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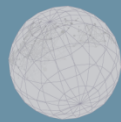
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Social media metrics for new research evaluation[1]

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Introduction

The field of *altmetrics* has grown impressively since its inception in 2010 with the Altmetrics Manifesto (Priem, Taraborelli, Groth, & Neylon, 2010). We now have regular *altmetric conferences* where academic and commercial data analysts and providers meet. A number of non-profit and for-profit platforms provide *altmetric data* and summarize these data in visually appealing presentations. This growth of altmetrics is partly fueled by the problems encountered in both peer review and indicator-based assessments of scientific activities, and also by the easy availability of novel types of digital data on publication and communication behavior of researchers and scholars. In this paper, we review and reflect on the state of the art with respect to these new *altmetric* data and indicators in the context of the evaluation of scientific and scholarly performance.

Since there is no theoretical foundation or empirical finding justifying the lumping together of such diversity of metrics (we use the term metrics here to refer both to *data* and *indicators*), under the term *altmetrics,* we adopt the term *social media metrics* (since most of them are actually data about social media use, reception and impact) to refer to these data and indicators, following the suggestion by Haustein, Bowman, & Costas (2016).

Social media metrics tools

In this section the main characteristics of tools based on social media metrics are described. The perspective is to discuss these tools as sources of information on the relationships and interactions between science and social media. Moreover, our aim is not to focus just on the currently available *altmetric sources* but rather on the concepts behind these sources. Thus, although the current tools, sources and platforms collecting an providing social media data may disappear or change in the future (in what Haustein (2016) has labelled as the *dependencies* of altmetrics), many of the events and acts currently captured by *altmetric data*

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aggregators could still be relevant in the future. For example, if Mendeley disappears, the idea of an online reference manager would still be feasible – with users from all over the world saving their documents – and counts on the number of different users (and by types of users) saving these documents would still be possible should other new platforms be created. The same holds for social media tools in general. These tools and their main conceptual social media significance are described below:

- *Online reference management, social bookmarking and tagging tools*. Several online reference managers allow the counting of the number of times publications have been saved, bookmarked, or tagged by different users of the platform. For instance, the *readership* counts provided by Mendeley (http://www.mendeley.com) include total number of users who have saved (added) a document to their private libraries; including information on the academic status, discipline and country of the users.
- *Microblogging tools* (such as Twitter or Weibo) offer the possibility of disseminating information in small messages. These tools are aimed at broadcasting, filtering and establishing interactions among their users. Most microblogging tools offer the possibility of linking to external objects, which may be publications (e.g. through their DOI) or other scholarly agents (e.g. scholars' websites, university websites, etc.). These technical options open the possibility to generate multiple indicators (e.g. the number of (re)tweets, likes, or followers around any particular scholarly object). An advantage of these platforms is that they provide rich information on users, tweets, and locations through both their web interfaces and their APIs.
- *Blogs and blog aggregators*. Blogs, and particularly scientific blogs, are emerging means of disseminating discussions on scholarly materials (Shema, Bar-Ilan, and Thelwall 2014) to other academics or the general public, by a diversity of bloggers (journalists, science journalists, scientists, etc.). Typical metrics that can be obtained from these platforms include blog mentions (e.g. the mentioning of a researcher or a university) or blog citations (e.g. citations to other scientific outputs).
- *Social recommendation, rating, and reviewing services*. Here we find some scholarly oriented tools like F1000Prime, which is a post-publication peer review service offering access to metrics such as views, downloads, as well as recommendation scores of biomedical literature, reviewed by their appointed users together with information (labels or tags) on their type of recommendation (e.g. for teaching, controversial, new findings, etc.). Other academic platforms include Publons or PubPeer, which offer post publication peer comments and scores for scholarly publications. A more general platform is Reddit, which provides information such as comments and votes to the posts provided by its users.
- *Wikis and collaborative content creation*. These platforms are seen as "collaborative authoring tool[s] for sharing and editing documents' by users" (Rowlands, et al., 2011). A common metric available through these sources includes mentions of scholarly objects (e.g. Wikipedia citations).
- *Social networking platforms* (e.g. LinkedIn or Facebook.). These generalist platforms allow their users to connect, interact and communicate in many different ways (messaging, sharing, commenting, liking, etc.). There are also *social networking platforms for researchers* (e.g. ResearchGate o Academic.edu). These tools provide information on scholars and their outputs, affiliations, and offer different metrics at the individual, institutional or country levels. This type of platforms, inspired in the more generalist social networking platforms, aim at facilitating networking and communication among scholars, finding academic content, experts, or institutions, as

well as sharing and disseminating their research with peers (Orduña-Malea, Martín-Martín, & López-Cózar, 2016 cited in Thelwall & Kousha, 2017).

- *Altmetric data aggregators*. These are tools such as Altmetric.com, Lagotto, PLoS ALM, Plum Analytics, and Impact Story, which aggregate metrics for scholarly materials from different sources. Although most of these aggregators are based on a similar philosophy (to capture online events around scholarly objects), they often differ in the sources they track, the methodologies they use to collect the data (e.g. using public or commercial APIs, etc.) and the way they process and report the metrics, as well as in their coverage and accessibility (Zahedi, Fenner, and Costas 2015).

Understanding the nature of social media metrics for research evaluation

Current methods of research evaluation do not focus on communication by social media, but are completely focused on the scholarly dimensions of research activities. Considering this dichotomy between social media and scholarly activities, we can introduce a novel perspective for the consideration of social media metrics. This perspective is related to the *foci* of the different social media metrics. Thus, we distinguish those social media metrics with a stronger *social media focus* from those with a stronger *scholarly focus*. These *foci* can be determined based either on the aims of the platform (e.g. Twitter, Facebook have a purely social media focus) or on the nature of the indicator that is produced (e.g. the number of followers in ResearchGate is a social media indicator, while the number of citations provided in the same platform could be seen as a scholarly indicator). As *social media focus* we understand the orientation of the tools, platforms, data and indicators that capture the interactions, sharing and exchange of information, ideas, messages, news, objects, etc. among diverse (online) users, and not necessarily restricted to scholarly users. As *scholarly focus* we refer to those tools, platforms, data and indicators that are more oriented towards the management, analysis and evaluation of scholarly objects, entities and activities. Thus bibliometrics, citations and peer review can be considered to fundamentally have a scholarly focus (Figure 1).
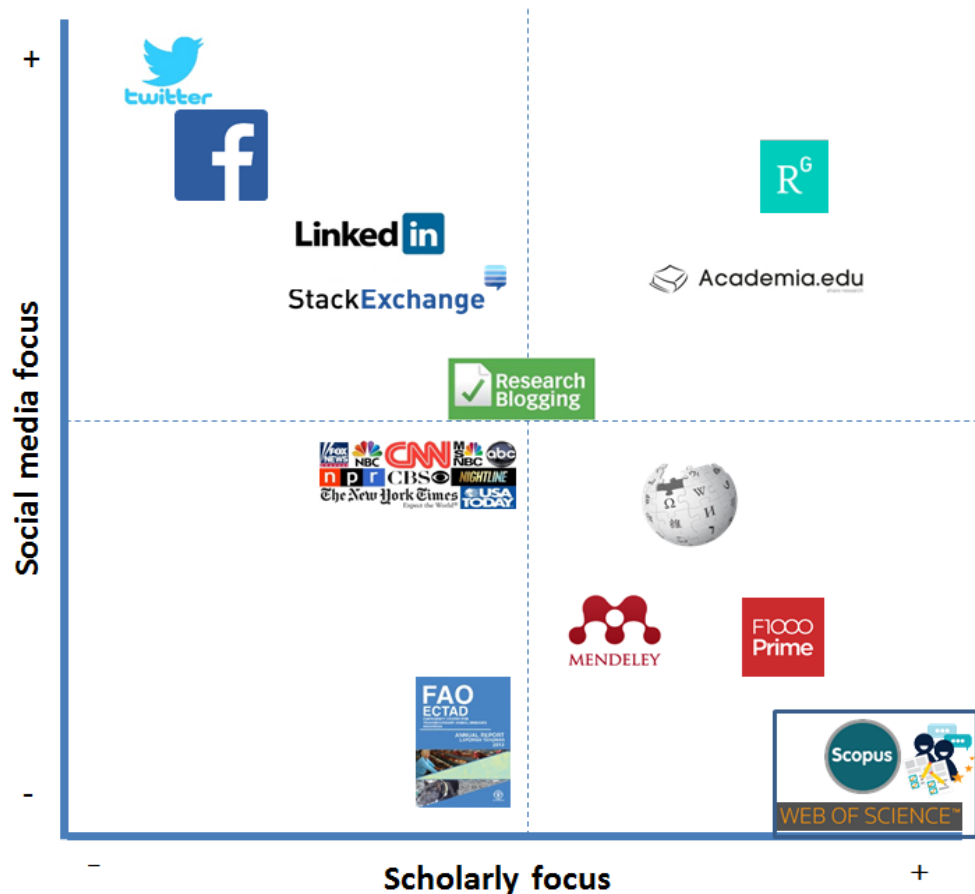
Figure 1. Metrics characterized by their focus: social media or scholarly

Figure 1 illustrates the different foci of the most important bibliometric and social media metrics arranged in four quadrants based on their scholarly or social media focus. In the bottom-right part of the figure we find the evaluative bibliometric and peer review indicators (represented by the databases Scopus and WoS and peers evaluating papers) with a strong scholarly focus (and low social media focus). In the top-left quadrant we find the platforms with the strongest social media focus (e.g. Twitter, Facebook, LinkedIn or StackExchange Q&A). These tools allow for the interaction and exchange of information among their users, but none of them have a genuine scholarly focus (although the realm of social media metrics would circumscribe itself to the interaction between these tools and scholarly objects). They have the largest distance with the scholarly focused indicators. The main reason for this distance lies in the open, multipurpose and heterogeneous character of these platforms. Anybody can create a profile on Twitter, Facebook or LinkedIn and tweet or mention a scientific publication. Acts derived from these platforms, as argued in Haustein et al. (2016), are driven by norms substantially different from those implicated in the act of citing (or peer reviewing) a publication.

In the bottom-right quadrant in addition to the traditional bibliometrics (e.g. based on Scopus or Web of Science) and peer review, we also find F1000Prime recommendations and Mendeley readerships (Bornmann & Haunschild, 2015; Mohammadi, et al., 2015; Haustein & Larivière, 2014; Zahedi, et al., 2014a; Zahedi, Costas, Larivière, & Haustein, 2016; Zahedi & Haustein, 2018) both with a reasonably strong scholary focus (both are mostly used by scholars and are about scholary outputs), although they also have some social media focus (e.g. both are user generated and interactions among users and outputs are possible). Wikipedia citations, although different from those found in scholarly publications (in theory

any person can write citations in a Wikpedia entry, although with some supervision), can still be considered similar enough to scholarly citations to be included in this quadrant.

In the top-right quadrant are platforms that combine both a strong social media and scholarly foci, such as ResearchGate and Academia.edu. These platforms are multipurpose and their indicators are quite varied. Their indicators can be grouped in those with a purely social media focus (e.g. the followers counts of scholars, number of endorsements, counts of Q&As on ResearchGate or the profile visits and mentions on Academia.edu) and those with a more scholarly focus (e.g. the counts of publications or citations). The RG score combines into a single indicator elements from both these social media and scholarly foci, thus suggesting the potential unreliability of this indicator.

In the bottom-left quadrant we find indicators that do not necessarily have either a social media focus or a scholarly focus. An example is citation from policy documents (currently collected by Altmetric.com and Plum Analytics). Policy citations are of course relevant from several perspectives (e.g. policy impact, societal impact, etc.), but they are not created under the same norms as scholarly citations. Moreover they do not have a social media focus (i.e. different types of users are not entitled to interact with the scholarly material discussed in the policy document, and there isn't any form of users' interactions). This calls into question whether policy documents citations can be considered as social media metrics at all.

In the center of the graph are mentions in blogs and news media. The central position of these indicators is explained because bloggers and science journalists could use scientific objects to support their arguments in their blog posts or news items and, as argued in Haustein et al. (2016), they could be driven by "similar *norms* as scholars", although not necessarily the same. Thus, these indicators would represent a bridge between the scholarly and social media foci.

Proposing alternative forms of research evaluation based on social media metrics

Based on the previous model, indicators with a stronger scholarly orientation would be more suitable for traditional research evaluation (comparable to how citations and peer review are currently used). Thus, Mendeley readership and F1000Prime recommendations and to some extent also Wikipedia citations could be seen as new tools to evaluate research, in a similar fashion as it is currently done with citations or peer review. However, as the social media focus of the indicators increases, one should consider how this would influence the evaluation (e.g. how non-academic Twitter users may be interacting with scientific publications, or whether blog citations can be seen as comparable to scholarly citations). Those social media metrics with a stronger social media focus are harder to incorporate in the more traditional and regular research evaluations. However, social media metrics capture novel interactions between social media users and scientific objects. Since, the relevance of social media activities is growing in many walks of life, particularly in the dissemination of ideas, awareness and discussion of current issues, as well as for sharing information, news and content; many scholars, universities and scholarly organizations may start to mind about their presence, activities and image on these platforms. It is therefore not unreasonable to claim that the social media reception of scholarly objects can be seen as a non-trivial aspect of scientific communication. Monitoring the coverage, presence and reception of scientific objects on social media can then be seen as a novel element in research evaluation. The focus wouldn't be on the scholarly impact or quality of the production of a research unit, but rather on the *social media reception* of its outputs. Thus, new evaluations would include questions

such as *how is the output of my university being discussed on Twitter? Are my publications visible among the relevant communities of attention? Do these communities engage with the publications? Is the social media reception and engagement of my output positive? Are the scholars of my unit active on social media? Do they contribute to disseminate their research and engage with broader communities to explain, expand or clarify their work? How are the social media communication strategies at the university working?*, etc.

Clearly, the questions above are new and they may not be relevant for all research managers and in all research evaluation contexts; however, we argue that if social media matter, then social media metrics also matter. From this point of view, whenever social media communication and interactions are relevant, then it is possible to conceptualize novel forms of research evaluation based on social media metrics. Table 1 summarizes (not exhaustively) some of these dimensions and indicators that can be considered in this social media evaluation of scientific objects of a given research unit.

Table 1. Conceptualization of new social media metrics research evaluation applications

Social media dimension	Example indicators (for a given research unit)
Coverage and presence on social media of scholarly objects	- # publications mentioned on Twitter, Facebook etc. - # scholars with a Twitter account - Growth in the % of publications mentioned on Twitter
Reception and attention on social media	- # of tweets to a given publication - # of tweets to a given publication with some degree of engagement - # of tweets to publications from highly followed tweeters
Engagement of social media users with scholarly objects	- # of tweets to a given publication containing comments, hashtags or remarks from the users
Communities of attention around scholarly objects	- # of tweeters tweeting the publications of the unit - # of highly followed tweeters tweeting the publications of the unit
Landscapes of social media attention around scholarly objects	- # of tweets to the outputs from the different fields of activity of the unit - # of tweets to outputs of the unit from social media users from different countries

Conclusions

Our main proposal in this paper is to define the metrics formerly known as altmetrics primarily on the basis of their origin: as data and indicators of *social media activity, use and reception*, or *impact in the context of academia*. This distinction restricts and enables their use in research evaluations. Social media play an important role in scientific and scholarly communication (Sugimoto et al, 2017). It enables a faster distribution of datasets and preliminary results, and a greater level of access to formal research publications; together with

the possibility of interacting and engaging with other communities beyond academic communities. It would therefore make sense to include this dimension of social media activity in research assessments whenever science communication is deemed relevant. We have sketched the conceptual outlines of such applications, together with the main constructs behind the current most important social media metrics tools.

The currently developed principles for responsible metrics (Wilsdon et al. 2017) therefore do not need to be changed in order to be valid for social media metrics. But a large number of social media metrics seem to fail some of the principles, in particular, ironically, concerning the requirements of transparency, openness and manipulability. Last, we propose to discard the term *altmetrics* and systematically start to speak about specific *social media metrics* (Haustein et al, 2015), or even more generally, about *social media studies of science* (Costas et al., 2017; Costas, 2017). This then leaves sufficient space to develop new forms of indicators for scholarly objects (including publications, datasets, code; as well as scholars, scholarly organizations, etc.) and the use of research without conflating them with social media indicators.

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