

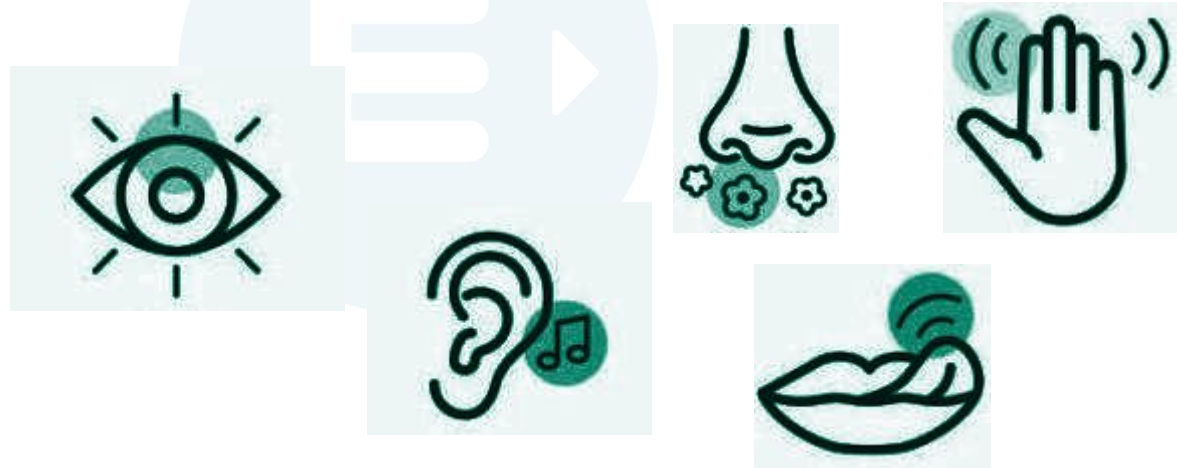
SENSATION

**Psychophysics, Signal detection theory,
subliminal perception, sensory adaptation**

SHAHAMA FEROZ

Sensation

The process by which sensory receptors receive information from the environment.

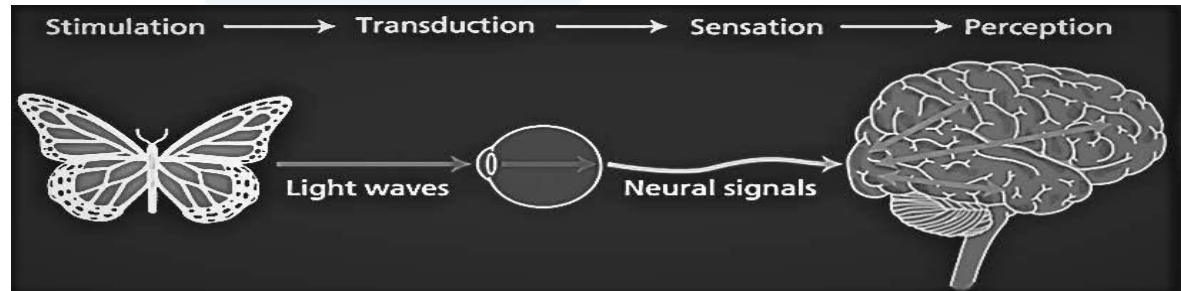


How sensory system work?

Transduction: Translation of physical energy into neural impulses or action potentials

Receptors: specialized neurons located in sensory organs

The electrochemical energy is sent to various projection areas in the brain along various neural pathways and can be processed by the nervous system



Psychophysics

study of the relationship between physical energy and psychological experiences.

Absolute threshold (RL for the German *Reiz Limen*) the smallest magnitude of a stimulus that can be reliably discriminated from no stimulus at all 50 percent of the time.

Sight		Seeing a candle flame 30 miles away on a clear night
Hearing		Hearing a watch ticking 20 feet away
Touch		Feeling a bee's wing falling a distance of 1 cm onto your cheek
Smell		Smelling one drop of perfume in a three room house
Taste		Tasting one teaspoon of sugar dissolved in two gallons of water

Difference threshold (DL for *Differenz Limen*/ just noticeable difference or JND): the smallest physical difference between two stimuli that a person can reliably detect 50% of the time.

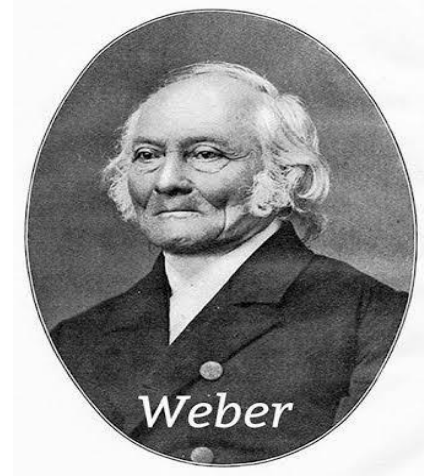
Absolute threshold is simply the JND from nothing (no stimulus input) to something.

Ernst Heinrich Weber (1795-1878)

German Physiologist

Work on lifted weights (1834)- Two relatively heavy weights must differ by a greater amount than two relatively light weights for one weight to be perceived as heavier than the other

Weber's Law: "size of a just noticeable difference is a constant proportion (Weber's fraction) of the size of the initial stimulus"



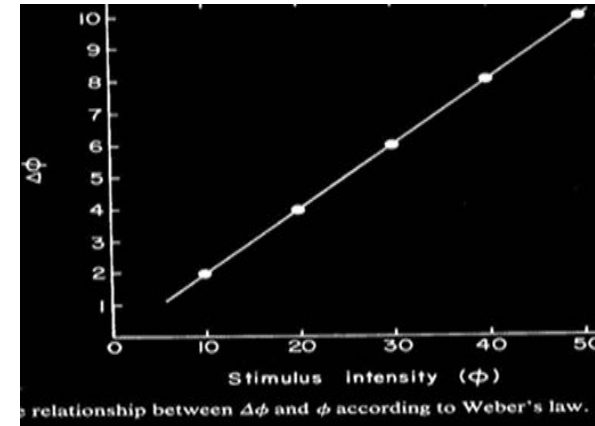
A black rectangular box containing the equation $\frac{\Delta I}{I} = K$ in white. Below the equation, the text "The Weber Fraction" is written in white. A white arrow points from the text to the equation.

So, when we have 10 candles we can make out that 11 candles appear brighter, the constant is equal to $11-10/10$. This equals $1/10$ or 0.1 .

When we start out with 1,000 candles, the constant is the same: $100/1000$ or 0.1 .

$$\frac{\Delta I}{I} = K$$

The Weber Fraction



The smaller the K , the better the sensitivity

1. The Weber fraction for certain sensory dimensions are given below. Indicate the most sensitive dimension



A. 0.083

B. 0.048

C. 0.036

D. 0.013

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The smaller the K, the better the sensitivity, thus answer is (D) 0.013, which is the lowest of all the options given.



The diagram shows the Weber Fraction formula $\frac{\Delta I}{I} = K$ on a black background. A white arrow points from the text "The Weber Fraction" to the equation.

$$\frac{\Delta I}{I} = K$$

The Weber Fraction

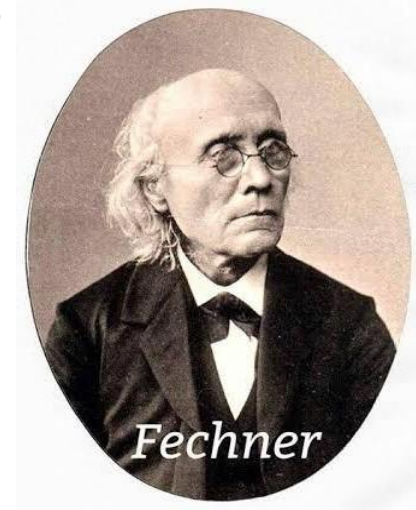
Gustav Theodor Fechner (1795-1887)

German Physicist

Elements of Psychophysics (1860)-Attempt to demonstrate connection between mind and matter in a quantifiable way

Relation between physical change and perceived change in stimuli

Derived from Weber's law, Fechner's law expresses the relationship between the intensity of the sensation and the intensity of the stimulus.

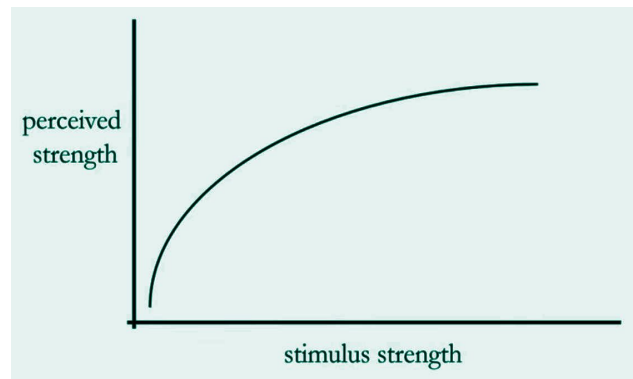


Subjective sensation is proportional to the logarithm of the stimulus intensity

$$S = k \log(R)$$

Logarithmic relation between stimulus and sensation- if a stimulus varies as a geometric progression (multiplied by a fixed factor), corresponding perceived strength is altered in an arithmetic progression (in additive constant amounts)

Sensation increases more slowly as intensity increases.



Signal Detection Theory

No single absolute threshold for sensation.

There is a cognitive component to sensation, explains why the exact same stimulus might be sensed in one situation but not in another

Detection of stimuli involves decision processes as well as sensory processes, depending on a person's experience, expectations, motivation and level of fatigue, besides stimulus intensity.

Signals must be distinguished from noise (events mistaken for stimulus)

Sensitivity: easy or difficulty with which the observer can distinguish signal from noise

Each trial is either a signal trial or a noise trial.

On each trial, subject is asked to indicate whether or not a signal was present.

There are four possible outcomes

- Hits: detecting signals when they are present
- Misses: failing to detect signals when they are present
- False alarms: detecting signals when they are not present
- Correct rejection: not detecting signals when they are absent

		Signal	
		Present	Absent
Response	Yes	Hit	False Alarm
	No	Miss	Correct Rejection

Higher the sensitivity, more the hits and correct rejections

Subliminal Perception

Derived from the term sub (below) and limen (threshold)

- Subliminal stimuli: Just strong enough to activate the sensory receptors but not strong enough for people to be consciously aware of them

Presumed ability to perceive a stimulus that is below the threshold for conscious experience

- Peirce and Jastrow- we can perceive things without even realizing it

- subliminal persuasion: strategy used by marketers to deliberately influence customers subliminally.

James Vicary (1957) increased sale of cola and popcorn by embedding subliminal messages like “eat popcorn” “drink coke” into a then popular movie- flashed on screen for so briefly time that audience were not aware of them.



Sensory Adaptation

Tendency of sensory receptor cells to become less responsive to a stimulus that is unchanging

Receptors no longer send signals to the brain

Occurs involuntary and unconsciously



2. Suppose that Mark is able to detect when a 2-pound weight is added to the 30-pound dumbbells he lifts, but he cannot detect any smaller addition. If Mark were instead lifting 60-pound dumbbells, the smallest weight he would notice being added would be

A. 1 pound

B. 2 pound

C. 4 pound

D. 10 pound

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C. 4 pounds

According to Weber's law, the just noticeable difference is proportional to the intensity of the stimulus. Thus, in this case, since the stimulus (the weights) is being doubled, the change in stimulus would need to be doubled as well for the difference to be detectable.

Since the original value of the added weight was 2 pounds, the new weight must be 4 pounds, making (C) correct.

3. The minimum change between two stimuli required to determine that they are distinct is known as



A. Weber's law

B. Absolute threshold

C. Just noticeable difference

D. Sensory adaptation

3. The minimum change between two stimuli required to determine that they are distinct is known as



A. Weber's law

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C. Just noticeable difference

The just-noticeable difference is the smallest amount by which two sensory stimuli can differ in order for them to be perceived as different; thus, (C) is correct.

Weber's law (A) states that the size of the just-noticeable difference is directly proportional to the strength of the original stimulus. Absolute

4. Reduced sensitivity to unchanging stimuli is called as



A. Transduction

B. Difference threshold

C. Sensory adaptation

D. Habituation

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A. Transduction

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The correct answer is

C. Sensory Adaptation

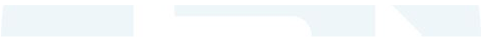
Sensory adaptation, (C), refers to an individual's decreasing response to a stimulus as a result of constant, prolonged stimulation, whereas habituation (D) is tendency of the brain to stop attending to constant, unchanging information.

In habituation, the sensory receptors are still responding to stimulation but the lower centers of the brain are not sending the signals from those receptors to the cortex. The process of sensory adaptation differs because the receptor cells themselves become less responsive to an unchanging stimulus and the receptors no longer send signals to the brain. Hence, the correct answer is (C) Sensory adaptation.

5. Signal detection analysis examines our ability to



A. tell the difference between blue and green



B. detect signals of distress in a baby



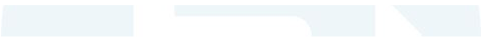
C. detect the latent meaning of a dream

D. separate true signals from background noise

5. Signal detection analysis examines our ability to



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B. detect signals of distress in a baby



C. detect the latent meaning of a dream

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The correct answer is

D. separate true signals from background noise

Signal detection theory predicts how and when we detect the presence of a faint stimulus and background noise. Thus the correct answer is (D).



THANK YOU