The Influence of Socio-Demographic Characteristics on Hunter Safety Decision Making Ability

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ABSTRACT

To determine the influence of various environmental and socio-demographic variables on sage hunter decision-making ability, 3431 subjects were tested on the Duelatron Electronic Target System at seven Wisconsin county and state fairs. The System consisted of 10 poster-sized targets depicting four Wisconsin game animals in safe and unsafe hunting situations. Five of the original ten targets were modified to improve their validity as testing tools and a questionnaire was used to record environmental variables, the socio-demographic characteristics of the participants, and System results.

During System development, a 4-second face time, 6-second interval time, and a random sequence of targets were chosen as the standardized test course. Although natural lighting resulted in higher test scores, artificial lighting was used at six of the seven test sites to maintain consistency. Sample size tended to increase as the population of the sampling site increased, however, target scores decreased as the number of subjects increased. Lowest mean System scores were recorded at the Wisconsin State Fair, the location with the greatest population and largest number of subjects sampled.

Many socio-demographic characteristics evaluated influenced the subjects' scores including: age, education, community size before age 18, present community size, ownership of a shotgun, rifle, handgun or bow, membership in a Sportsmen's Club, completion of the Wisconsin Hunter Safety Course, previous experience with the Duelatron, hunting frequency and experience, and participation in upland

game bird, waterfowl, small game, and big game hunting with a gun or bow. Ownership of a shotgun explained the greatest single amount of variation, 3.7%, and was not significantly confounded by the influence of other variables. Although age and hunting frequency also contributed significantly to the variation, their correlation to total score was spurious and actually due to the confounding effects of education, shotgun ownership, and hunting experience. Of five hunting participation categories, only upland game bird hunting remained significantly correlated to total score when the remainder of the categories were constant. Only 6.7% of the variation in total target system scores could be explained by these variables.

Because approximately half of the subjects scored incorrectly on at least one unsafe target and to avoid penalyzing subjects who did not shoot at the safe targets, analyses were re-run considering only the scores on the unsafe targets. The result of selected socio-demographic variables were similar, except that the influence of the community size a subject resided in before age 18, ownership of a handgun, and participation in small game hunting were not significant. Ownership of a shotgun contributed to the greatest percentage of variation, while the relationship of education and hunting frequency was spurious.

Subjects who participated in upland game bird, waterfowl, small game, or big game hunting scored higher on targets relating to those wildlife species. Waterfowl and upland game bird hunters made significantly more correct decisions on the mallard and pheasant target sets, respectively, although the latter scored poorer than non-upland game bird hunters on the two unsafe pheasant targets. In contrast, big game-gun hunters made fewer correct decisions on white-tailed deer targets.

Additional research is warranted to identify factors which remained unmeasured by this study, but accounted for the majority of the variation in System scores. Visual characteristics of the subject are suspected to be responsible for much of this variation.

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INTRODUCTION

The Wisconsin Department of Natural Resources (WDNR), defines a hunting accident as "an injury to a person or persons by a firearm or bow and arrow, outside the home, including travel to and from the hunting location" (WDNR, 1975). The 1975 Hunting Accident Report Form lists fifteen contributing factors to Wisconsin hunting accidents. One of these factors, defective hunter judgement, was involved in 56% of the 124 hunting accidents during the 1975 hunting season, in which causes could be determined (Ibid.). This included three fatalities. A five year survey indicated that 42-55% of all hunting accidents in Wisconsin involved defective hunter judgement (Moe, 1974). Even more significant is that from 52-80% of the fatal accidents were in this category (Ibid.). In these reports, hunter misjudgement included accidents where the victim: moved into the line of fire, was covered while swinging on game, was out of sight, or was mistaken for game.

Numerous authors cite poor hunter judgement as a major factor in hunting accidents throughout the country. Severinghaus and Brown (1956) reported that in a thirteen year period, from 1941-1954, 25% of New York hunting accidents were caused by the shooter mistaking the victim for a deer. Kulwar (1954) cites a National Rifle Association study of 440 hunting accidents in which 45% were caused by the victim being mistaken for game. Fifty-two percent of New Hampshire's 317 hunting accidents, between 1950-1961, were attributed to faulty hunter judgement. Although these statistics support the importance of hunter judgement, there is little information available explaining what causes defective hunter decision-making ability.

The WDNR recognized that little, if any, decision-making training was available as part of the Wisconsin hunter safety program. It was not known whether or not the present program was resulting in an increased ability of hunter safety graduates to make safe decisions. Further, there is little knowledge in the literature on what effect various physical and psychological factors had on hunter decision making performance.

In 1975, the WDNR proposed a multi-faceted hunter safety decision-making project. The project revolved around the use of the Duelatron Electronic Target System, an apparatus which could be programmed to allow a subject a variable amount of time to view one or several of ten targets, similar to those target systems used in law enforcement training. These targets were poster-sized depictions of hunting scenes, some safe to shoot at, others showing another hunter or non-game animal in the line of fire. Based on the goals of the proposal the objectives of this study, using the Duelatron Target System, were to:

1. Determine the effect of variable time and target sequences on safe decision-making ability. From these findings select a standardized test course, on the Duelatron, which would represent the most logical opportunity to make correct decisions.

2. Determine the effect of various physical conditions (i.e. light, hunter clothing color, etc.) on the ability to make correct decisions on the ten targets.

3. Identify which selected socio-demographic variables influence standardized test scores.

4. Prepare recommendations which would increase the ability of Wisconsin hunters to make correct "be sure before you shoot" decisions.

MATERIALS AND METHODS

Description and Development of the Duelatron Hunter Safety System

To measure a person's ability to make safe hunting decisions, observations should ideally be made during the hunting season, under field conditions, and without the knowledge of the subject. Such testing would be almost impossible due to the nature of hunting and the lack of control of such external factors as lighting and weather.

In 1975 the WDNR not only recognized the importance of decision-making training to be included in the Wisconsin Hunter Safety Course, but also the lack of information that existed on how well or why Wisconsin hunters make correct hunting decisions. In cooperation with the Advanced Training System of St. Paul, Minnesota, an electronic target system originally used for police training, was modified for hunter safety instruction. The target system allowed greater flexibility in training and testing for safe decision making as it could be used both indoors and in the field.

This apparatus, the Duelatron Hunter Safety Target System, consists of 5 target standards, each housing a motor unit which allows rotation of a 25" x 35" rectangular frame. Two poster sized targets are stapled back-to-back and slipped over each target frame. Each frame can be rotated 180o through three different positions: the front or back can be made to face the shooter, or the edge so that no target can be seen. There are, therefore, 10 different target displays possible. Appendix A is a diagram of the Duelatron Hunter Safety System and target positions. The Duelatron can be programmed to automatically display a target for a given length of time or targets can be manually selected.

Because the Duelatron would be used in hunter safety education, the original targets used for police training were substituted with targets depicting hunting scenes. Ten different full color, poster-sized targets were developed by the WDNR for use with the system. Pictures of the ten targets can be found in Appendix B. These targets can be grouped into 4 general sets, each set focusing on one of the following Wisconsin game species: the ring-neck pheasant, mallard duck, gray squirrel and white-tailed deer. In each set, one target depicts a hunting situation in which it would be "safe" to shoot, while one target represents an "unsafe" shooting situation. The unsafe target is identical in format to its safe counterpart in the game animal and background pictured. The unsafe target differs in that a partially concealed hunter is depicted in the line of fire.

In the pheasant and deer sets, a third target concerned with non-game species has been added. Again, the format of each of these two targets is identical to those of the set. The third target of the pheasant set shows a hen pheasant flying next to the normally legal-to-shoot rooster. Because the female pheasant is protected in Wisconsin, this target is considered "don't-shoot". The third target of the white-tailed deer set depicts a jumping horse rather than a leeping deer. For obvious reasons, it is also a don't shoot" target.

In summary the 10 Duelatron targets depict 4 different game species in safe-to-shoot situations. Six targets are considered "unsafe" because a hunter or non-game animal was in the line of fire.

These original 10 targets were an artist's conception of hunting scenes, drawn with the help of photographs and the advice of State game wardens. The objective in target design was to develop targets which could reasonably be expected to distinguish individuals with satisfactory versus unsatisfactory hunter safety decision-making ability. "Unsafe" targets which were so easy that almost everyone got them correct or so hard that most got them wrong were considered to be invalid measures of decision-making ability. The WDNR hunter safety specialists and project researchers decided that an acceptable rate of correct decisions on each of the "unsafe" targets would be 50-70%.

Preliminary testing revealed that on a 25 foot test course three of the six unsafe targets were so difficult that scores were extremely low; also, one unsafe target was so easy that virtually everyone scored correctly. On the unsafe targets of the pheasant-hunter and mallard-hunter target, WDNR Wardens with a 4-second viewing time scored only 19.2% and 32.5% correct, respectively. On the target of the jumping horse - all of the wardens thought it was a buck! Conversely, the unsafe squirrel target was so easy that the error rate of the State wardens was only 4.3%. Subjects indicated their decision on each target as it rotated towards them, by firing a BB gun, with the chamber remduco, if the target was thought to be "safe" and not firing if it was considered "unsafe".

Since the targets had already been mass-produced, only superficial changes could be made to improve the quality of the unsatisfactory targets. Modifications to improve the unsafe pheasant-hunter and mallard-hunter targets included shading, outlining, and substituting actual camouflage material for the light tan of the hunters' coats and hats. The posture and physique of the leaping horse was identical to that of the deer. The artist further complicated the scene by adding tree branches in the target's foreground, giving the appearance of antlers on the horse's head. Highlighting the mane and tail and shading the hindquarters was done to make a more characteristic "horse" appearance. The unnatural, bright blue color of the squirrel hunter's pants were suspected to clue the subject's response not to shoot. This portion of the target was cutout and an actual piece of denim substituted to give a more realistic representation of a squirrel hunter's attire.

The only safe target to be modified was the mallard duck. Many subjects recognized the decoys in the background of the target and did not shoot because decoys might indicate a hunter in the area. Since the idea of "safe" targets was to portray a situation where it would be safe to shoot, the decoys were removed.

This set of 10 targets, 5 of which had been modified to improve their validity, became the standard targets used during the study.

SAMPLING PLAN

Sampling involves selecting a given number of persons from a defined population as representative of that population (Borg and Gall, 1971). Project requirements demanded both a large sample size and representation from more than one region of Wisconsin. Several methods could have been used to select a random sample from the population of Wisconsin citizens. A simple random sample could have been achieved by testing every "nth" person from listings in Wisconsin phonebooks, assuming that there is no difference between those who do and do not own telephones. Samples could have been taken from naturally occurring groups such as people living within randomly selected towns within each WDNR district. Also, the population could have been stratified into certain subgroups on which information was needed, such as members of Wisconsin Sportsmens Clubs or women over age 60. A random sample could then have been chosen from each of these subgroups.

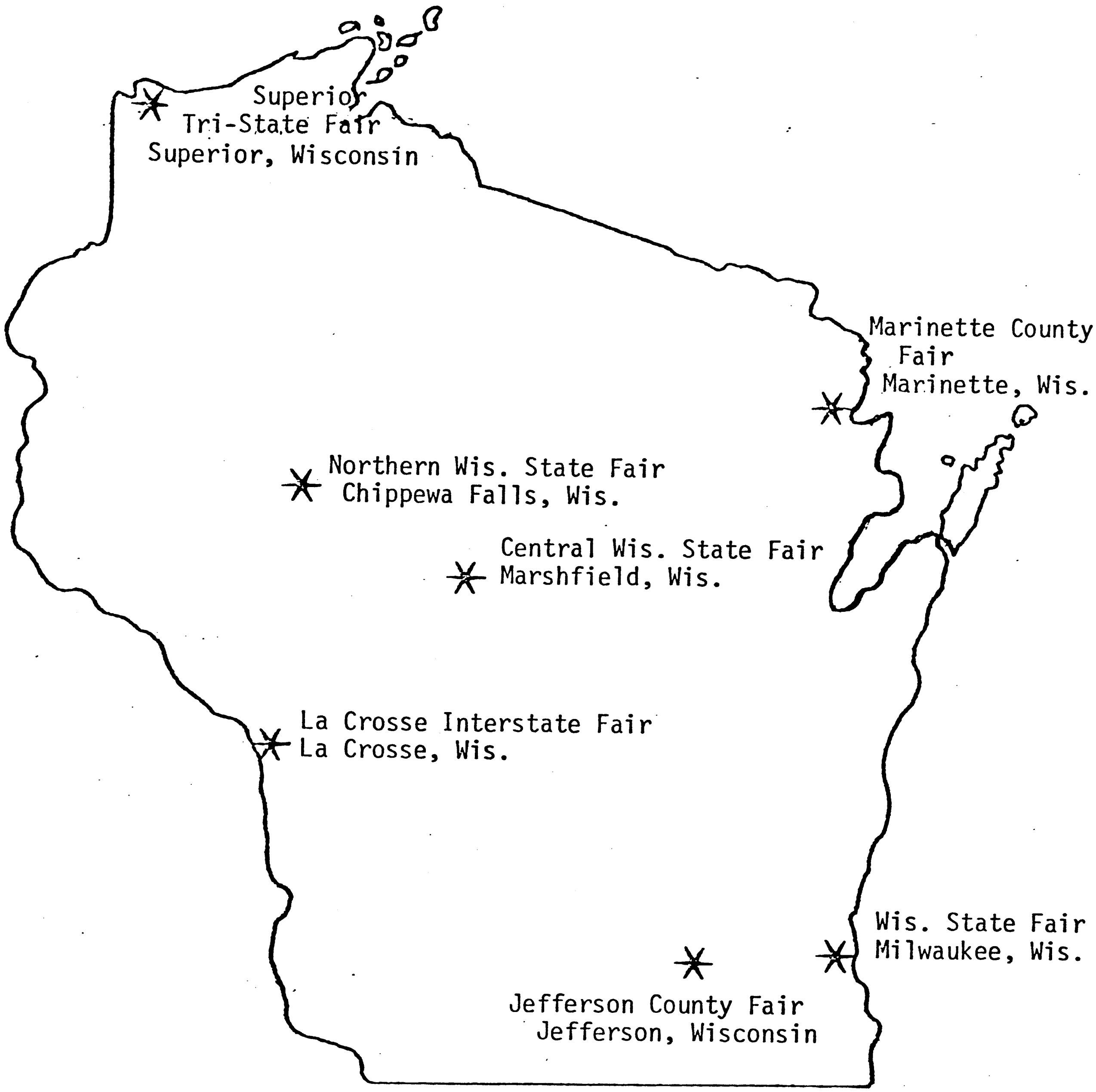
Unfortunately, due to the amount of equipment associated with the Duelatron, the space needed for testing, and the amount of time needed to set-up, it was not feasible to travel to each subject to gather the data. Instead, it was necessary to find centralized locations where subjects could come to be tested. Since the data was to be collected during one summer season, sampling locations were selected where a large number of potential subjects from several regions of Wisconsin would be available for testing. Seven county and state fairs were selected as sampling sites: the La Crosse Inter-State Fair (La Cosse), Jefferson County Fair (Jefferson), Superior Tri-State

Fair (Superior), Northern Wisconsin State Fair (Chippewa Falls), Wisconsin State Fair (Milwaukee), Marinette County Fair (Marinette), and the Central Wisconsin State Fair (Marshfield). The seven sites were chosen on the basis of location and attendance (Figure 1).

Of the six WDNR Field Districts, five were represented by a sampling site. Sampling at the Grant County Fair, within the Southern District, originally considered but was cancelled. We felt that since over three thousand people had already been sampled on the Duelatron, testing at the small Grant County Fair would not contribute much to the data already gathered.

Subjects were drawn from members of the public attending each of the six fairs. It was assumed that people who attended county and state fairs were representative of the general population. It was not possible to draw a random sample of fair attendees. Subjects were not actively approached to participate in the project. Instead, signs advertising the study were displayed and subjects volunteered to participate.

Figure 1. Location of Sampling Sites



DEVELOPMENT OF THE QUESTIONNAIRE

A questionnaire (Appendix C) was chosen as the most logical method to gather socio-demographic data and record each subject's score. The questionnaire was designed to be as short as possible and simple enough to be filled out by all participants. Demographic questions were first, followed by specific questions on hunter safety training and hunting experience. The questionnaire was arranged so that subjects who had never hunted needed only to complete the first 12 questions. Subjects were classified according to age, sex, completion of a rural or urban Wisconsin Hunter Safety Course, residency, hunting experience, whether or not the subject was a member of a Sportsmen's Club and if he or she had a valid Motor Vehicle license.

In an earlier study, Klessig and Hale (1972), considered several other socio-demographic variables of Wisconsin hunters. Several which were suspected to have an effect on decision-making ability were added to the original list of research variables. These were level of education, ownership of a weapon, community residence before age 18, size of the community presently residing in, county residence, previous hunter safety training, previous experience with the Duelatron, from whom the subject learned to hunt, and involvement in a hunting accident.

One final item was added to the questionnaire late in the study to determine if a relationship existed between the type of hunting participated in, success rate, and ability to make safe decisions. This was done at the request of researchers involved in a WDNR study on hunter behavior at the University of Wisconsin - LaCrosse.

The second function of the questionnaire was to record the results, time of testing, location, target course description, and lighting. The subjects' score on each of the 10 targets, either 10 points (correct decision) or 0 points (incorrect decision) was recorded. A total score for each subject was recorded which was the sum of the points accumulated on the ten targets. The maximum score was 100, the minimum zero.

A measurement instrument has "face validity" if it was relevance to what one is trying to measure (Selltiz, 1959). We felt that the research variables chosen for the questionnaire did adequately measure personal and social traits, as well as data on hunting experience and training. The questionnaire, developed with the assistance of social scientists at the University of Wisconsin - Stevens Point, was reviewed and approved by the WDNR Hunter Safety Coordinator. It was pretested by 182 subjects at the 1975 Milwaukee Sports Show. The Milwaukee Sports Show was chosen as a suitable site to pretest because participants there were believed to possess relevant characteristics similar to the study's target population. On the basis of the pre-test, the questionnaire was revised and reviewed by a team of WDNR Hunter Safety Specialists and Wardens who had previous field experience with the Duelatron. They found the questionnaire complete and acceptable in light of the study's objectives. Because of the many reviews and the rational format used in the developmental process, we consider the questionnaire to have an adequate measure of face validity.

DUELATRON FIELD SET-UP

The best way to house the Duelatron was in a tent. Although the use of a tent required time to set up, it had many advantages over outside or pavillion locations. Outside testing, as was done at the Marinette County Fair, had the advantage of natural lighting, but no protection for the equipment, testing could only be done during fair weather, and there was no control over such environmental factors as light and noise. Housing the Duelatron within a pavillion would have been ideal, except that no fair could provide the 20' x 30' space needed for the test course. We felt that the use of a tent would provide the weather-proof, private, controlled environment needed for consistent testing.

The five Duelatron target standards were placed along one end of the tent and taked into the ground for stability. The distance from the targets to the shooting line was 25'. Care was taken to place the shooting line at an angle so that the subject's view was not obstructed by the tent's two supporting poles. A researcher sat at a table across from the shooting line, facing the targets (Appendix D). It was his or her responsibility to run the Duelatron and record the subject's scores.

At most of the fairs the tent was located near other demonstration-type exhibits, such as 4-H displays, and away from the midway. At the Wisconsin State Fair, the Duelatron tent was set up in the midst of the large park-like WDNR exhibit. The popularity of that exhibit probably contributed to the large number of participants at that fair. Poor locations, away from the mainstream of fair-goer traffic, contributed to the lower sample sizes at the Jefferson County and Central Wisconsin State Fairs.

Large cardboard posters which "advertise" the study were hung on the outside of the tent. One poster identified the project as a cooperative effort between the WDNR and the University of Wisconsin - Stevens Point. Another poster posed the question, "Hunter Safety - How Good Are You?", lettered in blaze orange with a collage of game animals pictured. This and smaller signs which indicated that the demonstration was free were attention-getters.

A second researcher was located at a table outside the tent and assisted participants with the questionnaire. This method made completion of the questionnaire more personal and insured complete, accurate answers with the minimum of misunderstanding. The personal attention of the researcher not only eased any apprehensions, but was used to explain the purpose of the project. Each subject was told in a standardized narrative, the numbers and types of targets which would be seen. The subject was warned that some of the targets would be "safe" to shoot at and others "unsafe". The amount of time the subject would have to make the decision whether or not to shoot was also told. It was stressed that the "correctness" of the decision was not based on accuracy; but on a safe judgement. If the test subject believed the target was safe to shoot at, the decision was indicated by aiming and firing an unloaded BB gun at the target.

Early in testing it was discovered that many participants could not recognize the female pheasant and were unfamiliar with pheasant hunting regulations. We decided that each subject would be asked if he or she were familiar with pheasant hunting laws. If the subject was familiar with the law, it was assumed that he or she was also familiar with what the hen pheasant looked like. If the subject was not familiar with pheasant hunting regulations, the law protecting the female pheasant was explained. In some cases, it was necessary to show the subject a picture of the hen pheasant.

RESULTS

It was necessary first to develop a standardized test course or control so that any differences in scores might be attributed to the effect of socio-demographic variables rather than variations in the testing procedure. To provide the best measure of the influences on hunter safety decision making, the project outline recommended that "the combination of time and target sequences providing the most logical opportunity for making correct decisions be established for the majority of the testing".

In this section the effects of course development, environmental variables, and socio-demographic variables were examined. The student's t-test, Chi-square, and analysis of variance were the statistical tools selected to analyze these differences. When an analysis of variance showed a significant difference to exist between three or more categorical groups, the Scheffe Statistical Test which indicates the outstanding or significantly different variable(s) of a group of variables, was used.

Course Development Variables

First, it was necessary to define "the most logical opportunity". Because of time constraints, it was not feasible to allow subjects to view or rest between targets for an indefinite period of time. In addition it was felt that some time limit would help simulate the same quick reaction made by the hunter in the field. Because of a limited sampling schedule and since the WDNR had already designated 4 seconds as a likely standard face time to be used when testing for the effects of socio-demographic characteristics, only two other face times were considered: 2 and 6 seconds.

Target Face Time

When the independent variable, target face time, was compared to the dependent variable, total target score, analysis of variance showed a significant difference between the face times tested (Table 1). Total scores at a 2 second face time were found to be lower than scores at 4 or 6 seconds. While there was no significant difference between scores at 4 or 6 seconds, mean total score increased as face time increased. Since the four-second face time provided acceptable target system scores, made efficient use of sampling time, and was consistent with WDNR recommendations, it was chosen as the standard face time for the study.

Target Interval Time

The time allowed between targets, i.e. the target interval time, was thought to have a possible effect on decision-making ability. Too short a period might not permit adequate time to re-cock the target rifle. Too long an interval between targets might cause subject boredom. Three interval times were tested: 4, 6, and 8 seconds.

Mean total score did increase slightly as interval time increased (Table 2), although the difference was not statistically significant. Given the lack of significant difference, we chose six seconds as the standard target interval time.

Target Sequences

With ten different targets, a large number of possible target combinations existed. The possibilities were narrowed down to four target sequences (Table 3).

The project required that the effect of viewing a "shoot" before a "don't shoot" target be evaluated. It was not clear whether all the safe targets were to be viewed before all the unsafe targets or whether the safe and unsafe targets of each set of game animals be grouped together. Therefore, two target sequences were tested. "Sequence Four" presented all of the safe targets before all of the unsafe targets. The order of the safe and unsafe target was randomly chosen. The "Alternate" sequence presented the shoot before the similar don't shoot target of each set. The order of the target sets was also randomly chosen.

A third sequence, "Grouped", attempted to determine the effect of viewing all of the don't shoot before all of the shoot targets. The target order of this sequence was the reverse of "Sequence Four".

A "Random" sequence was developed by assigning each target a number, pulling the target numbers out of a hat and arranging the targets in that order.

An analysis of variance was used to compare the sample subject's total scores on the four sequences (Table 4).

Although the alternate sequence had significantly higher total scores, it was not selected as the standard target sequence to be used in the study. This sequence presented "shoot" before similar "don't shoot" targets for each target set. This we felt did not replicate field conditions and also encouraged learning bias. The possible effect of learning an individual as well as total target scores will be analyzed in the Discussion. Because the random sequence provided adequate target scores and best replicated hunting situations, it was chosen as the standard target sequence.

Combination of Target Face Time and Target Sequence

To measure the effects of various combinations of target face and interval times and target sequences on decision-making ability and because target interval time was not found to be a significant variable in earlier testing, only target sequence and face time were included in the test for combination effects (Table 5).

Scores on target system with different target sequences and face times did vary significantly. Subjects tested with the random sequence at a 2 second face time had much lower scores and those tested on the alternate sequence at a 4 second face time had much higher scores than the remaining test groups.

Neither of these two sequence-face time combinations were used in the study's standardized target course. The low scores of the random, 2 second face time combination seemed to be due to the lack of viewing time and therefore this combination was not a valid measure of hunter safety decision-making ability. Scores at the alternate sequence and four second face time seemed unreasonably high because of the unrealistic sequence of target portrayal that may have led to subject learning. The remaining sequence-face time combinations seemed to yield scores in the acceptable range for validly distinguishing decision-making ability. Of these, the random sequence, four second face time combination was selected as the standardized target course for the remainder of the study because it most closely reflected the real hunting situation and made efficient use of researches and sample subject time.

Unless otherwise specified, all further results contained in this study have been gathered using the standardized target system with a random sequence, four second face time and six second interval time.

Table 1. Analysis of variance and means for target face time compared with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	2	1911.04	7.56***
Within groups	3457	252.27	
Total	3459		

Face Time (seconds)	N	Mean	Standard deviation
2	50	52.40	12.71
4	3275	60.66	15.88
6	105	62.67	17.39

*** (significant at the .001)

Table 2. Analysis of variance and means for target interval time compared to total score.

Source of variation	Degrees of freedom	Mean Squares	F test value
Between groups	2	138.80	0.55
Within groups	3428	253.27	
Total	3430		

Interval Time (seconds)	N	Mean	Standard deviation
4	583	61.15	15.73
6	2813	60.50	15.98
8	35	59.14	13.80

Table 3. Mean Target Scores by position in each of the target sequences.

Random Sequence

Position	Target	Mean Score	Position	Target	Mean Score
1	Squirrel & hunter	2.4	6	Horse	3.3
2	Mallard alone	8.8	7	Rooster & Hen pheasant	7.1
3	Rooster pheasant	7.5	8	Mallard & hunter	5.0
4	Deer & hunter	6.0	9	Deer alone	8.9
5	Squirrel alone	8.5	10	Pheasant & hunter	2.8

Grouped Sequence

Position	Target	Mean Score	Position	Target	Mean Score
1	Deer & hunter	4.0	6	Rooster & Hen pheasant	7.4
2	Squirrel & hunter	3.8	7	Deer alone	9.0
3	Horse	4.6	8	Rooster pheasant	8.3
4	Mallard & hunter	3.8	9	Squirrel alone	8.5
5	Pheasant & hunter	3.2	10	Mallard alone	8.5

Table 3 (continued).

Alternate Sequence

Position	Target	Mean Score	Position	Target	Mean Score
1	Deer & Hunter	4.0	6	Squirrel alone	7.9
2	Deer alone	9.1	7	Squirrel & hunter	5.6
3	Horse	4.6	8	Rooster pheasant	8.3
4	Mallard alone	8.6	9	Pheasant & hunter	4.6
5	Mallard & hunter	5.8	10	Rooster & Hen pheasant	8.3

Sequence Four

Position	Target	Mean Score	Position	Target	Mean Score
1	Mallard alone	8.6	6	Pheasant & hunter	1.4
2	Squirrel alone	8.6	7	Mallard & hunter	3.6
3	Rooster pheasant	7.5	8	Horse	3.5
4	Deer alone	8.5	9	Squirrel & hunter	3.3
5	Rooster & Hen pheasant	6.6	10	Deer & hunter	5.5

Table 4. Analysis of variance and means for target sequence compared with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	3	3639.14	14.54***
Within groups	3425	250.36	
Total	3428		

Sequence	N	Mean	Standard deviation
Random	2914	60.41	15.74
Grouped	119	60.34	14.08
Alternate	185	67.41	18.93
Sequence 4	211	57.35	14.85

*** (significant at the .001)

Table 5. Analysis of variance and means comparing target face time-sequence combinations with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	5	2920.91	11.71***
Within groups	3421	249.41	
Total	3426		

Sequence x face time (seconds) combinations	N	Mean	Standard deviation
Random x 2	50	52.40	12.71
Random x 4	2760	60.47	15.69
Random x 6	103	62.82	17.40
Grouped x 4	119	60.34	14.08
Alternate x 4	185	67.41	18.93
Sequence 4 x 4	210	57.43	14.84

*** (significant at .001)

Environmental Variables

Target System Housing

At most of the sample sites the Duelatron test course was operated in a tent, with the exception of the Marinette County Fair where testing was done outdoors. An analysis of variance, significant at the .001 level, illustrated that total mean scores on the target system were higher when testing was done outside (Table 6). These higher scores probably reflect the influence of natural light.

Included in Table 6 are the results from indoor testing - preliminary work done at the Clam Lake Field Station; Clam Lake, Wisconsin prior to the summer's sampling. "Indoor" testing was done under artificial flourescent lights and is included here only for comparison purposes between natural lighting and artificial lighting within the tent.

Lighting Conditions

Six floodlights were used to illuminate the test course when testing was done in the tent. Later three more floodlights were added to help increase the light intensity. See (Appendix D) for the position of the floodlights in the Duelatron field set-up. At the Marinette County Fair it was necessary to test subjects outdoors, under natural light.

Table 7 indicates that individuals tested in natural light did score significantly higher than those tested under artificial light. No appreciable difference was found in the scores of individuals tested in the tent using six versus nine floodlights.

Location

Testing was done at seven Wisconsin test sites (Figure 1). When the target system scores of test subjects at various locations throughout the state were compared (Table 8) they were found to be significantly higher at the Marinette County and Central Wisconsin State Fairs. Subjects at the Wisconsin State Fair scored significantly lower than did subjects tested at other sites.

Time

As part of the information recorded describing the target system, the hour that the subject completed the Duelatron test course was recorded. The hours of testing were grouped into three categories: Morning, from 6:00 AM - 12:00 PM; afternoon, from 12:00 PM - 6:00 PM; and evening, from 6:00 PM - 12:00 AM.

The majority of the subjects tested, 59% were in the afternoon, 33% participated in the evening and 8% in the morning. A major reason for the lower percentage of morning participation was due to the fact that most of the fairs did not open until after noon.

Subjects who completed the course in the evening scored significantly higher than those who tested in the morning or afternoon (Table 9). Participants in morning testing had the lowest mean scores, 56.1%. Only at the Wisconsin State Fair was any significant testing done before noon. As previously mentioned, subject at the Wisconsin State Fair as a group had significantly lower scores than any of the other sampling sites. The low mean scores for morning participation may reflect this fact.

Target Color

Some testing was done to determine whether or not the color of clothing on the hunters pictured in the targets would affect the subjects ability to make safe decisions. Small pieces of actual hunter red and blaze orange clothing were cut to fit the shape of each of the hunter's hats in the standard unsafe targets. The portion of the poster depicting the hat was carefully removed and the colored cloth glued to the back of the target.

The addition of blaze orange or red attire did result in a significant increase in target system scores (Table 10). Slightly more correct decisions were made on the blaze orange modifications than on the red, although the difference was not significant.

Table 6. Analysis of variance and means for target system housing compared to total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	2	10709.27	44.90***
Within groups	2757	238.55	
Total	2759		

Housing	N	Mean	Standard deviation
Indoor	25	63.20	14.06
Outdoor	260	69.04	17.02
Inside tent	2475	59.54	15.28

*** (significant at .001)

Table 7. Analysis of variance and means comparing lighting conditions with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	2	13030.67	55.05***
Within groups	2752	236.71	
Total	2739		

Lighting conditions	N	Mean	Standard deviation
Natural	147	73.33	16.89
Artificial			
6 floodlights	2155	59.59	15.28
9 floodlights	438	60.07	15.36

*** (significant at .001)

Table 8. Analysis of variance and means comparing sample locations with total score.

Source of variation	Degrees of freedom	Mean Squares	F test value
Between groups	6	7598.60	33.02***
Within groups	2753	230.11	
Total	2759		

Sample location	N	Mean	Standard deviation
La Crosse Interstate Fair La Crosse, Wisconsin	358	60.73	14.90
Jefferson County Fair Jefferson, Wisconsin	170	62.24	14.22
Superior Tri-State Fair Superior, Wisconsin	354	61.33	15.87
Northern Wis. State Fair Chippewa Falls, Wisconsin	377	60.74	15.71
Wisconsin State Fair Milwaukee, Wisconsin	1273	57.67	14.77
Marinette County Fair Marinette, Wisconsin	175	73.89	16.53
Central Wis. State Fair Marshfield, Wisconsin	53	68.30	16.02

*** (significant at .001)

Table 9. Analysis of variance and means comparing the time testing was completed with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	2	761.39	3.43*
Within groups	2407	221.78	
Total	2409		

Time of testing	N	Mean	Standard deviation
Morning	195	56.15	14.29
Afternoon	1415	58.90	15.17
Evening	800	59.00	14.54

* (significant at .05)

Table 10. Analysis of variance and means comparing target color with total score.

Source of variations	Degrees of freedom	Mean squares	F test value
Between groups	2	27577.36	121.84***
Within groups	2752	226.34	
Total	2754		

Color modifications	N	Mean	Standard deviation
Standard target	2411	58.77	14.92
Blaze orange	227	73.30	15.29
Red	117	70.09	17.09

*** (significant at .001)

Socio - Demographic Variables

Age

The majority of subjects sampled, 57%, were under age 18. Nine percent were under 12 years of age. The 12-23 and 14-15 year groups were equally represented by 18% of the sample. Eleven percent were 16-17 years old. The largest single group of subjects, 22%, were between 18-25 years, 16% were 26-40, 4% were between 41-64, and less than 1% was 65 years or older.

Generally, as age increased, so did total score (Table 11). Subjects under the age of 12 scored significantly lower than other age groups. Those in the 26-40 year category had the highest scores.

Sex

Eighty-six percent of the participants in the study were male, 14% were female.

A *t*-test comparing the target system scores of men versus women showed no significant difference between the mean scores of the two groups (Table 12).

Education

Seventy-seven percent of the study subjects had a high school education or less: 37% had an eighth grade education or less, 40% indicated that they attended high school. Fourteen percent of the subjects had some college education, 6% had completed college and only 3% had done graduate work.

Significant differences were found between the mean target system scores when the various education categories were compared (Table 13). Generally, scores increased with an increase in education level. Individuals with an eighth grade education or less scored significantly lower than the individuals in the other categories. College graduates obtained the highest total target scores on the system - 63%. This increase in score with education may reflect the influence of age and experience. This possibility will be analyzed later.

Table 11. Analysis of variance and means comparing age with total score.

Source of variance	Degrees of freedom	Mean squares	F test value
Between groups	7	2140.23	10.43***
Within groups	2279	205.27	
Total	2285		

Age	N	Mean	Standard deviation
Under 12	209	52.92	13.43
12-13	413	56.51	14.84
14-15	441	57.14	14.38
16-17	250	57.56	15.34
18-25	498	59.50	13.99
26-40	372	62.37	13.94
41-64	98	59.08	14.00
65 or older	6	60.00	17.89

*** (significant at .001)

Table 12. Student's *t*-test of the difference in total scores of men versus women.

Sex	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Men	1975	58.23	14.53	0.68	2284	.049
Women	311	57.62	14.57			

Table 13. Analysis of variance and means comparing education with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	4	3159.15	15.33***
Within groups	2282	206.03	
Total	2286		

Education	N	Mean	Standard deviation
Less than 8th grade	843	55.39	14.22
9th-12th grade	920	59.05	14.56
Some college	323	59.75	14.70
College graduate	136	63.09	13.58
Graduate study	65	62.62	12.78

*** (significant at .001)

Community Size Before Age 18

Klessig and Hale (1972) found that the majority of Wisconsin hunters, 62%, were raised in a rural environment. The categories used in this question and the next one were taken from their study, "A Profile of Wisconsin Hunters". The intent of this question was to determine if subjects who had predominantly rural backgrounds, and possibly more exposure to hunting, would score better than their urban counterparts.

Twenty-nine percent of the subjects sampled stated that they had grown up in a rural area: 11% on a farm, 6.5% in open country but not a farm, and 12% in a small town. The majority, 71%, were raised in urban environments: 11% from cities of 2500 - 9999 in population, 25.5% from cities of 10,000 - 49,000, 16% from cities of 50,000 - 300,000 and 19% from urban centers with populations over 300,000.

As the size of community the subject grew up in increased, there was a slight tendency for hunter safety decision-making scores to decrease (Table 14). This tendency was so weak that no statistically significant differences were found among the various groups.

Size of Community Presently Living In

Of the subjects sampled, 28% indicated that they now reside in rural areas. Nine percent stated they live on a farm, 8% in open country, and 11% in small towns. The remaining 72% of the subjects indicated that they currently reside in urban areas: 11% in cities with a population of 2500 - 9999, 28% in cities of 10,000 - 49,999, 17% in cities of 50,000 - 300,000, and 17% in cities with populations over 300,000.

The amount of variation in the mean target scores of groups living in the various sized communities was small, ranging from 56.1 to 61.3, and not statistically significant (Table 15).

Table 14. Analysis of variance and means comparing community size before age 18 to total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	6	685.95	3.26*
Within groups	2273	210.22	
Total	2279		

Community size before age 18	N	Mean	Standard deviation
Rural			
Farm	245	59.63	13.80
Open country, not farm	148	61.28	14.81
Town less than 2500	269	57.51	13.55
Urban			
City of 2500-9999	243	59.01	14.28
City of 10,000-49,999	582	58.69	15.51
City of 50,000-300,000	359	56.85	13.96
City greater than 300,000	434	56.59	14.49

* (significant at .05)

Table 15. Analysis of variance and means comparing community size presently living in with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	6	562.80	2.67*
Within groups	2275	210.47	
Total	2281		

Community size now living in	N	Mean	Standard deviation
Rural			
Farm	202	58.71	14.40
Open country, not farm	177	61.30	15.00
Town less than 2500	249	57.59	14.31
Urban			
City of 2500-9999	261	59.12	14.66
City of 10,000-49,999	634	58.39	14.64
City of 50,000-300,000	383	57.15	14.05
City greater than 300,000	376	56.68	14.58

* (significant at .05)

County Residence

It was necessary to know what county the subject resided in so that the decision making ability of subjects from each of the Wisconsin DNR's six state districts could be compared (Appendix E). Of Wisconsin's 71 counties, all but eleven were represented in the sample: Burnett, Florence, Forest, Grant, Iron, Juneau, Lincoln, Polk, Richland, St. Croix and Vilas Counties. There were 297 subjects from out-of-state and 7 subjects from another country. Because of sample size, the counties were grouped into WDNR districts. There was a significant difference between the target system scores of subjects from the six WDNR districts (Table 16). The greatest percentage (42%) of subjects tested lived in the Southeastern District-site of the Wisconsin State Fair. Twenty-six percent of the participants indicated that they resided in the counties of the West Central District, 11.6% were from the Southern, 10.3% from the Northwestern, 8.6% from the Lake Michigan, and 1.4% from the North Central District.

Subjects who resided in the Lake Michigan District had significantly higher scores. The lowest mean scores were achieved by subjects from the Southeastern and West Central Districts. The low mean scores of the Southeastern District can probably be linked to the Milwaukee sampling site, already shown to have significantly lower scores than other sampling sites. These differences in target scores between the WDNR districts were found to be significant at the .001 level of confidence.

Table 16. Analysis of variance and means for county residents by WDNR Districts compared to total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	5	2048.22	9.25***
Within groups	2087	221.54	
Total	2092		

WDNR District	N	Mean	Standard deviation
Southern	243	60.45	13.91
Southeast	871	57.13	14.79
Lake Michigan	181	64.81	17.88
West Central	553	59.31	14.63
North Central	30	60.67	12.30
North West	215	60.51	14.54

*** (significant at .001)

Ownership of a Hunting Weapon

To determine if the ownership of a hunting weapon might effect decision-making ability, subjects were asked if they owned a shotgun, rifle, handgun or bow (Table 17).

Individuals sampled were almost evenly split among those who owned a shotgun, 49%, and the 51% who did not. Shotgun owners as a group scored significantly higher than those who did not own a shotgun. This difference was significant at the .01 level.

In contrast to shotgun owners, 54% of the subjects sampled owned a rifle. Rifle owners out-scored the non-owners 60% to 56%.

Only 19% of the subjects sampled indicated that they owned a handgun. Handgun owners, like owners of other weapons, scored significantly higher than did those who did not own a handgun. This difference was significant at the .01 level.

More sample subjects than expected, 40%, indicated that they owned a bow. Owners of a bow scored significantly higher at the .01 level of significance than those who did not.

Member of a Sportsmans Club

To evaluate the effect of sportsclub membership on decision-making ability, the 11% of the study's sample who belonged to a sportsmens club were compared with subjects who did not. Members of sportsmens club scored significantly higher than the remainder of the test subjects (Table 18).

Table 17. Students t-tests of the differences in total score of hunting weapon owners versus non-owners.

	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Shotgun owners	1122	60.95	14.27	-9.22	2285	0.00
Non-shotgun owners	1165	55.44	14.27			
Rifle owners	1233	60.02	14.46	-6.74	2285	0.00
Non-rifle owners	1054	55.95	14.32			
Handgun Owners	429	60.33	14.67	-3.46	2285	0.001
Non-handgun owners	1858	57.64	13.71			
Bow Owners	921	59.50	14.33	-3.70	2284	0.00
Non-bow owners	1365	57.22	14.60			

Table 18. Students _t_-test of the difference in total scores of Sportsman's Club members versus non-members.

Member	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	254	62.13	14.23	4.67	2277	0.00
No	2025	57.63	14.50			

Wisconsin Hunter Safety Course Instruction

A primary interest of the WDNR in this project was to determine if graduates of the Wisconsin Hunter Safety Course make safer decisions on the study's target system. Graduates of the course did score somewhat higher than those who had not and this difference was significant at the .01 level of confidence, although an analysis of variance found that the year the subject completed the Wisconsin Hunter Safety Course made no significant difference in his or her score (Table 19).

To determine whether subjects who had actually practiced with live-firing in their Wisconsin Hunter Safety Course would make safer decisions than graduates who received only text-book or "dry-run" experience in handling a firearm, their results were compared. The mean total score of Wisconsin Hunter Safety graduates who did not experience live-firing was actually higher than the 77% of the graduates who had practiced it as part of their training course. However, this difference was so small as not to significantly differ from zero (Table 20).

Analysis of variance also indicated that the size of town where the Wisconsin Hunter Safety Course was taken and the year the course was completed had no significant effect on the subjects ability to make correct decisions (Table 21).

Other Hunter Safety Instruction

Other types of hunter safety instruction such as: training through a Sports or rifle club; 4-H, Scout or non-sports club type training; a National Rifle Association Course, partial completion of the Wisconsin Hunter Safety Course; completion of another state's hunter safety course, and a school hunter safety program were tested.

The target system scores of subjects who had experienced some other type of organized hunter safety training were almost identical to subjects who had no such training and no significant difference was found between the two groups (Table 22).

Table 19. The difference in total scores of Wisconsin Hunter Safety graduates and their year of graduation versus non-graduates.

Graduate	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	429	60.49	14.83			
Year completed						
1964	1	80.00				
1965	2	75.00	7.07			
1966	2	85.00	21.21			
1967	9	55.56	8.82			
1968	12	62.50	15.45	3.71	2282	0.00
1969	12	63.33	9.85			
1970	13	55.38	14.50			
1971	30	61.00	16.89			
1972	45	60.22	14.54			
1973	62	59.84	14.43			
1974	100	61.10	14.42			
1975	109	60.92	15.25			
1976	29	57.24	15.56			
No	1855	57.61	14.41			

Table 20. Student's *t*-test of the differences in total scores of Wisconsin Hunter Safety graduates who participated in live firing versus those who did not.

Live firing	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	328	60.03	14.72	-1.35	425	.177
No	99	62.32	14.97			

Table 21. Analysis of variance and means comparing the size of the town where the Wisconsin Hunter Safety Course was completed with total score.

Source of variation	Degrees of freedom	Mean Squares	F test value
Between groups	4	148.78	0.609
Within groups	422	218.86	
Total	426		

Size of town	N	Mean	Standard deviation
Rural			
Less than 2500	110	59.55	14.86
Urban			
City of 2500-9999	87	61.95	14.21
City of 10,000-49,999	138	61.01	14.46
City of 50,000-300,000	43	61.63	14.95
City greater than 300,000	49	58.37	16.37

Table 22. Student's t-test of the differences in total scores of subjects who had taken other hunter safety courses versus subjects who had not.

Had other training	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	280	58.18	14.37	.004	2279	0.972
No	2001	58.15	14.57			

Previous Experience with the Duelatron

Since the Duelatron had been used in Wisconsin during the past several years, it was possible that some of our sample subjects might have had previous experience with the system and could score higher than those who had never used the device.

Only 4% of the subjects tested had previously taken the Duelatron test course; 92% indicated that they had no experience with the system; 4% were uncertain as to whether or not they had been previously tested. A significant difference in target system scores was found between the three groups (Table 23). Subjects who had previous experience with the Duelatron test course scored significantly higher than those who never had or were uncertain if they had taken the course.

Hunting Frequency

Seventy-five percent of the subjects had hunted before. Of these; 34% frequently participated in the sport, 23% only occasionally and 15% seldom. Four percent indicated they used to hunt but no longer do.

Target system scores generally increased with an increase in the frequency of hunting (Table 24). Subjects who frequently hunted had the highest total mean score, 60.8. Interestingly, subjects who used to hunt, but no longer do, had the second highest total mean score value, although it was not significantly different from the scores of the other frequency categories.

Hunting Experience

The remaining questions were completed only by those sample subjects who indicated that they had some hunting experience. We felt that the more hunting experience a subject had, the better his or her ability would be to make a safe decision and hence, score higher on the target system. The majority of the hunter subjects were "inexperienced" hunters, one who has been hunting less than five years. Twelve percent of the hunters had hunted less than one year; 46% had 1-4 years of experience; 22% of the hunters had 5-10 years of experience, and only 7% hunted for more than 21 years.

The inexperienced hunter had lower total scores than did those with five or more years of experience (Table 25). Subjects with 11-20 years of hunting experience had significantly higher scores than did other experience categories. Target system scores generally increased with an increase in hunting experience, the exception being hunters who had over 21 years of experience whose mean target system score was only 60.2.

Hunting Teacher

Klessig and Hale (1972) reported that 80% of the hunters that they sampled had been first introduced to hunting by a relative. The majority of subjects sampled in their study, 69%, also indicated they had first learned how to hunt from a relative . Only 16% were self-taught hunters, 10% learned from a friend, and 5% had their first experience through a hunter safety course. Less than one percent of the subjects stated that some teacher other than those listed had first introduced them to hunting.

Subjects who were self-taught or had learned to hunt under the guidance of a family member scored about the same on the target system, 59.4% and 59.3% respectively. Those who had been introduced to hunting by a friend had slightly lower scores, 58.2%. Subjects who had learned to hunt through a hunter safety course had the lowest target system scores of the four categories. The differences in target scores among these four groups were too small, however, to be statistically significant (Table 26).

Hunting Accident

This question was added to determine if a subject who had been involved in a hunting accident would be more cautious in making hunting decisions and score better on the target system. Three percent of the sample subjects indicated that they had been involved in a hunting accident. Their total mean score, 57.8%, was actually lower than the scores of the 97% of the subjects who had never been involved in a hunting accident (Table 27). A *t*-test found that the variation in target system scores between the two groups was not significantly different from zero.

Table 23. Analysis of variance and means comparing experience with the Duelatron to total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	2	2908.06	13.91***
Within groups	2280	209.03	
Total	2282		

Previous experience	N	Mean	Standard deviation
Yes	90	65.89	17.79
No	2092	57.90	14.36
Uncertain	101	56.44	13.16

*** (significant at .001 level)

Table 24. Analysis of variance and means of hunting frequency compared with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	4	2863.33	13.86***
Within groups	2280	206.56	
Total	2284		

Hunting frequency	N	Mean	Standard deviation
Frequently	770	60.81	14.45
Occasionally	531	58.40	14.73
Seldom	336	55.98	13.81
Used to, but no longer do	82	59.51	14.05
Never hunted	566	55.41	14.31

*** (significant at .001)

Table 25. Analysis of variance and means for hunting experience compared with total score.

Source of variation	Degrees of freedom	Mean squares	F test value
Between groups	4	2815.17	13.85***
Within groups	1711	203.25	
Total	1715		

Hunting experience	N	Mean	Standard deviation
Less than 1 year	197	55.94	13.80
1-4 years	797	57.42	
5-10 years	369	60.81	
11-20 years	226	64.16	
21 years or more	127	60.24	

*** (significant at .001)

Table 26. Analysis of variance and means of hunting teacher compared to total score.

Source of variation	Degrees of freedom	Mean square	F test value
Between groups	4	200.50	0.431
Within groups	1706	209.41	
Total	1710		

Hunting teacher	N	Mean	Standard deviation
Self Taught	266	59.40	13.53
Member of family/relative	1176	59.33	14.52
A friend	175	58.23	15.04
Hunter safety course	87	56.90	15.72
Other	7	54.29	9.76

Table 27. Student's _t_-test of the differences in total scores of hunting accident subjects versus non-accident subjects.

Accident	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	54	57.78	13.13	-0.67	1713	0.504
No	1661	59.12	14.52			

Types of Hunting Participated In and Success Rate

This question was added at the request of researchers at the University of Wisconsin-La Crosse who were involved in a WDNR hunter behavior study. Subjects were asked to indicate which type(s) of hunting they participated in and their rate(s) of success.

Twenty-six percent of the subjects sampled who were hunters indicated that they participated in waterfowl hunting; 74% of the subjects did not. A *t*-test comparing the scores of the two groups found that waterfowl hunters scored significantly higher on the target system than did those who were not waterfowl hunters. This difference was significant at the .001 level.

Thirty-four percent of these hunters indicated they were successful in bagging game 0-25% of the time they went waterfowl hunting, 32% said they were successful 26-50% of the time, 14% had a success rate of 51-75%, while 20% were successful 76-100% of the time. Waterfowl hunters whose success rate was 51-75% had the highest total scores while subjects who were successful only 0-25% of the time had the lowest. However, the differences in scores between the various success groups were so small that they were not statistically significant (Table 28).

Two-thirds of the hunters sampled did not hunt upland game birds. Like waterfowl hunters, those who participated in upland game bird hunting scored significantly higher on the target system than those who did not.

Thirty-nine percent of the subjects were successful at bagging upland game birds 0-25% of the time they went hunting, 28% were successful 26-50% of the time, 18% had a success rate of 51-75% and 14%

stated that 76-100% of the time they bagged game. An analysis of variance found no significant differences in the total scores of the upland game bird success categories, although scores generally increased with an increase in hunting success. As a group, the mean total scores of upland game bird hunters were almost identical to the scores of waterfowl hunters, 62.4 and 62.0, respectively (Table 29).

Sixty-three percent of the subjects who hunted, hunted small game. Small game hunters tended to score higher than non-small game hunters although the difference between the two groups was not found to be significant.

Total mean scores tended to somewhat increase as small game hunting success increased. Of the small game hunters 56.6% indicated that they were successful 0-25% of the time, 22.0% bagged game with a success rate of 26-50%, 10% had a success rate of 51-75%, and 11% were successful 75-100% of the time. The differences between the small game success categories were not significant (Table 30).

Of those sample subjects who hunted, 43% participated in big game hunting with a gun. Big game-gun hunters scored significantly higher than those who did not participate in this type of hunting. This difference was significant at the .001 level.

Generally, as the success rate of big game-gun hunting increased so did total score. Those who bagged game 51-75% of the time had the highest total mean scores. However, differences between success groups was not found to be statistically significant. As a group, the mean score of the big game-gun hunters was slightly lower, 60.6, than the total mean scores of the waterfowl and upland game bird hunters (Table 31).

The majority of the hunters did not hunt big game with a bow. However, the 18% that did scored significantly higher on the target system than those who did not. The difference was significant at the .01 level.

As might be expected, the success rate of big game-bow hunters was low. Ninety percent bagged game only 0-25% of the time, 3% had a success rate of 26-50%, one hunter was successful 51-75% of the time, and 6% of the bow hunters had a success rate of 76-100%. Although the mean total scores represented by two of the groups were quite high (70%), an analysis of variance found no statistically significant difference between the four success categories. This was probably due to the small sample size in all but the 0-25% success category (Table 32).

Table 28. The difference in total scores of waterfowl hunters and their rate of success versus non-waterfowl hunters

Waterfowl hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	151	61.99	15.62			
Success rate						
0- 25%	52	59.42	16.50			
				4.31	572	0.000
26- 50%	48	62.71	16.08			
51- 75%	21	68.57	12.76			
76-100%	30	60.67	14.37			
No	423	55.96	14.42			

Table 29. The difference in the total scores of upland game bird hunters and their rate of success versus non-upland game bird hunters.

Upland game bird hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	194	62.37	15.29			
Success rate						
0- 25%	76	60.92	14.25	5.67	572	0.000
26- 50%	55	60.91	16.02			
51- 75%	35	65.71	15.01			
76-100%	28	65.00	16.67			
No	380	55.08	14.21			

Table 30. Students *t*-test of the difference in total scores of small game hunters and their rate of success versus non-small game hunters.

Small game hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	362	58.15	14.80			
Success rate 0-25%	175	62.23	16.68	1.27	572	0.206
26-50%	68	62.35	16.03			
51-75%	31	66.13	18.38			
75-100%	35	64.29	16.5			
No	212	56.51	15.24			

Table 31. The difference in total scores of big game-gun hunters and their rate of success versus non-big game-gun hunters.

Big game-gun hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	245	60.53	15.26			
Success rate 0-25%	137	59.05	14.80			
26-50%	55	61.82	16.11	4.18	572	0.000
51-75%	24	64.17	17.17			
76-100%	28	62.50	14.04			
No	329	55.32	14.38			

Table 32. The difference in total score of big game-bow hunters and their rate of success versus non-big game-bow hunters.

Big game-bow hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	101	61.39	13.57			
Success rate 0-25%	91	60.88	13.22			
26-50%	3	70.00	17.32	2.86	571	0.004
51-75%	1	70.00				
76-100%	6	63.33	18.62			
No	472	56.72	15.16			

NEWSCORE

When analyzing the data, 47.4% of the sample subjects scored incorrectly on at least one of the four safe-to-shoot targets (Table 33). This reluctance to shoot may indicate that the subject was unable to recognize a safe target, perceived an unsafe element(s) in the target, or was very cautious before taking a shot - feeling that it was wiser to be safe. Subjects who were cautious might be penalized if they failed to shoot at a safe target. Analysis was re-run, evaluating only the scores on the unsafe targets. This would measure the subject's ability to perceive an unsafe situation.

The dependent variable used to describe the cumulative scores of the 6 unsafe targets was named "newscore". Only the newscore results which significantly differ from similar tests using the total target score as the dependent variable are reported. The relationships between the course development variables (target face time, target interval time, target color) and newscore were not analyzed. The effect of target sequence on the scores of the unsafe targets will be considered in the Discussion of this paper.

Table 33. Summary of the number of incorrect decisions made by sample subjects on safe-to-shoot targets.

Number of Targets	Incorrect Number	Percent
None of the targets	1451	52.57
One of the four targets	941	34.09
Two of the four targets	308	11.20
Three of the four targets	51	1.85
All four targets	8	.29

Lighting

Variations in lighting were found to cause significant differences in both total score and newscore, which were significantly higher when testing was done under natural rather than artificial conditions. Unlike total score, the results of a Scheffe test indicated a significant difference to exist in the newscores of sample subjects tested under six versus nine floodlights. Newscores were lower when nine floodlights rather than six were used to artificially light the course (Table 34). The nine floodlight set-up was used only at the Wisconsin State Fair and Central Wisconsin Fair.

Location

An analysis of variance comparing location with newscore showed that subjects made significantly more correct decisions on the unsafe targets at Marinette County Fair and significantly more incorrect decisions at the Wisconsin State Fair in Milwaukee.

Although subjects at the Central Wisconsin State Fair made slightly more correct decisions on the unsafe targets, their scores were not significantly different for the remainder of the location categories (Table 35). This differs from scores on the total target system; individuals at the Central Wisconsin State Fair scored significantly higher than those at any other site except the Marinette County Fair on the entire target system.

Time

The influence of time, whether or not the subject had completed the test course in the morning, afternoon, or evening, on newscore was significant at the .01 level of confidence. Subjects who completed the course in the afternoon and evening had higher newscores than morning participants. The relationship between time and total score was significant only at the .05 level (Table 36).

Table 34. Analysis of variance and means comparing lighting conditions with newscore.

Source of variation	Degrees of freedom	Mean squares	F-test value
Between groups	2	6390.94	29.52***
Within groups	2737	216.46	
Total	2739		

Lighting	N	Mean	Standard deviation
Natural	201	33.90	16.99
Artificial			
6 floodlights	2241	26.41	14.39
9 floodlights	298	23.99	15.43

*** (significant at .001)

Table 35. Analysis of variance and means comparing sample locations with newscore.

Source of variation	Degrees of freedom	Mean squares	F-test value
Between groups	6	8604.03	42.42**
Within groups	2754	202.83	
Total	2760		

Sample location	N	Mean	Standard deviation
La Crosse Interstate Fair La Crosse, Wisconsin	506	27.65	13.46
Jefferson County Fair Jefferson, Wisconsin	168	29.46	13.81
Superior Tri-State Fair Superior, Wisconsin	351	28.86	14.12
Northern Wis. State Fair Chippewa Falls, Wisconsin	379	27.84	15.03
Wisconsin State Fair Milwaukee, Wisconsin	1129	22.67	14.21
Marinette County Fair Marinette, Wisconsin	175	39.14	15.38
Central Wisconsin State Fair Marshfield, Wisconsin	53	33.40	14.67

** (significant at .01)

Table 36. An analysis of variance and means comparing time with newscore.

Source of variation	Degrees of freedom	Mean squares	F-test value
Between groups	2	1207.68	5.503**
Within groups	2873	219.45	
Total	2875		
Time	N	Mean	Standard deviation
Morning	246	23.74	14.87
Afternoon	1710	27.09	15.18
Evening	920	26.74	14.09

** (significant at .01)

Community Size Before Age 18

Similar to total score, subjects who before age 18 lived in open country, not a farm, had significantly higher mean newscores while those who had resided in cities of 300,000 or more had the lowest. This difference was significant at the .001 level (Table 37). While this relationship existed between community size before age 18 and total score, it was so weak that no significant differences were found among the various community categories.

Size of Community Presently Living In

Subjects who presently live in open country, not a farm, scored significantly higher while those from cities over 300,000 scored significantly lower than remaining community sizes tested on the unsafe targets (Table 38). Similar results were obtained when total score was compared with present community size, however the relationship was so weak that an analysis of variance failed to indicate any differences between the community categories.

County residence

Like total score, the relationship between county residence, as grouped into the six WDNR districts, and newscore was highly significant at the .001 level. However, a Scheffe procedure indicated that scores from the Southeastern District were significantly lower than the remaining districts. Although newscores from subjects residing in the counties of the Lake Michigan District remained the highest, they were not found to be different from the other districts (Table 39).

Table 37. Analysis of variance and means for community size before age 18 compared with newscore.

Source of variation	Degrees of freedom	Mean squares	F-test value
Between groups	6	1746.40	8.03
Within groups	2747	217.62	
Total	2753		

Community size	N	Mean	Standard deviation
Rural			
Farm	329	28.54	14.83
Open country	204	30.83	15.40
Town less than 2500	336	26.88	14.56
Urban			
City of 2500-9999	288	27.67	14.13
City of 10,000-49,999	718	27.30	15.26
City of 50,000-300,000	425	25.24	14.19
City greater than 300,000	454	25.57	14.62

Table 38. Analysis of variance and means for size of community presently living in compared to newscore.

Source of variation	Degrees of freedom	Mean squares	F-test value
Between groups	6	2085.70	9.61***
Within groups	2748	217.06	
Total	2754		

Community size	N	Mean	Standard deviation
Rural			
Farm	275	28.62	15.67
Open country, not farm	251	30.88	15.31
Town less than 2500	311	27.11	14.94
Urban			
City of 2500-9999	308	27.47	13.84
City of 10,000-49,999	777	27.17	14.83
City of 50,000-300,000	453	25.22	14.18
City greater than 300,000	380	22.82	14.63

*** (significant at .001)

Table 39. Analysis of variance and means for county residence by WDNR District compared to newscore.

Source of variation	Degrees of freedom	Mean squares	F-test value
Between groups	5	2997.42	14.76***
Within groups	2087	203.04	
Total	2092		

WDNR District	N	Mean	Standard deviation
Southern	243	27.20	13.86
Southeastern	871	22.66	14.37
Lake Michigan	181	30.72	16.70
West Central	553	26.17	13.64
North Central	30	23.67	12.99
Northwestern	215	28.56	13.65

*** (significant at .001)

Ownership of a Handgun

A *t*-test comparing total scores showed that handgun owners scored significantly higher than non-owners. This difference was considerably weaker (significant at the .034 level) when only the scores of the unsafe targets were analyzed (Table 40).

Big Game-Bow Hunters

Subjects who indicated that they hunted big game with a bow had both significantly higher total scores and newscores than those who were not big game bow-hunters. However, the tendency to make correct decisions was slightly stronger when only the unsafe targets were considered, being significant at better than the .001 level (Table 41).

Table 40. Student's t-test of the difference in newscores of handgun owners versus non-owners.

Owner of a handgun	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	503	28.02	14.51	-2.12	2759	0.034
No	2258	26.46	14.94			

Table 41. Student's t-test of the difference in newscore of big game-bow hunters versus non-big game-bow hunters.

Big game bow-hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	135	32.67	16.22	4.76	2759	0.000
No	2626	26.44	14.74			

DECISION-MAKING ON SPECIFIC WILDLIFE TARGET SETS

The ability of sample subjects with various socio-demographic characteristics and with differing amounts of hunting experience to make correct decisions on the overall target system and the six "unsafe" targets has been discussed. It was also felt that individuals who hunted a given wildlife species might also make more correct decisions on targets depicting that particular species than those who did not hunt it. To test this hypothesis, targets with specific wildlife (i.e. waterfowl, upland birds, small game, and big game) were used.

Waterfowl Decision-Making

A significant difference was found between the scores of the waterfowl hunters versus those who do not participate in this type of hunting on the two mallard targets. Waterfowl hunters had slightly higher scores on waterfowl targets than did non-waterfowl hunters. Although hunters, whose waterfowl success rate was 51-75%, had the highest mean scores on the mallard target set, an analysis of variance found no significant difference between the success categories (Table 42).

Fifty-nine percent of the waterfowl hunters did not shoot at the don't shoot target while 41% shot at the target with the hunter pictured in the background (Table 43). Forty-five percent of the hunters who do not hunt waterfowl made a safe decision on the target and 55% made a mistake. No significance was found between the ability to make a correct decision on the unsafe mallard target and the rate of waterfowl hunting success (Table 44).

Table 42. The difference in scores on the waterfowl targets of waterfowl hunters and their rate of success versus non-waterfowl hunters.

Waterfowl hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	187	14.97	5.52			
Success rate 0-25%	73	14.38	5.77			
26-50%	51	14.12	5.72	3.99	2409	0.000
51-75%	29	17.24	4.55			
76-100%	34	15.59	5.04			
No	2224	13.23	5.74			

Table 43. A Chi-square test of independence of scores on the unsafe waterfowl target between waterfowl hunters and non-waterfowl hunters.

Waterfowl hunter	Wrong decision	Correct decision	Raw total
Yes	77 3.2%	110 4.6%	187 7.8%
No	1233 51.1%	991 41.1%	2224 92.2%
Column Total	1310 54.3%	1101 45.7%	2411 100.0%

Corrected Chi-square = 13.58. Statistically significant at .001 level.

Table 44. A Chi-square test of independence of scores on the unsafe waterfowl target and waterfowl hunting success rate.

Success rate	Wrong decision	Correct decision	Raw total
0-25%	34 18.2%	39 20.9%	73 39.0%
26-50%	23 12.3%	28 15.0%	51 27.3%
51-75%	7 3.7%	22 11.8%	29 15.5%
76-100%	13 7.0%	21 11.2%	34 18.2%
Column Total	77 41.2%	110 58.8%	187 100.0%

Raw Chi-square = 4.80

Upland Bird Decision-Making

Surprisingly, those who did not hunt upland game birds had slightly higher scores on the set of three pheasant targets than did those who participate in this type of hunting. This difference was not significant at the .017 level. Rate of success made no difference on the subject's ability to make correct decisions on this target-set (Table 45).

The pheasant target set consisted of three targets, two of which were unsafe to shoot at. Non-game bird hunters scored better than the bird hunters (Table 46). Of those who hunted upland game birds 35.8% scored incorrectly on both of the unsafe targets, 49.6% made a correct decision on one of the targets, and 14.6% scored correctly on both. Of the hunters who did not hunt upland game birds, 26.3% erred on both targets. Just over 64.2% of upland game bird hunters scored correctly on one or both of the game bird targets, 73.7% of non-game bird hunters did this well.

There was no statistically significant difference between the success rate of upland game bird hunters and their scores on the unsafe pheasant targets (Table 46). However, the small sample size of the various success categories require very large differences in decision making ability in order to find statistical significance and could have affected these findings.

Table 45. Student's t-test of the difference in scores on the upland game bird targets of upland game bird hunters and their rate of success versus non-upland game bird hunters.

Upland game bird hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	240	14.83	9.24			
Success rate						
0-25%	95	15.16	9.77			
26-50%	68	14.26	8.52	-2.38	2409	0.017
51-75%	45	15.11	9.20			
76-100%	32	14.69	9.50			
No	2171	16.08	7.48			

Table 46. A Chi-square test of independence of scores on the unsafe upland game bird targets between upland game bird hunters and non-upland game bird hunters.

Upland game bird hunter	Number of Correct Decisions 0	1	2	Raw Total
Yes	86 3.6%	119 4.9%	35 1.5%	240 10%
No	572 23.7%	1263 52.4%	336 13.9%	2171 90%
Column Total	658 27.3%	1382 57.3%	371 15.4%	2411 100%

Raw Chi-square = 10.02. Statistically significant at the .01 level.

Table 47. A Chi-square test of independence of scores on the unsafe upland game bird targets and upland game bird hunting success rate.

Success rate	Number of Correct Decisions 0	1	2	Raw Total
0-25%	34 14.2%	42 17.5%	19 7.9%	95 39.6%
26-50%	28 11.7%	33 13.8%	7 2.9%	68 28.3%
51-75%	14 5.8%	27 11.3%	4 1.7%	45 18.8%
76-100%	10 4.2%	17 7.1%	5 2.1%	32 13.3%
Column Total	86 35.8%	119 49.6%	35 14.6%	240 100.0%

Raw Chi-square = 6.48.

Small Game Decision-Making

On the set of two squirrel targets small game hunters did not score significantly different from subjects who did not hunt small game. The rate of small game hunting success proved to have no significant effect on the subject's ability to make correct decisions on the target set (Table 48).

The variation of scores on the lone unsafe squirrel target of both the small game and non-small game hunters as well as the difference in scores between the hunter success rate categories was so small that the differences are likely due to chance (Tables 49 and 50). Slightly over 77% of all the subjects scored incorrectly on this target.

Table 48. Student's t-test of the differences in scores on the small game targets of small game hunters versus non-small game hunters.

Small game hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	435	11.15	4.85			
Success rate 0-25%	156	11.09	4.90			
26-50%	108	10.65	4.79	1.87	2409	0.062
51-75%	76	11.84	4.53			
76-100%	94	11.28	5.13			
No	1976	10.65	5.06			

Table 49. A Chi-square test of independence of scores on the unsafe small game target between small game hunters and non-small game hunters.

Small game hunter	Wrong decision	Correct decision	Raw total
Yes	331 13.7%	103 4.3%	434 18.0%
No	1530 63.5%	446 18.5%	1976 82.0%
Column Total	1861 77.2%	549 22.8%	2410 100.0%

Corrected Chi-square = 0.211

Table 50. A Chi-square test of independence of scores on the unsafe small game target and small game hunting success rate.

Success rate	Wrong decision	Correct decision	Raw total
0-25%	119 27.4%	37 8.5%	156 35.9%
26-50%	87 20.0%	21 4.8%	108 24.9%
51-75%	55 12.7%	21 4.8%	76 17.5%
76-100%	70 16.1%	24 5.5%	94 21.7%
Column Total	331 76.3%	103 23.7%	434 100.0%

Raw Chi-square = 1.90

Big Game-Gun Decision Making

Big game-gun hunters made significantly more incorrect decisions on the set of white-tailed deer targets than did those who did not hunt big game with a gun. This difference was highly significant at the .001 level of confidence. Surprisingly, the scores of big game-gun hunters tended to decrease as rate of hunting success increased. However, these variations were not found to be significantly different (Table 51).

Like the pheasant targets, there were two unsafe targets in the white-tailed deer target set. A Chi-square test of independence found that a real difference existed between the scores of big game-gun hunters versus other hunters on the two unsafe targets (Table 52). Of the subjects who were big game hunters, 40.8% erred on both the unsafe targets, 38.2% scored correctly on one, and 21.0% received the full 20 points. Only 33.0% of the subjects who did not hunt big game with a gun made an incorrect decision on both targets, 47.5% scored correctly on one, while 19.5% got both targets right.

The rate of big game-gun hunting success had no statistical significance on the hunters' ability to make correct decisions on the unsafe deer targets (Table 53).

Table 51. Student's t-test of the difference in scores on the big game targets of big game-gun hunters and their rates of success versus non-big game-gun hunters.

Big game-gun hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	310	15.32	9.81			
Success rate						
0-25%	175	15.71	9.56			
26-50%	68	15.29	10.0	-3.83	2409	0.000
51-75%	31	15.16	10.61			
76-100%	35	13.71	10.31			
No	2101	17.21	7.83			

Table 52. A Chi-square test of independence of scores on the unsafe big game targets between big game-gun hunters and non-big game-gun hunters.

Big game-gun hunter	Number of Correct Decisions 0	1	2	Raw Total
Yes	126 5.2%	118 4.9%	65 2.7%	309 12.8%
No	694 28.8%	998 41.4%	409 17.0%	2101 87.2%
Column Total	820 34.0%	1116 46.3%	474 19.7%	2410 100.0%

Raw Chi-square - 10.23. Statistically significant at the .01 level.

Table 53. A Chi-square test of independence of scores on the unsafe big game targets and big game-gun success rate.

Success rate	Number of Correct Decisions 0	1	2	Raw Total
0-25%	67 21.7%	70 22.7%	38 12.3%	175 56.6%
26-50%	29 9.4%	26 8.4%	13 4.2%	68 22.0%
51-75%	12 3.9%	13 4.2%	6 1.9%	31 10.0%
76-100%	18 5.8%	9 2.9%	8 2.6%	35 11.3%
Column Total	126 40.8%	118 38.2%	65 21.0%	309 100.0%

Raw Chi-square = 3.28

Big Game-Bow Decision Making

Like big game-gun hunters, subjects who hunted big game with a bow had lower scores on the white tailed deer targets than those who did not participate in this type of hunting. However, this difference was not significant. Again, rate of success made no difference on how well big game-bow hunters scored on the big game targets (Table 54).

No real difference was found to exist between the scores of big game-bow hunters and non-big game-bow hunters on the two unsafe targets of the white-tailed deer set (Table 55). No relationship was found between success rate and the ability of the bow hunters to make correct decisions on these targets (Table 56). However, the small sample size of some of the success categories may make the results of this test and the analysis of variance comparing success rates to the scoring ability of big game-bow hunters questionable.

Table 54. Student's t-test of the differences in scores on the big game targets of big game-bow hunters and their rates of success versus non-big game-bow hunters.

Big game-bow hunter	Number of cases	Mean	Standard deviation	T-value	Degrees of freedom	2-tail probability
Yes	129	16.20	9.86			
Success rate						
0-25%	113	15.49	9.82			
26-50%	5	22.00	8.37	-1.10	2409	0.27
51-75%	4	25.00	5.77			
76-100%	7	18.57	10.69			
No	2282	17.01	8.02			

Table 55. A Chi-square test of independence of scores on the unsafe big game targets between big game-bow hunters and non-big game-bow hunters.

Big game-bow hunter	Number of Correct Decisions 0	1	2	Raw Total
Yes	46 1.9%	52 2.2%	31 1.3%	129 5.4%
No	775 32.1%	1064 44.1%	443 18.4%	2282 94.6%
Column Total	821 34.1%	1116 46.3%	474 19.7%	2411 100.0%

Raw Chi-square = 2.48

Table 56. A Chi-square test of independence of scores on the unsafe big game targets and big game-bow success.

Success rate	Number of Correct Decisions 0	1	2	Raw Total
0-25%	44 34.1%	45 34.9%	24 18.6%	113 87.6%
26-50%	0 0.0%	3 2.3%	2 1.6%	5 3.9%
51-75%	0 0.0%	2 1.6%	2 1.6%	4 3.1%
76-100%	2 1.6%	2 1.6%	3 2.3%	7 5.4%
Column Total	46 35.7%	52 40.3%	31 24.0%	129 100.0%

Raw Chi-square = 7.52

MULTIPLE REGRESSION

Multiple regression is a statistical tool which can be used to evaluate the contribution of one or more independent variables in explaining the variation in the dependent variable. Total score, then newscore, were regressed on the independent socio-demographic variables: age, sex, education, community size before age 18, present community size, ownership of a shotgun, rifle, handgun, or bow, Sportsclub member, graduate of a Wisconsin Hunter Safety Course, experience with live fire, other hunter safety instruction, previous experience with the Duelatron, hunting frequency and experience, hunting teacher, involvement in a hunting accident, and the types and success rates of hunting the appropriate subject. Independent course development variables which were included were: time, location, target face and target interval time. County residence, the year that the Wisconsin Hunter Safety Course was completed, the town where the Wisconsin Hunter Safety Course was completed, sampling site, date, lighting, target sequence, and target color variables could not be included as they did not represent interval-type data.

The first analysis which was run attempted to include all of these independent variables into one step-wise regression. The outcome was that the increase in "R" value, or increase in the variance of the dependent variable explained, as each new independent variable was added seemed to alternate into and out of statistical significance haphazardly. The results could not be interpreted and the intercorrelation between the many variables was suspected to be strong enough to confound the step-wise regression. This type of confounding effect is called "multi-collinearity" (Nie, et al, 1975).

The independent variables were randomly divided into three groups and a multiple regression was run on each group (Draper and Smith, 1966). The variables whose explanatory powers were found to be significant in each of these preliminary tests were then combined into one final regression. In this way the effect of multi-collinearity was diminished and an hierarchy of the explanatory powers of the significant variables established.

The results of the final regression of these variables and total score are found in Table 57. The Pearson Product Moment, "r", represents how well correlated an independent variable is with the dependent variable and whether the relationship is positive or negative. This value, if squared, ("R"), indicates the percentage of variation in the dependent variable which is explained by the independent variable and is considered a clearer interpretation than simple "r" of the strength of that relationship.

Ownership of a shotgun was found to explain the highest percentage of variation in total score, 3.7%. Although this value was low, it was significant at the .05 level. The amount of education a subject received explained the second greatest amount of variation, 1.6%, raising the total explanatory power of these two variables to 5.3%. Both previous experience with the Duelatron and community size before age 18 each explained .5% while age contributed to only .3% of the variation. The remainder of the variables explained less than .1% and were not considered significant. Only 6.7% of the variation in total score could be explained by the independent variables in the final regression.

Because the independent and dependent variables were measured in different units, it was necessary to standardize them to have a mean of zero and a unit variance (i.e.the standard deviation of all the variables in the equation), equal to one (Roggenbuck, 1975). This permits the comparison of the relative effect of each independent variable on the dependent variable and allows calculation of partial regression coefficients, called "beta coefficients". Beta coefficients stand for the expected change in the dependent variable with each unit change in the independent variable while holding the effect of all the other independent variables constant or controlled for (Nie, et al, 1975).

Using the standardized beta coefficients (Table 57) total score could be predicted to increase .125 standard deviation units for each standard deviation unit change in ownership of a shotgun. This, however, is a poor example since ownership of a shotgun is an either-or situation. A better illustration is the .099 standard deviation unit change which can be expected with each standard deviation unit change in education, a more interval-type variable. The least amount of change in total score occurred for each standard deviation unit change in hunting frequency, beta= -.016. The negative direction of this relationship indicates that as hunting frequency of the subject decreased, so did total score.

Table 57. Final regression showing Pearson Product Moment correlation, "R" values, and beta coefficients of significant variables with total score.

Significant independent variable*	r	R	Beta
Ownership of a shotgun	.192	.037	.125
Education	.230	.053	.099
Previous Duelatron experience	.242	.058	-.079
Community size before age 18	.252	.064	-.073
Age	.257	.066	.069

* Significantly correlated at the .05 level.

Several of the variables which were found to be correlated with total score were also significantly correlated with newscore (Table 58). The eight variables in the final regression explained 6.3% of the variation in newscore. Only the variables: ownership of a shotgun, previous Duelatron experience, age, and present community size, were significantly correlated to newscore at a .05 level of confidence or greater. In the regression on newscore, ownership of a shotgun again was found to explain the greatest amount of variation in newscore, 2.3%. Previous experience with the Duelatron explained an additional 1.2%. Age and size of community presently living in had weak, but statistically significant correlation values.

One unit change in previous experience with the Duelatron was found to be associated with the greatest change in newscore (beta= -1.09). Again, this correlation was negative due to the coding procedures used in the study. In reality, the subject's scores on the unsafe targets would be expected to decrease 1.09 units for each unit increase in the Duelatron experience categories. The size of community presently living in had the second highest beta coefficient (beta=-.096) This was also a negative correlation and reflected the decrease in newscore as the size of the subject's present community increased. For each unit change in this variable, newscore could be expected to increase .087 units.

Although ownership of a shotgun explained the greatest amount of variance in newscore of the significant variables, it had the lowest beta coefficient (beta=.077). Because beta coefficients remove the effect of other variables it was suspected that the high multiple regression coefficient of shotgun ownership was due to the additive or confounding effects of other variables. This possibility will be considered in the discussion of partial correlation which follows.

Table 58. Final regression showing Pearson Product Moment, "R" values, and beta coefficients of significant variables with newscore.

Significant independent variable*	r	R	Beta
Ownership of a shotgun	.151	.023	.077
Previous Duelatron experience	.186	.035	-1.09
Age	.215	.046	.087
Present community size	.244	.060	-0.96

* Significantly correlated at the .05 level.

PARTIAL CORRELATIONS

This study is concerned with looking at the effect of selected socio-demographic variables on the subject's ability to make correct decisions on the Duelatron target system. Previous results have shown that many of the relationships between these variables and target scores were significant. By examining the zero-order correlations (Table 58), (i.e. the correlation between two variables with no control for the effects of the remaining variables), the significance of their relationship to total score and the degree to which they are intercorrelated is evident. The Pearson Product Moment, "r", is used to measure the strength of the relationship and indicates the goodness of fit of a linear regression line to the data (Nie, et al, 1975).

Variables which are highly intercorrelated may have a confounding effect on each other, that is the relationship between the first variable and total score may in fact be caused by a second variable. Partial correlation is the statistical tool used to determine the degree of relationship between an independent and a dependent variable while adjusting for the effects of the remaining independent variables.

To be considered for partial correlation analysis a variable had to meet two criteria:

1. be highly correlated with a second variable at a level of r=.50 or greater,

2. be significantly correlated with the depen-

dent variables at a .05 level of confidence or greater.

The latter was the most important criteria. Partial correlation would be useless if two highly intercorrelated variables were not significantly related to total score or newscore. The independent variables which met these criteria were: age, education, ownership of a shotgun, frequency of hunting, hunting experience, and hunting participation. It is evident by examining the zero-order correlations that the intercorrelation between total score and each of these variables was low, yet highly significant at the .001 level of confidence. Again due to the requirements of correlational testing, only interval and interval-like variables could be analyzed.

The strongest zero-order correlation existed between ownership of a shotgun and total score (r= .201). Zero-order correlations also indicated strong inter-relationships between ownership of a shotgun, ownership of a rifle, frequency of hunting, and hunting experience. To determine which of these variables truly had the greatest effect on total score, one variable was selected at a time, the effects of the remaining variables controlled for in a series of partial correlations, and the changes in "r" values observed.

Hunting experience was found to have the greatest single effect on the relationship between ownership of a shotgun and total score (Table 59). When its influence was controlled for the correlation value of shotgun ownership dropped to r= .134, but remained significant at the .001 level. Ownership of a rifle had the least confounding effect, decreasing the correlation value to r= .150 when its influence was controlled for. Although ownership of a rifle in conjunction with hunting experience had the greatest confounding effect, ownership of a shotgun remained significantly correlated to total score at the .01 level.

Table 60 lists the changes in "r" values between ownership of a rifle and total score when the effects of the remaining variables were controlled for. Ownership of a shotgun had the greatest single confounding effect, dropping the correlation from r= .155*** to r= .066***. Hunting frequency had the least influence. Although remaining significant at the .01 level, the explanatory power of this relationship dropped the greatest amount, 1%, when the combined effect of shotgun ownership and hunting experience were held constant.

The correlation between hunting frequency and total score may primarily be a function of ownership of a shotgun (Table 61). When the effects of shotgun ownership were removed the relationship became insignificant, indicating that ownership of a shotgun has a strong confounding influence on this variable. This effect in conjunction with any of the remaining variables was so great that when controlled for the ability of hunting frequency to explain variations in total score not only became significant, but the correlation became positive.

Hunting experience was correlated to total score at r= .160. Again, ownership of a shotgun had the greatest single effect on this variable dropping "r" values to .053***. Hunting frequency had the second greatest confounding effect on the relationship. Although the variable, ownership of a rifle had the least singlular effect on the correlation, when its influence in combination with shotgun ownership was held constant, "r" values decreased 1.2% and were not significant (Table 62).

It appears that ownership of a shotgun not only had the greatest confounding effect, but also had the strongest correlation to total score of the four variables. Rifle ownership explained slightly less variation and was somewhat confounded by the influence of shotgun ownership and hunting experience. The relationship between hunting frequency and target system scores was found to be spurious and strongly influenced by ownership of a shotgun. Likewise, hunting experience was dependent on shotgun, and to a lesser degree, rifle ownership.

Table 59. Zero-order partial correlation coefficients of intercorrelated interval-type varialbes significantly correlated to total score.***

	Education	Shotgun ownership	Rifle ownership	Hunting frequency	Hunting experience	Total score
Age	.724	.357	.274	-.261	.558	.153
Education		.233	.164	.157	.370	.144
Shotgun ownership			.464	-.632	.589	.201
Rifle ownership				-.528	.526	.151
Hunting frequency					-.758	-.144
Hunting experience						.160

*** All zero-order coefficients significantly correlated at the .001 level.

Table 60. First and second order partial correlation coefficients of ownership of a shotgun and total score, controlling for the effects of variables correlated to shotgun ownership at r= .50 or greater.

	Variables controlled for		
	Rifle ownership	Hunting frequency	Hunting experience
Rifle ownership	.150***	.129***	.120***
Hunting frequency		.144***	.130***
Hunting experience			.134***

*** (significant at the .001)

Table 61. First and second order partial correlation coefficients of ownership of a rifle and total score, controlling for the effects of variables correlated to rifle ownership at r= .50 or greater.

	Variables controlled for		
	Shotgun ownership	Hunting frequency	Hunting experience
Shotgun ownership	.066***	.062***	.051**
Hunting frequency		.089***	.073***
Hunting experience			.079***

*** (significant at the .001)

** (significant at the .01)

Table 62. First and second order partial correlation coefficients of hunting frequency and total score, controlling for the effects of variables correlated to hunting frequency at r= .50 or greater.

	Variables controlled for		
	Shotgun ownership	Rifle ownership	Hunting experience
Shotgun ownership	-.022	.001	.014
Rifle ownership		-.076***	-.017
Hunting experience			-.035*

*** (significant at the .001)

* (significant at the .05)

Table 6 3. First and second order partial correlation coefficients of hunting experience and total score, controlling for the effects of variables correlated to hunting experience at r= .50 or greater.

	Variables controlled for		
	Shotgun ownership	Rifle ownership	Hunting frequency
Shotgun ownership	.053**	.032	.050**
Rifle ownership		.096***	.061***
Hunting frequency			.079***

*** (significant at the .001)

** (significant at the .01)

Results of previous statistical tests, such as analysis of variance, indicated that a significant relationship existed between target system scores and the age of the subject. As might be expected, a high degree of correlation was found between age, education, and hunting experience (Table 58). When the singular effect of education and hunting experience was held constant, first order correlations dropped to r= .072*** and r= .078***, respectivelly (Table 63). However, the combined effects of these variables dropped the correlation value between age and total score 1.7% to r= .022. This value was not significant and suggests that the correlation may truly be a function of education and hunting experience.

When age and experience were held constant, education remained significantly correlated to total score. The singular confounding effect of age had the greatest influence on education, decreasing the "r" value to .049*** which was significant at the .01 level of confidence.

Despite controls for the effects of age and education, hunting experience remained significantly correlated at the .001 level. Of the two variables, age accounted for the greatest singular decrease in the "r" value. The influence of this variable should be suspect however, as it was found to be strongly dependent on education and hunting experience (Table 65).

A series of partial correlations were examined to determine the relationship between the participation in each of the types of hunting listed in the questionaire and total score. Zero-order correlations between these variables and total score were highly significant (Table 66).

No matter which of the hunting participation categories were controlled for, upland game bird hunting remained significantly correlated to total score at the .001 level. (Table 67). The second greatest amount of variation in total score was associated with participation in waterfowl hunting. The confounding effect of upland game bird and to a lesser degree participation in big game- gun hunting was strong enough to decrease correlation values of this variable to below the .05 level of confidence (Table 68).

The zero-order correlation of small game participation and total score was r= .059. The positive direction of this correlation was caused by the weak tendency of total scores to increase for subjects who were small game hunters. When the effect of each of the remaining participation categories was held constant, "r" values of participation in small game hunting dropped below acceptable levels. It is interesting to note that the correlation values of this relationship again became significant, although negative, when the combined influences of upland game bird hunting in combination with any of the remaining variables was held constant.

Upland game bird hunting participation also had the greatest confounding effect on the correlation of big game- gun hunting and total score. When its influence was held constant, "r" values dropped from a significant .106*** to an insignificant .026. Small game participation had the least influence on this category (Table 70).

Participation in big game- bow hunting was also influenced to the greatest degree by upland game bird hunting. Upland game bird participation alone, or in combination with any of the remaining categories except small game hunting, had such a confounding effect that it became insignificant when the influences of these variables were held constant (Table 71).

Table 6.4. First and second order partial correlation coefficients of age and total score, controlling for the effects of variables correlated to age a r= .50 or greater.

	Variables controlled for	
	Education	Hunting experience
Education	.072***	.022
Hunting experience		.078***

*** (significant at the .001)

Table 65. First and second order partial correlation coefficients of education and total score, controlling for the effects of variables correlated to education at r= .50 or greater.

	Variables controlled for	
	Age	Hunting experience
Age	.049***	.054***
Hunting experience		.092***

*** (significant at the .001)

Table 66. First and second order partial correlation coefficients of hunting experience and total score, controlling for the effects of variables correlated to hunting experience at r= .50 or greater.

	Variables controlled for	
	Age	Education
Age	.091***	.094***
Education		.116***

*** (significant at the .001)

Table 67. Zero-order partial correlation coefficients of intercorrelated hunting participation variables significantly correlated to total score.***

	Water-fowl	Small game	Big game-gun	Big game-bow	Total score
Upland game bird	.644	.604	.626	.469	.138
Waterfowl		.497	.570	.407	.114
Small game			.674	.421	.059
Big game- gun				.531	.106
Big game- bow					.096

*** (significant at the .001)

Table 68. First and second order partial correlation coefficients of upland game bird hunting and total score, controlling for the effects of hunting categories significantly correlated to upland game bird hunting at r= .50 or greater.

	Variables controlled for			
	Water-fowl	Small game	Big game-gun	Big game-bow
Waterfowl	.085***	.093***	.070***	.072***
Small game		.129***	.103***	.111***
Big game- gun			.092***	.084***
Big game- bow				.106***

*** (significant at the .001)

Table 69. First and second order partial correlation coefficients of waterfowl hunting and total score, controlling for the effects of hunting categories significantly correlated to waterfowl hunting at r= .50 or greater.

	Variables controlled for			
	Upland game bird	Small game	Big game- gun	Big game- bow
Upland game bird	.034*	.040*	.028	.028
Small game		.098***	.071***	.081***
Big game- gun			.066***	.060**
Big game- bow				.083***

*** (significant at the .001)

** (significant at the .01)

* (significant at the .05)

Table 70. First and second order partial correlation coefficients of small game participation and total score, controlling for the effects of the remaining hunting categories significantly correlated to small game hunting at r= .50 or greater.

	Variables controlled for			
	Upland game bird	Water-fowl	Big game-gun	Big game-bow
Upland game bird	-.031	-.041*	-.050*	-.040*
Waterfowl		.002	-.030	-.014
Big game- gun			-.018	-.022
Big game- bow				.020

* (significant at the .05)

Table 71. First and second order partial correlation coefficients of big game-gun hunting and total score, controlling for the effects of the remaining hunting categories significantly correlated to big game- gun hunting at r= .50 or greater.

	Variables controlled for			
	Upland game bird	Water-fowl	Small game	Big game-bow
Upland game bird	.026	.017	.046*	.014
Waterfowl		.050**	.059**	.031
Small game			.090***	.066*
Big game- bow				.065***

*** (significant at the .001)

** (significant at the .01)

* (significant at the.05)

Table 72. First and second order partial correlation coefficients of big game-bow hunting and total score, controlling for the effects of the remaining hunting categories significantly correlated to big game- bow hunting at r= .50 or greater.

	Variables controlled for			
	Upland game bird	Water-fowl	Small game	Big game-bow
Upland game bird	.036*	.031	.043*	.029
Waterfowl		.055**	.056**	.038*
Small game			.079***	.049**
Big game- gun				.047**

*** (significant at the .001)

** (significant at the .01)

* (significant at the .05)

Similiar results were obtained when newscore was used as the independent variable in the partial correlation analyses. Again, zero-order correlations were low, yet except for small game success, all were significantly correlated to newscore at the .001 level (Table 72). First and second order partial correlation tables will be shown only where results using newscore as the dependent variable differ significantly from results obtained using total score.

Like total score, a strong degree of intercorrelation existed between the variables: ownership of a shotgun, rifle ownership, hunting frequency, and hunting experience. However, zero-order correlation values of these variables and newscore were lower than with total score, indicating that their ability to explain variations in the unsafe target scores was less. Again ownership of a shotgun was the variable which remained the most highly correlated to newscore even when the influence of the remaining variables was removed. Likewise shotgun ownership had the greatest confounding effect on the correlations of the remaining variables.

The correlation between rifle ownership and scores on the unsafe targets was confounded to the greatest degree by ownership of a shotgun which contributed .068 correlation units to the original "r" value. When the joint effects of shotgun ownership and hunting experience were controlled for, correlations dropped even further, but remained significant at the.05 level.

The ability of hunting frequency to explain variations in newscore was most strongly influenced by the amount of hunting experience a subject had. The correlation value of this independent variable became insignificant when the effects of hunting experience were held constant. Like total score, the direction of the original correlation between newscore and hunting frequency reversed and became positive (although not significant) when the influences of both shotgun ownership and hunting experience were controlled for.

Unlike total score, hunting experience explained slightly more variation in newscore than did ownership of a rifle and remained significantly correlated to the dependent variable no matter what influences were controlled for. Only when the effect of shotgun and rifle ownership was jointly held constant, did the significance level of the relationship drop to the .01 level.(Table 73).

Age, education, and hunting experience were again highly intercorrelated as well as correlated to newscore at the .001 level of confidence. Education and hunting experience had less of a confounding effect on the ability of the variable, age, to explain variations in the unsafe target scores than was found using total score as the dependent variable. Age strongly influenced the relationship between education and newscore, reducing the correlation values of education below an acceptable level of significance when its effect was held constant. Hunting experience had a slightly stronger influence on the correlation between age and newscore than it did on education and the dependent variable. In neither case was the singular effect of hunting experience great enough to reduce "r" values below an acceptable level of significance (Table 74).

Despite controls for both age and education, hunting experience remained significantly correlated to newscore at the .001 level. Actually, the influence of age on hunting experience was small, reducing the correlation from r= .078** to r= .070, when its effects were held constant. It is also interesting to note that when the singular effect of education was held constant, the correlation value <u>increased</u> to r=.104***. Education appears to be making a stronger relationship between hunting experience and newscore (Table 75).

Except for small game participation the hunting categories remained highly intercorrelated and explained an acceptable amount of variation in newscore to warrant partial correlation analyses (Table 76). The zero-order partial correlation between small game hunting and newscore was so weak (r= .023) that it did not meet the criteria and was eliminated from further testing.

Of all the categories, upland game bird participation explained the greatest amount of variation in the dependent variable and remained the most highly correlated to the dependent variable despite controls for the influence of other participation categories. The ability of waterfowl hunting to explain variations in newscore was dependent on the influence of upland game bird hunting for significance, as were the correlations between big game- gun and big game- bow. When the influence of upland game bird participation in combination with any of the remaining participation categories was held constant, the significance of the participation variables dropped below an acceptable level.

Table 73. Zero-order partial correlation coefficients of intercorrelated interval-type variables significantly correlated to newscore.***

	Education Education	Shotgun ownership	Rifle ownership	Hunting frequency	Hunting experience	Newscore
Age	.724	.353	.274	-.254	.562	.152
Education		.241	.175	-.161	.386	.122
Shotgun ownership			.479	-.629	.585	.155
Rifle ownership				-.525	.520	.118
Hunting frequency					-.742	-.120
Hunting experience						.142

*** All zero-order coefficients significantly correlated at the .001 level.

Table 74. First and second order partial correlation coefficients of hunting experience and newscore, controlling for the effects of variables correlated to hunting experience at r= .50 or greater.

	Variables controlled for		
	Shotgun ownership	Rifle ownership	Hunting frequency
Shotgun ownership	.064***	.050***	.058***
Rifle ownership		.095***	.067***
Hunting frequency			.080***

*** (significant at the .001)

Table 75. First and second order partial correlation coefficients of education and newscore, controlling for the effects of variables correlated to education at r= .50 or greater.

	Variables controlled for	
	Age	Hunting experience
Age	.016	.021
Hunting experience		.088***

*** (significant at the .001)

Table 76. First and second order partial correlation coefficients of hunting experience and newscore, controlling for the effects of variables correlated to hunting experience at r= .50 or greater.

	Variables controlled for	
	Age	Education
Age	.070***	.070***
Education		.104***

*** (significant at the .001)

Table 77. Zero-order partial correlation coefficients of intercorrelated hunting participation variables significantly corelated to newscore.***

	Waterfowl	Big game- gun	Big game- bow	Newscore
Upland game bird	.649	.640	.468	.103
Waterfowl		.574	.421	.084
Big game- gun			.531	.090
Big game- bow				.078

*** All zero-order coefficients significantly corlated at the .001 level.

Table 78. First and second order partial correlation coefficients of waterfowl participation and newscore, controlling for the effects of the remaining hunting categories significantly correlated to waterfowl hunting at r= .50 or greater.

	Variables controlled for		
	Upland game bird	Big game- gun	Big game- bow
Upland game bird	.023	.015	.017
Big game- gun		.040*	.034*
Big game- bow			.057***

*** (significant at the .001)

* (significant at the .05)

On a list of dangerous activities, participation in hunting ranks low. Responsible for far more injuries and deaths are automobile accidents, disease, and falls. In 1976, the total number of hunting accidents in Wisconsin per 100,000 hunting licenses sold was 25.8 (Reed, 1977). The chance of becoming a statistic is much greater while driving to the hunting location than while actually participating in the sport.

Why then is so much emphasis placed on hunter safety? The primary reason is that most hunting accidents are caused by carelessness; they are tragic accidents and can be prevented. Much of today's emphasis on hunting ethics is an attempt to change the image of hunting as a dangerous sport whose participants are irresponsible and unthinking. Concern for safety is one way the hunter can help demonstrate a positive image of the sport.

Defective hunter judgement is involved in the majority of Wisconsin hunting accidents. The major objective of this study was to determine what effect various environmental and socio-demographic factors had on decision making ability in hunting situations. Other important aspects of the study included an evaluation of the Duelatron Electronic Target System, the apparatus used to simulate hunting decision making situations, and to make recommendations which would result in greater ability of Wisconsin hunters to make safe decisions.

Sampling Prodedures

In discussing sampling procedures, Simon (1969) states, " having 100% of the sample subjects is not necssary,.... whether the non-respondents can cause error depends on the reason for non-response or if the character of the non-respondent is related in any way to the information wanted". Theoretically, Simon's "non-response" bias, or in this case "non-volunteer" bias, could deny the inclusion of these characteristics in the study and limit the application of the data gathered in the study to the population as a whole. Simon adds, " unless you have very strong reason to believe otherwise, you should assume the non-respondents (non-volunteers) do not come randomly from the population". He suggests two remedial tactics be taken if volunteers must be used in order to establish reliable estimates for the universe as a whole.

The first tactic to help increase the chance of including in the sample those traits possessed by the non-volunteers is to increase the sample size. It was felt that the study's large sample of 3431 participants helped to offset "non-volunteer" bias. The second tactic, increasing the number of sampling sites, was accomplished by testing at six different locations throughout Wisconsin. Sampling was also done over a three month period, July 10- September 7, 1977. This increased the number of sampling days.

Course Development Variables

It was necessary to first develop a standardized test course on the Duelatron so that any differences in target system scores could be attributed to the influence in environmental or socio-demographic on decision making ability. In pre-testing the Duelatron, it was found that five of the original ten targets used in the test course to depict hunting scenes were too difficult and required modifications to insure their reliablity as testing tools.

Four course development variables were evaluated: target face time, target interval time, target sequence, and the combination of these variables. While the project outline suggested that a standardized test course be developed which would allow for the greatest number of correct decisions to be made on the system. it was equally important to attempt to duplicate field conditions as much as possible. Statistical analyses indicated that target face time, but not target interval time, had a significant effect on total score. Based on this and WDNR recommendations, four seconds was chosen as the standardized face time. A six second interval time was selected to make the most efficient use of time while allowing subject unfamiliar with the gun used in the course an adequate period to recock and be ready for the next target.

Although total system scores were significantly higher using the sequence which presented the "shoot" target before the similiar "don't shoot" of each target set, it was not selected for the standardized test course. It was suspected that the higher scores were due to the effect of learning. The subject may not have actually perceived the unsafe element(s) in the "don't shoot" target as such, but recognized the slight change in format from the preceding target and held back shooting. On all but the first target, scores on the unsafe situations were significantly higher using this combination of targets. This learning effect was not evident however, when all of the safe targets were presented before all of the unsafe targets. In fact scores were significantly lower. The inverse of this situation which displayed all of the "don't shoot" before all of the "shoot" targets resulted in a slight, but insignificant increase in total score. A random order of targets was chosen as it was felt that it best exemplified field conditions and decreased the chance of learning taking place.

Each of these sequences, except one, began with a "don't shoot" target. The mean score on the first target of these sequences was lower than when the target was in any other position. The majority of these incorrect decisions may have been due to subject anticipation. Most subjects were visibly anxious to begin the test and most tended to fire immediately at the first target as it turned toward them. In three of the four sequences, a snapshot at the first target was a wrong decision. In future testing, to help eliminate this problem, the subject should be given a trial or warm-up test which would allow him or her to become familiar with the testing procedure. Another alternative would be to begin the test with a test whose score would not be counted.

Environmental Variables

The environmental variable which had the greatest effect on target system scores was lighting. Mean scores were found to be significantly higher when natural, rather than artificial lighting was used to illuminate the test course. This points out one of the drawbacks of trying to simulate field conditions indoors. Control over the testing environment is gained, but the reality is sacrificed.

Evaluation of the scores at the six different sample sites reveals an interesting trend. As the total number of subjects sampled decreased, mean total scores increased. The smallest sample, gathered at the Central Wisconsin State Fair, had significantly the highest mean total score, while the largest number of people sampled in one site had the lowest. Mean target scores at the remaining sites also appeared to follow this trend. This pheomena may have been caused by two factors: researcher fatigue at the larger sample sites which caused relaxation of the testing procedure or scoring accuracy, or some factor inherent in subjects who attended larger fairs which were usually held in larger metropolitan areas.

In this study subjects shooting at targets which had a piece of blaze orange or red material substituted for each of the hunter's hats in the "don't shoot" targets, made more correct decisions than participants shooting at the regular targets. Woolner (1960) reported that on a pop-up target course with a four second viewing time (similiar to the set-up used in this study, but on a 25-100 yard course), out of six flourescent and non-flourescent colors tested, blaze orange was the most easily recognized by 1267 subjects. Traditional hunter red was one of the least noticeable colors. While blaze orange has been proven to be a superior color for visibility, its advantages over hunter red were not significant at the 25 foot test course used in this study.

Socio-Demographic Variables

Compared to the "typical" Wisconsin hunter, the majority of the study's subjects were younger, subsequently less educated, and from a more urban environment which reflected the larger samples gained at the more metropolitan sampling sites (Klessig and Hale, 1972).

The socio-demographic characteristics of the subjects which significantly influenced total score were: age, education, community size before age 18, community size presently living in, county residence, ownership of a shotgun, rifle, handgun, or bow, member of a Sportsmen's club, completion of the Wisconsin Hunter Safety Course, previous experience with the Duelatron, hunting frequency and experience, and participation in upland game bird, waterfowl, small game, big game- gun, and big game- bow hunting. Many of the differences in the mean total scores between the categories of these variables were small, yet significant which is typical in studies with large samples such as this one.

The variable which was found to contribute to the greatest explanation of variation in the dependent variable was ownership of a shotgun. The influence of this variable was so great, that when its effects were held constant through the use of statistical tests, the correlation values of hunting frequency and hunting experience and total score became insignificant. Although regression analyses did not indicate that it explained a great amount of variation in total score, ownership of a rifle nevertheless remained significantly correlated to total score despite controls for the confounding influence of shotgun ownership.

As might be expected, age, education, and hunting experience were highly intercorrelated. The relationship between age and total score was actually spurious and was a function of the relationships between education and hunting experience. Education remained a significant predictor of variations in total score, despite controls on any contributing influences of age and hunting experience. The ability of hunting experience to explain variations in total score was not significantly influenced by age or education however.

Of the hunting participation categories, only upland game bird hunting remained significantly correlated to total score when the influences of the remaining participation categories were held constant. The apparent ability of waterfowl, big game- gun, and big game- bow hunting to predict variations in decision making ability was spurious and significantly influenced by participation in upland game bird hunting.

Very few differences were noted in the ability of environmental and socio-demographic variables to explain variations in total target scores versus scores on only the unsafe targets. If a particular variable category was associated with significantly high total scores, chances are that it would cause significantly high scores on the unsafe targets.

IMPLICATIONS

From the results of the study it appears that the majority of the variables which were significantly correlated to the dependent variable in a positive direction, had to do with involvement in the sport of hunting (i.e. weapon ownership, Wisconsin Hunter Safety Course completion, hunting experience, etc.). Although many of these variables proved to be intercorrelated, these results point ou a general trend- subjects exposed to the elements of hunting tended to make more correct decisions on the target system than subjects who were not so involved. In planning future Wisconsin Hunter Safety Courses, the importance of field experience should be stressed. Although this study cannot positively identify why ownership of a weapon explained the greatest amount of variation in system scores, it implies that personnal accountability for the operation of a hunting weapon, in addition to a greater familiarity with hunting weapons, may result in more careful and correct decision making.

The negative correlations between community size variables and the dependnet variable indicate that decision making ability tends to decrease as a subject's residence becomes more urban. If this correlation is due to some unmeasured, intrinsic factor of urban dwellers and not the influence of environmental factors or the sampling site, decision making training might be most efficient and effective if aimed at the urban hunter.

The low percentage of variation explained in the decision making ability of the subjects tested may imply that further refinement of the testing equipment and procedure is necessary. The ten targets, although modified to be clearer, may still not be clear or adequately depict field situations and therefore limit the reliablity of the data to predict the influence of sociodemographic characteristics in actual hunting situations. Although steps were taken to combat sampling bias, the study's results may be atypical and reflect the decision making ability of only a small portion of the general population. The significant increase in scores when natural rather than artificial lighting was used implies that the subjects may not have been given the "best opportunity to make correct decisions", as directed by the guidelines for the study.

This is not to imply that the Duelatron is not a beneficial teaching instrument for use in the Wisconsin Hunter Safety Course. As shown by the high beta coefficient between previous experience with the Duelatron and newscore, subjects who had previously taken the Duelatron test course demonstrated a greater degree of recognition of unsafe hunting situations by their greater ability to make correct decisions on the "dont't shoot" targets. It is not known however, how much of the training experienced on the Duelatron is transferable to field situations. If this type of experience is transferable, training with the Duelatron could be expected to result in safer field decisions and fewer hunting accidents.

RESEARCH NEEDS

One of the primary research needs, as pointed out by this study, is determination of the degree of reliability between the Duelatron test course and actual hunting situations. This will be difficult to determine since no testing instrument or course can exactly duplicate the elements of a field experience, such as the anticipation, emotion, etc. which accompanies the hunter. Such research is needed however, to determine if training on the Duelatron is transferrable to field situations and will result in safer decisions being made while hunting.

Comparing the influence of similiar socio-demographic characteristics tested on the Duelatron against results obtained on some other type of hunter safety decision apparatus, such as one which uses slides or film to depict hunting situations, may result in a greater explanation in independent variable variation and point out weaknesses or strengths in the present system. While an audio-visual based system might more realistically replicate field situations, the results of this study indicate that experience and exposure to the sport of hunting is still the greatest determinant in safe decision making.

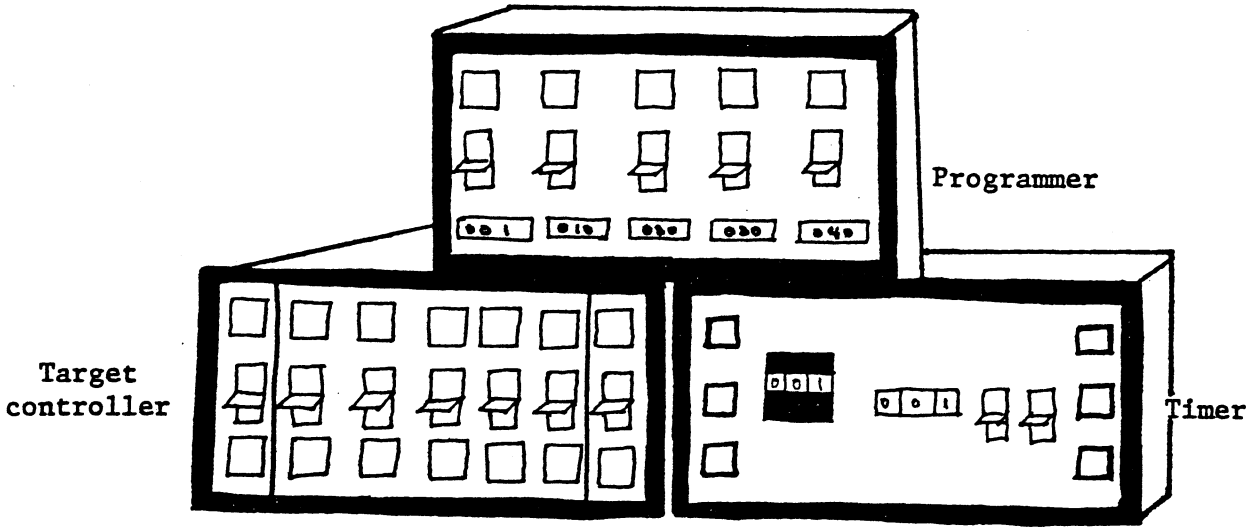
Because of a limited sampling schedule, the amount of time which was spent in the evaluation of target modification, course development variables, and environmental factors used in the standardized course was limited. These variables are the building blocks upon which any evaluation on the Duelatron is based. There are many more variations in these variables than could be tested in one summer's field work. If the Duelatron is to be used in further research or decision making training, more emphasis should be placed on the refinement of standardized test course and testing procedure.

With the adoption of a standardized test course, comparible data on the decision making ability of any subject participating in the system could be compiled.

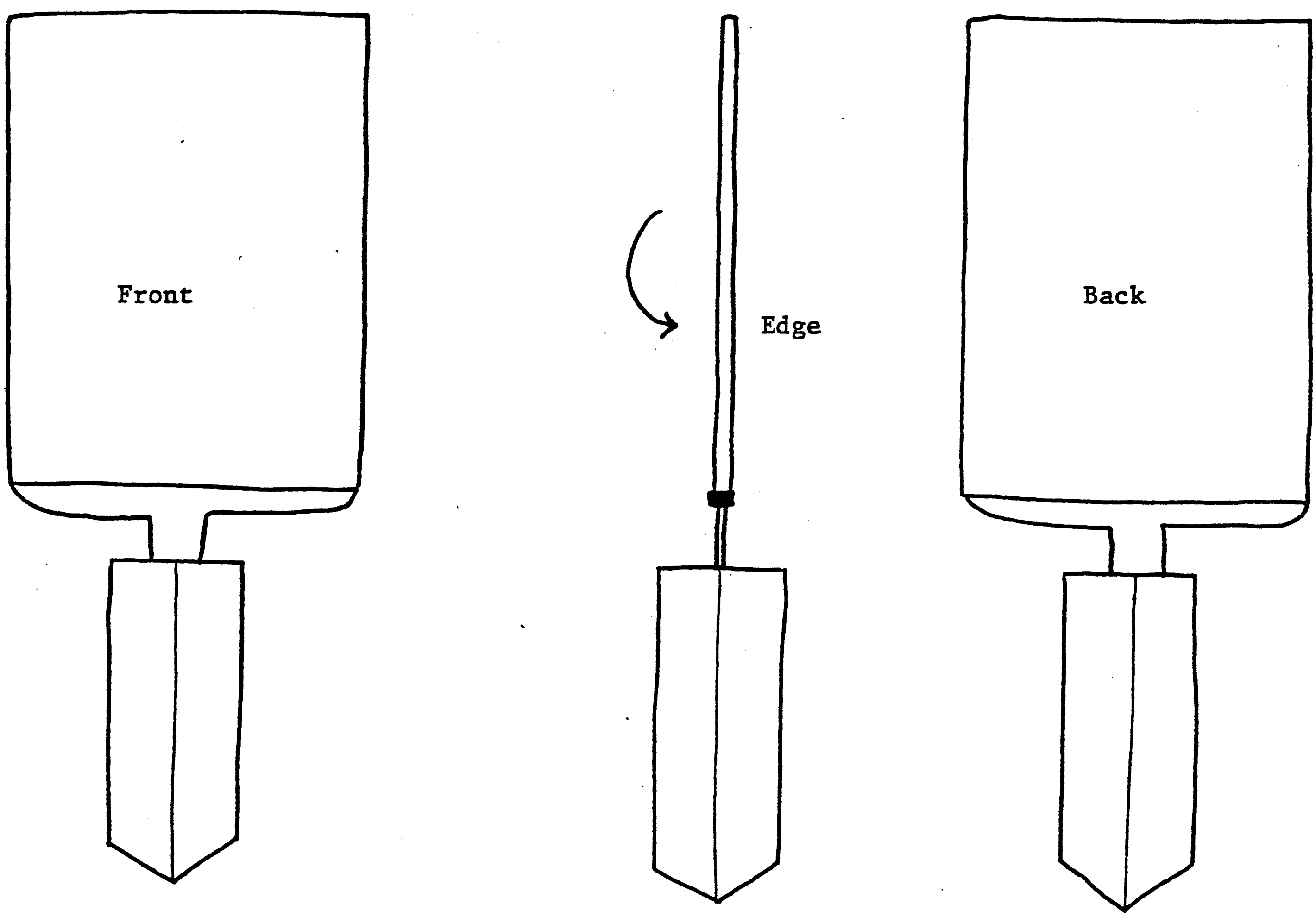
Research is needed to identify the unmeasured factors which accounted for 93.3% of the variation in the study's target system scores. It is suspected that visual characteristics greatly influenced the subject's ability to perceive unsafe elements in the targets and therefore were responsible for a significant percentage of this variation. More study is needed to determine what elements associated with hunting influence the ability to make correct decisions. Why does ownership of a weapon, particularily a shotgun, explain the greatest amount variation in target system scores? Does the decision making ability of urban subjects reflect a lack of experience with the elements of hunting, the influence of the testing environment, or an intrinsic quality of city dwellers which would cause lower system scores? How would other variables not measured by this study such as peer preasure, anticipation, etc., effect safe decision making ability?

APPENDIX A

Duelatron Electronic Target System



a. Duelatron 3-component control center: programmer, target controller, and timer.



b. Target positions: Front, Edge, Back

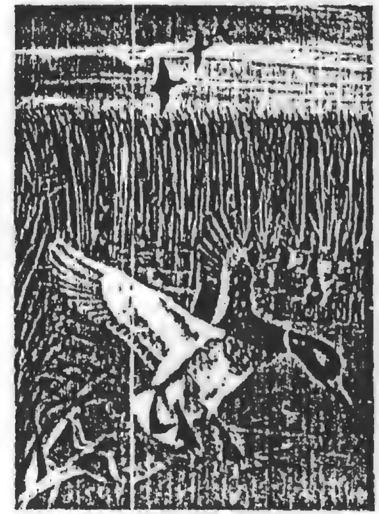
APPENDIX B

Duelatron Hunter Safety Target Series

Rooster with hunters .... "Don't Shoot"

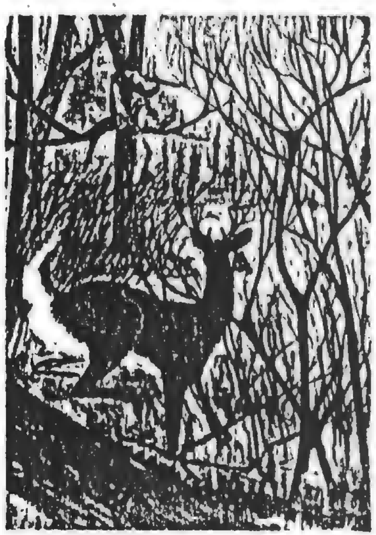
Rooster alone .... "Shoot"

Rooster with hen .... "Don't Shoot"

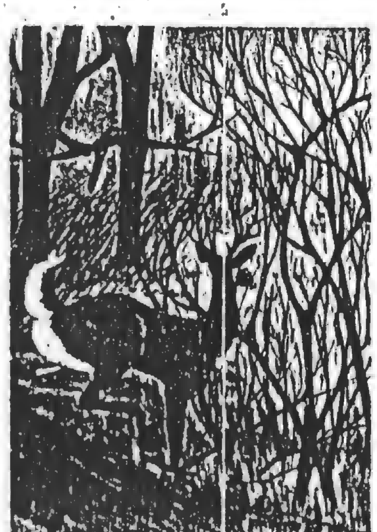


Mallard with hunter ..... "Don't Shoot"

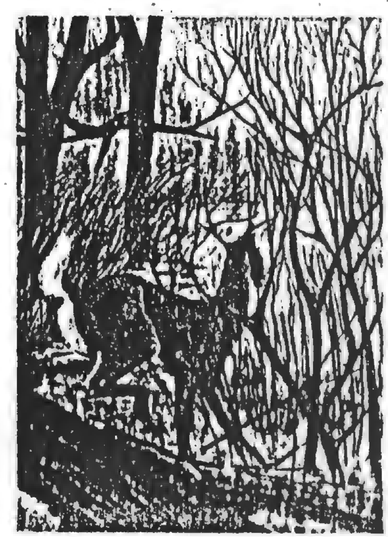
Mallard alone .... "Sh



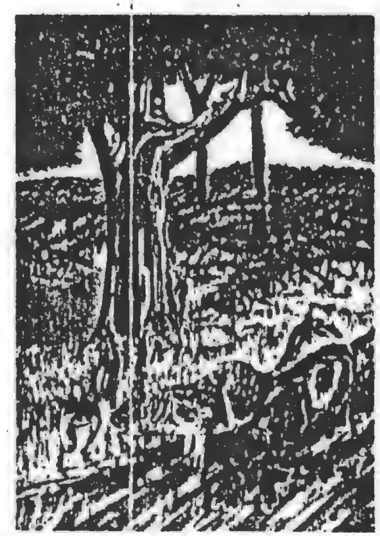
Deer with hunter .... "Don't Shoot"



Deer alone .... "Shoot"



Yearling horse .... "Don't Shoot"



Squirrel with hunter .... "Don't Shoot"

Squirrel alone .... "Sh

HUNTER SAFETY QUESTIONNAIRE

University of Wisconsin-Stevens Point
College of Natural Resources

1. What is your age?
   ______Under 12
   ______12-13
   ______14-15
   ______16-17
   ______18-25
   ______26-40
   ______41-64
   ______65 or older

2. Sex:
   ______Male
   ______Female

3. What is the highest grade of school which you have completed?
   ______8th grade or less
   ______9th-12th grade
   ______Some college
   ______College graduate
   ______Graduate study

4. How large was the community in which you spent most of your life before age 18?
   Rural: ______Farm
   ______Open country, not farm
   ______Town less than 2500
   Urban: ______City of 2500-9999
   ______City of 10,000-49,999
   ______City of 50,000-300,000
   ______City greater than 300,000

5. What is the size of the community in which you now live?
   Rural: ______Farm
   ______Open country, not farm
   ______Town less than 2500
   Urban: ______City of 2500-9999
   ______City of 10,000-49,999
   ______City of 50,000-300,000
   ______City greater than 300,000

6. What county do you now live in? ____________________________________

7. Please check any of the following hunting equipment that you own:

   ______Shotgun ______Rifle ______Handgun ______Bow

8. Are you a member of a Sportsmen's Club ______Yes ______No
   Please specify ____________________________________

9. Are you a graduate of a Wisconsin Hunter Safety Course? ______Yes ______No
   If you answer is NO, please go on to question 10.

   If you answer is YES: What year did you complete the course? 19_____

   Was live firing involved in the course? ______Yes ______No

   In what town did you take the course? ________________

10. Have you ever had any other type of organized hunter safety instruction?

    ______Yes: please describe ____________________________________

    ______No

11. Have you ever been tested on the "Duelatron" Hunter Safety Apparatus?

    ______Yes ______No ______Not certain

(OVER)

12. What statement below most closely describes how often you hunt?

Check one:
_____ I frequently hunt
_____ I occasionally hunt
_____ I seldom hunt
_____ I used to hunt, but no longer do
_____ I have never hunted

IF YOU HAVE NEVER HUNTED, PLEASE STOP HERE. THANK YOU.

----- ----- ----- ----- ----- ----- ----- ----- -----

FOR THOSE WHO HAVE HUNTED, PLEASE ANSWER THE FOLLOWING QUESTIONS:

13. How many years of hunting experience have you had?
_____ Less than 1 year
_____ 1-4 years
_____ 5-10 years
_____ 11-20 years
_____ 21 years or more

14. Who taught you how to hunt? Check One.
_____ I taught myself
_____ A member of my family or a relative
_____ A friend
_____ I learned from a hunter safety course
_____ Other, please specify ______________________________

15. Have you ever been involved in a hunting accident involving a firearm or a bow?

_____ Yes _____ No

16. What type(s) of game do you hunt and what percent of the times that you hunt are you successful in bagging game?
Type of game (check as many as apply) Success Rate (0-25%, 26-50%, 51-75%, 76-10

_____ Waterfowl . . . . __________
_____ Upland Bird . . . . __________
_____ Small Game . . . . __________
_____ Big Game - Gun . . . . __________
_____ Big Game - Bow . . . . __________

STOP HERE. THANK YOU FOR YOUR HELP.

Loc: _____ Indoor _____ Outdoor _____ Tent Specify: __________________

DATE: ___/___/___ Time: _____ - _____

Target Seq.:	R	G	A
Target Face:	2	4	6
Tar. Intrvl:	4	6	8
Target Color:	1	2	3
Light	1	2	

Vision:	1	2	3	4	5	6	7	8	9	10
T 4.5:	L	B	T	L	R	T	L	B	B	R
T 7.0:	+	o	*	o	□	□	♡	+	*	+ ♡ o

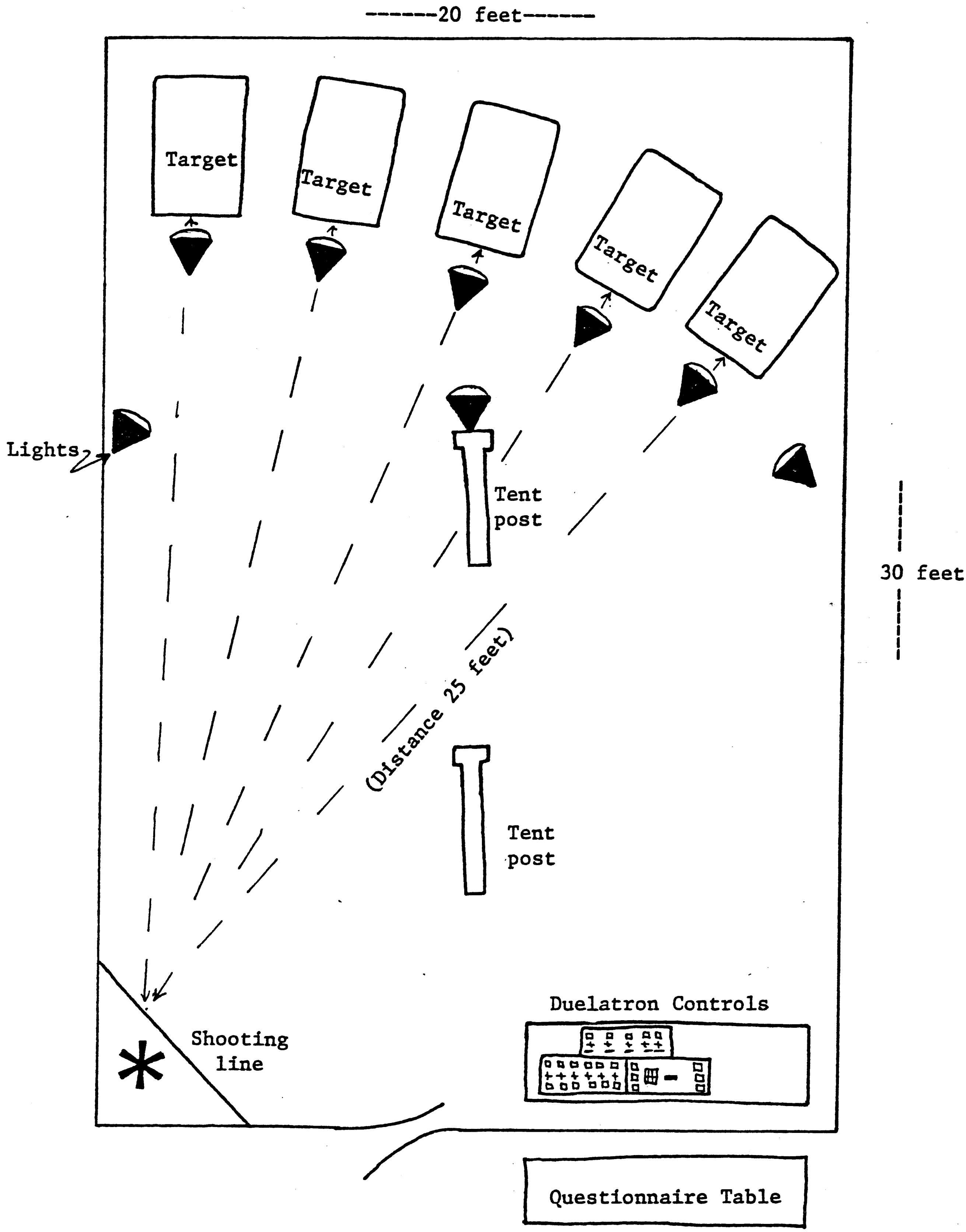
	Top	Left	Right
T 8:	32	79	23
T 9:	63	92	56

Tar.										
Pts.										

Total Score /100

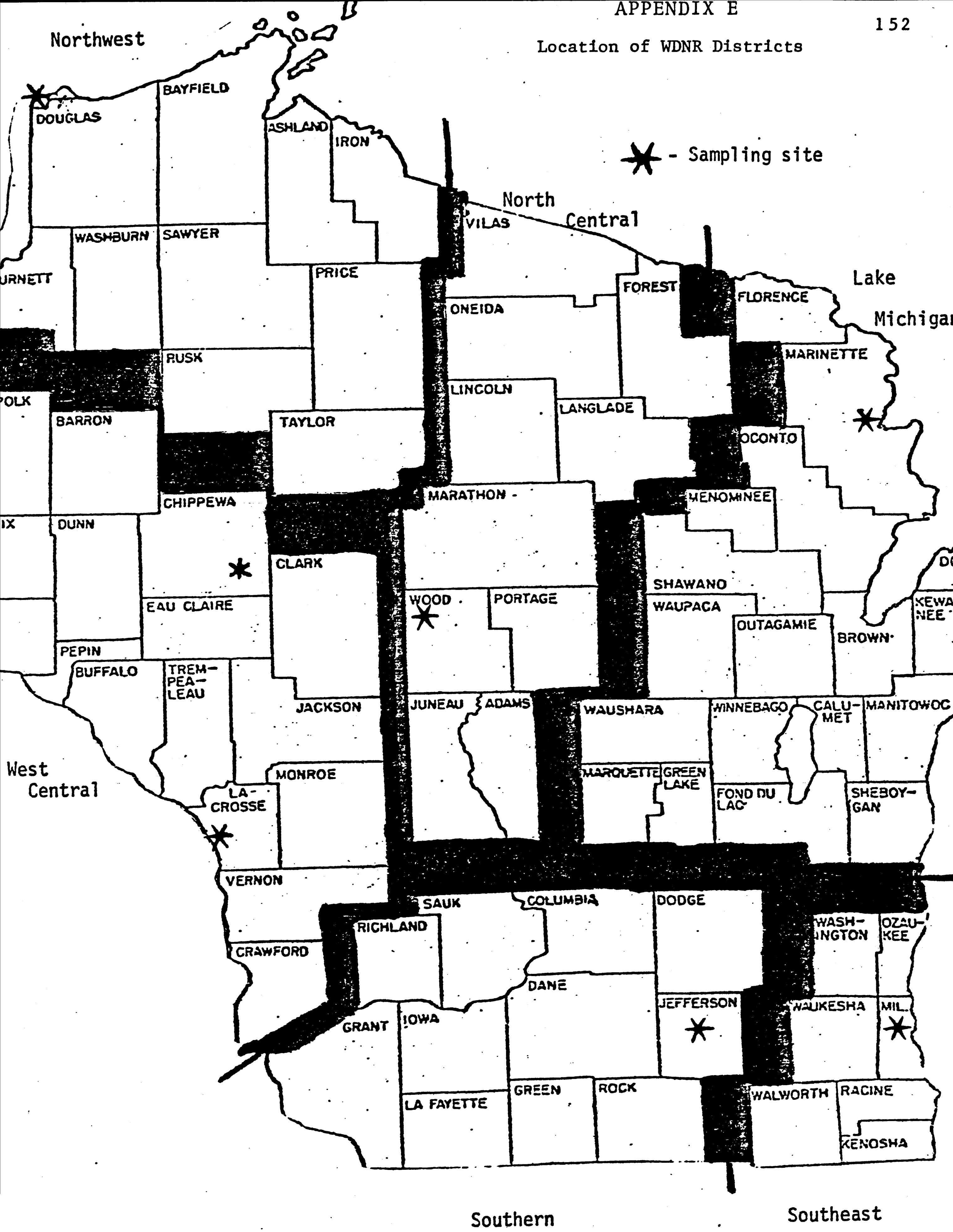
APPENDIX D

Duelatron Field Set-up



APPENDIX E

Location of WDNR Districts



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