



REPORT: A STUDY ON THE TESTING AND TRAINING OF DYNAMIC VISUAL SKILLS  
AND THE TRANSFERENCE TO JOB PERFORMANCE SKILLS

BY

THE NATIONAL INSTITUTE FOR SPORTS VISION INCORPORATED

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THIS IS A CONDENSED VERSION ON A MORE COMPREHENSIVE  
REPORT WHICH CAN BE MADE AVAILABLE ON REQUEST.

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## OBJECTIVE/HYPOTHESIS

1. To evaluate the Dynamic Visual Skills and Information Processing Abilities of the RCMP Special Emergency Response Team (S.E.R.T.). These consist of:
  - Eye-Hand Coordination
  - Speed and Span of Recognition
  - Peripheral Awareness
  - Visual Reaction Time
  - Anticipation Timing
  - Decision-making Skills - including Speed of Processing and Organization
  - Concentration
  - Performance Under Stress
2. To institute the NISV training programme designed to improve these skills and subsequently measure the improvement.
3. To aid in the set-up of duty/job related tests (to be administered concurrently by the RCMP) which will show that improving dynamic visual skills will transfer directly to performance on the job:
  - The member will absorb more information at a glance; will process that information faster and more accurately; and will initiate a response faster.
  - The ensuing gross physical movements will be faster and more precise.
  - Reactions to peripheral action will be faster and judgements more accurate.
  - Concentration levels will improve and performance levels will be less affected by stress.

## OVERVIEW

### 1. SET-UP

Two mirror-image groups will be used in the study; one - the test group; and the other - the control group. The test group ("Blue") will participate in both NISV and job related testing; the control group ("Gold") will participate in job related tests only (see RCMP protocol for detailed description of group participants).

The testing will take place at the RCMP Dwyer Hill Training Centre in Richmond, Ontario.



## 2. DURATION

(A) The Initial Evaluation of skill levels will take place over a two week period (October 30th to November 10th, 1989). Each participant will take part in 10 sessions.

(B) The Training Program will commence immediately after completion of the evaluation, and continue 5 days per week for a period of 3 months (November 13th to February 28th, 1990).

(C) The Initial Evaluation of the control group (Gold) will be completed after February 28th, 1990, to ensure that starting skill levels of both groups are approximately equal.

## 3. VISUAL SCREENINGS

These will be administered by a representative from the Division Medical Offices to all participants (Blue and Gold Groups), during the first two days, to ensure that there are no gross visual deficiencies present. Tests will include; Acuity (using the Snellen Chart); Colour-blindness (using Ishahara Plates); Stereopsis (using the Fly Test); Accommodation (using the Brock String).

## 4. NON-DISCLOSURE AGREEMENT

These will be entered into with each participant in an effort to minimize the confidence variable which may give the trained group an advantage. See Appendix 5.

## METHOD/PROCEDURE

### 1. INITIAL EVALUATION - CONDUCTED BY NISV TRAINER

Each participant will have 10 sessions (each is approximately 15 minutes in duration) and will complete the following test procedures:

#### A: Reaction Times:

1. Initial Visual Reaction
2. Motor Response Time

Tests are completed using both right and left hands. These include 8 repetitions of 1, 4 and 8 choice responses.

#### B: Speed And Span Of Recognition (Static):

1. 5 digit static flashes @1/100 (14 repetitions)
2. 6 digit static flashes @1/100 (14 repetitions)

C: Dynavision 2000 Runs:

1. Mode "A" (stationary) (8 runs)
2. Mode "B" @.75 second (8 runs)
3. Mode "B" @.5 second (8 runs)
4. Mode "B" @.75 sec. with 5 digit flash (12 per run) - 1 @.75 sec. and 1 @.1 sec.  
Mode "B" @.75 sec. with 6 digit flash - 1 @.75 sec. and 1 @ .1 sec.  
Mode "B" @.5 sec. with 5 digit flash - 1 @ .75 sec. and 1 @ .1 sec.  
Mode "B" @.5 sec. with 6 digit flash - 1 @.75 sec. and 1@.1 sec.

Note: See Appendix 1, 2 for detailed description of Equipment and procedures.  
See Appendix 3 for "Instructions To Participants."

2. TRAINING PROGRAM - MONITORED INITIALLY BY RCMP; SUBSEQUENTLY BY NISV PERSONNEL

Over a 3 month period each participant will complete:

A: An average of 35 sets or 175 runs on the Dynavision 2000.  
I.e.;

- 35 repetitions on Mode "A" (stationary)
- 35 on Mode "B" @.75 seconds
- 35 on Mode "B" @ .5 sec.
- 35 on Mode "B" @.75/.5 sec. with various digit flashes
- 35 on Mode "A" using a 4 minute "fatigue" run

B: 10 sessions of static tachistoscope work using 6 digit or activity specific slides.

Programmes will be tailored to fall within the "operational range" of each individual, to make sure that they are constantly challenged.

3. FINAL EVALUATION - CONDUCTED BY NISV PERSONNEL

This is identical to the initial evaluation process, and conducted over a similar period of time (10 sessions).

See Appendix 10 for individual and team percentage gains in pertinent categories.



## RESULTS/OBSERVATIONS

1. There were a number of unavoidable variables in the study, which may affect the purely scientific values, but which were not of major concern to the S.E.R.Team. In fact, the results may be more valid from their viewpoint, since the conditions faced will always be a factor in any on-going programme with the unit.
  - the number of training sessions and the time between sessions varied among the participants
  - there were significant gaps in training schedules due to holidays; annual leave and/or job-related absences; illness and/or injury; work schedules etc.
  - there was little correlation between NISV training schedules and Duty-related tests.
2. In most cases there seems to be a direct correlation between percentage (%) gains in skill levels and the amount and consistency of NISV training.
3. The percentage (%) improvement was directly related to each individual's attitude and intensity of effort.
4. The most impressive gains were made in speed of initiation of movement (V.R.) and in the two-task functions, where speed and accuracy of both physical response and decision making was a factor. It is interesting to note that this is also the area where "Blue Team" made the most significant advances in the duty-related testing (see results - RCMP report).
5. The most dramatic improvements in performance levels were recorded shortly after the implementation of individually tailored programmes. This also approximately corresponds to the beginning of "Blue Group" dominance in the duty-related testing (see RCMP report).
6. Motor Response Time - In all but 4 cases (A13, A17, A32, A33) there was improvement in the speed of the gross physical movement (M.R.T.). We (NISV) are generally of the opinion that our system does not improve this skill; that Motor Response is mainly enhanced by physical training regimens such as weight-lifting etc. The nature of the job (S.E.R.Team) requires each member to maintain a high level of fitness and as a group they are very dedicated to their conditioning regimens. Other than possible minor variations with a few individuals, these programmes were not varied during the study period. This would seem to indicate that the training does have some impact on the speed of movement and warrants further study. See Appendix 10 - Motor Response Time.

7. (Static) Speed Of Recognition was measured using 5 digit number flashes @ 1/100 second. See Appendix 8 and 11 - TACHISTOSCOPE - 5#.

Dynamic, or Two-Task Speed Of Recognition was measured using the Dynavision 2000 flash runs. See Appendix 1. As a group S.E.R.Team scores were significantly higher than the NISV database averages, and in a number of cases the initial evaluation performance left little room for improvement using our standard evaluation criteria. See Appendix 8 and 11 - DYNAVISION MODE "D"

8. (Static) Span Of Recognition - was measured using 6 digit numbers flashed at 1/100 seconds. See Appendix 8 and 11 - TACHISTOSCOPE - 6#.

Dynamic, or Two Task Span Of Recognition was measured using the Dynavision 2000 flash runs. Activity specific slides were utilized for training sessions (the exact nature of the slides cannot be discussed due to security reasons - suffice to say they were job-related action slides).

There was improvement in every participant except one and he remained the same. See Appendix 10 - SPEED OF RECOGNITION.

9. Speed Of Initiation (V.R.) was significantly improved in every instance. See Appendix 10 - Visual Reaction Time.
10. The most dramatic improvements were in;
- Two-Task Functions (Multi-Level Processing). See Appendix 10 - DVD
  - Response Time and Accuracy. See Appendix 10 - AVERAGE REACTION TIME - DVB, DVD; ACCURACY - DVB, DVD.
  - Dynamic Speed And Span Of Recognition. See Appendix 10 - DVD.
11. The initial evaluations of the two groups showed that skill levels were very comparable. The Gold group was marginally faster in speed and accuracy of movement. Blue group was slightly better with span of recognition but the two groups were equal in speed of recognition. See Appendix 8 AND 11 .

APPENDIX 1

DESCRIPTION OF EQUIPMENT

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DYNAVISION 2000	1 - 1
- Mode A	
- Mode B	
- Flash Mode	1 - 2
- Reaction Timer	
TACHISTOSCOPE	1 - 3



## DYNAVISION 2000

This is the most comprehensive tool that we have found for the training programme because it forces the individual to use so many of their dynamic visual skills at once. It is an effective tool for both evaluating (testing) and on-going training. The user not only has to recognize the existence of a peripheral stimulus, but must also judge the exact location of the stimulus and react physically to it without losing concentration on a key target. The timed modes increase stress levels and help fine tune concentration, and at the same time force the user to react faster to what he/she sees.

The Dynavision 2000 has flexibility for individualized programs because of its variety of functions. In most programmes the board is adjusted to eye-level (by turning the release handle and moving the working area up or down). The user is then instructed to concentrate (not stare) into the crimson coloured plexi-glass focal point. He/she should stand in a comfortable athletic stance at a distance so as to be able to reach all lights easily (suggested distance is approximately 1 foot away from board). Hands should be in a position ready to strike out at the lights as they come on one at a time. Users are instructed to strike and recoil as fast as possible so as to be able to move on to the next light.

### Mode A

One light comes on and remains on until the user contacts it. This initiates another light to turn on and so on (in random patterns.)

### Mode B

The lights travel in random patterns at various (pre-set) speeds. Depending on the user's skill level they will work at .75, .5, or .4 second light speed movements. Each speed increase puts more stress on the user, and then the effect of these rising levels of stress on the physical responses of the individual is monitored.

### Flash Mode

The Flash Option increases the amount of visual information in the focal area. This intensifies concentration and also trains the user in multi-level processing (i.e. processing visual information in both focal and peripheral areas of the visual field simultaneously). This also increases stress on a different level than that incurred by speeding the light movement. It allows the user to progress to higher processing levels on a very gradual, incremental basis.

The Flash Option will display from 1 to 7 digits at speeds of 1, .75, .5, .4, .25, .1, .05, or .001 seconds. A new (random) flash appears every 5 seconds, giving the user 12 flashes per 1 minute run.

### Reaction Timer

This programme contains 6 tests; 3 with the right hand and 3 with the left.

Tests 1 and 2 are between 2 fixed points (lights). The user simply holds one of the 2 target lights down (they will identify themselves by flashing) and reacts as quickly as possible with the same hand to strike the other light when it comes on. This process is then repeated with the other hand.

Tests 3 and 4 involve a linear random target switch. The user holds down the target switch and reacts to 1 of 4 possible lights along the same plane. This procedure is then repeated with the other hand (in the opposite direction).

Test 5 and 6 are again random, unknown targets which will appear in 1 of 8 different planes.

The results are displayed on the unit as well as printed out.

The first result is the Visual Reaction Speed, i.e. the amount of time it takes to identify the target and initiate a reaction.

The second result is the Physical Response Speed, i.e. a measurement of the total elapsed time from the introduction of the target stimulus to the physical completion of the task (striking out the light).

Overall Motor response Time is the amount of time (measured in 1/100's seconds) it takes to physically respond to the target, after the initial visual reaction.

The following equation illustrates this:

PHYSICAL RESPONSE (PR)=VISUAL REACTION (VR) + MOTOR RESPONSE (MR)

$$PR = VR + MR$$

ALSO  $MR = PR - VR$

### TACHISTOSCOPE

A high speed projector used to flash numbers or activity specific slides at speeds ranging from 2 to 1/100 seconds. It is used for evaluation and training of:

- . Peripheral Awareness
- . Speed And Span Of Recognition
- . Visual Memory
- . Visual Reaction Speed



APPENDIX 2

DYNAVISION 2000 BROCHURE

**D Y N A V I S I O N 2 0 0 0**

***A new era  
in performance***





**DYNAVISION  
2000  
DESIGNED  
TO TRAIN  
VISION  
SKILLS  
FOR:**

- SPORTS**
- HOCKEY
- BASEBALL
- TENNIS/SQUASH
- MOTORSPORTS
- FOOTBALL
- BASKETBALL
- SOCCER
- GOLF
- CLUBS**
- HEALTH CLUBS
- MARTIAL ARTS
- BOXING
- GUN
- REHABILITATION**
- PHYSICAL
- MENTAL
- GOVERNMENT**
- POLICE/TACTICAL
- MILITARY
- FIREFIGHTERS
- DRIVER TRAINING
- EDUCATION
- BUSINESS**
- MANAGEMENT
- PLANT
- AIRLINES
- TRUCKERS

# DYNAMIC VISION SKILLS

## CONCENTRATION

The ability to maintain a high level of focus on a specific task while also maintaining awareness of what is happening peripherally.

## EYE/HAND CO-ORDINATION

The eyes lead the body; the visual system leads the motor system. It is visual judgment alone that determines eye/hand co-ordination.

## PERIPHERAL VISION

A heightened awareness of what is happening around you.

## VISUAL REACTION

The amount of time required to process visual information and initiate a physical reaction/ response.

## SPEED AND SPAN OF RECOGNITION

The ability to absorb and interpret visual information instantaneously.

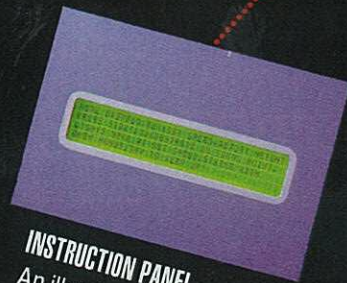
## ANTICIPATION TIMING

The ability to judge precisely when to act.



### AVAILABLE WALL MOUNT OR PORTABLE STAND

Coin operated units available.  
Built-in height adjustment.  
Height 48" Width 65" Depth 8"  
Weight 285 lbs



### INSTRUCTION PANEL

An illuminated panel provides easy to follow instructions to guide user through vision training programs.



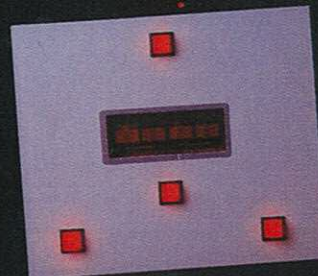
### PRINTER

A built-in printer provides an instant performance analysis by quadrant including % of hits and reaction times.



### CONTROL PANEL

An easy to use membrane control panel provides multiple options based on working area, time of program, speed of lights, number of digits, and speed of flash. Vision training at the touch of a button.



### FLASH OPTION

Flashes up to 7 digits at various speeds and greatly increases information workload in order to raise stress levels.

*DynaVision*  
2000





## APPENDIX 3

### INSTRUCTIONS TO PARTICIPANTS

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DYNAVISION 2000	3 - 1
TACHISTOSCOPE	3 - 1
- 5 Digit Flash	
- 6 Digit Flash	3 - 2
- Activity Specific Slides	
REACTION TIMER - DYNAVISION 2000	3 - 2
- 1 Choice Test	
- 4 Choice Test	
- 8 Choice Test	

### DYNAVISION 2000

- . Stand at a comfortable distance from the board (i.e. close enough to reach all outside lights, but far enough away to have a good peripheral range).
- . Red Focal Point window should be at eye-level when you are in your most comfortable working stance.
- . The lights will flash in a random pattern, one at a time. On the "A" Mode, the light will be stationary until you touch it to initiate movement elsewhere on the board. On the timed modes, they will move automatically at .75 or .5 second intervals or as fast as you can hit them. If you get to it on time, you will hear a beep, indicating that you scored. If you are too slow there will be no sound.
- . Keep your eyes focused on the Focal Point and use your peripheral vision to judge the location of the lights. Concentrate and focus on the screen at all times.
- . When the Flash Option is being used: Every 5 seconds, a number will flash on the screen for a fraction of a second. Repeat the number (in sequence from left to right) as quickly as possible after the flash, while maintaining your reaction speed to the lights in your periphery. Don't try to "read" the numbers as there isn't time. Watch the centre of the screen and take a mental picture of what you see, then repeat the numbers to me.

### TACHISTOSCOPE

#### 5 Digit Flash:

- . I will flash a 5 digit number on the screen (show the participant exactly where it will appear) at 1/100 of a second (or appropriate speed). Do not try to read the numbers from left to right since you do not have enough time. Just concentrate on the screen and take a mental picture of the whole number, then repeat it to me, in sequence from left to right, as quickly as possible.

6 Digit Flash:

- . Same as above with 6 digits.

Activity Specific Slides:

- . I will flash a picture on the screen for 1 second (or appropriate speed). I will either ask for a specific detail or you will be asked to describe the action in as much detail as possible.

REACTION TIMER - DYNAVISION 2000

1 Choice Option:

- . Place your left hand on the lit switch. As soon as the other light comes on (its location is previously indicated as it flashes before the test begins) strike it as quickly as possible using the same hand.
- . Repeat 8 times.
- . Repeat exercise using right hand.

4 Choice Option:

- . The four light possibilities will flash before the test begins.
- . Place your left hand on the lit switch.
- . Within 5 seconds, one of these 4 lights (along the same plane) will come on. As soon as it lights, strike it using the same hand, as quickly as you possible.
- . Repeat 8 times.
- . Repeat exercise using right hand.

8 Choice Option:

- . The eight light possibilities will flash before the test begins.
- . Place your left hand on the lit switch.
- . Within 5 seconds, one of these 8 lights (all on different planes) will come on. As soon as it lights, strike it using the same hand, as quickly as possible.
- . Repeat 8 times.
- . Repeat exercise using the right hand.



## APPENDIX 4

### DYNAMIC VISUAL SKILLS - AS THEY RELATE TO LAW ENFORCEMENT

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PERIPHERAL VISION/AWARENESS	4 - 2
SPEED AND SPAN OF RECOGNITION	4 - 2
VISUAL MEMORY	4 - 3
VISUAL REACTION TIME	4 - 3

## INTRODUCTION

Sports Vision Training consists of the learning and training of Dynamic Visual Skills - that is 'Vision In Motion'. These skills include, Accommodation and Convergence, Anticipation Timing, Concentration Under Stress, Depth Perception, Eye-Hand Coordination, Peripheral Awareness, Speed and Span of Recognition and Visual Reaction Time. These are all learned skills that will improve with practice.

The law enforcement officer's career is one requiring an acute awareness and at times, perhaps unexpectedly, intense concentration. Any lack or deficiency in awareness, or a lapse in concentration could have grave implications as a result of an ill-timed or inappropriate response.

The following is a comprehensive breakdown of the Dynamic Visual Skills and how they more specifically apply to the functions performed by the Law Enforcement Officer.

### ACCOMMODATION AND CONVERGENCE

Focusing flexibility and eye-tracking are two separate skills but inseparable as they must work together to achieve good, clear vision. The task could be as mundane as watching a busy intersection while catching up on paper-work, or as dangerous as a high-speed pursuit, but the necessity of good focusing flexibility and eye-tracking skills is ever present.

### ANTICIPATION TIMING

Most efforts fail not because the physical movements were wrong, but because they were made at the wrong time. Determining the correct moment to act is certainly a prerequisite skill to efficient self-defence and may spell the difference between life and death in an armed confrontation.

### CONCENTRATION

This skill, as it pertains to vision, is certainly the determining and underlying factor in efficiency of performance. It's the ability to remain focused on a task, to give it your complete attention, and not let yourself be distracted. Whether the task is report writing or conflict resolution, the final outcome, and the level of efficiency in arriving at it, is determined by one's ability to remain focused on the task.

### DEPTH PERCEPTION

Acute Depth Perception is a necessary skill for efficient driving, shooting, self-defence and even simple observation (to name a few). Both eyes must be working in unison to ensure accurate judgements of the distance, speed and revolution of objects in space.

### EYE-HAND COORDINATION

Because the visual system leads the motor system, our hands, feet or body respond to the information the eyes have sent to the brain. If this information is incorrect, even to the slightest degree, there will be error in the physical response. In the performance of their duty, peace officers are constantly required to use various pieces of equipment, or execute movements in stressful situations or against resistance. He/she may be operating a vehicle, executing handcuff techniques, or utilizing a defensive baton.

### PERIPHERAL VISION/AWARENESS

The member involved in an arrest procedure, surveillance, or in a protective security function must be fully aware of everything going on around him/her, while maintaining concentration on a key figure.

### SPEED AND SPAN OF RECOGNITION

The officer who is able to absorb large amounts of information instantaneously is better equipped and more efficient in situations that require him/her to scan and visually search. An increase in the speed in recognizing a visual stimulus has a positive effect in terms of overall performance. It drives the physical impulses to a better reflex level. The reflex action becomes more automatic and less thought out, and as a result, the officer's intervention/response is much quicker, more accurate, and more efficient.



### VISUAL MEMORY

The ability to remember and record details of objects, events and persons is the essence of field investigation. A detailed memory is not simply an asset, but a necessity to police function.

### VISUAL REACTION TIME

The amount of time required to process visual information and initiate a physical reaction/response.

APPENDIX 5

INDIVIDUAL PERCENTAGE GAINS

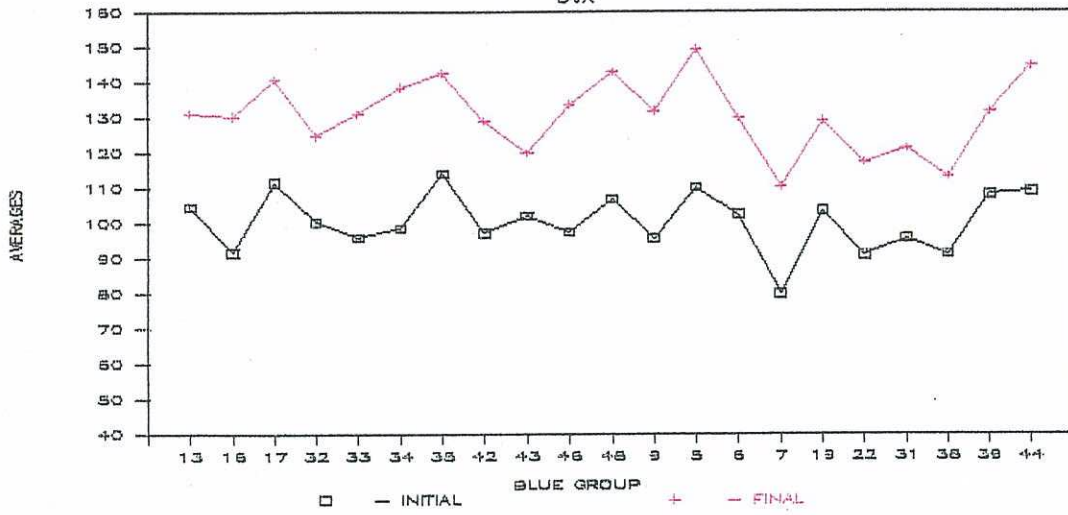
	<u>PAGE</u>
DVA	10 - 1
DVB	10 - 1
DVC	10 - 2
DVD	10 - 2
* AVERAGE REACTION TIME - DVB	10 - 3
* AVERAGE REACTION TIME - DVD	10 - 3
ACCURACY - DVB	10 - 4
ACCURACY - DVD	10 - 4
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* MOTOR RESPONSE TIME	10 - 5
SPEED OF RECOGNITION	10 - 6
SPAN OF RECOGNITION	10 - 6

\* NOTE REGARDING GRAPH VALUES: AN IMPROVEMENT IS REFLECTED BY A DECREASE IN SPEED/



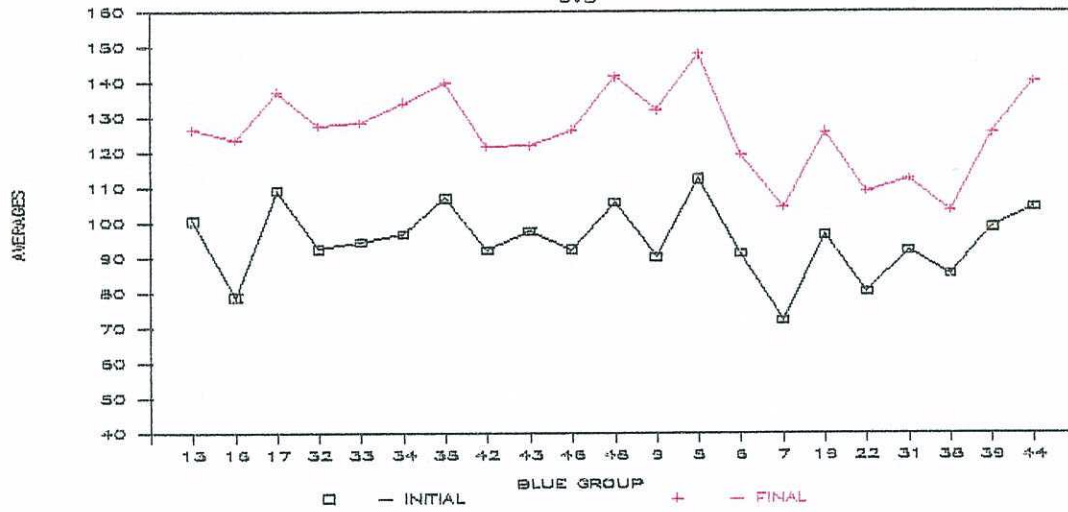
### RCMP S.E.R.T.

DVA



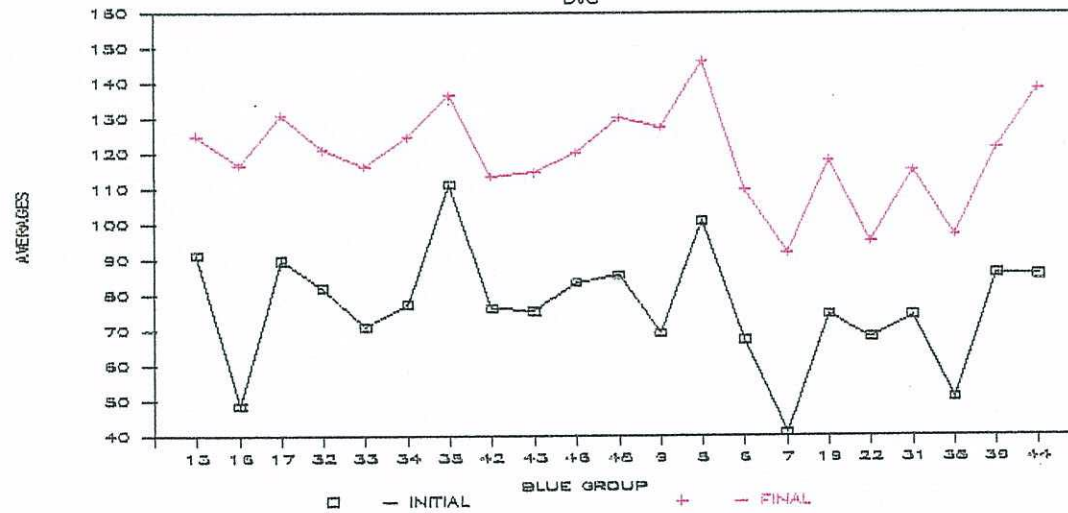
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DVA



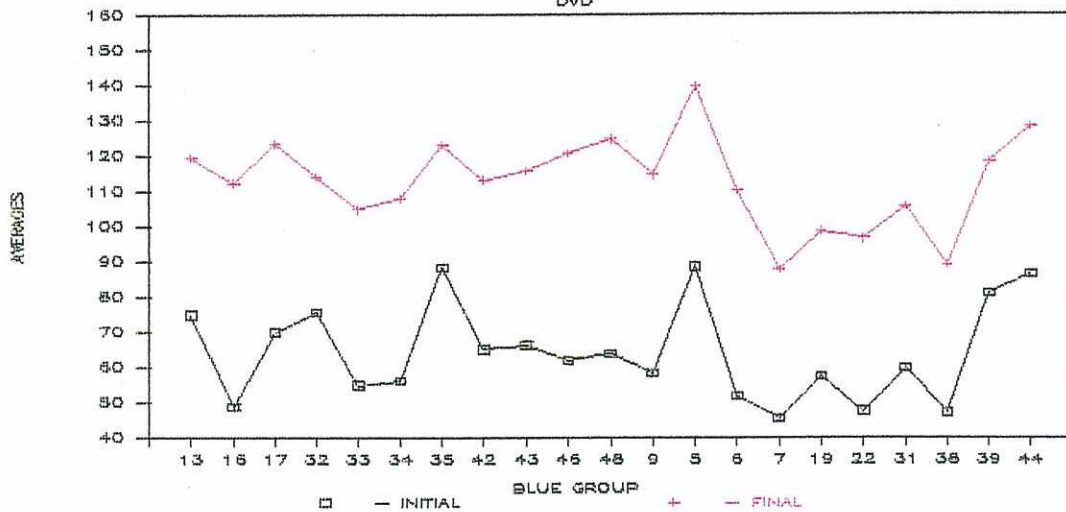
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DVC



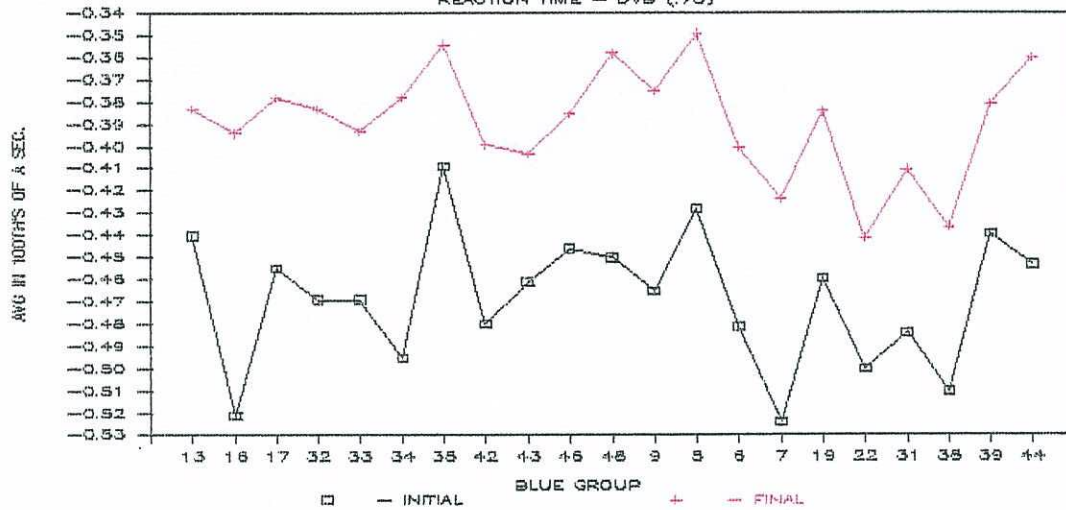
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DVD



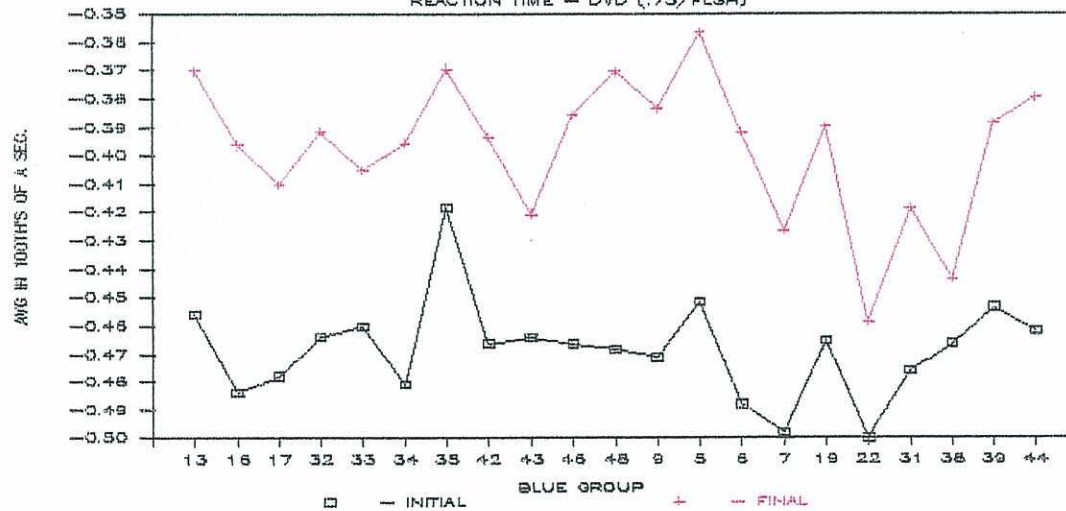
### RCMP S.E.R.T.

REACTION TIME - DVD (.75)



### RCMP S.E.R.T.

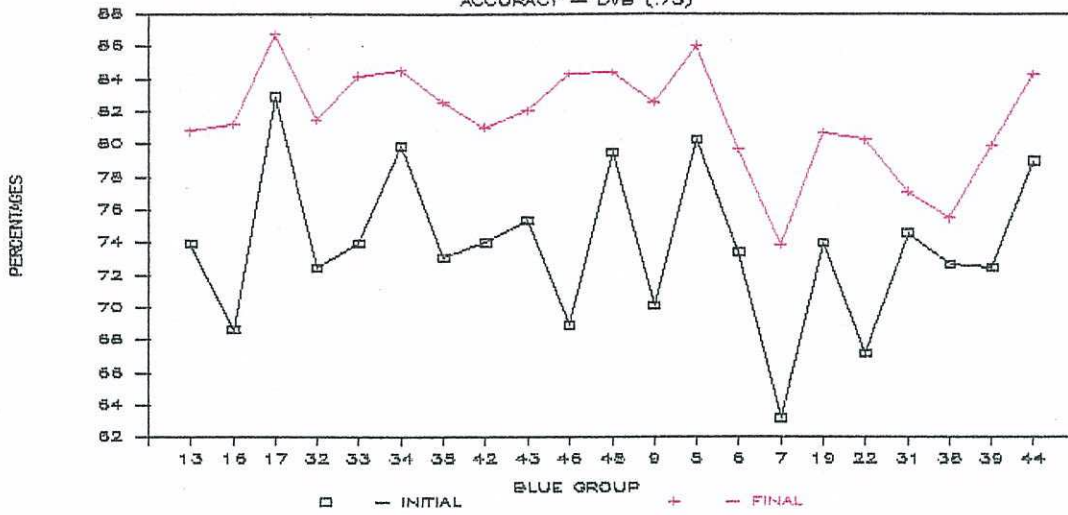
REACTION TIME - DVD (.75/FLSH)





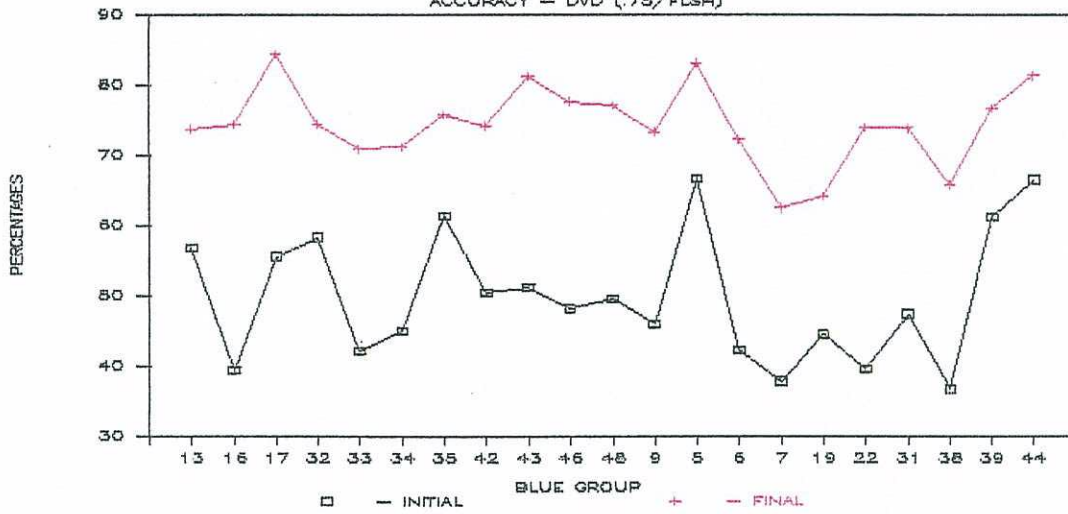
### RCMP S.E.R.T.

ACCURACY - DVB (.75)



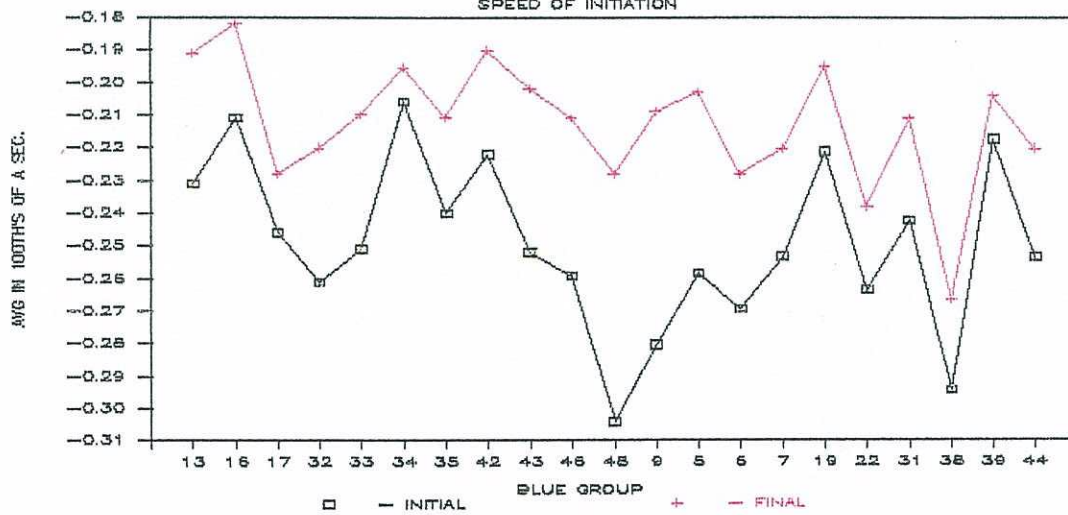
### RCMP S.E.R.T.

ACCURACY - DVD (.75/FLSH)

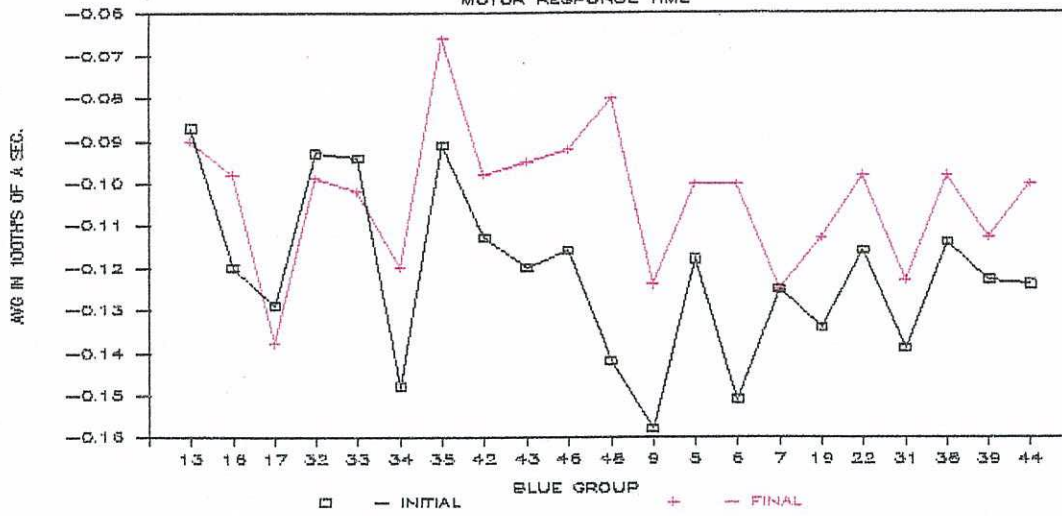


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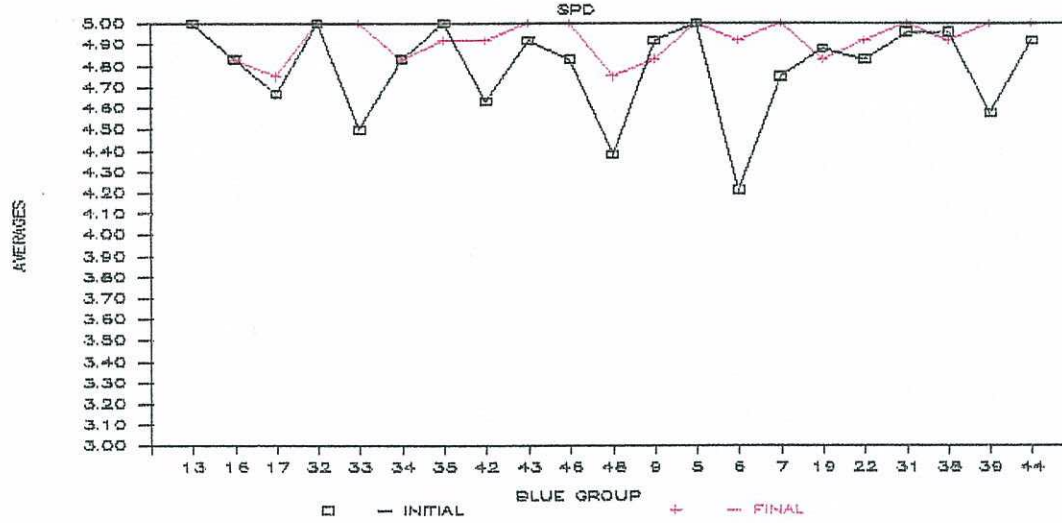
SPEED OF INITIATION



RCMP S.E.R.T.  
MOTOR RESPONSE TIME



RCMP S.E.R.T.



RCMP S.E.R.T.

