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Co-authorship of journal articles and book chapters in the Social Sciences and Humanities (2000-2010)

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Keywords

Co-authorship, social sciences and humanities, Flanders, collaboration, articles, book chapters

Abstract

We analyze co-authorship patterns in Social Sciences and Humanities (SSH) for the period 2000-2010. The basis for the analysis is the VABB-SHW, a comprehensive bibliographic database of peer reviewed publications in the SSH by researchers affiliated with Flemish universities. Combining data on journal articles and book chapters, our findings indicate that collaborative publishing in the SSH is increasing, though considerable differences between disciplines remain. Conversely, we observe a sharp decline in single-author publishing. We further demonstrate that co-authored SSH articles in journals indexed in the Web of Science (WoS) generally have a higher number of co-authors and increase thereof than those in non-WoS journals or than book chapters. This illustrates the need to include non-WoS data and book chapters when studying co-authorship in the SSH.

Introduction

This article analyses the evolution of co-authorship in the Social Sciences and Humanities (SSH) in Flanders, the northern Dutch speaking part of Belgium, based on a full-coverage set of bibliographic data from an eleven year period (2000-2010).

Co-authorship is one aspect of research collaboration. In spite of some caveats concerning co-authorship bibliometrics and their precise relationship to collaboration (Katz & Martin, 1997; Laudel, 2002), an important asset of co-authorship analysis remains its comparability. Basic metrics and their derived measures of collaboration are quite easily calculated and compared regardless of the underlying characteristics of the collaborative process (Egghe, 1991; Liao & Yan, 2012; Rousseau, 2011).

Scientific collaboration through co-authorship is internationally on the rise, even though important differences between disciplines remain (Benavent-Pérez, Gorraiz, & Gumpenberger, 2012; Newman, 2004; Glänzel & Schubert, 2004; Wagner & Leydesdorff, 2005; Kyvik, 2003; Piro, Aksnes, & Rorstad, 2013). For the Social Sciences and Humanities (SSH), which have adhered more than the sciences to single-author publications, similar trends have been demonstrated, albeit tentatively (Endersby, 1996). However, the validity of these results is uncertain because the major citation databases used for most co-authorship research, Web of Science (WoS) and Scopus, rely on indexing mostly English language articles in international journals at the expense of publications in other languages and of other types, foremost books (Hicks, 2004; Archambault, Vignola-Gagne, Côte, Larivière, & Gingras, 2006; Piro et al., 2013). Consequently, the observed frequency of co-authorship in citation index-based bibliometrics may be positively biased (Beaver, 2001; Mali, Kronegger, Doreian, & Ferligoj, 2012). In this article, we address this methodological issue.

As identified by previous research, there are multiple factors influencing research collaboration and co-authorship. Some structural elements seem important in explaining collaboration behavior. Belgium, for instance, has since long ranked among the top countries regarding relative frequency of international research collaboration (Glänzel & Schubert, 2005). This could well be explained by the trilingual character and the small size and central geographical location of the country. Research collaboration, however, is also subject to change. On the one hand there are factors changing the research, publication and dissemination contexts, thereby indirectly altering collaboration behavior as well. Examples of such factors are the increasing mobility of researchers and the new communication and information technologies (Melin, 2000), facilitating both the exchange of quantitative (sometimes computer-generated) data (Borgman, 2009) and collaboration between geographically dispersed colleagues (Beaver, 2001; Kretschmer & Aguillo, 2004), or enhancing the impact and visibility of co-authored articles in citation indexes (Beaver, 2001; Katz & Martin, 1997). In addition, however, other factors do not just facilitate collaboration and co-authorship, but actually offer researchers direct incentives to collaborate through joint publications. Output-based research-funding offers researchers one of the most

directly tangible publication incentives (Butler, 2003a; Butler, 2003b; Ossenblok, Engels, & Sivertsen, 2012). Particularly relevant for our case is the fact that the Flemish performance-based research funding system (PRFS), the BOF-key, actively encourages co-authorship through its use of whole counts, i.e. giving each institution full credit for an article which bears its name and address. This is opposed to systems that use fractional counts, i.e. counting an article as a single unit and fractionalizing the publication credit (Butler, 2010; Aksnes, Schneider, & Gunnarsson, 2012; Ossenblok et al., 2012).

It is our hypothesis that scholarly collaboration as measured through co-authorship in Flanders has increased during the decade 2000-2010. The factors outlined above (and others) have most likely played a role in altering collaboration behavior of scholars worldwide, hence including those in Flanders. At any rate, the lower starting point for the SSH regarding the prevalence of collaboration means there has been plenty of room for growth in co-authored publications. Moreover, we expect this trend towards more collaboration in the SSH to be even more pronounced in Flanders due to the influence of the Flemish PRFS on co-authorship. On the whole, although we expect most or all individual SSH disciplines to have increased their collaborative efforts, we are aware of the persistence of disciplinary cultures regarding authorship. Views on what it means to be an author or co-author vary across fields (Cronin, Shaw, & La Barre, 2003; Birnholtz, 2006) and reflect in different collaboration patterns (Biagioli & Galison, 2003).

The data analyzed for this article originates from the Flemish Academic Bibliographic Database for the Social Sciences and Humanities ('Vlaams Academisch Bibliografisch Bestand voor de Sociale en Humane Wetenschappen' or VABB-SHW). The VABB-SHW was constructed in 2008-2010 to achieve full bibliographic coverage from the year 2000 onwards of peer reviewed academic SSH publications by researchers affiliated with Flemish universities. As such the VABB-SHW supplements publication data previously obtained solely from the WoS and is used in the Flemish PRFS for the universities (see, for a full account in Engels, Ossenblok, & Spruyt, 2012).

In the following we first present the evolution of co-authorship as evident from SSH journal articles and book chapters by Flemish researchers in the period 2000-2010. The prevalence of co-authorship versus single-author publishing for articles and book chapters will be examined, both at the aggregate level of the Social Sciences (SS) and the Humanities (H), as at that of individual disciplines. We then present and compare measures of collaboration per discipline and publication type. Additionally, it is of interest to determine to what extent co-authorship in book chapters differs or not from that in journal articles. We conclude with a discussion on the regional PRFS influencing co-authorship patterns and the methodological necessity to include non-WoS data when analyzing co-authorship in the SSH.

Data and methodology

The data set used for this article consists of bibliographic information on 27,774 peer reviewed journal articles and 4,511 book chapters from the period 2000-2010 and registered in the VABB-SHW (www.ecoom.be/en/vabb). These publications originated in 16 SSH disciplines and 2 general categories, of which 11 SSH disciplines were selected on the basis of a minimum of a hundred yearly publications. Publications are assigned to one or more disciplines according to the author(s) affiliation(s). These disciplines are in the Humanities: History; Law; Linguistics; Literature; Philosophy; and in the Social Sciences: Economics & Business¹; Educational Sciences; Political Science; Psychology; Social Health Sciences; Sociology. The VABB-SHW consists of two subsets, the VABB-WoS and the VABB-GP. The VABB-WoS contains all journal articles and proceedings papers that are also indexed in one or more of the WoS journal or proceedings databases, i.e. the Science Citation Index Expanded, the Social Science Citation Index, the Arts & Humanities Citation Index, the Conference Proceedings Citation Index-Science and/or the Conference Proceedings Citation Index-Social Sciences and Humanities. The VABB-GP contains all publications that are not indexed in one of the aforementioned WoS databases. ‘GP’ stands for Gezaghebbend Panel (or Authoritative Panel), an independent body of academic experts entrusted by the Flemish government to uphold and set the criteria for inclusion of publications in the VABB-SHW. This includes making a selection of publication channels (journals and publishers) that apply peer review (Engels et al., 2012). The analyses presented here take all VABB-WoS journal articles (n=12,053) and all VABB-GP journal articles and book chapters (n=20,232) into account.

Table 1: Number of journal articles (@) and book chapters (BC) per discipline for VABB-WoS and VABB-GP (2000-2005 and 2006-2010).

	2000-2005			2006-2010			Total
	@WoS	@GP	BC GP	@WoS	@GP	BC GP	
Humanities	979	5,240	1,431	1,655	4,668	1,848	1,5821
Social Sciences	3,469	3,317	607	6,205	3,054	697	1,7349
Economics & Business	936	854	224	1,612	771	182	4,579
Educational Sciences	202	366	56	455	371	92	1,542
History	71	422	90	156	413	197	1,349
Law	61	2,270	193	96	1,961	216	4,797
Linguistics	199	568	289	418	513	385	2,372
Literature	69	393	199	117	347	273	1,398
Philosophy	290	474	186	412	392	217	1,971
Political Science	66	434	95	221	450	175	1,441
Psychology	845	381	77	1,707	312	58	3,380
Social Health Sciences	1,003	397	32	1,558	349	17	3,356

¹ Including Library and Information Science, as researchers in this field are mostly affiliated with the Economics & Business departments of the Flemish universities.

Sociology	213	453	63	470	355	79	1,633
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Table 1 presents the number of publications included in the analysis presented in this article. The data were divided in two periods, 2000-2005 and 2006-2010, to allow robust comparisons of co-authorship over time. Previous research has shown that the increase in total number of publications is the strongest for the Social Sciences and its corresponding disciplines. Furthermore, the increase for the whole of the SSH is most pronounced for the articles included in VABB-WoS (@WoS) (Engels et al., 2012), which is mainly due to an increase in WoS publishing and an increase in journal coverage by the WoS (Ossenblok et al., 2012). Table 1 indicates that book chapters (BC GP) are fewest in number for the Social Sciences as a whole and the corresponding disciplines. For the Humanities, however, book chapters mostly outnumber articles in VABB-WoS. This illustrates the importance of book chapters, and hence books, as a publication type for the Humanities (Hicks, 2004).

Table 1 totals for the Social Sciences and the Humanities do not equal, respectively, the sum of the listed Social Sciences (Economics & Business, Educational Sciences, Political Science, Psychology, Social Health Sciences, and Sociology) and Humanities (History, Law, Linguistics, Literature, and Philosophy) disciplines. This is explained firstly by the fact that disciplinary attribution of a publication in the VABB-SHW is determined by the author(s) affiliation(s) with an SSH unit (research group, research center, institute or department), which means that a publication can belong to more than one discipline and, in rare cases (2.9%), both to the Social Sciences and the Humanities. Secondly, disciplines that represent less than a 100 articles and chapters per year (i.e. Archeology, Art History, Communication Studies, Criminology, Theology), as well as the two general categories, SS-general and H-general, are not included in Table 1 as the analysis of co-authorship patterns of these disciplines would be too vulnerable to small fluctuations. However, in the totals for SS and H, these disciplines and categories are included.

As a first step of data processing we determined the proportion of co-authored publications. We then grouped the publications by number of authors, for the Social Sciences and the Humanities, as well as for individual disciplines. A next step consisted of calculating two measures of collaboration based on co-authorship: the Collaborative Index (CI) and the Revised Collaborative Coefficient (RCC). The CI is fairly basic and easily interpretable as it denotes

$$= \frac{\sum_{j=1}^q j f_j}{N}$$

where N= total number of publications, j= number of authors per publication and fj= number of publications having j authors in the collection and q= the max number of authors in a single publication. This comes down to the average number of authors per publication, which, however, makes the CI sensitive to outliers. Another drawback of the CI is its limited interpretability and

comparability between disciplines as there is no upper limit. The RCC on the other hand presents the amount of collaboration by a value between 0 and 1 - 0 corresponding to minimum collaboration, i.e. only single-authored publications, and 1 to maximal collaboration, i.e. all co-authored publications have the same number of authors as there are co-authored publications (N) in the collection. The RCC is calculated as

$$= \left(\frac{n}{n-1} \right) \left\{ 1 - \frac{\sum_{j=1}^q (1/j) f_j}{N} \right\}$$

Like the CI, the RCC differentiates among levels of authorship by taking into account the total number of publications having a certain number of authors (f_j). In addition, in the RCC the number of authors per publication (j) is fractionalized ($1/j$) in order to give less weight to each collaborated publication. By subtracting this weighted average from 1, an inverse effect occurs, resulting in a value between 0 and 1 to represent a low respectively high degree of collaboration. By multiplying the result of the second part of the formula by $n/n-1$ where n is the total number of authors in the collection, we obtain a value of 1 when there is maximal collaboration as defined above (Ajiferuke, Burell, & Tague, 1988; Egghe, 1991; Liao & Yan, 2012; Rousseau, 2011). Interestingly, the RCC correlates significantly with aspects of 'research quality' frequently associated with collaboration (Bukova, 2010; Katz & Martin, 1997). For example, RCC values have been found to correlate with journal impact factors and citation scores (Liao & Yan, 2012). In a final step we calculated the chi-square (χ^2) goodness of fit to show if there is a statistical significant evolution in the distribution of the number of authors per publication between the two periods under study. Therefore we calculated the χ^2 based on the observed number of publications per number of authors for the second period (2006-2010) and the expected number for this period based upon the proportion of publications per number of authors for the first period (2000-2005). Whenever the expected values were less than 5 or the total of the expected values was less than 50, we did not calculate the χ^2 as in those cases the χ^2 is not reliable. Because of the limited occurrence of co-authorship in the Humanities, the publications were grouped as single authored, duo authored, trio authored and multiple authored in view of the analyses at the discipline level. Hence in these analyses there are three degrees of freedom (DF) and the χ^2 is significant when it exceeds 7.8147. For the Social Sciences co-authorship was more frequent and hence the occurrence of publications authored with four and with five could also be studied. Hence there are five DF and the observed evolution is statistically significant when the χ^2 exceeds 11.0705.

Results

Co-authorship occurrence

One of the most directly apprehensible measures of the degree of collaboration through co-authorship is the proportion of publications written by more than one author. For our data set,

this proportion equals 80.8% of the Social Sciences (N= 17,349) and 28.9% of the Humanities (N= 15,821) publications (i.e. articles and book chapters). These proportions are in line with previous research showing that co-authorship occurrence is usually more frequent in the Social Sciences than in the Humanities (Larivière, Gingras, & Archambault, 2006). Figure 1 presents the evolution of this proportion for the Social Sciences and the Humanities, as well as for the subsets VABB-WoS and VABB-GP (articles as well as book chapters).

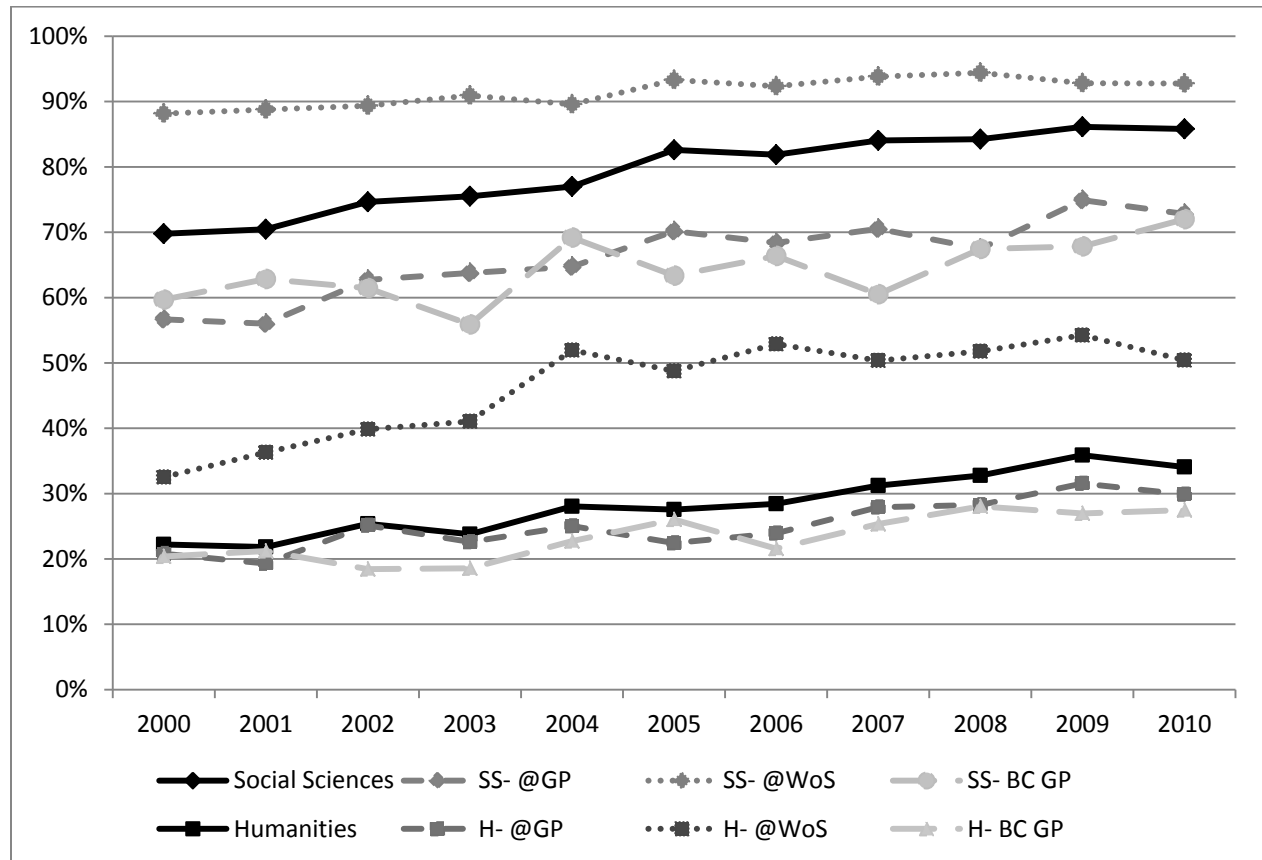


Figure 1: Proportion of co-authored publications, of co-authored WoS indexed articles (@WoS), of co-authored GP-approved articles (@GP), and of co-authored GP-approved book chapters (BC GP), by Social Sciences and Humanities (2000-2010).

As can be observed from Figure 1, there is indeed a considerable discrepancy between the Social Sciences (SS) and the Humanities (H) regarding the share of co-authored publications: between 2000 and 2010 the proportion for the Social Sciences has evolved from 69.9% to 85.8%, whereas for the Humanities the proportion remains well below 40%. The 11-year increase in the proportion of co-authored papers for the Social Sciences and the Humanities is respectively +16.0% (SS) and +11.8% (H). The most basic implication of this growth in co-authoring is a sharp decrease of single-authored SSH publications in the period under study: in 2000 about half

(55.6%) of all articles and book chapters were published by one individual, in 2010 this share has fallen to one third (36.8%). In addition, Figure 1 indicates a difference between the subsets VABB-WoS and VABB-GP, showing for both the Social Sciences and the Humanities a larger proportion of co-authored publications for VABB-WoS (only articles; @WoS) than for VABB-GP (articles as well as book chapters; @GP and BC GP). However, whereas the number of co-authored Humanities' articles in VABB-WoS (H-@WoS) shows an initially more pronounced increase (+17.9%) than that of Humanities co-authored articles and book chapters in VABB-GP (H-@GP; +9.1% and H-BC GP; +7.1%), the inverse holds for Social Sciences, where the increase in number of co-authored articles in VABB-GP (SS-@GP; +16.1%) and for book chapters (SS-BC GP; +12.3%) exceeds that of co-authored articles in VABB-WoS (SS-@WoS; +4.6%). Humanities scholars thus appear to have increased their collaborative efforts regarding publications in WoS journals in particular, while social scientists have done the same for GP approved journals and book chapters. The average evolution for the Humanities is close to that of its GP subset, as the number of articles therein (H-@GP) is more substantial than in its WoS counterpart (H-@WoS), largely due to low WoS coverage of Humanities journals.

An analysis of individual disciplines, represented in the Appendix, provides more detail regarding the disciplinary trends underpinning Figure 1. The individual Social Science disciplines show varying results. The most collaborative SS discipline is Social Health Sciences with 95% of all publications being co-authored, followed by Psychology (91.5%). The least collaborative SS discipline is Political Science (53.5%), followed by Sociology (72.5%). Political science, however, is the SS discipline showing the most pronounced evolution in terms of increase of co-authored publications over the two subperiods 2000-2005 and 2006-2010. In the other SS disciplines (except Social Health Sciences), single authorship decreased as well.

Contrary to the individual SS disciplines, every Humanities discipline shows a co-authorship occurrence in less than 50% of its publications. The most collaborative is Linguistics (37.5%), followed by Philosophy (35.5%). The least collaborative is Literature (18.5%), followed by History (20.5%). The strongest evolution towards more co-authorship over the two subperiods is shown by Linguistics (+11%). In the other H disciplines single authorship fell as well, but remained dominant nevertheless.

Number of authors per publication

In this section we group publications by number of authors. In Figures 2 and 3 we distinguish between single-authored publications, publications with two authors, three authors, four authors, five authors and publications with six to twenty authors. This fine-grained grouping allows for a more comprehensive understanding of the evolution of co-authorship patterns. Furthermore we divide the data into two time periods, i.e. 2000-2005 and 2006-2010, and look at the evolution of all publications (total) and of the different publication types (@WoS, @GP and BC GP) of both

the Social Sciences and the Humanities and of 11 corresponding disciplines (figures in Appendix).

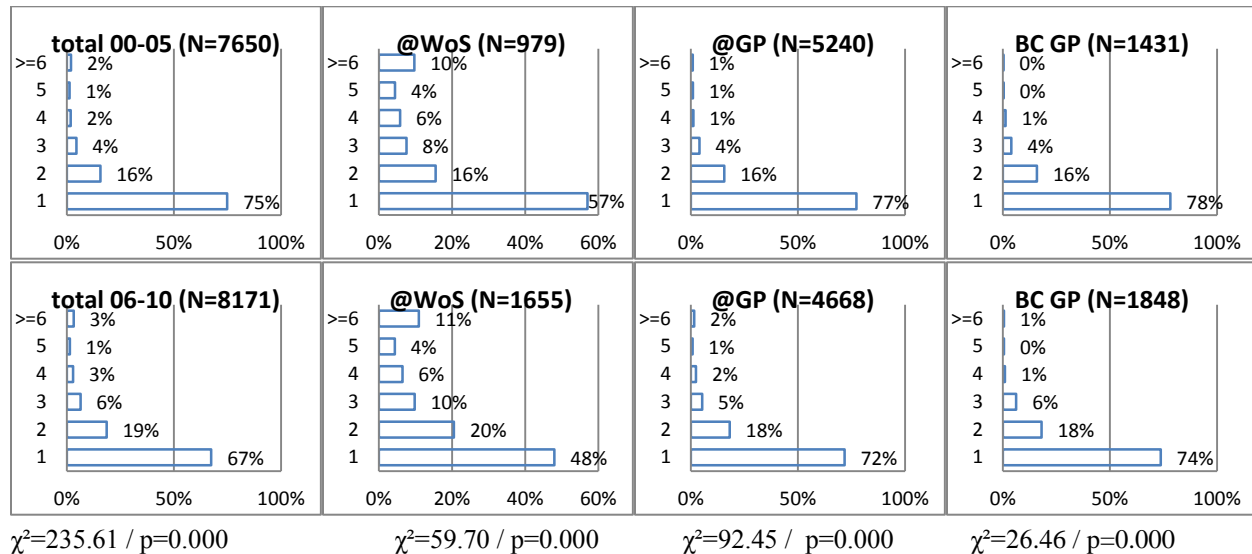


Figure 2: Grouping of Humanities publications per number of authors (2000-2005 and 2006-2010).

Figures 2 and 3 demonstrate the aforementioned decline of the proportion of single-authored articles and book chapters in the SSH, with for the Humanities a decline of -7.5% ($n_{00-05}=5733$; $\Delta n=224$) and for the Social Sciences a decline of -8.8% ($n_{00-05}=1795$; $\Delta n=255$). The Humanities display a corresponding increase in proportion and number of articles and book chapters with more than one author, i.e. with two (+3.0%; $n_{00-05}=1196$; $\Delta n=328$), three (+1.9%; $n_{00-05}=337$; $\Delta n=182$), four (+1.1%; $n_{00-05}=139$; $\Delta n=98$), five (+0.2%; $n_{00-05}=99$; $\Delta n=19$) and six or more (+1.3%; $n_{00-05}=148$; $\Delta n=118$) authors per publication. The Social Sciences, however, manifest along with a decrease in proportion and number of single-authored publications a slight decrease in the proportion of publications with two authors (-1.9%; $n_{00-05}=1886$; $\Delta n=467$). A corresponding increase is apparent in the proportion and number of articles and book chapters with three (+1.1%; $n_{00-05}=1364$; $\Delta n=581$), four (+2.7%; $n_{00-05}=864$; $\Delta n=568$), five (+1.7%; $n_{00-05}=559$; $\Delta n=364$), and, in particular, six or more authors (+5.0%; $n_{00-05}=925$; $\Delta n=839$). In this regard it is relevant to note that author counts of 11 to 20 for the Social Sciences, though limited in numbers ($n_{00-05}=108$; $\Delta n=204$), appear mostly (+6.0%) in the 2006-2010 period. This illustrates very clearly the ongoing evolution towards larger author numbers in both Humanities and Social Sciences. Moreover, for both the Social Sciences ($\chi^2(5, N=9957) = 652.74, p=.000$) and the Humanities ($\chi^2(5, N=8171) = 235.61, p=.000$) the chi-square test shows a significant difference between the observed number of publications per number of authors for the second period (total 06-10) and the expected number for this period based upon the proportion of publications per number of authors for the first period (total 00-05).

Thus the evolution towards more authors per publication is significant for both the Social Sciences and the Humanities.

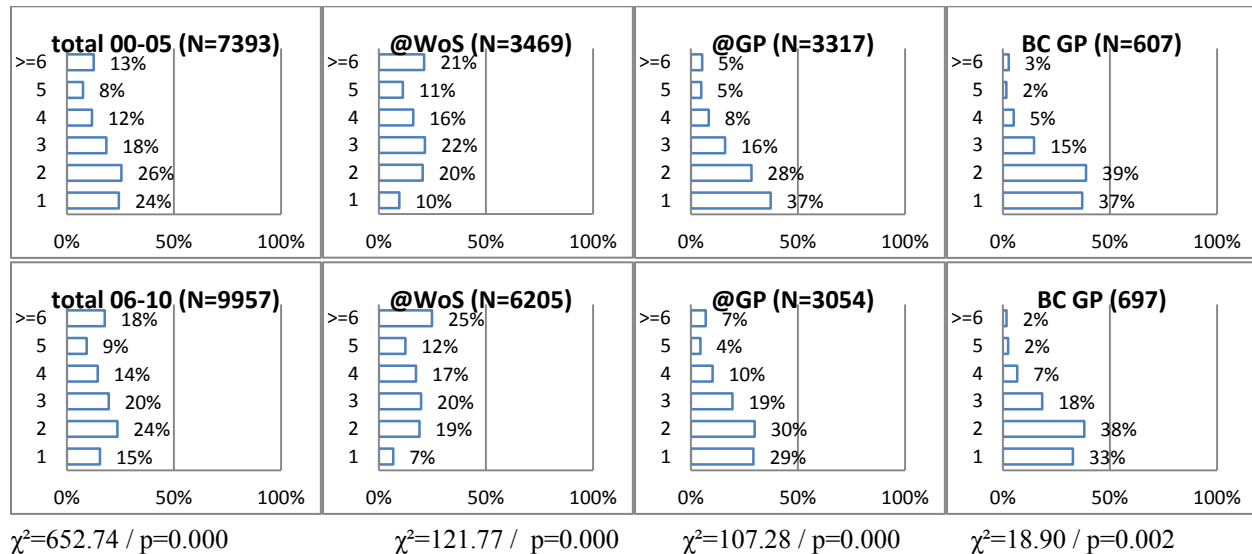


Figure 3: Grouping of Social Sciences publications per number of authors (2000-2005 and 2006-2010).

Let us now turn to the different publication types. For the Social Sciences the evolution towards publications with more than one author is proportionally the strongest for the articles in VABB-GP (@GP; +8.1%; $n_{00-05}=3317$), and more moderate for articles in VABB-WoS (@WoS; +3.1%; $n_{00-05}=3317$) and book chapters (BC GP; +4.4%; $n_{00-05}=607$). For the Humanities, the evolution towards larger author numbers is slightly different. The most notable increase of author numbers has occurred for articles in VABB-WoS (+9.0%; $n_{00-05}=979$), not for articles in VABB-GP (+5.5%; $n_{00-05}=5240$). At +4.5% the increase for book chapters with more than 1 author in the Humanities is comparable to that for the Social Sciences (SS $n_{00-05}=607$; H $n_{00-05}=1431$). However, as mentioned before (see Table 1) and shown in Figure 2, for both the Social Sciences and the Humanities, the number of articles in VABB-WoS more than doubled (+114.6%) over the two periods whereas the number of publications in VABB-GP (@ and BC; +10.5% and +37.8%) grew only moderately. In addition, for the Social Sciences the number of articles in VABB-WoS outnumbers the articles (with a factor of 1.5) and book chapters (with a factor of 7.4) in VABB-GP, whereas for the Humanities the number of articles in VABB-GP more than triples both of the other two publication types (@WoS with a factor of 3.8 and BC with a factor of 3.0). In sum, the trend towards more collaboration is more manifest for articles in VABB-GP for the Social Sciences and for articles in VABB-WoS for the Humanities. However, due to the large differences in number of articles per publication type, and the already high collaboration rate within VABB-WoS, for both Social Sciences and Humanities collaboration remains strongest within VABB-WoS (see also Figure 1).

Figures 2 and 3 also illustrate the differences between and within the publication types. A decrease in the proportion of single-authored publications is noticeable for all publication types. In addition, the chi-square test shows for all publication types a significant different distribution for the observed and the expected number of publications between the two periods under study. For the Humanities the distribution for all three publication types shows a clear skew with a large proportion of single-authored publications and a smaller proportion and a gradual decline for each additional author per publication. In contrast, for the Social Sciences we notice clear differences in distribution between the publication types. Both the GP-approved articles and book chapters have an almost equal proportion of one and two authored papers with a gradual decline for each additional author per publication. However, the WoS-indexed articles show a flat distribution with a small drop for the proportion of single-authored papers and a small peak for the papers with six or more authors. All in all though, whereas Humanities' researchers publish overall more by themselves than together, Social Science researchers publish mostly with one or two authors for publications included in VABB-GP and with three or more authors for publications included in VABB-WoS.

At the same time, both similarities and differences between individual SSH disciplines are distinguishable (see Appendix). For most disciplines a difference between the two periods is visible. The increase in co-authored publications varies between 2.5% (Social Health Sciences) and 14.5% (Political Science) of co-authored publications over the two periods. In every single discipline under study belonging to the Social Sciences, the co-authorship proportion is considerably larger for WoS-indexed articles than for GP-approved articles and book chapters. However, of the disciplines belonging to the Humanities, History and Literature do not show an explicit dominance of co-authored WoS-indexed articles, but display a general trend of a high proportion of single-authored papers for all publication types. Both disciplines have the highest proportion of single-authored publications in VABB-WoS. Moreover, the co-authorship pattern of History publications deviates from that of all other disciplines in that it is the sole discipline for which co-authorship in 2006-2010 is more common in book chapters than in articles in VABB-WoS. This finding corroborates research showing that historians operate mostly solitary in their research and ensuing publications (Verleysen & Engels, 2012). The distribution of the proportion of publications per number of authors per publication type for both the Humanities and the Social Sciences is followed by most of their corresponding disciplines. Law, Political Science and Social Health Sciences, however, manifest a distinct pattern with regard to co-authorship of WoS-indexed articles. Law shows a rather flat distribution for the WoS-indexed articles, albeit very small in number, hence showing no explicit single-author publication behavior for VABB-WoS-articles like most Humanities disciplines. The distribution of WoS-indexed articles for both Political Science and Social Health Sciences does not follow the general trend of the flat distribution of Social Sciences as the first shows a rather negative relation, i.e. the less authors per publication the larger the proportion of publications, whereas Social Health Sciences displays a positive relation, i.e. the more authors per publication, the larger the proportion of publications.

Co-authorship measures

The degree to which co-authorship is in fact indicative of research collaboration can be expressed in several ways. Here we present two existing measures: the Collaborative Index (CI) and the Revised Collaborative Coefficient (RCC) (Egghe, 1991; Liao & Yan, 2012; Rousseau, 2011). An analysis of CI and RCC values per discipline provides a further indication of how co-authorship of SSH articles and book chapters has evolved during the years 2000-2010, and to what degree social scientists and humanities scholars working in Flanders engage in research collaboration. Table 2 presents an overview of CI and RCC values per discipline and publication type for the years 2000-2005 and 2006-2010.

Table 2: Collaborative Index (CI) and Revised Collaborative Coefficient (RCC) for WoS-indexed articles, GP-approved articles and GP-approved book chapters (2000-2005 and 2006-2010).

		@ WoS		@ GP		BC GP	
		CI	RCC	CI	RCC	CI	RCC
Humanities							
	00-05	2.38	0.29	1.37	0.13	1.30	0.12
	06-10	2.54	0.35	1.50	0.16	1.39	0.15
Social Sciences							
	00-05	4.03	0.64	2.38	0.39	2.07	0.36
	06-10	4.46	0.67	2.69	0.45	2.15	0.40
Economics & Business							
	00-05	3.08	0.57	2.32	0.10	1.23	0.11
	06-10	3.42	0.61	2.61	0.11	1.36	0.16
Educational Sciences							
	00-05	3.55	0.61	2.49	0.12	1.36	0.17
	06-10	3.78	0.66	2.62	0.15	1.42	0.18
History							
	00-05	1.66	0.13	1.25	0.16	1.43	0.18
	06-10	1.41	0.14	1.32	0.22	1.58	0.22
Law							
	00-05	2.66	0.34	1.28	0.09	1.15	0.06
	06-10	3.34	0.48	1.38	0.09	1.21	0.07
Linguistics							
	00-05	2.36	0.32	1.46	0.17	1.20	0.09
	06-10	2.34	0.33	1.67	0.17	1.29	0.12
Literature							
	00-05	1.26	0.08	1.25	0.26	1.49	0.22
	06-10	1.43	0.14	1.23	0.34	1.79	0.33
Philosophy							

	00-05	2.32	0.28	1.47	0.38	1.73	0.31
	06-10	2.70	0.38	1.44	0.44	2.14	0.38
Political Science							
	00-05	1.98	0.35	1.72	0.42	2.06	0.40
	06-10	2.22	0.40	1.93	0.49	2.43	0.45
Psychology							
	00-05	3.74	0.65	2.90	0.45	2.04	0.38
	06-10	4.44	0.69	3.33	0.48	2.11	0.39
Social Health Sciences							
	00-05	5.50	0.75	4.09	0.50	2.51	0.46
	06-10	6.09	0.78	4.80	0.56	2.53	0.51
Sociology							
	00-05	3.94	0.56	2.28	0.64	4.31	0.70
	06-10	4.46	0.64	2.59	0.67	3.12	0.62

Unsurprisingly, the CI and RCC values point towards an increasing degree of collaboration in general, both for the Social Sciences and the Humanities. When comparing the aggregated Social Sciences to the Humanities, it is notable how the CI values of the Social Sciences are considerably higher than those of the Humanities. This is especially the case for the WoS-indexed articles, for which in the period 2006-2010 the average number of authors (CI) exceeds that of the Humanities by two. The corresponding divergence in RCC values indeed points to a general stronger collaboration in the Social Sciences. At the level of the disciplines too, most CI and RCC values indicated increased collaboration. However, in the case of History, which manifests relatively low CI and RCC values, the CI of the more recent WoS-indexed articles is the lowest, indicating a decrease (-0.25), rather than an increase, in the average number of authors per paper. For Linguistics the CI of the WoS-articles is stable over the two periods. For both disciplines the RCC values remain the same, indicating no increase in collaboration for WoS-indexed articles. Overall, the lowest CI and RCC values for all three publication types are noted for Literature. Philosophy and Literature are the only disciplines showing rather stable CI- and RCC-values for GP-approved articles. At the other end of the scale, the most collaborative discipline is Social Health Sciences. Here we observe increasing CI and RCC values for articles, but not for book chapters, which are very small in number (cfr. Table 1). The other disciplines show values in a range between the two opposites of Literature and Social Health Sciences, whereby all Social Sciences disciplines, except Political Sciences, show higher CI and RCC values than the Humanities disciplines. Of the Social Science disciplines studied here, Political Science appears to be the least collaborative.

In sum, collaborative publication practices in the SSH vary to a considerable extent between disciplines, and both WoS-inclusion and publication type are factors of importance in explaining the co-authorship characteristics of various fields of research.

Discussion

In this article, we studied co-authorship patterns of the SSH in Flanders using the VABB-SHW database. Currently, within the Humanities over one in three and within the Social Sciences over four in five of all publications, including articles in WoS-indexed journals, in GP-approved journals and book chapters with GP-approved publishers, have been published with more than one author. Furthermore, we find that between 2000 and 2010 co-authorship has been on the rise for all publication types, illustrating the continuing expansion of research collaboration. However, the degree of collaboration for both the Social Sciences and Humanities and their corresponding disciplines varies between the different publication types, with a main difference between publications included in the WoS and those not. Whereas for the Social Sciences more than 90% and for the Humanities almost 50% of all WoS-indexed articles is written in collaboration, the proportion for GP-approved articles and book chapters remains well below 75% for the Social Sciences and below 30% for the Humanities. In addition, where humanities scholars appear to have increased their collaborative efforts regarding publications in WoS-indexed journals in particular, social scientists, already collaborating highly when publishing in WoS journals, have done the same for GP-approved journals and book chapters.

In Flanders, the local PRFS stimulates co-authorship, also in the SSH. From 2003 onwards, when WoS-indexed publications were first taken into account, the publication-based part of the Flemish PRFS has opted for a whole-count schema, i.e. full credit counting per university, as opposed to the fractional counting method used in e.g. Norway, where the credit for a publication is distributed among all contributing institutions (Engels et al., 2012; Schneider, 2009; Sivertsen, 2010). It is likely that this incentive for co-authoring WoS-indexed publications has had a spillover effect upon the publications outside of the WoS, and hence on the VABB-GP publications published prior to 2010. From 2010 onwards, with the advent of the VABB-SHW, this stimulus-by-whole-counts was explicitly extended to non-WoS peer reviewed publications as well (Engels et al., 2012). That PRFSs can indeed have a measurable impact on publication practices has been demonstrated before (Butler, 2003a; Butler, 2003b; Butler, 2010). In a recent comparative analysis of Flemish and Norwegian SSH publication data the impact of the incentive the Flemish PRFS created for publishing in WoS-indexed SSH journals is clearly visible (Ossenblok et al., 2012).

The observed differences between SSH disciplines could be expected as previous research already showed substantially different collaboration patterns between and within the Social Sciences and Humanities (Larivière et al., 2006; Piro et al., 2013). There is a marked contrast between more collaborative SSH disciplines (e.g. Social Health Sciences and Psychology) and less collaborative ones (e.g. Literature and History). At the same time, the growth rate of collaboration varies across disciplines and publication types, both when counting co-authorship occurrence, as when comparing specific measures of collaboration like the CI and the RCC. The overall growth rate of collaboration varies between Literature (0.03) and Psychology and Sociology (+0,80) for the CI and between Literature (+0,01) and Sociology (+0,12) for the RCC.

When comparing our results to other studies, it appears that in Flanders the proportion of co-authored articles is relatively high. In Canada, for example, the proportion of co-authored articles in WoS-articles in the Social Sciences for the year 2002 stood at almost 70%; in the Humanities it was closer to 10% (Larivière et al., 2006). For Flanders, however, the corresponding percentages for 2002 are about 90% for the Social Sciences and about 40% for the Humanities. Even when allowing for a considerable increase in co-authoring over the last decade, the Canadian percentages are likely to remain well below these for Flanders.

In sum, the results of this study imply that over the last decade SSH researchers are collaborating more for both the WoS-articles and the non-WoS-articles and book chapters. However, the collaboration in WoS-articles is higher than that in non-WoS-articles for all disciplines under study, indicating the need for additional data when investigating collaboration patterns of SSH researchers. Furthermore, previous research has shown a correlation between author numbers and citation counts within the aggregated field ‘Law, Arts & Humanities’ (Costas and Van Bochoven, 2012). However, as this research is based upon WoS-articles only, it does not take into account books, which are especially important for various disciplines in the Humanities. Hence, further research in the SSH about the correlation between collaboration and impact is necessary. This brings us to the limitations of this study. First, the period under study is limited compared to research using WoS-data only. As the VABB-SHW database is updated yearly, however, more longitudinal data will be available in the future. Second, international comparisons are needed in order to pinpoint the influences of PRFSs. By isolating the differences in PRFSs, the effects of these differences can be distinguished and compared. Third, more research regarding the importance of books, especially in the Humanities, is needed. In this article we present results on co-authorship of non-WoS journal articles and of book chapters, which is an achievement in comparison with most studies on SSH co-authorship. However, monographs and edited books need to be brought into the picture as well in order to better understand collaboration in the SSH. In particular, new measures of collaboration are needed to capture the complex collaboration pattern involved in the publication of edited books (Ossenblok & Engels, 2012).

More research on co-authorship and collaboration in the SSH is clearly called for. Additional studies at the national level would certainly enhance the possibilities for international comparison. To this end, both WoS-data and, where available, non-WoS data should be included to corroborate our own findings regarding the bias resulting from the use of WoS data only. Additionally, multiple publication types should be included in future research. Given the importance of books in the SSH, the inclusion of monographs and chapters besides articles is essential if we are to gain full insight into the diverse patterns of collaboration in the SSH. With the advent of the WoS’ Book Citation Index (Adams & Testa, 2011), and the ongoing expansion of PRFS-embedded bibliographic databases in several countries (Hicks, 2012) this should prove feasible. To accurately explain differences in the observed patterns of co-authorship, more

analyses of the incentive structures influencing researchers' publication behavior are needed. The comparative study of PRFSs is an important element of this.

Conclusion

Co-authorship of articles and book chapters published by Social Sciences and Humanities researchers affiliated with Flemish universities is on the rise. In the period under study, the years 2000-2010, the overall proportion of co-authored publications has increased by 16% for the Social Sciences and by 11.8% for the Humanities. This corresponds with a steep drop of the observed frequency of single-author publishing from about half of all publications in the year 2000 to about one third in 2010. A central finding of our study is the 15-20% difference in the prevalence of co-authorship between WoS data (articles) and non-WoS data (articles as well as book chapters). This indicates the need to include non-WoS data when studying co-authorship patterns in the SSH. In all SSH disciplines, the increase of co-authoring goes hand in hand with growing author numbers per publication. However, differences between and within the SSH as practiced in Flanders remain considerable. The proportion of co-authored SSH publications is high and is probably partly due to the incentives for co-authorship provided by the Flemish PRFS.

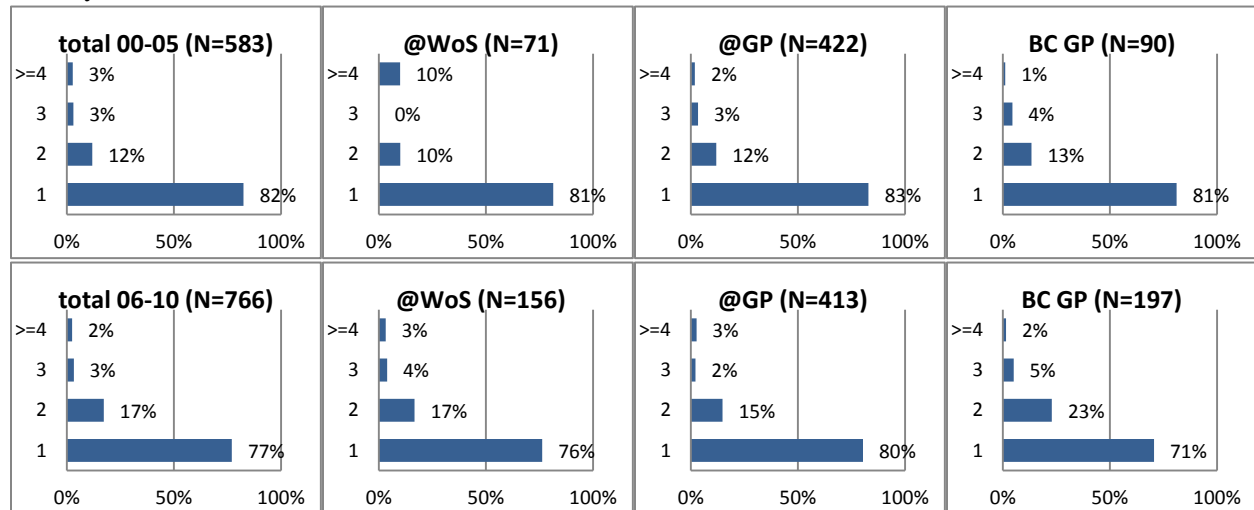
Acknowledgement

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Appendix: Proportion of classes of publications per number of authors – per discipline (2000-2005 and 2006-2010)

Humanities

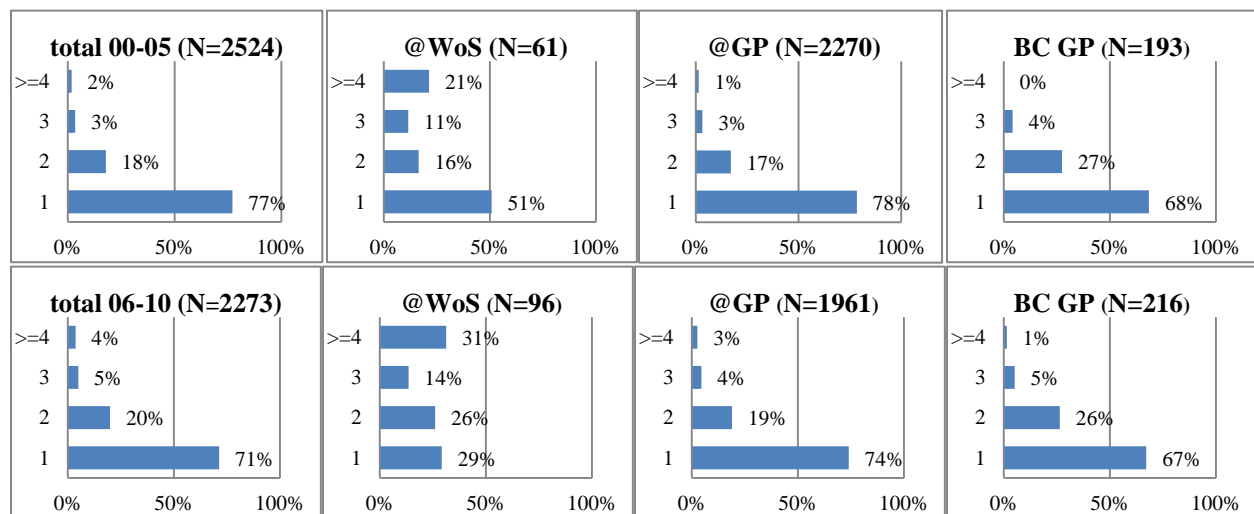
History



$\chi^2=23.46 / p=0.000$

$\chi^2=6.20 / p=0.000$

Law

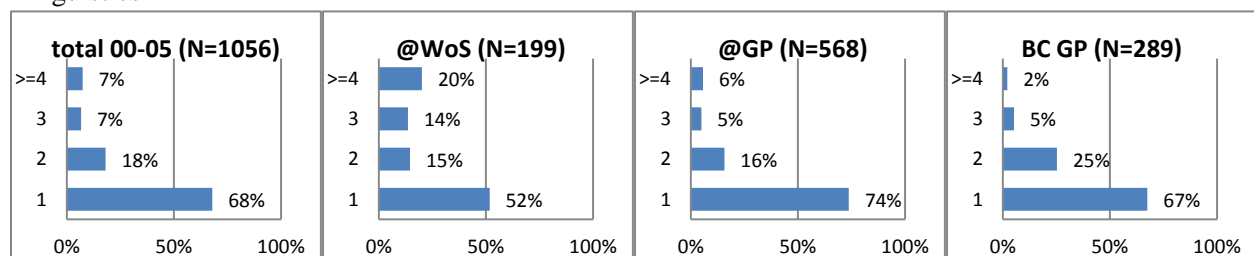


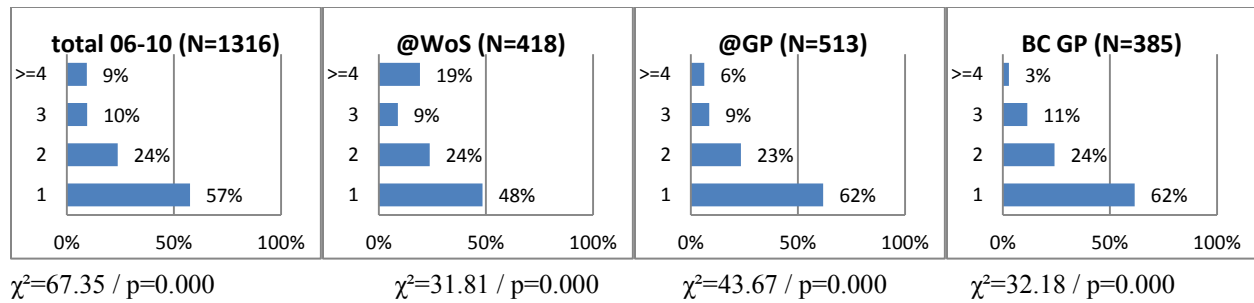
$\chi^2=79.17 / p=0.000$

$\chi^2=19.11 / p=0.000$

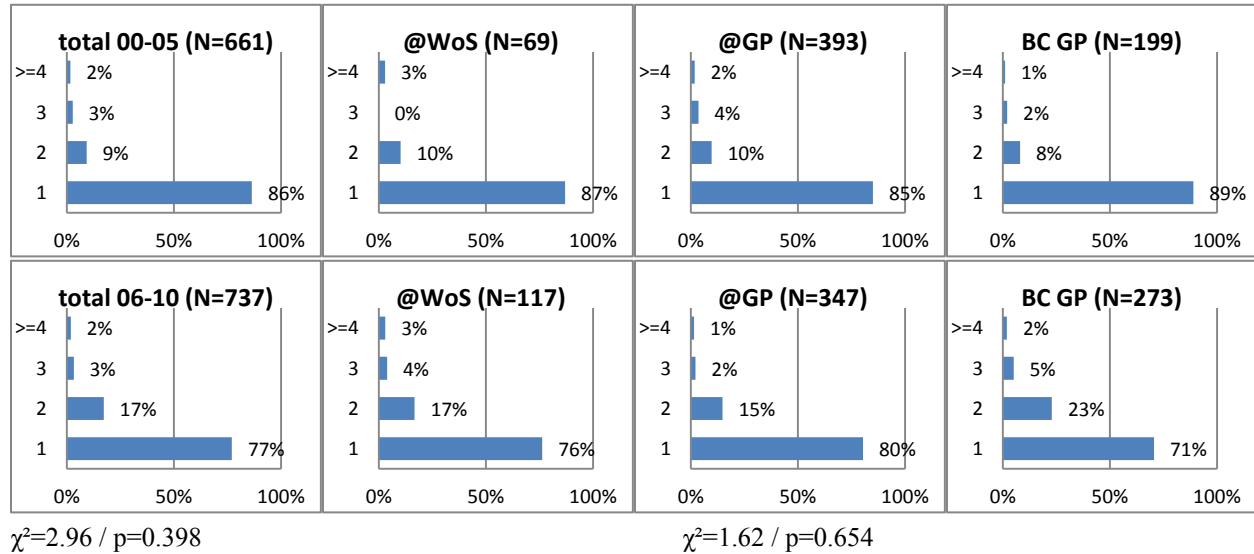
$\chi^2=41.82 / p=0.000$

Linguistics

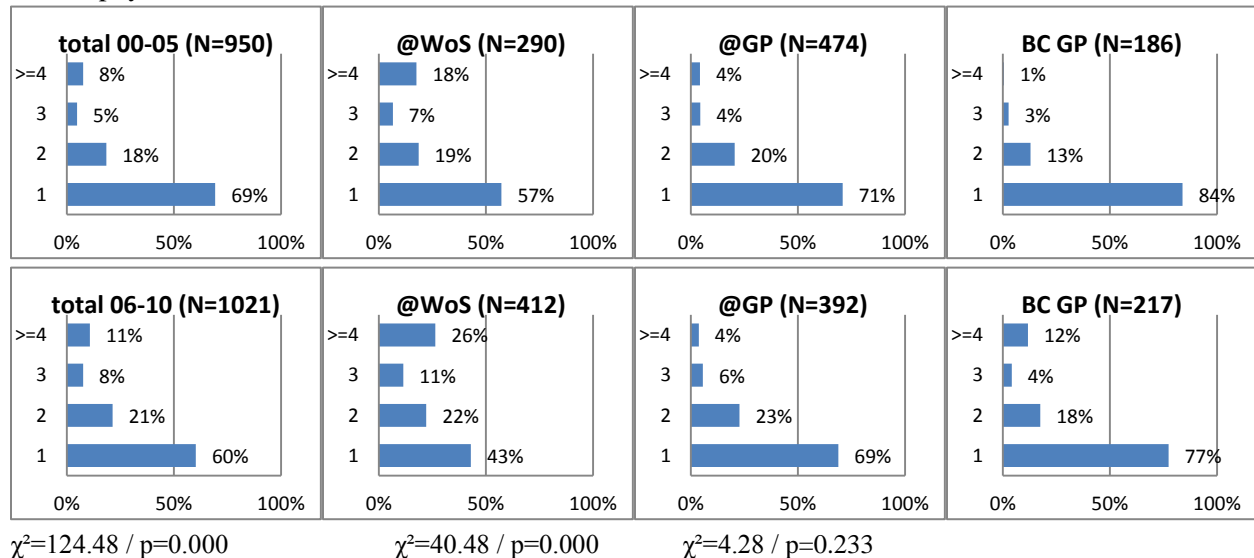




Literature

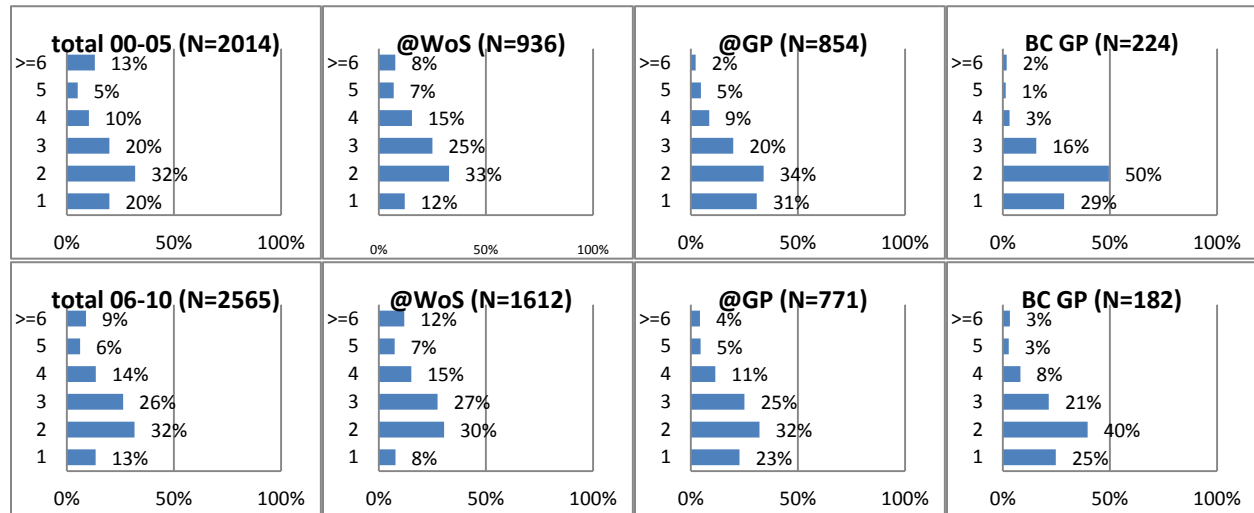


Philosophy



Social Sciences

Economics & Business

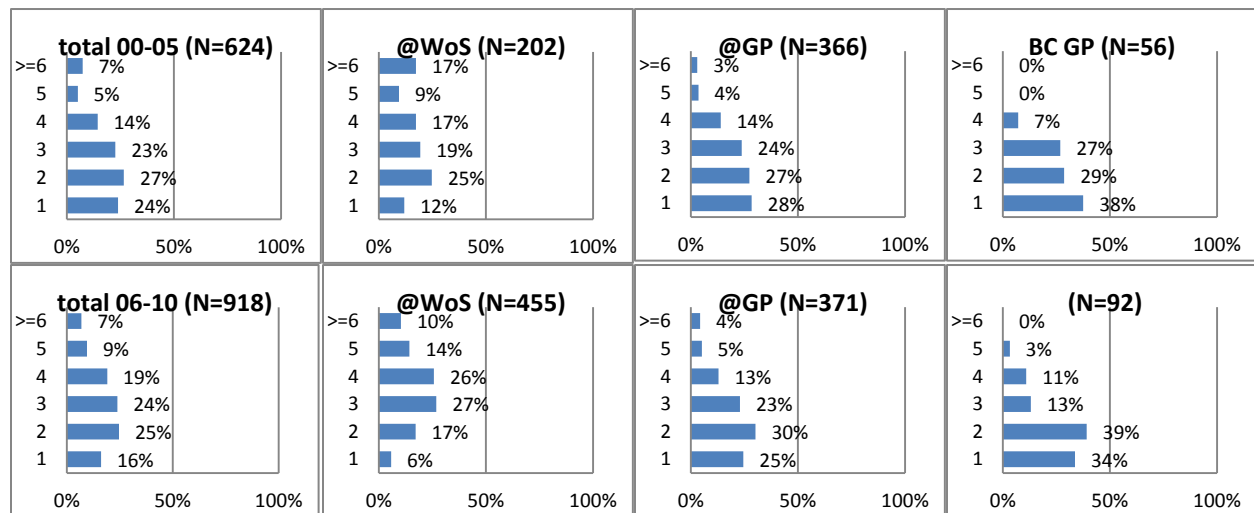


$\chi^2=233.57 / p=0.000$

$\chi^2=68.14 / p=0.000$

$\chi^2=50.05 / p=0.000$

Educational Sciences

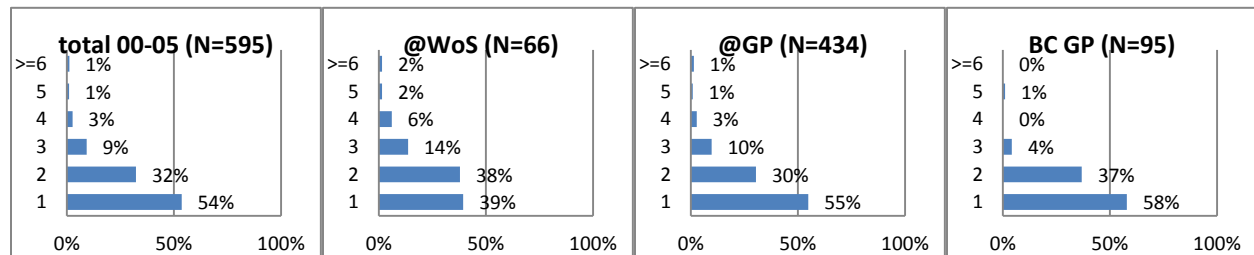


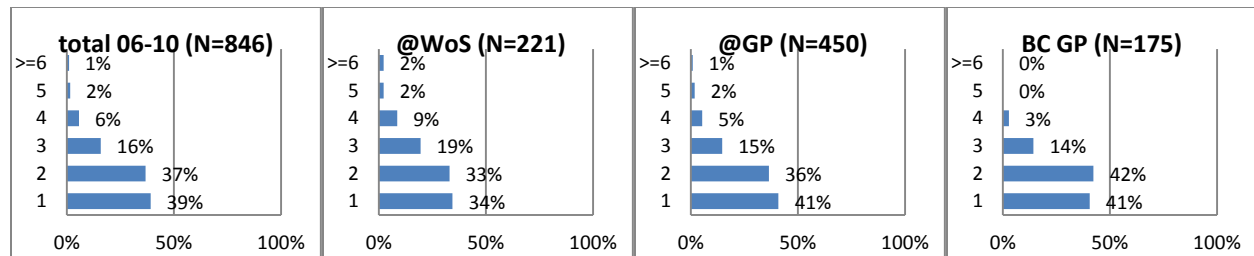
$\chi^2=73.01 / p=0.000$

$\chi^2=81.34 / p=0.000$

$\chi^2=8.15 / p=0.148$

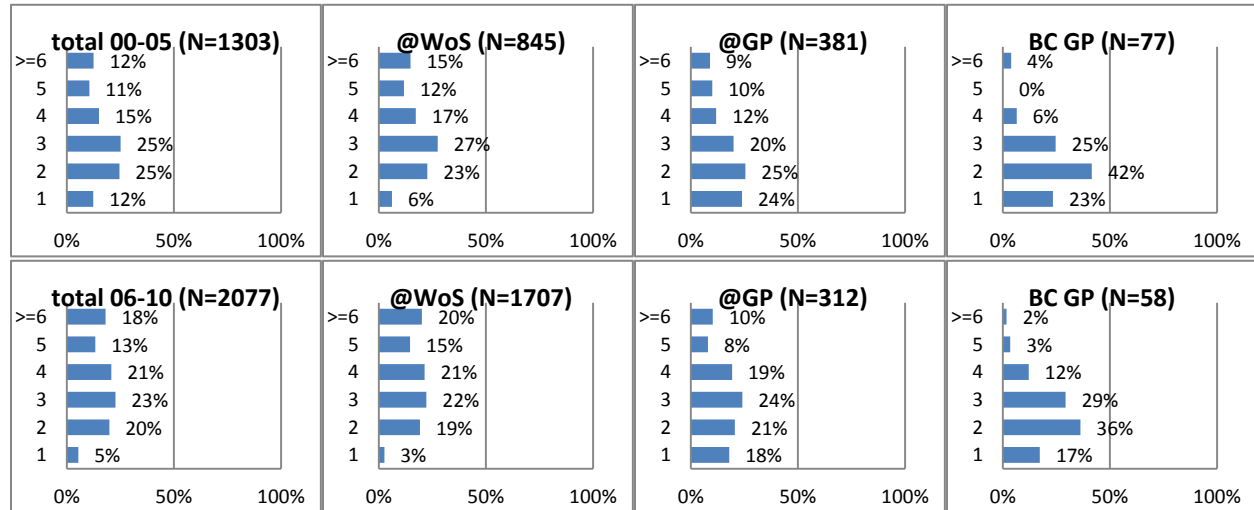
Political Science





$\chi^2=108.65 / p=0.000$

Psychology

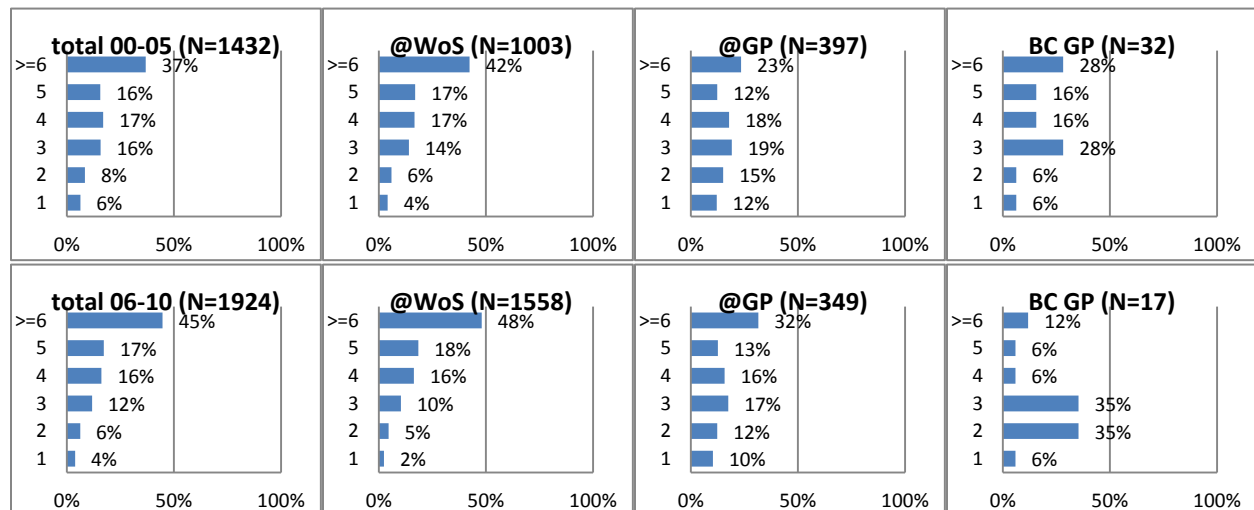


$\chi^2=220.265 / p=0.000$

$\chi^2=121.06 / p=0.000$

$\chi^2=26.59 / p=0.000$

Social Health Sciences

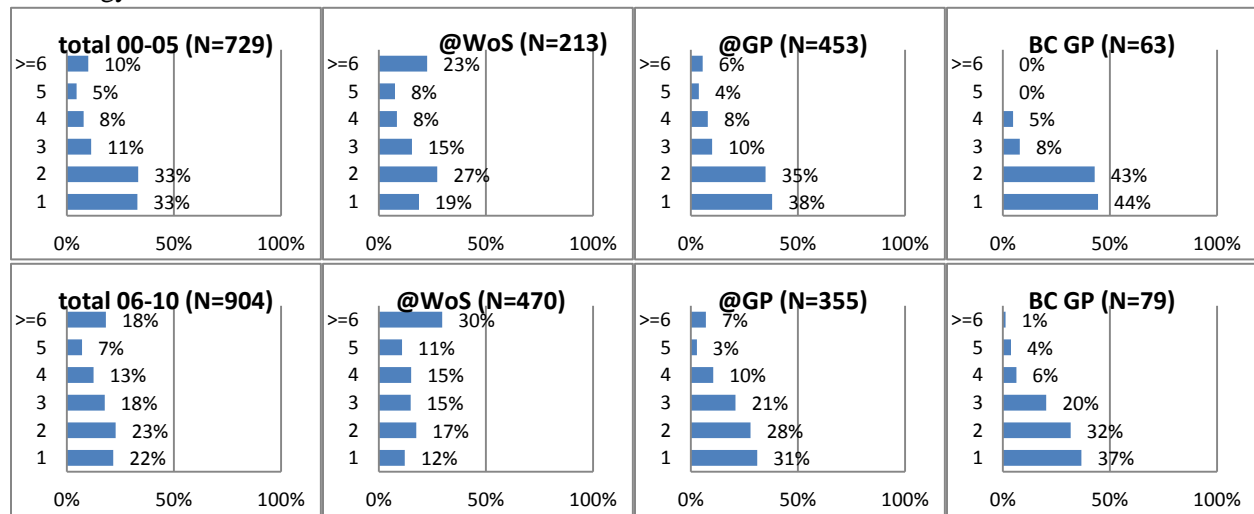


$\chi^2=86.09 / p=0.000$

$\chi^2=45.49 / p=0.000$

$\chi^2=13.87 / p=0.000$

Sociology



$\chi^2=196.13 / p=0.000$

$\chi^2=69.65 / p=0.000$

$\chi^2=57.14 / p=0.000$

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