R-129

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From: Supervisor, Psychoacoustics Section

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Subj: Contract Nonr-3579(04), Fifth Quarterly Progress Report (1 June 1965 through 31 August 1965), Transmittal of

Encl: Fifth Quarterly Progress Report on Contract Nonr-3579(04)

Defense Research Laboratory is pleased to submit the enclosure as a report of progress made during the period 1 June 1965 through 31 August 1965 on Contract Nonr-3579(04).

L. A. Jeffress

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Report for Contract Nonr-3579(04)
for the period 1 June 1965 through 31 August 1965
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Status of Proposed Problems

A. Problem 1-a. Receiver Operating Characteristics for Visual Detection (Ann Tucker and R. B. Evans)

This problem has been completed and the findings are being prepared for publication and issuance as a report under the grant. One important finding is methodological. Heretofore there has been uncertainty about whether rating-scale data yielded by a subject on one occasion can be combined with data from another occasion by simply adding the percentages associated with corresponding points along the scale (counter readings), or whether it is necessary to plot ROC curves for each sitting and average their coordinates. The latter procedure has the stronger theoretical support, but involves a great deal more time and effort. A study of a large quantity of data taken in connection with the present problem has shown that the curves resulting from the two procedures do not differ in any significant way. Even when extreme variability in the subject's responses exists, the data averaged the simple way yield essentially the same ROC curve as when averaged curve by curve. The time and effort saved by the simpler method is substantial.

Problem 1-b. Psychophysical Studies of Brightness (G. H. Jacobs and H. A. Gaylord)

These studies are continuing, and some results should be ready for summarizing in the next quarterly report.

Problem 1-c. Physiological Studies of Brightness (G. H. Jacobs and H. A. Gaylord)

An article covering a portion of the work being done under this problem has been accepted for publication in the Journal of the Optical Society of America

for November, 1965. Reprints of the article will be issued as a report under the grant. The article is entitled "Effects of Adaptation on the Lateral Geniculate Response to Light Increment and Decrement."

B. Problem 2. Signal Detection as a Function of Vigilance
(C. S. Watson and T. L. Nichols)

Work on this problem is under way in the newly installed Autonomics Laboratory of the Psychology Department. The work involves several stimulus situations in which selected trials are assigned enhanced importance--sometimes through the use of electric shock or the threat of shock. Both regularly scheduled stimulus intervals, and randomly occurring intervals are being employed; a record is kept of the subject's galvanic skin response to the various stimuli. A new method of measuring the GSR response is being employed with the hope that it will eliminate many of the sources of unwanted variability in subjects' responses.

C. Problem 3. Signal Duration and the Width of Critical Bands
(L. A. Jeffress)

Work on this problem is being deferred until a new set of filters with appropriate amplifiers has been assembled. Work so far indicates that the band is not symmetrical and the filters (low-pass and high-pass with very steep cutoffs) that are to be employed will obtain a better assessment of the shape of the critical band than is presently available.

D. New Problems
(L. A. Jeffress and A. D. Gaston)

The recent availability in the Defense Research Laboratory of a Computer of Average Transients (CAT) and various accessories for it has made possible a series of studies of the behavior of an electrical model incorporating several features believed to be employed by the hearing mechanism. With it studies are being made of detection under both monaural and binaural stimulus conditions. Two papers resulting from this work are being presented at the

November meeting of the Acoustical Society of America. Abstracts of the papers are appended to the present report. Results of experiments with the model have suggested three new experiments with human subjects: one involving the determination of the psychometric function for gated noise and signal as function of duration (this is closely related to Problem 3 on the width of the critical band). A second involves obtaining the psychometric function for antiphasic binaural detection. Observations with the model suggest that the shape of this function is different than that for monaural detection. A third, nearly completed, involves determining the shape of the ROC curve for antiphasic stimulus conditions.

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APPENDIX

STATISTICS OF INTERAURAL, TIME DIFFERENCES UNDER ANTIPHASIC STIMULUS CONDITIONS

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ABSTRACT

At the Austin meeting of the Society, Watson, Rilling, and Bourbon presented ROC curves obtained from subjects' responses under one antiphasic condition, NO Sπ. An attempt was made to fit their data from theoretically derived probability densities for noise and signal. The signal distribution was obtained by a rather tedious numerical computation. The present paper will show examples of the interaural time differences arising under various antiphasic stimulus conditions. The distribution for dichotically presented noise, Nπ, is sharply leptokurtic. The distribution obtained by adding a signal, Nπ SO, is bimodal with greater separation of the modes as the signal is increased. The distribution for NO Sπ has a density function which resembles the Rayleigh distribution, and has zero frequency of occurrence of zero interaural time differences.

ROC CURVES FROM AN EAR MODEL

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ABSTRACT

Many investigations have likened the ear in its ability to detect a tonal signal in noise, to a narrow filter followed by a detector mechanism. The present paper describes the performance of such a device, consisting of a 50 cps filter centered at 500 cps followed by an envelope filter. The latter is a half-wave rectifier, an RC integrator, and a low-pass filter. Gated noise or noise plus signal is presented to the device and its output is sampled at each presentation. For a stimulus duration equal to the reciprocal of the bandwidth of the filter, the efficiency measure, η, is near to unity. At longer and shorter durations the efficiency decreases. The ROC curves yielded by the device resemble those obtained with human subjects, and are shaped like those for the ideal detector of a signal of unknown phase.

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