

INTERVIEW WITH EUGENE GARFIELD, CHAIRMAN EMERITUS OF THE INSTITUTE FOR SCIENTIFIC INFORMATION (ISI)

Cortex: When did you first think about the idea of an Impact Factor (IF)?

Professor Eugene Garfield (Garfield@codex.cis.upenn.edu): I first mentioned the idea of an impact factor in 1955 in a paper published in *Science*. We needed a simple method for comparing journals regardless of their size. So we created the journal impact factor.

Cortex: Do you think it's possible to misuse the IF?

Garfield: At the beginning it did not occur to me that impact would one day become the subject of widespread controversy. It has been misused in many situations, especially in the evaluation of individual researchers. The term "impact factor" has gradually evolved, especially in Europe, to mean both journal and author impact. This ambiguity often causes problems. The use of journal IFs instead of actual article citation counts for evaluating authors is probably the most controversial issue. Arguably, recently published articles may not have had enough time to be cited, so it is tempting to use the impact factor as a surrogate, virtual count. Typically, when the author's bibliography is examined, a journal's IF is substituted for the actual citation count.

Cortex: How is the IF calculated?

Garfield: A journal's IF is based on 2 elements: a) the numerator, which is the number of citations in the current year to any items published in a journal in the previous 2 years, and b) the denominator, which is the number of substantive articles (source items) published in the same 2 years.

Cortex: The two-year window gives great emphasis on current research. Neuropsychology is rather a slow-moving field compared to other topics and therefore it may be penalized. Is there any way to take this bias into account?

Garfield: All citation studies can be normalized to take into account such time variables as half life as well as discipline or citation density. The citation density (references cited per source article) is significantly lower for a mathematics article than a life sciences articles. The half-life (number of years, going back from the current year, that cover 50% of the citations in the current year of the journal) would be longer in physiology than in molecular biology. The IF may not provide a complete enough picture for slower moving fields with longer half-lives. However, when journals are studied within disciplines, the rankings based on 1-, 7- or 15-year impact factors do not differ significantly.

Cortex: Does the IF disadvantage non-English journals?

Garfield: Editors of foreign language journals are not pleased with impact evaluations since English dominates international research and clinical literature. Local clinical journals are by definition less relevant for most researchers, and cited less frequently. They are of great interest to drug firms for marketing reasons.

Cortex: Which items published by scientific journals are or are not considered in calculating the IF?

Garfield: The *Journal Citation Reports* tacitly imply that editorial items can be neatly categorized. Journals publish large numbers of items that are neither traditional substantive research nor review articles. These items (e.g., letters, news stories and editorials) are not included in *JCR*'s calculation of impact. Yet we all know that they are cited, especially in the most recent year. However, the *JCR* numerator includes citations to all items published in these journals. The assignment of article codes is based on human judgment.

Cortex: This means for instance that publishing proceedings from a conference which might be quoted, but less than a full-blown paper, may dilute or increase the IF according to whether or not they are considered as source items. Does this imply that journals that publish lots of letters or editorials take advantage of the calculation?

Garfield: For a small number of journals a bias may be introduced by including in the numerator citations to items that are not part of the denominator of source articles. However, most journals publish primarily substantive research or review articles. Therefore, statistical discrepancies are significant only in rare cases. Most editorial discrepancies are eliminated altogether in another database called the *ISI Journal Performance Indicators (JPI)*. Because this database links each source item directly to its citations, the impact calculations are more precise. Using *JPI* one can also obtain cumulative impact measures for longer periods.



Eugene Garfield.

Cortex: Does the size of the scientific community that is served by a journal influence the IF?

Garfield: There is a widespread but mistaken belief that the size of the scientific community that a journal serves affects the journal's impact factor. While the larger journals receive more citations, the equally larger number of published articles must share them. The size of a field, however, will determine the number of "super-cited" papers. Some are theoretical while some will be methodology papers.

Cortex: What are the other variables that may influence the IF?

Garfield: The time required to review manuscripts may affect impact. If reviewing and publication are delayed, and references to articles are no longer current, they will not be included in the *JCR* impact calculation. Even the appearance of articles on the same subject in the same issue of a journal may have an effect. Indeed, journal impact performance varies from issue to issue.

Cortex: What is the principal application of IF?

Garfield: In addition to helping libraries decide which journals to purchase, journal IFs are also used by authors to decide where to submit their articles. As a general rule, the journals with high IFs are among the most prestigious today.

The perception of prestige is a murky subject. Some would equate prestige with high impact. However, some librarians argue that the numerator in the impact-factor calculation is in itself even more relevant. Journal impact can also be useful in comparing expected and actual citation frequency. Thus, when *ISI* prepares a "Personal Citation Report" it provides data on the expected citation impact not only for a particular journal but also for a particular year, because impacts change from year to year. For historical comparisons, a 1955 article cited 250 times might be considered a "citation classic", whereas the threshold for a 1975 article might be 400 and a 1995 article 1000. These are somewhat arbitrary thresholds. When we solicited author commentaries on *Citation Classics* we often chose the most-cited papers for a given journal which might be the only one in its field.

Cortex: Is IF deserving of our uncritical praise then?

Garfield: IF is not a perfect tool to measure the quality of articles but there is nothing better and it has the advantage of already being in existence. The use of IF as a measure of quality is widespread because it fits well with the opinion we have in each field of the best journals in our speciality.