

ball or a discharge of a gun, the ball is seen to be hit, or the puff of smoke is perceived before the corresponding sound is heard. The rate of speed of sound can be calculated and is found to vary according to the state and properties of the transmitting medium. It does not vary markedly, however, with its pitch, and with its loudness—fortunately for the musician.

All sounds travel through air rather more than 1,100 feet a second. The speed increases somewhat with the rise of temperature, the elasticity of the atmosphere, on which property the velocity of sound in any medium depends, increasing in a like degree. The rate at which, as well as the relative ease, with which sound travels through other media than gases has been carefully studied. As a rule solids are better transmitters than liquids, and liquids than gases. Sound passes through iron seventeen times faster than through the air. In virtue of this law the Indians, by applying the ear to the ground, ascertained the approach of enemies imperceptible by other means.

The density of the media through which sound passes influences its intensity. On a frosty night, the air being denser, sounds are more distinct. A famous Alpine climber relates that the report of a pistol at a great altitude appeared no louder than that of a small cracker at a lower level. The intensity also varies inversely as the square of the distance. This familiarly known law of inverse squares holds for wave-motions in general, whether of radiant heat, of light, or of gravitation.

An echo is reflected sound. The rattling of thunder is sound reflected from more than one surface. The whispering gallery of St. Paul's Cathedral illustrates the phenomenon of a series of reflections or echoes. Echoes sometimes cause difficulties in halls for music or public speaking. The defect is overcome by cutting off all sound-waves except those which travel directly between speaker and audience. Wires, tapestries, and, for that matter, the bodies of the hearers themselves serve the purpose. On the other hand, the principle of the echo, or repeated reflection of sound, is admirably utilized in the ear trumpet, and in all kinds of speaking tubes.

It is a truism to say that sounds differ greatly. The dividing line may not be easily drawn, but all sounds may be classed under two heads, noises and musical notes. The vibrations to which we give the plebeian name of noise are irregular, while the musical are regular. Here the psychologist asks why does one sound please and another grate? The physicist explains that, while ignorant how