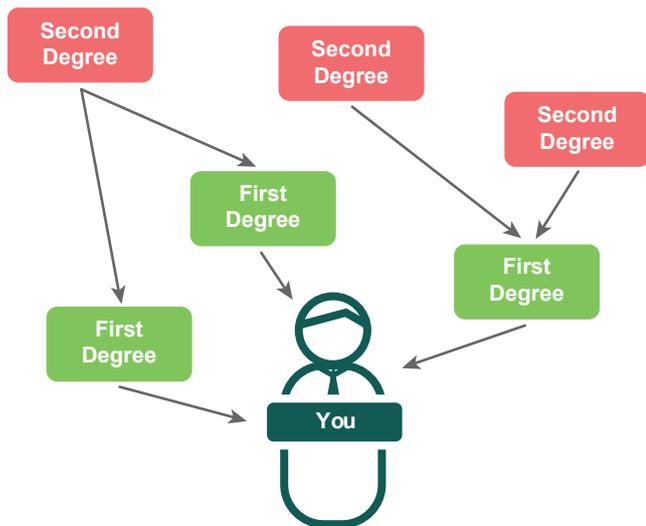


## Another way to assess your research impact: Citation and authorship networks



Visualizing extended citations

The impact of individual researchers can be assessed by various methods. Among these, numerical methods are popular because they are straightforward to calculate and provide a convenient metric for assessment. However, these metrics are vulnerable to manipulation and provide little insight into the actual influence of researchers. In this featured article, we discuss a non-numerical method for visualizing researcher influence: networks of relations among researchers.

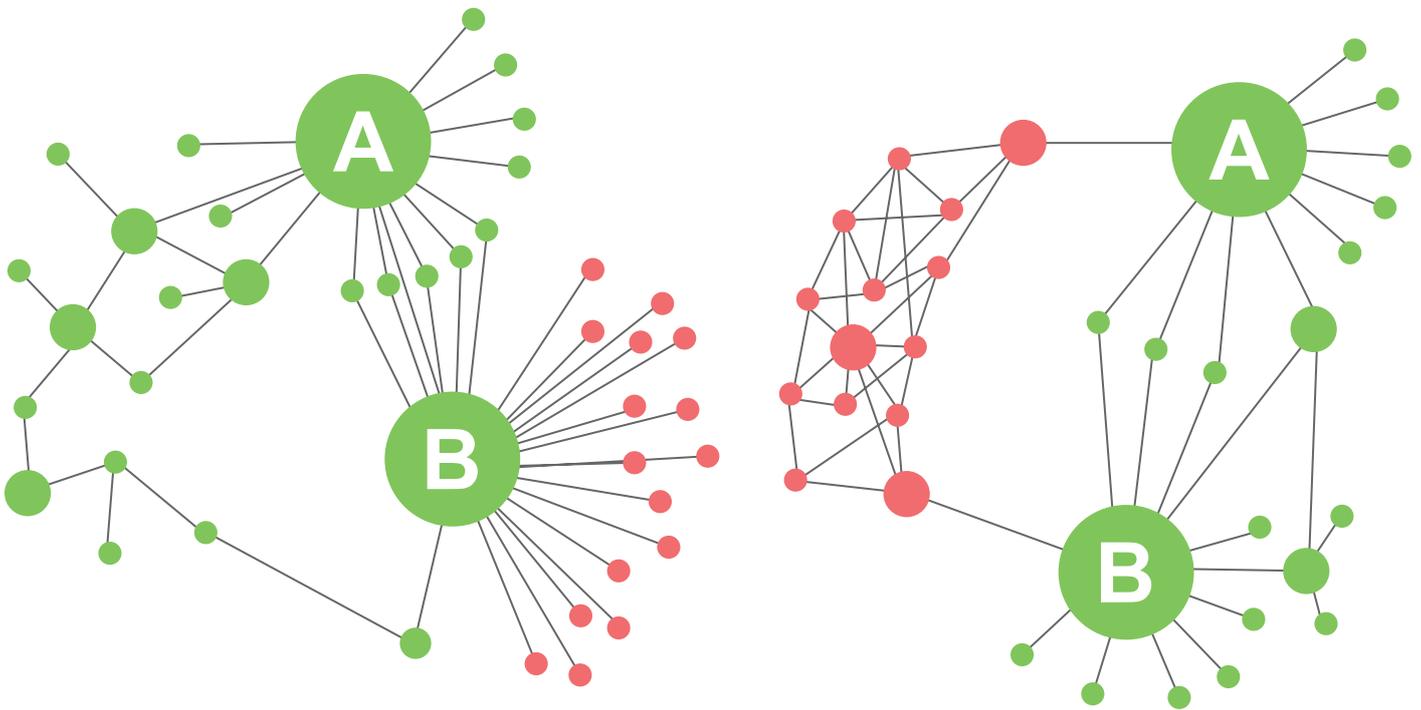
Nowadays, it is increasingly common to examine citation networks, which are mathematical graphs showing papers as circles and citations as lines between the circles. For example, in a [recent post on Scholarly Kitchen](#), Phil Davis uses a graph of this type to show possible collusion to inflate journal impact factors. This type of visualization is chosen because it is a natural way to show the influence of connections among researchers and papers.

Researchers can take advantage of this same idea to better understand and show their own research influence and positioning. This is one of the basic features offered by [Web of Science](#) (login required) and social media sites aimed at academics. Katy Jordan, a researcher at The Open University UK [has published on this in First Monday](#).

### Citation networks

To construct a citation network for yourself, build a list of all authors who cite papers by you. This can be done by hand or by using a service such as Web of Science or [Mendeley](#). The authors on this list are your first-degree citations. These are the citations typically considered, at the paper level, when calculating numerical indicators of influence. Repeat the process for your first-degree citations, building a list of authors who cite them. The authors listed here represent your second-degree citations. Typically, this is a much larger list. Repeating this process finds increasingly distant authors and can provide context for how your own work compares with other works in terms of its potential reach.

Tightly connected groups in citation networks represent groups of authors who cite mostly within the group. This often corresponds to areas of study, but can also indicate citation rings, as shown in the Scholarly Kitchen article.



Two examples of possible citation rings are shown here. The papers that might be falsely citing other papers are shown in pink. On the left, the pink papers all cite major paper B but not A. On the right, the pink papers cite one another, but probably should cite A and B.

## Authorship networks

Collaboration and co-authorship is common in most scientific disciplines, and somewhat less common in humanities. An authorship network is constructed in the same way as a citation network, except that people are connected by whether they have co-authored a paper together, instead of whether they have cited a paper.

This idea is well developed in mathematics, and is reflected in the somewhat tongue-in-cheek [Erdős number](#), which measures the number of lines necessary to move from a researcher to the prolific mathematician Paul Erdős, who co-authored more than 1,000 papers and had more than 500 collaborators.

## Other networks

In the future, the availability of large datasets and the increasing computational power of computers may make additional types of networks popular, and each of these provides information about a researcher's role within the research community. This could better recognize the efforts of those who do more than simply publish papers, including those highly involved in mentoring, peer review, science advocacy, and other activities that improve research.