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Introduction

Lauer and Silver (1941) described a special dark room for studying acuity and visual discrimination under low levels of illumination. The length of the room was about 20 feet, thus precluding certain measurements where greater distances were required. The test objects were also stationary allowing only for measurements being made at a fixed distance.

In connection with a recent study (1951) on perception of changes in relative distance and in variations thereof, it was necessary to construct a device which would not only give a greater distance potential, but which would allow for variations in speed of approach or recession and at the same time permit variations in the levels of illumination, either at the eye of the observer or that impinging upon the test object.

Various problems of the laboratory necessitate the measurement of seeing or perceptual time at different levels of illumination. Other problems such as dark adaptation measurements, the relation between acuity and visual discrimination of objects, effects of headlight glare, glare reduction aids, light tolerance, effects of centerline flicker, effects of high contrast and reflectorized vehicles, taillight efficiency, problems of highway markings, effects of distraction on driving, hypnotic effects of continued driving and the effects of roadside stimuli, require such an apparatus for certain phases of experimentation.

To date the application of the apparatus has been limited to measurements of the time and difficulty for perception of relative motion under various conditions of visibility, with certain patterns and with some variation in color background combinations.

Typical Procedure for Problems Being Studied at Present

Essentially the procedure involves the movement of a target on the belt or roadway either towards, or away from, the subject. When the target passes a certain point a contact switch is automatically closed which actuates the mechanism to open the shutter and start a timer or chronoscope. The subject or observer is instructed to give a standardized verbal response to indicate his judgment of the direc-

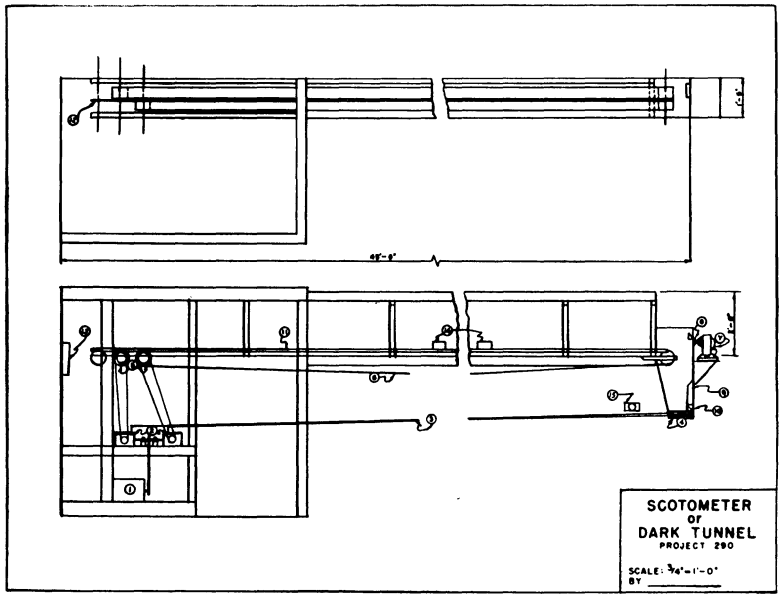

Fig. 1. Schematic Diagram of the Scotometer.

tion and rate of travel. An electronic voice key makes it possible for a verbal response to stop the timer and close the shutter. Judgment responses to a given subjective scale of measurement are obtained to determine the subjects impression of the difficulty and distance.

Visibility of the target can be varied by using different sizes, amounts of over-all illumination and contrasts between the target and background. The enclosing of the apparatus in the tunnel makes possible very carefully controlled studies of the effects of certain weather conditions such as fog or mist. Opposing lights are also used to determine the effects of glare. Various other procedures may be used to suit the nature of the problem to be studied. The apparatus has numberous applications in the field of applied and theoretical psychology and psycho-technology.

Essential Features of the Apparatus

The important features of the Scotometer are numbered in Figure 1 and are as follows:

1. A ½ h.p. shifting brush electric motor. This power source makes a wide selection of speed possible.
2. Two fluid-drive transmissions allow for smooth and easy motion in either direction. The right or left belts can be moved in either direction and at any speed desired by finger-tip control.

3. & 4. Spring steel wires and levers for remote control of the speed and direction of the target. These give the experimenter considerable advantage in many ways.
5. Drive pulleys for the belts provide for variations in speed at this point to suit the nature of the problem.
6. Endless painted web belts, 4 inches wide and approximately 86 feet long simulating actual roadways. The entire device is built on the scale of ½ inch to the foot.
7. Impinging light source with shutter and diaphragm making possible the control of intensity without change in wave length.
8. Shutter and variable aperature for timed exposures from 1/100 of a second up to several seconds. Shutter may be controlled either manually or automatically for any pre-determined time or distance.
9. Shutter mounted in the periscope for tachistoscopic as well as timed exposures when no change in lighting is desirable. This may also be controlled electronically or manually.
10. Periscopic prisms for economic use of space as well as shutter and light arrangements to simulate highway conditions more closely.
11. Switch automatically exposing stimuli and starting time when the target passes a pre-determined point or distance.
12. A small leather V-belt used between the two highways for studies of center-line colors and striping patterns.
13. An auxiliary target device is mounted at the end of the tunnel with Selsyn motor controls which make selective presentation of letters or other stimuli possible with a minimum expenditure of time and effort. Without this feature an assistant is necessary to conduct an experiment.
14. Targets which simulate vehicles on the roadway and which give a very realistic appearance.
15. Precision time-clock which is used to measure perception time, seeing time or any variable in which time is an element.

Results Obtained

In three series of studies the results obtained were compared with actual road studies. Both the magnitude and relative changes noted were consistent throughout in each of four variables, viz., (a) judgment of perception time, (b) ease of making the determination, (c) systematic error of distance placement, and (d) errors made.

Value in Highway and Vision Studies

Roadway studies on the highway are limited by numerous factors such as weather, lighting from moon, etc., traffic, suitable terrain, difficulty of getting observers at night, complicated apparatus set-up and other variables. The expense alone is considerable since at least two vehicles, with radio and radar, or some spacing equipment is necessary to carry on experimental observations. In addition, a crew of six or seven trained technicians is essential for consistent measurements in actual road studies. Thus great economy is accomplished in certain types of experimental study with this apparatus.

References

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