transformed and complicated the way the primitive singular/plural relationship is thought about and represented.

Songbirds offer a further illustration of both the connection and the gap between animal and human faculties. Birds learn songs in much the same way that humans acquire language. There's a critical early window in which exposure to certain stimuli is necessary; and, as with language, bird songs consist of highly structured sounds that are combined and recombined to create new songs. Yet in the case of birds, different combinations of sounds don't change the song's message. Individual variations serve to distinguish one bird from another, like an accent, but the song means only one thing (i.e., "I'm a territorial male...if you're a female and want to mate, come find me"). "It's not that birds don't have thoughts about the world," Hauser says. "They do. But the combinatorial ability doesn't get mapped onto the ability to create meaning, the way it does with language—allowing humans to combine and recombine sounds constantly to create different words and expressions."

Hauser describes animals as having "laser-beam" intelligence, in which each cognitive capacity is locked into a specific function. Humans, by contrast, have "floodlight" intelligence, he says: they can use a single system of thought in multiple ways and can translate information from one context to another. "Animals," he elaborates, "live in a world in which the systems don't talk to each other."

Take tool use, for example. In 1960, when Jane Goodall discovered a chimpanzee using a grass stalk to catch termites, a long-held theory about human uniqueness fell apart. "But the significance of tool use doesn't lie in the *fact* of tools," Hauser explains, "but rather in how they're conceived and used." Animal tools consist of only one material and have only one functional part, while human tools have evolved over time to be made of various materials and have multiple functions. A knife can be used to cut food, open a box, or stab an intruder. Forty years of research, he reports, have not revealed any evidence that animals can use one tool for multiple purposes.

Hauser summarizes the distinguishing characteristics of human thought under four broad capacities. These include: the ability to combine and recombine different types of knowledge and information in order to gain new understanding; the ability to apply the solution for one problem to a new and different situation; the ability to create and easily understand symbolic representation of computation and sensory input; and the ability to detach modes of thought from raw sensory and perceptual input.

Across the board, Hauser says, there are signs that animal evolution passed along some capabilities "and then something dramatic happened, a huge leap that enabled humans to break away. Once symbolic representation happened, if the combinatorial capacity was there, things just took off. Precisely how and when this happened, we may never know."

—ASHLEY PETTUS

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LIVING LIST

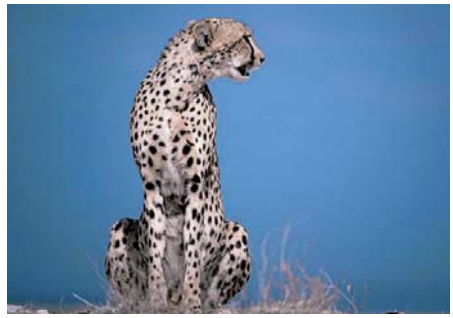
World-Wide Web of Life

Of the 23 types of salamander in the genus *Thorius* endemic to Mexico, 21 are endangered: so rare that they live only on certain mountain ranges, or, in some cases, on a single mountaintop. James Hanken, director of the Museum of Comparative Zoology (MCZ) and Agassiz professor of zoology, has studied these amphibians for years and thinks many of them may disappear. "We need to know a lot more about what we have if we're ever going to inventory additional, unknown species before they're lost," he says, "and if we're ever going to be able to save them."

In an enormous effort to collect what we *do* know about Mexico's salamanders—and about the rest of the 1.8 million known species on the planet—Harvard and other scientific institutions have come together to create an on-line catalog of all the planet's animals and plants, an Encyclopedia of Life (EOL).

In late February, the project went on line with roughly 35,000 specimen pages, culled from other digital resources such as FishBase (which explains why the encyclopedia initially had a ichthyologic bent). Scientists associated with the project have also built two dozen "exemplar pages": detailed looks at everything from a species' life cycle to its role in the ecosystem. But most of the site consists of a million blank place-holders—pages with lit-

DOUG BACKLUND, SOUTH DAKOTA DEPT. OF GAME, FISH, AND PARKS



GARY M. STOLZ

JIRI DUCHON

Images from the Encyclopedia of Life include an American burying beetle, a cheetah, and a smooth snake (*Coronella austriaca*). James Hanken plans to allow amateur ecologists to upload their own photographs to the catalog.

tle more than scientific names—waiting for contributions from scientists and amateurs alike. The aim is to give every species an on-line profile within 10 years.

Pellegrino University Professor emeritus E.O. Wilson (see Open Book, page 26, and "Of Ants and Earth," March-April 2003, page 36) first called for the Encyclopedia of Life in a 2003 article in the scholarly journal *Trends in Ecology & Evolution*

DAVID BURDICK

TIM BOWMAN

Above: A white tip reef shark. Right: A long-billed dowitcher

(fondly known in the field as *TREE*). "I even encountered a bit of skepticism," he recalls, when "a British scientist,...a former adviser to the prime minister and a friend, called me to ask if I were out of my mind." In 2003, he concedes, the idea was farfetched. But now, aided by the Biodiversity Heritage Library—10 libraries (including two at Harvard) that are in the process of digitizing 300 million pages of literature on comparative biology—it is possible to aggregate everything written about a particular species into a rough draft of its Web page.

Harvard is only one of what Hanken calls the encyclopedia's "cornerstones." Also involved, in contributing entries or managing the site itself, are the Smithsonian Institution, the Field Museum in Chicago, the Marine Biological Laboratory in Woods Hole, Massachusetts, and the Missouri Botanical Garden in St. Louis. (Hanken chairs the EOL's overall steering committee.)

But even the combined strength of the world's finest scientific institutions, Hanken believes, would fail to corral the planet's astonishing biodiversity. Early next year, the EOL will begin emulating Wikipedia and allow ecology buffs to upload information about their favorite species. "The only way the Encyclopedia of Life can succeed is with the contributions of tens of thousands, hundreds of thousands, of amateurs," says Jesse Ausubel '73, a senior research associate at Rockefeller University in New York City who helped the encyclopedia obtain $50 million in grants from the MacArthur and Sloan Foundations.

It won't be a complete free-for-all. "To maintain the support and participation of the professional community," says Hanken, "we have to exert some kind of control." Each page will have a curator who checks and authenticates user contributions. Fortunately, he says, certain amateurs are judged knowledgeable enough to curate their own pages. He also notes that because so little information exists about most species (typically the only paper on a species is the one in which it is named), amateur naturalists will be as capable as professionals at keystroking scientific literature into first-rate Web entries.

Hanken envisions the encyclopedia in the tradition of Carolus Linnaeus, who invented the modern taxonomic system, and Louis and Alexander Agassiz, who founded the MCZ and revolutionized the way natural-history museums display their collections (by separating public exhibits from scientific labs). "I think the Encyclopedia of Life is the equivalent in our age," he says, "putting information about biodiversity on line, making it accessible to people, displaying it, constantly updating it." Already, visitors to its website can learn about more than a dozen of Hanken's salamanders: modern technology helping to foster stewardship of life on earth.

—PAUL GLEASON

ENCYCLOPEDIA OF LIFE WEBSITE:
http://www.eol.org

WOEFUL WASTERS

The Financial Cost of Feeling

In 1890, Harvard psychology professor William James sought to redefine the "self," which, he wrote in *The Principles of Psychology*, includes not only our bodies and "psychic powers," but the clothes we wear, the house we live in, the horses we own, and the money we keep in the bank. How we feel, he said, is invariably tied to these belongings.

Today, this may sound obvious—yet during the century that followed James's assertion, economic theories on spending largely ignored emotion. Someone buying shoes, so traditional economics teaches, approaches the purchase with purpose, rationally weighing a pair's pros and cons—will they last through the season? will they match my clothes?—before calmly making a choice. The grief the purchaser happens to feel about a recent death in the family should have no bearing on what is spent. But Jennifer Lerner says it does.

"Emotions have a way of taking hold and directing behavior and carrying over