Long live the scientists: Tracking the scientific fame of great minds in physics

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ABSTRACT

This study utilizes global digitalized books and articles to examine the scientific fame of the most influential physicists. Our research reveals that the greatest minds are gone but not forgotten. Their scientific impacts on human history have persisted for centuries. We also find evidence in support of own-group fame preference, i.e., that the scientists have greater reputations in their home countries or among scholars sharing the same languages. We argue that, when applied appropriately, Google Books and Ngram Viewer can serve as promising tools for altmetrics, providing a more comprehensive picture of the impacts scholars and their achievements have made beyond academia.

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Some say that a man dies three times. The first time is when his heart stops beating and he dies physically. The second is when people come to his funeral and his identity is erased from society. The third time is when nobody on the earth remembers him anymore. Then he is really dead.

"Dragon Raja" by Lee Yeongdo

1. Introduction

Books are the stepping stones to human progress. According to UNESCO (United Nations Educational, Scientific and Cultural Organization), the number of estimated published books in 2017 alone is up to 2.2 million.[1] Such a large collection is undoubtedly a rich archive of human history and civilization. Yet, as one of the most telling embodiments of knowledge stock and advancement, books have not captured sufficient attention in quantitative research evaluation.

Fortunately, with access to Google Books and the Google Books tool Ngram Viewer, scholars are now able to trace cultural evolution on a long time scale based on digitalized texts and trillions of words. This application of high-throughput data collection to study human culture can be traced back to Michel et al. (2011). In this pioneering study, the authors utilized the Google Books corpus and conducted text-based statistical analysis to trace cultural trends. That innovative research method soon captured academia's attention and was adopted in the arenas of digital history (Sternfeld, 2011), the history of science

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[1] Data source: http://www.worldometers.info/books/. Accessed on January 18, 2018.

(Laubichler, Maienschein, & Renn, 2013), economics (Roth, 2013), social psychology (Acerbi, Lampos, Garnett, & Bentley, 2013; Greenfield, 2013; Zeng & Greenfield, 2015), and cultural psychology (Pettit, 2016).

Google Books has also been utilized to assess the fame of great scientists throughout history. Based on the word frequency of people's full names mentioned in books, Bohannon's Science Hall of Fame was built a as an objective evaluation of scientific fame over centuries (Bohannon, 2011a, 2011b). Moving beyond previous work, this paper utilizes both Google Books, which covers 36 million global digital books, and Google Scholar, which indexes 91 million academic items,[2] to examine the scientific fame of top physicists. We particularly focus on and compare two of the greatest physicists, Isaac Newton and Albert Einstein, depicting their fame evolution over centuries and exploring what they are famous for.

Our research reveals that the great minds are gone but not forgotten. Early scientists are still on the public's lips in modern society. Their scientific impacts on human history have persisted for centuries. This holds true for other prominent physicists as well. We also found that while Einstein's scientific fame has exceeded that of Newton among intellectuals since the mid-20th century worldwide, there is a different pattern of fame when the own-group preference is differentiated by the language of digitalized corpus. The computational analysis confirms that the influence of Einstein is largely related to his two contributions on general relativity and quantum theory, while the most frequently mentioned scientific achievements of Newton are the law of universal gravitation and the laws of motion.

This paper makes the following contributions to the literature. To begin with, this is the first attempt, within our best knowledge, to explore scientific fame based on the combination of both books and articles indexed by Google. In addition to depicting the evolution of fame of great minds, we also explore their most accredited achievements based on co-occurence analysis. Second, our study contributes to the discussion on the expected role of scientists in science promotion. By comparing the indicator for scientific impact (i.e., work being cited by scholarly publications) and the indicator for scientific fame (i.e., name being mentioned in books), our study sheds some light on how to gauge scientists' contributions beyond academia. We argue that, when applied appropriately, Google Books and Google Ngram Viewer can serve as promising tools for altmetrics, providing a more comprehensive picture of the impacts scholars and their achievements have made on society.

The rest of the paper is structured as follows. In the next section, we delineate our method and case selection justifications. Section 3 presents our analysis. In Section 4, following a summary of main findings, we conclude our paper discussing limitations and future research venues.

2. Method and data

2.1. Notion and measurement

There is no agreed-upon definition of scientific fame or its measurement. The term can be traced back to the book *The Life of Sir Charles Linnæus*, a biography of a Swedish botanist, physician, and zoologist whose fame is centered on his enduring achievement of binomial nomenclature (Stöver, Stöver, Trapp, Stoever, & Linne´, 2007). Yet many scientists are ordinary folks and are little known to the public (Astin, 1957; Menard, 1971; Merton, 1970). Some scholars have argued that the fame of scientists should be confined to professional achievements, while others believe scientific fame goes beyond academia (Bohannon, 2011a; Menard, 1971). Feist (2016) noted that regardless of either intrinsic or extrinsic research, the assessment of fame in science ultimately rests on productivity and its impact on advancing the research front. Previous studies often used being elected to prestigious societies or winning research awards or prizes as proxy indicators of scientific recognition or reputation (Bronk, 1976; Youtie, Rogers, Heinze, Shapira, & Tang, 2013 etc.). Instead of relying on the subjective judgment of panel experts, Bohannon's Science Hall of Fame (2011a) innovatively uses the appearance of people's names in books to capture scientists' influence across different domains throughout history. This is the approach we adopt in tracking and recording the fame of great scientific minds and their achievements.

2.2. Case selection

The focus domain in this work is physics. Among the myriad scientists, we purposely choose Isaac Newton and Albert Einstein for illustration based on the following considerations.

To begin with, both Newton and Einstein are in the field of physics, which makes their comparison relatively free from discipline differences of publication distribution. And given that both names consist of two words with similar length, the quality of their retrievals is fairly comparative. As the two most influential physicists in the history of science (Baker, 1984; Whittaker et al., 1943), Newton and Einstein are appropriate candidates for evaluating the historical fame of individuals. Finally, who is more influential has been a topic attracting much attention in the global scientific community. The debate has not been settled for more than half a century (Gribbin, 1987; Graneau & Graneau, 1993). Successor scientists have commemorated them on special anniversaries, such as "Science 1943: Aristotle, Newton, Einstein, the three-hundredth anniversary of Newton's birth" and "New Scientist 1987: Newton vs. Einstein, the three-hundredth anniversary of Newton's theory of gravity." In 2005, the Year of World Physics and also the Centenary of Einstein's Special Relativity Theory, the UK

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[2] The types of academic items Google Scholar includes are research articles, books, patents, case laws, and citations. In this research our search excludes patents and citations.