Unhandy Thermometer

So, you think you are good at determining what's hot and what's not….think again.

Introduction:

Fool your senses: Hot seems cold and cold seems hot.
Immerse your fingers into cups of water at different temperatures and at different times. See how you experience changes in temperature.

Ingredients:

- Three cups or bowls
- Three sources of water
    - Ice water
    - Room temperature water (standard tap water)
    - Hot water (Hot water from the tap should work,...about the temperature of a very hot bath)
- Your hands

To do and notice:

1. Fill your cups with the three different temperatures of water. Make sure you leave some room in your cups so the water won't spill out when you insert your fingers.
2. Line up your cups with the room temperature water, between the hot and cold water cups.
3. Place one or more fingers from one hand into the hot water and one or more fingers into the cold water.
4. Immerse your finger for at least 30 seconds and notice how your fingers feel.
5. Quickly move both sets of fingers into the middle, room-temperature water cup. How do your fingers feel now? Is this water sensed as hot or cold? Are your sensations what you expected?

By Eric Muller - Exploratorium Teacher Institute 2021 (originally 1995)

What's going on?:

After moving your fingers, the "hot water fingers" should feel cold and the "cold water fingers" should feel hot when placed in room-temperature water. Why? Your skin has tiny sensors called nerve receptors that send signals to your brain. There are different types of receptors in your skin, some sense pressure, some sense pain, and others sense temperature (hot and cold) called thermoreceptors.

Your receptors are best at noticing change. When you put your hands in the water, your brain gets information from your temperature receptors that say, "hey, that's hot" or "whoa, that's cold." If you keep your hands in the hot water or cold water long enough, your nerve receptors get used to the temperature of the water and slow their firing rate. The room temperature water is cooler than the hot water and warmer than the cold water. So, when you switch to the room temperature water, the receptors that got used to the hot water, send signals that sense it as cold; and the receptors that got used to the cold water sense the room temperature water as hot.

Going further:

You do not make a good thermometer!
Thermometers make good thermometers. Your nervous system works really well when comparing different inputs, but not that good at qualitative measurements. If you need accurate temperature readings, you need to use a calibrated device….a thermometer!

Notice what happens when you go from a hot outside temperature into a room with air conditioning or a cold outside temperature into a heated room. A similar thing happens in these scenarios as to what happened in the activity above (with your fingers). You have sensors all over your body that sense changes in temperature.

Resources:
https://www.scientificamerican.com/article/cold-or-warm-can-we-really-tell/

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