Computerized perimetry: Possibilities for individual adaptation and feedback*

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Abstract. Computerized perimetry is often poorly accepted by the tested subjects, presumably because of sparse feedback and lack of adaptation to individual capacity. Several remedies are suggested, including visual response feedback, active correction of erroneous responses, various fixation prompts, and continuous adaptation to current reaction time. Intuitively intelligible result displays are also desirable. A novel format representing threshold level by symbol size may meet this need.

Introduction

The advantages of computerized perimetry are partly offset by imperfect subject performance and acceptance. Ten to 27.5 per cent of subjects do poorly in automatic examinations (Greve et al., 1977; Bobrow and Drews, 1982; Beck et al., 1985). Automatic perimetry is often perceived to be more tiring and difficult than the manual counterpart (Beck et al., 1985; De Jong et al., 1985; Lewis et al., 1985) and is rarely the subjects' examination of choice (Aulhorn and Durst, 1977). These deficiencies are presumably reflections of inadequate feedback and adaptation to individual capacity.

During the development of a novel computer-graphics visual field screener it was found that there are several opportunities to create feedback and adaptation in computerized perimetry. While some of the proposals given in the following depend on the powers of computer graphics, others can easily be implemented also in ordinary computerized perimeters. Details of the new 'Ring Screener' itself, which derives its name from the shape of a new type of resolution target, are irrelevant here (cf. Frisén 1986, 1987).

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Adaptation to individual capacity

This involves primarily relieving uncertainty of perception, allowing correction of errors, letting the subject set his own tempo, and permitting rest at will.

Uncertainty of perception is inherent in the threshold approach of quantitative perimetry. It is compounded by internal noise in the visual system, an intrinsic activity that sometimes mimics the appearance of test targets. Both sources of uncertainty can be dealt with simultaneously, in two different ways, singly or in combination. One is to replace the ordinary type of perimetric target with one that presents a more distinctive appearance at threshold, e.g., a high-pass spatial frequency filtered resolution target (Fig. 1) (Frisén, 1986, 1987). Another means of alleviating uncertainty is to supply immediate visual confirmation after each legal response (Fig. 1). In ordinary perimeters, this can be done by briefly showing the target again in the same location, but this time with a clearly supraliminal intensity. Such a ‘ticket’ allows the subject to check the coincidence between perceived and actual locations, and helps to establish a stable criterion level.

It is a natural extension to arrange for immediate deletion of erroneous responses. An error is best signalled by holding down the response button. By sensing the duration of each button depression, the computer can distinguish a normal response from an error signal, and act accordingly. Precisely like legal responses, deletion requests should be acknowledged, audibly and/or visually. The Ring Screener replaces the fixation mark with a ‘Pause’ text, and suspends testing until the button is pushed again. This gives the subject unlimited time to regain composure after the blunder.

The Ring Screener also uses the same signal (extended button actuation) to recognize rest requests. While it may appear desirable to differentiate signals for rest and error correction, experience dictates that this is too difficult a task for many subjects. Actually, there is no real disadvantage in using the same procedure for both requests. It is true that one observation will be deleted even if a request concerns rest rather than error correction. However, it is likely that fatigue may have influenced results for some time before a request for rest finally is made. Hence, there is reason to delete additional observations in this case. The Ring Screener uses the length of the rest interval as a means of differentiation. An interrupt lasting less than 5 seconds is assumed to mean a request for error correction, and leads to deletion of the last observation. Longer interrupts are taken as evidence of fatigue, and causes deletion of the last three observations. Count is kept of the number of deletions and serves as an index of individual capacity.