AAAS MEETING

The Sophisticated Sounds of Simians

While the laboratory education of Washoe the chimpanzee, Koko the gorilla and other domesticated creatures is well documented, scientists have assumed that apes and monkeys in the wild do not communicate naturally with any "language." There is communication, to be sure — body movements in combination with various vocalizations are used to convey certain points — but nothing, it was thought, approaching the sophistication of the sign and symbol language assimilated by the famous lab primates.

Now, however, anthropologists at the University of California at Los Angeles (UCLA) report that wild vervet monkeys have "vocal repertoires [that] are far larger than originally believed." Moreover, computer analysis of the monkeys' specific "conversational" sounds reveals them to be surprisingly similar in some ways to human speech, according to the researchers.

"It's like watching humans in conversation," UCLA's Robert Seyfarth told SCIENCE NEWS. The monkeys, he says, have "gone some way along the road to language." He reported the findings last week in Los Angeles at the annual meeting of the American Association for the Advancement of Science (AAAS).

Seyfarth and UCLA colleague Dorothy Cheney say that the "elements of language" they have discovered among vervets are much more subtle and sophisticated than the alarm calls given off by the monkeys when threatened by predators. The researchers had reported previously that vervets sound specific alarms, depending on whether they are threatened by an eagle, snake, leopard or other predator (SN: 11/24/79, p. 357).

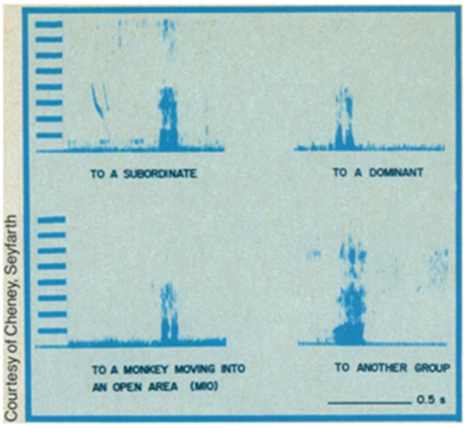
"That's what led us to investigate their grunts," Seyfarth explains. In contrast to alarm calls, which are more like screams, monkey grunts are uttered in all types of nonthreatening situations. And, Seyfarth says, they all seem to sound the same. "Even experienced observers can't tell the difference," he says.

But after years of study in Kenya, Seyfarth and Cheney thought they may have heard tiny differences in grunts made by monkeys in four specific situations: approaching a dominant monkey; approaching a subordinate; acknowledging a leader's call to move onto an open plain from a sheltered area; seeing another group of monkeys approaching.

As they had done in their alarm call studies, the anthropologists hid loudspeakers in the natural environment of six monkey groups in Kenya and played grunts recorded in each of the four situations. They filmed the responses and found that when the listener was addressed by the recorded grunt of a subordinate it looked "sharply" and confidently in the direction of the loudspeaker; when addressed by a dominant monkey, it moved away; when hearing the "open plain" grunt, it looked out toward that area; when hearing the "other group" grunt, it looked out even more strongly.

After viewing the films, Seyfarth brought the corresponding vocal tape recordings back to the UCLA phonetics laboratory for acoustic analysis. He used computer software that conducts "Fourier analysis" of human speech. The process, which analyzes speech waveforms, revealed that the grunt waves from each of the four categories differed in two respects: the placement of the strongest energy and the change of energy peaks over the duration of the grunt. The latter, Seyfarth says, is similar to how human speech distinguishes between vowels.

"There are definitely some elements of language," Seyfarth says. "They are using sound to represent features of their environment." However, he notes, while monkeys appear to have semantics, they lack syntax. "They don't combine two or more [sounds], they don't make sentences and there is no particular order with abstract structure," he says.



Courtesy of Cheney, Seyfarth

Computer analysis of these spectrograms reveals clear differences in grunt waves.

Still, he says, the findings "illustrate that you can't judge the size of vocal repertoire by ear alone." And Seyfarth adds that his research opens up the possibility that other animals, particularly apes, may have natural communication systems in the wild that are far more developed than is now believed. —*J. Greenberg*

AAAS

Dissection of the inebriated brain

The brain is the seat of alcohol's euphoric, intoxicating influence, as well as many of its long-term toxic consequences. But the mechanisms underlying alcohol's effects have been elusive, and no overall brain change has been observed that can explain all the striking effects of low doses of alcohol.

Recently developed methods are allowing scientists to examine alcohol's effects on individual groups of cells in the brains of laboratory animals. These effects are "highly specific to certain nerve pathways," reported Floyd E. Bloom of Scripps Clinic and Research Foundation in La Jolla, Calif., at the AAAS meeting. They comprise the first elements in what scientists expect eventually to add up to a biochemical scenario of intoxication.

The brain area that coordinates nerve cell activity to produce fine motor control, balance and muscle tone is currently spotlighted in such research. This area, the cerebellum, uses "Purkinje" cells with complex, branched structures to gather information from incoming cells and carry output to the rest of the brain.

In one line of research, these cells were examined in mice that had been inbred at the University of Colorado in Boulder for about 25 mouse generations to be extremely sensitive or extremely insensitive to alcohol. The Purkinje cells react differently to alcohol in the sensitive and insensitive mice. In the most sensitive mice, alcohol depresses the activity of the Purkinje cells more markedly and for a longer period than in the least sensitive mice. This differential activity is not seen with depressant drugs other than alcohols, and it is not seen in the hippocampus, the other brain area examined.

Alcohol sensitivity is a property of the cerebellar tissue, says Barry Hoffer of the University of Colorado Alcohol Research Center in Denver. In recent research he has transplanted pieces of cerebellum into the eyes of mice of the donor strain and those of different strains. The alcohol sensitivity of the Purkinje cells always reflects the donor, rather than the recipient, strain. Therefore, the cell itself, rather than its input, determines at least in part the response to alcohol.

But Bloom and his colleagues report that some of the cells that carry signals into the cerebellum also play a role in alcohol's effects. The Scripps group finds that in normal rats an intoxicating dose of alcohol increases the activity of one major source of input to Purkinje cells, the nerve processes called climbing fibers. This is a particularly important input, explains Bloom's co-worker Steven Henriksen, because it preempts the Purkinje cell, interrupting the cell's other activities. Thus, in