

Completing Hirsch's h-index measuring scholarly impact

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Ranking an individual's research impact is very hard. Unfortunately that's what administrators at universities and laboratories worldwide must do. Who should get more pay? Who should get tenure? Who is more impactful in the world of scholarship? It is seemingly impossible, yet we try anyway.

There is a temptation to take somebody's entire research portfolio and boil it down to one number so that he or she can be ranked more easily with others. One approach is just to count number of papers published, but this makes no sense at all with the rise of "predatory journals," and the willingness of many otherwise good journals to expand beyond reason to make room for low quality work beside high quality work.

Another number used in the past was total citations to research articles. Or in other words, how many times did somebody else write their own research paper and cite you in it. You are considered better if you have a higher number of citations to the body of your work. However, this isn't fair to young people who have not been in the field long, and who have not accrued a large number of citations over time despite perhaps being much better than an older researcher.

Another measure to rectify that is average citations per paper. This doesn't punish the young people as much, because if you have written 5 papers with 200 citations each on average, which makes a total of 1000 citations, it is probably a more impactful career, and a better scholar, than an older colleague who has written 200 papers over decades with only 5 citations each.

However, the problem with citations per paper is that an older person could have written a paper from 30 years ago and get a cagillion citations that accrue every year and not have to do anything more. Their career, and funding, and pay raises, and respect, would be based on interest payments of a good investment decades ago. That is not fair either.

And with this in mind Hirsch introduced [1] the "h index." A researcher's h index value is when they have written at least h number of papers with at least h citations for each paper. This is a nice compromise between consistent value and total citations. A researcher can have a huge number of citations accrued from a paper in 1977 but have a small h index.

The h index has taken universities by storm. Everybody wants to know a person's h index as the most important single number characterizing their research impact. That is not to say that

people do not understand the limitations. Some fields are huge with very large numbers of references in each paper, which inflates the h-index. Other fields have a huge number of authors, and get themselves on a quasi-infinite number of papers (high-energy experimentalists), many of which they have barely read. Their h index shoots up all the same.

Even within a subfield you can have vast differences in how easy it is to get citations and increase the h factor. For a while in particle theory if you had the words “ADS/CFT” or “Neutrinos” anywhere in your title, it automatically meant 50-100 citations. If you ambulance chase — meaning you wrote a paper very fast on an experimental anomaly — you often get very large numbers of citations. That is playing out in the cosmology community right now. There is a citations bonanza for all papers discussing the tensor mode fluctuations of the cosmic microwave background radiation perhaps seen by the BICEP2, or perhaps not.

But do not get me wrong, I think “piling on” for an interesting theory direction or experimental result is entirely appropriate. Experiments cost many millions or even billions of dollars and when results come they should be paid attention to, and focus should happen. And when an incredible theory discovery like the ADS/CFT correspondence comes along, researchers should squeeze it for everything it’s worth. It is nobody’s fault, and it is not dirty, that citations come from this. Trends in research are healthy to really crush the subfield and get all the meaning out that one can. I get annoyed by people who think that a sure proof of original thinking is that nobody cares or cites the paper. (They usually don't phrase it that way, but that’s the upshot.)

Anyway, on a recent visit to the University of Michigan Keith Dienes and I had a discussion about these matters. In the process he told me some of his very interesting insights regarding the h factor. He recognizes that the h factor as a single number measure of scholarly impact is perhaps better than anything else we have that is widely recognized and understood, but suggested how the h factor's utility could be greatly improved or “completed” in a conceptually straightforward way. The fundamental observation he made, which is something a good physicist would think of, is that “numbers of papers” and “citations” are different units. The h factor assumes that the conversion between these two units is always 1, but there are circumstances where that is entirely inappropriate and the h factor then carries no worthwhile meaning. The conversion factor must be calculated for each field, and ideally for each subfield to really measure the impact.

He has been encouraged to write up these thoughts (including by me), since this is such an important consideration at universities these days. Now the paper has appeared on the arXiv [2]. Anybody who is required to think about how impactful researchers are across different fields and even subfields may find it very helpful to read this interesting and insightful paper.

References

- [1] J.E. Hirsch. Proc. Nat. Acad. Sci. 46, 16569 (2005). arXiv:physics/0508025.
- [2] K.R. Dienes. Completing h. arXiv:1404.2603.