Songbirds' Brains Provide Clues to Human Speech

January 16 2008

Analyzing how the brains of songbirds respond to singing patterns has provided new information about how humans learn to communicate with each other, according to Duke University researchers.

A study in the latest edition of *Nature* reveals that individual cells in the brain display remarkably similar patterns of activity whether a sound associated with communication is being heard or produced. The study was performed using songbirds that sing back and forth in the wild to defend territory.

The researchers think that these specialized cells in the brain may be especially important for helping an individual be both a sender and a receiver in communication.

"The ability of the animals to communicate with each other through song and their ability to learn their vocal signals from other birds provide a powerful system for understanding how the brain enables learned forms of communication, including human speech," said Professor Richard Mooney, a Duke Medical Center neuroscientist who led the research. The study was supported by the National Institute of Deafness and Other Communication Disorders and the National Science Foundation.

"These birds have a small and distinct repertoire of songs that they can broadcast over a hundred yards or more," Mooney said. "We found certain neurons responded nearly identically when the bird heard or sang a certain song in its repertoire. This correspondence provides the first

demonstration of so-called 'mirror neurons' in vocal communication."

The researchers used a miniature device that recorded the activity of single neurons in the brains of swamp sparrows as they listened to songs presented through a speaker and subsequently sang them back.

"We feel this work is especially unique because making neural recordings in freely behaving wild songbirds like we did is a bit like balancing a small pebble on the end of a sewing needle while in a stiff breeze," Mooney said.

When the bird was listening, particular cells could only be excited by a specific song in the bird's repertoire or by a highly similar song of another swamp sparrow. The same cells also showed a nearly identical pattern of activity when the bird sang the song.

Mooney explains that the cells' activities were not simply the result of the bird hearing its own song, but instead arose from motor circuits in the bird's brain. "It's as if the motor program in the bird's brain is not only generating the commands that are used to produce the song, but also providing an internal estimation of what those signals should sound like when they are eventually transmitted out of the brain to the vocal organ," he said.

"Our discovery of these neurons and the fact that they are located in an area of the songbird brain important to singing and song perception strengthens the idea that mirror neurons play an important role in communication," said Duke neuroscientist Jonathan Prather, Ph.D., first author of the paper.

Auditory-vocal mirror neurons are located in an area of the songbird brain that is analogous to speech areas in the human brain. "In humans, mirror neurons similar to those we found in the songbird could be the

mechanism by which we rapidly decode speech and generate verbal responses," Mooney said.

Other members of the research team included Duke University biologists Stephen Nowicki and Susan Peters.

Source: Duke University Medical Center

Citation: Songbirds' Brains Provide Clues to Human Speech (2008, January 16) retrieved 24 April 2024 from https://phys.org/news/2008-01-songbirds-brains-clues-human-speech.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.