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University of British Columbia
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Universidade Federal do Rio Grande do Sul
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Scholarly publication of Brazilian researchers across disciplinary communities

Laura Baumvol[1], Simone Sarmento[2], and Ana Beatriz Arêas da Luz Fontes[2]
[1] University of British Columbia | [2] Universidade Federal do Rio Grande do Sul

This paper examines the context of scholarly knowledge production and dissemination in Brazil by comparing the publishing practices in both Portuguese and in English of Brazilian scholars who hold a research grant, across eight fields of knowledge. Data consists of 1,874 Curricula Vitae and the analysis focused on the language, number, and genres of publications over a three-year period (2014 to 2016). The study revealed a clear contrast regarding the more frequent use of English by researchers in the 'harder' sciences and the preference for Portuguese by those in the 'softer' sciences. The results also suggested an interconnection in which scholars who published the most tended to adopt English. Multiple factors involved in the genre and language choices made by academics were analysed, such as characteristics of the work produced by each disciplinary community, the audience of the research, the type of language used, and the need to obtain research funding. This investigation can potentially inform policies and investments in Brazilian higher education and research to provide continued support specific to the needs of different disciplinary communities, as well as foster the inclusion of multilingual scholars who do not have English as their first language in the global arena of knowledge production and dissemination.

Keywords: scholarly publication, multilingual scholars, knowledge production, knowledge dissemination, disciplinary communities

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1. Introduction

Publications are the tools for exchanging ideas and research findings to foster scientific development and, thus, are essential for enabling academics to contribute to the advancement of society. Scientific research papers or articles are the most established way of capturing, creating, and spreading new knowledge, which contributes to world development and generates knowledge capital (Bourdieu, 1984, 1986, 1991). At the same time, academic publications create social capital (Bourdieu, 1988) for scholars by the acquisition of more intellectual and professional prestige and more funding for research. In fact, academic publishing acts as a driving force of scholarly endeavour, being key not only to construct knowledge, but also to assess a scholar's professional competence (Hyland, 2015).

When choosing a language in which to publish, academics are greatly influenced by the tacit and/or explicit norms and conventions of the different disciplinary communities. To understand the status of English and other languages in academic and scientific communication, we must examine not only data regarding the entire global academic scientific community, as done in the seminal works of Tsunoda (1983) and Ammon (1998, as cited in Hamel, 2007), but also the practices within each country. Several authors (Ammon, 2006; Burgess et al., 2014; Hanauer & Englander, 2011; Lopez-Navarro, 2015) have emphasized the importance of mapping the publication patterns of a country's researchers, i.e., what, when and why they use their country's first language and/or English to produce knowledge.

Studies in the emerging field of English for Research and Publication Purposes (ERPP), a branch from English for Academic Purposes (EAP) (Cargill & Burgess, 2008; Lillis & Curry, 2006a), have demonstrated an increase in the proportion of English-medium papers published by multilingual academics who do not have English as their first language (Wood, 2001; Bordons & Gomez, 2004; Benfield & Feak, 2006; Flowerdew, 2013). In addition, considerable research related to the dominance of English for global knowledge production has been conducted in non-Anglophone settings (Ammon, 2010; Curry & Lillis, 2004, 2010; Englander, 2014; Ferguson et al., 2011; Flowerdew, 1999, 2001, 2007, 2008, 2013; Lillis & Curry, 2006a, 2006b, 2010a, 2010b, 2016; Lopez-Navarro et al., 2015; Perez-Llantada et al., 2011). Nevertheless, investigations are still scarce in geolinguistic regions located in the global semi-periphery, such as in Latin American countries, like Brazil and Mexico (Bennett, 2014; Canagarajah, 2002; Monteiro & Hirano, 2020).

This paper addresses, thus, a gap in the field of ERPP: the Brazilian context of knowledge production and dissemination. Brazil occupies the 15th position in the world ranking of number of publications between 1996 and 2019 (Scimago Journal

& Country Rank, 2020), with a much higher volume of knowledge production than its Latin American neighbours. Despite Brazil's important role in knowledge production, it has not yet been the focus of much investigation when compared to countries located in other global regions, such as Asia or Europe (Corcoran, Englander, & Muresan, 2019a).

The following research question guides our investigation: What are the differences and similarities in number and types of publications (articles in academic journals, books, book chapters, and full papers in conference proceedings) in Portuguese and in English amongst Brazilian CNPq research grant recipients from different fields of knowledge? The research grants awarded by the National Council for Scientific and Technological Development (CNPq) are intended for researchers affiliated with Brazilian HE or research institutions who stand out among their peers, aiming to value their scientific production, according to regulatory criteria established by the CNPq's advisory committees (CNPq, 2015). CNPq grants are considered a measurement of the quality of a researcher, of a graduate program, and even of a research institution.

We selected research grant recipients from the eight broad fields of knowledge (Agricultural Sciences, Applied Social Sciences, Biological Sciences, Engineering, Exact and Earth Sciences, Health Sciences, Human Sciences, and Linguistics, Literature, and Arts), officially adopted by the country's two most important funding agencies, CNPq and the Coordination for the Improvement of Higher Education Personnel (CAPES). For the purposes of data analysis, we grouped these eight fields of knowledge according to a continuum in which some academic disciplines and fields are considered 'harder' or 'softer' than others (Pigliucci, 2009). The 'harder' sciences are comprised of disciplines in the natural sciences, exact sciences, and health sciences (in the case of our corpus, the fields of Agricultural Sciences, Biological Sciences, Engineering, Exact and Earth Sciences, Health Sciences), while the 'softer' sciences include disciplines in the social sciences and humanities (in our corpus, the fields of Human Sciences, Linguistics, Literature, and Arts, and Applied Social Sciences).

It is important to note that this categorization does not account for specificities of academic disciplines, such as different subfields of Political Sciences, Economics, and Health Sciences, or interdisciplinary research. Most important of all, the classification does not imply any hierarchy between the 'harder' and 'softer' sciences. It is based on general methodological aspects, exactitude, the intrinsic nature of the object of study, and how strongly one can state, test and then accept or reject hypotheses (Helmenstine, 2018; Pigliucci, 2009; Storer, 1967). Fields pertaining to the 'harder' sciences commonly involve experiments in which controlled variables and objective measurements are relatively easily set and results can be represented mathematically. In contrast, those in the 'softer' sciences deal with

intangibles and commonly focus on the study of human and animal behaviours and interactions, thoughts, and feelings. In these areas, language discourse tends to be more complex and play a crucial role in interpreting results and building arguments, which requires language competence, rhetorical skills, and advanced academic literacy from the writers, as well as prior knowledge of the field.

A theoretical framework based on theories of linguistic imperialism (Phillipson, 1992, 1997, 2003, 2008, 2013, 2015, 2018; Philipson & Skutnabb-Kangas, 1994), legitimacy, and symbolic power (Bourdieu, 1982, 1984, 1991; Bourdieu et al., 2001) is adopted to approach the practices of knowledge production and dissemination in Brazil. In addition, the notions of discourse communities (Swales, 1990, 2004), of scientific discourse communities (Corcoran, 2015) and, more specifically, of disciplinary communities (Burgess et al., 2014; Hyland, 2007; Kuteeva & Mauranen, 2014; Lopez-Navarro, 2015) are used as the lens for analysing and interpreting the results of our investigation.

In the first section of the paper, we explore why and how different disciplinary communities in Brazil adopt English as their language of publication. The following section presents the methodology adopted in this study, followed by the analysis and discussion of the corpus. Finally, we draw conclusions and make suggestions for future research in the field.

2. The use of English for publication purposes in different disciplinary communities

Disciplinary communities can be understood as "socially embedded communities" with their own specificities and 'machinery' to produce knowledge (Herculano & Norberto, 2012; Kuteeva & Airey, 2014; Lopez-Navarro et al., 2015; Petersen & Shaw, 2002; Waltham, 2010). In their investigations, Mabe and Mulligan (2011) and Ware and Mabe (2015) found significant differences in patterns of publishing, reading, and using scholarly materials between multilingual scholars of certain disciplines. For instance, the importance of journal articles in scholarly communication is greater in the 'harder' than in the 'softer' sciences, in which books and monographs also play a significant role. According to data from the Thomson Reuters' Journal Citation Report, the average number of publications of a journal (more specifically "citable items", which are mostly articles, reviews, and proceeding papers) is 120 publications per year. In the fields of science and technology, the average is 140 publications per year, while in the fields of social sciences and humanities is only 45 publications per year (Mare & Wabe, 2015). Another difference is the speed of publishing, which is key in experimental

and empirical subject areas, due to the importance of ownership of ideas and discoveries; in the fields of arts and humanities this seems to be less important.

Regarding language choices, each disciplinary community is "more or less endo- or exocentric, more or less internationalized and anglicized, and more or less 'Anglophone' or 'local-language-oriented'" (Lopez-Navarro et al., 2015, p. 944). Thus, the 'degree of internationalization' of different academic disciplines affects the publishing rates in English and in a country's home languages. Based on data collected in Scopus from 1996 to 2011, Van Weijen (2012) demonstrated that most multilingual researchers publishing in English belong to fields related to the 'harder' sciences (e.g. physics, engineering, and materials science), while academics who prefer publishing in languages other than English (e.g. Dutch, French, Italian, Portuguese, or Spanish) tend to do so in the fields of the 'softer' sciences (e.g. social sciences, psychology and arts, and humanities). A range of intertwining factors account for such differences, involving (1) networks of research collaborations; (2) access to 'literacy brokers' who mediate English-medium text production in various ways; (3) the audience of the knowledge produced; (4) and the language skills of writers and potential readers, among other factors (Ammon, 2006; Carli & Calaresu, 2003; Curry & Lillis, 2010; Hammel, 2007; Lillis & Curry, 2006a; Martinez & Graff, 2016).

In these complex circumstances, previous research has questioned whether the choice of the language used for publication is actually the scholars' choice or not, since their decisions are somehow limited by larger sociocultural and historical conditions (McGrath, 2014; Salager-Meyer; 2014; Solovova, Santos, & Verissimo, 2018). Educational and research institutions, as well as publishing companies, are also heavily influenced by market conditions when choosing the language for their publications. The adoption of English as the language of publication brings not only economic benefits but also allows for these stakeholders' inclusion in the international, educational, and scientific arenas (Kirkpatrick, 2010; Perez-Llantada et al., 2011).

In addition, language choice is associated with the rewards given by different national academic systems to English-medium publications over national languages and the importance gained over time by publication metrics and ranking systems that privilege the exclusive use of English (Corcoran, 2015; Curry & Lillis, 2004; Englander, 2014; Hanauer & Englander, 2011). Both in Anglophone and non-Anglophone countries, scholars' research productivity and performance are measured by both their institutions and national evaluation agencies according to the frequency with which they appear in citation indexes. The conditions for scientific journals to be included in these indexes involve having English as their language of publication and their contributions referenced (the so-called 'referenced journals'). The great majority of these journals accept publications

only in English and, thus, academics are left with almost no choice but to publish in English (Curry & Lillis, 2010). The expression 'publish or perish', coined by Wilson (1942), has been used to describe the pressure endured by scientists to quickly and continuously publish their work in order to advance in their careers (Garfield, 1996). With the establishment of English as a global language of science, the expression has been adapted to 'publish in English or perish' (Curry & Lillis, 2004; Flowerdew, 2008, 2013; Nygaard & Bellanova, 2018). It should be noted, however, that if, on the one hand, multilingual academics have to cope with the unfair pressure to publish in English, on the other, it is difficult to deny that the use of one global scientific language helps in the networking and the exchange of ideas among academics, allowing for transnational scientific exchanges and collaborations.

Therefore, in this study we examine the publishing practices in Portuguese and in English of Brazilian research grant recipients, who are researchers with notable scientific contributions in their respective areas (CNPq, 2017). We introduce descriptive data on the genres preferred by the eight different disciplinary communities. In addition, data on the language chosen for publishing in each of the genres is presented.

3. Methodology

This study analysed and compared the information recorded in the Curricula Vitae (CVs) of Brazilian CNPq grant recipients from the eight fields of knowledge (Agricultural Sciences, Applied Social Sciences, Biological Sciences, Engineering, Exact and Earth Sciences, Health Sciences, Human Sciences, and Linguistics, Literature, and Arts). The CVs were extracted from the Lattes Platform (hereafter referred to as "Lattes CVs"), a platform that integrates detailed academic curricula of all scholars working in Brazilian post-secondary institutions and is used by funding agencies and other stakeholders for a number of reasons, including ranking of institutions and distribution of resources.

To obtain a proportional representation of scholars from the different areas, the filter "field of knowledge" of the Lattes Platform was crossed with the filter "CNPq research grant", resulting in a total of 18,785 Lattes CVs. Data were gathered from 10% of CVs from each area (a total of 1,874 CVs), selected in a randomized way with one in every five Lattes CVs examined.

This investigation compares the number of different types of publications between 2014 and 2016. Four types of written genres were considered: articles in academic journals, books (including full books and editing), book chapters, and papers in conference proceedings (only full papers, not abstracts). Each of these

genres were analysed considering total number of publications; number of publications in Portuguese; and number of publications in English. The independent variable was the eight fields of knowledge officially adopted by CNPq and the Lattes Platform. The final corpus consisted of publications from 404 scholars from Exact and Earth Sciences; 358 from Biological Sciences; 247 from Engineering; 232 from Human Sciences; 229 from Health Sciences; 211 from Agricultural Sciences; 126 from Applied Social Science; and 67 from Linguistics, Literature, and Arts, the smallest area.

4. Analysis

In this section, we present the data, followed by the overall analysis of the total number of publications by researchers in different fields of knowledge. Then, we provide a detailed examination and comparison of the language choices by these communities when publishing each of the four written genres. An important element of our analysis is the comparison between fields that integrate the 'softer' sciences (Applied Social Sciences, Human Sciences, and Linguistics, Literature, and Arts) and those in the 'harder' sciences (Agricultural Sciences, Biological Sciences, Engineering, Exact and Earth Sciences, and Health Sciences). Table 1 shows the average number of publications for each genre and for each language of publication used by scholars across the eight fields of knowledge in a three-year period (2014 to 2016). The number in parentheses after each field of knowledge indicates the sample size.

The total number of publications in Portuguese and in English suggests that academics from the 'harder' sciences published more than those in the 'softer' sciences. Also, some specific areas appear to have a higher average publication rate than others. For instance, the average in the Health Sciences, Agricultural Sciences, and Engineering varied between 27 and 29 texts, while the average of those in the Human Sciences was around 16 texts and of those in Linguistics, Literature, and Arts was 10.5.

When considering all four genres published in both Portuguese and in English, data from academics from four of the five fields that integrate the 'harder' sciences point to a preference for publishing articles in academic journals in comparison to the other genres (Agricultural Sciences, $M = 22.6$; Biological Sciences, $M = 16.3$; Exact and Earth Sciences, $M = 12.8$; Health Sciences, $M = 25.9$). This was also true for Applied Social Sciences ($M = 9.0$) and Human Sciences $M = 7.2$). The exceptions were Engineering, in which publication of full papers in conference proceedings seemed to be preferred ($M = 13.7$), and Linguistics, Literature, and

Table 1. Average publication of articles in academic journals, books, book chapters, and full papers in conference proceedings by participants from 2014 to 2016

	Agricultural sciences (211)	Applied social sciences (126)	Biological sciences (358)	Engineering (247)	Exact and earth sciences (404)	Health sciences (229)	Human sciences (232)	Linguistics, literature, and arts (67)
Articles in academic journals	22.6	9.0	16.3	12.3	12.8	25.9	7.2	3.8
Articles in Portuguese academic journals	7.3	5.8	1.0	1.8	0.5	4.4	5.4	3.0
Articles in English in academic journals	15.2	3.1	15.3	10.5	12.2	21.4	1.3	0.5
Books	0.5	1.1	0.2	0.3	0.2	0.3	1.7	1.2
Books in Portuguese	0.5	1.0	0.2	0.2	0.1	0.3	1.5	1.1
Books in English	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.3
Book chapters	2.0	3.2	1.1	0.8	0.7	2.1	4.9	4.4
Book chapters in Portuguese	1.7	2.6	0.6	0.2	0.2	1.8	4.1	3.4
Book chapters in English	0.3	0.5	0.5	0.5	0.5	0.3	0.5	0.6
Full papers in conference proceedings	2.9	8.2	1.3	13.7	2.6	0.7	2.1	1.1
Full papers in conference proceedings in Portuguese	2.4	5.9	0.6	7.7	0.7	0.3	1.9	1.0
Full papers in conference proceedings in English	0.6	2.2	0.7	6.0	1.9	0.4	0.2	0.1
Average total publication	**28.0**	**21.5**	**18.9**	**27.1**	**16.3**	**29.0**	**15.9**	**10.5**

Arts, which had book chapters as the most common way to produce knowledge ($M = 4.4$).

Additionally, a trend emerges pointing to greater differences between the types of publications in the 'harder' sciences than in the 'softer' sciences. For instance, when looking at the means it is possible to observe that the average publication rate of articles in Health Sciences was 86 times higher than that of full books, 37 times higher than that of full papers in conference proceedings, and 12 times higher than that of book chapters. In Biological Sciences, the average number of articles was 81 times higher than that of books, 15 times higher than that of

book chapters, and 12 times higher than that of full papers in conference proceedings. In Exact and Earth Sciences, the average quantity of article publication per scholar was 64 times higher than that of books, 18 times higher than that of book chapters, and five times higher than that of full papers in conference proceedings. In Agricultural Sciences, the average number of articles published was 45 times higher than that of books, 11 times higher than that of book chapters, and eight times higher than that of full papers in conference proceedings. As previously stated, the much higher rate of articles as compared to the other genres might be related to the value given by institutions, international and national funding agencies to publication of articles in peer-reviewed and high-indexed journals.

An inspection of the means shows an exception in the field of Engineering, in which the average publication rate of the top ranked genre (full papers in conference proceedings) was quite similar to that of the second ranked genre (articles in academic journals). In comparison to books, the average of full papers in conference proceedings per scholar was 45 times higher, and the average of articles was 41 times higher; in comparison to book chapters, the average number of full papers in conference proceedings was 17 times higher, and the average of articles was 15 times higher. Conversely, within the fields of the 'softer' sciences, an analysis of the means indicates that the differences in the number of publications amongst the four written genres were less evident. In Applied Social Sciences, the number of articles and full papers in conference proceedings were quite similar, being approximately eight times higher than that of books, and almost three times than that of book chapters. In Human Sciences, the average number of articles was only four times higher than that of books, three times higher than that of full papers in conference proceedings, and 1.5 times higher than that of book chapters. In Linguistics, Literature, and Arts, the average number of book chapters (the top ranked genre) and the average number of articles (second ranked genre) were very similar. They were both approximately three times higher than that of full papers in conference proceedings and books.

In terms of language preferences, the results suggest that academics from the 'softer' sciences published more in Portuguese than in English in all four types of publications. The largest mean differences were found in Linguistics, Literature, and Arts, in which academics published 15 times more Portuguese-medium books than English-medium ones, and 10 times more Portuguese-medium full papers in conference proceedings than English-medium ones. In these 'softer' sciences fields, the figures for books, book chapters, and full papers in conference proceedings in English were very low, varying between 0.1 and 0.6 over the three-year period. There were a few slightly higher figures for publications in English in the Applied Social Sciences (3.1 articles and 2.2 full papers in conference proceedings) and in the Human Sciences (1.3 articles). However, these numbers were still

lower when compared to the means of publications in Portuguese. In contrast, in most fields of the 'harder' sciences, the pattern of means points to a preference for English in the genres with the highest average rate of publications. For instance, 95% of articles in Exact and Earth Sciences and Biological Sciences were English-medium publications; 83% in Health Sciences; and 67% in Agricultural Sciences. English also prevailed in full papers in conference proceedings in the fields of Exact and Earth Sciences (73%) and of Health Sciences (57%).

Considering other types of publications, distinct patterns emerge. In Exact and Earth Sciences, for instance, the average number of published books was the same for both languages, with a low figure of only 0.1 book per scholar over the 3-year period examined. In Biological Sciences and Health Sciences, contrary to the overall trend for the 'harder' sciences, there was a preference for Portuguese in books ($M = 0.2$ and $M = 0.3$, respectively) and book chapters ($M = 0.6$ and $M = 1.8$, respectively). Here again, the figures were very low regarding the average number of books, varying between 0.2 and 0.3 for Portuguese-medium texts and between zero and 0.1 for English-medium ones. An inspection of means from the field of Engineering, indicates that language preference depends on the genre. For example, publication of articles in academic journals and book chapters was higher for English-medium publications compared to Portuguese, while the opposite pattern was found for books and papers in conference proceedings. The difference was striking between English-medium articles in academic journals ($M = 10.5$) and Portuguese-medium ones ($M = 1.8$), revealing that 85% of articles were published in English. However, the difference was much smaller between book chapters published in English ($M = 0.5$) and in Portuguese ($M = 0.2$).

With respect to full papers in conference proceedings and books, the difference between Portuguese-medium and English-medium publications was also smaller in comparison to articles, with an average of 7.7 papers in conference proceedings per scholar in Portuguese and 6.0 in English, which shows a distribution of 56% of Portuguese-medium papers and 44% of English-medium ones. Regarding books, the data showed an average of 0.2 books in Portuguese and 0.1 books in English per scholar in Engineering over the three-year period. Finally, these scholars did not seem to publish many books and book chapters, but published, by far, the largest number of full papers in conference proceedings among all fields of knowledge ($M = 7.7$ for Portuguese and $M = 6.6$ for English). Considering the use of both Portuguese and English through the four written academic genres by the 'harder' and the 'softer' sciences, an overall trend was identified. While the latter seemed to have preferred Portuguese, the 'harder' sciences opted mostly for English. However, there were some exceptions. The field of Agricultural Sciences was also predominant in the use of Portuguese in the four types of

publications, while Applied Social Sciences also prevailed in English-medium full papers in conference proceedings.

Figure 1 below summarizes the data presented in Table 1, allowing for a clearer visual comparison between the eight fields of knowledge.

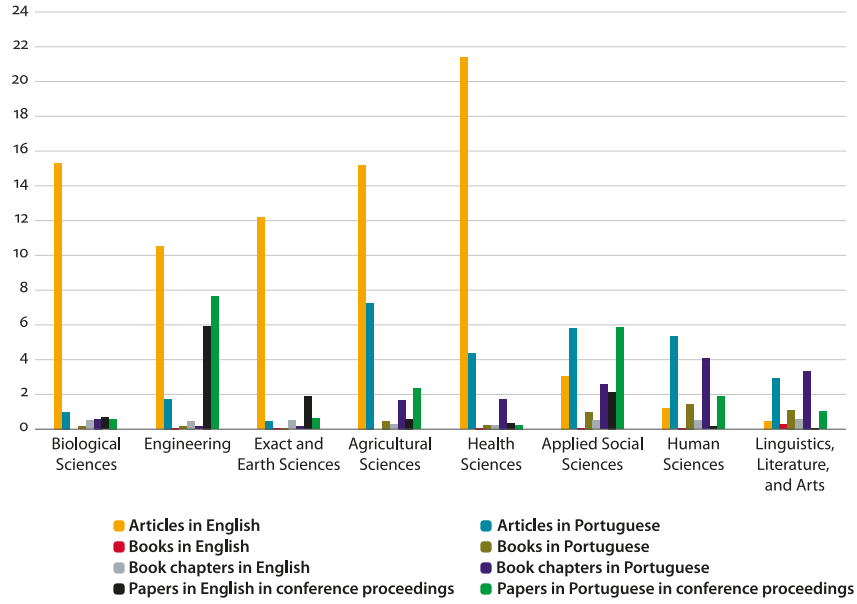

Figure 1. Average of articles in academic journals, books, book chapters, and papers in conference proceedings published in Portuguese and English by scholars from different disciplinary communities from 2014 to 2016

5. Discussion

This investigation focused on the research publication and dissemination practices in Brazil, a still under-explored geographic region by the field of ERPP. The results point in the same direction of investigations conducted in several other contexts (Kuteeva & Airey, 2014; Lopez-Navarro et al., 2015; Mabe & Mulligan, 2011; Motta-Roth et al., 2016; Solovova, Santos, & Verissimo, 2018; Waltham, 2010; Ware & Mabe, 2015, among others) in that each disciplinary community has their own practices regarding preferred languages of publication and types of written genres.

When examining the extent to which Brazilian scholars from the eight different fields of knowledge used English or Portuguese, our research suggests a contrast regarding the more frequent use of English by academics in the 'harder'

sciences in comparison to those in the 'softer' sciences over the period examined. This may be interpreted as the former disciplinary communities having a more exocentric, more internationalized, and more anglicized profile (Lopez-Navarro et al., 2015). The 'degree of internationalization' among different academic disciplines affects the publishing rates in English and in a country's home languages. Not only is English the most functional language for disseminating knowledge to international audiences, but it can also be more easily adopted due to the exactitude which prevails in the 'harder' sciences. In some cases, the employment of quantitative and formal terms and precise measurements might be rather distinct from the 'softer sciences' and, consequently, cause fewer difficulties in writing up the findings either in the local language or in English (De Swaan, 2001).

In contrast, our findings reveal that, overall, disciplinary communities in the 'softer' sciences appear to have produced knowledge more frequently in Portuguese than in English, being more endocentric and locally-language oriented. This could be related to the fact that disciplines in these fields are largely influenced by cultural and historical factors and, at the same time, are more locally oriented and have a greater intra-national interest from their academic communities (Ammon, 2006; Solovova, Santos, & Verissimo, 2018). In addition, the humanities and the social sciences are, in general, much more strongly bound to language, with discourse tending to be more complex and playing a more crucial role than in the 'harder' sciences.

Research in these fields commonly involves interpretation and argumentation rather than verification and falsification and, thus, does not favour uniform linguistic expressions, while in the 'harder' sciences the presentation of results from empirical studies allow for the use of linguistic standards that are more easily assimilated (Skudlik, 1991). While the adoption of Portuguese favours domestic audiences, which accept and understand publications more readily in Brazil's dominant language, it hampers scholars from sharing knowledge with a greater audience around the globe, and impairs the international awareness of the country's academic contributions.

A field whose results should be further explored is Applied Social Sciences. In the same manner as researchers in the other two fields in the 'softer' sciences (Human Sciences and Linguistics, Literature, and Arts), academics in Applied Social Sciences appeared to, overall, publish more in Portuguese than in English. However, they also seemed to have published more English-medium full papers in conference proceedings than three fields in the 'harder' sciences (Agricultural Sciences, Biological Sciences, and Health Sciences) and, thus tended to use more English than the other two fields in the 'softer' sciences. A possible explanation for these results may be that, in the classification used in our research, which is the same used by Brazilian funding agencies, the field of Applied Social Sciences

is comprised of a broad range of different disciplines, such as architecture and urbanism; business; communication; economics; home economics; industrial design; information sciences; law; museology; social service; tourism; and urban and regional planning. Thus, if we understand the distinction between 'harder' and 'softer' sciences on a continuum related to perceived scientific methodological rigour, exactitude, and objectivity differences (Helmenstine, 2018; Pigliucci, 2009; Storer, 1967), some of the academic disciplines included in Applied Social Sciences lean towards the 'softer' end (communication, law, social services, tourism, and museology); while others (business, economics, architecture and urbanism) can be 'softer' or 'harder', depending on the scientific method adopted. Such differences can be further explored in investigations that focus on more specific academic disciplines or sub-disciplines.

The results suggest a possible association between the different aspects examined regarding publications – volume, preferred language, and preferred written genre. When taking into consideration all the publications in Portuguese and in English together, our results point to a possible interconnection in which those academics who published the most – those in disciplines of the 'harder' sciences – tended to adopt English. On the contrary, those scholars who publish the least – the ones in the 'softer' sciences, seem to have a preference for Portuguese. This association might be justified by some characteristics of the fields in the 'harder' sciences, as these academics (1) have already adjusted to the criteria set by institutions and funding agencies of publishing in high prestige and high-indexed journals, which usually have English as their exclusive language of publication (Curry & Lillis, 2010); (2) use intermediaries in the writing process of English-medium texts more frequently, the so-called "literacy brokers" (Lillis & Curry, 2006a), as they usually can count on more resources to pay for language and copy-editing services; (3) very frequently participate in multi-authored publications; and (4) conduct research with empirical or experiential findings that need to be published faster and can more easily be reported in an objective and concise way, which also affects the speed of publications. In future research, these possible associations must be tested statistically.

In the 'harder' areas, publishing in English has become almost mandatory if scholars want to have their research widely read, recognized, and valued in the global scientific arena. In certain cases, using English is a condition to publish even in Brazilian journals, as some of the most prestigious journals in the country only accept submissions in English. In the field of Health Sciences, for instance, the *Brazilian Journal of Psychiatry* (Brazilian Journal of Psychiatry, 2020), the *Dementia & Neuropsychologia Journal* (Dementia & Neuropsychologia Journal, 2020), and the *Journal of Applied Oral Science* (Journal of Applied Oral Science Scielo, 2020) only accept English-medium publications. In addition, in general,

more researchers in the 'harder' sciences have articles in academic journals as the main genre for knowledge production than academics in the 'softer sciences', who have books and book chapters as the predominant types of publication.

Thus, our descriptive data suggest an overall trend in which academics who published the most (those in the 'harder' sciences) tended to (1) use English to a greater extent than Portuguese, and to (2) publish articles in English more frequently than the other three types of English-medium publications, with the exception of Engineering, in which the number of full papers in conference proceedings surpassed that of articles by a small margin. Conversely, academics who publish the lowest total number of texts (Linguistics, Literature, and Arts and Human Sciences) tended to (1) use Portuguese to a greater extent and to (2) publish books and book chapters more frequently. This points to a possible association between scholars' preferred language for publication and the amount of publications. As mentioned before, a myriad of factors is involved in the genre and language choices made by academics, such as characteristics of the work produced by each disciplinary community, the audience of the research, the type of language used, and the need to secure funding for carrying out research, among others.

In the fields of the 'harder' sciences, there tends to be more rigour in the publication system, as Brazilian researchers publish in high-indexed English-medium journals (or conference proceedings, in the case of Engineering), which are strictly peer-reviewed. The citation indexes of a journal vary immensely across the fields in the 'harder' and 'softer' sciences. As an example, the highest ranked Brazilian journal in the field of Biochemistry – the *Brazilian Journal of Medical and Biological Research* – had an h-index of 76 in 2017 (Scimago Lab, 2020a), while the highest ranked Brazilian Journal in Human Sciences – the *Boletim do Museu Paraense Emilio Goeldi: Ciencias Humanas*, which accepts publications in English, Portuguese, and Spanish – had an h-index of eight in the same year (Scimago Lab, 2020b).

The trends in the use of English in the academic and scientific context in Brazil are closely connected to changes in the language of publication in Brazilian journals indexed in the SciELO open-access platform, the largest provider of journals indexed by the Directory of Open Access Journals (DOAJ), currently operating in 15 countries (12 from Latin America, along with Portugal, South Africa, and Spain) (Packer, 2016, 2019). SciELO was created to index qualified national journals to complement international indexes with the goal of increasing the quality and visibility of knowledge produced in developing countries. The platform has contributed to the increase of the audience of Latin-American journals and the worldwide dissemination of knowledge produced in the region by supporting multilingual publications with the simultaneous use of English and either

Portuguese or Spanish (Packer et al., 2014; Packer, 2019). Moreover, to reinforce the insertion of research output of developing countries in the international flow of scientific communication, ScieLO indexing criteria established different minimum and recommended percentages of articles in English for each of the eight fields of knowledge. Between 2011 and 2015, there was a consistent rise in the number of English-medium publications and a continuous decrease in articles published in Portuguese in ScieLO (Packer, 2016). A milestone was achieved in 2014, when journals indexed in ScieLO Brazil started to publish more in English than in Portuguese and, by 2015, 62% of publications were in English.

When comparing the eight different fields of knowledge, publications in SciELO Brazil point in the same direction as the results we obtained in the present investigation, i.e., a clear predominance of English-medium in the 'harder' sciences when compared to the 'softer' sciences. As of 2015, 85% of the publications in SciELO Brazil were exclusively in English in the fields of Biological Sciences and Health Sciences and around 60% in the fields of Engineering and Exact and Earth Sciences. In our study, an average of 90% of the publications were in English in the areas of Exact and Earth Sciences, 87% in Biological Sciences, 77% in Health Sciences, 63% in Engineering, and 58% in Agricultural Sciences during the three-year period analysed. In contrast, the percentage of English-only publications in SciELO Brazil was considerably lower in Human Sciences (19%), Applied Social Sciences (20%), and Linguistics, Literature, and Arts (32%) (Packer, 2016). Our results also revealed an average of 13% of the publications in Human Sciences, 14% in Linguistics, Literature, and Arts, and 27% in Applied Social Sciences were in English.

The clear differences in the extent to which different academic disciplines adopt English for knowledge production can also be related to the fact that in non-Anglophone contexts, such as Brazil, students from the 'harder' sciences access a more internationalized academic community from the beginning of their post-secondary studies, as the foundational articles and research results are written exclusively in English. Conferences in these fields also tend to prefer submission of papers in English, even when they are hosted in a non-English speaking country like Brazil. For example, the 4th Brazilian in Composite Materials (BCCM4, 2020) and the 2017 HIV & Hepatitis in the Americas (HIV/HEP in the Americas, 2020) were held exclusively in English. It has been widely adopted for decades as the common language in the 'harder' sciences, and the publication of English-medium articles in high impact journals long ago became the established way that scholars' productivity is assessed by institutions and research funding agencies (Adams & Gurney, 2014). Thus, Brazilian academics in the 'harder sciences' find it natural to use this common global language. In contrast, the internal culture that has been established over time in the fields that constitute the 'softer'

sciences' is usually the publication of longer texts (mostly books and book chapters) in Portuguese. Additionally, multilingual scholars in the 'softer' sciences are also concerned that publishing exclusively in English might hinder access to the knowledge produced in the country, as well as weaken the role that Portuguese plays in the international academic context.

6. Conclusion

The global spread of English may have some undesirable consequences for the preservation of the linguistic and cultural national identities of countries in the periphery and the semi-periphery of the non-anglophone centre of knowledge production (Pennycook, 1994, 2003; Phillipson, 1992, 1997, 2008, 2013, 2015; Philipson & Skutnabb-Kangas, 1994; Skutnabb-Kangas, 1988), such as Brazil. Nevertheless, it does not seem possible – or even reasonable – to stop its advancement at this point. We propose, thus, the endorsement of the dissemination of English while acknowledging its darker side, turning the process around to facilitate both the universal empowerment and the gain of adopting a universal scientific and academic language to which everyone should have fully guaranteed access (Linn, 2016; Lysandrou & Lysandrou, 2003).

As other researchers in the fields of EAP and ERPP (Corcoran, 2019; Corcoran et. al., 2019b; Hanauer & Englander, 2011), we endorse a "critical-pragmatic approach" (Corcoran & Englander, 2016; Flowerdew, 2007; Hardwood & Hadley, 2004; Pennycook, 1994) when adopting English as the global language for scientific and academic knowledge production. This means that multilingual scholars should be given equal opportunity considering their inequitable situation and, at the same time, receive locally, continued, and institutionally situated extended support for scientific writing in English, including the establishment of writing centres at the post- secondary level.

Taking into consideration the "critical" piece in this approach, it is important to emphasize that one of the potential risks of the greater use of English in the Brazilian context is that Portuguese becomes less necessary or even dispensable in some disciplines. Thus, policies should ensure that English, rather than leading to the elimination of Portuguese in research, teaching, and publication, is a "healthy addition to people's linguistic repertoire and linguistic capital accumulation" (Phillipson, 2003, p. 4). For instance, SciELO has been promoting this by accepting multilingual publications with the simultaneous use of English and either Portuguese or Spanish (Packer et al., 2014). We do not support the idea that multilingual scholars produce and disseminate knowledge exclusively in English. Other languages still have a purpose, since research results are commonly

reported more than once through several written and oral genres, which are addressed to different groups of audiences who are more or less internationalized.

Therefore, the adoption of English should take into consideration the needs and goals of specific fields of knowledge and 'niche subjects', in which the use of languages other than English might make more sense because of the seminal theoretical perspectives that academics in these fields adopt (Amon, 2006). For instance, German and French philosophers have historically had a major influence in the fields of education and law in Latin American countries, especially in Brazilian academia. Researchers in certain academic disciplines might consider that accessing knowledge in its original language allows for a more in-depth understanding that contributes to their work. In the same way, knowledge production about local issues, such as Brazilian indigenous contexts and environmental issues, must be discussed within the country and, consequently, need to be disseminated in Portuguese. Nevertheless, when academics from the 'softer' sciences publish exclusively or mostly in their local language(s), as shown in the results of the present investigation, there is a high risk that significant knowledge remains restricted to members of these local communities, in a process described by Gibbs (1995) as 'lost science'. The example of research on Brazilian indigenous languages can also be mentioned here. A quick search on Scielo returned 16 articles written about the topic – all of them in Portuguese. Thus, while a larger community of linguists might be interested in the Brazilian indigenous language, access to such production is restricted to speakers of Portuguese. The country suffers from not using English to engage with international work about other native communities. In this way, Brazil remains isolated, unable to find solutions for problems which may be similar in other global contexts.

Currently, the Brazilian academic and scientific tradition, as with other Latin and Southern American countries, does not include country-wide institutional support for the development of scholars' English language writing and reading skills, such as specific training in academic writing[1] and access to writing centres. This directly affects the visibility of science produced, as well as the access to international knowledge. The wider adoption of English by Brazilian academics is decisive for being included and having a "voice" in the global scientific scene. Not publishing in English ultimately hinders the dissemination of scientific knowledge produced in Brazil and restricts international scientific collaborations (Meneghini & Packer, 2007). In addition, researchers in the humanities and social sciences usually access and produce knowledge inside their local Brazilian disciplinary

1. A comprehensive program called Languages without Borders (Sarmento, Abreu-e-Lima, & Moraes, 2016) which offered EAP classes in public universities in Brazil was terminated in 2019 due to government cuts in education, research and technology.

communities, perpetuating their seclusion and preventing the development and circulation of the scholarly knowledge generated in the country. An example of the importance of publishing in English can be seen in the work of scholars who advocate against the English imperialist dominance, such as Canagarajah (1999), and, to have their critiques effective and long-reaching, do so in English.

Research about the Brazilian knowledge production context is still extremely scarce. There is an imperative need to improve our understanding of the country's disciplinary communities and the elements that are likely to influence scholars' publication habits, patterns, and motivations. This pioneering nation-wide large-scale investigation allowed for comparisons and identification of trends in the volume, types, and language of publication by CNPq grant recipients from different fields of knowledge. This research has raised many questions in need of further investigation. First, the present investigation focused on the eight broad fields of knowledge officially adopted by CNPq, such as Applied Social Sciences, and did not examine preferred languages and genres as well as the amount of publications of specific academic disciplines and sub-disciplines that comprise these broader fields, such as architecture and urbanism; business; communication; economics; home economics; industrial design; information sciences; law; museology; social service; tourism; and urban and regional planning. Future research that takes into consideration such differences will likely show trends that would allow for the identification of nuances within the areas of knowledge. Secondly, it is worth noting that this investigation used descriptive statistics only and no inferential statistical analyses were conducted accounting for our variables of interest. Therefore, a natural progression of this work would be to conduct correlational or comparative analyses between genres and languages used for publication. Also, this study investigated only the use of two languages, English and Portuguese, for publication purposes and pointed to substantial differences among the areas. A further study could also investigate the use of other languages. Finally, this work focused exclusively on publication outputs, and did not look into other factors that influence the publication practices and motivations of academics from different disciplinary communities, including the prominent role played by those who mediate English-medium text production in various ways. This could be analysed through qualitative methods, such as interviews and surveys with open-ended questions focusing on stakeholders' perceptions about scholarly knowledge productions and dissemination. Also, such methods would allow for the understanding of academics' reasoning for adopting certain practices and languages and their perceived difficulties and needs, both in general and in specific sections of the most pre-eminent written academic genre – articles in academic journals.

In conclusion, we expect that the results of this study can inform national and institutional policies and investments in Brazilian higher education and research

aiming to provide continued support specific to the needs of different disciplinary communities. Furthermore, the results presented here may help to foster the inclusion of Brazilian scholars in the global arena of knowledge production and dissemination. As a country with a large number of research-intensive higher education institutions and vast high-quality knowledge production, Brazil is a unique and complex context. The adoption of English in Brazilian higher education should be a language policy decision involving research priorities, idiosyncrasies of the respective disciplinary communities, target audiences involved, and financial resources to support researchers' English writing training, translations and/or proofreading (Packer, 2016). In fact, improving the writing competence of all Latin America's academic and scientific communities should not be a minor issue in policy-making.

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Resumo

Este artigo examina o contexto de produção e disseminação de conhecimento acadêmico no Brasil através de uma comparação das práticas de publicação em português e inglês de pesquisadores brasileiros com bolsa de produtividade em pesquisa em oito diferentes áreas do conhecimento. Dados de 1.874 curricula vitae foram analisados em relação à língua, à quantidade e ao gênero textual de publicação ao longo de um período de 3 anos (2014 a 2016). O estudo revelou um contraste marcante em relação ao uso mais frequente de inglês por pesquisadores nas ciências mais exatas e a preferência pelo português por acadêmicos das áreas das ciências menos exatas. As análises também sugerem que aqueles pesquisadores que mais publicaram, tendem a utilizar mais a língua inglesa. Diferentes fatores envolvidos na escolha do gênero textual e da língua de publicação foram analisados, tais como as características do trabalho produzido por cada comunidade disciplinar, o público alvo da publicação, o tipo de linguagem utilizada e a necessidade de obtenção de financiamento de pesquisa. Os resultados desta investigação podem vir a informar políticas e investimentos no ensino superior brasileiro e em pesquisa, a fim de fornecer suporte contínuo e específico para as diferentes comunidades disciplinares, bem como de promover a inclusão de acadêmicos que não tenham o inglês como sua primeira língua na arena global de produção e disseminação de conhecimento.

Address for correspondence

Laura Baumvol
School of Journalism, Writing, and Media (JWAM)
Writing, Research, and Discourse Studies (WRDS)
University of British Columbia (UBC)
6388 Crescent Road
Vancouver, BC V6T 1Z2
Canada

laura.baumvol@ubc.ca