

SCIENCE & TECHNOLOGY

Competition And Evolution

"The Great God of Competition" by Daniel Simberloff, in *The Sciences* (July-Aug. 1984), The New York Academy of Sciences, 2 East 63rd St., New York, N.Y. 10021.

Competition among species is now commonly accepted as one of the chief forces in evolution. But according to Simberloff, a biologist at Florida State University, its impact has been exaggerated.

Simberloff does not challenge Charles Darwin's theory of evolution. But Darwin's notion of natural selection concerned competition *within* particular species. His scheme was given a new twist during the 1950s by Yale zoologist G. Evelyn Hutchinson, who argued that competition for food *between* different species leads to evolutionary changes that enable each to survive. For example, of two bird species with plant seed diets inhabiting the same area, one might evolve a larger beak that would allow it to grasp larger seeds that the rival species could not.

Hutchinson's theory won rave reviews in the scientific community. Important support for "Hutchinson's Law" came from a 1956 study by E. O. Wilson and William Brown, both of Harvard. The study suggested that related species developed sharper differences when they lived in overlapping habitats than when they lived apart. The reason: increased competition in the zone of overlap. During the 1960s, Princeton's Robert MacArthur developed a sophisticated mathematical model to predict the outcome of such interaction. "It is only a slight overstatement," Simberloff writes, "to say that this one man provided employment for two decades' worth of theoretical ecologists."

Not until the 1970s did scientists seriously question Hutchinson's Law. McGill University biologist Peter Grant re-examined the 1956 Harvard study and found that it overestimated the differences between species. Meanwhile, ecologists began to wonder whether they had made some unwise assumptions. Are changes in the size of a species's beak, body, or feet always due to competition with other species? Or do environmental variations also cause such changes?

Today, Simberloff concludes, ecologists are beginning to realize that they overstated the importance of competition between species. It is a "formidable force," but so are changes in climate, vegetation, and terrain, as well as the vagaries of parasitism and disease.

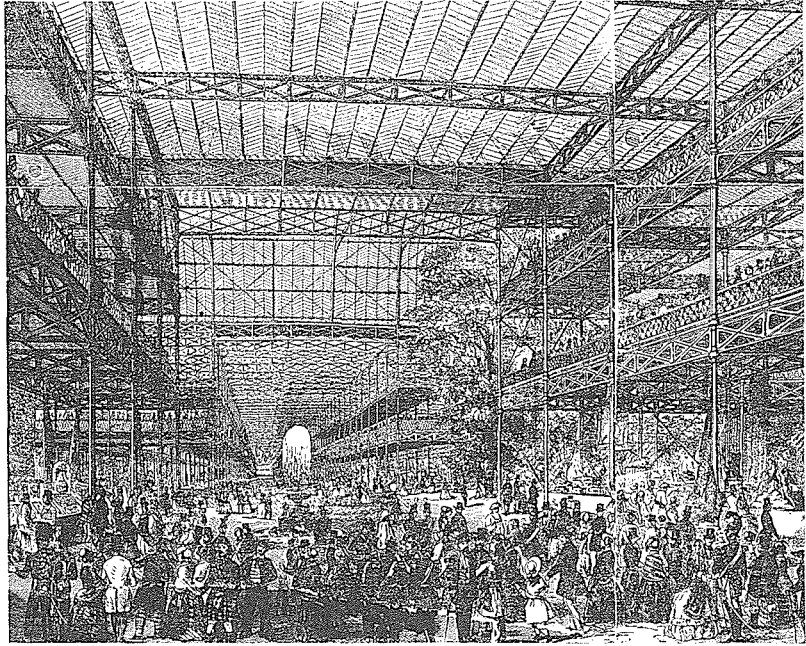
The Skyscraper's Great Ancestor

"The Crystal Palace" by Folke T. Kihlstedt, in *Scientific American* (Oct. 1984), P.O. Box 5919, New York, N.Y. 10164.

Today's glass-and-steel skyscrapers are hailed as modern marvels. But the technological advances that made them possible date back to the century-old design of England's Crystal Palace, which Franklin and Marshall College's Kihlstedt calls "one of the most influential buildings ever erected."

The glass-and-iron structure was built in London in 1851 to house the

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An 1851 *Scientific American* portrait of the Crystal Palace's interior.

first world's fair, The Great Exhibition of the Works of Industry of All Nations. Designed by Joseph Paxton, the Duke of Devonshire's head gardener and builder of many greenhouses, the palace covered 19 acres in Hyde Park. Seen from the outside, the quarter-mile-long building indeed resembled a gigantic greenhouse. Hollow cast-iron columns supported the 900,000 square feet of sheet glass that made up both the walls and the roof. Commenting on Paxton's design, the British magazine *Punch* joked, "We shall be disappointed if the next generation of London children are not brought up like cucumbers under a glass."

Paxton's simple but sturdy structure represented a radical departure from prevailing architectural styles, which relied on heavy, monumental forms in wood or masonry. Innovative engineering allowed the designer to break old constraints. As Kihlstedt notes, the Crystal Palace was "the world's first . . . large, free-standing iron-frame building, [and] the first building with what today would be called glass-curtain walls." What allowed Paxton to use glass walls—which provide no lateral stability against the wind—was his unique system of "portal bracing," which insured a rigid joint between vertical and horizontal cast-iron girders.

Under severe deadline pressure, Paxton improvised several new building techniques. The Crystal Palace was the first large building assembled from prefabricated modules. In addition, all parts were standardized and interchangeable. Specially designed machines took the

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place of craftsmen in preparing and painting miles of wooden gutters. The exhibition hall went up in 17 weeks, surviving (after being moved in 1852) until a fire gutted it in 1936.

With its simplicity of structure and novelty of design, declares Kihlstedt, the Crystal Palace ranks "with a handful of other preeminent buildings such as the Pantheon." It remains a monument to "the time when engineering was throwing off the mantle of intuitive craft to take on that of applied science."

RESOURCES & ENVIRONMENT

The Frontier Lives

"Survival of the American Frontier" by Frank J. Popper, in *Resources* (Summer 1984), *Resources for the Future*, 1755 Massachusetts Ave. N.W., Washington, D.C. 20036.

Americans are forever searching for "new frontiers." Meanwhile, says Popper, a Rutgers urbanologist, the *old* American frontier is alive and well.

The end of the American frontier was officially declared by the Bureau of the Census in 1890. By then, thanks to population build-up on the Pacific coast, it was no longer possible to draw the traditional national "frontier line" beyond which there were fewer than two people per square mile. Yet, many pockets of land where population density was below that level remained—and most have survived for a century. Today, about one-quarter (949,500 square miles) of the United States is still technically "frontier."

About half of this territory, 17 percent of the U.S. land area, has never even been surveyed.

Alaska (586,412 square miles) is almost entirely untouched; Nevada is 80 percent "frontier"; Idaho, 44 percent; Montana and Utah, 41 percent. Vast tracts of unsettled land remain in California, Colorado, Nebraska, New Mexico, Oregon, South Dakota, Texas, and Wyoming. Some aspects of the old frontier survive in altered form, according to Popper. Homesteading on federally owned land was largely discontinued in 1934; but several states allow it on land that they own, and the federal government permits it in selected areas, such as Alaska's Kuskokwim Mountains. To apprehend squatters, the U.S. Bureau of Land Management is creating a "contemporary cavalry" of sorts, Popper says. And lands where settlers once warred with Indians, the British, the Spanish, and others now serve as sites for military training exercises and weapons tests.

Obviously, the open lands are not what they were. Agriculture, big mining and timber operations, and public irrigation projects have all left their marks. The defining characteristics of America's remaining wilderness are its harsh terrain and climate, and its lack of water—qualities that have spared it greater encroachment by humans.