

Shrek or Superman? How to measure whether a scientific topic is hot or not?

Ye¹ suggests to determine whether a topic in science is hot or not by means of the so-called hot-degree H -index, which he defines as, ‘The hot-degree of a topic is equal to H , if H is the largest number of publications each with citations at least equal to H on the study of the topic’. This definition is of course based upon Hirsch’s definition of the h -index². In Ye’s opinion, ‘the hot-degree H could become an effective indicator for measuring hot topics. Higher the H value of a topic, more will be the studies on the topic and more will be its impact’.

This idea is interesting because it uses the most common representation of scientific recognition, that is, citation metrics. The more important for science a topic is, the more often it is (or will be) referred to and cited – probably everyone will agree with this. Thus citations – and scientometrics in general – are these days considered important aspects of science, and much work has been done on the topic of evaluating researchers and institutes. However, there should always be some caution while using any citation metrics, also the original Hirsch’s h as well as the hot-degree H indexes.

Below we discuss various aspects of the H -index of hot-degree of a topic that should be carefully considered while using it for searching of hot topics in science. It is important to remember that hereafter the H -index refers to the hot-degree of a topic, and wherever we will need to refer to the original Hirsch’s index, we will use the small letter h .

Out-of-date hot-degree topics – There are topics that have been hot some time ago, but are not anymore. However, since citation count cannot decrease, their H -indices will still be high. For this reason, such a topic can actually have higher H than a recent topic that might be currently considered hot and important. A simple solution to this problem is to consider the hot-degree H -index within a few recent years (for example, 5 or 10 years, depending on the topic) and not over 50 years or so.

Generality of the topic – Topics can be extremely ‘popular’ because of wide applicability. Examples are statistical methods that are applied in practically all disciplines. Correlation is such an exam-

ple; according to *Web of Science (WoS)* by Thompson Reuters, ‘correlation’ (searched in title or topic) has the H -index of 627. It suggests that one should search for hot topics that are clearly defined, are unambitious, and do not have a general meaning. ‘Correlation’ does not seem to be such a topic – because of its large generality and wide applicability.

Is always a hot topic highly cited? While using the hot-degree H -index as a measure of hot-degree of scientific topics, one must be aware that not all hot topics have already gained sufficient number of citations. In fact, very recent developments cannot be highly cited in many papers. Hirsch’s index itself, which could be considered a hot topic in scientometrics, has $H = 41$ (searched in title and topic as ‘Hirsch index’ or ‘Hirsch number’ or ‘ h -index’, beginning from 2005 and removing non-related articles), while the ‘impact factor’ (IF) has $H = 57$. Which of them is more hot these days is not an easy question, but for certain the IF has been in the game for a much longer time, which can be a reason of its higher H value.

We can imagine there are very recent findings with H below 10, and yet being presently really hot topics (although we cannot come up with good examples of such findings). On the other hand, it depends on how one defines a hot topic – is it a topic that is studied by many and cited by many? Or is it an important topic for science and the future development of science and society?

Relation to time – Ye¹ states that H is time-related. It is true and if we determine H for recent years only, the situation can change. For example, checking the H -index for ‘Hirsch index’ (as above) and ‘impact factor’ but for years 2010–2013, it is 17 for the former, while for the latter it is 18. This aspect is directly related to that described in the ‘Out-of-date hot-degree topics’.

Careful choice of key words – If one performs a search or the Hirsch index without limiting oneself to 2005 or later (68 papers on some other ‘ H -indexes’ were published before 2005), and ignoring that some of the articles are not related to Hirsch’s index (there are other h -indexes), then the H -index would

increase to 44. The difference between 44 and 41 is not too great, but it suggests caution while carrying out such searches.

Indeed, sometimes a keyword does not represent what one thinks it does. For example, we conducted a search in *WoS* for the hot-degree of chosen fairy tale characters (Table 1). It appears that among them Superman and Sleeping Beauty are the most hot scientific topics. However, worth noting is that most of the papers that use these keywords are not necessarily concerned with precisely these characters; instead, they rather use them as allegories, similes or in some other way.

Comparing Table 1 and Ye’s results¹, one might say Cosmos and Sleeping Beauty are similarly hot topics for sciences...

Ye¹ suggested the hot-degree H -index to be a rough measure of hot-degree of a topic. Indeed, it can be used to search for hot topics in various scientific disciplines, but with some caution and consideration of the aspects discussed above.

We have to remember other known facts about the original h index^{3,4}. Waltman and van Eck⁵ pointed out the inconsistencies in the behaviour of the h -index, which usually can be directly considered for the hot-degree H -index (although not all of them should be, like the one related to groups of scientists). It should not be forgotten that the original h index has already a lot of variants, each of which attempts to overcome one or another inconsistency of the original, although it has been proven that most of them do not incorporate sufficient new

Table 1. Hot-degree H index of chosen fairy tales characters. Data were collected on 15 March 2013 from *Web of Science* by Thompson Reuters

Fairy tale character	Hot-degree H
Sleeping Beauty	61
Superman	40
Cinderella	29
Robin Hood	17
Batman	15
Red Riding Hood (Red Hood)	7
Harry Potter	6
Frog Prince	6
Shrek	2

Table 2. Comparison of three categories based on the H -index representing the hot-degree of a topic (category) and the number of papers published in these categories

WoS category	H -index	No. of papers
Astronomy Astrophysics	623	579,524
Applied Physics	581	1,225,539
History	92	834,747

Data are based on WoS.

information compared to the original h -index⁶. Also, the quantitative aspect of citations represents the quality of a cited work, regardless of whether the citing work confirms or denies the findings in the referred paper. The discipline-to-discipline differences in citation counts, and in turn the hot-degree H -index, are known to be very large. Examples include the WoS category-to-category comparison (Table 2).

From this comparison it follows that the category with the fewest papers (among the three considered in Table 2), 'Astronomy Astrophysics', has the highest H -index, which is very much higher than that for a much larger category of 'History'. 'Applied Physics', a much larger category than 'Astronomy Astrophysics', has a smaller H -index. In this context, indeed the H -index might be a better representative of the hot-degree of a topic than, for example, a number of papers published on this topic; but still one needs to consider discipline-to-discipline differences. Nonetheless, when only very recent, say, two years are taken into account, many papers have not yet been cited. In such instances actually a

number of papers might be a better representative of the hot-degree of a topic than the H -index.

Ye¹ writes, 'With h values, we may investigate the hot topic distribution of research in the academic field, which would benefit topic selection and could stimulate truly scientific studies and academic progress'. We would like to mention that the hot-degree H -index should rather be treated as one of the methods for looking for hot topics rather than the only or even the most important one. And, as mentioned above, owing to the way the index is defined, it cannot catch most recent findings, and so one should not depend only upon this index to decide which topics are and which are not hot for science. Worth noting is that the H -index finds topics that have already been recognized by the scientific community, and new important topics do not have to be in this group.

It is then a researcher's task to ensure that the keywords he or she is considering as a candidate for the hot topic are properly defined. It is also the researchers' task to ensure proper diversity of research topics being studied worldwide.

We are not afraid to claim that had everyone studied only what is being considered most important, the development of science would have slowed down. Thus the hot-degree H -index can be helpful, but one needs to be aware of its limitations and use it with caution.

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