Homunculus - Crash Course Psychology #6

Crash Course: Psychology
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Homunculus! If you've heard that word, it probably wasn't in the context of psychology. A monster in Dungeons and Dragons, a song by They Might Be Giants, the bad guys in Fullmetal Alchemist, a novel by James Blaylock. It's Latin for 'little man' and in psychology, it refers to a kind of sensory map of the human body, a depiction of what we'd look like if each of our parts grew in proportion to how much we sense with them.

Witness!

Look at this dude. His ham hands could rip off a car door. I mean, if he could lift them, which he couldn't.

Is this what we're supposed to look like on the inside?

This freaky thing illustrates the weighted significance of our sensory receptors. His disproportional hands are monstrous, for example, because we primarily touch the world with our hands, not our elbows, so our hands are extremely sensitive. His mouth, meanwhile, is huge because we also have a ton of sensory receptors in our tongues and lips. It's what we use for tasting food and for sucking face.

As we continue our exploration of how we both sense and perceive the world, the Homunculus, while kind of freaky, is actually a pretty attractive model for understanding how our bodies interact with the environment. How we smell it with our outsized nose, taste it with our ridiculous Mick Jagger lips, and touch it with our enormous Donkey Kong hands. So join me, as we get to know the hideous little creature within you.

(Intro)

Last week we talked about the difference between sensation and perception: how sensation is the process by which our senses and brain receive information from the outer world, while perception is how we organize and interpret that information and give it meaning.

Like, right now, my sense of hearing is letting me detect sounds, while my brain is processing and interpreting them, allowing me to identify and perceive the individual sounds and determine if they're coming from the radio, or outside or right behind me.

Sound moves in waves that vibrate through a medium, like air. And although they function differently that waves of electromagnetic radiation, including what we think of as light, sound waves also can vary in shape. Short waves have a high frequency and a high pitch, like a plucky violin. Long waves have a low frequency and pitch, like a mournful cello. Wave height, or amplitude, determine a sound's loudness, which we typically measure in decibels. And just as light waves become electrical impulses that we register with our sight, so too do our ears turn vibrating air into signals that our brains can decipher.

While the human ear might not be as elegant as the jackrabbit's, or as wild as the long-eared bat's, it's actually a pretty incredible organ. Or, organs, since we have two of them, which helps give us directional stereophonic hearing. That's the 3D type of hearing we couldn't experience if we had just one big, freaky ear in the middle of our foreheads.

Your outer ear, the part that you can see and pierce and tug on, collects sound waves and funnels through the ear canal and into the middle ear, where they cause your eardrum to vibrate. From there, sound vibrations are amplified by the so-called 'ossicle bones', which also happen to be the most awesomely named bones in your body: the stirrup, the hammer and the anvil. From here, those physical vibrations travel to the inner ear, where they bump into the snail-shaped cochlea, and its surrounding fluids get jostled around, causing some of your 16,000 tiny cochlear hair cells to bend. This motion triggers neighboring nerve cells that convert that physical energy into electrical impulses zipping up the auditory nerve into the auditory cortex, where the brain is like 'Oh, songbirds!', or 'Elvis!', or 'Vengeance!', or whatever.
And you know what goes great with a little bit of rockabilly, or revenge? A nice meal.

One of the greatest joys in life is enjoying flavors; whether you prefer casserole or caviar, we all get our tasting done in the same way, starting with our taste buds. Each of our thousands of taste buds contains a sort of pocket-like pore that contains fifty to a hundred hair-like taste receptor cells that read food molecules and report back to the brain. "That chip is salty, that lemon is sour." Now, everybody used to think that our tongues just detected four distinct tastes: sweet, salty, sour and bitter. And you've probably seen the version of this bogus taste map, which incorrectly assigns certain tastes to certain parts of your tongue. But we now recognize a fifth flavor: the savoury, meaty, MSG-y taste, for which there is no English word, it's known as 'umami'.

But taste is nothing without smell. Plug your nose, and a bite of cold bacon is just a mouthful of salt. This is a prime example of sensory interaction; the principle that one sense can influence another.

I'll get back to smell in just a bit, but I want to take a moment to talk about what happens when those sensory interactions get messy.

Let us take a little questionnaire, shall we?

Do certain words trigger a strong, specific taste in your mouth? Like, does the word 'kitten' taste like candy canes?

Has hearing a sound ever made you see a color? Like does Prince's voice singing Purple Rain actually cause the color purple to flash before your eyes?

Do you ever feel like you're being touched when you smell something?

Like does the smell of lilies give you the sensation of touching a cold, metal surface?

Most of you said no to all of those questions, but at least one of you out there answered yes. And more likely than not, that person has synesthesia, a rare and fascinating neurological condition where two or more senses get wrapped together.

This kind of sensory mix up is involuntary, and it's experienced without forethought in a durable and consistent way. Like, the number seven is always going to taste like coffee, and it's never going to switch to tomato juice.

And we're still not sure what causes this phenomenon. One idea suggests that the rogue development of new neural connections may override normal boundaries that typically separate the senses. Another theory suggests that all babies are born with synesthesia and experience mixed sense until the brain matures and creates separate sense channels, unless they don't, in which case you grow up to be a synesthete. Yet another theory links the condition to wonky neurochemistry, in which the neurotransmitters associated with one function turn up way over in a different part of the brain.

Just another example of how the mind is still extremely mysterious.

So, back to the comparatively boring topic of smells that only smell... unlike our wave detecting senses of sight and hearing, out taste and smell are chemical senses. We differentiate the smells of spring lilacs, grilled cheese, and gasoline when airborne molecules

travel up the nose and reach the five to ten million receptor cells at the top of each nasal cavity; and yes, that means when you smell poop, there's poop particles in your nose.

These receptors send information to the brain's olfactory bulb, then zips it on to the primary smell cortex and parts of the limbic system responsible for emotion and memory. Unlike our five different taste receptors or two types of retinal receptors, we don't have specifically differentiated smell receptors, rather, odour receptors come together in different combinations.

So, just like pressing different keys on your keyboard can allow you to form tons of different words, so too can these distinct combinations of activated smell receptors communicate some ten thousand unique smells.

But, how we feel about a smell, and our perception of it, is often tangled up in our experiences with that scent. If our beloved grandma baked gingerbread every time we visited, those memories may make you partial to the smell of gingerbread. Even if we can't immediately name the odor, our brains are amazing at storing and recognizing old scents by their associations. Which is why you may suddenly feel happy when you walk into a bakery, even before you realize you're thinking of your grandma.

The emotional power of smell partly has to with how our sense circuitry connects to the brain's limbic system, right next to our emotional registry, the amygdala, and our memory keeper, the hippocampus. That's why scents can be so intimately tied with our feelings and memories. And how a whiff of Nag Champa can immediately transport to back to eating chips in your freshman dorm room.

Smelling, hearing, tasting, seeing: all fantastic, but if there's one thing that popular music taught us, besides a bunch of really terrible relationship advice, it's that when it comes to our senses, we're all about touching. We've got songs about magic touches and golden touches, invisible and human touches. Songs about touching ourselves, touching me, touching you, and even what you can't touch.

Touch is extremely important, especially during early development. Baby monkeys that are allowed to see, hear and smell, but not touch their mamas become extremely distraught. That's just a mean experiment. Premature human babies gain weight faster if they're held and massaged, and some studies indicated that children that didn't receive enough physical attention as infants are at higher risk for emotional, behavioral, and social problems as they grow.

Your sense of touch is actually a combination of four distinct skin sensations: pressure, warmth, cold, and pain. If you touch various spots of your skin with something soft like this anglerfish, you'll feel that you sense different amounts of softness on different parts of your body... just put that up there...

The same goes for a warm mug, or an ice cube, or a needle point. You'll sense that some spots are more or less sensitive to each of the four distinct sensations. Other skin sensations, like tickles, itches, and the experience of wetness, are just variations on those four different sensations.

Ultimately, your sense of touch joins forces with sensors in your bones, joints, and tendons to provide your personal kinesthesis: the way that body senses its own movement and positioning. You use your kinesthetic sense whenever you walk, dance, swim, or hula hoop. It's what the cops are testing drunk people for when they ask them to touch their noses with their eyes closed. This sense allows you to detect changes in the position of your body without relying on other senses, which is why you can still cha-cha, backstroke, and hula hoop with your eyes closed and your ears plugged.

The partner sense to your kinesthesis is your vestibular sense, which monitors your head's position and your balance. This sense of equilibrium is ruled by the pretzel-shaped, semicircular canals and the fluid-filled vestibular sacs that connect those canals to the cochlea in your inner ear. So, if you spin around a bunch and suddenly stop, it'll take a minute for that inner ear fluid to return to normal, which is what makes you feel dizzy. That moving fluid is actually fooling your brain into thinking your body is still spinning. It's a good example of how even our normal functioning senses can fool us. Understanding exactly how we get fooled helps us understand how our sensual perception system works, which is exactly what we're going to be talking about next time.

For now, hopefully you realized that your homunculus is actually kinda beautiful, in its own way, because you learned how your sense of hearing, taste, smell, and touch work.

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This episode was written by Kathleen Yale, edited by Blake de Pastino and myself, and our consultant in Dr. Ranjit Bhagwat. Our director and editor is Nicholas Jenkins. Michael Aranda is our sound designer, and our graphics team is Thought Café.