The Effects of Constant, Force-Drop and Variable Duration Training on Increasing the Useful Field of View

Kathleen Marie O'Connor

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THE EFFECTS OF CONSTANT, FORCE-DROP
AND VARIABLE DURATION TRAINING ON INCREASING
THE USEFUL FIELD OF VIEW

A Thesis
Presented to
the Faculty of the Department of Psychology
Western Kentucky University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
Kathleen Marie O'Connor
April, 1991
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THE EFFECTS OF CONSTANT, FORCE-DROP AND VARIABLE DURATION TRAINING ON INCREASING THE USEFUL FIELD OF VIEW

Kathleen M. O'Connor April, 1991 60 pages

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The Useful Field of View (UFOV) is the entire area in which information can be gathered without moving the head or eyes. It is generally found that the size of the UFOV shrinks with age. Additionally, research has shown that simple practice on the UFOV task can increase the size of the UFOV. However, simple practice may not be the most effective strategy for increasing the UFOV. The present study examined whether training directed toward a specific basis of UFOV loss (slower speed of processing) is more effective than simple practice at increasing field size.

Individuals received one of three types of training. Individuals who received variable duration training first performed the UFOV task at a pre-determined duration. Every time the individual obtained a field size of 30 degrees or greater across 2 consecutive blocks of trials, the duration of the visual display was decreased 25 milliseconds.

Individuals who received force-drop training also initially performed the UFOV task at a pre-determined duration. On the third day of training, the duration of the visual display was decreased 25 milliseconds regardless of the
individual's performance. On the fifth day of training, the duration of the visual display was again decreased 25 milliseconds regardless of the individual's performance. Individuals receiving constant training simply practiced the task at the pre-determined duration across all days of training.

Consistent with past research, training improved peripheral localization performance. Further, improvement in peripheral localization performance was greatest in the distractor condition among individuals receiving variable duration training. Variable duration training may be a more effective strategy for increasing the UFOV due to its challenging nature. Specifically, since the duration of the visual display is directly linked to the individual's own performance, motivation and interest in the training task may be maintained for a longer period of time. Further, the heightened motivation and interest may facilitate a greater degree of learning in the training setting which in turn influences the amount of training that will be retained and utilized in real-world settings.
Chapter I
Introduction

As the population of adults aged 65 and over continues to increase, so does the number of older adults continuing to work and drive. Older adults are heavily dependent on an automobile for their independence and active lifestyle. In fact, people over age 65 make 80% of their trips and errands by car (Kosnik, Winslow, Kline, Rasinski & Sekuler, 1988). However, older persons are involved in more traffic convictions, accidents and deaths per mile driven than any other age group (Transportation Research Board, 1988). This fact, combined with the growing number of older drivers, has directed research toward the abilities necessary to prolong independence and enhance the quality of life of older adults.

One way in which older persons differ from younger persons is in their quality of vision (Kosnik et al., 1988). Previous research has failed to show a relationship between driving performance and the visual capabilities that decline with age. One reason for this failure is that visual assessments are usually made under highly artificial conditions. Thus, environmental factors typically encountered when driving are minimized. For example,
environmental factors include moving objects, unpredictable stimulus events, highly visible objects in the presence of distracting clutter and the use of central and peripheral vision (Ball, Beard, Roenker, Miller & Griggs, 1988).

Sekuler and Ball (1986) developed a task which attempts to provide a more realistic assessment of visual performance by measuring the useful field of view (UFOV). Measures of the UFOV incorporate distractors and a secondary focal task in a peripheral localization test. In comparison to standard visual tests, the UFOV task is more predictive of older adult's difficulties with peripheral vision (Ball et al., 1988).

The size of the UFOV varies across individuals and situations. Factors known to decrease the size of the UFOV include the presence of a central task (Leibowitz & Appelle, 1969), increased cognitive difficulty of the central task (Ball et al., 1988; Williams, 1982), additional stimuli in the visual field (Ball et al., 1988; Mackworth, 1965; Scialfa, Kline & Lyman, 1987, Sekuler & Ball, 1986) and similarity between the target and the background distractors (Bloomfield, 1972; Drury & Clement, 1978). However, some of the age-related loss in the UFOV can be recovered with practice on the UFOV task (Ball, 1985; Ball et al., 1988; Jackson, 1990; Sekuler & Ball, 1986).

Three possible causes for the age-related constriction in the UFOV were investigated (Ball, Roenker, Bruni,
Jackson, Dahl & Rowan, 1990a; Ball, Roenker & Bruni, 1990b). These were reduced ability to divide attention between central and peripheral vision, reduced salience of a target against its background (distractor effect), and slower speed of processing (duration effect). Results revealed that young adults, compared to middle-aged and older adults, do not experience significant field loss due to the three effects. However, on the average, both middle-aged and older adults experience UFOV loss due to the three effects with the greatest reduction attributed to slower speed of processing (Ball et al., 1990a; Ball et al., 1990b). Additional analyses revealed that bases for field loss varied among individuals.

A slower speed of processing is the most prevalent of the three effects in middle-aged and older adults (Ball et al., 1990a). However, not all older adults are affected. Additionally, the degree of shrinkage in UFOV size varies among individuals. Some adults experience a field loss of only 5 degrees due to slow speed of processing while others experience a 35 degree field loss.

Four studies have looked at the effect of training on the UFOV and provide evidence that field size can be increased (Ball, 1985; Ball et al., 1988; Jackson, 1990; Sekuler & Ball, 1986). However, the training methods employed may not be the most efficient. Training in these studies consisted of simple practice on the UFOV task with
the duration of the stimulus presentation held constant. In light of recent evidence demonstrating that UFOV loss has different bases in different individuals, training may be improved taking this new information into account. Training to increase the UFOV may be improved if it is tailored to an individual's specific problem.

Past studies demonstrate that practice is an effective strategy for expanding the UFOV. The present study will examine whether training directed toward the specific problem of slower speed of processing is more efficient than general practice for increasing the UFOV.
Chapter II

Literature Review

Due to medical and technological advances as well as the emphasis placed on better diet and exercise, people are living longer, healthier lives. It follows that as the population of older adults continues to increase, so does the number of older adults continuing to drive. It is estimated that since the end of World War II, the percentage of drivers aged 65 and older has increased from 5 to 15% (Kosnik et al., 1988).

Driving is considered a privilege. However, a process such as aging may affect driving ability and be cause for this privilege to be taken away (Kline, 1986). Licensing agencies have a responsibility to protect the public from unsafe and incompetent drivers. However, driving skills of people over 55 vary widely (Transportation Research Board, 1988). Thus, restricting a person's driver's license on the basis of age alone is unfair as well as illegal. An understanding of the relationship between advanced aging and driving ability is essential before decisions regarding driving privileges can be made.

Aging and Driving

Kline (1986) states that as a group, older drivers do
not significantly contribute to the overall number of auto accidents. However, older drivers (past 55 for men and 60 for women) are involved in more accidents and traffic violations per mile driven than any other age group. Furthermore, the risk of collision increases after the age of 70 (Transportation Research Board, 1988). In fact, drivers over age 85 have 40 wrecks per 1,000,000 miles driven while drivers aged 35 to 65 have only 4 wrecks in the same number of miles driven (Transportation Research Board, 1988).

When considering miles driven, older adults are involved in more auto accidents than younger adults. However, the accident profile of an older driver is unique. Specifically, older adults are more likely to be in accidents involving failure to heed signs, to give the right of way or to turn safely (Kline, 1986). They are usually not involved in accidents characteristic of younger adults, such as those caused by speeding or reckless driving. The types of auto accidents and violations of older adults indicate a difficulty in processing information from the periphery (Ball et al., 1988). Since the pattern of accident involvement of older drivers demonstrates a deficiency in visual performance, an understanding of how vision changes with aging is necessary.

Aging and Vision

It is now established that sensitivity throughout the
visual field declines with age (Ball, Owsley and Beard, 1990c; Jaffe, Alvarado and Juster, 1986; Johnson, Adams, Adams and Lewis, 1988). Jaffe, Alvarado and Juster (1986) investigated the age-related changes of 25 patients' visual field. Seventy-two spots differing in degree of visual angle from the central fixation point were projected onto a hemispherical shell. The luminance of the spots were varied and the point of detection was recorded. Results indicated that mean sensitivity at each point declined with increasing age. Further, sensitivity declined more rapidly in the points in the periphery than in the central points. Similarly, Johnson, Adams, Adams and Lewis (1988) report a general age-related reduction in sensitivity for the entire visual field with slightly greater deficits in the peripheral areas.

Although usually taken for granted, the safe operation of an automobile is dependent upon good peripheral vision and an adequate field of view. Despite the important role peripheral vision plays in driving performance, little research examines functional peripheral vision. Rather, much of the data on age-related changes in the visual field is collected through the use of perimetric tests.

Perimetric Measures

The visual field is the spatial area that is sensitive to light. Perimetric tests clinically measure the boundaries of an individual's visual field. For example, in
a kinetic perimetric test, the eye under examination fixates on a target at the center of a dimly lit hemispherical shell. The examiner projects a spot of light varying in size and intensity onto various points of the shell's inner surface. The spot is moved from the periphery to the central fixation point and the location at which the observer sees the spot is recorded.

Studies utilizing perimetric tests indicate that the borders (isopters) of the visual field constrict as an individual ages. Although these measures indicate an age-related degeneration in visual field size, they are not predictive of the visual problems older adults experience when driving (Ball et al., 1990c). Failure to find a relationship between perimetric tests and driving performance may be due to the way the tests measure vision loss. Recall perimetric tests measure sensitivity to a luminance target presented in isolation. Thus, tests are conducted under highly unnatural conditions minimizing environmental factors typically encountered when driving. Driving involves complex visual scenes including movement, identification or localization of highly visible objects in the presence of clutter and the simultaneous use of central and peripheral vision (Ball et al., 1988).

Perimetric tests of the visual field and other common visual assessments (i.e., contrast sensitivity, acuity) do not tap the nature of the problem older adults experience
when driving (Ball et al., 1990c). Older adult's difficulty in driving does not seem to be related to an absolute sensitivity loss. Rather, it is more likely their problems are related to a difficulty in processing complex cognitive/visual information (Ball et al., 1990c).

When an individual must 1) divide his attention to perform a central task and locate a peripheral target, and 2) perform these tasks among clutter, the task more closely resembles the typical driving scene (Ball et al., 1988). Assessing peripheral vision under these more realistic conditions may better predict driving performance of older adults. In fact, Avolio, Kroeck and Panek (1985) report a relationship between driving accidents and performance in a visual task incorporating clutter.

The visual field size that incorporates distractors and a conflicting central task is defined as the functional or useful field of view (Sekuler & Ball, 1986). Measures of the useful field of view (UFOV) provide an index of the total area of the visual field in which useful information can be acquired without eye or head movements (Sanders, 1970). The UFOV is a measure of the adequacy with which peripheral targets can alert a person's attentional system to relevant information and events in their environment (Ball, Roenker, et al., 1990a; Ball, Roenker & Bruni, 1990b).
UFOV Measures of the Driving Task

A recent analysis divides the driving task into four stages (Transportation Research Board, 1988). First, visual stimuli must be sampled and registered at the sensory level. Second, once registered, stimuli must be identified and localized. Third, once the stimuli are identified and localized, the driver must decide on a specific action to take. Finally, the driver must execute a motor response to carry out the decision.

The majority of screening tests used to issue licenses assess driving performance at the first two stages only (i.e., to what extent the stimulus is seen and identified or localized). Additionally, these stimuli are presented under highly artificial conditions ignoring the complexity of the typical driving scene.

In contrast, Ball, Owsley and Beard (1990c) state measures of the UFOV assess all four stages of the driving task. Recall the first stage involves the sampling and registering of visual stimuli. Measures of the UFOV provide estimates of sampling rate and size by varying target duration and eccentricity. The second stage involves recognizing and locating positions of various peripheral targets while simultaneously attending to events in central vision. The UFOV task also assesses this ability by requiring observers to locate a peripheral target embedded in clutter while concurrently performing a central task.
The third stage of the driving task requires the observer to make a cognitive decision about a specific action to take. In the UFOV task, the observer must both decide the location of the peripheral target and also decide on the central task. The fourth stage requires the observer to carry out the decision by making a motor response. The UFOV task requires a response from the observer identifying the location of the peripheral target.

Visual tasks including clutter and the simultaneous processing of central and peripheral information more closely resemble the important components of the typical driving task. In fact, Owsley, Ball, Sloane & Bruni (in press) established a link between the UFOV and vehicle accidents in older drivers. The relationship was strengthened by a measure of mental status but was not enhanced by any other standard visual assessments (i.e., visual acuity, contrast sensitivity, color discrimination). In comparison to standard visual tests, laboratory tests designed to measure the UFOV better predict older observer's difficulties with peripheral vision (Sekuler & Ball, 1986) and better predict older adults' vehicle accidents. These tests will now be further examined.

Measures of the UFOV

Measures of the UFOV typically involve the detection, identification or localization of peripheral targets against complex visual backgrounds. As such, the size of the UFOV
varies across individuals and situations (Ball et al., 1988). For instance, Leibowitz and Appelle (1969) report a constriction in the UFOV by the simple presence of a central task. That is, the accuracy with which subjects can report the presence of peripheral stimuli decreases when they must concentrate on a central (foveal) task. Furthermore, increasing the cognitive difficulty (load) of the foveal task decreases the size of the UFOV (Ball et al., 1988; Williams 1982).

A second factor known to decrease the size of the UFOV is additional stimuli in the visual field (Ball et al., 1988; Mackworth, 1965; Scialfa et al., 1987; Sekuler & Ball, 1986). Several studies have specifically examined age differences in the UFOV as a function of both distractors and foveal task.

First, Sekuler and Ball (1986) assessed peripheral localization errors in young (mean age of 25.1 years) and old (mean age of 68.8 years) subjects. Specifically, the researchers measured how well a schematic face could be localized in the presence of 47 box distractors both with and without a concurrent foveal task. The schematic face randomly appeared along any of eight meridia (four cardinal and four oblique) and at any of three distances or eccentricities from the center of the display: 5,10 or 15 degrees. Thus, the face appeared at any of 24 different locations throughout the visual display.
Both the central task and distractors had significant effects on peripheral localization performance. However, the presence of distractors had a greater effect in older subjects especially at increasing eccentricities (Sekuler & Ball, 1986).

Scialfa, Kline and Lyman (1987) compared young and older adults on a peripheral target identification task. They varied the number of distractors (0, 2 or 19) to investigate the effect of distractors on the UFOV. The researchers report large age differences when there are more peripheral distractors. Thus, it is concluded that the number of distractors does have an impact on identification performance in the periphery.

Finally, Ball, Beard, Roenker, Miller and Griggs (1988) examined the effect of distractors and concurrent foveal task on peripheral localization performance. They varied the number of distractors (0, 23 or 47) as well as levels of cognitive difficulty of the central task. In addition, Ball et al. extended the visual field to 30 degrees. The results illustrated an increase in localization errors with both center task and distractors, regardless of the number of distractors (either 23 or 47). This contradicts the findings of Scialfa et al. (1987).

The discrepancy between the Scialfa et al. (1987) study and those reported by Ball et al. (1988) may be due to the nature of the task. A peripheral localization task seems to
be accomplished in a preattentive mode. In other words, the field is searched in a simultaneous, parallel fashion. Hence, the number of distractors does not cause differences in performance. On the other hand, a peripheral identification task seems to require a serial search where additional stimuli must be compared item by item causing a decline in performance speed.

One final factor known to influence the size of the UFOV is similarity between the target and background distractors (Bloomfield, 1972; Drury, & Clement, 1978). Individuals easily detect targets that differ from nontargets in many features (i.e., color, length, width) because they "pop out" from the background context. As the conspicuity of the target decreases, so does the area able to be examined in one fixation (Ball et al., 1988).

Ball, Owsley, Beard, Roenker and Ball (1989) assessed test-retest reliabilities of the UFOV task for individuals over the age of 40. Each individual was evaluated in two sessions that were spaced at least two weeks apart. The composite reliability, based on all age groups, was .973.

Results of experiments measuring the UFOV as a function of age, distractors, and concurrent foveal task illustrate the size of the UFOV is not static. Therefore, it may be possible through training to increase the UFOV. Several studies report that sufficient practice on a peripheral localization task can expand the UFOV (Ball et al., 1988;
Sekuler & Ball, 1986). Before exploring these studies, transfer of training and the learning principles that facilitate positive transfer will be discussed.

Training and Facilitating Positive Transfer

Training is a planned learning experience designed to facilitate permanent changes in an individual's knowledge, skills or abilities (Noe & Schmitt, 1986). Generally, the concern in training is not the amount of material that is learned but rather the amount of material that will transfer to another environment. Positive transfer of training is the degree to which information learned in the instructional setting results in improved performance in the transfer setting (Noe & Schmitt, 1986).

The transfer settings in training studies employing measures of the UFOV are vast and not limited only to driving. By training observers on the UFOV task, difficulty with any tasks involving peripheral vision should decrease. Thus, training should transfer to many settings including crossing a busy street or locating a friend in a group of people. Since training should transfer to a wide variety of situations, it would be difficult to assess the extent of positive transfer. Therefore, studies examining effects of training on the UFOV concentrate on enhancing the degree of original learning in the instructional setting.

The amount of original learning in the training setting influences the amount of positive transfer that will occur
Goldstein, 1986; Hagman & Rose, 1983). In other words, the better the UFOV task is learned in the instructional setting, the more likely it will be retained and utilized in the transfer setting. Learning theory provides information about a number of principles that can be used to enhance the degree of original learning. By incorporating these principles, the trainer controls the external, environmental arrangements of the training program in order to facilitate learning (Wexley & Latham, 1981). Learning principles include practice, overlearning, knowledge of results or feedback and individual differences of the trainees. Each of these will now be further detailed.

When trainees are learning the UFOV task, they are given the opportunity to practice what is being taught. Related to the principle of active practice is overlearning. This principle refers to training that extends beyond the first successful performance of a task (Schendel & Hagman, 1982). Overlearning increases the length of time training material will be retained (Hagman & Rose, 1983; Mandler & Heinemann, 1956; Schendel & Hagman, 1982). That is, repeatedly pairing a stimulus with a response strengthens the bond between the two and makes the response less likely to be forgotten. Furthermore, if observers are trained beyond initial success, they are more likely to maintain the quality of their performance during periods of stress (Wexley & Latham, 1981). Then, despite stressful conditions
in the transfer setting (i.e., inclement weather or passengers), the observer will effectively perform the task.

A third principle essential to learning is knowledge of results or feedback. If the observer does not have specific information as to the accuracy of their performance, they may become frustrated and give up. For this reason, auditory feedback identifying a response as correct or incorrect is provided for each trial of the UFOV task.

Feedback facilitates performance in two ways (Ilgen, Fisher & Taylor, 1979; Locke, Cartledge & Keoppel, 1968). First, feedback cues subjects as to type or extent of errors. Subjects can use this information to correct errors and make necessary adjustments in their subsequent behavior. Second, feedback may motivate subjects to try harder and persist longer at a particular task.

Komacki, Heinzmann and Lawson (1980) examined the necessity of feedback in training. Specifically, Komacki and her colleagues assessed whether training alone was sufficient or if feedback was necessary to improve and maintain performance. Preceding the implementation of a safety training program, vehicle maintenance employees were performing safely one third to two thirds of the time. Following the first stage of training only, the percentage of safe incidents increased 9% over baseline. During the training and feedback stage, safe incidents improved 16% over the training only stage and 26% over baseline. Komacki
et al. (1980) conclude that training alone does not significantly improve and maintain performance. Rather, training plus feedback provides the most effective instructional strategy.

A final variable that facilitates learning is individualizing the training program. That is, observers should be differentially selected and assigned to training programs that suit their needs (Hagman & Rose, 1983). This in turn will maximize instructional payoff (Goldstein, 1986).

Training to Increase the UFOV

The UFOV is not static and under certain circumstances can be expanded through training. Several studies have demonstrated that the size of the UFOV can be increased through training and that this improved performance endures over several months.

Recall Sekuler and Ball (1986) measured how well a schematic face could be recognized in the presence of distractors while simultaneously performing a central task. Part II of their experiment examined whether practice would improve older subjects' peripheral localization performance and the duration of such improvements. The presentation time of the visual display remained constant for all observers. Subjects simply practiced the task in four daily 1-hour sessions. Results demonstrated that peripheral localization improved significantly with moderate amounts of
practice. After rest periods from 3 to 5 weeks, older subjects were retested. Performance on the retention test did not differ from performance on the last day of practice indicating that improvements in peripheral localization performance had persisted.

In a similar study, Ball et al., (1988) examined the effects of practice on peripheral localization performance. Training consisted of 5 days of practice on locating a peripheral target embedded in distractors with a concurrent foveal task. Before training, localization of the schematic face in the periphery became more difficult with increasing eccentricity. More importantly, older subjects had more difficulty with the task than either middle-aged or young observers. After training, all three age groups had expanded the UFOV by 10 degrees with practice.

Follow-up examinations were conducted for a period of 6 months to determine how long the improved localization performance would last. All subjects were retested on the task at 1-month intervals over a period of 6 months. Results showed the performance improvements persisted over the 6 month period.

**Basis for Reduced UFOV**

It is generally found that the size of the UFOV shrinks with age (Ball et al., 1988). Applying an information-processing model, Ball, Roenker, Bruni, Jackson, Dahl and Rowan (1990a) investigated three possible causes for the
age-related constriction in UFOV size. First, a reduced ability to divide attention was examined. This refers to the difficulty an individual encounters when attention must be divided to process events in both peripheral and central vision. The second cause examined was reduced salience of the target against its background (distractor effect). This refers to an individual's inability to disembed a relevant stimulus from irrelevant stimuli (Avolio et al., 1985).

Finally, slower speed of visual processing (duration effect) was examined. As people age, their speed of processing visual information decreases (Botwinick, 1984). As a result, older adults require more time to detect, identify or locate visual stimuli.

Ball et al. (1990a) examined the data on 86 individuals for whom measures of each effect were available. The adverse effect of each of the three problems was assessed by measuring the change in UFOV size. For example, to assess the effect of distractors, the UFOV was first measured without distractors and then again after the addition of distractors. If the UFOV shrunk 5 degrees or more, it was concluded that distractors had a high impact on the individual. If the UFOV did not shrink more than 5 degrees with the addition of distractors, it was concluded that distractors had a low impact on the individual. Similarly, if an individual's field size decreased by 5 degrees or more when the duration of the visual display was reduced by 50
milliseconds, it was concluded that duration had a high impact on the individual.

All three problems had a low impact on all young adults (age < 40). Divided attention and distractors had a high impact on 27% of the middle-aged group (age 41 – 59). Duration had a high impact on 45% of the middle aged group. The three problems had a greater impact on older observers (age > 60). Specifically, divided attention had a high impact on 47% of the old observers and distractors had a high impact on 58% of the old observers. Duration, or slowing of speed of processing had a high impact on 69% of the older observers. Clearly, middle-aged and older observers experience the greatest reduction in field size due to slower speed of processing.

Further analysis revealed that the basis for reduction in UFOV size varied across individuals. Specifically, some individuals experience divided attention, duration or distractor problems while others do not experience difficulties with any of the three problems. Further, the degree of shrinkage in UFOV size varies between individuals. Some adults experience a field loss of 5 degrees due to one or more of the effects while others experience a 35 degree field loss. Finally, the basis for reduced UFOV in some individuals is due to one particular effect (i.e., divided attention) while other individuals experience a reduced UFOV due to multiple effects (i.e., duration + distractors).
To sum, it is evident that individuals experience different degrees of UFOV loss and the bases for the loss vary from individual to individual. However, slower speed of processing, or a duration effect, is the most prevalent problem experienced in both middle-aged and older observers. The next section reviews evidence for a slowing of visual processes in the elderly.

Deficit in Speed of Visual Processing

As people age, their speed of visual processing decreases (Botwinick, 1984). Thus, older adults take more time to detect, identify and locate visual stimuli. Botwinick (1984) provides the theory of stimulus persistence to explain this finding. The stimulus persistence theory suggests the nervous system of the older person slows as it ages. It takes more time for stimulus information to travel through the nervous system. As a result, older people experience an increase in the visual persistence of stimuli.

Older persons' nervous systems recover more slowly from the effects of stimulation than younger persons' systems. Thus, the first stimulus takes longer to clear through the nervous system (even when it is no longer physically present) and is more susceptible to interference from a second stimulus (Botwinick, 1984). The first stimulus must be presented longer or the delay between two stimuli must be increased for older people to process the first stimulus.
Hertzog, Williams and Walsh (1976) demonstrate that stimulus persistence can be reduced with training. Subjects were presented two stimuli in close temporal succession. Trials began without an interstimulus interval (ISI) between the stimuli. The ISI was increased 2 milliseconds per trial until a criterion of four successive identifications of the first stimulus was achieved. The ISI at criterion is the critical ISI (ISIc). This is the length of time needed to recognize two stimuli as separate elements.

Following the identification of the ISIc, 60 practice trials were administered. The ISI used in the practice trials was the determined ISIc. After practice, the ISIc was redetermined. The sequence of determining ISIc, practice, and redetermining the ISIc was repeated across 5 consecutive days.

Results showed practice was successful in reducing the time needed to recognize two stimuli as separate elements. Furthermore, both young and old observers reduced their times to a similar extent. The mean reduction in ISI for young people was 29 milliseconds and 33 milliseconds for old people.

Hypotheses
The present study is concerned with expanding the size of the Useful Field of View. As previously stated, practice on the UFOV task is an effective strategy for increasing a person's field size. However, it may not be the most
efficient strategy. In light of recent evidence demonstrating the individualistic nature of UFOV loss, training may be improved taking this new information into account. If training were directed toward a specific basis for UFOV loss, it should be more effective than general practice at increasing field size. It is this hypothesis that will be investigated in the present study.

The most prevalent basis for field loss experienced by older adults is slow speed of processing. In fact, 69% of adults aged 60 and over experience a reduction in field size due to this effect. Since many older adults are plagued with this problem, training will be directed toward reducing the effects of slower speed of processing thereby increasing the UFOV at a faster rate than general practice.
Chapter III

Method

Subjects

Twenty-one subjects aged 55-75 participated in the present study. Each participant had a valid drivers license and at least 20/25 corrected vision. Prior to their participation in the study, individuals were interviewed to assess their ocular history (i.e., cataracts, macular degeneration, glaucoma). This procedure was necessary to ensure that any observed individual differences were due to functional changes in vision rather than disease. A Subject Information Form was used to record participants' responses to inquiries of ocular disease as well as demographic information. Recruitment of subjects consisted of phone solicitation of older and middle-aged adults in the Bowling Green area.

The following procedure was applied to each person expressing an interest in participating in the study. First, an interview was conducted with each participant to assess their history of ocular disease. If an individual indicated that they had a history of ocular disease, they were informed that their participation was not possible due to the nature of the study.
Next, participants were given a description of the study and were told what was expected of them. They were asked to sign an Informed Consent Sheet and were told that they would be compensated for each experimental session they attended.

Finally, near acuity for each participant was measured at the experimental viewing distance (23.5 centimeters) using the Bailey-Lovie Near Chart. To ensure that participants would be able to see the central and peripheral targets, only those able to read the line of the chart corresponding to 20/25 vision (line 5) were asked to continue participation.

Stimuli

Each trial consisted of four successive displays controlled by a Zenith 386 computer. The stimuli were presented on a large NEC color monitor (20 inch diagonal). The first display was an outline of a box, 6 degrees x 6 degrees. This stimulus served to direct the observer's attention to the center of the screen and had a duration of 1.5 seconds.

The second display contained the target (either the center target alone or both the center and peripheral targets). It immediately followed the offset of the outline box.

The third display was a randomly patterned mask which was brighter than the stimulus. It was presented for a
duration of 500 milliseconds. The mask was presented to destroy any residual afterimage produced by the target image. There was not an interstimulus interval or time lapse between the stimulus display and the mask display.

The final display consisted of eight equally spaced spokes arranged in a radial pattern. Each spoke was labeled with a digit from one to eight at the end furthest from the center of the display. This display remained visible until the participant made a response. Two seconds elapsed between the subject's response and the onset of the next trial.

There were two types of center targets. The first was a cartoon likeness of a car, 6 degrees x 2 degrees in size. The second center target was a cartoon likeness of a truck which was the same size as the car.

The peripheral target was also a cartoon likeness of a car. The car used as the peripheral target was identical in size and luminance as the car presented as the center target. The peripheral target appeared concurrently with the center target (either a car or a truck) in one of 24 possible radial localizations. These locations were along the eight meridia (four cardinal and four oblique) at three different eccentricities (10, 20, 30 degrees) or distances from the center of the display. The peripheral target appeared randomly, yet equally often in each of the peripheral locations.
Forty-seven outline triangles (to mimic yield signs) served as distractors in the display. The triangles were located at every possible target position along the eight axes (except the position filled by the peripheral target) as well as the positions in between.

**Procedure**

**Screening phase.** A screening phase consisting of three subtests was administered to all participants. The screening test was a tool to aid in the assessment of UFOV loss and in the diagnosis of an individual's particular basis or bases for the loss (distractors, duration or divided attention).

Ball, Roenker & Bruni (1990b) found that the relationship between localization errors and target eccentricity is usually linear. The researchers further point out that when this relationship is not linear, it is usually due to floor and ceiling effects. A floor effect is the situation in which the participant makes very few or zero correct localizations at each eccentricity. In this case, the participant is assigned a UFOV of 5 degrees which corresponds to the radius required to perform the center task alone. A ceiling effect is the case of very good or perfect localizations at each eccentricity. Here, participants are assigned a UFOV of 35 degrees. This field size corresponds to the radius of the entire display. In all other cases, the best fitting line reflecting the
relationship between eccentricity and localization errors is used to compute the UFOV (Ball, Roenker & Bruni, 1990b). The size of the UFOV is defined as the area within which participants can correctly locate the peripheral target 50% of the time.

In subtest 1 of the screening phase, each participant was asked to indicate whether a presented stimulus was a car or a truck. After each stimulus presentation, the word, "CAR" appeared on the left side of the computer screen and the word, "TRUCK" appeared on the right side of the screen. The participant moved a joystick toward the word which identified the stimulus just presented. Thus, if the truck was presented, the participant moved the joystick toward the word, "TRUCK."

The duration of the visual display was varied in order to determine the time required to correctly identify the center target 75% of the time. Specifically, the duration of the visual display began at 240 milliseconds for each subject. When the subject made two consecutive correct identifications of the stimulus, the duration of the visual display decreased 37.5 milliseconds. The duration of the visual display decreased 37.5 milliseconds every time the subject made two consecutive correct identifications until the subject made one incorrect identification. Once the subject made the first incorrect identification, the duration of the visual display increased 17.5 milliseconds.
After the first incorrect identification, the duration of the visual display increased 5 milliseconds for every incorrect identification and decreased 5 milliseconds for every two consecutive correct identifications. The aim of the first subtest was to determine the time required to perform the center task alone.

Subtest 2 required the participant to make 2 responses. The observer first determined whether the stimulus presented in the center of the screen was a car or a truck. Second, the observer located the position of the peripheral target, the car. The peripheral target was presented without the triangle distractors. The participant's performance in subtest 2 was assessed across 6 blocks of 15 trials each. The duration of the visual display varied with each block of trials and ranged from 40 milliseconds to 240 milliseconds. The duration of the visual display increased and decreased in 40 millisecond jumps searching for the duration in which the subject obtained a field size of 5 degrees and the duration at which the subject obtained a field size of 35 degrees.

Specifically, the first block of trials in subtest 2 began at 80 milliseconds. If the subject obtained a field size of 35 degrees, the duration of the visual display decreased 40 milliseconds. The subject then performed the task at 40 milliseconds and the field size at this duration was recorded.
If the subject obtained a field size of 5 degrees at 80 milliseconds, the duration of the visual display increased 40 milliseconds. The subject then performed the task at 120 milliseconds and the field size obtained at this duration was recorded. If the subject obtained a field size of 35 degrees at 120 milliseconds, subtest 2 ended. If the subject obtained any field size less than 35 degrees, the duration of the visual display increased 40 milliseconds. This process continued until the subject obtained a field size of 35 degrees or until the duration of the visual display reached 240 milliseconds.

If the subject obtained a field size less than 35 degrees but greater than 5 degrees at 80 milliseconds in subtest 2, the duration of the visual display increased 40 milliseconds. If the subject did not obtain a field size of 35 degrees, the duration of the visual display again increased 40 milliseconds. This process continued until the subject obtained a field size of 35 degrees or until the duration of visual display reached 240 milliseconds. At this point the duration of the visual display decreased to 40 milliseconds and the field size obtained at this duration was recorded.

The aim of subtest 2 was to determine the time required to perform a divided attention task. Durations obtained in subtest 2 could be compared to durations obtained in subtest 1 to assess the effect of divided attention.
Finally, subtest 3 was the same as subtest 2 except that the peripheral target was embedded in 47 distractors to make it less conspicuous. The participant first identified whether the stimulus presented in the center box was a car or a truck. Secondly, the participant identified the location of the peripheral target. The peripheral target, the car, was embedded in 47 triangle distractors. Again, participant's performance was assessed across 6 blocks of 15 trials each. The duration of the visual display varied from block to block and ranged from 40 milliseconds to 240 milliseconds. The duration of the visual display began at 160 milliseconds and then increased or decreased by 40 milliseconds depending on the field size obtained in the same fashion as in subtest 2.

The aim of subtest 3 was to determine the effect of distractors. Specifically, the field sizes obtained in subtest 2 (task without distractors) could be compared to the field sizes obtained in subtest 3 (task with distractors) at each duration to assess the effect of distracting stimuli on peripheral localization performance.

Subjects who did not experience UFOV loss of greater than 5 degrees due to any of the three effects were not included in the training phase of the study.

Training phase.

The appropriate duration to begin training was individually determined for each subject by looking at their
data from subtest 3. Specifically, the function between the duration of the visual display and peripheral localization performance was examined to determine the point at which the function began to rise off the floor (chance performance). For example, one subject had a field size of 5 degrees at 120 msec., a field size of 5 degrees at 160 msec., and a field size of 12.5 degrees at 200 msec. The subject began to perform the task at more than chance level at 200 msec.; therefore 200 msec. was chosen as the point to begin the subject's training.

Each of the 21 subjects were matched on the characteristics of starting duration and field size at that duration. Participants were then randomly assigned to one of three training groups: constant, force-drop or variable duration. For example, three subjects had a starting duration of 160 milliseconds. The first subject had a field size of 14.99 degrees, the second subject had a field size of 15.00 degrees and the third subject had a field size of 15.24 degrees. These three subjects had the same start duration and similar field sizes at this particular duration. Thus, each subject was randomly assigned to either constant training, force-drop training or variable duration training.

The 7 individuals assigned to constant training were administered 6 blocks of 24 trials each across five daily sessions. The task this group practiced was similar to the
task outlined in Subtest 3. Individuals concurrently performed the center task while locating the peripheral target embedded in 47 distractors. The duration of the target display was held constant across all 6 blocks and across all 5 days at the subject's individually determined starting duration.

The seven participants in the force-drop training group were also administered 6 blocks of 24 trials each across five daily sessions. Similar to the constant training group, individuals concurrently performed the center task while locating the peripheral target embedded in 47 distractors.

On the first and second day of training, participants of the force-drop training group practiced the task at the duration time individually determined for them. On the third day of training, the duration of the visual display was "dropped" or decreased by 25 milliseconds. On the fourth day, the duration of the visual display was held constant across all six blocks of trials at the speed of the previous day. On the fifth day of training, the duration of the visual display was again decreased by 25 milliseconds. Thus, on the fifth day of training, participants were practicing the task 50 milliseconds faster than on the first day of training.

Finally, the 7 individuals receiving variable duration training concurrently performed the center task while
locating the peripheral target embedded in 47 distractors.

Six blocks of 24 trials each were administered to participants across five daily sessions. If the participant made 50% correct localizations or more at each eccentricity (field size of 30 or above) for two consecutive blocks, the duration of the stimulus presentation was decreased by 25 milliseconds. If the observer did not reach the criterion and was administered all 6 blocks of trials, they began the next training session at the same speed. Each time the participant reached a field size of 30 degrees or greater across two consecutive blocks of trials, the duration of the visual display was decreased by 25 milliseconds.

Table 1 illustrates the program design for the three training groups in terms of starting durations and number of trials performed in each training session. Ten days after

Table 1. Program Design For The Three Training Groups

<table>
<thead>
<tr>
<th>Session</th>
<th>Constant</th>
<th>Force-drop</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trials: 144 Speed: X</td>
<td>Trials: 144 Speed: X</td>
<td>For each training session:</td>
</tr>
<tr>
<td>2</td>
<td>Trials: 144 Speed: X</td>
<td>Trials: 144 Speed: X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Trials: 144 Speed: X</td>
<td>Trials: 144 Speed: X-25 msec</td>
<td>Trials: 144 Speed: X-25 msec</td>
</tr>
<tr>
<td>4</td>
<td>Trials: 144 Speed: X</td>
<td>Trials: 144 Speed: X-25 msec</td>
<td>if field size &gt;=30 for 2 consecutive blocks</td>
</tr>
<tr>
<td>5</td>
<td>Trials: 144 Speed: X</td>
<td>Trials: 144 Speed: X-50 msec</td>
<td></td>
</tr>
</tbody>
</table>

X = individual's start duration in milliseconds
their last day of training, each subject returned to the lab and performed the screening test. This procedure was necessary to assess the increase in field size due to training. Table 2 illustrates the training design and subtests performed in both the pre-test and post-test as well as in the 5 training sessions.

Table 2. Subtests Performed in Pre-test, Post-test and in Training

<table>
<thead>
<tr>
<th>Subtest 1</th>
<th>Subtest 2</th>
<th>Subtest 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Training 1</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Day Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

It was hypothesized that the force-drop and variable duration training strategies would be more effective than the constant training strategy at increasing an individual's UFOV. Further, it was hypothesized that the variable duration training strategy would be the most effective strategy since it is individualized training directly linked to each individual's own performance.

Results

As stated previously, there were 7 subjects in each training group. Mean age for participants in the constant, force-drop and variable duration training groups were 67.14, 63
and 64.57 respectively. Further, 4 females and 3 males received constant training, 5 females and 2 males received force-drop training and 3 females and 4 males received variable duration training.

In order to assure that each training group started at the same level of performance across training conditions, subjects were matched on the characteristics of field size and starting duration. The means and standard deviations for these variables are presented in Table 3.

Table 3. Means and Standard Deviations For Starting UFOV's and Starting Durations.

<table>
<thead>
<tr>
<th></th>
<th>Constant</th>
<th>Force-drop</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Duration in msec.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>124.00</td>
<td>141.00</td>
<td>163.57</td>
</tr>
<tr>
<td>SD</td>
<td>42.41</td>
<td>38.77</td>
<td>42.47</td>
</tr>
<tr>
<td>Field Size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>17.46</td>
<td>16.52</td>
<td>17.55</td>
</tr>
<tr>
<td>SD</td>
<td>3.98</td>
<td>2.36</td>
<td>2.83</td>
</tr>
</tbody>
</table>

Main effects of distractors (presence or absence of triangle distractors), duration (40, 80, 120, 160, 200 and 240 msec for the target display), pre-post (pre-training test versus post-training test) and training group (constant, force-drop and variable duration) were analyzed with a repeated measures ANOVA. The method of training was the only between groups variable (See Table 4).

The ANOVA revealed a main effect of distractors ($F (1,18) = 460.55, \ p < .01$), indicating the task was
significantly easier in the absence of distractors. There was also a main effect of duration \((F(5,90) = 17.53, p < .01)\) on peripheral localization performance indicating that the task was significantly easier at the slower durations. Finally, a main effect of pre-post indicated that training led to a significant reduction in peripheral localization errors \((F(1,18) = 44.15, p < .01)\). The absence of a main

<table>
<thead>
<tr>
<th>Source</th>
<th>Sums of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>F</th>
<th>Sign. of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train Group (T)</td>
<td>20.18</td>
<td>2</td>
<td>10.09</td>
<td>.08</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>2207.77</td>
<td>18</td>
<td>122.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distractors (D)</td>
<td>28367.70</td>
<td>1</td>
<td>28367.70</td>
<td>460.55</td>
<td>.000</td>
</tr>
<tr>
<td>D x T</td>
<td>463.02</td>
<td>2</td>
<td>231.51</td>
<td>3.76</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>1108.72</td>
<td>18</td>
<td>61.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Post (P)</td>
<td>3643.98</td>
<td>1</td>
<td>3643.98</td>
<td>44.15</td>
<td>.000</td>
</tr>
<tr>
<td>P x T</td>
<td>439.58</td>
<td>2</td>
<td>219.79</td>
<td>2.66</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>1485.82</td>
<td>18</td>
<td>82.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D x P</td>
<td>1279.45</td>
<td>1</td>
<td>1279.45</td>
<td>42.30</td>
<td>.000</td>
</tr>
<tr>
<td>D x P x T</td>
<td>376.85</td>
<td>2</td>
<td>188.40</td>
<td>6.23</td>
<td>.009</td>
</tr>
<tr>
<td>Error</td>
<td>544.48</td>
<td>18</td>
<td>30.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration (X)</td>
<td>10520.62</td>
<td>5</td>
<td>2104.12</td>
<td>120.00</td>
<td>.000</td>
</tr>
<tr>
<td>X x T</td>
<td>226.36</td>
<td>10</td>
<td>22.64</td>
<td>1.29</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>1578.15</td>
<td>90</td>
<td>17.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D x X</td>
<td>5767.88</td>
<td>5</td>
<td>1153.58</td>
<td>55.91</td>
<td>.000</td>
</tr>
<tr>
<td>D x X x T</td>
<td>258.52</td>
<td>10</td>
<td>25.85</td>
<td>1.25</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>1856.82</td>
<td>90</td>
<td>20.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P x X</td>
<td>157.19</td>
<td>5</td>
<td>31.44</td>
<td>2.02</td>
<td>N.S.</td>
</tr>
<tr>
<td>P x X x T</td>
<td>248.42</td>
<td>10</td>
<td>24.84</td>
<td>1.60</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>1400.86</td>
<td>90</td>
<td>15.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D x P x X</td>
<td>852.60</td>
<td>5</td>
<td>170.52</td>
<td>8.64</td>
<td>.000</td>
</tr>
<tr>
<td>D x P x X x T</td>
<td>371.36</td>
<td>10</td>
<td>37.14</td>
<td>1.88</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>1776.07</td>
<td>90</td>
<td>19.73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
effect of training group suggests that improvement on peripheral localization performance was equivalent among each of the three training groups.

In addition to distractor, duration and pre-post main effects, the distractor x pre-post interaction was also significant ($F(1,18) = 42.3, p < .01$). Mean field sizes before and after training for the distractor x pre-post interaction are presented in Table 5.

Table 5. Mean Field Sizes Before and After Training

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Distractors</td>
<td>32.81</td>
<td>35.00</td>
</tr>
<tr>
<td>With Distractors</td>
<td>14.62</td>
<td>23.18</td>
</tr>
</tbody>
</table>

After graphing the results of participant's pretest and posttest performance in both distractor conditions (with and without distractors), it was observed that a ceiling effect was the basis of the interaction. In other words, all participants could perform the peripheral localization task with few or zero errors in the absence of distractors before training. Thus, very little improvement was observed in the no distractor condition since everyone was able to successfully do the task before training.

The distractor x pre-post x training group interaction was also significant ($F(2,18) = 6.23, p < .009$) indicating improvement was greater for a particular training group. Specifically, improvement was found to be significant for
the variable duration training group in the distractor condition only (Tukeys, \( p < .05 \)). Further, improvement in the constant and force-drop groups in the distractor condition was not significantly different than zero. Mean field sizes before and after training for each group in the distractor condition are presented in Table 6.

The distractor x duration interaction was also significant (\( F(5,90) = 55.91 \), \( p < .01 \)). Figure 1 illustrates the linear functions between UFOV and

Table 6. Mean Pre-test and Post-test UFOV's For Constant, Force-drop and Variable Duration Training Groups

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Degree of Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>17.04</td>
<td>23.72</td>
<td>6.68</td>
</tr>
<tr>
<td>Force-drop</td>
<td>14.95</td>
<td>20.98</td>
<td>6.03</td>
</tr>
<tr>
<td>Variable</td>
<td>11.87</td>
<td>24.81</td>
<td>12.94</td>
</tr>
</tbody>
</table>

duration for both the condition with distractors and the condition without distractors.

Finally, the distractors x pre-post x duration interaction was significant (\( F(5,90) = 170.52 \), \( p < .01 \)). After graphing the results, it was observed that a ceiling effect in the no distractors condition was driving the interaction. In other words, in the absence of the triangle distractors, all participants were able to locate the peripheral target with few or zero errors. Hence, training was not of great value since everyone was able to do the
task before training. The post-test measure, employing distractors, was further broken down for each training group (See Figure 2). This was done to assess differences between the three groups at each of the six durations. No significant differences were found among the three groups at any of the six durations (Tukeys, p < .05).
Figure 1. Linear Functions Between UFOV and Duration for Distractor and No Distractor Conditions
Figure 2. Duration X Pre-post Interaction
Broken Down By Training Group
Chapter V

Conclusions

Previous studies have shown that the size of the Useful Field of View can be increased through training (Ball, 1985; Ball et al., 1988; Sekuler & Ball, 1986). Specifically, these studies have shown that simple practice on the UFOV task results in improved peripheral localization performance.

The results of the present study were consistent with these findings. However, the present study further investigated the effectiveness of training by comparing simple practice on the UFOV task to two training strategies (force-drop and variable duration) directed toward a specific basis of UFOV loss, namely slower speed of processing. It was hypothesized that training directed toward the problem of slower speed of processing would be more effective than simple practice for increasing the UFOV.

Overall, mean field sizes of subjects in the three training groups increased after the implementation of training. However, the lack of a main effect of training method indicates that all three training strategies may be equally as effective at increasing the UFOV.
Although no significant differences were found between training groups across all post-test conditions, improvement in peripheral localization performance was greatest for the variable duration training group in the distractor condition (See Table 6). Note that subjects receiving variable duration training had the lowest mean field sizes before training and the highest mean field sizes after training.

Variable duration training may be a more effective strategy for increasing the UFOV because of its challenging nature. Specifically, the duration of the visual display is directly linked to each subject's individual performance. Hence, the more correct peripheral localizations made by the subject, the less time the subject has to view the visual display and the more difficult the task becomes. Subjects may be motivated knowing that the better they perform, the more difficult and challenging the task.

In contrast, the force-drop method takes the control and individualization of training away from the subject. The duration of the visual display decreases on the 3rd and 5th day of training regardless of the subject's own individual performance. Thus, as daily training continues, the subject may become less interested and motivated in the UFOV task. This theory may explain why the degree of improvement is smallest in the force-drop training group.
Recall that one factor that facilitates transfer of training is individualizing the training program. This should begin with the determination of initial durations of the visual display for each subject. In the present study, initial durations were determined by examining the function between duration of the visual display and peripheral localization performance. This was done to determine the point at which the function began to rise off the floor (chance performance).

A more individualized method for determining the point to begin training may be first, plot the function between duration and localization performance across the six durations and then make a decision to begin training at a point where the slope of this function is somewhat flat. It may be a more effective strategy if a subject begins training at a slower duration time in order to grasp the concept.

It is possible to increase the UFOV through training. Therefore, older drivers who report problems in activities involving the use of peripheral vision may be able to improve their performance on these activities through the UFOV training task. One practical advantage of this finding is that insurance companies may be able to offer lower rates to older drivers in exchange for training on the UFOV task.
References


Appendix

Individual Performance of Subjects

Across Pre-test, Training and Post-test
Constant Training
S.C. (61)

Constant Training
B.S. (65)

Constant Training
J.D. (62)
Force-Drop Training
D.M. (66)

Force-Drop Training
H.S. (61)

Force-Drop Training
J.R. (64)
Variable Duration Training
M.R. (55)

Variable Duration Training
V.M. (67)

Variable Duration Training
W.M. (65)
Variable Duration Training
D.B. (63)

Variable Duration Training
L.S. (68)

Variable Duration Training
J.S. (67)

Variable Duration Training
A.D. (67)