

Fechnerian Psychophysics

* G. T. Fechner, *Elements of Psychophysics (Vol. 1)*. New York: Holt, Rinehart and Winston, Inc., 1860/1966.

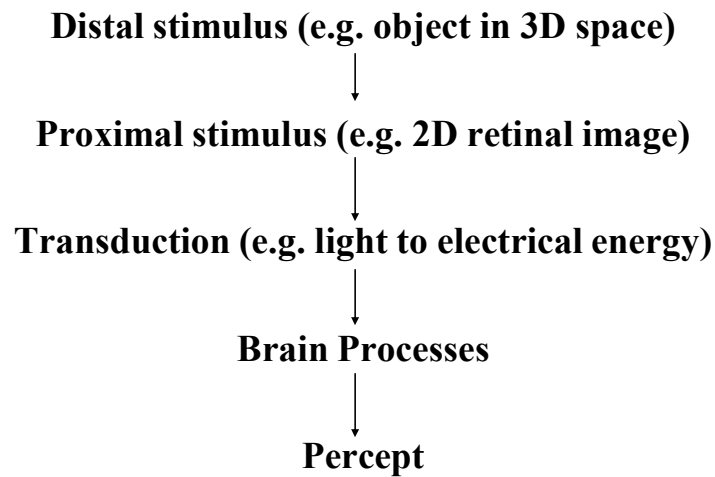
Outline

- **Definition of perception**
- **Fechnerian causal chain of events**
- **Inner and outer psychophysics**
- **Percept viewed as an inverse problem**
- **Definition of absolute and difference threshold**
- **Classical threshold theory**
- **Weber's Law**
- **Fechner's and Steven's Laws**

Definition of Perception

The goal (task) of perception is to acquire accurate and reliable (precise) information about the environment.

Fechnerian causal chain of events



Inner and Outer Psychophysics

- Inner psycho-physics refers to the relation between the brain and the percept (mind-body problem)
- Outer psycho-physics refers to the relation between the stimulus (distal or proximal) and the percept

*This course covers the methodology
of studying outer psychophysics*

Percept Viewed as an Inverse Problem

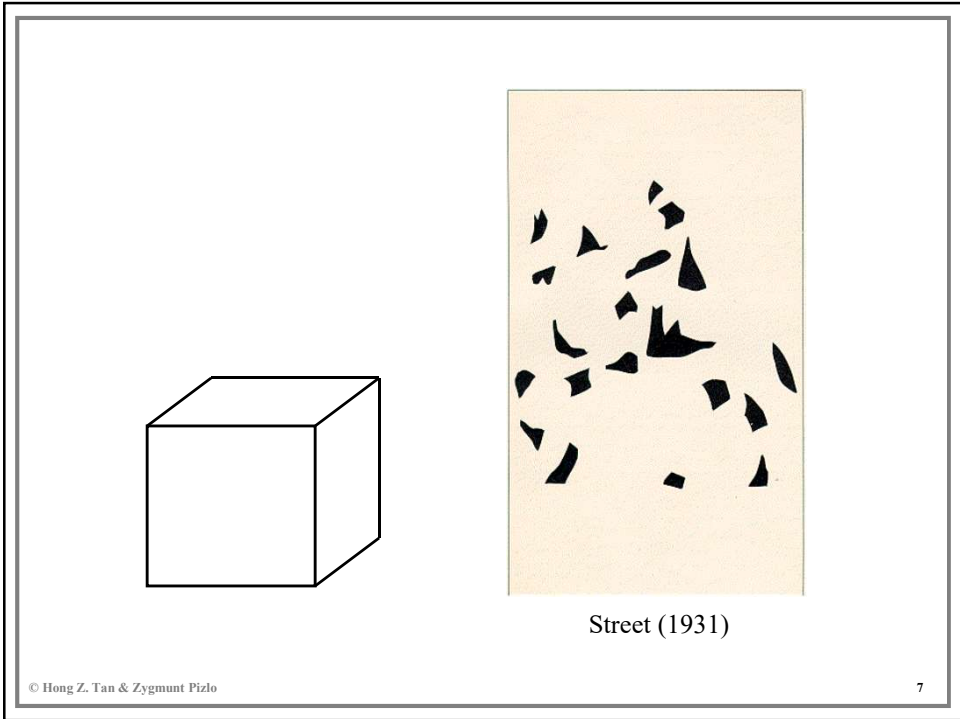
Outer psychophysics can also be viewed as a composition of forward and inverse problems:

distal stimulus → **proximal stimulus**

this is a forward problem and it is expressed in the rules of physics

proximal stimulus → **percept**

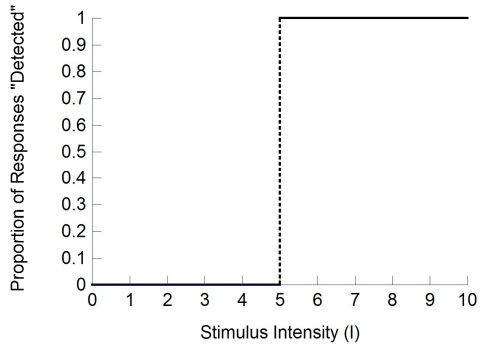
this is an inverse problem and it involves perceptual inferences - inverse problems are difficult



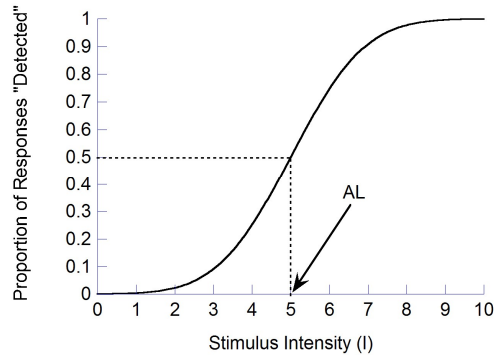
Absolute threshold

Absolute threshold (AL: *absolute limen*) is the smallest amount of stimulus energy that can be reliably detected

Classical Threshold Theory:

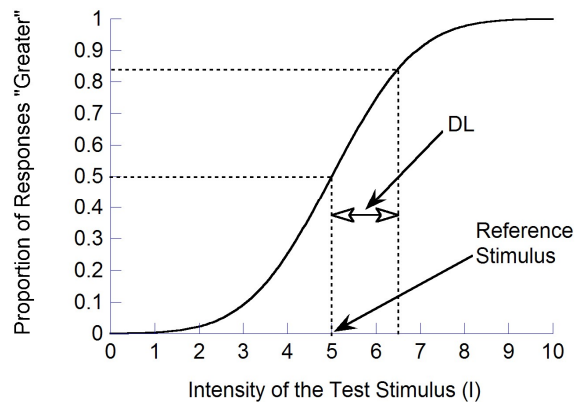


Perceptual representation of a stimulus is not constant; it involves an additive random error. It follows that the psychometric function is not a step-function. Instead it is an S-shaped curve. AL is defined as the 50th percentile point:



Difference threshold

Difference threshold (DL: *difference limen*) is the smallest difference between two stimuli that can be reliably detected



Weber's Law

Difference threshold is proportional to the magnitude (intensity) of the stimulus:

$$DL = w \cdot I$$

$w = DL/I$ is called the Weber fraction

w is a constant for many variables
(i.e., DL grows linearly with I)

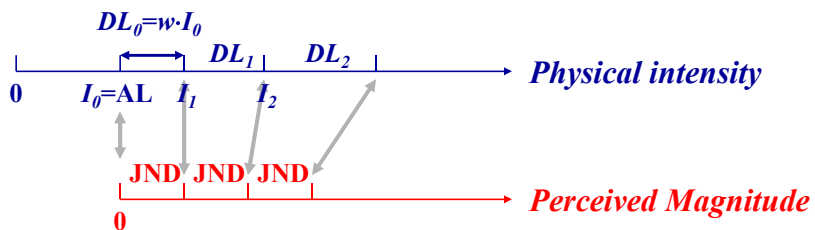
Perceived Magnitude

- Fechner's Law:

$$dP = c \cdot dI/I \quad \longrightarrow \quad P = c' \cdot \log(I/I_0)$$

- Compare to Weber's Law:

$$w = DL/I = \text{constant} \quad \longrightarrow \quad DL = w \cdot I$$



Perceived Magnitude (cont.)

- Stevens's (power) Law:

$$dP/P = c \cdot dI/I \longrightarrow P = c' \cdot I^n$$

(n: fraction or integer)

Reading

- Chapter 1 of Gescheider's Psychophysics book (available on the course website)