

PERCEPTION

AIMS OF TODAY'S SESSION

- ⊙ Introduction to perception
- ⊙ Gestalt theory
- ⊙ Depth perception
- ⊙ Perception theories (Gibson and Gregory)

WHAT IS PERCEPTION.

- ◉ the process or result of becoming aware of objects, relationships, and events by means of the senses, which includes such activities as recognizing, observing, and discriminating. These activities enable organisms to organize and interpret the stimuli received into meaningful knowledge and to act in a coordinated manner.
- ◉ APA Dictionary of Psychology (Online)

PERCEPTION

- Perception is the process by which the cognitive system constructs an internal representation of the outside world
 - Constructs
 - It is an active process (our mind is doing something with the input)
 - Not like a photograph (passive)
 - Representation
 - It may be different to reality (may represent reality in some way, but not 100% accurate)
- A bit like an artists painting
 - Own interpretation - actively constructs it



PERCEPTION

- ◉ What do we perceive with?
- ◉ With our senses! How many are there?

Sensory Modality	Organ
Vision	Eyes
Audition	Ears
Taste	Tongue
Smell	Nose
Touch	Skin
Equilibrioception	Ear (balance, gravity)
Thermoception	Skin (temperature)
Nocioception	All (pain)

GESTALT THEORY

- ◉ Gestalt psychology emerged early in the 20th century
- ◉ Usual scientific approach: reductionism
 - If something can be broken down, break it down
 - And investigate the smallest possible parts individually (benefits: find regularities and laws)
- ◉ Gestalt argues - you might miss something, you may miss the whole picture of something
 - In the whole there is sometimes more information than in the sum of the parts
 - Book - 25,000 Ls
- ◉ Gestalt - the principle of totality - one should investigate the whole percept - all parts

GESTALT THEORY

Gestalt
(German):
essence or shape
of an entity's
complete form

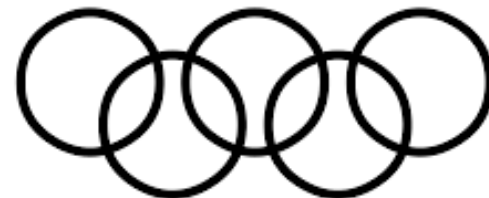
- Provides a description of perceptual principles
- TV- still pictures

One underlying principle

Pragnanz (concise, simple)

Reality is reduced to its simplest form

When we have sensory input our perceptual system always tries to create a percept that is as simple, stable, regular, orderly and/or symmetric as possible

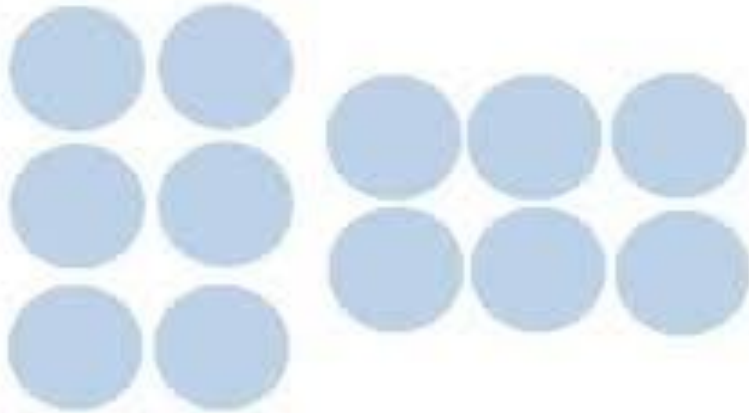


GESTALT THEORY

Laws (principles) of grouping

○ Law of Proximity

- Objects close together form a group



Law of Proximity:

Objects near each other tend to be grouped together.

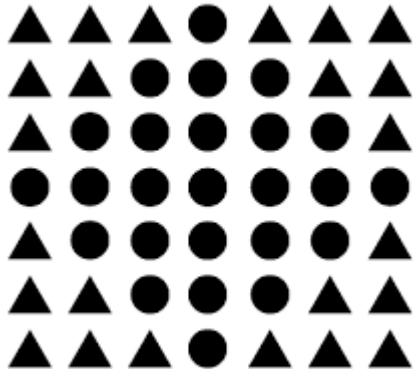
The circles on the left appear to be grouped in vertical columns, while those on the right appear to be grouped in horizontal rows.

Elements that are close together tend to be perceived as a unified group. Items close to each other tend to be grouped together, whereas items further apart are less likely to be grouped together.

GESTALT THEORY

○ Law of similarity

- Similar visual elements form a group



Pattern of lines – group together
(shapes and colour) our brain
notices a pattern



Law of Similarity:

Items that are similar tend to be grouped together.

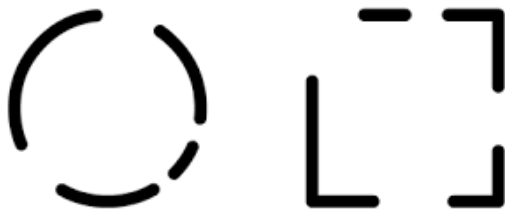
In the image above, most people see vertical columns of circles and squares.

GESTALT THEORY



◉ Law of closure

- Objects are perceived as whole even if they are not complete



Illustrates that perception is an active process -
representation of the object
- not an accurate
picture/copy

GESTALT THEORY

◉ Law of symmetry

- Objects that are symmetrical around a centre point form a group

() [] { }

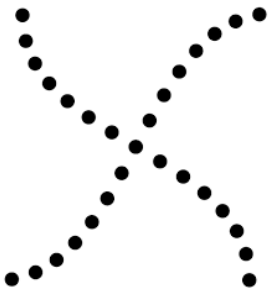
() [] { }

Symmetrical images perceived collectively, even in spite of distance (unlike proximity)

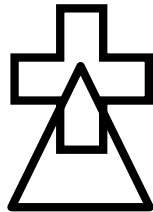
GESTALT THEORY

◉ Law of continuity

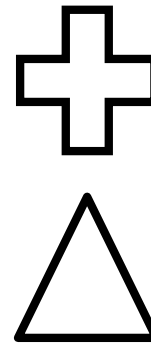
- We tend to perceive objects as forming smooth continuous patterns (lines are seen as following the smoothest path)



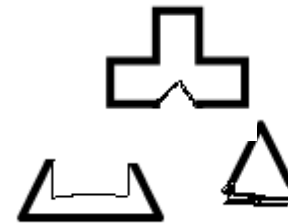
We tend to perceive this as 2 long lines



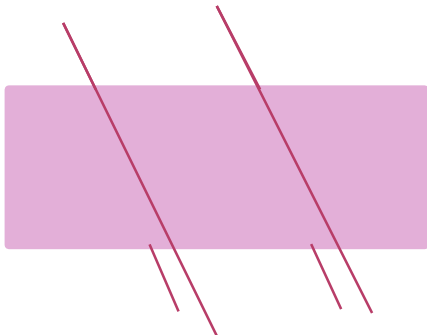
When we see this



We interpret it as this



Rather than this

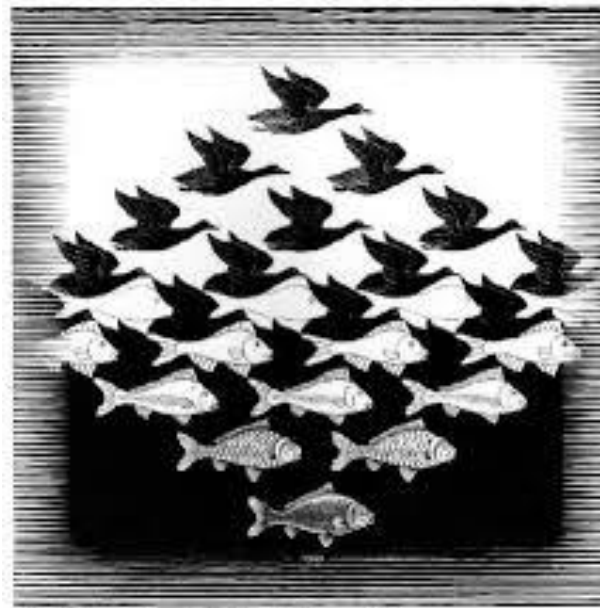
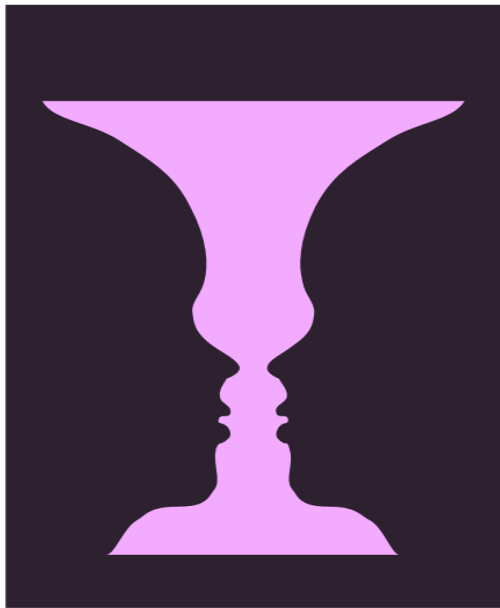


This is Pragnanz – try to make it simple for ourselves

GESTALT THEORY

○ Law of figure-ground segregation

- We tend to structure the visual field into two parts: a figure and a ground



M.C. Escher: Sky and Water I 1938 woodcut



The law of Figure/Ground states that we can distinguish an object (the figure of the rule) from background (the ground). This rule shows that when we look at a design, we perceive the figure from the ground distinctly

GESTALT THEORY - SUMMARY

- ◉ Describes the organizing principles that guide perceptual processes
- ◉ Principles - Similarity, Closure, Symmetry, Continuity, Figure-ground segregation.
- ◉ Criticisms
 - describes - but does not explain why these principles exist
 - No model or account of perceptual processing
 - No reference to depth perception

DEPTH PERCEPTION

- Our ability to see and perceive 3 dimension
 - Localising objects in a 3D world



Estimate proper distance of an approaching car

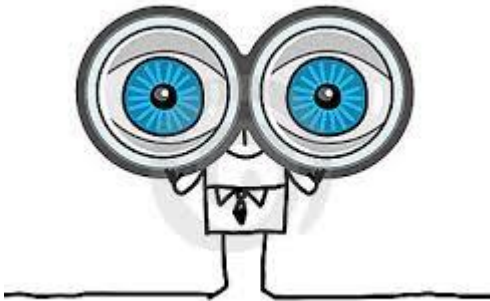


Position and navigate in environment

DEPTH PERCEPTION

The problem we have is that the world is projected onto the eye as a 2D image (like having 2 photographs)

How can we create a 3D percept by two 2D images?



dreamstime.com

2 types of information

Binocular cues
(info from both eyes)

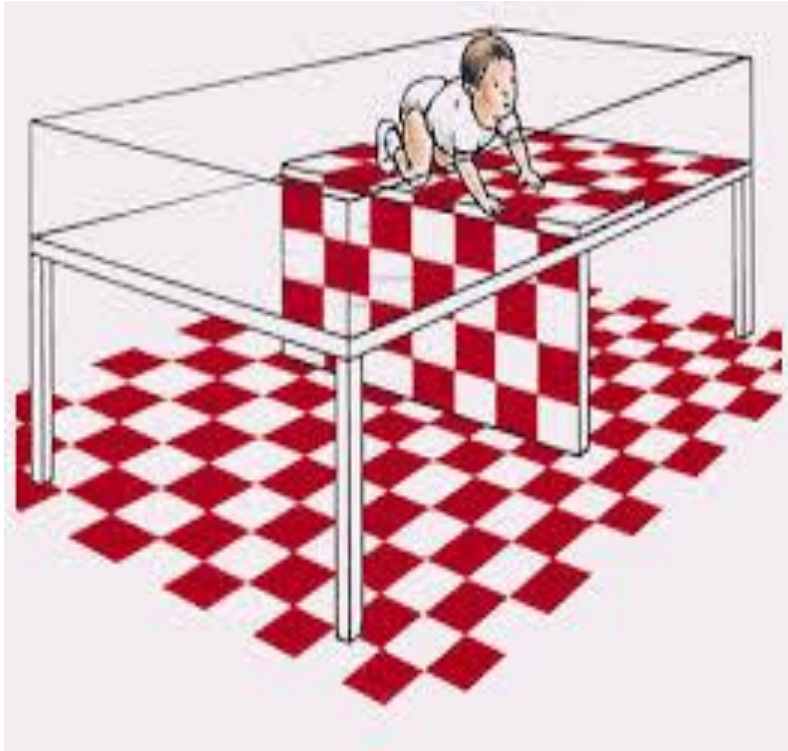
Monocular cues
(info from one eye)

DEPTH PERCEPTION

- ◉ The visual cliff
- ◉ Identify types of binocular cues
- ◉ Identify types of monocular cues



DEPTH PERCEPTION



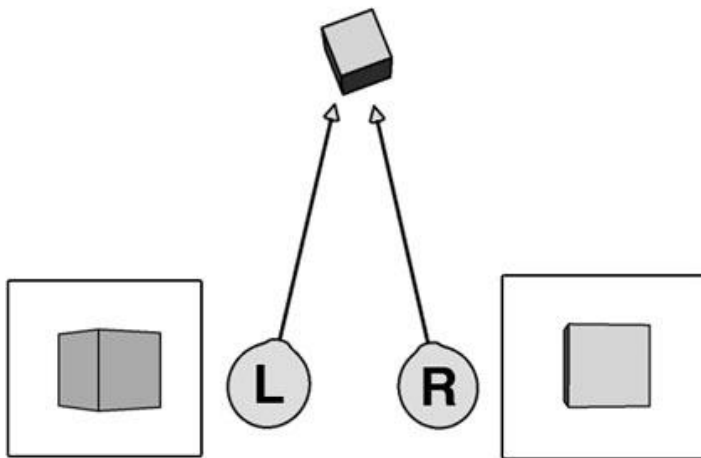
Visual Cliff (Eleanor Gibson)



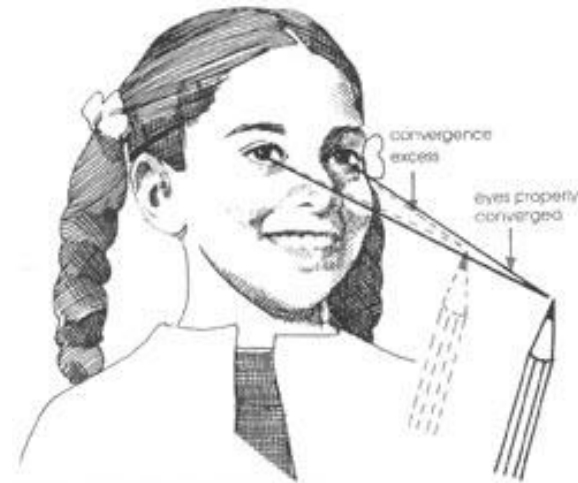
Figure 12.12 A mother calling to her child from across the deep side of the visual cliff. Despite the presence of the glass surface covering the cliff, the child refuses to cross over to the mother. (From Gibson & Walk, 1960. Photograph courtesy of William Vandivert.)

BINOCULAR CUES: 2 EYES

Retinal Disparity



Convergence



MONOCULAR CUES: 1 EYE

Relative Height



Light and shadow



MONOCULAR CUES: 1 EYE

Relative Size



Relative Clarity



MONOCULAR CUES: 1 EYE

Texture Gradient



Linear Perspective



MONOCULAR CUES: 1 EYE

Interposition



Relative Motion
(motion parallax)



THEORIES OF PERCEPTION



Gibson
(1966)

- his approach to perception grew out of aviation experiments that he did during World War II.

Gibson concluded that the usual laboratory approach to the study of depth perception is not well suited to improving a pilot's ability to land an airplane, and that, instead, it is necessary to take the study of perception **outdoors into the natural environment.**

Making sense of the world

What am I
seeing?



**Bottom-up
processing:**

taking sensory
information and
then assembling
and integrating it

**Top-down
processing:**

using
models, ideas, and
expectations to
interpret sensory
information



Is that
something I've
seen before?

GIBSON

BOTTOM UP APPROACH - A DIRECT THEORY

We “work upwards in our analysis of the visual world from basic sensory inputs at the bottom level towards the higher, more cognitive levels of the brain. “

What you see is what you get.

GIBSON (1966)

<https://www.youtube.com/watch?v=JF0ArkVDrT8>

‘Ground theory’ of space perception

Visual space is defined not by an object/s (as occurs for depth cues such as interposition, relative size, etc.) but rather is defined by the ground, a continuous surface or array of adjoining surfaces.

Thus, the spatial character of the visual world is defined not by objects but by information contained in the ground upon which these objects rest.

OPTIC ARRAY



Gibson proposed that the pattern of light reaching the eye could be thought of as an **optic array**.

This contains all the information we need to make sense of the world.

The structure of light in the environment, **unambiguous** information about the layout of objects in space.

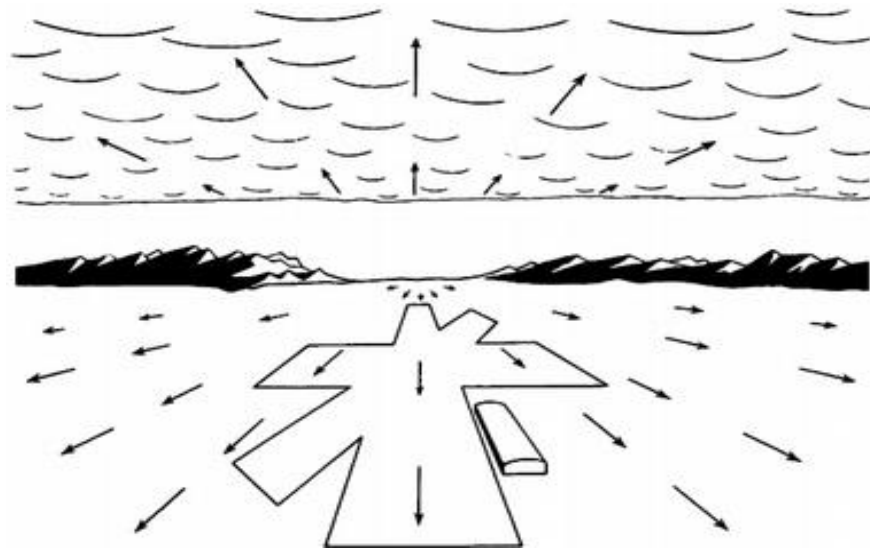
We don't see static 'retinal images' but we **move around** in a complex environment. If you move your eyes, your head or your body, the optic array changes- the optic array is **ambient**.

INVARIANT INFORMATION IN AN AMBIENT OPTIC ARRAY

- ◉ Despite the changes, there are some things in the optic array that are invariant (don't change).
 - ◉ We automatically extract this from the input data and it is used to gauge depth, distance and orientation.
 - ◉ This invariant information leads directly to perception (being able to see) (i.e. there is no need to interpret the information to make sense of it)
- ◉ Gibson suggested that the invariant information came in a number of forms.
 - ◉ Texture Gradient
 - ◉ Optic Flow Pattern

OPTIC FLOW

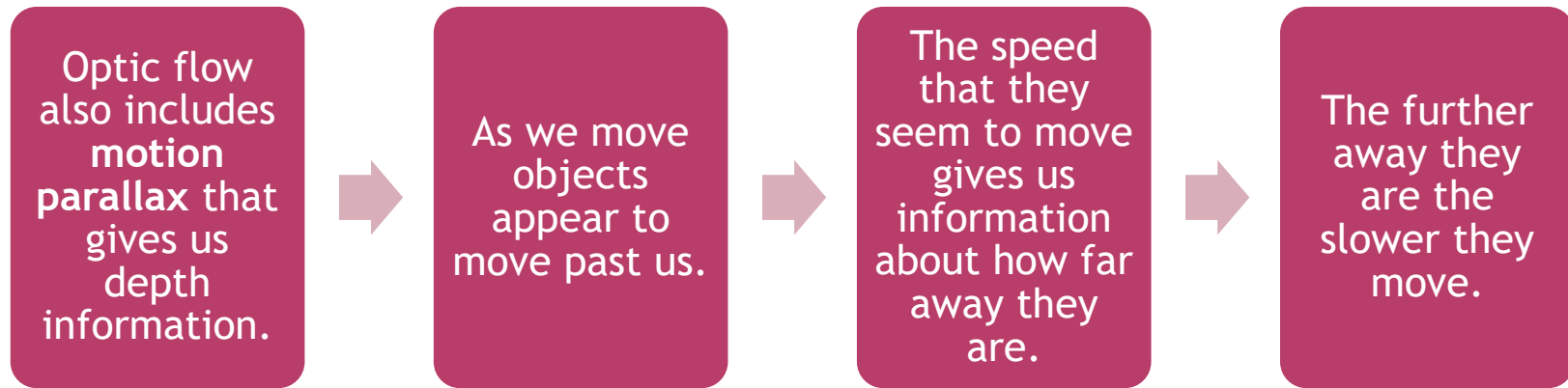
- This is the changes in light patterns that reach us when we move.
- As we move forward objects move past us.
- How the objects move provide us with information about our **speed** and **direction**.



<https://www.youtube.com/watch?v=ysGM3CfBVpU>

OPTIC FLOW

<https://www.youtube.com/watch?v=Y8FG7tEs4GM>



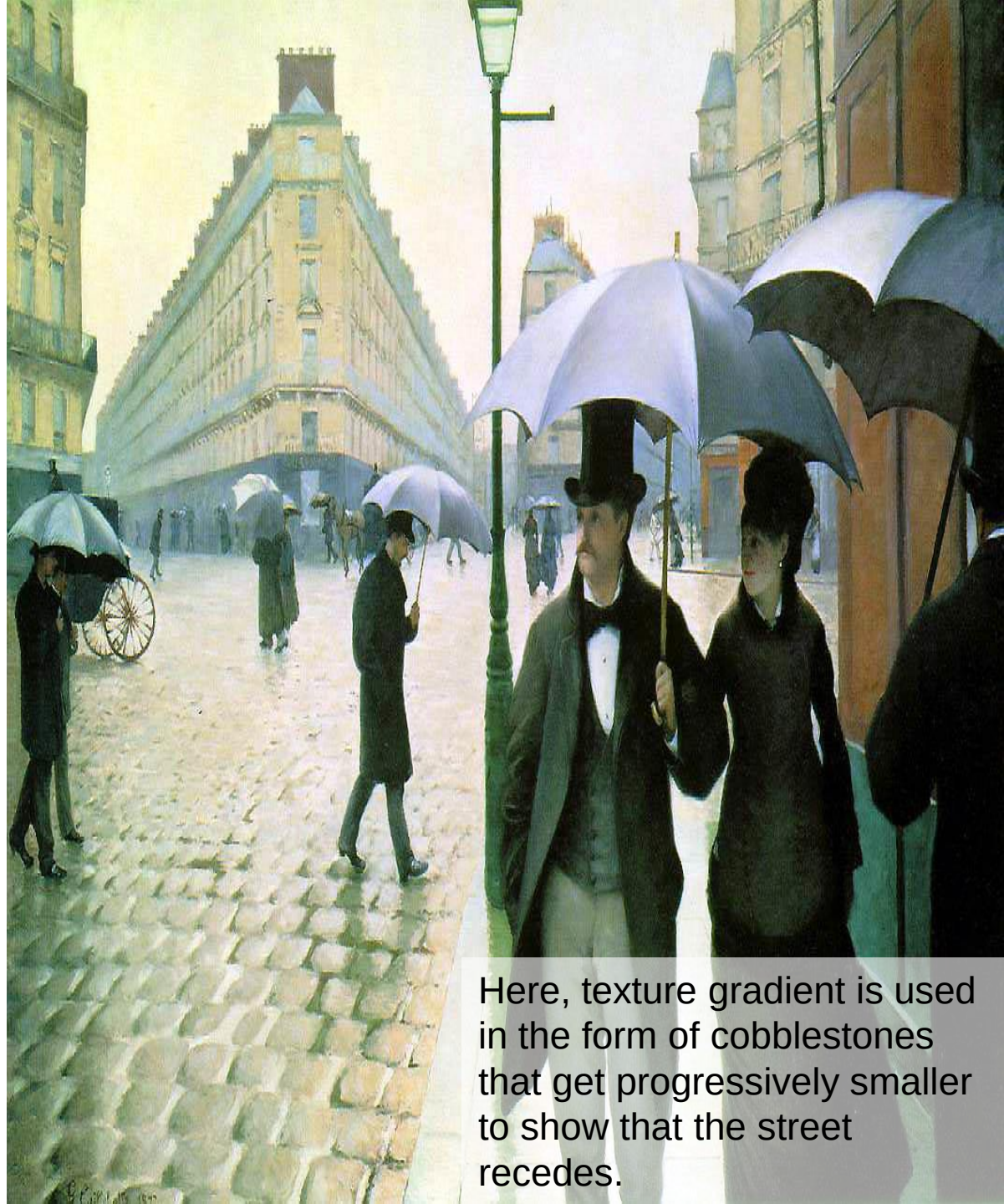
Johansson (1973) found that a black-clad actor wearing lights on his joints walking in a darkened room, was seen as a moving person, but standing still, he was not perceived as a stationary person.

<https://www.youtube.com/watch?v=rEVB6kW9p6k>

Maher and West (1993) filmed the movement of black-clad animals with light on their joints and found that participants could recognise the species of animal. This demonstrates the strength of movement information in determining optic flow patterns and shows that there is enough sensory information for perception to occur directly.

DEPTH CUES

- ◉ **Texture gradients** provide us with depth cues.
- ◉ The world is made up of surfaces with different textures.
- ◉ The closer the object the more detail we will see.



Here, texture gradient is used in the form of cobblestones that get progressively smaller to show that the street recedes.

TEXTURE GRADIENT



Gibson and Bridgeman (1987) showed participants photographs of surface textures. Participants could correctly identify objects, state their colour, identify the light conditions and say whether they were lying flat etc., suggesting that there is sufficient sensory information in surface textures to permit direct perception.

Frichtel *et al.* (2006) presented participants with a film of a car driving through scenery. Evidence was found that infants as young as 4 months old could perceive using texture gradient, implying that the ability is innate.

DEPTH CUES

- ◉ Parallel lines are known to converge as they move further away.
- ◉ A classic example of this is railway lines, but you can see the same effect in other things such as roads.



AFFORDANCES



One of the more contentious aspects of Gibson's theory is his idea of 'affordances'

The meaning of an object can be directly perceived, and can tell you what to do with that object.

His suggestion was that our visual system has evolved to inform us directly of what the function of an object is, e.g. a chair is for sitting on.

Or a chair 'affords' sitting down.



This stone affords sitting



This log affords sitting



This box affords standing on

THE USEFULNESS OF PERCEPTION

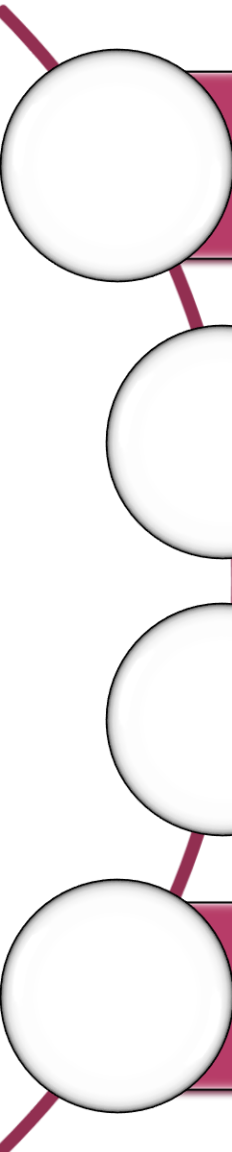
- ◉ Gibson believed perception isn't just about detection of information but detection of **USEFUL** information
- ◉ The fact that objects have affordances enables an animal to respond in an adaptive way to it's environment.

Gibson's theory has practical applications – such as road markings.



Horizontal lines are painted on the road, becoming closer together as driver approach junctions. These markings are often seen on the exit roads from motorways and serve to create the illusion of increasing speed, which causes the driver to slow down before joining a non-motorway road.

EVALUATION OF GIBSON'S (1966) DIRECT THEORY OF PERCEPTION



His theory cannot explain why perceptions are sometimes inaccurate, e.g. in illusions.

He claimed the illusions used in experimental work constituted extremely artificial perceptual situations unlikely to be encountered in the real world, however this dismissal cannot realistically be applied to all illusions.

For example, Gibson's theory cannot account for perceptual errors like the general tendency for people to overestimate vertical extents relative to horizontal ones.

Neither can Gibson's theory explain naturally occurring illusions. For example if you stare for some time at a waterfall and then transfer your gaze to a stationary object, the object appears to move in the opposite direction .

Gregory
(1970)

- a *constructivist (indirect)* theory of perception which is a '*top-down*' theory.

A lot of information reaches the eye, but much is lost by the time it reaches the brain (Gregory estimates about 90% is lost).

Therefore, the brain has to guess what a person sees based on past experiences. We actively construct our perception of reality.

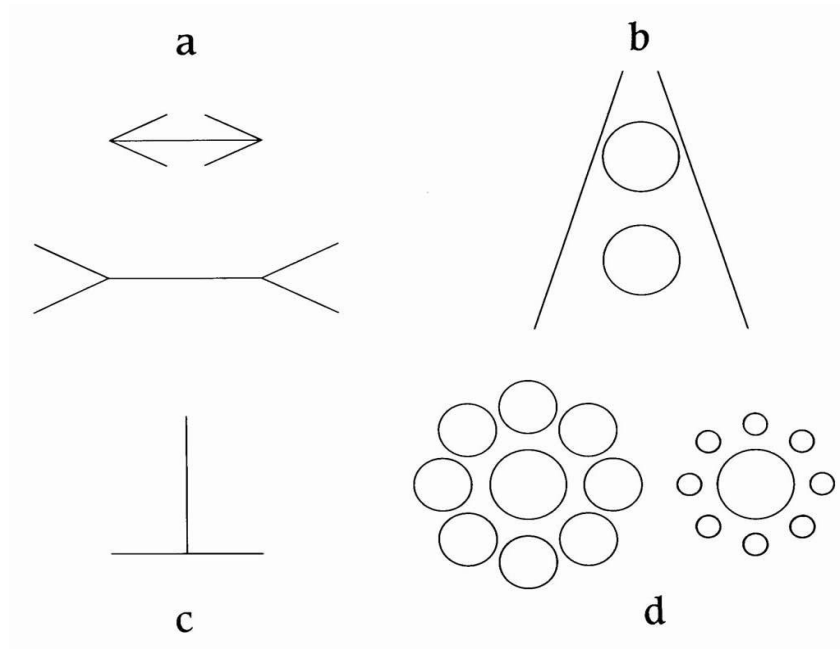
Our perceptions of the world are hypotheses based on past experiences and stored information.

The formation of incorrect hypotheses will lead to errors of perception (e.g. visual illusions like the Necker cube).

Necker Cube <https://www.youtube.com/watch?v=fEN8YAXdOak>

VISUAL DISTORTIONS ALMOST EVERYONE SEES

THESE DISTORTIONS, INCLUDING ANIMALS.



a Muller-Lyer's arrow illusion where a part of the figure appears longer/shorter, and of a different size even though when measured, the lines are identical in length

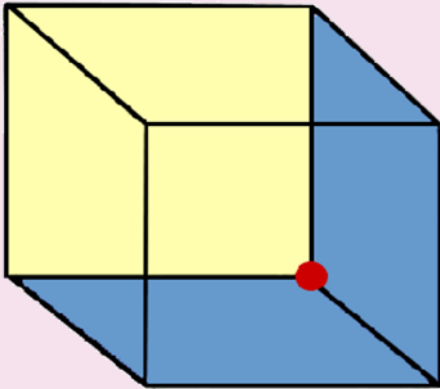
b The Ponzo, or railway line illusion where one circle looks larger than the other

c The Horizontal/Vertical Illusion the upright line looks longer than the base line it stands on, even though they are the same length

d Titchener Illusion - The centre circles look different sizes

Perceptions can be ambiguous

Given a little time, most people see this image in two different ways. Pay attention to how the red dot sometimes appears in the near corner and sometimes appears in the far corner.



It becomes unstable and a single physical pattern can produce two perceptions.

Hypothesis testing

Gregory argued that this object appears to flip between orientations because the brain develops two equally plausible **hypotheses** and is unable to decide between them.

When the perception changes there is no change of the sensory input, the change of appearance cannot be due to bottom-up processing. It must be set downwards by the prevailing perceptual hypothesis of what is near and what is far.

HYPOTHESIS TESTING

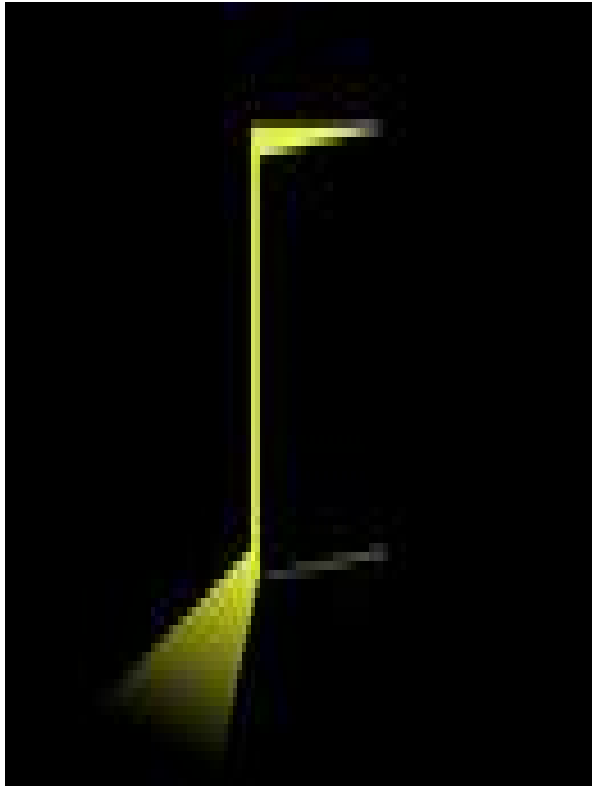
PREVIOUS KNOWLEDGE

Rotating masks:

<https://www.youtube.com/watch?v=sKa0eaKsdA0>

This amazing illusion is so strong that even when we are aware that we are looking at the concave, reverse side of the mask we cannot stop ourselves perceiving it as a convex, protruding face!

EVIDENCE TO SUPPORT GREGORY'S THEORY



'Perception allows behaviour to be generally appropriate to non-sensed object characteristics'.



For example, we respond to certain objects as though they are doors even though we can only see a long narrow rectangle as the door is ajar.

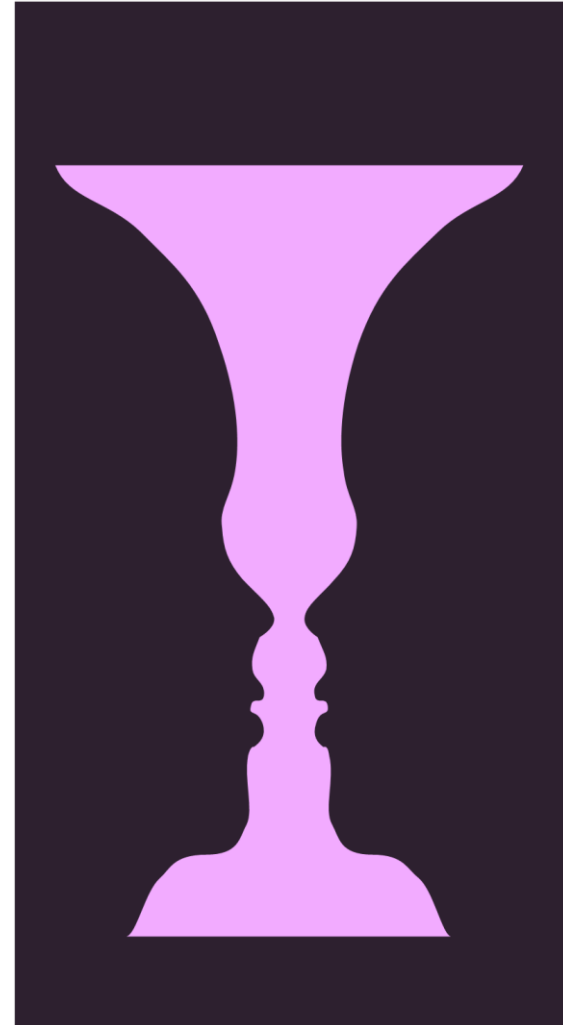
When two areas share a common boundary, the figure has a distinct shape with clearly defined edges. In contrast the ground is the region that is left over, forming the background.

There is a tendency to distinguish and focus on a stimulus that is classified as figure as opposed to background.

But in ambiguous figure-ground relationships, the figure and ground reverse from time to time.

Even in this ambiguous situation, our perceptual system imposes organisation on a stimulus, so that one portion stands out and the remainder recedes into the background.

FIGURE-GROUND ILLUSTRATION



EVALUATION OF THE TOP-DOWN APPROACH TO PERCEPTION

- If perceptions make use of hypothesis testing the question can be asked 'what kind of hypotheses are they?'
- Scientists modify a hypothesis according to the support they find for it so are we as perceivers also able to modify our hypotheses? In some cases it would seem the answer is yes.

THEORIES OF PERCEPTION: SUMMARY

Gregory's 'top down' theory

- An explanation that understands perception as an interpretation of sensory data based on previous experience.
- Perception is **indirect**, as it involves going beyond sensory data to analyze information at a higher **top down** cognitive level of processing.
- As sensory data is often incomplete/ambiguous, perception is constructed through **perceptual set**; a readiness to interpret data in a pre-set manner due to previous experience, emotional states, motivational factors and cultural influences.

Gibson's 'bottom up' theory

- An explanation that understands perception as arising from sensory data provided by the **optical array** (the pattern of light entering the eyes).
- Sensory data is seen as rich enough to permit **direct** perception without need for any higher level cognitive processing and thus is a **bottom up** procedure.
- Perception occurs through detection of **environmental invariances**, unchanging aspects of the visual world that permit features of the environment to be established.

EXTRA READING

- ⦿ <http://www.gestaltrevision.be/pdfs/A%20century%20of%20Gestalt%20psychology%20in%20visual%20perception%20l.pdf>