

Measuring Brain Function and Mapping the Brain

by Sophia Tutorial



WHAT'S COVERED

Welcome to today's lesson on brain function and mapping the brain. Different tools and techniques are used to map the brain. It is important to examine specific people that have brain damage or certain disorders to research possible treatments. It can also be used in healthy people to compare abnormal brain maps to normal brain maps. This tutorial will specifically focus on:

1. Assessing the Brain
2. Computed Tomography (CT)
3. Magnetic Resonance Imaging (MRI)
4. Electroencephalograph (EEG)
5. Positron Emission Tomography (PET)

1. Assessing the Brain

One of the first assessments of brain function and brain disorders involve the physiological and behavioral changes in a person. Since the brain controls a lot of our responses, we can assume that certain abnormal responses might be the result of different kinds of brain damage or problems with the brain function.

Now, these can be very obvious and profound differences. For instance, stroke patients might have noticeable difficulty moving or speaking, though they can also have more subtle signs.

A **neurological soft sign** is a term used for minor signs of nonspecific sorts of brain disorders. These are symptoms that might not normally be noticed by others, but psychologists are more trained to recognize and understand them as signs of neurological problems.

Besides noticing the outward behaviors that people might show as results of neurological problems, the brain structure itself can be analyzed. There are specific tools that scientists and psychologists use to measure the brain and its function. These tools either map or model the brain, generally in 3D.



TERM TO KNOW

Neurologic Soft Signs

2. Computed Tomography (CT)

Essentially, the **computed tomography (CT) scan** is a specialized x-ray device. It takes x-rays of the brain, taking multiple images, and then creates a 3D model of the brain from those multiple images. They can show some of the internal structures just like x-rays normally do.

Here is a CT scan of the brain:



TERM TO KNOW

Computed Tomography (CT) Scan

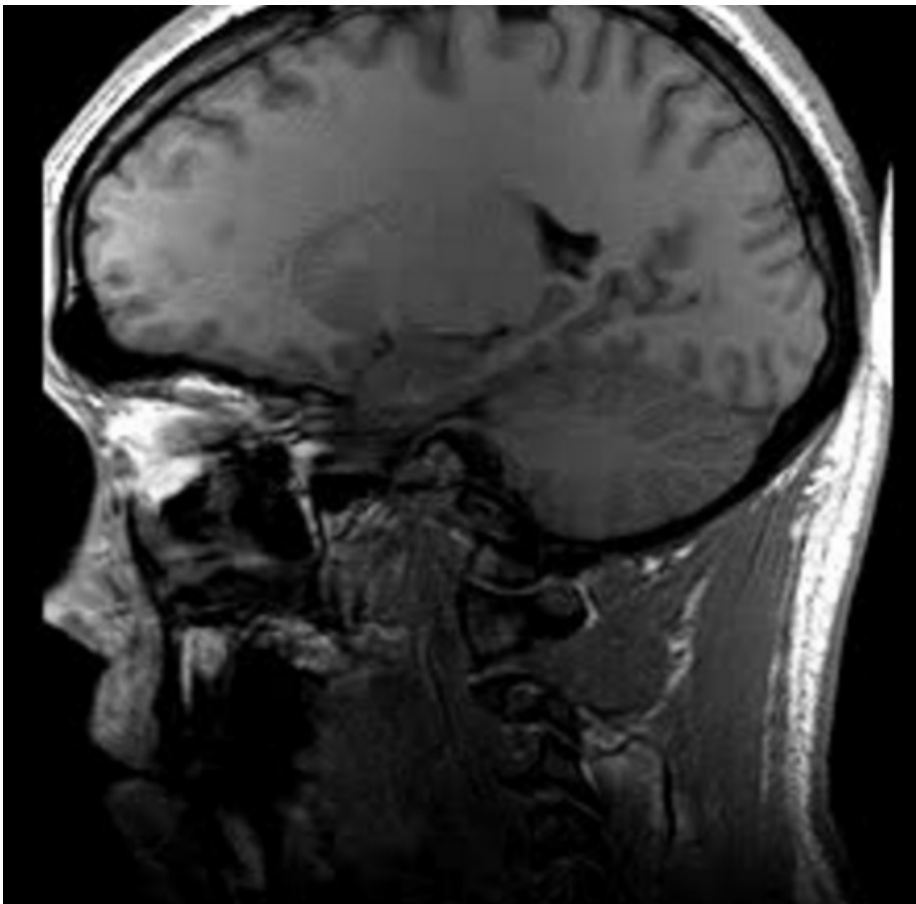
A specialized x-ray device that takes multiple images to create a 3D model of the brain

3. Magnetic Resonance Imaging (MRI)

A **magnetic resonance imaging (MRI)** device uses magnetic fields to provide more internal images of the structures of the brain in 3D. It doesn't use any radiation, like an x-ray device or CT scan. In that way, it's a bit safer for the person who's using it.

This is a tool that measures the brain's function itself, meaning that it doesn't just take a map or a picture, but rather shows how the brain is active over time through different sorts of behaviors. It is used to show which areas of the brain are related to certain kinds of thoughts and actions. In this way, it's a bit more comprehensive than some of the other brain structure tools.

Here is an MRI of the side view of the head. You can see the nose, lips, eye socket, brain, and lips.



On the other hand, a **functional MRI (fMRI)** will show blood flow to areas over a lapsed period of time.

➦ **EXAMPLE** If you wanted to see which areas of the brain were active when a person is dreaming, you would use a functioning tool, or fMRI.



TERMS TO KNOW

Magnetic Resonance Imaging (MRI)

A device that uses magnetic fields to provide images of the internal structures of the brain in 3D

Functional MRI (fMRI)

A device like an MRI that uses magnetic fields to measure blood flow to areas of the brain over time to measure how it works

4. Electroencephalograph (EEG)

An EEG or electroencephalograph is a device that places electrodes on a person's brain--therefore not very invasive--to amplify and measure all of the brain's different electrical activity in certain areas of the brain.



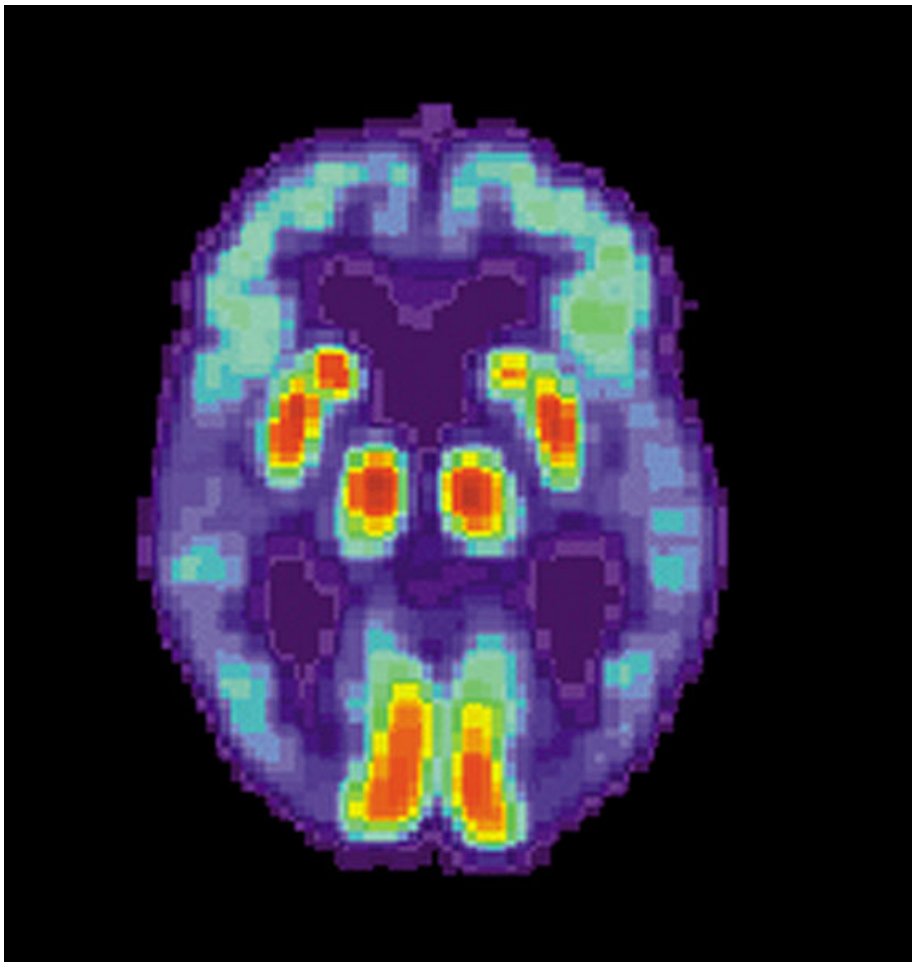
It can show the brain waves of specific areas of the brain, but they're very simple, and they don't actually show much of a concrete image--generally, just little lines on a piece of paper.

5. Positron Emission Tomography (PET)

To actually get a picture, a **positron emission tomography (PET) scan** would be used. The PET scan resembles a tunnel. An individual is injected with a radioactive fluid, called a tracer. Once the tracer has been injected into the blood, the individual conducts behavior or thinks about certain kinds of things. The radioactive tracer travels to those specific areas that are active.

The PET scan shows the areas where the blood flow is most prominent; they light up in the PET scan, indicating that those are the areas being used for that certain type of behavior.

The image below shows a PET scan of a human brain with Alzheimer's disease.



TERM TO KNOW

Positron Emission Tomography (PET) Scan

A device that uses a radioactive fluid, usually attached to glucose, injected into a person to measure which areas of the brain are active



SUMMARY

This tutorial discussed why it is important to **assess the brain**. It's important to compare and contrast abnormal brains with normal brains to help research causes and treatment of diseases and disorders. The **computed technology (CT)** scan is a specialized x-ray, whereas **magnetic resonance imaging (MRI)** shows more internal structures. A functional MRI, or fMRI, will show blood flow over a period of time.

An **electroencephalograph**, or **EEG**, is a device that's placed directly on a person's scalp and can help to amplify and measure all of the brain's different electrical activity in certain areas. Lastly, a **positron emission tomography (PET)** scan involves injecting a person with a radioactive tracer to show where blood flow is most prominent, measuring which areas of the brain are most active.

Good luck!

**Computed Tomographic (CT) Scan**

A specialized x-ray device that takes multiple images to create a 3D model of the brain.

Functional MRI (fMRI)

A device like an MRI that uses magnetic field to measure blood flow to areas of the brain over time to measure how it works.

Magnetic Resonance Imaging (MRI)

A device that uses magnetic field to provide images of the internal structures of the brain in 3D.

Neurologic Soft Signs

Minor signs of more non-specific brain disorders, like clumsiness or poor hand-eye coordination.

Positron Emission Tomography (PET) Scan

A device that uses a radioactive fluid, usually attached to glucose, injected into a person to measure which areas of the brain are active.