A DEVICE FOR PRESENTING BLURRED VISUAL STIMULI¹

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This article describes a simple and inexpensive device for presenting blurred visual stimuli. With this device visual stimuli can gradually be brought into focus along a continuous scale ranging from complete blurring to complete clarification. Materials cost about \$25.00. The "secret" of the device is the glass used to blur the stimuli. It is a rough-textured, non-glare glass easily obtained through glass or photography shops. Its primary purpose is to cover pictures so as to eliminate glare; it is only slightly more expensive than conventional glass. The glass has no apparent magnifying properties.

The device as shown in Figure 1 is 32 in. long, 8 in. high, and 14 in. wide (80 by 20 by 35 cm). At one end is a slot into which 5 by 8 in. (12.5 x 20 cm) cards containing visual stimuli are placed. At the other end is a head support and aperture. The subject looks through the aperture and moves his head forward to bring it in contact with an electric switch. This switch controls the forward movement of the glass. As the glass is gradually brought closer to the visual stimulus at the far end of the device, clarification of that stimulus is gradually increased. (To eliminate a recurring tendency among subjects to pull their heads back slightly, stop the movement of the glass, and examine the blurred stimulus, a light was installed. The light goes out whenever the subject disengages his head from the switch.)

When the subject makes a verbal response that accurately identifies the blurred stimulus, the experimenter reads the scale at the side of the device. Immediately afterward the experimenter presses a button on the side of the control box, which brings the glass back toward the subject. A microswitch placed in the guiding track determines where the returning glass will stop. The experimenter can manually change the position of the microswitch and thus determine each initial setting of the glass.

Forward speeds can be varied from 4 to 55 mm per second and are controlled by a variable control switch. Pressing a button on the side of this switch causes immediate return of the glass to the position determined by the microswitch mentioned above. The single return speed of 55 mm per second is the maximum possible with the specified motor.

The glass is mounted on a metal frame that moves along two plastic guides. The guides in this device are normally used with pull drapes, although any system of guides (or rollers) permitting easy transport of the

glass and frame would be satisfactory. A simple nylon cable traversing two pulleys, one of which is powered by the motor, provides for the movement of glass and frame. A spring maintains tension in the cable. That spring is attached to the frame by a small screw and provides the necessary contact between cable and metal glass frame.

Technical Description

The subject places his head against switch B_1 and actuates motor M . (See Figure 2.) The voltage reaching the motor is controlled by R_1 and T . The function of R_2 is to dampen the motor when the switch B_1 is released so as to stop the glass immediately. Rel_1 is used to establish an isolated circuitry so as to provide the light source that is used to light the blurred stimulus.

Fig. 1. General view of blurring device. Small box to left is controlled by experimenter and enables him to vary speed of glass and also to return glass to predetermined position.

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Fig. 2. Circuit diagram of blurred image device. Tr transform. 220 v/2 x 6 v; D1-D4 HEP 170; L 5-w light source; M 2 w-6 v 80 rpm dc motor; R1 1000-ohm potentiometer; R2 18-ohm 2-w resistor; Rel 1 SpST 6-v 120-ohm coil; Rel 2 DpDT 6-v 120-ohm; B1-B2 push button; S-microswitch; T-RCA SK3027.

After the subject identifies the blurred stimulus, the glass is returned to its initial position by pressing B_2 , which is on the side of the control box. A momentary press of B_2 actuates Rel₂. The upper contact of Rel₂ reverses the polarity of the motor and thus reverses the direction of the glass. The lower contact of Rel₂ is used to take over the function of B_2 . In the process of returning to its initial position, the glass is stopped by microswitch S. This contact de-energizes Rel₂ and readies the equipment for another experimental trail.

Application of the Device

While working with the above device to determine its reliability as a measuring instrument, the authors conducted a series of threshold studies in which subjects were required to identify a variety of common words. The findings from the studies suggested that identification of a word's first letter is an important determinant of how quickly a person can identify a blurred word.

Using what might be categorized as artificial words, other investigators (Levin, Watson, and Feldman, 1964; Marchbanks and Levin, 1965; Williams, Blumberg, and Williams, 1970) have also found that the first letter is an important cue to identification of a word. But the above studies differed from the present one

in that the subjects' performances were measured on an all-or-none basis; they either could or could not select the correct choice.

The purpose of the present study was to determine whether variations in line width of letters in five-letter words would cause corresponding changes in the recognition thresholds of those words. A second purpose was to determine whether intersubject threshold data obtained with the blurred image device would be such as to justify confidence in using the threshold levels as dependent variables. Previous research by Israel (1961) with a device that permitted blurring of visual stimuli showed that identification thresholds of blurred words can provide meaningful assessments of subject performance.

Six volunteer university students ranging from 20 to 28 yr were used as subjects. The study was conducted in the Flemish speaking part of Belgium and all subjects had Flemish as their native language.

Thirty-two Flemish nouns having five letters were used. All words were common words of concrete objects. Flemish is a phonetic language and each of the five letters had a sound. For each word the order of letters was consonant, vowel, consonant, vowel, and consonant; e.g., REGEN (rain), TAFEL (table). All letters were 14 mm high and line width of every letter was either 0.5 mm or 1.5 mm. Thus the thickest letters

LETTER GROUPS
 A- **REGEN** C- **HOREN**
 B- **TAFEL** D- **WATER**

Fig. 3. Mean threshold levels for words in the specified letter groups. Thresholds levels for Group A words have been established along a common baseline to facilitate inter-subject comparisons.

had three times the line width as the thinnest letters. All letters were the block-type shown in Figure 3.

Four words with equal letter thickness provided for familiarity with the experiment and also permitted adaptation to the visual stimuli. The 28 experimental words were divided into the four groups shown in Figure 3.

- A. Seven words; 1.5 mm line width (Group A)
- B. Seven words; 0.5 mm line width (Group B)
- C. Seven words with the first letter 1.5 mm in width and the remaining letters 0.5 mm (Group C)
- D. Seven words with the first letter 0.5 mm in width and the other four letters 1.5 mm (Group D)

In all four groups, the same number of words had the same first letters. Order of word presentation was random. The glass window that caused the words to be blurred moved at a rate of 11 mm per second.

Subjects were shown how to operate the blurring device and move the glass window in order to increase clarification of the blurred word. Every subject started with four practice words and was not shown the 28 experimental words until it was clear that he understood the task.

Figure 3 shows the mean distances the glass window had to travel in order for each subject to identify the words in a given group. Group A words were those in which all five letters were of the maximal line width of 1.5 mm. Although actual thresholds for Group A words varied for each subject, those thresholds were reduced to a common baseline for purposes of comparison.

An overall evaluation of Figure 3 shows that there was a consistent order in which subjects were able to identify the words. As seen by the common baseline, all subjects first identified the words in Group A. The

next identification threshold was for Group C words, which had maximal thickness of 1.5 mm; for the next four letters the thickness was 0.5 mm.

With the exception of S-4 and S-6, the third threshold was for Group B words. The final and longest threshold was for Group D words in which all five letters of each word were of the minimal 0.5 mm thickness. Once again the performances of S-4 and S-6 were a reversal of other subjects.

Two important features of the data seem worthy of emphasis. The first concerns the similarity in threshold level performances that existed between subjects: there were only two deviations from inter-subject performance consistency (S-4 and S-6's Group B and Group D thresholds were reversed). The second concerns the relatively large differences in threshold levels that existed between Group A words and words in the three other groups.

One important implication of these results is that teachers who are teaching word recognition should make sure that a word's first letter is part of the child's reading repertoire. This would seem especially true if a phonetic approach were employed and a child was learning to "sound out" the various letters as a first step to learning to identify the total word. These findings suggest that such phonetic "sounding out" of a word's letter might be unsuccessful if a child is unable to initiate the chain of verbal responses so necessary to the "sounding out" process.

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