

Explorer's Guide

Do You Know Where Your Hands Are?

How do you know what your arms, legs, and body are doing without looking?

Can you put a bite of food in your mouth with your eyes closed? Sure you can! But how do you know where your arms and hands are when you can't see them? Some experiments will help you figure out how this works.



Things You Will Need

▲ lined paper

▲ pencil

To Do and Notice

Finding Your Fingers

You'll be trying to touch each of your 10 fingertips with your eyes closed. Before you begin, read steps 1–5 below to see how you will do this, and then predict how many times out of ten you'll be successful. Record this prediction.

It's very important in this activity for you to keep your eyes closed the entire time, work quickly, and carefully observe how your body responds.

- ❶ Close your eyes and raise both hands above your head. Keep the fingers of your left hand totally still (no wiggling!).
- ❷ Touch the tip of your right index finger to the tip of your nose, then quickly use the same finger to try to touch the tip of your left thumb. Keep your left hand still. Even if you "miss," go on quickly to the next step.
- ❸ Again touch the tip of your nose with your right index finger and immediately use the same finger to try to touch the tip of your left index finger.

④ Repeat the process three more times, each time trying to touch a different finger on your left hand. Keep track of how many times you succeed in touching the correct finger, and record your observations.

⑤ Switch hands: hold your right hand still in the air above your head and use your left index finger to touch your nose, your right thumb, your nose, your right index finger, your nose, and so on. Record your observations.

How successful were you at finding each fingertip? Does your performance improve with time? Is there a difference between your two hands?

⑥ Now repeat the activity, but this time slightly wiggle the fingers of the hand you hold in the air. Are you more successful this time? If so, can you think of a reason why?

Finding the X

Before doing the activity, read all of these directions and then predict how many tries it will take you to hit the “X” with your eyes closed.

① Mark an X about 1 cm tall on a piece of paper. Observe its position on the paper.

② Grasp your pencil and close your eyes. Raise the pencil above your head and then lower it to the paper, trying to make a dot as near as possible to the X.

③ Open your eyes and check your results. If your dot was not directly on the X, repeat step 2 until you hit the X or until you’ve tried about six times.

④ Record your observations.

Did you hit the X on the first attempt? How close were you to your predicted number of attempts?

Writing Without Looking

① On a lined sheet of paper, write your name.

② Place your pencil on the line just below your name, close your eyes, and write your name again.

③ Compare the two written names. Is there much difference in their appearance? Record your results and observations.

Interpreting Your Observations

What generalizations can you make about your ability to do things with your hands without using your sense of vision?

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Materials

for each investigator

- ▲ lined paper
- ▲ pencil

Management

- ▲ Amount of time for the activity:
20–30 minutes
- ▲ Preparation time: none
- ▲ Group size: 1

Preparation and Setup

Activity Overview

Perform simple tasks that require sensing the position of the hands and fingers in space without the benefit of vision, and use the experiences to learn how proprioceptors provide information about the position of the body and its appendages.

Concepts

- › Proprioceptors, also known as stretch receptors, are tiny sensors in muscles, tendons, joints, and ligaments that detect tension, elongation, and other changes.
- › Proprioception provides us with an unconscious assessment of body position and posture.
- › While proprioception provides us with a general sense of the position of our body's appendages, most of us rely on vision for more detailed information.

Preparation

None.

Questions for Getting Started

- › Where are your feet right now? Are your legs crossed or not? How do you know?
- › Do you think you could brush your teeth in complete darkness? How would you find your mouth if you couldn't see it?

TIPS!

- The first exploration, *Finding Your Fingers*, captures the essence of proprioception. Therefore, the other two can be skipped if time is short.
- It may be helpful to demonstrate the *Finding Your Fingers* activity.

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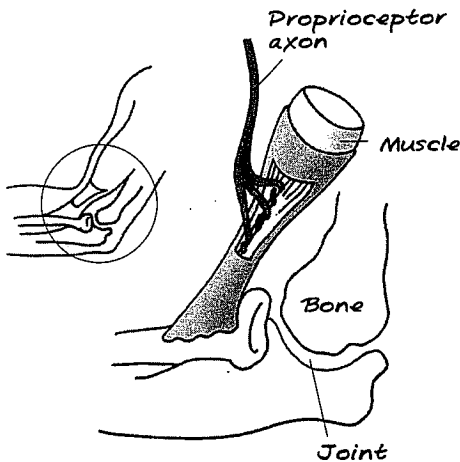


Figure 1:
A proprioceptor in
a human arm

Discussion Questions

- ❶ How can you form letters and write across a straight line when you can't see?
- ❷ Predict some of the things that might happen if you lost your sense of proprioception.
- ❸ How do you think visually impaired people can navigate through the world even though they cannot see well or can't see at all?

Going Further: Ideas for Inquiry

- › Is a person's dominant hand better at performing the tasks in this exploration than his or her other hand? Form a hypothesis and test it.
- › Test how practice affects the success rate in *Finding Your Fingers*. Have some friends do the activity wiggling their fingers the first time and keeping them still the second. Then compare these results to what you observed the first time you did the activity (when the wiggling came second).
- › Create your own ways of further investigating proprioception.
- › Invite a visually impaired person to come and talk about how he or she experiences his or her body in space.

The Basics and Beyond

Background

Even with your eyes closed, you have a sense of body position—where your arms and legs are; whether your back is straight, hunched, or arched; how you are holding your head. This sense of body position comes from information sent to your brain by proprioceptors, tiny sensors in your muscles, tendons, joints, and inner ear. The proprioceptors detect stretching, elongation, and other changes; this information is used by your brain to create an unconscious picture of the body and its parts in three-dimensional space.

Sighted people normally use visual information more than proprioception to perform tasks that require precise judgment of body position. When people have to perform such tasks without benefit of their sense of sight, they are forced to rely on proprioception alone, and this experience allows them to explore this taken-for-granted "sixth" sense.