The nature of a technological spin-off

THE NATURE OF A TECHNOLOGICAL SPIN-OFF

STUDY COMMISSIONED BY MOSST

Mosaic Consultants

The following report is submitted to the Ministry of State for Science and Technology by Mosaic Consultants in fulfillment of contract RN: 0S002-4-D244, FC: 1-1850-000-000-0413, Serial # 0SY40115.

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Introduction

Continuing concern with Canada's lack of entrepreneurs in the technical fields was the primary motivating force behind this study. There are several ways of attacking the problem: increase the availability of revenue to innovators, run management courses for scientists and engineers, provide tax incentives, etc. Implementation of these policies in the existing framework of society would be a blind, trial and error approach because no consideration is given to the nature of a successful technological spin-off (TSO). Information concerning the psychological make-up of such an individual should increase the success rate of attempts to identify and assist these people.

The present study is a follow-up of Atkinson's (1972) study in which several variables were investigated as to their ability to differentiate TSO's from their peers in the laboratory.

At that time eleven hypotheses were investigated. Eight of these were supported. These were the following:

1) Spin-offs had a significantly higher level of n'Ach then R&D personnel
2) Risk-taking using a combination skill-chance game differentiated group membership
3) Spin-offs had a significantly higher sensation-seeking score than their peers
4) No significant difference in intelligence exists between the two groups
5) Spin-offs were more concerned with intrinsic than extrinsic job reward concerns

6) Spin-offs had a significantly higher percentage of entrepreneurial fathers as compared to R&D personnel
7) Spin-offs were significantly higher on a dominance dimension
8) Spin-offs were lower on a harmavoidance dimension than their peers

The present study is an attempt to investigate some of these variables in greater depth due to recent advances in research. The specific variables to be further investigated are risk taking, sensation seeking, and intrinsic versus extrinsic job reward concerns. These three variables were previously examined as if they were unidimensional; whereas, recent findings all indicate their multi-dimensional nature. In addition, the value hierarchies of the two groups will be compared to determine if there are any values which can effectively determine group membership.

The method of analysis in the present report is more rigorous. A multivariate ANOVA was the statistical procedure employed previously. This technique indicates whether significant differences exist in the performance of groups, thus determining whether they are from the same population; however, it does not mean that the variable can differentiate between subjects. A discriminant function analysis was added to the data analysis procedure because it will provide a list of the variables which do discriminate group membership as well as the weights these variables should receive.

Intrinsic Versus Extrinsic Job Reward Concerns

Introduction:

The Atkinson (1972) study using an informal open-ended interview approach found that a significantly higher number of entrepreneurial subjects

mentioned intrinsic rewards as the reason for setting up their own company. Their technological peers conversely mentioned extrinsic rewards as the reason for not setting up their own firms. On the basis of this finding, it was decided to attempt to isolate those specific intrinsic factors which were responsible for the decision to spin-off.

The literature was searched for the following reasons:

1) To find a suitable measure
2) If no suitable device was located, to isolate those intrinsic and extrinsic variables which could be used to construct a device for this study.

No comprehensive measure was found; therefore, the second approach was adopted. The motivation literature basically concerns itself with various classification systems for motivators and a few validity studies. The job satisfaction, job motivation, turnover, and psychological motivation literature is the main source of research in this area.

It should be noted that any research and/or measurement device that purports to make statements about the nature and intensity of various motivators on a group or individual is clearly affected by time, the enveloping culture, and specific sub-cultural components (Behling & Shapiro, 1974). For the first points we need go no further than the U.S. in the twentieth century to see an example of the changes that have taken place over time. Americans at work in the early part of the century were strongly motivated by financial incentives. The well documented Taylorian incentive system lends support to this; whereas, recent research has shown that there is an increasing interest in self-actualization and achievement as powerful motivators.

Cross cultural differences abound in comparitive literature. For example, whereas autonomy is important to an American worker, his counterpart in a developing nation finds this much less desirable.

Sub-cultural variables such as socio-economic class are also influential in delineating an individual's concerns. Typical middle class concerns are positive affect for occupational achievement, a belief in the intrinsic value of hard work, striving for the attainment of responsible positions and a belief in the work related aspects of the protestant ethic. Blue collar workers conversely do not seek meaning in their work.

Another point of interest is how certain motivators have become such. It is possible that many of them have been created not out of need, but by reinforcing behavior that leads to them. This is the Skinnerian principle of operant conditioning. In the classic case of superstitious conditioning in pigeons, pigeons were found to repeat behaviors that were contingent to being fed a pellet because they had made the assumption that the behavior, no matter how bizzare, had led to the food. In business a popular fad (e.g. interpersonal communication) can be introduced and the emphasis of the company becomes to promote programs that will utilize the employees' need for that variable. Business now responds to every request for interpersonal communication and developes programs that reinforce behavior that leads to interpersonal communication. This is an interesting slant to motivation theory. It implies in the context of the present study that if the two groups show differing patterns of motivators, these could be varied by the industry itself and an entrepreneurial pattern of motivators created in the non-entrepreneurial group.

Academic Theories of Motivation

Herzberg's (1968) two-factor theory of motivation is the most well-known work in the area and has generated wide-spread research. The Herzberg approach was to interview a subject, ask him to think of a time he felt good/bad about his job and to describe what was occurring. The conclusion of this study was that a set of factors (recognition, etc.) is associated with satisfaction on a more-to-less continuum and that another set of factors (company policy, etc.) is associated with dissatisfaction on a more-to-less continuum. The satisfiers he identified were achievement, recognition, work itself, responsibility, advancement and growth. The dissatisfiers were company policy, supervision, work conditions, relationship with supervisor, salary, relationship with peers, personal life, relationship with subordinate status, and security. A typical critique of the Herzberg approach and one that is considered by the present study is the exclusive separation of the two lists (Evans, 1970). It is apparent that recognition and peers are in fact related in that peers supply the recognition. A more useful division of motivators is considered to be the extrinsic, intrinsic classification. Extrinsic motivators are perceived as those factors outside the person which influence a persons behavior. Intrinsic are those non-tangible variables within a persons psyche which influence his behavior.

Reece's (1972)research used a unique classification system -- event motivators and feeling motivators. Feeling motivators such as accomplishment, growth, etc. were found to be more influential in job satisfaction than event motivators such as challenging work. Some items

in these lists could be applied to an extrinsic-intrinsic framework as well. The ones selected were security, decision making, growth, promotion. This study was of particular note in that it compared government R&D personnel with private contractors. Contrary to the hypothesis of the present study and the finding of the Atkinson (1972) study, the contractors were more security-oriented than the R&D personnel. However, this could be as a result of the type of laboratory involved -- in this case exclusively government; whereas, university and industrial laboratories were used as well in the Atkinson study.

Gomersall's (1971) study employed a two-dimensional scaling system based on maintenance needs (workmen's compensation, fairness) and motivational needs (delegation, freedom to act). These again can be classed as extrinsic or intrinsic variables. The findings in this study are of significant note. Using R&D personnel of Texas Instruments as subjects, Gomersall found that they were highly motivated by achievement; whereas, company policy, pay and compensation were not even considered. This is contrary to Atkinson (1972) as she found extrinsic variables weighted more heavily with an R&D group. The IRI (1969) study group, however, concurred with the Atkinson report in that the most significant rewards were power, recognition, work and pay.

Arndt (1972) identified a variable which he felt distinguished entrepreneurs from their peers -- desire for distinction (status, prestige). To quote Herskovits (1940) "Among any group it is one of the most significant rewards men can strive for since nothing is so heady, so quickly appreciated in any level, as the recognition of ability, and the measure of respect and enhancement of social standing that accompanies it."

Business has appreciated for some time that incentives other than cash rewards are operating in the production process. McCabe (1971-72) perceives this as a function of this society's generally high level of affluence. People with more leisure time and disposable income seek the "inner luxuries" a sense of value and personal worth measured apart from the economic struggle. He defines salesmen as self-starters and men motivated by inner rather than external push-pull -- the current study proposes that entrepreneurs like salesmen would definitely be more inner than outer directed for the same reason.

A study that examined the differences between a scientist's and engineer's motivational framework found that salary was the key discriminating variable (Badawy, 1971). The current study hypothesizes that pay will discriminate between R&D personnel generally, whether scientist or engineer, and technological spin-offs. The argument supporting this statement is that entrepreneurs are more intrinsically than extrinsically motivated, therefore they have discarded a secure salary in favour of an autonomously created environment.

Bujake (1972) in an attempt to determine factors which affect the productivity of engineers developed an eleven area motivation test. He found that a dissatisfied engineer -- which could be perceived as a potential spin-off -- was basically concerned with achievement needs, non-motivating recognition, challenging work, personal growth and responsibility. These are all intrinsic rewards, thus they support the primary hypothesis. Another interesting finding which is congruent with this study was that R&D personnel's goals were mostly extrinsically related, e.g. live in a desirable community, employment stability.

Dewhirst (1973) found turnover was highly related to task importance. Those persons who considered their work to be insignificant were more likely to leave an organization than those who did not. Consequently, it is hypothesized that job importance is another variable which will distinguish the two groups.

Intrinsic versus Extrinsic Testing Device:

The following list of variables was selected to constitute items on the measuring device:

Intrinsic	Extrinsic
independence	peers
self-respect	hours for work
power & control	job location
decision-making	salary
challenge	physical working conditions
achievement	nature of work
responsibility	administration and communication
recognition	advancement opportunities
minimize stress and tension	social relevance
security	meaningfulness of work

Hypotheses:

In general, the influence of intrinsic versus extrinsic rewards is hypothesized to be significantly different for the two groups. TSO's should have a significantly higher score on intrinsic items than their peers. Considering the variables independently, all intrinsic variables are considered to be good discriminators of group membership. The reverse should hold as well. Extrinsic variables should discriminate R&D personnel from TSO's. The best discriminators will be independence, decision-making,

challenge, security and salary.

Sensation Seeking

Introduction:

Sensation-seeking (SS) was a variable in the Atkinson (1972) study upon which TSO's performed significantly higher than their peers. This variable was investigated at that time because it seemed logical to conclude that TSOs had a higher optimal level of novelty seeking by the very nature of the occupational pattern they had embarked upon. In addition, SS was previously found to correlate positively with such variables as: novelty seeking (McReynolds, 1970) risk taking (Watkins & Kirk, 1968), field independence (Linden, 1968), autonomy, change and exhibitionism (Zuckerman & Link, 1968). SS correlated negatively with anxiety (Kolin, Zuckerman, Price & Zoob, 1964), (Segal, 1973), deference, nurturance, and orderliness (Zuckerman & Link, 1968). In addition, the Sensation Seeking Scale (SSS) has shown itself to correlate with many forms of behavior such as smoking, drinking, drug usage, sexual behavior, hypermania and willingness to volunteer (Zuckerman, et.al., 1967).

Those characteristics listed above, more so than the behaviors are in line with the classical picture of the entrepreneur; thereby adding external validity to the concept of the entrepreneurs as a high sensation seeker. The negative correlation of anxiety and fear with SS was noteworthy. This could be interpreted as a biological adaptation by the organism to high levels of stimulation. This would prevent the organism from being in a constant state of stress due to stimulation, thus reducing risk of ulcers, etc.

The Four Dimensions of the SSS:

Farley (1960) suggested that the SSS was multi-dimensional. Zuckerman (1971) factor analyzed the SSS and discovered in addition to the general SS factor, four factors -- thrill and adventure seeking, experience seeking, disinhibition and boredom susceptibility. The thrill and adventure seeking factor consists of items which express a desire to engage in outdoor sports and other activities involving elements of speed and danger.

The experience seeking factor might be termed a "hippie" factor. It's essence is experienced for its own sake. This factor describes the seeking of arousal through the mind and the senses.

The disinhibition factor might also be labeled "swinger". It consists of items which express loss of social inhibitions.

The boredom and susceptibility indicates a dislike of repetition routines, dull people, and a restlessness with any form of stability. It incorporates the need for change and variety more than any other factor.

Hypotheses:

Boredom susceptibility is the sensation seeking factor that is predicted to discriminate most effectively between the two groups. Experience seeking is also hypothesized to account for the significant difference in the overall SSS found previously. The total sensation seeking score is predicted to discriminate group membership, those higher on this factor being TSO's.

Risk Taking

Introduction:

Risk taking in the form of a gambling situation, with very little skill input, discriminated between entrepreneurs and their peers in the Atkinson (1972) study. At that time risk taking was investigated because it seemed a necessary prerequisite to establishing business concerns in Canada and because it correlated positively with other variables being investigated such as n'ach (McLelland, 1961) and sensation seeking (Waters and Kirk,1968).

The Multi-dimensional Nature of RT:

At the time of the 1972 research, it was noted that risk taking was a multi-dimensional construct. According to Slovic (1964):

> "No one has fully explored preferences among gambles in which the expected value, variance and probability have all been systematically investigated, 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.225).

Gambles commonly are characterized as multi-dimensional stimuli. For example a two out-come gamble in which one outcome is a gain of some amount of money and the other is a loss can be described by its location on four basic risk dimensions -- probability of winning (Pw), amount to be won ($w), probability of losing (P_L) and amount to be lost ($\$_L$). A person typically pays more attention to some risk dimension than another in a risk situation. For example, a person with very little money and a great fear of losing it may focus his attention on the amount to lose and base his decisions almost exclusively on this dimension, largely

disregarding the other information present in the bet.

A review of the most influential theories and constructs used to describe RT will help place the present ideas in perspective.

A) The Expectation Models

1. Expected Value Model -- the attractiveness of a gamble corresponds to the gamble's mathematical expectation.

$$EV = Pw.\$w + P_L.\$_L$$

This model asserts that a person's choice between alternative gambles maximizes EV.

2. Subjective expected utility -- persons make decisions on the basis of subjective rather than stated probability.

$$SEV = S(Pw)\ u(\$w) + S(P_L)\ .\ u(\$_L)$$

where s(P) and u($) represent subjective functions.

B) The Probability Preferences

Each person has an ideal Pw. When other variables such as EV are controlled preferences among bets are determined by similarity of each bets Pw to the person's ideal.

C) Preferences for Variance

People base their risk decisions not only on expectation, but also on the dispersion of a gamble's possible outcomes.

$$var = PwP_L\ (\$w-\$_L)^2$$

A person's utility for risk often has been equated with his preference for variance (Kogen & Wallach, 1967).

The RT Model:

As a result of research in the above areas of RT Slovic,and Lichtenstein (1968) concluded that the only way to determine people's preferences and patterns in RT situations was to systematically manipulate the probabilities, variances and EV to permit a precise quantitative study of the manner in which responses to gambles change. The technique they employed, a duplex gamble, is capable of separating the (P_L) from (Pw) and \$w from $\$_L$. A correlational matrix of subjects responses to 27 gambles with an overall EV of 0 is used. A rather unusual model of risky decision making underlies this data-analysis technique:

$$AG = u + w_1Pw + w_2\$w + w_3P_L + w_4\$_L$$

AG is the attractiveness of a gamble and w's are the weights reflecting the relative importance of each dimension. This model combines in an additive fashion variables such as Pw and \$w or P_L and $\$_L$, which are usually thought to combine multiplicatively. There is support for this procedure in Hays (1963). In addition, it assumes that the impact of probabilities and payoffs is a linear function of their objective value.

Hypotheses:

There are two reasons for employing this approach. One is to determine what the pattern of weightings for the entrepreneurial group is. It seems logical to propose that the most important dimension will be the amount to be won. This is based on the previous Atkinson (1972) finding that perceived risk is relatively in line with the actual risk involved. This group typically gambles in a high risk manner; therefore,

the amounts rather than the probabilities are concluded to be the deciding factor.

The other reason is to determine whether any of the risk dimensions are capable of differentiating group membership. No specific hypotheses are advanced.

Values

Introduction:

Value measurement has over the past decade become a usable tool for assessing personality differences. Attention has been directed at deriving a theoretical framework in which to place values. Definitions were so abundant at one point that they were classified under fifteen headings (Thurstone, 1959). In recent literature there appears to be a convergence of a multitude of theoretical positions. Rokeach's definition is in accordance with Kluckhohn (1952), Smith (1969) and Williams (1967) when he states

> To say that a person has a value is to say that he has an enduring belief that a specific mode of conduct of end state of existence is personally and socially preferable to alternative modes of conduct or end states of existence. Once a value is internalized it becomes consciously or unconsciously a standard or criterion for guiding action for developing and maintaining attitudes toward relevant objects and situations for justifying one's own and others' actions or attitudes for morally judging self and others and comparing oneself and others. Finally a value is a standard employed to influence the values, attitudes and actions of at least some others, for example, our children's.

Value Attainment:

Values are generally incorporated into the self because the organism requires these values for personality integration and biological survival.

There are two sorts of requiredness: personal requiredness and

social requiredness.

1. Personal requiredness breaks down into two kinds; whereby, the individual incorporates values into his structure: conscious requiredness and self-requiredness. The first set of values are inflexibly held, irrationally applied, and are typically implicit or unconscious rather than explicitly formulated by the person who holds them. The latter values may be implicit but, in any case, are accessible to conscious formulation. They are actively embraced by the person and thus become constituents of self (Smith, 1969). These values are incorporated into the personality as a result of attempting to develop and maintain the personality as a more or less integrated system. Biological survival and functioning are also influential in the genesis of values.

2. Social requiredness values are those whose significance for the individual depends on the actual or imagined sanctions of approval or disapproval that back them up. They are extrinsically related to personality rather than intrinsically (Smith, 1969). Men are inevitably social. Being Social, they cannot in general dispense with standards in terms of which they judge their fellows (Woods, 1956). Additional value standards are developed within a culture in response to questions raised concerning congruity and priority among values, desirability of means, and the metavalues of the ultimate desirability of the culture itself (Williams, 1967). This concept of value change and the techniques by which it takes place supports an optimistic outlook for those interested in increasing entrepreneurial activity in Canada. If certain values are capable of discriminating between TSO's and their peers, then it should be possible to devise methods of teaching these to non-entrepreneurs. Rokeach in several studies (1968), (1971), (1973) has already demonstrated the usefulness of value measurement

in discriminating between various groups.

Hypotheses:

The present study hypothesized that four values of the eighteen in the Rokeach Value Survey will be part of the resultant discriminant function. These are freedom, exciting life, family security, and friendship. The first two are hypothesized to be ranked higher by the TSO's, the latter two lower. The former two are seen as important values to the TSO's as they seem to be inherent in their occupational choice. The latter two are seen as being less important to these men because of the nature of the risk they are willing to put their family through and the time dedication required to make a company successful.

Summary of Hypotheses

Seven major hypotheses are advanced in this study.

1. The 20 items on the intrinsic-extrinsic device will be good discriminators between TSO's and their peers in the laboratory. TSO's are hypothesized to rank intrinsic items significantly higher than R&D personnel. The latter are predicted to rank extrinsic items significantly higher. The items which are proposed to receive the highest weights in the Discriminant Function are:

independence

decision making

challenge

security

salary

TSO's will rank the first three higher than their peers and the last two lower.

2. The overall extrinsic score will effectively discriminate group membership. R&D personnel will have a significantly higher score.

3. The sensation seeking total score will be part of the discriminant function. TSO's will score significantly higher on this device.

4. Boredom susceptibility and experience seeking will both be discriminators. High scores will indicate membership in the TSO group.

5. Amount to be won will be the component which receives the heaviest weighting from the TSO's.

6. There will be a significant difference in the response patterns of the two risk groups which will result in one or two discriminators.

7. Four values of the Rokeach Value Survey will form part of the discriminant function. These are: freedom, exciting life, family security and friendship. The first two will be ranked as more important by TSO's than their peers, the latter two lower.

Sample:

R&D directors, persons engaged in the industry, and the R&D directory for Canada were the prime sources of potential subjects. Eligible persons were approached by mail or telephone to see if they would participate. The sample was drawn from those who agreed. This is not pure random sampling, but it was the only feasible approach as it is not possible at this time to identify all the R&D personnel or all the technological spin-offs. Within these constraints the procedure employed ensured regional representation as well as representation by various industrial groups (e.g. chemical, physical, etc.). The mean age of the R&D group was 39 years and of the TSO's was 44. The mean education level of the R&D's and of the TSO's was five years post-secondary or master's level.

Materials:

Intrinsic versus Extrinsic Rewards

Two devices were created based on twenty items - 10 intrinsic, 10 extrinsic. These items were selected after an intensive literature review.

The first device was a matrix with intrinsic items on the column axis and extrinsic items on the row axis. The subject was to respond by comparing two items at a time and indicating the most important one in a job related situation (See Appendix A).

The second device consisted of a random presentation of the same twenty intrinsic-extrinsic items which the subject must rank. (See Appendix B).

Sensation Seeking Scale

The modified form of Zuckerman's Sensation Seeking Scale consists of items representing four factors - thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility. It is rationally constructed paper and pencil measure (See Appendix C).

Risk-Taking Game

A duplex gamble created by Slovic and Lichtenstein (1968), was employed. The subject is presented with a roulette wheel on which specific probabilities have been marked off, either 20% and 80% or 40% and 60%. He is presented with either a win or a lose gamble under the following set of instructions (the alternate instructions are in brackets).

There is a X% chance that you can win (lose) $Y or a 100%-X% chance that you can win (lose) $0. How much will you pay to be allowed to play

(not to have to play) and spin the wheel? The subject is forced up to his maximum bid. He is led to believe he is playing with real money and that he and the interviewer will have to settle up later. His responses are recorded. Every subject is given 9 duplex bets. Every three subjects represent a total of 27 different bets the EV of which is 0. The amounts to be won or lost were $1, $2 or $4 (See Appendix D).

Value Scale

The terminal list of Rokeach's (1967) Value Survey was used (See Appendix E). This list includes 18 end-state goals on gum labels. The subject is asked to rank-order these values by sticking the labels in order of the most to least important to him personally.

Interview

The subject was asked four questions:

1. educational status
2. marital status
3. Father's occupation
4. age

This information was recorded. During the interview session an attempt was made to get the subject to relax and relate. The order of presentation of tests was to alternate monotonous ones with amusing ones. The same order of presentation was adhered to. The same interviewer was used for all subjects. She was fully trained in the administration of the various devices. She was also unbiased in that she knew nothing about the various hypotheses of the study or who the subjects represented. The scorer was

in a similarly blind position.

Results

Discriminant function analysis is a technique for identifying the dimensions on which prespecified groups are different. In other words, given the R&D group and the TSO group, how are they different. The discriminating function which is constructed is the linear composite of the variables included that maximally discriminate among the groups. You get one less discriminant function than you have groups. Unlike a lot of other multivariate analyses you get a significance test of the whole function.

The first phase of the analysis was to conduct three separate univariate analyses. The reason the data was broken into three groups was that there was too few subjects to look at the 51 variables in one analysis. The variables in the first group were marital status, father's occupation, extrinsic job reward concerns, thrill seeking, experience seeking, disinhibition, boredom, probability of winning, probability of losing, amount to be won, and amount to be lost.

Table 1 contains the results of the discriminant function analysis for this group of variables. The overall function was significant. The highest seven variables were chosen to form the discriminant function as they all had scaled weights higher than one. In order of their importance as predictors, the following list was constructed:

1. extrinsic job rewards
2. father's occupation
3. experience seeking (sensation seeking)
4. amount to be lost (risk)

5. probability of losing (risk)
6. disinhibition (sensation seeking)
7. marital status

In terms of an entrepreneur, a given individual is more entrepreneurial if he scores lower on extrinsic, higher on experience seeking and disinhibition, and is less concerned with the probability of losing and amount to be lost than his peers. In addition, if his father was an entrepreneur and he is unmarried then his chances of being a member of the TSO group are greater. All these findings are in support of the hypotheses with the exception of the disinhibition scale of the SSS. The original hypothesis was that the two scales which would account for the overall significance of the SS as a differentiating variable were the boredom susceptibility and the experience seeking scales. In retrospect the fact that boredom susceptibility does not account for differences could perhaps be explained by the fact that both groups have chosen a profession where investigation and curiosity are built-in parameters. Both R&D and TSO's, therefore, scored high and similarly on this variable.

In the next analysis, the 20 intrinsic, extrinsic variables were used. This function was significant. The eight variables with the highest scaled weights were selected as the best components of a discriminant function when this test is the only one to be given (See Table 2). These in their order of importance are as follows:

1. independence
2. administration and communication
3 self-respect
4. power and control

TABLE 1

Number	Variable Name	Group 1 R&D Mean	Group 2 TSO's Mean	Grand Mean	1-way ANOVA P(significance levels)	Discriminant Function Scaled Weights	Rankings of Best Discriminators
1	Marital status (0-1)	.90	.81	.86	.3	-1.044	7th
2	Father (0-1-2)	.48	.96	.70	.04*	2.205	2nd
3	Extrinsic concerns	26.6	17.8	22.6	.0006***	-2.928	1st
4	Thrill seeking	6.97	7.27	7.10	.7	.054	
5	Experience seeking	6.87	8.31	7.53	.047*	1.512	3rd
6	Disinhibition	5.03	4.69	4.88	.6	-1.228	6th
7	Boredom Susceptibility	8.77	8.58	8.68	.7	.606	
8	Risk (Pw-Bw)	.609	.617	.613	.8	.553	
9	Risk (P_L-B_L)	.490	.381	.440	.3	-1.355	5th
10	Risk ($w-Bw)	.478	.464	.472	.8	-.288	
11	Risk ($\$_L$-$B_L$)	.424	.424	.424	.9	1.474	4th

5. decision making
6. social relevance
7. job location
8. physical working conditions

Independence, administration and communication, self-respect, power and control, decision-making, and social relevance were all ranked as more important by TSO's than their peers. All but administration and communication were items connected with intrinsic rather than extrinsic rewards. The administration and communication item is logically consistent with a TSO's responsibilities. Job location and physical working conditions are ranked as less important by TSO's than their peers. These are both extrinsic variables. Security, challenge and salary all failed to support the hypothesis.

The third analysis which was significant was performed on the value survey results. The top seven scaled weights were selected as representing the best discriminant function on the basis of the one test (See Table 3). The values in their order of importance in this function are listed below:

1. self-respect
2. exciting life
3. freedom
4. mature love
5. world peace
6. national security
7. happiness

Self-respect, exciting life, national security and freedom were all ranked higher by TSO's than their peers. Mature love, world peace and happiness

TABLE

Number	Variable Name	Group 1 - R&D Mean	Group 2 - TSO's Mean	Grand Mean	1-way ANOVA P(Significance level)	Discriminant Function Scaled Weights	Ranking of Best Discriminators
1	Independence	7.97	4.50	6.38	.004****	-13.975	1st
2	Peers	13.22	13.65	13.42	.7	-6.236	
3	Security	11.10	16.46	13.54	.000004***	5.095	
4	Responsibility	5.64	5.42	6.91	.023*	.092	
5	Power & Control	13.54	12.61	13.28	.3	-9.683	4th
6	Hours for Work	16.13	15.50	15.84	.5	-5.682	
7	Reconigition	8.26	8.77	8.49	.6	-4.730	
8	Minimizing Stress and Tension	15.35	16.23	15.75	.4	-6.077	
9	Advancement Opportunity	10.87	11.85	11.32	.4	-6.869	
10.	Decision Making	8.74	8.31	8.54	.7	-9.118	5th
11	Job Location	12.87	13.23	13.04	.7	-7.636	7th
12	Challenge	4.94	4.77	4.86	.8	-3.978	
13	Social Relevance	13.35	12.65	13.04	.6	-8.636	6th
14	Self Respect	8.32	6.31	7.40	.08	-9.784	3rd
15	Salary	8.64	11.27	9.84	.039*	-3.545	
16	Achievement	5.03	4.58	4.82	.6	- 3.023	
17	Physical Working Conditions	15.68	13.46	14.67	.01	-7.265	8th
18	Nature of Work	6.58	7.42	6.96	.46	-4.106	
19	Administration& Communication	15.19	13.12	14.24	.06	-10.436	2nd
20	Meaningfulness of Work	7.67	6.12	6.96	.2	-4.960	

were ranked lower by TSO's than their peers. The original hypotheses concerning values are only partly supported by these findings. Exciting life and freedom are good discriminators, but friendship and family security are not. Family security was within the top half of the value dimension for both groups being slightly higher for the R&D's.

On the basis of psychological relevance, significance levels, and their scaled weights as discriminators, 22 variables were selected to undergo an additional discriminant analysis. The variables selected are shown in Table 4. The total SS score could be used in this analysis whereas it couldn't previously because of a linear independence requirement. The twelve variables associated with the highest scaled weights were selected as the best discriminators. They are listed below in their order of importance:

1. physical working conditions
2. amount to be lost
3. responsibility
4. exciting life
5. experience seeking
6. father's occupation
7. security
8. independence
9. sensation seeking total
10. self-respect
11. probability of winning
12. decision-making

An exciting life, experience seeking, sensation seeking, independence

TABLE 3

Number	Variable Name	Group 1 R&D Mean	Group 2 TSO's Mean	Grand Mean	1-way ANOVA P(significance levels)	Discriminant Function Scaled Weights	Rankings of Best Discriminators
1	Wisdom	6.10	5.61	5.88	.6	-7.006	
2	Friendship	8.74	9.46	9.07	.5	.971	
3	Self-respect	7.45	5.38	6.51	.08	-10.934	1st
4	Mature Love	8.03	8.23	8.12	.8	-9.128	4th
5	Family Security	5.97	7.42	6.63	.2	-6.650	
6	Sense of Accomplishment	4.94	4.19	4.60	.4	-7.214	
7	Happiness	8.03	8.50	8.24	.7	-7.274	7th
8	Inner Harmony	7.61	7.54	7.58	.9	-5.549	
9	Salvation	13.55	16.30	14.81	.064	-6.428	
10	National Security	15.68	13.85	14.84	.028*	-8.457	6th
11	Freedom	8.16	5.77	7.07	.028*	-9.306	3rd
12	World Beauty	10.81	12.85	11.74	.062	-3.378	
13	World Peace	10.55	11.96	11.19	.2	-8.876	5th
14	Equality	10.97	13.15	11.96	.058	-4.894	
15	Exciting Life	9.39	6.08	7.88	.006**	-9.941	2nd
16	Comfortable Life	10.03	10.77	10.37	.5	-2.736	
17	Social Recognition	11.39	11.23	11.32	.9	-5.796	
18	Pleasure	14.03	12.38	13.28	.065	-6.402	

TABLE 4

Variable Number	Variable Name	Discriminant Function Scaled Weights	Rankings of Best Discriminators
1	Father	-1.343	6th
2	Extrinsic	.297	
3	SS TOTAL	1.170	9th
4	Experience Seeking	-1.345	5th
5	Risk (Pw-Bw)	1.046	11th
6	Risk (P_L-B_L)	-.0003	
7	Risk ($w-Bw)	-.535	
8	Risk ($L-$B_L$)	-1.507	2nd
9	Independence	1.172	8th
10	Security	-1.286	7th
11	Responsibility	-1.419	3rd
12	Power & Control	.669	
13	Decision Making	1.035	
14	Self-Respect	1.078	10th
15	Salary	-.070	
16	Physical Working Conditions	1.583	1st
17	Administration & Communication	.552	
18	Self-Respect	-.018	
19	Mature Love	.742	
20	National Security	.430	
21	Freedom	.344	
22	Exciting Life	1.399	4th

self-respect, decision making and probability of winning are all higher for TSO's. Security and physical working conditions were ranked as less important. All the above fit with the various hypotheses advanced earlier. The only variables which showed up in this function which were missing in the individual analyses were: sensation seeking, responsibility and security.

One additional comment can be made as a result of the correlational study conducted on the Risk Taking output. The pattern created by the relative importance of the four dimensions for the TSO's was as follows: probability of winning, amount to be won, the amount to be lost and least important, the probability of losing. Although amount to be won was hypothesized to be the most important, these findings are still conceptually logical. It supports the thesis that the TSO's are high risk takers and do not concern themselves with loss. The R&D's, however, placed probability of losing as the second, not the fourth factor. The mean weightings can be seen in Table 1.

Conclusions

Of the seven hypotheses advanced, three were completely supported, three were partially supported and one failed. The findings lend support to the use of this type of approach in trying to predict group membership. Twelve variables were selected as the best discriminators from the overall discriminant function of the best 22 variables chosen on the basis of mathematical and psychological significance. In their order of importance these were:

1. physical working conditions

2. amount to be lost
3. responsibility
4. exciting life
5. experience seeking
6. father's occupation
7. security
8. independence
9. sensation seeking total
10. self-respect
11. probability of winning
12. decision-making

In the absence of time or money either the value survey or the intrinsic-extrinsic reward scale could be employed as a predictive criteria in trying to assess whether an individual belonged to TSO's or R&D personnel.

The results of the above study are encouraging to researcher's in the field of personality investigation. More work should be done in the area of risk taking. The instructions could be varied to see if this would induce change in behavior. For example, the subject could be given a stake to play with. The pattern of his responses while playing with windfall money, versus playing with his own money could be recorded and compared.

APPENDIX A

APPENDIX A

Rank the following variables in their order of importance to you in starting your own firm. Give a one to the most important. (Tso's instruction). Mark the following variables in their order of importance to you in looking for a new job. Give a one to the most important (R&D instructions).

1. independence
2. peers
3. security
4. responsibility
5. power & control
6. hours for work
7. recognition
8. minimize stress & tension
9. advancement opportunities
10. decision making
11. job location
12. challenge
13. social relevance
14. self-respect
15. salary
16. achievement
17. physical working conditions
18. nature of work
19. administration & communication
20. meaningfulness of work

responsibility

nature of work

challenge

decision making

minimize stress & tension

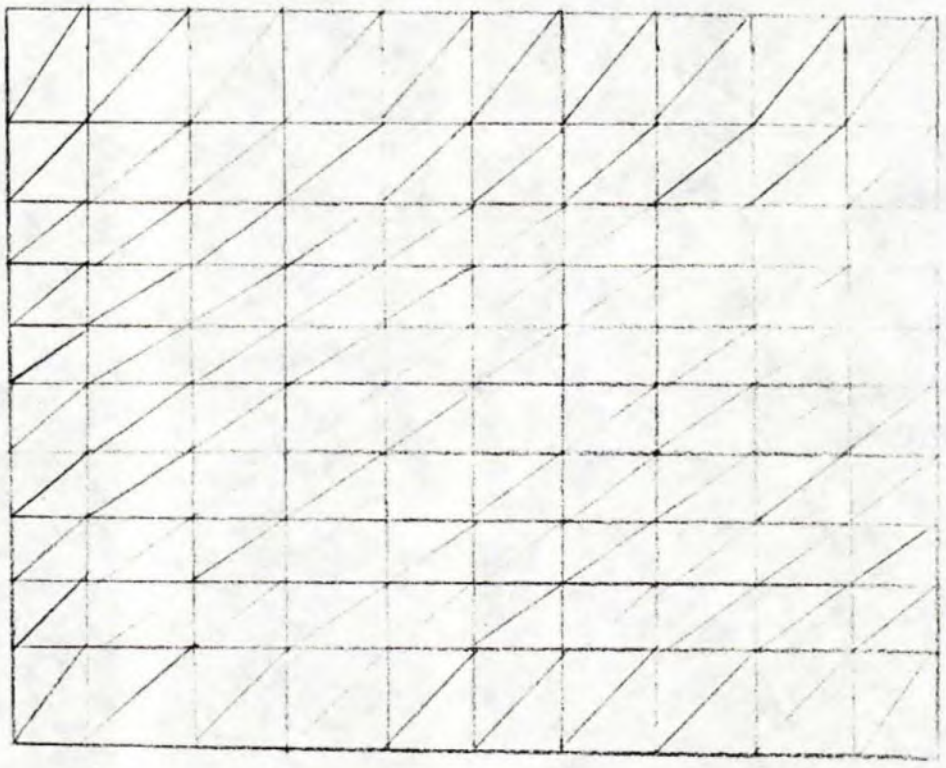
independence

meaningfulness of work

achievement

self-respect

power control



physical working conditions

peers

security

advancement opportunities

administration & communication

salary

job location

hours for work

social relevance

recognition

Tick off the upper box if the column variable is more important to you in the decision to look for a new job or start your own firm. Tick off the lower box if the row variable is more important in this decision.

APPENDIX B

APPENDIX B

PLEASE RESPOND TO THE FOLLOWING ITEMS AS THEY APPLY TO YOU, WITH A "TRUE" OR "FALSE".

		True	False
1.	I like to gamble for money.	☐	☐
2.	I can't stand watching a movie that I've seen before.	☐	☐
3.	I enjoy many of the rides in amusement parks.	☐	☐
4.	I would like to hitchhike across the country.	☐	☐
5.	I feel best after taking a couple of drinks.	☐	☐
6.	I have no patience with dull or boring persons.	☐	☐
7.	I think I would enjoy the sensations of skiing very fast down a high mountain slope.	☐	☐
8.	People should dress in individual ways even if the effects are sometimes strange.	☐	☐
9.	I enjoy the company of real "swingers".	☐	☐
10.	I sometimes like to do things that are a little frightening.	☐	☐
11.	I get bored seeing the same old faces.	☐	☐
12.	I like to dress in unusual styles.	☐	☐
13.	It's normal to get bored after a time with the same sexual partner.	☐	☐
14.	I usually don't enjoy a movie or play where I can predict what will happen in advance.	☐	☐
15.	I would like to try surfboard riding.	☐	☐
16.	I have tried marijuana or would like to.	☐	☐

		True	False
17.	Keeping the drinks full is the key to a good party.	☐	☐
18.	A person should change jobs from time to time simply to avoid getting into a rut.	☐	☐
19.	I would like to go scuba diving.	☐	☐
20.	I would like to take off on a trip with no preplanned or definite routes or timetable.	☐	☐
21.	I could conceive of myself seeking pleasures around the world with the "jet set".	☐	☐
22.	Looking at someone's home movie or travel slides bores me tremendously.	☐	☐
23.	I would like to try parachute jumping.	☐	☐
24.	I like to see men wearing beards.	☐	☐
25.	Almost everything enjoyable is illegal or immoral.	☐	☐
26.	I like to dive off the high board.	☐	☐
27.	I find people who disagree with my beliefs more stimulating than people who agree with me.	☐	☐
28.	I would prefer modern jazz or classical music to more popular or light classical music.	☐	☐
29.	I like "wild" uninhibited parties.	☐	☐
30.	I would like to sail a long distance in a small but seaworthy sailing craft.	☐	☐
31.	I get restless if I have to stay around home for any length of time.	☐	☐
32.	I prefer friends who are exicitingly unpredictable.	☐	☐

		True	False
33.	I often like to get high (drinking liquor or smoking marijuana).	☐	☐
34.	I wish I didn't have to waste so much of a day sleeping.	☐	☐
35.	I often wish I could be a mountain climber.	☐	☐
36.	I often enjoy flouting irrational authority.	☐	☐
37.	Most adultery happens because of sheer boredom.	☐	☐
38.	I enjoy a heated intellectual argument even if people sometimes get upset.	☐	☐
39.	I would like to take up the sport of water-skiing.	☐	☐
40.	I sometimes like to do "crazy" things just to see the effects on others.	☐	☐
41.	I like to date members of the opposite sex who are physically exciting.	☐	☐
42.	I would like to learn to fly an airplane.	☐	☐
43.	Although it is sometimes necessary, I usually dislike routine kinds of work.	☐	☐
44.	I sometimes use "four-letter words" to express my feelings or to shock someone.	☐	☐
45.	A person should have considerable sexual experience before marriage.	☐	☐
46.	When you can predict almost everything a person will do and say he or she must be a bore.	☐	☐
47.	I like to drive in open convertibles.	☐	☐
48.	I would like to travel to strange, out of the way places like the Upper Amazon or Antarctica.	☐	☐

		True	False
49.	I like people who are sharp and witty even if they do sometimes insult others.	□	□
50.	I would have preferred living in the unsettled days of our history.	□	□
51.	Sometimes I like to swim far out from the shore.	□	□
52.	I would like to make friends in some of the "far-out" groups like artists or "hippies".	□	□
53.	I enjoy watching many of the "sexy" scenes in movies.	□	□
54.	I like to try new foods that I have never tasted before.	□	□
55.	I would like to drive or ride on a motorcycle.	□	□
56.	I would like to try some of the new drugs that produce hallucinations.	□	□
57.	I like to try new brands on the chance of finding something different or better.	□	□
58.	I would like to meet some persons who are homosexual (men or women).	□	□
59.	I prefer friends who are excitingly unpredictable.	□	□
60.	I like to listen to new and unusual kinds of music.	□	□

		True	False
61.	The worst social sin is to be a bore.	☐	☐
62.	I like to have new and exciting experiences and sensations even if they are a little frightening, unconventional, or illegal.	☐	☐
63.	A good painting should shock or jolt the senses.	☐	☐
64.	I often find beauty in the "clashing" colours and irregular forms of modern paintings.	☐	☐

APPENDIX C

APPENDIX C

LIST OF THE 27 BETS EVALUATED BY EACH S

Bet	Pw	$w	P_L	$\$_L$	EV
1	.2	$2	.8	$2	-$1.20
2	.8	1	.2	4	.00
3	.2	1	.8	4	- 3.00
4	.8	2	.8	1	+ .80
5	.8	2	.4	4	.00
6	.4	4	.4	1	+ 1.20
7	.8	1	.8	2	.80
8	.2	2	.4	1	.00
9	.4	1	.4	4	- 1.20
10	.2	1	.4	2	- .60
11	.4	2	.4	2	.00
12	.8	2	.2	2	+ 1.20
13	.8	4	.4	2	+ 2.40
14	.8	4	.8	4	.00
15	.4	1	.8	1	- .40
16	.4	4	.8	2	.00
17	.4	2	.2	1	- .60
18	.2	4	.4	4	- .80
19	.2	1	.2	1	.00
20	.2	4	.8	1	.00
21	.4	4	.2	4	+ .80
22	.4	1	.2	2	+ .40
23	.2	4	.2	2	+ .40
24	.8	1	.4	1	- .40
25	.2	2	.2	4	- 2.40
26	.4	2	.8	4	+ 3.00
27	.8	4	.2	1	

APPENDIX D

APPENDIX D

VALUE SURVEY

INSTRUCTIONS

...page are 18 values listed in alphabetical order. Your task is to ...order of their importance to YOU, as guiding principles in YOUR ... printed on a gummed label which can be easily peeled off and ...es on the left-hand side of the page.

...t carefully and pick out the one value which is the most ... Peel it off and paste it in Box 1 on the left.

...the value which is second most important for you. Peel it off ...x 2. Then do the same for each of the remaining values. The ...ast important goes in Box 18.

...nd think carefully. If you change your mind, feel free to change ...e labels peel off easily and can be moved from place to place. ...ould truly show how you really feel.

1		A COMFORTABLE LIFE (a prosperous life)
2		AN EXCITING LIFE (a stimulating, active life)
3		A SENSE OF ACCOMPLISHMENT (lasting contribution)
4		A WORLD AT PEACE (free of war and conflict)
5		A WORLD OF BEAUTY (beauty of nature and the arts)
6		EQUALITY (brotherhood, equal opportunity for all)
7		FAMILY SECURITY (taking care of loved ones)
8		FREEDOM (independence, free choice)
9		HAPPINESS (contentedness)
10		INNER HARMONY (freedom from inner conflict)
11		MATURE LOVE (sexual and spiritual intimacy)
12		NATIONAL SECURITY (protection from attack)
13		PLEASURE (an enjoyable, leisurely life)
14		SALVATION (saved, eternal life)
15		SELF-RESPECT (self-esteem)
16		SOCIAL RECOGNITION (respect, admiration)
17		TRUE FRIENDSHIP (close companionship)
18		WISDOM (a mature understanding of life)

WHEN YOU HAVE FINISHED, GO TO THE NEXT PAGE.

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