

Beyond the dependencies of altmetrics: conceptualizing ‘heterogeneous couplings’ between social media and science

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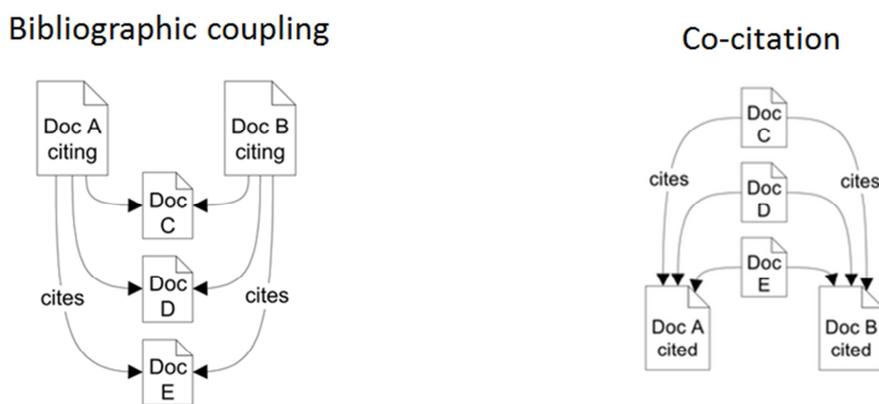
Introduction

Altmetrics, and more specifically social media metrics, have a genuine network nature (Haustein, Bowman, & Costas, 2016). However, this networked component has been less explored in the altmetric literature. Recent developments proposing the analysis of communities of attention (Haustein, Bowman, & Costas, 2015), the follower/followee relationships for scholarly authors on Twitter (Robinson-Garcia, van Leeuwen, & Rafols, 2015), or the co-readership (Kraker, Schlögl, Jack, & Lindstaedt, 2015) and readership coupling (Haunschild & Bornmann, 2015) networks on Mendeley have been already proposed. However, a general conceptualization and modelling of the different types of network interactions between social media and scholarly objects is still missing. The aim of this paper is to provide some systematic discussion around this point.

Heterogeneous couplings

In bibliometrics, there are two basic couplings among scientific documents that are based on citations: bibliographic coupling and co-citation. Bibliographic coupling happens when two documents cite the same document(s). These documents are expected to be conceptually connected. Co-citation happens when two documents are cited by the same documents, also pointing to a conceptual connection between the cited documents. Figure 1 schematizes these two approaches.

Figure 1. Bibliographic coupling and co-citation (source Wikipedia)



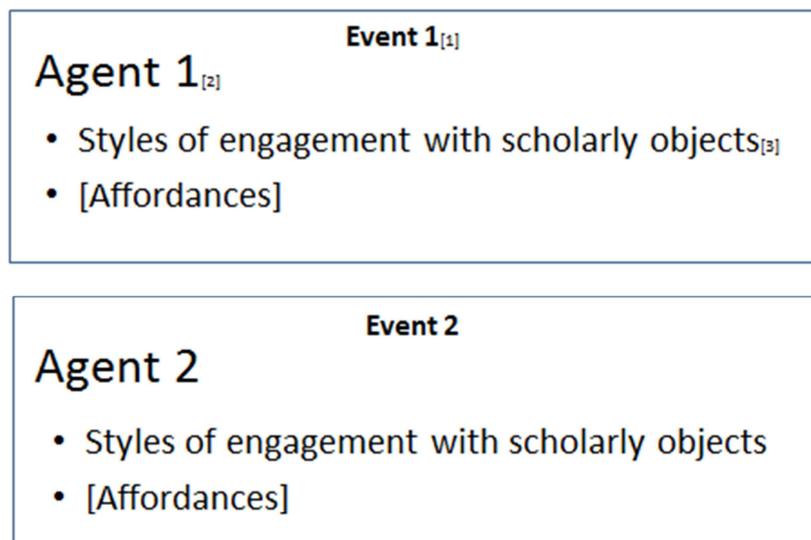
We argue that based on similar principles, it is also possible to conceptualize similar network relationship for most social media metrics. However, considering the more diverse and heterogeneous nature of social media actors and events, these relationships could be seen as more **heterogeneous couplings**. We

define **heterogeneous couplings** as the co-occurrence of linkages based on social media environments and their different elements with scholarly objects.

Generalizing heterogeneous couplings

From a general perspective, it is possible to establish different types of couplings of co-occurrence based on different social media sources. Here, we formulate a general model aimed at transcending current social media tools (e.g. Twitter, Facebook, etc.) and that conceptually could be applied to most forms of social media interactions with scholarly objects, thus the network perspective wouldn't be subject to the dependency on current social media tools (Haustein, 2016). In Figure 2 we present a general model of social media elements to generalize heterogeneous couplings.

Figure 2. General model of social media elements for heterogeneous couplings



[1] E.g. a tweet, a Facebook wall post, a blog, a news media mention, a Mendeley saving, etc.

[2] E.g. a tweeter, a Facebook user, a blogger, a news media journalist, a Mendeley user, etc.

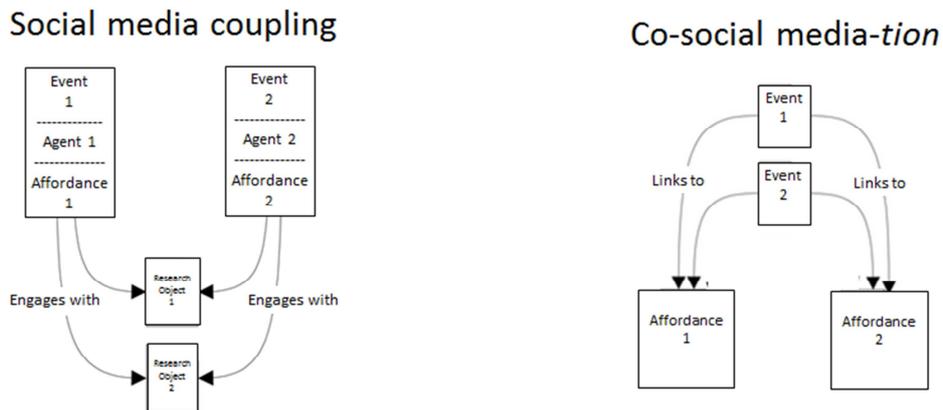
[3] E.g. links to (mentions of) publications, datasets, universities, researchers, etc.

In Figure 2, three main basic elements can be determined:

- *EVENT*: this refers to a recorded activity or action which relates to a scholarly object (Haustein et al, 2016) from a social media interface. In other words, events are recorded interactions between social media agents and scholarly objects. They include all kinds of social media events, including (but not restricted to) tweets, blog posts, Facebook posts, news media items, etc.
- *AGENTS*: entities that interact through the social media event. This includes Twitter users, Facebook users, bloggers, Mendeley users, etc.
- *STYLES OF ENGAGEMENT [AFFORDANCES]*: this refers to the various forms of interactions happening between social media agents and the scholarly object(s). Most of these interactions happen through the different affordances available in most social media platforms (e.g. linking, hashtags, user names, etc.).

Based on these elements it is possible to generalize different forms of couplings (Figure 3). As it can be seen, social media events, agents and affordances can be coupled based on their co-occurrence of scholarly objects. Similarly, scholarly objects can also be coupled by their co-engagement with social media events, agents and/or affordances.

Figure 3. Generalization of heterogeneous couplings for social media metrics



Looking forward

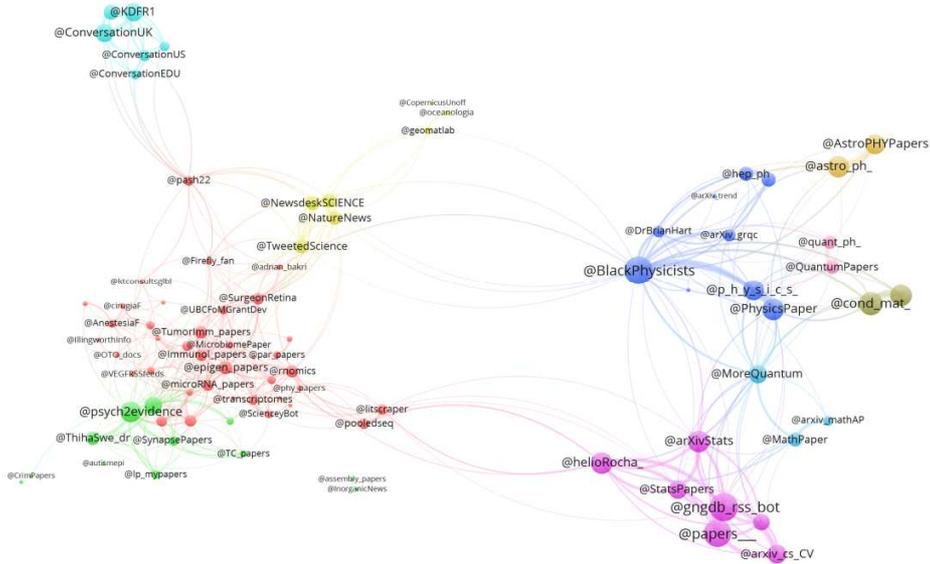
This paper presents a preliminary general conceptual discussion of models of heterogeneous couplings between social media and scholarly objects. The understanding of these couplings can open the opportunity for the development of novel applications and analysis on the interactions between social media actors and science. In Annex 1 we present some practical examples, the first one on the Tweeter coupling of tweeters active on Altmetric.com and the second one on the coupling of journals based on co-tweeter relationships (i.e. publications from these journals are co-tweeted by the same tweeters). Future research will focus on the discussion and operationalization of more of these applications.

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Annex 1. Practical examples of heterogeneous couplings

Tweeter coupling



Co-tweeter-ation (journals)

