


MODULE 19 → Visual Interpretation & Organization

2/19/2019

UNIT IV
Sensation and Perception

MODULE

- 01 Basic Concepts of Sensation and Perception
- 02 Influences on Perception
- 03 Vision, Sensory and Perceptual Processing
- 04 Visual Organization and Interpretation
- 05 Hearing
- 06 The Other Senses



Learning Targets

Module 19

Visual Organization and Interpretation

- 19-1 Describe the Gestalt psychologists' understanding of perceptual organization, and explain how figure-ground and grouping principles contribute to our perceptions.
- 19-2 Explain how we use binocular and monocular cues to perceive the world in three dimensions, and discuss how we perceive motion.
- 19-3 Explain how perceptual constancies help us construct meaningful perceptions.
- 19-4 Describe what research on restored vision, sensory restriction, and perceptual adaptation reveals about the effects of experience on perception.

"GESTALT"

How did the Gestalt psychologists understand perceptual organization?

Early in the twentieth century, a group of German psychologists noticed that people who are given a cluster of sensations tend to organize them into a **gestalt**, a German word meaning a "form" or a "whole."

Gestalt psychologists believe that in perception, *the whole may exceed the sum of its parts.*

How is perception understood by the Gestaltists?

Underlying Gestalt principles is a fundamental truth:


Our brain does more than register information about the world.

Perception is not just opening a shutter and letting a picture print itself on the brain. We filter incoming information and **construct** perceptions. Mind matters.

NECKER CUBE

How does the Necker cube illustrate a Gestalt?

The individual elements of this figure, called a *Necker cube*, are really nothing but eight blue circles, each containing three converging white lines. When we view these elements all together, however, we see a cube that sometimes reverses direction.



AP® Exam Tip 1

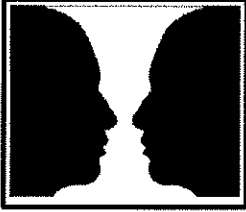
The Necker cube is an excellent vehicle for understanding the distinction between sensation and perception.

The only visual stimuli are the blue wedges. (sensation)

The circles, lines, and cube are all the products of your mind and not on the page. (perception)


What is figure-ground?

the organization of the visual field into objects (the *figures*) that stand out from their surroundings (the *ground*)



TRY IT

Can you detect figure and ground?



See if you can reverse the figure and make it the ground... now try making the ground the figure. Your choice of what is figure is what creates this illusion.

1. What Would You Answer?

Bryanna and Charles are in a dancing competition. It is easy for spectators to see them against the dance floor because of

- A. the visual cliff.
- B. the phi phenomenon.
- C. color constancy.
- D. relative motion.
- E. figure-ground relationships.

How do the Gestaltists apply rules for grouping to perception?

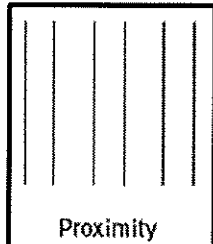
Our mind brings order and form to stimuli by following certain rules for **grouping**, also identified by the Gestalt psychologists.

These rules, which we apply even as infants and even in our touch perceptions, illustrate how the perceived whole differs from the sum of its parts, rather as water differs from its hydrogen and oxygen parts.

What is proximity?

A Gestalt law of grouping that states we group nearby figures together.

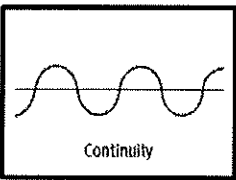
We see not six separate lines, but three sets of two lines.



Proximity

What is continuity?

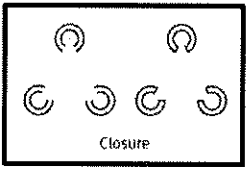
A Gestalt law of grouping that states we perceive smooth, continuous patterns rather than discontinuous ones. This pattern could be a series of alternating semicircles, but we perceive it as two continuous lines—one wavy, one straight.



Continuity

What is closure?


A Gestalt law of grouping that states we fill in gaps to create a complete, whole object. Thus we assume that the circles on the left are complete but partially blocked by the (illusory) triangle. Add nothing more than little line segments to close off the circles and your brain stops constructing a triangle.



Closure

TRY IT

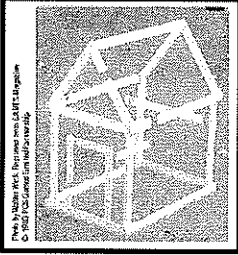
How can this be happening?



How are the principles of closure and continuity illustrated in this image?

The impossible dog house.

From the photo angle in the TRY IT picture, the Gestalt grouping principle of closure leads us to perceive the boards as continuous.



TRY IT

Talk with a partner: find one example from your life that illustrates each of the Gestalt laws below.

proximity

continuity

closure

VISUAL CLIFF

What is depth perception and how have we tested for it?

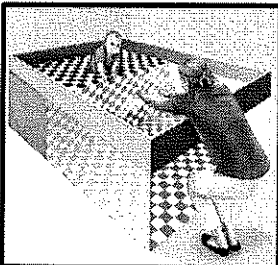
Depth perception is the ability to see objects in three dimensions although the images that strike the retina are two-dimensional; allows us to judge distance.

Eleanor Gibson and Richard Walk (1960) designed a series of experiments in their Cornell University laboratory using a **visual cliff**—a model of a cliff with a “drop-off” area that was actually covered by sturdy glass.

What did the visual cliff demonstrate?

6- to 14-month-old infants were placed on the edge of the “cliff” and coaxed by their mothers to crawl out onto the glass.

Most infants refused to do so, indicating that they could perceive depth.



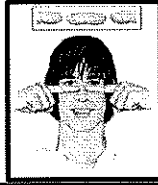
What are binocular cues and how do they help us judge depth?

Binocular cues are depth cues, such as retinal disparity and convergence, that depend on the use of two eyes.

As an object becomes closer or farther, both binocular depth cues operate to help us judge distance.

TRY IT

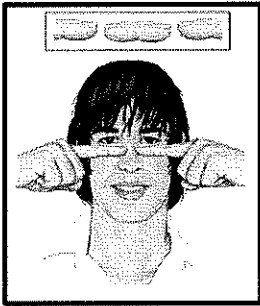
retinal disparity



Hold your two index fingers about 5 inches in front of your eyes, with their tips half an inch apart. Now look beyond them and note the weird result.

How does retinal disparity work?

By comparing retinal images from the two eyes, the brain computes distance—the greater the disparity (difference) between the two images, the closer the object.



What is convergence?

the inward angle of the eyes focusing on a near object

TRY IT

convergence

Hold your textbook or other written material out at arm's length and focus on the words on the page. While maintaining your focus (you may have to blink!), slowly bring the book closer and closer to your eyes.

Do you feel the slight pain/tightening around your eyes?

As the four muscles surrounding the eye work to move the eye to focus, they send signals to the brain that the object in front of you is getting closer.

2. What Would You Answer?

Narmeen is viewing the board in the classroom. She knows that the board is located far away because the view from her left eye is slightly different than the view from her right eye. Her ability to judge the distance of the board is due to which depth cue?

- A. relative disparity
- B. relative size
- C. linear perspective
- D. relative motion
- E. convergence

What are monocular cues and how do they help us judge depth?

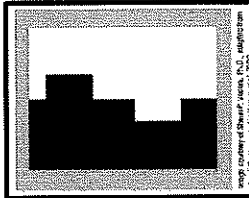
How do we judge whether a person is 10 or 100 meters away?

Retinal disparity won't help us here, because there won't be much difference between the images cast on our right and left retinas.

At such distances, we depend on **monocular cues** (depth cues available to each eye separately).

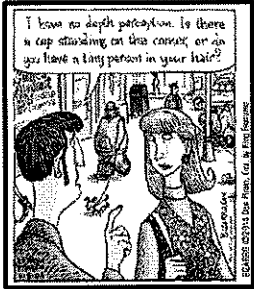
What is relative height?

We perceive objects higher in our field of vision as farther away. Because we assume the lower part of a figure-ground illustration is closer, we perceive it as the figure. Invert this illustration and the black will become ground, like a night sky.



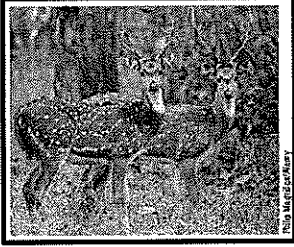
What is relative size?

If we assume two objects are similar in size, *most* people perceive the one that casts the smaller retinal image as farther away.




What is interposition?

If one object partially blocks our view of another, we perceive it as closer. The deer block the tree trunk...so the tree trunk seems farther.



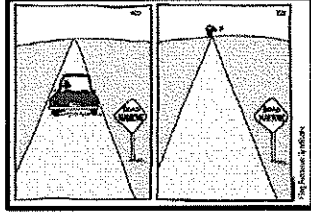
What is relative motion?

As we move, objects that are actually stable may appear to move. If while riding on a bus you fix your gaze on some point—say, a house—the objects beyond the fixation point will appear to move with you. Objects in front of the point will appear to move backward. The farther an object is from the fixation point, the faster it will seem to move.

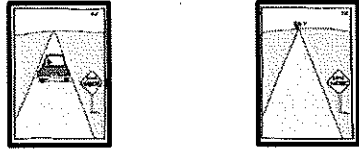


What is linear perspective?

Parallel lines appear to meet in the distance. The sharper the angle of convergence, the greater the perceived distance.



How does the brain perceive depth using linear perspective cues?



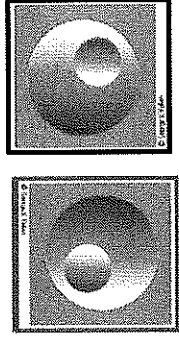

The yellow sign and the car, which are farther away from where the two parallel lines of the road seem to come together are perceived as close.

The car in this image is closer to where the two parallel lines seem to come together and is perceived as farther away.

What is light and shadow?

Shading produces a sense of depth consistent with our assumption that light comes from above.

In the inverted view, the hollow will become a hill.

AP® Exam Tip 2

The illustrations in the previous slides provide you with excellent opportunities to practice identifying monocular depth cues.

To really demonstrate your understanding, look for these cues in other drawings, photographs and real life.

There are almost always cues to identify and often more than one monocular cue will be present in an image. This practice will help you master the terms for the AP® exam.

What is stroboscopic movement and the phi phenomenon?

Our brain perceives a rapid series of slightly varying images as continuous movement (a phenomenon called *stroboscopic movement*).

We construct that motion in our heads, just as we construct movement in blinking marquees and holiday lights.

We perceive two adjacent stationary lights blinking on and off in quick succession as one single light moving back and forth. Lighted signs exploit this **phi phenomenon** with a succession of lights that creates the impression of, say, a moving arrow.

What is a perceptual constancy?

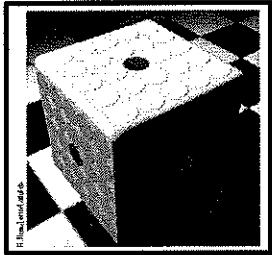
Perceptual constancy is a top-down process that recognizes objects without being deceived by changes in their color, brightness, shape, or size.

Regardless of the viewing angle, distance, and illumination, we can identify people and objects quite quickly.

Even if the image on our retina seems changing, our brain can keep it constant.

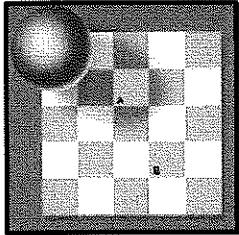
What is color constancy?

perceiving familiar objects as having consistent color, even if changing illumination alters the wavelengths reflected by the object



What is brightness constancy?

We perceive an object as having a constant brightness even as its illumination varies. This perception of constancy depends on *relative luminance*—the amount of light an object reflects relative to its surroundings.



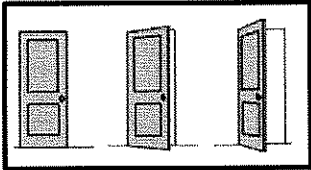
3. What Would You Answer?

Even though the banana seemed to change color as the lighting in the room changed, Jane knew that the color of the banana was not actually changing. This is due to

- A. perceptual adaptation.
- B. convergence.
- C. color constancy.
- D. interposition.
- E. brightness constancy.

What is shape constancy?

We perceive an object as having an unchanging shape, even while our distance from it varies.



What is size constancy?

We perceive an object as having an unchanging size even while our distance from it varies. We assume a car is large enough to carry people, even when we see its tiny image from two blocks away.

So...to our eyes...it appears an object (a car, a friend...) moving away from us is getting smaller. (sensation)

But our brain understands that friends and cars don't shrink like that and interprets the visual input as an increase in distance. (perception)

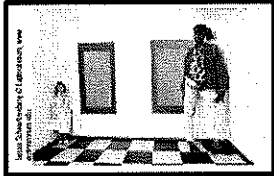
A pause for a quote...

"Sometimes I wonder: Why is that Frisbee getting bigger? And then it hits me."

Anonymous

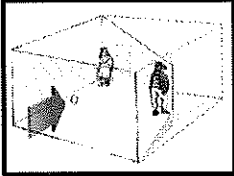
How does the Ames room alter our perceptions?

This distorted room, designed by Adelbert Ames, appears to have a normal rectangular shape when viewed through a peephole with one eye. The girl in the right corner appears very large because we judge her size based on the false assumption that she is the same distance away as the girl in the left corner.



How does the Ames room work?

As the diagram reveals, the girls are actually about the same size, but the room is distorted.



What have we learned from research on restored vision?

A few dozen adults who were blind from birth due to cataracts later gained sight. Most of their life they could see only diffused light.

After cataract surgery, the patients could distinguish figure from ground and could differentiate colors—suggesting that these aspects of perception are innate.

(Gregory, 1978; Huber et al., 2015; von Senden, 1932)

Is there a critical period for development of perception?

Surgery on children in India reveals that those who are blind from birth can benefit from removal of cataracts, and the younger they are, the more they benefit.

But their visual acuity (sharpness) may never be normal. For normal sensory and perceptual development, there is a **critical period**—an optimal period when exposure to certain stimuli or experiences is required.

(Chatterjee, 2015; Gandhi et al., 2014)

How does sensory restriction reveal the effects of experience on perception?

Researchers restricted the vision of infant kittens. After infancy, when their vision was restored, the kittens behaved much like the humans born with cataracts. They could distinguish color and brightness but not the form of a circle from that of a square. Their eyes had not degenerated; their retinas still relayed signals to their visual cortex. But lacking early stimulation, their brain's cortical cells had not developed normal connections.

(Hubel & Wiesel, 1963)


What is perceptual adaptation?

the ability to adjust to changed sensory input, including an artificially displaced or even inverted visual field

Can we adapt to inverted vision?

"Oops, missed," thought researcher Hubert Dolezal as he attempted a handshake while viewing the world through inverting goggles.

Yet, believe it or not, kittens, monkeys, and humans can adapt to an inverted world.



Learning Target 19-1 Review



Describe the Gestalt psychologists' understanding of perceptual organization.

- Gestalt psychologists searched for rules by which the brain organizes fragments of sensory data into **gestalts**.
- In pointing out that the whole may exceed the sum of its parts, they noted that we filter sensory information and construct our perceptions.

Learning Target 19-1 Review cont.



Describe how figure-ground and grouping principles contribute to our perceptions.

- To recognize an object, we must first perceive it (see it as a **figure**) as distinct from its surroundings (the **ground**).
- We bring order and form to stimuli by organizing them into meaningful **groups**, following such rules as proximity, continuity, and closure.

Learning Target 19-2 Review



Explain how we use binocular and monocular cues to perceive the world in three dimensions.

- **Depth perception**: seeing objects in three dimensions and judging distance.
- The **visual cliff** and other research demonstrate that many species naturally perceive the world in three dimensions at, or very soon after, birth.
- **Binocular cues**, such as **retinal disparity**, use information from both eyes.
- **Monocular cues** use information from only one eye.

Learning Target 19-2 Review cont.



Explain how we perceive motion.

- As objects move, we assume that shrinking objects are retreating and enlarging objects are approaching.
- A quick succession of images on the retina can create an illusion of movement, as in stroboscopic movement and the **phi phenomenon**.

Learning Target 19-3 Review



Explain how perceptual constancies help us construct meaningful perceptions.

- **Perceptual constancy** enables us to perceive objects as stable despite the changing image they cast on our retinas.
- **Color constancy** is our ability to perceive consistent color in objects even though the lighting and wavelengths shift.
- Brightness (or lightness) constancy is our ability to perceive an object as having a constant lightness even when its illumination—the light cast upon it—changes.

Learning Target 19-3 Review cont.



Explain how perceptual constancies help us construct meaningful perceptions.

- Shape constancy is our ability to perceive familiar objects (such as an opening door) as unchanging in shape or silhouette.
- Size constancy is perceiving objects as unchanging in size/dimension despite their changing retinal images.
- Knowing an object's size gives us clues to its distance; knowing its distance gives clues about its size, but we sometimes misread monocular distance cues and reach the wrong conclusions, as in the Moon illusion.