



### Activity 1: Grades 5-8

## Mind Mapping

As you learned in "[How Phineas Lost It](#)," phrenology, an 18th century pseudoscience, offered one of the earliest schemes for explaining brain function. Although based incorrectly on skull bumps and shapes, phrenology did attempt to organize and assign different purposes to different parts of the brain - the cornerstone of modern brain science.



In this activity, you'll have the chance to create your own "live" model comparing a phrenology chart to our modern understanding of brain function and anatomy. Rather than typical paper and pen illustrations, you will use a bathing cap as your canvas!

This activity page will offer:

- Construction of a unique phrenology map.
- Construction of a map that shows brain regions according to modern research.
- An opportunity to compare and contrast brain models.

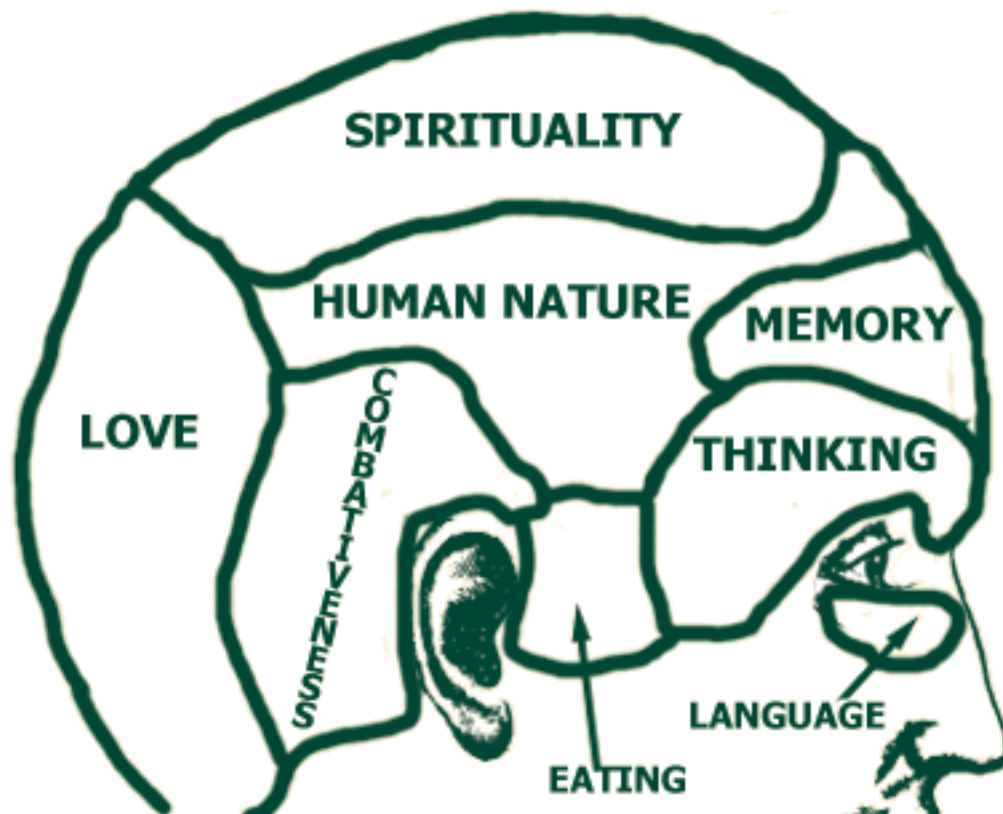
### MATERIALS

- White inexpensive bathing cap (cleaned)
- Wax pencils or non-toxic permanent markers that will write on bathing cap material

### PROCEDURE

Work in groups of two. Review the phrenology chart shown below. Although 37 mental and moral areas are defined on more elaborate phrenology charts, we've based our drawing on a chart that simplified and combined these "organs" into larger, composite regions. If you wish to view a more detailed phrenology chart, click [here](#)

(<http://dbs.ohiohistory.org/teachers/page.cfm?ID=73>.)



1. Have one member of your team assume the role of subject. The other becomes the artist.
2. Have your subject put on the bathing cap and adjust it for comfort.
3. As the artist, draw the regions as illustrated on the phrenology chart onto one side bathing cap. Use different colors to distinguish each region.
4. Remove the bathing cap.  
**Note:** When removing and handling the cap, be careful not to smear the ink.
5. Check out this illustration showing the major regions of the brain. Can you and your partner identify the name and function of the six regions highlighted here? Use both Web and hard copy resources to conduct your research. *Cerebrum -larger section of brain that is responsible for higher thinking and voluntary muscle control*  
*Frontal lobe - higher thought functions*  
*Temporal lobe - memory, sound processing*  
*Occipital lobe - processes visual information*  
*Parietal lobes - sensation and judgment, visual/spatial processing, language (left side)*  
*Cerebellum - muscle coordination and balance*  
*Brain stem - breathing, digestion, heart beat and other automatic functions)*



6. Have the new "subject" put on the bathing cap. Using the information you uncovered, draw an illustration on the opposite and blank side of the bathing cap that shows these brain regions.
7. When you are finished, thorough clean both your hands and workstations. Remove any unwanted marker stains.

### **Questions**

1. How is the phrenology chart similar to our modern day chart of the brain? Do any of its assigned areas match the correct functions of the brain?
2. How is the phrenology chart different from our modern day brain chart?
3. What were phrenology charts based upon?
4. What is our modern day understanding of brain anatomy based upon?

### **Critical Analysis**

What are the advantages in using a bathing cap for creating this model?  
What are the disadvantages?

### **EXTENSIONS**

### **Animated Model**

Can you animate a flipbook "trip" through the brain? Think about the cross-section images of the brain taken by the MRI scanner in the program. Use online resources to help create a better idea of what this series of views might look like (see the Web Connection below). Then sketch each cross section onto a separate scrap of paper. When all the frames have been drawn, use a large clip to fasten the stack together and flip through the frames. At the right flipping speed, it will appear as if you are moving through the brain, section-by-section!

### **Critical Thinking and the Web**

There is no insurance that Web sites are fair and unbiased in their presentation of material. The pseudoscience of phrenology offers an excellent arena for exploring and critically analyzing information that is presented on the Internet. For example, the following Web site states that its primary goal is to be an "advocate for a positive approach to scientific Phrenology." Under your instructor's guidance, examine this site and then discuss the subject of accurate information on the Web with your classmates. The URL is <http://134.184.33.110/phreno/index.html>

### **Intelligent Elevator**

How might the footprint profiles captured by an "intelligent floor" be used to improve elevator service? Should this intelligent floor be placed inside or outside of the elevator, or both? Explain the benefits of each approach. Could it address pranksters who might press all of the floor buttons? If so, how? How might the floor address a car that was overloaded?

### **Freedom of Movement**

The ability to track individuals on a floor might be interpreted as a challenge to a person's right to anonymity. Do you think this violates a person's rights as guaranteed by the constitution? Should a person need to sign a release in order for his/her footprint profile to be recorded? Suppose you were a lawyer who challenged the legality of this process? How would you present your case?

## **WEB CONNECTION**

### **Phrenology: the History of Brain Localization**

<http://www.epub.org.br/cm/n01/frenolog/frenologia.htm>

A detailed history of phrenology, including many illustrations.

### **The Whole Brain Atlas**

<http://www.med.harvard.edu/AANLIB/home.html>

This interactive atlas that shows brain sections and structure.

### **PBS - Secret Life of the Brain**

<http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/>

Take this interactive, 3-D tour of the brain (Shockwave plug-in required).

The activities in this guide were contributed by Michael DiSpezio, a Massachusetts-based science writer and author of "Critical Thinking Puzzles" and "Awesome Experiments in Light & Sound" (Sterling Publishing Co., NY).

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**Mind Mapping**



**Questions**

1. How is the phrenology chart similar to our modern day chart of the brain? Do any of its assigned areas match the correct functions of the brain?  
**(Both consider that the brain is divided up into distinct regions that have specific functions. "Thinking" is in approximately the correct place on the phrenology chart - the frontal lobes.)**
2. How is the phrenology chart different from our modern day brain chart?  
**(The phrenology chart is incorrectly organized into areas that are mostly emotionally or spiritually based. Our modern day organization considers brain regions primarily in terms of function.)**
3. What were phrenology charts based upon?  
**(Bumps and shapes of the skull. These outer signs suggested differences in the sizes and the level of activity of the brain "organs".)**
4. What is our modern day understanding of brain anatomy based upon?  
**(A wide research base that includes work with animal brains,**

## **understanding of brain disabilities, autopsies, MRI and PET scans, etc.)**

### **Critical Analysis**

What are the advantages in using a bathing cap for creating this model? **(Accept all reasonable answers, such as it gives a better feeling for the size, shape, and position of the real brain.)** What are the disadvantages? **(It's not flat and is difficult to read when removed from the head. Ink might smear. It's difficult to copy. It doesn't show inner anatomy.)**

### **CURRICULUM LINKS**

#### **General Science :**

Scientific Method : Modeling

#### **Life Science :**

Organs systems  
Structure and Function of the Brain  
Technology in Brain  
Mapping Phrenology  
Anatomy of the Brain

### **NATIONAL SCIENCE STANDARDS (Grades 5-8)**

#### **Science as Inquiry- Content Standard A**

Students will develop descriptions, explanations, predictions and models using evidence collected and they will explore the relationship between evidence and explanation.

Students will appreciate that advancement in the field of science occurs when a theory is displaced by a better theory.

Students will discover the role of technology as a data collection tool that can lead to scientific advancement.

#### **Life Science - Content Standard C**

Students gain familiarity of the structure and function in living systems by working with the anatomy of the brain.

#### **History and Science - Content Standard G**

Students will learn that all scientific ideas are subject to change, yet, even ideas that are changed have experimental and observational confirmation.

**Students are given insight into the nature of science by being shown that scientists change their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.**