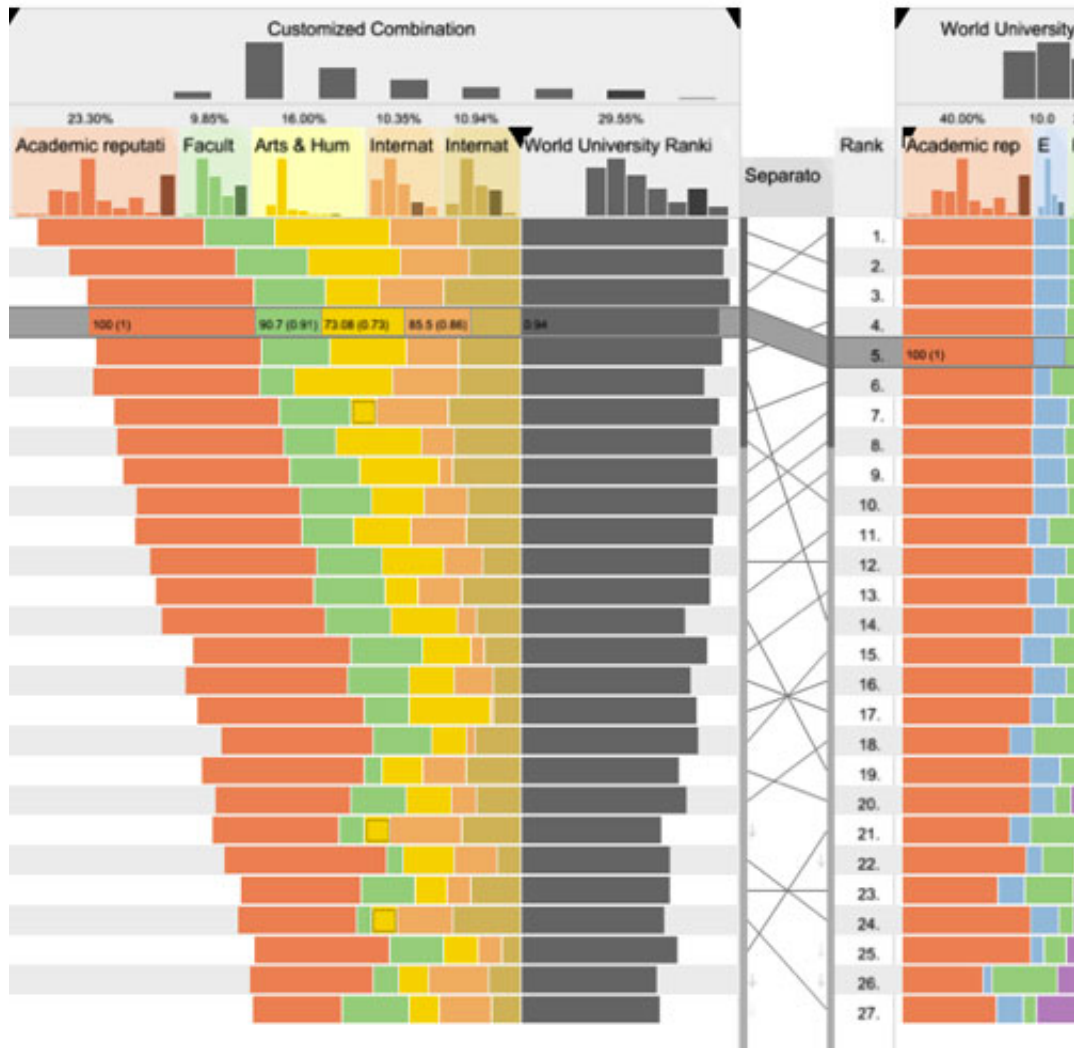


# What's behind a No. 1 ranking? Open-source LineUp software enables granular analysis of subjective ranking systems

January 31 2014, by Manny Morone



LineUp enables users to dynamically create their own rankings from raw data—in this example, the nutritional content of various breakfast cereals—by

subjectively prioritizing some attributes over others. Credit: Alexander Lex.

Behind every "Top 100" list is a generous sprinkling of personal bias and subjective decisions. Lacking the tools to calculate how factors like median home prices and crime rates actually affect the "best places to live," the public must take experts' analysis at face value.

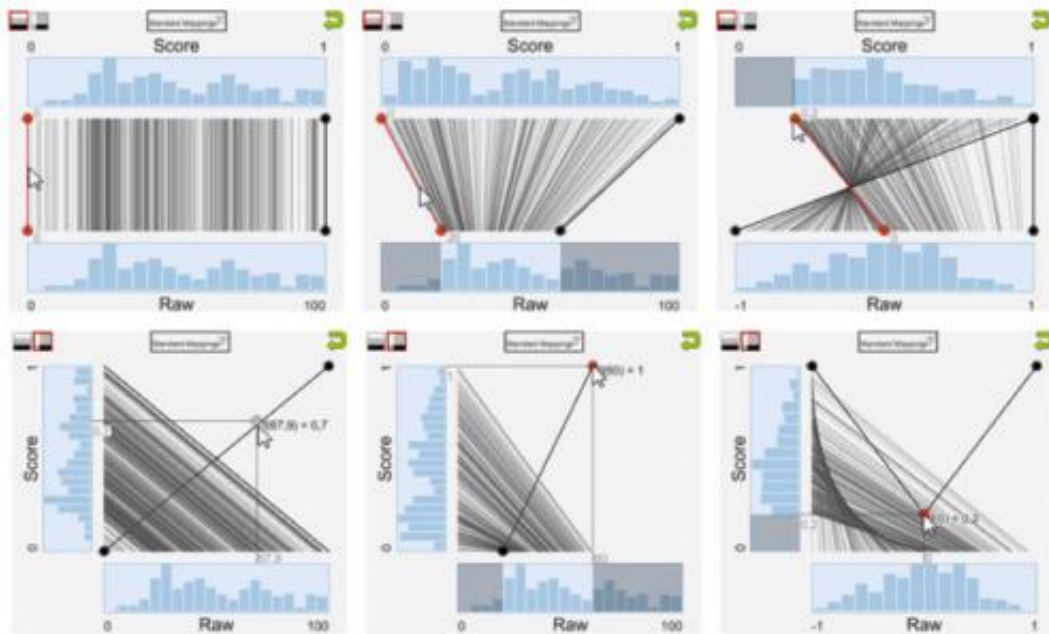
To shed light on the trustworthiness of rankings, Harvard researchers have created LineUp, an open-source application that empowers ordinary citizens to make quick, easy judgments about rankings based on multiple attributes.

"It liberates people," says Alexander Lex, a postdoctoral researcher at the Harvard School of Engineering and Applied Sciences (SEAS). "Imagine if a magazine published a ranking of 'best restaurants.' With this tool, we don't have to rely on the editors' skewed or specific perceptions. Everybody on the Internet can go there and see what's really in the data and what part is personal opinion."

The first dynamic [visualization software](#) of its kind, LineUp allows users to assign weights to different parameters to create a custom ranking. For example, users might look at the raw data behind [university rankings](#) and decide for themselves the relative importance of student-faculty ratios or the number of citations per faculty member.

So intuitive and powerful is LineUp, that its creators—Lex; his adviser Hanspeter Pfister, An Wang Professor of Computer Science at SEAS; Nils Gehlenborg, a research associate at Harvard Medical School; and Marc Streit and Samuel Gratzl at Johannes Kepler University in Linz—earned the best paper award at the IEEE Information Visualization (InfoVis) conference in October 2013.

LineUp is part of a larger software package called Caleydo, an open-source visualization framework developed at Harvard, Johannes Kepler University, and Graz University of Technology. Caleydo visualizes genetic data and biological pathways—for example, to analyze and characterize cancer subtypes.



LineUp visualizes the relationships between datasets. Credit: Alexander Lex

"LineUp really was developed to address our need to understand the ranking of genes by mutation frequency and other clinical parameters in a group of patients," explains Pfister. "It is an ideal tool to create and visualize complex combined scores of bioinformatics algorithms."

"We started thinking about how we can make this easy for biologists to understand and how we can tell them what the most important parts of the dataset are," says Lex.

While LineUp is still being applied to formal genetic research, the group has chosen to also apply their work to simpler, more familiar ranking problems—for example, the healthiness of different foods, best employers, or the best places to live.

LineUp introduces a dynamic element to the static analysis usually done on an Excel spreadsheet. It allows the user to immediately consider or ignore columns in a dataset by simply dragging them into or out of the window. It also enables side-by-side comparisons of alternative weighting systems.

And of course, not all metrics contribute to an item's rank the same way. Higher values of some metrics imply a higher rank, but not in all cases. LineUp has the ability to easily transform a dataset by inverting it, for example, making a lower crime rate correspond to a higher quality-of-life rank. Users can quickly apply and visualize the results of their intuitions.

Lex also emphasizes the potential for LineUp to be used predictively. Because LineUp makes it easy to pose many "what if" scenarios, a car manufacturer could devise a way to efficiently raise a vehicle's rank in a list of "best cars," perhaps by prioritizing fuel efficiency over style in the design process.

Previously, people without deep statistical or technical knowledge had no way of knowing authors' or institutions' potential biases or agendas. LineUp brings the public one step closer to simpler, personalized, and more meaningful data analysis.

"Essentially, it's a tool to allow people to explore the complexity of reality," says Lex.

LineUp is available as open-source software, free to use by anyone, at

<http://lineup.caleydo.org>. The team is currently working on a web-based version that will make it easier to share and create rankings.

**More information:** [data.icg.tugraz.at/caleydo/pub ...  
is Gratzl LineUp.pdf](https://data.icg.tugraz.at/caleydo/publications/Gratzl_LineUp.pdf)

Provided by Harvard University

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