HOW WE PERCEIVE THE WORLD AROUND US

TOPIC:

The Mechanism of Perception

SCIENTIST:

James Gibson 1904–1979

INTRODUCTION:

Perception is the process by which we detect and interpret information from the world around us. American psychologist James Gibson asked: "*How* do human beings succeed in perceiving the world around them?" Before Gibson, scientists had assumed that perception was a purely passive process. The sensitive parts of sense organs, such as the retina of the eye, were thought to be simple receptors of stimuli. In the case of the retina, when light stimulated its sensory cells, nerve cells carried the resulting impulses from the sensory cells to the brain, where the object was perceived as the organized sum of all the impulses. Unfortunately, this passive hypothesis did not work when tested experimentally. If an experimental subject was held in a passive state, including being physically constrained, he or she did not perceive the world as a world of objects and, eventually, stopped perceiving anything at all. The passive receptor hypothesis failed to explain the mechanism of perception. Gibson's ideas changed all this. He suggested that humans learn, or are programmed, to explore their environment actively. We do not sit still and wait for stimuli to stimulate our sense organs. Instead, hands, eyes and other sensors move constantly, altering the input of sensation to the perceptual system. In the course of this exploration we seek out the invariants in our surroundings—certain ratios and proportions that do not change—which correspond to the permanent properties of the environment. In addition, Gibson considered senses as perceptual *systems*, not simply as collections of individual nerves with each having a specific passive function (for example, the hand is a perceptual system consisting of a sensitive skin on the outside and, on the inside, the receptors in the joints between the moving finger and wrist bones). Gibson tested his hypothesis in a series of experiments, the most elegant of which was the "Cookie Cutter Experiment." In this experiment, blindfolded subjects were asked to identify the shapes of cookie cutters gently pressed into the palms of their upturned hands; this represented the passive condition. The same subjects were then asked to identify the shapes but this time were allowed to actively explore the shapes with their fingers; this represented the active condition. Not surprisingly, the participants in the active condition were far more successful than those in the passive condition. The next part of the experiment, however, was the most important: Subjects were not allowed to touch the cookie cutter but the experimenter rotated it while it was pressed into the palm of the subject's hand, so partially mimicking the exploratory movements of the hands. In this case the participants were more successful than in the passive condition but less successful than in the active condition. Gibson suggested that the perceptual system of the hand was now engaged, but not as fully as when the fingers were allowed to explore the shape. He concluded that the changing pattern of sensation determined the perception of shape. In his "cookie cutter experiment" Gibson demonstrated that active exploration and not passive reception plays a major part in the process by which we perceive the world around us.

TIME NEEDED:

1 hour

MATERIALS:

Note: You will need at least one partner for this experiment.

blindfold (*e.g.*, a scarf or a bandage)
calculator
range of cookie cutters of different shapes (10 if possible)

Original Materials:

Gibson used materials similar to these in his experiments.

Safety Precautions

Please read and copy the safety precautions at the beginning of this book.

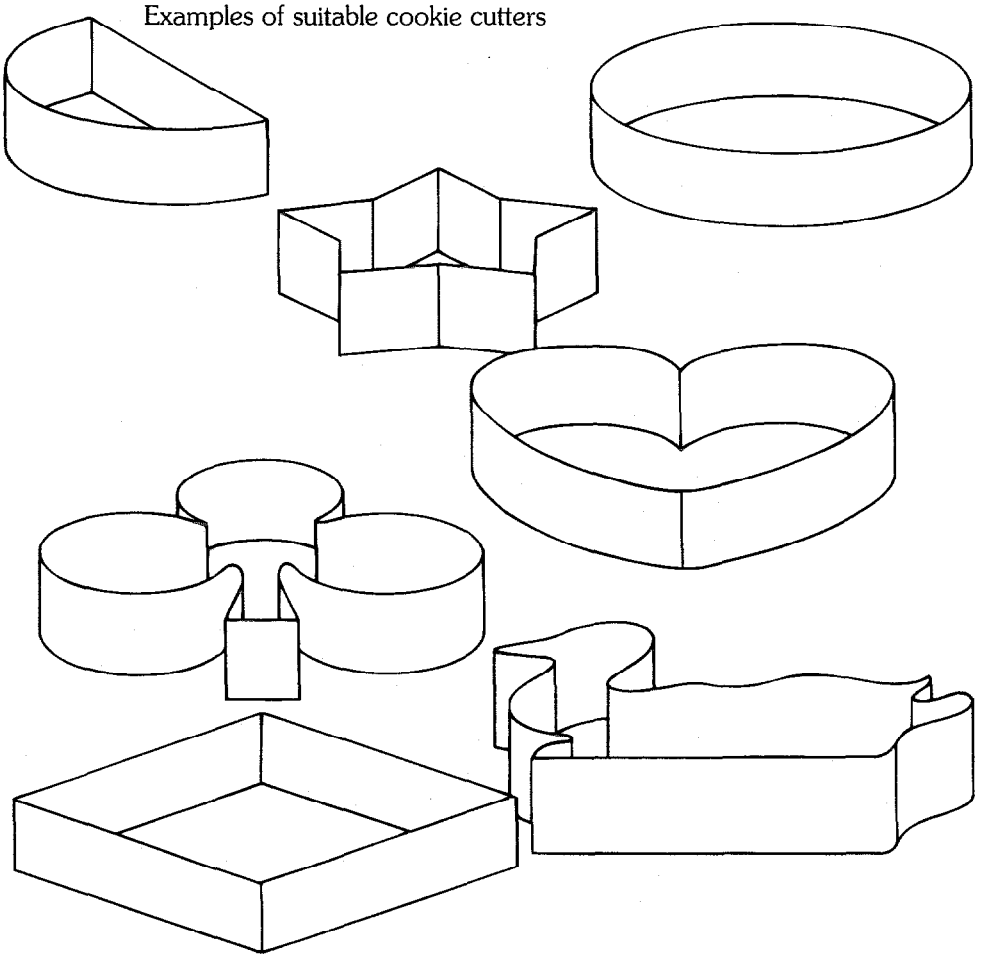
PROCEDURE:

Part 1

1. Put the cookie cutters onto a table (see figure 1).
2. Write a one-word description of each cookie cutter in the left-hand column of the Data Table. Next to each word, draw a simple outline showing the shape of the cookie cutter. While you are working, tell your partner (now the experimental subject) to spend 2 or 3 minutes inspecting the cookie cutters thoroughly without touching them.

Figure 1

Examples of suitable cookie cutters



3. Tell the subject to sit down. Tie the blindfold around her or his head so that the subject cannot see but not so tight that it causes discomfort.

Part 2

4. Tell the subject to hold out his or her hand, palm upwards.
5. Take a cookie cutter at random. Gently press it downward on the palm of the subject's hand. Do not move the cookie cutter on the palm or allow the subject to touch it.
6. Ask the subject to identify the shape of the cookie cutter (e.g., round, square, star-shaped or rabbit-shaped, etc.).

7. Record the subject's response with a ✓ for correct or an ✘ for incorrect in the column of the Data Table marked "Passive, no movement."
8. Repeat steps 5 to 7 with all the other cookie cutters in any order.
9. Allow the subject to rest, with the blindfold removed, for 10 minutes.

Part 3

10. Repeat step 3.
11. Give the subject a cookie cutter at random. Allow the subject to explore the shape of the cookie cutter using his or her fingers.
12. Ask the subject to identify the shape of the cookie cutter.
13. Record the subject's response with a ✓ for correct or an ✘ for incorrect in the column of the Data Table marked "Active."
14. Repeat steps 11 to 13 with all the other cookie cutters in any order.
15. Allow the subject to rest, with the blindfold removed, for 10 minutes.

Part 4

16. Repeat steps 3 and 4.
17. Take a cookie cutter at random. Gently press it downward into the palm of the subject's hand—on its side, not its edge—and gently rotate it horizontally.
18. Ask the subject to identify the shape of the cookie cutter.
19. Record the subject's response with a ✓ for correct or an ✘ for incorrect in the column of the Data Table marked "Passive with movement."
20. Repeat steps 17 to 19 with all the other cookie cutters in any order.
21. Remove the subject's blindfold.

Part 5

22. If possible, repeat the experiment with a number of other subjects so that several results can be pooled.

ANALYSIS:

1. In what percentage of cases was the subject correct in identifying the shape of the cookie cutter when it was pressed into the palm of the hand ("Passive, no movement")?

$$\text{Percentage of cases} = \frac{\text{Number of times correct}}{\text{Number of cookie cutters}} \times 100\%$$

If you tried the experiment with a number of different subjects, then calculate the average number of times correct, then calculate the percentage.

$$\text{Average number of times correct} = \frac{\text{Total number of times correct}}{\text{Number of experiments}}$$

$$\text{Percentage of cases} = \frac{\text{Average number of times correct}}{\text{Number of cookie cutters}} \times 100\%$$

2. Repeat the calculations described in 1 to calculate in what percentage of cases the subject was correct in identifying the shapes of the cookie cutters when a) the subject was allowed to feel the cookie cutters ("Active") and b) the cookie cutters were pressed down into the palm of the subject's hand and turned around ("Passive, with movement").
3. Why was it necessary to blindfold the subject(s) at the beginning of each part of the experiment?
4. From your results, how do you think we perceive objects in the physical world around us?
5. Why is it better to use a number of subjects in this experiment rather than just one?

OUR FINDINGS:

Click on above link to see what we found.

DATA TABLE

	Did the subject correctly identify the shape of the cookie cutter? ✓ = correct ✘ = incorrect		
Name and shape of cookie cutter (draw the cookie cutter outlines in this column)	PASSIVE no movement	ACTIVE	PASSIVE with movement

SPECIAL SAFETY NOTE TO EXPERIMENTERS

Each experiment includes any special safety precautions that are relevant to that particular project. These do not include all of the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely necessary that you read, copy, and remain mindful of the General Safety Precautions that follow this note.

Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Always prepare for unexpected dangers by following basic safety guidelines the *entire* time you are performing the experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note: The book assumes that you will read the safety precautions that follow, as well as those in the box within each experiment you are preparing to perform, and that you will *remember* them. Except in rare instances, these precautions will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE does not mean that you should be careless when simmering water or stripping an electrical wire. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it.

If you ever have a question about whether a procedure or material is dangerous, wait to perform it until you find out for sure that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the experiments in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARING:
—Clear all surfaces before beginning experiments
—Read the instructions before you start
—Know the hazards of the experiments and anticipate dangers

PROTECTING YOURSELF:
—Follow the directions step-by-step; do only one experiment at a time
—Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eye wash, and first-aid kit
—Make sure there is adequate ventilation
—Do not horseplay
—Wear an apron and goggles
—Do not wear contact lenses, open shoes, loose clothing, or loose hair
—Keep floor and work space neat, clean, and dry
—Clean up spills immediately
—Never eat, drink, or smoke in laboratory or work space
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USING EQUIPMENT WITH CARE:
—Set up apparatus far from the edge of the desk
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs
—Don't use your mouth to pipette; use a suction bulb
—Clean glassware before and after use
—Check glassware for scratches, cracks, and sharp edges
—Clean up broken glassware immediately
—Do not use reflected sunlight to illuminate your microscope
—Do not touch metal conductors
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders

USING CHEMICALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly

HEATING SUBSTANCES:
—Use goggles, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—Turn off hot plates, bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Have fire extinguisher on hand

FINISHING UP:
—Thoroughly clean your work area and glassware
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residue and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws

BE SAFETY CONSCIOUS AT ALL TIMES