Appendix B. Fingerprint Spoofing Lab

Materials:

- Device with Touch ID
- Aluminum foil
- Hot glue gun
- Hot glue sticks
- Elmer's glue
- Markers
- Paper

Step 1: Creating a Prosthetic Fingerprint

1. Make sure you know which finger you use to unlock your iPad with touch ID. It's most likely your thumb.
2. You will need a strip of aluminum foil to make your fingerprint molds on, and you will need to put your name on the piece of foil.
3. Hot glue guns are set up around the room. Once they are warmed up, you should put a dot of hot glue (about the size of a penny) onto your strip of foil. Wait about 20 seconds (or until it starts to get a little less see-through) for it to dry a little and cool off, and then place the finger you have stored for touch ID on your iPhone/iPad into the hot glue and make a mold. ***Caution: If you do not wait long enough, you will burn your finger.*** Place the finger directly on top of the drying hot glue, hold for a second or two, and then pull your finger straight up.
4. Repeat step 3 until you have four or five molds of the same finger. This is in case you mess one up or are unable to peel the prosthetic off during the second part of the lab.
5. Take your strip of foil back to your seat and wait about 5 minutes for the molds to cool, dry, and harden. Give the glue at least 10 minutes to dry. *Note to Teachers:* While students wait, they can be encouraged to try an extension activity or read a related article.

6. Once your molds are ready, go to the Elmer's glue station and make your prosthetic prints for each mold. Begin by depositing Elmer's glue on one side of the mold at its base (against the foil), then spreading a thin layer of the glue onto your mold. Make sure that the glue gets all the way into the mold across the main depression formed by your finger, and then that it comes back down onto the foil on the other side of the mold. This will create flaps so that it will be much easier for you to separate the Elmer's glue "print" from the mold once it dries.
7. Once you have made the prosthetic for all the molds, make sure your name is on the foil strip and leave them on the back table. This is the end of Part 1.

Now that the mold has been cast, it's time to learn more about what you are doing and why. Read Stanley Goodner's (2021) article about finger scanners and how they work found at: **https://www.lifewire.com/understanding-finger-scanners-4150464**

Step 2: Testing the Prosthetic Fingerprints

During step 2 of the lab, you will attempt to unlock your iPad using your prosthetic fingerprint. As you perform these tests, fill in the data table with your results (see Table 3). The control groups will be real fingers (either the one stored on your phone or an unstored finger). The test groups will be the prosthetic fingers. Begin by carefully peeling apart the Elmer's glue prosthetic from the hot glue mold. Work on separating them until one of them will come apart cleanly. It's okay if your first one doesn't go well, that's why you made four or five different prosthetics. After you are done, complete the postlab questions (see Appendix C) to showcase what you have learned!

Procedures (and questions):

1. Find your fingerprint molds and prosthetics from the back of the room.
2. Carefully bring your set of prints back to your seat and begin to peel apart the Elmer's glue prosthetic from the hot glue mold. Work on separating them until one of them will come apart cleanly. It's okay if your first one doesn't go well, that is why you made four or five different prosthetics. Remember that you want to use the dried Elmer's glue part as the prosthetic, NOT the mold from the hot glue. Try not to rip it!
3. Once you have your prosthetic fingerprint, you are ready to test your print and hack into your touch ID.
4. Pick a finger that is not stored in your touch ID settings. If all of them are stored, delete one of the stored fingerprints from your device (but not the finger you made the mold of), and then try to unlock your iPad with your unstored finger on its own. Obviously, this should not work (since this is an unstored print); a message will likely pop up on your device with a prompt to use your passcode/fingerprint or to try again.
5. Now try again, but this time use your prosthetic fingerprint. If you feel the two sides of the print, you will notice that one side is smooth, and the other has 3D ridges on it. Put the print **ridge-side down** onto the home button, and then put the same finger from step 4 on top of it and try again to unlock the iPad.

   What happened when you put the prosthetic print ridge-side down and put a non-stored finger on top of it? _____
6. Try again still using the non-stored finger with the prosthetic print, still with the ridge side of the prosthetic print down on the home button, but rotate it 180°so that it's upside down.

What happened when you put the rotated prosthetic print ridge-side down and put your non-stored finger on top of it? _____

7. Try again using the non-stored finger with the prosthetic print, this time with the smooth side down on the home button.

   What happened when you put the prosthetic print smooth-side down and put your non-stored finger on top of it? _____

8. This time try it with your stored finger, again with the smooth side down on the home button.

   What happened when you put the prosthetic print smooth-side down and put your stored finger on top of it? _____

9. Finally, try it by putting the print ridge-side down and getting a piece of paper to put between your finger and the prosthetic.

   What happened when you put the prosthetic print ridge-side down but put a piece of paper on top of it between it and your finger?

   _____

Using the hot glue gun to create the fingerprint mold.