# The Ever-changing Face of Chinese Interpreting Studies: A Social Network Analysis

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**Abstract:** As the discipline of Translation and Interpreting Studies (TIS) has continued to expand rapidly over the past twenty years, scientometric research has been increasingly applied to analyze its trends and patterns. Drawing inspiration from Social Network Analysis, this study aims to quantify academic research impact and identify patterns of influence at an institutional and regional level in Chinese Interpreting Studies (CIS), by seeking answers to the following questions: Which are the most influential publications? Which institutions and regions carry the most weight? How have their respective levels of influence evolved over time? By analyzing a near-exhaustive corpus of 59,303 citations from CIS literature, the study reveals that most of the 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, and geographical proximity does not determine whether neighboring regions belong to the same research community.

**Keywords:** Social Network Analysis, scientometrics, Chinese Interpreting Studies

## 1. Introduction

The genesis of scientometric research, which relies on the use of quantitative methods for analyzing 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-

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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, which could lead to efficiency gains in research (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 (Aixelá 2013), its scholars have increasingly realized the importance of analyzing 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 and identifying its most frequently cited publications (see for example Pöchhacker 1995; Gile 2006; Grbić & Pöllabauer 2009). However, simply counting the number of citations a paper receives is not a comprehensive and accurate way of measuring its academic influence (Ma, Guan & Zhao 2008). In addition, few TIS studies have shed light on which regions and institutions carry the most weight in terms of academic influence, and how their impact changes over time. These questions merit our attention because a location's academic status often plays an important role in determining the level of funding it receives to devote to research and because institutions are often the driving force for innovation in academic enquiry (Fasella 1999; Viana-Baptista 1999). Using some of the latest techniques from Social Network Analysis (SNA), this study examines scholarly communication between members of the Chinese Interpreting Studies (CIS)

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community, identifies the most influential papers and quantifies the interactions between various universities and regions – all of which have played a significant role in shaping the landscape of the discipline.

## 2. Literature review

The first challenge that scholars typically encounter when conducting scientometric research is the representativeness of the data collected. Uncomprehensive data can lead to biased samples, which can in turn lead to incorrect conclusions. Traditionally, researchers in other fields have often relied on information from commercial databases for analyzing well-defined small samples of data. For instance, Carr and Britton (2003) employed citations provided by the Journal Citation Reports (JCR) to assess the academic impact of journals in behavioral psychology. They concluded that the journals could be grouped into two broad types: those of the first were consistently cited more than 1,000 times per year, whereas those in the second were consistently cited fewer than 1,000 times and as a result had substantially less impact on the research literature. Even in a discipline like information science, which frequently uses citation analysis to measure scientific influence, analysis is typically performed using information retrieved from commercial databases. For example, White and McCain (1998) used data from Scisearch to examine the most frequently cited authors in a dozen premier journals; their findings suggested that scholars were showing an increasing interest in the cognitive aspect of the discipline.

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The fact that TIS is under-represented in leading general-purpose academic databases is a particular problem because it limits researchers' ability to find comprehensive citation data for their analysis. Grbić and Pöllabauer (2008) 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 localization[1] and signed 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, McCain, Lawrence & Giles 2001). These computer programs 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

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[1] Localization refers to the process of adapting a previously translated product so that it conforms to the cultural norms of the country where it is to be sold.

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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 library's journal collection, researchers at Delta State University analyzed 4,012 citations from 70 dissertations produced by its students, producing a list of the 18 most frequently cited journals (Okiy 2003). While the study reached its research objective in providing guidance on the journals the library should subscribe to, a sample size of 70 dissertations would be neither comprehensive nor unbiased enough for assessing the population of all dissertations. So while in-person data collection can result in high-quality information, those researchers engaged in it must strive to ensure that what they are gathering is representative of the whole population, so as to offset data variation arising from small sample sizes.

Though SNA is not commonly used in Translation Studies (TS) for studying influences and scholarly interactions, it has been used in numerous other fields to great effect (see for example, Otte & Rousseau 2002; Katona, Zubcsek & Sarvary 2011; Frank, Lo & Sun 2014). The concept of the social network was popularized 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'. A potential reason for SNA's massive popularity is based on the fact that as only small numbers of people are instrumental in propagating social ideas, products and

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behaviors to the extent that they become 'the new thing', it follows that if an individual succeeds in 'recruiting' the right team of such people to his cause, he potentially wields significant social influence.

Network analysis has been widely applied in the study of social sciences to assess the interaction between different scholars — how ideas are transmitted from one researcher to another (Wasserman & Faust 1994). An important notion in network theory is that of centrality, a quantitative measurement 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). Yan and Ding (2009) took this approach to studying 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 analyzing research impact.
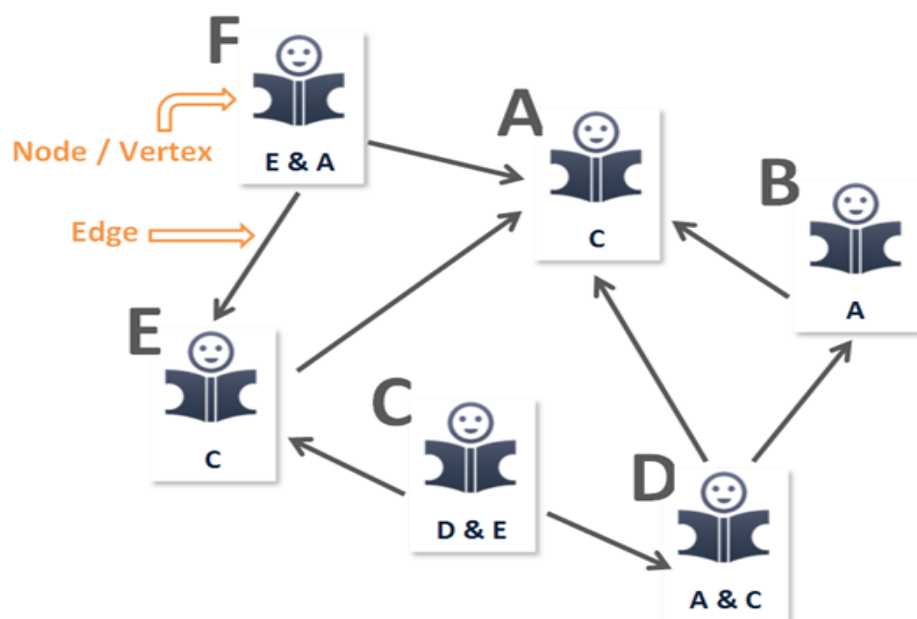
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Figure 1: An example of a network with nodes and edges. The direction of the edge is opposite to the direction of its influence. For example, if author A influences author B (B cites a paper written by A), then the edge direction goes from B to A.

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 neighbors in the same network, whereas the latter is based on his indirect interaction with the entire network, e.g. how he interacts with his neighbor's neighbor. For example, Joseph and Radev (2007) 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 citation network and to examine citation behavior between its scholars.
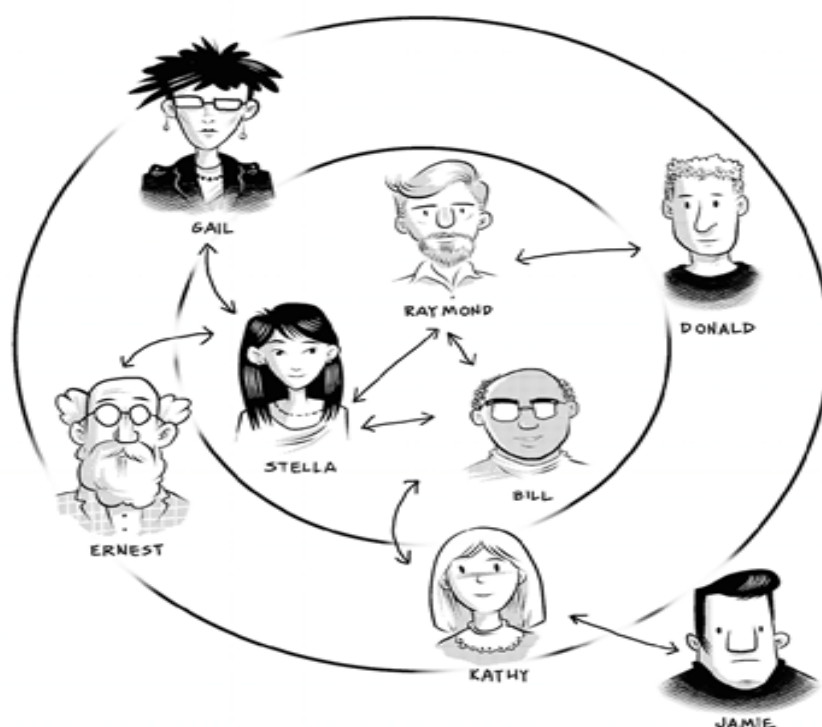
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Figure 2: First-, second- and third-order centrality within a social network

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 center.

A direct method of assessing authors' influence is to count the number of times they are cited on average per paper (their Impact Factor or IF), and to rank them accordingly. The IF method was introduced by Eugene Garfield in 1955 and was the foundation upon which both the Science Citation Index (SCI) and the Social Sciences Citation Index

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(SSCI) were built. Today nearly every major journal in the world uses IF to assess its own influence in the field and so attract submissions of high-quality manuscripts. The method measures the average number of citations for citable items (articles, book reviews, etc.) published in a given journal over a two-year period and is usually calculated at the end of the third year. For example, if a journal has an IF of 10 in 2014, this means that every citable item it published in 2012 and 2013 was cited, on average, 10 times in 2014. Some scholars have also taken this approach to evaluating individual papers: Franco Aixelá (2013), for example, calculated the IF scores for 51 of the publications most often cited in TIS between 2000 and 2009.

However, this approach can be problematic because not all citations should be treated equally. For example, a paper cited in a well-regarded book carries more weight than one cited in a master's thesis which has had little influence on the field. In addition, while a high IF score reflects the high number of citations a journal receives, it is ineffective in comparing the research impacts of journals across disciplines, which differ in size and may have distinct citation practices (Maslov & Redner 2008). For instance, Maslov and Redner 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 IF is useful in determining the absolute number of incoming citations, other systems of measurement paint a more detailed picture of academic influence.

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The H- and G-indices are more recent attempts to improve upon the IF method (see for example Maabreh & Alsmadi 2012). The H-index uses the number of papers an author has published and the number of times each of those papers has been cited. A scholar is said to have an H-index of $x$ if at least $x$ of their papers have been cited at least $x$ times. An H-index of $x$ further implies that no more than $x$ papers written by the scholar have been cited at least $x$ 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. The G-index also uses the numbers of published papers and of citations for each. It uses the same basic criteria but relies more heavily on cited papers and is more difficult to calculate. For a given author to have a G-index of $y$, the $y$ most cited papers must have an average of $y$ citations per paper. This does not require that each of the $y$ papers has individually been cited more than $y$ times. Rather it only requires that, taken together, the top $y$ papers have $y^2$ total citations between them. Each score's merits and drawbacks will be provided in the context of concrete examples in the next paragraph.

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 program's analysis of 129 of his publications: his H-index was 11 and his G-index 22. The first figure tells us that 11 of his papers received at least 11 citations apiece, 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 $x$ papers have at least $x$ citations. Thus, in the case of Gile, a paper with 100 citations

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counts the same as a paper with 12 citations because both papers meet that minimum benchmark of 11 citations or more. The G-index, however, increases with the number of citations of each paper. This is because it finds the largest set of papers such that the number of citations per paper on average is the same size as the set. In Gile's case it is likely that he had a few highly cited papers, but all we can tell from his H-index is that of his 12th to 22nd most cited papers, each had fewer than 11 citations individually. His G-index indicates that his first to 22nd most cited papers had 22 citations each on average, which can only be possible if some of the top 11 papers were highly cited. Clearly, using H-index alone would have missed the fact that some of Gile's work was highly cited. Similarly, using G-index alone would not have revealed that only a small set of his work received a high number of citations. Using both G- and 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 IF score: 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 in turn should not be considered the same as a citation in a groundbreaking, highly-cited work. Furthermore, the H- and G-indices are purely quantitative measures of a scholar's research endeavors: they provide little insight into which of his publications have impact and what makes him influential.

Figure 3: The PageRank score for a paper comprises both the citations included in the paper (represented by the arrows on the left) 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.

The PageRank algorithm, invented by Google's founders to rank the influence of web pages, addresses the limitations of the G- and H-indices mentioned in the previous section (Maslov & Redner 2008). As a matter of fact it was explicitly inspired by citation analysis (Page, Brin, Motwani & Winograd 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.

To visualize how PageRank works, imagine the following scenario. A hypothetical random student sits down to read a paper by a particular researcher (Author A). After

finishing it, he randomly picks one of Author A's citations and goes on to read work by the cited author (Author B). When he has finished Author B's work, he randomly picks one of that author's citations and goes on to read Author C, and so on. In the long term the student is more likely to be reading works by authors who are often cited by other authors who are themselves often cited. An author's PageRank score represents the long-term probability that the hypothetical student will be reading one of his papers. Mathematically speaking, the location of the random student is a Markov chain[2] with transition probabilities given by the citation graph, and the PageRank scores come from the chain's stationary state[3]. To put it in more accessible language, an author will receive a high PageRank score when he is much cited by highly-cited authors and cites highly-cited authors himself. (The same applies for individual papers too.)

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; they found that it enabled them to accurately identify influential papers which had only modest numbers of citations, papers which were easily recognizable to physicists but overlooked by the traditional ranking system. Bollen et al. (2006) demonstrated that in

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[2] A Markov chain is a stochastic process. Its key property is that the probability of transitioning from one state to another depends only on the current state the system is in, not on prior transitions. This is known as the 'memoryless' property.
[3] In truth the PageRank algorithm is slightly complicated by one other detail: when the student finishes reading, instead of always moving on to a paper by the cited author, there is a 10-15% probability that he might subsequently begin an article chosen entirely at random. This prevents the student from becoming 'stuck' in a cluster of documents that does not connect to the wider community. In a true chain, if a student were reading a paper that had no citation references to any other papers, he would never be able to leave the paper he started with. With the addition of this 'random probability factor' he can jump to a different set rather than staying in the connected set where he started.

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comparison with IF scores the PageRank algorithm is more reliable for attempting to objectively measure the influence of a journal.
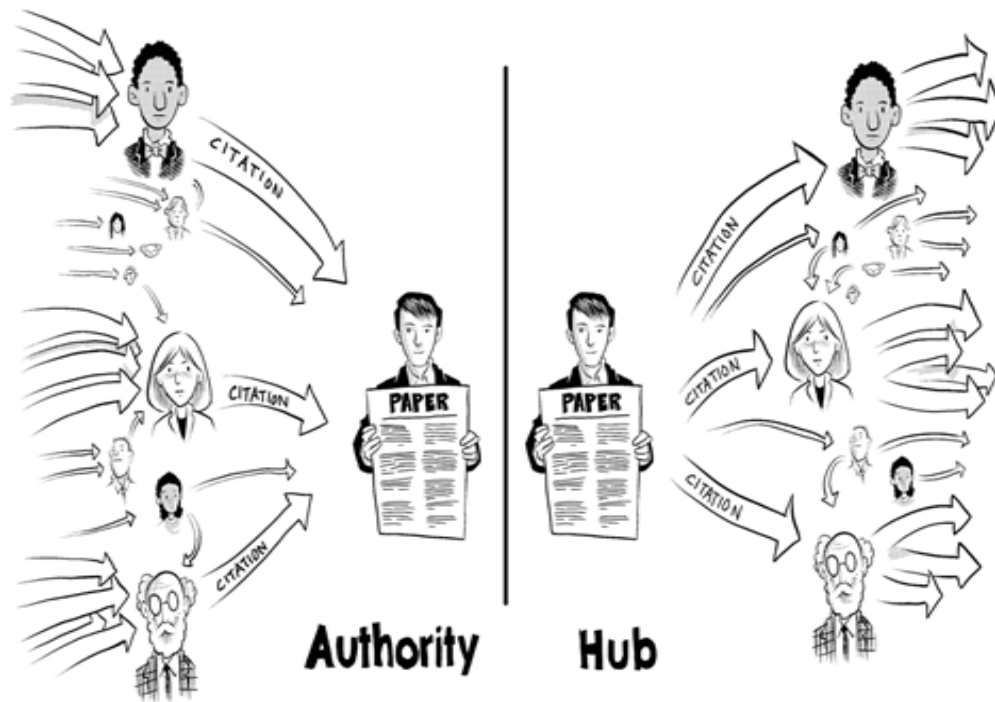


Figure 4: The Authority score of a scholar indicates how many other people cite him, thus measuring the authoritativeness of his position in the network. His Hub score measures how effective he is in serving as a center of information by calculating how many authoritative scholars he refers to in his papers.

The PageRank algorithm is effective for assigning a score to an author or paper when he is cited by other influential authors, and when he himself cites other influential authors. However, it is also sometimes useful to have a breakdown of this composite score, to identify which papers are often cited in other frequently cited papers, and in which papers other often-cited papers are cited. This is particularly relevant in citation analysis. For instance, a quality review paper may contain citations of other frequently cited works, but may be cited by very few researchers because of its lack of original research content

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(Newman 2010). Kleinberg (1999) introduced the concept of hub and authority scores, or the Hyperlink-Induced Topic Search (HITS) algorithm, which isolates these two situations that occur in networks: an author receives a high authority score when he is often cited by other often-cited authors, and a high hub score when he cites other often-cited papers. One notable use of the HITS algorithm is by ask.com, a search engine that provides answers to commonly posed questions. In the case of Google, their PageRank team specifically used Kleinberg's concept as one of their theoretical foundations (Page, Brin, Motwani & Winograd 1998). The HITS algorithm sheds more light on the centrality of each node in a network than the previously mentioned methods but, perhaps because of the wide popularity of PageRank, it has seen a somewhat limited application by researchers.

Another important measure commonly used in the Social Network Theory is that of 'betweenness centrality' (BC). Introduced by Anthonisse (1971), its purpose is to gauge the extent to which a given node lies on paths between others. To understand the concept, it may help to visualize a network in which items flow from place to place (node to node) along edges (paths). In a social network, for example, messages and items of news or information might pass from one person to another. Let us initially assume that each person in the network is equally likely to exchange one of these items with another over the same period of time, and that the items always move along the shortest (geodesic) path (if there are several such paths, one is selected at random). If a suitably long period is allowed to elapse, during which multiple items pass through each member (node) of the network on the way to their destinations, the number of items exchanged at a particular node is proportional to the number of geodesic paths which pass through it.

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This number of geodesic paths is referred to as the BC of that particular node (Newman 2010). Unlike other centrality measures, such as degree centrality, betweenness does not measure a node's degree of connectedness within the network, but how much control it has over the flow of information between other nodes. In other words, removing a node with a high BC score would seriously disrupt the delivery of information from one node to another.
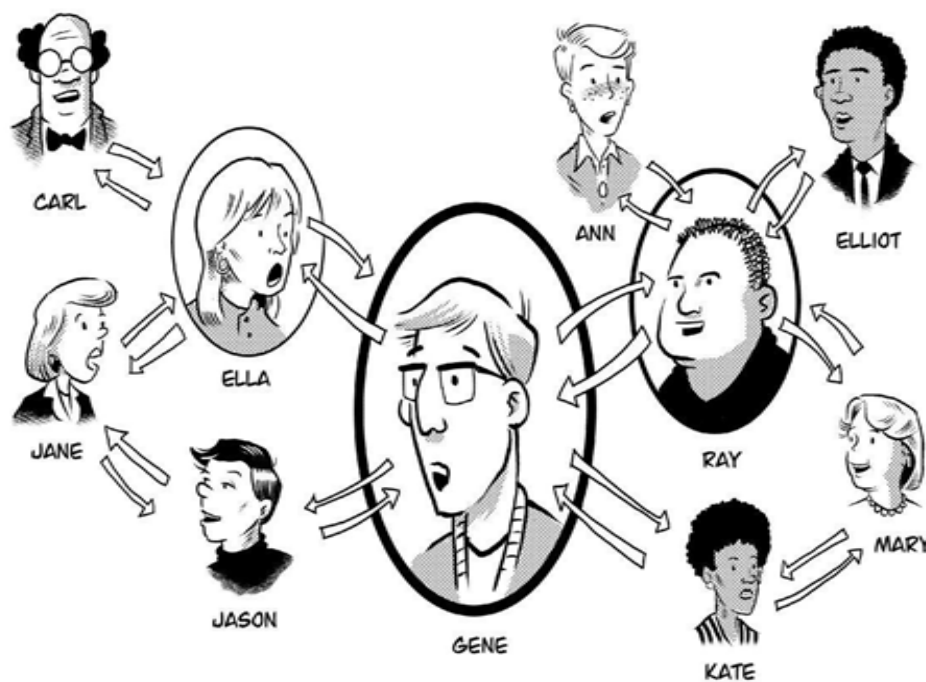
Figure 5: BC scores for various people within a network: Gene has the highest BC score, followed by Ray and then Ella. The removal of any of those three people would seriously disrupt the spread of information in this network. Though both Gene and Ray are connected to four people each, Gene has more control over the traffic in the network (without him, the people on the left hand side would not be able to communicate with those on the right), hence his BC score is higher than Ray's.

Scholars have applied betweenness centrality to the study of numerous complex networks such as those of wireless sensors (Cuzzocrea et al. 2012), air transport (Wang, Mo, Wang & Jin 2011) and pollination (González, Dalsgaard & Olesen 2010). The

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measurement has also been much used in citation analysis. Abbasi et al. (2012) examined research collaboration in the form of co-authorships by analyzing the BC scores of various academics; their research found that PhD supervisors and postdoctoral researchers score highly because they typically serve as 'brokers' between new academics and their own existing networks of collaborators. Leydesdorff (2007) studied all 7,379 of the journals archived in the *Journal Citation Reports of the Science Citation Index* and the *Social Sciences Citation Index*, and found that BC scores can serve as a reliable indicator of the level of interdisciplinarity of academic journals: the higher the BC score a journal receives, the more interdisciplinary it is.

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 scholar or publication is perceived within a particular community.  In addition to all the aforesaid measurements, the 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.

As the most commonly used technique in SNA, Graph Theory models the relationships between objects by means of graphic representations. It is now being extensively used 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 broad array of network phenomena that the process of identifying communities has been applied to include the following: Pereira-Leal et al. (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 6), 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 anonymized Facebook data; their study concluded that the students' online communities were largely organized by their year of enrollment 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 optimization to study the calls between a particular Belgian operator's 2.6 million cell phone users, finding that the entire network could be separated into 261 distinct communities, the majority of them characterized 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.
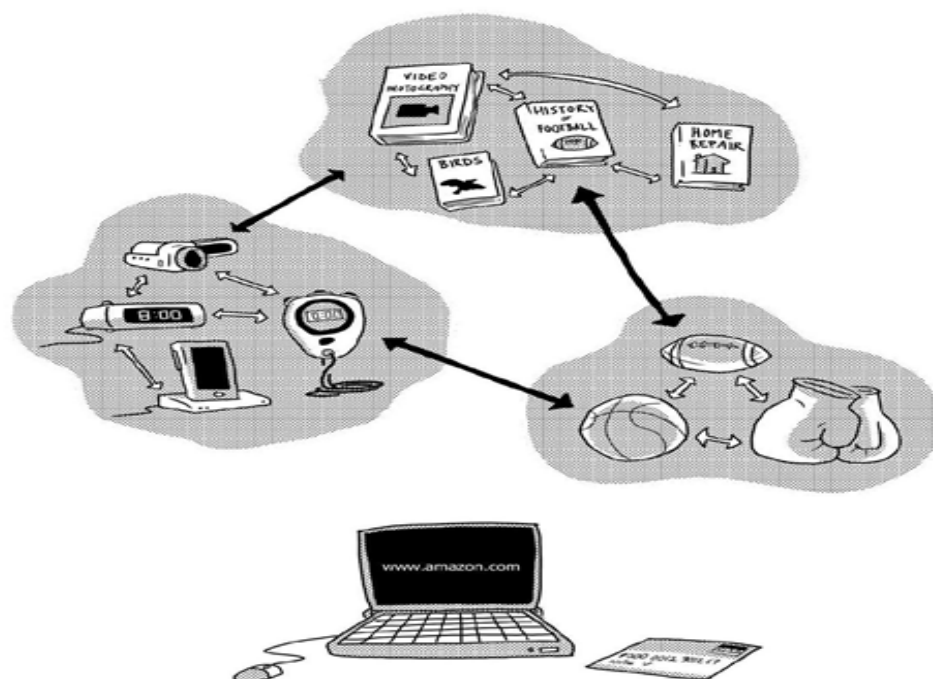
Figure 6: Communities of consumers with similar purchasing behaviors on an e-commerce website

In the context of citation analysis, members of each community share far more citations among themselves than with outsiders. Such groupings can offer us an insight into who closely cites who 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 analyzing the citation data from articles in *Physical Review* (1893-2007). Their study identified major communities within the citation network by using modularity maximization, and revealed that these were grouped according to the various distinct sub-disciplines that make up the wider field of physics. Alperin et al. (2011) explored meaningful communities in the same field, but took the technique to the next level by using the discrete communities to

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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 influences 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 for identifying communities in a network in the best possible way, even fewer studies have endeavored 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).

## 3. The Present Study

### 3.1 Research Questions

**1.  What are the most influential publications in the CIS community?**

As Meho (2006) observed, roughly 90% of academic papers published never receive any citations, and approximately half are never even read. While it is true that research takes time to be recognized as significant, funding agencies and universities increasingly use citation data as a primary measure to evaluate the importance of a research project. In

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the context of CIS, in addition to providing that indicator of importance, identifying the most influential publications can help determine which academic discipline and research methodologies have the greatest impact on the evolution of the field.

**2. Which institutions carry the most weight in CIS research? Are there any notably strong inter-institutional connections in terms of citations? How does this type of scholarly interaction change over time?**

The idea of ranking institutions can be traced back to 1983 when *US News and World Reports* 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 programs that meet the association's requirements for producing skilled 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 program has the greatest research impact. As the evolution of CIS is mostly institution and research-driven, it is important to measure how various universities contribute to research and how they influence one another.

**3. Does CIS research vary between regions? How do the regions' relative influences change over time?**

Over the past decade China has been a major global contributor to the advancement of science, as evidenced by its ranking second in terms of the total number of academic publications produced (Zhou & Leydesdorff 2006). One might wonder how the country's 35 administrative areas perform and compare with one another in terms of their contributions to the overall national scientific 'output'. Zhou et al.'s study of 2009 concluded that in terms of research productivity and citation impact, there existed a great deal of imbalance: the publications from which outgoing citations were primarily taken were concentrated in just a handful of places such as Beijing, Shanghai and Jiangsu. Their research covered 12 major scientific fields, but sadly Interpreting Studies was not among their number. Building on Zhou's foundational work, the present author set out to examine the differences in CIS research between regions and over time.

## 3.2 Data Organization

Given that there are no comprehensive academic databases like the Social Science Citation Index (SSCI) covering CIS literature, 59,303 citations from 1,289 Chinese MA theses, 32 doctoral dissertations and 2,909 research papers were manually entered by the author into a relational database which uses Structured Query Language (SQL) for managing data. Every attempt was made to collect all the publications in these three document categories from 1949 to 2012, from a variety of different sources: field trips to university libraries, interlibrary loans, book purchases, and academic databases such as CNKI, Wanfang and the National Digital Library of Theses and Dissertations in Taiwan. While it is possible that a few papers may have been inadvertently left out of the corpus

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owing to institutional embargo or other reasons, the data collected is believed fit to represent the full picture of CIS. For each paper in the database, its title, the authors' names, academic affiliation and all the references listed in the bibliography were manually entered; all the academic affiliations that appeared in the database were also tagged with the administrative region that they belong 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 the field of 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 the Graph Theory, Markov chain, and linear algebra. Taking four papers numbered 1-4 as an example, the procedure for calculating each of their PRA scores is as follows:
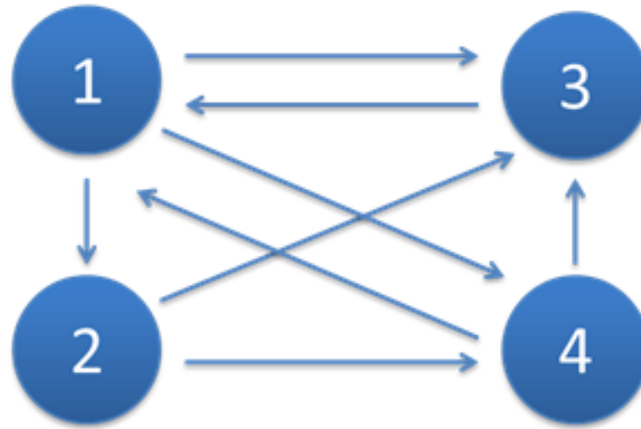
Figure 7: Schematic illustration of papers citations

(1) Each paper is treated as a node on the citation graph. A directional edge between two papers is established when one cites another (see Figure 7). For example, paper 1 cites papers 2, 3, and 4, so the arrows are facing away from paper 1 to the other three.



Figure 8: Weights for each paper

(2) Suppose that all nodes have equal weights. This means that the probability of paper 1 citing papers 2, 3 and 4 is the same, namely ⅓; the probability of paper 4 citing papers 1 or 3 is the same, namely ½; and so on (see Figure 8).
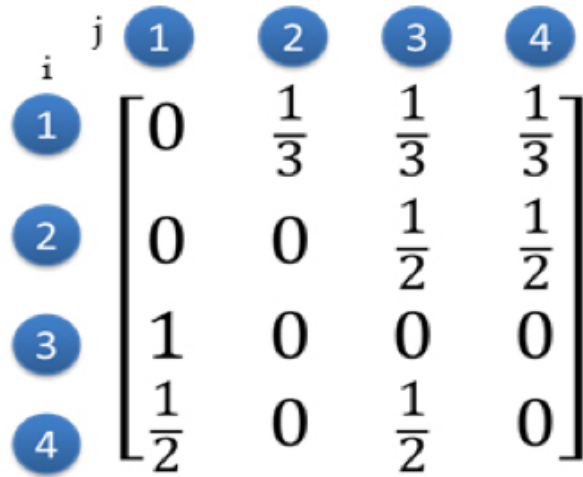
Figure 9: Transition matrix *A*

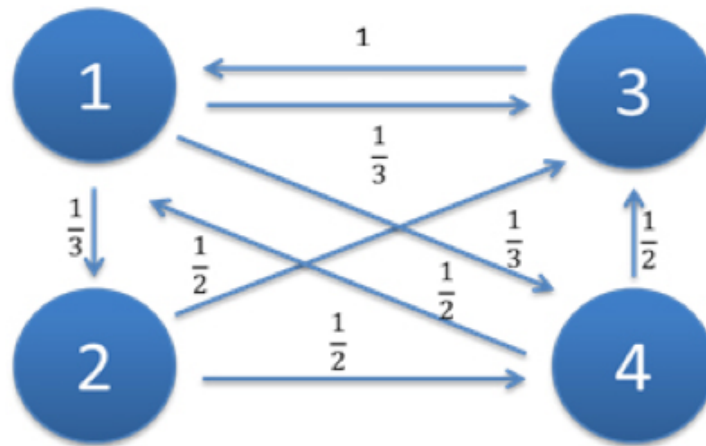(3) These probabilities form a transition matrix *A*, where each entry (*i, j*) represents the probability of documents in the *i* columns citing documents in the *j* rows (see Figure 9).

(4) Then we have to find the stationary state *r,* which is the PageRank scores for each publication. To obtain this we have to solve a linear equation:

$$r = \frac{1-d}{N}I + d\,Ar,$$

where $N$ is a number of nodes, $d \in (0,1)$ is a damping factor[4], and $I$ is a matrix of ones.

  The top 20 Chinese and Western publications were listed and classified according to their research methodologies, document types and disciplinary approaches. This data shed light on what constituted the most popular literature in CIS. It was expected that the majority of the most influential publications would be found to be non-empirical and

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[4] The damping factor in this study was set at 0.15, the same as used by Page et al. (1998).

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monographic, and that most papers would seldom have been cited by the most influential researchers. A further analysis was conducted to examine the top 20 Chinese and Western empirical studies to see if they differed markedly in these aspects from those of the overall total. It was expected that most items on both the Chinese and Western empirical lists would have been published as journal articles as opposed to other document types. Furthermore, most were expected to come from the field of Translation and Interpreting and use experiments or observation as their primary research methodology.

## 4.2 Which institutions carry the most weight in CIS research? Are there any notably strong inter-institutional connections in terms of citations? How does this type of scholarly interaction change over time?

Each of the 626 CIS institutions' PRA scores were calculated, generating a list of the ten most influential universities; this was compared with the list of the top ten paper-producing universities[5] to examine the degree of overlap between the two. It was expected that some of the top paper-producers would be absent from the top influencers' list, because their papers were not widely cited by influential authors in the field.

From the citations data a static graphic (see Figure 10) was created showing the network of connections between various institutions using Gephi, an open-source application for graph and network analysis (Bastian et al. 2008). The thickness of the plot's edges indicates the number of citations, while the colors of the nodes represent the network

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[5] That list was produced by the same author in an earlier paper (Xu, 2014).

communities that different institutions belong to. Each node is color-coded using the modularity cut algorithm based on 2012 data; the node size represents the total number of incoming citations[6] for that particular institution. It was anticipated that two broad CIS communities — one dominated by Guangdong Foreign Studies University (GFSU), the other by Shanghai International Studies University (SISU) — would be revealed, communities formed not according to research interests or methodologies but principally along geographical or institutional lines.

Using Gephi, a dynamic visualization of different CIS institutions in the citation network was also created to investigate how their influences change over the years (see Figure 11). The author expected to find that in the early 1990s schools such as the Beijing Language and Culture University (BLCU) were at the center of the citation network, but that the influence they exerted was thanks to only a handful of researchers. By the mid-2000s, GFSU and SISU were expected to have formed their own discrete citation communities, each with its own team of researchers and each growing in influence. It was further hypothesized that the trend towards the team would grow at others of the major influential universities, and that it would become exceptional for a single individual to be entirely responsible for the influence exerted by his school.

Google's PRA, which gives a score that serves as the unnormalized probabilities, analyzes 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

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[6] 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.

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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.

## 4.3 Does CIS research vary between regions? How do the regions' relative influences change over time?

Following the same methodology described in 4.2, a static graphic (see Figure 12) was created showing the network of connections between various locations. It was expected that three major research clusters would be found in the CIS community: (1) Guangdong and its surrounding regions; (2) Shanghai and surroundings; and (3) Beijing and surroundings. In addition, a dynamic visualization (see Figure 13) was created to illustrate how academic collaboration between regions changes over time. The CIS community's evolution was expected to fall into three phases: (1) in the early 1990s the entire community could be broadly classed as one research cluster with Beijing at its center; (2) towards the end of that decade Guangdong and Shanghai emerged onto the scene and Beijing's relative influence went into decline, though the former two cities remained part of the capital's research cluster; (3) by the late 2000s those two locations had formed clusters of their own, distinct from Beijing's. In addition, despite the increased number of citations across different regions over time, interactions in northern China were expected to remain few and far between.

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# 5. Results and discussions

## 5.1 What are the most influential publications in the field of CIS?

**Table 1:** Top 20 most influential Chinese documents in CIS

| Position | PageRank Score | Document Name (Chinese) | Document Name (English) | Author name (English) | Empir ical? | Disciplinary Approach | Document Type |
|---|---|---|---|---|---|---|---|
| 1 | 0.002665723 | 口译理论概述 | An Overview of Interpreting Theories | Bao Gang | No | Interpreting Studies | Monograph |
| 2 | 0.002278718 | 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 | No | Interpreting Studies | Monograph |
| 3 | 0.002132773 | 高级口译教程 | An Advanced Course in Interpreting | Mei Deming | No | Interpreting Studies | Textbook |
| 4 | 0.001410438 | 英汉同声传译 | English-Chinese Simultaneous Interpreting | Zhang Weiwei | No | Interpreting Studies | Textbook |
| 5 | 0.001397705 | 口译理论与教学 | Interpreting Theories and Education | Liu Heping | No | Interpreting Studies | Monograph |
| 6 | 0.001372465 | 口笔译理论研究 | Research on Interpreting and Translation Theories | Liu Miqing | No | Interpreting Studies, Translation Studies | Monograph |
| 7 | 0.001060445 | 实用口译手册 | A Practical Handbook of Interpreting | Zhong Shukong | No | Interpreting Studies | Textbook |
| 8 | 7.02E-04 | 新编英语口译教程 | A New Coursebook of English Interpreting | Lin Yuru | No | Interpreting Studies | Textbook |

| 9 | 6.36E-04 | 口译训练模式内容方法 | Interpreter Training: Models and Methodology | Zhong Weihe | No | Interpreting Studies | Journal article |
|---|---|---|---|---|---|---|---|
| 10 | 5.83E-04 | 口译理论与实践语言与交际 | Interpreting: Theory and Practice in Language and Communication | Li Kuiliu | No | Interpreting Studies | Monograph |
| 11 | 5.72E-04 | 实战口译 | Field Interpreting | Lin Chaolun | No | Interpreting Studies | Textbook |
| 12 | 4.89E-04 | 口译教程 | Interpreting Coursebook | Lei Tianfang | No | Interpreting Studies | Textbook |
| 13 | 4.76E-04 | 口译研究新探 | An Exploration of Interpreting Research | Cai Xiaohong | No | Interpreting Studies | Collective volume |
| 14 | 4.70E-04 | 口译教学研究:理论与实践 | Research on Interpreter Training: Theory and Practice | Yang Chengshu | No | Interpreting Studies | Monograph |
| 15 | 4.56E-04 | 英语口译教程 | A Coursebook of English/ Chinese Interpreting | Mei Deming | No | Interpreting Studies | Textbook |
| 16 | 4.51E-04 | 当代翻译理论 | Contemporary Translation Theories | Liu Miqing | No | Translation Studies | Monograph |
| 17 | 4.32E-04 | 以跨学科的视野拓展口译研究 | Interpretation Study with an Interdisciplinary Perspective | Cai Xiaohong | No | Interpreting Studies | Journal article |
| 18 | 4.32E-04 | 译员的知识结构与口译课程设置 | Knowledge Structure and Curriculum Design for Interpreter Training | Zhong Weihe | No | Interpreting Studies | Journal article |
| 19 | 4.24E-04 | 大学本科口译教学的定位及教学 | Positioning Undergraduate Interpreter Training | Bao Chuanyun | No | Interpreting Studies | Journal article |
| 20 | 4.18E-04 | 中国翻译教学 | Research on the Teaching | Mu Lei | No | Translation Studies | Monograph |

| | | 研究 | of Translation in China | | | | |
|---|---|---|---|---|---|---|---|

The PageRank Algorithm was used to analyze all the documents in the citations database so as to ascertain which were or were not influential. Table 1 shows the PRA scores of the top 20 most influential 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: they are often seen more as repositories for established facts 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.

It can also be seen that none of the top 20 documents was empirical in nature. Of the total, 90% fell into the category of IS and 15% into TS [7]. 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[8].

For a more nuanced analysis, a list of the top 20 most influential Chinese empirical documents in CIS was also generated:

**Table 2:** Top 20 most influential Chinese empirical studies in CIS

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

[8] 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 data-set.

| Position | PageRank Score | Document Name (Chinese) | Document Name (English) | Author name (English) | Disciplinary Approach | Document Type |
|---|---|---|---|---|---|---|
| 1 | 4.35E-05 | 中国口译研究又十年 | Another Decade of CIS Research | Hu Gengshen, Sheng Qian | Interpreting Studies | Journal article |
| 2 | 1.13E-04 | 从图式理论看背景知识在口译中的作用 | A Schema Approach to the Role of Background Knowledge in Interpreting | Liu Jianfu | Interpreting Studies | Journal article |
| 3 | 1.13E-04 | 面向教学的口译语料库建设理论与实践 | A Corpus-based Approach to Interpreter Training: Theory and Practice | Wang Binhua, Ye Liang | Interpreting Studies | Journal article |
| 4 | 1.12E-04 | 国内口译研究的发展及研究走向 | Development and Trends in CIS Research | Mu Lei, Wang Binhua | Interpreting Studies | Journal article |
| 5 | 1.11E-04 | 口译在中国调查报告 | Interpretation as a Profession in China | Wang Enmian | Interpreting Studies | Journal article/ Conference proceedings |
| 6 | 1.10E-04 | 汉英交替传译过程中译员笔记特征实证研究 | An Empirical Study of Note-taking in Chinese-English Consecutive Interpreting | Dai Weidong, Xu Haiming | Interpreting Studies | Journal article |
| 7 | 1.07E-04 | 对近十年中国口译研究现状的调查与分析 | A Survey of Interpreting Research over the Past Decade | Liu Shaolong, Wang Liuqi | Interpreting Studies | Journal article |
| 8 | 1.06E-04 | 记者招待会的口译和释意理论 | Interpreting for Press Conferences and the Interpretive Theory of Translation | Wu Xiaoli | Interpreting Studies | Journal article |
| 9 | 9.01E-05 | 台湾翻译产业现况调查 | A Report on the Taiwanese | Zhou Zhongtian, | Translation Studies | Report |

| | | 研究总结分析报告 | Translation Industry | Zhou Chang'e, Ye Xinxing | | |
|---|---|---|---|---|---|---|
| 10 | 8.66E-05 | 从发表文章的状况谈加强我国的口译研究 | The Need for Improving Interpreting Research: An Article Count Perspective | Hu Gengshen | Interpreting Studies | Journal article |
| 11 | 8.24E-05 | 大学生志愿者在会展口译实践中遇到的问题及对策 | Issues and Strategies in Volunteer Interpreting for University Students | Yuan Jian | Interpreting Studies | Journal article |
| 12 | 8.06E-05 | 口译过程的认知因素分析认知记忆能力与口译的关系 | Memory and Interpreting: A Cognitive Analysis | Zhang Wei | Interpreting Studies | Journal article |
| 13 | 7.91E-05 | 从温家宝总理2008年的记者招待会看口译员的跨文化意识 | Cross-cultural Awareness for Interpreters: A Case Study of Premier Wen's 2008 Press Conference | Jin Yan, Chen Ming | Interpreting Studies | Journal article |
| 14 | 7.83E-05 | 从交际学角度看同声传译的质量评估 | Quality Assessment of SI: A Communicative Perspective | Nie Yonghua | Interpreting Studies | Thesis |
| 15 | 7.70E-05 | 考试焦虑对错误记忆的影响 | The Influence of Test-related Stress on Memory Errors | Chen Shunsen, Tang Danhong | Cognition | Journal Article |
| 16 | 7.52E-05 | 中外记者招待会中口译员的角色定位 | Interpreters' Roles at Press Conferences | Su Wenda, Zhao Shuwang | Interpreting Studies | Journal article |
| 17 | 7.00E-05 | 背景知识与语言难度在英语阅读理 | Background Knowledge and Language Complexity in | Yuan Luxia, Wang Chuming | Linguistics | Journal article |

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| | | 解中的作用 | English Reading Comprehension | | | |
|---|---|---|---|---|---|---|
| 18 | 7.00E-05 | 汉英交替传译活动中译员笔记困难及其原因的实证研究 | An Empirical Study of Note-taking Problems During Chinese-English Consecutive Interpreting | Xu Haiming, Chai Mingjiong | Interpreting Studies | Journal article |
| 19 | 4.18E-04 | 同声传译与工作记忆关系的认知分析 | A Cognitive Analysis of Simultaneous Interpreting and Working Memory | Zhang Wei | Interpreting Studies | Doctoral dissertation/ monograph |
| 20 | 6.59E-05 | 话题熟悉程度语言水平和问题类型对efl听力理解的影响 | The Effects of Topic Familiarity, Language Proficiency and Question Types on EFL Listening Comprehension | Huang Zidong | Second Language Acquisition | Journal Article |

Table 2 paints a distinctly different picture from the list in Table 1 in terms of the document types: only one monograph was listed in the top 20 empirical list, compared with eight in the top 20 overall. As a matter of fact the said paper, by Zhang Wei (item 19 in the table), started out as his doctoral dissertation, which he spent three years writing under the close supervision of his advisor, Wang Kefei. While both empirical and theoretical studies are valuable to the development of CIS, in the former the process of collecting data can be as time-consuming as its analysis, which may explain why so few empirical studies are published as monographs. The fact that 11 of the top 20 empirical studies were co-authored seems to further corroborate this "many hands make light work" explanation: by contrast, *all* the top 20 non-empirical studies were single-authored.

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Doctoral studies have yet to become an important driver of influential empirical research. Only four of the top 20 empirical studies came from scholars' doctoral research: Xu Haiming and Zhang Wei produced two each. Unlike faculty members, who are burdened with teaching, fundraising and administrative responsibilities, one might expect doctoral students to have the time resources required to conduct thoroughgoing and important empirical research under the supervision of experienced faculty members. This may well be the case, but they tend to be at a disadvantage with regard to their established colleagues when it comes to recruiting willing participants and accessing data, both of which require academic connections, not to mention financial resources.

With regard to years of publication, the analysis revealed that in contrast to the 20% of documents in Table 18 that were produced between 2001 and 2004, 85% of the studies in Table 4 were journal articles published since the mid-2000s. This seems to indicate that the influence of Chinese empirical studies spreads quickly via journal articles, whereas for non-empirical research the primary channel of propagation is still via monographs and textbooks, the ideas of which can take a longer time to become widespread.

The present research revealed that none of the top 20 empirical documents featured in the top 100 most influential list. Hu Gengshen and Sheng Qian's *Another Decade of CIS Research*, for example, which ranked number one on the empirical list, ranked only 113th in the overall list, while the 20th most influential (Huang Zidong's *The Effects of Topic Familiarity, Language Proficiency and Question Types on EFL Listening Comprehension*) ranked low at 903rd. The low ranking of empirical studies would appear

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to indicate that in comparison to theoretical research they have yet to become truly influential in CIS.

When it came to research methodology, ten studies were observational, eight experimental and two questionnaire-based. It is interesting to note that half of the ten observational studies took a scientometric approach to analyzing the evolution of CIS, and that Hu Gengshen contributed to two of those five. None of the top 20 empirical studies was interview-based or ethnological. Only three of the top 20 most influential empirical studies fell outside Interpreting/Translation Studies, and all three were experimental.

**Table 3:** Top 20 most influential Western documents in CIS

| Position | PageRank Score | Document Name | Author Name | Empirical? | Disciplinary Approach | Document Type |
|---|---|---|---|---|---|---|
| 1 | 0.004853806 | Basic Concepts and Models for Interpreter and Translator Training | Daniel Gile | No | Interpreting Studies, Translation Studies (1995) | Monograph |
| 2 | 0.001675562 | Interpréter Pour Traduire | Danica Seleskovitch, Marianne Lederer | No | Interpreting Studies (1984) | Monograph |
| 3 | 9.02E-04 | Conference Interpreting Explained | Roderick Jones | No | Interpreting Studies (1998) | Monograph |
| 4 | 6.79E-04 | The Interpreter's Handbook | Jean Herbert | No | Interpreting Studies (1952) | Textbook |
| 5 | 6.18E-04 | La Traduction Aujourd'hui: Le Modèle Interprétative | Marianne Lederer | No | Interpreting Studies (1994) | Monograph |
| 6 | 6.06E-04 | Language, Culture and Translating | Eugene Nida | No | Translation Studies (1993) | Monograph |

| 7 | 5.99E-04 | Interpreting for International Conferences | Danica Seleskovitch | No | Interpreting Studies (1978) | Monograph |
|---|---|---|---|---|---|---|
| 8 | 4.99E-04 | Simultaneous Interpretation: A Cognitive Pragmatic Analysis | Robin Setton | No | Interpreting Studies (1999) | Monograph / doctoral dissertation |
| 9 | 4.80E-04 | Translating as a Purposeful Activity | Christiane Nord | No | Translation Studies (1997) | Monograph |
| 10 | 4.06E-04 | The Interpreting Studies Reader | Franz Pöchhacker, Miriam Shlesinger | Yes | Interpreting Studies (2001) | Collective Volume |
| 11 | 3.96E-04 | Relevance: Communication and Cognition | Dan Sperber, Deirdre Wilson | No | Linguistics, Cognition (1986) | Monograph |
| 12 | 3.82E-04 | Psychology of Language | David Carroll | No | Linguistics, Cognition (1985) | Monograph |
| 13 | 3.48E-04 | Pédagogie Raisonnée de L'interprétation | Danica Seleskovitch, Marianne Lederer | No | Interpreting Studies (1989) | Monograph |
| 14 | 3.33E-04 | An Introduction to Functional Grammar | M.A.K. Halliday | No | Linguistics (1985) | Monograph |
| 15 | 3.16E-04 | Approaches to Translation | Peter Newmark | No | Translation Studies (1981) | Monograph |
| 16 | 3.10E-04 | A Textbook of Translation | Peter Newmark | No | Translation Studies (1988) | Textbook |
| 17 | 3.09E-04 | Contexts in Translating | Eugene Nida | No | Translation Studies (2001) | Monograph |
| 18 | 3.08E-04 | The Interpreter's Resource | Mary Phelan | No | Interpreting Studies (2001) | Monograph |
| 19 | 2.93E-04 | Dictionary of Translation Studies | Mark Shuttleworth, Moira Cowie | No | Translation Studies (1996) | Reference Book |
| 20 | 2.89E-04 | Translation and Translating: Theory | Roger Bell | No | Translation Studies | Monograph |

| | | and Practice | | | (1991) | |
|---|---|---|---|---|---|---|

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). 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 social sciences as a whole, in which canonical monographs by figures such as Marx and Lenin are frequently cited (Line 1981). It might be speculated that TIS scholars are keen to demonstrate that ideas to be found in some of the discipline's pioneer texts can help to shed light on the subjects of today, and that those writings provide a unifying intellectual backdrop for what can often appear a somewhat disunited whole.

Notwithstanding the call for empirical research in the CIS community, 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. Despite the fact that Robin Setton's doctoral dissertation (later published as a monograph) contains a corpus of one German and two Chinese speeches, the contribution it has made to CIS has been primarily theoretical. 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 suggests that CIS scholars are more inclined to turn

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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 favor 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. 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.

**Table 4:** Top 20 most influential Western empirical studies in CIS

| Position | PageRank Score | Document Name (English) | Author name (English) | Disciplinary Approach | Document Type |
|---|---|---|---|---|---|
| 1 | 4.06E-04 | The Interpreting Studies Reader | Franz Pöchhacker, Miriam Shlesinger | Interpreting Studies | Collective Volume |
| 2 | 2.30E-04 | The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information | George A. Miller | Cognitive psychology | Journal article |

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| 3 | 1.36E-04 | Conference Interpretation: Expectations of Different User Groups | Ingrid Kurz | Interpreting Studies | Journal article |
|---|----------|------------------------------------------------------------------|-------------|---------------------|-----------------|
| 4 | 1.34E-04 | Remembering: A Study in Experimental and Social Psychology | Frederic C. Bartlett | Social Psychology | Monograph |
| 5 | 1.17E-04 | Role of the Reader's Schema in Comprehension, Learning and Memory | Richard C. Anderson | Educational Psychology | Journal article |
| 6 | 1.16E-04 | Fundamental Aspects of Interpreter Education | David Sawyer | Interpreting Studies | Monograph/ doctoral dissertation |
| 7 | 1.07E-04 | Testing the Effort Models' Tightrope Hypothesis in Simultaneous Interpreting | Daniel Gile | Interpreting Studies | Journal article |
| 8 | 1.06E-04 | Segmentation of Input in Simultaneous Translation | Frieda Goldman-Eisler | Interpreting Studies | Journal article |
| 9 | 1.06E-04 | A Description of Various Types of Omissions, Additions and Errors of Translation Encountered in Simultaneous Interpretation | Henri C. Barik | Interpreting Studies | Journal article |
| 10 | 9.75E-05 | Bridging the Gap: Empirical Research in Simultaneous Interpretation | Sylvie Lambert, Barbara Moser-Mercer | Interpreting Studies | Collective Volume |
| 11 | 9.21E-05 | Simultaneous Interpretation: Qualitative and Linguistic Data | Henri C. Barik | Interpreting Studies | Journal article |
| 12 | 9.05E-05 | Verbal Memory During Simultaneous Interpretation: Effects of Phonological Interference | Valeria Darò, Franco Fabbro | Interpreting Studies | Journal article |
| 13 | 8.98E-05 | The History of Research into Conference Interpreting | Daniel Gile | Interpreting Studies | Journal article |
| 14 | 8.42E-05 | Survey on Expectations of Users of Conference Interpretation | AIIC | Interpreting Studies | Report |
| 15 | 8.39E-05 | The Effects of Source Language Presentation Rate on the Performance of Simultaneous Conference | David Gerver | Interpreting Studies | Collection article |

| | | Interpreters | | | |
|---|---|---|---|---|---|
| 16 | 7.91E-05 | Information Processing among Conference Interpreters: A Test of the Depth-of-Processing Hypothesis | Sylvie Lambert | Interpreting Studies | Journal article |
| 17 | 7.90E-05 | Sight Translation and Interpreting: A Comparative Analysis of Constraints and Failures | Marjorie Agrifoglio | Interpreting Studies | Journal article |
| 18 | 7.88E-05 | How Faithfully do court Interpreters Render the Style of Non-English Speaking Witnesses Testimonies | Sandra Hale | Interpreting Studies | Journal article |
| 19 | 7.60E-05 | The Effects of Topic Familiarity on Second Language Listening Comprehension | Barbara C. Schmidt-Rinehart | Second Language Acquisition | Journal article |
| 20 | 7.25E-05 | Exploring Hesitation in Consecutive Interpreting: An Empirical Study | Peter Mead | Interpreting Studies | Collection article |

Following the same approach as that used to analyze the Chinese publications, a list of the most influential Western documents was generated. Examination of the document types revealed that, similar to the Chinese empirical list, monographs were the minority: of the 20 only two were monographs; one was the doctoral dissertation by Sawyer (2004), who examined the curriculum design of the Monterey Institute of International Studies (MIIS) under Drs. Karl-Heinz Stoll and Franz Pöchhacker. A distinct difference from the composition of the Chinese list is that two collective volumes were also among the top 20; even more worthy of remark is that one of them, which ranked number 1 on the empirical list, also featured in the top ten overall list. Interestingly, unlike the situation for the top Chinese empirical studies, where co-authorship was the norm, 85% of the top 20 Western studies were single-authored. This seems at first to suggest that the

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majority of the most influential empirical Chinese and Western scholars have markedly different preferences when it comes to collaborating on research. It is also possible, though, that the significantly higher number of co-authored publications on the Chinese list than on the Western may be due to the increasing complexity of research over time, with its resulting need for multiple inputs.

While the majority of authors on the list each had only one paper ranked among the top 20, two authors, of distinctly different academic backgrounds, stood out from the crowd with two each: Daniel Gile and Henri Barik. Gile came from the field of mathematics and has been involved in interpreting research since the 1980s — his 200+ published papers make him one of the most prolific authors in TIS. By contrast, Barik published the first ever dissertation on simultaneous interpreting, in 1969. All his IS publications date from the 1970s; since then he has focused primarily on second language acquisition. The dates of their papers on the list also differed markedly: Gile's were published in 1999 and 2000, Barik's were in 1971 and 1973. Among the various possible reasons for the popularity of Barik's research 40 years on may be that he was among the first to introduce methodology from experimental psychology into interpreting research, and that both of his papers on the list — items 9 and 11 in Table 4 — were subsequently reprinted in collective volumes — in fact in items 1 and 10.

When the publication dates of each paper on the Western empirical list (see Table 4) were examined and compared with those from the overall Western list (see Table 3), some interesting results were revealed. Of the top 20, only six papers were published in or after 2000, while seven dated from the 1990s and the remainder from even earlier; the

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earliest was *Remembering: A Study in Experimental and Social Psychology* by Frederic C. Bartlett (1932). This distribution is similar to that of the overall list, which was also skewed towards items published prior to 2000. This finding would appear to suggest that some classic Western studies, be they empirical or theoretical, have defied the passing of time, remaining popular sources of citations among influential CIS authors.

The top-ranking empirical publication, *The Interpreting Studies Reader*, is number 32 on the overall list, well behind many textbooks on interpreting, which are practical in nature. *The Magical Number Seven, Plus or Minus Two*, which ranks number 2 on the Western empirical list, is the only other study that made it into the top 100 — it ranked 84 on the overall list. At the other end of the spectrum, the 20th most influential Western study (Peter Mead's *Exploring Hesitation in Consecutive Interpreting*) received a ranking over all of 722. These findings are in general agreement with the earlier results for the most influential Chinese empirical studies, suggesting that CIS scholars with high research impact tend to favor citing theoretical rather than empirical publications.

Next, the research methodologies employed in these studies were examined in detail. After excluding the two collective volumes, which are compilations of multiple studies, it was found that 13 were experimental, three observational, three questionnaire-based, and two interview-based. It should be noted that the total number here does not add up to 18, because several studies used a combination of research methods. The finding suggests that experiments were the primary approach taken by most influential Western studies in CIS. This contrasts with the earlier finding for the top Chinese empirical studies, which favored observational over experimental studies. Similar to the Chinese empirical list, the

majority of the Western publications on the list came from the field of Interpreting Studies; the four studies that were from external disciplines all used experiments as their methodology.

## 5.2 Which institutions carry the most weight in CIS research? Are there any notably strong inter-institutional connections in terms of citations? How does this type of scholarly interaction change over time?

**Table 5:** 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 |

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.

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[9] (See Table 6). 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.

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[9] For this analysis, thesis-writing 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.

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**Table 6**: 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 |
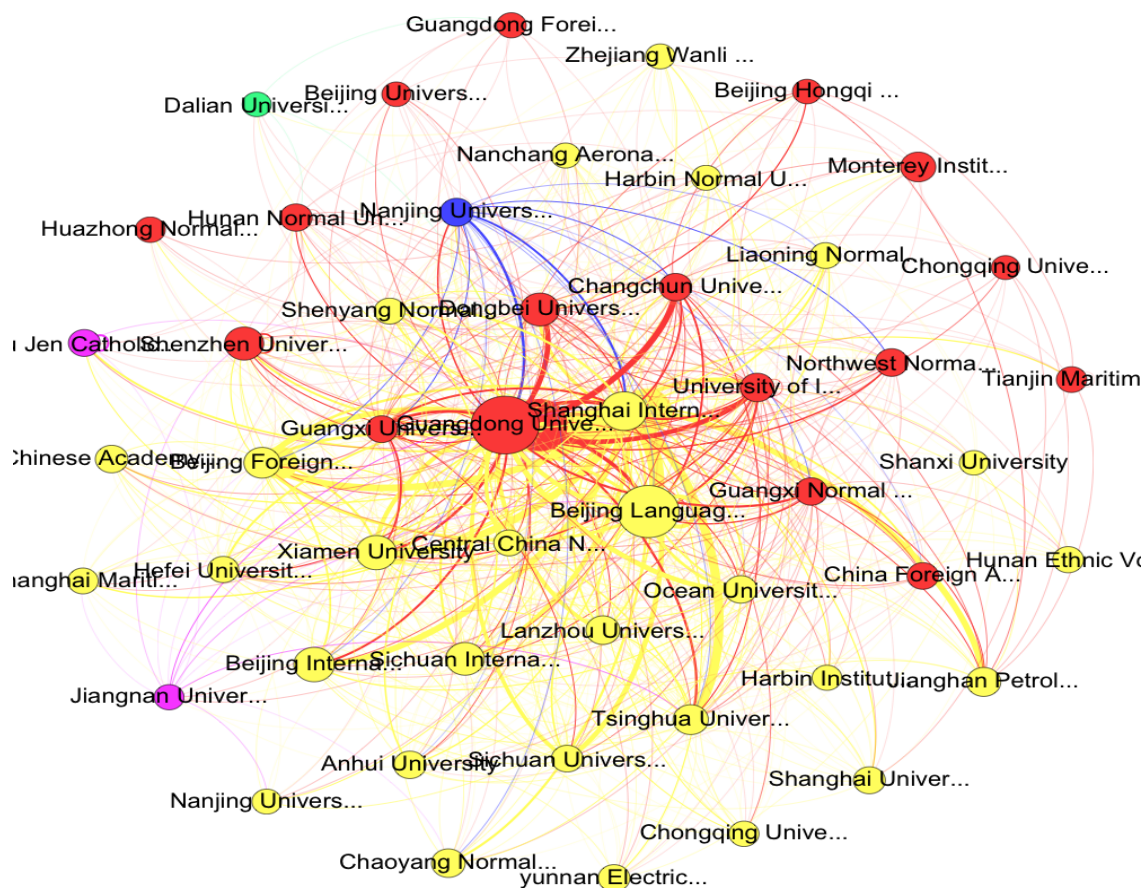
Figure 10: Static visualized citation network for institutions in CIS[10]

It is immediately apparent from Figure 10 that there are two major communities in the network, colored in red and yellow. The red has at its center 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 produced at GFSU. The yellow community was dominated by six of the other top ten institutions[11], with SISU and BLCU at its center. 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.

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 self-citations. Geographical

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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: http://interpretrainer.com/videosplay.php?id=15&view=1

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

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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 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.
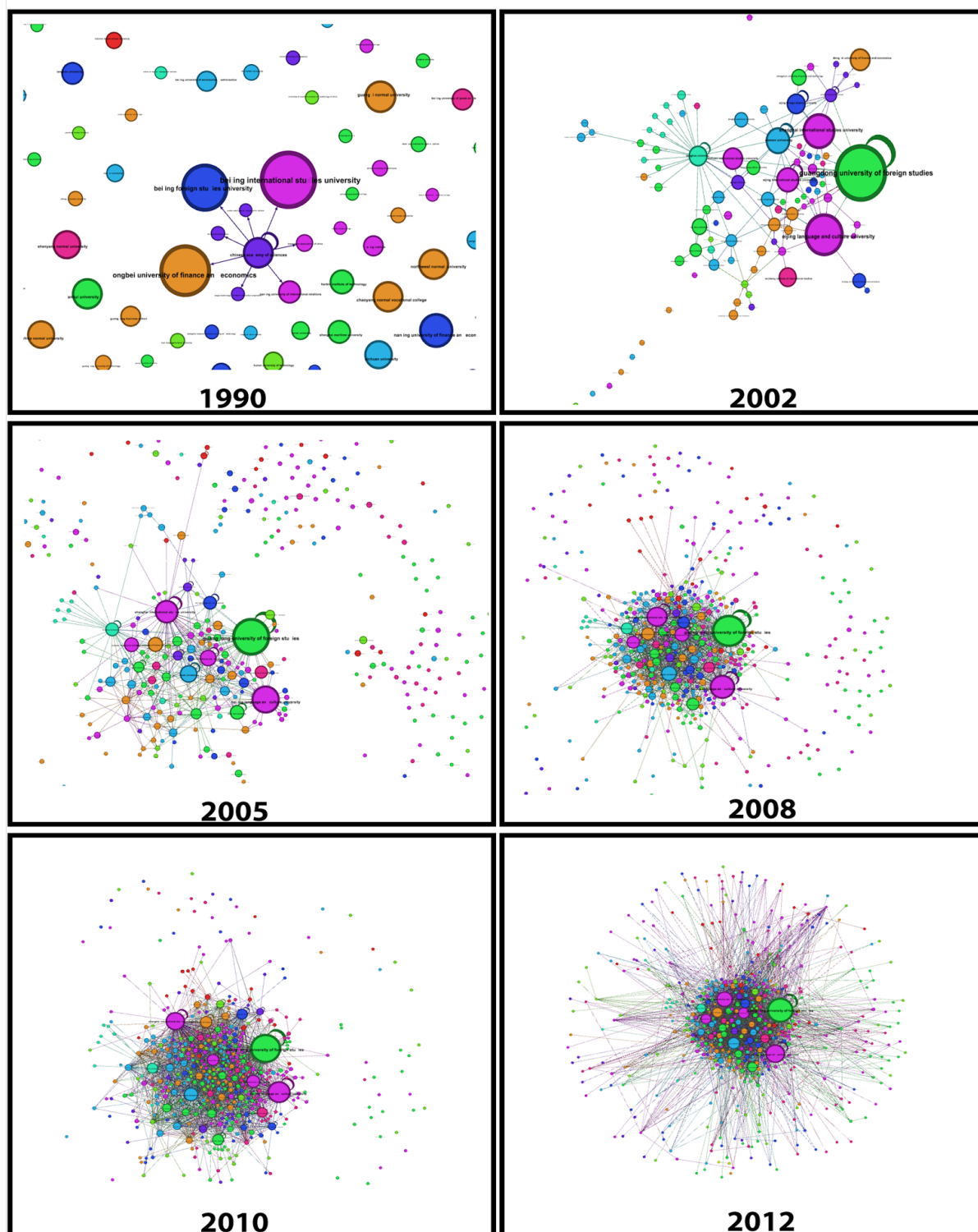
Figure 11: Institutional networks consolidated and centralized over time. Only the snapshots that most clearly show distinct patterns were selected for this figure.

It was clear from examining the dynamic visualization (Figure 11) that in 1990 CAS occupied the center 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 ('self-citations'). 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 and BLCU 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), Beijing International Studies University (BISU) and XU, 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

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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.

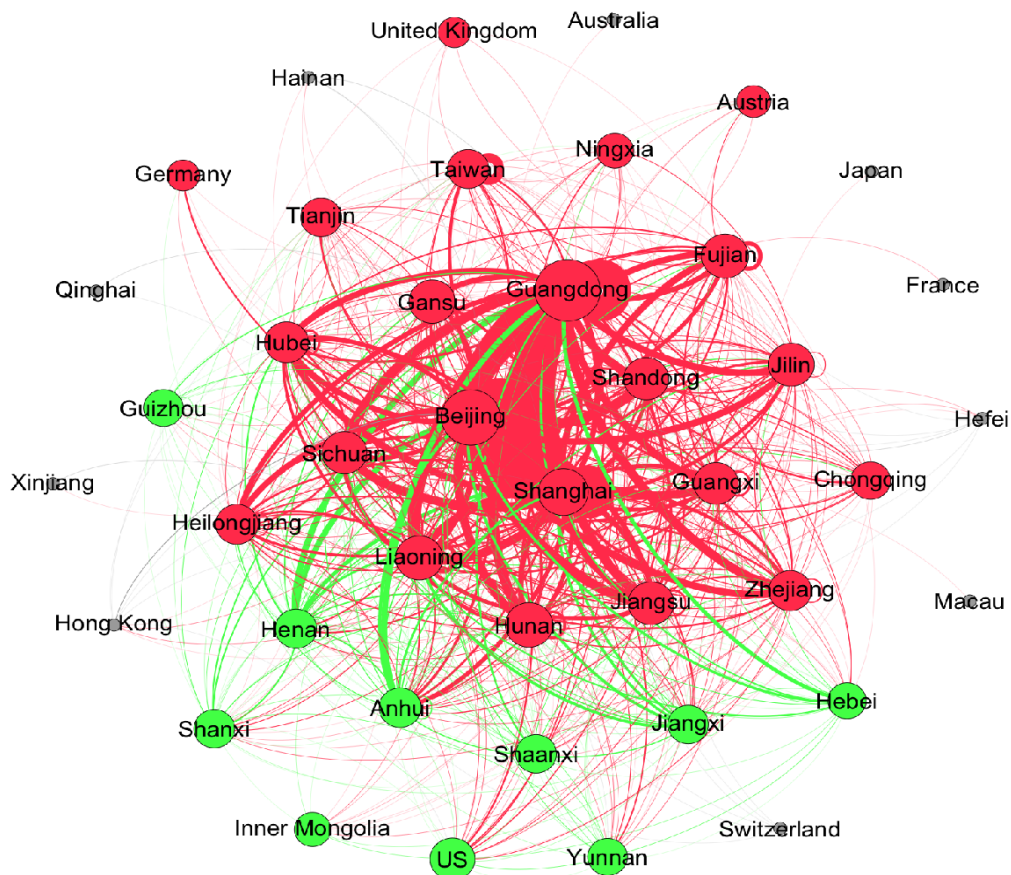## 5.3 Does CIS research vary between regions? How do the regions' relative influences change over time?



Figure 12: Static visualized citation network for locations based on 2013 citation data

Figure 12 demonstrates that, geographically speaking, the citation network was moderately homogenous in 2013: there are only three colored communities on the graphic – red, green and gray, with the first two being massively dominant. Beijing, Shanghai and Guangdong form the nucleus of the red community, having large numbers of incoming and outgoing citations, between both themselves and the wider community. It is immediately clear that there are no leading locations in the green community, because each place has very similar in-degree centrality scores, i.e. they have similar node sizes. In addition, both the green and gray communities are at the periphery of the citation network, indicating that their members have marginal research impact in CIS.
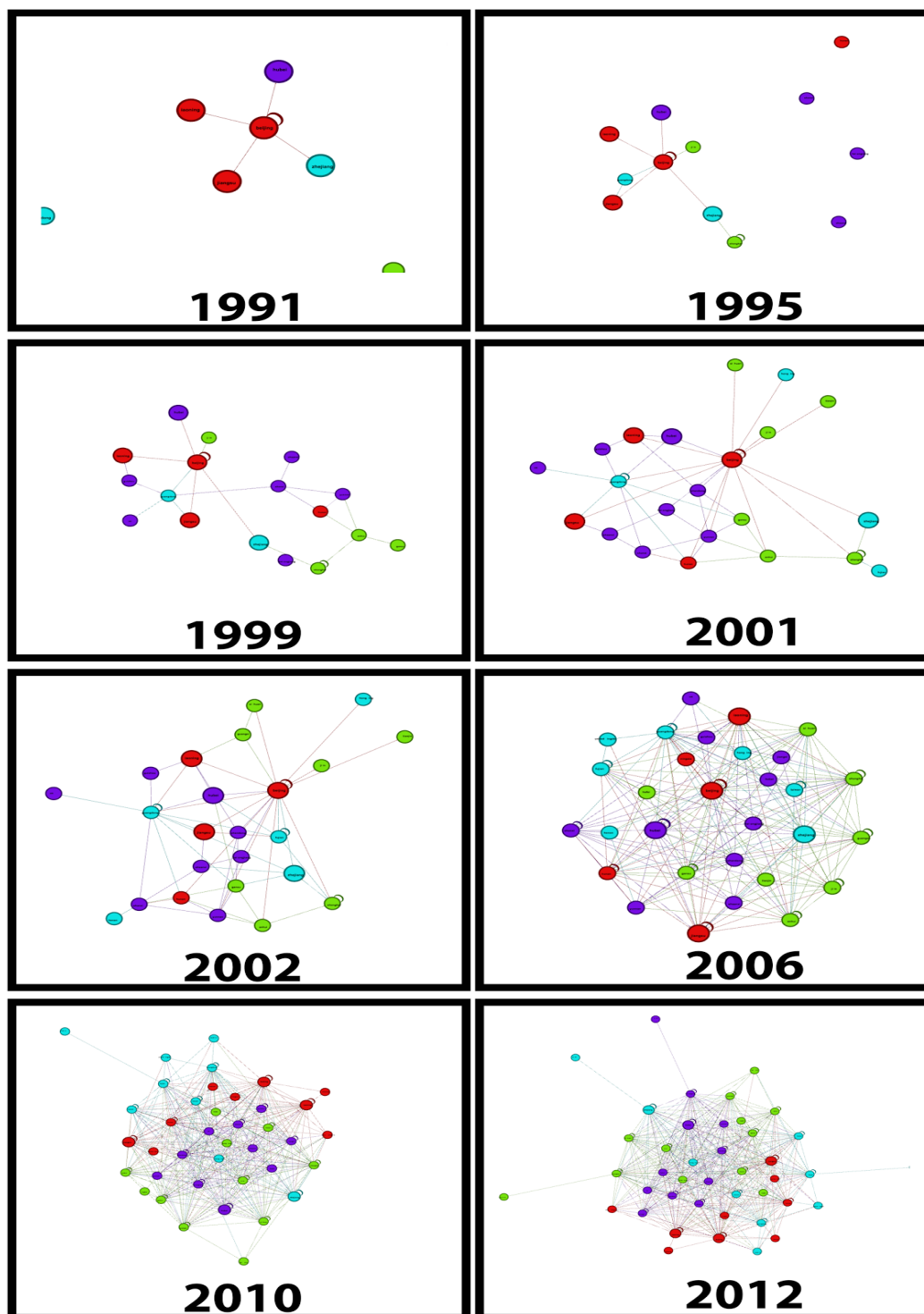
Figure 13: Locational networks consolidated and centralized over time. Only the snapshots that most clearly show distinct patterns were selected for this figure.

A dynamic visualization was created for the citation network of different locations in CIS[12] (Figure 13). In the 1990s, owing to the limited number of papers published in the community as a whole, each location had a similar number of incoming citations. Jiangsu, Beijing and Liaoning cited one another's works closely and belonged to the same community (red), but Beijing became the most influential in 1995. By 1999 the influence of Beijing and Hunan was continuing to rise as they received more incoming citations. By 2001 more locations were growing in influence, but Beijing continued its dominance. However, by 2002 Guangdong had emerged as another influential region in its own right. Together with Zhejiang, Chongqing and Fujian, it created a separate citation network (light blue), distinct from the red one formed by Beijing, Liaoning and Jiangsu.

By 2006, another new citation network (green), led by Shanghai, Gansu and Sichuan, had become a notable presence in the CIS community. By 2010 the purple citation network formed largely by Hubei and Shandong had become very visible. From that point forward sustained growth in the number of incoming citations for the different locations was observable, but Beijing, Guangdong, Liaoning, Hunan and Shanghai remained dominant. It should be noted here that geographical proximity does not determine which location belongs to which citation community: Jiangsu borders Shanghai, but it belongs to the red community of which Beijing is the center; Henan and Beijing are neighbors on the map, but the former is part of the light blue community

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[12] The animated version can be viewed by clicking this link:
http://interpretrainer.com/videosplay.php?id=14&view=1

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dominated by Guangdong; Hunan is situated to the northwest of Guangdong, yet forms part of Beijing's red community.

## 6. Conclusion

The 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 means of PageRank algorithm, and further examined the top-ranking Chinese and Western empirical studies, offering possible explanations for their popularity in CIS. The results revealed 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 one from the Western list adopted an empirical methodology. A more detailed analysis of the most influential empirical studies revealed that they were primarily published as articles in journals, as opposed to monographs or textbooks. Observational and experimental approaches were the preferred research methodologies for the most influential empirical studies.

The present author also sought to spotlight the merits of data visualization 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. When the various regions' influence on CIS research was examined, the results suggested that the citation network was dominated by one large community and influenced by two smaller marginal ones. Over the past two decades, Guangdong and Shanghai have created circles of influence of their own that are distinct from the long-standing one led by Beijing. Interestingly, geographical proximity does not determine the citation community a location belongs to. 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 endeavor.

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