



RESEARCH ON ACCIDENT PRONENESS

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THE IDEA THAT SOME PERSONS or groups appear to be especially vulnerable—or invulnerable—to misfortune is very old. It is a fundamental theme in history, art, and literature. It serves as the basis of much of ancient myth and modern fiction and is widely represented in the primitive world of totem and taboo. The story of Achilles shows well both its antiquity and importance, but it is seen in its fullest early development in the Book of Job, in which the interrogations and pronouncements of Job's pious friends illustrate the common inclination to attribute individual misfortune to undesirable personal characteristics that can be expiated, or at least uncovered, by appropriate therapy.

Against this background it is not surprising that the idea of accident proneness as a *scientific* concept concerned with unequal personal liability to accidents was greeted by research worker and layman alike with enthusiasm. In the 1920's, when it was introduced, attempts to explain the everyday world in scientific terms were increasingly numerous, and it is probable that this climate favored its popularity.*

Accident proneness proved to be one of those concepts which revolutionized a field of scientific investigation. And, as so often happens with such classical formulations, the disciples who followed pushed the concept far beyond what its originators intended. Coming at a time when the engineering approaches to accident prevention appeared to be reaching a point of diminishing returns, this brave, supposedly new idea of human vulnerability appeared to offer fresh hope for the conquest of accidents. Fifty years after its initial formulation in Great Britain by Greenwood and Woods, it still exerts a major influence upon accident research. For this reason, we feel it worth while to devote a separate chapter to this behavioral approach.

What is meant by accident proneness? First we have to distinguish between accident repetitiveness and accident proneness. The former simply refers to the descriptive fact that some individuals have more accidents than others, a distribution statistic that is true for a great many other social, psychological, and medical phenomena. There can be no quarreling with this statistical truth, but this is not what is meant by accident proneness, although a large number of studies proceed as if this were the case. Rather, accident proneness is offered as the *explanation* of why this distribution occurs, and it is this point that has aroused first minor, and now major, protest. As a theoretical explanation of repeated accidents on the part of the individual, accident proneness is a *psychological* abstraction and, as such, it is assumed to refer to the existence of an enduring or stable personality characteristic that predisposes an individual toward having accidents.

The critical words in this definition are the adjectives *enduring* and *stable*. Various researchers have attempted to identify such stable personality characteristics and have listed many unvalidated, negative personality traits, foremost among which are aggressiveness, impulsiveness, maladjustment, antagonism toward authority, immaturity, in-

* The notion that increased accident liability could be studied scientifically soon appeared in literature. For example, the plot of Thornton Wilder's Pulitzer Prize novel, *The Bridge of San Luis Rey* (1927), concerned an attempt to find the pertinent characteristics of a group of persons killed in the collapse of a bridge. "If there were any plan in the universe at all, if there were any pattern in a human life, surely it could be discovered, mysteriously latent, in those lives so suddenly cut off. Either we live by accident and die by accident, or we live by plan and die by plan. . . . But these occasions of human woe had never been quite fit for scientific examination. They had lacked what our good savants were later to call *proper control*." [Wilder's italics.]

considerateness, and hostility. Dunbar, one of the prominent exponents of the accident proneness concept, so described the accident-prone individual,^{1,2} as did Tillmann and Hobbs in a study discussed later in this chapter.

It should be obvious to the reader that so indiscriminate a listing of personality traits could hardly be expected to define a *single* type of individual. The list of distinguishing characteristics changes from study to study; the results concerning any single characteristic are inconsistent; and, in general, the correlations between personality characteristics and, hence, their predictive value, are extremely low.³⁻⁵ The bulk of evidence indicates that there is no such thing as a single type of "safe" or "unsafe" individual. Rather, each individual has a *range of behavior*, any portion of which may be safe or unsafe, depending on the environmental hazards to which he is exposed. Thus, instead of a single type of accident-prone individual, there may be many reasons why some individuals may incur more accidents than others.

For example, individuals may vary considerably: (1) in their exposure to hazards; (2) in their sensory, neural, and motor functioning; (3) in their capacity for correctly recognizing and making judgments concerning hazards; (4) in their experience and training; and (5) in the extent to which they are exposed to pertinent social and other environmental stresses. In addition, individual variations in susceptibility to trauma (see Chap. 9) may bias the data when accidents are defined in terms of the occurrence of given degrees of structural damage or personal injury. Finally, because individual variations in accident rates may result completely from chance, it is never adequate to show merely that a small fraction of similarly exposed individuals accounts for a disproportionate share of accidents. Rather, it is necessary to demonstrate that the disproportion observed is greater than that which would be commonly expected on the basis of chance alone. This has been overlooked by many, if not most, of those who have concerned themselves with accident proneness.

From this list it should be clear that accident proneness—as a psychological concept—must be viewed as only one possible explanation for individual variations in accident rates. This is not to deny the occasional usefulness of the concept but to indicate that there are other explanations which must always be considered.

ACCIDENT PRONENESS

—Edward A. Suchman, Ph.D., Alfred L. Scherzer, Ph.D.

The concept of accident proneness has been criticized on statistical, methodological, and theoretical grounds. Some of these criticisms are summarized in the following report.

* * *

ONE IDEA prevalent in accident research is that a high frequency of accidents incurred by certain individuals may be explained in terms of some abnormal personality char-

acteristic of those involved. There is a great deal of confusion and unprofitable debate about this concept of accident proneness. It is our contention that accident proneness does deserve a limited place in accident re-

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search but not the central position it is now given by many research workers.

The concept of accident proneness arose out of the observation that certain adults and children seemed to have more accidents than others. The term implies the existence of a particular personality type which is predisposed toward having repeated accidents. This predisposition is regarded as a psychological abnormality due to some underlying neurotic or psychopathic condition. For example, as summarized in the *Proceedings of the First Conference on Home Accident Prevention*, "The accidents, then, might well be unmotivated, and the defect a developmental one in the ego-control mechanisms."

Certainly a psychiatric point of view justifies the hypothesizing of a neurotic tendency on the part of some adults and children to inflict self-injury through deliberate accidents. Such clinical cases have been reported by various psychiatrists. However, can one use such clinical evidence to justify the use of accident proneness to explain all, or even most, of the cases of individuals who have a high frequency of accidents?

There are several reasons why this extension of a legitimate psychiatric concept is unwarranted. These reasons are statistical, methodological, and theoretical.

The existing evidence has serious statistical shortcomings. Since chance plays a part in many accidents, we would expect to find that during any given period a certain proportion of the population would suffer an inordinately high number of accidents *by chance alone*. The concept of accident proneness is based on the assumption that the membership of this group, in terms of individuals, remains unchanged with the passage of time. Actually, as Schulzinger observes, "The evidence indicates that if the period is sufficiently long, the small group of persons who are responsible for most of the accidents is essentially a shifting group of individuals with new persons constantly falling in and out of the group." Moreover, statistical correlations between present and future accidents are often low; the mathe-

tical models and techniques utilized to establish these relationships are subject to severe criticism by responsible theoreticians; observable injury or damage are not necessarily adequate indicators of the occurrence of accidents; and the multitude of possible intervening factors requires statistical controls which are not generally applied. After considering accident proneness from a theoretical and mathematical point of view, McFarland concludes that the scanty evidence which remains after critical review may hardly be taken as adequately supporting the concept.

From a statistical point of view the problem of prediction becomes extremely important as proof or disproof of the concept of accident proneness. To what extent can we predict that individuals with a high frequency of accidents in the past will continue to have more than their share of accidents in the future? Very few studies have attempted to do this.

* * *

Methodologically, too, there are a number of inadequacies in the current research on accident proneness. Perhaps most important is the failure to control an environmental exposure or risk. Certain individuals are more likely to be exposed to hazardous occupations or environments and thus to incur more accidents. Comparisons, therefore, must attempt to equate individuals on exposure before comparing them on accident frequency. Unless we take this differential exposure into account, we are likely to attribute to personality characteristics what is in fact attributable to the environments that attract such personalities.

There also appears to be some confusion between the concept of predisposing factors and accident proneness. Because certain groups of individuals (*i.e.*, young males) are apt to have more accidents than others, we cannot say that individuals who belong to these groups are accident-prone. There are a great many social factors which contribute to a differential rate of accidents among

subgroups of the population, and these factors have to be taken into account in explaining why some groups have more accidents than others.

Finally, from a theoretical point of view, there is some reason to doubt the existence of any identifiable personality type that could be labeled as the accident-prone personality. Dietrich is not fully convinced of the accident proneness concept because the accident repeater has not been successfully identified as a psychological entity. In fact, most studies have shown highly contradictory results concerning the traits of "the accident-prone personality." For example, in some cases this may be an overly timid individual, whereas in others this type of individual is more likely

to be aggressive. Unless the accident-prone individual can be identified and described as a meaningful type, it would seem to be more useful to identify those separate personality characteristics that are more or less associated with repeated accidents.

This analysis presents only some of the reasons why the concept of accident proneness must be viewed with caution. Certainly the evidence in its support is not conclusive. It seems likely that greater progress will be made in accident research through concentration upon the specific causes of repeated accidents and through restricting the concept of accident proneness to the limited number of psychiatric cases in the total population of accident repeaters.

The foregoing discussion should suffice to indicate that we are dealing here with a greatly misunderstood concept. In view of this, and in view of its considerable influence on accident research, we are reproducing below three of the early reports dealing with the subject. We do this not only for historic purposes but also because the first two remained the best work by far that had been done on the problem until the recent work of Cresswell and Froggatt (see below). We include also two more recent studies, one of which stresses a statistical and the other a clinical approach.

THE INCIDENCE OF INDUSTRIAL ACCIDENTS UPON INDIVIDUALS WITH SPECIAL REFERENCE TO MULTIPLE ACCIDENTS

—Major Greenwood, Hilda M. Woods

We begin with the classic paper in the field. As so often happens with new concepts, its originators state their case with greater moderation than their disciples. Greenwood and Woods did not describe some workers as "prone" to accidents† but developed the thesis that a small minority of individuals have greater numbers of accidents than would be expected on the basis of chance alone. This theoretical formulation led others to undertake hundreds of such studies and hence served as the basis for much of the research on accident proneness.

By studying accidents among workers in a British munitions factory during World War I, Greenwood and Woods found that accidents were not evenly distributed but that a relatively small proportion of the workers had most of the accidents. To explain this phenomenon, they proffered the theory of unequal initial liability—*i.e.*, that some individuals are inherently more likely to have accidents than others. Taking the accident records of a large number of work groups, they compared the observed frequen-

† See the preface to Newbold's work, other portions of which are reproduced in this chapter.

cies with three alternative hypothetical distributions. Further checks on consecutive time periods led them to propose that the presence of individuals with unequal liabilities best explained all the facts.

WHEN A NUMBER OF PERSONS engaged upon a specific task are observed over a period of some weeks or months, they are often found to have sustained a certain number of casualties; if such casualties are so trivial as to permit the victim to continue work, it may also be observed that the same person is injured more than once, so that the statistics of the whole period provide a certain number of persons who have passed through unscathed, some who have been injured once, others who have been injured twice, and so on.

A frequency distribution of this kind arises under various conditions and the proportions of the whole population found in its different subdivisions will be regulated by the group of causes which determine the happening of the event in question. If for instance we distributed amongst a set of families, each containing the same number of members, some source of infection (perhaps a person suffering from influenza might go to reside in each family), then we should ultimately have statistics of multiple cases of influenza, some families having no cases (other than that of the intruder), some having one, two, and so forth. But even without the supposed importation, and if sickening with influenza were as much a matter of chance as the drawing of an ace of spades from a well-shuffled pack of cards which we should do once on the average in every 25 trials, we should still expect to find that the statistics give instances of families with more than one case of influenza.

To take another illustration, let us suppose that 100 equally capacious and equally accessible pigeon holes are bombarded with 20 balls, none of which can fall clear of the

pigeon holes altogether, then the chance of any one ball lodging in any particular pigeon hole is one in a hundred, and at the end of the bombardment the distribution of pigeon holes with 0, 1, 2, etc. balls in each is given by the 21 successive terms of:

$$100 \left(\frac{99}{100} + \frac{1}{100} \right)^{20}$$

But the pigeon holes might not be of equal size. If some were very much larger than others, the former would receive a greater share of the balls and the distribution would be very different from that just given. Similarly if the pigeon holes changed size after the bombardment had commenced, the distribution would be affected. The extreme limits of the two modifications would be reached if either (a) all the pigeon holes save one were covered in, when the final distribution would necessarily be 1 pigeon hole with 20 balls and 99 with none, or (b) if directly a ball entered a pigeon hole a lid fell—as in the trap nest of a poultry fancier—which would lead to an ultimate distribution of 80 pigeon holes with no balls and 20 with one each.

These examples, although their analogy to the subject we are engaged upon is but imperfect, start a train of thought. Knowing the form of the ultimate distribution of pigeon holes with various numbers of balls, it is evidently practicable to form a judgment as to the nature of the causes which have operated in the distribution, since these will completely determine the result. We say advisedly "*form a judgment as to*" and not "*prove what was*" because an inverse problem of this kind presents certain difficulties which we have no space to discuss. Following up this trail might it not similarly be

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