of a person with epilepsy and one without epilepsy.

Nonetheless, scientists of all stripes still find much of value in a facet of mechanical objectivity that emphasizes the impartial application of standard mathematical methods, says Porter. Quantitative rigor proves most alluring to troubled scientific communities, which are buffeted by internal divisions and outside criticisms, he argues. Objective standards attempt to heal the distrust among researchers who are largely strangers to one another by making their specialized knowledge public and impersonal.

In contrast, and perhaps somewhat surprisingly, disciplines that enjoy a more secure status operate largely on the basis of informal, shared conventions rather than rigidly applied objective methods.

Porter explored several examples of this pattern in his book *Trust In Numbers* (1995, Princeton University Press). For instance, mathematically precise cost-benefit analyses were developed in the early 20th century by the U.S. Army Corps of Engineers. In the face of intense political pressure, the corps had been plagued by "utter disunity and savage infighting," Porter says. At the same time, powerful congressmen opposed the corps' efforts to plan and carry out major public works projects.

Analysis of congressional testimony, internal corps documents, and other sources indicates that strict cost-benefit formulas expressed in mathematically objective terms, such as those in the 1936 Flood Control Act, were developed by the corps to unite warring engineers and to overcome legislators' concerns about its competence to carry out complex tasks.

Yet, at the same time, the French government's engineering corps successfully resolved controversies over the location and costs of various public works without conducting a single cost-benefit analysis. Unlike their U.S. counterparts, the French engineers reached consensus on thorny issues through informal discussions informed by their past professional experiences. French politicians left the engineers alone, regarding them as elite and eminently trustworthy products of the national educational system.

Members of France's engineering corps showed no interest in cost-benefit rules until after World War II, when U.S. influence expanded in Europe, Porter contends.

Today, the small community of experimental high-energy physicists operates much in the tradition of France's prewar engineers, in his view. These scientists—a select few who survive a long process of formal training and research apprenticeships—have access to only a few particle accelerators and constantly adjust or even completely rebuild their own detectors for new experiments. Independent replication of experimental results proves extremely difficult when the equipment constantly changes from one researcher to another. Instead, influential physicists assess the skill and trustworthiness of experimenters and reach agreement as to whether a particular set of findings merits acceptance.

In contrast, experimental psychology, which faces stark internal divisions and considerable political pressures, clings to rigid statistical formulas of objectivity (SN: 6/7/97, p. 356), the UCLA researcher holds.

Historical work like Porter's challenges the widespread tendency to treat objectivity as "a given" that never changes, comments Hacking.

"Scientists employ techniques and ways of thinking which are powerful and effective, but which are often hard to articulate," Porter says. "In science, as in political and administrative affairs, objectivity has more to do with the exclusion of personal judgment and the struggle against subjectivity than with truth to nature." □

Astronomy

Star motions yield four more planets

The hunt for planets outside our solar system continues to show results. The latest findings include a nearby, sunlike star that may have two companions: a planet and a heavier object, known as a brown dwarf. Studies also suggest that three other nearby stars have closely orbiting planets, bringing to 16 the number of extrasolar planets that astronomers have indirectly detected around sunlike stars. As recently as August, only 10 such planets had been identified (SN: 8/8/98, p. 88).

The main search strategy has stayed the same since the first extrasolar planet was discovered in 1992. By tracking the back-and-forth motion of nearby stars toward and away from Earth, astronomers infer the gravitational tug of planets too faint to be detected directly. This technique favors the detection of massive, closely orbiting planets, since these bodies induce the largest wobbles in their parent stars.

Researchers have identified two planets among a sample of 82 stars they had begun monitoring recently at Lick Observatory on Mt. Hamilton in California. The team had already been studying 107 stars at Lick for several years. One of the newly found planets, which orbits the sunlike star HD195019, is at least 3.51 times as massive as Jupiter and whips around the star in just 18.27 days.

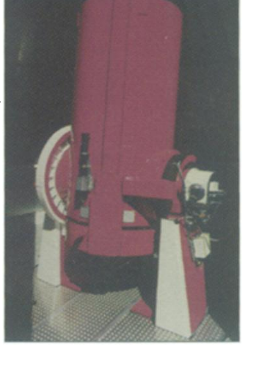
The other planet found at Lick Observatory circles the sunlike star HD217107 once every 7.12 days and is at least 1.27 times as massive as Jupiter. Geoffrey W. Marcy of San Francisco State University and the University of California, Berkeley and his colleagues, including R. Paul Butler of the Anglo-Australian Observatory in Epping, Australia, will report both Lick findings in the January 1999 Publications of the Astronomical Society of the Pacific.

A third discovery, which Marcy announced Dec. 2, during a talk at Marymount College in Palos Verdes, Calif., concerns a star whose motion was tracked at the W.M. Keck Observatory atop Hawaii's Mauna Kea. The wobble of the star HD168443 suggests that it has a planet, which is at least 4.96 times as massive as Jupiter, in a highly elongated orbit.

The tug of a single object can't fully explain the star's motion, however. Marcy proposes that the star has another companion—either a tiny star or a brown dwarf, an object heavier than a planet but too lightweight to shine continuously as stars do.

The fourth find comes from a Swiss team working at the European Southern Observatory's La Silla Observatory in La Serena, Chile. Using a new telescope and spectrograph devoted to tracking stellar wobbles, the team found evidence of a planet circling Gliese 86, a dwarf star with a mass 0.79 times that of the sun. About 35 light-years from Earth, this is the second-closest star known to harbor a planet.

Gliese 86 has another distinction: It possesses an unseen stellar partner. The separation between the two stars is probably more than 100 times larger than the distance between the newly discovered planet and the star it orbits, the Swiss team reports. The planet circles the star once every 15.83 days and is at least 4.9 times as massive as Jupiter. It is separated from its parent by just over one-tenth the distance between the sun and Earth. Didier Queloz of the Geneva Observatory and NASA's Jet Propulsion Laboratory in Pasadena, Calif., and his colleagues announced the finding on Nov. 24. —*R.C.*



Queloz et al./ESO

The new Leonard Euler Telescope at La Silla Observatory.