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# University Grant Program Research Report

FACTORS DISCRIMINATING BETWEEN TECHNOLOGICAL  
SPIN-OFFS AND RESEARCH AND DEVELOPMENT  
PERSONNEL

by

M.H.E. Atkinson

Faculty of Graduate Studies  
University of Western Ontario  
August, 1972

## Rapport de recherche sur le Programme de subventions aux universités

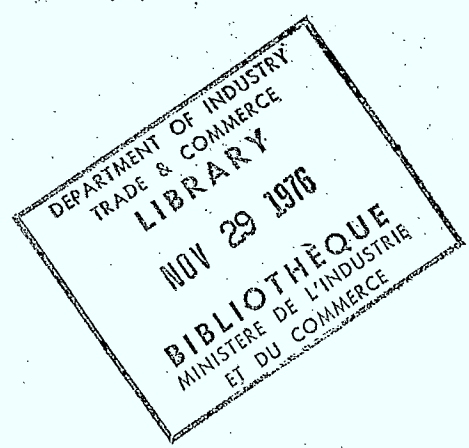


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Ottawa, Canada



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The views and opinions expressed in this report  
are those of the author and are not necessarily  
endorsed by the Department of Industry, Trade  
and Commerce.

FACTORS DISCRIMINATING BETWEEN  
TECHNOLOGICAL SPIN-OFFS AND RESEARCH AND DEVELOPMENT PERSONNEL

by

Mary Helen Elizabeth Atkinson

Submitted in partial fulfillment  
of the requirements for the degree of  
Master of Arts

Faculty of Graduate Studies  
The University of Western Ontario

London, Canada

August 1972

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THE UNIVERSITY OF WESTERN ONTARIO - FACULTY OF GRADUATE STUDIES  
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Bob Keach  
Chairman of Examining Board

## ABSTRACT

The purpose of this study was to investigate various factors which discriminate between men who have left Research and Development and started their own technologically based enterprise (spin-offs) and men who have remained in Research and Development. Eighty-two subjects, 41 spin-offs and 41 Research and Development personnel participated in this study. They were situated in seven major centres across Canada. Seven personality measures, a risk taking measure, a sensation seeking measure, intelligence levels, and biographical information were obtained for all subjects. Eleven hypotheses were subjected to analysis, of which six were supported, and the remainder received partial or no support.

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## INTRODUCTION

The purpose of this study was to determine whether certain personality characteristics and attitudes would discriminate between spin-offs and Research and Development personnel, in an attempt to illuminate attributes specific to spin-offs. Spin-offs are defined as those who create new companies seeking to exploit technological advances. They are the ones who take an idea and promote it through to a finished product, process or service. Research and Development personnel are men actively engaged in research and/or development in a government, university or industrial laboratory, who did not at the time of the study wish to leave that environment to start an enterprise. The variables investigated were: need achievement (n Ach); risk taking; sensation seeking; intelligence; the Personality Research Form (PRF) dimensions of autonomy, dominance, impulsivity, affiliation, harm-avoidance, aggression, achievement; extrinsic versus intrinsic job reward concerns; and occupational heritage.

### Economic Rationale for the Study

Canada appears to be lagging in technological innovation, implying a deficit of participating spin-offs. Conclusive proof is elusive in respect to these matters because of the severe statistical difficulties encountered when making international comparisons - quite apart from the problem of selecting adequate indicators and appropriate time periods. An examination of the underlying sources of economic growth reveals that the growth which has been achieved in recent decades

has not been achieved very efficiently (Thom, 1972). Roughly two thirds of Canada's rate of growth in total National Income from 1950-62 can be attributed to factor productivity, that is, to gains in the efficiency with which labour and capital were combined in the production process (Economic Council of Canada, 1968).

A substantial portion of improvements in factor productivity is a consequence of technological innovation, and Canada's performance here has not been bright. The Organization for Economic Cooperation and Development (1970) in its publication The Conditions for Success in Technological Innovation used four performance indicators to rank 10 industrialized nations: Belgium, Canada, France, Germany, Italy, Japan, The Netherlands, Sweden, Britain, and the United States. In the numbers of significant innovations since 1945 Canada ranked 10th. In monetary receipts for patents, etc. (1963-64) Canada ranked 8th. In the number of patents taken out in foreign countries (1963) Canada ranked 9th. In the overall complex index, Canada ranked 10th. These are partial and limited measures but extensive analysis by other observers, including the Senate Special Committee on Science Policy, supports the view held by the Organization for Economic Cooperation and Development.

#### McClelland's Need Achievement

McClelland (1961) advanced a theory of entrepreneurism which was based on the motivational construct need achievement (n Ach). Need Achievement was originally defined as a learned motive with relevant behaviours occurring in situations involving standards of excellence and competition (McClelland, 1961). The concept of n Ach evolved to include the idea of the importance of self-involvement or ego involvement.

It now is interpreted as a desire to do well for the sake of an increased feeling of personal accomplishment (McClelland, 1962).

The original investigations advanced the hypothesis that countries with a high level of n Ach would have superior economic growth to those with low n Ach. By so doing McClelland (1961) placed the emphasis on internal factors: "the human values and motives that lead man to exploit opportunities to take advantage of favourable trade conditions, in short, to shape his own destiny (p. 60)." McClelland, by this statement, relates economic growth to the individuals' values and aspirations within the economic system being considered. He believes that with an increase in n Ach within a society more entrepreneurs emerge and consequently the economy grows. Spin-offs are by definition entrepreneurs, thus this premise applies to them also.

McClelland (1961) postulated that level of n Ach could be measured by a country's folk tales or children's readers. As Mead (1951) stated, "a culture has to get its values across to its children in such simple terms that even a behavioural scientist can understand them, (p. 108)." An analysis of n Ach of 21 stories from each of 23 countries around 1925 and 40 countries around 1950 was conducted. Growth was defined as either growth in National Income in International Units per capita or growth in electrical output in Kilowatt Hours per capita. The study found that the estimate of n Ach based on second, third, and fourth grade readers around 1925 was positively correlated ( $r = .46$ ,  $p < .02$ ) with the combined indices of economic growth cited above.

Canada, however, exhibited a peculiar pattern in that in the initial time period it had the third highest n Ach level. This dropped from 2.67 in 1925 to 2.27 in 1950. There was a loss in expected value

of National Income, over the time period considered, of 3.1 International Units per capita and a gain in electrical output of 210.95 Kilowatt Hours per capita. The regression equation for Canada was curvilinear rather than the linear relationship obtained in 20 of the original 23 countries measured. McClelland (1961) considered this a saturation effect, stating that countries high on initial levels of n Ach couldn't be expected to maintain this level and so reduced the regression weight for Canada to .9 to get the predicted growth values. McClelland's (1961) data shows Canada's drop in n Ach level. If this is a continuing trend, it could partly explain the lagging technological innovation.

Spin-offs having started their own enterprises are by definition engaged in entrepreneurial activity. On the basis of the research of McClelland (1961), McClelland and Winter (1969), and Turner (1969), cited above, it is hypothesized that spin-offs will be significantly higher on a n Ach dimension than Research and Development personnel.

#### Problems in Assessing n Ach

Like other constructs to be discussed, measurement of n Ach has posed a problem. Weinstein (1969), Carney (1966), and Klinger (1966), have reviewed literature which used projective techniques such as the Thematic Apperception Test (McClelland, Atkinson, Clark and Lowell, 1953), French Insight Test (French, 1958), and the Doodles to measure n Ach. Klinger (1966) did a literature survey of existing studies to determine what the relationship was between fantasy n Ach [as measured by the Thematic Apperception Test, French Insight Test and Hurley's (1955) Iowa Picture Interpretation Test] and achievement motivation and performance. The relationship appears to be a tenuous one as

fantasy n Ach proved unstable. Klinger (1966) stated that "it seems clear that whatever n Ach scores measure is quote ephemeral, capable of registering differently in different fantasy instruments, differently in fantasy as contrasted with cognitive task instruments, and differently at different times in the same experimental session with the same or similar instruments, (p. 300)." A n Ach measure does not appear to give an immediate reflection of a regnant achievement motive. Although McClelland (1949) was able to affect n Ach and subsequent performance with motive arousing instructions other studies have failed to replicate this finding (Klinger, 1966). Non-motivational variables must be influencing achievement related performance. Klinger (1966) stated that the relevant variables had not yet been isolated but that they behaved like such variables as perceptual set, associational properties of the testing situation, and possible modeling processes.

Most of the above mentioned problems do not pertain to the French Insight Test. Klinger (1966) found that the French Insight Test produced nearly uniformly significant results in the studies relating n Ach to performance; whereas, both the Thematic Apperception Test and the Iowa Picture Interpretation Test measure of n Ach compared with performance produced more non-significant than significant results. The French Insight Test also surpassed the other tests in studies measuring the relation of n Ach to level of aspiration. Need achievement and level of aspiration were consistently related using the French Insight Test while many non-significant results occurred using the Thematic Apperception Test and the Iowa Picture Interpretation Test.

Weinstein (1969) found when comparing the success of the French Insight Test, Doodles, and the Thematic Apperception Test, in studies involving the relation of n Ach to risk preferences, that the French Insight Test was the only one that produced consistently significant results. In addition Weinstein found that, although not a very good internal consistency, the French Insight Test, nevertheless, had the best internal consistency ( $r = .48$ ) of the three measures.

The findings of Klinger (1966) and Weinstein (1969) cited above, indicate that by using the French Insight Test certain weaknesses of the Thematic Apperception Test which are probably affecting the validity of the findings when this measure is used could be eliminated. Kolb (1965) found that the French Insight Test measured a construct that behaved just like McClelland's n Ach as measured by the TAT. Therefore, it seems justifiable to use the measures interchangeably. If the current study using the French Insight Test supports the findings of McClelland (1961) by n Ach differentiating between the two groups then some of the doubt aroused as a result of McClelland's choice of the Thematic Apperception Test as his measure of n Ach would be eliminated.

### Risk Taking

Research into risk taking has increased considerably in the last decade. There are two basic approaches to risk taking investigations. One has its origins in attempts to elaborate formal decision making models; the other has its impetus from motivational theory. The former approach has involved the examination of subjective utility (perceived payoff) and probability (perceived probability of winning or losing). The latter approach is focused on possible correlates of



risk taking such as n Ach (Williams, 1965).

The investigation of risk taking has evolved from the embryonic concept of risk taking as merely a function of attractiveness of alternatives to the recognition of risk taking as a multidimensional attribute. The early studies were limited in that they involved examining individual differences in risk taking as a function of the decreasing probability of winning and increasing size of payoff. Expected value is usually held constant in these studies as a control for the possibility that one set be objectively considered more "rational" than another. Expected value is the probability of winning multiplied by the size of the payoff (Cutler and Heilizer, 1968). Later research has been concerned with other aspects of risk taking. Slovic's and Lichenstein's (1968) concern was in the role that "importance beliefs" and "information processing" played in weighting the dimensions of risk taking in decision making. The pattern that emerged was one of the individual decision maker struggling to integrate several sources of information into a single judgement. Certain beliefs plus reductionist strategies determine the decision maker's behaviour.

Little (1968) found, in a well designed study, that training in decision making increased a person's level of risk taking. Persons who were already employed in positions of decision making were high risk takers; whereas, the non-decision makers had an even dissemination of risk taking responses.

Risk taking is endemic to decision making and goal-directed activity. In seeking solutions and pursuing purposes there are probable costs as well as probable gains (Weinstein and Martin, 1969). Risk

taking is a concern of the current study insofar as it is an important aspect of any entrepreneurial venture. Spin-offs, because of the nature of their work, are in the role of decision makers. It is hypothesized that spin-offs are guided by the belief that it is better to take a greater risk and increase your payoff than take a low risk which assures a small payoff. The Research and Development personnel, on the other hand, are postulated to be guided by the belief that it is better to achieve a low payoff than take high risks where everything could be lost. This, in conjunction with the fact that spin-offs are in a position of decision making, leads to the prediction that spin-offs will be significantly higher risk takers than Research and Development personnel.

#### Problems in Assessing Risk Taking

A problem that has come to the fore recently, plaguing researchers in the area of risk taking, is whether risk is a value (Wallach and Wing, 1968). Is there a convergent validity among the varying measures used to assess risk? Do risks involving skill versus those involving pure chance elicit the same general behaviour from the individual? Is risk taking behaviour situationally dependent or do individuals exhibit a persistent level of risk taking? The current study assumes that risk is a value; therefore, that it is generalizable, that skill elicits different risk taking behaviour than chance and that individuals exhibit a persistent level of risk taking.

It is assumed that the risk taking behaviour demonstrated in this study applies to other facets of the S's life, such as the business risks the S is willing to undergo. There is some support for this assumption. Kogan and Wallach (1964) report measureable generalities:

among hypothetical and questionnaire measures of risk taking. Slovic (1964), after extensive analysis, found that convergent validity of most measures was negative. In the subsequent arguments, however, Slovic (1964) was able to explain this apparent lack of convergent validity. The primary explanation was that risk taking is a multidimensional concept and most of the presumed risk relevant measures have been tapping these dimensions differentially. According to Slovic (1964), "No one has fully explored preferences among gambles in which the expected value, variance, and probability have all been systematically manipulated, but it would seem likely that a complete description of a person's risk taking propensities would require consideration of his unique pattern of preferences in such situations (p. 228)." Subjectivity of risk is another relevant dimension affecting risk taking. An individual's perceived level of risk (how risky the individual sees his action as being) and the reaction to that risk are factors influencing the evaluation of the risk. Emotional arousal is another dimension of risk taking behaviour. For example, Cohen and Hansel (1956) suggest that risky behaviours are usually entered upon with a sense of danger rather than a conscious calculation of motives and probabilities. For the purposes of the current study only one dimension of risk was examined, so, the fact that convergent validity does not exist between measures of diverse dimensions of risk taking does not really apply. Perceived level of risk is measured in the current study which accomodates Slovic's (1964) finding regarding the influence of this dimension. Unfortunately, the current study had no way of controlling for emotional arousal, except by standardizing conditions of presentation for the risk taking measure.

A second premise of the study is that business requires risks that are a combination of skill and chance. The behaviour under a pure chance orientation has been shown by Littig (1962), Lupfer and Jones (1971), and Kogan and Wallach (1965) to differ significantly from the risk taking behaviour demonstrated under a skill orientation. A skill and chance taking game was seen as being representative of the type of risks involved in an entrepreneurial venture.

A third assumption concerning risk taking is that risk taking is not situationally dependent but prevalent across situations. Tajfel, Richardson and Everstine (1969) conducted a study, the results of which lend support to an underlying risk taking level. Weinstein and Martin (1969) found that willingness to take material risks even generalizes to risks of an interpersonal nature. It would appear that the third assumption is true. The current study consequently chose a risk taking measure that paralleled an investment situation whereby skill is involved in utilizing the available information to choose the best stock, thereby maximizing the payoff, but where the investor has no control over which way the stock will go. This incorporates McClelland's (1961) concept of high need achievers using feedback as well.

#### Perceived Level of Risk Taking

Slovic (1964) stated that an individual's perceived level of risk influenced the subject's decision; for example, even though an action might be very risky, if the person involved did not perceive that action as a high risk action, his perceived level of risk would be low. Collins and Moore (1970) hypothesized that a spin-off only feels secure

when he is working for himself. Consequently, it follows that even though the related risks to spinning off may actually be high compared to working for others the spin-off is likely to perceive them as lower. The current study hypothesizes that the spin-off's obtained level of risk differs significantly from the perceived level of risk, the former being higher. No significant difference is hypothesized to exist between the obtained and perceived level of risk taking for the Research and Development group.

#### Need Achievement and Risk Taking

The other major approach to risk taking involved examining the personality correlates. Extensive research has been conducted assessing the relationship between n Ach levels and various dimensions of risk taking. High need achievers were found to have a particular approach to risk taking when it involved skill, preferring intermediate odds as opposed to the extremes (Atkinson, Bastian, Earl, and Litwin, 1960). This is the model used by McClelland (1961) when considering the risk taking behaviour of entrepreneurs and, as such, should apply equally to spin-offs.

Additional support is lent to this theory by Gilson (1969) and Brown (1969). Gilson found low need achievers chose significantly more often than did high need achievers those bets with a higher probability of success. Brown found that high versus low risk takers among educational and business executives were distinguishable on the basis of n Ach, initiative, and their own perceptions of organizational development.

Risk taking is so clearly linked with n Ach that in programs developed to increase achievement risk is one of the variables manipulated.

Trainees are taught to use intermediate odds for achieving their goals. Kolb (1965) found that he was able to increase n Ach and subsequent achieving performance in underachieving school boys by training them to employ moderate risk taking, use of feedback, and the art of accepting responsibility for their actions.

Atkinson's (1957), Brown's (1969), McClelland's (1961), Gilson's (1969) and Kolb's (1965) findings lead to the prediction that a significant correlation should exist between n Ach and risk taking in the current study for the spin-off group.

### Sensation Seeking

Henry (1948) challenged the assumption that the controlling factor in the relation of the personality to external events of stress and uncertainty was one of shock, with the resultant effort directed to reduce this environment to a state of total predictability. Henry hypothesized that a complex state of manageable uncertainties was the framework within which most persons revolved. He felt many individuals might receive positive reward and satisfaction from the constant need to cope with the changing environment; summarily expressed, the amount of environmental stimulation people enjoy varies among individuals.

The concept of optimal level of stimulation as offered by Hebb and Thompson (1954), Leuba (1955) and Berlyne (1960) was a substitute for the unsatisfactory concept of drive reduction minimizing stimulation (Zuckerman, Kalin, Price and Zoob, 1964). Recognition of individual differences in what would be the optimal level of stimulation led to the creation of a sensation seeking scale.

The sensation seeking scale has shown correlations with such

concepts as risk taking (to be discussed later) and willingness to volunteer for unusual experiments. Zuckerman, Schultz and Hopkins (1967) found a significant difference in sensation seeking scores between those willing to volunteer for an hypnosis experiment and those unwilling to volunteer; volunteers having significantly higher scores.

Technological innovation, the concerns of spin-offs, is the creation of new products, processes or services. This concern with the creation of the new, implies a concern with seeking the novel, or sensation seeking. Spin-offs in some ways could be compared to volunteers, they are the ones in a society who volunteer to take on the process of technological innovation. The above mentioned has led to the prediction that spin-offs will score significantly higher on the sensation seeking scale than Research and Development personnel.

#### Sensation Seeking and Risk Taking

Waters and Kirk (1968) established a relationship between the Stimulation Seeking Scale and risk taking, obtaining product moment correlations of .30, .37, and .29 (all at  $p < .05$ ). They employed the same risk taking device as the current study. Consequently the present investigation should support their view, thus predicting the existence of a relationship between the Sensation Seeking scores and the risk taking dimension for both groups.

#### Intelligence

Roberts and Wainer (1966) found that spin-offs were usually educated to the MSc degree level. This was the median level of education obtained in their sample of 69 spin-offs. Active involvement in the

field of Research and Development generally requires at least a BSc or a BEng. A moderately high level of intelligence is expected in the two groups, because both are university graduates. There is no reason to expect any difference in the mean level of intelligence of the two groups as a result of the above. Personality characteristics other than intelligence are hypothesized to be partly responsible for one man spinning out while another man stays.

#### Collins' and Moore's Theory of Entrepreneurship

Collins' and Moore's theory of entrepreneurship stresses persistence, self-control, low social mobility drive, and autonomy as being characteristics of spin-offs. These characteristics do not become evident until the individual has spun off. While employed by others Collins and Moore suggested that the potential spin-off is a drifter motivated by a 'grass is greener' philosophy. He is the man who hangs his hat on the corner of the desk so it is within easy reach. Collins and Moore (1970) sum up the character of a spin-off by stating that "many men dream of having a business of their own. It is only the man with the peculiar character structure of the entrepreneur who can make this dream a reality. It is precisely his fear of subordination, his distrust of peers, his tendency to cut intolerable situations rather than stay and solve them which sooner or later cause him to dissolve restricting ties. It is also these characteristics which cause him eventually to go into business for himself (p. 26)."

The PRF dimension of impulsivity is defined as tending to act on the spur of the moment and without deliberation. It is hypothesized in support of Collins' and Moore's picture of the potential spin-off



with his hat on the corner of the desk, that spin-offs in the current study will have a significantly higher score on this dimension than Research and Development personnel.

The PRF dimension of autonomy is defined as trying to break away from constraints. This is consistent with Collins' and Moore's portrait of the spin-off as one who cuts intolerable situations breaking restraining ties; therefore, it is postulated that spin-offs will be significantly higher on this dimension than Research and Development personnel.

Dominance is defined on the PRF as attempting to control one's own environment. It is predicted therefore that the spin-off's "fear of subordination" which is postulated by Collins and Moore to be typical will cause this group to have a significantly higher score on the dominance dimension.

#### The Relationship Between Spin-offs and the PRF Dimensions of Harmavoidance, Affiliation, Aggression and Achievement

The PRF dimension of harmavoidance is defined as not enjoying exciting activities, being fearful, cautious, and avoiding risks. This is the opposite to the previous hypothesis that defined a spin-off as a relatively high risk taker who enjoys sensation seeking. It follows, therefore, that spin-offs will be significantly lower on this dimension than Research and Development personnel.

Wainer and Rubin (1967) found in their study of 51 spin-offs that need for affiliation (n Aff) exhibited a mildly negative relationship with entrepreneurial success. They define n Aff as concern with the

establishment, maintenance, and restoration of positive affiliative relationships.

The PRF dimension of affiliation is defined as making efforts to win friends and maintain associations with people. This definition is consistent with the description of n Aff, indicating support of Roberts' and Wainer's results that a significant difference will exist between two groups in the current study. It is hypothesized that the PRF dimension of affiliation will be significantly lower for spin-offs as compared to the Research and Development group.

The PRF dimension of achievement is similar to n Ach by definition. Achievement is aspiring to accomplish difficult tasks, and responding positively to competition and willingness to put forth effort to attain excellence. Need Achievement has previously been hypothesized to differentiate between the two groups in the current study. It is logical to assume, therefore, that PRF Achievement will do likewise. It is postulated that spin-offs will score significantly higher on the PRF achievement dimension than Research and Development personnel.

The popular legend of the businessman as an aggressive tycoon led to the hypothesis in the present study that spin-offs would be significantly higher on the PRF dimension of aggression than Research and Development personnel.

Extrinsic Versus Intrinsic Job Reward Concerns

Lueptow (1968) stated, "Sanctions and thus the motivational significance of roles operates at two levels: (1) in the role performers themselves, and (2) in the reinforcement to the actors who exhibit the performance expected of the role incumbent. The first type of sanction

involves intrinsic satisfactions, while the second involves extrinsic rewards originating outside of the role performance itself, (p. 304)." Leuptow defines intrinsic factors as the use of special abilities and aptitudes, concern with creativity and originality, and personal responsibility for work performance. Extrinsic factors were defined as status and prestige, money and success, and security and comfort.

McClelland (1961), Atkinson (1958), and French (1956; 1958) related high n Ach to intrinsic factors rather than extrinsic factors. Minor and Neel (1958) demonstrated a significant positive relationship between level of n Ach and the prestige rank of the individual's occupational preference. Lueptow (1968) hypothesized that high need achievers would be more concerned with occupations that could satisfy intrinsic rather than extrinsic needs. The definitive characteristics describe a work context in which according to Lueptow (1968) "the actor initiates and is responsible for the task and in which he can evaluate the task outcome and relate it back to self (p. 305)." This description is typical of the type of behaviour exhibited by spin-offs.

Williams (1965) found a relationship between risk taking and concern with internal or external job rewards. High risk takers were found to be more concerned with the intrinsic aspects of job rewards and low risk takers with the extrinsic aspects.

On the basis of the relationship of extrinsic and intrinsic job rewards to risk taking and n Ach and the previous hypotheses stating that spin-offs are significantly higher on these dimensions it follows that in the present study spin-offs will demonstrate a significantly higher concern with the intrinsic aspects of their jobs than Research and Development personnel.

### Occupational Heritage

Occupational heritage was investigated in an attempt to further substantiate Roberts' and Wainer's (1966) finding that entrepreneurial fathers had significantly more entrepreneurial sons than non-entrepreneurial fathers. A reverse relationship was hypothesized for the current study. Spin-offs were postulated to have significantly more entrepreneurial fathers than Research and Development personnel.

### Purpose and Postulates of the Study

The purpose of this thesis was to test the following hypotheses concerning personality differences between technological spin-offs and persons engaged in Research and Development:

- 1) Spin-offs will have a significantly higher level of n Ach than Research and Development personnel.
- 2) The risk taking level of the spin-off group will be significantly higher than the Research and Development group.
- 3) The perceived level of risk taking will be significantly lower for the spin-off group than the obtained level. The perceived level of risk taking for the Research and Development group is hypothesized not to differ from the obtained level.
- 4) Significant correlations will exist between n Ach and risk taking for the spin-off group.
- 5) Spin-offs will have a significantly higher score on the Sensation Seeking Scale than Research and Development personnel.
- 6) Significant correlations will exist between sensation seeking and risk taking for the spin-off group.

- 7) No significant difference exists between the intelligence level of the two groups.
- 8) Spin-offs will be significantly higher on the following PRF dimensions: autonomy, dominance and impulsivity than Research and Development personnel.
- 9) Spin-offs will be significantly lower than Research and Development personnel on the PRF dimensions: harmavoidance and affiliation. Spin-offs will be significantly higher than Research and Development personnel on the PRF dimensions of achievement and aggression.
- 10) Spin-offs are significantly more concerned with the intrinsic (e.g., challenge) aspects of the job; whereas, Research and Development personnel are more concerned with the extrinsic (e.g., money time) aspects of the job.
- 11) Spin-offs will have a significantly greater percentage of entrepreneurial fathers as compared to Research and Development personnel.

## METHOD

### Subjects

The approach to the problem outlined in the previous section was to obtain samples of behaviour from two groups, spin-offs and their technological peers in Research and Development. The sampling procedure involved sending letters to spin-offs, Directors, and Chairmen and Deans of Engineering, Science and Mathematic Faculties of various institutions in Canada asking for participation and/or other names. The Research and Development Directory for Canada was a main source.

The spin-off sample consisted of a randomly selected group of 41 technological spin-offs who had spun out of Research and Development laboratories starting enterprises consistent with their technological base. Three spun out of university, 13 out of government and 25 out of industrial laboratories. The other group consisted of 41 scientists or engineers engaged in Research and Development: 5 were employed in universities, 18 were employed in government and 19 were employed in industrial laboratories. Their positions ranged from doing pure research to Directors of laboratories.

The two groups were similar with respect to age, educational level obtained and all were males. The average age for the Research and Development group was 44.5 years, as compared with 46.3 years for the spin-offs. The average number of post-secondary years of education was 5.34 for the Research and Development group as compared to 5.02 for the spin-off. The samples were selected from seven major cities in Canada: Vancouver, Edmonton, Winnipeg, Toronto, Montreal, Halifax and Ottawa.

## Materials

Jackson's (1967) PRF Form A was used which gives 15 personality attribute scales based on 16 items each (see Appendix A). The PRF was rationally constructed influenced by Jackson's research on response biases. All scales were measured, but only seven were scored.

The French Insight Test, a projective technique constructed by French (1958), was used to measure level of n Ach. This projective paper and pencil measure requires the S to describe a given person's character based on the presentation of one characteristic behaviour (see Appendix B). Need Achievement is operationally defined in this study as that which the French Insight Test measures.

The Sensation Seeking Scale used is a rationally constructed paper and pencil measure constructed by Zuckerman, Kalin, Price and Zoob (1964) (see Appendix C). The Sensation Seeking Scale is made up of items which describe four types of sensation-seeking; visual sensation seeking and antisocial sensation seeking, thrill seeking and social sensation seeking.

The Risk-Taking Game designed by Waters and Kirk (1968) was used. This game employs a deck of cards and a 1-5 rating scale. The game selected is a combination skill and chance orientation which controls for expected value. The subject was allowed 20 draws from the top of a shuffled deck of 52 cards. For each draw the S made a bet as to what he would draw. The allowable bets were colour, suit, denomination, colour plus denomination, and a combination of suit and denomination which yield the probabilities of being drawn of 1/2, 1/4, 1/13, 1/26, and 1/52. The subject received both verbal and written instructions

(see Appendix C). These informed the S that if on any draw, the bet was realized, his score on that draw is the denominator of the strategy elected for that draw; whereas, if the S failed to achieve his bet then the score for that draw was 0. In addition, the S was informed that the card drawn was not replaced and he could refer to all the drawn cards before placing his next bet. Further instructions informed the S that the purpose of the game was to achieve the highest possible score. If a score was obtained which surpassed an undisclosed total, a dollar would be paid by the interviewer. It was explained that the score would be undisclosed so as not to influence the S's strategy. The S was told to attempt to equate the way he played the game with a real life business venture. The probability and payoff for each strategy were stressed and a trial session was undergone. After completion of the second trial the S was asked to rate his own level of Risk Taking on a 1-5 point scale with 1 low, 3 moderate, and 5 high.

The information sheet contained a graph of the various probability distributions over 20 draws, and a list of the various strategies with their payoffs. The Expected Value over an infinite number of draws for all strategies was 20.

The player, depending on his skill, could utilize the incoming information and alter his strategy appropriately to maximize his score. It was hypothesized that anyone who is by nature unwilling to take the risk of losing, would adopt the high probability, low payoff strategies.

The Interview conducted was structured around the difficulties encountered in starting a business in Canada, reasons for so doing, and eliciting bibliographical information as to father's occupation, career pattern, and marital status (see Appendix E).



Ammons' and Ammons' (1962) Quick Test of Verbal Intelligence was used. All three forms of this test were administered (see Appendix F). Each form consists of 50 words which must be associated with 1 of 4 pictures. Each list of 50 words, progressed in difficulty from age 3 to superior adult, thus, only the last 20 words of each form were administered. The S was given credit for the first 30 words of each form.

#### Procedure

The PRF, and the Sensation-Seeking Scale were sent in the mail with a covering letter. They were to be completed prior to the interview session. An hour and a half was scheduled for the interview. During the interview session, the Quick Test was administered by the interviewer. This was followed by the administration of the French Insight Test, then the Risk Taking game. The interview was conducted in the remaining time.

## RESULTS

The French Insight Test was scored for n Ach by an experienced scorer with a demonstrated interscorer reliability of .88. The Risk Taking game was scored for each S by averaging the denominators of the strategies selected for each of the 20 draws on the second trial. The mean score for each of the two groups on each of the dependent variables is reported in Table 1.

The data for the PRF personality traits: Achievement, Aggression, Affiliation, Autonomy, Dominance, Harmavoidance, and Impulsivity, the Risk Taking, n Ach, Sensation-Seeking and IQ scores were subjected to one way multivariate analysis of variance. The results of this analysis are shown in Table 2. The effects of Groups across all dependent variables was found to be significant ( $F_{[11,80]} = 3.819, p < .05$ ). Therefore, a t-test was performed for each of the dependent variables. The results of this analysis are shown in Table 1. Significant effects were found for Dominance ( $t_{80} = 2.12, p < .05$ ), Harmavoidance ( $t_{80} = 2.5, p < .05$ ), Risk Taking ( $t_{80} = 2.88, p < .01$ ), Sensation-Seeking ( $t_{80} = 2.5, p < .05$ ) and n Ach ( $t_{80} = 2.75, p < .01$ ).

The perceived level of risk taking was obtained by standardizing each S's scaled score and his obtained score. The obtained score was then compared with the perceived score for each group. A t-test was used. A significantly higher perceived score was obtained ( $t = 5.61, p < .001$ ) for the spin-off group. A significantly higher perceived score ( $t = 8.45, p < .001$ ) was obtained for the Research and Development group.

TABLE 1  
 Comparison of Means of Two Groups  
 on All Dependent Variables

<u>Dependent Variable</u>	<u>Non-Spin-Off Mean Scores</u>	<u>Spin-Off Mean Scores</u>	<u>d.f.</u>	<u>t</u>
Achievement	15.61	16.56	80	1.399
Affiliation	13.07	13.32	80	.304
Aggression	4.61	5.34	80	.728
Autonomy	8.73	9.24	80	.712
Dominance	11.15	13.07	80	2.116*
Harmavoidance	10.27	8.29	80	2.109*
Impulsivity	8.80	10.00	80	1.176
IQ	136.63	138.61	80	1.393
Risk Taking	6.46	13.12	80	2.876**
Sensation Seeking	13.85	16.37	80	2.500*
n Ach	9.05	14.00	80	2.746**

\*  $p < .05$

\*\*  $p < .01$

TABLE 2

Group Multivariate One Way ANOVA  
for all Variables

<u>SOURCE OF VARIATION</u>	<u>LOG GENERALIZED VARIANCE</u>	<u>U-STATISTIC</u>	<u>d.f.</u>	<u>F-STATISTIC</u>
Groups	80.57	1.692994	1,80	2.8192*

\*  $p < .05$

The biographical information obtained was summarized by an impartial scorer into a chart of responses indicating why a S did spin out from Research and Development, or in the case of the Research and Development group what it would take to make them spin out. These are reported in Table 3. These responses were further analysed into concern for extrinsic as opposed to intrinsic rewards categories. An analysis revealed that a significantly greater number of spin-offs were interested in intrinsic job rewards ( $\chi^2$  18.30,  $p < .001$ ). These results are reported in Table 4.

An analysis was conducted to determine whether spin-offs had a significantly greater number of entrepreneurial fathers than did Research and Development personnel. A significantly greater number of spin-offs had entrepreneurial fathers ( $\chi^2$  4.253,  $p < .05$ ) than did Research and Development personnel. The results are reported in Table 5.

A correlational analysis of the 11 variables for the spin-off group showed significant correlations between sensation seeking and harmavoidance  $-.42$  ( $p < .01$ ), harmavoidance and intelligence  $.32$  ( $p < .05$ ), affiliation and aggression  $-.46$  ( $p < .01$ ), and affiliation and dominance  $.32$  ( $p < .05$ ). The results are reported in Table 6. A correlational analysis of the 11 variables for the Research and Development group revealed correlations between harmavoidance and dominance  $-.45$  ( $p < .01$ ), harmavoidance and sensation seeking  $-.50$  ( $p < .01$ ), dominance and sensation seeking  $.48$  ( $p < .01$ ), and aggression and impulsivity  $.42$  ( $p < .01$ ). These results are reported in Table 7.

TABLE 3

Classification and Frequency of Responses  
for Spinning-Off or Remaining in Research and Development  
for Spin-off and Research and Development

	<u>G R O U P S</u>		
	<u>FREQUENCY OF INTRINSIC RESPONSES</u>	<u>FREQUENCY OF EXTRINSIC RESPONSES</u>	<u>FREQUENCY OF OTHER RESPONSES</u>
<u>Spin-Off Responses</u>			
Determining Own Environment	22		
Stimulation	16		
Challenge	9		
Saw Opportunity for Success		14	
Money		5	
Job Loss			7
<u>Research and Development Responses</u>			
Lack of Current Job Satisfaction	23		
Guaranteed Security		29	
Money		15	
Hours		7	
Necessary Skills			10
Financing			9

TABLE 4

A Comparison of Frequencies of Responses Indicating  
Intrinsic versus Extrinsic Job Reward Concerns for  
Spin-Off and Research and Development Personnel

<u>GROUPS</u>	<u>INTRINSIC</u>	<u>EXTRINSIC</u>	<u><math>\chi^2</math></u>
Spin-Offs	47	19	
Research and Development Personnel	23	51	18.30**

\*\*  $p < .001$

TABLE 5

The Frequency of Entrepreneurial Fathers Having Entrepreneurial Sons  
Compared with Entrepreneurial Fathers Having Research and Development Sons

<u>GROUPS</u>	<u>ENTREPRENEURIAL FATHERS</u>	<u>NON-ENTREPRENEURIAL FATHERS</u>	$\chi^2$
Spin-Offs	16	25	
Non-Spin-Offs	7	34	4.253*

\*  $p < .05$



TABLE 6

## Correlation Matrix of 11 Variables for Spin-Offs

<u>Variables</u>	1	2	3	4	5	6	7	8	9	10	11
1. Achievement		-.08	.15	.25	.30*	-.21	-.06	-.30*	.10	.09	.12
2. Affiliation			-.15	-.46**	.32*	-.06	.08	-.01	.08	.19	.00
3. Aggression				.08	.29	.02	.21	.00	.06	.17	-.24
4. Autonomy					-.11	-.11	-.10	.03	-.29	.05	-.24
5. Dominance						-.11	.18	.06	.22	.16	.23
6. Harmavoidance							.12	.32*	-.10	-.42**	.07
7. Impulsivity								.15	-.11	.21	-.05
8. Intelligence									-.54**	.11	.11
9. Risk Taking										-.06	-.15
10. Sensation Seeking											-.02
11. N Ach											

\*\* p &lt; .01

\* p &lt; .05

TABLE 7

## Correlation Matrix of Variables for Research and Development Personnel

<u>Variables</u>	1	2	3	4	5	6	7	8	9	10	11
1. Achievement		.03	-.19	.27	.26	-.17	-.04	.13	.13	.23	.04
2. Affiliation			-.15	-.40	.10	-.04	-.15	-.17	.12	.14	.18
3. Aggression				.19	.15	-.26	.42**	.11	.03	.25	.02
4. Autonomy					-.04	-.34	.28	.17	-.11	.08	.00
5. Dominance						-.45**	.16	.18	.04	.48**	.25
6. Harmavoidance							.17	-.21	.00	-.50**	-.25
7. Impulsivity								.03	-.20	.16	.05
8. Intelligence									-.21	.07	.08
9. Risk Taking										-.06	.10
10. Sensation Seeking											.15
11. N Ach											

\*\* p &lt; .01

\* p &lt; .05

## DISCUSSION

The discussion will centre on the eleven hypotheses as stated in the Introduction. These are:

- 1) Spin-offs will have a significantly higher level of n Ach than Research and Development personnel.
- 2) The risk taking level of the spin-off group will be significantly higher than the Research and Development group.
- 3) The perceived level of risk taking will be significantly lower for the spin-off group than the obtained level. The perceived level of risk taking for the Research and Development group is hypothesized not to differ from the obtained level.
- 4) Significant correlations will exist between n Ach and risk taking for the spin-off group.
- 5) Spin-offs will have a significantly higher score on the Sensation Seeking Scale than Research and Development personnel.
- 6) Significant correlations will exist between sensation seeking and risk taking for the spin-off group.
- 7) No significant difference exists between the intelligence level of the two groups.
- 8) Spin-offs will be significantly higher on the following PRF dimensions: autonomy, dominance and impulsivity than Research and Development personnel.
- 9) Spin-offs will be significantly lower than Research and Development personnel on the PRF dimensions: harmavoidance and affiliation. Spin-offs will be significantly higher than Research and Development personnel

on the PRF dimensions of achievement and aggression.

10) Spin-offs are significantly more concerned with the intrinsic (e.g., challenge) aspects of the job; whereas, Research and Development personnel are more concerned with the extrinsic (e.g., money time) aspects of the job.

11) Spin-offs will have a significantly greater percentage of entrepreneurial fathers as compared to Research and Development personnel.

The above hypotheses will be discussed with reference to the present study and in relationship to the findings of previous investigators.

#### Need Achievement Levels for Spin-Offs as Compared to Research and Development Personnel

McClelland (1961, 1965; 1969; and 1970) and Turner (1969) found that entrepreneurial activity in a country was related to an Ach level of the population in that country. This leads to the prediction that those engaged in entrepreneurial endeavours should have a higher level of an Ach than those who are not. Spin-offs fall in the former category; therefore, it was predicted that they would be significantly higher on an n Ach dimension than Research and Development personnel. This hypothesis was supported in the current study.

McClelland and Winter (1969) reported a study in which by an Ach motivation training an Ach was increased in a group of Indian businessmen subsequently increasing entrepreneurial activity in the group. An extension of this study could be carried out in Canada by attempting to raise the n Ach level in a Research and Development group. A follow-up of their activity for two or three years would reveal whether a signi-

ificantly higher incidence of spinning-off or entrepreneurial activity occurred in this group as compared to a control group.

In addition to the above study, one could be undertaken that used current n Ach level as a predictor of entrepreneurial endeavours internally or externally in a large Research and Development establishment. If the high n Ach group performed in a more entrepreneurial fashion then further support would be lent to the findings in the present study.

#### Risk Taking Level of the Spin-Off Versus the Research and Development Group

Little (1968) found that persons in a position of decision making are greater risk takers than persons in a non-decision making role. Gilson (1969) found that low need achievers chose significantly more often than did high need achievers those bets with the greater probability of success. In the present study, because spin-offs are, by definition, in decision-making roles, and as previously predicted and confirmed higher need achievers than Research and Development personnel the following hypothesis was advanced: spin-offs would be higher risk takers than Research and Development personnel. This postulate was confirmed in the current study.

No conclusion can be drawn as to the actual level of risk taking as normative data on the risk taking game that was used has not yet been assembled. It would be informative to conduct a study in which statements about the actual level of risk taking of the two groups compared to the overall population could be made.

Variations in the Perceived Level of Risk Taking as Compared to the  
Obtained Level of Risk in the Two Groups

Collins and Moore (1970) suggested that a spin-off only feels secure when he is working for himself, in other words, he considers working for others to be high risk and working for himself to be low risk. As a result it follows that his perceived risks in business would be lower than the actual risks he was taking.

Consequently, in the current study it was postulated that a spin-off's perceived level of risk taking would be lower than the obtained level of risk taking. Contrary to the prediction, the spin-offs had a significantly higher level of perceived risk taking than their obtained level on the risk taking dimension.

Two inferences could be made from this finding. First, for no apparent reason, the spin-offs were performing more conservatively in the current risk taking game than they normally behave in risk taking ventures. Secondly, spin-offs perceive themselves as greater risk takers than they actually are. There is some support for the latter conclusion in the findings of Wallach and Wing (1969). They found that if a culture values risk taking that the persons in that culture tend to perceive themselves as significantly higher on the risk taking dimension than they actually are.

The findings of the present study concerning the perceived level of risk taking for the Research and Development group were not as predicted. The perceived level of risk taking was significantly higher than the obtained level of risk taking. The findings of Wallach and Wing (1969) cited above are advanced in explanation of this finding as well.

### Variations in the Sensation Seeking Scores for the Spin-Off and Research and Development Group

Henry (1948) predicted that many individuals receive positive reward and personal satisfaction from the constant need to cope with the changing environment. Spin-offs by the nature of their work are constantly seeking the novel. It would logically follow that spin-offs would be significantly higher on a risk taking dimension than Research and Development personnel. This postulate was supported in the current study.

There was a major problem with the Sensation Seeking Scale that was used in the current study which should be noted. There are instances in the measure where neither answer is correct or where both are correct for some individuals. A good example of the former type of item and one that evoked criticisms from the Ss was:

- a) I think all people who ride motorcycles have an unconscious need to hurt themselves;
- b) I would like to drive a motorcycle.

Problems such as the one cited above should be rectified. A more rigorous examination of sensation seeking could be conducted which looks at the various categories of this dimension, such as thrill seeking. The current study implies that sensation seeking could be an important discriminatory variable.

### Correlations Between N Ach and Risk Taking for the Spin-Off Group

Gilson (1969), Brown (1969), and Atkinson, Bastian, Litwin and Earl (1960) found that risk taking was related to n Ach. High n Ach levels were significantly more often associated with moderate levels

of risk. This led to the postulation in the current study that  $n$  Ach would be correlated with risk taking for the spin-off group. No significant correlation was found.

One reason that could account for this fact was that the risk taking measure used was not typical of the risk taking measures used by McClelland (1961). McClelland's risk taking measures, such as the ring toss, involve skill both in selecting the payoff and influencing the outcome. The game employed in the current study only permitted the S to use skill in selecting the payoff strategy not in influencing the outcome, the turn of the card being a matter of chance. The result obtained in the present study implies that there is no correlation between the S's level of risk taking in this type of situation and his  $n$  Ach level. Further research into the possible correlates of the type of risk taking game used in the current study might prove illuminating.

#### Correlations Between Sensation Seeking and Risk Taking

Waters and Kirk (1968) using the same game as the current study found product moment correlations of .30, .37, and .29 (all at  $p < .05$ ), between sensation seeking and risk taking. As a result the current study set out to see if a significant correlation would be found in both groups between the two variables. This was not supported in the current findings, no correlation was found to exist between sensation seeking and risk taking. Two implications result from this finding. The first is that an unknown variable was operating in the Waters and Kirk study causing the correlation and that it was not present in the current study. The second is that the findings of Waters and Kirk (1968) are not generalizable.



### IQ as an Indicator of Spin-Off Tendency

Roberts and Wainer (1966) found that the average educational level obtained in the professional group from which both samples in the current study were drawn was an MSc. This led to the prediction that no significant difference in intelligence exists between the two groups. This postulate was supported in the current study.

### Comparison of Spin-Offs and Research and Development Personnel on the PRF Dimensions of Autonomy, Dominance and Impulsivity

Collins' and Moore's (1970) outline of the characteristics predominant in the personality of a spin-off included such variables as autonomy, fear of subordination, and a tendency to cut intolerable situations rather than stay and solve them. These three characteristics align with the PRF dimensions of autonomy, dominance and impulsivity, respectively. In support of Collins' and Moore's theory it was postulated in the current study that spin-offs would be significantly higher than Research and Development personnel on these dimensions. The findings in the present study only partly supported the hypothesis. Dominance was significantly higher for the spin-off than the Research and Development group. Concern for Dominance was also reflected in the responses of the spin-off group in the interview. Thirty percent of the responses of the group as to why they had spun off were concerned with "being the decision maker", "maintaining independence" and "controlling their own destiny".

Collins' and Moore's portrayal of the spin-off as a man who is trying to break away from restraints is not supported by the mean autonomy score. Neither group was markedly autonomous. No significant

difference between the two groups was found. As a result of a precipitating crisis and/or job dissatisfaction, however, 19.2% of the spin-offs were created. The net result of a new enterprise rather than that of working for others, implies some autonomy. Comparable data on the Research and Development personnel was not collected unfortunately. Starting a new enterprise was given as a possible consideration if a job dislocation occurred, however, by 12% of this group.

No significant difference was found on the impulsivity dimension between the two groups in the present study. This could suggest that the move into their own industries by the spin-offs was not a result of high impulsiveness, alternatively, perhaps this step was a well-thought-out plan.

Comparison of Spin-Offs and Research and Development Personnel on the PRF Dimensions of Harmavoidance, Affiliation, Achievement and Aggression

The PRF dimension of harmavoidance is by definition similar to risk taking. A low harmavoidance score implies lack of concern with regard to safety and lack of cautiousness. In conjunction with the previously mentioned risk taking literature of Gilson (1969) and Little (1968) it was postulated that spin-offs would score significantly lower on the harmavoidance dimension than Research and Development personnel. Support was gained for this hypothesis in the current study. Harmavoidance was a differentiating variable between the two groups.

Wainer and Rubin (1967) reported a negative relationship between need for Affiliation ( $n$  Aff) and entrepreneurial success.  $N$  Aff is, by definition, the same as the PRF's affiliation dimension, both

stressing the importance of friendship and acceptance. As a result of this it was hypothesized that a significant difference would exist between the two groups on the PRF dimension of Affiliation.

No significant difference was found in the current study on the Affiliation dimension. Two conclusions could be drawn from this finding: first, that n Aff as measured by the TAT is not the same dimension as Affiliation as measured by the PRF; secondly, that there is no relationship between affiliation as measured by the PRF and spinning off.

By definition achievement as measured by the PRF and n Ach are the same. Therefore, it was hypothesized that the PRF dimension as well as the French Insight measure of n Ach would differentiate between spin-offs and Research and Development personnel. This was not supported in the present study, achievement did not differ significantly between the two groups. This is not surprising in view of the findings of Klinger (1966) or Grisé (1972). Klinger's literature review found there was very sporadic correlation between the various measures of achievement. Grisé, from his findings, concluded that n Ach is not differentiating in the subsequent performance between high and low need achieving groups but rather, that anxiety is the key factor. He further postulates that a correlation would exist between the French Insight measure of n Ach and PRF Achievement if you could partial out the effects of anxiety.

The typical portrait of the aggressive businessman remains unsupported by this study. Aggression scores fell within 1 standard deviation of population norms. No significant difference existed between the two groups on the aggression dimension.

### Other Correlations

The negative correlation between harmavoidance and sensation seeking for both groups is consistent with Waters' and Kirk's (1968) finding; whereby, an individual becomes less cautious as the sensation seeking score goes up.

No explanation is advanced for the relationship found between dominance and sensation seeking and dominance and harmavoidance in the Research and Development group.

The product moment correlation of .46 ( $p < .01$ ) between affiliation and aggression in the spin-off group is logical by the definition of the two terms. A person highly concerned with friendship would not likely be aggressive, as it would be contrary to his purpose of starting and maintaining friendships. It should be noted however, that this finding was not duplicated in the Research and Development group.

No explanation is advanced for the other correlations found in the spin-off group between harmavoidance and intelligence .34 ( $p < .05$ ), intelligence and risk taking  $-.54$  ( $p < .01$ ), achievement and harmavoidance  $-.30$  ( $p < .05$ ) and Achievement and dominance .30 ( $p < .05$ ). It is curious to note, however, the relationship between intelligence and risk taking, and intelligence and harmavoidance for this group.

### Extrinsic versus Intrinsic Job-Reward Concerns and Resulting Preferences for the Spin-Off and Research and Development Personnel

Leuptow (1968) found that those persons with high N Ach were more concerned with occupations satisfying intrinsic needs; whereas, low need achievers were more concerned with those occupations satisfying

extrinsic needs. Williams (1965) found the same distinctions between high and low risk takers. Extrinsic needs were defined as concern with status and prestige, money, security and comfort. Intrinsic needs were defined as concerned with creativity, originality, the use of special abilities, and personal responsibility for work performance (Lueptow, 1968). Therefore, it was predicted in the current study that, because spin-offs were seen as both higher need achievers and higher risk takers than Research and Development personnel, their interests should lie mainly in the concern for intrinsic needs category. Research and Development personnel, being postulated to be lower need achievers and more conservative risk takers should be mainly concerned with extrinsic needs.

The current study asked two questions in the Interview that pertained to this issue of Intrinsic versus Extrinsic needs. To the spin-offs the question "Why did you spin out?" was addressed. To Research and Development personnel was addressed the question "What would it take to make you spin out?". The answers were sorted into intrinsic and extrinsic categories. On the basis of the above, it was postulated that significantly more of the spin-off responses would show concern with intrinsic job needs than Research and Development personnel. Research and Development personnel were hypothesized to show a significantly greater concern with extrinsic job rewards. These hypotheses were supported. Lueptow's category of intrinsic responses labeled "personal responsibility for work performance" was paralleled in the present study by a high frequency of responses from the spin-off group in the category "determining our own environment". "Challenge" responses in the present

study were reflective of "creativity and a use of special abilities" in the Lueptow study. "Status and prestige" was the only category of response in Lueptow's analysis that did not appear in any form in the current study.

#### Comparison of Percentage of Entrepreneurial Fathers for the Spin-off and Research and Development Groups

In a previous study Roberts and Wainer (1966) found that entrepreneurial fathers had disproportionately more entrepreneurial sons than a control group of non-entrepreneurial fathers. In their study, 24% of the non-entrepreneurial fathers as compared to 50% of the entrepreneurial fathers had entrepreneurial sons. On the basis of this previous finding, the reverse relationship might be expected in the present study, that is, that the spin-off group would have significantly more entrepreneurial fathers than the Research and Development group. As predicted the spin-off group had significantly more entrepreneurial fathers than the Research and Development group. Seventeen percent of the Research and Development group had entrepreneurial fathers whereas 39% of the spin-off group had entrepreneurial fathers.

It would appear that the son adopts the value system of the parents, which, if the father is self-employed, is probably achievement oriented. It seems logical that individuals with high n Ach would, on the average, tend to drift or find themselves in the business world as it requires those characteristics which they possess. In addition, close contact with a successful model probably had an influence on the son's behaviour. Little (1968) found that those most willing to take risks

were those who had been exposed to a high risk-taking decision maker.

### Implications and Conclusions

Hypotheses 1, 2, 5, 7, 10, and 11 were entirely supported. Hypothesis 8 was supported for the dominance dimension. Hypothesis 9 was supported for the harmavoidance dimension. This implies that personality characteristics are capable of discriminating between the spin-off and Research and Development groups. It would appear that if Canada is genuinely concerned with increasing technological innovation that there be a realization of the significance of personality characteristics in relation to this problem.

Perhaps if a high n Ach environment was initiated and perpetuated in the area of Research and Development more entrepreneurial activity would result. The current findings supported the concept of spin-offs being higher need achievers. If high n Ach behaviour was reinforced by governmental, educational and familial institutions, raising Canada's overall level of n Ach, more entrepreneurial ventures would result.

Secondly, if the risk taking data in the current study is further supported in future investigations then either the amount of risk involved in starting an enterprise has to be reduced or the risk taking level of the technological population and investors in Canada has to rise. Traditional conservatism appears to be the antithesis of successful innovation.

Persons who are recognized as being high on the dimensions of n Ach, risk taking, stimulation seeking and dominance should be encouraged to take the step of spinning out, or should be allowed more scope for innovative activity in their present positions.

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## APPENDIX A

### PERSONALITY RESEARCH FORM SCALES

<u>SCALE</u>	<u>DESCRIPTION OF HIGH SCORER</u>	<u>DEFINING TRAIT ADJECTIVES</u>
Achievement	Aspires to accomplish difficult tasks, maintains high standards and is willing to work toward distant goals; responds positively to competition; willing to put forth effort to attain excellence.	striving, accomplishing, capable, purposeful, attaining, industrious, achieving, aspiring, enterprising, self-improving, productive, driving, ambitious, resourceful, competitive.
Affiliation	Enjoys being with friends and people in general; accepts people readily; makes efforts to win friendships and maintain associations with people.	neighbourly, loyal, warm, amicable, good-natured, friendly, companionable, genial, affable, cooperative, gregarious, hospitable, sociable, affiliative, good-willed.
Aggression	Enjoys combat and argument, easily annoyed; sometimes willing to hurt people to get his way; may seek to "get even" with people whom he perceives as having harmed him.	aggressive, quarrelsome, irritable, argumentative, threatening, attacking, antagonistic, pushy, hot-tempered, easily-angered, hostile, revengeful, belligerent, blunt, retaliative.
Autonomy	Tries to break away from restraints, confinement, or restrictions of any kind; enjoys being unattached, free, not tied to people, places, or obligations; may be rebellious when faced with restraints.	unmanageable, free, self-reliant, independent, autonomous, rebellious; unconstrained, individualistic, ungovernable, self-determined, non-conforming, uncompliant, undominated, resistant, lone-wolf.
Dominance	Attempts to control his environment and to influence or direct other people; expresses opinions forcefully; enjoys the role of leader and may assume it spontaneously.	governing, controlling, commanding, domineering, influential, persuasive, forceful, ascendant, leading, directing, dominant, assertive, authoritative, powerful, supervising.

<u>SCALE</u>	<u>DESCRIPTION OF HIGH SCORER</u>	<u>DEFINING TRAIT ADJECTIVES</u>
Harmavoidance	Does not enjoy exciting activities, especially if danger is involved; avoids risk of bodily harm; seeks to maximize personal safety.	fearful, withdraws from danger, self-protecting, pain-avoidant, careful, cautious, seeks safety, timorous, apprehensive, precautionary, unadventurous, avoids risks, attentive to danger, stays out of harm's way, vigilant.
Impulsivity	Tends to act on the "spur of the moment" and without deliberation; gives vent readily to feelings and wishes, speaks freely; may be volatile in emotional expression.	hasty, rash, uninhibited, spontaneous, reckless, irrepressible, quick-thinking, mercurial, impatient, incautious, hurried, impulsive, fool-hardy, excitable, impetuous.

## APPENDIX B

### French Insight Test

#### Verbal Instructions

This is a test of your understanding of the reasons why people behave as they do. You will be given a characteristic behaviour of each of 10 men. Your task is to explain why each man behaves as he does. Read each description then decide what you think would usually be the reason why a man behaves as this man does.

Describe what this man is LIKE, what he wants to have or do, and what the results of his behaviour are apt to be.

If you think of more than one explanation, give the most likely.













## APPENDIX C

### SENSATION SEEKING SCALE

\*\*

1. (MF) A. I would like a job which would require a lot of travelling.  
B. I would prefer a job in one location.
2. (MF) A. I am invigorated by a brisk, cold day.  
B. I can't wait to get into the indoors on a cold day.
3. (M) A. I find a certain pleasure in routine kinds of work.  
B. Although it is sometimes necessary I usually dislike routine kinds of work.
4. (MF) A. I often wish I could be a mountain climber.  
B. I can't understand people who risk their necks climbing mountains.
5. (MF) A. I dislike all body odors.  
B. I like some of the earthy body smells.
6. (MF) A. I get bored seeing the same old faces.  
B. I like the comfortable familiarity of everyday friends.
7. (MF) A. I like to explore a strange city or section of town by myself, even if it means getting lost.  
B. I prefer a guide when I am in a place I don't know well.
9. (MF) A. I would not like to try any drug which might produce strange and dangerous effects on me.  
B. I would like to try some of the new drugs that produce hallucinations.
10. (MF) A. I would prefer living in an ideal society where everyone is safe, secure, and happy.  
B. I would have preferred living in the unsettled days of our history.
11. (MF) A. I sometimes like to do things that are a little frightening.  
B. A sensible person avoids activities that are dangerous.
12. (MF) A. I order the dishes with which I am familiar, so as to avoid disappointment and unpleasantness.  
B. I like to try new foods that I have never tasted before.
14. (M) A. If I were a salesman I would prefer a straight salary, rather than the risk of making little or nothing on a commission basis.  
B. If I were a salesman I would prefer working on a commission if I had a chance to make more money than I could on a salary.

\*\* Sex of subject to whom question is directed.

15. (MF) A. I would like to take up the sport of water skiing.  
B. I would not like to take up water skiing.
16. (M) A. I don't like to argue with people whose beliefs are sharply divergent from mine, since such arguments are never resolved.  
B. I find people that disagree with my beliefs more stimulating than people who agree with me.
17. (MF) A. When I go on a trip I like to plan my route and timetable fairly carefully.  
B. I would like to take off on a trip with no preplanned or definite routes, or timetables.
20. (MF) A. I would like to learn to fly an airplane.  
B. I would not like to learn to fly an airplane.
21. (MF) A. I would not like to be hypnotized.  
B. I would like to have the experience of being hypnotized.
22. (MF) A. The most important goal of life is to live it to the fullest and experience as much of it as you can.  
B. The most important goal of life is to find peace and happiness.
23. (MF) A. I would like to try parachute jumping.  
B. I would never want to try jumping out of a plane, with or without a parachute.
24. (MF) A. I enter cold water gradually giving myself time to get used to it.  
B. I like to dive or jump right into the ocean or a cold pool.
26. (MF) A. I prefer friends who are excitingly unpredictable.  
B. I prefer friends who are reliable and predictable.
27. (MF) A. When I go on a vacation I prefer the comfort of a good room and bed.  
B. When I go on a vacation I would prefer the change of camping out.
28. (MF) A. The essence of good art is in its clarity, symmetry of form, and harmony of colors.  
B. I often find beauty in the "clashing" colors and irregular forms of modern paintings.
31. (MF) A. I prefer people who are emotionally expressive even if they are a bit unstable.  
B. I prefer people who are calm and even tempered.

32. (MF) A. A good painting should shock or jolt the senses.  
B. A good painting should give one a feeling of peace and security.
33. (M) A. When I feel discouraged I recover by relaxing and having some soothing diversion.  
B. When I feel discouraged I recover by going out and doing something new and exciting.
34. (MF) A. People who ride motorcycles must have some kind of an unconscious need to hurt themselves.  
B. I would like to drive or ride on a motorcycle.

APPENDIX D  
Risk Taking Game  
Verbal Instructions

These are the probabilities on any single draw, if you call this bet, of achieving it. (Point to probabilities) For example, if you say this card is red the odds are 1 in 2 you will be right. If you say it is a black 10, 1 in 26.

The purpose of this game is to figure out a way of maximizing your score in 20 draws. Your score on any draw in which you are right is the denominator of the strategy you adopted, for example, 2, 4, 13, 26, or 52 points.

If you beat an undisclosed score, you will win \$1.00. The score is undisclosed so as not to influence your strategy. You may adopt 1 or a combination of strategies. Try to equate this to your business behaviour.

## APPENDIX D (continued)

<u>Payoff</u>	<u>Bet</u>	
2	1/2	Colour (e.g., black)
4	1/4	Suite (e.g., clubs)
13	1/13	Denomination (e.g., 9)
26	1/26	Colour + Denomination (e.g., red 10)
52	1/52	Suite + Denomination (e.g., 10 of clubs)

Probability Curves



## APPENDIX E

### INTERVIEW QUESTIONS FOR RESEARCH AND DEVELOPMENT PERSONNEL

1. Where did you obtain your post secondary education? What degrees do you have? What year did you graduate?
2. Give me a brief resume of your job history since graduation. Please tell me whether the emphasis was on research and/or development.
3. When did you get married?
4. When did you have your first child?
5. Why have you not started your own technologically based firm with your know how?
6. Why aren't more Canadians starting their own firms?
7. How many marketable ideas do you have a year on the average?
8. What would you do about the business, financial and marketing aspects of your firm if you were to start one?
9. If you were fired or laid off what would you do?
10. Were you born in Canada?
11. Did your father own his own firm?
12. What would it take to make you start your own company?

## INTERVIEW QUESTIONS FOR ENTREPRENEURS

1. Where did you obtain your post secondary education? What degrees do you have? What year did you graduate?
2. Give me a brief resume of your job history since graduation. Please tell me whether the emphasis was on research and/or development.
3. When did you get married?
4. When did you have your first child?
5. Why did you spin out?
6. Why are not more Canadians in your position spinning out?
7. What was the single biggest problem in starting your own firm?
8. Where did you get your business experience?
9. Where did you get your marketing experience?
10. Did your father own his own firm?
11. Were you born in Canada?

APPENDIX F

QUICK TEST

FORM 1	FORM 2	FORM 3
crystalized	proprietor	exhibition
turntable	inattentive	soothed
saccharin	indulging	caress
immature	precipitation	combatant
cordiality	freshet	forlone
velocity	transom	nutrient
decisive	consumption	solace
laceration	aquatic	pacify
foliage	perilous	contorted
imperative	terrain	jets
intimacy	imminent	doleful
concoction	foresight	tines
conviviality	condensation	disconsolate
chevrons	satiation	sustenance
condiment	visceral	maudlin
cacophony	bovine	gustatory
miscible	replete	poignant
imbibe	prehension	bellicose
amicable	ingress	comestible
pungent	celerity	despondency

VITA.

Name: Mary Helen Elizabeth Atkinson

Date and Place  
of Birth: February 1, 1945  
Toronto, Canada

Education:

Stratford Teachers' College  
Stratford, Ontario  
Elementary Permanent Teaching Certificate  
Standard 4

Waterloo Lutheran University  
Waterloo, Canada  
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