Physics Explains Why University Rankings Won't Change

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A Duke University researcher says that his physics theory, which has been applied to everything from global climate to traffic patterns, can also explain another trend: why university rankings tend not to change very much from year to year.

Like branching river channels across the earth's surface, universities are part of a relatively rigid network that is predictable based on "constructal theory," which describes the shapes of flows in nature, argues Adrian Bejan, J. A. Jones Professor of Mechanical Engineering at Duke's Pratt School of Engineering.

According to the theory, the hierarchy of university rankings -- in which few schools consistently land at the top and many more contend for lesser spots -- persists because that structure supports the easiest flow of ideas, Bejan reported in the recently published issue of the *International Journal of Design & Nature and Ecodynamics*, referenced as Vol. 2, No. 4, (2007) 319-327.

"This hierarchy is here to stay," Bejan said in an interview. "The schools at the top serve everybody well because they serve the flow of ideas. We're all connected."

That structure also allows talent to flow and arise naturally in the "right places," he said.

First conceived by Bejan and published in 1996, the constructal law

arises from the natural tendency of flow systems to evolve over time into configurations that make their movements faster and easier.

More recently, Bejan and Gilbert Merkx, also of Duke, co-edited a book entitled "Constructal Theory of Social Dynamics," including a collection of essays applying the tree-like patterns of constructal theory to business, crowd dynamics, legal systems and written languages, among other human endeavors.

In extending the theory to university rankings, the first step was to define the flow system of the university, Bejan said, "what territory it covers, and what currents flow through it."

He suspected that a school's rank might reflect the flow of the ideas its faculty members generate. In support of that notion, he found that the most highly ranked engineering schools are also those with the most people on the Institute of Scientific Information's most-cited listing, meaning that their work is more often referenced by other researchers.

He also found that university rankings follow a hierarchical pattern that mirrors the distribution of city sizes. The more highly ranked a university or larger a city, the fewer competitors it has. The opposite is also true: the lower the rank, the more numerous are the candidates that compete for that position.

"The similarity is further evidence that the distribution of sources of knowledge is intimately tied to geography," he said, and to the flow of information across the globe.

So, is there a way to change rankings? In Bejan's view there is, but he says it takes "cataclysmic" events that encourage the free flow of ideas to alter such deeply ingrained channels. Such shifts have occurred in the past, he noted. For instance, a "brain drain" from post-war Europe after

World War II led to significant changes in the academic landscape, catapulting American universities onto the world stage. Similar shifts were also seen after the launching of Sputnik, with the enormous jump in funding for basic science, he added.

"The university is the professors, their disciples, and the disciples' disciples," Bejan wrote. "It is the ideas that flow through these human links and into the books of our evolving science and culture. In time, this global vasculature evolves like a river basin during the rainy season: all the streams swell, but their hierarchy remains the same."

For more on constructal theory, see constructal.org .

Source: Duke University