Sensation and Perception

Psyc 615

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Questions:

• What is perception?

  Perception is about perceiving.

What is perceiving?

What do we do when we perceive?

  We see, smell, hear, feel, taste, …
What do eyes, a nose, ears, a tongue, and skin do?

- Eye:
- Ear:
- Nose:
- Tongue:
- Skin:
What does the eye do?

• Eye:

  Seeing,

  yes but what is seeing?

  – detecting light

  What is light?

  **electromagnetic energy**
What is electromagnetic energy?

- Electro + magnetic + energy = electromagnetic energy

- Electromagnetic energy is a stream of photons.
What are photons?

• They are massless particles each traveling in a wave-like pattern and moving at the speed of light.

• The smallest (quantum) unit of light/electromagnetic energy.

• It is the carrier of electromagnetic radiation of all wavelengths
  – such as gamma rays, X-rays, ultraviolet light, visible light, infrared light, microwaves, and radio waves.
So what is “seeing”?

- Detecting the movement of photons (electromagnetic radiation).
What does the ear do?

Hears a sound

What is sound?

the vibration of air.

What is the vibration of air?
Where do they come from?

Air moves when something else moves
What does the nose do?

- Nose:
  
is for smelling

- Where does smelling come from?
  
  - Smelling is a “sensation caused by odorant molecules dissolved in air.” (Wikipeida.org)
Odorant molecules? What are they?

- Odorant (aroma compound)
  - chemical compound (e.g., H2O; a chemical substance of two or more different chemical elements.)

- Where do they come from?
  - Organic compounds → foods, flowers,
  - Inorganic compounds → ammonia,…
Taste

• How do we get that?
  – From our tongues.

• Where do we get that?
  – From foods we eat.
  – From specific chemicals.
What does the skin do?

- Detect temperature:

- What is temperature?
  - It is about how hot or cold something is.

- How does something get hot or cold?
  - Temperature goes up or down due to the motion of particles.
  - Temperature increases as the energy of this motion increases. (wikipedia)
What does the skin do?

feels touching

– It responds to mechanical stimulation or pressure
So, what is perception?

- Perception is a system that tells us about an environment.
Eye, ear, nose, tongue & skin

• They are sensors.

• They are detecting some kind of changes in an environment.
So, studying perception we need to study

- How the eye works,
- How the ear works,
- How the nose works,
- How the tongue works, and
- How the skin works

- Is that all?
What tools do we have for perceiving?

• Eyes, ears, nose, tongue, skin,
  – Eyes → see, ears → hear, nose → smell,
  – tongue → taste, skin → feel
• Are these all?
• NO!

→ Brain (not Bryan)
The brain is the locus of perception

• To study perception, we have to study of the brain and behavior.
A quick demonstration

• Tell me what you see.
Visual Illusions

• Why does this happen?

• Tell me what these illusions teach us.
What is perception?

- Perception involves:
  - Detecting the information in the environment.
  - Sending the information to the brain, and interpreting it.

- Perception is about
  - Detecting and interpreting
Let’s have some break.

- Listen to music
- See a painting
Henri Rousseau: The Dream
What’s going on?

• Perception is about detecting, but also more than detecting.
What’s going on when we see the pictures?

• When we listen to beautiful music, we often see a picture.

• When we see a beautiful picture, we hear music. How come?
Key points:

• Perception is about finding out what is going on in an environment.

• Perceptual organs (eyes, ears, nose, skin, a tongue) are basically detectors (sensors)

• Perception requires transforming physical information (e.g., light) into neural information.

• Perception also involves “interpretation,” which is carried out by the brain.
Studying perception

• How perceptual detectors work.
• How physical information is transformed (e.g., light) into neural information.
• How neural information is processed in the brain.
• How neural information is interpreted and triggers a specific form of perception (psychological state).
How come?
– Different types of physical information (air vibration, light energy) are translated into a common language in the brain
– → neural information

Environmental Stimuli (e.g., light energy)

Transduction

Neural Processing

Perception
Demonstration (attention & perception)

• An interaction between
  – attention and perception
  – cognition and perception

• Tell me what you see.
Demonstration (knowledge and perception)
How come?
– Different types of physical information (air vibration, light energy) are translated into a common language in the brain
– → neural information

Environmental Stimuli (e.g., light energy)

Transduction

Neural Processing

Perception
Measuring Perception

• Psychophysical level of analysis
  – Description
    • Phenomenological method
      • E.g., Let a person describe what they see
  – Recognition
  – Detection
• Detection
  – Absolute threshold
    • is the smallest amount of stimulus energy necessary to detect a stimulus.
      → E.g., eye exam

  – Difference threshold
    • is the smallest difference between two stimuli that a person can detect.
Demonstration
Demonstration: Measuring weight

• DL (difference threshold) gets larger as the standard stimulus gets larger.
The impact of standard stimuli

• DL (difference threshold) gets larger as the standard stimulus gets larger.

• Weber’s law

  \[
  \frac{DL}{S} = K
  \]

  • DL: difference threshold
  • S: standard stimulus
  • K: constant
Weber’s law

(a) 100 g  100 g + 2 g  DL = 2 g

(b) 200 g  200 g + 4 g  DL = 4 g
Question:

• With a standard stimulus 1 kg, John’s difference threshold was 0.25 kg. With a standard stimulus 10 kg, what would be John’s difference threshold?
Question:

• With a standard stimulus 1 kg, John’s difference threshold was 0.25 kg. With a standard stimulus 10 kg, what would be John’s difference threshold?

\[
\frac{DL}{S} = K
\]

\[
\begin{align*}
\text{DL: } & 0.25 \\
\text{S: } & 1 \\
\text{K: } & 0.25
\end{align*}
\]

\[
\frac{DL}{S} = K
\]

\[
\begin{align*}
\text{DL: } & ? \\
\text{S: } & 10 \\
\text{K: } &
\end{align*}
\]
Magnitude estimation

- Assign a value to a standard stimulus
- The subject estimate the value of a target stimulus.
Magnitude estimation

Standard: 10

Target: ??

Standard: 100

Target: ??
Standard: == 100

Target: == ?
Standard: == 100

Target: == ?
Steven’s power law

\[ P = KS^n \]

- \( S \) is the physical magnitude of a target that you are estimating.
- \( P \) is your estimation
- \( K \) is some value (constant)
- \( n \) is some value
Magnitude estimation

=100

=?

=?

=10

=?

=?
1cm = 100

2cm = ?

4cm = ?

1cm = 10

4cm^2 = ?

9cm^2 = ?
Steven’s power law

\[ P = KS^n \]

- S is the physical magnitude of a target that you are estimating.
- P is your estimation
- K is some value (constant)
- n is some value
Experiment (you are estimating the length of lines)
Standard = 100    Target = ?
<table>
<thead>
<tr>
<th>Target</th>
<th>Your estimations</th>
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<tbody>
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<td>128</td>
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</tbody>
</table>

\[ P = KS^n \]

- \( P \): your estimation
- \( S \): stimulus intensity
- \( n \): some value = 0.33
- \( K \): some value (constant) = 21.5

**Estimating the length of stimuli**
Experiment (you are estimating the intensity of electric shock)

Standard = 100

Target = ?
P: your estimation
S: stimulus intensity
n: some value = 1.5
K: some value (constant) = 0.1

\[ P = KS^n \]

Estimating the intensity of electric shock
Estimating electric shock

Estimating the length of lines
Steven’s power law

\[ P = KS^n \]

- \( S \) is the physical magnitude of a target that you are estimating.
- \( P \) is your estimation
- \( K \) is some value (constant)
- \( n \) is some value
Threshold

- Absolute threshold
- Difference threshold
Difference threshold

- Weber’s law
- Stevens’s law