AN EXPERIMENTAL INVESTIGATION INTO THE RELATIONSHIP BETWEEN SIMULATED ACCIDENTS AND LABORATORY TESTS OF LEARNING AND PERCEPTION

BY

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ACCIDENT PRONENESS, LEARNING AND PERCEPTION

BY

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A C K N O W L E D G E M E N T

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Chapter I

The Accident Proneness Hypothesis

Accidents as a social problem:

Accidents have long been surrounded with a halo of mystery and, like death, been regarded as inevitable. But the advent of industry and the growth of big cities has put man face to face with accidents as a great social problem.

Statistics of the damage and loss caused by accidents make one realize the seriousness of the problem. In 1932, the time lost through injuries in industry in the U.S. amounted to $643,000,000.(1) In 1946, the total costs of accidents was $6,400,000,000 of which industrial accidents accounted for $2,400,000,000.(2) In 1953, 95,000 people were killed, 9,600,000 were injured and the cost amounted to $9,100,000,000. The total number of the deaths caused by automobile accidents was 38,300.(3) In evaluating these figures, one may bear in mind that these are only the direct costs of accidents, and that many indirect costs are also involved.

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(1) Maier, N.R.F., Psychology in industry, (2nd Ed.) Houghton Mifflin Co., 1955, p. 498.

(2) Teel, G.E., Occupational Safety, In Fryer, D.H. and Henry, E.R., Handbook of Appl. Psychol., New York, Rinehart, Vol. 1, 1950, p. 277.

(3) Blum, M.L., Industrial psychology and its foundations, New York, Harper and Brothers, 1956, p. 451.

These costs brought accidents to the attention of the industrialist and ultimately of the psychologist, This led to the introduction of safety programs and selection procedures as preventive measures, in the hope of reducing the number of accidents.

a. Safety Programs:

Safety programs involve two main aspects, one directed towards the situation, the other to the individual. The accident potentiality of a situation, in industrial plants for instance, is a function of the overall layout of that plant and the design of particular pieces of equipment. Thus, equipment can be spread in such a way as to minimize accidents to individuals moving around the plant, and safety devices can be incorporated into individual machines. Both these practices have been adopted in recent years by industrial safety engineers. Similarly, overall factors like the elimination of excessive fatigue, the provision of good lighting and control of temperature and humidity have been used to good effect.(4)

The approach to the individual has been through training and clinical re-education.

The influence of training on accident reduction is well illustrated by Ghiselli and Brown.(5) They collected

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(4) Maier, op.cit. pp. 509-511.

(5) Ghiselli, E.E., and Brown, C.W., Learning in accident reduction, J. Appl. Psychol., Vol. 31. 1947, pp. 580-582.

the accident records of 60 street car motormen and 34 motor coach operators for the first 17 months of their employment after they had completed their formal training. In most cases, training was carried out in two or three weeks. They showed that a considerable amount of on-the-job learning as measured by a reduction in accident rate was manifested by the two groups. Some six or seven months were required before the rate of improvement fell to a minimum. The writers suggested that "it would seem much more profitable to change the nature of the training program, basing it upon a sound psychological analysis of the types of abilities required by the complex situation in which the vehicles are operated".(6)

As against formal training for accident prevention, some industrial firms have also introduced clinics for the study and treatment of individuals showing tendencies to have repeated accidents. In these clinics a worker is interviewed and undergoes therapy in which he is given "a clear understanding of his personality difficulties and ... why they interferred with satisfactory performance ... and what probable outcome of them would be unless a change in general outlook and behavior on the job were shown."(7) Some success for this method has been claimed although the results have been challenged.(8)

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(6) Ibid. p. 282.

(7) Blum, op.cit. p. 454.

(8) Johnson, H.M., The Detection and Treatment of Accident-prone drivers, Psychological Bulletin, Vol. 43, 1946, pp. 489-532.

b. Selection:

The selection of workers so that accident rates are reduced is possible if there are individual differences in performance on a specific job and in the tendency to have accidents in that job. Thus by selecting out those individuals most likety to have accidents from the outset, the expectation is that fewer accidents will occur than otherwise.

The conventional method for selecting individuals to fill job vacancies has been the interview. More recently, psychological tests have played a significant role. However, the interview method has been severely criticized (9) and, moreover, its use for large scale purposes is severely restricted. Thus psychological tests have come to play a more and more prominant role in employee selection in industry, particularly insofar as the detection of "accident prone" individuals is concerned.

For the most part, psychometric tests for the prediction of accident liability have been closely tailored for specific jobs. That is, accident potentiality has been included in the analysis of these jobs and tests relevant to this end devised. The job analyst first begins with the description of what the individual does as well as the conditions of the job. Then he proceeds to find the attributes required in the individual for that job, and thus be able to

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(9) Eysenck, H.J., Uses and Abuses of Psychology, Pelican, 1958, p. 106.

base his tests on all these different aspects. In the case of automobile drivers, for instance, it was supposed that good reaction time, wide field of vision, ability to estimate distance accurately and absence of color blindness were all necessary in order for an individual not to be a poor accident risk. Similarly different visual tests have been widely used to detect individuals more likely to have accidents.

However, as we have already pointed out, this approach has severe limitations because it says nothing about the theoretical aspect of accidents in general and does not allow for the generalizations of tests from one job to another. Thus it is necessary to undertake some theoretical analysis of accidents and then construct tests relevant to this theory and then apply them to a variety of accident situations. But still we are first faced with the problem of whether accident repeaters can be selected anyway, for the implication is that individuals having accidents in one situation or period of time will also be involved in accidents in other situations or time periods. It was the claim that this and similar statements are true that led to the hypothesis of accident proneness.

2. <u>The accident proneness hypothesis</u>:

One of the observations in the early systematic investigations of accident records was that a small percentage of the population of a particular institution are involved in a large percentage of actual accidents. This observation led

some writers [10] to postulate that some workers are more prone to accidents than others, and that, these individuals differ along a personality diversion which they called "accident proneness".

Altogether seven related lines of evidence have been enlisted in support of this concept.[11]

1. The fact that a large percentage of accidents fall to a small percentage of the population.
2. The fact that some individuals have more accidents than others within a given period of time.
3. The fact that individuals who have above the average number of accidents in one period tend also to have more than the average number of accidents in some subsequent period of time.
4. The fact that individual accident records are positively correlated over different periods of time.
5. The fact that when high accident individuals are transferred from one population to another, the accident rate in the former population is reduced.
6. The fact that clinical re-education reduces the accident rates of high accident individuals.
7. The fact that individuals with high accident rates on one task tend to have high accident rates in other different tasks.

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(10) Thorndike, R.L., The Human factor in Accidents with special reference to Aircraft accidents, U.S.A.F. School of Aviation Medicine, Randolph Field, Texas, 1951, p. 41.

(11) Keehn, J.D., Accident proneness, avoidance learning and perceptual defense, (unpublished manuscript).

All of these seven items of evidence have been called into question. The first is inevitably the case when the number of accidents is less than the number of people in a given population. If there are, for instance, 100 workers with a total number of 50 accidents, then 50 workers would have 100% of the accidents if no worker has more than one accident; and the number of workers having accidents may be less than 50, for it is expected that some of them will have more than one accident by chance.(12) This latter point also discounts the second line of evidence listed above, for if some workers might have more accidents than others by chance, then there is no need to invoke the accident proneness hypothesis to account for differential accident rates. However, when statistical allowance is made for chance factors as shown in table II, there is still some slight evidence that some persons are involved in more accidents than would be expected.(13)

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(12) Mintz, A., and Blum, M.L., "A re-examination of the accident proneness concept", J. Applied Psychology, Vol. 33, 1949, p. 196.

(13) Thorndike, op cit. p. 33.

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

Table II - Comparison of actual and theoretical accident distribution.(14)

The third and the fourth types of evidence both depend upon comparisons over different periods of time, and in the last analysis are based upon correlational analysis. However, during the periods compared, many extraneous factors came into the picture such as age, health, experience and job hazards. These are difficult to keep constant and may increase or decrease the number of accidents irrespective of individual differences in proneness to accidents. Despite these difficulties correlational analysis have for the most shown positive correlations although they have been low and largely insignificant.

(14) Thorndike. op cit. p. 33.

The fifth and the sixth lines of evidence did not allow for the fact that the number of accidents may be reduced in a given population without clinical re-education or the transference of the accident-repeaters, just as 'spontaneous recovery' seems to occur in some neurotics without benefit of psychotherapy.(15)

The last line of evidence, although initially accepted soon came to be regarded with suspicion. It has been sometimes found that the correlation between accidents in different situations is low. However, such correlational analyses are open to the same difficulties mentioned above. In addition, the maximum correlation will depend upon the reliability of each of the measures being correlated. But the number of accidents in any one situation will depend upon the hazards involved in that situation and also on the accuracy and adequacy of the records that are kept. This latter problem necessitates the need for a careful definition of an accident, for unless the same criterian of an accident is used in both cases then any correlation between them will be meaningless.

Defining an "accident" and "accident proneness":

The common man as well as the psychologist has tried to define the word 'accident' and it is convenient to cite

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(15) Eysenck, H.J., The effects of psychotherapy: An evaluation. J. Consult. Psychol., Vol. 16, 1952, pp. 319-324.

here some of these definitions. The Oxford Dictionary defines it as "anything that happens without foresight or expectation, any unusual event, which proceeds from some unknown cause, or is an unusual effect of a known cause.... esp. an unfortunate event, a disaster, a mishap". Similarly, Webster's Dictionary defines an accident as "an event that takes place without one's forsight or expectation; an undesigned, sudden, and unexpected event.... a mishap resulting in injury to a person or damage to a thing". Technical definitions do not differ greatly from these. Le Shan and Brame,[16] for instance, defining an accident as "a mishap with a sudden onset".

However, for the purposes of compiling individual accident records, the definition of an accident raises many questions. For one thing it raises the difficulty of differentiating between an accident and a disease. It is hardly possible to differentiate between a disease resulting from the neglect of health instructions and an accident caused by the neglect of safety precautions.[17]

There is also the problem of differentiating between accidents for which an individual is responsible and those

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(16) Le Shan, L.L., and Brame, J.B., A note on techniques in investigation of accident prone behavior, J. Appl. Psychol., Vol. 37, 1953, p. 80.

(17) Ibid. p. 80.

in which he might be an innocent victim. If a passenger interferes with the driver of a car or if one person is the victim of a mistake made by another person, who is then the responsible party in such cases? Such cases of 'accidents' are not necessarily admitted by us in our formulation of the concept of accident proneness but they have usually been included in accident records by past investigators as there is no safe way of differentiating these so-called "non-chargeable accidents" from "chargeable" ones. However, it is possible that the difference between these two kinds of accidents is more apparent than real, for Le Shan,(18) in a survey of a trucking company records, found that individuals who had high rates of chargeable accidents tended to have high rates of non-chargeable accidents. This relationship may arise from the tendency of accident repeaters to put the blame of their faults on somebody else.

Similar problems are raised in the differentiation between major accidents, minor accidents and near-accidents. A general concept of accident-proneness should include all these kinds of accidents within the definition of an 'accident'. It must subsume all kinds of behaviour which result in actual or potential damage to the well-being and adjustment of the individual to his environment. For if we are to assume that behaviour which is likely to lead to accidents

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(18) Ibid. p. 80.

is an enduring or predictable part of a person's personality, it is useful for us to know all the occasions in which he would have had accidents, as well as those on which accidents occurred. Just as one person might cause another to have an accident so a third party might act so to prevent a person from accidentally injuring himself. Moreover, accidents refer to a variety of events in everyday life and can not be limited to the obvious ones such as motor or industrial accidents. Breaking articles, tripping, slips of the tongue and so forth can all be regarded as accidents.

It is clear, then, that to take major, chargeable accidents as the sole criterion against which to validate tests of 'accident proneness' is unsatisfactory from our point of view. This limitation must be borne in mind in our discussion of tests of accident proneness, for in almost all cases only records of accidents of the chargeable kind have been used as the external criterion. The problem of defining an adequate criterion is one of the major tasks of this thesis and will be discussed below. Suffice it to say that no wholly adequate criterion can be obtained except in a major investigation going beyond the limits of the present study.

<u>The psychometric approach to accidents</u>:

Efficiency, safety, personnel selection and the urge for accident reduction in industry brought about job analysis as a preliminary step toward the assessment of the skills suitable for a particular job. It was hoped that

tests would be constructed to evaluate the attributes required for each job and consequently used as accident predictors.

Intelligence was one of the first factors to attract attention. Studies mostly show that there is no consistent relationship between intellectual abilities and accidents. Intelligence tests do not seem promising in selecting accident free individuals.(19) (20)

Despite the inconsistency of the results demonstrating the role of intelligence in accidents, it is plausible to suggest, as has Tiffin,(21) that a minimum of intelligence is required for avoiding job hazards on the part of the worker.

Psychomoter tests have also been used as a means of discovering the accident liability of individuals. Lahy and Karngold as reported by Thorndike(22) used a battery of these tests in trying to discriminate between a high accident group and a low accident group. Their test battery included a reaction time test, tapping test, dynamometer, dotting and a test for ability to divide attention. Table III shows the

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(19) Brown, C.W., and Ghiselli, E.E., Factors related to the proficiency of motor coach operators, J. Appl. Psychol., Vol. 31, 1947, pp. 477-479.

(20) Ghiselli, E.E., and Brown, C.W., Personnel and industrial psychology, 2nd Ed. McGraw-Hill Co., 1955, pp. 347-348.

(21) Tiffin, J., Industrial psychology, New York, Prentice-Hall INC., 1948, p. 444.

(22) Thorndike, op.cit. pp. 54-55.

critical ratios of differences between psychomotor test scores of accident and non-accident individuals, demonstrating different levels of usefulness in differentiating between the two groups.

Test		Critical Ratio
Simple reaction time test (to auditory stimulus)	Mean time	2.86
	Standard deviation	4.13
	Variation, relative to speed	5.88
Tapping test (paper and pencil version)	Right hand speed, precision instructions	3.71
	Left hand speed, precision instructions	4.04
	Right hand speed, no precision instructions	5.70
	Left hand speed, no precision instructions	4.44
Dynamometer (hand)	Force	5.80
	Persistence of Effort	3.14
Dotting (variation of McDougall test)	Number of hits	6.52
Divided Attention Test, (Complex reaction test, with several different responses to visual and auditory cues.)	Time to learn	5.41
	Errors during learning	7.35
	Visual stimulation, % correct resposes	7.90
	Visual auditory stimulation. % correct responses.	8.84

Table III: "Critical ratios of differences between psychomotor test scores of accident and non-accident railroad workers."(23)

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(23) Thorndike, op cit. p. 55.

Ghiselli and Brown[24] Bertelme *et al.*[25] have used dotting, tapping, judgement of distance, distance discrimination and mechanical tests to predict accident-free performance. Among other tests, these tests were found by the former writers to be the best predictors of accidents.

Drake (1940), as reported by Tiffin,[26] measured the visual discrimination and the speed of reaction of groups of accident free and accident prone individuals. The scores of the first group on the motor tests were lower than their scores on the perceptual tests. The second group had higher motor test scores than perceptual test scores.

Visual abilities have also been studied as discriminatory factors in accident liability. Tests on acuity, depth perception, color vision and phoria have been found to be significantly related to accident proneness in some

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(24) Ghiselli, E.E., and Brown, C.W., The prediction of accidents of taxicab drivers, J. Appl. Psychol., Vol. 23, 1949, pp. 541-543.

(25) Bertelme, P.F., Fletcher, E.D., Brown, C.W. Ghiselli, E.E., The prediction of driving skill, J. Appl. Psychol., Vol. 35, 1951, pp. 98-100.

(26) Tiffin, op cit. pp. 444-445.

situations.(27) (28) (29) (30)

It is interesting to observe that the intelligence tests, the psychomotor tests (tapping) and the visual acuity tests which are claimed to discriminate between accident prone and accident free individuals are among those which have been used to differentiate between normals, neurotics, psychotics, hysterics and dysthymics. The intelligence of the dysthymics is found to be significantly higher than the intelligence of hysterics.(31) On the other hand, normals have been shown to differ significantly from neurotics on a tapping test.(32) There is also a striking difference between the mean visual acuity of normals, neurotics and psychotics.(33) These findings, though not conclusive, do

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(27) Tiffin, op.cit. p. 219.

(28) Stump, N.F., A statistical study of visual functions and safety, J. Appl. Psychol., Vol. 29, 1945, pp. 467-470.

(29) Tiffin, J., Parker, B.J., and Harbersat, R.W., Visual performance and accident frequency, J. Appl. Psychol., Vol. 33, 1949, pp. 499-502.

(30) Parker, J.W., Jr. Psychological and personal history data related to accident records of commercial truck drivers, J. Appl. Psychol., Vol. 37, 1953, p. 319.

(31) Eysenck, H.J., Dimensions of personality, London, Routledge & Kegan Paul Limited, 1947, pp. 152-153.

(32) _____., The scientific study of personality, London, Routledge & Kegan Paul Limited, 1952, p. 218.

(33) Granger, G.W., Simple perceptual processes, In Eysenck, H.J., Granger, G.W., and Brengelmann, J.C., Perceptual processes and mental illness, The Institute of Psychiatry, Chaprian and Hall Ltd., 1957, p. 24.

at least suggest that tendency to have accidents is not an isolated dimension but an integral part of more broader personality characteristics. The following statement bears this out, and at the same time specifies more particularly the kind of individual likely to become involved in accidents:

> "... (neurotic) extraverts show a tendency to develop hysterical conversion symptoms. ..., they are ... accident prone ... 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 finicking work (tweezers test). Their level of aspiration is low, but they tend to over-rate their own performance... Their handwriting is distinctive"(34)

The clinical approach to accidents:

Like the psychometric approach, the clinical approach is also concerned with individual differences and the distinctive attributes underlying accident-proneness.

Freud in his book the 'Psychopathology of Everyday Life' treated accidents as determined phenomena for which underlying motives could always be found. Name forgetting, for instance, is explained as due to the repression of unpleasant experiences associated with the person whose name is forgotten. Accidental injuries may reflect the desire for self punishment.(35)

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(34) Eysenck, op cit. p. 247.

(35) Freud, S., Psychopathology of everyday life, Mentor Books, 1951, pp. 25, 84, 85.

Many writers have associated accidents with the feeling of guilt, hatred and resentment.[36] [37] [38]

Accidents are regarded as an expression of these feelings towards others. They may have a secondary purpose of arousing the sympathy and attention of others for the individual sustaining the injury.

With the concept of secondary motives in mind, Hill and Trist[39] [40] argued that accidents have two sides, injury and absence from work. These writers regard involvement in accidents, sickness and voluntary absence from work as a negativistic reaction towards the institution in which the individual is employed. This idea suggested to them that sickness and accidents may be forms of unconsciously motivated absence.

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(36) Rowson, A.J., Accident-proneness, Psychosomatic medicine, Vol., 6, 1944, p. 91.

(37) Dunbar, F., Psychosomatic diagnosis, N. Y., London, Paul B. Hoeber, INC., 1948, pp. 207-211.

(38) Fenichel, O., Psychoanalytic theory of neurosis, N. Y., W. W. Norton and Co. INC., 1945, pp. 500-501.

(39) Hill, J.M.M., and Trist, E.L., A consideration of industrial accidents as a means of withdrawal from the work situation, Hum. Rel., Vol. 6, 1953, pp. 357-380.

(40) Hill, J.M.M., and Trist, E.L., Changes in accidents and other absences with length of service, Hum. Rel., Vol. 8, 1955, pp. 121-152.

The above approach brings to attention the adjustment of accident-prone individuals to their jobs and figures of authority. According to Dunbar[41] accident cases have histories of frequent trouble with their parents, step-parents, with the church and job, and finally with their husbands and wives.

Le Shan and Laurence[42] tried to find the distinctive characteristics of accident prone individuals through the use of a personality inventory called the Worthington Personal History. One characteristic of individuals with high accident records that they found was that they formed only superficial ties with others. They had no close friends or intimate relationships with other workers. Accident prone individuals were also characterized by their resistence and agression towards authority.

These characteristics are contrasted to those of "safety proneness" found by the same writers.[43] One characteristic of 'safety prones' is their warm relationship with others. They are well adjusted to their work and show no agression towards their organization.

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(41) Dunbar, op cit. pp. 195, 212.

(42) Le Shan, L., and Laurence, L., Dynamics in accident prone behavior, Psychiatry, Vol. 15, 1952, pp. 73-80.

(43) Le Shan, L., and Laurence, L., Safety prone, Psychiatry, Vol. 15, 1952, pp. 465-568.

This maladjustment in interpersonal relationship runs through many other descriptions of accident prone individuals. Speroff and Kerr,[44] for instance, found that the least popular workers have most of the accidents, but whether unpopularity causes accidents or involvement in accidents leads to loss of popularity is not yet known.

In a sentence completion test used by Davids and Mahoney,[45] high accident subjects got low scores on "positive or socially desirable personality disposition". These subjects held negative attitudes towards their job, supervisors and bosses.

Accident prone individuals are also described by Rowson[46] as impulsive individuals who tend to respond to stimuli by action rather than by thought. He thinks that their maladjustment towards their parents makes them unable to adjust to their employers.

Again, Dunbar has described accident repeaters as characterized by irregular work records. They occasionally remained without work and tended to shift from one job to

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(44) Speroff, B., and Kerr, W., Steel Mill "Hot strip" accident and interpersonal desirability values, J. Clin. Psychol., Vol. 8, 1952, pp. 89-91.

(45) Davids, A., and Mahoney, J.T., Personality dynamics and accident proneness in an industrial setting, J. Appl. Psychol., Vol. 41, 1957, pp. 303-306.

(46) Rowson, op cit. p.93.

another with more than average frequency. They were always ready to try any available job without planning or training for that particular job. One of Dunbar's fracture patients described himself as a person who is interested in crowds and who enjoys mixing with others. He also described himself as restless and worried about his job and his relationship with his boss; often angry and disgusted and with no care about the future.(47)

Alexander has described the accident prone individual as "... an impetuous person who immediately converts his momentary inpulses into action"(48) which is one of the characteristics often attributed to the extraverted individual. On the other hand Eysenck in discussing the characteristics of the extravert says that:

> "...(neurotic) extraverts show a tendency to develop hysterical conversion symptoms ... have a bad work history, and are hypochondrical ... they are ... accident prone, frequently off work through illness, disgruntled, and troubled by aches and pain."(49)

Thus from the clinical as well as the psychometric point of view we are confronted with opinions relating extraversion with proneness to accidents.

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(47) Dunbar, op.cit. pp. 196, 665.

(48) Alexander, F., Psychosomatic medicine, London, George Allen and Unwin LTD., 1952, p. 214.

(49) Eysenck, op.cit. p. 247.

Summary Statement:

In this chapter we have pointed to the importance to society of the solution of the problem of accidents. We have discussed the question of accident proneness and shown that although this concept was initially accepted without criticism, more recently the evidence on which it was based has been called to question. However, much of the difficulty in assessing the validity of the accident proneness hypothesis was in the unreliability of accident-records. It, therefore, becomes imperative to clarify our ideas as to what constitutes an accident for a particular individual and to use as our criterion not the consequences of a particular act but its occurrence. That is, we must turn our attention from accidents themselves to the kind of behavior which might lead to them. This takes us out of the field of accident studies into the more general area of personality studies.

When attention is turned to the kind of psychometric tests which have proved of some use in the selection of accident repeaters, it turns out that similar tests have often been used for more general personality assessment. Broadly speaking, accident repeaters perform on tests more like maladjusted personalities of one kind or another than normals. Clinical studies lead to the same view and lead to the more specific suggestion that high accident rates form part of the behavioral make-up of the extraverted neurotic kind of individual.

Chapter II

Accident Proneness in Terms of Avoidance Learning.

Conditioning and accidents:

According to the evidence reviewed in the previous chapter the great majority of accidents are avoidable. If this is so then it is reasonable to suppose that individuals with high accident records may be those who learn poorly in avoidance situations. It is therefore pertinent to examine the psychology of avoidance learning to see if hypotheses about accident proneness can be derived.

One of the earliest scientific accounts of avoidance behavior derives from Pavlov. To his view, this behavior is conditioned in the classical manner. He says:

> "The strong carnivorous animal preys on weaker animals, and these if they waited to defend themselves until the teeth of the foe were in their flesh would speedily be exterminated. The case takes on a different aspect when the defense reflex is called into play by the sights and sounds of the enemy's approach. Then the prey has a chance to save itself by hiding or by flight". (50)

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(50) Pavlov, F.P., Conditioned reflexes: An investigation of the physiological activity of the cerebral cortex, Oxford University Press, 1927, p. 14.

This statement presents a happy picture for the organism, that is, it may react to the "sight and sounds" of the approaching animal and thus be able to avoid the danger of extermination. Nevertheless, it contradicts the Pavlovian original concept of conditioning.

The Pavlovian concept of conditioning assumes that for conditioning to take place, the conditioned stimulus should be paired with the unconditioned stimulus so that it acquires the ability to arouse the conditioned response. Accordingly, the 'sights and sounds' should be associated with the actual attack of the carnivorous animal before they are able to arouse the conditioned reflex of the weak animal and thus enable it to avoid the danger. Thus the weak animal is liable to be killed before it is ready to defend itself. According to this view, accidents are inevitable and one has to suffer repeatedly from them before having the chance to learn how to avoid them. This explanation does not seem to give any resolution to the question of avoidance of accidents and at the same time it does not provide for the safety of the organism.

Hull was conscious of the inconsistency and contradiction within the Pavlovian explanation. Nevertheless, he fell victim to the Pavlovian principle of contiguity in the explanation of his "law of primary reinforcement". This principle tries to explain reinforcement in terms of the

paired presentation of stimuli.[51] Thus, he found himself faced with the same Pavlovian problem which he called the "dilemma of the conditioned defense reaction".

The Hullian 'dilemma' goes like this:

"For a conditioned defense reaction to be wholly successful, it should take place so early that the organism will completely escape (avoid) injury, i.e., the impact of the nocuous (unconditioned) stimulus. But in case the unconditioned stimulus fails to impinge upon the organism, there will be no (?) reinforcement of the conditioned tendency which means (one would expect) that experimental extinction will set in at once. This will rapidly render the conditioned reflex impotent, which in turn, will expose the organism to the original injury. This will initiate a second cycle substantially like the first which will be followed by another and another indefinitely, a series of successful escapes (avoidances) alternating with a series of injuries..."[52]

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(51) Hull, C.L., Principles of behavior: An introduction to behavior theory, New York, Appleton-Century Crafts INC., 1943, p. 80.

(52) Mowrer, O.H., Learning theory and personality dynamics: Selected papers, New York, The Ronald Press Company, 1950, pp. 92-93.

Putting this 'dilemma' in an accident terminology, it may look as the following: When the organism is accident free for a period of time, there is no reinforcement available to the responses which enabled him to avoid the accident situation. These avoidance responses will suffer from extinction and thus expose the organism to accidents. The alternating of reinforcement and extinction will put him in a vicious circle of accidents According to this point of view, Hull seems to give a cyclic or periodic concept of accident-proneness.

This picture does not seem attractive from the biological point of view. If accidents are unavoidable, then organisms and particularly the weak will be exterminated. Actually, this is not the case, for the survival of life in a world full of risks and danger seem inconsistent with this view. Besides, it is generally observed that certain individuals tend to repeat accidents more than others, thus questioning both the Pavlovian and the Hullian point of view.

The Classical Viewpoint Questioned:

The paired presentation of the conditional stimulus with the unconditioned stimulus in classical conditioning which assumes that the conditioned stimulus should be always followed by the unconditioned stimulus was questioned by Brogden et al. (1938). They used an avoidance procedure which differred from the classical one. Two groups of guinea pigs were placed in revolving cages, and after a conditioned stimulus (buzzer) was presented, they were given

a shock which evoked running behavior. One group of animals trained according to the Pavlovian procedure were shocked whether they ran or not. The other,group, trained according to the arrangements of avoidance learning, were not shocked if they ran. The results showed that learning began similarly in both groups, but reached a higher level in the avoidance group. (53) A similar finding war reported by Gibson(54) using goats. These experiments may allow us to conclude that the avoidance procedure is more efficient in learning than the classical one.

The Pavlovian classical interpretation of avoidance conditioning as a simple stimulus substitution is also questioned by Mowrer and Lamoreaux, reported by Mowrer(55), and by Keehn.(56). These writers have demonstrated that the so-called conditioned avoidance response can be different from the unconditioned response or the escape response.

The non-correspondance between the conditioned response and the unconditioned response is explained by introducing fear as an intervening variable in such experiments where a noxious

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(53) Hilgard, E.R., Marquis, D.C., Conditioning and Learning, New York, Appeleton-Century Co. INC., London, 1940, P.58.
(54) Gibson, E.J., The role of shock in reinforcement, J. Comp.Phys.Psychol.,Vol.45, 1952, pp.18-30.
(55) Mowrer, op.cit. pp.129-151.
(56) Keehn, J.D., On the non classical nature of avoidance behavior, Amer.J.Psychol.(in press).

unconditioned stimulus is used. Furthermore, it has been noticed[57] that the following three conditions are lacking in the Pavlovian classical conditioning:

1. The conditioned stimulus acquires the capacity to elicit the secondary motive of fear.
2. This motive produces a variety of random responses.
3. The termination of the conditioned stimulus and fear reduction reinforce the connection between fear and anyone of these responses which caused its reduction regardless of its similarity to the conditioned stimulus.

The assumption of fear as an acquired drive or motive seems to be satisfactory from the point of view of biological adaptation, for it allows for the reinforcement of an avoidance response without the necessity of continuous attacks. However, there is still the problem as to how fear is learned in the first place.

Fear as an acquired drive:

The statement that fear is an acquired drive implies that it can be learned and can also motivate new learning. Such an assumption has received experimental support from many writers.[58] (59) (60)

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(57) Mowrer, op.cit. p. 130.
(58) Miller, N.E., Studies of fear as an acquirable drive: I - Fear as motivation and fear reduction as reinforcement in the learning of new responses, J. Exp. Psychol., Vol. 38, 1948, pp. 89-101.
(59) May, M.A., Experimentally acquired drives, J. Exp. Psychol., Vol. 38, 1948, pp. 66-77.
(60) Brown, J.S., and Jacobs, A., The role of fear in motivation and acquisition of responses, J. Exp. Psychol., Vol. 39, 1949, pp. 747-759.

For our purpose, we cite here Miller's classical experiment which demonstrates the learning of fear by albino rats. The subjects were put one at a time in a box with two compartments, one white and one black. These rats had no preference for either of the compartments. When they were given 10 electric shocks in the white compartment, they learned to run to the black compartment in order to escape the shocks. In giving them 5 more trials without a shock, they continued to run to the black compartment. Then it was intended to teach the rats how to learn a new response in order to go to the black compartment. The door between the compartments was closed, but the rats could open it by moving a wheel. The rats learned to turn the wheel and run to the black compartment. Besides, they also showed many signs of fear in the white compartment. It was thus demonstrated that neutral cues in the white compartment were able to motivate a new response in the same way as primary drives such as hunger and thirst.

In accepting fear as an acquired drive, one may raise the following question: "Is the learning involved in the associative shifting of the response of fear dependent upon drive reduction 'reward' or upon drive onset 'punishment'?" (61)

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(61) Mowrer, op.cit. p. 278.

The acquisition of fear in Pavlovian terms is that it becomes attached to the conditioned stimulus by the mere association of the conditioned with the unconditioned stimulus. Here, the emphasis is on the onset rather than the termination of shock or pain. The Pavlovian procedure of fear learning is illustrated in Fig.I.

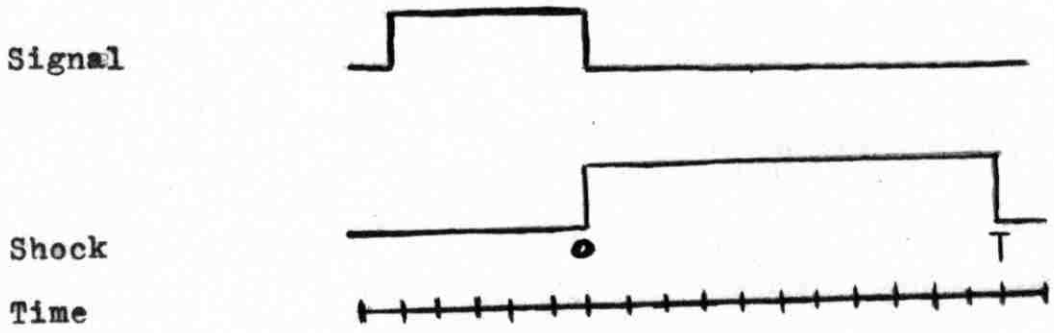

Fig.I - Schematic representation of the Pavlovian procedure where the signal goes off at the shock onset instead of lasting until shock termination.(62)

In the Hullian system, the acquisition of secondary drives is recognized in the following statement:

> "Where neutral stimuli are repeatedly and consistently associated with the evocation of a primary or secondary drive and this drive undergoes an abrupt diminition, the hitherto neutral stimuli acquire the

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(62) Mowrer, op.cit. p.279.

capacity to bring about the drive stimuli S_D which thereby become the condition C_D of a secondary drive or motivation"(63)

According to this view, fear is acquired by the "abrupt dimution" in the primary drive. Fear is reinforced by pain reduction and it is by no means depending on its onset. The Hullian theory of fear learning is illustrated in Fig.II.

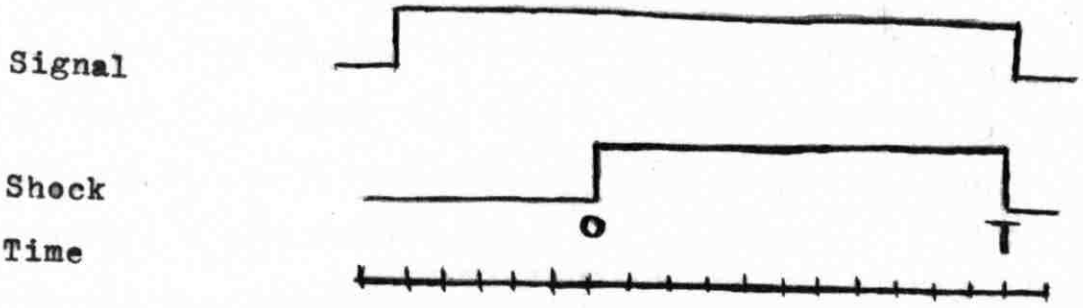

Fig. II - Schematic representation of the Hullian procedure where the signal lasts until shock termination.(64)

While the Hullians think that better learning should result in the Fig. II procedure where the signal lasts until shock termination, the Pavlovians expect similar results in both Fig. I. and Fig. II. procedures. When both hypotheses were tested by Mowrer, it was found that equally good learning was obtained in both procedures. That writer concluded that "conditioning, properly speaking is not depemdent upon the coincidence of the conditioned stimulus and the termination of the unconditioned stimulus".(65) The support given

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(63) Hull, C.L., Essentials of behavior, New Haven, Yale University Press, 1951, p.25.
(64) Mowrer, op.cit. p.279.
(65) Mowrer, op.cit. p.292.

to the Pavlovian interpretation of acquired fear is further substantiated by Mowrer and Solomon[66] and Mowrer and Aiken.[67]

The above evidence that learning of fear is dependent on the onset of pain or shock rather than its reduction is logical from the biological point of view. A signal which acquires the property of arousing the response of fear when the danger is over has no survival value to the organism. It is only when it has a warning function that it becomes useful to the organism. Mowrer summerizes this whole issue by putting it into a stimulus-response terminology:

> "a so-called "traumatic" ("painful") stimulus (arising either from external injury, of whatever kind, or from severe organic need) impinges upon the organism and produces a more or less violent defense (striving) reaction. Furthermore such a stimulus-response sequence is usually preceded or accompanied by originally and "indifferent" stimuli which, however, after one or more temporally contiguous associations with the traumatic stimulus begin to be perceived as "danger signals" i.e. acquire the capacity to elicit an "anxiety" reaction."[68]

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(66) Mowrer, O.H., and Solomon, L.N., Contiguity vs. drive reduction in conditioned fear: The proximity of abruptness of drive reduction, Amer. J. Psychol., Vol. 67, 1954, pp. 15-25.

(67) Mowrer, O.H., and Aiken, E.O., Contiguity vs. drive reduction in conditioned fear: Temporal variation in conditioned and unconditioned stimulus, Amer. J. Psychol., Vol. 67, 1954, pp. 26-38.

(68) Mowrer, op.cit. p. 17.

The anticipatory attribute of anxiety and the reinforcing nature of its reduction, as pointed out by Mowrer,(69) may also give a better understanding of avoidance bahavior. In instrumental avoidance training, the new response is strengthened in the absence of any stimulus such as food or the cessation of shock. Absence of stimulation can obviously have no influence on behaviour, only if there exists some sort of expectation to it. In the case of avoidance behavior, reinforcement does not come from avoiding punishment or injury but from the reduction of their expectation. If a conditioned avoidance response occurs when the individual is anxious, the reduction of anxiety is reinforcing to this response and thus it will be learned. Then, the concept of anxiety reduction can easily account for anticipatory bahaviour in avoidance learning in terms of reinforcement with no need to postulate teleological responses. On the other hand, the same concept may make it possible for avoidance behavior to function, to some extent, independently of the original shock or pain, thus bringing more chances for safety to the organism than what the Pavlovians and Hullians have suggested.

Individual Differences in Conditioning: The Role of Anxiety.

Avoidance learning according to Mowrer, we have seen, depends upon the prior conditioning of anxiety or fear. It

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(69) Mowrer, op.cit. p.150.

is therefore pertinent to enquire into individual differences in rates of conditioning if we wish to draw conclusions about individual differences in reactions to avoidance situations. In these terms we would expect individuals showing high anxiety to begin with would learn an avoidance task more easily than non-anxious individuals.

The above assumption has received experimental support in the case of eyelid conditioning, Taylor.(70) It is clearly shown in Fig.III. that anxious individuals have reached significantly higher level of conditioning than non-anxious individuals. Individual differences in paired associate learning, reported by Spence(71), between high anxiety and low anxiety subjects is also relevant to the same question.

Furthermore, hysterics, normals and dysthymics also demonstrate different levels of conditioning.(72) Fig.IV. shows that dysthymics gave the highest rate of conditioning, hysterics gave the lowest and normals come in between the two groups. If the superiority of the dysthymics in the rate of conditioning is due to the fact that they are more anxious than hysterics or normals, then it is another support to our previous assumption of individual differences in avoidance conditioning.

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(70) Taylor, J.A., The relationship of anxiety to the conditioned eyelid response, J. Exper. Psychol., Vol.41, 1951, pp.81-92.
(71) Spence, K.W., Behavior theory and conditioning, New Haven, Yale University, 1956, pp.226-227.
(72) Eysenck, H.J., The dynamics of anxiety and Hysteria, London, Routledge and Kegan Paul, 1957, p.116.

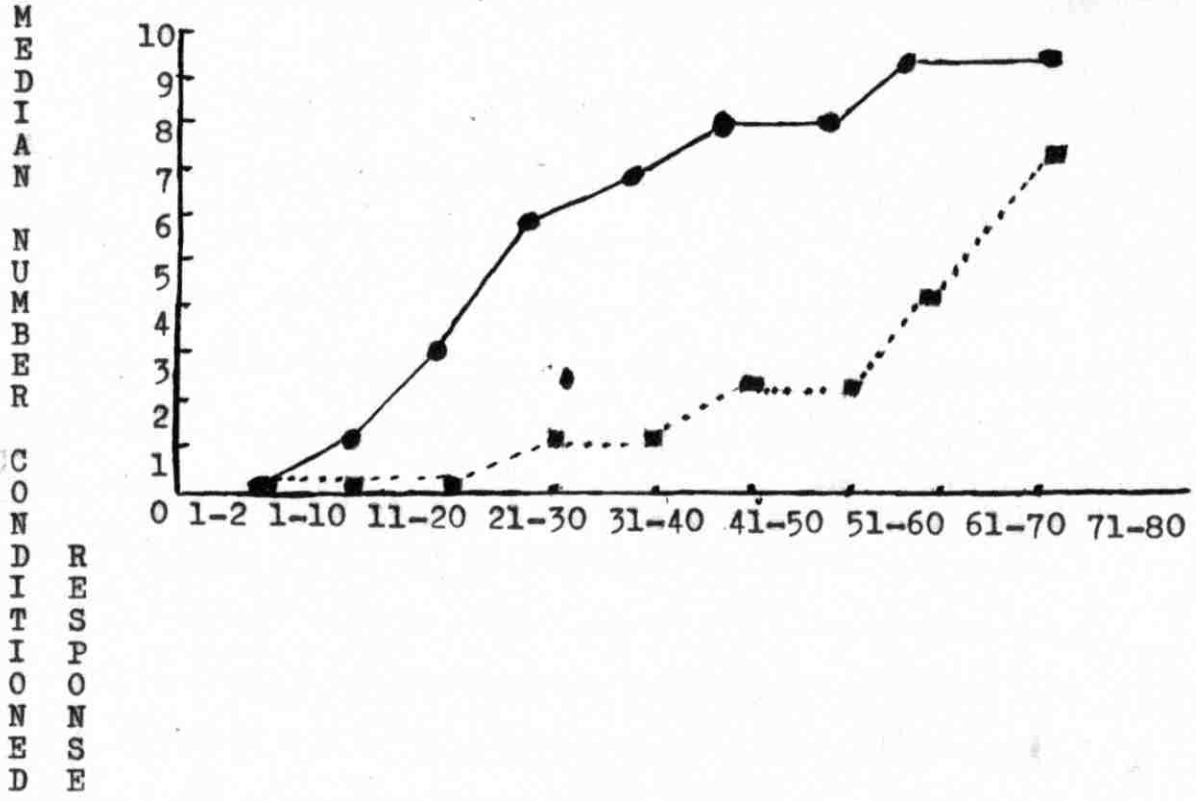

Fig. II. Acquisition curves showing the median number of conditioned eyeblink responses of anxious and non-anxious groups in successive blocks of 10 trials.(73)

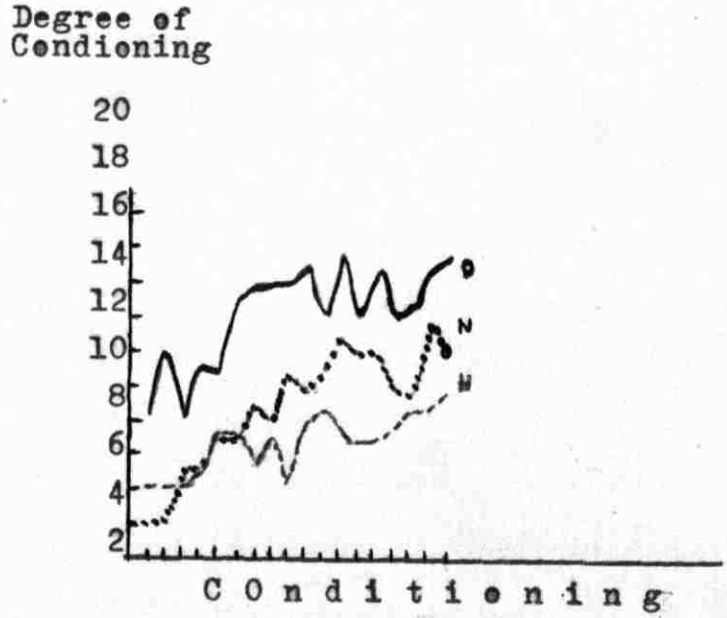

Fig. IV. Course of conditioning and extinction of groups of dysthymic (D), normal (N), and hysteric (H) subjects.(74)

(73) Taylor, op.cit, p.88.

(74) Eysenck, op.cit, p.116.

However, if one subsumes accident proneness under the concept of avoidance learning, this may provide hypotheses about individual differences in the tendency to be involved in accidents. The differences in the performance of anxious and non-anxious individuals in the avoidance situation may also be found among accident prone and accident free individuals. That is, accident free individuals are expected to be conditioned more easily and show higher level of conditioning than accident prone individuals. From this reasoning we should also expect high accident individuals to be poorer learners than low accident subjects in an avoidance learning task and one of the aims of this thesis is to put this conjecture to experimental test.

Summary Statement:

Our main concern in this chapter is not with actual accidents as such, but with the behavior underlying them. We have suggested that if accidents are avoidable, they should be amenable to the same kind of analysis as has been applied to avoidance learning situation. In our search for a similar interpretation to accident behavior, it turned out that Pavlovian as well as Hullian theories of learning do not provide a satisfactory answer to our present purpose. Moreover their acceptance of the contiguity principle in learning doesn't seem adaptive and rather makes accidents necessary. However, the introduction of fear as an intervening variable seems to make avoidance behavior possible.

That is, the organism fears a danger signal and thus avoids the forthcoming danger. Nevertheless, the signal does not equally arouse the emotion of fear in all organisms, for individual differences have been experimentally demostrated in avoidance conditioning. Similarly, we expect individual differences between accident free and accident prone individuals. One hypothesis that we should test is that accident repeaters will be less successful in a laboratory avoidance learning task than individuals who tend not to be imvolved in accidents.

Chapter III

Accident proneness in terms of Perceptual Defense

The 'New Look' in Perception:

We have outlined in the previous chapter a possible relationship between accident and avoidance situations, bringing to attention the reaction to the signal as a necessary condition in avoidance behavior. We may assume here that the individual has to perceive that signal first before he can react to it. This necessitates a clear understanding of the role of different factors in perception with the hope of finding further clues to the problem of accidents.

Motivation, a traditionally overlooked factor in perception, has been brought to the foreground through the 'New Look' movement. This movement has emphasized the influence of physiological needs and values on the perception of the individual of this environment. The food responses of hungry subjects, for instance, have been found to increase steadily with the increase of the hours of deprivation.(75) (76) It was similarly demonstrated that in a free choice situation, the subjects state of hunger was significantly related to his perceptual accuracy for hunger related material.(77)

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(75) McClelland, D.C., and Atkinson, J.W., The projective expression of needs: I- The effects of different intensities of the hunger drive on perception, J. Psychol.,1948, Vol.25, p.207.

(76) Atkinson, J.W., and McClelland, D.C., The projective expression of needs: II- The effect of different intensities of hunger drive on thematic apperception J.Exp.Psychol., Vol.38, 1948, p.643.

(77) Lazarus, R.S., Yousen, H., and Arenberg, D., Hunger and Perception, J.pers., Vol.21, 1953, PP.312-328.

Moreover, it has been found that socially valued things, such as coins are overestimated in size by some subjects. The personal need of the subject may effect his judgement or his estimation.(78) (79) (80) There is also experimental evidence to suggest that positive as well as negative values may lead to perceptual accentuation.(81)

We are already familiar with a similar emphasis on personal motives on the tendency of persons to be involved in accidents. It is quite possible that the same motives which make these persons defend against the signal play the main role in accident involvement.

The Perceptual Defense Hypothesis:

The original experiment of perceptual defense was performed by Bruner and Postman (1947). They found different recognition thresholds to emotion arousing and neutral words. Subjects whose recognition threshold to these words is lower than the neutral words are called perceptual sensitizers. On the other hand, those who recognized the neutral

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(78) Bruner, J.S., and Goodman, D.D., Value and need as organizing factors in perception, J. Abnorm. Soc. Psychol., Vol. 42, 1947, pp. 33-44.

(79) Carter, L.F., and Schooler, K., Value, need and other factors in perception, Psychol. Rev., Vol. 56, 1949, pp. 200-207.

(80) Bruner, J.S., and Rodrigues, J.S., Some determinants of apparent size, J. Abnorm. Soc. Psychol., Vol. 48, pp. 17-24.

(81) Bruner, J.S., and Postman, L., Symbolic value as an organizing factor in perception, J. Abnorm. Soc. Psychol., Vol. 27, 1948, pp. 203-208.

words more easily than the emotion producing words are called perceptual defenders.(82)

Further experimental evidence to support the original claims of the perceptual defense hypothesis was pointed out by Postman et al.(83) These writers found that words which represent the subjects different value areas on the Allport-Vernon test have different recognition thresholds, words in high value areas being recognized more quickly than other words. Besides perceptual defense and sensitization, they suggested resonance to account for the machanism underlying their subject's pre-recognition guesses.

Another classical experiment in perceptual defense is that of McGinnies.(84) He demonstrated a relationship between the emotional tone of words and their recognition thresholds.

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(82) Stein, K.B., Perceptual defense and perceptual sensitization under neutral and involved conditions, J.Pers., Vol.21, 1952, p.467.

(83) Postman, L., Bruner, J.S., McGinnies, E.M., Personal values as selective factors in perception, J. Abnorm.Soc.Psychol., Vol.43, 1948, pp.142-154.

(84) McGinnies, E., Emotionality and perceptual defense, Psychol.Rev., Vol.56, 1949, pp.244-251.

The same writer tried to interpret the perceptual defense phenomenon in terms of "discrimination without awareness". He pointed out that some stimuli "arouse automatic reactions characteristic of anxiety or pleasure prior to the conscious awareness of the nature of the stimulus."(85) His evidence for such a claim is the finding that emotionality, defined in terms of the subjects G.S.R., was significantly greater during the pre-recognition exposures of the critical words than the neutral words.

Lazarus and McCleary(86) also claimed to demonstrate a discriminative ability by their subjects in terms of the automomic nervous system response when stimuli were exposed at a speed too rapid for the subjects to verbalize or consciously identify. They gave the name 'subception' to the process underlying this phenomenon. The subception effect was attributed to the difference between verbal perception and autonomic discrimination.

Eriksen and Brown(87) and Eriksen(88) tried to show the inadequacy of the concept of discrimination without awareness as a way of explaining perceptual defense. They

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(85) Ibid. P.245.

(86) Lazarus, R.S., & McCleary, R.A., Autonomic discrimination without awareness: A study of subception, Psychol, Rev., Vol.58, 1951 pp.113-123.

(87) Eriksen, C.W., and Brown, T., An Experimental and theoretical analysis of perceptual defense, J. Abnorm. Soc.Psychol., Col.52, 1956, pp.224-230.

(88) Eriksen, C.W., The case for perceptual defense, Psychol.Rev., Vol.61, 1954, pp.175-182.

preferred to describe it in terms of behavior theory and principles derived from avoidance conditioning and punishment. However, before fully developing this new approach, let us acquaint ourselves with the controversy over the perceptual defense hypothesis.

The Perceptual Defense Controversy:

The early concept of perceptual defense as an explanatory principle to account of the high recognition threshold of certain critical stimuli has been a controversial issue. The experiments involved in the controversy have used taboo words and seem to produce contradictory results. If one experimenter, for instance, gets high threshold for critical stimuli, he regards these results as an evidence for the perceptual defense hypothesis. On the other hand, if the recognition threshold is found to be low, the same hypothesis is put to question.

The first criticism to the original notion of perceptual defense was raised by Howie.(89) That writer questioned as to how proponants of the perceptual defense theory can speak of the perceptual process as both knowing and the avoidance of knowing. A similar criticism of the perceptual defense hypothesis was put in a rather general way: How can the individual defend againsy a stimulus without perceiving it? It was thought that he must perceive it first before he

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(89) Howie, D., Perceptual Defense, Psychol.Rev., Vol.59, 1952, pp.308-316.

could defend against it. The concept of discrimination without awareness was unacceptable to many writers, Howes and Soloman(90) Postman et al.(91) Bitterman and Kniffin(92) Whittaker et al.(93) These writers perferred to explain the perceptual defense phenomenon in terms of the deliberate delay of report or the suppression of socially unacceptable words. By manipulating the subject's readiness to report taboo words, some experimenters suggested that there is no perceptual defense mechanism. Postman et al.(94) However, other writers pointed to experimental as well as theoretical evidence contrary to the explanation of perceptual defense in terms of the subject's refusal to report taboo words. Chodorkeff(95) Cowen and Beier (96) Dulany (97)

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(90) Howes, D.H., and Solomon, R.L., A note on McGinnies' "Emotionality and perceptual defense" Psychol.Rev., Vol.57, 1950, pp.229-225

(91) Postman, L., Bronson, W.G., and Gropper, C.L., Is there a mechanism of Perceptual Defense?, J.Abnorm. Soc.Psychol., Vol.48, 1953, pp.215-225.

(92) Bitterman, M.E., and Kniffin,C.W., Manifest Anxiety and Perceptual Defense, J. Abnorm. Soc.Psychol., Vol.48, 1953, pp.248-252.

(93) Whittaker, E.M., Gilchrist, J.C., and Fischer, J.W., Perceptual defense or response suppression, J.Abnorm. Soc.Psychol., Vol.47, 1952, pp.732-733.

(94) Postman et al. pp.215-225.

(95) Chodorkeff, B., Self perception, Perceptual Defense and adjustment, J. Abnorm. Soc.Psychol., Vol.49, pp.508-512.

(96) Cowen, E.L., Beier, E.O., Threat expectancy word frequencies and perceptual pre-recognition hypothesis, J.Abnorm.Soc.Psychol., Vol.49, 1954 pp. 178-182.

(97) Dulany, D.E., Avoidance Learning of perceptual defense and vigilance, J. Abnorm. Soc.Psychol., Vol.55, 1957 pp.333-338.

Another controversial question in the perceptual defense hypothesis is the lack of control of factors other than the nature of the stimuli. One factor is the differences in the frequency or familiarity of the stimulus words to the subjects. Howes & Soloman(98) Postman & Schneider.(99) The McGinnies study, for instance, was criticized for leaving this factor uncontrolled and taking only emotionality into consideration.

However, a solution to the word frequency question was given by Postman et al.(100) who suggested that neutral and critical words should be equated for familiarity before starting to compare their thresholds. Furthermore, experiments on the recognition of the success and failure words(101) as well as the completed and uncompleted tasks(102) seem to challenge the familiarity or frequency hypothesis. The recognition threshold in these experiments is entirely independ-

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(98) Howes and Solomon, op.cit. pp.229-235.

(99) Postman, I., and Schneider, B., Personal values, visual recognition and recall, Psychol.Rev., Vol.58, 1951, pp.271-284.

(100) Postman, et.al., op.cit.pp.215-225.

(101) Eriksen,C.W., Defense against ego threat in memory and perception, J. Abnorm.Soc.Psychol., Vol.47, 1952, pp.230-235.

(102) Eriksen, C.W., Psychological defenses and "ego strength" in the recall of completed and incompleted tasks, J. Abnorm.Soc.Psychol, Vol.49, 1954, pp.45-50.

ent of frequency of material under consideration. Nevertheless, it was recently suggested that the ralationship between frequency and recognition threshold could not be given a perceptual interpretation, because such a relationship has been demonstrated in the absence of the perceptual stimulus. Goldiamond and Hawkins.(103)

A radical change in the concept of perceptual defense came with the methodological criticism of Eriksen.(104)

To test the perceptual defense hypothesis adequately according to this writer, two methodological requirements should be met:

a. Care must be taken to ensure "that the stimuli to be perceived are anxiety provoking for the individual subject."
b. "that the subjects have learned to deal with anxiety from this source by using avoidance defenses."

Early experiments in perceptual defense such as the ones by Bruner and Postman, cited by Stein (105) and Postman et al.(106) and McGinnies(107) have not paid any attention to these requirements.

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(103) Goldiamond, I., and Hawkins, W.F., Verierversuch: The log.relationship between word-frequency and recognition obtained in the absence of stimulus words, J.Exp.Psychol., Vol.56, 1958, pp.457-463.

(104) Eriksen, op.cit. p.176.

(105) Stein, op.cit. p.467.

(106) Postman, etal.op.cit. pp.142-154.

(107) McGinnies, op.cit. pp.244-251.

It seems that the perceptual defense controversy is partly due to the early tendency to overlook the Eriksen suggestions cited above. These suggestions imply that taboo words are not anxiety provoking stimuli to all individuals and that there are individual differences in dealing with anxiety. Such assumptions lead us to the discussion of the modern concept of perceptual defense, particularly to its interpretation in terms of the behavior theory of learning

New Developments: Behavioral Approach.

The behavior approach to perceptual defense has its beginning with the article of McGinnies entitled "Emotionality and perceptual Defense". He attempted to explain this phenomenon in terms of emotional conditioning in childhood. Nevertheless, it is only with Eriksen(108) that this approach reached a mature stage, being described in terms of behavior theory principles derived from avoidance conditioning and punishment.

The basic principle underlying the theory of defense as explained by Eriksen(109) concerns the ability of the human organism to detect the presence of anxiety arousing stimuli at an unconscious level of awareness so that it will be prevented from spreading to the conscious level. Defense mechanisms according to this view, are ways of avoiding or dealing with anxiety. Thus, the writer described the perceptual defense situation in the following statement:

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(108) Eriksen, op.cit. pp.175-182.
(109) Eriksen, op.cit, pp.175-182.

> In a tachistescopic exposure the subject receives a few fragmentary cues from which to reconstruct the entire stimulus. If anxiety may be assumed to interfere with the availability and flexibility of hypothesis, then it is to be expected that stimuli provoking anxiety require more cues before correct recognition occurs".(110)

This approach has been further developed by Eriksen and Browne(111) who extended the work of Dollard and Miller(112) to the study of perceptual defense. These latter writers tried to analyse thought and verbal behavior in terms of behavior theory and suggested a theory of repression based on the avoidance of responses that produce conditioned anxiety arousal.

Eriksen and Browne(113) suggested that if R1 is closely followed by anxiety and the cues produced by it are conditioned stimuli for anxiety arousal, its position as the

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(110) Eriksen, op.cit. p.180.

(111) Eriksen and Browne, op.cit. pp.224-230

(112) Dollard, J., Miller, N.E., Personality and psychotherapy, and Culture, New York, Toronto, London, McGraw-Hill Book Company, INC., 1950 pp.198-221.

(113) Eriksen and Browne, op.cit. pp.224-230.

strongest response in a habit family hierarchy will change. It he word 'shot' is exposed at progressively increasing periods of time, at short duration, it is perceived as shot, shat, shun, shum... etc. If any of these is followed by anxiety or punishment, the possibility of its perception or verbalization decreases. If the word 'shot' evokes anxiety in the subject, the probability of this word as a respense would be expected to decrease. The subject responds with it less frequently than with another word which does not lead to anxiety.

Perceptual defense has been similarly approached by McGinnies and Bowles,(114) and by McGinnies and Sherman,(115) These writers attempted to explain this phenomenon in terms of reinforcement theory:

> ".... verbal responses involving taboo symbols have, for most individuals, been punished by parents and parents-surrogates. The taboo words thus become secondary negative reinforcing agents. When operating

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(114) McGinnies,E., and Bowles, W., Personal values as determinants of perceptual fixation,J.Pers., Vol.18, 1949, 224-235.

(115) McGinnies, E., and Sherman, H., Generalization of Perceptual Defense, J. Abnorm.Soc.Psychol., Vol.47, 1952, pp.81-85.

as stimuli, they signal a state of approaching punishment and consequently become cues for eliciting the anxiety associated with actual punishment."(116)

Thus, high thresholds result from the failure of the individual to establish what may effectively reduce the anxiety associated with these taboo words. On the other hand, stimuli which have been previously associated with such anxiety may have a low threshold if their recognition has been remarked by escape from anxiety,(117) This interpretation of perceptual defense in terms of anxiety reduction may remind us of the Mowrer theory of avoidance learning discussed in the second chapter.

The application of Mowrer's theory of avoidance learning to the study of perception has also been adopted by Dulany.(118) He thinks that when an anxiety response is conditioned to a previously neutral stimulus, any perceptual reaction such as vigilance or defense are possible. The different perceptual reactions are conceived as forming a hierarchy of probability of occurance, and "selective reinforcement" as the effective agent in changing this response hierarchy. If one perceptual response is punished while the competing perceptual responses are instrumental

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(117) Reece, M.M., The effect of shock on recognition thresholds, J. Abnorm.Soc.Psychol., Vol.49, 1954, pp.165-172.

(118) Dulany, op.cit. pp.333-338.

to the avoidance of punishemnt and the reduction of anxiety perceptual defense is learned. On the other hand, perceptual vigilance is learned when one perceptual response is instrumental to the avoidance of punishment while the competing perceptual responses are punished.

These interpretations of perceptual defense and vigilance describe nicely avoidance learning of the skeletal responses. Furthermore, they may guide our steps in the search for individual differences in perception similar to these found in conditioning.

Individual Differences in Perceptual Reactions to "Threat":

The interpretation of perceptual defense in terms of avoidance learning may contribute more to our understanding of the accident situation, and the tendency of certain individuals to be involved in accidents. Thus individual differences in perception may be regarded as a further development of our argument in chapter two.

We are already familiar with many instances of individual differences in perception based on the ways individuals handle or deal with anxiety. It is assumed that individuals use two means of responding to threat or anxiety; some use psychological avoidance and forget or 'repress' stimuli associated with anxiety. These individuals show perceptual defense as against others who show sensitization to the same stimuli.(119) Similar tendencies have been

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(119) Eriksen. op.cit. pp.175-182.

manifested by sex repressers as against sex sensitizers and also hostility repressers as against hostility sensitizers.(120)

Furthermore, attempts have been made to relate individual differences in perception to adjustment or to the individual's habitual ways of handling his success or failure. Chodorkoff(121) Postman and Solomon(122) Eriksen(123). It was found, for instance, that the more well adjusted the individual, the more he tends to sensitize threatening stimuli; and the less he is adjusted, the more he tends to avoid them. However, individual differences in the reaction to threat have lent themselves to a different interpretation in terms of differences in learning ability, Keehn.(124)

A finding of great interest to us is that intellectualizers (obsessive compulsive neurotics) show significantly greater accuracy of recognition of threatening material than repressers (hysterics). The performance of the former group on a sentence completion test also shows more ready than the latter group. Lazarus et.al.125)

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(120) Carpenter, B., Wiener, M., and Carpenter, Jeneth, T., Predictability of perceptual Defense behavior J.Abnorm,So.Psychol., Vol.52, 1956, pp.380-383.
(121) Chodorkoff. op.cit. pp.508-512.
(122) Postman, L., and Solomon, R.L., Perceptual sensitivity to completed and incompleted tasks, J.Pers. Vol.18, 1950, pp.347-357.
(123) Eriksen, op.cit. pp.230-235.
(124) Keehn, J.D., Increase in perceptual sensitivity as a function of learning in the test situation, Brit.J.Psychol (in press).
(125) Lazarus, R.S., Eriksen, C.W., and Fonda, C.P., Personality dynamics and auditory perceptual recognition, J.Pers., Vol.19, 1951, pp.471-482.

These individual differences in reaction to threat and failure among patients suggest that perception is a part of broad dimensions of personality such as hysteria - psychasthenia or extraversion - introversion. Such interpretation of perception has been initiated by Eriksen (126) who tried to compare subjects who memorized completed and incompleted tasks to Eysenck's extravert - introvert and hysteric - dysthymic personality dimension. According to Eriksen, extraverts and hysterics recall more completed than incompleted tasks because of their emphasis on success. Similarly, Eysenck's (127) extraverts and hysterics tended to over-rate their performance in the level of aspiration experiment, thus paying no attention to their repeated failures.

Furthermore, hysteria - psychasthenia can be related to perception through the effect of anxiety on stimulus generalization and discrimination. There is usually a gradient of stimulus generalization which increases with corresponding increase in the level of anxiety. (128) It was demonstrated by Eriksen (129) that subjects scoring high on the M M P I hysteria scale show more stimulus generalization than the subjects scoring high on psychasthenia. In

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(126) Eriksen, op.cit. pp. 45-50.

(127) Eysenck, op.cit. p. 247.

(128) Rosenbaum, G., Stimulus generalization as a function of level of experimentally induced anxiety, J. Exp. Psychol., Vol. 45, 1953, pp. 35-43.

(129) Eriksen, C.W., Some personality correlates of stimulus generalization under stress, J. Abnorm. Soc. Psychol., Vol. 49, 1954, pp. 561-565.

the perceptual defense situation, psychasthenics show perceptual vigilance while hysterics show defense, because the former group are more accustomed to deal with anxiety at the conscious level.

This argument about individual differences in perception may direct our attention to similar conclusions we have made about avoidance conditioning. Both analyses suggest that individual differences exist both in avoidance learning and in perceptual reactions to threat, and agree that the extraverted or extraverted neurotic (hysteric) individual will show poorer avoidance learning and greater perceptual defense than normal or introverted subjects. The hypotheses that both poor avoidance learning and a high degree of perceptual defense might be seen as potent contributors to accident repetition has, then, at least presumptive support in that extraverts (or hysterics) show both the former characteristics and also tend to be accident repeaters. It is the purpose of this thesis to put this hypothesis to test by examining the relationship between laboratory tests of perceptual defense, avoidance learning, and certain selected criteria of accident repetition.

Chapter IV

Experimental Procedure.

The problem of accident criteria:

Any investigation into the problem of accident proneness must deal first with the problem of subject selection. Two methods have been traditionally used, the interview technique and the survey of accident-records.

A major limitation of the interview method is the tendency of individuals to forget some accidents, so that the interviewer is never sure about the percentage of accidents actually recalled by an interviewee. What may make it more difficult for the accident repeater to remember his accidents is that he is often required to recall them a long time after they have taken place.

Added to the forgetting of their accidents, individuals may deliberately lie if they grasp any implications regarding their dismissal or rejection from a job.

Similarly, accident records of industrial organizations, police-files, insurance records or driving clinics are biased towards certain kinds of accidents rather than others.

Owing to these limitations we decided to confine ourselves to two other classes of possible accident criteria, one based on the actual "accidents" occurring in specified

laboratory situations and the other concerned with a subjects' general report on his tendency to have accidents in certain kinds of situations. This second criterion did not involve the subject remembering particular accidents, but only on his general impression about his own behavior.

Accident criteria:

In the present study, we have tried to minimize the above limitations of the traditional accident criteria by using the following:

A. The Accident Index:

The Accident Index seen in Appendix I consists of 41 questions about different accident situations. In constructing this Index, we have the advantage of including many areas of the subjects every day life not normally considered in accident studies. Moreover, although response to this questionaire must depend to some extent upon specific memories, they do not play as important a role as in the case of the interview technique.

B. Laboratory Tests:

A second alternative to the traditional methods of criterion group selection is one where the subjects are confronted with potential accident situations in the form of laboratory tests. One advantage of these tests is that they keep exposure to hazards constant for all subjects. Thus, the potential hazards of various accident situations which cause fluctuation in accident records are kept constant.

Besides, other variables such as age and health of subjects can also be controlled. Another advantage of these tests is that all subjects have no previous experience in these tests which may influence the accident potentiality of the subjects. Moreover, they allow us to record accidents objectively and accurately. The two tests used were a motor test and the Porteus Maze test.

1. The Motor Test:

This test consisted of an artificial street in the form of a line one centimetre wide, painted around a revolving wheel similar to a memory drum. The paint had been taken off the left side of the 'road' at irregular intervals, forming "blocks" 5 milimetres wide and coming half way into the artificial street. These blocks were intended to represent parked cars. They were always on the left side of the street to see if the subjects could learn to use this cue to avoid them. A stylus was used to represent a driven car. When it came into contact with the blocks or ran off the painted street it closed an electric circuit which started an electric timer which recorded the time that S failed to keep the stylus on the moving road. The 'road' moved at 33.3r.p.m. approximately.

Administration:

S sat on a chair facing the motor test, holding the stylus in his preferred hand, E read the following instructions:

"Imagine that this white line is a street and you are driving a car along it, but instead of the car going along the street, the street will move under your car like this (start road turning and demonstrate). This is your car (E takes the stylus and places its tip at the starting point of the street), and you have to drive it along this street. When I ask you to start from here (E points out the starting point of the street), the street will be moving towards your car. There are many blocks or cars like these along the street (E points them out to S). If you run over these cars or your car leaves the street you will have an accident. Remember that you are driving a car and do not take it off the street. First let us have a trial run (E gives the stylus to S and adjusts the starting point of the street). Are you ready (E starts road turning). Now we will do the test properly. Ready?"

Ten trials were given. After each run E stopped the wheel, and recorded the error score. When S finished the ten runs, he was asked "Did you notice any cue that helped you to drive the car on the street without running into the blocks". A record was made of whether or not S had noticed that all the blocks occured on the left side of the street.

2. <u>The Porteus Maze:</u>

The adult Porteus Maze seen in Appendix II was used as our second alternative to the questionaire as an accident criterion. This test is like a static version of

the artificial street discussed above, for it has sometimes been used as a motor driving situation with the parallel lines as the sides of a street and the pencil as a car.(130) The corners of the Maze may be regarded as a substitute to the blocks used in the artificial street.

Administration:

S sits on a chair holding a pencil in his preferred hand. E puts the Maze on the table with its opening upwards, then he asks S to put the tip of the pencil on letter "S" in the centre of the Maze, giving him the following instruction: "Drive your pencil through this Maze and find your way out".

The accident score was the number of times S's pencil cut one of the sides of the Maze.

The Perceptual Defense and Avoidance Learning Tests:

As the main purpose of this study is to investigate the nature of accident proneness, a further step from finding accident criteria is to look for some tests which may discriminate between the accident prone group and the accident free group. According to our previous analysis of accident proneness in Chapters 2 and 3, we hypothesized a relationship between accidents on the one hand and avoidance learning and perceptual defense on the other. The following tests were chosen as measures of perceptual defense and avoidance learning:

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(130) Porteus, S.D., The Porteus Maze Test and Intelligence, California, Palo Alto, Pacific Books, 1956, p. 163.

A. Tests for Perceptual Defense:

1. The Tachistoscope Test: In this test, a circle with a small hole in its circumference was projected tachistoscopically on a pale green wall. Exposure times varied from 0.01 sec. to 1 sec. in ascending order with 0.50, 0.25, 0.10, 0.5, 0.2, sec. exposures between. The spot appeared either at the top, bottom, left, or right of the circle in random order. Recognition thresholds for the four positions were determined.

S sat on a chair 14 feet away from the wall. E sat beside the tachistoscope which was behind S, and gave the following instructions:

"On this wall, you can see a dark ring. On the right side of the dark ring you can see a small spot of light. This spot will appear on the four sides of the circle - up, down, right, left - (E exposes the four positions and asks S if he can detect them). This dark circle will be flashed on the wall and you have to recognize whether the spot is up or down, right or left. I will not tell you whether you are right or not. Go on saying the positions of the spot as you see it on the wall with every flash. Ready".

E began with the spot in the U - position exposing it first at .01 Sec. for three trials. If S identified the position on any one of these trials, E gave one more exposure as a safeguard against random guesses. If S failed to identify the correct position, E increased the interval to .50 Sec. and so on until S correctly identified the position of the

spot on 2 successive exposures. Then, the same procedure was followed 15 more times with the following order of positions: L, D, R, D, U, R, L, L, D, U, R, R, L, U, D.

Following this initial pre-shock threshold measure, E adjusted electrodes to the first and third fingers of S's right hand and gave the following instructions:

"The same dark circle will be flashed on the wall again, and you have to recognize again the position of the spot inside the circle. One of these positions will be accompanied by a shock, but if you recognize it, you will receive no shock. Focus on the place where the circle was - Ready".

E exposed the four positions 16 times on the same order mentioned above. All these 16 exposures were for .01 Sec. only, and shocks were given when the spot was in the L. position regardless whether S's verbalization was right or wrong.

In the last part of the experiment, E instructed S:

"We shall now go through the first section again. This time, there will be no shock (E removes electrodes)". The post-shock thresholds were then measured with the same procedure as before.

Owing to a failure on the part of the tachistoscope half way through the experiment a second test of perceptual defense was devised for the remainder of the subjects.

2. The Reading Test: This test has been used by Cowen and Beier (131) and White (132) as a measure of perceptual defense. In the present instance it consisted of two booklets of 10 carbon copies of nonsense syllables. These copies were arranged from the most blurred to the clearest one. Each page in these booklets had the same four nonsense syllables repeated four times each, but the order of their arrangement differed in the respective booklets. Besides these two booklets, a third one consisting of 16 carbon copies also was used. Each copy contained one of the original nonsense syllables all blurred to the same degree. The order of the nonsense syllables as they appeared on the copies of the booklets is shown in Appendix III.

In the first part of the experiment S was given the following instructions:

"I am going to show you some typed nonsense syllables. These nonsense syllables are blurred and you may have difficulty in reading them, but try to identify as many as you can of the words on each page".

Then E uncovered the pages one by one and recorded the page on which each syllable was first identified.

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(131) Cowen and Beier, op.cit. pp. 178-182.

(132) White, M.A., A Study of Schizophrenic Language, J. Abnorm. Soc. Psychol., Vol. 44, 1949, pp. 61-74.

In the second part, E gave S the following instructions:

"I am now going to show you some typed nonsense syllables, each on a separate page. They are also blurred, but try to identify as many as you can. One of these nonsense syllables will be accompanied by a shock, but if you recognize it, you will receive no shock".

E presented S with the 16 copies one by one, shocking S through finger electrodes whenever the page with the nonsense syllables 'Buce' was presented.

In the third part of the experiment, E instructed S as follows: "Let us go through the first part of the experiment again. Now, there will be no shocks (E removes electrodes from S's fingers)." The order of nonsense syllables in the booklet presented to S was slightly different from the one used in the first one. E recorded again the page on which each syllable was first identified by S.

B. Tests of Avoidance Learning:

1. The Word - Association Test: This test was based on a similar one devised by Eriksen and Kuethe (133) to investigate the effects of electric shock on word associations.

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(133) Eriksen, C.W., and Kuethe, J.L., Avoidance conditioning of verbal behavior without awareness: A paradigm of repression, J., Abnorm. Soc. Psychol., Vol. 53, 1956, pp. 203-209.

The series of 15 stimulus words shown in Appendix IV was presented to S in an irregular order by tape recorder. The interval of presentation between these stimuli was 10 seconds. E adjusted finger electrodes to the right hand of S and read the following instructions:

"You are going to hear a list of words. When you hear each word say the first word that comes into your mind as quickly as possible. The same list of words will be repeated over and over again, but each time the words will occur in a different order. Sometimes you will receive a small electric shock like the one you have just experienced (E administers the shock to S). You will receive the shock under two conditions, one is when your association to the word is late, i.e. you don't reply quickly enough with a word to the word given from the tape recorder. The second condition under which you will receive a shock will not be told to you. It is your job to find this second condition and avoid the shock. Now let's hear the instructions again on the tape".

At the end of the instructions on the tape recorder the presentation of the stimulus words began. The first presentation was only to familiarize S with the words. In the second presentation, S's responses to the four underlined words in Appendix IV were shocked. On the following 8 presentations of the list, E continued to give S shocks

whenever the first responses to these stimulus words were repeated. These shocked responses thus gave a measure of avoidance learning for each S. As a control the number of times that S altered his responses to the non-shock syllables was also recorded.

The above tests along with a number of others unrelated to the present study were given to 61 paid volunteer students taking elementary courses in Psychology and Sociology at the American University of Beirut. These students were above the Freshman level and from both sexes. They were asked by their professors to participate in the experiments and it took each subject four hours to complete the whole battery of tests.

Chapter V

Results and Interpretations.

The Accident Criteria:

As the problem of subject selection is repeatedly referred to in the analysis of different investigations of accident proneness, one main task of this thesis is to find an accident criterion. The Accident Index, motor test and the Porteus Maze were used for this purpose.

If these tests are all concerned with the phenomenon of accidents, it is reasonable to suppose that they would correlate with each other. As shown in Table IV, the correlations between the Accident Index and motor test, and between the Accident Index and Maze are - 0.12 and + 0.22, neither of which is significant. On the other hand, there is a correlation of + 0.44 between the motor test and the Maze which is significant at 0.01 level of confidence.

Tests	r	Level of significance
A.I. and Motor	- 0.12	N.S.
A.I. and cuts	+ 0.22	N.S.
Motor and Cuts	+ 0.44	0.01

Table IV. The correlation coefficients between the three accident criteria, the Accident Index, the motor test and the Maze (cuts), with their levels of significance.

This significant correlation between these last two tests as compared with their correlations with the Accident Index may be due to the nature of these tests, reflecting a difference between questionaire and objective tests. Moreover, the Accident Index consists of a multiplicity of accident situations, while the motor and Maze tests are restricted to very particular kinds of 'accidents'. Thus, these findings suggest that the motor test and the Porteus Maze represent similar potential accident situations, but there is no indication that they serve a similar purpose to the Accident Index. We therefore, decided to use two seperate accident criteria, an objective test and the questionaire. Owing to certain technical problems which may have effected scores on the motor test it was decided to use only the Maze test as the objective test accident criterion.

The split - half reliabilities of the retained accident criteria are indicated in table V. The correlation between the odd and even items of the Accident Index after correction for attenuation by the Spearman - Brown formula is + 0.84. The split half corrected correlation of the Porteus Maze is + 0.78. Both these correlations are significant at 0.01 level.

Tests	r	corrected r	Level of significance
Accident Index	+0.73	+0.84	0.01
Maze (cuts)	+0.64	+0.78	0.01

Table V. The correlation coefficient and the corrected correlation by the Spearman - Brown Formula of the split half tests of Accident Index and Maze (cuts), indicating their level of significance.

The high reliability of the Accident Index is of particular interest owing to the diversity of items contained in the questionaire. It has been shown,(134) however, that the questionaire is uni-factorial, but even so the obtained reliability is probably an under-estimate as the items are not all measures of the same thing.

Criterion Groups.

The 61 subjects used in this study obtained scores ranging from 10 to 82 on the Accident Index and made from 0 to 15 cuts on the Porteus Maze. Subjects scoring high and low were selected as criterion groups to be compared on the following tests. Criterion groups were compared rather than correlations computed owing to the vast amount of labor required in the latter case with so many comparisons to be made.

(134) Keehn, J.D., Factor analysis of reported minor personal mishaps, J. Appl. Psychol. (in press).

I. Avoidance Learning:

a. Accident Index: The high accident group on the Accident Index consisted of 11 subjects whose scores were more than 39. On the other hand, the low accident group had the same number of subjects having scores less than 22.

b. Porteus Maze: Two criterion groups consisting of 18 subjects each were also selected according to the number of cuts they had on the Maze test. Subjects scoring more than 5 cuts were regarded as the high accident group, while subjects scoring less than 2 cuts were used as the low accident group.

II. Perceptual Defense.

Since 26 subjects of the original group used in this study took one kind of perceptual defense test (the tachistoscope test) and 36 took the reading test (one S took both tests), E had to select his criterion groups in the following way:

1. Tachistoscope Test: From the 26 subjects who took this test high and low accident individuals were selected according to the Accident Index and the Porteus Maze respectively.

a. Accident Index: The high group consisted of 9 subjects who had scored more than 36 on the Accident Index. The low group, in contrast, consisted of 8 subjects scoring less than 27 on the same questionaire.

b. Porteus Maze: The high group consisted of 10 subjects with more than 5 cuts, while the low group consisted of 9

subjects having less than 1 cut on the Maze.

2. Reading Test: The 36 subjects who took this test were also seperated into different criterion groups on the Accident Index and the Porteus Maze.

a. Accident Index: The high group consisted to 9 subjects scoring more than 38 on the Accident Index, while the low group, consisting of the same number of subjects had scores less than 24.

b. Porteus Maze: Similarly selected, a high group consisted of 11 subjects with more than 3 cuts on the Maze in contrast to a low group of 10 subjects scoring less than 1 cut.

These various criterion groups allowed E to go further in his investigation of accident proneness. That is, if the concept of accident proneness is related to avoidance learning and perceptual defense, then, different tests of these two phenomena would be expected to discriminate between the above criterion groups.

Results of Avoidance Learning Tests:

In our analysis of the accident situation, we have particularly emphasized the importance of the signal, implying that individual differences in the tendency to be involved in accidents may be due to the awareness of that signal. Thus, the high and low group on the Accident Index were compared with regard to their awareness of the motor one. Table VI indicates a X^2 of 0.0048 which is not significant. Similarly, a X^2 of 0.009 in table VII shows no significant difference of awareness between the high and low group on the Maze.

Both results give no support to the assumption that low accident subjects learn cues of likely accidents to a greater extent than high accident subjects as defined by our criterion.

	S's Awareness of Motor Cue			
Criterion Groups	Yes	No	X^2	Level of significance.
Group I High A.I.	7	3	0.0048	N.S.
Group II Low A.I.	8	3		

Table VI. The X^2 of the high and low groups on the Accident Index showing the difference in the degree of their awareness to the motor cue (the cue of 1 subject of the original criterion groups was not determined).

	S's Awareness of Motor Cue			
Criterion Groups	Yes	No	X^2	Level of significance
Group I High cuts	13	5	0.009	N.S.
Group II Low cuts	12	4		

Table VII. The X^2 of the h i g h and l o w groups on the Maze showing the difference in the degree of their awareness to the Motor cue (the cue of 2 subjects of the original criterion groups was not determined).

Further, it was also expected that the criterion groups on the Accident Index and the Maze would be discriminated on the word - association avoidance test. That is, the high

accident group would show less avoidance of the shocked responses than the low group. Table VIII shows a t-test of 0.17 indicating that the difference in avoidance learning between the high and low groups on the Maze is not significant. Similarly, table IX shows no significant difference in avoidance learning between the high and low groups on the Accident Index.

Criterion Groups	Mean		t	Level of Significance
Group I High cuts	1.4	1.9	0.17	N.S.
Group II Low cuts	1.5	1.5		

Table VIII. The Mean, sigma and t-test, showing difference in avoidance of the shocked responses in the word-association test between the h i g h and l o w group on the Maze.

Criterion Group	Mean		t	Level of significance
Group I High A.I.	0.87	3.98	1.02	N.S.
Group II Low A.I.	1.74	1.70		

Table IX. The Mean, sigma and t-test, showing difference in avoidance of the shocked responses in the word-association test between the h i g h and l o w groups on the Accident Index.

These negative results throw doubt on our interpretation of accident proneness in terms of avoidance learning but they may reflect the controversial nature of this phenomenon, for fear or anxiety as an intervening variable

in avoidance behavior is by no means a settled issue and alternative suggestions are experimentally supported.(135) (136) (137).

Moreover, there is the possibility that the effect of the electric shock was not painful enough for the subjects, for E adjusted its strength according to S's wish rather than to a predetermined level. However, our study is limited to only one test of avoidance learning which makes it difficult to generalize or give a final conclusion.

Results on Tests for Perceptual Defense:

In the perceptual defense tests two kinds of scores were used uncorrected and corrected. Uncorrected scores refer to changes in threshold of the shocked condition only, corrected scores refer to adjustments made to the uncorrected score to take account of threshold changes in the unshocked condition. In the tachistoscope test, for instance, the uncorrected score is the difference between pre-shock and post-shock scores of the L (shock) position. The uncorrected score is subtracted from the mean of the pre-shock minus post-shock scores of the other three positions to obtain the corrected

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(135) Keehn, J.D., The effect of a warning signal on unrestricted avoidance behavior, Brit. J. Psychol., (in press).

(136) Sidman, M., Some properties of the warning stimulus in avoidance behavior, J. Comp. Physiol. Psychol., Vol. 48, 1955, pp. 444-456.

(137) Sidman, M. and Boren, J.J., The relative aversiveness of warning signal and shock in an avoidance situation, J. Abnorm. Soc. Psychol., Vol. 55, pp. 339-344.

score. The four nonsense syllables in the perceptual reading test were similarly treated. Thus, the uncorrected and corrected scores of the criterion groups on the Accident Index and the Maze were compared.

A. Results on Reading Test:

According to our analysis of accident proneness in terms of perceptual defense, those subjects showing high accident scores should show a high degree of perceptual defense, and vice versa. Table X contains the t-tests of the uncorrected and corrected scores of the Maze criterion groups. There was no significant difference between the high and low accident groups on this perceptual defense task. The t-tests of the uncorrected and corrected scores of the Accident Index criterion groups as indicated in table XI also do not show significant differences.

	Uncorrected scores.			Corrected scores.		
Criterion Groups	Mean	t	Level of significance	Mean	t	Level of significance
Group I High cuts	0.50	1.69		-0.59	2.51	
		0.72	N.S.		0.66	N.S.
Group II Low cuts	0.80	1.11		+0.30	1.39	

Table X. Means sigmas and t-tests of the uncorrected and corrected scores in the perceptual reading test, showing the significance of difference between the two Maze criterion groups.

	Uncorrected scores			Corrected scores		
	Mean	t	Level of significance	Mean	t	Level of significance
Group I High A.I.	0.38	0.71		0.33	1.00	
		0.35	N.S.		0.30	N.S.
Group II Low A.I.	0.21	1.17		0.35	1.38	

Table XI. Means, sigmas and t-tests of the uncorrected and corrected scores in the perceptual reading test, showing the significance of difference between the two Accident Index criterian groups.

B. Results on Tachistoscope Test:

The appropriate criterion groups on cuts and Accident Index were compared on the tachistoscope perceptual defense test. Table XII shows that the means of the uncorrected and corrected scores of the experimental and control groups on Maze cuts did not differ significantly. However, table XIII shows that the t-test of the uncorrected scores of the Accident Index criterion groups is 2.95 which is significant at 0.05 level of confidence. This result indicates that high group on the Accident Index show more defense in the perception of the tachistoscopically exposed items than the low group. But when the scores are corrected, the same table indicates that the t-test becomes 0.61 which is non-significant.

	Uncorrected scores			Corrected scores		
Criterion Groups	Mean	t	Level of significance	Mean	t	Leve of significance.
Group I High cuts	1.39	1.17		0.30	1.22	
		1.41	N.S.		0.098	N.S.
Group II Low cuts	0.74	1.37		0.24	1.29	

Table XII. Means, sigmas, and t-tests of the uncorrected and corrected scores in the perceptual tachistoscope test, showing the significance of difference between the two Maze criterion groups.

	Uncorrected scores			Corrected scores		
Criterion Groups	Mean	t	Level of significance	Mean	t	Level of significance
High A.I.	0.08	1.08		0.36	1.13	
		2.95	0.05		0.61	N.S.
Low A.I.	1.50	0.76		0.03	0.92	

Table XIII. Means, sigmas, and t-tests of uncorrected and corrected scores in the perceptual tachistoscope test, showing the significance of difference between the two Accident Index criterion groups.

These contradictory and rather inconclusive results may lead to many interesting interpretations. There is the same possibility, as in the avoidance learning experiment, that the shock was not painful enough for the subject, for

E had similarly administered the shock. However, without the tachistoscope breakdown which forced us to use more than half of our subjects on the Reading test, we might have obtained more significant results. As it is, the present perceptual defense results do partly support the hypothesis that there is a relationship between perceptual defense and accident proneness, which suggests that a similar research using larger samples and better equipment might yield more definite results. However, it should be borne in mind that we obtained only 1 difference at the 5 per cent level of significance in 12 significance tests, so that although this one was in the expected direction it might well have occurred by chance alone.

Chapter VI

Summary and Conclusion.

1. The Accident Proneness Hypothesis:

When early in the present century it was realized that accidents were a serious social problem, two preventive measures were taken to reduce their number. One of these measures was the introduction of safety programs which consisted of safety devices, training and clinical re-education. The second measure was the introduction of psychological procedures to select individuals likely to be involved in accidents. Most of these procedures involved the use of specially constructed tests based on job analyses and depended for their use on the assumption that certain individuals were more prone to have accidents than others. However, these tests as such give no indication of the psychological basis of accidents and do not allow for generalization from one accident situation to another. That is, if low reaction time is taken to be one of the causes of motor car accidents, it may not equally apply to some industrial or other accidents. Furthermore, the evidence for accident proneness is not yet well established. The seven major lines that have been usually given have all been questioned in one time or another.

Nevertheless, some psychometric tests like intellectual abilities, psychomotor tests and tests of various

visual abilities do seem to have some validity in predicting those individuals likely to have repeated accidents. It is noteworthy that those very tests have also been frequently used as personality measures, which allows us to hypothesize that liability to have accidents is part of a wider personality syndrome.

The clinical approach to the problem of accidents has also emphasized their general nature and discarded the concept that they are truly accidental. This approach has pointed out the role of motivation in the tendency of some individuals to be involved in accidents. Moreover, it has emphasized the fact that these individuals are maladjusted people who have difficulties in their interpersonal relationship. Their maladjustment to authority and particularly to their jobs has been stressed by many writers.

Thus, both the psychometric and clinical approaches suggest directly or indirectly that there are individual differences in the tendency to be involved in accidents. Nevertheless, the investigator in this area is still faced with the difficulty of testing the validity of the concept of accident proneness, for the above two approaches depended on unreliable accident records.

Accident Proneness, Avoidance Learning and Perceptual Defense:

If accidents are avoidable, it follows that the psychology of accidents bears some relationship to the psychology of avoidance learning.

One theory of avoidance learning gives aversive attributes to the signal in that it is said to elicit the emotion of fear in the organism; and avoidance behavior is said to reduce this emotion and thus be reinforced through drive-reduction. This interpretation leads to the possibility that individuals may differ in the rates of fear conditioning. That is, anxious individuals may be conditioned more easily than non-anxious individuals. Bearing in mind that the accident situation may be the same as the avoidance situation, it was hypothesized that similar individual differences may be found between accident free and accident prone individuals.

The above relationship between accident proneness and avoidance learning brings to our attention the perception of the warning signal as a necessary condition to make avoidance behavior possible. This observation is emphasized by some attempts to interpret the phenomenon of perceptual defense in terms of avoidance learning. As in the case of conditioning, many perceptual defense experiments have suggested that individuals differ in the way they handle threatening or anxiety arousing situation. These individual differences, particularly among patients, may further suggest that perception is a part of broad dimensions of personality. Furthermore, these differences may be due in part to the effect of anxiety on stimulus generalization and discrimination.

This argument may provide a link between conditioning, perceptual defense and accident-proneness. That is, since the signal plays a main role in these three phenomena, then, individual differences in both avoidance conditioning and perceptual defense refer to similar individual differences in the tendency to be involved in accidents. It is the main task of this thesis is to see if there is an empirical relationship between tests for avoidance conditioning and perceptual defense on the one hand and certain selected criteria of accident repetition on the other.

Tests and Results:

A. Accident Criterion Tests: We have suggested two kinds of accident criterion tests, an Accident Index and laboratory tests. The Accident Index consists of questions concerned with a variety of accident situations. The laboratory tests, on the other hand, are the adult Porteus Maze and a motor test with an artificial street. High and low groups on these tests were selected from 61 subjects, and then used as criterion groups in this investigation.

Results have shown that there is no correlation between the Accident Index and motor test or Accident Index and Maze. On the other hand, there is a positive correlation significant at 0.01 level between the motor test and the Maze. These results, in general, reflect a difference in the nature of questionaire and objective tests.

Moreover, tests of reliability of the Accident Index and the Maze showed that they are both highly reliable. The

split-half reliabilities of these two tests were significant beyond the 0.01 level of confidence.

B. Tests for Avoidance Learning and Perceptual Defense:

1. Tests for Avoidance Learning: Two tests for avoidance learning were used, one to find whether the various criterion groups differed in their awareness of a cue while driving on an artificial 'road'. The other was a word-association test in which the effect of shock in changing the responses of the criterion groups was tested.

2. Tests for Perceptual Defense: Two tests for perceptual defense were used. A tachistoscope test was used to find the effect of shock on the recognition threshold of the criterion groups. The second, reading test was used for a similar purpose of finding the effect of shock on the ability of the same groups in reading words with blurred letters. It must be noted here that different criterion groups were selected to take the tachistoscope test and the reading test, for subjects (with the exception of one) who took the former test did not take the reading test and vice versa.

Results on both tests for avoidance learning and perceptual defense were mostly negative, and t-tests showed no difference between the criterion groups. That is, these tests did not discriminate between the accident free and the accident prone individuals as defined by our criteria. However, the perceptual defense tachistoscope test showed a significant difference between the high and low criterion groups on the Accident Index. This one significant t from

a total of 12 could have arisen by chance, and does not necessarily support the hypothesis that the high accident group on the Accident Index show more perceptual defense than the low group.

Conclusions: A major purpose of this thesis was to attempt to clarify some of the problems involved in an experimental investigation into the psychology of accidents. Two points have been particularly emphasized. One is that the lack of acceptable evidence for the concept of accident proneness may be due to the unreliable accident criteria used by investigators in this area. Secondly, most studies show a need for a more comprehensive view of the concept of accident proneness.

The above considerations led us to suggest simulated accidents as an alternative criterion to actual or real accidents. We have also tried to subsume the concept of accident proneness under more general psychological theories of avoidance learning and perception. It was assumed that in the psychological laboratory where many variables could be controlled, more useful findings about the concept of accident proneness might be obtained.

Accordingly, this research was an attempt to find out whether tests for avoidance learning and perceptual defense discriminate between high and low accidents groups as defined by our criteria.

Although results were primarily negative, they may draw our attention to some of the difficulties a research

of this kind has to tackle. It was necessary, for instance, to discard the motor test half way through the experiment and no final conclusion about it could be reached. On the other hand, it may be that the Accident Index measures no more than the tendency of subjects to respond in the positive direction rather than to the contents of the questions as such. Thus, we are left with the Maze to be used as the only accident criterion. However, the validity of the Maze as an accident criterion is still left unsettled, for the negative results may be due to the difficulties in administration of tests for avoidance learning and perceptual defense. e.g. adjusting the strength of shock.

Generally speaking, this research does not support the hypothesis that accident proneness is related to avoidance learning and perceptual defense, but it may serve as the basis for further research along similar lines.

APPENDIX NO. I

Accident Index

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 seem 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 or 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

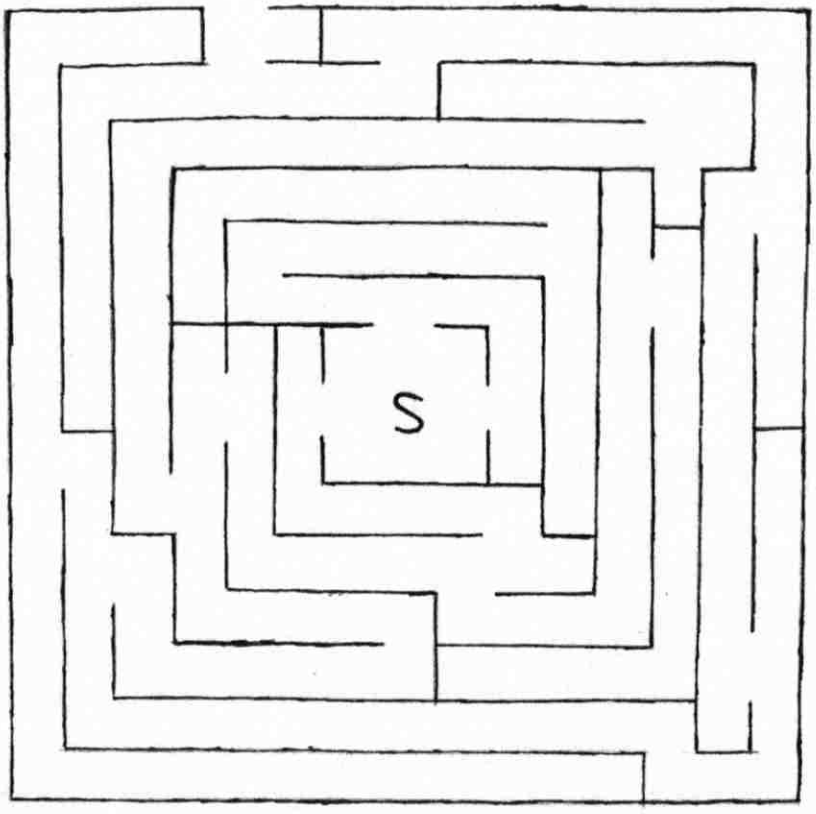
38. Do you have one or more scars on your body? Yes ? No

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 NO. II



The Adult Porteus Maze.

APPENDIX NO. III

I. Arrangement of the 4 stimulus nonsense syllables on pages of booklet I.

ROGE	QURF	BUCE	DOOF
DOOF	BUCE	QURF	ROGE
QURF	DOOF	ROGE	BUCE
BUCE	ROGE	DOOF	QURF

2. Arrangement of the 4 stimulus nonsense syllables on pages of booklet III.

DOOF	BUCE	QURF	ROGE
BUCE	DOOF	ROGE	QURF
ROGE	QURE	BUCE	DOOF
GURF	ROGE	DOOF	BUCE

3. Order of presentation of the 4 stimulus nonsense syllables on the 16 pages of booklet II, with the shocked nonsense syllables underlined.

No. of pages	nonsense syllable	No. of pages	nonsense syllable
1	DOOF	9	<u>BUCE</u>
2	<u>BUCE</u>	10	QURF
3	QURF	11	DOOF
4	ROGE	12	ROGE
5	QURF	13	ROGE
6	DOOF	14	<u>BUCE</u>
7	ROGE	15	DOOF
8	BUCE	16	QURF

APPENDIX NO. IV

Stimulus words in the word-association test, with the shocked words underlined.

Light	Buy
Man	In
Good	Small
Stop	Old
Boy	Happy
Black	Quick
Up	Pen
Free	

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