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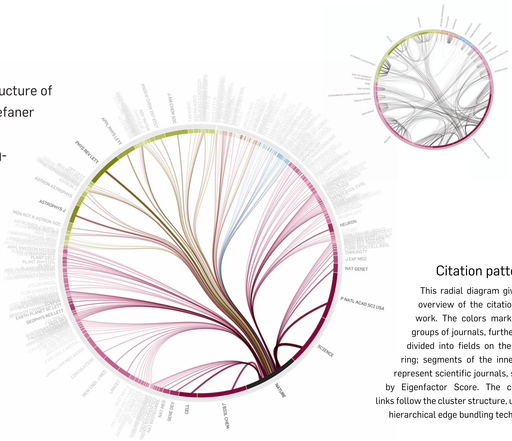
# WELL–FORMED.EIGENFACTOR

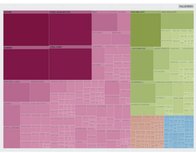
## Visualizing information flow in science

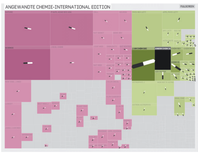
The Eigenfactor™ Project analyses the structure of science, based on flow of ideas. Moritz Stefaner turns this data into information–aesthetic visualizations, providing a variety of engaging views on this information network. The overarching approach is to map science from an information flow perspective: As citation is the currency of science, the interactive diagrams are based on network analysis of citation structures.




### Citation patterns

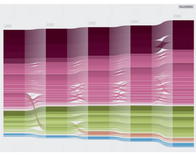
This radial diagram gives an overview of the citation network. The colors mark large groups of journals, further subdivided into fields on the outer ring; segments of the inner ring represent scientific journals, scaled by Eigenfactor Score. The citation links follow the cluster structure, using a hierarchical edge bundling technique.

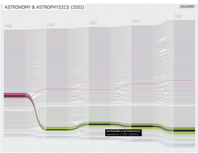



### Clustering

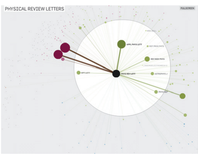
Based on the squarified treemap layout algorithm, this visualization features "magnetic pins" to indicate the amounts of incoming and outgoing citation flow for a selected journal. The rectangle sizes correspond to the Eigenfactor score of the respective journal.



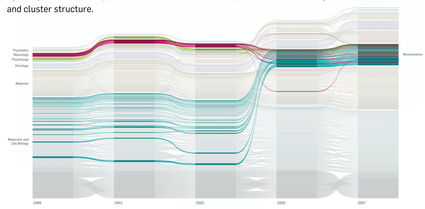

### Change over time

Inspired by Sankey diagrams and stacked bar charts, this visualization displays changes in Eigenfactor score and clustering over time. The journals are grouped vertically by their cluster structure and horizontally by year. Bars belonging to the same journal are connected. Clicking highlights a journal over the years, and all clusters it has been part of, to track changes of influence and cluster structure.


### Map

This map visualization puts journals, which frequently cite each other, closer together. You can drag the white magnification lens around to enlarge a part of the map for closer inspection. Clicking one of the nodes will highlight all its citation connections.




### The Neuroscience Story

This visualization documents the formation of neuroscience as a field of its own right over the last decade. Originally scattered across related disciplines (such as medicine, molecular and cell biology or neurology), the neuroscientific journals gather in a dense cluster emerging in 2005. Structurally, it follows the same organization as "Change over time" visualization, but we highlighted all journals in the cluster that corresponds to the field of neuroscience in year 2007. The color hue is based on the cluster assignments in the first year, 1999.

### Data analysis

First, almost 8000 scientific journals are clustered into groups, based on their citation patterns, and using the map equation. In short, for a network partitioned into groups, the map equation specifies the theoretical limit of how concisely we can describe a trajectory of a random walker on the network. Therefore, minimizing the map equation over all possible network partitions reveals regularities of information flow across directed and weighted networks or, in our case, the structure of how citations flow through science.

Second, using the Eigenfactor™ Score, the journals are assigned a measure of importance, much as Google's PageRank algorithm ranks the importance of web pages. The Eigenfactor™ Score measures the percentage of time that researchers would spend with the respective journal, if they were to move through the network by randomly following citations in the journals.

### Credits

We use a subset of the citation data from Thomson Reuters' Journal Citation Reports 1997–2005. The complete data aggregate, at the journal level, approximately 60,000,000 citations from more than 7000 journals over the past decade.

The interactive visualizations were produced using Adobe Flash and the flare framework (http://flare.prefuse.org). We used cytoscape (http://www.cytoscape.org) for calculating the coordinates in the map visualization.

A cooperation between the Eigenfactor Project (University of Washington) and Moritz Stefaner (University of Applied Sciences Potsdam).

http://well–formed.eigenfactor.org