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Journals as retention mechanisms of scientific growth

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Among the many discoveries that Derek de Solla Price made during his lifetime, I find Figure 1 the most inspiring *(1)*. In this picture, de Solla Price provides a graphic illustration of the exponential growth of scientific journal literature since the appearance of the first journals in 1665. De Solla Price was fascinated with journals and their exponential growth in size and numbers ever since his first study of the *Philosophical Transactions of the Royal Society* of London from its very beginning in 1665 *(2, 3)*.

On the basis of an experimental version of the Science Citation Index in 1961, de Solla Price formulated a program for mapping the sciences in terms of aggregated journal-journal citation structures as follows:

> "The total research front of science has never, however, been a single row of knitting. It is, instead, divided by dropped stitches into quite small segments and strips. From a study of the citations of journals by journals I come to the conclusion that most of these strips correspond to the work of, at most a few hundred men at any one time. Such strips represent objectively defined subjects whose description may vary materially from year to year but which remain otherwise an intellectual whole. If one would work out the nature of such strips, it might lead to a method for delineating the topography of current scientific literature. [...] Journal citations provide the most readily available data for a test of such methods" *(4)*

Organization of knowledge

Over the past 20 years, I have addressed the question of whether the aggregated citation relations among journals can be used to study clusters of journals as representations of the intellectual organization of the sciences. If the intellectual organization of the sciences is operationalized using journal structures, three theoretically important problems can be addressed:

> 1. In science studies, this operationalization of the intellectual organization of knowledge in terms

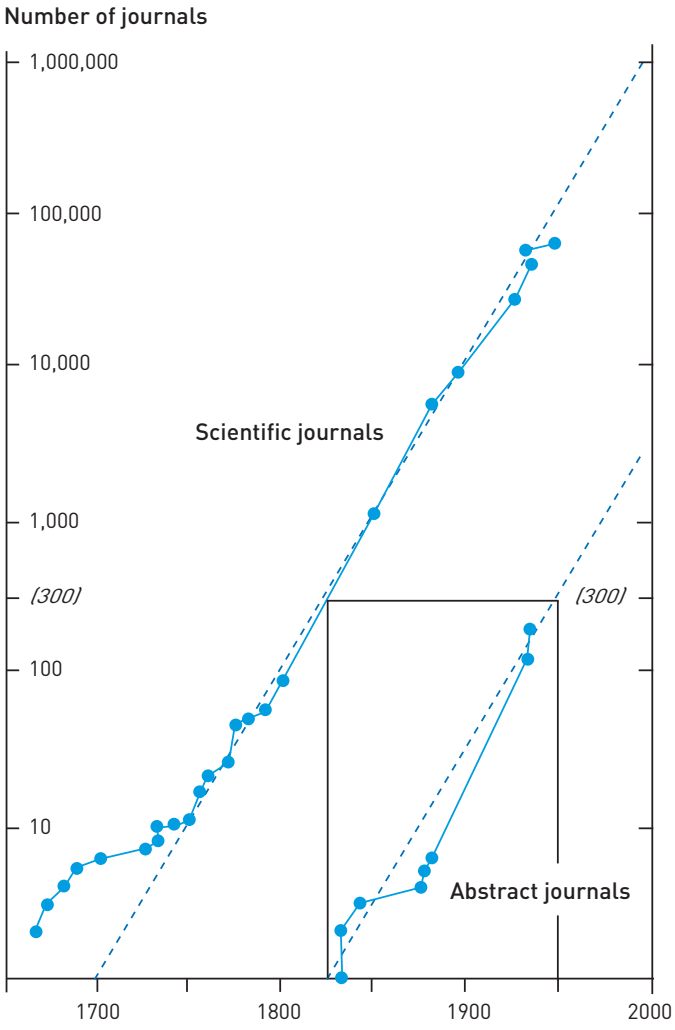

Figure 1 – In this graph showing the number of journals founded (*not* surviving) as a function of date (NB, the two uppermost points are taken from a slightly differently based list), de Solla Price provides a graphic illustration of the exponential growth of the scientific journal literature since the first journals in 1665 *(1)*.

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of texts (journals), as different from the social organization of the sciences in terms of institutions and people, would enable us to explain the scientific enterprise as a result of these two interacting and potentially coevolving dimensions *(5, 6, 7).*

2. In science policy analysis, the question of whether a baseline can be constructed for measuring the efficacy of political interventions was raised by Kenneth Studer and Daryl Chubin *(8; cf. 9, 10).* Wolfgang van den Daele *et al* distinguished between parametric steering, in terms of more institutional activities due to increased funding, versus the relative autonomy and potential self-organization of scientific communication into specialties and disciplinary structures *(11).*

3. While journal Impact Factors are defined with reference to averages across the sciences *(12, 13),* important parameters of intellectual organization, such as publication and citation frequencies, vary among disciplines *(14).* In fact, publication practices across disciplinary divides are virtually incomparable *(15, 16, 17).* The Impact Factor is a global measure that does not take into account the intellectual structures in the database.

Mapping the data

De Solla Price conjectured that specialties would begin to exhibit 'speciation' when the carrying community grows larger than a hundred or so active scientists *(18).* Furthermore, the proliferation of scientific journals can be expected to correlate with this because new communities will wish to begin their own journals *(4, 19).* New journals are organized within existing frameworks, but the bifurcations and other network dynamics feed back on the historical organization to the extent that new fields of science and technology become established and existing ones reorganized.

Whereas the variation is visible in the data, the selection mechanisms remain latent and can therefore only be hypothesized. On the one hand, these constructs are needed as dimensions for the mapping of the data. On the other hand, constructs remain 'soft'; that is, open for debate and reconstruction. De Solla Price's dream of making scientometric mapping a relatively hard social science *(20)* can, with hindsight, be considered as fundamentally flawed *(21, 22).* When both the data and the perspectives are potentially changing, the position of the analyst can no longer be considered as neutral *(23).*

De Solla Price's dream of making scientometric mapping a relatively hard social science can, with hindsight, be considered as fundamentally flawed

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