

AN ASSESSMENT OF CERTAIN PHYSICAL AND PSYCHOLOGICAL CHARACTERISTICS  
LEADING TO SUCCESS IN SAILING

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by  
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## PREFACE

The results of this study should be interpreted with reservations. Due to the limitation in sample size the findings require replication. Until such additional results are obtained, the conclusions of this study should be considered those of a pilot investigation.

## CHAPTER I

### Introduction

Researchers have attempted to determine whether success in various physical activities is related to certain individual abilities (23, 27, 115).

When assessing an individual's performance in a specific sport, it seems obvious that achievement should be first related to an athlete's physical characteristics. Studies have shown that numerous physiological and anatomical factors determine an individual's ability to utilize force, to react quickly or to move with speed (45). Within these physical limitations, however, individual motor performance is extremely variable and may ultimately be limited by psychological factors. This observation is supported by such authorities as Ikai and Steinhaus (66). Significant differences were found in voluntarily executed, maximal muscle contractions under varying psychological conditions. These results seemed to indicate that psychological rather than physiological factors determined the limits of the performance.

Of particular interest to the investigator is the achievement of performance in the sport of sailing.

In competitive sailing only limited knowledge is available pertaining to the "desirable" motor abilities and psychological factors of an expert sailor. Research done in this field has centred on the

materials such as the boat, its shape and the sails (67, 104, 129).

Some physical characteristics of a successful sailor have been mentioned by Pinaud (104) and Illingworth (67), such as muscle strength and good static balance which are thought to be essential for a successful performance in the sport of sailing small boats. The skipper needs physical stamina according to some contemporary authors, who have suggested that such a person should be reasonably fit, be able to judge a situation realistically, and be aggressive yet prudent (77, 129). Jogging and rope climbing are recommended as a specific physical preparation prior to the sailing season; however, research to verify these factors is non-existent.

Certain authors contend that the individual who races a sail boat is more important than the boat he controls (119). The psychological qualities of a successful skipper have been studied in a limited manner. One empirical study showed that a skipper's action in a race is determined as much by his emotional reactions to other competitors as by the actual manoeuvres of his boat (67). There seems to be a general agreement that emotions intervene to a very high degree in competitive situations. One of the essential characteristics for winning sailing competitions seems to be aggressiveness (77, 100, 129).

Thus, the performance appears to be determined by a combination of physical and psychological factors in the individual skipper. A study of these relationships as they affect achievement in sailing will provide insight into the characteristics of a successful sailor.

### Statement of Problem

The purpose of this study is to assess certain psychological and physical characteristics and to determine their relationship to success in the sport of sailing, at a regional level. More specifically the following questions were asked:

1. What personal attributes are prevalent in a group of people who are actively engaged in the sport of small boat sailing?
2. What is the importance of these selected physical and psychological variables as potential predictors of performance in sailing?

### Definitions of Terms

Small boat: is defined as being a sailing boat manned by a skipper and a one man crew.

Skipper: is defined as an individual in charge of the small boat and handling the tiller. Skipper is used synonymously with sailor or helmsman.

Success in sailing: is defined as the overall performance of a sailor, during a week of competition, on a regional level.

Expert: an expert in small boat racing is defined as being a person with more than 5 years of experience in small boat racing.

Perception: is defined as the awareness and interpretation of a situation, as measured by Witkin's Rod-and-Frame Test.

### Limitations

This study is limited by the validity of the tests used, as well as the size and relative homogeneity of the sample. Other factors limiting this investigation are the level of performance in sailing, the geographical area, which is restricted to Hull and Western Quebec, the language used in the personality test and the time limit imposed.

### Scope of Study

A survey was conducted in order to determine some important characteristics of a successful skipper in small boat racing. The questionnaire was filled out by 20 experts from the Ottawa-Hull region. Based on the results of this survey, some physical and psychological factors were selected to be investigated in the main study.

The testing involved 20 subjects, male and female, aged 18 to 30 who were taking a one-week sailing course in June, 1970, at the summer camp of the University of Ottawa.

These persons were tested on the following motor abilities: strength (dynamic and static), multi-limb coordination, static balance, reaction time and perception (field-dependence vs. field-independence); they also completed the I.P.A.T. 16 Personality Factor Questionnaire. During their stay at the camp, all subjects participated every day in different sailing competitions. These partial scores, plus their scores in the final competition made up their performance score, as expressed in rank order by the instructors.

The data was treated in the following way:

- a. linear correlations were computed among all variables.
- b. a multiple stepwise regression procedure was applied.

#### Significance of the Study

In the sport of sailing, researchers have investigated primarily the equipment necessary for a successful performance. However, it has been suggested that, besides essential motor abilities, certain personality factors influence the action of a skipper to a high degree. Success does not result exclusively from a first-rate boat. This study, therefore, proposes to get a closer look at specific physical and psychological factors of an individual and their relationship to his performance in sailing.

It will be of interest to find out what abilities are prevalent in a group of people who are actively engaged in the sport of small boat sailing and what characteristics are the best predictors of sailing performance. This study represents a contribution to research done in the field of psycho-physical abilities which are thought to influence performance in a specific sport.

## CHAPTER II

### REVIEW OF LITERATURE

The purpose of this study was to investigate the relationship of certain physical and psychological characteristics leading to success in sailing. A group of 20 French speaking skippers was tested on specific motor abilities, as well as on personality traits. These characteristics were then related to the success of the individual skipper in small boat racing.

In the following subchapters, a selected review of recent literature will be presented. First, some studies in the specific areas of motor abilities, perception and personality are presented. This is followed up with some discussions on physical activities and their possible relationship to certain psychological dimensions of an athlete. A summary will conclude this review of literature.

#### Selected Motor Abilities

In research literature, in general, the terms motor abilities and psychomotor abilities have been used interchangeably. Sometimes, psychomotor abilities are considered to be more refined than general motor abilities (115). Psychologists, such as Guilford (56) and Fleishman (44) have factor analyzed abilities they called "psychomotor". Some of the dimensions they isolated were strength, speed, impulsion, precision, flexibility and others. This seems to indicate that there is no clear distinction between "motor" abilities and "psychomotor"

abilities, as these dimensions overlap considerably with those investigated by physical educators. As we are assessing the "making" of the response rather than the "selection", we will use the term motor abilities in this study.

In the study of motor behavior, a primary conflict arises between the common observation that some individuals seem to evidence proficiency in a number of skills, and the experimental findings that abilities are specific (26). Proponents of the generality of motor abilities, such as Guilford (56), Fleishman (5), McCloy (86), used factor analysis to determine general abilities. Other researchers, such as Henry (61), are opposed to this theory. This author argues for the specificity of movement speed, strength and reaction time. His findings are supported by recent studies, such as stated by K. Williams (133a).

Some abilities depend more on genetic than learning factors, but most depend on both to some degree. In measuring some of them, we are interested in determining to what degree they are present at a given moment in the selected subjects, and then relate them to the performance of these individuals in the sport of sailing.

In the field of motor ability testing, subjects are generally presented with some standardized tasks. The response is usually made up of muscular activities which can be measured. In this study, four motor factors were assessed, namely strength, reaction time, coordination and static balance.

The area of strength has been covered quite extensively in the literature (22, 29, 39, 48, 65, 73, 87, 103, 122).

have been developed and utilized as early as the 1920s (73). It seems obvious that this motor ability, in varying degrees, should influence all motor performance. Singer (115) states that a weakness in any area of the body may severely limit the coordination and effort needed for the performance of a skill. Thus, an optimum amount of strength is a necessity for motor performance.

When Fleishman (46) factor analyzed 30 different tests, three broad factors emerged. These factors were called explosive strength, dynamic strength and static strength.

The motor ability, named balance, is less well defined. Two broad types of balance have been identified as static and dynamic balance (46, 108, 111). A very low correlation coefficient has been reported between these two variables (33, 123). The first factor seems to represent the ability to maintain bodily equilibrium in some fixed position. The second factor demands body orientation in off-balance situations. Of particular interest to this study are those research endeavors that attempted to relate balance measures to specific skills or to the prediction of skill (33, 52, 92, 108, 123).

Thompson and Gross (52) found that individuals having superior dynamic balance swim better and faster than individuals with poorer balance. Mumby (92) attempted to predict wrestling skill with a measure of balance and obtained significant differences. Sanborn (108) determined the relationship among balance tests and olympic balance beam performance and found a significant predictor for performance on the olympic balance beam in the form of a dynamic balance test.

However, the studies just reviewed do not allow any kind of

generalizations. The subjects represent a limited part of the population, mostly college students, and their number was often rather small. All studies should be cross-validated with different samples, in order to test the validity of the findings. In particular, this should be done in investigations where a certain performance is predicted using multiple step-wise regression coefficients (24).

An area of physical proficiency in its own right seems to be that of coordination. This factor appears to be important to potential athletic success (3, 46, 115). Yet correlational studies have failed to reveal an ability which could be labeled with confidence "general motor coordination" (48). The tests used to measure motor coordination have included such abilities as throwing a ball, balancing a stick, or patting the head and rubbing the stomach.

In the interest of reaching some agreement on the definition and validity of this variable, Cumbee (22) tried to determine through factor analysis what these various "coordination" tests really measure. Out of 21 variables tested, 5 major factors emerged. They were named a) balancing objects, b) tempo, c) two-handed agility, d) speed of change of direction of arms and hands, e) body balance. However, no final definition of motor coordination could be given in terms of these abilities.

Fleishman (47) continued to study this ability and came to the conclusion that there are probably several types of coordination. This author identified two major factors which he named multi-limb coordination and gross body coordination (22, 44, 46, 48). The first variable is common to psychomotor apparatus tasks in which the subject must

coordinate the simultaneous movements of two limbs. The second factor seems to emphasize more gross activity of the whole body. One may wonder if this is the same variable other authors have called agility. This lack of definition might explain the scarcity of recent research literature on coordination in the field of physical education. It might be difficult to develop pure tests of coordination, as in a complex task other motor abilities, such as balance or flexibility, intervene in different degrees.

In one recent study on coordination, results indicated that people tended to perform with a definite movement pattern when presented with different coordination tasks (94). Witkin (133) reported another interesting finding. He found that field-independent persons tended to perform significantly better on the rotary pursuit coordination task than field-dependent individuals. Results showed that the ability to keep an item separate from the field was related significantly at the .01 level to the ability to carry out coordinated hand movements without conforming to the field. These findings applied to men, as well as to women.

Some other devices measuring coordination were used for testing potential pilot success or probable athletic achievement. There have been attempts to relate such tasks to success in industry, dentistry and piloting a plane. The tests have demonstrated moderately predictive values. Singer (115) believes "that the more related the task to the actual criterion, the higher the anticipated correlation will be". Relationships between movements required for the coordination tasks, often used by psychologists, and the coordinated movement patterns desired in

sport, should probably not be high because of the lack of similarity in the nature of the required responses.

Speed of movement and quick reactions are prized abilities in athletics. In today's research one generally distinguishes between three different terms in this area. Reaction time is defined as being the interval of time between the presentation of the stimulus and the initiation of the response. Movement time is usually viewed as the time a particular act takes to be completed after it has been initiated. Response time is thought to be the time it takes to complete the entire movement and includes the other 2 factors mentioned (27, 48, 73, 115).

The reaction time and the movement time of an individual have been compared to determine relationships between these factors. F. Henry (62) provided reasonings why reaction time should be considered a separate factor from movement time. He obtained consistently near-zero correlations between reaction time and movement time. In a recent study, he found a  $r$  of .02 between these two factors. Pierson (101, 102), however, did not agree with these conclusions. He pointed out that, when subjects other than male college students were used, results indicated a significant relationship between reaction time and movement time. He used a group of 400 subjects, aged 8 to 83. His findings seem to indicate that a person with a fast reaction time will most probably also have a fast movement time.

The evidence on selected motor abilities, as presented in this subchapter, points to a theory on specificity of motor responses. The motor factors reviewed were strength, reaction time, co-ordination and balance. Most authors seem to agree that some of the essential

in athletics are: an optimum amount of strength, quick reactions, good balance and coordination.

### Perception

Although perception has been generally studied separately from motor learning, researchers agree that perceptual mechanisms operate preceeding any skilled motor act (27, 77, 115). More specifically, it has been stated that a person's ability to receive and distinguish among available cues in a given situation, enables him to perform more skillfully (115).

Usually, perception is distinguished from other processes involving thought, consciousness and judgement (127). The definition of perception might well be determined by one's viewpoint of psychology. According to Bartley (4), perception is a form of discriminating behavior, involving the overall activity of the person immediately following or accompanying stimulation of the sense organs. Friedman (50) has defined perception as being the reception and interpretation of stimuli. Gestalt theorists assumed that all people perceive the same way and that perception is influenced by the surrounding stimuli rather than by one's physiological and psychological structures (79).

In contemporary times, perceptual theories have taken different directions. Some psychologists, exemplified by Witkin, emphasize the role of perception in personality development, believing that perception is primarily affected by personal factors. They support the theory that perception is influenced by emotions, personality and motivation, in addition to environmental variables. Witkin (133) has stated

"that an individual's perception is a function of the personality variables deeply rooted in his psychological make-up".

More specifically, Witkin (135) defined perception in his Rod-and-Frame test as being an individual's ability to organize space in a consistent and characteristic way. This measuring instrument was designed to determine the extent to which persons are self-consistent in their manner of space orientation in a variety of situations.

Witkin identified two modes of perception, naming them field-dependence and field-independence. The first type refers to a less analytical organization of space, whereas the second type perceives items readily as being discrete from field. This tendency toward one perceptual style or the other, seems to be a pervasive feature of an individual's perceptual functioning.

It has been shown that individuals tend to be quite consistent in perceiving in a more analytical or less analytical fashion even under different conditions (133). This consistency has been extended by the demonstration that this way of functioning characterizes not only an individual's perception but also his intellectual activity (136). A consistent, characteristic way of functioning in the cognitive sphere has been called a "cognitive style", of which field-dependence or field-independence is a perceptual component.

Some criticism has been levelled against this cognitive style research. Postman (54) and Gruen (105) point out that much of Witkin's work has concentrated on extreme groups, whereas in fact most people fall somewhere nearer the middle. Researchers on cognitive styles have been accused of claiming findings of general validity more quickly than

the small and selected samples of subjects in their experiments could allow.

In his research, Witkin not only focused on the perceptual style of individuals, but also tried to relate them to many aspects of his subjects' lives. Janis (68) objects, stating that this measurement should not be used to assess indirectly other traits. Postman and Gruen agree, suggesting that the links of perceptual phenomena to what is usually thought of as personality are vague, analogical, or just empirical correlations. It is known that field-dependent people are often passive in social situations but it is not understood, why, or where the causal connection is. However, the issues raised seem to be important ones which would warrant much more research.

There is a great deal of literature relating perception to the performance of aviation personnel, but it is rather difficult to find some research material connecting perception to motor abilities. One of the few ones was done by Gruen (53). He studied the relationship between dancing experience and personality as related to perception. A stabilometer was used to measure motor performance, which we probably would call dynamic balance ability. His findings indicated that professional women and male dancers performed significantly better on this test than the control group. However, there were no significant differences when using the RFT, neither for female nor male dancers.

The question arose whether field-dependent persons, given training specifically designed to improve their performance on the RFT will show durable improvement in the test. In a study by Elliott and McMichael (35), one of their trained field-dependent groups improved significantly.

However, when retested after seven weeks under standard conditions, without special instructions nor feedback, the improvement was lost completely. This seems to indicate that perception, as measured by the RFT, can be attributed to some basic postural and kinesthetic cues. If the ability to refer to the body as a source of reference in these space orientation tests depended on body training, the dancers in the first study should have excelled in the RFT tests.

Perception has been reviewed in the light of Witkin's concept of field-dependence vs. field-independence. Research results seem to indicate that perception, as measured by the RFT, can be attributed to some basic postural and kinesthetic cues. Some critique levelled against Witkin's research centres on the fact that the RFT is often used with extreme groups, when most people actually fall somewhere nearer the middle on the continuum field-dependence vs. field-independence.

### Personality

Everybody routinely spends a great deal of time assessing the personalities of others. In its first and basic sense, personality assessment means an informal process of getting to know people and to describe them. Secondly, personality assessment refers to a scientific and professional speciality which analyzes and measures personality (13, 34, 68 ).

It has been stated that each individual has a personality, unique and distinct from every other person (2, 109). However, not all scientists support this statement. Some propose that the unique individual is simply the point of intersection of a number of quantitative variables (16, 41).

Until recent times, the meaning of personality was never clearly outlined. The word itself is said to be derived from the Greek expression *prosôpon* which means a theatrical mask (57). In this sense it referred to external appearance, or the role one plays. In more recent years, Gordon W. Allport (109) located 48 separate definitions for the term personality, with theological, philosophical, psychological and other connotations.

Allport (2) considers personality to be the pattern of habits, attitudes and traits that determine an individual's characteristic behavior and thought, emphasizing the uniqueness of the individual person. Other researchers propose that the uniqueness of a person is mainly to be found in the pattern of traits, rather than in the elements (16, 56, 68). But even Allport admits that, when comparing one person with another, some common traits or factors have to be used.

The assessment of personality is based on the theory one subscribes to. In this investigation, Cattell's trait theory was used, which studies the consistency of human behavior. Cattell (16) defines trait as "being some relatively permanent and broad reaction tendency".

The source to arrive at traits, may be by rational derivations or by statistical analysis. The first objective tests to be developed in the assessment of personality were adjustment inventories. R.B. Woodworth invented the first personality inventory which he called the Personal Data Sheet (57, 68). For many years, other researchers followed in Woodworth's footsteps, until Flanagan (43) proved the shortcomings of their method of constructing personality tests which was based exclusively on theory. He subjected some tests to factor analysis and showed

that all the information provided in these tests could be accounted for by only two factors. Guilford, Thurstone and R.B. Cattell are among the best known of the psychologists who followed with other personality inventories, constructed with the aid of factor analysis.

Using statistical tools, R.B. Cattell, (16, 17) distinguished two broad categories of traits, and named them source and surface traits. A source trait is thought to be an unitary dimension or factor, operating as an underlying source of behavior. Surface traits appear to be made up of different source traits, and may be considered as clusters of factors. Cattell suggests that one way of assessing personality would be to assign scores on a spectrum of traits.

The Sixteen Personality Questionnaire, which we will call from now on 16 IPAT PF, is based on 16 source traits. By using factor analysis, Cattell (58) found 12 of these factors in tests where observers rated traits, the other four were found in questionnaire responses.

Cattell (57) claims that among personality tests, this is as pure a product of factor analysis as can be found. He states that each item has appreciable saturation by one of the 16 source traits. Furthermore, the items are said to represent an even sampling from the personality sphere with a minimum of overlapping of factor scores. His critics, however, object quite strongly (58, 84, 137). They state that no objective evidence is presented to support these claims. Information is also lacking regarding the saturation of items or the intercorrelation of factor scores. Neither is there any indication of the correlation of factor score with other personality measures. Correlation coefficients for separate test form A and B are not reported either.

Lubin (84) points out that there is no actual validating data, but that it had been substituted by mental estimate of the importance of a given factor, based on an understanding of the intrinsic meaning of each of 16 factors.

Harsh (58) and Lubin (84) conclude that in its present form, it seems unlikely that the 16 IPAT PF can give an assessment of personality much superior to that of other multifactor paper tests. Wittenborn (137) and Adcock (1) arrive at a more positive conclusion. They feel that, despite the limitations mentioned above, the questionnaire may be valuably employed in a variety of personnel research undertakings, but that the questionnaire should not be considered a finished tool.

In the field of physical education, personality has been investigated recently in relationship to athletic participation, motor ability and physical fitness, to mention only some major topics (9, 15, 76, 81, 82, 89, 93, 110, 121, 130, 131).

Booth (9) reported in 1958 that, using the MMPI, he found 22 items yielding significant differences between athletes and non-athletes. Some of them could be used to discriminate between poor and good competitors. Slusher (117), in contrast, found no differences in personality traits in his studies between athletes and non-athletes.

Using the California Personality Inventory, Schendel (110) identified psychological differences of athletes and non-athletes at 3 different educational levels. He concludes that there are significant differences in psychological characteristics of athletes and non-athletes. Another study was made by Merriman and Burton (89), supporting these findings. They compared the upper 25% against the lower 25% athletes

against non-athletes. The results indicated that motor ability related significantly at the .05 level to such personality traits as dominance, sociability, achievement and tolerance.

These studies and a large number of others which have been referred to throughout this review of literature influenced Cooper (25) to state in his Review on Athletics, Activity and Personality in 1969 that "the most striking aspect of the research in this area is the coherence of the picture of the athlete which emerges". He does not hesitate to add results from all the different personality inventories in order to describe the personality of an athlete. One of the traits given reads "that athletes are more outgoing and socially confident", as demonstrated by Behrman (6) and Merriman (89). However, the first researcher used the Guilford-Zimmerman Temperament Scale, whereas the second one worked with the California Personality Inventory. There is no indication in the literature that these tests measure the same traits.

It has been pointed out at different occasions that neither psychologists in general, nor factor analysts of personality in particular, have yet agreed upon basic personality traits or dimensions (20, 68, 109). We therefore propose to compare only results from studies done with the same personality inventory, such as the 16 IPAT PF.

An examination of the limited data available, when a common measure such as the 16 IPAT PF is applied, does permit a more rational speculation about the relationship between athletic achievement and personality. We will look at some recent data which has been presented by Rushall (107), Ogilvie (95), Cooper (25) and a few others (69, 81, 130).

The traits reviewed and found significant in these various

studies do not assume a clear hierarchical order. We will discuss some of the dimensions which emerge through more than one study.

The trait of "emotional stability", "C", appears to be in essence the ability to control one's emotions and impulses, especially by finding for them some satisfactory, realistic expression. Some of the more important elements of this trait have been called maturity, steadiness, persistency, emotional calmness, a realistic approach to problems (16). In terms of logical expectations, studies do support the significant contribution of "emotional stability" to athletic success (25, 31, 95, 107).

In the field of physical performance, one should however be cautious when comparing different sport activities. Sports situations vary considerably and different psychological elements of the same trait might be more important in one situation for success than in another. This could be interpreted that, although in both cases trait "C" emerged as significant, in one case the element of persistency was the most important contributor to success, whereas in another situation the maturity of the participant was essential.

Factor "E" where "dominance vs. submissiveness" is assessed, seems to be another important contributor to athletic success. Persons placing high on this continuum are said to be confident, self-assertive, aggressive, vigorous, willful. At the submissive end we find individuals who are unsure, meek, quiet, obedient (16). This factor should, however, not be identified with the common notion of an "authoritarian personality", but rather be viewed as the attribute of a highly independent person who tends to lead groups (81, 107).

The trait "tough-tender-mindedness", "I", identifies an individual

at the tender end of the continuum as being demanding, impatient, dependent, immature, easily anxious (15, 16). At the other end we find the tough persons who are emotionally mature, independent minded and possess a hard, realistic outlook. Ogilvie (95) claims to have collected data upon over 10,000 athletes, ranging from high-school through the most professional athletes. Trait "I" emerged with consistency. The probability of "tough-mindedness" as being significantly related to athletic ability and athletic achievement is very high for both sexes. In one recent study on habitual exercisers vs. non-exercisers it has been found that the first group was significantly more tough-minded than the second one (70). One result opposing these findings emerged from an investigation on the Canadian cross-country ski team. Subjects scored significantly higher on this dimension, indicating a higher degree of tender-mindedness (69).

The trait "self-assured vs. apprehensive, worried", can be identified with much empirical support at every level of competition for both males and females (95). At the negative end would be found individuals who are depressed, easily upset and excessively guilt-prone. The positive end of the continuum would describe the athlete as being confident, adequate, cheerful and serene (25, 95, 107). These studies point to a highly consistent relationship between self-assurance and the attained level of athletic success. Any competitive situation will induce some amount of stress. Any individual who is highly apprehensive and worried will have difficulties in excelling. "Self-confidence" appears to be a trait which might be developed by means of athletics, in order to become a positive force in the lives of youth.

Another personality factor, called "surgency vs. desurgency" or simply "F", has been associated with athletic achievement. Rushall (107) found this trait in the dependent champion type athlete, who is said to rely upon the coach for guidance and direction. Tillman (121), indicated in his study on fitness and personality that subjects with a high level of fitness, also scored high on the trait of surgency. Jetté (70), however, found that the non-exercisers emerged with slightly higher scores on this factor than the habitual exercisers. The level of this trait seems to reflect in large part the level of inhibition imposed on the individual in his upbringing (16). This might explain the different findings in these two studies. The first group was made up of high school students who were probably brought up in a much more permissive environment than the second group of adults.

A factor pattern which turns up in successful athletes is the trait "H", describing the level of "adventurous vs. shy" (107). This trait is thought to have the highest degree of inheritance found among personality source traits (1, 16). Cattell suggests that the parasympathetic nervous system predominates in individuals scoring high on this trait. Therefore, this part of the factor "H" has been named "parmia". It seems that scores for the very shy person change with age (16). This could mean that shyness of an excessive kind tends to cure itself.

An interesting observation was made through the study of sex differences in traits; Cattell (16) stated that correlational studies on the traits of both sexes show a very similar trait structure. As far as the major source traits are concerned, the important observation is that, apparently, men and women are primarily human personalities and

only secondarily of a particular sex. It is possible that a person of either sex could stand at any level of a particular trait.

Ogilvie (95) supports this theory. Using data available for sports women, he states that one can predict the probability of "tough-mindedness" as being significantly related to athletic ability and athletic achievement by using factor analysis. The subjects in these investigations were female competitors at a national level. One more study was cited supporting these findings. Rushall (107) found that United States competitors had most of the personality traits in common, independent of sex. Both samples were described as being outgoing, bright, emotionally stable, self-assertive, happy-go-lucky, having a high conscience development and tending toward tough-mindedness and self-sufficiency.

Some reservations may arise as we reconsider the traits related to athletic achievement. Offering social reward for the reinforcement of behavior that eventually leads, for example, to tough-mindedness, might be questionable. We suggest that the presence of other positive traits such as emotional stability and self-confidence might provide a balance, and control the exaggeration of any single personality trait.

Summarizing this review on personality, the following points seem to be of some importance. Cattell's assessment of personality is based on the trait theory which investigates the consistency of human behavior. Critics charge that his 16 IPAT PF questionnaire has no actual validating data. They suggest that any interpretation of findings resulting from the 16 IPAT PF should be done with reservations. Traits which seem to have some significant relationship with physical

performance are factors called "dominance", "tough-mindedness", "self-assurance", "surgency" and "adventurousness".

#### Physical Activities and Psychological Dimensions

Physical educators have attempted for many years to determine physical and motor factors underlying general performance success, as well as the attributes specific to certain sports (23, 27, 78, 111, 115). One of their interests is research which investigates the relationship of different physical and psychological characteristics with problems of exercise and sports.

It seems rather obvious that there should be a relationship of physique to athletic performance and success, such as is reported by Parnell (98), Cureton (31), Cratty (28) and others. Kretschmer (80), was one of the first researchers to establish a relationship between the physique and temperament. He devised a classification, which Sheldon (136) improved at a later date. Individuals were classified according to their body types, and each group was attributed certain psychological characteristics. More recently, Eysenck (42) reported also a relationship between personality types and body build: extroverts tend to be of a stocky, broad body-type, while introverts tend to be lean and narrow-chested.

As early as the 1940's, Henry (61) was analyzing the personality of sportsmen. Throughout the literature there is a variety of theories on personality. But terminology is often confusing or has been used operationally. This in turn does not allow for easy comparison of the so-called personality of individuals in these studies. It also leads P. Berlin (7) to state in a recent article that "few terms are more

used and abused than that of personality". She even wonders if the subject matter of personality defies systematic and rational ordering.

Regardless of its present status, the concepts, theories, and research problems of personality seem to hold increasing attraction to physical educators. There have been numerous investigations and articles depicting relationships between participation in motor activities and personality, social status and athletic achievement, and in general a combination of social and personal factors with proficiency or interest in physical activities (6, 8, 9, 25, 61, 71, 74, 76, 82, 89, 93, 95, 99, 107, 110, 117, 131 etc.). To date, many of these studies have merely scratched the surface as to the interrelationship of the above variables. One basic problem in these studies is the lack of a clearly defined theoretical framework. Theory helps determine the kind of data required and facilitates the research design. It also provides a device for systematically ordering the obtained data and directing how it might be interpreted. There is also an absence of well validated scientific measuring instruments and cause-and-effect experiments which very often lead to generalized assumptions in this area.

The evidence described throughout this review on literature should not be weighed for its limitations, but rather for the insight it provides into better understanding of some of the psychological problems associated with motor performance.

Reviewing some recent studies on the relationship of athletics and various personality factors, such as done by Booth (9), Werner (131),

Kroll (82), Schendel (110), Tillman (121) and others, we find that the problem of a theoretical framework for the study of personality has not been touched. The investigators appear to accept existing theories and psychological tests without questioning. They take for granted that the psychological measurements proposed will give meaningful results on the so-called personality factors of an individual. One specific objection to personality assessment has been put forward by P. Berlin (7). This author points out that in personality study, the healthy or normal individual has never achieved the importance given to clinical cases. This can be demonstrated in our own field. Ogilvie (95), a psychologist known for his studies of the personality of athletes, indicated in his investigation of 1968 Olympic athletes that his knowledge in the area of athletic personality is based on extensive clinical experiences with problem athletes.

In the studies mentioned above, researchers investigated mostly the relationship of personality traits and athletic participation or motor ability. An athlete was defined as being a person who has gained varsity recognition within his school program. Results however, are quite contradictory. Some authors found no significant differences between athletes and non-athletes (76, 82, 117, 131). Other investigators did show some significant results (6, 9, 34, 71, 89, 93, 110). None of these results seem to weigh enough to allow a generalization of these findings.

As different group-administered personality measures were used, such as the 16 IPAT PF, the California Personality Inventory, the Minnesota Multiphasic Personality Inventory, it seems unclear, whether

a response labelled "sociability factor" can be compared to the "social factor" of another test. Cooper suggests that even factor analysis has not yet solved this problem. Concerning the physical criterion of "athletic participation vs. non-participation", one may wonder why this variable has not been better defined and measured on a physical level. Merriman (89) found that when subjects were matched on motor ability, many of the personality differences between athletes and non-athletes dropped out. If we can generalize this finding, we must raise a broader question, as to the significance of using athletic participation as the physiological criterion.

In summary, the relationship of different physical and psychological characteristics with problems of exercise and sports has been reviewed. It was found that many of these studies merely scratched the surface. In order to get more meaningful results, it was suggested that a clearly defined theoretical framework of the psychological dimensions be established and cause-and-effect experiments be developed.

#### Summary

In Summary, there seems to be a general agreement that certain physical factors and motor abilities underlie performance success in different sports. Regarding the psychological variables influencing athletic achievement, the relationship of personality to performance has been extensively investigated. One basic problem in these studies appears to be the lack of a clearly defined theoretical framework for the study of personality.

In recent research, there is also an absence of cause-and-effect experiments. Any evidence resulting from these studies should be

interpreted with reservations. One should view these investigations as a possible first step in the study of the relationship between personality and performance, or athletic participation.

The area of motor abilities has been investigated more thoroughly. Based on factor analysis, evidence points to the specificity of motor responses. Dimensions such as strength, balance, coordination, reaction time and others represent motor abilities and are thought to be common to different skills.

In general, the factor perception has been studied separately from motor abilities. Researchers, however, agree that perceptual mechanisms operate preceeding any skilled motor act. In the present study, Witkin's concept of perception was used. He showed that perceiving in a more or less analytical way is characteristic of an individual's functioning in the cognitive sphere. Witkin's field-dependence vs. field-independence is a perceptual component of such a cognitive style. Certain studies in the field of perception, as measured by the RFT, seemed to indicate that this factor can be attributed to some basic postural and kinesthetic cues and is not trainable in adults.

Reviewing Cattell's 16 IPAT PF more in detail, contradictory opinions emerged regarding the validity of this test. However, as a temporary conclusion, researchers seem to agree that this questionnaire may be valuably employed, but should not be considered a finished tool. Some of the traits which have been shown to relate significantly to athletic achievement are: "emotional stability", "self-confidence", "surgency and desurgency", "adventurousness" for athletes, as well as "dominance" and "tough-mindedness" for national competitors.

The evidence found in the relationship of an individual's psychological dimensions and motor abilities to performance or athletic participation does not yet allow for generalized statements. However, it is felt that this is a promising area which may hold an answer to the problem of athletic achievement; as any performance is thought to be the result of the combined influence of an individual's psychological and physical dimensions.

## CHAPTER III

### RESEARCH METHODS

The relationship of an individual's physical and psychological dimensions with his performance in sailing was investigated in this study. The selection of the physical and psychological variables was based on a survey, whereas performance in sailing was measured by different competitions during a specific week.

The following chapter is presented in two parts. The first section contains the summary of the survey. Based on the results of these questionnaires, the physical and psychological factors were selected which were measured in this study. In the second section the main study will be described.

#### Survey

Based on the opinion of three experts, each with more than 10 years of experience in small boat racing, as well as on the review of literature on psycho-motor abilities (28, 45, 47, 58, 115), 12 physical and 12 psychological variables were selected for a questionnaire. A factor was chosen, if two out of three experts had agreed on its importance. The selected variables appear in appendix A (p.60).

This questionnaire was submitted to 20 experts in small boat racing in the area of greater Ottawa, as presented in appendix B (p. 61). These persons were asked to choose 5 essential physical and 5 essential psychological characteristics leading to success of the

skipper in the sport of small-boat racing. These variables were to be enumerated in order of importance.

After the completion of the questionnaire, an individual discussion with each skipper followed. During this period, which averaged 30 minutes, each skipper explained the reasons underlying his different choices. The content of these discussions was summarily retained by the investigator. Only questionnaires which were fully completed and followed up by a personal discussion were considered valid. Based on 16 such questionnaires, the following factors emerged:

#### PHYSICAL FACTORS

|                      |           |
|----------------------|-----------|
| Coordination         | 48 points |
| Reaction time        | 47 "      |
| Balance              | 42 "      |
| Endurance (physical) | 39 "      |
| Strength             | 20 "      |

#### PSYCHOLOGICAL FACTORS

|                        |           |
|------------------------|-----------|
| Perception             | 44 points |
| Aggressiveness         | 36 "      |
| Desire for achievement | 36 "      |
| Space relationship     | 33 "      |
| Intelligence           | 23 "      |

The results had been tabulated by adding all points attributed to the rank order of the variables chosen. First choice equalled 5 points, the second choice 4 points and so on.

Based on this survey, the following variables were selected for inclusion in the test battery: coordination, reaction time, balance, strength, perception and personality traits.

During the follow-up discussions with the consulted experts it was found that "endurance" had been defined in too many different ways. It was also pointed out that "endurance" would play a minor role in

short competitions. This factor, therefore, was not considered an essential characteristic of a successful sailor, as defined in this study. It was decided to disregard this variable.

The influence of "weight" emerged only as the 6th most important factor in this survey. Some authors have pointed out that weight-height factors have no value in either predicting athletic success or dividing classes into homogeneous performance groups (Espenschade (37), Miller (90), Mitchem (91) ). But in the sport of sailing small-boats, it was felt weight and/or height could influence the performance of the skipper. Therefore, these two variables were included.

Another variable called "intelligence", emerged as 5th factor in order of importance. However, as the tested performance in sailing was to be restricted to a regional level, it was felt that this factor would not be of primary importance for the success of the skipper.

One additional variable was mentioned quite often during the follow-up discussion in this survey, namely "experience". In this study, however, it was found that all individuals were practically on the same level and, therefore, this variable was not included.

Singer (115) suggests that successful performance is based on "the development, implementation and control of a wide range of physical, motor, cognitive, perceptual and emotional factors". Variables selected represent these five categories. Height and weight are physical factors. Motor abilities are measured by tests on reaction time, strength, coordination, and balance. Witkin's Rod-and-Frame test is used to assess a perceptual variable, whereas the personality inventory covers cognitive and emotional factors.

### Study

Subjects. A group of 20 French speaking persons, aged 18-30, was chosen to participate in this study. These individuals took part in a weeklong sailing course from June 21st, 1970 to June 27th, 1970 at the summercamp of the University of Ottawa. Of this group, three were females. However, as the performance in sailing was assessed exactly in the same way for each subject, it was felt that all participants should be kept in one group. This decision is supported by the findings of two authors. In his review on personality traits for high-level competitors, Ogilvie (95) found that personality traits of sports-women are very similar to those of male competitors. Hendry (60) reported in his study on personality traits in the coach-swimmer relationship, a profile similarity coefficient of .8 between female and male swimmers. Therefore, he considered these two groups to be reasonably homogeneous and hence treated them as one population.

Choice and description of tests. The selection of tests for the main study was based on the results of the survey. It was also taken into consideration that these tests should have high validity and reliability coefficients and be feasible for application in a camp situation.

COORDINATION. Multi-limb coordination emerged as the first variable in the survey. Singer (115) suggests that "the more related the task to the actual criterion, the higher the anticipated correlation will be". As there was no such test available, a peg board test was adapted to sailing.

The basic coordination movement of the test was changed to resemble closer the asymmetric arm and hand movements used in sailing.

A skipper's hand often works with the rope in one direction, while the other hand directs the tiller in the opposite direction. It was also felt that the movement should be relatively gross. Therefore, the peg board size was increased. Pegs were made to be 2 inches long and  $\frac{1}{2}$  inch in diameter, in order to eliminate the precision factor as much as possible (47, 115). The instrument used was made to specifications in the Biokinetics Laboratories of the School of Physical Education, as shown in appendix C (p. 62 ). This instrument was said to measure the variable "multi-limb coordination".

The procedure and instructions in French had been normalized prior to the camp using 20 persons, other than the participants of the main study. Detailed instructions are to be found in appendix D (p.63). A reliability coefficient was established, measuring 20 persons aged 18-35 and using the test - retest method with an interval of 7 days. The reliability coefficient was: .87.

REACTION TIME. As a second factor, reaction time was measured. A standard Automatic Performance Analyzer (APA) was used to test reaction time. This is a widely used and accepted standard instrument in the field of physical education and other related areas.

The instructions to the subject were translated into French, prior to the testing period. Otherwise, standard procedures were used. The random choice of intervals in the 5 trials was the same for all subjects and read as follows: seconds 3, 1, 4, 5, 2.

BALANCE. The next factor to be measured was balance. Sanborn (108) reports that balance is not a general ability. Two broad types of balance have been identified, namely static and dynamic balance (115).

Considering the skipper's position during a race, it was decided that static balance was the more important factor to be assessed.

In a factor analytical study done by Fleishman (48) on static balance, it was the so-called "One-foot Lengthwise" Balance Test", with closed eyes, which loaded highest on static balance: .72. Reliability coefficients reported ranged up to .82. It was decided to use this test which is referred to as Fleishman's Balance "A" Test.

The measuring instrument, a wooden balance rail, was made to specifications by the School's Biokinetics Laboratories. Instructions had to be translated into French. Standard procedures were used (48).

STRENGTH TESTS. The items chosen are standard tests with a high degree of validity and reliability and are widely used. In recent studies, reliability coefficients ranged from .82 to .91 (45, 47).

Taking the physical performance of a skipper into consideration, where explosive strength does not seem to play a major role, it was decided to assess static and dynamic strength. The following tests were selected:

1. Grip strength (static strength factor). Factor loading on the hand grip strength is reported as .72 (48). Standard equipment and standard procedures were applied with the exception of the language of instruction which was French.

2. Suspension (dynamic strength factor). The test selected to measure this factor is called "Bent-arm-hang". This is also a standard test and procedures were followed as given by Fleishman (48). The factor loading reported by the same author is .73.

3. "Hold-half-sit-up" (trunk strength factor). Although this variable is also a dynamic strength factor, it measures partially

the abdominal muscles. Fleishman reports a factor loading of .45. As the abdominal muscles play a major role in most movements which require dynamic strength, it has been strongly recommended to include an item measuring these muscles in any strength test battery (47). For the administration of this test, standard instructions and procedures were applied.

PERCEPTION. Based on the results of the survey, perception emerged as the most important factor in the group of psychological characteristics. It was felt that Witkin's Rod-and-Frame test would be useful in assessing perceptual types (126, 127, 133, 136). This test was considered to have some relationship with an actual situation in sailing, where the skipper has to judge continuously the position of his boat, referring to the mast as the point of reference.

The Rod-and-Frame test, (RFT), was designed to reveal the extent to which a subject perceives his surroundings in a more analytical or a less analytical way. The first mode of perception was called field-dependency, in which the overall organization of the prevailing field is dominant. Conversely, we speak of field-independency when items are readily experienced as discrete from field (4, 127, 133).

The instrument used was a standard portable RFT apparatus. Reliability coefficients reported range up to .95 (97). The RFT has been validated against the Embedded Figure test. This is a test which measures analytical ability without implicating body movements. Witkin reported a significant correlation of .76 (135).

The test was conducted in a separate room, under daylight. First, the standard inspection procedures for this instrument were executed, as given by P. Oltman (97). The regular procedure for the RFT

was followed with the exception of the language of instruction. All instructions had been translated into French and tried out with some subjects, in order to clarify instructions.

16 IPAT PF. The 16 IPAT PF by R.B. Cattell was chosen for a number of reasons. This personality inventory is oriented and standardized on normal populations and it has a variety of norms available. The 16 IPAT PF is thought to provide a description of the whole personality in easy-to-understand terms (14, 15, 16, 112). It has also been translated into French and been used with French speaking subjects.

Another advantage of this psychological test appears to be the mode of assessment. The answers are scored according to mechanical rules. Scores may then be subjected to various statistical manipulations which do not require any human judgement, subjective estimate or the like. This makes it easier for an investigator without formal training in psychology to use this personality inventory.

Cattell (115) reports reliability coefficients for factors, using split-halves method and combining Forms A and B, to range from .71 to .93. Estimated validities are stated to vary from .73 to .96. However, variables are not to be taken at face value. They are considered as stimulus variables, and a variable is assigned to a factor measure not because of its meaning but because of the usual mode of response to it. Standard procedures were applied as described in the manual (115).

Organization. All tests measuring physical factors, as well as the Rod-and-Frame Test, were tried out during the week preceeding the testing period. Instructions had to be clarified, as they were to be given in French.

On the arrival day, each subject was asked to fill out a card pertaining to personal data. Then height and weight measurements were taken.

For the following day, the order of tests was chosen considering the possibility of an influence of fatigue. Johnson (2) supports the opinion that slight fatigue does not reduce balance control, therefore position 3 for the balance test does seem appropriate. Items also alternated between a strength factor and another variable. The order of the tests was as follows: 1) Coordination, 2) Hand-Grip, 3) Balance, 4) Suspension, 5) Reaction time, 6) Hold-half-sit-up. According to the findings of Forbes (49), reaction time to light seems to be unaffected by ordinary degree of fatigue. Therefore, the 5th place for reaction time should not influence its measurement.

A schedule for these events was worked out, taking into consideration the established program of the sailing week, as presented in appendix E (p. 64).

The Rod-and-Frame test was given during the 3rd and 4th day of the week. Candidates were asked to take an appointment. The test was given in a separate room, under day-light, with only the participant and the investigator present.

Characteristics of data. The data collected is characterized in the following way: Independent variables are presented with raw scores. The dependent variable was first expressed by rank order. As a second step this score was normalized, using percentile rank and standard score.

Analysis of data. The following steps were undertaken to analyse the data : a) a linear correlation among all variables was computed, using the Pearson Product Moment Correlation coefficient, b) a multiple step-wise regression procedure was executed.

## CHAPTER IV

### RESULTS AND DISCUSSION

This study was designed to investigate the relationship between certain physical and psychological dimensions of a skipper and his performance in small boat racing.

The following paragraphs contain a description of the results. This section will be followed by a discussion on significant and/or possible relationships of the different variables.

Means and standard deviations for all variables are presented in table 1(p. 41).

The scores for the first variable, perception, represent the sum of 8 trials. A standard deviation of 16.37, with the mean being 20.28 appears to be, at first look, rather high. However, when compared to other studies, the results are proportionately very similar. In two recent studies Oltman(97) reports an average of 52.4 for females with a standard deviation of 41.0 and a mean of 45.8 for males with a standard deviation of 36.9. This spread of scores seems to be a characteristic of the RFT.

The scores for grip strength are expressed in kg pressure. Results from a recent study with 83 subjects, aged 20 - 22 for five different groups are given with average scores between 106 pounds pressure and 117 pounds pressure (103). Fleishman calculated national norms for grip strength. He states that the norms for 18-year-olds can

TABLE I

Means and Standard Deviations  
for all Independent Variables

| Variable                                                              | Mean   | s     |
|-----------------------------------------------------------------------|--------|-------|
| Perception                                                            | 20.28  | 16.37 |
| Reaction Time                                                         | 1.40   | 0.25  |
| Handgrip                                                              | 58.79  | 11.64 |
| Suspension                                                            | 55.22  | 14.69 |
| Static Balance                                                        | 4.75   | 2.25  |
| Coordination                                                          | 47.41  | 3.87  |
| Hold-half-sit-up                                                      | 66.94  | 14.82 |
| Weight                                                                | 154.29 | 21.61 |
| Height                                                                | 68.37  | 3.01  |
| 16 PF CATTELL                                                         |        |       |
| A' reserved vs. out-going                                             | 8.88   | 3.37  |
| B less intelligent vs. more intelligent                               | 8.00   | 1.37  |
| C emotional instability vs. stability                                 | 17.29  | 4.09  |
| E submissiveness vs. dominance                                        | 16.35  | 3.33  |
| F desurgency vs. surgency                                             | 14.82  | 3.54  |
| G positive character integration vs.<br>immature, dependent character | 11.35  | 3.52  |
| H adventurous vs. withdrawn                                           | 16.29  | 3.11  |
| I tough-minded vs. tender-minded                                      | 10.18  | 2.83  |
| L cheerful vs. frustrated                                             | 10.26  | 2.75  |
| M practical vs. non-conventional                                      | 13.59  | 4.24  |
| N naive vs. sophisticated                                             | 10.47  | 2.85  |
| O confident vs. insecure                                              | 9.35   | 3.16  |
| Q1 radicalism vs. conservatism                                        | 13.00  | 3.18  |
| Q2 group-dependent vs. self-sufficient                                | 10.06  | 3.34  |
| Q3 undisciplined vs. controlled                                       | 10.24  | 3.15  |
| Q4 low nervous tension vs. high nervous<br>tension                    | 12.29  | 4.90  |

be used as a basis for adult performances (48). The mean score of 129 pounds pressure of our subjects, including the scores of 3 girls, is situated at the 80th percentile. We, therefore, may state that our group has above average static strength.

As an indicator of dynamic strength, the factor suspension emerges with an average score of 55.22 seconds. Fleishman (48) reports a mean of 35.21 seconds in one of his basic studies on 201 subjects in the Great Lake Naval Training Centre. The subjects tested can therefore be viewed as possessing above average dynamic strength.

The variable hold-half-sit-up yields a mean score of 66.94 seconds. Fleishman reports an average score of 37.6 seconds in the same study as mentioned above. When applying the national norms, our group is situated at the 70th percentile. This seems to indicate that the subjects tested have slightly above average abdominal and trunk strength.

The mean score for reaction time, per trial, reads .280 seconds (table 1). Using the same timing device (APA), a mean reaction time of .386 seconds per trial has been reported in a recent study on 80 college students (88). These findings seem to suggest that the group tested in the present study may possess a shorter reaction time.

Static balance is recorded with a mean score of 4.75 seconds (table 1). Fleishman (48) reported an average score of 5.31 in his basic study. This may indicate that static balance is not an essential characteristic for a successful sailor.

When normalizing the raw scores of the 16 IPAT PF, using the table for general population, a few personality traits emerge which are different from the average population. An average score is considered

to fall between points 4.5 to 6.5 (15).

The group tested scored high on "general intelligence", factor "B+", with a standard score of 8. This finding seems to support the original survey, where the factor "intelligence" had emerged as the 5th most important variable. It may also reflect the fact that the group tested included teachers and professors, which one expects to score high on "general intelligence".

The factor "E+" is an indicator of the trait "dominance". These individuals have a slightly higher mean, 7, than the average person. As shown in the review of literature, this variable is thought to be an important contributor to athletic success.

The trait "conscientiousness" is represented by factor "G+ ". The mean score of the group tested is situated slightly below average at 4. This denotes a person who is expedient, impatient and relaxed.

Turning to the factor "Q1+", the mean score for the group tested is above average, at 7. Such persons are thought to be more critical and better informed than the average person. They also seem to have a tendency to try new solutions (15).

The correlation coefficients of all physical and psychological factors with the variable performance are presented in table 2. These findings will be discussed simultaneously with the results from the multiple step-wise prediction procedure.

Table 3 contains the results of the multiple step-wise prediction.

The factor called "suspension" emerges as the best predictor. This variable is related significantly at the .01 level to performance.

TABLE II

Correlation of Physical and Psychological  
Variables with Performance

| Variable                                                             | $r^+$ |
|----------------------------------------------------------------------|-------|
| Perception                                                           | 0.04  |
| Reaction Time                                                        | -0.47 |
| Handgrip                                                             | 0.43  |
| Suspension                                                           | 0.62  |
| Balance                                                              | -0.02 |
| Coordination                                                         | 0.51  |
| Hold-half-sit-up                                                     | 0.61  |
| Weight                                                               | 0.16  |
| Height                                                               | -0.02 |
| 16 PF CATTELL                                                        |       |
| A cyclothymia vs. schizothymia                                       | -0.08 |
| B general mental capacity vs. mental defect                          | 0.06  |
| C emotional stability vs. instability                                | - .23 |
| E dominance vs. submissiveness                                       | 0.15  |
| F surgency vs. desurgency                                            | 0.06  |
| G positive character integration vs.<br>immature dependent character | 0.31  |
| H adventurous vs. withdrawn                                          | 0.19  |
| I sensitive vs. rigid                                                | -0.34 |
| L cheerful vs. frustrated                                            | -0.15 |
| M non-conventional vs. practical                                     | 0.05  |
| N sophisticated vs. naive                                            | 0.01  |
| O insecure vs. self-confident                                        | -0.26 |
| Q1 radicalism vs. conservatism                                       | -0.02 |
| Q2 self-sufficient vs. socially dependent                            | -0.09 |
| Q3 strong will vs. without control                                   | 0.12  |
| Q4 high nervous tension vs. low nervous tension                      | -0.11 |

+ correlation was determined by the Pearson Product Moment coefficient

TABLE III

Stepwise Multiple Predictors of Performance in  
the Sport of Sailing

| Variables                   | R   | B     | B <sup>2</sup> | % contribution† |
|-----------------------------|-----|-------|----------------|-----------------|
| <u>Step 1</u>               | .62 |       |                |                 |
| suspension                  |     | .62 " | .38            | 100%            |
| <u>Step 2</u>               | .72 |       |                |                 |
| suspension                  |     | .71   | .50            | 78.1            |
| C (ego strength)            |     | -.38  | .14            | 21.9            |
| <u>Step 3</u>               | .81 |       |                |                 |
| suspension                  |     | .84   | .71            | 64.6            |
| C (ego strength)            |     | -.48  | .23            | 20.9            |
| B (general mental capacity) |     | .40   | .16            | 14.5            |
| <u>Step 4</u>               | .86 |       |                |                 |
| suspension                  |     | .79   | .62            | 50.4            |
| C (ego strength)            |     | -.53  | .28            | 22.7            |
| B (general mental capacity) |     | .48   | .23            | 18.6            |
| I (sensitive vs. rigid)     |     | -.32  | .10            | 8.3             |
| <u>Step 5</u>               | .88 |       |                |                 |
| suspension                  |     | .80   | .64            | 47.1            |
| C (ego strength)            |     | -.58  | .37            | 27.2            |
| B (general mental capacity) |     | .42   | .18            | 13.3            |
| I (sensitive vs. rigid)     |     | -.35  | .12            | 8.7             |
| F (surgency vs. desurgency) |     | .23   | .05            | 3.7             |
| <u>Step 6</u>               | .91 |       |                |                 |
| suspension                  |     | .80   | .64            | 40.3            |
| C (ego strength)            |     | -.66  | .43            | 27.0            |
| B (general mental capacity) |     | .43   | .19            | 12.0            |
| I (sensitive vs. rigid)     |     | -.42  | .18            | 11.4            |
| F (surgency vs. desurgency) |     | .31   | .10            | 6.2             |
| Balance                     |     | .23   | .05            | 3.1             |

† this contribution is determined by using the formula  $B^2 / \Sigma B^2$ . It represents the contribution of the accounted for variance ( $r^2$ ) at each step.

" with a significant F-level of .01

The first variable to be picked up in such a procedure, is the one with the highest correlation coefficient of zero order, which in this case equals .62 (table 2). Variables are added or deleted according to the statistical significance of their contribution to the prediction of the criterion (24). Although only the first variable is correlated significantly with performance, results up to step 6 are presented in table 3. This represents some information as to the relative contribution of the next 5 variables.

Perception, as indicated in table 3, does not emerge as a good predictor of performance in sailing. However, a comparison of the mean of this group with other studies reveals the subjects to be field-independent (85, 97, 133). In order to verify this tendency, a t-test was applied with one of the most recent studies on the portable RFT, n=163, by P. Oltman (97). The result was significant at the .01 level. This strengthens our observation that one of the prevalent attributes of a sailor may be field-independency.

One of the peculiarities of the multiple stepwise regression equation is the fact that there may be quite a few good predictors which, however, are never picked up by this procedure. We therefore believe it necessary to look also at the correlation matrix (table 2). If we verify the relationship of performance with the other physical variables, we find that four of the five factors are significantly correlated with the dependent variable, at the .05 level (table 2). They also show a high relationship with the best predictor "suspension". These correlation coefficients read as follows:

|                                  |         |
|----------------------------------|---------|
| reaction time with suspension    | r. -.55 |
| hand-grip with suspension        | r. .75  |
| coordination with suspension     | r. .31  |
| hold-half-sit-up with suspension | r. .61  |

It is expected that strength variables would correlate with each other, because they measure part of the same ability. Reaction time and coordination also show a reasonably high relationship with suspension.

It seems that the factor suspension reflects in some way also the relative level of these four physical variables. As all these factors mentioned represent certain motor abilities, it is suggested that their respective levels are relatively similar in each of the tested subjects.

The only motor ability which does not fit into this picture is static balance. This factor shows a very low correlation of  $-.04$  with suspension. It is interesting to note however, that static balance is the second best physical variable to be selected in the multiple step-wise prediction, in step no. 6 (table 3), although its contribution is not significant. It seems that the ability called static balance, is unrelated to the respective levels of the other 5 motor abilities as measured in this study. The low correlation of  $-.02$  with performance also indicates that static balance is not a good predictor variable. It is quite possible that sailing requires some kind of a different balancing ability.

The results for weight and height factors support those authors who have pointed out that these variables have no value in predicting athletic success (37, 90, 91). Their relationship to performance in sailing was expressed with  $.16$  and  $-.02$  coefficients respectively (table 2).

Within the scope of this study, one may state that the factors

dynamic strength, static strength, reaction time and coordination are reasonably well related to performance in sailing. The factor suspension emerged as the significant predictor of success in sailing. However, it may be that motivational factors influenced the results of some of the tests. Individuals with excellent sailing performance seemed to score below their potential in certain tests, whereas the less successful skippers did their utmost to excel in the physical measurements. However, at the time when the tests were administered, these differences in motivation were not visible.

The psychological results may have been limited by the level of competition which was restricted to a regional level. Significantly different traits have emerged only when subjects were tested at a national or international level of competition. It seems probable that the personality traits of the subjects in this study do not differ significantly from the general population at this low level of performance in the sport of sailing.

In summary, within the limits of this study, the factor suspension emerged as the significant predictor of an individual's sailing performance. One of the prevalent attributes of skippers may be field-independency, as measured by the RFT.

## CHAPTER V

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### Summary and Conclusion

This study was designed to investigate the relationship between certain physical and psychological variables and a skipper's success in small boat racing. The selection of these variables was based on an initial survey of experts in the greater Ottawa-Hull area. Seventeen French speaking individuals completed all the requirements. They were tested in static strength, dynamic strength, coordination and reaction time prior to a weeklong period of sailing competitions at the University of Ottawa Summer camp in June, 1970. During this week, the subjects also took a test in perception and answered CATTEL'S 16 IPAT PF questionnaire. Their performance score in sailing was based on daily competitions and expressed in rank order by the instructors.

Using a multiple step-wise regression procedure, one variable emerged as a significant predictor, namely the factor suspension. Based on high correlation coefficients with the factor suspension and on a peculiarity of the above mentioned procedure, one may suggest that four of the other physical variables are also possible good predictors, namely reaction time, coordination, grip strength and hold-half-sit-up. The factor static balance does not seem to be an essential characteristic of a successful sailor.

Perception, as measured by Witkin's RFT, does not emerge as a

good predictor. However, the group as a whole seems to have the attribute of field-independency. Due probably to the low level of competition, the personality traits of the subjects tested in this study do not differ significantly from the general population.

#### Recommendations

a) Further studies should be done also under laboratory conditions.

b) Eliminating more physical and psychological variables in the pilot study would permit the researcher to focus on a few selected characteristics of a successful sailor.

c) Longitudinal studies should be done to determine the effect of personality development on performance and the effect of performance on the personality development of young athletes.

d) A cross-validation of studies is suggested.

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## APPENDIX A

Questionnaire

Instructions: Choose the 5 most important factors which you think essential for winning small boat races. These qualities apply to the skipper. Arrange them in Rank order (1st factor = most important etc.).

## A. PHYSICAL FACTORS

- |                              |              |
|------------------------------|--------------|
| 1. Coordination (multi-limb) | YOUR CHOICE: |
| 2. Reaction time             |              |
| 3. Endurance (physical)      | 1st:.....    |
| 4. Strength (leg muscles)    | 2nd:.....    |
| 5. Flexibility               | 3rd:.....    |
| 6. Influence of height       | 4th:.....    |
| 7. Strength (hand, arms)     | 5th:.....    |
| 8. Balance (static)          |              |
| 9. Influence of weight       |              |
| 10. Strength (trunk-muscles) |              |
| 11. Balance (dynamic)        |              |
| 12. Be a good swimmer        |              |

## B. PSYCHOLOGICAL FACTORS

- |                                            |              |
|--------------------------------------------|--------------|
| 1. Perception                              | YOUR CHOICE: |
| 2. Steady, persistent                      |              |
| 3. Agressive                               | 1st:.....    |
| 4. Emotionally calm                        | 2nd:.....    |
| 5. Desire for Achievement                  | 3rd:.....    |
| 6. Space relationship<br>(distal-proximal) | 4th:.....    |
| 7. Realistic                               | 5th:.....    |
| 8. Conscientious                           |              |
| 9. Low anxiety                             |              |
| 10. High intelligence                      |              |
| 11. Confident                              |              |
| 12. Enthousiastic                          |              |

Initials:.....

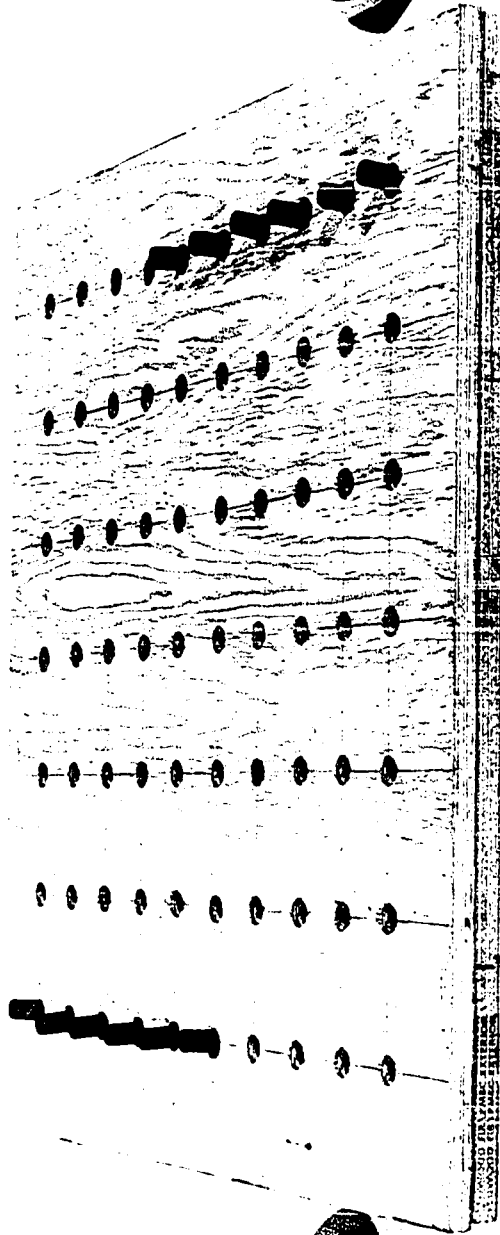
## APPENDIX B

General Data of Survey

- Criterion:** To be eligible to answer the questionnaire, sailors were required to have at least 5 years of experience in small boat racing (2 men per boat).
- Subjects:** 20 persons were found to be eligible to answer the questionnaire. They were contacted between June 4th, 1970 and June 8th, 1970.
- Clubs:** These individuals belonged to one of the following yacht clubs:  
- Britannia Yachtclub  
- RA Yacht Club  
- Navy Yachtclub  
- University of Ottawa ("unattached")
- Method:** Questionnaire, followed up by discussion with individuals in order to discover the underlying reasons for his choices and to detect any misinterpretations.
- Tabulation:** Of 20 questionnaires completed, 16 qualified for tabulation. The names of these persons are listed here-with:
- L. Hill, RAYC
  - Dr. T. Grygier, Britannia
  - N. Jacques, RAYC
  - L. Deschenes, U of O
  - B. Downey, RAYC
  - D. King, RAYC
  - C. Turgeon, U of O
  - K. Davis, RAYC
  - B. McGee, Britannia
  - B. Medaglia, Navy YC
  - A. Dykstra, RAYC
  - B. Conway, RAYC
  - M. Anderson, Britannia
  - J. Faucher, U of O
  - A. Lewis, Britannia
  - H. Fenton, Britannia

APPENDIX C

Diagram of Multi-limb Coordination Test



Measurements: Pegboard 24" x 23". Pegs length  $2\frac{1}{2}$ "; diameter  $\frac{1}{2}$ ".

## APPENDIX D

Procedure and Instructions for the Multi-limb  
Coordination Test

Subjects were seated in front of a table, where the peg board was placed. They were asked to place their hands on the table on each side of the board. Two low box tops were situated on each side. The one on the right was filled with 40 red pegs, the one on the left with 40 blue pegs.

The following instructions were given to the subject: "You will try during 60 seconds to fill as many holes as possible on this pegboard. Your two hands must work alternately. Only one hole may be filled at a time. Your left hand fills the holes starting at the left/upper corner and always working toward the body. Your right hand starts at the right/lower corner, always working away from your body". The investigator demonstrated the movements using 3 blue and 3 red pegs. Then the instructions continued: "You may start with the hand you prefer. You will be penalized with one point each time for making a mistake eg. when putting two pegs in place at once. Now you may try for 10 seconds when I say go; then take your initial position and in 15 seconds you will execute. My signals are "go" and "stop".

## APPENDIX E

Schedule for Testing Period - June 1970Sunday, 21st June 1970

7 - 9 p.m. collection of personal data of participants,  
measuring height and weight, preparation of tests.

Monday, 22nd June 1970

6:15 p.m. - 7:30 p.m. Testing of assistants E, G, F, D.  
7:30 p.m. - 8:30 p.m. Testing of subjects. Time allowance  
per test: 3 minutes per person.

Order of tests: 1. Coordination KS  
2. Grip-strength CT  
3. Balance CA  
4. Suspension LD  
5. Reaction time APC  
6. Hold-half-sit-up LL

Order of candidates: B,C,H,I,K,L,M,N,O,P,Q,R,S.

Time needed per person: 20 - 25 minutes.

Tuesday, 23rd and Wednesday, 24th, 1970

6:15 p.m. - 7:45 p.m. Test on perception, Witkin's portable RFT,  
subjects are asked to take appointment.

Time needed: 10 minutes per person.

Friday, 26th June, 1970

6:30 p.m. - 4:30 p.m. CATTELL'S 16 IPAT PF  
all subjects at the same time, in the classroom.

Monday, 21st June - Saturday, 27th June, 1970

Continuous testing on performance in small boat racing, as  
scheduled by instructors in daily races.