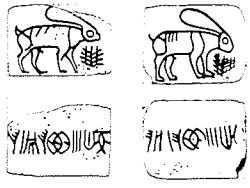
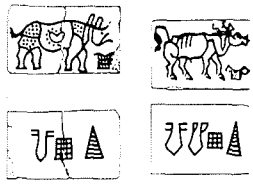
Science & Technology

ARCHAEOLOGY & LANGUAGE: The Puzzle of Indo-European Origins
by Colin Renfrew
Cambridge, 1988
346 pp. $29.95





The links between the various tongues of Europe and the languages of India are a mystery. After all, as Cambridge archaeologist Renfrew notes, "between Europe and Iran and India lies a great tract of land where very different languages are spoken." According to linguistic orthodoxy, Proto-Indo-European, ancestor of such modern languages as English and Hindi, was spoken by the seminomadic Kurgan people living around 4000 B.C. in the steppe region of southern Russia. Around 3500 B.C., these warlike nomads conquered the Danube valley and also began moving southward, ultimately conquering the Indus valley in what is now India; from the Danube, the proto-language, or *Ursprache*, was carried farther west by such tribes as the Germans and the Celts.

Renfrew comes up with a different scenario. Combining linguistic theories and archaeological evidence, he places the homeland of the first speakers of Proto-Indo-European in eastern Anatolia (modern Turkey) at roughly 7000 B.C. Neither bellicose nor rootless, Renfrew's *Ursprache*-speakers were peasant farmers whose moves proceeded at the pace of a few kilometers per generation. Advances in agricultural technology led to population growth, which in turn extended the frontiers of farming and Proto-Indo-European. The *Ursprache* may have diversified during the movement period or later.

Renfrew's hypothesis offers what the old one lacked: a plausible reason for the movement of the Proto-Indo-European speakers. Renfrew is confident, too, that the synthesis of linguistics and archaeology will yield more information about the origins of specific language groups and "about the time when the linguistic and conceptual abilities of fully modern man made their appearance."

FEARFUL SYMMETRY: The Search for Beauty in Modern Physics
by A. Zee
Macmillan, 1987
322 pp. $25

If we observed the universe by looking at its reflection in a mirror, would we arrive at the same laws of physics? If so, the universe would be "reflection invariant." Similarly, does all physics have "rotational symmetry," or is there a preferred direction in the universe?

Following in the footsteps of Albert Einstein, contemporary physicists, including author Zee of the University of California, Santa Barbara, are

driven by a search for beauty in the universe. Indeed, the belief that nature at the fundamental level "is beautifully designed" guides physicists to "replace the multitude of phenomenological laws with a single fundamental law, so as to arrive at a unified description of Nature."

Even as long ago as the 17th century, Galileo recognized that two experimenters in constant motion with respect to each other—for example, one on a cart and the other standing still on the ground—should arrive at the same results in conducting their experiments. The symmetry of "relativistic invariance tells us," Zee says, "that it is impossible to decide whether we are at rest or moving steadily." Not so obvious or intuitive was Einstein's revelation that when the relative speed of two experimenters, one standing on a train platform, the other on a train, begins to approach the speed of light, space and time as observed by the two take on strange and new properties. According to the mathematics of the Special Theory of Relativity, the experimenter on the train would see that clocks on the platform seem to tick slowly, and objects would all seem to be compressed. But the observer on the platform would see the same effects on the train whizzing by. Although the general public has long been amazed by these "strange features," few people realized that only through his "profound appreciation of the power of symmetry" was Einstein able to arrive at his conclusions about "spacetime."

In 1956, physicists T. D. Lee and C. N. Yang found that the symmetry of reflection was violated during a certain subatomic process: It seems that an electron emitted in the decay of a particular nucleus is more likely to emerge in one direction than the other. Although shaken by this discovery, physicists continue to dream of "a unified description of Nature" in which the four forces of physics—the strong nuclear force, the weak nuclear force, electromagnetism, and gravity—are tied together in a "Grand Unification Theory."