

New perspectives on article-level metrics: developing ways to assess research uptake and impact online

Altmetrics were born from a desire to see and measure research impact differently. Complementing traditional citation analysis, altmetrics are intended to reflect more broad views of research impact by taking into account the use of digital scholarly communication tools. Aggregating online attention paid to individual scholarly articles and data sets is the approach taken by Altmetric LLP, an altmetrics tool provider. Potential uses for article-level metrics collected by Altmetric include: 1) the assessment of an article's impact within a particular community, 2) the assessment of the overall impact of a body of scholarly work, and 3) the characterization of entire author and reader communities that engage with particular articles online. Although attention metrics are still being refined, qualitative altmetrics data are beginning to illustrate the rich new world of scholarly communication, and are emerging as ways to highlight the immediate societal impacts of research.

Altmetrics and the digital scholarly landscape

As the scholarly usage of blogs, social media platforms and other online communication channels becomes increasingly commonplace, it is now more important than ever for funding bodies, publishers, libraries and institutions to be able to characterize and measure the online attention paid to research and to researchers. Since citations are slow to accumulate, rapid indicators of online research uptake such as basic access statistics (download counts and page views) and social media metrics (number of tweets, number of Facebook wall posts, etc.) are becoming more informative. Therefore, due in part to the rapid adoption of various new internet-based modalities for disseminating research, there has been a strong impetus to account for online attention and assess impact more immediately and broadly, in conjunction with traditional citation-based analyses. Accordingly, the concept of altmetrics, measures of *online* scholarly impact, was born from a desire to assess research impact differently.

From the development of diverse, innovative tools to a growing body of case studies illustrating the flexibility of article-level metrics, there are strong signs that altmetrics have the potential to fill in the missing pieces of the impact puzzle. In this article, we discuss the benefits of an article-centric approach to altmetrics, while also providing examples of ways that altmetrics have recently been used to illustrate the value and impact of scholarly articles.

An article-centric approach to altmetrics

Several new tools and services for measuring and showcasing altmetrics have been developed, including Altmetric.com¹ (from Altmetric LLP), ImpactStory² and Plum Analytics³. However, all of the tools are in their early stages of growth. Altmetrics measures are not standardized and have not been systematically validated; there has been no clear consensus on which data sources are most important to measure; and technical limitations currently prevent the tracking of certain sources, such as multimedia files⁴. In spite of the difficulties, the various tools and services



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have established their own unique ways to collect and measure altmetrics, and each approach may be better suited to particular use cases.

Closely aligned with altmetrics is the idea that the research impact of a particular piece of work might be more fairly assessed with the use of new 'article-level metrics', rather than sole use of the journal impact factor and traditional citation-based analyses⁵. This is the outlook that we have taken at Altmetric LLP (not to be confused with the online altmetrics community), a London-based technology company that specializes in delivering article-level metrics to institutions, scholarly publishers and researchers⁶.

At Altmetric, our approach to collecting and measuring altmetrics has been focused at the article level. On a daily basis, we capture approximately 12,000 online mentions (altmetrics data) of individual scholarly articles and data sets by scanning through social media, blogs, mainstream news outlets, YouTube and various other sources. Such online mentions of articles and data sets range widely in complexity, from simple shares, e.g., a tweet containing a link to a scientific article, to more comprehensive analyses, e.g., blogs and online journal clubs. Altmetrics data is either displayed in article details pages (discussed below) on Altmetric.com or through a web application called the Altmetric Explorer⁷.

In order to discuss the value of altmetrics in the context of article-level metrics, we must first describe our approach to aggregating data. After gathering relevant altmetrics data for each mentioned article, Altmetric displays the metrics alongside the actual content, e.g., original tweets, Facebook posts, links to news reports and blog posts, etc., on article details pages (see Figure 1). The left-hand column displays attention metrics, including an aggregate attention score (shown within the coloured donut), along with a breakdown of the individual metrics that comprise the score. The main body of the page includes several tabs delineating different data sources that have mentions of the scholarly article in question (e.g., Twitter, Facebook, News, Blogs, and so on). Clicking on each tab displays the qualitative altmetrics data, which consists of the actual conversations, mentions, reports and posts associated with the scholarly article.

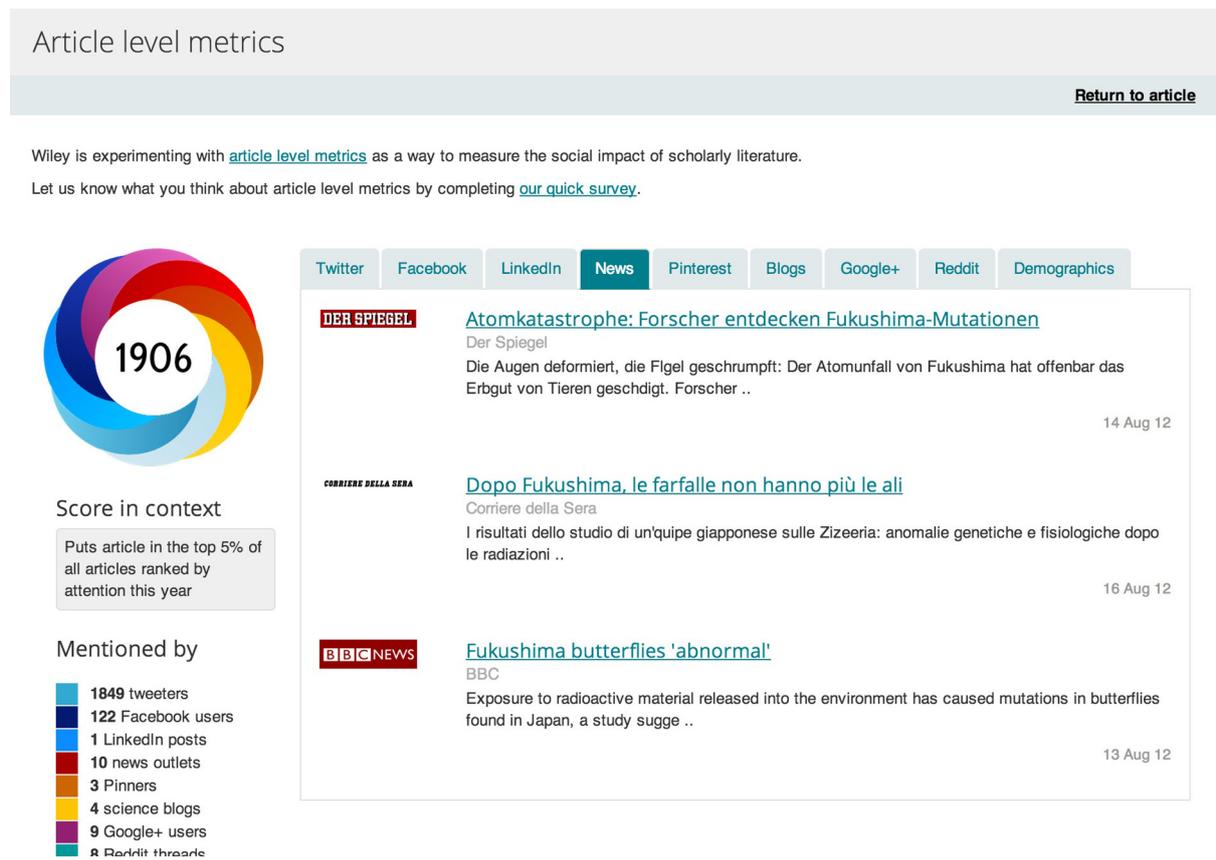


Figure 1. Screenshot of an Altmetric article details page for a scholarly article

155 The purpose of these article details pages is to make altmetrics data auditable; this way, users can see for themselves where the attention came from, rather than relying on the numbers alone. Through the details pages, readers have access to a greatly enriched set of material that is specifically related to one article. Accordingly, for some articles that have been mentioned in multiple communication channels, readers may have several choices for supplementary reading and viewing, in addition to the original text. One might be able to read a plain-language summary through a news report, read an analytical blog post written by another researcher, or even watch a YouTube video depicting a phenomenon described in the article. Of course, relying only on tweets, news reports, or blogs to understand a research article is generally insufficient. However, we feel that the use of detailed article-level metrics pages as portals to related content can potentially give authors and discerning readers a better impression of an article's value and societal impact.

Seeing past the popularity contest: interpreting altmetrics data using context

Although the discussion of research by publishing journal articles is a purely academic endeavour, sharing and discussing articles using Twitter and other online platforms is not, and non-specialists participate freely in discourse on scholarly topics. It is the fact that online communication channels are populated by content from members of the public, as well as scholars, which has generated some scepticism towards the value of altmetrics. Such concerns are understandable, especially when one examines some of the trending articles that have garnered extremely high scores of online attention. In our experiences at Altmetric, many of the articles that have gone viral are humorous, unusual, or even fictitious in nature; others frequently pertain to specific topics that are strongly emphasized in mainstream media (for instance, sexuality, psychoactive drugs and human psychology). The tendency of such articles to explode in popularity online has led many to question whether judging an article's impact through popular opinion actually advances scholarly progress in any meaningful way.

We argue that how useful particular aspects of altmetrics are really depends on what kinds of questions are being asked of the data. For example, if a publisher wants to find out what topics are of greatest interest to all readers, then understanding the general public's tastes by identifying trending articles might be important. Other use cases, such as research assessment for institutions, require a more nuanced examination of the altmetrics data. In light of the existence of significant outliers, such as 'sexier' papers with abnormally high altmetrics, we do not recommend the simple use of the raw metrics alone to assess research value and impact. Instead, placing metrics in context is far more informative: for instance, comparisons of attention can be made within a single journal or discipline, and this information is readily available from altmetrics services, such as Altmetric's context tab on article details pages or ImpactStory's textual descriptions. Comparing an article's uptake to that of all published literature will usually paint a completely different picture of impact than would be obtained by comparing an article's uptake with the normal thresholds of the discipline. Ultimately, users must frame appropriate questions and decide what information they want the altmetrics data to provide.

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Perspectives on the value of article-level metrics

Assessing uptake of a single article within a specific community

How can one assess the immediate impact of a published article that was targeted at a specific community? For signs of rapid uptake of an article in a particular specialist community, citation counts are generally uninformative in the short term, as publication cycles mean that citations can take months or years to accumulate. However, for certain cases in which the online community is active and comprised of the target specialist audience, discussions on blogs and conversations on social media can serve as strong indicators that the article's insights have been influential.

156 A very recent example comes from a 2013 open access position paper written by members of the American College of Physicians (ACP) and the Federation of State Medical Boards (FSMB) and published in *Annals of Internal Medicine*⁸. Specifically aimed at physicians in the United States, the position paper outlined guidelines of the ACP and FSMB on appropriate social media use, as well as recommendations for maintaining professionalism online. Within a week of the paper's publication, it was clear from the altmetrics data that the paper had already made an impact on its target audience⁹. Social media demographic data collected by Altmetric indicated that roughly 47% of all tweets about the paper were sent from the United States, and approximately 20% were sent by doctors and other healthcare professionals. Moreover, influential Twitter accounts of several professional associations (including the American College of Physician Executives and the North American Spine Society) shared the article with thousands of followers, increasing the reach of the article within the intended network. In addition to receiving a large amount of attention on social media, the paper was comprehensively discussed on physician-authored blogs, as well as in perspective pieces published by the mainstream news media, e.g., two articles in *Forbes*¹⁰. In this case, the altmetrics data demonstrated that there was immediate uptake of the paper by its highly connected community, which was rather fitting since the content dealt specifically with the use of social media.

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Not every article has an obvious online footprint of impact. It may be that the rapid uptake of the ACP and FSMB paper was somewhat unusual, especially given that social media usage is still not the norm within all scholarly communities. However, it is worth bearing in mind that altmetrics are still extremely new tools for impact assessment. Even if every academic does not currently use social media or blogs, scholarly adoption of such tools is still growing. Altmetrics are positioned to reflect all of the attention arising from these online communication channels, and are poised to play a hugely important role in future assessments of research impact.

Assessing a body of intellectual output

Rapid assessments about entire sets of articles can be easily achieved using existing altmetrics tools. As long as articles in the sets have unique identifiers, such as digital object identifiers (DOIs), PubMed IDs, Handles, and so on, then their associated altmetrics data, if they exist, may be retrieved. Many publishers, institutions and individual researchers have already begun to use altmetrics tools, usually through an application programming interface (API), to view a breakdown of metrics from different data sources. Although this approach strips away all qualitative assessments, i.e., from article details pages, the metrics can be used alongside citations counts to collectively provide a broader view of the online impacts of a collection of scholarly works.

Although there is some evidence that Twitter activity¹¹ and the Altmetric score¹² may be associated with subsequent citations, most altmetrics measures have not yet been rigorously validated against traditional metrics in systematic studies. Some informal efforts have been made to showcase ways in which some alternative metrics can highlight the uptake of publications from a specific institution or journal. Earlier this year, a blog post described an interesting altmetrics analysis that was performed by the editorial staff at the *Journal of Ecology* on 150 articles published in their 2012 Centenary volume¹³. After comparing Altmetric's social media and online reference manager metrics (retrieved through the Altmetric API), Web of Science citation counts, and abstract downloads, the editors concluded that each metric reflected a different form of reader usage¹⁴. From a toolmaker's perspective, it is reassuring to see that the newer metrics are in line with editors' understanding of reader activities. Moreover, it appears that there is also growing interest in the use of article-level metrics as new ways to monitor the performance of journals and institutions.

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Gaining insights into communities

Not only have digital technologies brought profound changes within the scholarly publishing industry, they have also added significantly to the ways that academics from all disciplines can communicate with their peers and with the rest of society. Twitter is currently the largest source of scholarly conversations on social media, although other platforms and the blogosphere are also thriving: each week, approximately 780 new blog posts are published on over 3,700 blogs contained in Altmetric's manually curated list. In this new era of digital scholarship, article-level metrics are emerging as excellent tools for identifying the online communities that share, discuss, and analyse articles and data sets.

"... article-level metrics are emerging as excellent tools for identifying the online communities"

Viewing qualitative data, as well as demographic details, on article details pages have already unmasked some fascinating insights about specific communities. For example, the article-level metrics of a 2008 essay in the *Journal of Cell Science* revealed the presence of a strong online community of bench scientists who are passionate about sharing their experiences about their unique career challenges¹⁵. The essay, which reassured young scientists that productive stupidity was an important aspect of the scientific endeavour¹⁶, was the subject of over 1,000 posts on social media, and was also extensively discussed alongside personal anecdotes on blogs run by PhD-level scientists and graduate students¹⁷. In effect, the raw article-level metrics data were able to unveil a life sciences researcher blogosphere and a large network of social media users who collectively contribute to the discussion of science and the scientific endeavour online. The metrics showed that the essay was directly able to influence the people who conduct experiments in laboratories, author scientific articles, and work to influence a new generation of scientists. Other insights might have been gained through an examination of the article-level metrics of related articles.

By looking at article-level metrics in reverse and determining how articles with the greatest uptake were shared, or if specific communities had preferences for particular communication channels, it may be possible to better understand the different communities' usage patterns of scholarly communication tools. In turn, such knowledge may enable further refinement of altmetrics measurements, and possibly even inform ways to make scholarly communication more efficient in the digital age.

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Even though altmetrics tools are in their early days of development and a number of discipline-specific benchmarks will still need to be set, article-level metrics are becoming increasingly useful as research assessment tools. We believe that both qualitative and quantitative altmetrics data should be used as complements to traditional citation analyses in order illustrate the value and societal impact of intellectual outputs by individual researchers and their institutions.

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