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Can you train yourself to develop 'super senses'?

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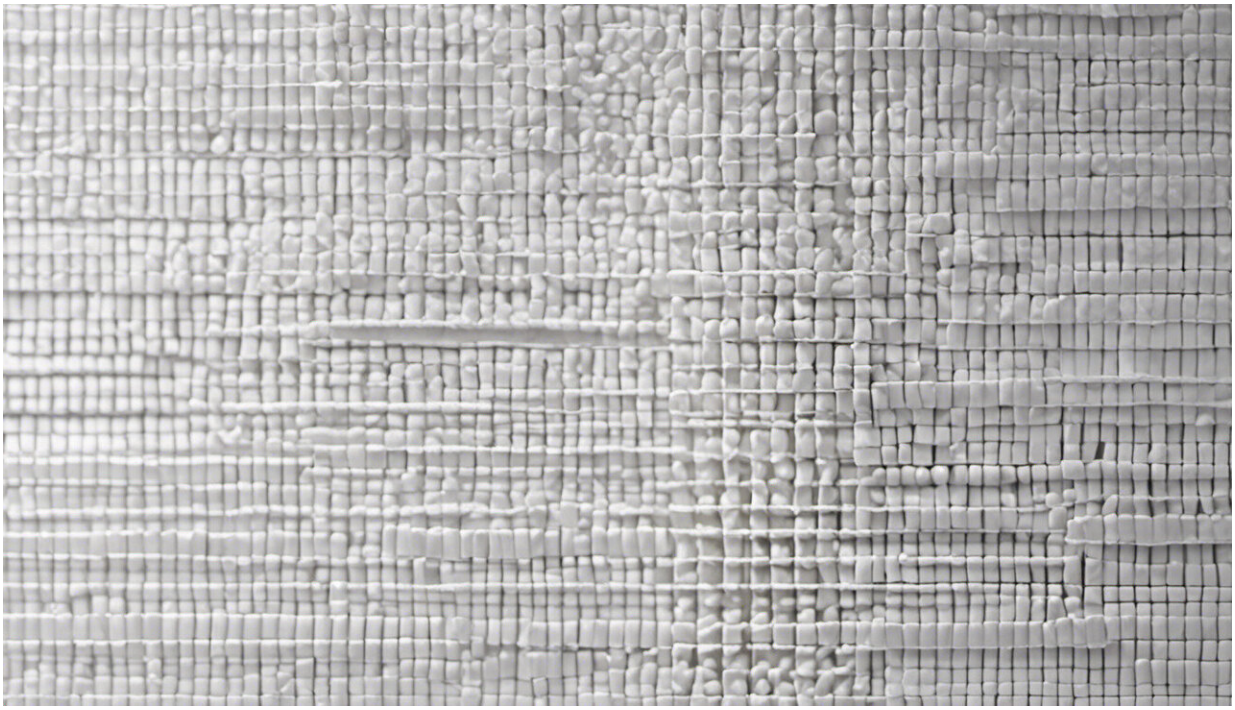

Credit: AI-generated image (disclaimer)

Wouldn't it be great to be able to hear what people whispered behind your back? Or to read the bus timetable from across the street? We all differ dramatically in our perceptual abilities – for all our senses. But do we have to accept what we've got when it comes to sensory perception? Or can we actually do something to improve it?

Differences in perceptual ability are most obvious for the more valued senses – hearing and vision. But some people have enhanced abilities for the other senses too. For example, there are "supertasters" among us mere mortals who perceive stronger tastes from various sweet and bitter substances (a trait linked with a greater number of taste receptors on the tip of the tongue). It's not all good news for the supertasters though – they also perceive more burn from oral irritants like alcohol and chilli.

Women have been shown to be better at feeling touch than men. Interestingly, this turns out not to really be a gender thing at all, but rather down to having smaller fingers. This means touch receptors that are more closely packed together, and therefore the possibility for perception at a finer resolution. Thus, if a man and woman have the same sized fingers, they will have equivalent touch perception.

Perceptual learning

The sensory receptors on our body largely set a limit on what we can perceive. However, this is not the end of the story. Our perception is much more malleable than you might expect. The scientific field of "perceptual learning" is helping us to understand perception and, therefore, how we can enhance it.

This research reveals that, in the same way we can train to improve skills such as sports or languages, we can train to improve what we can see, hear, feel, taste and smell. In a typical sensory training, the trainee is presented with a range of sensory stimuli that vary in how easy they are to perceive. Taking touch as an example, these might be bursts of vibrations on the fingerpads that vary in frequency (how fast they pulse).

The trainee usually has to make a judgement about the two stimuli, such as whether they are the same or different. Typically, this starts with easy comparisons (very different stimuli) and gets successively harder.

Feedback on whether a response is correct or not significantly improves learning, as it allows people to match what they see/feel with the properties of the actual stimuli.

It was long thought that you could only improve your perception by this explicit training, but it is also possible boost perception without actively doing anything or even realising it is happening. In one incredible example, scientists trained participants in a brain scanner to generate a pattern of brain activity matching what would be seen if they were looking at particular visual stimuli. They gave them feedback on how well they were generating this pattern – a process known as "neurofeedback".

By the end of training, participants were asked to identify various visual stimuli including the one they had "seen" in training. It turned out they were faster and more accurate in reporting the stimulus from the training despite having not physically seen it. Talk about inception.

Dramatic results

But how much can we expect our senses to improve? That largely depends on how long and hard you train, and how effective your training is. It can be substantial: in our studies, touch training has produced improvements of up to about 42% of participants' original acuity, from just two hours of training. What is surprising is that some studies report enhancements of perception into a range beyond what the sensory receptors should allow – into the "hyperacuity" range.

For example, in vision, people are actually able to see at a finer resolution than the spacing between individual receptors in the eye. You can think about this in the terms of pixels in a photo – the more pixels you have, the more details you can see. In the case of hyperacuity, people can see better than the pixel resolution should permit (with

similar findings across the senses, including touch and audition).

So how on Earth can this occur? It's due to clever processing in the brain : our brains look across the whole grid of receptors to determine where the "centre of gravity" of the image falls – revealing position and shape by the spatial clustering of information on the grid. In fact, a surprising amount of perception turns out to be determined less by the receptor organ than by the brain.

For instance, training your vision to improve does not do anything to alter the photoreceptors in your eye. While all the same sensory information is getting into the system through these receptors, the training allows the brain to filter out noise and more effectively "tune into" the sensory signal.

Another piece of evidence that learning can't be happening at the level of sensory receptors is that sensory learning *spreads*. For instance, if you train perception to improve on one finger of the hand, this learning miraculously spreads to other fingers that are linked in the brain.

The fact that we can train our brains to improve the way we extract sensory information from the world really is good news for all of us. Not least because our sensory perception declines as we age.

On the upside, savvy tech developers and scientists alike have been hard at work franchising this idea – using concepts of perceptual learning to create brain training apps. These apps cannot *overcome* the problems of sensory degradation caused by faulty or ageing receptors (and some are ineffective or based on dubious science). However if designed correctly, they can give you a significant boost. There is even some evidence that such sensory training programmes can translate to real world benefits, such as visual training boosting baseball performance.

Some are already available on the web, such as UltimEyes – an app designed by perceptual learning researchers at University of California in Riverside. The also have an auditory training prototype in crowdfunding, and other groups are following suit. Maybe soon we will have the power to modify our own sensory perception in the palm of our hand (well, in the phone in the palm of our hand).

With rapid scientific progress we move towards fantastic opportunities to maximise the function of our senses, aid rehabilitation for people who've experienced sensory loss and just generally become more awesome.

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