

SIGNS OF 'CITATION HACKING' FLAGGED IN SCIENTIFIC PAPERS

An algorithm that analyses citation patterns aims to find scientists who have manipulated reference lists.

By Richard Van Noorden

Scientists who get too many references to their own work inserted in others' papers – whether by prior arrangement or by asking for extra references during peer review – might leave telltale fingerprints in the citation record, say two researchers who have developed a way to detect what they call citation hacking.

"If someone is trying to manipulate their citations, they have to leave this mark," says bioinformatician Jonathan Wren at the Oklahoma Medical Research Foundation (OMRF) in Oklahoma City. On 13 August, he and Constantin Georgescu, also at the OMRF, posted an analysis of 20,000 authors' citation patterns to the bioRxiv preprint server. They found around 80 scientists whose citations, they say, indicate "chronic, repeated" reference-list manipulation (J. D. Wren and C. Georgescu Preprint at bioRxiv <http://doi.org/d65b;2020>).

Manipulating citations

Researchers often complain that reviewers ask them to add unnecessary references to papers, a practice termed coercive citation. Surveys suggest that around one-fifth or more of scientists have experienced this. Wren began to study citation patterns after he discovered an outlandish case in which a highly cited US biophysicist, Kuo-Chen Chou, repeatedly manipulated the peer-review process to gain extra citations. Chou was subsequently barred from reviewing papers for the journals *Bioinformatics* (where Wren is an assistant editor) and *Database*, and from serving on the editorial board of the *Journal of Theoretical Biology*. Chou told *Nature* that he had not engaged in "reviewer coercion".

Wren says that after he uncovered Chou's behaviour, he began getting e-mails from researchers asking him to check the records of other scholars whom they thought might be involved in citation hacking. But because most peer-review processes are confidential, Wren hoped to spot such cases by examining citation records. Heavy self-citation is easy to measure, but deciding what counts as an unusual pattern involving other authors is much harder.

Wren and Georgescu considered many potential "red flag" indicators, such as when researchers frequently receive blocks of consecutive citations in others' papers, or get disproportionately many citations from one journal. They found that a key measure that correlates with many of the red flags is the overall skewness, or inequality, in the distribution of citations that scientists get from others' work: some researchers are cited an unusually large number of times by a few papers.

The researchers analysed public records in the database PubMed, and restricted themselves to authors with middle initials on papers, to make misidentification less likely. This limits the study, but gives an idea of the citation patterns for around 20,000 scientists. Around 80 – including Chou – have extremely skewed patterns of citations accrued from others, together with other red-flag indicators.

Asked for comment, Chou told *Nature* that the study was "meaningless", because the "number of citations is not important".

Unexpected skew

The analysis points only to unusual citation patterns, and can't assess whether a researcher actually did arrange for extra references to their work; there might be innocent explanations for strange distributions, Wren notes.

Plotting the global distribution of skewness in records of scientists' citations by others ought to produce a symmetrical curve, says Wren, but doesn't. On that basis, he suggests that around 16% of authors overall have engaged in some kind of reference-list manipulation, even if it's not possible to conclude that their individual records are unnatural. But Ludo Waltman, a bibliometrician at Leiden University in the Netherlands, doesn't feel comfortable with the way in which the analysis draws a binary distinction between 'manipulated' and 'non-manipulated' references, when there are many complex reasons for citing others.

Wren would like editors and reviewers to develop a database that makes clear which references were added during peer review. Both Waltman and Vincent Larivière, a bibliometrician at the University of Montreal in Canada, say that making peer-review reports more transparent might help to address the issue.

Q&A

Funding chief



MIKE THORNTON

Plant scientist Ottoline Leyser has the most powerful job in UK science – director of a research funding agency that oversees a £7-billion (US\$9-billion) research budget. Leyser took on the post at UKRI – which united nine separate research councils when it was created in 2018 – in June, during the COVID-19 pandemic, and as Britain prepares to leave the European Union.

What's it like taking on this role amid the COVID-19 outbreak?

I have come in in the midst of a crisis but, at the same time, at a point where there's a huge desire to shift the focus onto the future. The opportunity to rebuild our economy in a more inclusive way is a key part of what I hope UKRI can help to do.

What do you see as UKRI's benefits?

We have extraordinary depth and breadth of expertise across research, industry and academia. There are many cross-disciplinary challenges. I think we are in a much better position to address these as UKRI than as the nine organizations it replaced. A good example is how we've responded to COVID-19 in a pan-disciplinary, integrated and agile way.

How do you want to improve research?

The thing that I think is most important is people and the research culture. [Research] is a system that is in a lot of stress. Poor cultural practices are a real problem in terms of bullying and harassment, research integrity and keeping the widest range of people in the system. Getting people to enjoy the work they're doing is crucial.

The UK research system is very racially homogeneous. How will you tackle this?

The way we've typically thought about equality, diversity and inclusion has been by collecting up the numbers and trying to 'fix' the minority. To me, that's not going to work. You have to create a system that genuinely supports diversity and values difference. Difference is where all the good stuff is.

Interview by Elizabeth Gibney

The interview has been edited for length and clarity.