

Appendix

The articles published by the reformers and meta-scientists that are analyzed in *Psychologists psychologizing scientific psychology* were selected based on a citation analysis of Raymond Nickerson's (1998) review paper on confirmation bias. The citation analysis does not represent a comprehensive view of the whole reform literature in psychology, nor does it completely exhaust the talk of bias in that literature. It was just used as a technical searchlight for the papers that fulfil three criteria a) they discuss psychology's reform movement b) they talk of cognitive biases and c) they are highly cited. Based on my familiarity with the reform literature, I selected Nickerson's paper and later Ioannidis' to "carve" out the part of the citation network that will be relevant for reconstructing the indigenous epistemology of irrationality.

The analysis was done with CitNetExplorer, v. 1.0.0, an openly available program for citation analysis designed and maintained by Nees Jan van Eck and Ludo Waltman at CWTS at Leiden University - <http://www.citnetexplorer.nl/>

In this appendix, I will shortly describe the steps needed to retrieve the relevant data and conduct the analysis. This is not a full technical manual for using CitNetExplorer, so I will not explain each technical term in great detail. Publications explaining the software and the method of citation analysis in greater detail can be found on the above linked website. This appendix only serves to track the steps I took in downloading the data and generating the citation network.

Search query

The visualization was based on the data retrieved from Clairvate Analytics database Web of Science, accessed through the library subscription at [redacted] University. I searched the Web of Science Core Collection on January 24th 2018, using the Cited Reference Search. The used query was "Confirmation Bias: A Ubiquitous Phenomenon in Many Guises", searched in the field Cited Title.

The query produced 23 hits. They were inspected individually to ensure that they indeed refer to Raymond Nickerson's 1998 paper under the above title. In this way, two of the hits were disqualified, as show below. The remaining hits all represent different ways that Nickerson's paper on confirmation bias is recorded as a reference in Web of Science.

Cited Reference Search

Find the articles that cite a person's work.

Step 2: Select cited references and click "Finish Search."

Hint: Look for [cited reference variants](#) (sometimes different pages of the same article are cited or papers are cited incorrectly).

[View our Cited Reference Search tutorial.](#)

CITED REFERENCE INDEX
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Select	Cited Author	Cited Work [SHOW EXPANDED TITLE S]	Year	Volume	Issue	Page	Identifier	Citing Articles **	View Record
<input checked="" type="checkbox"/>	Nickerson	REV GEN PSYCHOL	1998	2	2	175		17	
<input checked="" type="checkbox"/>	Nickerson, R. S.	REV GEN PSYCHOL	1998	2		175		2	
<input checked="" type="checkbox"/>	Nickerson	REV GEN PSYCHOL	1998	2		175		1	
<input checked="" type="checkbox"/>	Nickerson, R	REV GEN PSYCHOL	1998	22	2	175		1	
<input checked="" type="checkbox"/>	Nickerson, R.	REV GEN PSYCHOL	1998	2	2			2	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	GEN PSYCHOL	1998	2		175		1	
<input checked="" type="checkbox"/>	Nickerson, Raymond S	REV GEN PSYCHOL	1998	2		175		1	
<input checked="" type="checkbox"/>	Nickerson, RS	REV GEN PSYCHOL	1998	2		45		3	
<input checked="" type="checkbox"/>	Nickerson, R. S.	REV GEN PSYCHOL	1998	2		75		3	
<input checked="" type="checkbox"/>	Nickerson, R. S.	REV GEN PSYCHOL	1998	2		174		1	
<input checked="" type="checkbox"/>	Nickerson, R. S.	REV GEN PSYCHOL	1998	2		175		1	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	REV GEN PSYCHOL	1998	2		175	10.1037/1089-2880.2.2.175	1348	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	REV GEN PSYCHOL	1998	2		176		5	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	REV GEN PSYCHOL	1998	2		177		4	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	REV GEN PSYCHOL	1998	2		178		5	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	REV GEN PSYCHOL	1998	2		179		1	
<input checked="" type="checkbox"/>	Nickerson, Raymond S.	REV GEN PSYCHOL	1998	2		210		3	
<input checked="" type="checkbox"/>	Nickerson, R. S.	REV GEN PSYCHOL	1998	2		737		1	
<input type="checkbox"/>	Owad, T.	REV GEN PSYCHOL	2008	2		175		2	
<input checked="" type="checkbox"/>	Raymond, N. S.	REV GEN PSYCHOL	1998	2		175		3	
<input checked="" type="checkbox"/>	Nickerson Raymond, S	REV GEN PSYCHOL	1998	2	2	175		2	
<input type="checkbox"/>	Sperber, Dan + [Show all authors]	REASONING AS A SOCIA	2012					1	
<input checked="" type="checkbox"/>	[Anonymous]	REV GEN PSYCHOL		2		175		1	
Select	Cited Author	Cited Work	Year	Volume	Issue	Page	Identifier	Citing Articles **	View Record

Select Page Select All* Clear All Finish Search

Restrict results by languages and document types:

All languages	All document types
English	Article
Afrikaans	Abstract of Published Item
Arabic	Art Exhibit Review

* "Select All" adds the first 500 matches to your cited reference search. not all matches

Query results

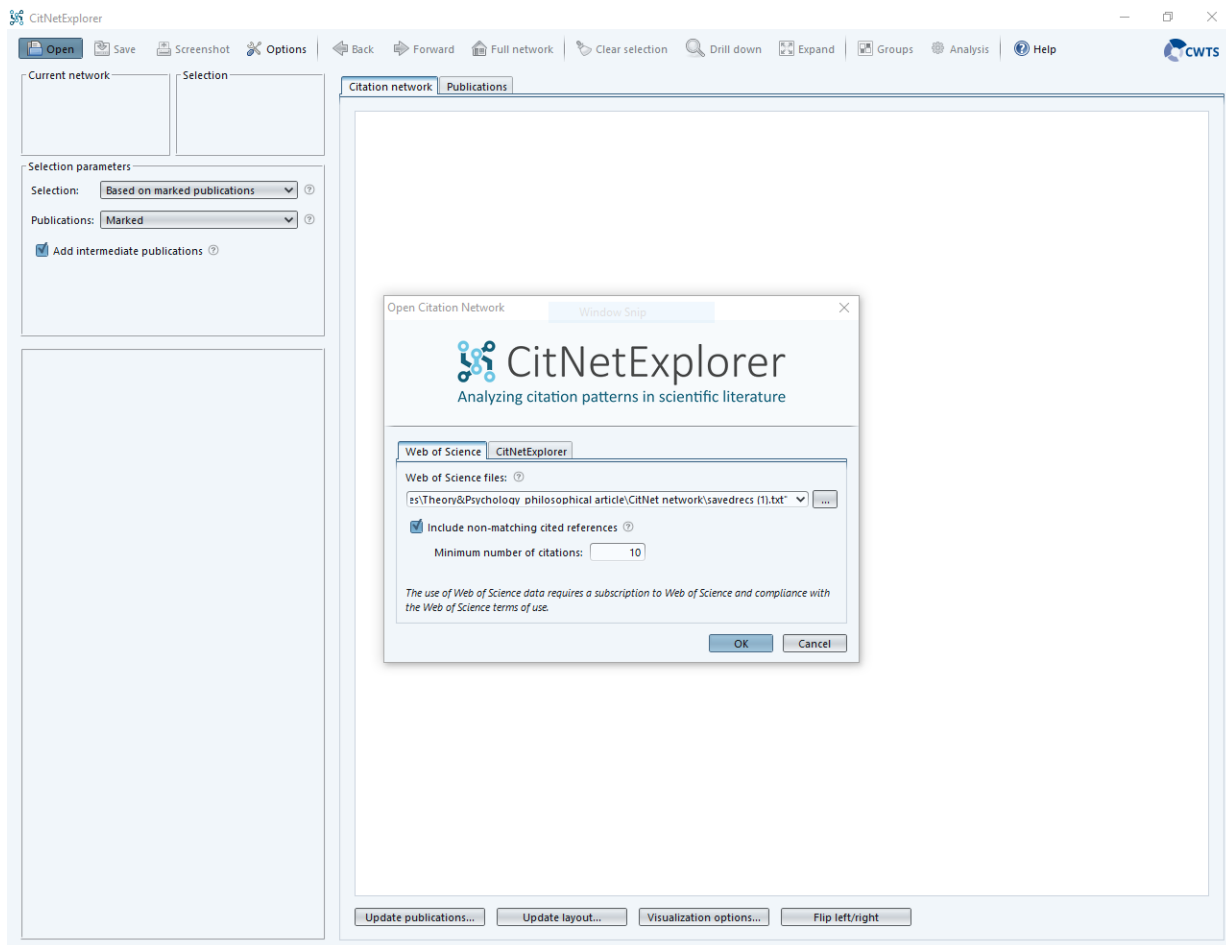
The 21 hits were cited 1202 times in WoS Core Collection. All of those citing articles were download in three files containing up to 500 hundred full citations each. To download them, one needs to click *Save in Other File Formats -> Full Record and Cited References -> Tab-Delimited (Win)*.

Producing the visualization

Step 1 – Loading WoS files into CitNetExplorer

The visualization is produced by loading the files downloaded from WoS into CitNetExplorer. I will cover all the steps taken in producing the visualization so my analysis can be inspected and reproduced. Unfortunately, I cannot share the data retrieved from WoS because it is proprietary.

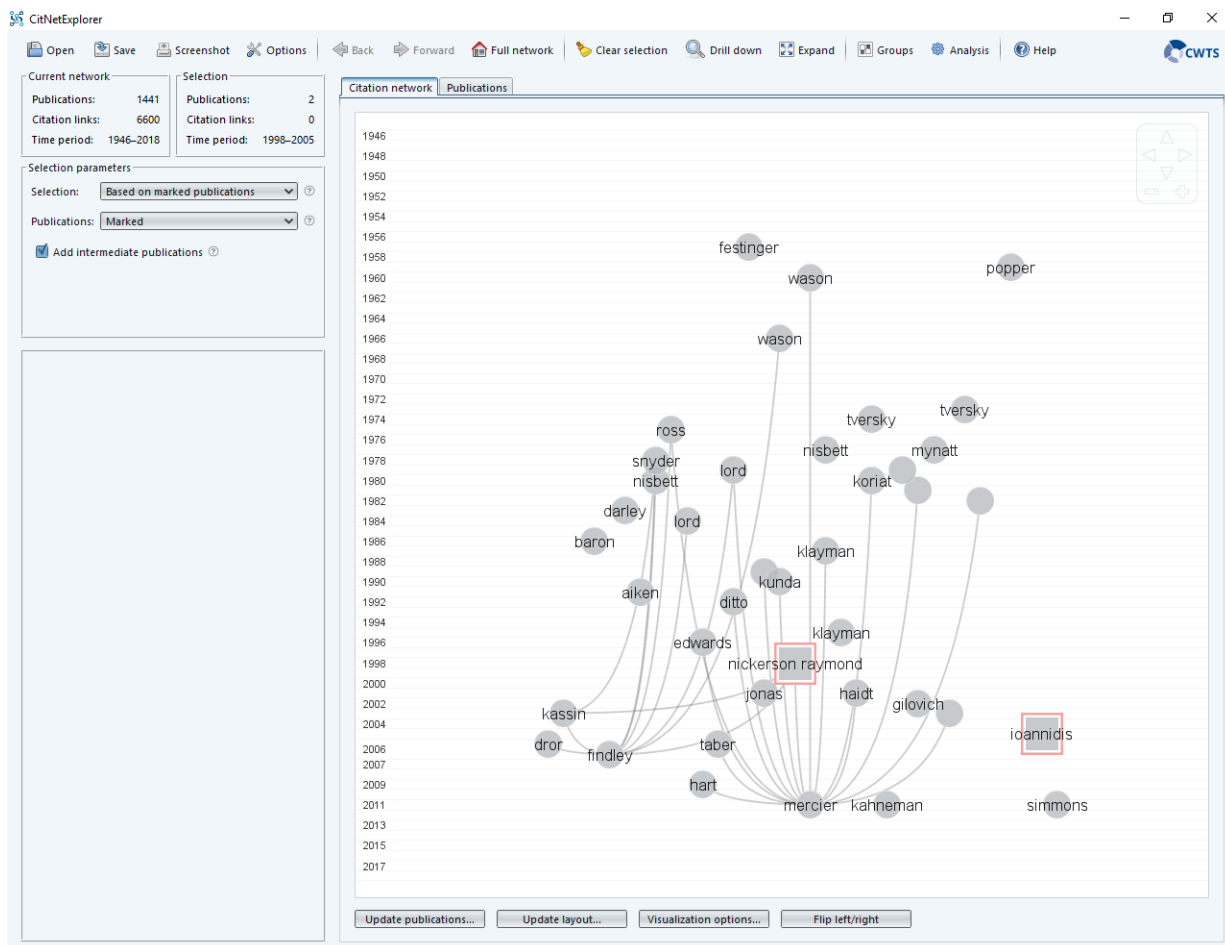
When loading the WoS files, I chose the default minimum number of citations per paper to be included which is 10 and the option to include non-matching cited references (WoS's cited reference record is spotty at best, so it often does not include full information for each reference).



Step 1 – Screen for loading WoS data

Step 2 – Drilling down to psychology's reformers

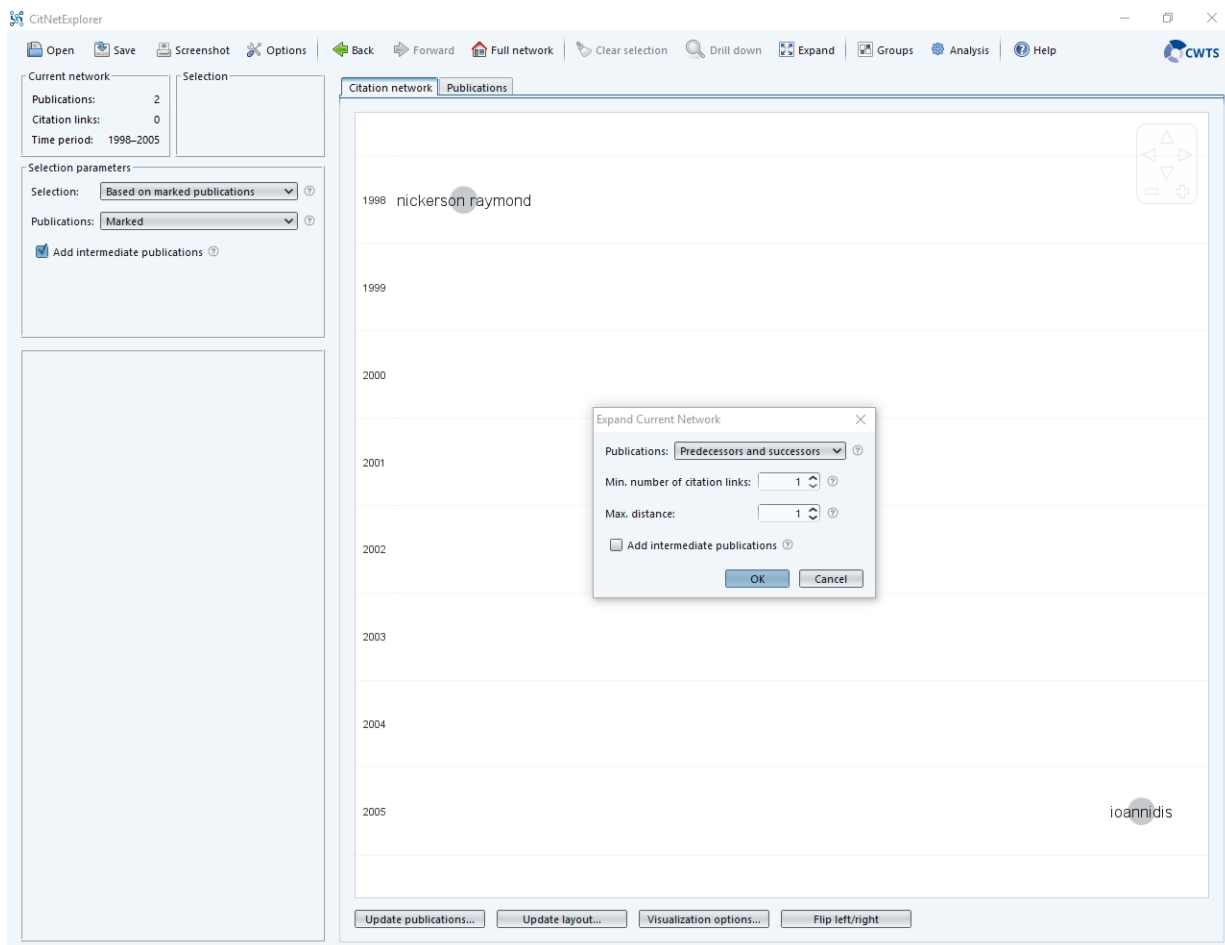
The first step produces the first citation network. The network visualizes 40 publications out of 1441 in the time period from 1946 to 2018.



The first network visualization

Multiple ways of drilling down to the parts of the citation network you are interested are possible. Keep in mind that the visualization is only a small part of the whole citation network. I will describe the steps I used to produce the visualization in the article. I selected two publications – Raymond Nickerson’s 1998 paper *Confirmation bias: A ubiquitous phenomenon in many guises* from the *Review of General Psychology* (in the first network visualization, it is the ‘nickerson raymond’ red square in the middle) and the John Ioannidis 2005 paper *Why Most Published Research Findings Are False* from PLOS (the ioannidis red square on the right).

In CitNetExplorer’s selection criteria, I chose to drill down ‘Based on marked publications’ (the above two papers). Drilling down on those two papers produced an intermediate visualization with just the two papers.



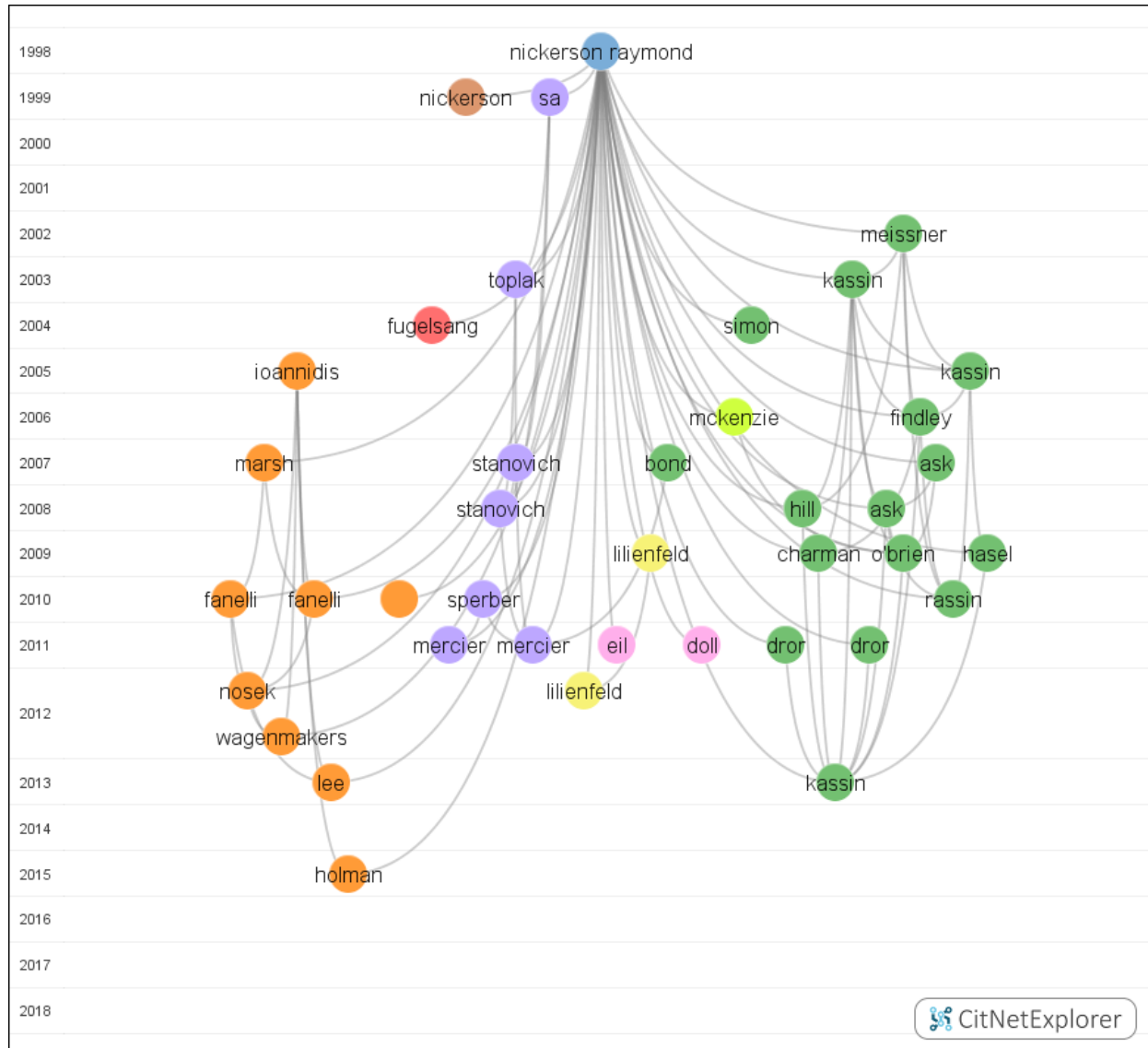
Step 2 - Expanding from the two papers

To see what kind of papers surround those two – the small group of publications relating both to Nickerson’s and Ioannidis’ papers – I used the CitNetExplorer Expand function. In the Expand function, I chose only to Expand into the citations that are Successors to the Nickerson and Ioannidis papers, in order to avoid the large literature that Nickerson cites in his review paper which is not interesting for my analysis. I specified the minimum number of citation links as 1 and the maximum distance as 1, to get the very closest successors to Nickerson and Ioannidis.

This Expand function produced the visualization that was used in the article. I used the default clustering of CitNetExplorer to color the groups of papers for easier inspection (click Analysis -> Clustering; the default parameters are Resolution 1.0; Minimum cluster size: 10; unselected ‘Merge small clusters’; Number of random starts: 1; Number of iterations: 10; Random seed: 0).

The visualized citation network represents the 40 most cited papers in close proximity to the Nickerson and Ioannidis papers. The orange cluster is easily identified as the cluster that contains papers on science reform and the replication crisis. Considering the way we expanded from the Nickerson and Ioannidis papers, all the publications in the orange cluster necessarily cite either the Ioannidis paper or the Nickerson paper, or both (except the Ioannidis paper itself – it is

actually the only paper in the visualized orange cluster that does not directly cite Nickerson. Four of the papers from the orange cluster were chosen to be discussed in detail in the article: two papers by Daniele Fanelli, one by Nosek, Spies, and Motyl, and one by Wagenmakers, Wetzels, Borsboom, van der Maas, and Kievit. They were chosen based on high citation scores.



Visualization of Nickerson citations

The other visualized papers in the orange cluster are the following (from the top of the group to bottom, the easternmost orange bubble without a name is the Hergovich paper):

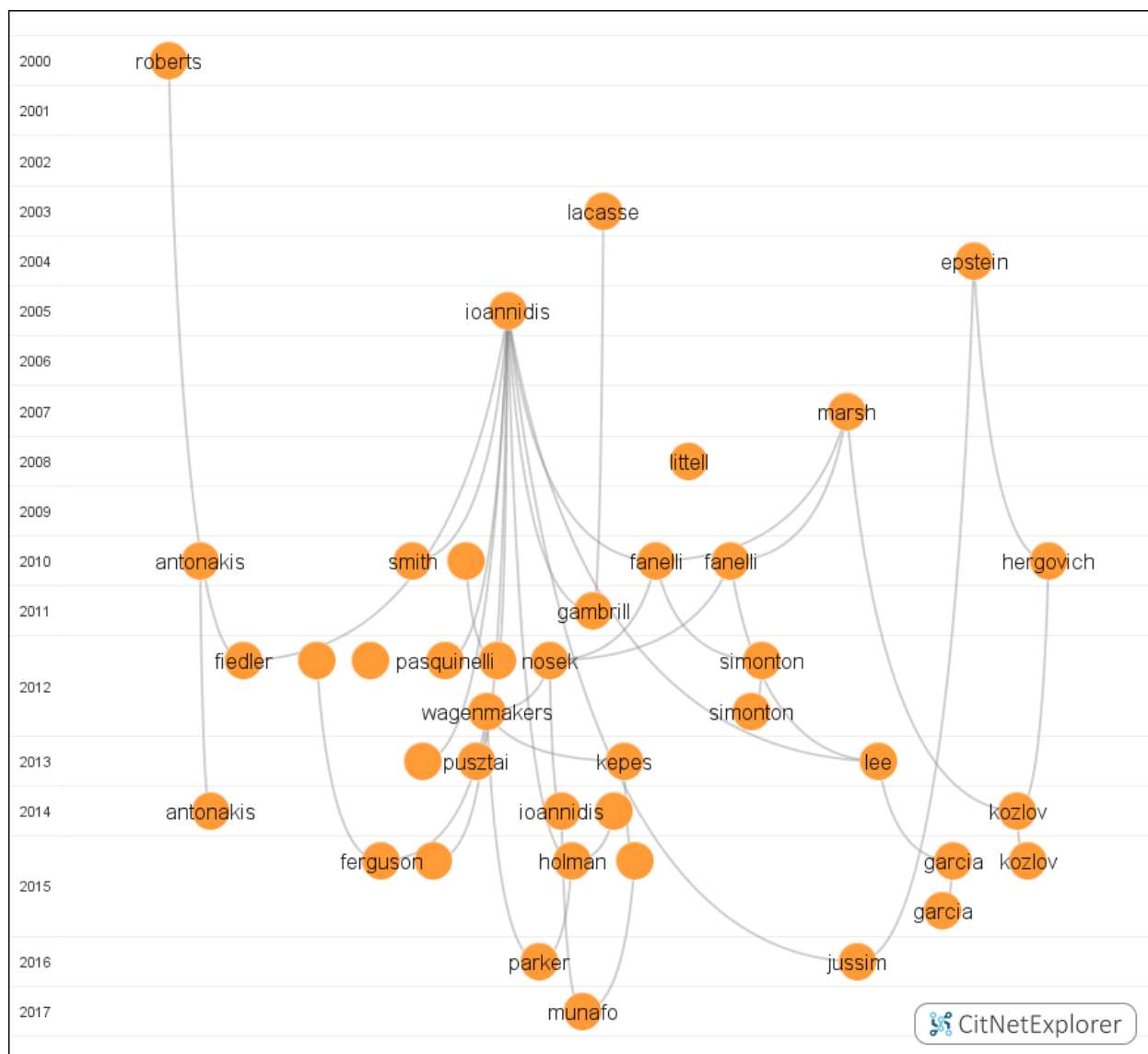
Marsh, D. M., & Hanlon, T. J. (2007). Seeing what we want to see: Confirmation bias in animal behavior research. *Ethology*, 113(11), 1089-1098.

Hergovich, A., Schott, R., & Burger, C. (2010). Biased evaluation of abstracts depending on topic and conclusion: Further evidence of a confirmation bias within scientific psychology. *Current Psychology*, 29(3), 188-209.

Lee, C. J., Sugimoto, C. R., Zhang, G., & Cronin, B. (2013). Bias in peer review. *Journal of the Association for Information Science and Technology*, 64(1), 2-17.

Holman, L., Head, M. L., Lanfear, R., & Jennions, M. D. (2015). Evidence of experimental bias in the life sciences: why we need blind data recording. *PLoS biology*, 13(7), e1002190.

Keep in mind that the citation network that produced the visualization is much larger and messier than what was discussed in the article. If we increase the number of visualized publications and drill down to just the orange group, we can see the full network of 83 publications in the orange cluster, for example. Inspecting this network indeed shows that the papers discussing science reform are nestled in downstream from the Nickerson's review of confirmation bias. This visualization could be further clustered, or expanded in different directions, but that goes beyond this article.



Drilled down orange cluster (all 83 publications)

The full list of publications in the orange cluster can be found in the supplementary materials on Figshare, following this link: <https://doi.org/10.6084/m9.figshare.5962564.v1>