BOOKS: COGNITION

# Elementary, My Dear Chimpanzee

Marc D. Hauser

Research on cognitive evolution has had a contentious history. Many scientists have argued in favor of vast differences between humans and other animals, trumpeting our unique capacity to produce fire, art, music, and humor. In contrast, others have argued for the similarities by showing that we are not alone in our capacity to hunt, make tools, and navigate in a Machiavellian world of status striving and deceit. As the field has matured, however, it has become clear that all creatures, humans included, have evolved unique mental signatures, designed to solve the most significant problems of the past. Therefore, two of the most pressing questions are: How do human minds differ from the minds of other animals? And what selective pressures have led to such patterns over evolutionary time?

**Folk Physics for Apes**
The Chimpanzee's Theory of How the World Works
*by Daniel J. Povinelli*
Oxford University Press, Oxford, 2000. 407 pp. $85. ISBN 0-19-857220-4.

*Folk Physics for Apes*, written by anthropologist Daniel Povinelli, represents a recent contribution to this contentious history. In parallel with his views on social knowledge, Povinelli's bottom line is that chimpanzees think about the physical world in a way radically different from our own. Whereas humans can reason about imperceptible physical forces such as gravity, mass, and inertia, chimpanzees can only reason about perceptible things such as the learned association between dropping a rock onto a palm nut and then eating the fleshy meat inside. If Povinelli's conclusions are correct, our cognitive departure from nonhuman primates is even more dramatic than previously believed.

*Folk* is an unusual book in that none of the empirical work it presents has ever been peer reviewed. Povinelli discusses 27 experiments designed to reveal what chimpanzees know about physical objects, how they work, what their defining features are, and what they can be used for. Each study tested the same group or subgroup of seven chimpanzees, first as juveniles and then as young adults. These chimpanzees were simultaneously used in Povinelli's research on social knowledge; thus all were exposed to and trained in a variety of experimental conditions. Although several experiments in *Folk* are based on studies initially designed by other researchers, Povinelli argues that only his experiments explicitly determine whether subjects solve a problem by attending to perceptually tangible cues as opposed to causally imperceptible physical factors. The results indicate that chimpanzees either fail to solve the task or succeed, when they do, on the basis of perceptible causes alone (i.e., simple associations). As such, a chimpanzee's understanding of the physical world is radically different from our own and perhaps much more like that of a young child.

**Limited reasoning.** Povinelli argues that the chimpanzee (*Pan troglodytes*) can only think about perceptible things such as the learned association between cracking palm nuts and eating the enclosed fleshy meat.

**Puzzling success.** Although they do not use tools in the wild, cotton-top tamarins (*Saguinus oedipus*) can solve some cognitive problems that chimpanzees fail.

Povinelli's results challenge earlier data and seem surprising to anyone familiar with the tool traditions of chimpanzees in the wild. But it is not possible to take his claims at face value because of problems of scholarship, experimental design, and interpretation. On scholarship, Povinelli fails to properly credit the Darwin of this field, David Premack, and then discusses only a small portion of Premack's work, thereby undercutting its importance (*1*). He also fails to cite the critical essays of Heyes (*2*) concerning social cognition, several of which forced Povinelli to abandon his earlier conclusions and to take seriously the distinction between performance based on perceived associations (as opposed to such imperceptible causes as beliefs or intentions). Nor does he mention numerous pertinent studies of human infant and nonhuman primate tool use, object knowledge, and comprehension of imperceptible physical causes that also argue for the use of alternate methodologies (e.g., looking time techniques) to assess the cognitive capacities of nonlinguistic creatures (*3*, *4*). These omissions might give some readers the false impression that only Povinelli and his students have made the relevant theoretical distinctions and created the appropriate methods to test them.

There are five methodological problems in *Folk*. The first concerns the age of the chimpanzees tested. As several field studies have revealed (especially Tetsuro Matsuzawa's work, which Povinelli mentions only briefly), chimpanzees are incompetent tool users until they are young adults, eight to nine years old. In most work on chimpanzee cognition where successes have been reported, experiments involve fully adult subjects. Because Povinelli's experiments begin with five- to six-year-olds and end with nine- to ten-year-olds, we can not determine whether some of the subjects' failures are due to age or conceptual incompetence. Second, Povinelli's experiments confound age and experience. When subjects are retested at later ages and succeed, we don't know if the improved performance is due to age or to additional experience. Third, the failures of older subjects could be due to insufficient experience with the task or to biases introduced from other experiments, such as training and modeling by humans. For example, in some experiments chimpanzees fail because response biases lead them to pick a familiar tool rather than a functionally appropriate one, a pattern that implicates the negative consequences of prior training. In other experiments, humans model the task

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for the chimpanzees, but Povinelli doesn't provide sufficient information to evaluate what was done and how this might influence the subjects' performance. Fourth, Povinelli never asks whether the older chimpanzees (which have considerable experience with a variety of tools) can solve some of the earlier problems or, more importantly, can solve different physical problems that are combined in a session instead of presented separately in a block of trials. Testing subjects with a mixture of problems is important because numerous studies have demonstrated that subjects develop learning strategies that enable them to solve one problem at a time but not a variety of conceptually different problems. Although Povinelli may be justified in claiming that young chimpanzees' understanding of the physical world is radically different from our own, we simply don't know if this claim translates to older chimpanzees or to subjects with different experimental histories. Fifth, there are some problems that chimpanzees fail but at least one other nonhuman primate—the cotton-top tamarin—solves (*4*, *5*). The tamarins' success is puzzling because, unlike chimpanzees, they are neither natural tool users nor highly dextrous. Differences in experimental procedure might account for the contrasting results, but the tamarins' performance raises serious questions about why chimpanzees fail.

Had I been asked to evaluate *Folk Physics for Apes* for a peer-reviewed journal, I would not have recommended publication. Povinelli's assessment may be correct, and future work may show that the chimpanzee mind differs from ours in that it myopically focuses on perceptible associations. However, given the methodological problems raised above and recent evidence that chimpanzees understand some of the imperceptible causes of the social world (*6*), my hunch is that they also understand many of the imperceptible forces of the physical world. As humans, we will always find ways to show that we are unique. But if we are interested in evolution, we must show how and why.


**References**

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# Westward Impulse Embodied


**Stephen J. Pyne**


"Soldier. Explorer. Scientist." Add "Administrator," for the government bureaus he oversaw, and the epitaph on his gravestone encompasses most of what the American public knows about Major John Wesley Powell. That he continues to survive in the national memory is a remarkable testimony not only to his striking accomplishments but also to his success in finding a bard to sing of them. Wallace Stegner's survey of the Powell era, *Beyond the Hundredth Meridian*, is widely acknowledged as a canonical work of Western Americana. It's a tough act to follow, for one must confront not only the historical Powell of the Colorado but the hagiographic Powell of Stegner's "biography of a career."

Donald Worster has plunged into those historiographic canyons with the same combination of zest and method that Powell showed when he launched his boats down the Colorado River in 1869. *A River Running West* is a full-gauge biography, a rich broth of detail about Powell's life and times. Those who know his story will discover many fresh tidbits and informed insights. Those who don't will find no better introduction. Here, in careful measure, are Powell's Methodist-ministering, émigré-westering parents; his desultory introduction to learning on the Illinois frontier, his efforts (aborted) to claim a college degree, and his lapse into schoolteaching; his Civil War service as a volunteer officer of artillery, who lost his right arm at Shiloh; his unquenchable zeal for natural history, which led him into museum posts that, in turn, brought him to the Rocky Mountains for specimen collecting and then through his celebrated first-descent down the Colorado River from Green River, Wyoming to Callville, Nevada.

The fame that followed that exploit steadily moved Powell from the field to the office as a captain of industry in the expanding realm of government-sponsored science. He ran one of the four post–Civil War western surveys, centered in Utah. He was instrumental in the founding of geomorphology, both through personal contribution and, even more, by sponsoring others like G. K. Gilbert and Clarence Dutton. He worked on the Indian question as it affected the Utes and Paiutes, and created and oversaw the Bureau of Ethnology, nestled in the Smithsonian Institution. He became the second director of the U.S. Geological Survey—effectively its founding patriarch. From that post he promoted a vision of science-based settlement of the West. His *Report on the Lands of the Arid Region of the United States* (1878) landed him on the Public Lands Commission; it still survives as one of the great documents of American conservationist thinking. The USGS became a model government agency, the "mother of bureaus." Eventually politics and his maimed arm drove Powell out of public life and into abstract philosophy. On his death in 1902, however, he was widely honored as a prophetic figure.


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The particulars alone—the outcome of meticulous scholarship—are worth the price of admission. But Worster labors heroically to arrange these pieces within the force field of the times. He does what great historians do best: he gives context to contingency. Specifically, he positions Powell within his "true home," the nation, and he aligns Powell's moral fervor for reform within the "great nineteenth-century gospels of salvation, the nation-state and natural science." Wes Powell was not simply a "man of the West," but an American. The rapids of the Colorado River were only minor riffles in the real "river flowing west," which was America's flood-tide surge across the continent.

**A River Running West**
The Life of John Wesley Powell
*by Donald Worster*


Oxford University Press, New York, 2000. 687 pp. $35. ISBN 0-19-509991-5.


Asking which of the biographies, Stegner's or Worster's, is better is like asking whether an electron is a particle or a wave. Each book is a creature of its time; each tests for different traits by different means. The novelist Stegner emphasizes the hard particle of character, the historian Worster the wave-propagating properties of the field. Published the year of the controversy over the Echo Park dam in Dinosaur National Monument, Stegner's account portrays Powell as a bold Westerner and a clairvoyant conservationist, a man who saw Facts and spoke Science. Worster's Powell is a multicultural American, a man who lost an arm fighting to end slavery, who brought his intrepid wife West to share some of his surveys, who demonstrated sympathy for Mormon settlement, and who, above all, became fascinated by American Indians and sought to enlist science and government to aid their progress. Unlike his companion geologists who saw only rock, Powell always imagined people amid the stone and, in fact, "inserts Indians into the story even where they were not really there."

With this new biography, Powell has become twice blessed. But it may be said equally that he has twice blessed his biographers. By transporting Powell's reputation beyond the canyons of the arid West and onto a national scene, Worster has so moved his own.