Sight, Sound Processed Together and Earlier than Previously Thought

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The area of the brain that processes sounds entering the ears also appears to process stimulus entering the eyes, providing a novel explanation for why many viewers believe that ventriloquists have thrown their voices to the mouths of their dummies.

More generally, these findings from Duke University Medical Center offer new insights into how the brain takes in and assembles a multitude of stimuli from the outside world. By studying monkeys, the researchers found that auditory and visual information is processed together before the combined signals make it to the brain's cortex, the analytical portion of the brain that assembles the stimuli from all the senses into coherent thoughts.

"The prevailing wisdom among brain scientists has been that each of the five senses – sight, hearing, smell, touch and taste – is governed by its own corresponding region of the brain," said Jennifer Groh, Ph.D., a neurobiologist in Duke's Center for Cognitive Neuroscience. "The view has been that each of these areas processes the information separately and sends that information to the cortex, which puts it all together at the end.

"Now, we are beginning to appreciate that it's not that simple," Groh continued. "Our results show that there are interactions between the sensory pathways that occur very early in the process, which implies that the integration of the different senses may be a more primitive process and one not requiring high-level brain functioning."

The results of Groh's experiments were published early online in the *Proceedings of the National Academy of Sciences*.

Groh has a particular interest in a tiny round structure in the brain known as the inferior colliculus. This structure, less than a half-inch in diameter, is located in the most primitive area of the brain. It is one of several early stops in the brain for signals leaving the ear, headed for the cortex.

"In our experiments, we found that this structure, which had been assumed to mainly process auditory information, actually responds to visual information as well," Groh explained. "In fact, about 64 percent of the neurons in the inferior colliculus can carry visual as well as auditory signals. This means that visual and auditory information gets combined quite early, and before the 'thinking part' of the brain can make sense of it."

That is why ventriloquism seems to work, she said. The association between the voice and the moving mouth of the dummy is made before the viewer consciously thinks about it. The same process may also explain why the words being spoken by a talking head on television appear to be coming out of the mouth, even though the television speakers are located to the side of the set.

"The eyes see the lips moving and the ears hear the sound and the brain immediately jumps to the conclusion about the origin of the voice," Groh said.

Groh said that it makes logical sense for hearing and vision to have some level of integration in the monkeys she studied, and in humans.

"We generally live in similar ecological niches; we are active during the day and tend to communicate vocally," she said. "The inferior colliculus

is similar in both species, and with the advent of new imaging technology, like functional MRI, which can visualize brain regions in real time. We should be able to correlate what we're seeing in animal models with what happens in humans."

Groh and her team are now conducting experiments to determine whether or not one of the senses influences how the other is perceived.

Source: Duke University