

SOUND1

SPEED
PERIOD
WAVELENGTH

THE
BOOK IS
NOW
AVAILABLE!

PLAY WITH SOUND

MANUAL FOR ELECTRONIC
MUSICIANS AND OTHER SOUND
EXPLORERS



TOMMASO ROSATI
TIMOTHY HSU

A Focal Press Book

R

TOMMASO ROSATI
SOUND ART

Sound

(from the Latin *sonum*)

is the sensation given by the vibration of an oscillating body. Our ears along with our brain, collect these vibrations that occur and interpret them as sounds.

A sound in order to exist needs:

a source, that creates vibrations, such as a drum

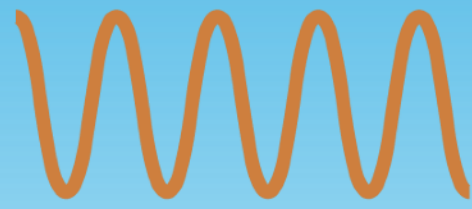
an elastic medium that waves travel through, such as air

our **receiver** such as our auditory system that acts as a transducer and converts these waves into electrical signals that our brains process.

SOURCE



WAVE



AUDITORY
SYSTEM

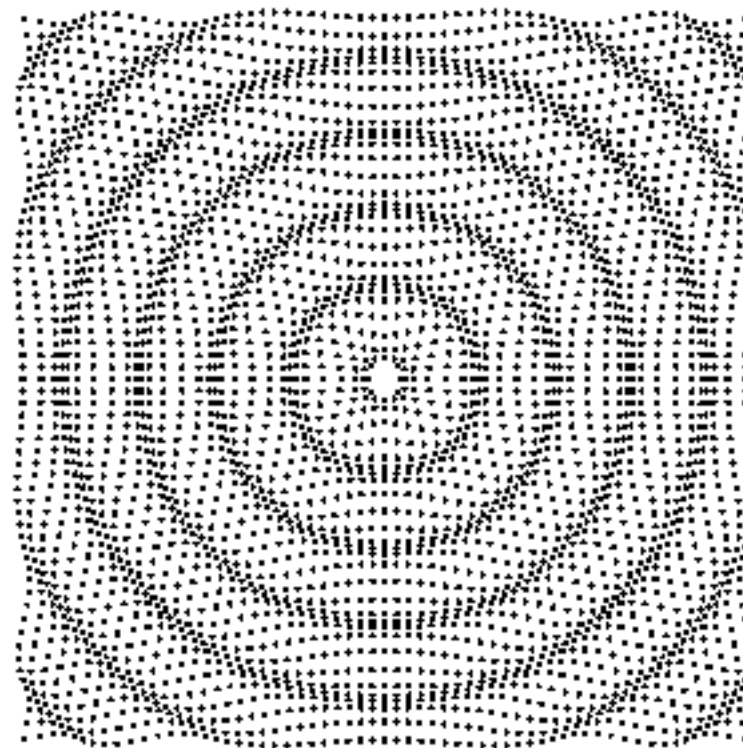


ELASTIC MEDIUM

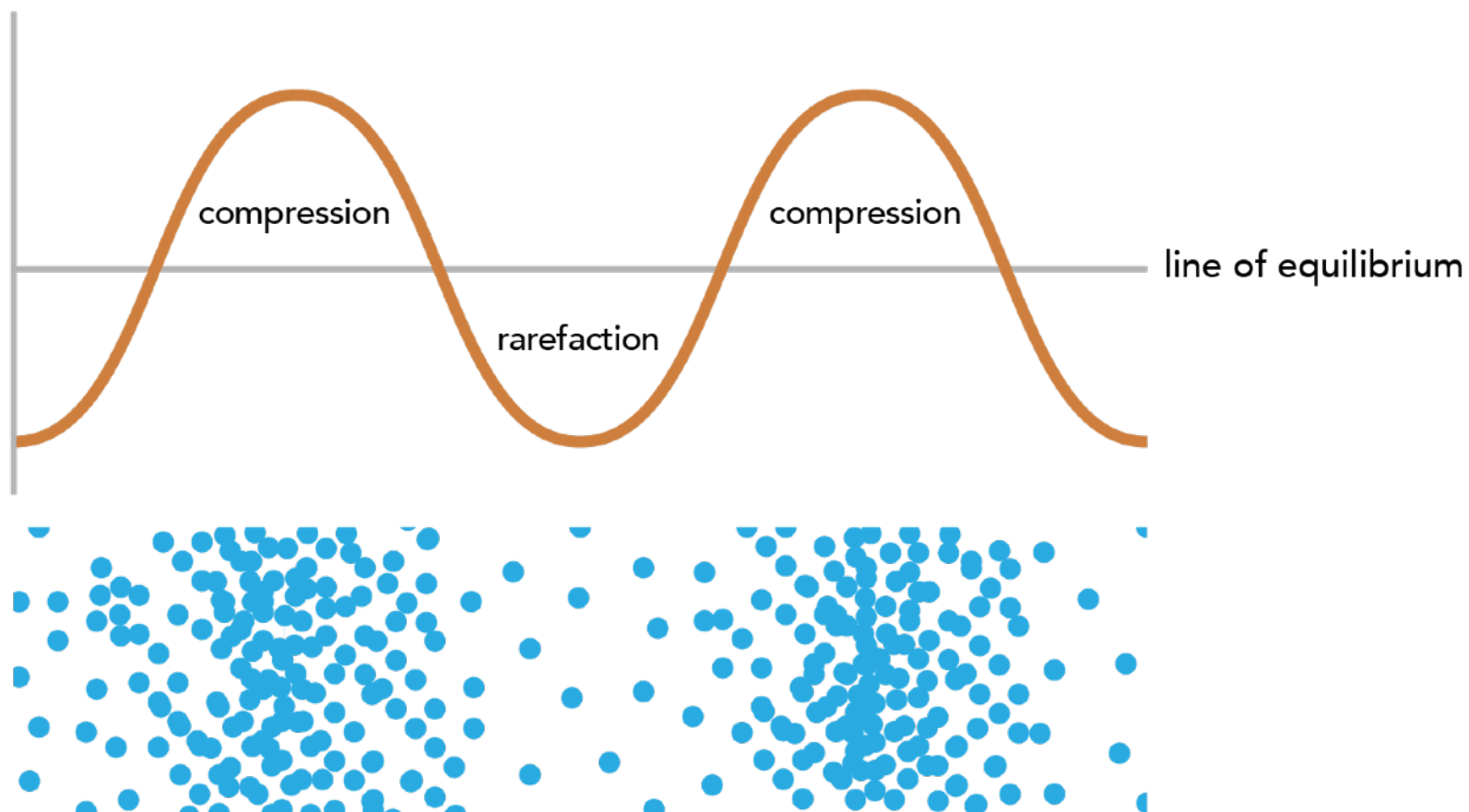


The **elastic medium**, whether it is a gas (like air), a liquid, or a solid, is made up of many **molecules** that are close together. As the vibrating body oscillates, it first pushes the molecules that are closely adjacent to the body closer together causing compression. Compressions exhibit higher pressures. Rarefactions are areas of lower pressure. When the vibrations stop, then we return to silence.

Sound energy is thus a mechanical process that begins at the vibrating source and propagates as sound waves through an elastic medium towards the listener.



The wave is often represented as a graph depicting pressure, describing what happens as the pressure variations travel through the air.



Sound sources



string bowed into vibration by friction



string beaten by hammer



reed blown into vibration



lips buzzed by a performer



cymbal struck by wood sticks

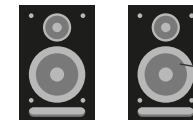
membrane (skin), beaten by wood sticks



air column sent into vibration from blown air



vocal cords sent into vibration by expelled air



cone sent into vibration by an electrical signal

Speed of sound

+Elasticity = +speed

+Hot = +speed

One of the properties that describes an elastic medium is the speed of propagation (speed of sound)

In air at 20° C it's

343 m/s

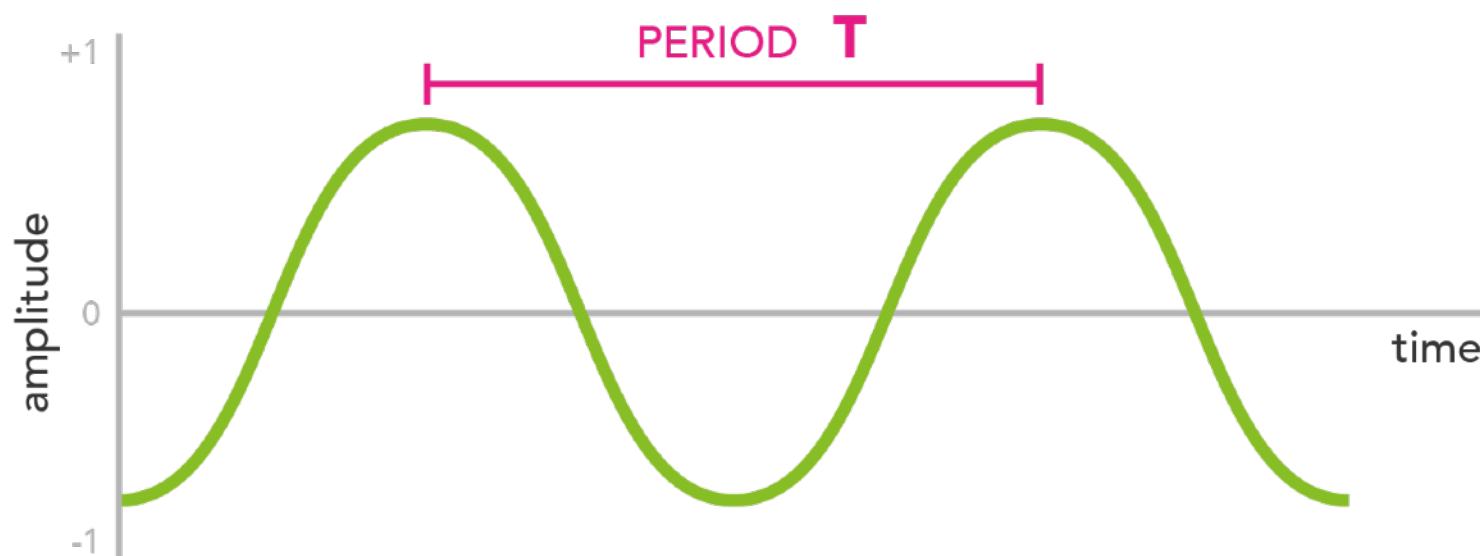
		temperature			
		0°C - 32°F	20°C - 68°F	80°C - 176°F	
GAS					density ↑ elasticity ↓
air	331	343	375		
helium	972	1007	1105		
LIQUIDS					
water	1403	1481	1555		
SOLIDS					
iron	*	4910	*		

* = differences in solids at temperature changes are negligible

Cycle - Period

The complete oscillation of the wave, that repeats over and over again, from a point in a repetition to the same point in the next repetition, is called a **cycle**

We define **period (T)**, usually measured in milliseconds, as the time it takes for the wave to complete one cycle.



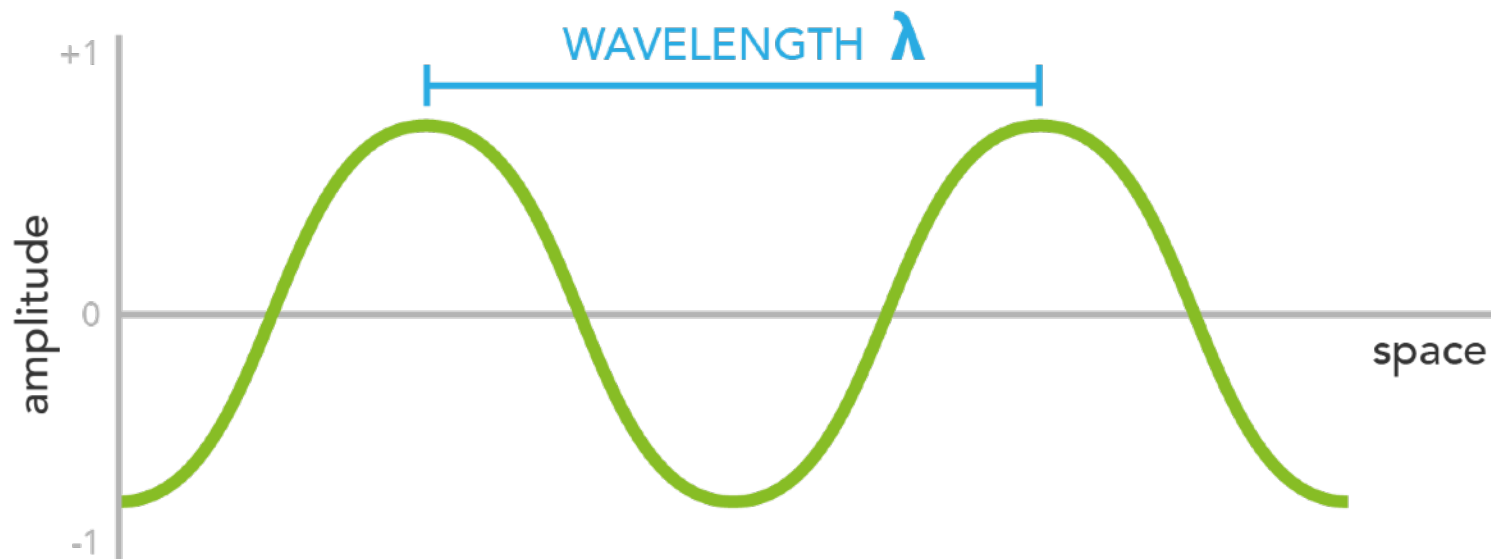
$$\text{period } T = \frac{1}{f}$$

stands for 1 second of time
wave frequency

Cycle - Wavelength

Wavelength λ (Lambda) :

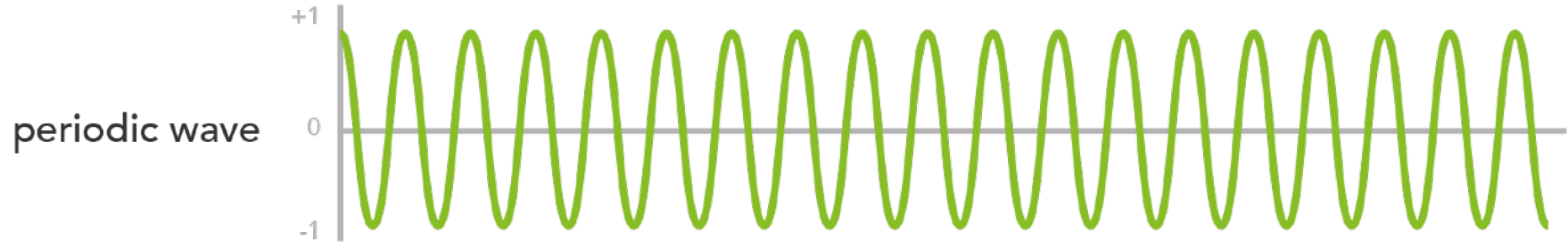
is the distance in space occupied by one wave cycle



wavelength $\lambda = \frac{v}{f}$

speed of sound in the given elastic medium

wave frequency



If a wave consists of exact copies of a cycle that repeats over and over again, it is called a **periodic wave**.



A wave is an **aperiodic wave** if there are no repeating segments or recognizable cycles.

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