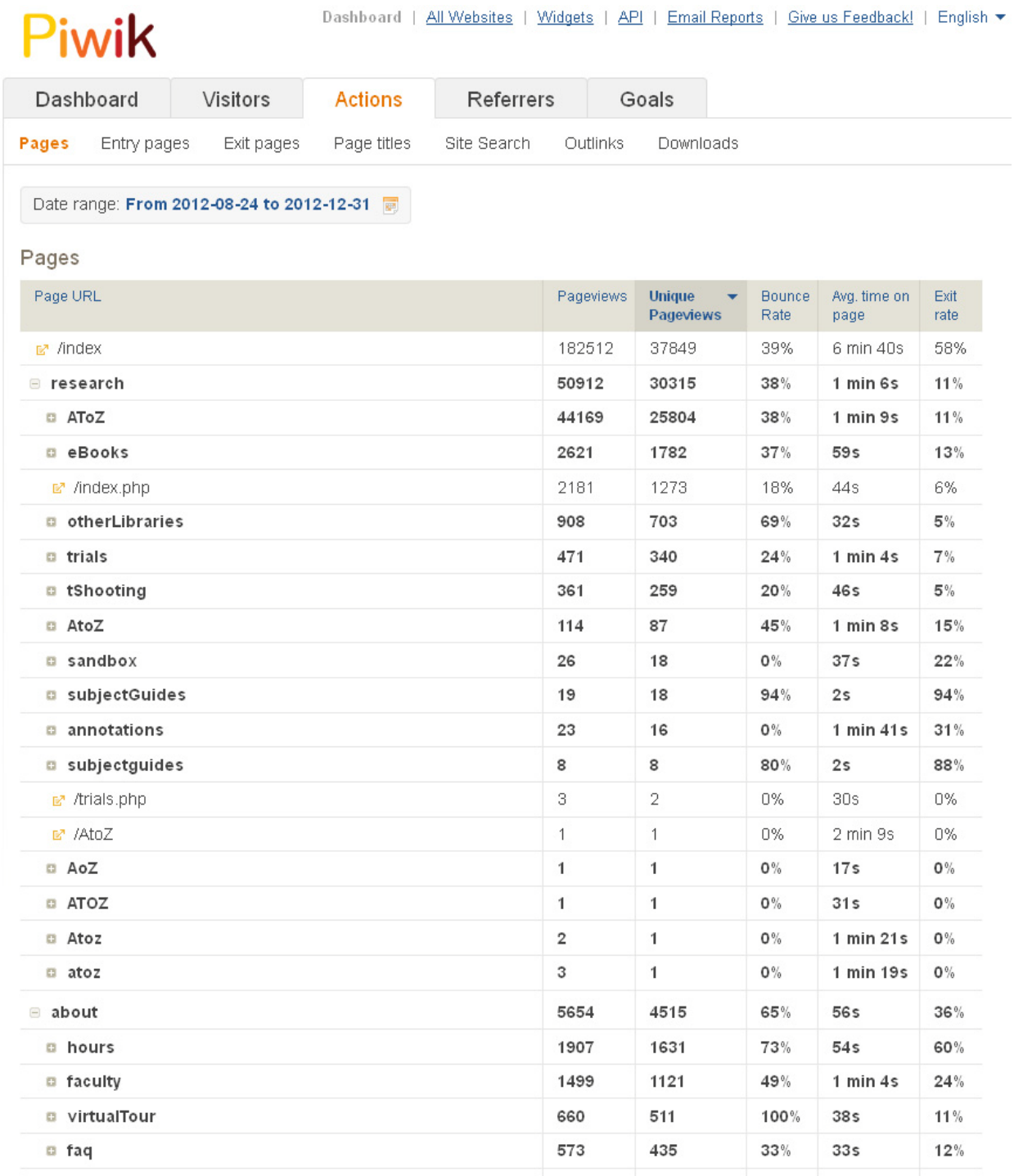

Ursula C. Schwerin Library
New York City College of Technology, CUNY
Search this site:
Search
Home
Research Tools
Services
Research Help
News
About the Library
Links
Find Books
Find Articles
Find eBooks
Find Journals
Subject Guides
Search the CUNY Online Catalog to find books, multimedia materials, and other resources.
Search by:
Keyword
Search CUNY | Advanced Search | My Account | Other Libraries | Interlibrary Loan (For Faculty)
Services
» For Students
» For Faculty
» Computer Services
» More...
How Do I...
» find books on the shelf?
» log into esims?
» check my campus email?
» More...
Research Help
» Library Classes
» Workshops
» Online Tutorials
» More...
Library News
» LibraryBuzz Blog
» Library Newsletter
• Claiming Your CUNYFirst Account
• Faculty Workshop: Introduction to Citation Managers
Ask Us!
Need to ask a librarian a question? Trying to find information for your research project? Stop by the reference desk, ask a librarian by email or call us at 718-260-5485.
Hours: Wednesday 8:30 am - 10:30 pm
About the Library
» Hours
» FAQ
» Library Faculty
» More...
Links
» City Tech Homepage
» CUNY First
» Blackboard
» CUNY Testing Programs
Contact | Mobile Version | City Tech Homepage | Campus Email | Sitemap | Comments
Ursula C. Schwerin Library
New York City College of Technology
of the City University of New York
Circulation: 718.260.5470
Reference: 718.260.5485
300 Jay Street, Brooklyn, NY 11201
Privacy Policy

Figure 5



Page URL	Pageviews	Unique Pageviews	Bounce Rate	Avg. time on page	Exit rate
/index	182512	37849	39%	6 min 40s	58%
research	**50912**	**30315**	**38%**	**1 min 6s**	**11%**
AToZ	**44169**	**25804**	**38%**	**1 min 9s**	**11%**
eBooks	**2621**	**1782**	**37%**	**59s**	**13%**
/index.php	2181	1273	18%	44s	6%
otherLibraries	**908**	**703**	**69%**	**32s**	**5%**
trials	**471**	**340**	**24%**	**1 min 4s**	**7%**
tShooting	**361**	**259**	**20%**	**46s**	**5%**
AtoZ	**114**	**87**	**45%**	**1 min 8s**	**15%**
sandbox	**26**	**18**	**0%**	**37s**	**22%**
subjectGuides	**19**	**18**	**94%**	**2s**	**94%**
annotations	**23**	**16**	**0%**	**1 min 41s**	**31%**
subjectguides	**8**	**8**	**80%**	**2s**	**88%**
/trials.php	3	2	0%	30s	0%
/AtoZ	1	1	0%	2 min 9s	0%
AoZ	**1**	**1**	**0%**	**17s**	**0%**
ATOZ	**1**	**1**	**0%**	**31s**	**0%**
Atoz	**2**	**1**	**0%**	**1 min 21s**	**0%**
atoz	**3**	**1**	**0%**	**1 min 19s**	**0%**
about	**5654**	**4515**	**65%**	**56s**	**36%**
hours	**1907**	**1631**	**73%**	**54s**	**60%**
faculty	**1499**	**1121**	**49%**	**1 min 4s**	**24%**
virtualTour	**660**	**511**	**100%**	**38s**	**11%**
faq	**573**	**435**	**33%**	**33s**	**12%**

Figure 6

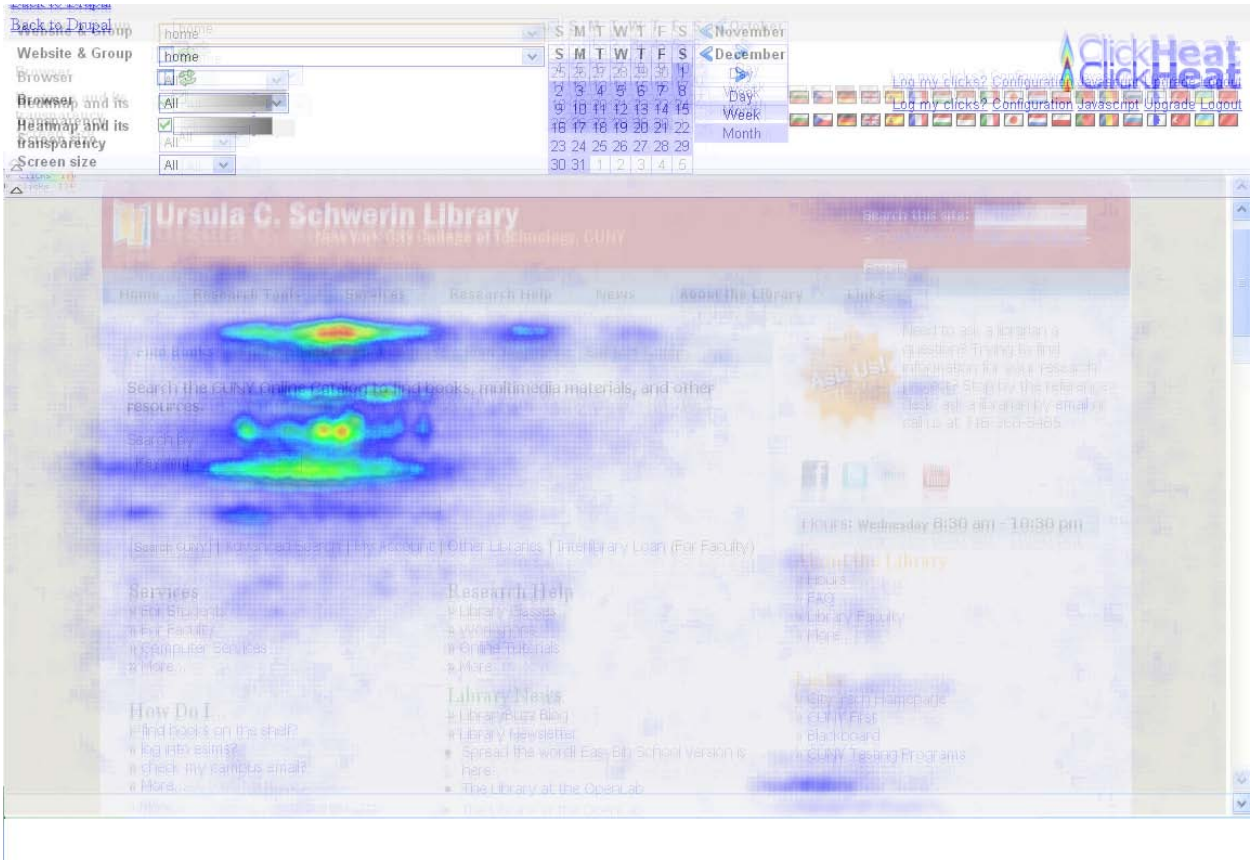


Figure 7 Most clicked areas on the Ursula C. Schwerin Library homepage according to ClickHeat, August 24th 2012 – December 31st, 2012.

The Mobile Interface

The analytics above helped justify decisions on what content should be available on the library's mobile site. First, library hours are prominently displayed on the home page of the mobile Web site (see Figure 8). This page is one of the most visited pages on the desktop site, ranking as the sixth-most visited page over the Fall semester, confirmed by both GA and Piwik. The hours page also conforms to the idea of "quick and on the go" type of information mentioned earlier. A link to library directions, which is the second link found on the mobile site, is placed below for similar reasons. This information can be quickly accessed at a glance from the site.

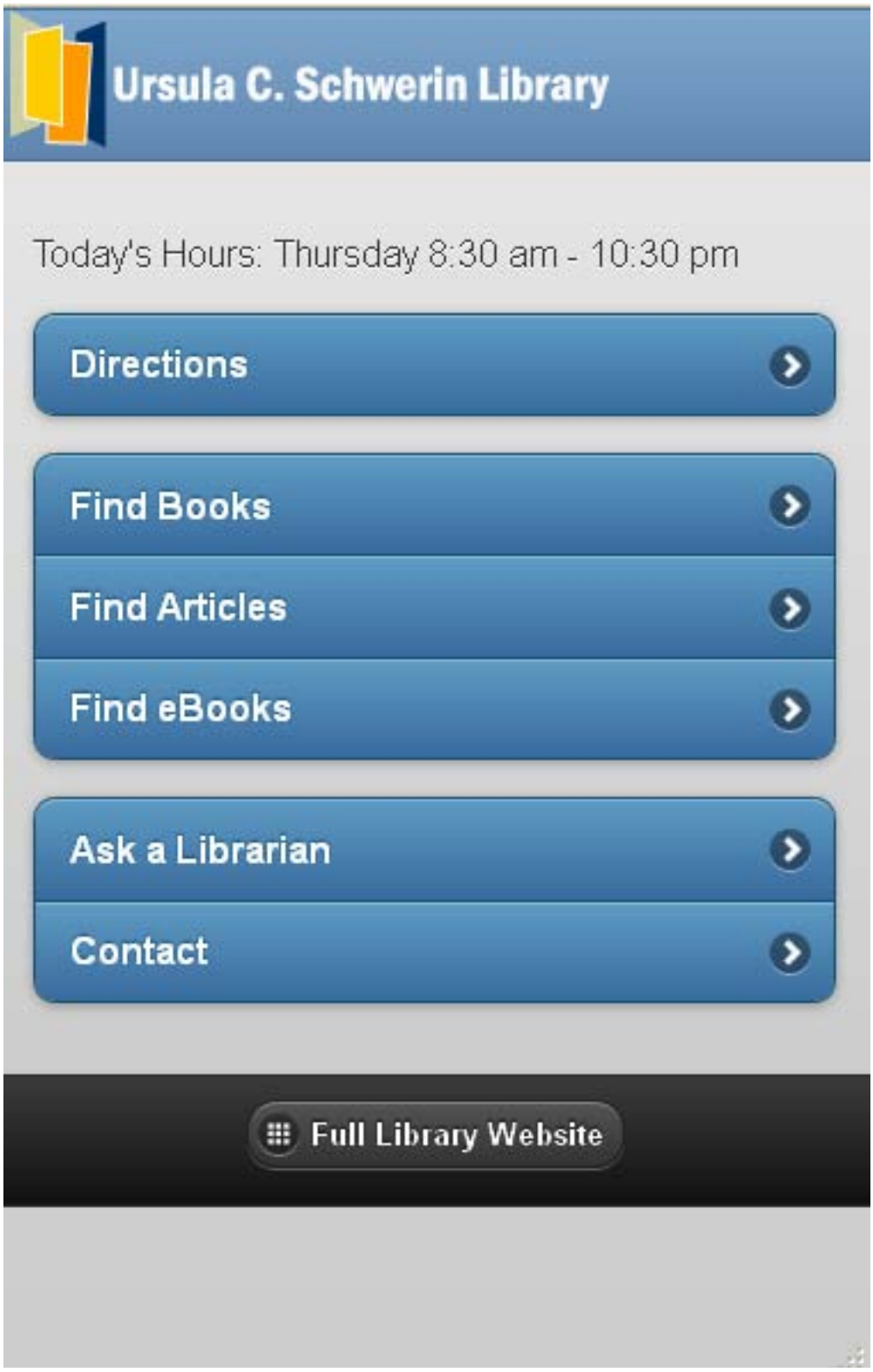

Ursula C. Schwerin Library
Today's Hours: Thursday 8:30 am - 10:30 pm
Directions
Find Books
Find Articles
Find eBooks
Ask a Librarian
Contact
Full Library Website

Figure 8

Analytics information for our desktop site has shown that the most-used pages should also be the most prominent on the mobile site. The most-used pages on the desktop site include the library's home page, the CUNY catalog, the A to Z list of electronic resources, and electronic books page. Other than information about the library, the mobile site displays links to the library catalog, subscribed electronic databases, and e-books. The CUNY catalog that is linked to the site is not mobile optimized. However, for current handheld devices, it can still be used to search for monographs and other materials. This is especially true for iOS devices, which are most used to connect to our desktop site. Electronic databases linked from the mobile site include only those that have a mobile or mobile-optimized site. A link to the library's e-books follows the link to our electronic databases. These e-book resources may not be necessarily mobile-optimized either, but similarly to the use of the CUNY catalog, they are generally usable through iOS devices.

The final two links on the library's mobile site are used for contact information. This includes a link to our reference desk phone number and email address, and another link for our circulation desk and snail-mail address. According to our analytics, traffic for online reference transactions are quite low, however, following to the functions and form of most mobile smartphones, we felt it was important to have hyperlinked phone contacts and email addresses on our library site. Additionally, having contact information available is not only a common trend among academic library mobile Web sites (Han & Jeong, 2011), but it allows users another access point to interact with the library through their phones.

One other function that the mobile site includes is a link to the full desktop version. Even though the mobile site displays what is used most on the desktop site, it is important to provide users access to what is not available. If there are interactions that go beyond the scope of the

mobile Web site, the option of having access to the traditional site can meet those needs. Also, since the library's site is visited mostly by iOS devices, there is a link specifically for subscription database iOS mobile apps.

Limitations of the study

Analytics can provide multiple points of data, but there are gaps. Elizabeth Black mentions that usability tests provide more data about users rather than analytics alone (2009). Users may come and visit a particular page on a Web site, but data does not explicitly explain why they are accessing that information.

Separate analytics tracking for the mobile site has been enabled for both Piwik and Google Analytics. This will allow comparing metrics between the traditional desktop site with that of the statistics collected from the mobile site. For instance, separate analytics can reveal how many visitors use the desktop site using mobile devices, and what specific pages they are visiting.

ClickHeat is useful as supplementary information. On its own, ClickHeat did not provide information that couldn't be found in other analytics systems. Tabatha Farney notes that it is more useful when used in conjunction with another analytics tool (2011). ClickHeat's graphic interface can also be problematic for dropdown menus or switchable tabs within library Web pages. One example is that there might be a collection of clicks on a section of a Web page that contains no links. However, opening a cascading menu or switching a tab can produce the links that are initially invisible. This can cause confusion on what was clicked or not. Having analytics available, or a usability study, to compare such scenarios can help administrators make data-informed decisions.

Another consideration to take into account is that statistics may not be accurate. Based on our GA network provider data, we can infer that the majority of users (67%) come from within the library through shared public workstations. However, these statistics on the actual number of users may be under-reported. Multiple users who are using the same workstations within the library are counted as single users since analytics software records individual IP addresses. Additionally, the workstations use a computer reservations system that is configured so cookies are cleared from the cache daily instead of between user sessions. This contributes to inaccurate visitor information (e.g., returning visitors).

Discrepancies among analytics programs should also be expected. For instance, over the course of the fall 2012 semester, Piwik recorded that over 16,000 users using the college network visited the site. GA, on the other hand, reported over 66,000 visitors. This large disparity may be the result of a wide range of variables. This may include devices and/or users that don't enable JavaScript or cookies, the use of multiple browsers on a single workstation, bots and crawlers spoofing their user agents as real browsers, or a combination of these events. With that in mind, it may not be possible for analytics programs to be entirely exact or accurate.

Lastly, as mentioned before, Web analytics and metrics only show part of the picture. To fully understand the needs of mobile users, other data, such as usability testing, focus groups, and surveys, are needed. These forms of input should be frequently conducted to keep up with both users' expectations and the constant flux of mobile technologies. Future usability testing is planned for the library's mobile Web site.

Conclusion

Institutions that are initially developing mobile sites can find value in analytics information gathered from their traditional, desktop websites. Multiple points of analytics collection from Google Analytics, Piwik and Clickheat, can show generalized details about library Web site visitors. Data collected from these sources may not be necessarily consistent, yet can be used as a foundation to make educated decisions on the design of a mobile web interface.

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