

70 34467
CR 112843

FINAL REPORT

DISTANCE AND RATE JUDGMENTS IN SIMULATED SPACE

NASA IGR 44-009-018

1 September 1967 - 30 November 1969

CASE FILE
COPY

To: Winnie M. Morgan
Technical Reports Officer
Office of University Affairs
Attention: Code Y
National Aeronautics and Space Administration
Washington, D. C. 20546

From: Malcolm D. Arnoult and Robert P. Markley
Principal Investigator Associate Investigator

Department of Psychology
Texas Christian University
Fort Worth, Texas 76129

Introduction

The research program was designed to use the unique apparatus developed under Contract NAS 2-1481, "Visual Perception of Objects in Space" between Texas Christian University and NASA Ames Research Center. In addition, the research was a continuation and extension of the research accomplished under that contract. Under Contract NAS 2-1481 an optical device was designed and constructed to simulate the essential visual properties of objects outside of the earth's atmosphere (Arnoult, Vincent, Brown, Markley, and Hensleigh, 1969). With this apparatus, studies of distance judgment were completed using both verbal and nonverbal response measures.

Current Research Program

1. Apparatus. - The TCU Space Visual Simulator is a system for producing continuously variable images of a scale model target by reflecting light from the target through a set of five lenses. The target and lenses are housed in a 4 ft. x 30 ft. steel chamber. All the optical components except the final ocular lens can be moved in a coordinated fashion by means of steel tapes connected through a set of cams and pulleys, by continuously changing the distances between the simulated distances of 200 ft. and 20,000 ft. A special feature of the apparatus is that the simulated distance is achieved by having the apparent source of the light rays appropriate to the distance being represented, and by having an image which is actually three-dimensional. Thus, all the visual target cues which would be present in the real situation are provided in the simulation.

The experimental subject views the target from a station in an adjoining room. He is seated in a fully-enclosed "capsule" and views the target through a "porthole", the glass surface of which is adjacent to the final ocular lens set in the forward end of the simulator tank. The subject's head is enclosed

In a soft helmet which keeps his eyes on the optical axis and attenuates ambient sounds. An intercom system provides communication with the experimenter. Between the "porthole" and the final ocular lens is a remotely controlled shutter which can be closed between trials.

Research: Much of the activity carried out under this grant is summarized in the following list of reports. These include data collected during the preceding contract NAS 2-1481 but analyzed or written up with support from NGR 44-440-018.

1. Vincent, R. J., Brown, B. R., and Arnoult, M. D. Magnitude estimation of perceived distance over various distance ranges. NASA CR-73172, 1967.
2. Vincent, R. J., Brown, B. R., and Arnoult, M. D. Distance discrimination in a simulated space environment. NASA CR-73205, 1968.
3. Arnoult, M. D., Brown, B. R., Vincent, R. J., and Tees, S. Verbal estimation of distance in a simulated space environment. NASA CR-73206, 1968.
4. Arnoult, M. D., Vincent, R. J., Brown, B. R., Markley, R. P., and Hensleigh, R. C. A description of the NASA-TCU Space Vision Simulator. NASA CR-73305, 1969.
5. Markley, R. P., Brown, B. R., and Arnoult, M. D. Fractionation of distance in simulated space. NASA CR-73306, 1969.
6. Markley, R. P. Magnitude estimation: The exponent and range of response. Technical report submitted for NASA publication November 30, 1969.

The magnitude estimation paper by Markley is now being revised for possible journal publication. Revised versions of two of the earlier reports were also published in psychological journals.

1. Vincent, R. J., Brown, B. R., Markley, R. P., and Arnoult, M. D. Magnitude estimation of perceived distance over various distances ranges. Psychonomic Science, 1969, 13, 303-304.

2. Vincent, R. J., Brown, B. R., Markley, R. P., and Arnoult, M. D.

Distance discrimination in a simulated space environment. Perception & Psychophysics, 1969, 5, 235-238.

Much of the active data collection during the first year of the grant was devoted to questions of distance discrimination. The results were contained in a third published article:

3. Worley, Johnny K. and Markley, R. P. Distance discrimination in a reduced cue setting. Psychonomic Science, 1969, 17, 237-238.

A final set of data on magnitude estimation of distance was collected in late 1969. This was done to check the reliability of the results contained in the magnitude estimation report by Markley (1969). Twelve observers from the previous study were recalled. Twenty-four additional naive male observers were requisitioned from an Introductory Psychology class. These latter subjects were not screened for visual defects. Magnitude estimations of distance were obtained from both old and new observers. One group of naive subjects judged the size of a space craft (LM) rather than distance. Essential results were: (1) response ranges were not effected by instructions to judge either size or distance; (2) observers altered their range of response directly as the stimulus range changed; (3) the experienced observers were not as accurate in judging a narrow range of distances as were naive subjects. There was no group difference in performance on a larger range; (4) inter-observer variability was high.

Attempts to obtain judgments of the velocity of a moving target were a failure. There were continuing problems with the operation of the simulator throughout the period of the grant. It was impossible to obtain reliable constant velocities. In the absence of adequate physical control of this variable, psychological judgments were useless. Efforts to involve the design engineer, R. H. Hensleigh, in solution of these problems were not successful.