

Bias Against Novelty in Science: A Cautionary Tale for Users of Bibliometric Indicators: Research Policy (2017)

The Question: Science often advances through incremental work that builds on established veins of research. But sometimes it takes large steps forward through “novel” projects that push science in uncertain but fruitful directions. Predicting these unexpected breakthroughs is a challenge for scientists, journals, and funding agencies. Identifying high-impact, novel projects is difficult to do systematically in publication data. This paper proposes a new way to measure novel papers by identifying articles that made new combinations of reference journals across diverse fields. The authors ask how these novel research articles compare in mean and variance of impact to work that is more closely tied to a single discipline.

The Results: The most novel articles are 57% more likely to become “hit” papers as measured by citations. But the variance of eventual citations is large, with many novel papers producing very little overall impact. The dispersion of citations is 18% higher for the most novel paper than non-novel papers, suggesting these projects can be quite risky. Despite their possibility of future impact, the journals that accept and publish the most novel papers have 17% lower impact factor. The accumulation of citations takes longer for novel papers. On average it takes seven years for novel papers to surpass non-novel papers in their likelihood of being in the top 1% of highly-cited papers. The eventual success of novel papers is in part driven by the fact that they are cited by a broader set of disciplines than non-novel papers.

The Lessons: Scientific research has been characterized of as a combinatorial process. By combining disparate ideas, methodologies, and questions in unique ways, scientists can push the frontier forward in new and productive directions. Novel research in particular can take a long time to be recognized as path-breaking or important. This may be because of resistance from the research community to new ideas or simply because new ideas need an incubation period for their full impact to be realized. But funding agencies may have short time windows (perhaps three to five years) to assess the impact of research tied to grants or fellowships, and declarations of success or failure for these projects may be premature. These short-term assessments of impact may discourage scientists from embarking on novel research and exploring diverse fields of knowledge that could be combined into the next important breakthrough.

The Research Approach: The authors of this paper measure novelty by counting the number of times an article creates new combinations of cited journals. For example, a clinical psychologist might develop a new medical procedure by citing psychology journals alongside a genetics journal that had not been cited in the psychology literature before. An additional indicator of novelty is that the two journals in the newly cited pair are far apart in intellectual distance as measured by citation networks. Novelty in this setting is determined by summing the number of new combinations weighted by their intellectual distance. With this measure in hand, the authors analyze the success of the novel papers by measuring the Impact Factor of the journals they are published in and the number of citations they accrue both in their own field of study and in other disciplines as well.