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The Austrian scientist Ernst Mach (1838–1916) carried out work of importance in many fields of enquiry, including physics, physiology, psychology and philosophy. Many significant thinkers, such as Ludwig Wittgenstein and Bertrand Russell, benefited from engaging with his ideas. Mach delivered the twelve lectures collected here between 1864 and 1894. This English translation by Thomas J. McCormack (1865–1932) appeared in 1895. Mach tackles a range of topics in an engaging style, demonstrating his abilities as both a researcher and a communicator. In the realm of the physical sciences, he discusses electrostatics, the conservation of energy, and the speed of light. He also addresses physiological matters, seeking to explain aspects of the hearing system and why humans have two eyes. In the final four lectures, he deals with the nature of scientific study. *The Science of Mechanics* (1893), Mach's historical and philosophical account, is also reissued in this series.

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Popular Scientific Lectures

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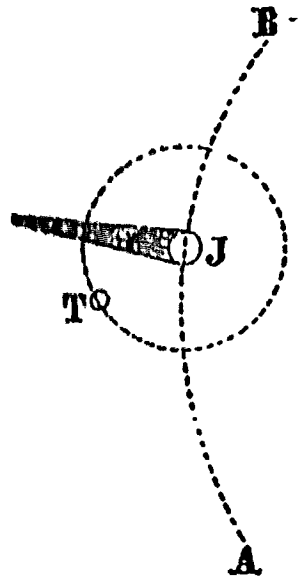
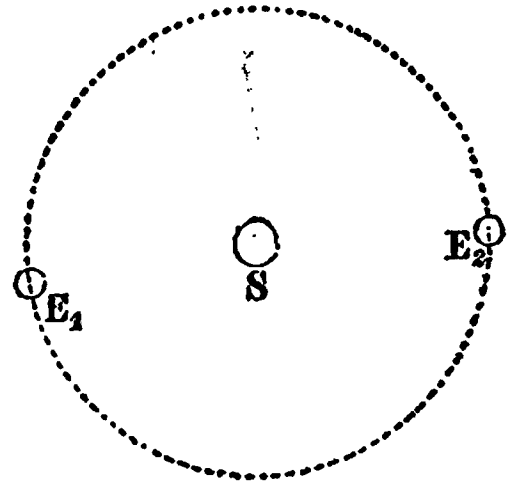
POPULAR SCIENTIFIC LECTURES

ERNST MACH
TRANSLATED BY
THOMAS J. MCCORMACK





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cannot simply observe it but must also *feel* it, because it comes to us mostly with supercilious arrogance, mostly unvanquished. The hero of my novel would be a cockchafer, venturing forth in his fifth year for the first time with his newly grown wings into the light, free air. Truly it could do no harm if man would thus throw off his inherited and acquired narrowness of mind by making himself acquainted with the world-view of allied creatures. He could not help gaining incomparably more in this way than the inhabitant of a small town would in circumnavigating the globe and getting acquainted with the views of strange peoples.

* * *

I have now conducted you, by many paths and by-ways, rapidly over hedge and ditch, to show you what wide vistas we may reach in every field by the rigorous pursuit of a single scientific fact. A close examination of the two eyes of man has conducted us not only into the dim recesses of humanity's childhood, but has also carried us far beyond the bourne of human life.

It has surely often struck you as strange that the sciences are divided into two great groups, that the so-called humanistic sciences, belonging to the so-called "higher education," are placed in almost a hostile attitude to the natural sciences.

I must confess I do not overmuch believe in this partition of the sciences. I believe that this view will appear as childlike and ingenuous to a matured age

as the want of perspective in the old paintings of Egypt do to us. Can it really be that "higher culture" is only to be obtained from a few old pots and palimpsests, which are at best mere scraps of nature, or that more is to be learned from them alone than from all the rest of nature? I believe that both these sciences are simply parts of the same science, which have begun at different ends. If these two ends still act towards each other as the Montagues and Capulets, if their retainers still indulge in lively tilts, I believe that after all they are not in earnest. On the one side there is surely a Romeo, and on the other a Juliet, who, some day, it is hoped, will unite the two houses with a less tragic sequel than that of the play.

Philology began with the unqualified reverence and apotheosis of the Greeks. Now it has begun to draw other languages, other peoples and their histories, into its sphere; it has, through the mediation of comparative linguistics, already struck up, though as yet somewhat cautiously, a friendship with physiology.

Physical science began in the witch's kitchen. It now embraces the organic and inorganic worlds, and with the physiology of articulation and the theory of the senses, has even pushed its researches, at times impertinently, into the province of mental phenomena.

In short, we come to the understanding of much within us solely by directing our glance without, and *vice versa*. Every object belongs to both sciences. You, ladies, are very interesting and difficult problems

for the psychologist, but you are also extremely pretty phenomena of nature. Church and State are objects of the historian's research, but not less phenomena of nature, and in part, indeed, very curious phenomena. If the historical sciences have inaugurated wide extensions of view by presenting to us the thoughts of new and strange peoples, the physical sciences in a certain sense do this in a still greater degree. In making man disappear in the All, in annihilating him, so to speak, they force him to take an unprejudiced position without himself, and to form his judgments by a different standard than that of the petty human.

But if you should ask me now why man has two eyes, I should answer:

That he may look at nature justly and accurately; that he may come to understand that he himself, with all his views, correct and incorrect, with all his *haute politique*, is simply an evanescent shred of nature; that, to speak with Mephistopheles, he is a part of the part, and that it is absolutely unjustified,

> "For man, the microcosmic fool, to see
> Himself a whole so frequently."

ON SYMMETRY.*

AN ancient philosopher once remarked that people who cudgelled their brains about the nature of the moon reminded him of men who discussed the laws and institutions of a distant city of which they had heard no more than the name. The true philosopher, he said, should turn his glance within, should study himself and his notions of right and wrong; only thence could he derive real profit.

This ancient formula for happiness might be restated in the familiar words of the Psalm:

"Dwell in the land, and verily thou shalt be fed."

To-day, if he could rise from the dead and walk about among us, this philosopher would marvel much at the different turn which matters have taken.

* Delivered before the German Casino of Prague, in the winter of 1871. A fuller treatment of the problems of this lecture will be found in my *Contributions to the Analysis of the Sensations* (Jena, 1886), English Translation, Chicago, 1895. J. P. Soret, *Sur la perception du beau* (Geneva, 1892), also regards repetition as a principle of æsthetics. His discussions of the *æsthetical* side of the subject are much more detailed than mine. But with respect to the psychological and physiological foundation of the principle, I am convinced that the *Contributions to the Analysis of the Sensations* go deeper.—MACH (1894).