

Chapter Title: Social Media Metrics as Indicators of Repository Impact

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Book Title: Making Institutional Repositories Work

Book Editor(s): Burton B. Callicott, David Scherer, Andrew Wesolek

Published by: Purdue University Press. (2016)

Stable URL: <https://www.jstor.org/stable/j.ctt1wf4drg.22>

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14 | Social Media Metrics as Indicators of Repository Impact

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and Daniel Beucke*

The altmetrics movement has introduced user counts generated from social media platforms as crowdsourced filters of the relevance of scientific content and thus as broader and timelier measures of research impact than citations (Priem, Taraborelli, Groth, & Neylon, 2010). Various altmetrics, or social media metrics as a particular subset, might be useful for repositories to measure the visibility of their contents on social media and bookmarking platforms complementing download and citation metrics. This is particularly true for preprint repositories because activity on social media can keep up with the acceleration of the publication life cycle: opposed to citations, social media activity is visible in real time right after online availability. For example, tweets to scientific papers have been shown to peak shortly after online availability (Eysenbach, 2011; Shuai, Pepe, & Bollen, 2012). Thus, a significant share of Twitter activity is assumed to reference the preprint version in the repository rather than the published version in the journal of record (Haustein, Bowman, Macaluso, Sugimoto, & Larivière, 2014). Hence, repositories may be in an especially advantageous position to use altmetrics; however, altmetrics are not widely provided by repositories yet. Studies from Germany, Austria, and Switzerland have shown that out of 173 investigated repositories only one offered altmetrics as a value-added service (Kindling & Vierkant, 2014). This is likely to change as new tools and new services are being opened to help repositories integrate altmetrics. This chapter will provide an overview of various social media metrics and discuss possibilities and challenges in applying them in the context of online repositories.

THE VARIOUS TYPES AND SOURCES OF SOCIAL MEDIA COUNTS

In an environment where research is constantly being monitored and evaluated to optimize it, citations have come to play a substantial role in scholarly communication. Citation counts have often become a synonym for research impact and quality and are being used in funding and hiring decisions as a quick and simple way to obtain information about the impact and quality of earlier research and to provide a supposedly more objective substitute for peer assessment. This trend has caused protests in the scientific community to reduce the excessive use of simple and flawed citation indicators such as the h-index and the impact factor (see, for instance, the San Francisco Declaration on Research Assessment, DORA, at <http://am.ascb.org/dora/>), and also paved the way for altmetrics as a way to include other, broader forms of impact (e.g., bookmarks, online mentions and discussions, likes and shares) and output (e.g., blog articles, software, code, presentations). Some of these metrics have been shown to have at least some potential in measuring academic interest, impact, or attention from the general public, while others reflect mere online visibility. The term *altmetrics* is frequently used as an umbrella term that covers many different online sources for metrics about various scientific activities and products, but—since it is derived from “alternative metrics”—it is probably not a good name (Rousseau & Ye, 2013) for the new metrics, as it has already been shown that they do not provide an alternative to citations but rather are complementary (Costas, Zahedi, & Wouters, 2014; Haustein, Larivière, Thelwall, Amyot, & Peters, 2014; Haustein, Peters, Sugimoto, Thelwall, & Larivière, 2014; Thelwall, Haustein, Larivière, & Sugimoto, 2013).

Some altmetric data aggregators such as Impactstory and PLOS Article-Level Metrics (ALM) have introduced ad-hoc classifications of different social media platforms into types of impact (viewed, saved, discussed, recommended) onto different audiences (scholarly vs. general public). However, we refrain from a classification of social media metrics based on usage and audience type because we think that this approach is too simplistic. Tweeting a link to a scholarly article, for example, might range from plain diffusion of bibliographic information in the manner of an RSS feed or content alert to an in-depth discussion of an article’s results by either a group of scientists or the general public. Since so far qualitative studies investigating the particular user behavior behind the counts are lacking—that

is, identifying “tweeter motivations” parallel to “citer motivations”—we describe different types of platforms currently used for social media metrics, focusing on the most common sources: blogs, microblogs (Twitter), and social bookmarking (Mendeley).

Research Blogs

As scholarly blogs have been shown to be important in scholarly communication, at least for some researchers (Kjellberg, 2010), they could be an important source for altmetrics. It has been shown that the mentions, or the so-called blog citations, scientific articles receive from blogs can in fact predict future citations (Shema, Bar-Ilan, & Thelwall, 2014). It is, however, very difficult to monitor and aggregate the information from thousands or perhaps even millions of blogs that would be required to conduct analyses going beyond a small sample of articles or journals. Altmetric.com attempts to do so by automatically tracking mentions for a manually curated list of blogs. Based on this list, less than 2% of recent journal articles get mentioned in research blogs (Costas et al., 2014; Haustein, Costas, & Larivière, 2015), which is to be expected given the selectivity and effort involved in blog posts in contrast to other social media metrics.

Microblogs

Twitter has been shown to be one of the largest social media sources of scientific journal papers (Thelwall et al., 2013), and data from it are accessible with relative ease, given that tweets are constantly harvested through Twitter’s Application Programming Interface (API). After an early study based on as few as 55 papers of the *Journal of Medical Internet Research* stating that tweets serve as an early indicator of citation impact (Eysenbach, 2011), more recent large-scale and systematic studies show that the correlations between tweet counts and citations have been very low or nonexistent (Costas et al., 2014; Haustein et al., 2015; Haustein, Larivière et al., 2014; Haustein, Peters et al., 2014). The scientific articles mentioned on Twitter have often reflected popular generic topics and curious titles and represent “the usual trilogy of sex, drugs, and rock and roll” (Neylon, 2014, para. 6), suggesting that the attention gained and created on Twitter mainly comes from the wider, general audience (Haustein, Peters et al., 2014). In other countries, other microblogging platforms are important, such as Weibo in China.

Social Bookmarking

Social bookmarking counts were among the first altmetrics before the term was even invented (Taraborelli, 2008). Supported by medium to high correlations, they are those of the new metrics most related to citations, which is to be expected given the academic user group compared to social media tools like Twitter. In fact, as social bookmarking has become an important part of the scholarly communication life cycle at least for some researchers, social bookmarking and reference manager counts might be most suitable as early indicators of citations. Mendeley is the prominent source of altmetrics data because of the availability of data; a technical dependency is, in fact, prevalent in all altmetrics. Other earlier tools such as CiteULike, Connotea, and BibSonomy (Haustein & Siebenlist, 2011) do not have actual relevance anymore because they could not accumulate the critical mass needed to be considered useful resources. Zotero could become an alternative source for reader counts, as they have announced that they will provide data via an API soon. Mendeley has shown moderate to high positive correlations with citations, indicating an academic interest (Haustein, Larivière et al., 2014; Li, Thelwall, & Giustini, 2011; Mohammadi & Thelwall, 2014; Mohammadi, Thelwall, Haustein, & Larivière, 2015). However, correlations are not high enough to consider Mendeley reader counts as alternatives to citations. There seems to be a higher focus on methodological papers, and also more general science papers have more readers than citations. Social reference/bookmarking counts seem promising as a metric that can reflect academic interests more broadly and slightly earlier than citations, although it is not yet clear how representative Mendeley is for the entire readership of scientific papers.

Other Types of Altmetrics

Other online resources have also been suggested as valuable sources of altmetrics about scientific activities, many of which have previously been completely uncredited or have been an invisible part of scholarly work. SlideShare, Figshare, Dryad, and GitHub aim to credit the creation of presentations, datasets, and code and provide metrics about how others have used them. Peer-review systems and journals such as F1000Research, Publons, and PubPeer and the expert recommendations on F1000Prime give credit to researchers about their reviewing tasks and could provide

statistics about this previously hidden part of scholarly work. The reviews and comments to scientific articles on these platforms may provide some information about the perceived value of the articles. A clearly under-researched area of altmetrics is that of mainstream media and news. Scientific articles are mentioned and linked to in newspapers and other more traditional media sources. It should be noted that most of these altmetrics appear only for a small fraction of scientific papers—for example, less than 1% of recent Web of Science journal articles were cited in mainstream media tracked by Altmetric.com (Costas et al., 2014; Haustein et al., 2015)—either because the sources are particularly selective or because their uptake is still low.

SOCIAL MEDIA IMPACT FOR REPOSITORIES

Institutional repositories (IRs) are built to manage and disseminate digital content, such as research articles and datasets, created by the members of an institution. Their main job is to provide access to research carried out at the institution and to preserve it. Part of this work is to collect usage statistics, partly to provide researchers information about how their research is being used, but also partly to justify their own existence to university administrators. Ever since repositories came into existence, usage of their contents has been measured with tools such as Google Analytics or AWStats, which, for example, provide information about page views, unique visitors, and downloads. For some of the most common repository platforms, such as DSpace and EPrints, available plug-ins track download counts and display them both at item and collection level (Konkiel & Scherer, 2013). These metrics show content visibility and use and increase the repository's visibility. These advantages are, however, accompanied by challenges, such as a lack of transparency in the calculation of usage statistics as well as a lack of standardization, which make it difficult to compare different repositories. COUNTER (Counting Online Usage of Networked Electronic Resources) is a quasi-standard in the field of usage data for digital objects. The COUNTER initiative was originally established by publishers and libraries to set standards for collecting and reporting usage statistics of journals. In 2014, COUNTER published the *COUNTER Code of Practice for Articles* to provide a standard at the individual article level for IRs (<http://www.projectcounter.org/counterarticles.html>).

Social media metrics are the most recent addition to the metrics toolbox, monitoring and reflecting the impact of digital objects in repositories. These metrics are generated by users of various social media sites and usually collected through an API. Altmetrics aggregators, such as Altmetric.com and Plum Analytics, collect these user-generated mentions of scientific products from social media, use advanced algorithms to filter the data, and offer metrics—altmetrics—indicating the impact and visibility that the research products have gained in social media (Herb & Beucke, 2013). These companies offer altmetrics for different target groups and have somewhat different business models.

PlumX from Plum Analytics is a commercial tool that offers an impact dashboard for institutions. The tool aggregates data from different sources and divides the metrics into five categories: citations, usage, mentions, captures, and social media. It covers a lot of different formats of scientific output such as articles, books, datasets, posters, and many more. Subscribed institutions can embed the PlumX widget in their repository and present these metrics on the item level.

Impactstory is a commercial service for individual researchers to show what kind of impact and visibility their work has gained. Impactstory aggregates metrics for a researcher's online portfolio of scientific products and generates a type of CV showcasing various forms of impact. The data are open to reuse, but there are no plug-ins for repositories to integrate the metrics in their own services.

Altmetric.com is a start-up company collecting, aggregating, and providing scientific social media metrics. They provide various tools for different focus groups. On the one hand, they offer a subscription model for publishers and institutions to show the impact on the article and individual levels. On the other hand, Altmetric.com offers a free badge showing the altmetrics at article level for open access, noncommercial repositories.

As one of the early adopters of altmetrics, the Public Library of Science (PLOS) has its own software for aggregating article-level metrics. This software (Lagotto) is under an MIT license for free use. For now, publishers use the software to aggregate data, which are categorized in a similar manner as in PlumX (usage, citations, social bookmarking and dissemination activity, media and blog coverage, discussion activity, and ratings). For a single institutional repository it would be a huge effort to use this software because

it has to harvest all the social media services and to store all the aggregated metrics.

While some of the services mentioned above operate with the same data, there are no standards for collecting, aggregating, or presenting altmetrics. Although the National Information Standards Organization has started an initiative to create standards for altmetrics (http://www.niso.org/topics/tl/altmetrics_initiative/), it seems premature to introduce standards of altmetrics before we know more about the meaning and validity of them. Currently most of the discussions about standards seem to be regarding basic technical definitions, as for example, how to collect tweets referring to scientific documents. Altmetrics can be collected from many different sources, some of which may provide indicators of scientific activities or broader societal impact and some that may not. This raises some caution for aggregating all the data available into a single score, which supposedly measures the impact of a scientific article or a researcher. More research is needed as to whether various social media metrics are valid indicators and what kind of impact they measure.

Currently, some institutional repositories include altmetrics as a value-added service for their users. In autumn of 2014, Altmetric.com provided its free badge to more than 30 institutional repositories, and this number can be expected to increase in the future. From a selection of badges displaying the altmetrics doughnut (a doughnut-shaped visualization demonstrating the sources for and their impact on the altmetric score), repositories can select which badge they want to display for each of the articles. Clicking on the badge will take the user to a page hosted at Altmetric.com, but pages can be customized to match the design of the repository. On this page the score is broken down by sources and the user can see from which social media sites the metrics originate. Instead of just showing the aggregated impact, the context in which the impact has been created can thus be explored. In fact, Altmetric.com emphasizes the value of exploring the details and stories behind the counts. Figure 14.1 provides an example of the implementation of the Altmetric.com badge by the open access scholarly publishing service bepress (<http://digitalcommons.bepress.com/>) for the institutional repository of the University of Massachusetts Medical School. They use the free altmetric badge and have a customized landing page on Altmetric.com (Figure 14.2).



Figure 14.1. Example article from the institutional repository of the University of Massachusetts Medical School.

Palmer (2013), who is an institutional repository manager at University of Massachusetts Medical School, states that the benefits of introducing altmetrics into the repository include the possibility of delivering impact measures for publications that have not been published in scientific journals, such as posters, dissertations, datasets, and books. Altmetrics can also help the repository managers to demonstrate the impact of open access, while providing the authors more information about the impact and attention their work has gained. In fact, Altmetric.com recently showed that there is an open access advantage in terms of social media activity (Adie, 2014).

An international interest group under the umbrella of COAR (Confederation of Open Access Repositories) has been set up to collect and enhance information about usage data and altmetrics for repositories. COAR is an international association whose aim is to enhance the visibility and application of research outputs through global networks of open access repositories. The interest group “Usage Data and Beyond” (<https://www.coar-repositories.org/activities/repository-interoperability/usage-data-and-beyond/>) gathers knowledge of repository managers that work together to collect, standardize, aggregate, and visualize metrics for repositories.



Figure 14.2. The landing page hosted by Altmetric.com showing the Twitter mentions of an article.

POSSIBILITIES AND CHALLENGES, FUTURE DIRECTIONS

As impact measures of scientific products and activities are increasingly being used as tools for administrative purposes, altmetrics in general and altmetrics in repositories in particular can be more useful in providing a broader view of the attention and impact than citations, which are limited to a particular use by citing authors. As social media metrics go beyond traditional impact measures (citations), usage measures (downloads) and measures of awareness (page views, unique visitors, etc.), together with these indicators can potentially give a more multifaceted view about where and how scientific output has left its traces. However, since a proof for the validity of various metrics is still lacking, one should be careful when using altmetrics and not apply them for evaluative purposes of scientific impact (yet).

Although the amount of research investigating the various social media metrics is constantly growing, studies are often restricted to quantitative approaches measuring the extent to which scientific content (mostly journal articles) is represented on different platforms (i.e., the percentage of items saved, tweeted, recommended, shared) and to what extent they

correlate with citations as the common impact metric. Qualitative studies are fewer and mostly limited to surveys determining which social media platforms are used by academics (Pscheida, Albrecht, Herbst, Minet, & Köhler, 2013; Rowlands, Nicholas, Russell, Canty, & Watkinson, 2011; van Noorden, 2014). More research is clearly needed to gain a better understanding of the meaning of these counts and whether they are valid indicators of impact. However, altmetrics can already provide some interesting and useful information for authors, university libraries and institutional repositories, and university administrators from an exploratory point of view.

For authors altmetrics can help give credit where credit is due for activities and research products previously invisible. As researchers are able to see the online attention to their research, it may even have a positive impact on motivation and productivity. With the constantly increasing number of scientific publications it can be very difficult for researchers to keep themselves up-to-date in their field. Altmetrics may be able to help researchers in their information seeking by showing what is popular and what has gained most attention. For repositories, altmetrics may help to justify their existence and secure funding, as the use and impact of the articles (and data) in the repositories can be better communicated to administrators. Some researchers may see bringing their articles and data into repositories as unnecessary additional work, but as researchers learn more about the impact of their research their attitudes toward repositories may change.

There are, however, some challenges facing altmetrics. All the data are currently provided by third parties and neither the services aggregating altmetrics nor the authors or repositories using them would have anything to say if social media sites like Twitter or Mendeley decided to restrict the use of their APIs or close them completely. It is also important to acknowledge that a particular social media count relevant today may not be relevant in the future. Some of the technical challenges with altmetrics involve the complexity in correctly identifying research products, as there is no universal system to do so yet. Altmetric.com, for instance, can track the impact of an article as long as they can track its DOI, PubMed ID, arXiv ID, or Handle (other identification methods are likely to be included in the future).

Some of the challenges are more related to what these new metrics actually measure. In this context it is important to remind ourselves that altmetrics is an umbrella term that covers many different sources for data about the impact and visibility that research products have received in social media, and some of these may indicate scientific interest while others may not. Moreover, what is considered an altmetric is merely based on the technical feasibility and ease of collecting data rather than what is worth measuring. As stated above, more research is needed before we can fully understand what kind of impact various social media metrics are measuring and before we have proof of their validity. A correlation between specific social media counts and citations does not necessarily prove validity; it only proves a connection between the two measures. The validity of Twitter as impact metrics have in fact recently been questioned as the existence of scientific bots automatically tweeting arXiv submissions was detected (Haustein, Bowman, Holmberg, Tsou, Sugimoto, & Larivière, 2015).

CONCLUSION

The ease of collecting social media metrics as well as the discontent with citation-based measures (citation delay, misuse of impact factor as substitute for paper impact) have created a hype around altmetrics and led to the implementation of social media metrics on journal Web sites, in researchers' CVs (Piwowar & Priem, 2013), and in institutional repositories, and triggered the discussion in the community of research evaluators, scientific journals, and university libraries to consider these types of new metrics. As many altmetrics are accumulated in the days following the publication of a research product, repositories and altmetrics collected from repositories can fulfill the promises of timelier data about impact. The proposed benefits of showing altmetrics in institutional repositories include showing impact measures for research products that have not been published as articles in scientific journals, reporting the impact and visibility of their work to authors, demonstrating the impact of open access, and providing better and more diverse usage statistics of repository content. Other possible uses for altmetrics, such as highlighting popular articles in information retrieval, have also been suggested. There are, however, many challenges that need to be solved before altmetrics can be taken as a reliable impact measure,

the greatest of which is determining which of the plethora of social media counts are valid indicators of research impact.

ACKNOWLEDGMENTS

This work was partly supported by the Alfred P. Sloan Foundation Grant #2014-3-25.

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