The ever-changing face of Chinese Interpreting Studies

A social network analysis

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As the discipline of Translation and Interpreting Studies (TIS) has continued to expand rapidly over the past twenty years, scientometric research has been applied increasingly often to analyse its trends and patterns. Drawing inspiration from Social Network Analysis (SNA), this study aims to quantify academic research impact and identify patterns of influence at an institutional level in Chinese Interpreting Studies (CIS), by seeking answers to the following questions: Which are the most influential publications? Which institutions carry the most weight? How have their respective levels of influence evolved over time? By analysing a near-exhaustive corpus of 59,303 citations from CIS literature, the study reveals that the majority of influential publications are monographs and theoretical in nature, though many Chinese textbooks on interpreting are also highly influential. It also finds that an institution's ranking in research productivity does not necessarily translate into high academic influence.

Keywords: Social Network Analysis, scientometrics, Chinese Interpreting Studies, data science

1. Background

The genesis of scientometric research, which relies on the use of quantitative methods for analysing scientific communication, can be traced back to the 1960s (Garfield 1979). Though it was originally used by librarians facing limited shelf space and an ever-widening pool of scientific literature for the purposes of identifying which reference materials should take priority (Archambault and Lariviere 2007), it has gradually developed into a discipline in its own right. With the burgeoning of scientific research in the latter half of the 20th century, it became increasingly necessary to introduce criteria that could help determine which research

fields or projects should be funded: scientometrics began to play an influential role in this decision-making process. It was even claimed that it could lead to efficiency gains in research funding (Beck 1978).

As the field of Translation and Interpreting Studies (TIS) has undergone rapid expansion over the past two decades, with thousands of papers now published every year (Franco Aixelá 2013), its scholars have increasingly realized the importance of analysing patterns of growth and emerging trends. Using various sizes of citation databases, a number of pioneers have taken a scientometric approach to tracing the discipline's evolution (e.g., Pöchhacker 1995; Gile 2000; Grbić and Pöllabauer 2008b) and identifying its most frequently cited publications (e.g., Gile 2005, 2006). However, simply counting the number of citations a paper receives is not a comprehensive and accurate way of measuring its academic influence (Ma, Guan, and Zhao 2008). In addition, few TIS studies have shed light on which institutions carry the most weight in terms of academic influence or how that influence changes over time. These questions merit our attention because the academic rankings of institutions – so often the driving force for innovation in scholarly enquiry – frequently play an important role in determining the level of funding they receive to devote to research (Fasella 1999; Viana-Baptista 1999). Using Social Network Analysis (SNA) as its primary methodological approach to analysing data, this study examines scholarly communication between members of the Chinese Interpreting Studies (CIS) community, identifies the most influential papers, and quantifies the interactions between various universities, with the aim of describing how the landscape of the discipline has been and continues to be shaped by these interconnected forces.

2. Scientometrics as a methodological tool

2.1 An introduction to scientometrics and citation analysis

The first challenge that scholars typically encounter when conducting scientometric research is the representativeness of the data collected. Unrepresentative data can lead to biased samples, which can in turn lead to incorrect conclusions. Nevertheless, researchers in other fields have traditionally relied on information from commercial databases for analysing well-defined small samples of data. For instance, Carr and Britton (2003) employed citations provided by the non-comprehensive Journal Citation Reports (JCR) commercial database to assess the impact of journals in behavioural psychology. Grouping the journals into two broad types with a cut-off of 1,000 citations per year, they found that those cited less

often had impact factors far lower than those above the cut-off, and therefore had substantially less influence on the research literature.

Despite the growth in use of citation indices, the increasing diversification of scientific research and the resulting growth of new disciplines over the past four decades has resulted in numerous high-quality journals being excluded from the 'baskets' used by the leading ones. This is particularly problematic in TIS which, despite having evolved into an area of academic enquiry in its own right, is still regarded by many as a subspecialty of traditional disciplines such as Literature or Linguistics. Evidence of this can be seen in the fact that TIS is under-represented in leading general-purpose academic databases. Grbić and Pöllabauer (2008a) observed that of the hundreds of translation journals published worldwide, only four were indexed in the Web of Science. But even some language-oriented databases, such as that of the Modern Language Association (MLA), do not necessarily contain comprehensive information on TIS, because they employ specific criteria such as citation frequency for selecting which journals to include. Many TIS journal publishers find it difficult to meet these rigid criteria, because the community is small and covers a wide range of issues from the literary, technical, and legal aspects of translation to localisation and sign language interpreting.

Because of the limited availability of comprehensive citation data in commercial databases, scholars have attempted to use computer-generated algorithms such as autonomous citation indexing (ACI) for extracting citations (Goodrum et al. 2001). These computer programmes can rapidly retrieve a much larger amount of bibliographic information from the Internet than any traditional databases could possibly manage. However, this approach can potentially yield noisy data with an average error rate of 10%, leading, for example, to non-existent authors such as 'Ann Arbor' being credited with outstanding academic impact, despite that being the name of a university city in Michigan (Postellon 2008). So while this method has allowed researchers to automate the entire data-gathering process, it can lead to inaccurate sampling material.

To improve data quality, researchers can opt to collect their citations in person. However, given the time-consuming nature of this work they are seldom able to collect samples of any meaningful size. For example, to assess its own library's journal collection, researchers at Delta State University analysed 4,012 citations from 70 dissertations produced by its students, producing a list of the 18 most frequently cited journals. While the study reached its research objective in providing guidance on the journals the library should subscribe to, a sample size of 70 dissertations, all with a common supervisor, would be neither comprehensive nor representative enough for generalising to the population of dissertations.

2.2 Social network analysis

As we have seen, citation analysis is a common scientometric technique in which references from scholarly research articles are collected as data and analysed to assess authors, institutions and publications for their impact, quality and influence. However, it is important to remember that scientometrics is a broad field that looks beyond citations to other factors that influence scientific development (Moed 2005). Though at the time of writing (January 2016) only a handful of studies in the Translation and Interpreting community, such as Grbić and Pöllabauer (2008b) and Xu and Pekelis (2015), have employed SNA to study influences and scholarly interactions, it has been used in numerous other fields to great effect (e.g., Otte and Rousseau 2002; Katona, Zubcsek, and Sarvary 2011; Frank, Lo, and Sun 2014). The concept of the social network was popularised by Gladwell (2000): he argued that when certain social phenomena reach a tipping-point, they spread through society like epidemics. In fact, his idea became so popular that its language has become incorporated into everyday English – videos, for example, are often described as "going viral" (Jenkins, Ford, and Green 2013). A potential reason for SNA's massive popularity is the fact that as only small numbers of people are instrumental in propagating social ideas, products and behaviours to the extent that they become 'the new thing,' it follows that if individuals succeed in 'recruiting' the right team of such people to their causes, they may potentially wield significant social influence.

Network analysis has been widely applied in the study of social sciences to assess the interaction between different scholars, i.e., how ideas are transmitted from one researcher to another (Wasserman and Faust 1994). An important notion in network theory is that of centrality, a quantitative measure to indicate the importance of each node in a network system. Mathematically speaking, there are numerous ways to calculate a node's centrality. The most straightforward approach is through degree, which is the number of edges attached to each node (Newman 2010). Figure 1 provides an example of a network in which the nodes are connected by edges; the direction of an edge is opposite to the direction of its influence. For example, if author A influences author B (B cites a paper written by A), then the edge direction goes from B to A. Yan and Ding (2009) used the approach to study co-authorship networks in library and information science: using data from 16 journals they concluded that centrality measures strongly correlate with citation counts. Their research confirmed the usefulness of centrality measures in examining research impact.

Centrality-based measures can be divided into two categories: first-order and higher-order. The former is based on the direct interaction of an actor (node) with his neighbours in the same network, whereas the latter is based on his indirect
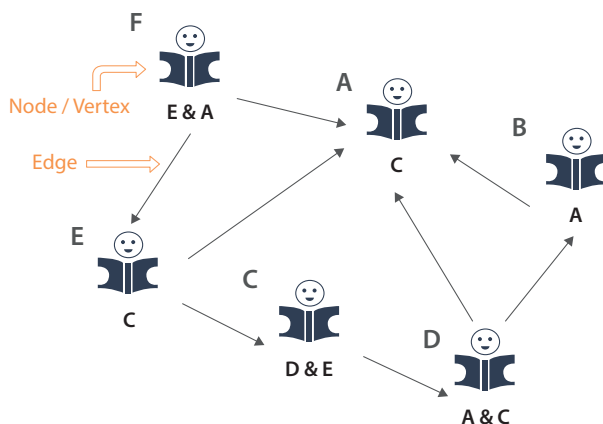
F

Node / Vertex   E & A

A

B

Edge

C

A

E

C

C

D & E

D

A & C

Figure 1. An example of a network with nodes and edges

interaction with the entire network, for instance how he interacts with his neighbour's neighbours. Joseph and Radev (2007), for example, extracted citation data from the Association of Computational Linguistics' digital repository, and used a mixture of first-order and higher-order centrality measures to identify the most influential papers within the discipline's citation network and to examine citation behaviour between its scholars.

2.2.1 *First-order centrality measures*

In Figure 2, Stella, Raymond, and Bill comprise the first-order zone of the network because each member is linked to everyone else. Ernest, Kathy, Donald, and Gail comprise the second-order zone: all are connected to someone in the first-order zone but they themselves are not central. Jamie comprises the third and final order zone, as he is not directly connected to anyone in the first-order zone and is far removed from the network's centre.

A direct method of assessing the research impact of authors is to count the total number of times all the papers they have published are cited, and to rank each author accordingly. This approach can, however, be problematic because not all citations should be treated equally. For example, a paper cited in a well-regarded book could be said to carry more weight than one cited in a master's thesis which has had little influence on the field. In addition, while a high Impact Factor (IF) score[1] reflects the high number of citations a journal receives, it is ineffective in comparing the research impacts of journals across disciplines; fields differ in size and may have distinct citation practices, as described by Maslov and Redner

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1. IF indicates the average number of times that articles appearing in a given journal over a two-year period have been cited in ISI-indexed journals during the year following.
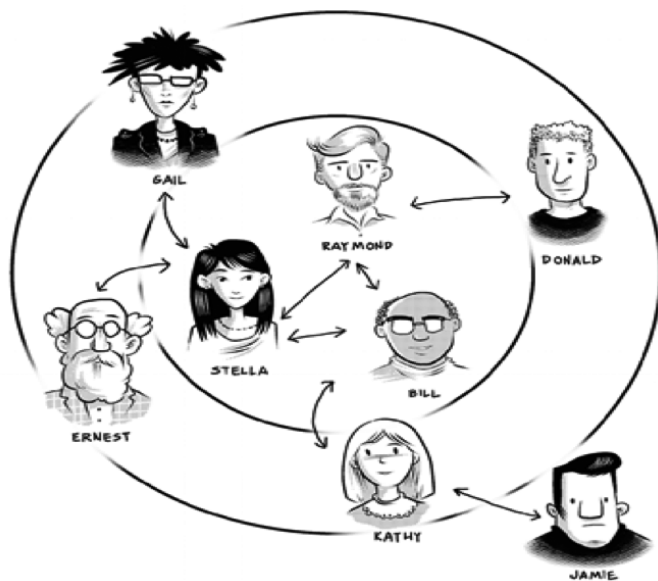
Figure 2. First-, second- and third-order centrality within a social network

(2008), who observed that each paper in life sciences receives six citations on average, while in mathematics the figure is only one. *Scientometrics,* a journal which touches on both computer and social sciences, has an IF score of 2.133, much higher than the 0.095 received by *Interpreting.* This does not mean that the former is necessarily more prestigious than the latter: the discrepancy merely indicates that those scientific communities are far larger than the TIS community. So while the method is useful for determining absolute numbers of incoming citations, other systems of measurement paint a more detailed picture of academic influence.

H- and G-indices are recent attempts to improve upon the straight citation counting method (e.g., Maabreh and Alsmadi 2012): they were designed mainly to examine an author's research influence, though Google Scholar also uses the H-index to evaluate journals' research impacts. The H-index uses the number of papers an author has published and the number of times each of those papers has been cited. Thus a scholar is said to have an H-index of k if at least k of his papers have been cited at least k times. An H-index of k further implies that no more than k papers written by the scholar have been cited at least k times. For example, if an author published 10 papers, with two being cited 25 times, six cited 4 times and two never cited, he would have an H-index of 4.

There are many reasons why the H-index is not considered a reliable metric for evaluating the research influence of a scholar. Earlier studies argued that the popularity of the H-index is mostly due to the absence of a more accurate

quantitative metric, rather than its actual effectiveness in evaluating a researcher's impact in general (Engqvist and Frommen 2008; Williamson 2009; Kotov 2010). One of its major drawbacks is that it precludes new researchers from ever having high scores. Even if, for example, a novice researcher's first paper was cited 100 times, his H-Index would still only be 1, given that it was his sole publication. Another of the index's shortcomings is that a scholar can increase his score ranking by way of self-citation. For example, a person who has published ten papers can receive an index value of 9 by citing all his papers in all his own publications even if no one else has cited his work. It should be noted that there is a high correlation between the number of papers an author has published and his H-index score, so this additional measure does not add a different dimension to quantifying research impact. It simply states that an author has published k papers.

The G-index also uses the numbers of published papers and of citations of each. The basic criteria are the same as for the H-index but it relies more heavily on cited papers and is more difficult to calculate. For a given author to have a G-index of n, the n most cited papers must have an average of n citations per paper. This does not require that each of the n papers has individually been cited more than n times; rather it only requires that, taken together, the top n papers have n^2 total citations between them. Each score's merits and drawbacks are described in the context of a concrete example below.

Grbić and Pöllabauer (2009) studied Daniel Gile's research impact up to 2007 by calculating his H- and G-index scores based on the Publish or Perish computer programme's analysis of 129 of his publications: his H was 11 and his G 22. The first figure tells us that 11 of his papers received at least 11 citations each; the second that his top 22 most cited papers averaged 22 citations each. The disparity can be explained by the difference in the calculation of the two measures. The H-index does not allow for a small number of highly-cited papers to increase the score, as it simply denotes that h papers have at least h citations. Similarly, the G-index alone would not have revealed that only a small set of his works received a high number of citations.

Using both the G-index and the H-index, as in this case, affords us a much broader picture of the impact of a scholar's publications. However, both indices are purely dependent on the number of citations a scholar receives, and therefore have some of the same limitations as the straight counting approach: they do not account in any way for the secondary influence of the source paper. A citation in a paper that never receives any citations should not be considered the same as a citation in a groundbreaking, highly-cited work. Furthermore, H- and G-indices are purely quantitative measures of a scholar's research endeavours: they provide little insight into which of an author's publications have impact and what makes him influential.

The PageRank algorithm, invented by Google founder Larry Page to rank the influence of web pages, addresses some of the limitations of the G- and H-indices (Maslov and Redner 2008). It was explicitly inspired by citation analysis (Page et al. 1998), and awards more value to citations of and by influential papers or researchers. Consequently, professors who are cited frequently in their students' less influential papers but little by their own peers do not rank as highly as those often cited by other influential people in the field.

A paper's PageRank score comprises both the citations included in it (represented by the arrows on the left in Figure 3) and the citations of it (represented by the arrows on the right). The more often a paper cites and is cited by important articles, the higher its PageRank score.

In the world of scientometrics the PageRank algorithm has been adopted by various scholars to assess the influence of individual papers and journals. Chen et al. (2007) adapted it to quantify the influence of all papers in *Physical Review* from 1893 to 2003; the approach enabled them to accurately identify influential papers which had only modest numbers of citations – papers which were easily recognisable to physicists but overlooked by the traditional ranking system. Bollen, Rodriquez, and Van De Sompel (2006) suggested that in comparison with IF scores the PageRank algorithm is more reliable for objectively measuring a journal's influence.

To date higher-order centrality measures have not been actively applied in TIS research: such explorations might shed new light on how influential a certain

**Figure 3.** Illustration of the PageRank Score

scholar or publication is perceived to be within a particular community. In addition to all the aforesaid measurements, Social Network Theory offers other ideas for quantifying research and collaboration within academic communities, but the ones described above are those that have proved the most popular with scholars.

2.2.3   *Graph theory*

As the most commonly used technique in SNA, Graph Theory models the relationships between objects by means of graphic representations. It is now used extensively in disciplines such as information technology and sociology. Networks in the real world do not take the form of regular shapes such as lattices; instead some of their nodes may have multiple connections via edges, while the connections between other nodes may be few and far between. Groups of nodes joined by dense bundles of connections are very likely to have properties in common and/or perform similar functions, and are referred to as 'communities' within the network. The process of identifying communities has been applied to a wide range of network phenomena, including the following: Pereira-Leal, Enright, and Ouzounis (2004) used the technique for creating an algorithm to group proteins into communities with similar functions. Reddy et al. (2002) applied it in e-commerce, using a dense bipartite graph to identify communities of customers with similar interests (see Figure 4), with the aim of setting up an efficient product recommendation system. Traud et al. (2011) constructed friendship networks between students from five American universities using anonymised Facebook data; their study concluded that the students' online communities were largely organised by their year of enrolment or according to which dorm they lived in. Lipay (2011) employed a sample of data from Twitter to divide its users into various communities; his findings revealed that geographical location was not a strong factor in forming those communities. Blondel et al. (2008) used modularity optimisation to study the calls between a particular Belgian operator's 2.6 million mobile phone users, finding that the entire network could be separated into 261 distinct communities, the majority of them characterised by their users' sharing of the same language; their analysis also revealed that most of the communities were monolingual, highlighting the language divide between the two halves of the Belgian population.

In the context of citation analysis, members of each community share far more citations among themselves than with outsiders. Such groupings can offer us insight into who closely cites whom and which scholars belong to the same 'ideological camp' or share similar research interests. Along these lines Chen and Redner (2010) examined the evolution and interconnectivity of the sub-disciplines of physics by analysing the citation data from articles in *Physical Review* (1893–2007). Their study identified major communities within the citation network by using
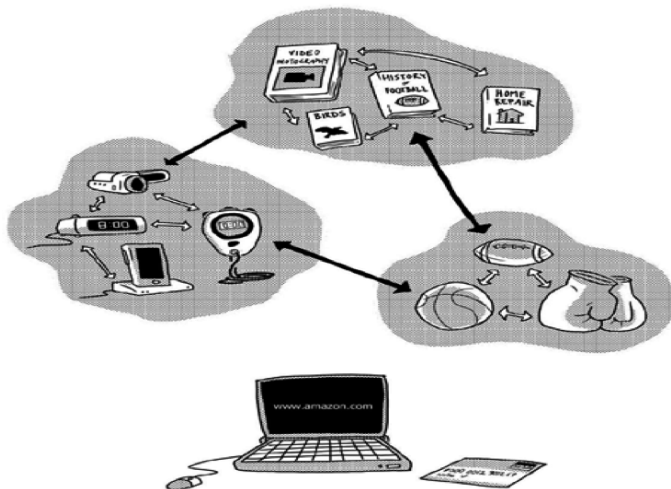
Figure 4. Communities of consumers with similar purchasing behaviours on an e-commerce website

modularity maximisation, and revealed that these were grouped according to the various distinct sub-disciplines that make up the wider field of physics. Alperin, Rodia and Quimby (2011) explored meaningful communities in the same field but took the technique to the next level by using the discrete communities to generate unique identifiers for each author, a procedure which helps in attributing papers to the correct author when multiple scholars share the same name.

While SNA has proven effective in developing systematic approaches to ranking the academic influence of individuals and papers in diverse fields such as computer science, mathematics, sociology and psychology, few studies have investigated how, at a macro level, research clusters such as authors' affiliated institutions and regions influence one another, and how their impacts ebb and flow over time. In addition, despite the fact that new algorithms are continuously being developed to identify communities in a network in the best possible way, even fewer studies have endeavoured to use meta-information about citation data (authors' backgrounds and research interests, the content of cited papers, etc.) to describe, in a meaningful way, the shared features of such communities – to explain, in short, *why* they exist. The aim of this paper is to explore precisely these untraveled avenues of scientometric research into interpreting studies (IS). The following section will present an overview of the research questions and the data used for the study.

3. The present study

3.1 Research questions

Given the overall aim to map the patterns and directions of influence within the CIS community, the research questions were devised to capture the relevant elements of this overall picture. The first set is concerned with the identification of individual-level characteristics of the network, while the second set is concerned with institutional-level characteristics.

As Meho (2007, 32) observed, roughly 90% of all published academic papers never receive any citations, and approximately half are never even read. While it is true that research takes time to be recognised as significant, funding agencies and universities increasingly use citation data as a primary measure to evaluate the importance of a research project. In the context of CIS, in addition to providing that indicator of importance, identifying the most influential publications can help determine which external academic discipline and research methodologies have the greatest impact on the evolution of the field.

1. What are the most influential publications in the CIS community?
    1a. Which research strategy (empirical vs. theoretical) is most often employed by authors published in influential CIS publications, both Chinese and Western?
    1b. What document types (monographs, MA theses, etc.) are most often published by those publications?
    1c. Works employing which research strategy are most often cited by the most influential researchers?

The idea of ranking institutions can be traced back to 1983 when *US News and World Report* started publishing lists of the best American colleges with the aim of helping high-school students and their parents select those that delivered quality education. Since then various ranking systems based on the demands of the public have been proposed in different countries. In the field of interpreting, the International Association of Conference Interpreters (AIIC) has, since the early 1990s, published a directory of schools, detailing programmes that meet the association's requirements for producing skilled conference interpreters. The list is based on surveys completed by different establishments, but its coverage of China is rather limited: it features only one school in mainland China and three in Taiwan. Furthermore, the directory does not measure the research performance of the schools listed, a drawback for students who, wishing to pursue an academic career, need to know which programme has the greatest research impact. An earlier study (Xu and Archambault 2015) shows that since the 1990s, nearly 300 CIS

students have entered the academic sphere, and the number of aspirants is rising annually. While no study to date has been conducted to gauge students' level of interest in pursuing academic positions outside China, the sheer number of doctoral summer and winter schools held around the world is very telling. In addition, a significant number of interpreter training programmes, especially those in compliance with the European Masters in Conference Interpreting (EMCI), have started to offer research-related courses. All of this indicates that there is a genuine interest in research into IS, and that measuring the academic influences of schools in CIS does matter to students and faculty alike.

Important institution-level patterns of influence will be investigated through the following research questions:

2. Which institutions carry the most weight in CIS research? Are they also the most productive in terms of research output?

2a. Does citation behaviour reveal any appreciably strong connections between particular institutions?

2b. How does this type of scholarly interaction change over time?

3.2 Data organisation

Given that there are no comprehensive academic databases like the Social Science Citation Index (SSCI) covering CIS literature, the author manually entered 59,303 citations from 1,289 Chinese MA theses, 32 doctoral dissertations and 2,909 research papers into a relational database which uses Structured Query Language (SQL) for managing data. Every effort was made to collect the citations in all three categories, which date from 1949 to 2012, from a variety of different sources: university libraries, interlibrary loans, book purchases, and academic databases such as CNKI, Wanfang and the National Digital Library of Theses and Dissertations in Taiwan. The aforementioned databases archive digital copies of research articles, theses and dissertations in CIS from 1949 to the present. While their coverage of articles is quite comprehensive, their representation of theses and dissertations is much less so: visits to libraries of various thesis-producing schools, interlibrary loans, and book purchases effectively filled this gap in the coverage. While it is possible that a few papers may have been inadvertently left out of the corpus owing to institutional embargo or for other reasons, the author believes that the data collected is representative of CIS. For each paper the title, author's name (or authors' names), academic affiliation(s), and bibliographic references were entered manually into the database; all the affiliations were also tagged with the administrative region they belonged to. A unique 'key' was generated for each author to ensure that that particular person was referred to in a consistent way in each of the database's various tabs.

4. Methodology

4.1 What are the most influential publications in CIS?

To answer this question PageRank Algorithm (PRA) scores were calculated for all the works appearing in the citation data. The main idea behind PRA is quite simple, but its technical implementation involves Graph Theory, Markov chain, and linear algebra. For those interested in learning the technical details of calculating PRA scores for each paper that appeared in the citation network, please refer to the Appendix to this paper, which can be found here: http://interpretrainer.com/wp-content/uploads/2016/10/Appendix.pdf.

The number of citations received by each work in the top 20 Chinese and Western publications was calculated, and each publication was classified according to its most favoured research methodology, document type and disciplinary approach.

For the present paper's purposes the research strategies of all the documents were grouped into two broad categories: empirical and theoretical. The former method arrives at conclusions based on data collected from experiments or observations, while the latter discusses ideas or theories from existing literature with the aim of expanding, confirming or refuting them.

Each document was further labelled as textbook, monograph, academic article, MA thesis or doctoral dissertation. For our purposes journal articles and conference proceedings were considered as equivalent and labelled as academic articles. A piece of writing appearing in both formats, or in one format in multiple publications, was only collected once for the data-set. Interviews, book reviews, obituaries, reminiscences, discussions of exam questions, and tips for students were all excluded because they represent a different type of data and are therefore outside the scope of this project. This data shed light on what constituted the most popular literature in CIS.

When Interpreting Studies was starting to become established as an independent discipline in the 1990s it was deeply influenced by concepts and methodologies from other more established disciplines (Pöchhacker 2016). With this in mind, to establish the final element in the coding process each document's content was used as an indicator to identify its disciplinary approach or approaches – interpreting, translation, psychology, linguistics, sociology, cross-cultural communication, etc. For example, Carroll's *Psychology of Language* (1989) was labelled as "linguistics" and "cognition" because it uses a cognitive approach to address psycholinguistics and therefore touches on both disciplines.

Following on from Franco Aixelá's study (2013), in which he found that the overwhelming majority of the publications in his most cited list for Translation

Studies were early modern classics in book format, a number of hypotheses were drawn up at this point: these will be tested later in the data analysis. The hypotheses were as follows:

1. The majority of the most influential Chinese and Western publications in CIS will be non-empirical.
2. The majority of the most influential Chinese and Western publications in CIS will be monographs.
3. The majority of empirical papers will seldom be cited by the most influential researchers.

4.2 Institutional research influence in CIS

Each of the 626 CIS institutions' PRA scores were calculated, generating a list of the ten most influential universities; this was compared with a list of the top ten paper-producing universities[2] to examine the degree of overlap between the two.

Using Gephi, an open-source application for graph and network analysis (Bastian et al. 2008), the author employed the citations data to create a static graphic representation (see Figure 5) showing the network of connections between various institutions: the thickness of the edges indicates the number of citations, while the colours of the nodes represent the network communities that different institutions belong to. Each node is colour-coded using the modularity cut algorithm based on 2012 data; the node size represents the total number of incoming citations[3] for that particular institution.

Again using Gephi, a dynamic visualisation of different CIS institutions in the citation network was also created to investigate how their influences change over the years (see Figure 6).

Google's PRA, which gives a score that serves as the non-normalised probabilities, analyses the relevance of a whole web page rather than each of its paragraphs. Removing or adding a highly relevant section in a web page will have a considerable effect on its PRA score. This analysis is analogous to how PRA is used in the present study to understand authors and their relationships to the institutions that employ them. If one of the most influential authors at an institution leaves, its PRA score will fall.

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2. Which list was produced by the same author in an earlier paper (Xu 2014).

3. The number of outgoing citations was not taken into account when generating the graphics, because incoming citations are a more reliable indicator of influence: an author could write a single paper containing 200 citations, but if that paper was not cited in multiple others, its influence would be minimal.

Three hypotheses were formulated as follows:

1. Some of the top paper-producers will be absent from the top influencers' list, because research productivity does not automatically translate into academic influence: some of the top producers' papers may not be widely cited by influential authors in the field.
2. Large CIS communities will be formed along geographical or institutional lines rather than according to scholars' research interests or methodologies, because in China institutions and regional governments play a greater role in determining the form and direction of research than individuals' intellectual preferences.
3. As more and more scholars and universities contribute to CIS research, newly developed interpreter training programmes will catch up with old, established players, forming their own discrete citation communities. It will become increasingly difficult for single individuals to be entirely responsible for the influence exerted by their schools.

5.   Results and discussions

5.1   The most influential publications in CIS

In this section we examine the most influential publications in the CIS community along with their research methods and document types. We will also discuss whether the most influential researchers are most likely to cite empirical or theoretical works.

The PageRank Algorithm was used to analyse all the documents in the citations database to ascertain which were or were not influential. Table 1 shows the PRA scores of the top 20 most influential Chinese documents in CIS, of which eight were monographs, seven textbooks, four journal articles and one a collective volume. The proportion of textbooks (35%) is unusually high in comparison with related disciplines such as linguistics, where textbooks are often seen more as repositories of established facts, rather than sources of cutting-edge research or insights. Those in the corpus were predominantly cited for examples of speeches and their corresponding translated versions to illustrate the use of a particular technique in interpreting; in a few cases they were cited for their definitions of various types of interpreting.

Table 1. Top 20 most influential Chinese documents in CIS

Posi-tion	PageRank Score	In-Degree[4]	Document name (Chinese)	Document name (English)	Name (English) and date	Em-piri-cal?[5]	Disciplines	Document type
1	0.002665723	816	口译理论概述	*An Overview of Interpreting Theories*	Bao Gang (1998)	No	Interpreting Studies	Monograph
2	0.002278718	609	口译技巧:思维科学与口译推理教学法	*Interpreting Techniques: Scientific Thinking and the Use of Inference in Interpreter Training*	Liu Heping (2002)	No	Interpreting Studies	Monograph
3	0.002132773	573	高级口译教程	*An Advanced Course in Interpreting*	Mei Deming (1996)	No	Interpreting Studies	Textbook
4	0.001410438	418	英汉同声传译	*English-Chinese Simultaneous Interpreting*	Zhang Weiwei (1999)	No	Interpreting Studies	Textbook
5	0.001397705	377	口译理论与教学	*Interpreting Theories and Education*	Liu Heping (2005)	No	Interpreting Studies	Monograph
6	0.001372465	493	口笔译理论研究	*Research on Interpreting and Translation Theories*	Liu Miqing (2004)	No	Interpreting Studies, Translation Studies	Monograph
7	0.001060445	386	实用口译手册	*A Practical Handbook of Interpreting*	Zhong Shukong (1984)	No	Interpreting Studies	Textbook
8	7.02E-04	162	新编英语口译教程	*A New Coursebook of English Interpreting*	Lin Yuru (1999)	No	Interpreting Studies	Textbook
9	6.36E-04	190	口译训练模式内容方法	"Interpreter Training: Models and Methodology"	Zhong Weihe (2001)	No	Interpreting Studies	Journal article

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4. Degree centrality calculates the number of edges connected to a particular node in the network, and an author's in-degree score represents the number of other authors citing him.

5. Each of the documents was coded either "empirical" or "not empirical," as opposed to the binary approach of "theoretical vs. empirical." This is because certain publications, such as Zhong's *A Practical Handbook of Interpreting* (1984), use examples to illustrate techniques in Chinese-English interpreting and cannot be considered either empirical or theoretical.

Table 1. (*continued*)

Position	PageRank Score	In-Degree[4]	Document name (Chinese)	Document name (English)	Name (English) and date	Empirical?[5]	Disciplines	Document type
10	5.83E-04	56	口译理论与实践语言与交际	*Interpreting: Theory and Practice in Language and Communication*	Li Kuiliu (1994)	No	Interpreting Studies	Monograph
11	5.72E-04	141	实战口译	*Field Interpreting*	Lin Chaolun (2004)	No	Interpreting Studies	Textbook
12	4.89E-04	101	口译教程	*Interpreting Coursebook*	Lei Tianfang (2008)	No	Interpreting Studies	Textbook
13	4.76E-04	180	口译研究新探	*An Exploration of Interpreting Research*	Cai Xiaohong (2002)	No	Interpreting Studies	Collective volume
14	4.70E-04	137	口译教学研究:理论与实践	*Research on Interpreter Training: Theory and Practice*	Yang Chengshu (2000)	No	Interpreting Studies	Monograph
15	4.56E-04	96	英语口译教程	*A New Interpretation Course for College Students*	Mei Deming (2008)	No	Interpreting Studies	Textbook
16	4.51E-04	120	当代翻译理论	*Contemporary Translation Theories*	Liu Miqing (1999)	No	Translation Studies	Monograph
17	4.32E-04	139	以跨学科的视野拓展口译研究	"Interpretation Study with an Interdisciplinary Perspective"	Cai Xiaohong (2001)	No	Interpreting Studies	Journal article
18	4.32E-04	104	译员的知识结构与口译课程设置	"Knowledge Structure and Curriculum Design for Interpreter Training"	Zhong Weihe (2003)	No	Interpreting Studies	Journal article
19	4.24E-04	71	大学本科口译教学的定位及教学	"Positioning Undergraduate Interpreter Training"	Bao Chuanyun (2004)	No	Interpreting Studies	Journal article
20	4.18E-04	87	中国翻译教学研究	*Research on the Teaching of Translation in China*	Mu Lei (1999)	No	Translation Studies	Monograph

It can also be seen that none of the top 20 Chinese documents was empirical in nature. The most influential empirical Chinese publication, Hu Gengshen and Sheng Qian's (2000) *Another Decade of CIS Research,* for example, ranked only 113th in the overall list, while the 20th most influential empirical paper (Huang Zidong's "The Effects of Topic Familiarity, Language Proficiency and Question Types on EFL Listening Comprehension" [1998]) ranked astonishingly low at 903rd. The low ranking of empirical studies would appear to indicate that in comparison to theoretical research they have yet to become truly influential in CIS.

Of the total, 90% fell into the category of IS and 15% into TS.[6] The fact that TS works are highly cited by IS academics indicates that there is a certain level of "internal interdisciplinarity" (Gile 2006) within the CIS community.[7] And, because the majority of the publications on the list are from IS, a very young discipline in China, their publication years are mostly between the late 1990s and early 2000s, contrasting sharply with the dates from Franco Aixelá's study (2013) on TS, in which the bulk of the most cited publications were concentrated in the second half of the 20th century.

As was the case for the most influential Chinese works, monographs were the most popular type of publication in the top 20 Western documents, with 16 entries, followed by textbooks (2), reference books (1) and collective volumes (1), as illustrated in Table 2. Journal articles did not, however, appear on the top 20 list. The tendency to cite monographs is not unique to CIS scholars. Gile (2005), Nasr (2010) and Franco Aixelá (2013) found that monographs were also the most frequently cited publication type among the Western TIS community. This intellectual tradition in TIS is similar to that in the social sciences as a whole, in which canonical monographs by figures such as Marx and Lenin are frequently cited (Line 1981).

Notwithstanding the call for empirical research in the CIS community (Zhang 2012), only one of the top 20 Western documents was empirical in nature: *The Interpreting Studies Reader* is a collective volume of pioneering research in the field. Robin Setton's doctoral dissertation (published as a monograph [1999]) contains a micro-analysis of a corpus of German and Chinese speeches, and uses Relevance Theory to explain discourse processing by simultaneous interpreters. Though Gile's work proposes theoretical models for training interpreters and translators,

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6. Liu Miqing's monograph straddled both Interpreting and Translation Studies, hence the two proportions do not add up to 100%.

7. Franco Aixelá's study revealed that few IS scholars were influential in the Western TS community, so one may speculate that a similar situation exists in China; unfortunately, an examination of citation patterns in that community is outside the scope of this paper, requiring as it does a completely different dataset.

Table 2. Top 20 most influential Western documents in CIS

Position	PageRank Score	In-Degree	Document Name	Name and date	Empirical?	Disciplinary approach	Document type
1	0.004853806	1043	*Basic Concepts and Models for Interpreter and Translator Training*	Gile (1995)	No	Interpreting Studies, Translation Studies	Monograph
2	0.001675562	377	*Interpréter pour traduire*	Seleskovitch and Lederer (1984)	No	Interpreting Studies	Monograph
3	9.02E-04	272	*Conference Interpreting Explained*	Jones (1998)	No	Interpreting Studies	Monograph
4	6.79E-04	176	*The Interpreter's Handbook*	Herbert (1952)	No	Interpreting Studies	Textbook
5	6.18E-04	103	*La traduction aujourd'hui: le modèle interprétative*	Lederer (1994)	No	Interpreting Studies	Monograph
6	6.06E-04	245	*Language, Culture and Translating*	Nida (1993)	No	Translation Studies	Monograph
7	5.99E-04	265	*Interpreting for International Conferences*	Seleskovitch (1978)	No	Interpreting Studies	Monograph
8	4.99E-04	250	*Simultaneous Interpretation: A Cognitive Pragmatic Analysis*	Setton (1999)	No	Interpreting Studies	Monograph/ doctoral dissertation
9	4.80E-04	147	*Translating as a Purposeful Activity*	Nord (1997)	No	Translation Studies	Monograph
10	4.06E-04	179	*The Interpreting Studies Reader*	Pöchhacker and Shlesinger (2001)	Yes	Interpreting Studies	Collective Volume
11	3.96E-04	173	*Relevance: Communication and Cognition*	Sperber and Wilson (1986)	No	Linguistics, Cognition	Monograph
12	3.82E-04	204	*Psychology of Language*	Carroll (1985)	No	Linguistics, Cognition	Monograph
13	3.48E-04	74	*Pédagogie raisonnée de l'interprétation*	Seleskovitch and Lederer (1989)	No	Interpreting Studies	Monograph

Table 2. (*continued*)

14	3.33E-04	70	*An Introduction to Functional Grammar*	Halliday (1985)	No	Linguistics	Monograph
15	3.16E-04	153	*Approaches to Translation*	Newmark (1981)	No	Translation Studies	Monograph
16	3.10E-04	65	*A Textbook of Translation*	Newmark (1988)	No	Translation Studies	Textbook
17	3.09E-04	146	*Contexts in Translating*	Nida (2001)	No	Translation Studies	Monograph
18	3.08E-04	123	*The Interpreter's Resource*	Phelan (2001)	No	Interpreting Studies	Monograph
19	2.93E-04	85	*Dictionary of Translation Studies*	Shuttleworth and Cowie (1996)	No	Translation Studies	Reference Book
20	2.89E-04	122	*Translation and Translating: Theory and Practice*	Bell (1991)	No	Translation Studies	Monograph

it also has chapters with empirical experiments. A further reason that empirical papers may attract less research interest is that they focus on single, often very specific phenomena, which might not have a broad enough appeal to many readers. When examined from a disciplinary perspective, the data revealed another difference from the Chinese documents: in addition to IS (10 mentions) and TS (8), the literatures of linguistics and cognitive science were also influential, with three and two mentions respectively. This finding is in line with the conclusion from earlier studies (Xu 2014, 2015), which identified the dominant and consistent influences of linguistics and cognitive science on CIS, and suggests that CIS scholars are more inclined to turn to other disciplines of Western literature for inspiration and factual or theoretical support than is the case for 'home-grown' literature.

Also worthy of remark is the fact that books on the Interpretive Theory of Translation found particular favour with CIS academics: of the top 20, four were the work of its leading proponents Danica Seleskovitch and Marianne Lederer, writing separately or together. It should be noted here that nearly all the Chinese authors cited the Chinese translated versions of these works as opposed to the originals. The widespread availability of these translations may have contributed to the Interpretive Theory's popularity among the CIS community; also, Liu Heping and Cai Xiaohong, pioneers of CIS who completed their PhDs in Paris, have played an important role in introducing Seleskovitch and Lederer's theories to China. It should be noted that, in addition to the pairing of Seleskovitch and Lederer, three other collaborative studies featured in the top 20 Western list, contrasting

sharply with the situation in the top 20 Chinese list, where co-authorship was non-existent. Within the Chinese academic community, being listed as the first author is important for career advancement, a factor which may deter CIS scholars from embarking on collaborative projects.

5.2 Institutional research impact in CIS

Our task in this section is to quantify the levels of influence exerted by CIS institutions and to compare those levels with their research productivity. Using SNA we will look at research projects involving collaboration between institutions, mapping them out and dividing them into discrete communities, and examining how such academic interaction has evolved over the past two decades.

Table 3 shows that the top two institutions in terms of PRA scores also happen to be the top two paper-producing universities (Xu 2014), but from the third place downwards things look very different. The universities of Guangxi, Guangxi Normal and Gannan, which appeared among the top ten paper-producers, are absent from the top ten PRA rankings here. This indicates that the studies produced by those three universities have yet to generate significant research impact within the CIS community, despite their being numerous. At the same time, the Chinese Academy of Sciences (CAS) and Shenzhen University (SU), which were not among the top ten paper-producing institutions, ranked 8th and 9th on PRA scores, suggesting that research produced by authors affiliated with those two institutions is highly influential.

Table 3. The most influential academic institutions in CIS

University	PageRank algorithm
Guangdong Foreign Studies University	0.04550179562
Shanghai International Studies University	0.03229189315
Beijing Language and Culture University	0.02141445616
Xiamen University	0.01704954987
Beijing Foreign Studies University	0.0162242336
Fu Jen Catholic University	0.01327604974
Beijing International Studies University	0.009729564475
Chinese Academy of Sciences	0.009066149694
Shenzhen University	0.008832757971
University of International Business and Economics	0.008316114419

Closer examination of the data revealed that the influence of both CAS and SU can be attributed to only a handful of individuals at those two institutions. In the

case of CAS, the dataset contained only three published authors: Tao Shuang and Hong Lei co-authored one article, while Hu Gengshen single-handedly produced 15. At SU, Zhang Jilin was the only author to publish articles on interpreting, with 19 papers to his credit.

Further analysis revealed that cases such as CAS and SU, where the amount of influence exerted by the institution is almost exclusively determined by single contributors, are the exception to the norm. The remaining eight of the top ten most influential universities all had more than six published authors (see Table 4).[8] In addition, the analysis revealed that of 626 CIS institutions, 328 had three or more researchers actively publishing papers. These findings indicate that while the PRA scores for schools such as CAS and SU may fluctuate as their affiliated authors switch to new posts, those for the majority of the most influential institutions, where populations of scholars remain relatively constant over time, should remain correspondingly stable, thus making the time-series analysis of individual schools' levels of influence a meaningful and worthwhile exercise.

Table 4. Number of affiliated authors for the top ten most influential CIS institutions

Top ten most influential CIS institutions	Number of affiliated authors
Guangdong Foreign Studies University	63
Shanghai International Studies University	34
Beijing Language and Culture University	6
Xiamen University	15
Beijing Foreign Studies University	6
Fu Jen Catholic University	12
Beijing International Studies University	13
Chinese Academy of Sciences	3
Shenzhen University	1
University of International Business and Economics	10

It is immediately apparent from Figure 5 that there are two major communities in the network, coloured in red and yellow. The red has at its centre GFSU, which received a large number of citations from other universities; of the top ten most influential institutions, SU and the University of International Business and Economics (UIBE) belonged to the same community. GFSU's authors cited a large amount of research produced by the former, and the latter's scholars frequently cited works

8. For this analysis, graduate students were excluded from the total count because of their status as researchers-in-training. Had they been included, the total number of affiliated authors for each university would have been further greatly boosted.

produced at GFSU. The yellow community was dominated by six of the other top ten institutions,[9] with SISU and BLCU at its centre. SISU functioned as a hub, generating a large number of outgoing citations towards other schools, such as BLCU and Xiamen University (XU). By contrast, BLCU received numerous incoming citations from institutions across the CIS community. It should be noted that though schools tend to cite members of the same community, there are always exceptions: for example, BLCU scholars cited an appreciable amount of research by GFSU: of 134 outgoing citations generated by BLCU, 24 were directed at GFSU.
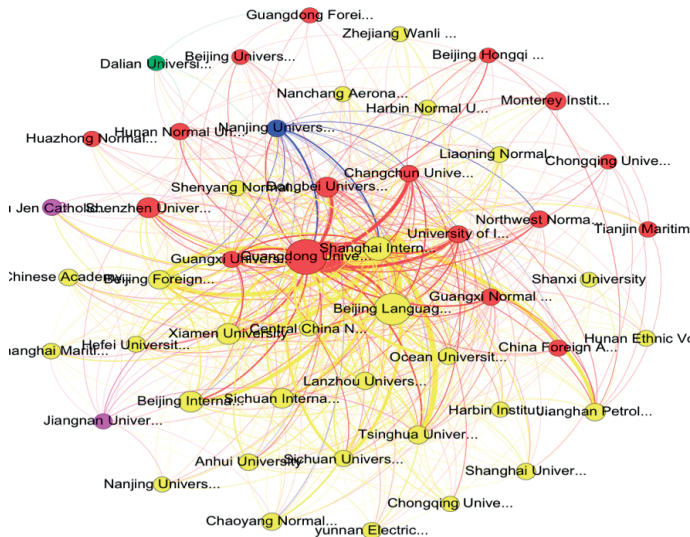
Figure 5. Static visualised citation network for institutions in CIS

Aside from those two major communities, it was observed that two stand-alone universities functioned as communities in and of themselves: the pink node of Fu Jen Catholic University (FJCU) and the blue of Nanjing University of Finance and Economics (NUFE). The former had a total of 71 incoming citations, of which 20 were by the National Taiwan Normal University and 14 were 'in-house' citations. Geographical factors may be a contributing factor to FJCU's being separate from the two major CIS communities: Taiwan is somewhat divided from mainland China, creating numerous cultural and linguistic differences between the communities on either side of the Taiwan Strait, and making it difficult for FJCU scholars to interact with the rest of the CIS community. It is interesting to observe that NUFE was not part of the yellow community led by Shangai International

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9. Fu Jen Catholic University, the sole institution from the top ten not to appear in either group, belongs to a separate (pink) community.

Studies University (SISU); Nanjing is a satellite city of Shanghai, and Shanghai has provided a great deal of faculty support for Nanjing candidates wishing to take the Shanghai Interpretation Accreditation Test. A detailed citation analysis revealed that NUFE was in fact influenced in roughly equal measures by both the yellow and red communities, which may explain its autonomous status in the citation graphic: it received 10 incoming citations from GFSU (a major node in the red community) and 8 from SISU (major in the yellow), and generated 16 and 13 outgoing in return, respectively.

It was clear from examining the dynamic visualisation (Figure 6)[10] that in 1990 CAS (purple) occupied the centre of the citation network. In addition to receiving a number of citations from other Chinese universities, it received a number from within its own ranks. However, at the time no one institution stood out as an influential leader, as reflected in the similarity of scores in in-degree centrality measures. The situation remained relatively stable until 2002 when GFSU (green) and BLCU (pink) emerged as influential leaders among all the CIS institutions. The first of these received numerous self-citations, while the second received none. In the same year various other institutions, among them Beijing Foreign Studies University (BFSU) (blue), Beijing International Studies University (BISU) (pink) and XU (cyan), also generated a number of self-citations.

The dominance of GFSU and BLCU continued into 2005, but by that time a number of 'rising stars' had also appeared – SISU, BISU, Tsinghua University (TsU) and XU. A possible reason for TsU's rise was that Hu Gengshen, the leading contributor of CIS research at CAS, transferred there. It should be noted, however, that not all these up-and-coming institutions maintained their momentum. For example, the growth in TsU's incoming citations slowed appreciably over the next few years. By 2008, as the total number of publications continued to increase rapidly, the gap in the leading institutions' levels of influence continued to widen: GFSU's research impact continued to increase while BLCU remained in second place, its influence growing more slowly than GFSU's; SISU came a close third to BLCU.

However, some of the promising universities mentioned above did continue to grow in influence: by 2010 XU had clearly overtaken TsU, for example, and Dongbei University of Finance and Economics (DUFE) and SU had come to the fore. From 2010 to 2012, despite the surge in the overall number of citations, the leading institutions such as GFSU and BLCU continued their dominance within the CIS community. At the same time, those universities which had shown great promise in 2005 (SISU, SU, XU, TsU etc.) also experienced a steady growth in their incoming citations.

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10. The dynamic version of this graph, which shows how institutions' influence changes over time, can be viewed at the following link: https://vimeo.com/179560539
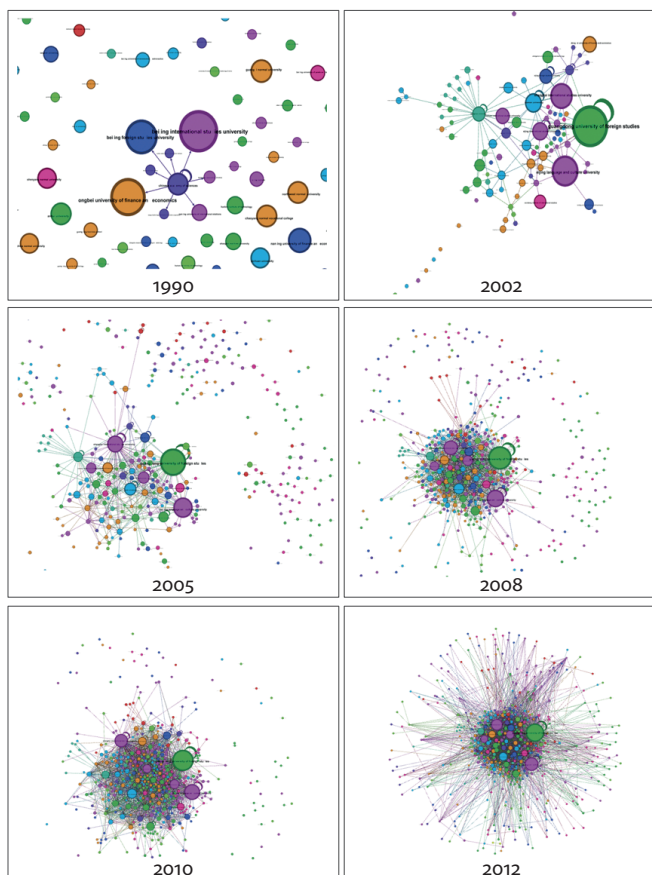
Figure 6. Institutional networks consolidated and centralised over time. Only the snapshots that most clearly show distinct patterns were selected for this figure

6. Conclusion

For many decades Interpreting Studies was considered a speciality of linguistics and, unlike other applied academic disciplines, was only offered at selected schools in the countries where it was available at all. However, thanks to a growing interest – from both within and without – in understanding the craft, professional interpreters and researchers from other disciplines have begun to produce a significant number of publications in a wide variety of formats: journal articles, conference proceedings, dictionaries, encyclopaedias, MA theses and doctoral dissertations. The growth of these publications over the past decade or so has been nothing short of spectacular: as of May 2015 no fewer than 10,000 papers on IS have been published worldwide. It is also worth noting that despite a common focus on the subject of interpreting, these studies have used wide-ranging research

methodologies, many of which have their origins in other fields such as cognitive science and linguistics, making interpreting an established discipline in its own right (Moser-Mercer 2011).

Chinese Interpreting Studies deserves special attention because it boasts the largest population of researchers in the world (over 3,500 in comparison to just a handful in many European countries), who have produced over 4,200 publications (Xu and Pekelis 2015). The growth of CIS papers has shown no signs of slowing down; rather, it is expected to sustain its momentum into the foreseeable future (Xu 2015). CIS' substantial research activities are no doubt boosted by China's rapid economic development and trade liberalisation, and its increasingly close ties with the rest of the world in the spheres of investment and politics.

The methodological aim of this study was to demonstrate the usefulness of applying SNA to TIS scientometric research. It sought to quantify the academic influence of CIS publications by employing the PageRank algorithm, and further examined the top-ranking Chinese and Western studies, offering possible explanations for their popularity in CIS. The results reveal that monographs were the most popular document type of both Chinese and Western publication, though textbooks were almost as popular in the Chinese category. None of the top 20 Chinese publications and only three from the Western list contained elements of empirical research.

Assessing academic influence in TIS was traditionally performed with first-order centrality measures, such as straight counting or calculating Impact Factors, but both these forms of analysis proceed on the assumption that all citations are created equal – that one from a student's thesis would carry the same weight as one from a peer-reviewed paper penned by a highly respected scholar. Furthermore, all scholars' research contributions ought to be evaluated on their own merits by weighing the citations they receive from highly influential colleagues in the field, rather than relying on their academic affiliations, i.e., whether or not they belong to a prestigious school.

The PageRank measure used in this paper effectively addressed these issues, providing an objective means of quantifying the influence of scholars in the field. PR measures might serve as a spur to scholars to focus on producing high-quality papers, rather than generating opinion pieces for lower-tier journals. It should be noted that this higher centrality measure approach has already gained some traction in the field: the ranking of CIS universities according to academic influence, proposed by the present author in a preprint version of this paper, has received recognition from the Beijing Language and Culture University, one of the premier providers of T&I training in China. The practice of SNA, whose roots can be traced back to the early 1900s, has become one of the prime methodologies for modelling human behaviour and network dynamics in contemporary sociology, and can help

us understand how the discipline's scholars interact with one another. It can also help us to identify the major sources of influence in TIS, which is often perceived to be a somewhat fragmented field of academic enquiry with numerous schools of thought competing for recognition.

The author also sought to spotlight the merits of data visualisation techniques in teasing out hidden patterns and connections when dealing with a massive amount of complex data. The study revealed that an institution's research productivity is not necessarily reflected in its academic influence; and that CIS can be broadly divided into two major communities, most of whose members tend to cite from within their own communities. It was also found that by the early 2000s GFSU and BLCU had risen to become the leading institutions with the greatest research impact, and their momentum continued into the 2010s. However, some other rising stars of the early 2000s were unable to sustain their growing influence, which visibly slowed toward the end of the decade.

Future researchers might employ the principles of scientometrics to examine in detail how the research influence of individual scholars has changed – or not changed – over the past twenty years. Were the most influential researchers in the 1990s able to maintain their rankings into the 21st century, or did any of their lights begin to dim? What might account for the waxing or waning of their popularity? The author hopes that the present study, along with the increasing amount of scientometric research into Translation and Interpreting Studies that is being carried out, will help guide the relevant authorities to make informed decisions on the future direction of academic endeavour.

Acknowledgements

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