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Multilevel Structures, Connection and Balance: The Evolution of the Structure of Science

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Introduction

Efforts to map the structure of science began in the sixties with the work of Garfield, Sher, and Torpie (1964), among others. Since then, various other approaches have been developed. In this study, we examine how updates to the Web of Science (WoS) categories influence these scientific maps

Journal categories and their groups and broad categories

When categories in the WoS are updated, we wonder what influence this has on the resulting maps. In this contribution, we make a comparative study to answer this question. We collected data, using the same method as in Liu (2018) to construct a map of the structure of science of 2024. When exploring the logic and landscape of the knowledge system, multilevel structures are often used to map the structure of science (Li, 2016).

There are two subject categorization schemes provided by the WoS. One scheme is for the Journal Citation Reports (JCR) specifically. In this scheme, the journals in the JCR are assigned to categories. In the 2024 version of the JCR, we notice that the categories are further divided into 21 groups. Another scheme is shared by all Web of Science product databases. In this scheme, the objects of all the databases are divided into different research areas. Research areas are classified into five broad categories: Arts & Humanities; Life Sciences & Biomedicine; Physical Sciences; Social Sciences; and Technology. We add multidisciplinary as the sixth broad category.

Table 1 shows the basic framework used here to analyze the structure of science, while the resulting structures of science are shown in Figures 1a and 1b, using VOSViewer.

Results

JCR categories schemes and research areas are two subject categorization schemes provided by the WoS. We map the two schemes and obtain a multilevel structure of journals, JCR categories, JCR groups, and Broad Categories. The change of categories leads to a change in the structure of science. The structure based on the 2016 data is like two opposite poles, with Science and Technology at one pole, and

Humanities & Social Sciences at the other one. The categories in the structure of 2024 are connected and have a triangular shape. The first one is that art & humanity and social sciences are split into two clusters in 2024's structure. One cluster includes more of the categories of art and humanity, the other contains more of the categories of the social sciences. Most of the moved categories are in the broad categories of technology, life science & biomedicine. Changes are explained by the fact that knowledge itself evolves and has no clear borders between disciplines. It percolates through a multilevel structure as shown in this article.

Table 1. Multilevel subject categorization scheme used in this study.

Broad categories	*JCR groups*	*Number of JCR categories*	*Number of journals*
Art & Humanity	Arts & Humanities, Interdisciplinary	8	1016
	Philosophy & Religion	7	988
	Literature & Language	17	1628
	Visual & Performing Arts	10	930
Social Sciences	History & Archaeology	9	1403
	Psychiatry/Psychology	16	1555
	Economics & Business	21	3464
	Social Sciences, General	41	6561
Life Sciences & Biomedicine	Agricultural Sciences	7	441
	Biology & Biochemistry	34	4026
	Plant & Animal Science	17	1635
	Clinical Medicine	59	7627
Physical Sciences	Chemistry	21	2412
	Physics	34	3067
	Mathematics	12	1807
	Environment/Ecology	13	1753
	Geosciences	14	1112
Technology	Materials Science	17	1660
	Engineering	41	3663
	Computer Science	14	1619
Multidisciplinary	Multidisciplinary	36	5859

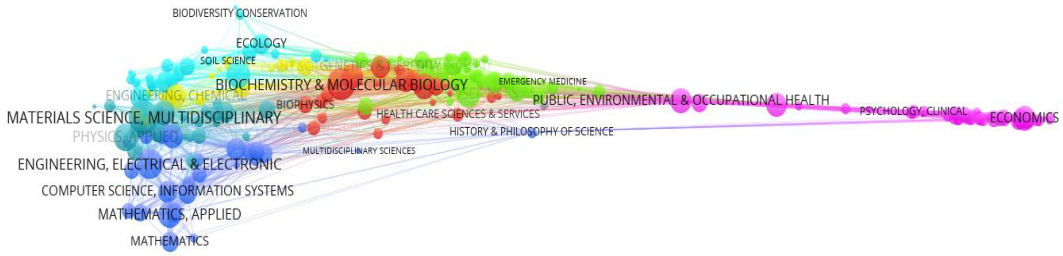

Figure 1a. 2016's structure of science constructed with JCR categories with the number of common journals as linkage strength.

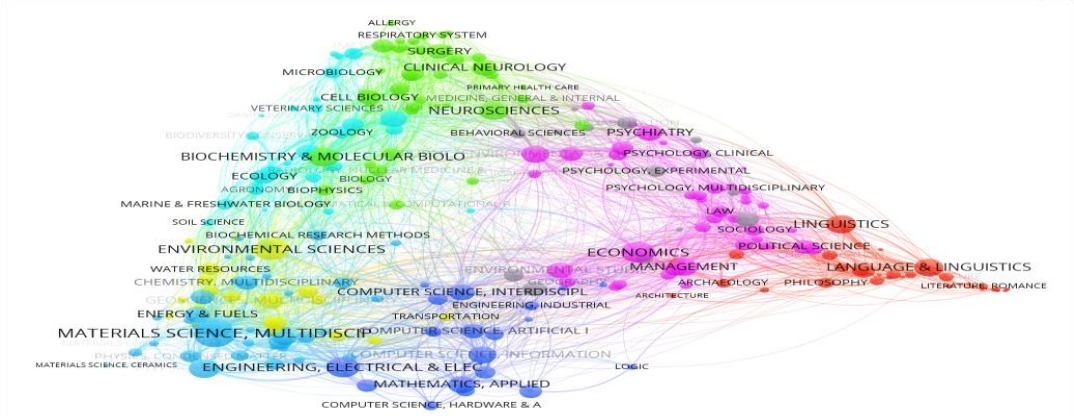

Figure 1b. 2024's structure of science constructed with JCR categories using the number of common journals as the linkage strength.

Acknowledgments

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