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The Dynamics of Remembering and Forgetting

Carlos Baquero and Rosa Cabecinhas consider how we make assumptions about authors' roles and relative contributions when reading papers.


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Biases in Author Recognition
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Human memory does not correspond to the objective recollection of events or the simple storage of a fixed past. It is a selective process of permanent interpretation and reconstruction as a function of a given context. The dynamics of remembering and forgetting are shaped by various personal, societal and cultural factors, and are subject to various 'biases' (Hegarty and Klein 2017, https://bit.ly/3s5DwRV). Our perception of people and events is shaped by an economy of attention in which certain aspects are noticed and others remain unnoticed, even when we strive to pay as much attention as possible (Consider trying out the following selective attention tests on YouTube: Simons and Chabris 1999 (https://bit.ly/3ybKRDm) and Marissa Webb 2018 (https://bit.ly/3MMnzbw), you might be surprised.) Thus, it is not unexpected that when reading papers, we also make simplifications and have assumptions about author roles and relative contributions.

Imagine a paper by Alice, Bob, and Eve. Depending on the field of research and respective author order conventions, there are different possible assumptions: *Alphabetic order*—These names are in alphabetic order, so it might imply that the authors followed that convention and thus one can expect, absent of more information, that each did an equivalent share of contribution to the work; *Contribution/role order*—In this case, maybe Alice was the primary author, Bob did some research work, and Eve was the senior author, possibly having a role in the financing of the research.

While some fields, such as mathematics, are very likely to follow alphabetic order, other areas, including computer science, do not show such a clear trend; see Fernandes and Cortez 2020 (https://bit.ly/3sa4yrn). Some journals, such as *Nature* scientific reports (https://go.nature.com/3s4LSJN), address contribution ambiguity by requiring the papers to explicitly include *Author contribution statements*, clearly indicating the amount and nature of the contribution to the paper for each author. However, in Computer Science, this practice is less established.

Preferential Attachment

When the World Wide Web started to show some scale, in the late 1990s, Barabási and Albert 1999 (https://bit.ly/3MMHC9z) explained how preferential attachment was a better model for the Web and other networks than a more uniform random model. Pages that already were popular were more likely to receive new links and

become more popular. A similar effect happens with academic papers; works that are already popular are more likely to gather further citations. The flip side of the coin is that some papers never get a single citation. In Engineering and Technology, the fraction of papers that stay uncited is as high as 20% after 10 years; see Noorden 2017 (https://go.nature.com/3KDp2zh). A sobering thought.

Although citations increase with popularity, papers do age. With time, concepts migrate to review articles, and citation rates to the original article decay; see Klemm and Eguíluz 2002 (https://bit.ly/3sauuDh). The increasing growth in scientific publishing makes it harder for researchers to deal with information overload. Humans like to simplify their work. At some point, a concept is so well-known, like RAID, that authors no longer cite the seminal work by Patterson, Gibson, and Katz 1988 (https://bit.ly/3FarMmF). It's both a tragedy and a compliment.

Matthew Effect

We can observe the effects of preferential attachment dynamics in author recognition even within a single paper. In the imaginary Alice, Bob, and Eve paper, if Eve is very well-known in the field and the others are less known, it is very likely that readers will attribute most of the papers' merit to Eve and probably say to others: "I read this very nice paper from Eve's team." Readers might not even recall the other authors' names.

This attribution skew is known as the Matthew Effect, see Merton 1968 (https://bit.ly/3s6pFLu) and Merton 1988 (https://bit.ly/3LGeuRr). The name comes from a biblical parable by Matthew. Luke has a similar parable, a bit more explicit: "I tell you, that to everyone who has will more be given; but from him who has not, even what he has will be taken away." This is not surprising, given what we now know about the dynamics of Pareto (https://bit.ly/3kxQjZv) distributions and asymmetries in allocation and growth of wealth.

Nobel laureates often state that when their name is seen in a new paper, they might get all the merit and recognition and render other authors invisible. This might look tragic for a young scientist that publishes with an established and recognizable author. However, even if the young author might be less visible in those works, there is an interesting retroactive effect at play. As the young scientist continues to work and eventually publishes significant work alone or with other less-known authors, this retroactively affects the appraisal of the earlier work. As a bonus, publishing with a well-known author increases the likelihood the paper will be read and cited.

Merton also observed that the success of a new work depends not only on its factual quality, but on the prior recognition of the author and its institution. Work done at more prestigious departments can diffuse more rapidly through the science networks. The bias that occurs both on author and institution recognition is now well-known and a justification for blind review mechanisms. However, a blind review process is not standard in grant applications.

Early Birds

We should ask: How damaging can the Matthew effect be in the allocation of recognition?

Bol, Vaan, and Rijt (https://bit.ly/382Q5XB) analyzed in 2018 the Matthew effect on science funding, and found it has a significant impact on career evolution. Imagine two early-career scientists, Alice and Eve. Both applied for a grant and, among many candidates, Alice was the last candidate funded, while Eve was just below the funding threshold and was not funded. Although they both had very comparable proposals when applying, the study found Alice will probably secure twice as much funding as Eve in the next eight years.

Early success in grant applications is beneficial (for winners) for several reasons. One is that grant applications are usually non-blind, and reviewers tend to consider past success when evaluating the proposal. Sometimes this is even an explicit evaluation criterion. A more subtle effect is that losing a grant often deters scientists from applying to further grants. An early disappointment can lead to self-defeating practices later on. A take-home message here is to learn how to cope with failure and keep trying. Statistically, it pays off.

Hidden Figures

The story of Robert Merton's work on the Matthew effect is not complete and holds a last surprise. Merton was not alone, and most of the work was based on interviews conducted by his invisible collaborator Harriet Zukerman, who didn't co-author that paper (Merton acknowledged her important role in that research in his 1988 paper). This brings us to the Matilda effect, coined in the work of Rossiter 1993 (https://bit.ly/3kzz9dZ). In science history, there are many cases where women were hidden figures. Sometimes women were simply omitted from lists of scientists, and often they had important roles that were not recognized until many years later.

Even when reading Merton's initial work, written in the 1960s, we see phrases that equate scientists to men: "In papers co-authored by men of decidedly unequal reputation, … " In all fairness, it is a mistake to reanalyze the 1960s from the perspectives of today, but this also shows that there was social change and more awareness of these biases.

Probably there will always be hidden figures, figures that made the research possible and never made it to the authorship, or authors that were easily forgotten. This anonymous collective is probably the motivation for the authors that pay homage to those invisible contributors by including a fictitious name, Camille Noûs (https://bit.ly/3kzzlKf), in the author list. As this name becomes more famous and recognizable maybe one day, due to the Matthew effect, future readers will only remember Camille's name in the papers they read. But this would be too simple an answer.

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