

T  
317

An Experimental Investigation of  
Some Factors Related to  
Accident-Proneness

by  
Emma Oshagan

A Thesis

Submitted in Partial Fulfillment for the Requirements of  
the Degree Master of Arts  
In the Psychology Department of the  
American University of Beirut  
Beirut, Lebanon

**Accident-Proneness, Paper-and-Pencil-Tests**

**and**

**Extraversion-Introversion**

**by**

**Emma Oshagan**

### ACKNOWLEDGMENT

The writer wishes to express her gratitude to Professor J. D. Keehn and Professor J. D. Davis of the Department of Psychology at the American University of Beirut for their guidance and help without which the writing of this thesis would not have been possible.

Also gratitude is expressed to Professor Levon Melikian, Chairman of the Department of Psychology at the American University of Beirut, Professor E. T. Prothro and Professor L. N. Diab of the Psychology Department at the American University of Beirut for their helpful suggestions.

The writer wishes to thank Miss Rita Tabourian for her help in the statistical analysis of this thesis, and Miss Sumaya Kurani for typing the script.

Emma Oshagan

## PREFACE

Since human behavior is involved in many phases of industry, a study of the psychological aspects of accidents can be useful in selecting industrial personnel. Consequently, a proper choice of employees would result in the reduction of accidents both in industry and the highway.

It has been observed that there are always the same few individuals responsible for most of the accidents. This fact has given rise to the concept of accident-proneness. However, investigators are far from being unanimous about its existence. Studies have shown that environmental factors, some sensory mechanisms, and psychomotor abilities have a bearing on accident liability. Personality theories and tests built on these theories are suggested by different psychologists for the selection of industrial personnel.

The main problem of this thesis will be to study the accident-proneness concept by establishing, first, a criterion of accidents. Then, the validity of some of the paper-and-pencil tests used in former investigations will be tested. There will also be an attempt to study Eysenck's personality theory of extraversion in reference to accidents. A review of the literature relevant to the problem in general will be presented before the specific problem, the results and the conclusions.

TABLE OF CONTENTS

	<u>PAGES</u>
PREFACE	iv
LIST OF TABLES	vi
CHAPTERS	
I            Introduction - The Concept of Accident-Proneness and the Problem of Criterion Establish- ment.....	1 - 14
II            Clinical Approach to Accidents	15 - 29
III           Psychometric Approach to Accidents.....	30 - 43
IV            Procedure.....	44 - 50
V             Description of Subjects and Administration of Tests.....	51 - 58
VI            Results and Interpretations	58 - 69
VII           Summary and Conclusion	70 - 78
APPENDICES I - VII	79 -102
BIBLIOGRAPHY	103 -109

LIST OF TABLES

<u>TABLES</u>		<u>PAGES</u>
I	Hypothetical Distribution of Accidents in a Group of Workers.....	7
II	Comparison of Actual and Theoretical Accident Distribution.....	9
III	The Correlation Coefficient, the Corrected Correlation, $r/S.D._r$ and the Level of Significance of the Split-Half Reliabilities by the Spearman Brown Formulas of Accident Index and Porteus Maze.....	60
IV	The Correlation Coefficient, $r/S.D._r$ , and the Level of Significance of the Intelligence Tests with the Accident Index and the Porteus Maze.	61
V	Correlation Coefficients, $r/S.D._r$ , and Level of Significance of the Dotting, Tapping and Cancellation Tests with the Accident Index and the Porteus Maze.....	63
VI	Correlation Coefficients, $r/S.D._r$ , and Level of Significance of the Free Association Test with the Accident Index and the Porteus Maze.	64
VII	Correlation Coefficients, $r/S.D._r$ , and Level of significance of the Reading Test and the Stroop Ratio with the Accident Index and the Porteus Maze.....	65
VIII	Correlation Coefficients, $r/S.D._r$ , and Level of Significance of the Difference of Perceptual Matching and Tweezers Tests with the Accident Index and the Porteus Maze.....	67
IX	Correlation Coefficients, $r/S.D._r$ , and Level of Significance of the Annoyances Test, Worries Test, and the Maudsley Personality Inventory with the Accident Index and the Porteus Maze.....	68

## CHAPTER I

### Introduction

#### The Concept of Accident Proneness and the Problem of Criterion Establishment

After World War I interest in the causes of accidents in the industrial setting increased tremendously. The great cost both in human lives and in material loss led many psychologists into the investigation of the causes of accidents.

"The National Safety Council of the United States estimated total accident costs for the year 1946 alone at \$6,400,000,000 of which industrial accidents accounted for \$2,400,000,000. Accidental deaths for 1946, an average year, totalled 99,000 and 10,400,000 persons were reported injured during the same period, 370,000 of whom received permanent physical impairment." (1)

A survey carried out by Dietrich (2) shows that accidents in 1953 killed "more children below the age of 15 years than did pneumonia, cancer, leukemia, tuberculosis, kidney disease, intestinal infections,

- 
- (1) Teal, G. E. Handbook of Applied Psychology, p. 430
  - (2) Dietrich, E. F. Accidents: Childhood's No. 1 Killer, Public Affairs Pamphlet No. 225, Public Affairs Committee.

influenza, meningitis and meningococcal infections combined, and these are the nine deadliest diseases of childhood(3)."

Jensen (4) also says that in the State of Minnesota accidents caused 33% of all the deaths of children between the ages of 1-14 years of age in 1950.

The research into causes of accidents has established few facts about the causes and ways of prevention of accidents. There is no doubt that physical factors such as age (5)(6), sex (7)(8), temperature (9), illumination (10), noise (11)(12), play important role in the prevention of accidents. It is shown in these studies that

- 
- (3) Ibid., p. 2
  - (4) Langford, S. L. et al. Pilot study of childhood accidents. Pediatrics, 1953, 11, 405-415.
  - (5) Tiffin, J. Industrial Psychology
  - (6) DeSilva, H. R. & Channell, R. Driver Clinics in the field. J. Appl. Psychol., 1958, 22, 59-69.
  - (7) Kerr, W. A. Accident Proneness in Factory Departments. J. Appl. Psychol., 1950, 34, 167-170.
  - (8) Maier, N.R.F. Psychology in Industry.
  - (9) Tiffin, op cit.
  - (10) Blum, N. L. Industrial Psychology and its foundations.
  - (11) Tiffin, op. cit.
  - (12) Almeida, D. Noise and Absenteeism. J. Appl. Psychol., 1953, 37, 321-322.



the physical environment in which the employee works is important and that certain situations may cause an appreciable rise in the accident rate.

The difference of opinions with respect to accidents in industrial psychology exists mainly in the field of the personality correlates of accidents. Here psychologists do not agree and neither clinical nor psychometric studies have given clear out answers to the accident problem. The argument mainly revolves around the concept of 'accident proneness.' This concept implies that, "accidents do not distribute themselves by chance but... happen frequently to some men and infrequently to others as a logical result of a combination of circumstances" (13).

Thorndike has summarized the findings of the earlier investigators in the following way, "Individuals differ in their propensity for having accidents. The implication is that there exist relatively stable and persisting characteristics of the individual which predispose the person with these characteristics to have accidents. The person who has a large number of these predisposing characteristics is considered to be accident prone." (14)

It was with the appearance of the studies by Greenwood and Woods, Newbold, Farmer and Chambers (15) that the concept of accident proneness became established.

---

(13) Blum, op.cit.

(14) Thorndike, R. L. The human factor in accidents with special reference to aircraft accidents. USAF Sch. Aviat. Med. Proj. Rep., 1951, Proj. No. 21-30-001, Rep. No. 1

(15) Ibid.

In 1919 Greenwood and Woods (16) studied the accident frequency of 11 groups of industrial workers, mostly women, working in British war industry during World War I. The observation period was from 2-6 months. They applied to this data the Poisson curve to see how well it applies to the data they had gathered. The curve did not fit in most cases. A year later Greenwood and Yule (17) tried a study which was based on the assumption of the individual differences in the tendency to have accidents, and they came to the conclusion that accident liability does not change with time.

In 1925-26 Newbold's study (18) of 22 different factories came to the same conclusion as the first two, namely, that accidents were not distributed on a chance basis and that there were individual differences in the liability to have accidents.

In 1926 Marbe (19) demonstrated that the more a man had accidents in the past the more likely it was that he would have accidents in the future.

The first book wholly devoted to the accident problem was published by Heinrich (20) in 1931. With this publication there was

---

(16) Ibid

(17) Ibid

(18) Ibid

(19) LeShan, L. L. Dynamics in accident prone behavior. Psychiatry, 1952, 15, 73-80.

(20) Ibid

an open recognition of the psychological aspect of the accident problem. Heinrich estimated that around 98% of industrial accidents are preventable. Of these around 90% involve such things as faulty inspection, inability of the employee, poor discipline, lack of concentration, unsafe practice and mental or physical unfitness to the job. Only 10% of the accidents were caused by faulty equipment or bad environmental conditions.

In 1936 Farmer, Chambers and Kirk (21) reported a study of accidents of 5 groups of naval dockyard apprentices who were followed up for five years. They came to the conclusion that there were individual differences in liability but that these differences were not stable from year to year.

In 1939 two different point of views came into clash, those of DeSilva (22) and Johnson (23). DeSilva (24) reported improvement of 180 drivers through educational clinics. Johnson (25) and Cobb (26) criticized this educational procedure saying that there were many fallacies in the selection procedure itself. They reported that they

- 
- (21) Thorndike, op.cit.
  - (22) DeSilva, H. R. Automobile Drivers Can Be Improved. Psychol. Bull., 1939, 36, 284-285.
  - (23) Johnson, H. M. Evidence for Educational Value in Drivers' "Clinics", Psychol. Bull., 1939, 36, 674-475.
  - (24) DeSilva, op.cit.
  - (25) Johnson, op.cit.
  - (26) Cobb, P. W. The limit of usefulness of accident rate as a measure of accident proneness. J. Appl. Psychol., 1940, 24, 154-159.

themselves selected a class of drivers according to the number of accidents in one 3-year-period. The group average number of accidents dropped in another 3-year period to one-seventh of the previous period without any diagnosis or treatment.

The researches of those early studies have established seven related lines of evidence for the concept of accident proneness (27):

1. A small percentage of workers account for a large percentage of accidents.
2. In a given period of time some individuals have more accidents than others.
3. A group of individuals who have a high number of accidents in one year tend to have more accidents than the average number in following years.
4. Individual accident rates tend to correlate positively over different periods of time.
5. The high accident rate of the individual does not change with change of tasks.
6. A transference of the high accident rate group from one population to another shows a decline on the accident rate of the first population.
7. Clinical 're-education' seems to decrease the accident rate of high accident individuals.

---

(27) Keehn, J. D. Accident tendency, avoidance learning and perceptual defense. Unpublished Paper.

All these seven items have been criticized. Mintz and Blum (28) and Thorndike (29) point out that, generally, in an industrial situation there are more people than accidents. It naturally follows that a small percentage of people will have more of the accidents without resorting to the notion of accident proneness. As an illustration of this point we may take Thorndike's example of the hypothetical 500 workers whose accident data is collected. We may get the following distribution:

Accident frequency	Number of Individuals	Number of Accidents
0	317	0
1	105	105
2	48	96
3	23	69
4	5	20
5	2	10
	<hr/> 500	<hr/> 300

Table I: Hypothetical Distribution of Accidents in a Group of Workers (30).

As it is obvious from Table I, there are not enough accidents for each worker. If nobody had more than one accident still 60% of the people would have 100% of the accidents.

(28) Mintz, A. & Blum, M. L. An examination of the accident prone concept. J. Appl. Psychol., 1949, 33, 195-211.

(29) Thorndike, op. cit.

(30) Thorndike, op. cit., p. 30.

There is still another factor to be taken into consideration. Equal liability towards accidents does not necessarily mean a uniform distribution of accidents among these individuals. Chance alone could account for some persons to have more accidents than others. For example, if a group of people are playing bridge during an evening we would not expect them all to make the same number of grand slams even if they are all very good players. Due to the way the cards are distributed some people may make many grand slams and others none at all.

The reduction of accident rate reported by De Silva through clinical re-education has been put into question by Johnson (31):

The factors discussed above have brought about a great deal of discussion about the proper statistical approach to accident populations. Many investigators, like Johnson (32) and Thorndike (33), believe that a comparison of the actual data with the theoretical distribution can give us a basis for comparison. Applying Poisson's distribution to a hypothetical population and number of accidents we will get the following table:

---

(31) Johnson, op. cit.

(32) Johnson, H. M. Detection and Treatment of Accident Prone Drivers. Psychol. Bull., 1946, 43, 489-532.

(33) Thorndike, op. cit.

---

Accident frequency	Actual No. of Cases	Theoretical No. of Cases
0	317	275
1	105	165
2	48	49
3	23	10
4	5	1
5	2	0

---

Table II: Comparison of Actual and Theoretical Accident Distributions (34).

However, Arbous and Kerrich (35), Maritz (36), Webb and Jones (37), Burke (38) and others tend to believe that the correlational approach is the best, especially when successive periods of an individual accident

- 
- (34) Thorndike, op. cit. P. 33.
- (35) Arbous, A. G. & Kerrich, J. E. Accident Statistics and the Concept of Accident proneness. Biometrika, 1951, 2, 340-428.
- (36) Maritz, J. S. On the validity of inference drawn from the Fitting of Poisson and Negative Binomial distributions to observed accident data. Psychol. Bull., 1950, 47, 434-443.
- (37) Webb, W. B. & Jones, E. R. Some Relations Between Two Statistical Approaches to Accident Proneness. Psychol. Bull., 1953, 50, 133-136.
- (38) Burke, C. J. A Chi-Square Test for "Proneness" in accident data. Psychol. Bull., 1951, 48, 496-504.

tendency is compared. There is one important point to be taken into consideration in this approach and that is changes in age, experience and the specific task performed may prevent the periods from being strictly comparable.

#### Accident Criterion and Subject Selection.

Aside from these statistical problems there is the problem of the establishment of accident criterion. How to select groups of subjects whose accident rates are greater than other groups?

Johnson (39) in an article called the 'detection and treatment of accident prone drivers' gives a good critical review of the method of selection of subjects for study. The following are the different methods used in selecting samples for study:

1. Biographical method. requires the collection of information concerning the history of every subject in respect to every detail that may seem to be important, and then to classify him first, in respect to each detail and then in respect to his accident rate. Johnson, after reviewing the literature, thinks that this method is not yet adequately exhausted. Studies usually use this method in so far as subject age, estimate of annual mileage of drivers and especially the accident rate within a specific period are concerned. The method has its shortcomings. A record of mileage covered by the driver is not usually kept either by driver or companies. Complete records of accidents are

---

(39) Johnson, op. cit.



difficult to obtain because:

- a. Not all accidents are recorded. Usually only major accidents are recorded.
- b. A driver may not be involved in major accidents but may have had many 'near-accidents' or he may have caused other drivers to have accidents because of his bad driving habits.
- c. Some accident-prone operators change from one study period to another just by themselves without any treatment but the names of these operators will still be found on the records. So choice of these operators on the basis of accident history would be quite misleading. This fact is shown in Johnson's study (40).

2. Interview or questionnaire method. Requires the collection of information through direct question and answer. In the interview method the interviewer tries to revive the subject's past history of accidents by asking him specific questions and recording the answers given to these questions. In the questionnaire a list of all possible accidents are handed to the subject and he is asked to check the accidents that he has had in the past. This method also has its shortcomings since it depends on the memory of the subject. Moreover, Le Shan (41) finds that accident prones are more liable to forget the number and kind of accidents that they have had than non-accident subjects.

---

(40) Johnson, op. cit.

(41) Le Shan, L. L. op. cit.

There is another psychological factor which plays an important role in almost all testing situations. When a subject knows that he is being tested he may either wilfully distort the answers on the questionnaire or he may not answer the interviewers' questions with sincerity, and this is likely to affect the results of any test.

3. Tests.

a. Direct form. This kind usually requires testing of a skill under a trained observer. For example, in driving emergency situations are created for testing the driving ability or the skill of the operator. Again this creates difficulties because in a short period of time of testing the unskilled operator will not have enough opportunities to make accidents to compare him with the good or skilful operator. And also in a test situation he may retain a new set of attitudes which either will decrease or increase his accident rate.

b. Indirect form. To make the subject go through tests for attention, skill, information etc. symbolizing the actual work situation. There are three assumptions on which these tests are usually built. They are:

1. Test performance should imitate all the requirements of the task for which the subject is being tested. According to Johnson this is invalidated right from the beginning because this resemblance factor is not measurable on objective grounds (42)

2. Test demands should merely symbolize demands of task. This form is quite widely used and is preferred by some investigators

---

(42) Johnson, op. cit.

like Viteles (43). This, however, creates problems of reliability and validity. How much does the test situation symbolize the actual? Does it really test what it should.

3. One merely specified the demands of the test and the subject's "degree of success" in meeting them. Corresponding information is gathered also about the demands of his vocation. Then correlations are worked out between these two variables. If the coefficient is high enough then the test is supposed to be useful or else it is not used. But the investigator never asks why there has been a correlation between two apparently unrelated variables. The answer is very hard to find in the case of many tests. And so the association is treated as a fact without trying to find an explanation. This is the short-coming of this assumption. How can an investigator use a test without explaining the reason of its use? However, tests formed on this basis are very widely used in selecting subjects for investigations and finding relationships of personality factors with accident prone individuals (44).

So far some of the approaches to accident studies have been discussed, and some of the difficulties of subject selection have been listed. These initial studies show us that the uncritical acceptance of statistics is not possible. In spite of all the difficulties of subjects selection and the specification of an accident the matter is still open to study. In fact clinicians give fairly definite picture of

---

(43) Johnson, op.cit.

(44) Johnson, op.cit.

of the accident personality. For the clinical psychologist there is no doubt that there exists a sharp distinction between the personalities of the accident prone and the non-accident prone subject. The tendency to have accidents of certain individuals comes right from child-hood and it is a function of certain personality correlates.

In the following chapter the clinical attitude to the accident problem will be discussed.

## CHAPTER II

### The Clinical Approach to Accidents

The clinical approach to accidents stems largely from the psycho-analytic theory of Freud.

Accidents according to Freud (45) include slips of the tongue, forgetting, mistakes in reading and writing, breaking things, misplacement of belongings, erroneous actions and so on.

Analysis of the examples of forgetting which Freud cited in his book, shows that in his view the motive of forgetting is always an unwillingness to recall something which may create painful feelings. Mistakes in reading and writing, as in slips of the tongue, seem to originate from unconscious thoughts which threaten the "self-betrayal" of the person through his speech (46).

Misplacing a thing has the same significance as forgetting. A faulty action is a symbolic representation of a definite thought which was not accepted consciously. All "seemingly accidental awkward movements" if examined carefully will be found to be guided by some intention and a sureness of aim. Both the force and the sureness of the accidental motion resemble the "motor manifestations of the hysterical neurosis (47)." Breaking things falls in this category. Freud says, "In latter years, since I have been collecting

---

(45) Freud, S. Psychopathology of Everyday Life.

(46) Ibid, p. 233

(47) Ibid, p. 234

such observations, it has happened several times that I have scattered and broken objects of some value, but the examination of these cases convinced me that it was never the result of accident or of my unintentional awkwardness (48).<sup>2</sup> And he gives the example of his own breaking of a valuable marble statue. His self-analysis proves to him that it was a "destructive madness" in him which had been in action which had precipitated after bearing the recovery of a very sick person in the family. The destructive instinct had appeared in the form of a grateful feeling toward fate and as he would have offered a sacrifice if she had got well, so he had destroyed the valuable statue as a sacrifice on the occasion of the sick relative's convalescence (49).

And he sums up all his ideas on accidental mistakes and movements in the following way, "... the common character of the mildest as well as the severest cases, to which faulty and chance actions contribute, lies in the ability to refer the phenomena to unwelcome, repressed, psychic material, which, though pushed away from consciousness, is nevertheless, not robbed of all capacity to express itself (50).<sup>2</sup>

Other psychoanalysts have a different version of the same principle, such as Klein (51) who fully accepts the purposiveness

---

(48) Ibid., p. 131

(49) Ibid. p. 133

(50) Ibid. p. 239

(51) Klein, M. Psychoanalysis of Children.

of accidents but attributes a definite direction and purpose to the accident by saying that accidents are deliberate attempts at self-annihilation.

In 1936, Ackerman and Chidster (52) held to the idea that an accident is not the work of fate or chance, but affords the child "one means by which to deny magically his own hostility to others; it tends to allay anxiety which emerges from this source and thus eases his contacts with other persons." (53) The child is said to learn this pattern of behavior from adults. They have also found that 'accident-prone' children show more fear and more unexpressed hatred and guilt feelings than the accident-free child. There are many motives which drive the child to show his feelings through accidents. One of these motives can be the craving to have more attention and sympathy from adults.

A little later in the same year Dunbar (54), in a study of fracture patients, describes the accident-prone as impulsive, impetuous, more interested in immediate pleasures and satisfactions, resentful of authority, irresponsible toward family or sex, lacking in self-discipline, concern about health, and showing a lot of accumulated guilt feelings. The accident-prone seems decisive in

---

(52) Ackerman, N. W. & Chidster, L. Accidental Self-injury. Arch. Pediat., 1936, 53, 711-721.

(53) Ibid. p. 714

(54) Dunbar, F. Psychosomatic Diagnosis.

his actions to gain more independence and to show more self-reliance.

She sums up her study by saying that,

"the area of focal conflict of patients with the accident habit, like those suffering with cardiovascular disease, is in the realm of authority but, unlike the patient with cardiovascular disease, the accident-prone patient's characteristic reaction to his conflict is to strive for independence and autonomy outside authority relationships and to avoid conflict with authority, but not by submissiveness. When characteristic defenses fail, and the conflict with authority becomes unavoidable, accident takes place, i.e. aggressiveness breaks out in an impulse to punish both the individual himself and those responsible for his frustration (55)."

Dunbar has found that the accident-prone has no identification with authority figures. They have accidents either for punishment of themselves for feeling hostility against authority or punishing someone else. They seem to Dunbar to be people who have not solved the oedipal conflicts and hostilities.

In 1938, Karl Menninger formed the phrase, "purpose accidents" because he believed that accidents took place motivated by some unconscious intention to satisfy, especially, some kind of desire. Accidents served,

"not only as the price of atonement but as a permission for further indulgences in the same guilty acts or fantasies... The guilty act stimulates the conscience to demand of the ego a price... The act is partial self-destruction. The symbolic castration complete annihilation (56)."

---

(55) Ibid

(56) Menninger, K. Purposive accidents as an expression of self destructive tendencies. Int. J. Psychoanal., 1936, 17, p. 9.



Fabian and Bender (57) agree with Dunbar that accidents seem to take place mostly during the oedipal period. Children at this age, are full of anxieties and they try to give out their hostilities and guilts in form of accidents.

A few years later there seemed to be no doubt in Fenichel's mind of the existence of the accident-prone individual. According to him the accident-prone's superego is over-strict and incapable of forgiveness. Instead of rebelling the accident-prone individual gets involved in an accident in order to appease the superego through self-sacrifice and suffering. This way of behaving is typical of depressives. In his own words, "there are persons who experience accident after accident without ever being able to placate their strict superego, or who arrange their lives so that they suffer one remorse after another in miserable 'neuroses of destiny' (58)".

Driving against the laws and police regulations, Fenichel interprets as an identification of the police with the father who has been a very strict and punishing figure. This hidden rebellion and the masochistic nature of accidents makes Fenichel see a distorted kind of passive sexual pleasure in the accident-prone situation.

---

(57) Le Shan, op. cit.

(58) Fenichel, O. The Psychoanalytic Theory of Neurosis. P. 500.

Another type of accident-prone individual, according to Fenichel, is the person in whom transference of the past to the present is very strong. These patients go through acts that represent unconscious attempts to get rid of old instinctual conflicts. "The patients may appear as restless, hyperactive personalities or their activity may be hidden and their life history may give the impression that they are the toys of a malicious fate, the repetitions being experienced passively and rationalized as occurring against the person's will (59)."

In 1944, Rawson (60) after reviewing the clinical field on accident-proneness, agreed with Dunbar that accidents are the manifestations of repressed guilt and hate. He also found psychotherapy, which pays special attention to neurotic traits to be the best means of curing the accident habit after the occurrence of the first accident (60).

English and Pearson, in their book on Emotional Problems of Living (61), divide accident-prone children into four groups:

1. Those whose accidents are deliberate attempts on the part of the individual to injure himself. This feeling is unconscious. Accident-prones are unable to inhibit the impulsive expression of hostility. They have to suppress their feelings because of very strict parents (strong superegos).

---

(59) Ibid., p. 500.

(60) Rawson, A. J. Accident Proneness. Psychosomatic Medicine, 1944, 6, 88-94

(61) English, O. S. & Pearson, G. H. H. Emotional problems of living

2. Some children have a great desire of dependency. This desire is suppressed because it is in conflict with the child's growing pride. However, the need is felt in his conscious mind and he tries to prove to himself that he has grown up. He undertakes many difficult tasks and succeeds. It is only when this need becomes so great that he feels the need of being taken care of that accidents take place.

3. In this group fall those children who have strong super-egos but who want to do something forbidden. Instead of getting rid of the superego or not doing the action, the child both does the action and in the process gets hurt to punish himself.

4. In this group fall those children for whom accidents are an impulsive need to commit suicide. The motivation is to take revenge on the parents by making them feel remorseful (62).

English and Pearson (63) think that accident-prone children need immediate psychiatric care because age does not change them and they remain the same in adult life.

In 1948 Bakwin and Bakwin (64), after reviewing the theories of other clinical psychologists, conclude, "when the person with an accident habit fails and can neither submit to nor avoid authority, his aggression breaks out and he punishes himself and those responsible

---

(62) Ibid., p. 233

(63) Ibid.

(64) Bakwin, R. M. & Bakwin, H. Accident Proneness. J. Pediatrics, 1948, 749-752.

for his predicament, without any conscious plan. Guilt and resentment are common reactions after the accident (65).<sup>1</sup> Furthermore, the injury that he receives gives him attention and sympathy. It also makes him avoid responsibility. The child hurts himself and thus, relieves himself of his sense of guilt.

All of these writers mentioned here believe that there are accident-prone individuals who are mainly motivated by an unconscious desire to relieve guilt by having accidents.

Lately, there has appeared another point of view supported by Hill and Trist (66) and Castle (67). They find a relationship between absences and the tendency to have accidents. Hill and Trist interpret this as a desire on the part of the individual to withdraw from work and the accident is a means to attain his goal of withdrawal from work.

Castle conducted a study based on the assumptions of Hill and Trist (68) and concluded that, "1. accidents are caused by conscious or unconscious motivation to withdraw from the work situation in a way acceptable to all... 2. Accidents are most associated with least sanctioned forms of absence showing also a

---

(65) Ibid., p. 751

(66) Hill, J. M. & Trist, E. L. A consideration of Industrial Accidents as a means of withdrawal from the work situation. Human Relations, 1953, 6, 357-380

(67) Castle, F. C. Accidents, absence and withdrawal from the work situation. Human Relations, 1956, 9, 223-233.

(68) Ibid.

hostility against authority (69).\*

Aside from the psychoanalysts, there are non-analytic clinical psychologists who find the accident-prone to have some outstanding traits of character. Tillman and Hobbs (70) find that high and low accident groups differ markedly in personality characteristics. High accident group shows marked intolerance and aggression against any authority, childhood instability, parental discord and lack of persistence in any work, irresponsibility in marriage and sex. However, they believe that the accident-prone is not doomed to be so. Sometimes marriage or other changes may bring a change in the accident pattern of the individual.

LeShan (71) has led a study on accident-prone persons by giving them the Worthington Personal History Blank. He has found them to be superficial in their ties with others, worried over health, ambitious, aggressive toward authority, poor in planning for the future, impulsive, low in frustration tolerance.

The validity of the Personal History Blank used in LeShan's study has been put also to question by Clark and Owens (72) and Peck and Stephenson (73).

---

(69) Ibid, p. 223

(70) Tillman, W. A. & Hobbs, G. E. The accident prone automobile driver. Amer. J. Psychiat., 1949, 106, 321-331.

(71) LeShan, op.cit

(72) Clark, J. G. & Owens, W. A. A validation study of the Worthington Personal History Blank, J. Appl. Psychol., 1954, 38, 85-88.

(73) Peck, R. F. & Stephenson, W. A. Correction of the Clark-Owens validation study of the Worthington Personal History Technique. J. Appl. Psychol., 1954, 38, 368-369

There are other studies using adjustment inventories which support the idea that high accident groups show marked emotional instability. Teal (74) reports a study by Body which utilizes the Bell Adjustment Inventory. A high accident group shows higher scores on the Inventory than a low accident group. The Minnesota Multiphasic Personality Inventory is used by Parker (75) on high and low accident groups. The high accident group is consistently lower on masculinity, hypochondriasis, psychasthenia and has a lower hypo-mania score. Whitlock and Crannel (76) have collected data on 100 accident employees on a period of 3 years and have matched them with another 100 accident free group. They have given the Bernreuter Personality Inventory to both groups and have found that, unlike Parker's study, the accident prone are less neurotic, less introverted and more self-confident than the accident free group.

Other causes for accidents based on studies are advanced by different writers. For example, Davids and Mahoney (77) have

- 
- (74) Teal, op.cit.
- (75) Sperroff, B. & Kerr, W. Steel mill "hot strip" accidents and interpersonal desirability values. J. clin. Psychol., 1952, 8, 89-91
- (76) Whitlock, J. B. & Crannel, C. W. An analysis of certain factors in serious accidents in a large steel plant. J. Appl. Psychol., 1949, 33, 494-498.
- (77) Davids, A. & Mahoney, J. T. Personality Dynamics and accident proneness in an industrial setting. J. Appl. Psychol., 1957, 41, 303-306.

found, "a slight indication of positive association between high accidents and high scores on socially undesirable personality dispositions of egocentricity, anxiety and resentment and a negative attitude towards employment."

Sperroff and Kerr (78) have found two causes for accidents in a steel mill. They are:

1. Interpersonal rejection causes worry which result in accidents.

2. Some workers lack the perceptual and/or motor skills to handle their work adequately. However, they believe that the first cause produces more accidents than the second.

Krall (79) using the doll play technique on children have found that accident-prone children are more unrealistic in their play, less inhibited in action and have changed schools many times. However, the validity of these findings is questioned by other authors. Their findings and also the general doubt found for the very existence of the concept of accident-proneness talked about in the previous chapter, make us hesitate in the acceptance of these descriptions of the accident-prone personality. Langford et al (80) in a study on children found no evidence of pent-up aggression and resentment, guilt or self-destructive tendencies. They found that the accident child accepted authority with

---

(78) Sperroff & Kerr, op.cit

(79) Krall, V. Personality characteristics of accident repeating children. J. abnorm. soc. Psychol., 1953, 48, 99-107

(80) Langford, et al. op.cit.

overt criticism.

McLean (81), after reviewing several studies concluded,

"it is important to emphasize individual variation. Rarely will two individuals react in exactly the same way to a given situation. We must constantly consider the dynamic equilibrium in which the employee lives. With such a total picture in mind, we must not be too anxious to blame a single aspect of the job situation or a single personality characteristic for a given accident."

McFarland (82) also seems to believe that the clinical approach is too hasty in its conclusions. There are other factors too that should be taken into consideration such as age, fatigue and the psychological environment of the employee.

There is still another point of view advanced by Eysenck (83) who has tried to bring together the two fields in psychology - learning and personality theory. This attempt was made by Dollard and Miller (84) and later by Mowrer (85), but Eysenck finds their theories inadequate. He thinks that it is not possible to approach the field of personality

- 
- (81) McLean, H. A. Accident proneness; a clinical approach to injury liability, Industri. Med. Surg., 1955, 24, 122-126.
- (82) McFarland, A. R. Psychological and psychiatric aspect of highway safety. J. Amer. Med. As., 1957, 163.
- (83) Eysenck, H. J. A dynamic theory of anxiety and hysteria. J. Ment. Sci., 1955, 101, 28-51.
- (84) Dollard, J. & Miller, N. E. Personality and Psychotherapy.
- (85) Mowrer, O. H. Learning theory and the neurotic paradox. Amer. J. Ortho., 1948, 18, 571-610.



on clinical insight. As learning theory is scientifically oriented, so personality theory should be based on scientific proofs before a rapprochement of the two fields is possible.

Influenced by Jung's theory of extraversion-introversion (86), Eysenck developed a three-dimensional theory of personality, one of the main dimensions being extraversion-introversion. After conducting a whole series of experiments on normals and neurotics (87) he describes extraverts in the following way,

"In comparison with introverts, (neurotics) extraverts show a tendency to develop hysterical conversion symptoms, and a hysterical attitude to their symptoms. Furthermore, they show little energy, narrow interests, have a bad-work history, and are hypochondriacal. According to their own statement, they are troubled by a stammer or stutter, are accident-prone, frequently off work through illness, disgruntled, and troubled by aches and pains. In their body build, horizontal growth predominates over vertical growth; their effort response is quite good, and their choline esterase activity low. Salivary secretion is not inhibited. Their intelligence is comparatively low, their vocabulary poor, and they show extreme lack of persistence. They tend to be quick but inaccurate; they are bad at finishing work (Tweezers Test). Their level of aspiration is low, but they tend to overrate their own performance. They are not very rigid, and show great interpersonal variability. Their aesthetic preferences are towards the colorful, modern type of picture. In aesthetic

---

(86) Jung, D. Psychological Types.

(87) Eysenck, H. J. Dimensions of Personality.

aesthetic creation, they produce scattered designs, often having abstract subjects. They appreciate jokes, and are particularly fond of sex jokes. Their handwriting is distinctive (88)."

This description by Eysenck of the extravert has many similarities of his own on accident-prones.

"...the accident prone individual is an impetuous person who immediately converts his momentary impulses into action. He harbors a deeply ingrained rebellion against the excessive regulations of his upbringing - a deep resentment against persons in authority. At the same time he has a strict conscience which makes him feel guilty for this rebellion. In the unconsciously provoked accident he expresses his resentment and revenge, atoning for his rebellion by his injury (90)."

Again Dunbar in her study on fracture patients (91) using the Rorschach has found two definite kinds of personalities and she has called them constrictive and introversive. The characteristics of happy-go lucky individuals, talkativeness, cheerfulness, lack of sexual inhibitions, which she mentions are already associated with extraversion by Eysenck (92).

---

(88) Ibid, p. 247

(89) Keehn, J. D. Accident tendency, avoidance learning and perceptual defense. Unpublished paper.

(90) Ibid. p. 6

(91) Dunbar, op. cit.

(92) Eysenck, op. cit.

Such clinical descriptions of the accident-prone, other studies carried in industrial and experimental settings, and the kind of tests used in these studies give us some ground for believing that the kind of analysis and tests which Eysenck has used on extraverts may also be applied to accident repeaters. "There is reason to expect groups of extraverts and groups of accident repeaters to behave similarly in the kinds of situations that Eysenck and his co-workers have devised, although the evidence is not such as to make this necessarily so." (93)

In this chapter the clinical approaches to accidents have been discussed. In the opinion of the clinician there is no doubt of the existence of the accident-prone individual. But still, there is the psychometric approach and one inevitably asks, how does the psychometric approach stand in relation to the clinicians results?

In the following chapter the psychometric studies to the accident problem will be discussed.

---

(93) Keehn, *op.cit.*, p. 10

## CHAPTER III

### The Psychometric Approach to Accidents

Psychometric studies in the field of industrial psychology have helped a great deal in the selection of employees for different jobs and especially the studies on vision have greatly reduced the accident occurrence in the industrial setting. However, according to Thorndike, "accident frequency is dependent to a considerable extent upon so-called 'chance factors'...The proportion of the variance in accident frequency which is due to factors of this type varies widely from one set of data to another, but the proportion is usually large (93)." This fact does not let us predict with precision an individual's accident liability from tests given to him.

Nevertheless, the results of many studies have established a few facts in the field of industrial psychology. Psychometric studies are generally divided to three kinds - intellectual, motor, and perceptual.

A. Intellectual - Some studies on intelligence have given positive correlations with accidents and others have exactly the opposite results. Schaefer and Henig (94) found positive relationships between test scores and accidents, i.e. the more intelligent an individual the less accidents he has. Bonnardel (95) reports positive results on a battery of tests of

---

(93) Thorndike, op. cit., p. 48

(94) Ghiselli, E. E. & Brown, C. W. Personnel and industrial psychology.

(95) Thorndike, op.cit.

concrete intelligence used to identify between high and low accident groups. His conclusion is similar to that of Shaefer and Henig's that those subjects who score low on the tests show also an excess in accident repetition.

Farmer and Chambers (96) have administered 11 different psychological tests to subjects around 1500 in number, and have found no significant correlations between intelligence test scores and accident frequency.

Again in Lahy and Korngold's study (97) the accident-free group score consistently higher than the accident liable group.

Thorndike finds all these studies unsatisfactory "in terms of the adequacy with which data are presented concerning reliabilities of test and accident measures, the nature of the tests used, and the statistics through which test differentiation is evidenced (98)."

It is generally accepted that feeble-minded individuals or borderline intelligences are more liable to have accidents when exposed to danger than normal subjects (99)(100). According to Thorndike (101) tests of cognition in general show a slight tendency towards a

---

(96) Chambers, E. Psychological Tests for accident proneness.

(97) Thorndike, op.cit.

(98) Thorndike, op.cit., p. 53

(99) Thorndike, op.cit.

(100) Keehn, op.cit.

(101) Thorndike, op.cit.

differentiation between high and low accident groups.

B. Motor - The same ambiguity exists in the results of motor tests. The tests, which Farmer and Chambers (102) used in their extensive study, fail to correlate significantly with accidents. Among the three tests - reaction time, a variation of the McDougall dotting test, pursuit motor - used on shipyard workers, only the pursuit motor shows some positive correlation.

Lahy and Korngold (103) have used a battery of tests including a tacking test, punch test, two-hand coordination test, simple reaction-time test, tapping test, dynamometer, dotting, divided attention test. The only test which shows any ability differentiation between the accident and non-accident groups is the divided attention test. Lahy and Korngold (104) confirm these results in their own study.

Candee and Blum (105) try to find the efficiency of finger and tweezer dexterity in the selection of workers in a watch factory. They find a correlation of .26 between the O'Connor Finger Dexterity Test scores and foreman's ratings of efficiency of each worker. They also find a statistically significant difference between good and inefficient workers. However, the Tweezer Test shows no relationship with the efficiency of workers in a watch factory even though in a

---

(102) Chambers, op. cit.

(103) Thorndike, op. cit.

(104) Thorndike, op. cit.

(105) Candee, B. & Blum, M. Report of a study done in a watch factory. J. appl. Psychol., 1937, 21, 572 - 582

similar job most of the work has to do with the handling of tweezers.

Again, Tiffin and Greenly (106) report the usefulness of the O'Connor Finger Dexterity Test in the selection of electrical fixture assemblers. However, their correlation coefficients are much higher when a composite test is used combining finger dexterity with precision tests, visual acuity and color perception.

In connection with dexterity Drake has advanced a theory where dexterity combined with muscular-coordination gives a good index for the selection of efficient employees. In his investigation Drake uses mainly tests of the manipulative kind. Drake hypothesises that individuals with lower perceptual speed than their motor speed are likely to have accidents, i.e. they respond before they see the situation clearly. Drake tests his hypothesis on 40 female employees in a metal factory. He uses an inspection test where defective items have to be taken out and a motor test where screws have to be turned into threaded holes. Drake finds significant results when the difference of performance on the two tests is measured (107)(108).

Blum and Candee (109) using Drake's hypothesis carried out an investigation dealing with the relation between the efficiency of

- 
- (106) Tiffin, J. & Greenly, R. J. Employee selection tests for electrical fixtures assemblers and radio assemblers. J. Appl. Psychol., 1939, 23, 240-263.
- (107) Tiffin, op.cit.
- (108) Thorndike, op.cit.
- (109) Blum, M. & Candee, B. J. Appl. Psychol., 1941, 25, 76-85.

wrappers and packers in a store and the scores of the same workers on the Minnesota Placing and Tuning Test. The correlations of job success with test scores are only .35 and .27 respectively.

Reaction time experiments have attracted the attention of many investigators. But the results of these studies are far from giving a final relationship between test performance and job success of employees. Chambers (110) finds a positive relationship between a reaction time test and low accident rate of employee. Ghiselli and Brown (111) quote Minimum's results as similar to those of Chambers' on this subject. Meanwhile Bartelme et al (112) using a battery of pencil-and-paper tests on 200 drivers find no relationship between driver skill and test performance on a reaction time test.

Lauer (113), Ghiselli and Brown (114) find a negative relationship between reaction time tests and accident frequency.

Cation, Mount and Breuner (115) have used a reactometer in a simple reactiontime experiment on a sample of 104 Radio Patrol

- 
- (110) Chambers, op.cit
  - (111) Ghiselli & Brown, op.cit.
  - (112) Bartelme, P. F., Fletcher, E. D., Brown, C. W. & Ghiselli, E. E. J. Appl. Psychol., 1951, 35, 98-100.
  - (113) Lauer, H. R. Comparison of group paper-and-pencil tests with certain psychophysical tests for measuring driving aptitude of army personnel. J. Appl. Psychol., 1955, 39, 318-321.
  - (114) Ghiselli & Brown, op. cit.
  - (115) Cation, W. L., Mount, G. E. & Brenner, R. Variability of reaction time and susceptibility to automobile accidents. J. Appl. Psychol., 1951, 35, 101-107



officers. Their hypothesis is to see if variability of reaction time is an indication of susceptibility to accidents. Their results fail to show any significant correlation between variability of reaction time and accident rate.

Bennett (116), after reviewing the literature found on the subject and carrying out an investigation himself, concludes, "there is a definite accident-proneness in multiple sclerotics, the result of the combined personality changes and neurologic handicaps (117)."

Bodily stability or static ataxia, has some predictive value in motor coach operators, according to a survey reported by Ghiselli and Brown (118).

Thorndike (119) quotes Weiss et al's results on personal tempo which shows some relationship with accident rate.

The elaborate study carried by Rimoldi (120) with personal tempo tests shows that similar tests tend to form clusters and that prediction of performance from one cluster to another is unreliable but prediction from one test within the cluster is possible, i.e. a test within the cluster correlates highly with similar tests. Rimoldi

---

(116) Bennett, A. E. Accident proneness in multiple sclerosis. J. ment. nerv. Dis., 1951, 113, 198-210.

(117) Ibid., p. 199

(118) Ghiselli and Brown, op. cit.

(119) Thorndike, op. cit.

(120) Rimoldi, H. J. Personal Tempo. J. Abnorm. soc. Psychol., 1951, 46, 283-303.

also concludes that the natural tempo of the individual within each cluster is consistent.

We may summarize by saying that, generally, it is accepted that motor abilities play a role in the occurrence of accidents. Yet studies fail to show any consistency in the findings.

C. Perceptual - Vision in industry is very important because practically every job requires the use of the eyes. Measurement of vision becomes important because different jobs need different aspects of vision. A sewing job needs good near vision while driving requires good far vision. Another characteristic of visual skills is that they change with age or can be modified with proper medical care (121).

Tiffin (122) divides visual skills to four major categories to be used for the placement of the employees on different jobs.

They are:

1. Keeness of vision or visual acuity at appropriate distances.
2. Discrimination of differences in distance, depth perception or steriopsis. This category deals mainly with the perception of the spatial relationships of objects.
3. Discrimination of differences in color. In some jobs color discrimination is very important and the employee

---

(121) Tiffin, op. cit.

(122) Tiffin, op. cit.

should be able to discriminate between very fine shades of color.

4. Phoria - postural characteristics of the eye under different distances. With some testing devices the eyes are prevented from converging on one point and so the eyes converge or diverge from that required in normal seeing at the test distance. This amount of convergence or divergence is measured either laterally or vertically according to the deviation from the normal position of the eyes.

Tiffin (123) reports the results of a study by Coleman on the relationship of visual acuity to job performance. Coleman finds the better producers to have better acuity.

Stump (124) uses 12 visual tests incorporated in the Bausch and Lomb Ortho-Rater to take measures on heavy industry employees and he finds that workers with better far vision were accident free.

On the other hand, Tiffin, Parker and Habersat (125) again, using the Bausch and Lomb Ortho-Rater in an optical industry have found the injury free group has superior visual performance on near vision tests. They explain this fact saying, "in Stump's studies the critical ratios were high for several distance visual skills, but

---

(123) Tiffin, op. cit.

(124) Stump, N. R. A statistical study of visual functions and industrial safety. J. Appl. Psychol., 1945, 29, 467-470.

very low for near visual skills. This may be due to the fact that on the jobs in a heavy industry, distance visual skills are more frequently required in performing the job. For the jobs, the present study, in the optical industry, near visual skills are essential and are, therefore, important for safety (125)."

Minimum (126) has administered a variety of tests to three groups of streetcar motormen and has compared the scores with accident records. His results indicate that tests of speed and accuracy and of judgment of distance give the best predictions. These findings are verified for a group of taxicab drivers by Ghiselli and Brown (127).

---

(125) Tiffin, J., Parker, B. J., & Habersat, R. W.  
Visual performance and accident frequency.  
J. Appl. Psychol., 1949, 33, 499-502.

(126) Ghiselli & Brown, op. cit.

(127) Ghiselli & Brown, op. cit.

The National Safety Council (128) reports on a series of visual tests administered to 180 motor coach operators which show very little relationship with safety from accidents.

Thorndike (129) reports Cobb's results on 3000 drivers in the state of Connecticut. Correlations of 28 variables concerned with visual sensation and perception do not exceed .10 in absolute value.

Again, Thorndike reports the results of Bransford's study on 2000 persons in the District of Columbia. Bransford has used four kinds of visual tests - depth perception, glare sensitivity, color vision, speed estimation. The correlations with accident rate are very low and none is significantly different from zero. Only visual acuity tests show some positive correlations with accident rate.

Parker (130) and Stump (131) in their studies give some indication of phoria or ocular muscle imbalance correlating with accident rate. They both used the Bausch and Lomb Ortho-Rater

- 
- (128) Ghiselli & Brown, op. cit.
- (129) Thorndike, op. cit.
- (130) Parker, J. W. Jr. Psychological and personal history data related to accident records of commercial truck drivers. J. Appl. Psychol., 1953, 32, 317-320.
- (131) Stump, op. cit.

in their studies.

However, Davis's (132) study on trying to find correlation between visual acuity tests and clinical tests make us very cautious in the treatment of these test results. Davis finds that phoria-accident relationships do not correlate well with clinical estimates of phoria.

These psychometric tests discussed here showing correlations with accidents have also been used in other studies to measure different forms of psychological disorders. For example static ataxia which Ghiselli and Brown (133) use as a predictor of accidents, is used by Eysenck (134) as a measure of neuroticism. Eysenck (135) has also used speed of tapping and accuracy in the dotting test to differentiate between normals and neurotics and mainly to differentiate between extraverts and introverts. Granger (136) used a number of tests, such as color perception tests, as indicators of psychological disorders and he agrees with

- 
- (132) Davis, C. J. Correlation between scores on ortho-rates tests and clinical tests. J. Appl. Psychol., 1946, 30, 596-603.
- (133) Ghiselli and Brown, op. cit.
- (134) Eysenck, op. cit.
- (135) Eysenck, op. cit.
- (136) Granger, J. W. Personality and visual perception: a review. J. ment. Sci., 1953, 99, 8-43.

Eysenck's distinction of the extravert and introvert. Granger has also shown that under some conditions neurotics and psychotics are inferior to normals in dark vision and visual acuity and phoria. Eysenck (137) has also found that the intelligence of dysthymics or introverts is slightly higher than the intelligence of hysterics or extraverts. High personal tempo and lack of persistence which has been found to correlate with accidents, have also been found by Eysenck to correlate with extraverts. Thorndike's conclusion that accident individuals tend to sacrifice accuracy for speed, is found also true for extraverts. The galvanic skin response which is used by Venables (138)(139) to find some relationship with motor tests, has also been used by Eysenck for a differentiation between extraverts and introverts (140).

In conclusion to this section we can say that those psychometric test that have shown some validity in predicting accident likelihood have also shown some validity as measures of more general personality characteristics, such as Eysenck's and

- 
- (137) Eysenck, op. cit.
- (138) Venables, P. H. Some findings on the relationship between GSR and motor task variables. J. gen. Psychol., 1956, 55, 199-202.
- (139) Venables, P. H. Changes in motor response with increase and decrease in task difficulty in normal industrial and psychiatric patients. Brit. J. Psychol., 1955, 36, 101-110.
- (140) Eysenck, op. cit.

his co-workers studies show.

### Hypothesis

In the review of the literature on the accident problem in this and the previous chapter we have seen that there is a great deal of ambiguity existing from the point of view of accident criteria, the definition of accidents, the description of accident personality and lastly the kind of tests used to find the psychomotor abilities of the worker. We have also seen that several of the tests used in the accident situation are also used by Eysenck (141) and others to differentiate between more gross personality syndromes including extraversion or introversion. And also taking Eysenck's description of the extravert mentioned on page 27 of this thesis, we formulate the following hypotheses to be dealt with in this study:

First, our major task will be to find a criterion of accidents and to see how our criterion tests correlate with the scores on a battery of paper-and-pencil tests and few motor tasks, like the Drake Index.

Second, we shall try to find out whether those who score highly on extraversion and neuroticism on the MPI will also score highly on all the rest of the tests. In other words, how do the

---

(141) Eysenck, op. cit.



tests used in this study correlate with our criterion tests, and especially, how do the scores of extraversion and neuroticism on MPI correlate with the criterion tests, i.e. whether Eysenck's assumption of the extravert being an accident-prone individual is justified.

And thirdly, we shall attempt to cross validate tests used in previous studies.

## CHAPTER IV

### Experimental Procedure

#### A. Description of Tests

Any study into the causes of accidents brings us face to face with two problems which are discussed quite extensively in the first chapter, namely, the establishment of the criterion and the selection of subjects. As it was mentioned before a study can be carried either by the administration of different verbal or motor tests or by the interview or questionnaire methods. Both methods have their shortcomings. The first type measures only the present motor aptitude of the individual disregarding his verbal abilities and past while the second type - the interview - may be highly incorrect in the picture it gives of the subject because the interview may either forget the number of accidents he has had or fearing to leave a bad impression on the investigator he may intentionally minimize his tendency to have accidents.

To avoid these difficulties two kinds of criterion tests were used - the accident index, a questionnaire, and the Porteus Maze, a motor test.

##### 1. Accident Index

This questionnaire, seen in Appendix I, was especially constructed by professor J.D. Keehn of the Psychology Department, Mr. Ihsan Al-Issa, and the writer. Accidents mentioned in the criteria of different studies were collected and 41 questions of the most common everyday accidents were selected. Even though memory plays a role in trying to mark the accidents the individual has had, the Index emphasizes more the tendency of having accidents or rather the liability the individual has of committing

accidents. In this way the Index is an improvement over the interview method which emphasizes mainly the memory of past accidents.

## 2. Porteus Maze

The adult Porteus Maze, shown in Appendix I, is mainly used as a counterpart to the Index as a more direct reprint of the actual accidental situation. It is like an artificial street, the lines of the Maze are considered the walls of the street and the pencil in the hand of the subject is considered the car which has to find its way through the walls of the maze. This test has also been used by others in its present form as a street and the pencil as a car (142).

## Accidents and Extraversion-Introversion

Our main purpose, as mentioned before in the hypotheses in chapter III, in this study, is to cross-validate some of the tests used before in accident studies and to investigate Eysenck's hypothesis that the accident individual is also an extravert. For this purpose our main task was to find tests which were used both in accident investigations and in extraversion-introversion studies. We had also to define the extravert personality in terms of Eysenck's theory of personality to enable us to obtain the desired correlations. To measure extraversion we have used the Maudsley Personality Inventory, and two other questionnaires which measure different aspects of the extraverted personality which are said to correlate with accidents.

---

(142) Porteus, S. D. The Porteus Maze Test and Intelligence.

1. Extraversion-Introversion Questionnaires

a. Annoyances - is a questionnaire of 30 statements which may possibly annoy some people. According to Eysenck the introvert is more irritable than the extrovert (143). The questionnaire is constructed having this point in mind.

b. Worries - Again according to Eysenck's description the introvert has a tendency to develop more anxiety than the extravert (144). Having this as a lead a questionnaire of 15 groups of possible anxiety producing ideas is constructed.

c. Maudsley Personality Inventory - as is shown in the Appendix is an extravert-neuroticism test of 80 questions constructed and used by Eysenck in the Maudsley Hospital on milder neurotics (145). The questionnaire is used in this study in its original form except for very slight changes. The Inventory has its own key for analyzing the answers. Twenty-four are items of extraversion and 24 are items of neuroticism. The subject has three choices for each question - yes, ?, and no. A higher score than the average, in let us say extraversion items, means the person is more extraverted than introverted.

Tests of Accident Proneness

1. Intelligence Tests

These group of tests are widely used in accident studies by Henig and Chambers (146). These two investigators in their independent studies have definitely found a positive or negative relationship

---

(143) Eysenck, op. cit.

(144) Eysenck, op. cit.

(145) Eysenck, H. J. The Scientific Study of Personality.

(146) Tiffin, op. cit.

between low intelligence scores and accidents. Moreover, Eysenck defines the extravert as lower in intelligence and poorer in performance on vocabulary test.

In our investigation we have used two intelligence tests.

a. Vocabulary test - commonly known as the Hill Mill vocabulary test used with a little variation. It consists of 49 words. On each row there are 4 similar words to the first word given. The subject has to underline the word most similar to the first word given. The test is timed. Each correctly underlined word gets a score of one.

b. Reasoning test. - It is known as the Pearson Reasoning Test. It consists of 30 groups of numbers on each row. Again the test is timed. The subject has to underline the group of numbers which is exactly the same as the first group of numbers. The more groups are underlined correctly the higher the score.

## 2. Personal Tempo

These kinds of tests are another group of tests which are widely used in accident studies. Farmer and Chambers (147) and Rimoldi (148) have given special attention to them. The following are two examples of these.

a. The Dotting Test - is a test used by Farmer and Chambers (149) and also by Eysenck. Rows of circles in a regular sequence are printed on a sheet of paper and the subject is asked to put a dot in

---

(147) Farmer & Chamber. Psychological Tests for Accident Proneness and Industrial Proficiency.

(148) Rimoldi, op. cit.

(149) Farmer & Chamber, op. cit.

each circle. The score is the number of circles dotted.

b. The Tapping Test - is a test used by Rimoldi (150). The device used for this test in our study is a little varied from Rimoldi's even-though the principle is kept the same. The subject is seated in front of an automatic device which he taps easily with his forefinger, and the subject is asked to strike on the key with his natural tempo. The time in seconds is taken for 40 strokes. The score is the average time of the two trials that the subject is asked to perform.

c. The cancellation test - Also used by Farmer and Chambers (151). A slight variation of this test is used by Eysenck (152). Rows of numbers are printed on the paper and the subject is asked, the first time, to draw a line over all number 2s and the second time to draw a line over all number 9s. The subject has two 15 seconds trials. His score is the average number of cancellations on the two trials.

#### 5. Reaction Time

a. Word Association - Reaction time tests are widely used in accident experiments. Eysenck has utilized reaction time to differentiate between extraverts and introverts. In this test the subject is seated comfortably on a chair and is given a word to which he is asked to respond with the first individual word which comes to his mind until he is asked to stop. The score is the number of words he has associated in 30 seconds.

---

(150) Rimoldi, op. cit.

(151) Farmer & Chambers, op. cit.

(152) Eysenck, op. cit.

## 6. Perceptual

According to Eysenck neurotics and extraverts are more color conscious than normals. Accident individuals, according to the clinicians are quick but inaccurate in their perceptions (153)(154). In the present study we have utilized two tests for measuring perception - Stroop Ratio and Reading Test.

a. Stroop Ratio - This is a test devised by Stroop. This test consists of two black cards on which the name of colors are printed in a systematic order. On one of the cards the colors are printed in white letters and on the second the colors are printed in the colors mentioned on the card but each label has a color unattached to the label. The subject is first presented with the uncolored card and is asked to read the rows in a horizontal order and the time he takes to finish the reading is recorded. Then the subject is presented with the colored card and is asked to read it. The time is recorded similarly. The difference of the two readings is his score.

b. Reading test - A part of a story is printed on a page and the subject is asked to read it as quickly and as accurately as he can. Both the time and the mistakes he makes are recorded.

## 7. Sensori-motor tests - Drake Index

This Index is used by Drake (155). According to Drake's theory the accident individual reacts before he perceives and so he

---

(153) Eysenck, op. cit.

(154) Tiffin, op. cit.

(155) Tiffin, op. cit.

makes accidents. For this purpose two tests are used; a perceptual test and a motor test.

a. Perceptual Matching - A similar test is used by Farmer and Chambers (156) and Eysenck (157) to measure perception. On a sheet of paper rows of mixed groups of letters and numbers are printed. One of the groups is exactly the same as the first group in the row. The subject is asked to underline the correctly matching group with the first group. The score is the number of underlinings in 1 min.

b. Tweezers Test - a similar test is used by Drake in his study and Rimoldi (158). The subject is given a rod, a pair of tweezers and 15 iron rings. He is asked to place the rings on the rod with the tweezers one by one. The time he takes to finish the 15 rings is recorded. Then difference of the performance on the two tests is taken as his final score.

In this chapter we have tried to give a description of the tests used in this study. In the next chapter we will try to give the word by word administration of the tests.

---

(156) Farmer & Chambers, op. cit.

(157) Eysenck, op. cit.

(158) Rimoldi, op. cit.



CHAPTER V  
Description of Subjects  
and  
Administration of Tests

As it was mentioned before subject selection is a problem in accident studies. In this study university students were selected. They were mainly volunteers who were paid a small amount of money for the help they were offering us. No sex differentiation or class was taken into consideration. The age range was 21 - 25 years. As they were all university students no intelligence test was given.

We have chosen 15 tests for this study and decided to have a sample of around 50 subjects taking the tests. To cover the desired number we elected 60 subjects taking into consideration that in a similar study elimination of subjects because of some failure either in the test administration or in the subject's performance is inevitable. After elimination of the incomplete tests 57 subjects were left for analysis.

In the previous chapter a detailed description of the tests was given. In this chapter we will deal with the administration of each test.

1. Criterion tests
  - a. Accident Index

This test is a group test but for purposes of convenience

it was administered individually as a part of the series of tests to be given in the whole study. The subject was seated in front of the table and was given the following instructions which were printed on the top of the questionnaire.

"Will you please answer each question by putting a circle round 'yes' or 'no'. If you cannot make up your mind, circle the '?'. Work quickly and do not worry too long about the exact meaning of each question. There are no right or wrong answers, and no trick question. Remember to answer every question as accurately as you can."

b. Porteus Maze.

S was given a pencil to be used by his preferred hand. E put the Maze on the table in front of S with its opening upwards. S was asked to put the pencil on letter "S" in the center of the Maze and he was given the following instructions:

"Drive the pencil through this maze and find your way out." His accident score was the number of times the pencil cut one of the sides of the Maze.

2. Questionnaires

a. Annoyances

Again it is group test administered individually. S was seated in the room of the experiments and was given the questionnaire on which the instructions were printed. He was instructed to "put" a tick against any of those things which annoy you." His annoyances score was simply the number of ticks he put on the questionnaire.

b. Worries

Like the Annoyances the test was given individually directly

after finishing the previous questionnaire. S was given the following instructions printed on the top of the list of worrying statements: "Read through the lists given below and cross out everything about which you have at any time of your life felt worried, anxious, or nervous. Cross out as many or as few items as you wish. Be sure to cross out everything about which you have ever worried."

The number of crossings is the score recorded.

c. Maudsley Personality Inventory

This questionnaire also was given when S was in the experimenting room. The following instructions were printed on the top of the inventory: "Please answer each question by putting a circle round "yes" or "no". If you cannot make up your mind, circle the "?". Work quickly and do not worry too long about the exact shade of meaning of each question. There are no right or wrong answers, and no trick questions. Remember to answer each question."

This inventory has a special key for scoring the answers. Both extraversion and neuroticism get scores which are added later. This numerical value is of interest only in comparison with the norm.

3. Intelligence

a. Vocabulary

This test is a group test but was given individually. The test was timed and S was given the following instructions: "You have a list of words here. In each row of five words below, underline the word which means the same as the first word in that row. You have to stop when you are asked to. You have only 4 minutes to finish the list. Read, start."

His vocabulary score was the number of correct underlinings.

b. Reasoning Test

First S was given a page explaining and demonstrating the principles of how to work on the test. Then E helps him to solve few of the numbers demonstrating how to work them out. S is given the following instructions: "On this page you have more rows of numbers like the ones that we solved together. In each row three of the groups of numbers are alike in some way. Underline the one that is different. You have only four minutes to work on this test. Ready? Start."

S's score is the number of correct underlinings.

4. Personal Tempo

a. Dotting

The page of printed circles is placed in front of S. He always has a pencil in his hand. This instruction is given:

"In these circles you have to put a dot with your pencil, like this (fill some of the circles in the bottom of the page to show him how to do it). When you hear a tick on the table you have to draw a line over the circle which is under your pencil on the moment, like this (cross the circle when you produce a tick with your other hand.) You will stop when you are told to stop. Ready? Start!"

Originally this test was to be scored differently and to be used to measure the progression of S's tempo from the first 15" to the 8th 15". But later this method was thought unnecessary for the purposes of the study and S's score was taken the number of dotted circles in two minutes.

b. Tapping

S was seated with his left side parallel to the table. E put his arm on the table opening his fingers and placing his forefinger on the tapping instrument demonstrating to S how to perform the experiment. When he was instructed: "You have to tap this instrument (show him how) at your normal speed. You will have two trials on this test. You will stop when you are asked to stop and then you will start again when you are told to do so. Ready? Start!"

S's score is the time he takes to tap forty on the first trial and the time he takes for forty tappings in the second trial. The average of the two trials is S's final score.

c. Cancellation

A page of numbers are presented to S. E tells him: "You have to cross all number 2s on each row, like this (demonstrate on the bottom of the page). You will stop when you are told to stop. Ready? Start!"

2nd trial - another page of numbers is given to S, "This is a page similar to the first one, except that on this page you have to cross out all the number 9s (like this (show him how)). Like the first time you will stop when you are asked to. Ready? Start!"

S's score is the number of the crossed out 2s in 15 seconds in the first trial and the crossed out 9s in 15 seconds in the second trial. Later the average of the two trials is taken as S's final score.

5. Reaction time

Word Association: S is placed on a chair in front of E. E gives

him the following instructions: "In this test I am going to say a word and then you must continue by saying all the words that come into your head until I tell you to stop. The words must come just as you think of them and you must not construct sentences. Suppose I say black. You must not say - The black boy went for a walk down the road etc. But just separate words like: blue, green, grass, tree and so on. Is this clear? Don't forget - When I say the word you say the first word that it reminds you of and then continue to say words until I tell you to stop. Ready? the word is tree (start watch)."

S's score is the number of associations he makes in 30 seconds.

## 6. Perceptual

### a. Stroop Ratio

S is seated in front of a table comfortably. All pencils and extra papers and books are removed from the table. The cards are shown by one in turn. First the top line of the non-colored card was exposed and he is instructed: "I want you to read the words on this page as quickly as possible (reading top line). Ignore this line, and start with the first word under the line and go along all these lines as quickly as you can to the end of the page. Are you ready? Go. If you make a mistake repeat the word and then go on.

Next top line of the colored card is exposed.

"Now I want you to do exactly the same with this card. Just read the words (read top line to the subject) as quickly as you can. Start again at the first word under the line and go on to the end as quickly as possible. If you make a mistake you may correct it. Ready, Go!"

S's score is the time he takes to read each card. His final

score is the difference of the two readings.

b. Reading Test

A printed paragraph is presented to S and E tells him: "Here is a paragraph for you to read. Read it aloud normally as you would read it in class or to yourself or to a group friends listening to you. We will stop when you finish reading the paragraph. Start."

S's score is the time he takes to read the paragraph.

7. Sensori-motor-Drake Index

a. Perceptual matching

Rows of letters and numbers mixed in a random order are printed on a page of paper and presented to S. S is instructed: "Here are rows of letters and numbers. One of the groups on each line is exactly the same as the first group of that same line. (Illustrate on bottom of the page). You have to underline the right hand group which exactly matches the left hand group. Ready, Start!"

S's score is the number of underlinings in one minute.

b. Tweezers Test

S is seated in front of a table and is presented with all the necessary materials for the test. Everything else is removed from the table. S is instructed: "Here are a pair of tweezers, iron circles and an iron rod. You have to pick up each iron circle with the tweezers having the side of the circle in between the tweezers, and place it on the rod, (show him how to do it). You are not permitted to hold more than one at a time or to hold the iron circles in any other way, or use your other hand. You will repeat the performance until all the fifteen

little rings are resting at the bottom of the rod. You do not have to hurry. Work at your most convenient speed. Are you ready? Go. (Start the watch)."

The score is the time  $S$  takes to finish all the fifteen circles. In the next chapter we will discuss the mode of analysis of all the performance on these tests and we will give the results of these tests.



## CHAPTER VI

### Results and Interpretations

Subject selection in accident proneness studies has always presented big problem. It is a greater problem especially when there are a number of tests to be correlated. So one major task in this thesis has been to find first of all a criterion of accidents which will help us both in the selection of our subjects and the correlation of different tests used by other investigators. The Accident Index (A.I.) and Porteus Maze (P.M.) are used for the purpose of establishing a criterion.

Our initial assumption was that those two criteria tests would correlate with each other since they are both measures of the accident proneness idea. But after correlating the answers of 57 students on the Accident Index with the Maze cuts we obtain only a correlation of +0.22 which is not significantly different from zero. This result may be due to the fact that even though both are measures of accident-proneness each measures a different aspect of the same phenomenon. The different nature of these two tests may again affect the result. One is an objective test - the Porteus Maze, and the other is a questionnaire highly dependant on the memory and disposition of the subject. Also the Accident Index represents a collection of different kinds of accident situations while Porteus Maze offers only a very restricted range of accident situations for which the subject is tested.

However, both of our criterion tests seem to be quite reliable. The split-half reliabilities of both criteria tests are calculated and

after using the Spearman-Brown formula on the odd and even items of the Accident Index a corrected correlation of 0.84 is obtained. The Porteus Maze yields a correlation of 0.78. Both are significantly different from zero at the 0.01 level of significance.

Tests	Correlation Coefficient	Corrected Correlation	r/S.D. <sub>r</sub>	Level of Significance
Accident Index	0.73	0.84	4.35	0.01
Maze (cuts)	0.64	0.78	4.19	0.01

Table III. The correlation coefficient, the corrected correlation,  $r/S.D._r$  and the level of significance of the split-half reliabilities by the Spearman Brown Formula of Accident Index and Porteus Maze.

The high reliability of the Accident Index merits special attention since the questionnaire is formed by different kinds of accident situations.

Correlation of criterion tests with paper-pencil tests.

One of our problems is to find whether some of the different tests used by other investigators are measures of accident-proneness, in other words, do those tests measure the concept of accidents. We have to find also if the concept itself exists. To achieve our different aims we have chosen carefully our ten tests described in chapter IV and V and correlated them each one separately with the Accident Index and then the Maze.

We have grouped these tests according to what they measure as indicators of accident-proneness.

As our next major hypothesis was to find whether the extravert

and the neurotic personality is an accident-prone individual, we have also included a battery of three extraversion-introversion tests.

Our aim has been to present all our tests to 61 students but because of some missing or badly administered test items on the Accident Index we have been obliged to reduce the number to 57 subjects. But we have been able to keep the 61 subjects on the correlations with the Maze.

And finally to obtain the desired correlations we have used Pearson's product-moment-correlation-coefficient.

The scores on the Accident Index questionnaire range from 10 to 82 and the Maze cuts from 0 to 15 .

Criterion tests and Intelligence tests correlated

The scores of the two intelligence tests - vocabulary and reasoning - have been converted to z-scores, to obtain one common value to be correlated with the two criterion tests. To obtain the level of significance of our correlation values we have calculated the Z score with the formula  $\frac{r}{S.D._r} = r \sqrt{N-1}$ .

The  $\frac{r}{S.D._r}$  value with the Accident Index is -0.45 which is not significantly different from zero and with the Maze is 3.41 which is significantly different from zero at the 0.01 level of significance.

Tests	Correlation coefficient	$\frac{r}{S.D._r}$	Level of Significance
Accident Index & Intelligence test	-0.06	-0.45	Non-significant
Maze and Intelligence	0.44	3.41	0.01

Table IV. The correlation coefficient,  $\frac{r}{S.D._r}$  and the level of significance of the Intelligence tests with the Accident Index and the Porteus Maze

These results show that these particular intelligence tests used in this study show no correlation with our Accident Index questionnaire or if they show any it is in the direction of a negative relationship, while they correlate highly with the Maze.

The non-significant relationship of the Accident Index and the Intelligence tests can be explained by taking into consideration the nature of the two tests. Accident Index is a highly subjective test which depends on the memory of the subject and his disposition towards the testing at the moment, while the intelligence tests we have used depend on the actual reasoning ability of the subject and they are highly objective in their form. With different tests probably it will be possible to get significant relationships. However, the correlation between the Maze and the Intelligence tests we have used are in the expected direction as many investigators have already shown that intelligence plays a role in accident situations.

#### Personal Tempo and Criterion Tests

The three personal tempo tests used in this study are each separately correlated with the two criterion tests. As is shown in Table V the  $\frac{r}{S.D.r}$  scores of the Dotting test with the Accident Index is 0.55, the Tapping test is -0.82 and the Cancellation 0.22. None of these correlations are significantly different from zero.

The  $\frac{r}{S.D.r}$  scores of these three tests with the Maze are: Dotting test 0.26, Tapping 0.27, Cancellation 1.86. Again they are not significantly different from zero. Only the Cancellation test approaches the 0.05 level of significance.

Tests	Correlation Coefficient	$\frac{r}{S.D._T}$	Level of Significance
Accident Index & Dotting	0.074	0.55	non-Significant
Accident Index & Tapping	-0.11	-0.82	"
Accident Index & Cancellation	0.029	0.22	"
Maze & Dotting	0.033	0.26	"
Maze & Tapping	0.035	0.27	"
Maze & Cancellation	0.24	1.86	"

Table V. Correlation coefficients,  $\frac{r}{S.D._T}$  and level of significance of the Dotting, Tapping and Cancellation tests with the Accident Index and the Porteus Maze.

These results mean that none of these tests are measures of accidents according to our criteria tests. The Tapping test shows a negative correlation.

This non-significant relationship may be due to the fact that the two other tests were administered in a given time limit and the subject was urged to work more or less under stress. On the Tapping test the subject was asked to tap the instrument at his natural speed without hurry. The number of tappings was kept constant and the time varied according to the subjects' speed. If the time was kept constant and the number of tappings varied then the results could most probably be different. However, the almost significant relationship of the Cancellation test with the Maze may indicate a larger positively

significant correlation if larger numbers of subjects are provided for a future study.

Reaction Time and criteria Tests

The speed in reacting to a certain situation is considered a measure of accident proneness or accident safety by many investigators. The Free Association Test was used as a reaction time test in this study. Again because of some mistakes in the recording of the results of this test only the scores of 40 subjects were available for correlations. The  $\frac{r}{S.D._r}$  score with the Accident Index is 0.87 which is non-significant and with the Maze 3.02 which is significant at the 0.01 level.

Tests	Correlation Coefficient	$\frac{r}{S.D._r}$	Level of Significance
Accident Index and Free Association	0.14	0.87	non-significant
Maze and Free Association	0.46	3.02	0.01

Table VI. Correlation coefficients,  $\frac{r}{S.D._r}$  and level of significance of the Free Association Test and the criterion test.

These results indicate that while for some situations, as in the Maze, which provides in its make-up, a very approximate situation to driving where motor speed is essential, the free association test can be used in a battery of other tests for prediction purposes of accident prone. The non-significant relationship with the Accident Index indicates that in cases where motor speed is not asked for the Free Association test adds nothing for prediction.

Percentual Tests and Criterion Tests

According to Eysenck extroverts and neurotics are more color conscious than normals. Many clinicians also believe that accident individuals are quick but inaccurate in their perceptions. This hypothesis would be accepted if we find a significant correlation of the Stroop Ratio with the Accident Index and the Maze. Again a significant relationship of the Reading Test with the Accident Index and the Maze would give a confirmation of the clinical view.

The  $\frac{r}{S.D._T}$  scores of the Stroop Ratio with the Accident Index is 0.096 which is not significantly different from zero and with the Maze is 0.92, again non-significant. The Reading Test gives a  $\frac{r}{S.D._T}$  of -1.11 with the Accident Index and -0.52 with the Maze which are both not significantly different from zero.

Tests	Correlation Coefficient	$\frac{r}{S.D._T}$	Level of Significance
Accident Index & Reading Test	-0.15	-1.11	non-significant
Accident Index & Stroop Ratio	0.013	0.096	"
Maze and Reading Test	-0.067	-0.52	"
Maze and Stroop Ratio	0.12	0.92	"

Table VII. Correlation coefficient,  $\frac{r}{S.D._T}$  and level of significance of the Reading Test and Stroop Ratio with Accident Index and Maze.

In this study no indication of the validity of Eysenck's theory is found about the accident-prone being more color conscious.

But a larger number of subjects and a comparison of the scores of the most extroverted with the most introverted personalities, in a further study, can give us better grounds for the final refusal of Eysenck's assumptions. However, a better idea for future studies which may give more significant results, would be to count the mistakes that subjects make while reading the passage. The mistakes he makes while reading may be better indicators of the probable accidents that the same subject may make in a real life situation, than just the time he takes for reading the passage.

#### Drake Index and Criterion tests

According to the Drake hypothesis (Chapter IV) an accident-prone person is faster in reaction and slower in perception, i.e. he reacts to an accident situation without first perceiving and comprehending the stimulus. So the difference of the scores of a perceptual and a motor test is taken to test the Drake Index. A minus result- perceptual minus motor test - indicates an accident prone subject, while a positive result indicates higher perception and an accident free person.

Following the steps of Drake, in this study, we have a Perceptual Matching Test and a Tweezers Test. Each test was administered separately and then the z-scores of the actual test scores were computed and the difference of the Perceptual minus the Motor test was taken. This score was correlated with the Accident Index and Maze.

The  $\frac{r}{S.D.}$  score with the Accident Index is -0.38 while with the Maze -1.46. Both are not significantly different from zero. The correlation with the Maze gives slightly higher results which approaches the 0.01 level of significance.



Tests	Correlation Coefficient	$\frac{r}{S.D._T}$	Level of Significance
Accident Index and Drake Index	-0.05	-0.38	non-significant
Maze and Drake Index	-0.19	-1.46	"

Table VIII. Correlation Coefficient,  $\frac{r}{S.D._T}$  and level of significance of the difference of Perceptual Matching and Tweezers Tests with Accident Index and Maze.

Following these results, in this study, the hypothesis of the Drake Index is rejected. But because the Maze is more like the car on the actual street situation we have a higher negative correlation which approaches a significant level. This fact gives us more ground to say that the issue can not be considered closed unless the study is repeated. Probably sharper personality differences, having a high accident record persons compared with individuals having a low accident record, may give more significant results.

Extraversion-Introversion and Criterion Tests.

Our next hypothesis in this study was to test Eysenck's assumption of extraverts and neurotics being more accident prone than introverts. For this reason we have administered three tests: Annoyances Test in which the subject has to mark the statements which annoy him, the Worries Test where again the subject has to mark all events which have worried him in the past or which worry him when he thinks of the future. More marks means an anxious, worried person which indicates a neurotic tendency and an accident-prone individual. As a more reliable measure of extraversion and neuroticism we have used the Maudsley Personality Inventory which Eysenck himself has used in an extensive study. Those

three tests are each independently correlated with the two criterion tests.

The  $\frac{r}{S.D.r}$  with the Accident Index of the Worries is -0.34, Annoyances 1.39. The Maudsley Personality Inventory gives two separate scores - an extraversion score and a neuroticism score. Because the questions are so arranged that some of them are strictly measures of neuroticism and others measures of extraversion, we have two separate scales. The  $\frac{r}{S.D.r}$  of the Accident Index is 1.41 with extraversion and 3.78 with neuroticism. The  $\frac{r}{S.D.r}$  scores of the Maze with Annoyances is 2.02, Worries 1.24, extraversion 1.69 and neuroticism 0.85.

Tests	Correlation Coefficient	$\frac{r}{S.D.r}$	Level of Significance
Accident Index & Annoyances	0.18	1.39	non-significant
Accident Index & Worries	-0.045	-0.34	"
Accident Index & Extraversion	0.19	1.41	"
Accident Index & Neuroticism	0.51	3.78	0.01
Maze & Annoyances	0.26	2.02	0.05
Maze & Worries	0.16	1.22	non-significant
Maze & Extraversion	0.22	1.69	"
Maze & Neuroticism	0.11	0.85	"

Table IX. Correlation coefficients,  $\frac{r}{S.D.r}$  level of significance of Annoyances Test, Worries Test and Maudsley Personality Inventory with Accident Index and Maze.

The two significant relationships of the Accident Index with Neuroticism and the Maze with Annoyances are towards the expected direction as many clinicians and Eysenck have said in their studies that the neurotic or the nervous personality is an accident prone individual. Except the Worries Test which gives both a negative and a non-significant result with the Accident Index, all the rest of correlations are positive and approaching a significant result. These results may be taken, in this study, as an indication that our hypothesis cannot be definitely rejected or accepted without further study. However, we can definitely say that the Worries test shows almost no relationship with the criterion test the Accident Index. And also the very low relationship of the Neuroticism with the Maze probably means that neuroticism may not play a great role in accident situations where activities like driving are in question. A larger study where only these criterion tests are correlated with the neuroticism and extraversion tests is recommended.

In the next chapter there will be an attempt of summarizing all the results discussed in this chapter to reach a final conclusion for this study.

## CHAPTER VII

### Summary and Conclusions

In the modern world where machines have taken the place of hand labour and where precision is very important, there are many opportunities for the worker to make accidents. It is the great loss of money and human lives that has driven a number of psychologists into the investigation of the accident problem. Their researches have not been unfruitful. Some factors have been found as precipitators of accidents, such as environmental conditions, age, fatigue. However, there is a great deal in the field of industrial accidents that have not been settled yet.

When attention was directed towards the psychological factors in accidents a new concept attracted the attention of the investigators and that was the hypothesis of accident-proneness. Observation of industrial workers led them to believe that these were some individuals who were more apt to have accidents than others. By learning out these individuals - accident prone - they believed that the number of accidents could be greatly reduced. Many superficially conducted experiments were devised which confirmed the existence of the concept. But later when statisticians analyzed the underlying mathematical factors of the problem they discovered that a number of cases were expected to have an accident record by the basis of chance alone. Also the possibility of greater risks in the industrial situation made a number of cases appear to have more accidents than others. Only some of the studies carried out on the highway and on industrial

accidents could give a significant result which made the hypothesis of accident proneness acceptable.

Clinical studies on the accident repeating individuals shifted the focus of the accident-proneness from statistical factors to the motivational and background factors of the industrial worker. They emphasized especially unconscious and repressed childhood experiences which manifested themselves in making accidents to dissipate hostility, to draw attention, or to punish himself and to get rid of the bothering superego. An unconscious desire to withdraw from work also created a heavier balance of more accidents for some individuals. Case analysis of these individuals settled the issue for the clinician who established the concept of accident-proneness definitely without any doubt.

On the other hand psychometric studies on high and low accident groups established the fact that intelligence plays some role in producing accidents. Some of the motor speed and coordination tests showed some relationship with accident frequency. There was also evidence of sensory mechanisms being important in industrial situations where accident safety was desired.

A theoretical analysis of introversion-extraversion by Eysenck advanced a new personality theory approach to the accident problem. It was especially interesting that he used many of the tests used in accident-proneness studies in his own studies for the differentiation of the extravert and the introvert. Through his experimental findings on hospital patients he came to the conclusion that the extrovert had a bad work history, he was off-work

often, and he was accident-prone.

Eysenck's theory of extraversion-introversion is open to criticism. Many psychologists do not agree with him. But this rapprochement between a personality theory based on theoretical analysis and the accident syndrome can be very fruitful in finally identifying and eliminating the accident individual and reducing the number of accidents in industry. It opens a new field for investigation.

Thus, so far, all the extensive researches on industrial workers have failed to produce one single measure which has a close relationship with accident frequency. Many kinds of measures have been found to differ from one person to another. Various tests of sensory and psychomotor mechanisms, personality factors and clinical appraisals of the individual have been useful in detecting accident individuals, and in reducing the rate of accidents. Test results have shown that accident-proneness, if it ever exists, is a very complex problem and the factors which make a person labeled so differ from one individual to another. This review shows that there cannot be any one definite test to identify the accident-prone individual.

#### Accident-proneness. Criteria problem. Extraversion-Introversion

Regarding the ambiguity of the accident-proneness concept and the various tests claiming reliability as measures of accidents, it was necessary to establish first, for any study, a criteria of accidents. This criteria would serve to test the concept of accident-proneness and to validate some of the tests used by previous investigators and especially by Eysenck in his studies of extraversion-introversion. If the validity of these tests, through correlation with the criteria

tests, was established then they could be recommended for use in future studies.

Also, seeing the utility of Eysenck's clear cut theory in a vast problem like the accident situation it was thought worthwhile to add a third hypothesis and to use the Maudsley Personality Inventory, an extraversion-neuroticism test used also by Eysenck on hospital patients. If we could find any correlations between the Maudsley Personality Inventory and our criteria test then we could say that the extravert is an accident-prone individual.

Since most of the past studies on accident proneness were carried on highway and industrial accidents or the subjects of the studies were individuals who had a long history of accidents, to make prediction possible it was thought better to take a sample of normal individuals who have never been in any industrial situation. If our results were significant then these tests would be used for selecting personnel for industry or driving. It was also necessary to eliminate risks of exposure of the subjects to dangerous industrial accidents. We had to have also a sample of homogeneous individual differences in respect to accidents in the past. It was also necessary to have a sample of normal individuals to test the extraversion-introversion hypothesis because Eysenck himself had used samples of hospital patients in most of his studies.

In choosing our criterion tests two points had to be taken into consideration:

1. We had to have a motor test which could provide, on a theoretical basis, the driving situation where possibilities of accidents were

presented to the subject. This laboratory test was essential because it was practically impossible to test subjects by exposing them to real accident situations. Moreover, in stimulated accident situations many outside factors could interfere in the results, such as when the subject knows that he is on the actual test field. While with laboratory tests many factors such as familiarity with the test which affect the result could be eliminated.

2. We had to give our subjects an inventory of all the possible kinds of accidents, both industrial and those occurring in real life, to be able to distinguish those who have a liability of accidents from those who don't.

Therefore a list of all possible accidents mentioned in clinical and other investigations, was made and then the most representative accidents were selected. The Accidents Index gave a general report on the subject's tendency to have accidents in certain kinds of situations.

The Porteus Maze had been used by others in accident investigations and was therefore used in this one. Language difficulty and the enormous work needed to translate our 18 tests from English to Arabic confined us to the selection of our sample from the University students who spoke English well.

#### Conclusions and Suggestions

There was no significant correlation between our criterion tests, Porteus Maze and Accident Index, which indicated that they were not measures of the same thing. It may be that the Accident Index was only a measure of a tendency according to the subjects'



Judgment and the Maze only a motor test used adequately in driving situations. This difference in the nature of the two tests may account for some of the tests showing a significant correlation with the Maze and others with Accident Index only.

In a future study, to obtain more significant results, it can be suggested a choice of more than two tests of the same nature to be used as criterion tests.

In general, the tests used in this study for validation showed no significant correlations with criteria even though some were in the expected direction. Only the Intelligence Test yielded a high significant correlation at the 0.01 level with the Maze. As many have established the fact that intelligence plays a role in accidents we can say that those tests can be used for predicting intelligent action in an accident situation especially if driving ability is in question. Another reason for this correlation may be due to the fact that the Porteus Maze was also used as an intelligence test in other non-accident studies. There is also quite a strong reason for the acceptance of the Drake hypothesis since the correlations of the perceptual tests and the Maze were slightly less than the 0.01 level of significance. The Cancellation Test, a personal tempo test, also gave with the Maze a correlation slightly lower than the 0.01 level of significance. This may be an indication of the reliability of Ribaldi's assumption that a slow uniform personal rhythm is an important factor in prevention of accidents. The next significant correlation was

between the Free Association Test and the Maze. In this test quick reaction was necessary. This is also required in avoidance of accidents. We may accept the validity of this test in a battery of other tests for measuring reaction to accident.

However, in spite of the non-significant correlations of the criterion tests with the other tests, we cannot definitely reject these tests as measures of accidents. The correlations even though small are in the expected directions. So we can only suggest, for future studies, the use of larger samples and more heterogeneous groups than only university students, because the age factor, sex differences, the cultural background of subjects may have a significant bearing on the results.

The next major hypothesis of this study was to test Eysenck's theory of the extravert being an accident prone individual. The Maudsley Personality Inventory was used specifically for this purpose. In addition the Annoyances test and the Worries test were administered. The correlations of the Worries test both with the Accident Index and the Porteus Maze were not significantly different from zero. The Annoyances test showed only a significant relationship with the Maze. The correlation of this test with the Accident Index was not significantly different from zero but it approached the 0.05 level of significance. This may indicate that the individual who gets easily annoyed is liable to have more accidents than the person who does not take much notice of annoying situations in the environment. The extraversion scale on the Maudsley Personality Inventory showed no significant difference both with the Maze and

the Accident Index. However, both results approached the 0.05 level of significance which may indicate that if larger samples were used results were possibly more significant. The neuroticism scale of the Maudsley Personality Inventory showed a significant relationship at the 0.05 level of significance with the Accident Index but no significant relationship with the Maze. These findings could reflect a tendency of the neurotic to being an accident-prone. But the lower correlation with the Maze may indicate that following the avoidance learning theory the neurotic being more on the lookout for changes may avoid accidents when faced with an actually dangerous situation.

These results on the Maudsley Personality Inventory are in agreement with another study carried out by Professor J. D. Keehn(159) on University students in Beirut. He also has found a significant relationship between the Accident Index and the N scale but no significant relationship between the E scale of the Maudsley Personality Inventory and Accident Index.

Following the findings of this study we have to reject Eysenck's hypothesis that the extravert is an accident prone. But because this is an important problem suggestions can be given for further researches with the Maudsley Personality Inventory on the accident problem. The questionnaire should be translated to the native language of the subjects and after administration it is a good idea to separate the high extraversion scores from the low extraversion scores and then to find the significant relationship of each group with the criterion tests and then compare the results

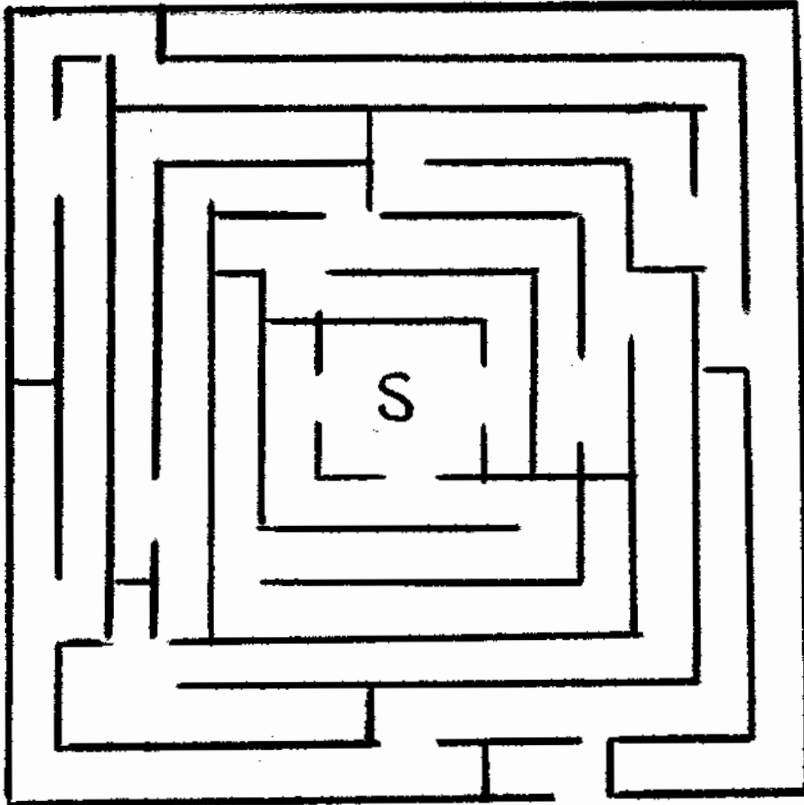
---

(159) Keehn, J. D. Response Sets and the Maudsley Personality Inventory. Unpublished Paper.

for interpretation.

In this study we have not been able to say that the accident proneness concept exists and is related definitely to extraversion. We have not been able to find a battery of paper-and-pencil tests to be used effectively in predicting accidents. This research may serve as a basis for similar researches in the future.

APPENDIX I  
CRITERION TESTS



The Porteus Maze

### Accident Questionnaire

Please write your number here \_\_\_\_\_

Will you please answer each question by putting a circle round "yes" or "no". If you cannot make up your mind, circle the "?". Work quickly and do not worry too long about the exact meaning of each question. There are no right or wrong answers, and no trick questions. Remember to answer every question as accurately as you can.

1. Do you often seem to cut yourself when you use sharp things? Yes ? No
2. Do you often bump into things and hurt yourself? Yes ? No
3. Have you ever eaten bad food or accidentally drunk a poisonous liquid? Yes ? No
4. Do you tend to make mistakes when you are writing? Yes ? No
5. Have you ever accidentally torn a book or newspaper or similar object? Yes ? No
6. Have you ever trapped your finger in a door? Yes ? No
7. Do people tend to bump into you on the street? Yes ? No
8. Do you find that by the time you made up your mind over something it is too late? Yes ? No
9. As a child did you always seem to be hurting yourself one way or another? Yes ? No
10. Have you ever broken one of your bones? Yes ? No
11. Do you tend to drop things and break them? Yes ? No
12. Do you often burn yourself by touching hot places? Yes ? No
13. Have you ever burned your mouth by eating or drinking something that was too hot? Yes ? No
14. Did you ever swallow a harmful object as a child? Yes ? No
15. Would you call yourself a careless person? Yes ? No
16. Are you the kind of person who always seems to be knocking things over? Yes ? No
17. Do you think you are an unlucky kind of person? Yes ? No
18. Do you sometimes bite your tongue when talking or eating? Yes ? No

19. Have you ever been almost hit by a car or other vehicle? Yes ? No
20. Do you often seem to be twisting or spraining your ankles and wrists? Yes ? No
21. Have you ever accidentally received an electric shock? Yes ? No
22. Have you ever hit your finger accidentally with a hammer? Yes ? No
23. Do you tend to spill things frequently? Yes ? No
24. Do your belongings seem to wear out quicker than you expect? Yes ? No
25. Do you sometimes misunderstand what people are saying to you? Yes ? No
26. Do you often tend to lose or misplace things? Yes ? No
27. As you walk do you sometimes trip over things? Yes ? No
28. Do you find it difficult to write neatly without making mistakes or marks on the paper? Yes ? No
29. Would you say that you are the kind of person who often has accidents? Yes ? No
30. Have you ever scalded yourself by, for instance, putting your hand in a hot liquid or putting your foot into a hot bath? Yes ? No
31. Do you frequently bruise yourself? Yes ? No
32. Do you find yourself sometimes forgetting things that you know very well? Yes ? No
33. Have you ever fallen down stairs? Yes ? No
34. Do you find difficulty in remembering which is the hot tap in your bathroom? Yes ? No
35. Have you ever mistaken the time after looking at your watch? Yes ? No
36. Have you ever felt yourself in danger while swimming? Yes ? No
37. Are you the kind of person who is frequently late for appointments? Yes ? No

- |   |       |    |
|---|-------|----|
| 38. Do you have one or more scars on your body?                         | Yes ? | No |
| 39. Have you ever touched a hot stove or similar object by mistake?     | Yes ? | No |
| 40. Do you tend to get ink on your fingers while you are writing?       | Yes ? | No |
| 41. Do you ever find that people's feelings are hurt by things you say? | Yes ? | No |



## APPENDIX II

### QUESTIONNAIRES (EXTRAVERSION-INTROVERSION)

Write your number you have been given here \_\_\_\_\_

Date \_\_\_\_\_

#### ANNOYANCES

Put a tick against any one of these things which annoy you.

1. A dog barks continuously.
2. Your bed is creaking.
3. A pneumatic drill outside your window.
4. The banging of a door.
5. The sound of hammering.
6. A noisy jazz band.
7. The sound of the radio when you want to be quiet.
8. Windows rattling.
9. The sound of a knife grating on a plate.
10. Creaking shoes or boots.
11. Being late for an appointment.
12. Losing your way.
13. Having too many things to do.
14. Forgetting what you are looking for.
15. Being unable to sleep.
16. Finding you have made a silly mistake.
17. Travelling in a crowded railway carriage.
18. Not being able to remember a name which is on the tip of your tongue.
19. Mislaying one of your possessions.
20. Oversleeping.

21. Having your leg pulled.
22. Being watched.
23. Someone telling you how to do your job.
24. Rude remarks about your personal appearance.
25. Unnecessary orders.
26. Stupid jokes at your expense.
27. Someone who keeps picking holes in your work.
28. Unpleasant gossip about your personal affairs.
29. Someone who keeps forgetting your name.
30. Being accused of something you haven't done.

Write the number you have been given here: \_\_\_\_\_

Date \_\_\_\_\_

### WORRIES

Read through the lists given below and cross out everything about which you have at any time of your life felt worried, anxious, or nervous. Cross out as many or as few items as you wish. Be sure to cross out everything about which you have ever worried.

1. War, cruelty, murder, loneliness, death.
2. Fear, weakness, irritability, shyness, stammering.
3. Marriage, aggressiveness, relations, sex, fickleness.
4. Unemployment, kissing, discouragement, headache, depression.
5. Insults, sleep, palpitations, drink, indigestion.
6. Forgetfulness, work, accidents, awkwardness, tiredness.
7. Overeating, sweating, falling, shouting, drowning.
8. Self-consciousness, impatience, moodiness, indifference, dizziness.
9. Teasing, rudeness, fault-finding, dullness, helplessness.
10. Nightmares, parties, suspicions, dances, quarrels.
11. Crowds, hysterics, whispering, strangers, dreams.
12. Persecution, unfairness, madness, darkness, parents.
13. Neighbors, burglars, animals, impulses, heights.
14. Athletics, wireless, poison, fireworks, knives.
15. Sickness, enemies, looks, fainting, blushing.

MAUDSLEY PERSONALITY INVENTORY

NAME (BLOCK LETTERS) \_\_\_\_\_

ADDRESS \_\_\_\_\_

COUNTRY OF BIRTH \_\_\_\_\_ AGE \_\_\_\_\_ SEX \_\_\_\_\_

MAJOR \_\_\_\_\_ DATE \_\_\_\_\_

**INSTRUCTIONS:** Please answer each question by putting a circle round "yes" or "no"; If you cannot make up your mind, circle the "?". Work quickly and do not worry too long about the exact shade of meaning of each question. There are no right or wrong answers, and no trick questions.

REMEMBER TO ANSWER EACH QUESTION.

1. Do you tend to limit your friends to a select few Yes ? No
2. Do you prefer action to planning for action? Yes ? No
3. Do you nearly always have a "quick answer" for remarks directed at you? Yes ? No
4. Are your daydreams frequently about things that can never come true? Yes ? No
5. As a child, did you always do as you were told, immediately and without grumbling? Yes ? No
6. Do you tend to be quick and sure in your actions? Yes ? No
7. Do you have difficulty in making new friends? Yes ? No
8. Do you sometimes put off until tomorrow what you ought to do today? Yes ? No
9. Do you tend to take your work casually, that is, as a matter of course? Yes ? No
10. Do you often feel disgruntled? Yes ? No
11. Do you tend to think a lot about your past? Yes ? No
12. If you say you will do something do you always keep your promise, no matter how inconvenient it might be to do so? Yes ? No
13. Do you like to mix socially with people? Yes ? No
14. Do you tend to be shy in the presence of the opposite sex Yes ? No

- |     |  |     |   |    |
|-----|--|-----|---|----|
| 15. | Do you sometimes get cross?  | Yes | ? | No |
| 16. | Do you often experience periods of loneliness?   | Yes | ? | No |
| 17. | Are you sensitive on various subjects?   | Yes | ? | No |
| 18. | Do you often find that you have made up your mind too late?  | Yes | ? | No |
| 19. | Are you completely free from prejudice of any kind?  | Yes | ? | No |
| 20. | Do you tend to be overconscientious?   | Yes | ? | No |
| 21. | Do you often "have the time of your life" at social affairs?   | Yes | ? | No |
| 22. | Do you ever change from happiness to sadness, or vice versa, without good reason?                          | Yes | ? | No |
| 23. | Do you like to play tricks upon others?  | Yes | ? | No |
| 24. | Do you sometimes laugh at a dirty joke?  | Yes | ? | No |
| 25. | Does your mind often wander while you are trying to concentrate?   | Yes | ? | No |
| 26. | Would you rate yourself as a tense or nervous person?  | Yes | ? | No |
| 27. | After a dangerous moment is over, do you usually think of something you should have done but failed to do? | Yes | ? | No |
| 28. | Would you much rather win, than lose a game?   | Yes | ? | No |
| 29. | Do you find it easy, as a rule, to make new friends?   | Yes | ? | No |
| 30. | Do you ever have a strange feeling that you are not your old self?   | Yes | ? | No |
| 31. | Do you ever take your work as if it were a matter of life or death?  | Yes | ? | No |
| 32. | Are you frequently "lost in thought" even when supposed to be taking part in a conversation?               | Yes | ? | No |
| 33. | Do you always feel genuinely pleased when a bitter enemy achieves a merited success?                       | Yes | ? | No |

34. Do you derive more real satisfaction from social activities than from anything else? Yes ? No
35. Do ideas run through your head so that you cannot sleep? Yes ? No
36. Do you sometimes boast a little? Yes ? No
37. Can you usually let yourself go and have a marvellous time at a gay party? Yes ? No
38. Do you like to daydream? Yes ? No
39. Have you often felt worn out and tired for no good reason? Yes ? No
40. Are all your habits good and desirable ones? Yes ? No
41. Are you inclined to keep quiet when out in a social group? Yes ? No
42. Are you sometimes full of energy and sometimes very sluggish? Yes ? No
43. Do you always answer a personal letter as soon as you can after you have read it? Yes ? No
44. Would you rate yourself as a talkative person? Yes ? No
45. Do you occasionally have thoughts and ideas that you would not like other people to know about? Yes ? No
46. Would you be very unhappy if you were prevented from making a lot of social contacts? Yes ? No
47. Are you happiest when you get involved in some project that calls for rapid action? Yes ? No
48. Do you spend much time in thinking over good times you have had in the past? Yes ? No
49. Do you sometimes talk about things you know nothing about? Yes ? No
50. Have you ever been bothered by having a useless thought come into your mind repeatedly? Yes ? No
51. Do other people regard you as a lively individual? Yes ? No
52. Do you sometimes gossip? Yes ? No
53. Do you usually keep in fairly uniform spirits? Yes ? No

- |     |   |     |   |    |
|-----|---|-----|---|----|
| 54. | Are your feelings rather easily hurt?   | Yes | ? | No |
| 55. | At times have you ever told a lie?  | Yes | ? | No |
| 56. | Do you generally prefer to take the lead in group activities?   | Yes | ? | No |
| 57. | Would you rate yourself as a happy-go-lucky individual?   | Yes | ? | No |
| 58. | Have you many worries at times?   | Yes | ? | No |
| 59. | Do you have periods of such great restlessness that you cannot sit long in a chair?                     | Yes | ? | No |
| 60. | Do you usually mix well with people?  | Yes | ? | No |
| 61. | Would you rate yourself as a lively person?   | Yes | ? | No |
| 62. | Have you ever been late for an appointment or work?   | Yes | ? | No |
| 63. | Do you ever feel "just miserable" for no good reason?   | Yes | ? | No |
| 64. | Are you often troubled with feelings of guilt?  | Yes | ? | No |
| 65. | Do you tend to be moody?  | Yes | ? | No |
| 66. | Do you like to have many social engagements?  | Yes | ? | No |
| 67. | Once in a while do you lose your temper and get angry?  | Yes | ? | No |
| 68. | Do you sometimes feel happy, sometimes depressed, without any apparent reason?                          | Yes | ? | No |
| 69. | Is it difficult for you to become carefree even at a lively party?                                      | Yes | ? | No |
| 70. | Are you ordinarily a gay person?  | Yes | ? | No |
| 71. | Do you have frequent ups and downs in mood, either with or without apparent cause?                      | Yes | ? | No |
| 72. | Would you always declare everything at the customs, even if you knew that you could never be found out? | Yes | ? | No |
| 73. | Do you like work that requires considerable attention to details?                                       | Yes | ? | No |





APPENDIX III

INTELLIGENCE

VOCABULARY INSTRUCTIONS

The first word in the following line is "big."

big            ill        large        down        sour

One of the other words means the same as "big." The word "large" has been underlined because it means the same as "big."

The first word in the following line is "ancient." Underline one of the other words that means the same as "ancient."

ancient        dry        long        happy        old

You should have underlined "old" because it means the same as "ancient."

In each of the following lines underline the word that means the same as the first word.

quiet	blue	still	tenue	watery
safe	secure	loyal	passive	young
brave	hot	cooked	red	courageous

STOP HERE. DO NOT TURN OVER UNTIL YOU ARE TOLD

Time: 4 minutes

VOCABULARY

In each row of five words below, underline the word which means the same as the first word in that row.

moist	curt	humane	damp	moderate
quick	major	hasty	narrow	vigorous
annual	variable	yearly	listless	untenable
splendid	expansive	gay	rigid	excellent
customary	nocturnal	radial	prime	usual
fluid	livid	dead	liquid	talkative
idle	lazy	cross	wild	useful
deserted	drab	absurd	disturbed	abandoned
rare	holy	crass	infrequent	weak
contented	nasty	continuous	defamatory	satisfied
enraged	pleasing	poor	angry	domestic
beneficial	artificial	tamable	helpful	piquant
moldy	tonic	misty	shapeless	mute
rasping	harsh	minute	kinaesthetic	marshy
sober	dirty	cloudy	serious	fitting
droll	delighted	odd	forceful	foreign
stately	dignified	thin	digestible	valid
disreputable	shameful	forensic	horticultural	susceptible
genteel	wealthy	urban	polite	ignorant
original	oral	derelict	first	reliable
novel	expensive	new	gloomy	radical
famous	celebrated	faithful	renewed	nimble

TURN OVER AND GO STRAIGHT ON

Go straight on without waiting

systematic	laudatory	orderly	jubilant	ambitious
fatigued	pliable	grave	weary	fanatic
resplendent	phonetic	tart	brilliant	fearless
generous	oblivious	ardent	liberal	defiant
kingly	bland	facial	recent	regal
flexible	pitiabile	formal	pliant	peaceful
sagacious	exotic	apparent	wise	mild
heedless	patient	eligible	parallel	rash
deficient	constant	dreary	lacking	peculiar
vigilant	watchful	indulgent	valorous	nascent
minimum	humid	restricted	tranquil	least
giddy	feminine	casual	dizzy	comical
discreet	caustic	redolent	honorable	prudent
destined	simplified	fated	directional	lucky
eternal	momentous	benign	priceless	perpetual
lavish	combined	ribald	worthy	extravagant
defective	concealed	mythical	faulty	external
vague	numb	obscure	indecent	vermiculate
essential	classical	indispensable	deplorable	candid
impulsive	impetuous	petrified	immature	compulsory
diffident	fabulous	shy	valuable	alphabetical
erroneous	solemn	false	ironic	tragic
benevolent	kind	native	suitable	modest
grimy	stern	filthy	grim	colorful

TURN OVER AND GO STRAIGHT ON

Go straight on without wating

lacerated	disgruntled	mangled	fringed	stricken
insolent	studious	envious	arrogant	accidental
gallant	chivalrous	authentic	treacherous	probable

**STOP HERE**

Time: 4 minutes

NUMBER GROUPING INSTRUCTIONS

Look at the groups of numbers below

1123

1314

1358

1146

Three of the groups have two number 1's. The group which does not have two 1's is underlined.

Here is another problem. Three of the groups are alike in some way. Can you find three groups which are alike? Underline the one that is different.

4613

3456

1234

6789

In three of the groups the numbers are arranged in numerical order. The first group is not in numerical order. You should have underlined it to show it is different.

Three of the groups in the next row are alike in some way. Underline the group that is different.

6234

6123

4789

6567

Three of the groups start with 6. You should have underlined the third group which is different.

Here is another problem. Underline the group that is different.

1345

4789

2356

3567

Three of the groups omit one number. You should have underlined the second group which is different.

Here are more problems for you to work. In each row three of the groups are alike in some way. Underline the group that is different. Go right ahead.

3334

3337

3339

3368

5432

9876

4215

8765

1233

3453

1231

6786

2346

5679

4568

1236

STOP HERE: DO NOT TURN OVER UNTIL YOU ARE TOLD

NUMBER GROUPING

In each row three of the groups of numbers are alike in some way.  
Underline the one that is different.

2226	2252	2221	2229
1234	5678	3456	2389
1452	3894	7458	6457
3535	1212	3561	4141
1237	3215	1234	1236
6448	6118	6338	6458
5234	5123	2789	5456
4898	2343	6787	5676
1233	5567	4566	7899
6789	4562	1232	5672
1457	4157	1345	4175
6786	3453	2342	7898
4567	4321	8765	9876
3171	3575	3672	3474
2268	7292	4129	5232
6778	2344	1223	4556
4567	6789	1356	2345
5657	1213	7879	4547
1362	1263	6427	3612
1245	3478	2356	5689
7456	4123	7345	9678
6273	7481	4354	1829
1243	5687	2364	6798
3479	1256	6734	1289
1342	3674	6898	4125
3345	6788	1123	5567
3164	5297	7148	5648
1542	4875	2213	8349
5445	3223	6776	9889
7888	6667	7778	5666



**APPENDIX V**  
**REACTION TIME**  
**FREE-ASSOCIATION**  
**(SEE CHAPTERS IV AND V)**



APPENDIX VI

STROOP RATIO

RED	GREEN	BLUE	GREEN	RED	YELLOW	BLUE	YELLOW	BLUE	GREEN
YELLOW	RED	BLUE	YELLOW	GREEN	RED	BLUE	RED	BLUE	YELLOW
GREEN	BLUE	BLUE	YELLOW	YELLOW	YELLOW	RED	RED	YELLOW	GREEN
BLUE	YELLOW	YELLOW	BLUE	RED	BLUE	YELLOW	YELLOW	GREEN	RED
RED	GREEN	GREEN	GREEN	RED	GREEN	GREEN	YELLOW	RED	GREEN
YELLOW	RED	GREEN	YELLOW	BLUE	GREEN	RED	GREEN	GREEN	BLUE
BLUE	GREEN	RED	RED	GREEN	RED	GREEN	BLUE	YELLOW	YELLOW
RED	YELLOW	YELLOW	RED	BLUE	YELLOW	BLUE	YELLOW	GREEN	GREEN
YELLOW	BLUE	RED	BLUE	GREEN	GREEN	YELLOW	BLUE	BLUE	RED
GREEN	RED	YELLOW	BLUE	YELLOW	BLUE	RED	GREEN	RED	BLUE
BLUE	RED	BLUE	GREEN	RED	YELLOW	BLUE	BLUE	YELLOW	RED

READING TEST

Among the high mountains of our country there is a little village with a small but needle-fine church spire. Conspicuous above the green of abundant fruit trees, this spire - because the slates are painted vermilion - can be seen far and wide against the faint blue of the mountains. The hamlet nestles in the very center of a fairly wide valley, an almost perfect ellipse. Besides the church, a schoolhouse, and a parish-house, there are a few stately homes around a square with four linden trees and a stone cross in the center. These are not simple farmhouses, but a haven of handicrafts, providing the mountain people with essential commodities. In the valley and scattered along the mountainsides are many little huts of a sort common to such regions - whose inhabitants belong to the village, use its church and school, and support its craftsmen by buying their wares. Even more distant huts are also part of the village, but, hidden away in the mountains, cannot be seen from the valley; the people rarely come down among their fellow parishioners; often, indeed, they must keep their dead with them over the winter till they can bring them to the valley for burial after the snow has melted. The great man of the village is the priest. The villagers regard him with veneration, and he, after a protracted stay in the valley, usually becomes used to isolation, stays on not unwillingly, and then just goes on living there. Since time immemorial no priest in the village has ever craved a change, none has been unworthy of his calling.

APPENDIX VII

SENSORI-MOTOR - DRAKE INDEX

PERCEPTUAL MATCHING

MATCHING INSTRUCTIONS

Look at the left hand group of symbols below. Notice that in the five groups of symbols to the right one has been underlined. This is the group which exactly matches the left hand group.

13759      13957      13979      13759      13779      13795

In the rows below underline the group to the right which exactly matches the left hand group.

6PY7Q      6PQ7Y      6P7YQ      6YP7Q      6PY7Q      6PYQ7  
AIQI4      AIQI4      AIQI4      AIQI4      AIQI4      AIQI7  
64.131      6.4131      64131      .64131      64.131      61.434

DO NOT TURN OVER

On the next page you will find more sets of symbols. In each case underline the right hand group which exactly matches the group on the left.

DO NOT TURN OVER UNTIL YOU ARE TOLD

Time: 1 minute

MATCHING

Underline the right hand group which exactly matches the left hand group.

123567	12356	12367	123567	123456	123567
XPQABO	XPQAPQ	SPQAPQ	XYPOQA	SPQABO	SPQABQ
6432A8	643218	643288	6432A3	643218	6432A8
IRsOPY	IRSOFY	IrsOPY	IRsOPY	lrsOPY	lSrOPY
--3-	--3--	--3-	-3--	3--3-	---3
!S!73q	!s!73q	!S!73q	!S.73q	!S!78q	!S!73Q
Wr9-73	WR73-9	wR-793	WR-37	37-WR9	Wr9-73
IPQltA	PAtilq	QITipA	LPqITA	LPQltA	lPAItQ
93.646	9346.6	93646.	93446	93664.	93.646
-0-00A	--AQA-	-0-AQA	-0-AQA	-0-00A	0-0A00
XY-OPy	XY-yPQ	XY-yOP	xy-OPY	XYOP-x	XY-OPy
S89xy3	S3y89x	S8xy93	S89xy3	S89x3y	S893yx
40381A	30481A	4031BA	4031A8	04381A	40381A
31.969	31.699	3.1696	319.69	31.969	31960.
83833A	83A883	88333A	33833A	83833A	38388A
AIQ11a	AQIeal	AIQ11a	AQ111a	AQIa11	AIQa11
KITzME	MIKtze	KITMze	MIKtztz	TIKzME	KITzME
"-sTV	-"STv-	"-STV	"-s-TV	"-STV-	"-sTV
779754	997457	775974	775497	779754	777954
XYdAPR	XYdAPr	YXdApR	XYdAPR	XYDaPR	XYDAPR
A38AAT	A83ATA	A38AAT	A338AT	A38TAA	38AAAT
879.99	978.89	978.99	87.999	879.99	789.99

TWEEZERS

(SEE CHAPTERS IV AND V)

## BIBLIOGRAPHY

1. Ackerman, N. W. and Chidster, L. Accidental Self-Injury. Arch. Pediat., 1936, 53, 711-721
2. Almeida, D. Noise and Absenteeism. J. Appl. Psychol., 1953, 32, 321-322.
3. Arbous, A. G. and Kerrich, J. E. Accident Statistics and the Concept of Accident Proneness. Biometrics, 1951, 7, 340-428
4. Bakwin, R. M. and Bakwin, H. Accident Proneness. J. Pediat., 1948, 749-752
5. Bartelme, P. F., Fletcher, E. D., Brown, C. W. & Ghiselli, E. E. The prediction of driving skill. J. appl. Psychol., 1951, 35, 98-100.
6. Bennet, A. E. Accident proneness in multiple sclerosis. J. ment. nerv. dis., 1951, 113, 198-210.
7. Blum, M. L. Industrial psychology and its social foundations. New York, Harper and Brothers, 1956.
8. Blum, M. & Candee, B. The selection of department store packers and wrappers with the aid of certain psychological tests. J. abnorm. Psychol., 1941, 25, 76-85.
9. Blum, M. L. and Mintz, A. Correlation vs. Curve Fitting in Research on Accident Proneness: Reply to Meritz. Psychol. Bull., 1951, 48, 413-418.
10. Burke, C. J. A Chi-Square Test for "Proneness" in Accident Data. Psychol. Bull., 1951, 48, 496-504.
11. Candee, B. & Blum, M. Report of a study done in a watch factory. J. abnorm. Psychol., 1937, 21, 572-582.

12. Castle, F. C. Accidents, absence and withdrawal from the work situation, Human Relations, 1956, 9, 223-233.
13. Cation, W. L., Mount, G. E., & Brenner, R. Variability of reaction time and susceptibility to automobile accidents. J. appl. Psychol., 1951, 35, 101-107.
14. Chambers, E. G. Psychological tests for accident proneness and industrial proficiency. Med. Res. Council Memor., HMSO, London, 1955, No. 31.
15. Clark, J. C. & Owens, W. A. A validation study of the worthington Personal History Bland, J. Appl. Psychol., 1954, 38, 85-88.
16. Cobb, P. W. The limit of usefulness of accident rate as a measure of accident proneness. J. Appl. Psychol., 1940, 24, 154-159.
17. Davids, A. & Mahoney, J. T. Personality dynamics and accident proneness in an industrial setting. J. Appl. Psychol., 1957, 41, 303-306.
18. Davis, C. J. Correlation between scores on ortho-rater tests and clinical tests. J. appl. Psychol., 1946, 30, 596-603.
19. De Silva, H. R. Automobile drivers can be improved. Psychol. Bull., 1939, 36, 284-285.
20. De Silva, H. R. & Channell, R. Driver clinics in the field. J. appl. Psychol., 1938, 22, 59-69.
21. Dietrich, H. F. Accidents: Childhood's No. 1! Public Affairs Pamphlet No. 225, Public Affairs Committee, 1955.
22. Dollard, J. & Miller, N. E. Personality and Psychotherapy, New York, McGraw Hill, 1950

23. Dunbar, F. Psychosomatic diagnosis. New York, Harper, 1943.
24. English, O. S. & Pearson, G. H. J. Emotional problems of living.  
New York, Norton, 1945
25. Eysenck, H. J. Dimensions of personality. London, Kegan Paul,  
1947.
26. Eysenck, H. J. A dynamic theory of anxiety and hysterics. J. ment.  
Sci., 1955, 101, 28-51.
27. Eysenck, H. J. The dynamics of anxiety and hysteria. London,  
Routledge and Kegan Paul, 1957.
28. Eysenck, H. J. Scientific study of personality. London,  
Routledge and Kegan Paul, 1952
29. Fenichel, O. The psychoanalytic theory of neurosis. New York,  
Norton, 1945.
30. Freud, S. Collected Papers. New York, International Psychoanalytic  
Press, 1953.
31. Freud, S. The outline of psychoanalysis. London, Hogarth Press, 1949
32. Freud, S. Psychopathology of everyday life. New York, Macmillan,  
1948.
33. Fuller, E. M. & Baume, H. B. Injury-proneness and adjustment in a  
second grade. Sociometry, 1951, 14, 210-225.
34. Ghiselli, E. E. & Brown, C. W. Personnel and industrial psychology.  
New York, McGraw Hill, 1955, (2nd Edition)
35. Ghiselli, E. E. & Brown, C. W. The prediction of accidents of  
taxicab drivers. J. appl. Psychol., 1949, 33, 540-546.
36. Granger, G. W. Personality and visual perception: a review.  
J. ment. Sci., 1953, 99, 8 - 43.
37. Hall, C. A primer of Freudian psychology. Cleveland, World Publishing  
Company, 1954.

38. Hill, J. M. & Trist, E. L. A consideration of industrial accidents as a means of withdrawal from the work situation, Human Relations, 1953, 6, 357-380.
39. Johnson, H. M. Detection and treatment of accident prone drivers. Psychol. Bull., 1946, 43, 489-532.
40. Johnson, H. M. Evidence for Educational value in drivers' "clinics", Psychol. Bull., 1939, 36, 674-675.
41. Jung, C. G. Psychological types, London: Kegan Paul, 1926.
42. Keehn, J. D. Accident tendency, avoidance learning and perceptual defense. unpublished paper.
43. Keehn, J. D. Response sets and the Maudsley Personality Inventory. unpublished paper.
44. Kerr, W. A. Accident proneness in factory departments. J. Appl. Psychol., 1950, 34, 167-170
45. Klein, M. Psychoanalysis of children. London, Hogarth Press, 1957
46. Krall, V. Personality characteristics of accident repeating children. J. abnorm. soc. Psychol., 1953, 48, 99-107.
47. Langford, W. S., Gilder, R., Wilking, V., Genn, M. M., & Sherrill, H. Pilot study of childhood accident; preliminary report. Pediatrics, 1953, 11, 405-415.
48. Lauer, A. R. Comparison of group paper-and-pencil tests with certain psychophysical tests for measuring driving aptitude of army personnel. J. Appl. Psychol., 1955, 39, 318-321.
49. Le Shan, L. L. Dynamics in accident-proneness behavior. Psychiatry, 1952, 15, 73-80.



50. Le Shan, L. L. & Brame, J. B. A note on techniques in the investigation of accident prone behavior. J. appl. Psychol., 1953, 37, 79-81
51. Maier, M.R.F. Psychology in industry. New York, Houghton Mifflin Company, 1946
52. Maritz, J. S. On the validity of inferences shown from fitting of poisson and negative binomial distributions to observed accident data. Psychol. Bull., 1950, 47, 434-443.
53. McFarland, A. R. Psychological and Psychiatric Aspect of Highway Safety, J. Amer. Med. Ass., 1957, 163, 233-237
54. McLean, H. A. Accident Proneness: A Clinical Approach to Injury Liability. Industr. Med. Surg., 1955, 24, 122-126.
55. Menninger, K. A. Purposive accidents as an expression of self destructive tendencies. Int. J. Psychoan., 1936, 17, 6-16.
56. Miller, G. A comparison of high-accident and low-accident bus and street car operators. J. prof. Tech., 1955, 19, 146-151.
57. Mintz, A. The inference of accident liability from the accident record. J. appl. Psychol., 1954, 38, 41-46.
58. Mintz, A. & Blum, M. L. A re-examination of the accident proneness concept. J. appl. Psychol., 1949, 33, 195-211.
59. Mowrer, O. H. Learning theory and the neurotic paradox. Amer. J. ortho., 1948, 18, 571-610.
60. Owens, W. A. A reply to Drs. Peck-Stephenson. J. appl. Psychol., 1954, 38, 371-372.
61. Parker, J. W. Jr., Psychological and personal history data related to accident records of commercial truck drivers. J. appl. Psychol., 1953, 37, 317-320.

62. Peck, R. F., & Stephenson, W. A correction of the Clark-Owens validation study of the Worthington personal history technique. J. appl. Psychol., 1954, 38, 368-369.
63. Rimoldi, H. J. A. Personal tempo. J. abnorm. soc. Psychol., 1951, 46, 283-303.
64. Rowson, A. J. Accident proneness. Psychosomatic Med., 1944, 6, 88-94.
65. Speroff, B. & Kerr, W. Steel mill "hot strip" accidents and interpersonal desirability values. J. clin. Psychol., 1952, 8, 89-91.
66. Stump, N. R. A statistical study of visual functions and industrial safety. J. appl. Psychol., 1945, 29, 467-470.
67. Stump, N. F. Industrial safety and visual functions. J. Psychol., 1945, 20, 369-379.
68. Teal, G. E. Occupational safety. In Fryer, D. H. & Henry, E. R. (Eds.) Handbook of Applied Psychology. Vol. I. New York, Rinehart, 1950.
69. Teel, K. S. & Dubois, P. H. Psychological research on accidents: some methodological considerations. J. appl. Psychol., 1954, 38, 397-400.
70. Thorndike, R. L. The human factor in accidents with special reference to aircraft accidents. USAF Sch. Aviat. Med. Proj. Rep., 1951, Proj. No. 21-30-001, Rep. No. 1.
71. Tiffin, J. Industrial Psychology. New York, Prentice Hall, 1947.
72. Tiffin, J. & Greenly, R. J. Employee selection tests for electrical fixture assemblers and radio assemblers. J. appl. Psychol., 1939, 21, 240-263.

73. Tiffin, J., Parker, B. J., & Habersat, R. W. Visual performance and accident frequency. J. appl. Psychol., 1949, 33, 499-502.
74. Tillman, W. A. & Hobbs, G. E. The accident-prone automobile driver; a study of the psychiatric and social background. Amer. J. Psychiat., 1949, 106, 321-331.
75. Trites, D. K., Kubala, A. K. & Sells, S. B. Aircraft accidents vs. characteristics of pilots. J. aviat. Med., 1955, 26, 486-494.
76. Venables, D. H. Changes in motor response with increase and decrease in task difficulty in normal industrial and psychiatric patients. Br. J. Psychol., 1955, 36, 101-110.
77. Venables, D. H. Some findings on the relationship between GSR and motor task variables. J. gen. Psychol., 1956, 55, 199-202.
78. Venables, P. Car-driving consistency and measures of personality. J. appl. Psychol., 1956, 40, 21-24.
79. Webb, W. B. & Jones, E. R. Some relations between two statistical approaches to accident proneness. Psychol. Bull., 1953, 50, 133-136.
80. Whitlock, J. B. & Crannel, C. W. An analysis of certain factors in serious accidents in a large steel plant. J. appl. Psychol., 1949, 33, 494-498.
81. Accident Facts. National Safety Council, Chicago, 1952.