

A STUDY OF THE EFFECTIVENESS
OF THREE RACING STARTS IN SWIMMING

A Thesis

Presented to

the Faculty of the Graduate College
Wisconsin State University-La Crosse

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

by

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ABSTRACT

Terry Roy Warner, "A Study of the Effectiveness of Three Racing Starts in Swimming" (Master's thesis, Wisconsin State University-La Crosse, 1967).

This research was designed to compare the effectiveness of three methods of performing the racing "start" in competitive swimming. The three "starts" are: (1) "arms back," (2) "arms down," and (3) "arms front." The subjects used for the study were those enrolled in three advanced beginning swimming classes. All thirty-nine subjects were novices to competitive swimming. The subjects were taught the "start" assigned to their swimming class in four weeks with a total of eight sessions. Each practice session was organized on a precise time schedule. Instructions for each session were typed into a lesson plan to maintain uniformity of instruction between the three swimming classes. The study was filmed with a sixteen millimeter Bell and Howell camera. The film of the three "starts" was analyzed on a stop-action Bell and Howell projector. Three measurements were taken for each "start:" (1) reaction time; (2) time to the water; and (3) time to the distance of twenty feet. Results show the arms-front "start" and the arms-down "start" to be superior to the arms-back "start" in reaction time and time to the water which is significant at the one per cent level of confidence. In time to the distance, however, no significant difference among the three "starts" was found. A review of the research study films shows that differences in angle of entry into the water and the position on entry probably account for no significant difference among the three "starts" in time to the distance.

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CHAPTER I

INTRODUCTION

The "start" in competitive swimming is an important part of the over all skill development of every swimmer. In competition if all other factors are equal, it would seem logical to assume that the swimmer first off the block should win the race. It is an accepted fact among coaches that a sprint race requires a fast "start." Today, a fast "start" in swimming is important for distance men as well as for sprinters. The 200, 400, and 500 yard freestyle races are becoming sprint events. Thus a fast "start" is a necessary part of a competitive swimmer's skills for all distances.

During the Big Ten swimming meet of 1965, held at the University of Wisconsin, John Farley and Carl Robie of the University of Michigan tied for first place in the 1650 yard freestyle. The timers and judges declared that the race between Farley and Robie was a tie. Only after the electric timers were split to the 1/1,000 of a second was first place awarded to Carl Robie.¹ The minute difference in this long distance race supports the importance of perfecting and performing a well-executed "start."

¹"Personal Correspondence of the Author, letter from John Hickmen, April 11, 1967."

The style of a swimmer's starting position varies with particular likes and dislikes. Some swimmers "start" by holding the head up and focusing their eyes on the far end of the pool; other swimmers keep the head down on the "start." Body positions vary from a full crouch to a slight forward bend of the trunk at the waist. Knee flexion and foot placement vary from a full knee bend with the feet spread wide apart to a slight knee bend with the feet close together. If a particular starting position could be found which would be the most effective, teaching and experimenting with starting positions which are less effective could be eliminated.

I. THE PROBLEM

Statement of the problem

This study was designed to compare the effectiveness of three methods of performing the racing "start" in competitive swimming. Specifically, this study investigates a comparison of the three types of racing "starts" most frequently used in swimming. The three "starts" are: (1) "arms back," (2) "arms down," and (3) "arms front." A description of the three starting positions is given on pages five, six, and seven under the heading DEFINITIONS OF TERMS USED. The methods for evaluation are based on (1) reaction time to the sound of the starting gun; (2) the time from the "start" to entering the water; and (3) the time from the "start" to a distance of twenty feet from the starting block.

Purpose of the study.

In recent years swimming has become a precision sport where the difference between winning and losing may be at the "start." If one starting position is superior to another it would be logical for competitive swimmers to use the most effective style of "start."

Need for the study.

Over many years competitive swimming has been a sport in which the United States swimmers have established many world records. The United States coaches have led the way in the scientific development of stroke mechanics and conditioning programs in past years. After losing the Olympic swimming title in 1932, 1956 and 1960, the American swimming coaches sought ways to regain the title. One indication of the results of this scientific research is that American swimmers won championships in the 1924, 1928, 1936, 1948, and 1952 Olympic Games. Continuing research resulted in regaining the Olympic swimming title at Tokyo, Japan, in 1964.

The findings of the scientific developments were used in the Amateur Athletic Union age-group swimming programs and in many school and college swimming programs. Evidence of this can be seen in the past issues of the Amateur Athletic Union swimming guides and the National Collegiate Athletic Association swimming guides. Record breaking performances in swimming are increasing remarkably in the United States. There has been a limited amount of research, however, on evaluating starting positions.

Both earlier and recent studies conducted on swimming "starts" have been done with varsity competitive swimmers as subjects. Component factors to be treated statistically were reaction time and time to a set distance.

Delimitations.

This study will be concerned with thirty-nine male university students at Wisconsin State University-La Crosse. All subjects used for the experiment are novices.

Limitations.

Reaction time, somatotype, neuromuscular coordination, and athletic ability are variables over which the researcher has no control.

The positioning of the subject for each of the three starting positions will be exact. No variant position of the head, arms, trunk, legs or feet will be permitted.

The scope of this study is limited by the number of students placed in the three swimming classes to be taught by the researcher.

II. DEFINITIONS OF TERMS USED

Arms-back "start." The unique characteristics of this "start" is the positioning of the arms--they are held in back of the body in a horizontal position, the palms facing upward with the elbows slightly flexed. The head is held up with the eyes focused down the pool.

The trunk is angled forward almost parallel to the deck of the pool.
The legs are flexed in a comfortable position with the feet parallel
and in line with the hips.

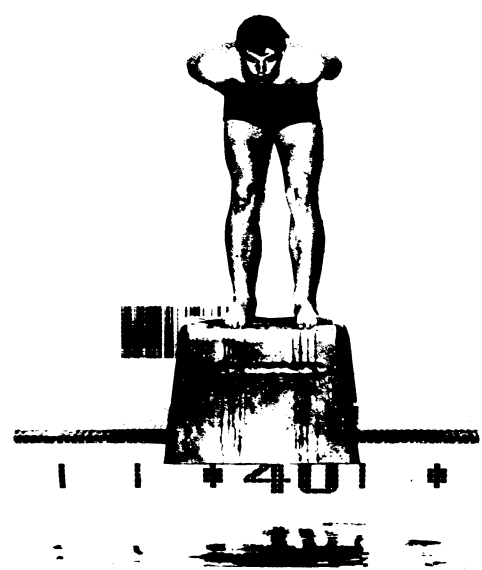


Figure 1. Arms-back (front view)

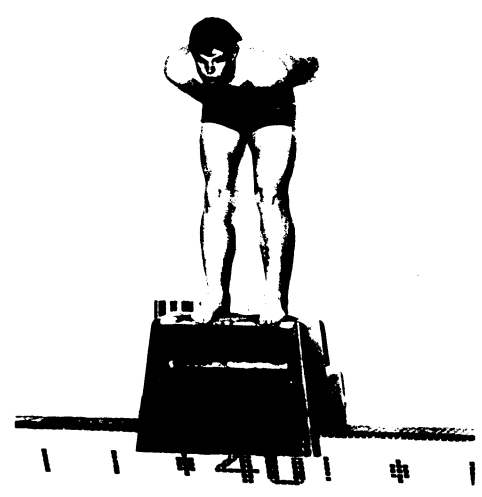


Figure 2. Arms-back (angle view)



Figure 3. Arms-back (side view)

Arms-down "start." In this "start" the arms are hung loosely in front of the body, hanging downward, just in front of the shoulder plane. The head is held up with the eyes focused down the pool. The trunk is angled forward almost parallel to the deck. The legs are flexed in a comfortable position with the feet parallel and in line with the hips.

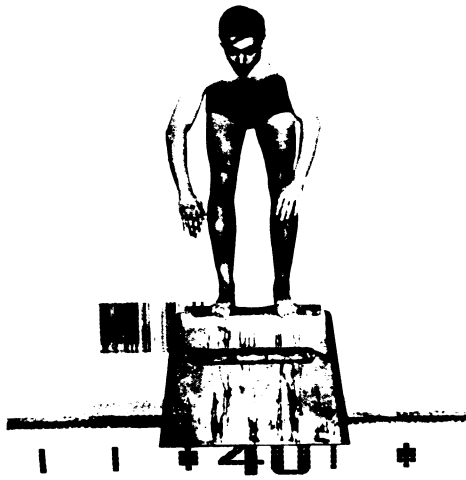


Figure 4. Arms-down (front view)

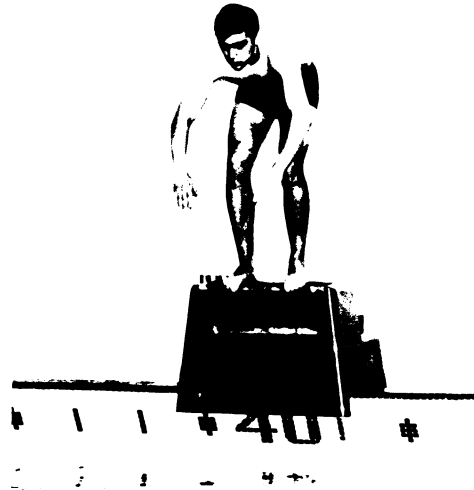


Figure 5. Arms-down (angle view)



Figure 6. Arms-down (side view)

Arms-front "start." In this "start" the arms are held in a horizontal plane in front of the body and the legs are locked at the knees. The head is held up with the eyes focused down the pool. The trunk is angled forward almost parallel to the deck of the pool. The legs are straight with the feet in line with the hips.

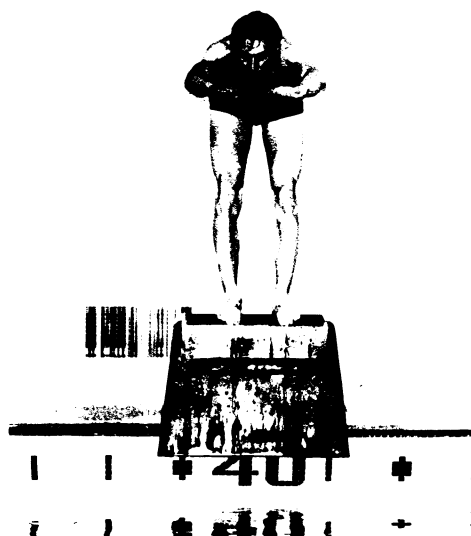


Figure 7. Arms-front (front view)

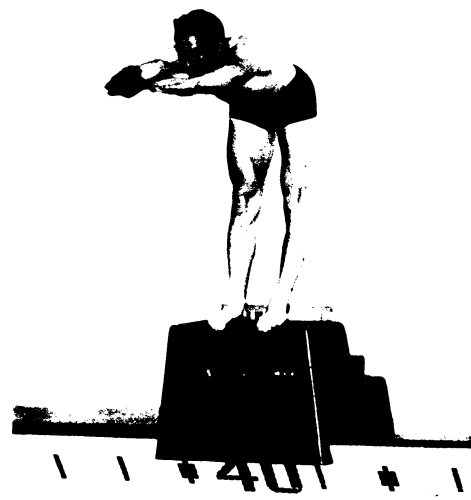


Figure 8. Arms-front (angle view)



Figure 9. Arms-front (side view)

Reaction time. This is the interval of time between the sound of the gun and the moment the subject's feet leave the starting block.

Time to the distance. This is the interval of time between the sound of the gun and the moment the swimmer's fingers cross a mark twenty feet out from the starting block. This is shown as measured by a study of the motion picture.

Time to the water. This is the interval of time between the sound of the gun and the swimmer's first contact with the water.

Starting position. This is the position in which the subject places himself on the command "take your mark." This position is held until the gun is fired.

"Start." This is the action of the subject in moving from the starting position into the water.

Vertical jump. All subjects assumed their starting position. From the starting position they exploded upward driving with the legs and reaching with the arms in a vertical position.

Trunk rotation. The hands are on the hips, the feet spread wide apart. Starting to the left or right side, the trunk is bent forward at the waist. Movement is started to the front, the side, the back, the opposite side, and then it is repeated starting to the front. This exercise is done to a four count cadence. The direction of movement is reversed on the sixth repetition.

Trunk twister. The hands are clasped behind the neck. The head is erect and the feet are spread apart. This four count exercise is started to the left or the right. The upper body is twisted to the side, the front, the opposite side, and then back to the front.

Neck rotation. With the hands placed on the hips the head is rolled around five times in one direction and five times in the opposite direction.

Toe touches. Starting with the hands on the hips, and the feet together, this four count exercise is done by touching the toes with the fingers on counts one, two, and three, and straightening back up to the starting position on count four.

Curls. This exercise is a modified sit-up. It is done on a two count cadence. While lying on the back with the palms of the hands resting on the thighs, the hands slide forward until the fingers touch the knee caps. This is all done on count one. The body is lowered to the pool deck on the second count.

Neuromuscular coordination. The development of motor skills of various types . . .

Is largely a matter of improvement in speed and accuracy with which the nervous system coordinates muscle activity. A large part of training for any

sport or activity is concerned with improving this 'neuromuscular' coordination.²

Somatotypes. This refers to the various body types which are a limitation of this study. Body type classifications are Sheldon's: (1) endomorph; (2) mesomorph; and (3) ectomorph.³

²Laurence E. Morehouse and Augustus T. Miller, Physiology of Exercise (St. Louis: The C.V. Mosby Company, 1948), p. 35.

³William H. Sheldon, The Varieties of Human Physique (New York: Harper and Brothers Publishers, 1940), p. 5.

CHAPTER II

REVIEW OF RELATED LITERATURE

Literature directly related to the study is both old and new. Studies were done in the early 1930's while a recent interest is shown by studies in the 1960's. Most of the studies use subjects who are skilled in competitive swimming.

In 1939, Tuttle, Morehouse, and Armbruster¹ conducted two studies in swimming "starts." With eighteen varsity swimmers and the use of a Dunlap sound key and chronoscope, they determined that starting blocks were a disadvantage over the flat wall "start." These data were collected during regular practice sessions. Each swimmer took twenty "starts" from the block and twenty "starts" from the flat wall. They also determined that the optimum time for holding a swimmer on his mark is two seconds.

Bender, in 1934, found that a distance runner has a slower reaction time than a sprinter. He reported that:

There are two types of reactors . . . the sensory type and the motor type. In the sensory type of reaction a subject concentrates on the stimulus. The analogy in track is a sprinter who concentrates on the sound of the gun. In the motor type of

¹W. W. Tuttle, L. E. Morehouse, and David Armbruster, "Two Studies in Swimming Starts," Research Quarterly, 10: 89-98, March, 1939.

response a subject focuses attention on his muscular set, i.e., on getting away at the sound of the gun. When comparing these two types of reactors, it was found . . . that the motor reactor's time was much shorter than that of the sensory reactor. Other things being equal, the sprinter who anticipates the gun shot, but who concentrates on his muscular set and responds reflexly, will start faster than a sprinter who concentrates on the shot of the gun.²

Westerlund and Tuttle did a study on reaction time and its relationship to running events in track. Using twenty-two trained university men with trials on three consecutive days (a total of nine trial runs) they concluded that the longer the distance to be run, the slower the reaction time for the start of the race. Psychologically the subjects reacted faster to running a shorter distance than when running a longer distance.³ The emphasis in teaching the swimming "start" should be placed on the shortness of the distance so that all swimmers will put out maximum effort.

The latest study done on swimming "starts" was conducted at the University of Minnesota, in 1964, by Mowerson, McAdams, and O'Brien. Using a Dekan Sports Analyser, a comparison of two methods of starting

²W. R. G. Bender, "Factors Contributing to Speed in the Start of a Race and Characteristics of Trained Sprinters," Research Quarterly Supplement, 5:72-78, March, 1934.

³J. H. Westerlund, and W. W. Tuttle, "The Relationship Between Running Events in Track and Reaction Time," Research Quarterly, 2:95-100, October, 1931.

in competitive swimming was made with nine varsity swimmers. The data recorded was reaction time and time from the "start" to a distance of five yards from the starting block. A heel strap was used to stop the clock for both measurements. A total of ten "starts" were taken for each type of "start" on two consecutive days. Of the ten "starts," five were taken for reaction time, and five for the five yard distance. Mowerson found no significant difference between the two types of starting positions.⁴

Lockhart, in a survey of devices used for measuring short time intervals, stated that a common method of timing is by showing the occurrence of the events by means of photography. Motion picture cameras are operated at a known rate of speed and, therefore, can be used in timing.⁵ The variation of film travel due to friction, the spring drive's running down, and expansion or shrinkage during processing are variables that need to be controlled.

⁴G. Robert Mowerson, Robert E. McAdams, and Ronald O'Brien, "A Comparison of Two Methods of Performing the Racing Start in Competitive Swimming," The Swimming World, 5:4, February, 1964.

⁵Aileen Lockhart, "A Survey of Devices Used in Measuring Short Time Intervals," Research Quarterly, 12:757-764, December, 1941.

CHAPTER III

PROCEDURE

The subjects used for the study were those enrolled in three advanced beginning swimming classes. All thirty-nine subjects were novices to competitive swimming. Each subject was required to swim twenty-five yards of backstroke and twenty-five yards of freestyle in order to be eligible for this study.

In each of the three swimming classes the course of instruction was divided into two four-week lessons as shown in Table I. The first four weeks were spent working on skill requirements for completing the university swimming course, and the second four weeks were used to conduct the research study. Classes met twice a week for a total of eight fifty-minute sessions. Starting positions were assigned to each swimming class by the method of random selection. The sixth hour Monday-Wednesday class performed the arms-back "start." The second hour Tuesday-Thursday class performed the arms-down "start," and the fifth hour Tuesday-Thursday class performed the arms-front "start."

Each practice session was organized on a precise time schedule. After adjustments were made, during the first meeting of each session, the time schedule was strictly followed.

The research study was filmed using a sixteen millimeter Bell

TABLE I

ARRANGEMENT OF CLASS CALENDAR FOR TEACHING AND RESEARCH WORK

WEEK NUMBER	CLASS INSTRUCTION	
1	January 30th to February 3rd	
2	February 6th to February 10th	
3	February 13th to February 17th	
4	February 20th to February 24th	
RESEARCH PROJECT		
5	February 27th to the 28th March 1st to the 2nd	Session One Session Two
6	March 6th to the 7th March 8th to the 9th	Session Three Session Four
7	March 13th to the 14th March 15th to the 16th	Session Five Session Six
8	March 20th to the 21st March 22nd to the 23rd	Session Seven Session Eight

and Howell electrically driven movie camera. The camera was run at a film speed of twenty-four frames per second. The placement of the camera and the arrangement of the pool area for recording the study will be explained later in Sessions #7 and #8 on page 24.

All collected data were analyzed using the Analysis of the Variance¹, and the small sample "t" test² of the significance of the differences between the means of the three groups.

¹E. F. Lindquist, Statistical Analysis in Educational Research (Boston: Houghton Mifflin Company, 1940), p. 100.

²John I. Griffin, Statistics, Methods and Applications (New York: Holt, Rinehart and Winston, 1962), p. 206.

SESSION # 1

At the first session the plan for the research project was introduced to each of the three groups. The three types of starting positions were demonstrated by the researcher. After the demonstration the subjects were told what starting position they would be performing. "Reaction time," "time to the water," and "time to the distance" (the three component factors) were explained to give the subjects a better understanding of the research study. They were told that the purpose of the study was to determine the effectiveness of each of the three starting positions. Further explanation to the subjects indicated the importance of being on time to each session, staying healthy, and being ready to work hard during each session. They were also told that their grades in the course would depend primarily on their work for the first four weeks, but that absences, attitude, and co-operation would affect their final grade. These directions to the subjects were given from typed cards to insure uniformity of directions.

The explanation of the starting position to be used by the subjects was also read from a typed card. Directions were short, concise, and to the point. No elaboration of the starting position was given at this time. A demonstration was given by the researcher of the starting position. This was followed by using one subject from each class to demonstrate the starting position. The researcher guided the subject into the correct starting position.

A series of six warm-up exercises were done by each group. Each exercise was selected to prepare the subjects for the day's work. The exercises were done in the same order in every session with ten repetitions of each of the following exercises: (1) vertical jump; (2) trunk rotation; (3) trunk twisters; (4) neck rotation; (5) toe touches; and (6) curls. The researcher led the exercises, except for the vertical jumps, which were supervised only. Following the warm-up, a short rest period was taken and the starting position to be performed was reviewed.

The subjects worked on mastering the starting position and the "start." The subjects were spread out along the raised edge of the pool deck. Facing the pool deck, each subject assumed the starting position twenty times. Correct body position was checked by the researcher. The subjects worked individually on taking the starting position and jumping forward onto the deck.

After the subjects had completed practicing their starting position, the researcher demonstrated the starting position, flight through the air, the entry into the water, and the glide. The "start" was demonstrated twice with the subjects watching along the side of the pool. Each subject was given an opportunity to question the researcher about the "start" following each demonstration.

All the subjects were given the starting commands and told to take ten "starts" going across the pool working individually. They were to work on body feeling (knowing that their arms and legs are in

the correct position for the "start"), on driving hard from the side of the pool, on keeping the body straight, and on gliding for distance.

The starting commands "take your mark--two second wait--go" were to be thought about by each subject when starting himself.³ The researcher checked each person's "start" during this time and made any necessary corrections.

Before dismissal, the subjects dried themselves off and sat in the bleachers. At this time the researcher asked how they felt, answered any questions, encouraged them, and asked them to refrain from practicing out side of class.

SESSION # 2

Session number two began with the same warm-up exercises as listed in the previous session, led by the researcher. Care was taken to do the exercises slowly and correctly so as to get the most beneficial results from the exercises without straining sore muscles.

Following the warm-up, the starting position was reviewed. The subjects stood at the edge of the pool facing the water and assumed the starting position ten times, working individually. They were told to look at the starting positions of others in the class and to ask questions if they were not sure that they were getting into the correct starting

³W. W. Tuttle, L. E. Morehouse, and David Armbruster, "Two Studies in Swimming Starts," Research Quarterly, 10:89-98, March, 1939.

position. The researcher checked the starting positions and made corrections during this time.

Pool work involved taking fifteen "starts" across the pool. This activity was done working individually. Thinking about the starting commands the subjects dived into the water, glided across the pool, climbed out of the water, and then repeated the same procedure starting from the opposite side of the pool. They worked on perfecting the starting position during which time the researcher evaluated each person's "start" and made corrections.

After a brief rest, five "starts" were taken by the group on commands given by the researcher. They were told to relax, to loosen their arms and legs by shaking them, and to concentrate on getting a good "start." A whistle was used as the starting signal. The researcher started the subjects from many different positions so they would concentrate on their "start," and not look to see where the starter was positioned.

The subjects dried off and rested in the bleachers before being dismissed. They were asked how they felt and if they had any questions pertaining to the "start." It was announced that the next meeting would be held in the audio-visual room of the physical education building.

SESSION # 3

To start the third session a film pertaining to the "start" which each group was performing was shown. The film shown was of the pilot

study done by the researcher earlier in the year on racing "starts." A stop action Bell and Howell motion picture projector was used to illustrate the following points: (1) body position on the "start;" (2) arm movements; (3) leg drive; (4) flight through the air; and (5) entry into the water. This analysis was done for each person filmed in the pilot study. A question-answer session followed. Subjects were then dismissed to dress for swimming class.

Warm-up exercises on the pool deck were done as usual.

The pool work consisted of ten "starts" across the pool. Subjects worked individually under the guidance of the researcher. They watched the starting positions of members of their group while the researcher pointed out both good and bad points of the performing subjects' "starts." Objectives for this session were to perfect the starting position, to drive hard from the edge of the pool, and to straighten the body during the flight through the air.

Five "starts" were taken on command, practicing the above objectives. This ended the third session.

SESSION # 4

Warm-up exercises were done as usual. A dry area of the pool deck was used during each session to make conditions more pleasant for the subjects and to provide for their safety.

For this session the starting blocks were introduced for the first time. Instructions were given on the placement of the starting

blocks. Six starting blocks were placed on the far side of the pool. How to place the blocks and how to hold them flush with the deck while a person is taking his "start" were demonstrated.

Ten "starts" from the starting blocks began the pool work for this session. Each subject was to work individually in getting adjusted to the height of the starting blocks and becoming used to starting from them. After starting from the block the subject swam across the pool and climbed out on the far side. During this time the researcher corrected starting positions, and encouraged subjects to keep their bodies straight during the flight through the air and on the entry into the water.

Five whistle "starts" on command finished the pool work. Points stressed were: (1) coming down into the starting position together; (2) holding the starting position steady; (3) driving hard with the legs; and (4) holding the glide.

The subjects were asked how they felt and whether or not they had any questions. The majority of questions asked pertained to the proper angle of entry into the water.

SESSION # 5

The starting blocks were set up on the narrow side of the pool before the beginning of the session. Six blocks were used--each one spaced about five feet apart.

Warm-up exercises were done on the deck at the deep end of the pool. The exercises were done as listed in SESSION # 1 and were led by the researcher.

To begin the pool work each man took one "start" while being observed by the other members of his group. The starting order was from the class roll call list. All subjects were to observe and to evaluate the subject's "start." The "start" was on command. An evaluation by the group and researcher was given each subject following completion of his "start." Four "starts" were then taken individually by all subjects. Errors were corrected. Stress was placed on the entry into the water and holding the glide.

Upon completion of a short rest period, five gun "starts" were taken by each subject. The "starts" were done on command by the researcher. This procedure closely simulated the actual testing procedure which would be used during the recording session.

Before being dismissed, the subjects were asked how they felt and whether or not they had any questions.

SESSION # 6

The starting blocks were put in their proper places before the class began.

Warm-up exercises were executed as usual.

Pool work consisted of ten "starts" on command by the researcher. Since a fewer total number of "starts" were being taken in this session, quality in the "start" was stressed as being very important. The first four "starts" were done on command and started by the researcher's

whistle. The remaining six "starts" were gun "starts." Subjects were told to act and think as experts on racing "starts." They should loosen the arms and legs, hyperventilate slightly, and concentrate on getting a good "start."

While the subjects relaxed in the bleachers, the researcher asked how they felt and whether or not they had any questions about the "start." A brief explanation of next week's recording session was introduced at this time. All subjects were to do the following: (1) bring a sweatshirt, towel and/or sweat pants to the session; and (2) get a tight fitting swimming suit from the equipment issue room. Rotation of the subjects would be according to roll call list, which was to be posted for quick reference next to the bleachers. Before starting the recording session one practice "start" would be taken, simulating the actual recording procedure.

SESSIONS # 7 AND # 8

The final two sessions were used to record the study. Both sessions involved the same preliminary instructions, warm-up, and pool work. The time schedule was also the same for each session.

Preliminary instructions were for all subjects to bring a sweatshirt and wear it while on the pool deck, to wear a tight fitting swimming suit, and to place the six starting blocks in place before the warm-up exercises.

During the time before the warm-up, the pool was set up for filming the subjects. A $1 \frac{3}{8}$ " red ribbon was stretched across the pool and taped to the deck twenty feet from the starting block. The twenty foot mark was placed in a vertical position going up the wall. This aided the lining of the camera on the focal point of the twenty foot mark. The sixteen millimeter Bell and Howell movie camera used to record the study was electrically driven at twenty-four frames per second and set on a tripod for filming the study. The camera was set up at the deep end of the pool. The starting block to be used by the subjects was placed forty feet from the deep end of the pool. A music stand and black metal sheet was used as a background for seeing the smoke after the gun was fired. It also shielded the gun from the subject on the starting block. The photographer was the same person who filmed the pilot study. The above procedures are shown in figures ten, eleven, twelve, and thirteen.

Warm-up exercises followed the setting up of the pool.

An explanation of the recording session was read to the subjects. A total of six "starts" were recorded. Three "starts" were taken at each of the two sessions. Each person performed his "start" in the order listed on the class roll call sheet. All subjects were started individually. To keep the recording session moving the following procedure was used: (1) one subject was to be on the starting block ready to be started; (2) two subjects were to be waiting their turn; (3) the edge of the starting block was to be wiped off; (4) the glide was to be held; (5) the subjects were to swim over to the ladder on the

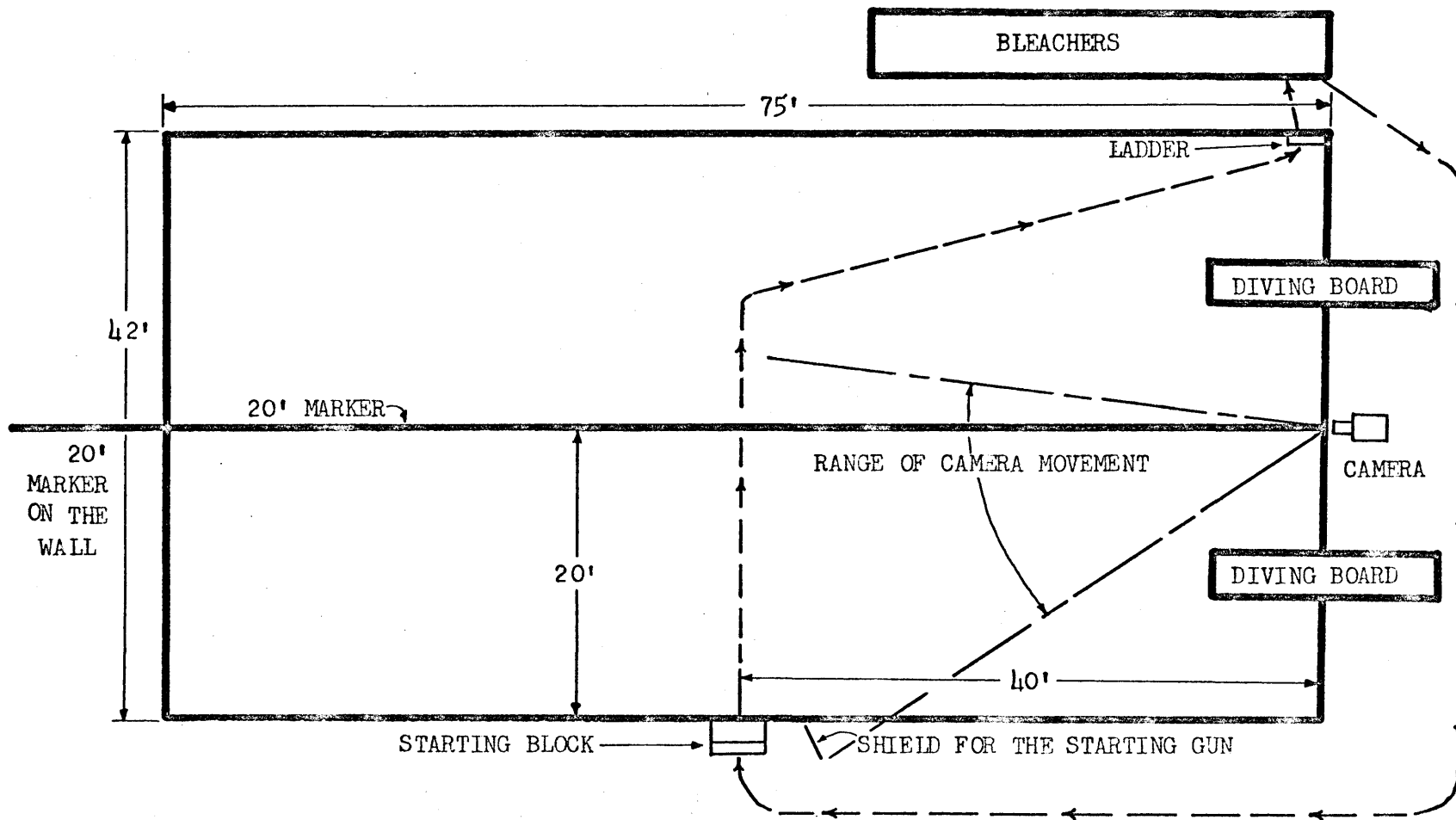


FIGURE 10

PLACEMENT OF THE STARTING BLOCK, SHIELD FOR THE STARTING GUN, CAMERA,
 RANGE OF CAMERA MOVEMENT, TWENTY-FOOT MARKER, AND MOVEMENT
 PATTERN FOR ALL SUBJECTS DURING THE RECORDING SESSION
 IN THE WISCONSIN STATE UNIVERSITY-LA CROSSE
 SWIMMING POOL

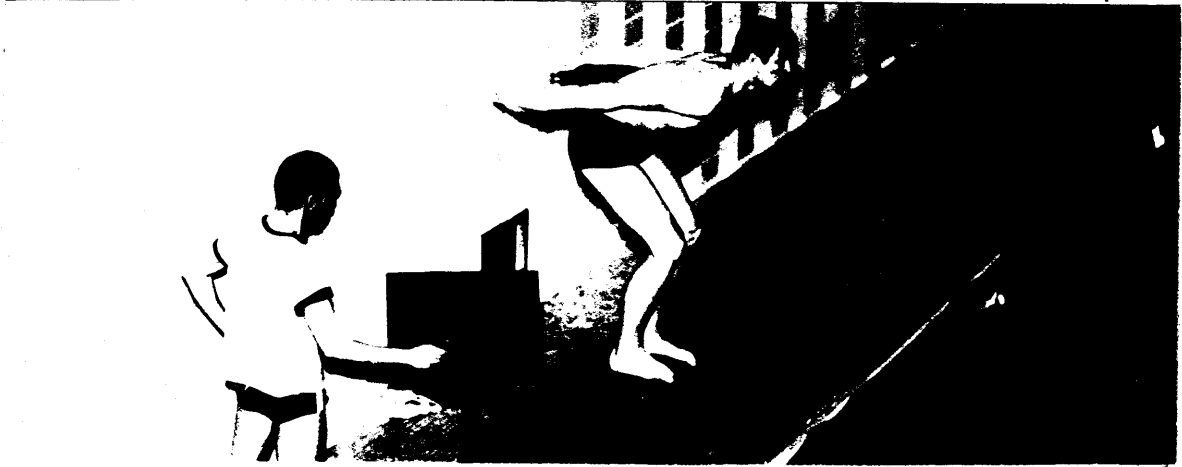


Figure 11. Subject ready to be started from the starting block.



Figure 12. Camera, photographer, subjects, and twenty-foot marker.

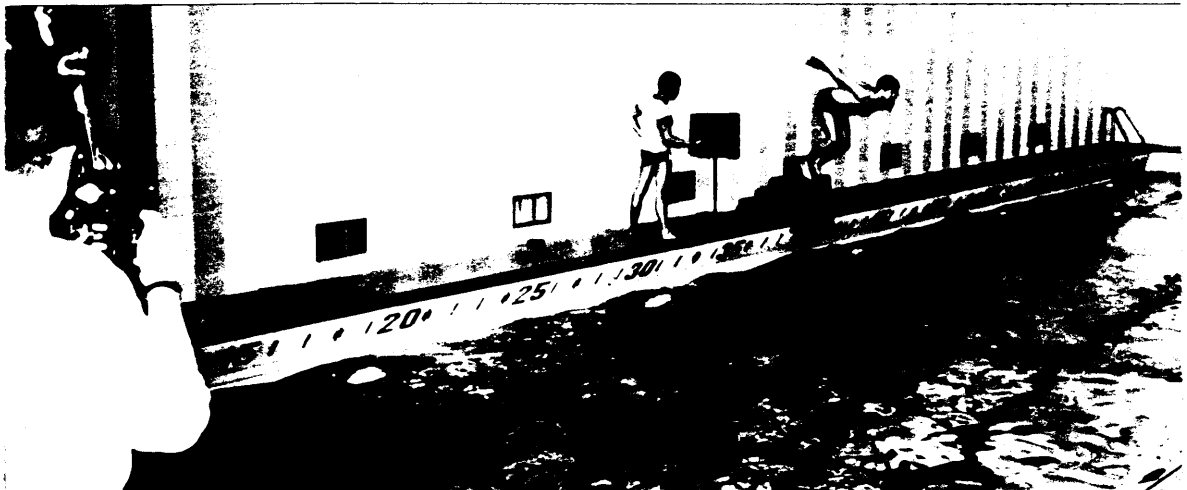


Figure 13. Photographer filming a subject driving off the starting block.

bleacher side of the deep end; (6) the subjects were to climb out of the pool using the ladder; and (7) the subjects were to dry off, sit in the bleachers and relax. The subjects were also told to be alert to help each other and to keep the recording session running smoothly.

One practice "start" for each subject was taken using the testing procedure.

During the recording of the three "starts" for each session, the subjects were given time to relax, loosen up their arms and legs, and hyperventilate before taking their "starts." Corrections on the "starts" of each subject was made by the researcher during the recording session. Every attempt was made to keep the recording session similar to all preceding sessions. The starting commands were given loudly and clearly. The length of time between the command "take your mark" and the gun shot varied to keep the subjects from timing the "start." All subjects were instructed to be in balance in their starting position and to concentrate on getting a good "start."

The recording session went very smoothly with no problems. Each subject could leave following the recording of his last "start."

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

This chapter contains an analysis of the findings of this study. The statistical treatment of these collected data was interpreted by use of the Analysis of the Variance¹, and also the "t" test² which indicates the significance of the difference between two means. The one per cent and five per cent levels of confidence were used in accepting or rejecting the null hypotheses.

I. FILM ANALYSIS

The film of the three "starts" was analyzed on a stop-action Bell and Howell projector. Three measurements were taken for each "start": (1) reaction time; (2) time to the water; and (3) time to the distance of twenty feet. When the first frame showing the smoke from the firing of the gun was seen, the frame counter on the projector was set at zero. The film was advanced by a hand crank until the frame appeared showing where the subject's feet had left the starting block. The number of frames showing on the frame counter was then recorded on a master sheet for reaction time. Further

¹ E. F. Lindquist, Statistical Analysis in Educational Research (Boston: Houghton Mifflin Company, 1940), p. 100.

² John I. Griffin, Statistics, Methods and Applications (New York: Holt, Rinehart and Winston, 1962), p. 206.

advancement of the film revealed the frame showing the entry of the body into the water. The frame counter reading was taken and the time to the water was recorded on the master sheet. Continuing with the hand cranking, the film was advanced to the frame where the subject's fingers touched the twenty foot mark. The reading was taken from the film counter and recorded on the master sheet for the time to the distance. The number of frames for each of the three component factors was converted into time using a time conversion table for a film speed of twenty-four frames per second. The time was recorded to the 1/100th of a second. This is shown in Table II.

All collected data were processed by the Computer Center of the Wisconsin State University-La Crosse. An International Business Machine computer number 1130 was used. Each of the three component factors were analyzed by use of the analysis of the variance between three groups, and by use of the "t" test of the significance of the difference between the means of the three groups.

TABLE II

TIME CONVERSION TABLE FOR A FILM SPEED
OF TWENTY-FOUR FRAMES PER SECOND

FRAMES	TIME
1/24 .....	.04
2/24 .....	.08
3/24 .....	.13
4/24 .....	.17
5/24 .....	.21
6/24 .....	.25
7/24 .....	.29
8/24 .....	.33
9/24 .....	.38
10/24 .....	.42
11/24 .....	.46
12/24 .....	.50
13/24 .....	.54
14/24 .....	.58
15/24 .....	.63
16/24 .....	.67
17/24 .....	.71
18/24 .....	.75
19/24 .....	.79
20/24 .....	.83
21/24 .....	.88
22/24 .....	.92
23/24 .....	.96
24/24	1.00

II. REACTION TIME

Table III shows the mean reaction times for the three "starts" were: (1) arms-front .99; (2) arms-back 1.15; and (3) arms-down 1.00. The total mean reaction time for all three "starts" was 1.05.

TABLE III
MEAN REACTION TIMES AND TOTAL MEAN REACTION TIME
FOR THE THREE STARTS

START	TIME
Arms front .....	.99
Arms back	1.15
Arms down	1.00
Total mean time	1.05

The F score was 21.58 for the analysis of the variance for reaction time as shown in Table IV. This was significant at the one per cent level of confidence with degrees of freedom of two between groups and thirty-six within groups.

TABLE IV
ANALYSIS OF VARIANCE FOR REACTION TIME

SOURCE OF VARIATION	df	MS	F
Between group	2	.1047	21.58 a
Within group	36	.0049	
Total	38		

a significant at the 1 per cent level

The mean of the total scores for the subjects' five "starts" taken for reaction time was 4.97 for the arms-front "start," 5.78 for the arms-back "start," and 4.98 for the arms-down "start."

The standard deviation for the arms-front "start" was .41, for the arms-back "start" .26, and for the arms-down "start" .31.

The standard error of the mean was .12 for the arms-front "start," .07 for the arms-back "start," and .09 for the arms-down "start."

The "t" test of the significance of the difference between the means were as follows: (1) the arms-front "start" and the arms-back "start" had a "t" score of 5.75 which is significant at the one per cent level of confidence; (2) the arms-back "start" and the arms-down "start" had a "t" score of 6.59 which is significant at the one per cent level of confidence; and (3) the arms-front "start" and the arms-down "start" had a "t" score of .07 which is not significant at the one per cent or five per cent levels of confidence. The above statistical data are shown in Table V.

TABLE V

NUMBER, MEANS, STANDARD DEVIATIONS, STANDARD ERROR OF THE MEAN, AND t RATIOS FOR THE THREE STARTING POSITIONS FOR REACTION TIME

START	N	MEAN	S.D.	S.E.M.	t
Arms front	13	4.97	.41	.12	AF-AB: 5.75 a
Arms back	13	5.78	.26	.07	AB-AD: 6.59 a
Arms down	13	4.98	.31	.09	AF-AD: .07

a significant at the 1 per cent level

III. TIME TO THE WATER

Table VI shows the mean times to the water for the three "starts" were: (1) arms-front 1.32; (2) arms-back 1.51; and (3) arms-down 1.25. The total mean time to the water for all three "starts" was 1.36.

TABLE VI
MEAN TIMES AND TOTAL MEAN TIME TO THE WATER
FOR THE THREE STARTS

START	TIME
Arms front	1.32
Arms back	1.51
Arms down	1.25
Total mean time	1.36

The F score was 35.65 for the analysis of the variance for the time to the water as shown in Table VII. This was significant at the one per cent level of confidence with degrees of freedom of two between groups and thirty-six within groups.

TABLE VII
ANALYSIS OF VARIANCE FOR THE TIME TO THE WATER

SOURCE OF VARIATION	df	MS	F
Between group	2	.2353	35.65 a
Within group	36	.0066	
Total	38		

a significant at the 1 per cent level

The mean of the total scores for the subjects' five "starts" taken for reaction time was 6.62 for the arms-front "start," 7.53 for the arms-back "start," and 6.23 for the arms-down "start."

The standard deviations for the arms-front "start" was .44, for the arms-back "start" .32 and for the arms-down "start" .40.

The standard error of the mean was .13 for the arms-front "start," .09 for the arms-back "start" and .11 for the arms-down "start."

The "t" test of the significance of the differences between the means were as follows: (1) the arms-front "start" and the arms-back "start" had a "t" score of 5.76; which is significant at the one per cent level of confidence; (2) the arms-back "start" and the arms-down "start" had a "t" score of 8.80 which is significant at the one per cent level of confidence; and (3) the arms-front "start" and the arms-down "start" had a "t" score of 2.29 which is significant at the five per cent level of confidence. The above statistical data are shown in Table VIII.

TABLE VIII

NUMBER, MEANS, STANDARD DEVIATIONS, STANDARD ERROR OF THE MEAN, AND t RATIOS FOR THE THREE STARTING POSITIONS FOR THE TIME TO THE WATER

START	N	MEAN	S.D.	S.E.M.	t
Arms front	13	6.62	.44	.13	AF-AB: 5.76 a
Arms back	13	7.53	.32	.09	AB-AD: 8.80 a
Arms down	13	6.23	.40	.11	AF-AD: 2.29 b

a significant at the 1 per cent level

b significant at the 5 per cent level

IV. TIME TO THE DISTANCE

Table IX shows the mean times to the distance for the three "starts" were: (1) arms-front 2.29; (2) arms-back 2.35; and (3) arms-down 2.27. The total mean time to the distance for all three "starts" was 2.30.

TABLE IX
MEAN TIMES AND TOTAL MEAN TIME TO THE DISTANCE
FOR THE THREE STARTS

START	TIME
Arms front	2.29
Arms back	2.35
Arms down	2.27
Total mean time	2.30

The F score was .01 for the analysis of the variance for the time to the distance as shown in Table X. This was not significant at the one per cent or five per cent levels of confidence.

TABLE X
ANALYSIS OF VARIANCE FOR THE TIME TO THE DISTANCE

SOURCE OF VARIATION	df	MS	F
Between group	2	.0228	.01
Within group	36	.0540	
Total	38		

The mean of the total scores for the subjects' five "starts" taken for time to the distance was 11.44 for the arms-front "start," 11.75 for the arms-back "start," and 11.33 for the arms-down "start."

The standard deviation for the arms-front "start" was 1.56, for the arms-back "start" .82, and for the arms-down "start" .79.

The standard error of the mean was .45 for the arms-front "start," .24 for the arms-back "start," and .23 for the arms-down "start."

The "t" test of the significance of the differences between the means were as follows: (1) the arms-front "start" and the arms-back "start" had a "t" score of .61 which is not significant at the one per cent or five per cent levels of confidence; (2) the arms-back "start" and the arms-down "start" had a "t" score of 1.28 which is not significant at the one per cent or five per cent levels of confidence; and (3) the arms-front "start" and the arms-down "start" had a "t" score of .22 which is not significant at the one per cent or five per cent levels of confidence. The above statistical data are shown in Table XI.

TABLE XI

NUMBER, MEANS, STANDARD DEVIATIONS, STANDARD ERROR OF THE MEAN, AND t RATIOS FOR THE THREE STARTING POSITIONS FOR THE TIME TO THE DISTANCE

START	N	MEAN	S.D.	S.E.M.	t
Arms front	13	11.44	1.56	.45	AF-AB: .61 a
Arms back	13	11.75	.82	.24	AB-AD: 1.28 b
Arms down	13	11.33	.79	.23	AF-AD: .22 c

a significant at the 60 per cent level

b significant at the 30 per cent level

c significant at the 90 per cent level

CHAPTER V

SUMMARY AND CONCLUSIONS

SUMMARY

This research was designed to compare the effectiveness of three starting methods of performing the racing "start" in competitive swimming. An attempt was made to determine whether or not one starting method was better than the other two in regard to the component factors of reaction time, time to the water, and time to a distance of twenty feet.

A sample of thirty-nine university students from three advanced beginning swimming classes at Wisconsin State University-La Crosse were used as subjects. Each group was randomly assigned to one of the three starting positions. The starting positions were the arms-back, the arms-down and the arms-front.

The researcher attempted to teach a selected "start" to each group in a four week period consisting of eight fifty-minute sessions. Each session was organized and planned to accomplish the desired end results for each subject, that of mastery of his "start."

At present a variety of starting positions are being used by competitive swimmers. Some are variant forms of the three starting positions tested in this study.

CONCLUSIONS

Results show the arms-front "start" and the arms-down "start"

to be superior to the arms-back "start" in (1) reaction time, and (2) time to the water at the one per cent level of confidence. In time to the distance, however, no significant difference among the three "starts" was found. A review of the research study films shows that differences in angle of entry into the water and the position on entry probably account for no significant difference among the three "starts" in time to the distance.

Those subjects performing the arms-back "start" appear in general to have (1) a straighter body position during the flight in the air, (2) a better angle of entry into the water, and (3) greater force in driving upward and outward from the starting block.

It is possible to assume from careful analysis of the research study films that not all subjects in each group had reached complete mastery of their "start" within the eight sessions. Bending at the waist, entering the water too deeply, holding the head up during the glide, and arching the back on the entry into the water all slow the forward momentum of the subject.

Further studies should be conducted using the three starting positions with experienced competitive swimmers, and grouping the three body types and teaching each group a different one of the three "starts." The use of experienced competitive swimmers should minimize the problems of differences in the angle of entry into the water and body positions on the entry into the water. Grouping the body types and teaching each group a different one of the three "starts" might possibly show one starting position to be more effective for a particular body type than the other starting positions.

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APPENDIX

INTRODUCTION OF THE RESEARCH STUDY
TO THE SUBJECTS AT
THE FIRST SESSION

A. EXPLANATION

This research project is being done to try and determine the efficiency and effectiveness of three types of competitive starting positions. The starting positions are: the Arms Back (AB); the Arms Down (AD); and the Arms Front (AF). The start you will be using is the Arms _____.

There are three (3) components to be tested for each starting position. They are: (1) reaction time, (2) time from the start to hitting the water, and (3) time from the start to a 20 foot distance.

Once again the purpose of this experiment is to determine the efficiency and effectiveness of the three starting positions.

Because of the size of our group, it is very important for you to keep healthy. An absence can throw the experiment off. Try and come to this session in a happy mood. Be relaxed and ready to do your best in learning this starting position.

B. DECK WORK

The warm-up exercises will be done together as a group, led by one of the group. The exercises to be done in order are: vertical jumps, trunk rotation, trunk twisters, neck rotation, toe touches, and curls. Ten (10) repetitions of each.

C. The time schedule for our sessions will be strictly adhered to.

INSTRUCTIONS FOR THE ARMS-FRONT "START"

The starting position we will be using is the arms front.

FEET: Toes are curled around the edge of the pool with a firm grip. The feet are in line with the hips.

LEGS: The legs are straight with no bend at the knees.

BODY: The body is bent at the waist. The trunk is angled forward to a point above the horizontal.

HEAD: The head is up with the eyes looking down the pool, focusing on the opposite end just above the water line.

ARMS: The arms are held outward in front of the body in a horizontal plane. The elbows are slightly flexed.

EXECUTION OF: The body is placed into position with the legs and feet in line with the hips. On the command "take your marks," the arms reach forward into the horizontal position as the trunk bends at the waist, with the eyes looking down the pool.

On the command "Go" or the starting signal, the arms circle outward, the legs flex, and the body leans forward. The legs and arms drive simultaneously and the body is hurled outward just above the horizontal.

The flight through the air is in a horizontal plane from the starting point. The head is up looking for the far side. The body is stretched and straight. The arms are extended and reaching forward and the legs are straight with the toes pointed.

As the body begins to drop, the head is put between the arms and the arms squeezed close together.

The body enters the water at a slight angle, just below the surface of the water, and with the body stretched the glide is held.

INSTRUCTIONS FOR THE ARMS-BACK "START"

The starting position we will be using is the arms back.

- FEET:** The toes are curled around the edge taking a firm grip. The feet are placed directly under the hips, 6 to 8 inches apart.
- LEGS:** The legs are in line with the hips and are flexed in a comfortable position.
- BODY:** The body is bent at the waist and held just above a horizontal position.
- HEAD:** The head is up with the eyes looking across the pool at a spot just above the water level.
- ARMS:** The arms are held in back of the body in a horizontal position with the elbows slightly flexed and the palms facing up.

EXECUTION OF: On the command "take your mark" the legs flex into a comfortable position, the body bends forward at the waist, the arms move backward and the head is up with the eyes focusing on a spot above water level across the pool. These movements are executed at nearly the same time. (The arms back starting position is assumed.)

On the command "Go" (the starting signal) the body leans forward as the arms raise upward, the arms swing through and the legs drive the body out and upward as the arms reach forward and the head looks for the target across the pool.

The flight through the air is in a horizontal plane from the starting point. The head is up looking for the far side. The body is stretched and straight. The arms are extended and reaching forward and the legs are straight with the toes pointed.

As the body begins to drop, the head is put between the arms and the arms squeezed close together.

The body enters the water at a slight angle, just below the surface of the water, and with the body stretched the glide is held.

INSTRUCTIONS FOR THE ARMS-DOWN "START"

The starting position we will be using is the arms down.

FEET: The feet are placed on the edge of the pool with the toes curled around the edge firmly. The feet are placed in line with the hips, about 6 to 8 inches apart.

LEGS: Knees are flexed in a comfortable position.

BODY: The trunk is bent at the waist and hunched forward. The shoulders when hunched forward are about level with the waist.

HEAD: The head is up, looking down the pool, with the eyes focusing on the opposite end just above the water line.

ARMS: The arms are hung relaxed in front of the body pointing at the water. The elbows are slightly flexed.

EXECUTION OF: On the command "take your marks" the starting position is assumed.

On the command "Go" (or whatever the starting signal may be) the arms make a small circle going outward in front of the body. With the arms driving, the legs extend. As the arms reach forward for the far side of the pool, the legs are giving a final simultaneous thrust with the extension of the foot giving the final driving force.

The flight through the air is in a horizontal plane from the starting point. The head is up with the eyes looking for the far side. The body is stretched and straight. The arms are extended and reaching forward and the legs are straight with the toes pointed.

As the body begins to drop, the head is put between the arms and the arms squeezed close together.

The body enters the water at a slight angle, just below the surface of the water, and with the body stretched the glide is held.

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
FIRST SESSION

- I. INTRODUCTION (in the bleachers)
- A. Explanation of the research project.
 - 1. Types of starting positions.
 - 2. The starting position the class will be learning.
 - 3. The three components involved in each start: reaction time, time to hitting the water, and time to a 20 foot distance.
 - 4. Purpose of this experiment is: to determine the effectiveness and efficiency of the three starting positions.
 - B. Importance of being on time, staying healthy, and working hard.
 - C. Grading will continue. Absences, attitude, and cooperation.
- II. STARTING POSITION
- A. Explanation.
 - 1. Short and concise. No elaboration of the starting position at this time.
 - 2. Demonstration for the men of their start on the deck.
 - B. Deck Work.
 - 1. Warm-up exercises. (10 repetitions of each exercise).
 - A. Vertical jumps.
 - B. Trunk rotation.
 - C. Trunk twisters.
 - D. Neck rotation.
 - E. Toe touches.
 - F. Curls.
 - 2. Rest and review of the starting position.
 - 3. Work on starting position.
 - A. On the edge of pool facing the deck.
 - B. Get men into position and working separately on start. Do (take) twenty (20) starts. Move the arms through the correct swinging movement as explained.
 - C. The instructor to check each man's position.
 - C. Pool Work.
 - 1. From edge going across the pool, demonstrate the start, flight and entry into the water.
 - 2. Give group the starting commands and have them think them before taking their start (take your mark-- $1\frac{1}{2}$ sec.--go).
 - 3. Take 10 starts on your own.
 - 4. Work on the body feel.

FIRST SESSION (continued)

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5. Work on clean body entrance and drive and glide for distance.

III. DISMISSAL

- A. Ask how they feel.
- B. Questions.
- C. No practice outside of our sessions.

TIME SCHEDULE

INTRODUCTION :05 - :10

STARTING POSITION

- A. Explanation :11 - :15
- B. Deck Work :16 - :23
- C. Rest and Review :24 - :25
- D. Practice starting positions (20) :26 - :30

POOL WORK ten starts (10) :31 - :45

DISMISSAL :46 - :47

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
SECOND SESSION

- I. WARM UP
 - A. Exercises as listed.
 - B. Led by the instructor.

- II. DECK WORK
 - A. Review of starting position. (Use of typed cards).
 - 1. On the edge of the pool facing the pool.
 - 2. Ask if they have any questions.
 - 3. Take starting position ten (10) times. Instructor to check each person's position.

- III. POOL WORK
 - A. Take (15) fifteen starts across the pool.
 - 1. Alternate starting from both sides.
 - 2. On their own.
 - 3. Correct body position.
 - 4. The instructor will evaluate each person's start and make necessary corrections.
 - B. Starts with commands and whistle. (5)
 - 1. Shake out the arms and legs.
 - 2. Concentrate on your start.

- IV. DISMISSAL
 - A. How do they feel.
 - B. Questions???
 - C. Meet in A.V. Room, Monday, March 6.

TIME SCHEDULE

- I. WARM UP :05 - :10

- II. DECK WORK :11 - :15

- III. POOL WORK :16 - :35 (Fifteen starts)
 - B. Starts on command :36 - :42 (Five starts)

- IV. DISMISSAL :43 - :45

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
THIRD SESSION

- I. FILM - A.V. room of the Physical Education Building.
 - A. Room 120 NPE.
 - B. Film set and ready to go.
 - C. Students should sit near the front of the room.
 - D. Roll call taken.

- II. SHOWING OF THE FILM
 - A. Pilot study film.
 - B. Pay close attention to:
 - 1. Body position.
 - 2. Arm movements.
 - 3. Leg action.
 - 4. Flight.
 - 5. Entry.
 - C. Questions and answer session on starts in the film during the showing of the film and after.
 - D. Dressing for class.

- III. WARM UP
 - A. Exercises as listed.

- IV. POOL WORK
 - A. Take ten (10) starts on your own across the pool.
 - 1. Look at each other to see the starting position as others do it.
 - 2. Work on perfecting your form on the block and the flight in the air.
 - B. Five (5) starts on command.

TIME SCHEDULE

- I. FILM OF PILOT STUDY :05 - :15

- II. WARM UP EXERCISES :21 - :25

- III. POOL WORK
 - A. Ten (10) starts on their own :26 - :39
 - B. Five (5) starts on command :40 - :45

SWIMMING STARTS RESEARCH PROJECT

PILOT STUDY FILM

I. INTRODUCTION

- A. On all starts check the positioning of the:
 - 1. Head - up, eyes looking across the pool.
 - 2. Body - slightly above the horizontal.
 - 3. Arms - parallel to the deck.
 - 4. Legs - slightly flexed in a comfortable position.
 - 5. Feet - in line with the hips, toes gripping the edge of the starting block.
- B. Flight in the air.
 - 1. Straight body - no piking or arching of the body.
 - 2. Head up looking at the target.
 - 3. Legs together, toes pointed, arms stretched forward reaching for the far side.
- C. Entry.
 - 1. Head dropped between the arms.
 - 2. Arms closed together.
 - 3. Slicing into the water.
 - 4. Holding of the glide past the mark of 20 feet.

II. SHOWING OF THE PILOT STUDY FILM

- A. Starts that the group is performing.
- B. Stop and show for each person filmed, his:
 - 1. Starting position.
 - 2. Drive from the block.
 - 3. Flight in the air.
 - 4. Entry into the water.
 - 5. Glide to and through the 20 foot mark.
- C. Answer all questions during the showing of the film and after.
- D. Give names of persons doing the starts in the pilot study.

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
FOURTH SESSION

- I. WARM UP
- A. Exercises as listed.
 - B. At deep end of the pool.
 - C. Ten repetitions of each exercise.
- II. POOL WORK
- A. Set up starting blocks.
 1. On far side of the pool near the wall.
 2. Six (6) blocks each to be 5 feet apart.
 3. Set blocks up starting with number 25.
 4. Care in setting the blocks in place. Put the front end in first. Take out by lifting the back end first.
 5. Next person to go holds the block down for the person ahead who is taking his start.
 - B. Starts.
 1. Ten (10) starts to be taken on their own.
 2. Get used to the block and the height difference.
 3. Swim out to the opposite side.
 - C. Starts on Command.
 1. Five (5) starts to be taken on instructor's command.
 2. Come down together.
 3. Hold starts.
 4. Drive hard with the legs.
 5. Hold the glide.
- III. DISMISSAL
- A. How do they feel?
 - B. Any questions?

TIME SCHEDULE

- I. WARM UP :05 - :10
- II. POOL WORK
- A. Setting up the starting blocks.
 - B. Starts (10) :11 - :30
 - C. Starts on Command (5) :31 - :40
- III. DISMISSAL :41 - :43

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
FIFTH SESSION

- I. SET UP THE POOL
 - A. Starting blocks set in place on the far side of the pool.
 - B. Blocks five feet apart.

- II. WARM UP
 - A. At deep end of the pool.
 - B. Exercises done as listed.

- III. POOL WORK
 - A. One (1) start for each man.
 - 1. Order of starting by class roll list.
 - 2. One start performed by each man.
 - 3. Other men to watch the start and evaluate it.
 - 4. Start to be on command.
 - 5. Evaluation given to the person following his start by members of the class with corrections and/or additions by the instructor.
 - B. Four (4) starts on their own.
 - 1. Work on correcting errors in their starts.
 - 2. Stress holding of the glide.
 - C. Five (5) Gun Starts.

- IV. DISMISSAL
 - A. How do they feel?
 - B. Questions?

TIME SCHEDULE

- I. SET UP THE POOL (before the session starts)

- II. WARM UP :05 - :10

- III. POOL WORK :11 - :45
 - A. One (1) start for each man :11 - :25
 - B. Four (4) starts on their own :26 - :31
 - C. Five (5) gun starts :35 - :45

- IV. DISMISSAL :46 - :47

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
SIXTH SESSION

- I. SET UP STARTING BLOCKS
 - A. At far side of the pool.
 - B. Blocks set 5 feet apart.
 - C. This is done before the class warm up.

- II. WARM UP
 - A. Exercises done as listed.
 - B. At the deep end of the pool.

- III. POOL WORK
 - A. Four (4) starts on command.
 - 1. Use of the whistle for the start.
 - 2. Be sure to get the feet set and hold the starting position steady.
 - B. Six (6) Gun Starts.

- IV. DISMISSAL
 - A. How do they feel?
 - B. Questions?
 - C. Procedure for the next weeks recording session.
 - 1. Bring a sweatshirt, towel, and/or sweat pants.
 - 2. Get a good, tight fitting swimming suit from the cage.
 - 3. We will go one at a time.
 - 4. Rotation will be according to roll call list.
 - 5. The list will be posted.
 - 6. One (1) practice start before each recording session will be taken by each man.

TIME SCHEDULE

- I. SET UP THE BLOCKS (before class session starts)

- II. WARM UP :05 - :10

- III. POOL WORK
 - A. Four (4) starts on command :11 - :19
 - B. Six (6) gun starts :20 - :32

- IV. DISMISSAL :33 - :40

ORGANIZATIONAL PROCEDURE AND TIME SCHEDULE
FOR SWIMMING STARTS RESEARCH PROJECT
SEVENTH AND EIGHTH SESSIONS

RECORDING SESSIONS --

- I. PRELIMINARY INSTRUCTIONS
 - A. Bring a sweatshirt and wear it while on the deck.
 - B. Have a tight fitting tank suit.
 - C. Place all six starting blocks in place.

- II. WARM UP
 - A. Exercises done as listed.
 - B. Where the deck is driest.
 - C. Supervised and led by the instructor.

- III. POOL WORK
 - A. Explanation of the recording session. (see attached sheet)
 - B. Practice start.
 - 1. One start for each man.
 - 2. In groups.
 - C. Recording Session.
 - 1. One at a time.
 - 2. Rotation as listed on the posted roster sheet.
 - 3. Six (6) gun starts for each man. (3 the first session, 3 the second)
 - 4. Next man ready to move in for his start.
 - 5. Keep loose and relaxed.
 - 6. Concentrate on the job to be done.
 - 7. Hold your glide.

TIME SCHEDULE

- I. PRELIMINARY INSTRUCTIONS (Before class starts)

- II. WARM UP :05 - :10

- III. POOL WORK :11 - :45
 - A. Explanation of the recording session :11 - :13
 - B. Practice Starts (1) :14 - :17
 - C. Recording Session :18 - :45

SWIMMING STARTS RESEARCH PROJECT
SEVENTH AND EIGHTH SESSIONS

EXPLANATION OF THE RECORDING SESSION

1. We will perform six (6) starts. Three (3) this first session and three (3) our next session this week.
2. Each person will perform his start in roll call order as listed.
3. One person will go at a time.
4. The next two persons will be waiting in the corner by the 3 meter diving board.
5. The rest of the class will remain in the bleachers until their time to go.
6. Two people are to be ready to go while one person is on the block.
7. Wipe off the edge of the block, get your legs and arms shaken out and relaxed, and then set your feet in place and be ready to go.
8. We will move quickly.
9. Hold the glide.
10. Swim out to the ladder on the bleacher side of the deep end and climb out of the pool using the ladder.
11. Dry off and put on your sweatshirt. Keep warm and relaxed.
12. Be alert to help each other and keep things running smoothly.

WISCONSIN STATE UNIVERSITY

LA CROSSE, WISCONSIN 54601

April 5, 1967

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Dr. John Hickman
Swimming Coach
University of Wisconsin
Madison, Wisconsin
53705

Dear Dr. Hickman:

I would like to get documented evidence of the Big Ten 1650 freestyle finish between Robie and Farley held at Wisconsin in 1965. It is my understanding that both had tied for 1st place. The timers watches were the same, the ballot system had tied the two men, and the times on the electric timers to the 1/100th of a second were identical. Robie was declared the winner after checking the electric clocks to 1/1,000 of a second.

Dr. Wille is my thesis committee chairman and he suggested that I get documentation for material I used in my chapter on related literature. Can you Help???

Yours truly,



Terry Warner
Faculty Assistant

Robie and Farley had identical times of 16:54.06 on the electronic judging and timing system. The judging system showed Robie finished first, Farley second. While our clocks show 100ths of seconds, the judging system is sensitive beyond 1000th of a second.

