Influence of *Human Behaviour and the Principle of Least Effort* on library and information science research

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Introduction

The principle of least effort (PLE), a concept advanced by the American linguist George Kingsley Zipf, indicates that people complete tasks by choosing the way of least effort among various options (Zipf, 1949). To prove that the PLE is an indication of human nature, Zipf analyzed numerous empirical data collected from various human activities and used mathematical formulae to explain his findings. Zipf explained the PLE in detail in his classic 1949 entitled *Human Behaviour and the Principle of Least Effort: An Introduction to Human Ecology* (HBPLE).

The PLE represents a common human behavior; it may thus be expected that the HBPLE has become visible in various fields and applied to various human activities. HBPLE was also compared with similar theories and was reconceptualized in the field of library and information science (LIS) (Austin, 2001; Gratch, 1990). The LIS publications on PLE have indicated that the concept of the PLE is connected to various topics (Bronstein, 2008; Chrzastowski, 1995, 1999; Kim, 1982; Wang, 2001).

This paper presents partial results of a research project for exploring the interdisciplinary influences of HBPLE. The focuses is this paper are on which concepts and citation functions of HBPLE were cited by authors of LIS articles that were published between 1949 and 2013. We analyzed citation frequency trends and the research topics of citing articles to identify emerging trends in the influence of HBPLE on LIS research and to determine which topics in LIS research have involved applying the concepts in HBPLE. In addition, citation context analysis was used to identify the cited concepts and the citation functions of HBPLE; thus, whether the PLE was the most frequently cited concept in HBPLE and the reasons HBPLE was cited were identified. The results may contribute to the understanding how a classic book on linguistics has influenced LIS research.

Methodology

The bibliographic records of LIS articles citing HBPLE published between 1949 and 2013 were searched and collected from the database Web of Science. The LIS journal candidates had to be included in the subject category of "Information Science and Library Science" in the 2012 Journal Citation Reports and the subject category of "Library and Information Science" in the database provided by Ulrichsweb.com. The publication language of articles had to be English and only research articles were collected. Regarding the search strategy used for collecting the citing articles, search terms were combined in two designated fields: the cited author field and publication year of the cited work.

A citing article could have two or more citation contexts referring to HBPLE. Each in-text citation was defined as an independent citation context. Of the 274 citing articles, three were excluded from the dataset because of citation errors existed between the in-text references and reference lists (two articles), or because full-text articles could not be obtained (one article). Finally, we analyzed 260 citing articles including 310 citation contexts. The records of cited concepts were analyzed and divided into several categories. The classification scheme of citation functions was developed based on a temporary classification scheme devised after reviewing previous studies and was modified during the analysis process. The main topic of each citing article was also coded.

Results

Topics of citing articles

Table 1 shows that HBPLE is more associated with bibliometrics and information retrieval research than are other research topics.

Table 1. Distribution of citing article topics.

Topics	No. of articles	Percentage
Bibliometrics	121	46.5
Information retrieval	64	24.6
Information behavior	24	9.2
Information system	12	4.6
Information service	7	2.7
Collection development	7	2.7
Information science	7	2.7
Knowledge organization	7	2.7
Management	5	1.9
Scholarly communication	3	1.2
Resource allocation	2	0.8
Information literary	1	0.4
Total	260	100.0

Cited concepts and citation functions

Table 2 shows the distribution of 17 cited concepts in 11 citation functions. The most frequently cited concept was "Zipf's law" and was mainly used for comparison with other bibliometric laws, whereas the second-most cited concept, the "PLE," was mainly used as evidence.

Among 201 citation contexts referring to the concept of "Zipf's law," 52.2% used the term "Zipf's law," 28.4% used other terms, such as "Zipfian distribution," "power law," "hypobolic distribution," and "rank-size law," and 19.4% contained a statement to describe or imply the concept of "Zipf's law." Although Zipf's law is a well-known informetrics law, not all authors have used the formal term "Zipf's law" to refer to the law emphasizing the relationship between word rank and word frequency.

Although the concept of the PLE, which is derived from Zipf's law, is the focus of HBPLE, the number of citation contexts referring to the PLE was lower than that referring to "Zipf's law." This result ran counter to our assumption that the number of citation contexts referring to the concept of the PLE would be highest. This implies that citing behavior is complicated and that various motivations for citing publications also affect the visibility of cited publications.

Table 2. Distribution of cited concepts according to citation functions.

Cited concepts	Citation functions										
	E	C	RS	H	R	D	E	F	Exp	T	M	Total
Zipf's law	29	38	30	27	21	22	17	7	4	5	1	201
Principle of least effort	15	13	8	6	11	7	1	4	8	3		76
HBPLE	2		2	2	2		1					9
Word distribution	3	1	1				1					6
Human behavior			2									2
Information cycle	2											2
Publication productivity			1	1								2
Rank				1								1
Sample size						1		1		1		3
Information nonuse		1										1
Language analysis	1											1
Lotka's law					1							1
Richer effect									1			1
R.Y. Chao	1											1
Signal information theory							1					1
Social physics							1					1
Optimization problem							1					1
Total	53	52	45	37	34	30	21	14	13	9	2	310

Note: (1)E: Evidence. (2)C: Comparison. (3)RS: Related studies. (4)H: History. (5) R: Relationship (6)D: Definitions. (7)E: Examples. (8)F: Further reading. (9)Exp: Explanations. (10)T: Terms. (11) M: Methods.

The 17 cited concepts were examined by year. Figure 1 shows large fluctuations for the two concepts of "Zipf's law" and the PLE; opposing trends appear. A "falling after rising" trend was observed in the concept of "Zipf's law" whereas a "rising after falling" trend was evident for the concept of the PLE. These opposing trends have resulted in a decreased difference in the annual percentage between the top two cited concepts.

Although a close relationship exists between the PLE and Zipf's law, they exert an evidently different influence.
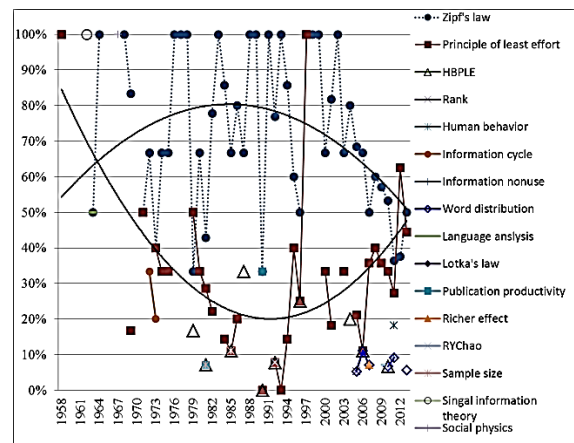

Figure 1. Changes in the percentage of cited concepts by year.

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