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From h to g: the evolution of citation indicies

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Expert opinion

From h to g: the evolution of citation indices

Professor Leo Egghe

The h-index has become a familiar term among bibliometricians since its inception in 2005, and is being increasingly adopted by non-bibliometricians. The letter h is often thought to stand for the h in Hirsch, the name of the physicist who developed it, although it is actually short for 'highly cited'. The h-index is therefore the number of papers that receive h or more citations. For example: Professor X has an h-index of 39 if 39 of his 185 papers have at least 39 citations each and the other 146 (185-39) papers have not more than 39 citations each.

Previous indices have tended only to focus on the impact of individual journals, using the average number of times published papers are cited up to two years after publication. This means that one paper in the journal might have been highly cited and another hardly at all but the authors of both are judged equally on the Impact Factor of their journal. While the h-index can measure individual authors, thereby overcoming the shortcomings of journal Impact Factor, it has limitations of its own. "It is insensitive to the tail of infrequently cited papers, which is a good property," says Professor Leo Egghe, Chief Librarian at Hasselt University, Belgium and Editor-in-Chief of the *Journal of Informetrics*, "but it's not sufficiently sensitive to the level of highly cited papers. Once an article belongs to the h top class, the index does not take into account whether that article continues to be cited and, if so, whether it receives 10, 100 or 1000 more citations."

What's in a name?
The g-index is so called for two reasons: Egghe rejected the name 'e-index' on the grounds that it has a different connotation in mathematics. He therefore looked at the two g's in his surname instead. G also falls immediately before h in the alphabet, reinforcing its link to the h-index.

Lotka's Law

This is where the g-index has evolved from its predecessor. It has all the advantages and simplicity of the h-index, but also takes into account the performance of the top articles. It was in direct response to his criticisms of the h-index that Egghe developed the g-index. No newcomer to bibliometrics, Egghe's main area of expertise is Lotka's Law. The premise of this Law is that as the number of articles published increases, the authors producing that many publications decreases. This principle forms the basis of the h- and the g-indices, the formulae for both of which Egghe was the first to prove. The difference between them is that while the top h papers can have many more citations than the h-index would suggest, the g-index is the highest number g of papers that together received g^2 or more citations. This means that the g-index score will be higher than that of the h-index. It also makes the differences between two authors' respective impacts more apparent. "The only disadvantage I've found so far with the g-index is that you need a longer table of numbers to reach your conclusions!" says Egghe.

Access to funds

For many scientists, there is a direct correlation between where they are ranked in their field and the amount of funding they can attract. "Everything is measured these days, which explains the growth of bibliometrics as a whole," says Egghe. "The g-index enables easy analysis of the highest cited papers; but the reality is that as time passes, it's not going to be possible to measure an author's performance using just one tool. A range of indices is needed that together will produce a highly accurate evaluation of an author's impact."