BUILD YOUR OWN TOUCH SCREEN STYLUS

Target Population:
Students, ages 11–14

Smithsonian
Science Education Center

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Build Your Own Touch Screen Stylus is part of the STEM²D Student Activity Series. The content and layout were both developed by the Smithsonian Science Education Center as part of Johnson & Johnson's WiSTEM²D initiative (Women in Science, Technology, Engineering, Mathematics, Manufacturing, and Design), using a template provided by FHI 360 and JA Worldwide. This series includes a suite of interactive and fun, hands-on activities for girls (and boys), ages 5-18, globally.

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Build Your Own Touch Screen Stylus

Challenge: **Build a functional stylus that will activate a capacitive touch screen**

Target Population: **Students, ages 11–14**

ACTIVITY DESCRIPTION

Students will save money and solve the problem of getting their touch screens dirty with fingerprints and smudges by building a simple stylus from everyday materials. The take-away stylus will meet all the following criteria: it is flat, it is smooth, it has a conductive surface, and the conductive surface is more than ¼ inch wide. Students will troubleshoot to solve engineering problems with their designs.

Materials

For 100 students:

- 100 Cotton swabs (Q-tips)
- 5 Metric rulers
- 1 Roll aluminum foil
- 3 Pairs scissors
- 2 Rolls clear tape
- 1 Glass of water
- 100 Pipe cleaners, various colors (Instructions Option 2)
- 100 Straws, various colors (Instructions Option 2)

Safety

Pipe cleaners can be sharp, especially when cut. Avoid injury to fingers and eyes.

There is no risk of electric shock. The amount of electricity used by the screen is closer to low-level static electricity and is not hazardous.

Step-by-Step Instructions:

Option 1: Instructions

Provide students with the above materials and ask them to design a stylus that meets the following four criteria:

- A conductive surface: It must be able conduct an electrical charge between a hand and the screen.
- At least ¼-inch wide: When filtering data, the processor ignores areas that are significantly smaller than a human fingertip.
- A relatively flat end: Having a flat tip ensures that the whole face of the stylus can get close enough to the screen to be detected.
- A smooth surface: This will ensure the screen does not get scratched.

Option 2: Instructions

- Give each student a straw and a pipe cleaner.
- Have them fold the pipe cleaner in half.
- Insert the pipe cleaner into the straw so that the folded end is sticking out.
- Moisten the folded end of the pipe cleaner with water.
- Have the student try making the folded part bigger or smaller and notice differences in how it works.

To help guide the thought process, ask students:

1. Why did we fold the pipe cleaner? *(By folding the pipe cleaner we created a non-sharp wire covered in fuzz to avoid scratching the screen.)*

2. Does the pipe cleaner have to be wet to work? Why or why not? *(It does need to be wet. The fuzz is not conductive until it is wet. The water in the wet fuzz conducts electricity to the wire in the pipe cleaner so that electricity can change the electrostatic field of the screen.)*

Background Information/Resources

Most smartphones and tablets have capacitive touch screens. This is an impressive bit of technology that lets someone interact directly with the screen using only their finger. But there is one problem with this kind of interface: dirty fingers. Nobody wants fingerprints all over their screen.

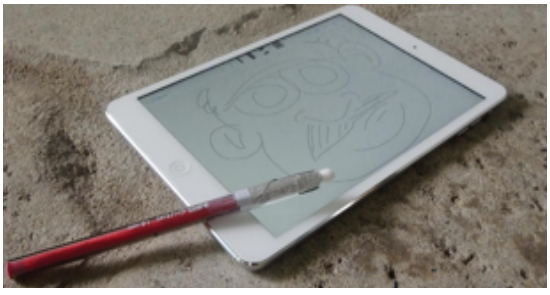
When a stylus is used, the same principles as a finger apply. The only difference is that the stylus is acting as a conductor to transmit an electrical charge between someone's hand and the phone.

At some point, most people realize that their finger isn't always ideal for touching a smartphone or tablet. They also realize a stylus would help them draw more accurately on their tablet. Because most people are not willing to spend $10 to $30 on a piece of metal or wait for the product to ship, they could opt for a do-it-yourself (DIY) solution.

To function properly, a stylus must be able to carry the static electricity from a person's finger to a conductive material and onto the screen. A capacitive stylus must therefore meet several criteria:

- A conductive surface: It must be able to conduct an electrical charge between a hand and the screen. If the material is too resistive or if the distance between a hand and the screen is too great, the signal reaching the screen may be too weak to be detected.
- At least ¼-inch wide: When filtering data, the processor ignores areas that are significantly smaller than a human fingertip. This helps avoid unintentional activation. Having a stylus that is about ¼-inch wide will ensure that there is enough surface area to be detected.
- A relatively flat end: Having a flat tip ensures that the whole face can get close enough to the screen to be detected.
- A smooth surface: This will ensure that the screen does not get scratched.

Following these criteria, there are a wide variety of common items that can be used to activate a capacitive touch screen.



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Questions/Assessment:

1. What part of your stylus was conductive?

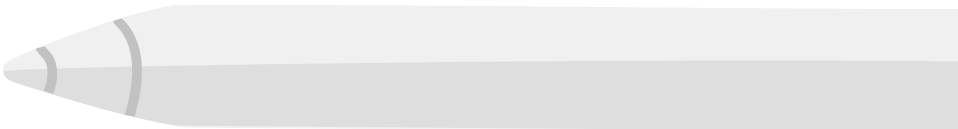
2. Did you try changing the tip size? What did you like best?

3. How did you keep the tip of the stylus smooth?

4. Did your stylus work?

5. What troubleshooting did you need to do?

6. Did you enjoy doing this engineering activity?



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