Psychology 260 - Lecture 1-1

Vision as Inference I: Visual Illusions

Readings: Rama, pp. 1-12

1.0. Background

1.1 Ancient belief about how we see (Aristotle)
- objects cast off copies of themselves (shells, or “eidola”), which are then picked up directly by the eye (vitreous humour, a 3D substance)
  - direct “pickup” of reality
  - brain itself doesn’t have much to do with this process
- how can this be tested?

1.2 Modern belief about how we see
- objects reflect light that originates in sun (or light source)
- light falls onto 2D retina in eye; forms image (cf. camera)
- brain then tries to recover the “lost” third dimension
  - makes a guess about what is going on, based on knowledge (top-down)
  - tests this against information received through eyes (bottom-up)

1.3 Perception as Controlled Hallucination
- starts with construction of a hypothesis (based on knowledge)
- followed by verification of that hypothesis (based on information)
- how can this be tested?

- Immediate implications:
  - no direct connection between reality and our percepts
  - our experience of the world is a construct of the mind; a form of hallucination

- Long-range implications:
  - this is true of everything we experience, including our experience of ourselves
1.1 Visual Illusions
- good illustration that perception doesn’t always match reality
- the patterns of errors can provide information about the underlying neural mechanisms
  o look at how the illusion behaves under various conditions

1.1.1 Distortions
- percept isn’t accurate
  o e.g. incorrect size or shape (Mueller-Lyer illusion)

- how can such a proposal be tested?
  o look at how the illusion behaves under different conditions
- thus, need to
  1. quantify behaviour – measure the strength of the illusion
  2. choose appropriate conditions – which ones might provide information about the mechanisms involved.
- measuring how the strength of the illusion depends on different conditions provides:
  1. a description of how it behaves (interesting in its own right)
  2. a test between two (or more) different explanations
    - helps choose between them
- e.g. test various lengths of upper line: does strength of illusion get larger?
  - if inappropriate perspective is responsible, strength of illusion should increase with the size of the stimuli (test line)
  - 2 possibilities:
1.1.2 Ambiguities
- percept isn’t stable; flips from one percept to another
  - e.g., Necker cube: alternates between two different 3D interpretations
    
    ![Necker Cube Image]

    - possible explanation: Two different hypotheses fit the data in the image
      - brain attempts to find the (remembered) structure that best fits
      - more than one explanation found; to reason to favour either
      - explains why “blends” of the two possibilities are never found

  - how can such a proposal be tested?
    - look at how the illusion behaves under different conditions

1.1.3 Paradoxes
- no globally consistent interpretation can be found—only local ones
  - e.g., “impossible” figures: no consistent 3D interpretation possible
    
    ![Impossible Figures Image]

  - possible explanation: No hypothesis can account for all the data in the image
    - brain finds local explanations; can go no further

  - how can such a proposal be tested?
    - look at how the illusion behaves under different conditions
1.1.4 Hallucinations

- interpretation does not correspond to anything in reality
  - e.g., “illusory” figures; percept does not correspond to a real figure

[(Diagram of Kanisza triangle)]

- possible explanation: Figure is constructed (“imagined”), since it is the simplest hypothesis that accounts for the facts (the information in the image)
  - other explanations may be possible, but not considered to be as likely
  - brain constructs and maintains such hypotheses as long as there is no evidence against them

- how can such a proposal be tested?
  - look at how the illusion behaves under different conditions