Comparative Analysis of Networks of Collaboration of Canadian Researchers in the Natural Sciences, Social Sciences and the Humanities[1]

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Abstract

A basic dichotomy is generally made between publication practices in the natural sciences and engineering (NSE) and social sciences and humanities (SSH). However, while researchers in the NSE share lots of common practices with researchers in SSH, the spectrum of practices is broader in the latter. Drawing data from the CD-ROM versions of the *Science Citation Index*, *Social Science Citation Index* and the *Arts & Humanities Citation Index* from 1980 to 2002, this paper analyses collaboration in the SSH compared to the NSE. We show that, contrary to a widely held belief, researchers in the social sciences and the humanities have distinct collaborative practices. In fact, collaborative activities of researchers in the social sciences are more comparable to those of researchers in the NSE than to scholars in the humanities. Also, we see that language and cultural proximity influences the choice of collaborators in the SSH, but also in the NSE.

Introduction

A basic dichotomy is generally made between natural science and engineering (NSE) and social sciences and humanities (SSH). However, while researchers in the NSE share practices with researchers in SSH, the spectrum of practices is broader in the latter. In addition, while some studies have compared collaborative activities in the NSE and the social sciences (SS) (Glänzel 1995; Stefaniak 2001), none has analysed collaborative practices of scholars in the humanities. This paper analyses collaboration practices of researchers in the SSH compared with those in the NSE, using Canada as an example. The first section will present some methodological issues related to the application of bibliometric methods to literature in the SSH and will detail the sources and methods used in this study. In the second section, we analyse the different collaborative practices of researchers in the SSH and the NSE by using the Canadian example. This empirical analysis sheds a new light upon the collaborative activities of researchers in the NSE compared to those in the SSH.

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Methods

The application of bibliometric methods to the analysis and evaluation of research practices in the NSE is well established. Their application to the analysis of the SSH is, however, made with greater care. In this section, we review the shortcomings associated with bibliometric analyses of research in the SSH. The methods and sources used in this study will also be detailed.

Bibliometrics in the SSH

Bibliometric methods are very useful for measuring the dissemination of knowledge in the natural sciences, but they are less effective in some applied fields, such as engineering (van Raan 2003). Applied to the SSH, bibliometric methods poses three main problems.[2]

First, knowledge dissemination media and, by extension, communication media in general are more varied in the SSH than in the NSE. A number of scholars have highlighted these fundamental differences between the scientific communication practices of scholars in the NSE and those in the SSH (Glänzel and Schoepflin 1999; Hicks 1999 and 2004; Moed, Luwel and Nederhof 2002; van Raan 2003). This is reflected in the greater role played by monographs, conference papers and proceedings, and non-scientific literature in the SSH. Depending on the discipline, articles may be a relatively minor publishing medium compared with others, such as books. Unfortunately, no database covers these other forms of publication as systematically and exhaustively as Thomson ISI does for journal articles.

Second, SSH research subjects are sometimes more local in orientation and, as a result, the target readership is more often limited to a country or region (Glänzel 1996; Hicks 1999; Hicks 2004; Ingwersen 1997; Nederhof et al. 1989; Nederhof and Zwaan 1991; Webster 1998; Winclawska 1996). SSH scholars reportedly publish more often in their mother tongue and in journals with a more limited distribution (Gingras 1984 and 2002; Line 1999). These research and publication practices have important consequences on the coverage of SSH publications from countries which main language is not English.

Furthermore, according to Hicks (1999), a number of SSH disciplines have more paradigms competing with one another than do those in the NSE, and as a result SSH literature is more fragmented – a situation that hinders the formation of a solid "core" of scientific journals (Hicks 1999), thereby making article-based bibliometric analysis more difficult to conduct successfully.

Therefore, one cannot rely on Thomson ISI's data to calculate publication rates or produce research impact indicators, nor to compare, rank or benchmark the research performances of research institutions. However, these data can be used to map SSH scholars' collaborative activities by measuring joint publication of articles and highlighting differences among disciplines. The resulting collaboration rates must be interpreted as being the output of scholars who publish articles, not the output of all scholars in the SSH. In fields in which the article is not a major dissemination medium, our analysis will probably provide less insight into overall practices. However, it will still bring out the characteristics of an important subset of the SSH scholar population: those who publish articles. Furthermore, in spite of its limitations, measuring collaboration on the basis of articles is probably the best approach

[2] For an exhaustive profile of the use of bibliometrics in the SSH, see Archambault and Vignola Gagné (2004).

currently available. According to Moody (2004), the collaboration rate for books is generally lower than that for articles. Therefore scholarly articles are a more informative medium for analysing collaboration not only in the natural sciences but also in the social sciences and humanities, although we must be careful not to generalize the results to all scholarly research output.

Building bibliometric statistics

The bibliometric data presented here comes from Thomson ISI's databases on CD-ROM: SCI, SSCI and AHCI. From these three data sources, a relational database has been created in which each piece of information was inserted into specific tables (articles, authors, addresses, journals, research fields, etc.) and fields (author's names, departments, institutions, cities, countries, etc.) For all Canadian addresses, a complete harmonization of institutions has been performed to regroup under one designation the multiple ways an institution could be written[3]. Also, each institution was classified into sectors such as universities, governments, hospitals, industries, etc. Although these three databases list several types of document, only articles, research notes and review articles are generally used for bibliometric studies because they are the main knowledge dissemination media. However, there are no clear standards on this subject (Moed, 1996): other types of document are deemed to be important in some disciplines but not in others.[4]

Table 1 gives the number and percentage share of the various document types in the social sciences, humanities and natural sciences. It shows that, while the three types generally used for bibliometric studies – articles, research notes and review articles – account for nearly 80% of NSE scholars' research output and 62% of those in the social sciences, they account for slightly less than 35% of documents listed in the humanities. Book reviews play an important role in knowledge dissemination in the social sciences (27%) and in the humanities (57%) reflecting the importance of books in those disciplines. Including this type of document for bibliometric statistics would no doubt have yielded increased coverage. Yet, as Table 1 shows, the mean number of addresses per book review is very low, suggesting that book reviews are rarely co-published.

Accordingly, while the selected document types (articles, notes and review articles) represent a lower percentage of publications listed in the SSH database than in the NSE, they are most likely to be produced collaboratively, and since the purpose of the study is to measure the collaborative activities of SSH scholars, we have decided to use only these three document types.

[3] McGill University, for instance, could be written as McGill-Univ, MacGill-Univ, McQuill-Univ, or as one of its affiliated colleges, Macdonald-Coll.
[4] For example, meeting abstracts in engineering disciplines. See Godin (1998).

Table 1: Document types in all fields of the natural sciences, social sciences and humanities—percentage share and mean number of addresses, 1980-2002

Document Type	Natural Sciences			Social Sciences			Humanities		
	No. of Documents	%	Mean No. of Addresses	No. of Documents	%	Mean No. of Addresses	No. of Documents	%	Mean No. of Addresses
Article	**10 050 775**	**72,194%**	**1,80**	**908 483**	**58,640%**	**1,43**	**371 240**	**31,682%**	**1,06**
Artistic Production	2	0,000%	1,50	83	0,005%	1,06	32 397	2,765%	1,03
Bibliography	950	0,007%	1,52	454	0,029%	1,41	1 911	0,163%	1,18
Biography	14 059	0,101%	1,25	4 713	0,304%	1,19	5 113	0,436%	1,09
Book Review	8 252	0,059%	1,07	421 800	27,226%	1,03	665 994	56,836%	1,01
Chronology	49	0,000%	1,29	39	0,003%	1,08	58	0,005%	1,02
Correction	14 034	0,101%	1,89	530	0,034%	1,48	130	0,011%	1,10
Criticism	4	0,000%	1,25	389	0,025%	1,02	19 702	1,681%	1,03
Discussion	20 922	0,150%	2,29	3 868	0,250%	2,08	3 027	0,258%	1,88
Editorial Content	256 537	1,843%	1,39	58 757	3,793%	1,23	20 682	1,765%	1,16
Letter	577 003	4,145%	1,39	34 109	2,202%	1,09	15 374	1,312%	1,03
Meeting Abstract	2 024 856	14,544%	1,51	49 184	3,175%	1,26	2 755	0,235%	1,09
News	2 767	0,020%	1,23	302	0,019%	1,13	365	0,031%	1,04
Note	**611 672**	**4,394%**	**1,55**	**35 080**	**2,264%**	**1,30**	**17 190**	**1,467%**	**1,05**
Other Reviews	3 002	0,022%	1,13	1 411	0,091%	1,08	2 085	0,178%	1,03
Reprint	2 663	0,019%	2,84	490	0,032%	1,31	163	0,014%	1,07
Review Article	**334 260**	**2,401%**	**1,66**	**29 559**	**1,908%**	**1,37**	**13 593**	**1,160%**	**1,10**
All types	**13 921 807**	**100%**	**1,72**	**1 549 251**	**100%**	**1,30**	**1 171 779**	**100%**	**1,03**

This paper uses the fields classification developed by CHI Research and used by the National Science Foundation in the U.S. The main advantage of this classification is that categories are mutually exclusive and therefore each journal appears in only one field. The advantage of this type of classification is that it bypasses problems associated with multiple counts. Unfortunately, a similar classification has not been developed for the SSH. Thus, it was necessary to classify SSH journals and to associate them to mutually exclusive fields and sub-fields.

Types of collaboration

Originally, this paper was meant to include six distinct, albeit non exclusive, types of collaborative activities[5]. However, due to space limitations, we only compiled the three types that were the most significant: multi-authored papers, international collaboration and inter-institutional collaboration. Rates of collaboration for the three other types were extremely low, especially in the SSH.

Here, we consider that a paper is the result of an international collaboration when it comprises at least two different institutional addresses from at least two countries. In the Canadian context, this means that articles with at least one Canadian address and one address in another country are considered to be the result of international collaboration. The same principle applies to calculating interinstitutional collaboration: articles with at least two addresses from different Canadian institutions will be counted as instances of interinstitutional collaboration. Interinstitutional collaborations are, thus, collaborations between two Canadian institutions. The counting of articles with more than one author serves to measure overall collaboration between scholars. Once an article is attributed to more than one author, it is considered to be the result of a collaboration.

[5] Multi-authors articles, international, interprovincial, intersectorial, intrasectorial and interinstitutional collaboration. For a detailed analysis of these different types of collaborations, see Larivière, Lebel and Lemelin (2004)

Collaborative Practices

This section provides insight into SSH scholars' collaborative practices and illustrate differences in practices among SSH disciplines. First, we will analyse articles written by more than one author to determine overall collaboration by Canadian scholars. Second, we will examine international collaboration with a view to determining Canada's position in a global collaborative network. Third, we will look at the collaborative networks of Canadian institutions.

Multi-author articles

The proportion of articles written by more than one author reflects the overall level of collaboration by Canadian scholars. As mentioned previously, a paper must be signed by at least two authors to be considered the result of a collaborative activity. Figure 1 shows the trend for multi-author articles. It shows that almost all articles in the NSE are joint publications, which is hardly surprising, considering that research output in those disciplines is usually the result of a team effort. Canadian scholars are slightly above the world average here. In 2002, more than 2 out of 3 Canadian papers in the social sciences had multiple authors, compared to 1 out of 2 papers at the world level. In the humanities, on the other hand, the vast majority of articles were written by just one scholar. Overall, the collaboration rate in the humanities stayed low at about 10%, but there was a slight increase over the 23-year period. The increase was still much lower than the one in the social sciences, where the rate of growth outstripped that observed in the NSE. While these figures indicate three distinct trends, they also suggest that the collaborative practices of scholars in the social sciences correspond more closely to those in the natural sciences than to those in the humanities.

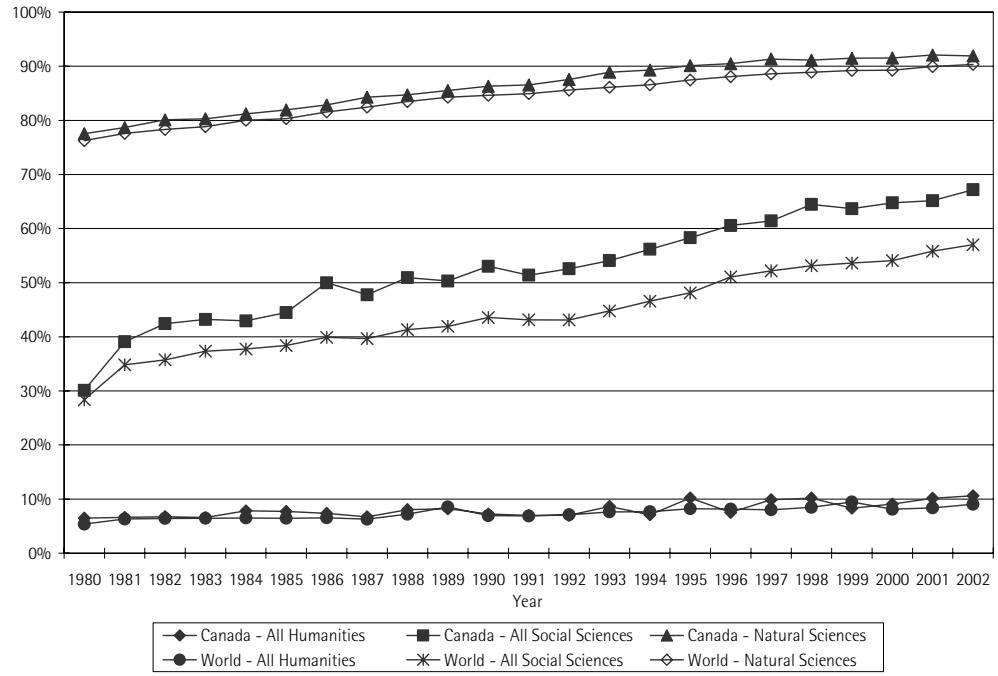

Figure 1: Multi-author article trends in NSE, social sciences and humanities, Canada and the world, 1980-2002

Multiple-authorship variations among disciplines are quite considerable. In 1998-2002, most articles in psychology and economics and management were written by more than one author, compared with about 60% in the social sciences and education. Slightly more than 1 article

out of 3 resulted from collaboration in law, compared with about 10% in history and the humanities. Multi-authorship is marginal in literature (4%), the only discipline with no observed growth.

Table 2: Canadian multi-author articles, by discipline, 1980-2002

Field	1980-1985		1986-1991		1992-1997		1998-2002		Total	
	N	%	N	%	N	%	N	%	N	%
Law	43	17,8%	68	27,2%	68	33,7%	56	39,7%	235	**28,2%**
Economics and Management	1 162	44,0%	1 742	50,0%	2 326	60,5%	2 005	67,2%	7 235	**55,9%**
Education	362	40,5%	462	45,3%	530	45,5%	422	58,9%	1 776	**46,8%**
History	159	10,6%	180	12,0%	216	13,4%	188	14,5%	743	**12,6%**
Other Humanities	290	7,6%	284	8,0%	335	9,5%	260	10,8%	1 169	**8,8%**
Literature	98	4,0%	80	3,4%	89	3,6%	72	4,3%	339	**3,8%**
Psychology	1 535	61,1%	2 506	70,5%	3 011	75,0%	2 682	82,2%	9 734	**73,0%**
Other Social Sciences	1 800	33,2%	2 993	42,4%	4 318	49,8%	4 199	57,6%	13 310	**46,8%**
Canada (Social Sciences and Humanities)	**5 449**	**27,9%**	**8 315**	**36,5%**	**10 893**	**42,7%**	**9 884**	**50,0%**	**34 541**	**39,4%**
Canada (Natural Sciences)	**83 507**	**80,0%**	**110 581**	**85,1%**	**135 721**	**89,6%**	**116 349**	**91,6%**	**446 158**	**87,0%**

International Collaboration

Our study shows that the contribution of international collaboration in the NSE and the social sciences grew steadily over the 23-year period, both for Canada and for the world (Figure 4). In 1980, only 15% of Canadian articles in the NSE and 11% in the social sciences involved international partners, but by 2002 the figures had risen to 42% and 25% respectively. The international collaborative activities of Canadian scholars were well above the world average in 2002, in both the NSE (20%) and in the social sciences (10%)[6].

The practices of scholars in the humanities were different. The amount of international collaboration by Canadian scholars remained fairly stable during the target period, which is hardly surprising since very few papers had more than one author. Worldwide, there was a modest increase, but international collaboration remained the exception rather than the rule.

The proportion of output resulting from international collaboration varies from country to country (Table 3). However, while for most countries the international collaboration rate in the social sciences is almost comparable to that in the natural sciences, it is way below in the humanities, for which the percentages are stagnant at a negligible level. Between 1998 and 2002, only two countries had an international collaboration rate above 15% in the humanities: China and Hong-Kong. Here also, we can see that the social sciences have a different collaborative pattern to that of the humanities.

[6] One might note that the world's international collaboration rate is lower than the lowest international collaboration rate for a country (United States). In 2002 (NSE), 116 459 articles out of 586 034 counted at least two address from at least two countries, for a world collaboration rate slightly below 20%. By comparison, the US had 50 435 international collaborations out of 192 821 articles, for a collaboration rate of 26%. This distortion between the world's and countries international collaboration rates is caused by the fact that the international collaborations are not only bilateral collaborations between two countries, but multilateral collaborations. Thus, an article that is the result of international collaboration is counted for each country, but only account for one paper in the world's international collaboration rate. This distortion could probably be resolved by using fractional counting.

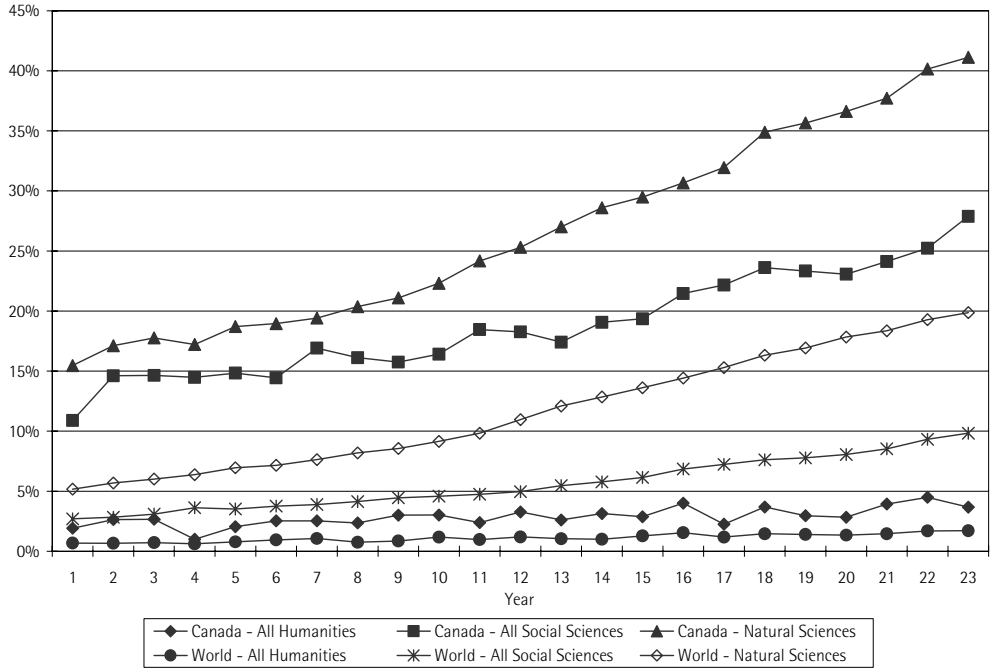

Figure 2: International collaboration trends in NSE, social sciences and humanities, Canada and the world, 1980-2002

Table 3: International collaboration rates of countries in humanities, social sciences and NSE, 1980-2002 (1000 or more publications in SSH as a whole)

Country	1980-1985			1986-1991			1992-1997			1998-2002		
	Hum.	SS	NSE	Hum.	SS	NSE	Hum.	SS	NSE	Hum.	SS	NSE
Republic of Korea	0,0%	42,1%	32,7%	6,3%	56,0%	29,0%	14,0%	54,1%	27,5%	9,9%	45,4%	25,1%
Belgium	4,6%	19,0%	23,4%	4,0%	28,1%	33,9%	4,6%	36,6%	44,9%	6,3%	42,8%	53,4%
China	1,9%	20,7%	19,0%	12,6%	30,7%	24,4%	13,9%	52,4%	28,1%	17,1%	42,6%	26,9%
Hong Kong	7,0%	16,2%	22,6%	1,3%	24,0%	22,8%	10,8%	38,2%	38,6%	15,0%	39,7%	43,1%
Switzerland	4,6%	15,0%	28,0%	4,0%	20,1%	37,5%	4,5%	27,2%	46,8%	3,4%	34,6%	53,5%
Italy	2,7%	11,6%	18,3%	4,3%	22,1%	25,9%	4,0%	30,3%	33,4%	4,8%	34,1%	39,0%
New Zealand	2,0%	14,5%	14,4%	3,1%	18,5%	21,8%	6,6%	25,6%	31,1%	6,7%	30,2%	38,5%
France	2,2%	11,1%	17,2%	2,0%	16,3%	25,0%	2,0%	24,0%	34,2%	2,1%	29,8%	42,0%
Netherlands	5,5%	11,0%	18,4%	5,9%	15,8%	24,0%	6,5%	21,1%	34,6%	8,9%	28,1%	44,8%
Israel	4,7%	23,5%	23,1%	5,9%	28,2%	30,2%	5,1%	28,7%	37,8%	4,1%	28,1%	41,9%
Norway	4,5%	12,8%	20,8%	7,3%	15,9%	27,8%	6,1%	20,0%	39,0%	2,5%	25,4%	47,5%
Spain	0,5%	13,5%	13,1%	1,2%	21,5%	22,0%	2,0%	24,1%	30,4%	2,0%	24,8%	36,9%
Canada	**2,1%**	**14,4%**	**17,6%**	**2,7%**	**17,0%**	**22,2%**	**3,1%**	**20,6%**	**30,4%**	**3,6%**	**24,7%**	**38,3%**
Japan	2,8%	12,8%	6,0%	6,2%	16,6%	9,1%	3,4%	21,7%	14,0%	8,5%	24,1%	18,6%
India	1,1%	11,4%	6,1%	3,0%	12,4%	10,1%	4,4%	16,6%	14,5%	5,8%	23,7%	20,1%
Sweden	5,0%	14,3%	19,9%	0,9%	17,2%	26,8%	5,1%	21,3%	38,0%	8,1%	22,9%	46,2%
Australia	2,3%	11,0%	13,5%	3,7%	13,4%	18,7%	4,5%	16,3%	26,5%	5,6%	20,3%	35,4%
Germany	1,5%	5,8%	15,5%	2,2%	8,6%	23,1%	2,9%	12,7%	32,5%	4,0%	19,0%	40,7%
U.K.	2,2%	8,0%	14,2%	2,9%	10,2%	19,2%	3,4%	14,0%	28,2%	3,8%	18,2%	37,3%
U.S.	0,9%	3,6%	8,2%	1,2%	4,8%	11,8%	1,4%	7,0%	17,8%	1,6%	9,1%	24,1%

Zitt, Bassecoulard and Okubo (2000), have shown that, for NSE, historical, language and cultural ties have an impact on the choice of collaborators. Though not included here for a lack space, our international networks of collaboration show this is still true in the humanities and SS, as illustrated by the high rates of collaboration between Austria and Germany, the Netherlands and Belgium, and New Zealand and Australia. This is also true for Canadian provinces: while the U.S. is the main partner of all provinces, the statistics show relatively

stronger ties between the researchers from the French province of Quebec and scholars for France and Belgium.

Interinstitutional collaboration

Figure 3 presents trends in interinstitutional collaboration of Canadian researchers. It shows the growing importance of this form of collaboration in the social sciences as well as in the NSE. While the interinstitutional collaboration rate was higher in the NSE than in the social sciences (26% compared with 22% in 2002), the gap narrowed over the course of the target period. The rate for the humanities remained stable at 2–3%.

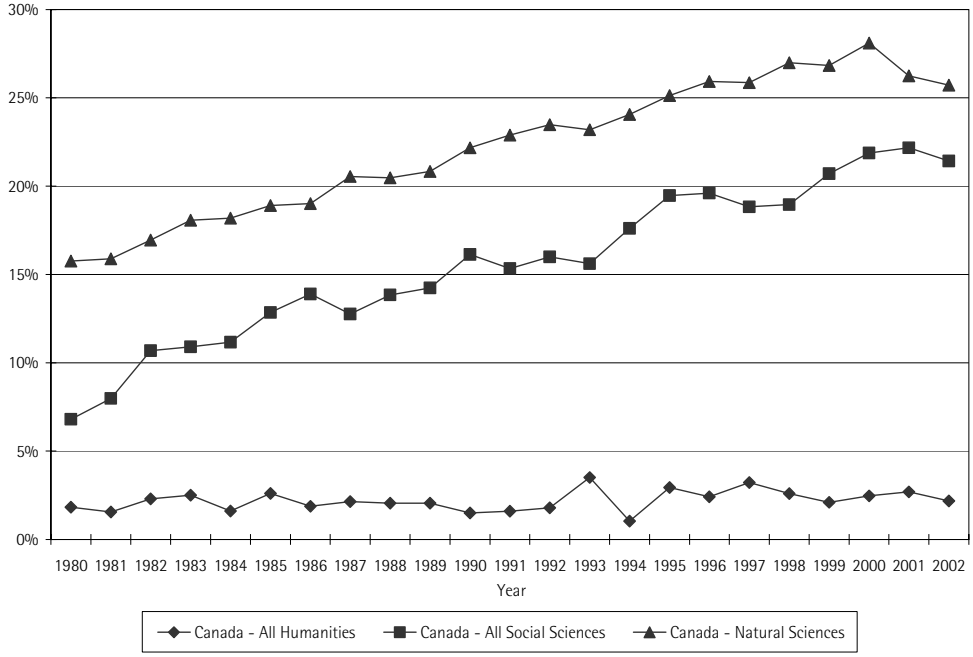

Figure 3: Trends in interinstitutional collaborative activities of Canadian scholars in NSE, social sciences and humanities, 1980-2002

Figures 4 and 5 were created with UCINET (Borgatti, Everett, and Freeman 2002) and NETDRAW (Borgatti 2002) network analysis software programs. They present the Canadian interinstitutional collaborative networks in the SS and in the NSE[7]. In both cases, the University of Toronto is the central node of the network, even though it is not the main collaborator of every player as, for example, the U.S. is in the area of international collaboration. Note also that geographic and proximity seems to be a decisive factor in choosing collaborators. The close ties between institutions in the West, between institutions in Quebec and between those in Ontario are evident, in both SS and NSE. This should come as no surprise: as shown by Zitt, Bassecoulard and Okubo (2000) geographic proximity and language ties influence, at the macro level of countries, the choice of collaborators. Our data shows that this is still true between institutions in a country that has two official languages. These affinities facilitates the sharing of information and ideas between researchers by reducing communication and transportation costs and also increases the probability of sharing research interests. Though Internet does facilitate the exchanges, it seems that physical distance stills play a structuring role.

[7] Rates of interinstitutional collaboration in the humanities were too low to compile a network.

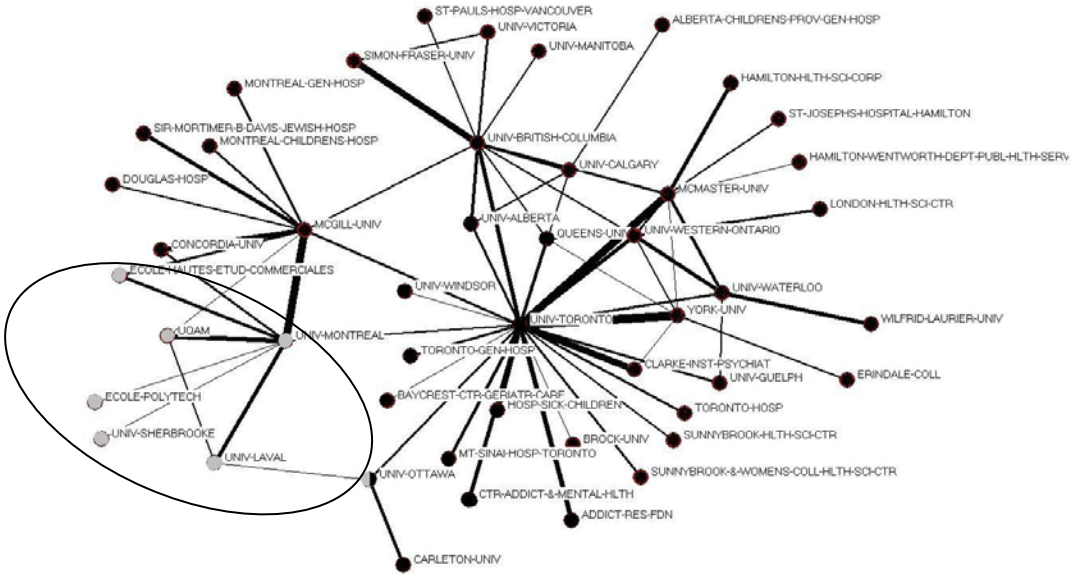

Figure 4: Interinstitutional collaborative activities of Canadian scholars in social sciences, 1980-2002 (30 or more joint publications). Black nodes represent English-speaking universities; grey nodes represent French-speaking universities.

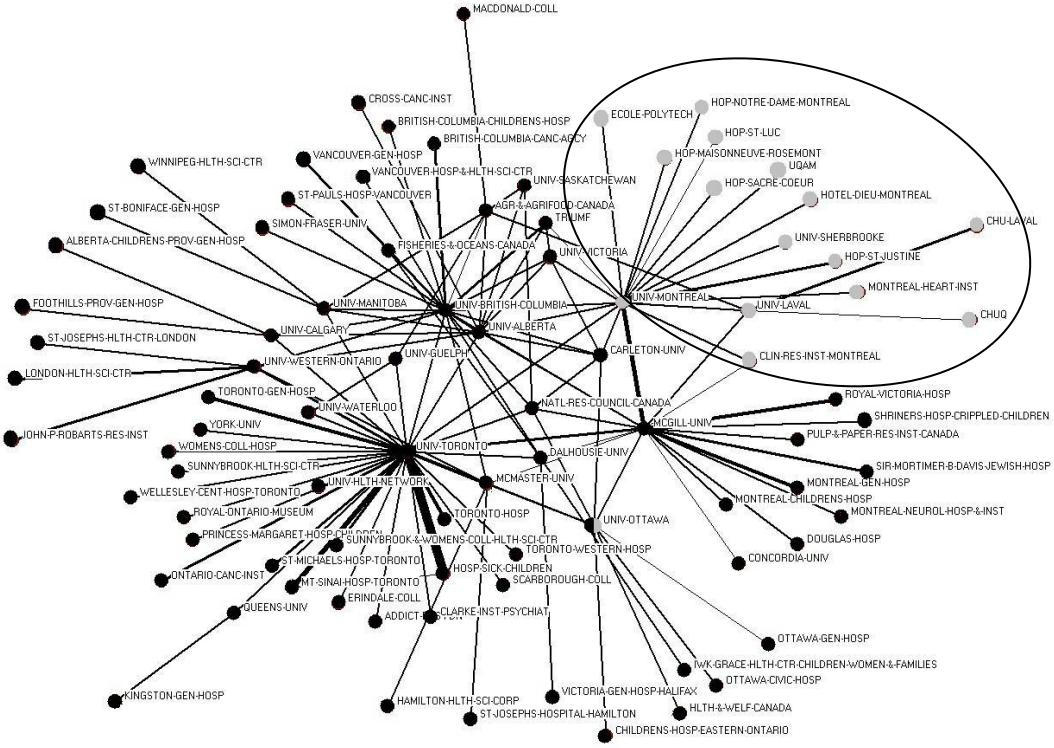

Figure 5: Interinstitutional collaborative activities of Canadian scholars in the NSE, 1980-2002 (250 or more joint publications). Black nodes represent English-speaking universities; grey nodes represent French-speaking universities.

Conclusion

The collaborative activities of Canadian scholars, as measured by the number of joint publications, are increasing in both the NSE and the SSH. There is also an upward trend in international collaboration. However, the rate of growth is not the same across all disciplines.

While rates for all types of collaboration in the social sciences rose steadily since 1980, collaboration rates for the humanities remained unchanged in a number of cases. Overall, psychology and economics and administration were the disciplines with the strongest collaboration, followed by social sciences, education, and law. In the humanities, history was the discipline in which collaborative activities were most frequent, but the rate remains very low. In the humanities and literature, collaboration was a marginal phenomenon. Not surprisingly, in general, the disciplines with the highest collaboration rates are also the ones in which journal articles are the main medium of knowledge dissemination. Also, these findings tend to confirm those of Moody (2004), who showed that quantitative research was more likely to be performed in collaboration.

The most visible expression of scientific collaboration is obviously co-authorship. Almost all articles in the NSE are jointly published, compared with two thirds in the social sciences and about 10% in the humanities. The most common form of partnership leading to a joint publication is international collaboration, followed by interinstitutional collaboration within Canada. Expressed in another way, in a slim majority of cases, Canadian scholars work more often with collaborators in foreign institutions than with those in other Canadian institutions. In both NSE and SSH, geographic and linguistic proximity also has an influence on the choice of these interinstitutional collaborators. While this is hardly surprising for scholars in SSH, who tend to work on more local topics, this was less expected for researchers in NSE, whose research objects are more universal and whose audience is therefore more international. Thus, even though collaborative practices vary considerably between the social sciences, the humanities and the natural sciences, the choice of countries or institutions of collaboration isn't influenced by disciplinary practices.

This being said, we should not drawn to conclude that research in the social sciences, and above all in the humanities, is produced by individual scholars who work in isolation and who collaborate only on rare occasions. In fact, even though writing is still an activity performed individually, collaboration is very probably taking on other forms that cannot be measured by bibliometrics, such as participation in conferences and seminars, co-direction of theses and co-publishing of books or book chapters. More research in the sociology of science is required to gain insight into the different forms of research collaboration in the social sciences and humanities. This being said, bibliometric mapping of collaborative networks gives a very good idea of the overall trends in collaboration and highlight the gaps between the humanities, the social sciences and NSE. In fact, this paper shows that social sciences are probably nearer to the NSE than to the humanities.

Bibliography

Archambault, É. & Vignola Gagné, É. (2004) *The Use of Bibliometrics in the Social Sciences and Humanities*, Report presented to the Social Sciences and Humanities Research Council, Montreal: Science-Metrix.

Borgatti, S. P., Everett, M. G. & Freeman, L. C. (2002). Ucinet for Windows: Software for Social Network Analysis. Harvard: Analytic Technologies.

Borgatti, S. P. (2002) NetDraw: Graph Visualization Software. Harvard: Analytic Technologies.

Gingras, Y. (1984). La valeur d'une langue dans un champ scientifique. *Recherches Sociographiques*. 25(2): 286-296.

Gingras, Y. (2002). Les formes spécifiques de l'internationalité du champ scientifique. *Actes de la recherche en sciences sociales*, No. 141-142, pp. 31-45.

Glänzel, W. (1995). International Scientific Cooperation in a Changing Europe: A Bibliometric Analysis of Co-Authorship links and profiles of 5 East-Eastern European Countries in the Sciences and Social Sciences, 1984-1993. *Science and Science of Science*. 4: 24-31.

Glänzel, W. (1996). A bibliometric approach to social sciences: National research performance in 6 selected social science areas 1990-1992. *Scientometrics*. 35(3): 291-307

Glänzel, W. & Schoepflin U. (1999). A Bibliometric Study of Reference Literature in the Sciences and Social Sciences. *Information Processing and Management*. 35: 31-44.

Godin, B. (1998). Measuring Knowledge Flows Between Countries: The Use of Scientific Meeting Database. *Scientometrics*. 42 (3): 313-323.

Hicks, D. (1999). "The difficulty of achieving full coverage of international social science literature and the bibliometric consequences". *Scientometrics*. 44(2): 193-215.

Hicks, D. (2004). The Four Literatures of Social Science. In Moed, H.F., Glänzel, W. & Schmoch, U. (Eds.) Handbook of Quantitative Science and Technology Research (pp. 476-496). Dordrecht: Kluwer Academic.

Ingwersen, P. (1997). The Central International Visibility of Danish and Scandinavian Research 1988-1996: A General Overview of Science & Technology, the Humanities and Social Sciences by Online Publication Analysis. CIS Report 5.3. Centre for Informetric Studies, Royal School of Library and Information Science, Denmark.

Larivière, V., Lebel, J. & Lemelin, P. (2004). *Les recherches collaboratives en sciences humaines: Analyse bibliométrique des pratiques*. Report presented to the Social Sciences and Humanities Research Council, Montreal: OST.

Line, M.B. (1999). Social Science information - the poor relation. 65th IFLA Council and General Conference.

Moed, H. F. (1996) Differences in the Construction of SCI-Based Bibliometric Indicators Among Various Producers: A First Overview. *Scientometrics*, 35(2): 177-191.

Moed, H.F., Nederhof A.J. & Luwel, M. (2002). Towards performance in the humanities. *Library Trends*. 50: 498-520.

Moody, J. (2004). The Structure of a Social Science Collaboration Network: Disciplinary Cohesion from 1963-1999. *American Sociological Review*. 69(2): 213-239.

Nederhof, A.J. & Zwaan, R.A. (1991). Quality Judgments of Journals as Indicators of Research Performance in the Humanities and the Social and Behavioral Sciences. *Journal of the American Society for Information Science*. 42(5): 332-340.

Nederhof, A.J., Zwaan, R.A., Debruin, R.E. & Dekker, P.J. (1989). Assessing the Usefulness of Bibliometric Indicators for the Humanities and the Social and Behavioral Sciences: A Comparative Study. *Scientometrics* 15(5-6): 423-435.

Stefaniak, B. (2001). International Co-Operation in Science and in the Social Sciences as Reflected in Multinational Papers indexed in SCI and SSCI. *Scientometrics*. 52(2): 193-210.

Van Raan, A.F.J. (2003). The use of bibliometric analysis in research performance assessment and monitoring of interdisciplinary scientific developments. *Technikfolgenabschätzung*. 12(1): 20-29. English translation available: http://www.itas.fzk.de/tatup/031/raan03a.htm

Webster, B.M. (1998). Polish Sociology Citation Index as an Example of Usage of National Citation Indexes in Scientometric Analysis of Social Science. *Journal of Information Science*. 24(1): 19-32.

Winclawska, B.M. (1996). Polish Sociology Citation Index (Principles for Creation and the First Results). *Scientometrics*. 35(3): 387-391.

Zitt, M., Bassecoulard, E., & Okubo, Y. (2000). Shadows of the Past in International Collaboration: Collaboration Profiles of the Top Five Producers of Science. *Scientometrics*. 47(3): 627-657