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NASA TECH BRIEF

Ames Research Center

Visual Sensitivity Tester

The problem:

The equipment ordinarily used for determining the available visual field of the human eye and for locating retinal blind spots can not provide high quality data because they yield results which are not sufficiently accurate and reproducible. Moreover, the objective qualities of tests performed with available equipment tend to be diluted by human involvement, for when the experimenter is required to move the visual stimulus over the patient's visual field and record the observer's comments, human reaction time and judgment play too large a role in the interpretation and recording of results.

The solution:

A visual sensitivity testing device which uses specially-prepared closed-loop film cassettes to project programmed visual stimuli on a screen which the observer views through a lens that makes the stimuli appear to be at optical infinity. As a stimulus spot moves over the visual field, one pen of an X-Y-Y′ recorder moves correspondingly to provide a permanent graphic record of the position of the stimulus. The second pen makes a record of when and where the observer sees the stimulus disappear and reappear. The correspondence or lack of correspondence between the two pen plots can be used as an indication of a particular change in visual function.

How it's done:

A commercially available 8-mm screen movie projector was modified to include: (1) a photocell array to sense stimulus position, (2) an infinity viewing lens, (3) a bite-board and forehead support, (4) an eye centering device, (5) a means for inserting both chromatic and neutral density optical filters in front of the viewing lens, (6) three visual fixation cross projectors, and (7) storage areas for all needed film cassettes and spare parts.

A standard X-Y-Y′ two-pen recorder is connected to the projector. One of the two pens is activated by the photocell array and corresponds to the direction of motion and position of a small white spot of light (stimulus) as seen on the viewing screen by the observer. The second pen is actuated by a finger button, and the kind of vision test being conducted determines the use of this button. In any event, the second pen records when the observer senses or does not sense the stimulus. The correspondence or lack of correspondence between the two pen plots is used to indicate visual function.

The position of the observer is standardized prior to each test by adjusting the forehead rest and a bite plate bearing his dental impression so that he is able to see the position of the image of the particular fixation cross that has been selected for the test as he looks through the viewing lens with the eye centering plate in its rack. The plate is then removed.

During the test, the observer keeps the direction of his gaze on the fixation cross, and holds the response button in readiness to react to the stimulus. The film cassettes provide programmed sequences of stimuli which consists of a small, white spot of light moving slowly across the field of view in various straight paths, appearing and disappearing unexpectedly. As long as the observer cannot see the stimulus, the button is to be depressed; it is to be released while he sees the stimulus. The electronic control unit interprets stimulus position information furnished by the 8 photocells, and directs the pens accordingly. The

(continued overleaf)

design of this unit makes it possible to operate the response plotter in each of three modes: (1) automatically from screen images that operate the photocells; (2) manually from the front face of the control unit; and (3) from an external device such as a digital computer.

A standard two-pen X-Y-Y′ recorder, associated with an electronic control unit, is connected to the projector to plot the stimulus in green ink and the response in red ink. Both pens move in parallel as they track the movement of the stimulus. However, the observer's response switch and the stimulus off/on information cause the pens to drop onto the paper independently. The degree to which the observer's reactions correspond with the positions and actions of the stimulus is a direct measure of the retinal sensitivity in the central visual field, and the X-Y-Y′ polar plot displays this information unequivocally.

As the vision tester is currently used, two types of tests are given. One determines the observer's visual sensitivity within a 30° arc from the fovea, and the other maps the size, shape, and location of the blind spot. In each case, a polar plot is developed, with motion of the pens being directed radially toward or away from the origin. To the eye, in the visual sensitivity test, paths of the stimulus are toward or away from the fovea. In mapping the blind spot, the stimulus moves into and out of the blind spot. A special calibration observation is made in this test to locate the fovea on the diagram. The fixation cross provides correlation.

The tests described yield a direct indication of existing abnormalities in vision; when compiled for one subject over a period of time, they are a sensitive indicator of changes.

Notes:

1. Initial impetus for development of the test apparatus was the need for daily measurement of the visual conditions of men confined for an extended time in a space vehicle simulation chamber.
2. The tester is especially useful for determining changes in glautomatous visual field sensitivity because of the high degree of reproducibility of tests performed over long intervals of time.
3. A wide variety of films can be prepared to provide special types of visual stimuli.
4. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)
   Reference:
   NASA TN D-6190 (N71-18971), Development of an Automated Visual Sensitivity Tester.
5. No additional documentation is available, Specific questions, however, may be directed to:
   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B72-10203

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

Patent Counsel
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