

**REPRINTED FROM: NEUROSCIENCE ABSTRACTS
SOCIETY FOR NEUROSCIENCE, 8TH ANNUAL MEETING
NEW YORK CITY 1975. PRINTED IN THE U.S.A.**

SPEAKER RECOGNITION BY THE CENTRAL NERVOUS SYSTEM

Manfred Clynes, The Biocybernetic Institute, La Jolla, and UCSD,
La Jolla, California 92037

Although differentiation between individual speakers is fairly successfully done by computers and voice prints leading to recognizable patterns for visual or analytic discrimination, little is known about how the nervous system itself performs this auditory function (The problem is quite different from recognizing speech, phonemes and expressive or syntactic inflections).

It was observed earlier in our laboratory that even small steady changes of speed of a tape recording of a speaker's voice interfere with recognition of the speaker's identity, while leaving intact recognition of speech, syntactic, and expressive inflections. This also raised the question whether alteration of speech speed (rate), or of pitch, or both, played a key role in disabling speaker recognition. In order to test this question, an Eltro Rate Changer was used allowing the rate of speech to be changed without changing the pitch, or vice versa. The device operates without significant loss of fidelity as tested by using it twice, the second time to restore the original rate or pitch. Pairs of speakers of the same sex and of comparable voice characteristics were chosen, and 30 second portions of their speech were presented to subjects who could identify the speakers correctly, without error. The same speech segments were then presented, altered in rate without changing pitch, and also in pitch without changing rate, in increasing or decreasing increments chosen at random.

Starting from small 1% increments it was found that when the change reached only 6% (slightly less than a semitone), the change in pitch was sufficient to disable speaker recognition, from errorless to no better than chance, but a 6% rate change still permitted errorless identification. All ten subjects tested in this way showed lack of impairment of recognition when rate was changed only, but not pitch - while showing strong impairment of recognition with changes in pitch, at unaltered rate.

Since when a tape recording is changed in velocity, all frequencies are changed in the same proportion and thus all relative clues remain, the results signify that the nervous system has a surprising capacity, in effect, of remembering absolute pitches for speech, a function which is known to be developed and used only by some for musical sounds. Thus it seems most of us appear to have a stable reference or an aspect of absolute sense of pitch, for patterns, or gestalts, of speech.