Altmetrics and analytics for digital special collections and institutional repositories

Stacy Konkiel¹, Michelle Dalmau², David Scherer³

¹Altmetric, London, n1 9xw, United Kingdom ² Digital Collections Services, Indiana University Bloomington Libraries, Bloomington, IN, 47405, USA, ³Scholarly Publishing Services, Purdue University Libraries, West Lafayette, IN, 47907, USA

Introduction
This white paper describes uses for usage statistics, altmetrics, and other quantitative and qualitative impact metrics in the context of services for digital special collections (DSCs) and institutional repositories (IRs) stewarded by academic libraries¹. First, we articulate a problem statement, which describes the current state of metrics. We then outline recommendations for how libraries can leverage usage statistics and altmetrics to measure the value of their IR and digital special collections and prove their worth to stakeholders. Finally, we discuss further work related to retroactively implementing metrics into existing digital repositories.

¹ Much of the content outlined in this paper was realized during the Determining Assessment Strategies for Digital Libraries and Institutional Repositories Using Usage Statistics and Altmetrics working session held as part the Digital Library Federation (DLF) Forum in 2013. The session brought together librarians, technologists, and other library professionals to identify areas of commonality in how we measure our collections across various digital collections and IR platforms. The authors are indebted to working session participants, whose insights helped shape this paper.

Contact Stacy Konkiel at stacy.konkiel@gmail.com.

Published 2015 via Figshare. http://dx.doi.org/10.6084/m9.figshare.1392140
Table of Contents

Problem Statement
  What do we measure?
  Why do we measure?
  Who are we measuring impacts for?
  How are we measuring impact?
    Quantitative metrics
    Qualitative measures
  Limitations of our current metrics

Recommendations
  What should we measure?

Types of Metrics & Their Uses
  Quantitative metrics
  Qualitative measures

How to collect metrics
  Timing
  Tools for collection

Future Work

In Conclusion

Acknowledgements

References

Appendix: Examples
Problem Statement
This paper comes at a time when conversations about measuring research impact are increasing in number and complexity at many universities. As information experts, librarians are increasingly being named as on-campus resources for researchers and administrators interested in learning about and using research metrics. And yet we rarely use research metrics ourselves outside of collection development, even for IR and DSC content, whose impact might be easily quantified.

In this section, we outline what is being measured, libraries’ reasons for assessing their IR and DSC collections, the current state of the art for measuring the value of our digital holdings, and discuss those metrics’ strengths and limitations.

What do we measure?
Digital special collections and institutional repositories each contain different types of content that is measured (both in terms of use and quantity) in a variety of ways. Here, we briefly describe the content that is being measured; below, in the “How we measure” section, we discuss the various metrics currently in use.

Digital special collections
For digital special collections, we often track metrics for both digitized objects and descriptive information related to those objects, including:

- Compressed and uncompressed versions of images, videos, and audio files;
- Text files (available in XML, PDF, and HTML formats);
- Descriptive information about the object captured in a variety metadata standards; and
- Contextual information about an object or a collection described in accompanying essays, timelines, and visualizations.

Institutional repositories
In institutional repositories, on the other hand, we usually track metrics only for the content that we host, which often includes:

- Scholarly publications (pre-print, post-print, and publisher versions),
- Conference Proceedings,
- White Papers & Technical Reports,
- Software,

---

2 Digital special collections are for the purposes of this paper the software and related services that allow for the archiving and dissemination of digitized archival and special collections materials. Digital special collections are primarily stewarded by libraries and other cultural heritage organizations, though on occasion individual scholars may create collections that function similarly (particularly in the case of the digital humanities).

3 Institutional repositories may be defined as the software and related services that allow for the archiving and dissemination of individual institutions’ research outputs (journal articles, working papers, data sets, software, posters, slides, and more). Institutional repositories are often administered by libraries.
Datasets (binary files, sometimes streaming media), and
Conference Posters and Slide Decks.

Why do we measure?

Demonstrate value
Often, we measure our collections to prove their value to stakeholders, including donors, faculty, and library and university administration. With the tightening of belts across academic divisions, libraries also use metrics to document the “ROI” of staff hours and collections dollars (Mays, Tenopir, & Kaufman, 2010; Dinkins & Kirkland, 2006). Metrics are also used to persuade stakeholders of the value of Open Access collections (Plum Analytics, 2014), in an effort to change university policy and researchers’ personal publishing practices.

Existing approaches to track the impact of DSC and IR content sometimes assemble important information about how content is being used and (to some extent) by whom. We need to extend the metrics we track to present a more complete and compelling story of scholarly and popular use of library-hosted digital content, which can be framed as a story of impact and reach for a particular article, item, or collection.4

At an institutional level, “popular” metrics (tweets, Facebook shares, mainstream media mentions, etc) can be appreciated in terms of public relations, especially for land grant institutions with a public mandate. It may be difficult for library administrators to see the value in popular metrics beyond marketing, but item-level metrics are ever more important today for scholars and, to some extent, academic departments as scholarly exchanges are increasingly taking place via online networks, including social media platforms (Lavoie et al., 2014).

Digital special collections in particular can have value to the public, beyond their use for research and scholarship. Many collections are reused by the casual reader in ways that can leave traces of impact like unexpected references to the source collections on the Web in the form of memes, “fan” websites, and other “pop culture” formats. It is important that we measure how our collections are used and referenced “in the wild,” by researchers and the general public alike.

Decision making
Metrics are used every day by libraries to determine how collection development budgets are administered, whether new staff are hired to support particular areas of study, and what monographs or journals are worth keeping versus deaccessioning. Our dependence on metrics to make important decisions naturally extends to IR and DSC administration.

Early on, institutional repository managers understood the importance of usage data, especially content counts, in managing collections. Metrics could be used to deaccession or make decisions about moving little-used content from hard disk/server storage to “cold” or

4 Institutional repositories already tracking user testimonials include Harvard University and University of Kansas. For more information and other examples, see the Appendix.
tape storage (Digital Library Federation Forum Working Group Session Notes, 2013). IR depositors also use usage data to understand interest in and impact of their deposits.

In addition, metrics are used to monitor user experience and improve the functionality of library web sites for DSC content (Dalmau & Hardesty, 2008). Metrics can also help plan for future digitization projects (Digital Library Federation Forum Working Group Session Notes, 2013).

Who are we measuring impacts for?

Tracking, collecting, and analyzing metrics become more meaningful once we understand the stakeholders that may use these metrics. Identifying stakeholders can be a daunting task when libraries publish a significant percentage of open-access digital content that can be accessed by the entire world and work with a diverse set of audiences and stakeholders.

Below, we provide examples of various stakeholder groups and they might use the metrics we collect. Note that your institution’s stakeholders may differ, based on your library’s mission, mandates, and the content that you publish.

**Scholars**

Scholars often use metrics to make a case for tenure and promotion or in grant and job applications. Metrics related to their content stored in IRs may be a part of such cases. Scholars may also use metrics to evaluate DSC and IR content, when deciding whether or not to download, cite an item, or otherwise reuse it.

**Students**

Students may also find IR and DSC metrics useful for professional purposes. For those that have deposited work such as a capstone project or thesis in a repository, metrics can help that student demonstrate interest in their scholarship—a useful tool in the academic job and grad school application process. Library and information science students who have contributed to digital collections as interns or hourly workers could benefit from metrics that can demonstrate the value of the metadata, markup, and scanning they have done.

**Educators**

Educators may use metrics to understand how their own IR content (learning objects, in particular) is being used. They might also use metrics to teach information literacy concepts, when teaching students how to identify and evaluate potentially high-quality IR and DSC content like datasets, theses, etc.

---

5 Few studies have been done to date on the reasons why different audiences use metrics for scholarly content, so the use cases we provide below should be taken with a grain of salt. The authors intend to update this section with appropriate references as such studies are published.
Librarians & Archivists

Librarians and archivists might use metrics to help make decisions on IR and DSC content to deaccession or invest in. Metrics can guide library outreach and promotion efforts, helping to market DSC content in particular to new audiences, scholars, and even donors. Metrics can also be useful when building a case to library or university administration for increased DSC and IR resources. Patterns of use may indicate ways to capitalize on public engagement for projects like crowdsourcing metadata or transcription.

Library Administrators

Similarly, administrators may use metrics to make decisions on how to allocate resources, particularly to justify costs of building and sustaining an IR or DSC. Metrics can also be a handy way to demonstrate value to funders, whose grants often enable libraries to digitize collections and build critical IR and DSC infrastructure.

University Administrators

University administrators may use IR metrics to determine compliance with national open access mandates (wherein researchers are required to make their work available to the public in OA repositories).

Funders

Funders may use metrics to determine the impact of research they fund⁶, as well as the success of their overall funding initiatives. Some such as the Higher Education Funding Council for England (HEFCE) are also considering using metrics to evaluate universities for the purpose of allocating funding.⁷

How are we measuring impact?

In this section, we describe the ways in which many IRs and DSCs currently measure the impact of their collections. Further on, we discuss additional recommended metrics.

Quantitative metrics

Usage statistics and content-related metrics were historically the core metrics tracked by DSCs and IRs. It’s worth noting that at many institutions, such tracking is not happening systematically nor transparently enough.

Usage statistics

Usage statistics include, but are not limited to, page views, downloads, search queries and other data related to the access of content in an IR or DSC. Usage statistics were once the sole domain of system administrators, pulled from server logs and often only accessible from the command line. Usage data has historically been kept hidden from public view (particularly in DSCs), though more and more repositories and digital collections are beginning to publicly report download and pageview statistics by default.

---

⁷ [http://www.hefce.ac.uk/whatwedo/rsrch/howfundr/metrics/](http://www.hefce.ac.uk/whatwedo/rsrch/howfundr/metrics/)
**Platform based usage statistics**
Many IR platforms track usage statistics “out of the box” (Konkiel & Scherer, 2013). Pageviews and downloads are commonly reported on publicly-facing report pages, while systems track and privately report other useful information (top search queries, unique visitors, etc) to system administrators or individual authors.

**Web logs and Google Analytics**
Both IRs and digital special collections tend to keep and reference web logs and Google Analytics data. We often use these systems to patch together unique reports tailored to the “system specificities” of our collections and cyberinfrastructure (for digital special collections) or tailored to the needs of administrators and other stakeholders (for IRs). Some examples of useful metrics that can be sourced from web logs and Google Analytics include: operating systems and devices used to access content; time-based metrics (to be used internally to optimize server maintenance times); landing pages for most popular content; and collection-level usage statistics.

**Content-related statistics**
Content-related metrics report on the amount of files in a DSC or IR system and their characteristics (file size, format, color profile, etc).

Wacha & Wisner (2011) report that often, open access IRs use collection size to assess the value of an IR’s holdings, rather than usage data.

Digital special collections content statistics are often focused on the “repository” or “workflows,” including the total number of objects in a collection, file types, characteristics of metadata, benchmarking, and so on.

It’s unclear whether or not these metrics are useful for assessing the *impact* of content; it’s the perspective of the authors that these metrics are instead mostly useful for preservation, maintenance, and collection development tasks.

**Qualitative measures**
Many qualitative measures for the use of content in IRs and DSCs are based on interviews and ethnographic usability studies about patrons’ use of these systems (Covey, 2011; Russell & Day, 2010; Kim & Kim, 2008; Westell, 2006; Jeng, 2005; Cunningham, Reeves & Britland, 2003).

Quotes from users and, often, themes to user feedback are also often collected in an ad hoc manner, as users contact collection administrators to request reuse permission for content found in DSCs and IRs.

Whether or not content appears in syllabi (and if those syllabi are from courses held at the same institution as the DSC/IR that hosts the content) is also sometimes used to demonstrate the educational value of DSC and IR content.
Limitations of our current metrics

Lack of context
Currently, neither DSC or IR metrics are able to capture the context surrounding consumption and reuse. For the most part, we do not know who is using our content, nor for what purposes—though at least one study has shown that it is possible to create narratives based on server log and usage data (Angelo, 2013).

Our current metrics also lack context in that we do not yet have sets of metrics that can help librarians gauge the varied types of significance that collections may have. “Hits” alone do not always convey value; we need to enhance our current use of metrics—and perhaps find new metrics—that can help us better pinpoint the value of DSC and IR content. One suggested way to do so would be to find metrics or qualitative measures that help us understand the unique ways that scholars and the public use and benefit from our content, similar to the manner that researchers have been able to find “flavors” of impact for STM literature by measuring the correlations of particular types of metrics (Priem, Piwowar & Hemminger, 2012).

Gaming
How can IRs and DSCs record meaningful statistics if we are unable to better detect and prevent the “gaming” of usage statistics? In the case of IRs in particular, depositors may artificially inflate download and pageview metrics in order to fake the value of their deposits. (There is little evidence that such gaming is currently an issue, however.) They may do this either purposefully or inadvertently (for example, by tweeting out links to their own work to share it with others, or by viewing their own work in an IR to get updates on download and pageview statistics).

Gaming can be achieved by both manual (repeated human-initiated requests) and automated means (repeated computer initiated requests, often achieved with the help of “bots”). Gaming is currently less of a concern to DSCs, which tend to worry more about the effective filtering of robots that are deployed to index DSC content (more on this below).

Ways to correct “gamed” metrics include banning the IPs of potential gamers and bots, using altmetrics reporting services like Altmetric that account for self-tweeting and other types of self-promotion (Adie, 2013), and in the case of social media metrics making available the underlying, qualitative data, so users can see exactly who is tweeting, blogging, citing, and bookmarking IR content.

Filtering out the noise
Both IRs and DSCs face the challenge of filtering out hits and queries for content initiated by “spiders” and institutional testers. Crawlers can be identified, but mass downloaders are harder to identify, as they change IPs frequently. Browser caching and dynamically assigned IPs can also make counts inaccurate and make it harder to profile and track our users.
Multiple http requests for a single page (where “hits” occur for web page graphics, css, external javascript files, etc) sometimes can inflate metrics for digital collections, in particular.

Associating multiple versions of an item & means of access

An additional challenge to creating reliable metrics for both IRs and DSCs is that multiple versions of content often exist: for a single image within a digital collection, that could be the image’s thumbnails, low-resolution copies, high-resolution copies, and preservation-ready “master” files; for IRs, that could a journal article’s pre-print or post-print (hosted by the IR, subject repository, or author’s website) and the publisher’s version (hosted by the publisher).8

Institutional culture & other influencers of attention

The promotion of collections, especially unique resources, impact those collections’ metrics. Marketing and outreach in particular have an important effect on the attention that digital library collections receive, yet each institution’s ability to perform marketing, outreach, and SEO optimization on collections differs, making cross-institutional comparisons difficult.

Institutional cultures of assessment are important to consider. Many institutions do not have assessment practices beyond ad hoc ones, or have not adopted existing common and best practices. Creating longitudinal sets of metrics for a long-term view into the impact of a collection is crucial, but not practiced consistently.

Recommendations

This section of the report proposes important metrics to capture, methods for collecting metrics, and guidelines for how to leverage metrics when reporting impact. In addition, we provide some related resources that can provide further guidance on implementation and integration of the metrics.

What should we measure?

In addition to the commonly used metrics identified above—which can be very valuable for IR and DSC assessment—libraries should consider adopting the most famous traditional scholarly metric: the citation. Citations can uncover the scholarly attention that digital materials receive. They can be be sourced from popular databases like Scopus and Web of Knowledge, or from platforms like PubMed, Google Scholar, and CrossRef. Citations are much easier to track when permanent identifiers like DOIs are available for content and, of course, used by whomever is citing DSC or IR content.

---

8 University of Kansas IR staff attempt to associate content through metadata enhanced during the submission workflow, where official citations and DOIs are added if they exist (Digital Library Federation Forum Working Group Session Notes, 2013).

9 A good primer on the many reasons that scholars cite can be found in Cronin, Blaise. 1984. The Citation Process: The Role and Significance of Citations in Scientific Communication. London: Taylor Graham.
Altmetrics cull metrics from the social web related to sharing and reuse of scholarly content\textsuperscript{10}, usually using APIs. They can shed light on the various audiences for DSC and IR content (the public, policy makers, educators, etc). Because they are reported directly from the source, they accumulate quickly. They are often combined with citations and usage statistics\textsuperscript{11} when reported out through third-party services like Altmetric.com\textsuperscript{12} and PlumX\textsuperscript{13}.

These services also collect links to mentions on social media in one place, so the end user can discover conversations surrounding a particular paper or item.

Beyond raw counts, context is often required to understand the impact of scholarship. (Who is interested and why? Are they a scholar or a member of the public? Are they using a University Archives photograph or pre-print of a physics paper?) We need to augment text mining and content analysis techniques (as Altmetric.com does\textsuperscript{14}) to parse context.

Context is also important in terms of longitudinal use. While some collections may see a short spike in popularity, others garner incremental interest over the years, and could be said to have greater impact in the long term.

Context should be easy for both librarians and end-users to understand, especially if collection and item metrics are made publicly available. Ways of adding context include listing clearly displayed:

- Percentiles (“This image has 291 views. That’s more than 97% of other images in this collection, and 76% of all images held by the University Libraries’ Digital Collections”)
- Demographic information (“Of the 9,815 views this video has received, 25% are from users in the US, 17% are from users in the UK, and 58% are from elsewhere in the world.”)
- Data collection parameters (“Download and pageview metrics have been collected since the item’s deposit on 17 June 2012. Twitter mentions have been collected since September 30, 2013. Blogpost mentions have been collected since September 30, 2012, and include only posts that occur on the ResearchBlogging network.”)

To summarize: where possible, libraries should display DSC and IR citation metrics and altmetrics alongside their important contextual information.

\textsuperscript{11}Usage statistics usually refer to any measurement of viewing and consumption that is captured by server logs and reported by automated means. Often, usage statistics is shorthand for downloads and pageviews. \textsuperscript{12}http://www.altmetric.com/
\textsuperscript{13}https://plu.mx
\textsuperscript{14}http://www.altmetric.com/blog/new-features-enriched-context-for-altmetric-scores/
Types of Metrics & Their Uses

Below we present various types of metrics organized by their quantitative and qualitative characteristics. We do not intend to dichotomize these characteristics, but instead encourage a combination of both approaches. Caveats for capturing the different types of metrics exist and are highlighted below.

The list below is not comprehensive, but instead reflects metrics that are commonly used and easily tracked, and which can be used to measure impact among various types of audiences.

Quantitative metrics

Quantitative metrics are arguably easier to capture, and though they may not be fully indicative of how items are consumed, they are indicative of interest. Furthermore, by combining traditional web analytics with altmetrics, a fuller picture of end user consumption can be surfaced as evidenced by peer recommendations (shares), bookmarking or bibliographic compilation (saves), and number of comments.

**Page views** are commonly tracked in analytics software, and are often valued as impressions. The duration of time spent on a given page may reveal clues about engagement. Tracking visit duration along with page views may provide additional information regarding content consumption, but this information could be skewed by multitasking, tabbed browsing, and bandwidth issues. Time spent on a site, though more compelling, is fundamentally flawed since most analytics software do not calculate the time spent on the last page viewed. Transaction logs and Google Analytics are excellent means to track this metric.

**Visits**, especially returning visits, are session-based metrics that track a user by IP and/or browser mechanisms (i.e., persistent cookies), and can provide some indication of engagement. Dynamic IPs, different people using the same computer, or one person using multiple browsers can impact data collection. Privacy implications of the use of cookies are a possible issue here. Transaction logs and Google Analytics are excellent means to track this metric.

**Referring sites** straddle the quantitative and qualitative realms in that a subset of referring sites serve as some indication of scholarly (i.e., Wikipedia and Google Scholar) or popular relevance (i.e., news outlets and reddit) that could be further traced for citations and references in context. Google Analytics reports referring sites well.

**Downloads** are another common metric for tracking use especially in the context of IRs that convey, at the very least, that items are being successfully exposed in the broader Web. In some ways they are akin to circulation counts, which have historically been regarded as an important metric of use for libraries. Possible issues with tracking downloads are not necessarily related to accuracy of numbers, but ability to actually track the items that are being downloaded. This is particularly problematic for digital special collections that are
stored in digital object repositories, but are referenced via persistent URLs (PURL).

Server transaction logs and Google Analytics can track downloads. A common misconception is that Google Analytics cannot be used to track download statistics for content, but some in DLF Working Session group had configured the platform to do just that (Knowles, 2012). The COUNTER guide to implementing auditable download metrics is useful for more information\(^{15}\).

**Direct links** are incredibly important to track since a significant amount of scholarly communication happens via email in which links are shared\(^{16}\), and we should also take into account links typed directly in the browser. (Admittedly, in the age of Google that behavior is less and less likely to occur.) To a limited extent, direct links may be trackable in Google Analytics.

**Shares** are the crux of social media and provide a powerful mechanism for circulating content across a vast network of people. While sharing content does not always mean the content has been viewed or read, the act of sharing increases the chance of consumption. The act of sharing can signal implicit endorsement of the content being shared\(^{17}\). Altmetrics aggregators are well-equipped to track shares on social media.

**Saves, Favorites, and Bookmarks** can capture the endorsement of or interest in a given item. In the case of saving items to a reference manager (i.e., Mendeley and Zotero), the act of building a bibliography of sorts can be indicative of the value of the item saved. Altmetrics aggregators are well-equipped to track saves, favorites, and bookmarks on social media.

**Adaptations** relate to the creation of derivative works -- new research or creative works based on existing images, data, research, software, etc. Tracking adaptation is difficult to do, even in systems that provide mechanisms for doing so (forking in GitHub, etc). For example, while some GitHub users may fork code or data directly on GitHub--which would create a "forked" indicator so the original creator knows that the code has been adapted--but others might download the code in order to adapt it privately, on their desktop. And the problem is larger for works like images, videos, and other digital library content that requires end users to manually offer attribution--what if they don’t? Altmetrics aggregators can track some adaptations, as can thoughtfully constructed Google Alert/Mention search queries.

**Requests for hi-res DSC content**, submitted via automated means, could be an indicator of later citations or reuse and adaptations. Further study is needed. These are usually collected

---


\(^{16}\) See Alexis Madrigal’s “Dark Social” article for more contexts in which web content is shared in ways that are not easily tracked: [http://www.theatlantic.com/technology/archive/2012/10/dark-social-we-have-the-whole-history-of-the-web-wrong/263523/](http://www.theatlantic.com/technology/archive/2012/10/dark-social-we-have-the-whole-history-of-the-web-wrong/263523/)

\(^{17}\) [http://www.danah.org/papers/TweetTweetRetweet.pdf](http://www.danah.org/papers/TweetTweetRetweet.pdf)
on an ad hoc basis, as they're often submitted via email. In DSCs where the request process is automated, Google Analytics and transaction logs may record this information.

**Citations** help us understand the use of our DSCs and IR content in a scholarly context, particularly when cited in books and journal articles. Citations to DSC and IR content can be difficult to uncover, however, as it's unclear to what extent common citation indices like Scopus and Web of Science can create citation reports for libraries and institutions, like they do for individual authors, or for digital content that isn't a book, book chapter, or journal article.

**Visitor demographic information** is another quantitative metric of interest to libraries. Demographic information like age and user interests can be sourced from third-party services like Facebook or Google (which are sometimes used to allow visitors to login to library websites), from IP addresses that help determine users’ location, or even from library-administered surveys. For example, we can use demographic information to determine if Indiana University's William V.S. Tubman Photograph Collection\(^\text{18}\) is being visited by users from Liberia. There are obvious privacy implications to tracking visitor's demographic information.

**Qualitative measures**

Qualitative metrics require a more personal engagement with a user, or a closer look at usage patterns and themes that may emerge as a result of applying coding or content analysis or a similar methodology for qualitative data analysis.

**Mentions** can be as informal as a "shout-out" or as formal as a citation, though in either case the mention may not be constructed in easily traceable ways (i.e., resolved URL). In venues where mentions are more easily tracked and aggregated like Twitter and Wikipedia, they can be harvested to better understand context: what is being said about a particular item? And who is involved in the discussion?

Mentions have a huge potential for understanding impact, but are harder to trace as they can be appear in the wild web in many forms: course syllabi, blog posts, policy documents, and news articles. Google Alerts (free) and fee-based services like Mention provide ways for gathering information about an item, project or person of interest. Altmetric gathers mentions that occur in policy documents and mainstream media.

**Reviews or comments** provide another avenue for determining impact. Again, the number of comments do not matter as much as the nature of the review or comment. In addition, the reviewer or commenter becomes equally important in the content analysis\(^\text{19}\). To a limited

---

\(^{18}\) The Tubman Collection is part of the larger Indiana University Liberian Collections. It contains photographs from the administration of the former president of Liberia, William Vacanarat Shadrach Tubman. More at [http://webapp1.dlib.indiana.edu/images/splash.htm?scope=lcp/tubman](http://webapp1.dlib.indiana.edu/images/splash.htm?scope=lcp/tubman)

\(^{19}\) Identity verification systems like this ORCID plugin for Wordpress comments might help: [http://pigsonthewing.org.uk/orcid-plugin-for-wordpress/](http://pigsonthewing.org.uk/orcid-plugin-for-wordpress/)
extent, altmetrics aggregators can collect this information in the form of blog posts, blog comments and Twitter mentions.

**Reference inquiries** regarding digital content published by Libraries should be factored into assessment as they provide a face to and a story about the research process beyond web analytics. They also create opportunities to follow-up with users to learn more about their research interests with respect to the digital resources a library publishes. Reference inquiries can be used to justify the allocation of staff time at the launch of collections, when questions from the public are likely to circulate. These are often collected and recorded on an ad hoc basis, as they're often submitted via email, telephone, or in person.

**How to collect metrics**

**Timing**

**For institutional use:** Though it's a time-consuming process, it can be useful to collect metrics at times that coincide with both annual, library-wide internal reviews and external reporting (like for ARL reports, LibQual statistics, and so on). That way, you can reuse the metrics collected for both purposes.

**For end users:** Delivery of content for user-facing stats should be immediate or, if manual intervention is required (such as to parse server logs for relevant information), regularly delivered and transparent, so users can understand what they are looking at and can evaluate the usefulness of those metrics accordingly.

**Tools for collection**

The following are some simple tips for getting started with data collection. A holistic evaluation framework that librarians might also find useful is JISC’s Toolkit for the Impact of Digitised Scholarly Resources (TIDSR).20

**Web server logs**

- Metrics reported: downloads, referring sites, visits, pageviews, limited demographic information.
- Be sure to export information at regular intervals, as consistent collection is important for longitudinal analysis.
- Web server log data often adhere to certain formats (Apache Custom Log Format, W3C Extended File Log Format, etc.) and can be processed and visualized for human consumption with the help of tools like Webalizer, AWStats, and Tableau (described below).
- The free software Tableau21 can help with web server log analysis, grouping, and visualization by creating dashboards, user population assessment, usage over time (free, and stats are available publicly).

20 [http://microsites.oii.ox.ac.uk/tidsr/](http://microsites.oii.ox.ac.uk/tidsr/)
21 [http://www.tableausoftware.com/solutions/google-analytics](http://www.tableausoftware.com/solutions/google-analytics)
Institutional repository web interface

- Metrics reported often include download and pageview statistics, and sometimes referring links and the location of viewers and downloaders.
- IR web interface statistics are especially useful to repository administrators lacking the technical chops to retrieve and evaluate web server logs.

Google Analytics

- Metrics reported: downloads, referring sites, visits, pageviews, limited demographic information.
- Google Analytics has some dashboard functionality that’s useful for saving elements you want to review regularly. GA is also useful for longitudinal analysis, showing big trends in traffic and use.
- For digital collections: Szajewski (2013)\(^\text{22}\) has written an excellent guide to using the tool to measure the impact of digital special collections.
- For repositories: A good guide to using Google Analytics for measuring the use of institutional repository content can be found in a 2013 presentation by Durrant & Coates\(^\text{23}\)

Altmetrics aggregators: Altmetric & PlumX\(^\text{24}\)

- Metrics reported: Shares, saves/favorites, adaptations, mentions, and some other quantitative and qualitative data sourced from the social web. For full lists of each service’s metrics, visit their websites\(^\text{25}\).
- These services collect data from across the web related to any scholarly outputs, which can be displayed in embedded badges (free from Altmetric) or widgets (with paid subscription from PlumX). Both are well-equipped to handle institutional repository content. Their applications for digital libraries haven’t yet been widely explored.
- Altmetric collects altmetrics for any content in an institutional repository or digital special collection. For institutional repository items that have multiple versions stored elsewhere (i.e., the publisher’s “version of record” of a journal article stored on the publisher site, plus the author preprint stored on the repository), the reports it generates include both metrics for the preprint in your repository as well as metrics related to the publisher’s version on the journal website.
- PlumX tracks altmetrics for repository content and as well as repository download and pageview statistics in the PlumX dashboard and widget. As of publication time, parent

\(^{22}\) [http://practicaltechnologyforarchives.org/issue1_szajewski/](http://practicaltechnologyforarchives.org/issue1_szajewski/)

\(^{23}\) [http://connect.ala.org/files/Durrant%26Coates_2013_LITAFortum_DataRepoWebAnalytics_0.pdf](http://connect.ala.org/files/Durrant%26Coates_2013_LITAFortum_DataRepoWebAnalytics_0.pdf)

\(^{24}\) We are not including non-profit altmetrics service Impactstory in this report as Impactstory does not provide services for repositories, nor does it report IR and DSC-sourced metrics (download and pageview stats, etc). Impactstory does however make its open source code available for use and adaptation by libraries. The code and documentation can be found here: [https://github.com/total-impact](https://github.com/total-impact)

company Plum Analytics had not confirmed whether their tool is equipped to track
digital special collections.

- Both aggregators provide important qualitative data behind the numbers they report,
  although to varying degrees. For example, in addition to seeing that items in your
  repository have been mentioned 17 times on Wikipedia, you can also see exactly what
  has been written about them. However, PlumX does report some metrics that do not
  have the underlying qualitative, auditable data available for review.
- Examples of repositories that use Altmetric and PlumX data can be found in the
  Appendix.

Altmetrics data via social media APIs

- It is also technically possible for IRs and DSCs to connect with individual social media
  platforms’ APIs to search for mentions of their content. This might be a good option for
  IRs and DSCs that do not issue permanent identifiers like Handles or DOIs; they could
  monitor social media sites for mentions of relevant URLs, instead.
- The main drawback to this option is the the developer time required to build
  customized solutions for each IR/DSC. It could possibly result in much duplicated
  effort.
- Another possible drawback are the limitations placed on search APIs by platforms
  themselves; for example, Twitter’s search API is typically restricted to fetching data
  from only the previous week, and the API’s rate limits restrict the retrieval of large
  amounts of data at once (Kinsley, 2014).

Qualitative data via Google Alerts/Mention26

- Track when your content has been shared on the web by setting a Google Alert or
  Mention alert for your:
  - digital library’s name
  - digital library’s base URL
    (http://collection1.libraries.psu.edu/cdm/singleitem/collection/amc/id/314/rec
    /1),
  - your repository’s Handle or DOI shoulder
    (https://scholarworks.iu.edu/dspace/handle/2022/9564 and
    http://hdl.handle.net/2022/9564; http://dx.doi.org/10.5061/dryad.pp67h and
    http://datadryad.org/resource/doi:10.5061/dryad.pp67h), or
  - special URLs created for collections
    (http://webapp1.dlib.indiana.edu/vwwp/welcome.do)
- For important collections, you might also want to set alerts for titles or names relevant
  to those collections (i.e. for Penn State’s “Advertising Trade Cards from the Alice
  Marshall Women's History Collection,” they might also set alerts for “Advertising Trade
  Cards” and “Alice Marshall”).
- Google Alerts is free to use; Mention is a subscription service.

26 https://en.mention.com/
Future Work

This report provides a foundation for developing best practices for assessment of digital content published by libraries that takes into account the current literature on the topic, anecdotal evidence collected by authors of this report, and the findings from the DLF Working Group on Determining Assessment Strategies for Digital Libraries and Institutional Repositories Using Usage Statistics and Altmetrics. We realize that further, collaborative work is required to address a number of issues, big and small, that were uncovered as part of the working group. Some of these issues were identified as follows:

1. **Standards/best practices**: Some have argued for a need for standards in collecting and displaying metrics depending on the audience and application. Others have pointed out that standards are difficult to achieve in an age when web services thrive and die in the course of months or years. Instead, the best practices with respect to the transparency of collection, calculation, and display of metrics--auditability--is key. Metrics and their implementation should be well-documented, and documentation should be easily understood by end-users. Any recommended practices or guidelines that are created--either at the institution level or for the entire field of digital libraries--should be organically created and updated regularly. Some initial suggested best practices are that metrics be:
   
   a. Transparently collected and displayed
   b. Auditable (in a manner similar to COUNTER metrics)
   c. Appropriate to the medium being measured
   d. Include context (via percentiles, demographic information, etc)
   e. Open data (freely available and thereby auditable and also available for reuse under as permissive a license as possible)

2. **Persistent identifiers**: Both IRs and DSCs deal with the issues of persistence (at the page level, object level, collection level, and repository/DSC level) and the many ways that various URLs can resolve. Adopting commonly used permanent identifiers, like DOIs, is recommended for their granularity, metadata portability, and usability and understandability on the part of end-users. Permanent identifiers should be incorporated into URLs, so the reuse of content on the social web and in scholarly literature can be more easily tracked.

3. **Standard citation formats**: Need for agreed-upon citation practices that take into account issues with persistence at the page and object levels, how persistent URLs resolve, and multiple versions of the same item.

4. **Creation of a community-wide knowledge base**: Need for a central, open, shared, and community-curated knowledge base in which use cases for metrics, methods for capture, reviews of web analytics and altmetrics tools and services and so on can be

---

referenced, and, in turn, augmented by library professionals involved in assessment of digital content. At least one of the authors (Stacy) suggests that this knowledge base only be implemented if: a) it's in a way that does not silo the content by putting it into a format or platform from which the content cannot be extracted in a reusable, machine readable format or, at the very least, copied and pasted into new venues; b) it is licensed CC-BY or CC-0 so there might be minimal restrictions on the reuse of said content; and c) anyone can edit the document without having to gain approval or belong to an institution to receive editing privileges (for example, avoiding a Shibboleth-based login systems that would require one to have an institutional affiliation in order to participate).^28

5. **Better mechanisms for tracking who accesses content**: A third-party login like Facebook or Google could provide much-needed demographic information that could enrich our own DL design and outreach. Privacy implications for such practices are many.

6. **Clear and open display of metrics for stakeholders**: Need to provide access to the metrics we collect to our various stakeholders, both via web services and APIs. Metrics should be displayed according to users’ needs; both alongside digital library items and also perhaps in custom, private dashboards, depending upon stakeholders’ needs.

7. **Align statistics tracking with larger practices, so as not to duplicate efforts**: Encourage alignment between consortial and member-based organizations statistical tracking like Association for Research Libraries^29 reports.

8. **Define “high impact” qualitative use**: Do we judge this by the use of our materials for the most social good? By the most (and most diverse) types of audiences? Would it be more “high impact” as in “relevant for end-users” if we used our ability to produce metrics and data-mine in order to offer suggested content (i.e., “Users who visited this illustration also liked the illustration by Dr. X.”). Work with subject experts to find meaningful qualitative measures relevant to the communities using specific collections or subject-related materials. An alternative might be to track users’ movements within our systems, so that we might be able to reverse engineer or divine meaning from their actions, which could then be used to iteratively build statements of impact of certain content^30.

---

^28 Stacy says, “Too often, libraryland likes to restrict access in the name of attempting to ensure information quality. We should take a page from the book of the Open Science community and create spaces where anyone can participate, regardless of affiliation or formal credentials. The peace of mind offered by creating a sanctioned, preservable space that’s supported by a centralized organization like DLF/CLIR can be improved upon by creating open wikis, collaborative documents, and the like that are regularly backed up to repositories like Zenodo.”


^30 In terms of useful metrics, many ideas were shared at the 2013 DLF Forum session. At Ohio State University, the IR’s user group communicated a need to develop metrics that communities can use to drive their own marketing initiatives, separate from Library-based outreach. Staff provided the group with statistics (after a good amount of cleaning) that the community identified as important: country of visits, number of item downloads.
9. **Research and define “flavors” of IR and DSC impacts:** “Impact” can be different for teaching materials vs. IR content vs. digital collections. There should be a different package of metrics for each of the different products we produce, a different suite of lenses through which to look at the impact of a resource. As one DLF 2013 session attendee pointed out, “We can’t just come up with one [metrics] ‘package’ and apply it to everything.” Measurements of impact need to reflect the needs of the community and the stakeholders therein, as stated previously.

10. **Determine whether the use of content-related statistics are useful for determining impact, and if so what relationship they have to altmetrics:** It’s unclear whether content-related metrics like collection size and characteristics are useful for the measurement of the impact of DSC and IR collections. It’s possible that these metrics may be more appropriately used for preservation and management purposes, instead. More research in this area is needed.

11. **Research and articulate privacy implications of tracking metrics for DSC and IR content:** self-explanatory.

**In Conclusion**

The proper use of altmetrics to better understand the use of library-hosted digital content is a pressing need, and the questions and solutions offered in this paper come at an important time. Currently, libraries know very little about how the digitized content they make available is being reused, and by whom.

Meanwhile, other stakeholder groups in academia (namely researchers, administrators, funders, and publishers) are increasingly calling for more and better quantification of the use of scholarship. New technologies and measurement frameworks are introduced regularly, and altmetrics services are improving our ability to understand the impact of scholarship. Libraries should learn from the work being done on altmetrics by other stakeholder groups, while making clear the distinctions between our own and others’ needs. This paper is a step in that direction.

It’s worth mentioning that in most library-related discussions related to metrics—including the 2013 DLF Forum working session we organized—librarians are uncomfortable articulating the usefulness of metrics for their own purposes, or making decisions about their use (or lack thereof).

At the 2013 DLF Forum working session, participants were wary of identifying specific types of metrics that they or their administrators and users could potentially find useful in an IR or digital collection. Much emphasis was put on the need to identify stakeholders other than librarians themselves and tailor assessment plans to their needs.

The authors both agree and disagree. If libraries are to deliver metrics that are meaningful to end users, we must work with stakeholders to identify their needs and build tools to meet
them. We must also strive to stay attuned to altmetrics technologies developed outside of the world of libraries, and leverage those technologies to meet our stakeholders’ needs.

But we disagree that librarians are not a stakeholder group of the same stature as other groups. Do we not also have a stake in determining the impact of the collections which we spend so many hours curating, describing, uploading, and preserving access to? Should we not track—and be able to speak proudly and confidently about—how widely used our collections are, by diverse user groups across many platforms, both scholarly and popular? As those who hold the purse-strings seek to cut “non-essential” library services that don’t meet that year’s Strategic Plan, is it not in our best interest to be able to provide evidence that showcases just how well we are in fact meeting that year’s Library Strategic Plan, as well as the University Strategic Plan, and so on?31

Part of our responsibility—to ourselves, to others in the profession, to our external and internal stakeholders—is to articulate our own needs (whether they are shaped by “common sense,” strategic plans, or professional responsibility towards “the common good”) and share them without reservation with other librarians, so we can identify commonalities and create a core suite of metrics and metrics-tracking technologies that serve specific purposes.

No one size fits all approach will work here. Indeed, librarians are accustomed to serving the long tail. However, we also have a terrible habit of believing that our universities and departments are special snowflakes and that no common infrastructure, metrics, etc will serve our users. It’s time to leverage our commonalities into a shared portfolio of community-supported best practices for collecting, displaying, and sharing quantitative and qualitative metrics that serve specific communities (which are more alike across institutions than they are similar to other departments at their own institutions), rather than constantly reinventing the wheel.

We hope that this white paper will be the starting point for the creation of widely adopted best practices for the use of metrics in digital libraries and institutional repositories, and also a tipping point for widespread incorporation of the display of metrics therein. Hard data is crucial to informed decisionmaking and demonstrating the value of our services to our funders, our users, and our administrators.

Acknowledgements

The authors wish to acknowledge open peer reviewers Ricky Erway, Sarah Potvin, Jennifer Vinopal, Anton Angelo, Ronaldo F. Araujo, Ernesto Priego, Jody DeRidder, Elizabeth Joan Kelly, and Amy Chen for their invaluable feedback.

31 The authors acknowledge that this argument in favor of finding “evidence” does a disservice to those fighting neoliberalism within the ever-more-corporatized higher ed environment that currently exists in the United States. However, we are pragmatists and—until we’re able to buck the trend—wish to give librarians the tools they need to understand their value and share it with others.
References


Appendix: Examples

Here, we’ve collected a non-comprehensive list of examples of institutional repositories and digital special collections that collect and display metrics—including altmetrics—for their content.

User testimonials

Some university libraries collect user testimonials related to their IR/DSC for internal use. Examples that were shared in anecdotes during the DLF 2013 working session include Harvard University and University of Kansas. Please contact IR/DSC librarians at those institutions for more information.

Altmetrics

As of 2014, only 9% of repositories collected and displayed altmetrics or citation metrics for their content. These repositories tend to source their altmetrics data from Altmetric and PlumX. Examples of repositories that use both services can be found below. For more information on connecting your repository to these services, visit their websites: PlumX, Altmetric.

The case for DSCs using altmetrics data is less clear cut. Altmetric offers a private altmetrics dashboard (via their Altmetric Explorer and Altmetric for Institutions apps) for many DSCs, including the Biodiversity Heritage Library. However, there are no documented cases of DSCs using Altmetric data in publicly-facing altmetrics reports. And as of publication, Plum Analytics had not responded to inquiries as to whether their data is in publicly- or privately-facing use with any DSCs.

Altmetric

There are over 70 institutions globally with Altmetric data embedded in their IR, including:

- IUScholarWorks repository (DSpace) https://scholarworks.iu.edu/dspace/
- Purdue University’s ePubs repository (and all other bepress Digital Commons-based IRs) http://docs.lib.purdue.edu/
- London School of Economics (Eprints) http://eprints.lse.ac.uk/37292/
- Cardiff University (Eprints) http://orca.cf.ac.uk/13208/
- University of Iowa (bepress Digital Commons) http://ir.uiowa.edu/psychology_pubs/6/

---


35 More information on Altmetric Explorer and Altmetric for Institutions can be found here: https://www.altmetric.com/institutions.php
• University of Queensland repository (Fez software)
  http://espace.library.uq.edu.au/list/author_id/81813

PlumX
• University of Pittsburg D-Scholarship repository (EPrints)
  http://d-scholarship.pitt.edu/19115/

Usage Statistics
Repositories
• bepress Digital Commons-hosted repository usage statistics are privately communicated to repository administrators and authors
• DSpace: IUScholarWorks repository (Indiana University Bloomington)
  https://scholarworks.iu.edu/dspace/handle/2022/17122/statistics
• EPrints: D-Scholarship repository (University of Pittsburgh)
  http://d-scholarship.pitt.edu/19115/

Digital special collections
• HumBox and other selected examples recorded in this report by Meyer (2011)37

Qualitative data
Digital special collections
• Indiana University’s “Charles Cushman Collection” featured on NPR38 - thanks to media monitoring powered by Google Alerts, collection coordinators were pleased to find out that NPR created an interactive exhibit in 2012, based on the collection’s photographs.

36 http://www.bepress.com/download_counts.html
38 http://www.npr.org/news/specials/2012/cushman/