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★The socio-epistemic networks of general relativity, 1925–1970.
The renaissance of general relativity in context, 15–84, *Einstein Stud.,* 16,
Birkhäuser/Springer, Cham, [2020],

The authors present a scientometric study of research related to Einstein's general theory of relativity, unified field theory and quantum gravity from 1915 to 1975. The field and period are not chosen at random: scientific interest in this domain waned with the discovery of quantum mechanics in 1925 and remained modest until the 1960s, when advances in relativistic astrophysics and cosmology were realized. The latter evolution, loosely described as the "renaissance" or "golden age" of relativity, is what this paper aims to quantify.

A major obstacle for such an endeavor is the paucity of publications in the field prior to the 1950s. The authors seek to overcome this barrier with social network analysis, the details of which they present in a companion paper [Scientometrics **122** (2020), no. 2, 1129–1170, doi:10.1007/s11192-019-03327-1]. The present paper describes three quantitative approaches, referred to as "layers": social (i.e., personal and institutional collaborations), semiotic (i.e., citation and co-citation analysis), and semantic (i.e., topic modeling and analysis). Articles and books from a corpus of 8296 titles extracted from the Web of Science (WoS) database are grouped by co-citation figures and characterized by centrality measures of betweenness and closeness, in five-year bins from 1946 to 1975.

The robustness of the semantic model is not quantified, while the authors acknowledge the dependence of centrality measures on subjective pruning of the dataset in one of the five-year bins (p. 57, footnote 29). The publication corpus itself is constructed mostly from title keywords, with a complement of items citing Einstein's publications. By construction, the corpus is thus biased in favor of Einstein's approaches to general relativity and unified field theory, discounting, in effect, the many alternatives proposed over the years. A second built-in bias arises from selective journal indexing by WoS, which affects identification of co-citation networks and centrality measures. For instance, George D. Birkhoff advanced a flat-space theory of gravitation in 1942 [G. D. Birkhoff, Rev. Ci. (Lima) **44** (1942), 253–257; MR0007308; see also Bol. Soc. Mat. Mexicana **1** (1944), no. 4 and 5, 1–23; MR0011950], when the yearly average (as reported by the authors) was less than 25 publications. Had the WoS indexed the *Boletín de la Sociedad Matemática Mexicana,* which published seven papers on Birkhoff's theory in 1944 and 1945, the theory would have been identified in a co-citation cluster. As it stands, even without the *Boletín*'s papers, the authors' "semio-semantic" fusion of topic modeling and co-citation analysis points to a significant role for Birkhoff's theory in the late 1950s.

Overall, the authors' innovative multi-layer analysis gives rise to a valuable new perspective on the evolution of research related to general relativity and unified field theory in the period of study.

{For the collection containing this paper see MR4305117}

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