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BIBLIOMETRIC ANALYSIS OF SOCIAL PRESENCE

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Abstract

As a popular phenomenon today, social presence theory plays a signified issue in the information systems and education fields since this theory was introduced by Short et al. in 1976. Furthermore, social presence has been receiving a growing attention in the academic literature. This study aims to investigate the current state of the academic literature regarding social presence theory and to analyze its knowledge base by using bibliometric method. All articles collected from SSCI database were published from 1977 to 2013. The result indicated that the literature productivity on social presence theory is still growing. The result also found that the author productivity distribution data was related to social presence theory matched Lotka's law.

Keywords: Bibliometric, Social presence theory, Lotka's law

1 INTRODUCTION

The concept of social presence was first proposed by Short, Williams, & Christie (1976), and this theory discusses the social effects a medium of communication may generate. Social presence is the degree to which people establish close and interpersonal connections with each other during interaction in a communication medium (Fulk, Schmitz, & Streinfield, 1990; Short, Williams, & Christie, 1976). To date, the social presence has been widely applied to study website design (Cyr, Head, Larios, & Pan, 2009), education environment (Liu, Liao, & Pratt, 2009), e-commerce (Gefen & Straub, 2004) and community media (Dunlap & Lowenthal, 2009).

In the past, Bibliometrics was a research method used in library and information sciences. Bibliometric methods were used to serve the purposes of description, evaluation and scientific monitoring (Polanco, 1995). This study attempts to use bibliometric analysis to identify the current state of the academic literature regarding social presence and analyze its knowledge base such as research authors, research countries, document type, keyword analysis, and subject areas. Furthermore, Lotka's law is applied to perform author productivity analyses in this field during 1977- 2013 for discovering historical vein and research tendency in the future.

In the following section, the related literature including that on the Lotka's law and social presence will be reviewed. Then, the applicability of the research methodology in the empirical context will be reported in Section 3, followed by an analysis and the empirical results in Section 4. The conclusion and implication will be presented in the final section.

2 DATA COLLECTION

In this study, all articles were collected from the Citation Database of Social Science Citation Index (SSCI) and obtained on Web of Science created by the Institute for Scientific Information (ISI). The first issue related to social presence was published in 1976 (Short et al., 1976), thus the articles from 1977 to 2013 were adopted and analyzed in this study. In addition, two keywords, "social presence theory" and "social presence", were used to filter articles' title in order to obtain the most relevant articles to this topic. As the results, a total of 423 papers in social presence published during 1977-2013 were analyzed. The document information included title, publication year, keywords, subject categories, countries, and publishing journals. Microsoft Excel was also utilized to analyze those records.

3 DESCRIPTIVE STATISTICS

The analysis of the research articles was focused on the period from 1977 to 2013. The number of articles published in academic journals was only 1 in 1982, and that publications are also increasing gradually each year. To date, 74 articles have been published in 2013; if this growth rate continues, we could expect to see approximately 100 academic articles on social presence theories published in SSCI journals most considerable rate. The distribution of number of published papers in each year is presented in Table 1.

Publication Year	Record Count	%	Publication Year	Record Count	%
2013	74	15.49%	2001	6	1.58%
2012	64	16.80%	2000	6	1.58%

2011	51	13.39%	1999	5	1.31%
2010	40	10.50%	1998	4	1.05%
2009	32	8.40%	1997	3	0.79%
2008	28	7.35%	1996	2	0.53%
2007	15	3.94%	1994	2	0.53%
2006	15	3.94%	1993	2	0.53%
2005	13	3.41%	1992	2	0.53%
2004	13	3.41%	1990	1	0.26%
2003	10	2.63%	1986	1	0.26%
2002	6	1.58%	1982	1	0.26%

Table 1.   The tendency of literature growth of social presence

Obviously, the number of literature citation of social presence has been increasing steadily and gradually since 2005. It appears that the research on social presence has been very popular and still in the highly mature period as shown in Figure 1.
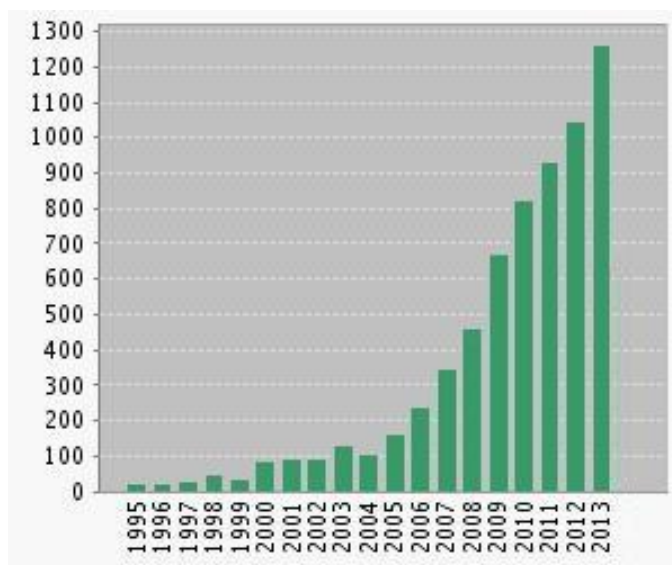

Figure 1.   Citation in each year

It is important for researchers to gain a better understanding into the distribution of top 10 subject areas for future trends and research directions. In this study, indicates the top five subject areas of social presence are "Education & Educational Research", followed by "Information Science & Library Science", "Management", "Psychology, Multidisciplinary", and "Communication",. The result discoveries that social presence has been considered as an important issue in Education & Educational Research; this is, social presence has been widely used cross-discipline theme.

According to our retrieval and statistics from SSCI database, Table 2 shows the top 10 countries from which social presence theories are most widely published. Among all the country matters listed here, USA takes the lead with 208 papers (50.13%) against the total of 423 papers retrieved, following by the Canada, South Korea, England, and People's Republic of China which achieved the record count as

45 (10.63%), 33 (7.80%), 24 (5.67%), and 24 (6.67%). Noteworthily, Taiwan is ranking as (7 in this research domain, indicating that Taiwan is still the main productivity country within the research aspect of social presence in the world.

Ranking	Country	Record Count	%	Ranking	Country	Record Count	%
1	USA	208	49.17%	7	GERMANY	20	4.72%
2	CANADA	45	10.63%	7	TAIWAN	20	4.72%
3	SOUTH KOREA	33	7.80%	9	AUSTRALIA	15	3.55%
4	ENGLAND	24	5.67%	10	FRANCE	11	2.60%
4	PEOPLES R CHINA	24	5.67%	10	SPAIN	11	2.60%
6	NETHERLANDS	22	5.20%		Others	70	19.95%

Table 2.   Distribution of top 10 productivity countries

In this section, we limited the number of articles to only those authors who have 4 or more articles during the period 1977-2013 for reporting purposes. Table 3 lists the resulting 5 authors, sorted by the number of publications, along with their current affiliation. The top 1 author in the list is Lee K.M., with Sungkyunkwan University. According to the analysis of article, the authors with relatively higher productivity are from North America academic institutions and performed high productivity in this research domain. That means social presence has been caught more attentions by North America authors.

Ranking	Author	Affiliation	Record Count	%
1	Lee, K.M.	Sungkyunkwan University	10	2.62%
2	Jin, S.A.A.	Boston Colleage	8	1.83%
3	Lowry, P.B.	Brigham Young University	8	1.83%
4	Shin, D.H.	University of British Columbia	7	1.83%
4	Garrison, D.R.	McMaster University	6	1.58%

Table 3.   Distribution of top 5 authors

Besides the subject area, this study also analyzed the distribution of publishing journals in social presence. Table 4 shows the top 10 primary journals that social presence articles were published in, and they are as follows: Computers in Human Behavior has 36 publication papers (8.51%), followed by the Computers & Education (25 record counts, 5.91%), Internet and Higher Education (17 record counts, 4.02%), International Review of Research in Open and Distance Learning (12 record counts, 2.84%), and Presence: Teleoperators and Virtual Environments (10 record counts, 2.36%). The top five journals with the most publications belong to the subject category of education & educational research and others are mostly the subject categories of information science & library science, management and communication. These distributions are basically consistent with the trend of category pattern analyzed previously. The result conjecture can be made that social presence research in the field of education has continuously developed to a mature stage.

Journals	Record Count	Rank (%)

Computers in Human Behavior	36	8.51
Computers & Education	25	5.91
Internet and Higher Education	17	4.02
International Review of Research in Open and Distance Learning	12	2.84
Presence: Teleoperators and Virtual Environments	10	2.36
British Journal of Educational Technology	9	2.13
Journal of Management Information Systems	9	2.13
MIS Quarterly	9	2.13
International Journal of Human Computer Studies	8	1.89
Cyberpsychology Behavior	7	1.66

Author keywords: the keyword provided by authors; %: the percentage of the author keyword.

Table 4.   The publishing journal of social presence

In addition, this research also conducted the keyword analysis. The author keyword analysis could provide the information of research trends which is concerned by most authors. In previous studies, bibliometric analysis can use author keywords to analyze the trend of research (Xie et al., 2008). By examining the articles during this period, we found that 1600 author keywords were used. The top five keywords are, "Social presence", "Computer-mediated communication", "Online learning", "Social Network", and "Community of inquiry".

4   LOTKA'S LAW AND AUTHOR PRODUCTIVITY ANALYSIS

This study contained only journal articles published during 1977-2013 on various aspects of social presence. The least-squares method described by Pao (1985) was employed. In the first and second stage, this study calculated data and described authors' productivity in social presence (see Table 5). 415 articles and 773 authors in total were summed up in this study. Among the 773 authors, 2 authors published more than five articles, with the maximum count being nine. Furthermore, 472 (88.56%) authors published only one article. The result displayed that the papers of social presence were usually generated by a single author.

(A)Record Count (x)	Author(y)	X=log(x)	Y=log(y)	XY	XX
1	702	0	2.67	0	0
2	45	0.3	1.65	0.495	0.09
3	11	0.38	1.04	0.5992	0.2304
4	3	0.3	0.48	0.188	0.36
5	1	0.4	0	0	0.49
9	1	0.4	0	0	0.9025
Total	773	3.03	5.84	1.3822	2.0729

Table 5.   The productivity analysis of authors

In the third stage, the n value is calculated by Lotka method using the following equation (2):

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

(2)

We can use the values from Table 10 into equation (2), and the value of n = -3.0741.

In the forth step, the value of constant C is calculated using the following equation (3):

$$C = \frac{1}{\sum\limits_{1}^{p-1} \frac{1}{X^n} + \frac{1}{(n-1)(p^{n-1})} + \frac{1}{2*p^n} + \frac{n}{24*(p-1)^{n+1}}}, p = 6, \quad X = 1,2,3,4,5.$$

(3)

$$C = \frac{1}{\sum\limits_{1}^{5} \frac{1}{X^n} + \frac{1}{(n-1)(6^{n-1})} + \frac{1}{2*6^n} + \frac{n}{24*5^{n+1}}}, X = 1,2,3,4,5.$$

C = 0.780036343

When we got n=-3.1341, C=0.780036343, we can use the value of n and C into equation (1)

(i.e., $f(x) = \frac{0.780036343}{x^{-3.1341}}$).

Pao (1989) indicated that absolute value of n should be from 1.2 to 3.8 which were formulated by the generalized Lotka's law, and the result is matched the reference data by observation. In order to test the theoretical value and the observation value are fit, this study further used K-S test to evaluate the preciseness of Lotka's law. Regarding the n and C value derived from the formula, this study calculated the expected value and the accumulation value of author, following by K-S test examination.

Finally, according to the K-S test, we find Dmax= 0.0446 (Dmax= Absolute Value $|Fo(X) - Sn(X)|$);

and if the sampling number is bigger than 35, the threshold value is 0.0398 ($\frac{1.63}{773^{0.5}} = 0.0606$). Since the value of Dmax is less than the threshold value, the result matched the generalized Lotka's law; that is, the author productivity distribution data in Table 6 is consistent with social presence theories.

Record Count(a)	Observation by Author(s)	Accumulated Value Sn(X)	Expected Value by Author(s) %	Accumulated Value Fo(X)	Absolute Value |Fo (X)-Sn(X)|
1	0.8856	0.8856	0.8400	0.8400	0.0456
2	0.0844	0.9700	0.0999	0.9400	0.0300
3	0.0206	0.9906	0.0288	0.9687	0.0219
4	0.0056	0.9962	0.0119	0.9806	0.0156
5	0.0019	0.9981	0.0060	0.9866	0.0115
9	0.0019	1.0000	0.0034	0.9900	0.0100

Table 6.   The productivity analysis of authors

5 CONCLUSIONS

The topic of social presence has been receiving a growing attention in the academic literature. According to the analysis of this study, several findings are reported as follows. First, the literature productivity on social presence is still growing. Second, the main research scholars have written most of the social presence papers in the North America. Third, social presence has been mainly applied into some subject areas such as Education & Educational Research, Information Science & Library Science, Management, Communication, and Psychology Multidisciplinary. Fourth, the result of the main keyword analysis indicated some popular trends that have been discussed were computer-mediated communication, online learning and e-commerce. Finally, K-S test proved that the frequency indexes of author productivity distribution certainly followed Lotka's law.

In conclusion, the productivity distribution related to social presence was explored using the bibliometric methodology in this study. Our findings have the following implications. First, this research on the productivity distribution of social presence may inform researchers and scholars of current issues and development of social presence. Second, with regard to author productivity, our study proposed a theoretical model, based on Lotka's law, for author productivity analysis of social presence, which can serve as reference for different areas of study in the evaluation of author productivity models. Also, in order to allow researchers to gain in-depth insights, this study aimed to report the most published institutions and keep track of the growth and trend of author productivity, by which scholars in related fields are provided with more opportunities for academic communication and technological cooperation.

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