Collaboration in the Humanities, Arts and Social Sciences in Australia

Gaby Haddow, Jianhong (Cecilia) Xia & Michele Willson
Curtin University

This paper reports on the first large-scale quantitative investigation into collaboration, demonstrated in co-authorship, by Australian humanities, arts and social sciences (HASS) researchers. Web of Science data were extracted for Australian HASS publications, with a focus on the softer social sciences, over the period 2004 – 2013. The findings show that collaboration has increased over the last ten years, with strong intra-region collaboration concentrated on the east coast of Australia. International collaboration occurred most frequently with English speaking countries at vast distances from Australia. On average, fields in the social sciences collaborated at higher rates and attracted higher citations than humanities fields, but co-authorship of any kind was likely to increase citation rates. The results provide a snapshot of collaboration by Australian HASS authors in this time period and can be used as a benchmark to explore collaboration patterns in the future.

Keywords: HASS, humanities, social sciences, collaboration, Web of Science

Introduction

A report into the humanities, arts and social sciences in Australia stated: 'In an era when collaboration is encouraged by institutions and by funding mechanisms, the pattern of collaboration is becoming an important consideration' (Turner & Brass, 2014, p. 69). This paper seeks to explore aspects of collaboration in specific humanities, arts and social sciences (HASS) fields in order to identify the extent of collaboration, the countries Australian HASS authors are collaborating with, and to test whether collaboration is associated with higher impact as reflected in citations. It considers both national and international collaboration to gain an insight into collaboration patterns by different Australian regions and by different HASS fields. As a purely quantitative study, the research used co-authorship as a proxy for collaboration, thereby presenting a subset of the full range of activities that may occur in research collaboration.

There are a number of reasons why collaboration is encouraged, including to share expertise and the costs associated with research, and to boost research productivity and scholarly impact (Beaver, 2001; Katz & Martin, 1997). For researchers in the sciences, the need for large-scale facilities can be a strong driver for collaboration. This has previously been seen as less relevant for HASS researchers as they generally do not have the same requirements for costly equipment and research facilities. On the other hand, sharing skills and expertise, 'intellectual companionship', and the potential for higher

visibility of research are common to all disciplines (Katz & Martin, 1997, p. 15). For research funders, policy-makers and institutions, increases in productivity and impact contribute to improved performance in world university rankings and the pressure to collaborate, particularly with international partners, from funding agencies and institutions is applied across the disciplines.

The research reported in this paper is the first large-scale quantitative study of research collaboration, represented by co-authorship, by HASS researchers in Australia. Using data from the Thomson Reuters Web of Science database, the research findings are a valuable source of information about Australian HASS collaboration patterns over the past ten years and establish a benchmark from which future collaboration trends can be measured.

Background

The use of co-authorship as a proxy for measuring collaboration is an established, if imperfect, method to explore patterns and trends in research collaboration (Glänzel & Schubert, 2005). It is imperfect because co-authorship does not capture other forms of collaboration that occur between researchers, such as research supervision activities, access to research equipment and informal sharing of research data (Katz & Martin, 1997; Laudel, 2002). Co-authorship captures only the formal published outputs of research by two or more authors, using data that are commonly collected from established indexing sources such as Web of Science. When examining HASS fields, the nature of scholarly communication and coverage of the databases used to gather data introduces additional factors that influence results. For example, a substantial proportion of the research outputs by HASS researchers – books, book chapters and creative works – are not indexed by the databases to the same extent (if at all) as journal articles (Hicks, 1999, 2005; Moed, 2005; Universities UK, 2008).

Despite the acknowledged limitations, HASS collaboration using co-authorship as a proxy has attracted increasing attention over the last two decades and the findings of the research can be summarised as follows: social sciences authors collaborate at lower rates than authors from science fields, but more than authors from humanities fields (Abramo *et al.*, 2014; Bordons & Gómez, 2000; Endersby, 1996; Gossart & Oezman, 2009; Larivière, Gingras & Archambault., 2006; Ma *et al.*, 2014; Marshakova-Shaikevich, 2006; Nikzad *et al.*, 2011; Ossenblok *et al.*, 2014; Puuska *et al.*, 2014; Stefaniak, 2001). Focusing on international collaboration, the fields of psychology, education, economics and management tend to collaborate at higher rates than other social sciences (Abramo *et al.*, 2014; Larivière, Gingras & Archambault, 2006), and within the humanities fields collaboration in history is the strongest – the researchers qualifying their findings with: 'in the humanities and literature, formal collaboration based on co-authorship is a marginal phenomenon' (Larivière, Gingras & Archambault, 2006, p. 531).

The motivation and pressure to collaborate are given impetus by research that suggests 'internationally co-authored papers are cited up to twice as frequently as single-country papers' (Katz & Martin, 1997, p. 6). Moed (2005) sought to determine why citation rates tend to increase with collaboration and found that citation impact varied depending upon the number and combination of countries involved in a co-publication. The widespread perception that citations increase with collaboration was also tested by Luukkonen, Persson and Sivertsen (1992), who found less developed countries sought to collaborate with developed countries. Physical proximity (Hoekman *et al.*, 2010; Katz, 1994; Katz & Martin, 1997; Larivière, Gingras & Archambault, 2006; Luukkonen *et al.*, 1992), length of experience, experience in a number of workplaces (van Rijnsoever & Hessels, 2011, p. 469), and 'social distance' (Katz & Martin, 1997, p.5) can also influence collaboration rates. Hoekman, Frenken and Tijssen's (2010, p. 667) research into physical proximity and language as factors influencing collaboration in Europe found that, on average, the share of within-country co-authored publications in social sciences and humanities was 90 and 97 per cent (of all co-authored publications), respectively: the highest proportion of national collaboration across all fields. The authors also found that 'lingual area', that is regions with a common language, was strongly associated with co-authorship for social sciences (93 per cent) and humanities (97 per cent) publications.

There has been an increase in co-authored papers, internationally (Beaver, 2001; Ossenblok, *et al.*, 2014; Wuchty *et al.*, 2007) and Australia is the second highest publisher in the Asia-Pacific region, with a substantial proportion (40 per cent) of international collaboration (Haustein *et al.*, 2011, p. 736). According to a UK report, Australia experienced an average growth in international collaboration of 162 per cent between 1996 and 2005 (Universities UK, 2008). Biglia and Butler (2009) and the Office of Chief Scientist (2012) reported a similar growth rate of collaboration, however only science fields were included in the 2012 report and field analysis was not presented in the 2009 study.

Several studies have examined collaboration by HASS fields in Australia, including a study of international collaboration by Larivière, Gingras and Archambault (2006, p. 527). This research found Australian social sciences and humanities fields collaborating at 20.3 per cent and 5.6 per cent, respectively, over the period 1998 – 2002. Focusing on the Australian educational research workforce, Bennett *et al.* (2013, p. 487) reported 67.6 per cent of their sample (504 education academics) was involved in 'active collaborations' and 49.4 per cent had engaged in international collaborations (this was not limited to co-authorship). Collaboration with partners from English-language speaking countries formed the majority of collaborations, while only a quarter of the collaborations were with collaborators in Asia. Noting the limitations to using co-authorship to measure collaboration in HASS, Turner and Brass (2014) drew on data from national competitive grant applications and Australia's 2010 and 2012 national research assessment exercises (Excellence in Research for Australia, ERA) to gauge the extent of collaboration in HASS fields. The report's findings echo those of Bennett *et al.* (2013), with Europe (primarily the United Kingdom) providing the largest group of international collaborators (56 per cent), followed by North America (27 per cent), and 10 per cent Asian collaborators. Like previous international studies (Abramo *et al.*, 2014; Larivière, Gingras, & Archambault, 2006; Ma *et al.*, 2014; Ossenblok *et al.*, 2014), Turner and Brass (2014, p. 71) found that psychology, education and management fields had the highest rates of collaboration, at a national level, in HASS.

This study of Australian HASS fields gathered benchmark data about collaboration activity by researchers as reflected in co-authored publications indexed by the Web of Science database. It focussed on humanities and the 'softer' social sciences fields, which tend to be overshadowed in bibliometric analyses by large fields such as psychology and economics (with scholarly communication practices often more akin to sciences). The research sought to answer the following research questions in relation to these Australian HASS fields over a ten-year period, 2004 – 2013:

1. Which publication types and how many are produced through national and international collaborations?
2. What are the citation rates for national and international collaborations, and for which fields?
3. Are proximity and language associated with higher national and international collaboration?
4. Which fields are involved in higher rates of national and international collaboration?

The research does not claim to be representative of all collaboration activity that occurs in Australian HASS. It cannot due to the fields selected for examination, the acknowledged limitations of using co-authorship as a proxy for collaboration, the nature of scholarly communication in HASS, and database coverage – which is biased towards the large English-speaking publishing nations in North America and Europe. However, the results can be examined against existing international quantitative studies of HASS collaboration, particularly in relation to the influence of proximity and language. It also affords closer attention to the selected HASS fields.

An overview of the Australian HASS environment

Across the Australian higher education sector there are approximately 17,840 full-time equivalent research staff associated with HASS, as defined in the Turner and Brass (2014) report. This number accounts for 42.7 per cent of all research academics in the 39 universities. HASS includes fields ranging from the strongly scientific (such as some areas of psychology) and mathematical (as in economics), to performance and art. HASS is an unwieldy grouping that is difficult to define, and research and publication practices vary enormously across it. While HASS fields are found in all Australian universities, their place in faculty, college and school structures differ. For example, the majority of universities (64 per cent) locate psychology with science faculties and schools in their organisational structure, while economics and law are commonly located in schools of business or management.

There are also differences in the methods applied to assess HASS research in Australia by the Excellence in Research for Australia (ERA). While research outputs in 'Psychology and Cognitive Sciences' are assessed by citation analysis, other social sciences are assessed through peer review Furthermore, the humanities, arts and most social sciences fields are co-located under a number of divisions in the research classification scheme (the Australian and New Zealand Standard Research Classification (ANZSRC), (Australian Bureau of Statistics, 2008)) used in the ERA. 'Psychology and Cognitive Sciences', 'Economics', and 'Law' stand alone in their own divisions. For all HASS fields, the research classification is applied to research outputs, with journal articles automatically assigned the Field of Research (FoR) codes specified in the approved ERA Journal List (Australian Research Council, 2012). At the time of writing the revised journal list for ERA 2015 had not been made available to the public.

Methods

As a purely quantitative examination of HASS collaboration in Australia, the research drew on publications data from the Web of Science database. This source was selected due to the database's advanced search functions that allow refinement and identification of specific subject fields. The search for relevant publications was limited to the Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH), and the Book Citation Index–Social Sciences & Humanities (BKCI-SSH), with a publication year between 2004 and 2013. This period was selected to provide some indication of change across ten years. It also incorporates the years before the ERA was introduced (prior to 2010) and several publishing years subsequently. 'Australia' was used in the address field to limit results to publications with at least one author affiliated with an Australian institution. In order to focus on the humanities, arts and softer social sciences fields, the subject search applied the strategy: (SU = Archaeology OR Architecture OR Art OR Arts & Humanities Other Topics OR Asian Studies OR Classics OR Dance OR Film, Radio & Television OR History OR History & Philosophy of Science OR Literature OR Music OR Philosophy OR Religion OR Theatre OR Communication OR Cultural Studies OR Demography OR Education & Educational Research OR Ethnic Studies OR Family Studies OR Geography OR Linguistics OR Social Issues OR Social Sciences Other Topics OR Social Work OR Sociology OR Urban Studies OR Women's Studies). The results were refined to exclude publications indexed with science-related Research Area terms. Only the document types 'article', 'book chapter' and 'book' were included in the final data set for analysis. All records indexed as 'proceedings papers' in the results were in fact journal publications, and therefore this document type did not feature in the analysis. A total of 21,217 publication records comprised the data for analysis.

Although psychology, economics and law are associated with HASS, these fields were not included in the study. Previous research in Australia and internationally indicates that psychology, and to a lesser extent economics and law, are closer to science fields in scholarly communication practices and coverage by Web of Science. In relation to scholarly communication, a comparison of referencing practices (Larivière,, Archambault, Gingras, & Vignola-Gagnè, 2006) found that journal literature makes up over 50 per cent of the share of references in the fields of psychology, economics and law, while all other HASS fields are substantially below that. Butler and Visser (2006, p. 329) reported Web of Science coverage of Australian university publications in psychology journals was 73 per cent compared with less than 50 per cent for other HASS fields. By limiting the research to the humanities, arts and softer social sciences in this study, the research was able to closely examine fields that are often lost amongst the findings for HASS more broadly.

The full records for the retrieved items were downloaded into an Excel spreadsheet. In their original form, the data included concatenated fields and inconsistent naming rules which required extensive cleansing to identify collaborating authors, institutions, regions and countries. A Perl script was used to parse the raw data to extract, group and codify data of interest and to reformat so that the data could be imported into JMP11 (2014) and IBM SPSS Statistics (2013) to conduct frequency analyses. The data were analysed using descriptive statistics functions of Excel and IBM SPSS Statistics. To enable field of research (subject) analysis, the FoR codes assigned to journals in the ERA (Australian Research Council, 2012) were recorded against journals in the spreadsheet and the 'research areas' terms assigned to individual records by Web of Science were also included.

Citations data are reported as means and at the citation level of the 75th percentile in the analysis of authorship categories and research areas. The 75th percentile was chosen as the cut-off level, as performed by Levitt and Thelwall (2010) in their analysis of economics literature and after testing the higher 90th percentile cut-off level. ArcGIS software was used to create visual representations of the density of collaborating countries.

The main subsets of data examined were the authorship categories: sole-authored; national co-authored; and international co-authored (IC) publications. If a publication had two or more authors and all were affiliated with Australian institutions, it was classed as a national collaboration. Publications with at least one international co-author were categorised as international collaborations.

Results

From the total 21,217 publication records, 12,964 (61.1 per cent) were sole-authored, 5,526 (26.1 per cent) were national co-authored, and 2,727 (12.8 per cent) were IC. In contrast to earlier studies of science fields (Biglia & Butler, 2009; Haustein *et al.*, 2011; Office of the Chief Scientist, 2012), the international collaboration of these HASS publications occurs at much lower rates. The set was comprised of 15,228 (71.7 per cent) articles, 5,981 (28.2 per cent) book chapters, and eight books.

Table 1: Publication types by authorship categories

	SA		NC		IC		Total
	n	%	*n*	%	*n*	%	*n*
Articles n	8973	58.9	4301	28.2	1954	12.8	15228
(%)	(69.21)		(77.83)		(71.65)		
Book chapters n	3986	66.6	1224	20.5	771	12.9	5981
(%)	(30.75)		(22.15)		(28.27)		
Books n	5	62.5	1	12.5	2	25.0	8
(%)	(0.04)		(0.02)		(0.07)		
Total n	12964		5526		2727		

Note: SA – sole-authored; NC – national co-authored; IC – international co-authored

Publications, publication year and citations

The types of publications produced by each authorship category were analysed to explore whether differences existed between sole-authored, national co-authored and international co-authored outputs (see Table 1). The results for journal articles and book chapters differ across the authorship types, with sole authors producing the majority of all publication types. The proportion of articles is slightly higher than book chapters for national co-authored publications, but there is no difference between these publication types for international co-authored publications. The number of books (8 in total) in the data set is too small to achieve reliable results relating to books specifically, however, book publications were included in analyses of Research Areas.

To determine whether a trend in publication outputs emerged over the period studied, the publications (per cent of total set) produced each year by the different authorship categories was examined. For example, under 6 per cent of international co-authored publications in the dataset were published in 2007, rising to over 12 per cent in 2009. Figure 1 presents the findings, which show a decline in the number of international co-authored publications in 2010, followed by a rise and steadying off in 2011 and 2012. The trend lines indicate international co-authored publications have increased at higher rates than national co-authored, with sole-authored publications growing at the lowest rate across the period.

The mean number of citations per publication was calculated for the three authorship categories and for the different publication types. Across the full data set the mean citation rate was 2.27; journal articles had an average citation rate of 2.94, and chapters were cited 0.55 times on average. The book publications had the highest mean citation rate at 4, but this finding is unreliable due to the very low number of books (eight). The highest number of citations to a single publication in the authorship categories was 208 for a 2006 international co-authored publication, 196 for a 2007 national co-authored publication, and 122 for a 2004 sole-authored publication: all journal articles.

Citation rates across the full data set were also calculated for the authorship categories. Per publication: sole-authored was 1.64; national co-authored was 3.02: and international co-authored was 3.75 citations. As a comparison, a calculation of the 75th percentile was used as a cut-off to compare citation levels across the different authorship categories. These calculations for book publications are not included as a separate row in Table 2 because the low number of books is likely to produce unreliable

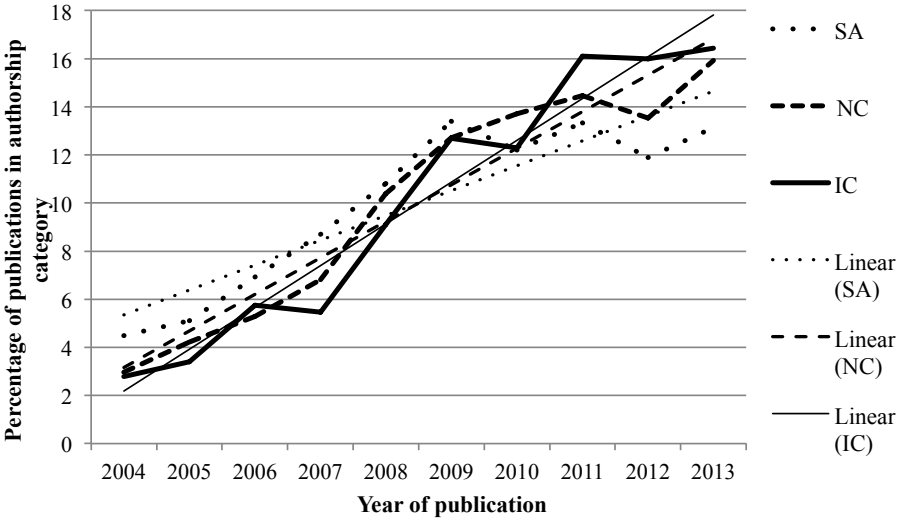

Figure 1: Publications by authorship categories and year of publication

Note: SA – sole-authored; NC – national co-authored; IC – international co-authored

Table 2: Mean citations and citation level of the 75th percentile for publication types by authorship categories

	SA	*NC*	*IC*
All publications	(n=12964)	(n=5526)	(n=2727)
Mean citations	1.64	3.02	3.75
Citation level at 75th percentile	1	3	4
Journal articles	(n=8973)	(n=4301)	(n=1954)
Mean citations	2.16	3.73	4.94
Citation level at 75th percentile	2	4	6
Book chapters	(n=3986)	(n=1224)	(n=771)
Mean citations	0.47	0.52	0.72
Citation level at 75th percentile	0	0	1

Note: SA – sole-authored; NC – national co-authored; IC – international co-authored

data. The results indicate that publishing with co-authors, either at national or international levels, will advantage Australian authors in terms of potential to attract citations, and that journal articles are likely to attract higher numbers of citations than book chapters.

Authors, affiliations and national collaboration

The average number of publications per collaborating author in the full data set was 1.46. The number of co-authors on national co-authored publications ranged from 2–14, with an average of 2.63 authors per publication. International co-authors ranged from 2–20, with an average of 3.18 authors per publication. In the national co-authored publication set, 2,284 authors had collaborated on two or more publications, while less than half that number (1,002) of authors had collaborated on two or more international co-authored publications. Across both collaboration types only 93 authors (0.58 per cent) had co-authored more than 10 publications. Two Australian authors affiliated with the field of linguistics were the most frequent collaborators across the national co-authored and international co-authored publications sets (140 and 111 publications, respectively), 111 of which were co-authored with each other.

The data were analysed to determine the extent to which Australian states/territories engaged in co-authorship. New South Wales (NSW), Victoria, and Queensland collaborated on 36.6 per cent, 29.2 per cent and 24.7 per cent of national co-authored publications respectively, while the other states and territories were collaborators on less than 10 per cent of national co-authored publications. The states with the highest national co-authored collaboration were also the highest collaborators on international co-authored publications, with 31.4 per cent, 24.6 per cent, and 20 per cent respectively.

To explore the extent of collaboration between states/territories, the affiliations of national co-authored publications were analysed by disaggregating the affiliation data for each national co-authored publication to identify the one-to-one collaborations across Australia. Overall, intra-state/territory collaboration occurred at higher rates than inter-state/territory collaboration. Only Tasmania and the Northern Territory had higher rates for inter-state collaboration. The highest intra-state collaboration was by authors affiliated with NSW (3,749), followed by Victoria and Queensland (3,208 and 2,700, respectively). The highest inter-state/territory collaboration occurred between NSW and Victoria (480), Victoria and Queensland (284), NSW and Queensland (274), and Victoria and the ACT (204). The other inter-state/territory collaborations numbered 148 or less.

Collaborating countries

In total, 101 different countries were represented in the international co-authored publication set. Across it, there were 4,903 international co-authors on 2,727 publications. This count was derived from counting the number of international co-authors regardless of country affiliation; for example, a publication with two authors from the US, two from England, and one from China was counted as five. Two analyses were performed on the international co-authored publications data to determine the number of publications by a collaborating country (for example, if one or more co-authors on a publication was from the United States then this was counted as one instance) and by the number of authors from a collaborating country across the whole international co-authored set. The top five most frequently collaborating countries are presented in Table 3.

With the exception of China, the highest collaborating countries share the same language with Australia. There was a substantial decrease to the sixth highest collaborating country: 100 publications had a co-author affiliated with Singapore; and Singapore and the Netherlands were each represented by 153 authors on international co-authored publications. Some of Australia's nearest neighbours (Indonesia, Malaysia, Philippines, Cambodia, Thailand, Brunei and Laos) collaborated on 134 publications in total. ArcGIS mapping software was used to illustrate the density (in raw numbers) of international co-authors by country affiliation, seen in Figure 2.

Table 3: Top five collaborating countries by publications and authors

Collaborating country by publications			*Collaborating country by authors*		
	n	%		n	%
England	646	23.7	USA	995	20.3
USA	613	22.5	England	957	19.5
NZ	280	10.3	NZ	382	7.8
China	234	8.6	China	332	6.8
Canada	209	7.7	Canada	308	6.3

HASS fields: Collaboration and citations

Differences between subject fields can be analysed in a number of ways, including the terms assigned to records by a database, the journals in which articles are published, or through more formalised research classification like Fields of Research codes, as in the ERA. Each of these methods was used to examine the publications in the co-authored data sets. The sole-authored publications were included in some analyses for comparative purposes. It is problematic, however, to compare the findings from these various approaches due to differences in how a subject is assigned or interpreted. For example, journal titles rarely describe their full content, assignment of Fields of Research codes were somewhat haphazard (Haddow, 2015), and databases index at article level using their own set of terms.

Journals that had published the highest number of articles in the national co-authored and international co-authored sets were identified and the top five titles are presented in Table 4. Education is strongly represented in the national co-authored set, while the international co-authored journals have a slightly broader subject representation. The findings that only 18 titles in the national co-authored set had 50 or more articles and only 10 titles in the international co-authored set were responsible for 20 or more articles indicate a 'long tail' of journals in which very few Australian HASS authors publish.

The FoR codes assigned to journals for the ERA were recorded against all journals with five or more articles in the national co-authored and international co-authored sets. The frequency of FoR codes in the sets was analysed after the codes were proportionally distributed at the two digit level. Proportional distribution of the FoR codes was undertaken to account for the varying number of codes assigned to journals. For example, Geographical Research is assigned the single Multidisciplinary FoR code and therefore each of its articles was counted as one multi-disciplinary code in the analysis. The Journal of Social Issues is assigned two FoR codes and half the number of articles were distributed to each code. For a journal that is assigned three FoR codes, such as Australian Feminist Studies, a third of the articles were distributed to each code. The total number of articles included in this analysis was 3,532 for national co-authored (82 per cent of the total number of national co-authored articles) and 1154 articles in the international co-authored set (59 per cent of the total international co-authored articles). The difference between the sets is due to the longer tail of international co-authored journals with fewer than five articles.

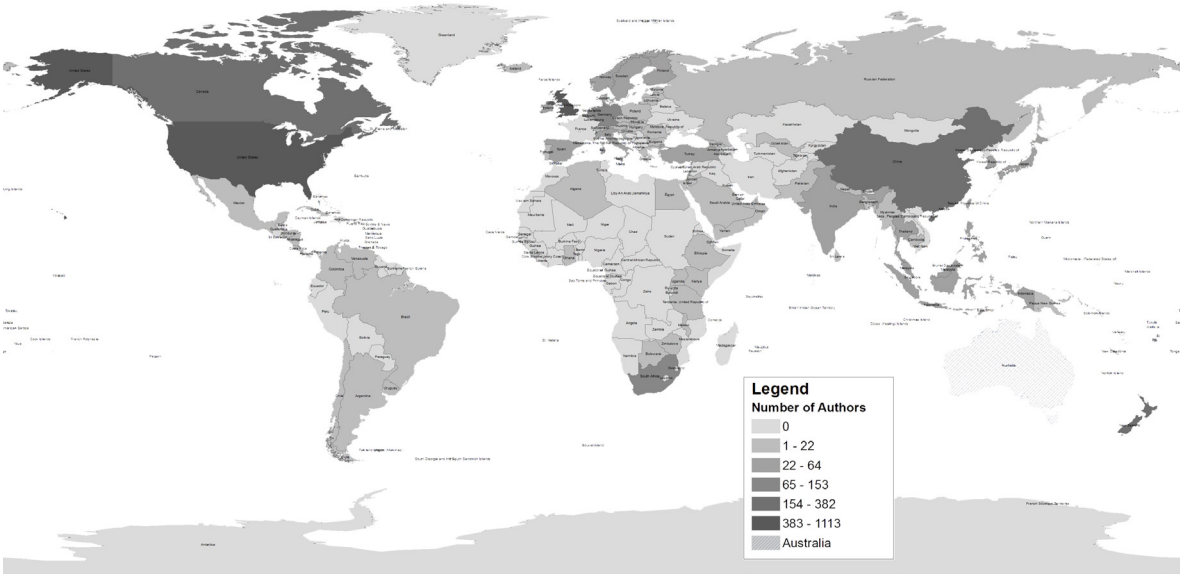

Figure 2: International collaboration density by countries *Source: Web of Science*

Table 4: Journal titles with highest number of articles with Australian co-authors

NC		*IC*	
Title	*Articles (n)*	*Title*	*Articles (n)*
Australasian Journal of Educational Technology	124	Antiquity	31
Australian Geographer	118	Social Indicators Research	29
Australian Journal of Social Issues	108	Annals of Tourism Research	28
Higher Education Research & Development	97	International Journal of Science Education	26
Australasian Journal of Early Childhood	94	Teaching & Teacher Education	26

Note: NC – national co-authored; IC – international co-authored

Figure 3 presents the findings for this analysis and suggests more similarities than variation exists between the fields in which national co-authored and international co-authored article authors are publishing. National co-authored articles are stronger in the 'Multidisciplinary' (8.75 per cent) and 'Education' (41.79 per cent) codes than international co-authored publications, at 4.77 per cent and 32.58 per cent, respectively. International co-authored articles have higher representation in 'Commerce, Management, Tourism and Services' (16.98 per cent) compared with 7.93 per cent in the national co-authored articles, and in 'History and Archaeology' at 6.85 per cent compared with 4.61 per cent for the national co-authored articles. The field 'Studies in Human Society' is represented in almost equal proportions in the two articles' sets, with a less than one per cent difference.

The analysis performed on the Research Area terms of Web of Science included an examination of subject fields across the full data set. Web of Science assigns more than one indexing term to some records. In the Australian HASS data set, approximately 78 per cent of the records were indexed with one Research Area term only; 22 records were not assigned terms. On this basis, the first (or only) Research Area term assigned to a record was used in the analysis. A total of 32 different Research Areas were assigned to records in the data set and all were social sciences or humanities terms, indicating the search strategy achieved its aim.

In the first calculation, the data were sorted by Research Area and by authorship type. Authorship types within each of the Research Area sets were calculated as a percentage of all records indexed with that Research Area term. The 10

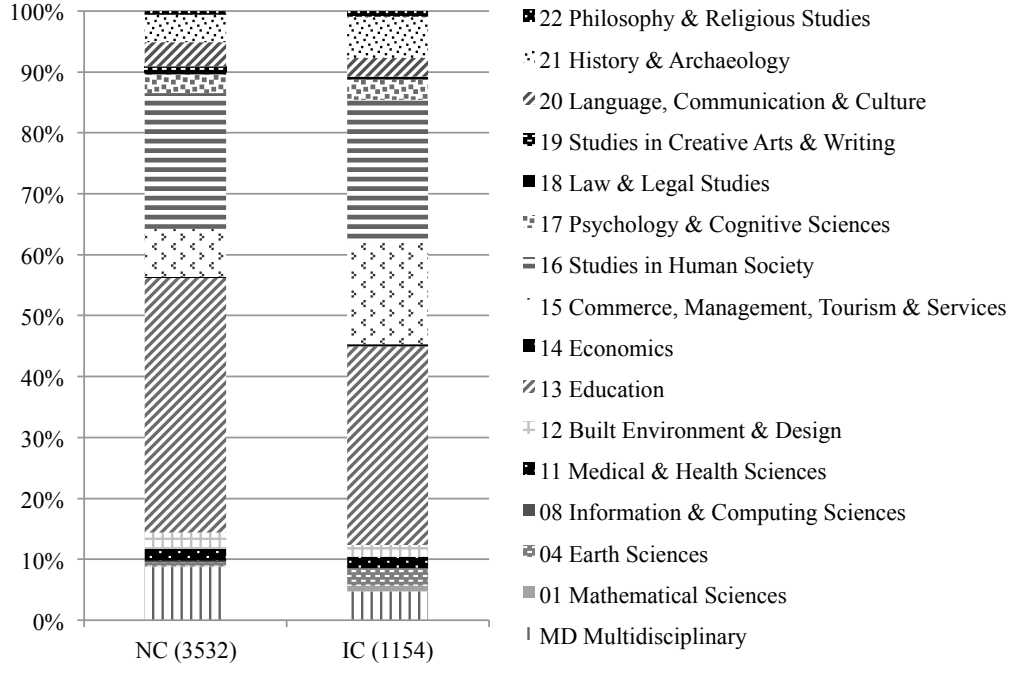

Figure 3: Field of Research code analysis for journals with five or more articles with national or international co-authors (number of articles)

Note: NC – national co-authored; IC – international co-authored

Research Areas with the highest number of records in the dataset are presented in authorship categories in Figure 4.

The large set, Social Sciences – Other Topics, had the highest rate of IC, followed by Archaeology, Geography, and Education & Educational Research. These same Research Areas and Sociology were also collaborating at the highest national co-authored rates. Literature had the highest proportion of sole-authored publications (95.5 per cent) in the top 10 publishing Research Areas and across the full data set. Of the Research Areas with fewer publications (excluding those with less than 20 publications), Demography (300 publications) had the highest international co-authored rate at 29 per cent and highest rate overall and Family Studies (393 publications) had the highest proportion of national co-authored publications (47.6 per cent).

In order to identify any associations between publication types and citations (discussed below), the Research Areas were analysed for publication type distribution. Table 5 presents the Research Areas that had a majority of book chapter publications and the five Research Areas with the highest proportion of article publications. Because the full data set was made up of over 70 per cent articles, most Research Areas were found to publish more articles than other publication types, therefore the analysis presented in Table 5 was limited to the top five Research Areas.

With the exception of Geography and Arts & Humanities – Other Topics these Research Areas tended to have lower numbers of publications in the set. The humanities fields published more journal articles than book chapters; a finding that is probably related to database coverage rather than anomalous scholarly communication behaviour of Australian humanities authors.

The final analysis explored citation rates by Research Areas. Presented in Table 6, average citations and citation level at the 75th percentile were calculated for sole-authored, national co-authored and international co-authored publications in the top 10 publishing Research Areas. Co-authorship creates a citation advantage in the majority of these Research Areas. An exception is the History international co-authored set, which has lower citation rates than for its national co-authored and sole-authored publications. Potentially accounting for this outlier, the History international co-authored publications comprised 53 book chapters with a total of 2 citations and 34 journal articles with a total of 37 citations.

Large publishing Research Areas are likely to produce more reliable results for this analysis, however another approach to examining citations by Research Area is to explore the influence of collaboration overall. Of the Research Areas in Table 6, three had collaboration (national co-authored and international co-authored) rates of over 50 per cent: Education & Educational Research, Geography, and Social Sciences – Other Topics. Several Research Areas with fewer publications also had collaboration rates of greater than 50 per cent and these are presented, with mean citations and citation level at the 75th percentile, in Table 7.

Tables 6 and 7 suggest that Research Areas that engage in high rates of collaboration and for which journal articles are the major publication type (illustrated by Geography, Family Studies, and Social Issues) will attract citations at or above the mean and 75th percentile level for national co-authored and international co-authored publications. The fields with higher citation rates than

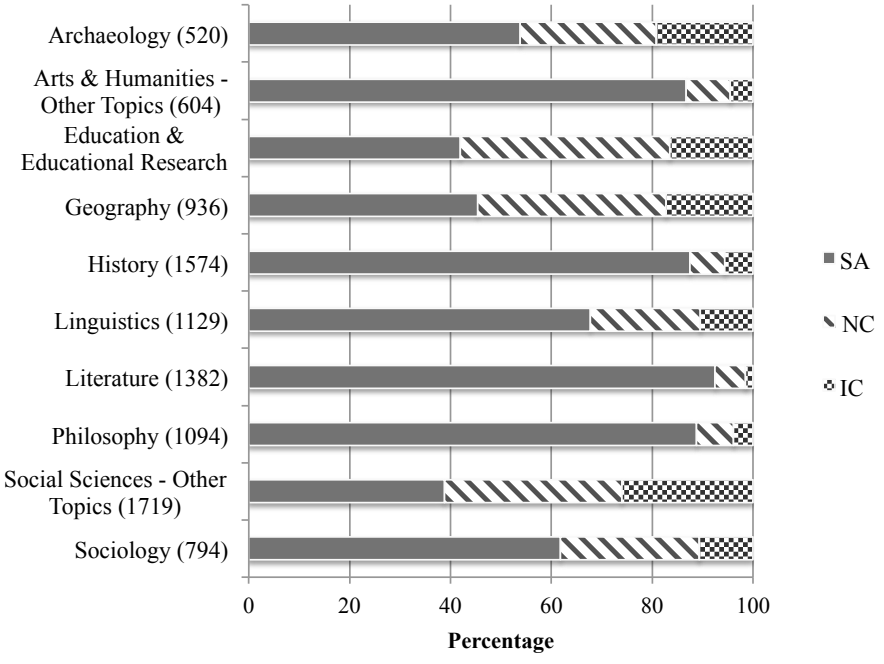

Figure 4: Top 10 publishing Research Areas (no. of publications) by authorship category

Note: SA – sole-authored; NC – national co-authored; IC – international co-authored

the average for international co-authored and national co-authored publication (3.75 and 3.03, respectively) are social sciences. In contrast, the social sciences field Criminology & Penology, which had a high proportion of book chapters and was involved in just under 50 per cent collaboration, had low average citation rates of 0.72 and 1.03 for national co-authored and IC, respectively.

Table 5: Research Areas with a majority of book chapters and highest proportion of journal articles

Research Area (n)	*Book chapters*	*Articles*
	%	%
Film, Radio & Television (245)	73.47	
Ethnic Studies (180)	67.78	
Criminology & Penology (139)	61.15	
Women's Studies (339)		98.23
Geography (936)		95.19
Social Issues (319)		92.79
Family Studies (393)		92.11
Arts & Humanities – Other Topics (604)		90.89

Discussion

This study considered collaboration patterns by Australian authors publishing in HASS fields by seeking answers to the following questions: Which publication types and how many are produced through national and international collaborations? What are the citation rates for national and international collaborations, and for which fields? Are proximity and language associated with higher national and international collaboration? And which fields are involved in higher rates of national and international collaboration? Publications records from the Web of Science database were the primary data and these were limited to publications between 2004 and 2013 that were indexed with terms relating to humanities and softer social sciences fields. Journal articles comprised the majority of publications (over 70 per cent), which corresponds with Turner and Brass' (2014, p. 65) analysis of the ERA 2012 data. Articles also made up the highest proportion of national co-authored publications, while book chapters and articles were produced in almost equal proportions by international co-authors. The number of books was negligible across the data set.

Table 6: Top 10 publishing Research Areas (number of publications): Mean citations and citation level at 75th percentile by authorship category

	SA		*NC*		*IC*	
Research Area (n)	*Mean*	*75th*	*Mean*	*75th*	*Mean*	*75th*
Archaeology (520)	1.60	2	1.47	2	2.41	3
Arts & Humanities – Other Topics (604)	0.76	1	1.26	1	2.48	2
Education & Educational Research (5596)	2.35	2	2.84	3	3.75	4
Geography (936)	5.78	8	6.44	8	6.55	7
History (1574)	0.66	1	1.06	1	0.45	0
Linguistics (1129)	1.93	2	1.43	2	2.68	3
Literature (1382)	0.45	0	0.36	0	2.86	4
Philosophy (1094)	1.41	1	1.58	2	3.21	5
Social Sciences – Other Topics (1719)	2.65	2	3.63	4	4.28	4
Sociology (794)	3.11	3	4.30	5	6.52	6

Note: SA – sole-authored; NC – national co-authored; IC – international co-authored

Table 7: Research Areas (number of publications) with >50% collaboration: Mean citations and citation level at 75th percentile by authorship category

	NC+IC	*SA*		*NC*		*IC*	
Research Area (n)	%	*Mean*	*75th*	*Mean*	*75th*	*Mean*	*75th*
Demography (300)	57.67	4.15	4	3.37	3.75	3.29	4
Family Studies (393)	60.31	2.76	3	3.50	4	5.76	5.75
Social Issues (321)	57.94	2.65	3	4.16	4	5.53	9
Social Work (479)	62.84	2.12	3	2.46	3	3.18	5

Note: SA – sole-authored; NC – national co-authored; IC – international co-authored

The results showing Australian HASS authors collaborate with international partners at lower levels (12.8 per cent) than reported for science fields (40 per cent) are not surprising and support numerous earlier studies' findings (Abramo *et al.*, 2014; Bordons & Gómez, 2000; Endersby, 1996; Gossart & Oezman, 2009; Larivière, Gingras & Archambault, 2006; Ma *et al.*, 2014; Marshakova-Shaikevich, 2006; Nikzad *et al.*, 2011; Ossenblok *et al.*, 2014; Puuska *et al.*, 2014; Stefaniak, 2001). The reported increase in international collaboration generally (Beaver, 2001; Haustein *et al.*, 2011; Ossenblok *et al.*, 2014; Universities UK, 2008; Wuchty *et al.*, 2007) was also

seen in this study, which found international co-authorship tripled over five years, between 2005 and 2009, and by 2011 had exceeded national collaboration growth rate. In this respect, the results were similar to those found for science fields over a similar period (Office of Chief Scientist, 2012, p. 140). The steady rise in international co-authorship is possibly attributable to the release of a report (Department of Education, Science and Training, 2006) that proposed using international benchmarks to assess research quality, leading to predictions that international collaboration would increase (Genoni *et al.*, 2009, p. 94). Another explanation could be the increased coverage of Australian journals by Web of Science in the late 2000s (Haddow & Genoni, 2009), in part due to the creation of an eligible journal list for the ERA and lobbying of Thomson Reuters by the national Academies and journal editors. If the latter, the increases reported may reflect the availability of data for analysis rather than a real growth in international co-authorship.

Previous research has found that HASS has higher rates of national, or inter-institutional, collaboration than other fields (Hoekman *et al.*, 2010). This can be related to the national focus that characterises many social sciences fields (Hicks, 2005) and Australia's physical size is likely to be an additional factor that influences research collaboration activities. Compared with the findings for Australian science fields (Office of Chief Scientist, 2012, p. 140), with approximately 28 per cent of 'domestic' publications, the findings for national collaboration for the HASS fields at just over a quarter of the publications do not support the earlier study. However, collaboration generally was found to be very low with less than 100 Australian HASS authors collaborating on more than 10 publications; that is, half a per cent of the total number of collaborating authors. The higher levels of national collaboration that was found for the east coast of Australia is explained by the density of universities in those regions and physical proximity, relative to the rest of the country.

Physical proximity, language, social distance and cultural ties have been found to affect the extent of international collaboration (Hoekman *et al.*, 2010; Katz, 1994; Katz & Martin, 1997; Luukkonen *et al.*, 1992). In Australia, it appears that proximity is less important than language and cultural ties for international co-authorship. With the exception of New Zealand, Australian HASS authors collaborate most often with geographically distant English-speaking countries; England and the United States. Australian authors in science fields collaborate similarly, with the United States and United Kingdom as the main co-authors. Unlike the HASS authors, New Zealand is not amongst the top five collaborating countries for science authors, although it features strongly when a calculation for 'collaboration intensity' is reported (Office of Chief Scientist, 2012, p. 142). HASS co-authorship with Chinese partners was in the top five collaborating countries, however, co-authorship with others in the Asian region is limited, echoing the findings of Turner and Brass (2014) for HASS collaboration and the results for educational researchers' collaborations (Bennett *et al.*, 2013).

The broad agreement, with some qualifications (Katz & Martin, 1997; Moed, 2005), that international co-authorship increases citation rates is confirmed for this selection of Australian HASS publications. Overall, mean citation rates were lowest (1.64) for the sole authored publications, rising to 3.02 for national co-authored publications, and 3.75 for international collaborations. However, citation rates varied across fields and appeared to relate to the social sciences – humanities continuum and the types of publications most frequently authored. Social sciences fields (Geography, Family Studies and Social Issues) had the highest citation rates and these fields also had high collaboration rates. Regardless of the field however, the findings suggest that any type of collaboration will improve the potential to attract citations. For example, mean citations to internationally co-authored publications in the Arts & Humanities – Other Topics are three times that of sole authored publications, and in Literature internationally co-authored publications are cited at five times the rate of sole authored publications.

Education journals were well represented in co-authored articles in the study's Field of Research codes analysis, particularly national collaborations. These findings support earlier work that shows strong collaboration rates for the education field (Abramo *et al.*, 2014; Larivière, Gingras & Archambault, 2006; Ma *et al.*, 2014; Ossenblok *et al.*, 2014; Turner & Brass, 2014). In relation to the findings for Web of Science Research Areas, it was the Social Sciences – Other Topics field that had the highest international and overall collaboration rates and the majority of Geography publications were also co-authored. Less-often studied social sciences fields, Demography and Family Studies, collaborated internationally and nationally, respectively, at the highest rates, while none of the humanities fields had more than 13 per cent of co-authored publications. It is in the nature of social sciences, especially fields such as education and social work which are bound by common policy and labour systems, that publications are likely to focus on national issues. Certainly, the Education field in this study had the highest (of the large publishing fields) ratio of national to international collaboration.

In terms of limitations to the study, the existence of two subject schemes, Fields of Research codes and Web of Science Research Areas, introduces additional complications and resulted in finding marked differences in the two analyses. For example, in the article FoR code analysis psychology and management codes were found, whereas neither field appeared in the Web of Science Research Areas assigned to publications. In addition, the FoR codes are assigned to journals only, so that a comparison across the whole data set was not feasible. While acknowledging that research classification schemes are created for different purposes (Glänzel & Schubert, 2003), the variance between schemes is a consideration for researchers undertaking subject fields analysis within a specific context, such as in this Australia study.

The search strategy used for this study was successful in identifying publications in the humanities, arts and softer social sciences, however the Web of Science data presented challenges. Cleansing the data was time-consuming and involved extensive parsing and reformatting to create individual records that conformed to a standard data format. More importantly, Web of Science coverage is likely to influence the study's results. There are many factors that contribute to this caution, including the dominance of journal articles in Web of Science, compared to the types of publications that characterise HASS scholarly communication, such as book and chapter publications (Hicks, 1999, 2005; Moed, 2005). The coverage of HASS fields by Web of Science may also produce variations in the results that do not reflect a completely true picture of collaboration in different fields. In 2006, Butler and Visser examined Web of Science coverage of a large sample of Australian articles. This study found, for example, that Web of Science included 34 per cent of all Australian history articles but only 18 per cent coverage of the field's total output. Butler and Visser's (p. 329) list of fields differ to those discussed in this paper, which makes precise comparisons difficult, however along with history, the fields of philosophy, education and language are listed. Philosophy had a relatively high Web of Science coverage of articles, 49 per cent, with 32 per cent coverage of all philosophy outputs. Education and language had lower Web of Science coverage, with 25 per cent of all articles and 14 per cent of all outputs. It is reasonable to conclude, therefore, that the data set represents a sample (proportion unknown) of co-authored HASS publications. A fuller picture of HASS collaboration could be developed from other sources, such as author generated publication lists and surveys of authors. Although a major undertaking, this approach may also shed light on the higher levels of national collaboration in some fields.

Conclusion

This first quantitative analysis of Australian HASS co-authorship has identified patterns that both support and contest previous research findings. Like many earlier studies, the research found an increase in international co-authorship was occurring for Australian HASS, and international collaboration was growing at higher rates than national collaboration. While proximity appears to influence national collaboration, international collaboration does not appear to be affected in the same way and occurs most often with countries that are at extreme distances from Australia, both in terms of geography and time zones. These countries, the United States and England, are those with which Australia has strong language and cultural ties. Given Australia's isolation, one could speculate that international collaboration with distant co-authors is an accepted mode of research for Australian HASS authors.

Although mindful that this research "must be interpreted as being the output of scholars who publish …, not the output of all scholars in the SSH" (Larivière, Gingras & Archambault, 2006, p. 520), the results have provided a quantitative benchmark for Australian HASS collaboration not previously available. The results present future researchers with a foundation from which to explore Australian HASS collaboration in other forms and to examine patterns in Australian HASS co-authorship in the years ahead.

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Gaby Haddow is a senior lecturer in the Department of Information Studies, Curtin University, Perth, Australia.
Contact: G.Haddow@curtin.edu.au

Jianhong (Cecilia) Xia is an associate professor in the Department of Spatial Sciences, Curtin University, Perth, Australia.

Michele Willson is an associate professor in the Department of Internet Studies, Curtin University, Perth, Australia.

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