# Curiosity Guide #905
# Sense of Touch

Accompanies Curious Crew, Season 9, Episode 5 (#905)

## What's the Point?

Investigation #1

### Description

Everyone needs a 2-Point Discrimination Tester! Find out how to make and use one!

### Materials

- Paper clips
- Metric ruler
- A friend

### Procedure

1) Prepare the 2-point Discrimination Tester by bending a paperclip so that it is in the shape of a U. Keep the points about a centimeter apart.
2) Make additional testers, some wider and some closer than 1 centimeter.
3) Have your friend lay her hand on the table palm down and look away.
4) Ask the friend to report if she feels one or two points touching her.
5) Try the different clips, sometimes touching with one-point, other times touching with two.
6) What did you notice?

My Results

Explanation

The sense of touch requires nerves in the skin to be stimulated either through touch, pressure, temperature, or a combination of these things. The skin is the body's largest sensory organ. Although nerve endings are located throughout the skin, the concentration of nerve endings changes in different parts of the body. For example, there are many receptors in the palm of the hand and fingertips. This makes the hands extremely sensitive, just like the feet, face, lips, and tongue are sensitive because of the large number of receptors compared to other parts of the body. Less sensitive regions include the chest, upper arms, thighs, and lower back. The 2-Point Discrimination Tester helps to demonstrate regions of the body that have fewer receptors in a given area compared to regions that have many receptors. Doctors can use the test as one indicator of brain recognition to stimuli in different parts of the body. Doctors also find out how sensitive patients are in discriminating the distances of the pressure points.

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## Mysterious Materials

Investigation #2

### Description

Get ready for a really touching investigation!

### Materials

- Long box with lid
- Scissors
- Dishwashing gloves
- Fabric scrap
- Tape
- Objects for the box, like fruit, ice cube in a lid, cotton, feather, rock, Play-Doh, and a ball

### Procedure

**Preparing the box:**

1) Cut a hole in each small end of the box so that someone's arms can reach into the box from each end at the same time.
2) Cut two fabric flaps to hang over the holes on the inside of the box. Secure the tops of the flaps with tape.
3) Make sure the lid can lift on and off.
4) Cut a viewing window that can flap open on one long side of the box so the person trying the activity can't see, but others can see inside.
5) Place the mystery objects inside the box, making sure that the viewing window's flap is closed and facing away from your friend.

**Performing the investigation:**

1) Keep track of your friend's guesses in the section, My Results. You could make 3 columns: Both Gloves, One Glove, and No Gloves.
2) Make sure the large window in the box is turned out toward the viewers, not the friend. Open the viewing flap when your friend is ready to go to work.
3) Ask a friend to put on dish gloves.
4) Have the friend reach into the box with one hand in each of the holes in the ends of the box.
5) The friend's job is to make some guesses as to what the objects are.
6) Tell your friend: Don't grip the items or bend your fingers. Rest your hands on the items to try to guess what the items are.
7) Now pull one hand out and remove the glove.
8) Reinsert the hand again, keeping both hands flat.
9) What can your friend identify now?
10) Finally, remove the second glove. Let your friend feel the items, describing what he or she notices and guessing the items.

My Results

| Objects | Both Gloves | One Glove | No Gloves |
|---|---|---|---|
| | | | |

Explanation

In order to interpret sense of touch, nerve impulses must be sent to the brain from the nerve endings in the body. Wearing a pair of gloves significantly reduces the tactile information getting to the brain, so identifying what you are touching without seeing is very difficult. Using the flat hand gives more information, so your friend can begin to identify textural differences, like if something is soft, rough, smooth, or bumpy. When your friend is allowed to actively feel the item with moving fingers, a clearer picture of the objects comes to mind. This is because each finger has 3,000 receptors that signal information to the brain. The fingers are highly sensitive to sense of touch.

**A "touch" more to think about!** Your skin is constantly at work, sensing the world through your sense of touch. In fact, your skin is the largest sensory organ in your body. The skin has a lot of sense receptors. These sense receptors allow you to identify temperature, like if something is hot or cold. You can also tell the difference between a faint touch, a vibration, if your skin is getting stretched, or when your skin experiences deep pressure. Those receptors send messages to your brain all the time. Even though you probably pay no attention to most of the messages your skin sends, your sense of touch is always working. Wow! That's cold!

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## Puzzle Race

Investigation #3

### Description

Who can finish a puzzle first? There's just one catch!

### Materials

- 2 wooden puzzles, each with 4 to 6 pieces
- 2 blindfolds
- 2 friends
- 2 towels

### Procedure

1) Set up two small wooden puzzles. Cover the puzzles with a towel so your friends can't see.
2) Explain to your friends that this is a race to put the puzzles together, but there's one catch. Your friends must do the task blindfolded.
3) Blindfold each friend and say, "Ready, Set, Go!"
4) Ask your friends to describe what being blindfolded for this task was like.

My Results

Explanation

The sense of touch requires nerves in the skin to be stimulated either through touch, pressure, temperature, or a combination of those three things. The skin is the body's largest sensory organ. Although nerve endings are located throughout the skin, the concentration of nerve endings changes in different parts of the body. The fingers are extremely sensitive but still had a daunting task when putting the puzzles together. Your friends had to build a mental picture of the shape of the puzzle pieces and the openings by moving their fingers to differentiate the shapes. Only then could the nerve impulses travel to the brain to construct a mental image. Very challenging!

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## Cookie Cutter Quiz

Investigation #4

### Description

A cookie cutter is a simple shape, or is it?

### Materials

- Cookie cutters
- Blindfold
- A friend

### Procedure

1) Blindfold a friend.
2) Tell your friend that first you want him simply to hold a cookie cutter without moving any fingers.
3) Ask your friend: Without moving your fingers, can you identify the cookie cutter's shape?
4) Then let the friend feel the item with the fingers on both hands. Can your friend identify the shape now?

### My Results

Explanation

The sense of touch requires nerves in the skin to be stimulated either through touch, pressure, temperature, or a combination of those three things. The skin is the body's largest sensory organ. Although nerve endings are located throughout the skin, the concentration of nerve endings changes in different parts of the body. The fingers are extremely sensitive because there are many nerve endings, and building a mental picture of the shape of the cookie cutter requires moving the fingers to differentiate its shape. Simply holding the item in the hand provides slight pressure and touch, but it is too difficult to use those nerve impulses to construct a mental image.

**Think about this:** You noticed that it was easier to identify shapes when your friend could use her fingers. This is because there are more than 3,000 sensory receptors in a fingertip. Your body has millions of receptors in the skin to identify different kinds of touch. Some parts of your body have more than others, and this makes those body parts very sensitive. Fingertips are a great example; fingertips have a lot of receptors close together, so the sense of touch in your fingers is very sensitive. Your toes and lips also have a lot of receptors, so they are sensitive, too. Amazing!

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## Touchy Trick

Investigation #5

### Description

A fun Dot-to-Dot! Can your friend come close?

### Materials

- Washable markers or ballpoint pens
- A friend
- Blindfold
- Ruler

### Procedure

1) Blindfold a friend. Have your friend hold her nondominant hand out with the palm facing up.
2) Gently touch the palm of your friend's hand with the marker or pen.
3) While your friend is still blindfolded, hand him a marker of a different color. Ask your friend to place the tip on the same spot you touched.
4) Then remove the blindfold and measure how close your friend could come to the same spot.
5) Try again with the upper arm. How close could your friend get to the dot in that area?

My Results

Explanation

The skin is the body's largest sensory organ. Although nerve endings are located throughout the skin, the concentration of nerve endings changes in different parts of the body. For example, there are about 17,000 receptors in the palm of the hand, with 3,000 in each fingertip. Less sensitive regions include the chest, upper arms, thighs, and lower back. Your friend probably got closer in the palm of the hand than the upper arm, simply because there are more nerve endings there to identify the specific spot.

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## Back Confusion

Investigation #6

### Description

How well does your back communicate touch information? Let's find out!

### Materials

- Objects of different shapes, hidden in a box. Some ideas are a sponge, a tennis ball, and a pinecone.
- A friend

### Procedure

1) Stand behind your friend's back.
2) Pull out each object, one at a time.
3) Place the item on the person's lower back, so that the friend can feel the touch and pressure. Don't move the object around.
4) Can your friend identify what the object is?
5) Try the same thing with another object.

### My Results

Explanation

The lower back is one part of the body that has fewer proportional nerve endings than other parts of the body. As a result, identifying unseen objects placed on the lower back is very difficult. Although your friend can feel the presence of an object and the pressure of contact points, there is not enough stimulus to indicate what the specific object is. The sense of touch is not as precise in the lower back as it is in the hands, feet, or face.

**Here's some more "touchy" information for you!** There is one area of the brain that processes your sense of touch. This specialized area is called the somatosensory cortex, or sensory cortex. Different regions of the sensory cortex receive touch signals from different parts of the brain, and these regions differ in size. For example, the brain space dedicated for touch signals from your hand and fingers is much larger than the region for the whole trunk of your body. So, if a body part has a lot of touch receptors, then the body needs a larger area in the sensory cortex to process all that information. I know from my cortex, that feels soft!

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## Van Frey Hairs

Investigation #7

### Description

Make some Van Frey Hair Testers and tickle your friends!

### Materials

- Popsicle sticks
- Fishing line in different thicknesses
- Marker
- Scissors
- Ruler
- Glue
- A few hairs
- A friend

### Procedure

1) Make a Von Frey Hair Tester by cutting a $1\frac{1}{2}$ -inch length of one of the fishing lines.
2) Glue a single hair on the end of the stick so that the hair is perpendicular to the stick.
3) Label the weight of the line on the stick.
4) Repeat with fishing line of other weights to create several Hair Testers.
5) Have a friend close his eyes.
6) While holding the stick as a handle, lightly touch the tip of the line on your friend's skin, so that the line slightly bends.

7) Have your friend report when she can feel the sensation.
8) Try different sticks.
9) Try touching an arm, the face, the back, and notice what parts of the body are most sensitive.

My Results

Explanation
This device is used to measure detection thresholds, specifically for tactile detection. Because the lines are different thicknesses, some bend with very little contact, so neurologists can figure out what is the smallest amount of pressure someone can detect. The skin is the body's largest sensory organ Although nerve endings are located throughout the skin, the concentration of the nerve endings changes in different parts of the body. For example, there are more receptors in the hands, which make the hands extremely sensitive, just like the feet, face, lips, and tongue. Less sensitive regions include the chest, upper arms, thighs, and lower back.

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## Reading Braille

Investigation #8

### Description

Have you ever wondered how to read Braille with your fingers?

### Materials

- Braille Cards
- Braille alphabet
- A friend
- Cardboard cube with open lid
- Straight pins
- Fine-tipped marker

### Procedure

1) Show a friend the six-dot braille system and how the different letters are configured.
2) Challenge your friend to pass her fingers over the dots to see if she can describe the dot positions and figure out what letters the dot patterns represent.
3) Prepare the box cube by first drawing in the dot positions for one letter on each side.
4) Pierce a pin through each mark so that just the head of the pin is on the surface of the box.
5) Challenge your friend to identify the side of the box with a specific letter by touch alone.

My Results

Explanation

The Frenchman Louis Braille invented the Braille system in 1824. The text is made by imprinting bumps into the paper. The bumps correspond to six positions. How the dots are combined determines the letter, number, or punctuation produced. The Braille writer has six keys to produce the text. When a text has been keyed into Braille, a blind person can pass his fingers over the bumps on the paper. Using their practiced and sensitive sense of touch, blind persons can recognize the dot positions by feeling and reading the text with their fingers.

**Think about this!** Our sense of touch plays a significant role in our development. It is the first sense that develops and is especially important for babies. Snuggling a baby helps the development in the immune system to fight sickness, the digestive system, the baby's emotional health, and brain development. As we get older, the sense of touch keeps us healthy. Also, if we are on sports teams, scientists have found that players who fist bump, high-five, and make supportive contact actually play better as a team. High 5 for the Sense of Touch!

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## Making 2-Point Discrimination Testers

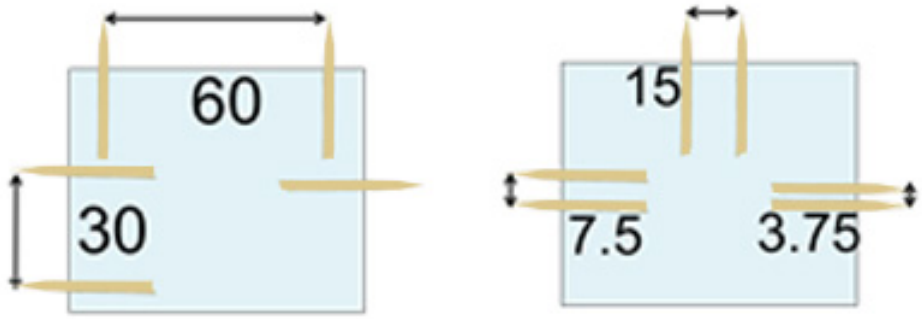
STEM Challenge

### Description

These testers can be useful and fun!

### Materials

- Toothpicks
- 3" by 5" notecards
- Glue
- Metric ruler
- Tape
- Scissors
- Paper
- Pencil
- Markers



Procedure

**Creating the testers:**

1) Cut a note card in half so that each section is about 3" by 2.5".
2) Cut 6 toothpicks in half with scissors.
3) Glue or tape down parallel pairs of toothpicks so that the points hang one centimeter off the edge of the cards. Each card will have points on three sides. See the illustrations.
4) On one card, place a toothpick pair 60mm apart and glue or tape down. Place a second pair 30mm apart, and the final side with a single stick glued down.
5) On the second card, place the points of a toothpick pair 7.5mm apart. On another side, place a pair separated by 15mm, and the final side at 3.75mm.

**Using the testers:**

6) Use the My Results section to record your results.
7) Test a friend, starting with the 60mm tester and working down to 3.75mm. Make sure that both points make contact at the same time. The person tested cannot look and reports whether they felt one or two points.
8) Use the single point periodically during the test to decrease guessing.
9) Try testing a friend's hands, arms, forehead, and back.
10) On which areas did your friend report a single point when there were really two?

My Results

| Body Part | Tester Used | Felt 2 Points | Felt 1 Point |
|---|---|---|---|
| | | | |

Explanation

The sense of touch requires nerves in the skin to be stimulated either through touch, pressure, temperature, or a combination of these things. The skin is the body's largest sensory organ. Although nerve endings are located throughout the skin, the concentration of nerve endings changes in different parts of the body. For example, there are about 17,000 receptors in the palm of the hand with 3,000 in each fingertip. This makes the hands extremely sensitive, just like the feet, face, lips, and tongue are sensitive because of the large number of receptors compared to other parts of the body. Less sensitive regions include the chest, upper arms, thighs, and lower back. The 2-Point Discrimination Tester helps to demonstrate regions of the body that have fewer receptors in a given area compared to regions that have many receptors. Doctors can use the test as one indicator of brain recognition to stimuli in different parts of the body and find out how sensitive patients are in discriminating the distances of the pressure points.

**Think about this!** Our sense of touch is incredibly important, and we still don't understand everything. Neurologists and brain surgeons know more than most, but scientists keep making more discoveries about the sense of touch. In fact, as touch screen technologies have developed, Swedish scientists realized that a person's finger can feel a ridge change as small as 13 nanometers. That is so small we can't even see it! The human finger could sense a large molecule or even single-cell organisms by touch. Now, that's sensitive!

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