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The sum of it all: Revealing collaboration patterns by combining authorship and acknowledgements

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ABSTRACT

Acknowledgments are one of many conventions by which researchers publicly bestow recognition towards individuals, organizations and institutions that contributed in some way to the work that led to publication. Combining data on both co-authors and acknowledged individuals, the present study analyses disciplinary differences in researchers' credit attribution practices in collaborative context. Our results show that the important differences traditionally observed between disciplines in terms of team size are greatly reduced when acknowledgees are taken into account. Broadening the measurement of collaboration beyond co-authorship by including individuals credited in the acknowledgements allows for an assessment of collaboration practices and team work that might be closer to the reality of contemporary research, especially in the social sciences and humanities.

1. Introduction

Acknowledgments are one of many conventions by which researchers give credit and publicly share gratitude and recognition towards individuals, organizations and institutions that contributed to the work that led to publication. Although they could be perceived as the "scholar's courtesy" (Cronin, 1995), acknowledgements convey rich information that can shed light on researchers' collaborative activities that cannot be revealed by analysing co-authorship. In that sense, acknowledgements can be conceived as markers of symbolic capital (Bourdieu, 1975) that complements authorship, and have been included as a component of the "reward triangle" alongside authorships and citations (Cronin & Weaver-Wozniak, 1993). In most natural and biomedical sciences disciplines, teamwork constitutes the norm rather than the exception (Cronin, 2004; Wuchty, Jones, & Uzzi, 2007). Henriksen (2016) and Larivière et al. (2006) have further shown that the rise in research collaborations also extends to most social sciences disciplines, in terms of average number of authors, share of co-authored articles, as well as international collaboration. However, these results, as most bibliometric investigations of collaboration, are limited to formal collaborations as measured by co-authorship. Indeed, as highlighted by Katz and Martin (1997), many instances of collabo-

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ration do not lead to co-authorship, while indirect interactions between researchers might actually do. This has led them to conclude that co-authorship is a "rather imperfect or partial indicator of research collaboration between individuals." Katz and Martin (1997, p.11).

Laudel (2002) also challenged that traditional bibliometric practice of using co-authorships as a proxy for research collaboration and identified six types of research collaborations associated to distinct patterns of rewards. Based on interviews with researchers and an analysis of 133 publications, Laudel (2002) showed that, while some contributions were associated with authorship, one third of all contributions analysed were only rewarded by acknowledgements and about half of contributions were not associated to any public recognition and were thus invisible in formal communication channels. More recently, Ponomariov and Boardman (2016) surveyed academic researchers on their relationship with their collaborators and showed that in many instances, collaboration does not entail co-authorship, a finding which leads the authors to suggest using data that go beyond co-authorship when studying collaboration.

Types of contributions that get rewarded by authorship vary in their nature but also by field, discipline and specific teamwork culture (Larivière et al., 2016). High Energy Physics (HEP) represents a telling example of discipline-specific authorship attribution practices, with projects typically involving thousands of individuals and almost as many institutions. In that context, specific guidelines govern authorship. For instance, all members the project are included in a standard author list and each paper emerging from the project will be alphabetically co-authored by all those on the list (Biagioli, 2003; Birnholtz, 2006). In 2015, a new record for the largest number of authors on a single research article has been set by a HEP publication, co-signed by more 5000 individuals (Castelvecchi, 2015). A contrasting example is found in medical research, where the notion of authorship is closely linked to responsibility and accountability. Given the dangerous consequences associated to fraud in those disciplines and its rising co-authorship rates, the International Committee of Medical Journal Editors (ICMJE) published, for the first time in 1988, the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals. Updated in 2015, the ICMJE criteria recommends that authorship be based on:

- substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, AND
- drafting the work or revising it critically for important intellectual content, AND
- final approval of the version to be published, AND
- agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. (ICMJE, 2015).

Moreover, "contributors who meet fewer than all 4 of the above criteria for authorship should not be listed as authors, but they should be acknowledged" (ICMJE, 2015). This suggests that when the ICMJE guidelines are strictly followed, many contributions may be insufficient to warrant authorship and should rather be rewarded by an acknowledgement only., Contrasting with the ICMJE authorship guidelines, Rennie, Yank, and Emanuel (1997) proposed that the notion of author is "outmoded", and that it cannot appropriately account for credit and responsibility in multi-authors publications.[1] They proposed a system where the notion of contributorship would replace the notion of authorship. The main objective of their proposition was to ensure more equitable and reliable credit and responsibility attribution practices, where all collaborators would systematically disclose their specific contributions. This radical alternative would eliminate "the artificial distinction, mostly of a social nature, between authors and non-author contributors—that is, between 'authors' and 'acknowledgees'" (Rennie et al., 1997, p. 584). Almost two decades later, the contributorship model, as envisionned originally, has not been implemented anywhere. However, many journals, mostly in the medical field, now include contribution statements (e.g. Nature, PNAS, the British Medical Journal and the PLOS series of journals).

Notwithstanding their potential to reveal often invisible contributions to research, the current format of acknowledgements limits their use. As highlighted by McCain (1991), '[t]he format of acknowledgment varies from field to field and from journal to journal. As noted, persons and institutional sources may be listed in the methods and materials section of an article or explicitly thanked in an acknowledgements section' (p.506). This lack of standardization—highlighted by many researchers (e.g. Cronin, 1995; Giles & Councill, 2004; Mackintosh, 1972; Paisley & Parker, 1967)—has contributed to the ambiguous reputation of acknowledgements in the scientific community. This unstandardized space of thanking leads to very heterogeneous testimonies of gratitude, and contributions getting rewarded by an acknowledgement can be even more heterogeneous than those leading to authorship. On the one hand, Cronin et al. (1993) classification of acknowledgements ranges from conceptual and intellectual contributions to provision of financial support, access to data and materials, technical assistance and manuscript preparation; these same types of contributions can be sufficient to warrant authorship in certain contexts. On the other hand, contributions that could be perceived as trivial or hardly relevant in light of most authorship criteria can lead to authorship in some instances. For example, in a recent article, one of the authors' contribution consisted

[1] It should be noted that the ICMJE authorship guidelines were slightly different at the time of Rennie, Yank and Emmanuel proposal and consisted of the following: "Authorship credit should be based only on substantial contributions to (a) conception and design, or analysis and interpretation of data; and to (b) drafting the article or revising it criticallyfor important intellectual content; and on (c) final approval of the version to be published. Conditions (a), (b), and (c) must all be met." (ICMJE, 1997:311).