TED-Ed Video Lesson:

An elderly woman named Rosalie was sitting in her nursing home when her room suddenly burst to life with twirling fabrics. Through the elaborate drapings, she could make out animals, children, and costumed characters.

Rosalie was alarmed, not by the intrusion, but because she knew this entourage was an extremely detailed hallucination.

Her cognitive function was excellent, and she had not taken any medications that might cause hallucinations.

Strangest of all, had a real-life crowd of circus performers burst into her room, she wouldn't have been able to see them: she was completely blind.

Rosalie had developed a condition known as **Charles Bonnet Syndrome**, in which patients with either impaired vision or total blindness suddenly hallucinate whole scenes in vivid color. These hallucinations appear suddenly, and can last for mere minutes or recur for years.

We still don't fully understand what causes them to come and go, or why certain patients develop them when others don't.

We do know from fMRI studies that these hallucinations activate the same brain areas as sight, areas that are not activated by imagination. Many other hallucinations, including smells, sights, and sounds, also involve the same brain areas as real sensory experiences.

Because of this, the cerebral cortex is thought to play a part in hallucinations. This thin layer of grey matter covers the entire cerebrum, with different areas processing information from each of our senses.

But even in people with completely unimpaired senses, the brain constructs the world we perceive from incomplete information.

For example, our eyes have blind spots where the optic nerve blocks part of the retina. When the visual cortex processes light into coherent images, it fills in these blind spots with information from the surrounding area.

Occasionally, we might notice a glitch, but most of the time we're none the wiser. When the visual cortex is deprived of input from the eyes, even temporarily, the brain still tries to create a coherent picture, but the limits of its abilities become a lot more obvious.

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The full-blown hallucinations of Charles Bonnet Syndrome are one example. Because Charles Bonnet Syndrome only occurs in people who had normal vision and then lost their sight, not those who were born blind, scientists think the brain uses remembered images to compensate for the lack of new visual input.

And the same is true for other senses. People with hearing loss often hallucinate music or voices, sometimes as elaborate as the cacophony of an entire marching band.

In addition to sensory deprivation, recreational and therapeutic drugs, conditions like epilepsy and narcolepsy, and psychiatric disorders like schizophrenia, are a few of the many known causes of hallucinations, and we're still finding new ones.

Some of the most notorious hallucinations are associated with drugs like LSD and psilocybin. Their hallmark effects include the sensation that dry objects are wet and that surfaces are breathing.

At higher doses, the visual world can appear to melt, dissolve into swirls, or burst into fractal-like patterns. Evidence suggests these drugs also act on the cerebral cortex.

But while visual impairment typically only causes visual hallucinations, and hearing loss auditory ones, substances like LSD cause perceptual disturbances across all the senses.

That's likely because they activate receptors in a broad range of brain areas, including the cortical regions for all the senses.

LSD and psilocybin both function like serotonin in the brain, binding directly to one type of serotonin receptor in particular. While serotonin's role in the brain is complex and poorly understood, it likely plays an important part in integrating information from the eyes, nose, ears, and other sensory organs.

So one theory is that LSD and psilocybin cause hallucinations by disrupting the signaling involved in sensory integration. Hallucinations associated with schizophrenia may share a similar mechanism with those caused by LSD and psilocybin.

Patients with schizophrenia often have elevated levels of serotonin in the brain. And antipsychotic drugs relieve symptoms of schizophrenia by blocking the same serotonin receptors LSD and psilocybin bind to.

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And, in some cases, these drugs can even relieve the hallucinations of patients with Charles Bonnet Syndrome.

We're still a long way from understanding all the different causes and interconnected mechanisms of hallucinations.

But it’s clear that hallucinatory experiences are much more closely tied to ordinary perception than we once thought. And by studying hallucinations, we stand to learn a great deal about how our brains construct the world we see, hear, smell, and touch.

As we learn more, we’ll likely come to appreciate just how subjective and individual each person’s island universe of perception really is.