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The relationship between corresponding authorship and author position¹

Zaida Chinchilla-Rodríguez*, Rodrigo Costas**, Vincent Larivière***, Nicolás Robinson-García**** and Cassidy R. Sugimoto*****

**zaida.chinchilla@csic.es*

Instituto de Políticas y Bienes Públicos (IPP)-Consejo Superior de Investigaciones Científicas (CSIC), Albasanz 26-28, Madrid 28037 (Spain)

***rcostas@cwts.leidenuniv.nl*

Centre for Science and Technology Studies (CWTS), Leiden University, Wassenaarseweg 62, Leiden 2333 (Netherlands)

DST-NRF Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy, Stellenbosch University (South Africa)

****vincent.lariviere@umontreal.ca*

Université de Montréal, CP 6128 Station Centre-Ville, Montréal, Québec (Canada)

*****elrobinster@gmail.com*

Facultad de Comunicación y Documentación, Universidad de Granada, Campus de Cartuja, Granada (Spain)

******sugimoto@gatech.edu*

School of Public Policy, Georgia Institute of Technology, 685 Cherry Street, GA30332, Atlanta, (United States of America)

Introduction

As authorship plays an important role in career progression, several studies have identified demonstrable difference in both the amount and type of contributions according to author order. Research communities differ in how they represent author contribution in the byline of publications. While some disciplines order authors by decreasing order of contribution, (Bu et al. 2020), in most lab-based disciplines, first and last authors performed the most contributions (Larivière et al. 2016; Larivière, Pontille and Sugimoto 2021) with some exceptions where authors sign in alphabetical order (Waltman 2012).

It has been studied that first authors are more likely to be those who did most of the work (Lariviere et al. 2016) and they also tend to be academically younger. Last authors tend to be seniors' researchers associated with “advising” and the provision of scientific resources (Tscharntke et al. 2007). There are variations by discipline, but these patterns seem to hold for

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the large majority of publications (Dance 2012). Given this relationship between contribution and author order, many have moved to using the order of authors as proxies for contribution (Sauerman and Haeussler 2017; Robinson-Garcia et al 2020). First and last author have been validated through surveys (Smith et al 2020). However, there is a third category, that of corresponding author, who merits additional investigation.

Journals typically require that one of the authors identifies as the corresponding author. Corresponding authors take primary responsibility for communication with the journal during the manuscript submission, peer review, and publication process, and typically ensures that all the journal's administrative requirements are properly completed. They also should be available to respond to editorial queries, to respond to critiques of the work after publication and cooperate with any requests from the journal (ICMJE 2017).

Examining fields covering the journals subscribing to the ICMJE's guidelines in European countries, Mattsson, Sundberg, and Laget (2011) stated that in the Science Citation Index (SCI) the corresponding author is labelled as "reprint author" and that less than 60% of publications had a "reprint author" before 1998, while from 1998 and onwards on average 98% include them. They also found that first author was more likely to be the corresponding author with smaller team sizes while for larger team sizes were divided between first and last, especially in international co-authored papers, while for national co-authored papers corresponding author, more commonly, appears as first author.

Corresponding author can also be considered as an indicator of leadership. At the international level, although research groups are organized around different structures when they collaborate with external colleagues, they delegate the corresponding authorship to a researcher and by extension, to the country and institution they are associated to. For example, corresponding address has been used to demonstrate the leadership of particular countries (Chinchilla-Rodríguez et al. 2019, Zhou & Leydesdorff, 2006). A higher presence as first or corresponding authors suggests greater leadership; absence of such these roles could be associated with subordination, secondary role (González et al. 2017)

Despite this importance of corresponding authors, little empirical studies have studied the presence and distribution of corresponding authorship across bibliometric databases. We therefore take as our main objectives the following:

- a) to identify corresponding authors in WoS and Scopus and study how they relate to each other; and
- b) to investigate the role of corresponding authors according to discipline and country specifically in WoS.

Data and methods

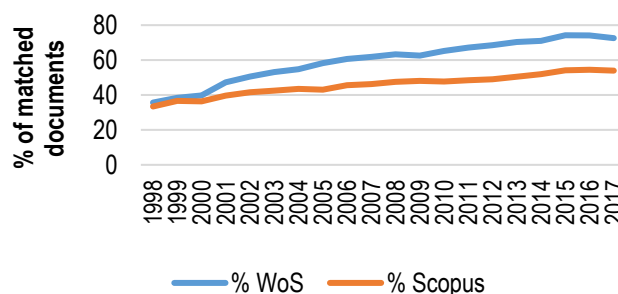
A total of about 33 million documents from WoS Core Collection and 43 million of documents from Scopus were retrieved from the in-house versions of those databases hosted at CWTS of Leiden University, all document types included. We used Digital Objects Identifiers (DOIs) to match more than 20 million documents published between 1998 and 2017 (n=20,461,917). The matched dataset represents 62% of all WoS publications and 47.4% of all Scopus publications.

Both databases have increased in the inclusion of DOIs over time, with the matched set representing 72.5% of WoS documents in 2017 and 54% of Scopus documents (Figure 1). According to the Scopus Content Coverage Guide², 60% of journals of more than 5,000

² https://www.elsevier.com/_data/assets/pdf_file/0007/69451/Scopus_ContentCoverage_Guide_WEB.pdf

international publishers are not associated with major publishers. As DOI registration requires investment and infrastructure that may be lacking for some countries or institutions, this might explain the lower proportion of documents with DOIs in Scopus.

Figure 1. Percentage of full databases represented by the set of publications matched with DOIs.



Bibliometric databases do not include metadata for corresponding author explicitly. Rather, the Reprint Address is the indication of the author to whom correspondence should be addressed³. Therefore, we operationalize corresponding author as reprint author and will use these terms interchangeably.

Results

Comparison reprint author in WoS and Scopus.

The number of documents with reprint authors has increased steadily across time. In the entire matched dataset, on average about 98% of WoS documents contain at least one reprint author, whereas only 87% of Scopus documents have these metadata. However, for those with reprint authors, Scopus has a higher proportion of documents with more than one reprint author—reaching 30% of our sample by 2016—and increasing at a more rapid pace than the inclusion of multiple reprint authors in WoS.

Figure 2. Number of documents within the database with at least one reprint author (A) and more than one reprint author (B)

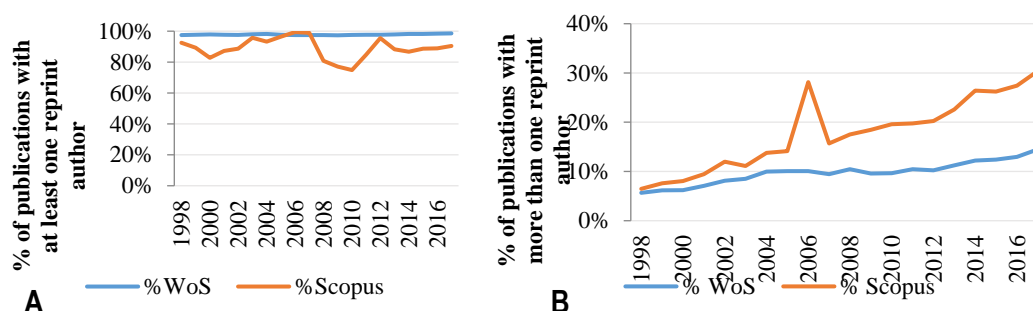


Table 1 shows whether WoS and Scopus assign the same corresponding author, as a function of the type of collaboration and order of the corresponding author (first, middle and last). For

³ https://support.clarivate.com/ScientificandAcademicResearch/s/article/Web-of-Science-Core-Collection-Explanation-of-Reprint-Address?language=en_US

all publications, the percentage of documents with the same reprint author in both databases is close to 86%, and WoS registers reprint authors in 12% of documents that Scopus does not, and only 1% of documents have no reprint author in both databases. For single authored publications (11.8% of all matched documents), nearly 80% have the same reprint author, whereas significant differences remain in documents where only one database identifies the reprint author. WoS always has more unique documents with reprint authors than Scopus (10.5% and 5.4% respectively). Around 4.5% of documents do not record any reprint author any of the two databases.

Table 1. Distribution of the position of reprint author in author order

	Same	In Wos and not in Scopus	In Scopus and not WoS	No reprint in both databases
% All	85.70	12.19	1.05	1.06
% Single authored	79.55	10.51	5.38	4.56
% Co-authored	86.51	12.41	0.48	0.60
% First	47.60	9.79	1.52	41.10
% Middle	25.51	3.76	1.08	69.65
% Last	13.42	1.58	0.66	67.44

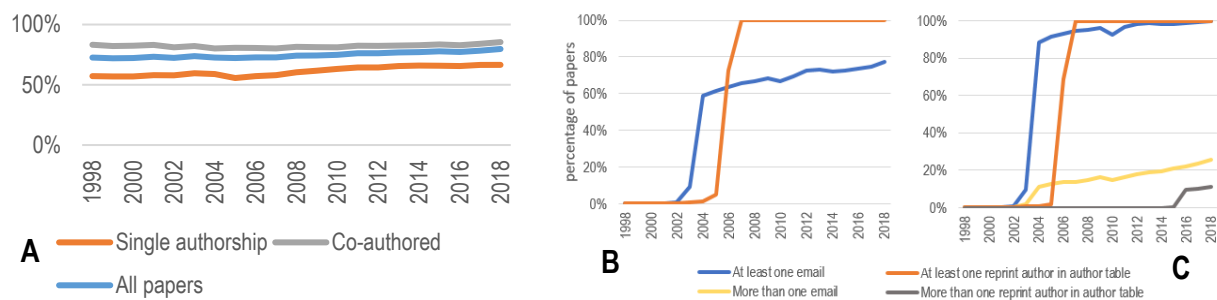
For co-authored publications and where the first, middle and last author appears as reprint author, 48%, 25% and 13% respectively of documents have the same reprint author. As described before, WoS has more unique documents where the reprint author is assigned than Scopus (second and third columns) and only a very low proportion of documents (4.5%) has no reprint author in both databases. In contrast, almost 70% and 67% respectively of documents where middle and last authors appear as corresponding authors have not been registered in WoS and Scopus.

Corresponding authorship in Web of Science.

We analyse more than 45 million documents for the period 1998-2018. The distribution of papers with reprint address metadata shows that for nearly 28% of all papers in 1998, and 20% in 2018, there is no metadata for reprint address (Figure 3A). For single authored papers, this percentage raises from 57% in 1998 to 67% in 2018, while for co-authored papers, percentages are higher (from 83% in 1998 to 85% in 2018)

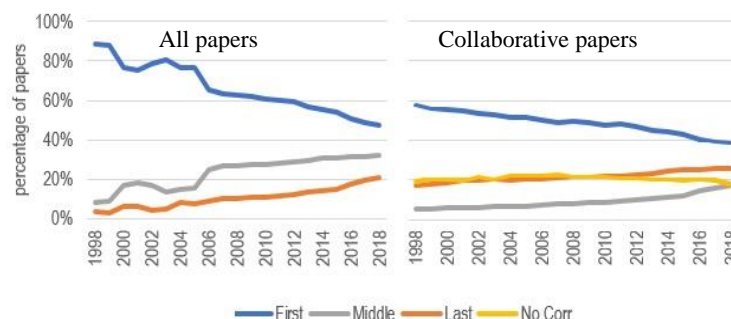
In the right panel, we can observe that WoS starts registering email addresses from 2001 onwards. As of 2004, it seems consistent but there is still incomplete in single-authored papers (in 2018, 21% of papers lack this information) (Figure 3B). Email addresses in reprint address field have been completely recorded over the last years in collaborative papers (Figure 3C). Besides, WoS starts registering consistently reprint author metadata in 2005; more than one email address in collaborative papers in 2004 increasing steadily over time (more than 25% of papers in 2018); and more than one reprint author per paper in 2016

Figure 3. Percentage of papers with reprint address metadata in WoS for all, single and co-authored papers (A); percentage of single-authored (B) and co-authored papers (C) with email addresses and reprint author metadata in WoS in relation with those that have a reprint address.



We also explored the position of corresponding author/reprint author (Figure 4). From 1998 to 2018, first author is the most common position in all papers although begins to decline in favour of middle (more than 30% of papers) and last author (more than 20%) as corresponding authors (left panel).

Figure 4. Evolution over time of author order position as corresponding author in all papers (left) and in collaborative papers (right) with at least one reprint author in the author table



When considering collaborative papers with reprint author metadata in all disciplines (right panel), the percentage of papers with corresponding author as first author descends (from 88% to 46%) while papers with last author as corresponding author multiply by four times and middle authors increase 6 times. It seems that first author was the corresponding author by default in early years and now last and middle authors are increasing at a higher rate than the rest. However, the percentage of papers with no corresponding author remain steady (around 20%).

Figure 5 (left panel) provides the evolution of corresponding authors' position by broad scientific fields. First authors are decreasing over time in MED, NSE and SS, while it remains the most prevalent author order of corresponding authors in AH—especially since corresponding authorship becomes properly indexed. NSE presents the higher decrease (around 40%) of first authorship and papers with no corresponding author also decrease over time (from

6% to 1.7%). MED shows a lower decrease in first authorship than NSE, but still significant (from 54% to 40%). However, it is the scientific field with a higher proportion of papers whose corresponding authors are last authors. This trend remains over time with around 35% of papers in 2018. In SS, first authorship is the most common order position (77% in 2018) with a slight decrease (10%) over time, while last and middle authorship multiply for two and three times respectively their presence as corresponding authors (15% and 10% respectively in 2018).

The right panel (Figure 5) shows the position of corresponding author by disciplines for collaborative papers. First authors are corresponding authors in almost all disciplines, except for those related with NSE and MED. Biomedical Research (46%), Chemistry (38%), and Biology (28%) exhibit the highest percentage middle authors as corresponding authors, while last authorship is higher in Chemistry (23%) and Engineering & Technology (18%).

Figure 5. Percentage of collaborative papers by corresponding authorship and broad scientific field (left panel); percentage of all papers and co-authored papers with at least one reprint author by author order as corresponding author and discipline (right panel)

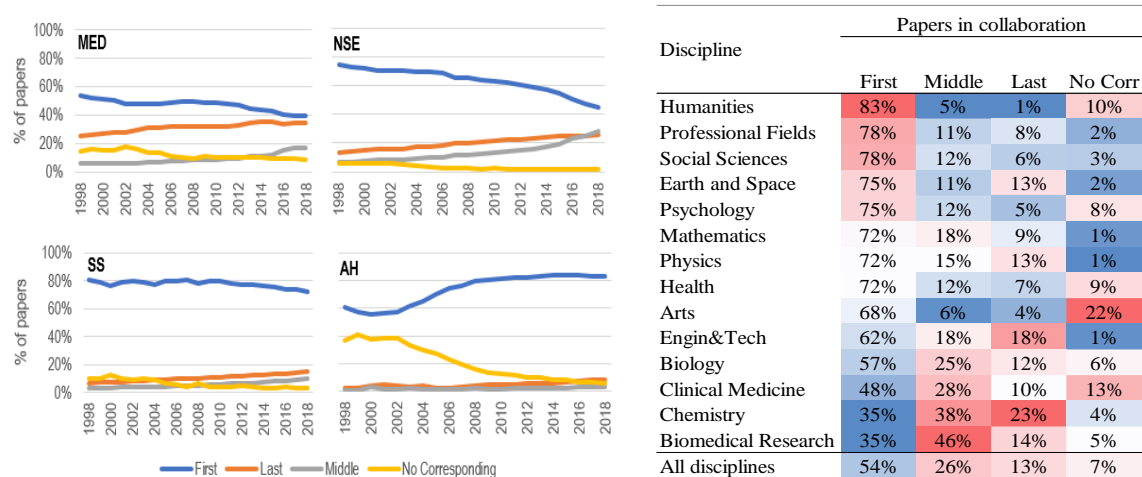
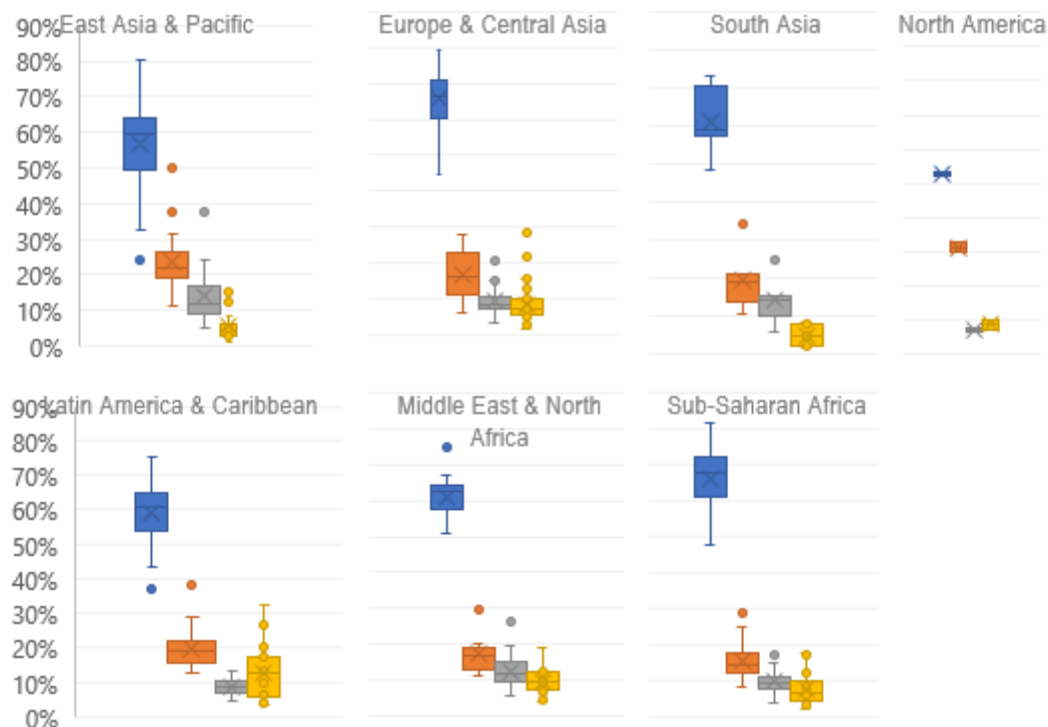


Figure 6 shows how the position of corresponding authors vary by regions. A higher proportion in first authorship is observed in all regions. There are extreme cases, however—in East Asia & Pacific—with South Korea showing 25% of first and 50% of middle position as corresponding author, and China, Taiwan and Indonesia, which have a higher proportion of last and middle corresponding authorship.

Figure 6. Distribution of papers according to the order position of corresponding author in countries classified by geographical regions. Legend: First (blue); last (orange); middle (grey) and no corresponding author (yellow).



Discussion

Authorship is a marker of scientific capital and prestige (Cuschieri 2022), and corresponding authorship is associated with higher scientific status. Several studies have examined the relationship between corresponding author and author order; however, these studies often focus on small datasets, covering a limited number of research fields or time period (Yu and Yin 2021). This study presented an empirical analysis of corresponding authorship as indexed in two major bibliometric databases (WoS and Scopus).

We found that although the number of documents with reprint author has increased steadily over time, WoS indexed more papers with reprint author metadata than Scopus, while the number of documents with more than one reprint author is larger in Scopus than in WoS. Besides, there are significant differences in documents where only one database identifies a reprint author or the reprint author is not the same. Therefore, there is an important need of future research to further understand these differences in indexing strategies between these two databases.

In our analysis of corresponding author in WoS, we found that WoS started registering consistently reprint author metadata from 2005 onwards and more than one reprint author in 2016, including author email data. We also found that first authorship is the most common position of the corresponding author, although this is declining in favour of middle and last author as corresponding authors, especially in MED and NSE fields. The average of percentage of papers with no corresponding author remain steady over time (around 20%).

There are also some country differences. Although first authorship is more likely to serve as corresponding author in most countries, there are exceptions such as South Korea, China or

Taiwan, suggesting that different scientific cultures may also play a role in the choice of the corresponding author. Moreover, the percentages of articles with more than one corresponding author or “equal first authors” has risen over time (Hu 2009). This might also point that funding incentives have implications on the raise of more than one corresponding author in publications, which open new research questions to be further investigated.

Given the value of bibliometric metadata for science policy (Fuyuno and Cyranosky 2006; Franzoni, Scellato and Stephan 2011; Quan, Chen and Shu 2017), it is important to assess their strengths and weaknesses (Bornmann 2018; Guerrero et al. 2021) in order to guarantee the bibliometric relevance of the sources. This is particularly relevant nowadays, with more bibliometric databases being developed (e.g. Dimensions.ai or OpenAlex). How these databases operationalize specific metadata elements may differ substantially among them, and sometimes important metadata elements like the corresponding authors may even be overlooked (e.g. the current version of OpenAlex does not include corresponding author identification). It is therefore important to continue studying these differences among data sources and provide better evidence for researchers to choose those which better represent their ultimate goals.

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