combine to form distinct "combination" tones. Ohm's law disavowed such waves; but, argued Seebeck, the ear can hear them.

In 1856, Hermann von Helmholtz, German philosopher and physicist (1821–94), settled the dispute in Ohm's favor. Using more refined instruments to measure sound, Helmholtz discovered that Seebeck's "combination" tones were, in fact, Ohm's "component waves." Within the ear, he argued, these waves are "subjectively" distorted and not "heard out" as simple waves.

By separating mechanics from psychology, Helmholtz was able to apply his "theory of signs" to acoustics. He contended that the mind, when receiving information of little use, generalizes the existence of the information through "unconscious inference." Thus, the experienced human ear finds the complex tones of voices and instruments "sufficient" to establish the identity of the sound-producing body. Hearing the component tones adds no useful information. Helmholtz's interest in acoustics, Turner speculates, developed from his earlier *optical* discovery: that for precisely the same utilitarian reason, the human eye does not see the "blind spot" where the optic nerve enters the retina.

Is the Sun Predictable?

"The Case of the Missing Sunspots" by John A. Eddy, in *Scientific American* (May 1977), 415 Madison Ave., New York, N.Y. 10017.

Sunspots—strong magnetic fields on the surface of the sun—have been thought to appear and disappear in 11-year cycles. Closely linked to the aurora borealis, or "northern lights," sunspots have for centuries been taken as evidence that the forces of the sun are constant and predictable. In 1893, however, E. Walter Maunder, Superintendent of the Royal Greenwich Observatory, made a curious and little-noted discovery. While perusing old astronomical records, he found that for a 70-year period ending in 1715, sunspots and other solar activity had virtually vanished from the sun.

Setting out to re-examine this "skeleton in the closet of solar physics," Eddy, an astronomer at the Harvard College and Smithsonian Astrophysical Observatories, confirms the accuracy of Maunder's original research. Between 1645 and 1715—a period which Eddy calls the "Maunder minimum"—there were few aurora sightings and not a single account of sunspot-induced streamers, which can be seen trailing from the sun's corona during an eclipse.

More intriguing evidence involves analysis of carbon 14 content—which correlates directly with solar activity—in the annual growth rings of the bristlecone pine. Plotting carbon 14 levels not only confirmed the Maunder minimum but revealed at least 12 other similar periods during the past 5,000 years, each lasting from 50 to 200 years and ushering in particularly cold eras in the history of the earth's climate. The Maunder minimum itself corresponds to the 17th century's so-called "little ice age."