CPSC 532E — Week 3: Lecture

Illusions; How HCI & Psych can Interact

- Survey of various illusions
- Basic vs applied research
- Interaction strategy for HCI & Psych

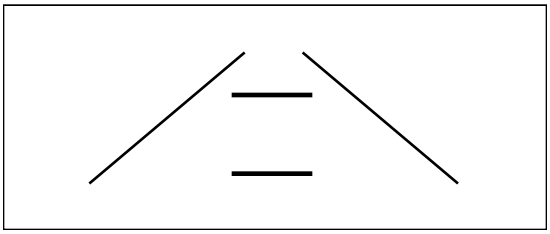
1. Illusions

Four main kinds of illusion:

1. Distortions

Percept isn't accurate (e.g., incorrect size or shape)

Example 1: Ponzo illusion



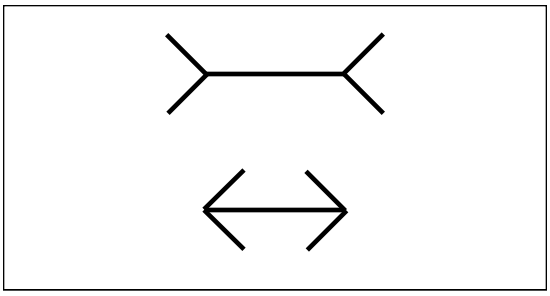
Upper line seen as larger

One explanation: inappropriate use of perspective

Normally, image size of an object gets smaller
as object gets further away

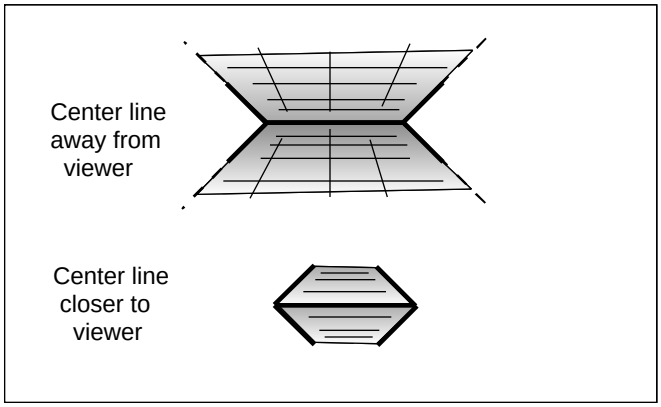
Thus, item of same size in image, further away
-> interpreted as being larger

Example 2: Mueller-Lyer illusion



Line in “wings-out” configuration seen as larger

One explanation: Inappropriate use of perspective



- wings-out: line is further away

Same size in image, but further away
-> interpreted as larger

Example 3: Snake illusion (Adelson)

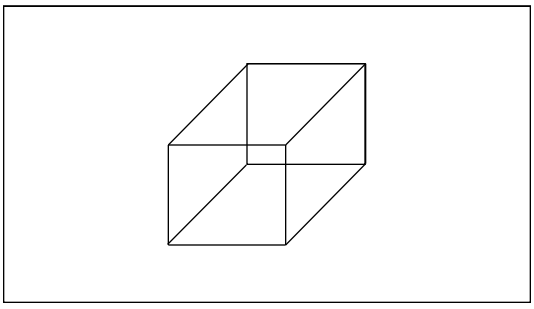
Examples: Motion Illusions

4. Roelofs Effect	Motion induced by surroundings
5. Waterfall Effect	Motion via aftereffect
6. Polarity Offset	Motion via polarity alternation
7. Flash Lag	Apparent lag of moving item

2. Ambiguities

Percept isn't stable (e.g., alternates)

Example 1: Necker cube



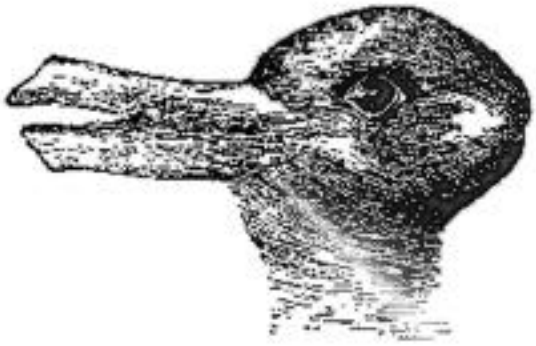
Percept alternates between configurations

Explanation: two different hypotheses (percepts) are compatible with image

Brain attempts to find (remembered) structures that are compatible with the data.

If more than one is found, the percept **alternates**
- is not a blend of the two possibilities

Example 2: Rabbit-duck (Jastrow)



Percept alternates between interpretations

Explanation: two different hypotheses (concepts) are compatible with image

Brain attempts to find (remembered) structures compatible with the data.

Again, note that the percept **alternates**
- is not a blend of the two possibilities

Example 3: Anstis effect

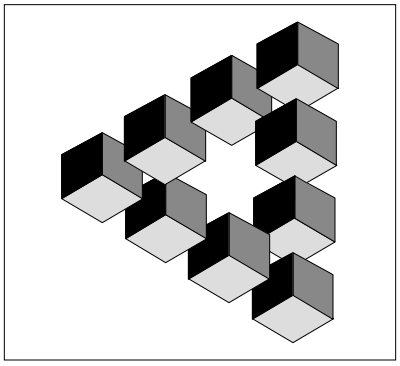
Two possible directions of apparent motion

Anstis effect

3. Paradoxes

No hypothesis is possible (e.g., no consistency)

Example 1: Impossible figure (Reuterswärd)

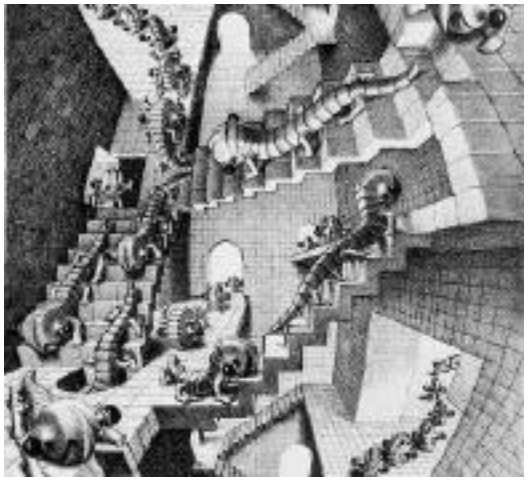


If interpreted as 3D, not possible for these cubes to exist in the world

Example 2: Impossible figure (McAllister)

If interpreted as 3D, not possible for this box to exist in the world

Example 3: Impossible figure (Escher)



If interpreted as 3D, it is not possible for this room to exist in the world

Explanation: no hypothesis can account for the entire image

Brain can find local interpretations (e.g. cubes)

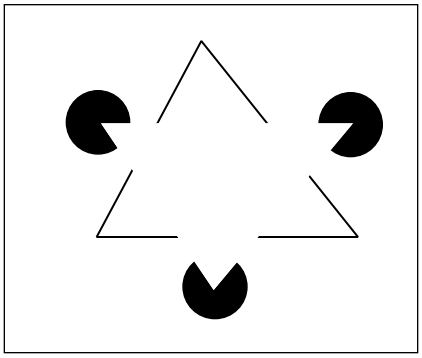
But no globally consistent interpretation is possible

Result is a **paradoxical percept** — different hypothesis for each part of the image

4. Hallucinations (Fictions)

Hypothesis is independent of reality
(e.g., seeing things that aren't really there)

Example 1: Illusory figure (Kanisza)



Perception of
occluding triangle,
even though
it's not really there

Explanation: a triangle is "imagined", since it is
the simplest account of image pattern

Brain will hypothesize such structures, provided
there is no evidence against the interpretation

Example 2: Vegetable man (Arcimboldo)

Perception of a man, even though he's not really there

Explanation: a man is "imagined", since it is consistent with image at an abstract level (i.e., overall form)

Brain will hypothesize such structures, even if the details don't fit exactly

Basic vs. Applied Science

Commonly believed there are two kinds of science:

1. Basic (theoretical) science
   - important in the scholarly world
   - unimportant in the "real" world

2. Applied science
   - unimportant in the scholarly world
   - important in the "real" world

Sometimes a bias to view applied science as "better"

Sometimes a bias to view basic science as "better"

However, these two are not disconnected:

- Basic science often gives rise to applications

  (eg. German dye industries based on discoveries in basic chemistry)

"People with little understanding fail to observe the mysterious threads that bind the factory to the laboratory, just as the stream is connected with its source".

Ramon y Cajal

This course: Design of effective visual displays has its roots in psychology

The connection between basic and applied science can go **both ways**:

- basic discoveries often give rise to applications

-> applications often give rise to basic discoveries

-E.g.:

- Pasteur discovered many biological phenomena, and even overturned a central dogma of biology (spontaneous generation of life)

- motivated by investigations of problems with wine fermentation

In psychology,

- work on the source of automobile accidents led to discovery of change blindness, provided new insights into attention

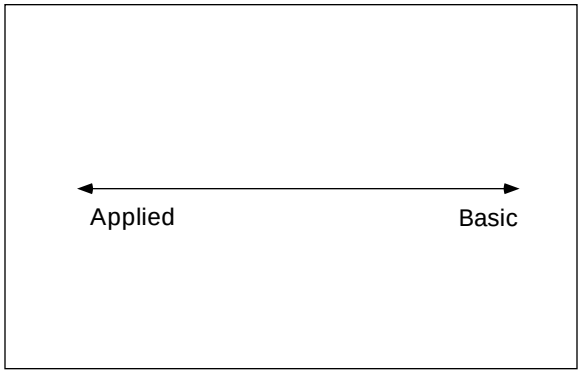
In general, problems encountered in industry can be the source of new discoveries in basic science.

- tests done by engineers are a kind of experiment
- can provide interesting data

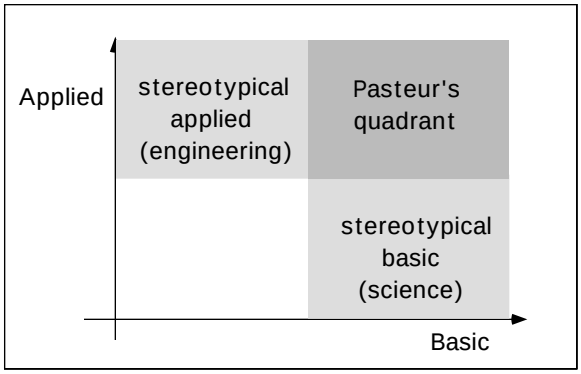
Note: many problems in the design of visual displays / interfaces raise serious challenges to current theory in psychology

(e.g. development of small-screen displays)

"Standard" way of viewing science:
- basic vs applied = position along one dimension



But maybe it's better to view this as **two dimensions**
- basic: degree to which work affects ***theories***
- applied: degree to which work affects ***industry***



HCI & Psych is an area in Pasteur's quadrant

Interaction Strategy for HCI & Psychology

- HCI : generally concerned with the construction of effective systems
- Psychology: generally concerned with the study of underlying mechanisms

Rationale for linkage:

HCI: knowledge of perception required for design of optimally effective displays/interfaces

Psych: experiences with displays/interfaces can lead to important insights into mechanisms

One approach…

1. **Start with a description of the problems** about the development of the system

2. Isolate the **perceptual issues** involved (perceptual bottlenecks responsible)

3. **Investigate** these issues
   - check relevant literature
   - design experiments if needed (possible)

4. Develop **guidelines** (general constraints)
   - ways to handle problem
   - alternative approaches

Note: If part of a university team interacting with industry:

Don’t go beyond the development of guidelines

Don’t get involved in the design or production of a product.

(Their engineers are far better at this than you…)