Sharing Ideas on the Teaching of Psychology
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SENSATION: MOVEMENT DETECTORS IN THE CEREBRAL CORTEX

This simple demonstration helps students experience, first hand, the operation of movement detectors in the cortex, and the mutually inhibitory aspect of cells that detect movement in opposite directions.

The procedure involves rotating, for about 60 seconds, a black-and-white spiral pattern in front of the students' eyes so that the spiral appears to be receding from them. Tell the students to fix their gaze on the center of the spiral and not to let their eyes move. This will overstimulate cortical cells that detect outward movement. Now ask the students to shift their gaze to some other object, such as your head, a light fixture, or whatever.

When the outward-movement detectors stop firing, there is a tendency for inward-movement detectors to start firing for a few seconds, creating the dramatic illusion that the object the students now look at is moving toward them; some will experience the object as expanding in size. (The mechanism is similar to the physiological basis for complementary color afterimages in the ganglion cells of the retina). The same effect occurs when, for example, one looks for a long time at falling water; for a few seconds afterward, other objects will appear to be rising.

SOME VARIATIONS:

1. Initially rotating the spiral in the opposite direction (so that it appears to be expanding) creates the opposite effect on the object to which the students shift their gaze: They will see your head as shrinking, or receding.

2. To demonstrate that the effect occurs in cortical, not retinal cells, have the students view the spinning spiral with only one eye, then look at your head, or whatever, only with the other. Since the retina that saw the spiral was not the same as the one that saw the new stimulus, the effect must have taken place in the brain.

SOME TIPS:

1. The effect is strongest when the spiral pattern stimulates a large segment of the retina, so ask your students view it head on rather than at an angle, and to get within a few feet of the disk. (In very large classes, you may want to do the

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1 I do not know the original source of this demonstration, but it appears in several textbooks and instructors manuals.
demonstration separately with small groups, or to construct a very large spiral.

2. To create steady stimulation of the same set of cells, rotate the disk at a constant speed and without moving it left, right, up, or down.

EQUIPMENT NEEDED:

A black-and-white spiral pattern, approximately 18 inches in diameter, painted on or glued to a cardboard or foam disk of the same size. To make it easy to rotate the disk, drill a small hole in its center into which you insert a pencil, or mount a small rod in the center of its rear surface. If you want to get fancy, mount the disk, like a record, on a lightweight turntable like the ones sold in toy stores.

To create a nice spiral, wrap a string around a pencil whose point is placed at the center of a sheet of black construction paper or cardboard. Tie a pencil to the free end of the string. Then, while moving the tethered pencil in a circle around the center pencil (or having someone rotate the paper), gradually pay out the string. The resulting ever-widening "circle" will provide the tracing for a spiral that can then be filled in with white ink or paint. Special note: Practice making the spiral a few times until you get one in which its white stripe is relatively narrow, thus creating a pattern very high in visual contrast during rotation.

The ideal pattern looks like this:
ACTIVITY

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THE PULFRICH PENDULUM EFFECT:
WHEN TO AND FRO IS ROUNDABOUT
Ludy T. Benjamin, Jr.

Concept

The Pulfrich phenomenon is one of the most effective demonstrations in visual perception and one of the easiest to prepare. This simple demonstration evokes a powerful illusion of movement or, more specifically, a perceived misdirection of movement. The student views an object swinging back and forth at eye level in a plane perpendicular to the line of vision. Viewing is binocular, but one of the student's eyes is covered with a sunglasses lens (or some other form of light filter). The swinging object will appear to be moving in an elliptical or circular orbit rather than in a straight line. When the lens is shifted from one eye to the other, the object will reverse its direction of movement.

Materials Needed

The simplest way to demonstrate the Pulfrich effect is to attach a string to the ceiling with a weight tied to the free end. The weight should be about the size of a flashlight battery or nine-volt transistor radio battery. In fact, either of those objects will work quite well. The only problem with this technique (and it is not really a drawback for demonstrational purposes) is that one must continually restart the pendulum action when the arc begins to decrease. If motion of the object at a constant speed is important for systematic data collecting, then the pendulum should be attached to a motor. One solution is to find a motor designed for this kind of motion. For example, many motors used in window display advertising are often geared to moving an object back and forth. These motors are not usually heavy-duty, so the shaft of the pendulum and the pendulum bob must be lightweight. A ping pong ball, painted some dark color so that it contrasts well with light-colored walls, makes an excellent bob. The shaft can be a rod made of some thin metal such as aluminum. It should be light enough not to induce undue strain on the motor yet heavy enough to remain rigid in the pendulum motion.

Preparation of Class

Announce in advance that students should bring their sunglasses to class on the day of the demonstration. Other light filters can be used, such as exposed film (as long as it isn't too dark).

Instructions

Position the students toward the center of the classroom as near to the back of the room as is possible. Some may be sitting while others stand behind them. Optimal viewing distance is from 15 to 20 feet, although shorter distances can be used. In demonstrating this phenomenon the background is a critical variable. There should be ample distance (from 6 to 10 feet) between the path of the swinging object and any adjacent walls; otherwise the magnitude of the effect will be diminished. Ask students to cover their right eyes with the sunglasses lenses. If a student is
using an intact pair of sunglasses, the best procedure is to hold both legs of the glasses, one in each hand, with the sunglasses turned around and held in a vertical position. That is, the lenses are up and down, with the student looking through the lower lens. This allows rapid switching of the lens from one eye to another.

When students have their glasses in place, remind them that they are to view the pendulum with both eyes open. Start the bob swinging and instruct the students to watch the motion of the bob. After a few seconds, ask them to describe what they are seeing. They will usually say that they see the object moving in a circle or an ellipse. (With the lens over the right eye, the front part of the orbit will be seen as left to right. When the lens is switched to the left eye, the direction of the orbit reverses.) When most of the students report seeing the movement, have them quickly switch the lens to the left eye and describe the direction of the movement. Once they see that it reverses, they can shift the lens from eye to eye to repeat the effect. The darker the sunglass lens, the greater the magnitude of the illusion.

Other interesting effects can also be observed. For example, if the teacher stands to the side of the arc of the pendulum and positions one hand so that it is in front of the bob near the end of the arc, the bob will appear to pass through the hand as it makes the forward pass of its illusory orbit. Feel free to experiment with the effect. Varying the nature of the background can also change the magnitude of the effect. Placing the bob so that the arc is parallel and close to a wall causes the back portion of the orbit to flatten out.

Discussion

By covering one eye with a filter, the eye is said to be partially dark-adapted. This produces a difference in the time it takes information to be transmitted from the eye to the brain. That is, the dark-adapted eye will transmit its neural messages slower than the other eye. This delay causes the dark-adapted eye to see the bob slightly in the past. It is the difference in transmission times from the two eyes that produces the perceived illusory elliptical orbit. In other words, the brain receives information exactly like that it receives when viewing an object swinging in an elliptical orbit with normal binocular vision. The figure below (from Gregory, 1973) is helpful in explaining the effect and should be reproduced as a handout for students or illustrated on a chalkboard.

**Pulfrich Pendulum Effect**

![Diagram of Pulfrich Pendulum Effect](image)

SENSORY PROCESSES AND PERCEPTION 41
Suggested Background Readings


PROP (6-n-propylthiouracil) Papers
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1. Source of PROP pharmaceutical grade 6-n-propylthiouracil
   Pfaltz-Bauer
   172 E. Aurora St.
   Waterbury, CT 06708 (203-574-0075)

2. PROP papers
   The papers are made from filter paper (Whatman 1). Heat tap water to near boiling and then
   add 5 grams PROP to 500 ml water. The aim is to make a saturated solution so you can adjust to be
   sure that you have as much as possible in solution. (As the solution cools, crystals will come out of
   solution.) Dip the pieces of filter paper in the PROP solution so that they are completely soaked.
   We use small pieces of filter paper (3 cm circles of Whatman grade 1 filter paper) and allow them to
   dry individually on sheets of aluminum foil. The PROP crystallizes into the filter paper. Thus the
   paper is a convenient way to deliver a few crystals of PROP to a subject.
   To taste the paper, put the whole piece in your mouth and let it get well moistened with
   saliva. The bitter taste may build slowly or may be perceived immediately. When the bitter taste is
   at a maximum, rate the bitterness on the scale below (see item 6).

3. Toxicity of PROP
   PROP is a medication used to treat Grave's Disease (hyperthyroidism). If you were taking
   this medication for Grave's Disease, you might take 3-4 tablets (50 mg each) daily. Each PROP
   paper contains about 1.6 mg PROP. PROP is marketed by Lederle. If individuals have Grave's
   Disease and have had medical problems with PROP, we suggest that they not try this test. Although
   the amount of PROP is very small, little is known about reactions to small amounts in thyroid
   patients who are sensitive to PROP.

4. PROP tasting and tongue anatomy
   In the laboratory, we can look at the stained tongue under a microscope. We see small blue
   dots on most of the fungiform papillae. These are taste pores, the conduits to taste buds. In size, the
   taste pores are to the fungiform papillae as a sesame seed is to a hamburger bun.

5. Staining Fungiform Papillae
   For a description of the method we use in the laboratory see: (Bartoshuk, Duffy, & Miller,
   1994).
   The bumps on the anterior (mobile) tongue are papillae. The most numerous are the filiform
   papillae but these have no taste function. The fungiform papillae look like tiny button mushrooms
   (hence their name). The fungiform papillae are the most densely distributed on the tip of the tongue
   and thin out as you move toward the center of the tongue. The fungiform papillae are the structures
   that contain taste buds. Although supertasters tend to have more taste buds on each papillae than
   nontasters, what really makes them supertasters is that they have many more fungiform papillae.
   Counting fungiform papillae requires only a magnifying glass, a flashlight, blue food coloring and
   Q-tips.
   Swab the blue food coloring on the front of the tongue (cover the tip and about 1/2 inch
   back). Have the subject move the tongue around in the mouth and swallow. This distributes the
dye. You will see pink circles emerge from the blue background. The pink circles are the fungiform papillae. The fungiform papillae appear pink because they do not stain as well as the filiform papillae.

Counting fungiform papillae can be done in a science lab or classroom as well as used for research. You need a template that can be placed on tongues in a consistent manner. For example, you can use a paper punch to punch a hole in a 1 inch square of wax paper or you can use the reinforcements sold for notebook paper. Either of these will give you a hole about 6-7 mm in diameter. After staining the tongue, place the template so that the hole is in a standard position (see sketch below). Using a flashlight and a magnifying glass, count the fungiform papillae.

For our laboratory studies, subjects hold a disposable plastic slide on their tongues. The slides flatten the tongue and make the fungiform papillae easier to photograph. The fungiform papillae tracings shown below were obtained in this way. If we enlarge the image, we see small blue dots on most of the fungiform papillae. These are taste pores, the conduits to taste buds. In size, the taste pores are to the fungiform papilla as sesame seeds are to a hamburger bun.

The circles correspond approximately to the hole produced by a typical paper punch or to the hole inside a notebook paper reinforcer.

Source of slides:
Rinzl vinyl plastic micro slides; box of 144 slides: $8.50; item # SB14080M
NASCO (414-563-2445)
901 Janesville Ave.
Fort Atkinson, Wisconsin 53538-0901

6. Perceived bitterness of PROP paper to nontasters, medium tasters and supertasters.
To quantify the intensity of the bitter taste, we use a scale called the general Labeled
Magnitude Scale shown below (Bartoshuk, Duffy, Fast, Green, & Snyder, 2002). This scale was derived from the Labeled Magnitude Scale (Green, Shaffer, & Gilmore, 1993). The scale covers the whole range of sensory intensity. Thus, "strongest imaginable sensation of any kind" refers to the strongest sensory intensity the subject can imagine in any sensory modality (e.g., strongest pain, looking at the sun, hearing a fire engine go by right by your ear, etc.).

25% of U.S. subjects fall above this point

25% of U.S. subjects fall below this point

The lines on the scale indicate roughly how the attendees at lectures (currently about 5,500 attendees) divided into the lowest 25%, the intermediate 50% and the highest 25% using PROP paper.
References

Bartoshuk LM, Duffy VB, Fast K, Green BG, Prutkin JM, Snyder DJ. Labeled scales (e.g., category, Likert, VAS) and invalid across-group comparisons. What we have learned from genetic variation in taste. *Food Quality and Preference* 2002;14:125-138.


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DEMONSTRATION OF DEPTH OF PROCESSING AND MEMORY¹

This demonstration can help your students appreciate the relationship between the depth to which information is processed and the likelihood that it will be encoded in and retrieved from long-term memory. For best results, do the demonstration before describing the effect.

Read a list of words after instructing half the class to count or estimate the number of vowels in the words or to rate each item listed, on a 1-5 scale, in terms of its value to a person stranded on a desert island. (The differing instructions can be given via differing overhead transparencies shown to each half of the class): Here is a sample word list:

UMBRELLA, GASOLINE, ORCHESTRA, YACHT, HAMMER, DIAMOND, UNIVERSITY, MACARONI, EYEGGLASSES, GARDEN, UNDERWEAR, NEWSPAPER, ALCOHOL, BOUQUET, MICROSCOPE, CAMOUFLAGE, POLLUTION, RESTAURANT, INSECT, ELEPHANT, SULPHUR, LEMONADE, MOSQUITO, BOTTLE.

To displace from short-term memory the words in the latter part of the list, ask the students spend about 30 seconds performing a distracting task, such as writing their name, address, phone number, major, and social security number.

Now give the students one minute to write down as many words from the list as they can recall. Retention scores from those who processed the words superficially (by counting or estimating vowels) should be much lower than those from students who processed the information more deeply (by thinking about, and possibly visualizing, the usefulness of each item in a particular situation.

You may want to relate the results of this demonstration to the advice given in study skills courses to avoid study methods that process course material superficially (e.g. simply reading or underlining) in favor of deeper processing tasks such as outlining chapters, writing examples of the relationship between new material and that already read, or writing test questions about the material.

¹ This demonstration was suggested by one of my instructors in introductory psychology who was unable to remember the original source.
Count or estimate the number of vowels in each word
Rate each item on a 1-5 scale (5 being high) in terms of its value to a person stranded on a desert island.
Statements

1. physical appearance is an important factor in getting a job
2. participation in athletics builds character
3. taking vitamin C reduces your chances of having a cold
4. sleep loss impairs your ability to make correct decisions
5. on multiple-choice exams you should stick with your first answer because it is usually correct; that is, you should not change answers on objective exams

experiment

testable hypothesis

operational definitions

independent variable(s)

dependent variable(s)

experimental group(s)

control group(s)

subject selection

assignment of subjects to groups

subject variables to be controlled

experimental conditions to be controlled

standardization of testing conditions

control procedures (e.g., single-blind, double-blind, placebo, counterbalancing, etc.)

precision in measurement

significance of results

what would the experiment be like if it were conducted under conditions of naturalistic observation?
MEANING AND MEMORY:
AN ASSIGNMENT TO BE FORGOTTEN
Ludy T. Benjamin, Jr.

Concept

This exercise is intended to illustrate the importance of meaning as a factor in retention. The procedure purportedly originated with the magician Harry Blackstone.

Instructions

For this activity, you will need a chalkboard, a piece of chalk, an eraser, and some facility at acting, including the ability to keep a straight face. This activity requires from 10 to 15 minutes (depending on how longwinded you choose to be) and should be conducted at the close of a class period. It represents a particularly good way to introduce your class to the topic of memory. End your lecture (or other activity) early and announce to the class that you are about to give them a homework assignment. A possible script is as follows:

“I am going to give you a homework assignment that I expect you to have successfully completed by our next class meeting. This assignment will require no writing or reading. In fact you don’t even have to do any thinking. Nevertheless, it is an important assignment, one that I believe is critical for your performance in this course. Frankly, I am concerned that some of you will not take this assignment seriously. You will no doubt view it as a trivial activity and will therefore put out little or no effort in an attempt to complete it. If you are in that category, then I suggest you seriously consider why you are taking this course. It could be that you are wasting your time. On the other hand, there are those of you who will work extremely hard on this assignment and for that effort I am very grateful.” (etc., etc.)

Your speech should be serious in tone as well as content, and your face should project that concern as well. Time your “message” to end approximately one minute before the end of the class period. At that point, go to the chalkboard and write a three-digit number (107 for example). Make large numbers so they are clearly visible in the back of the room. Step to the side in order not to obscure the view of the students. Keep looking at the numbers (not at the students) for about 5 to 10 seconds. Then erase the numbers. Turn toward your class and announce, “Your assignment for our next class meeting is to forget the number you just saw.” In a few seconds you should begin to observe some smiling faces (hesitantly at first) and then laughter as more and more of the students realize what has happened. Indicate that you have attempted to demonstrate how meaning can be attached to an otherwise meaningless number. You might ask for a show of hands from those students who believe they will be unable to complete the assignment. Most of the students (if not all of them) will usually raise their hands.

Discussion

At the next class meeting, ask for a show of hands from those students who were unable to forget the number and from those students who
were able to forget. Ask them to verbalize why they were or were not able to forget. You can then lead the discussion to a number of related topics on the importance of meaning in learning and memory—the use of nonsense syllables, grouping of material (chunking), mnemonic systems or devices, learning material in an unfamiliar language compared to learning the same material in your native language, and so forth. This discussion presents a good opportunity to talk about the ease of learning and remembering material that is highly valued by an individual. For example, many people seem to have incredible memories on certain topics: batting averages in baseball, mintage figures for coins, a myriad of facts about old movies and movie stars, and details about Civil War battles. Get the class to speculate about the nature of learning and forgetting in situations like those described.

While it is likely that the emphasis you attached to the number is the reason it was remembered, it is also possible that the retention was due to rehearsal. That is, in attempting to forget the number, the student was forced to think of the number and thus rehearsed it many times in an attempt to consciously forget it. Although this explanation seems less plausible, it can provide some interesting discussion about what really happens to prevent one from forgetting the number.


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AN ALL-PURPOSE MEMORY DEMONSTRATION

This demonstration provides an excellent way of either introducing the topic of memory or summarizing a range of material covered in memory lectures.

The procedure requires only that you ask the class to listen as you read, at about a word per second, the following list:

Bed, quilt, dark, silence, fatigue, clock, snoring, night, toss, tired, night, artichoke, turn, night, rest, dream.

Now give the class 15-30 seconds to write down as many of the words as they can recall.

When time is up, ask how many people recalled the word "sleep." A third or more will have done so, but only through constructive memory, since this word is not on the list. (If you played a tape recording of the list rather than actually reading it, you can prove this point to the skeptics.)

Now repeat the list in order and ask for a show of hands by those who correctly recalled each word. By plotting on the blackboard the frequency of correct recall you should produce a reasonable approximation to the classic serial position curve. Recall scores should be best at the beginning of the list (primacy effect) and the end of the list (recency effect). Words in the middle of the list should have the lowest scores, except for "artichoke" which should be recalled better than its neighbors because of its semantic distinctiveness (it has nothing to do with sleep).

The word "night" should also have a particularly high score, not only because of the recency effect because its higher frequency on the list allowed for better rehearsal.

Now count the number of people who correctly recalled both "toss" and "turn." Due to chunking, recalling one should evoke the other (ask for a show of hands by those who recalled these words in sequence on their lists).

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1 One of my instructors in introductory psychology found this one, but could not recall the source.
PENNY DEMONSTRATION

Illustrating that familiarity does not ensure recall

1. Who appears on the front of a penny?
2. Which way does the person face? Right, left, forward, backward? (draw diagram on board)
3. What else appears on the front of the penny? Are there any words or numbers?
4. What appears on the back of a penny (assuming it was minted since 1959)?
5. What numbers or words appear on the back of a penny?

afterwards

The denomination (value) on the penny says "one cent."

What does the value statement say on each of the other U.S. coins?
Possible Goals for the Introductory Psychology Course*

1. **Educational Preparation**: To prepare students for future study in psychology.

2. **Psychology and Society**: To develop in students an awareness of the uses of psychology in society in order to develop more informed consumers of psychology.

3. **Scientific Processes**: To teach students about the investigative approaches to behavioral observation, formulation of hypotheses, setting up experimental situations, gathering and analyzing data.

4. **Vocational Preparation**: To aid students in occupational planning.

5. **Personal Interest and Curiosity**: To develop in students interest and curiosity about behavior.

6. **Philosophy of Life**: To assist students in developing a clear philosophy of life.

7. **Values Clarification**: To assist students in articulating and clarifying their feelings and values.

8. **Scientific Values**: To develop in students the willingness to adopt the ethics and values characteristic of psychologists in their everyday behavior, e.g., objectivity, open-mindedness, criticalness of evaluation, concern for the welfare of subjects.

9. **Social and Interpersonal Skills**: To develop in students an understanding of social and interpersonal processes and to apply this understanding to more effective interpersonal interactions in social, family, and love relationships.

10. **Study Skills**: To assist students in applying psychological knowledge to develop more effective learning and study skills.

11. **Content**: To provide students a balanced overview of the elementary concepts and facts of the discipline of psychology.

12. **Self Knowledge and Understanding**: To develop in students a better knowledge, understanding, and acceptance of self.

13. **Multicultural Awareness**: To develop a broader understanding of the experiences, values, and behaviors of groups differing by gender, race, ethnicity, sexual orientation, etc.

14. **Learning to Learn/Life-long Learning**: To develop in students the tools for learning and the motivation for learning in their years beyond the university.

15. **Critical Thinking**: To develop in students an ability for logical and critical analysis.

16. **Computer Research Skills**: To expose students to the methods of information search and retrieval from the World Wide Web.

17. **Writing Skills**: To use writing assignments to help students learn to write (learning to write) and to learn psychology (writing to learn).

18. **Other:**

* Modified from a survey developed by Samuel Cameron.
Questionnaire

1. A spider eats a fly.
2. Two wolves fight for leadership of the pack.
3. A soldier shoots an enemy at the front line.
4. The warden of a prison executes a convicted criminal.
5. A juvenile gang attacks members of another gang.
6. Two people fight for a piece of bread.
7. A person viciously kicks a cat.
8. A man, while cleaning a window, knocks over a flowerpot which, in falling, injures a pedestrian.
9. A girl kicks a wastebasket.
10. Mr. Bradley, a notorious gossip, speaks disparagingly of many people of his acquaintance.
11. A woman mentally rehearses a murder she is about to commit.
12. An angry daughter purposely fails to write to her mother, who is expecting a letter and will be hurt if none arrives.
13. An enraged boy tries with all his might to inflict injury on his antagonist, a bigger boy, but is not successful in doing so. His efforts simply amuse the bigger boy.
14. A woman dreams of harming her antagonist but has no hope of doing so.
15. A senator does not protest the escalation of bombing to which she is morally opposed.
16. A farmer beheads a chicken and prepares it for supper.
17. A hunter kills an animal and mounts it as a trophy.
18. A dog snarls at a mail carrier but does not bite.
19. A physician gives a flu shot to a screaming child.
20. A boxer gives his opponent a bloody nose.
21. A Girl Scout tries to assist an elderly woman but trips her by accident.
22. A bank robber is shot in the back while trying to escape.
23. A tennis player smashes his racket after missing a volley.
25. A cat kills a mouse, parades around with it, and then discards it.