

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

Distal stimulus (e.g. object in 3D space)



Proximal stimulus (e.g. 2D retinal image)



Transduction (e.g. light to electrical energy)



Brain Processes



Percept

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 \longrightarrow proximal stimulus

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

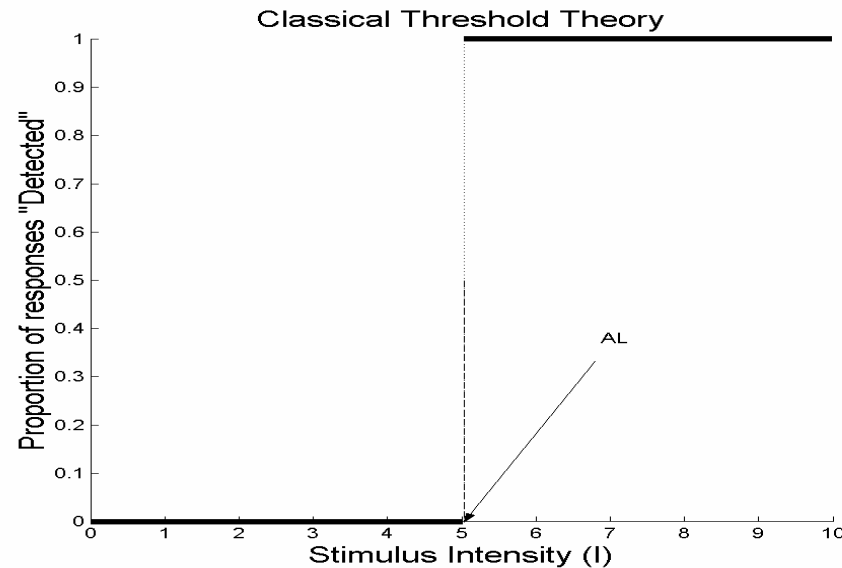
proximal stimulus \longrightarrow percept

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

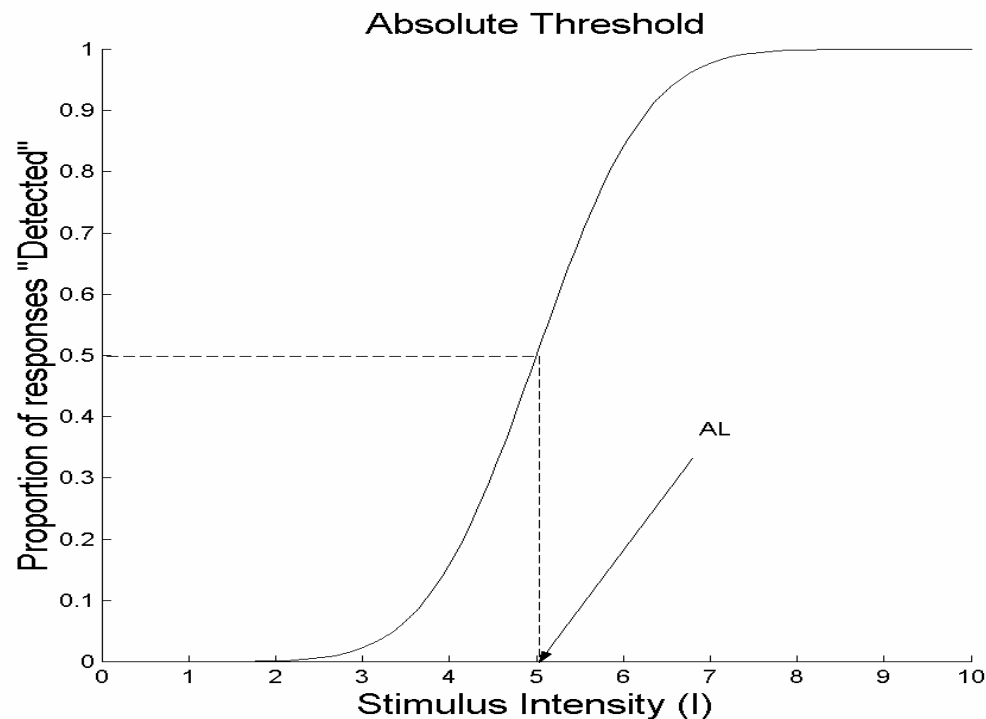
Absolute threshold

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

Classical Threshold Theory:

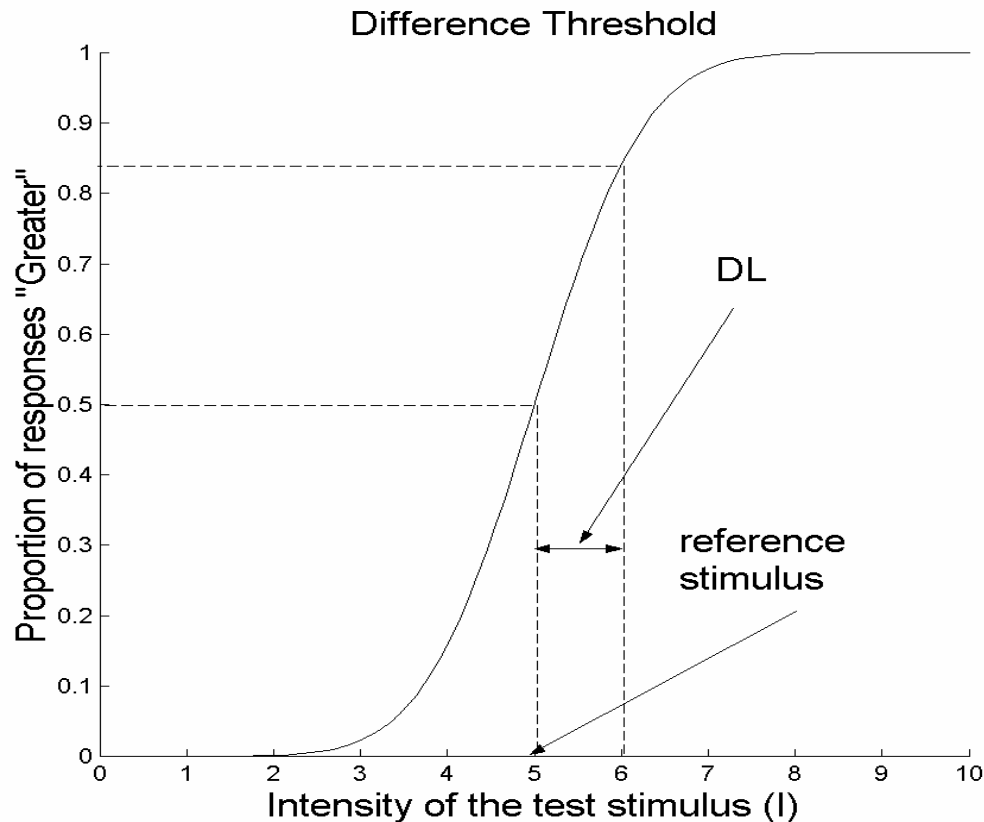


Perceptual representation of a stimulus is not constant; it involves an additive random error. It follows that the psychometric function is not a step-function. Instead it is an *S*-shaped curve. AL is defined as the 50th percentile point:



Difference threshold

Difference threshold (DL) 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:

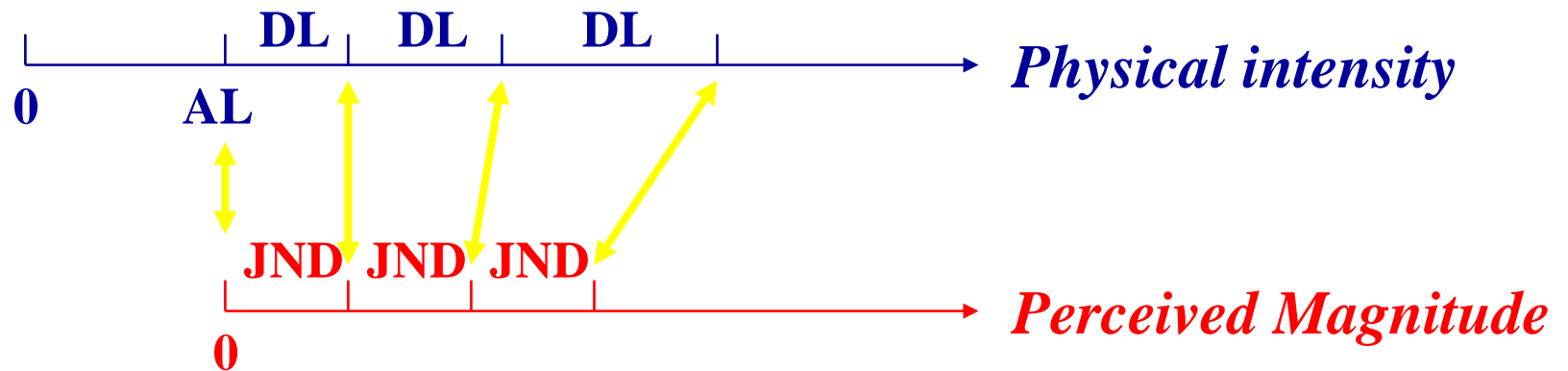
$$DL = w \cdot I$$

w - Weber fraction

Perceived Magnitude

■ Fechner's Law:

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



Perceived Magnitude (cont.)

- Stevens's (power) Law:

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

Reading

- **Chapter 1 of Gescheider's Psychophysics book**

(available at course website, next to today's lecture notes)