

*The Journal of Social Psychology, 1957, 45, 3-9.*

## COMPLEMENTARY THEORIES OF SAFETY PSYCHOLOGY\*

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### A. BACKGROUND

Probably the most universally ignored area of safety psychology is that pertaining to the psychological climate of the workplace. A devotion to safety gadgets on the one hand and concern for the alleged proneness factors within the accident repeater on the other hand has led to the almost total neglect of the situational factors which help shape work personality and help manufacture accident-free or accident-labile employees.

Many investigators (21) have shown that becoming a safe worker is a typical learning function. The decline in accidents from date of employment in the typical job is a representative learning curve. But like other learning curves, the decline in error performance can be obstructed by a multitude of other factors. It now appears that a chief obstruction to the rapid decline in error performance is defective psychological climate. This conclusion, to be supported in this paper, stands in sharp contrast to past emphasis upon the accident proneness theory.

### B. THE ACCIDENT PRONENESS THEORY

Before presenting the crucial evidence on this theory, the term "accident proneness" should be defined. *Accident proneness* is a constitutional (i.e., permanent) tendency within the organism to engage in unsafe behavior within some stated field of vocational activity. A temporary tendency to have accidents is not proneness; it is liability. And proneness is not general; that is, its referent to an activity field must be limited to be meaningful, for, obviously, *everyone* is "accident prone" in a general sense because there are potential tasks that no human being can perform without accident (e.g., climb the outside walls of the Empire State Building to the top with one's bare hands).

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\*Received in the Editorial Office on April 1, 1955.

<sup>1</sup>The present paper is adapted slightly from one presented before an A.P.A. symposium, Washington, D. C., Sept. 4, 1952, and repeated before the National Safety Congress and the American Society of Safety Engineers, Chicago, Oct. 21, 1953.

Professors Mintz and Blum (17) and Maritz (15) have shown that the accident proneness theory has been explaining entirely too much of the industrial accident rate. The research of Cobb (1), Johnson (10), Whitlock and Crannell (24), Forbes (3), Farmer and Chambers (2), and Harris (7) point toward the same conclusion. Mintz and Blum showed that the frequency of "repeater" accidents approximates a pure chance (Poisson) distribution. Maritz then suggested that the final crucial test of variance in the industrial accident rate accounted for by proneness is the correlation between one's accidents experienced over two different periods of accident exposure—such as the last two years and the next two years. Ghiselli and Brown (5) have collated 18 such coefficients from the literature, and the present author has computed their median; it is .38. This typical value suggests that only about 15 per cent of the variance in individual accidents is accounted for by variance in individual accident proneness; furthermore, this even may be spuriously high because such coefficients are contaminated by the correlation of the worker's position hazard with the consistency of his accidents over split time periods. In fact, it is almost certain that much, if not most, of this 15 per cent of potential variance due to accident proneness actually is due to environmental factors (temperature differences, fumes, congestion-space-threat differences, etc.) left uncontrolled and hence correlated with each other in the 18 coefficients cited.

Even allowing the unreasonable assumption that these 18 coefficients were not influenced by fatigue and stress differences in different job locations, the 15 per cent of variance in accidents "accounted for" by proneness still leaves 85 per cent of the variance in accident rates unaccounted for.

It is interesting that an earlier study of automobile drivers by Forbes (3) arrived independently at the similar conclusion that the accident repeater contributes not more than three or four per cent to the accident problem. Both Johnson (10) and Thorndike (20) who later surveyed the entire research literature on automobile safety likewise found that such constitutional factors as basic aptitudes yielded negligible relationships with accident records. Relevant, also, is the fact that Hunt, Wittson, and Burton (9) computed the psychiatric discharge rate at Naval induction stations and subsequently during World War II to vary between four and nine per cent (such discharges were, of course, those individuals regarded as "prone" to behavior unsafe to themselves and/or their country).

Two situational or climatic theories may explain the remaining non-chance variance.

### C. THE GOALS FREEDOM ALERTNESS THEORY

Plainly, both management and union training activities, policies, and leaderships are responsible for some interference with the normal decline of error performance.

In stating this theory now, we hold that *great freedom to set reasonably attainable goals is accompanied typically by high quality work performance.* This theory regards an accident merely as a low-quality work behavior—a “scrapage” that happens to a person instead of to a thing. Raising the level of quality involves raising the level of alertness; such high alertness cannot be sustained except within a rewarding psychological climate. The more rich, therefore, the climate in diverse (economic and non-economic) reward opportunities, the higher the level of alertness—and the higher the level of work quality. Obviously, the rewards system must be geared to support high quality work behavior.

In business practice some training interferes by too much “telling what to do and what not to do” and too little encouragement to the new worker to do his own thinking and “stand on his own feet.” Union leadership likewise often is guilty of too much propagandizing and not enough “asking” in relations with new workers. Such initial climate for the new worker is less conducive to alertness than to a relatively unmotivated, resigned, passive conformity to the apparently already-structured total situation.

Accidents, of course, show that the total situation is *not* firmly structured and from them the worker gradually accepts more self responsibility in order to survive. But an accident is an expensive teaching device. Furthermore, if it occurs in a climate in which the employee is expected to supply his energy but not his opinions or ideas, the accident is misunderstood as a foreign intruder which does not belong in the scheme of events. In such circumstances, it rarely occurs to management, union, or worker that an accident is made necessary and inevitable in order to teach the employee his own individuality and essential personal dignity.

Even the teaching efficiency of the accident itself is interfered with, however, if most aspects of the total psychological climate in effect deny that the individual's own mental content is important.

If the climate encourages the individual to set up long-term and short-term goals with reasonable probability of attainment, the *Gestalt* of the work situation seems less fixed and the worker feels himself to be a significant participant. Significant participation makes for habits of alertness, problem-raising, and problem-solving. The psychological work environment must

reward the worker emotionally for being alert, for seeking to contribute constructive suggestions, for passing a tip to a co-worker on how best to do something or how not to get hurt, and for achievement out of the ordinary. The worker must feel free to exercise influence over his environment.

Considerable evidence supports this theory. Factory departments with more movement of personnel among departments, that is, intra-company transfer mobility, have fewer accidents (12); the same is true of departments with greater promotion probability for the typical employee ( $r$  is  $-.40$ ) (12). Departments with the best suggestion records (rewarded) tend to have fewer accidents (12). Additional evidence of the influence of the stimulating individual climate on safety is found in the tendency toward fewer accidents in individual-type than in crew-type jobs at the International Harvester Works (11). In individual-type work, the employee rarely is uncertain about his responsibility for consequences; he better knows his immediate work goals. Another interesting bit of evidence is that in two different studies (11, 12) the factory departments with incentive pay systems, although problem departments in regards to monotony, lower job prestige, and lower promotion probability, still have no more accidents than departments without incentive pay systems. This seems in such defiance of expectations as to suggest that incentive pay systems restrict accidents by encouraging greater individual initiative and alertness.

Accidents are more frequent in jobs of lower-rated prestige (11, 12); one interpretation of this finding is that climatically the job must seem worthy enough to the worker to sustain his euphoria level. This interpretation is supported by the finding of Hersey (8) that out of 400 accidents which were studied clinically, more than half took place when the worker was in a worried, apprehensive, or some other low emotional state.

This individual goals-freedom-alertness theory suggests the climatic need for providing emotional reward opportunities for alertness—such as special economic incentives, prestige-building honors, extra privileges, machine and work space decoration contest participation, and representation on special committees and councils. These rewards held as attainable goals by workers in relatively “dead end” jobs should operate to raise the average level of alertness, not just to hazards but to everything.

#### D. THE ADJUSTMENT STRESS THEORY

The individual goals opportunity alertness theory of safety seems to cover much of the variance not covered by the proneness theory, but some variance still remains and it appears necessary to verbalize a third theory. Prob-

ably almost all of the remaining variance can be explained by a third theory—an *adjustment stress theory*. It holds that *unusual, negative, distracting stress upon the organism increases its liability to accident or to other low quality behavior*. This too is a climatic theory, because environment is internal as well as external, and this theory refers to distractive negative stresses imposed upon the individual organism either by internal environment (such as disease organisms, alcohol, or toxic items) or by external environment (such as temperature excesses, poor illumination, excessive noise level, excessive physical work strain). Its stresses are different from those experienced by the accident prone; their stresses result from a *constitutional* inadequacy. Ordinary adjustment stress is *not* the result of constitutional inadequacy but of temporary conditions.

What often appears at first to be constitutional accident proneness may be shown very clearly upon more careful examination to be the operation of *temporary* stress factors. The most sobering example of this is found in the curve of accident rates of successive age groups of industrial workers (13). This curve shows high rates in the first 10 years of the worklife and a secondary increase in rates between the ages of 40 and 55. These age periods also are the great stress periods in the typical worklife; this is suggested by the fact that the accident rate curve and the turnover rate curve (14) superimpose almost perfectly upon each other when plotted through successive age groups of the industrial population. The alleged proneness within the young accident repeater is largely dissipated when one considers that most of the stress is environmental—and associated with adjustment to work discipline, attaining self-sufficiency away from parental ties, courtship, marriage, assumption of family economic responsibilities, and the struggle for a foothold on a vocational ladder that seems to lead somewhere worthwhile. Another set of obvious stress explanations comes to mind to account for the “middle-age boom” in accident rate.

Temporary stress factors which already have been found significantly correlated with accident rates include employee age (13), workplace temperature (6), illumination (23), mean rated comfort of the shop ( $r$  is  $-.70$ ) (11), degree of operational congestion (11), obvious danger factor threateningly present (11), manual effort involved in job ( $r$  is  $.47$ ) (11), weight of parts handled (11), frequency of parts handled (11), alcohol consumption (22), and influence of disease organisms (18).

## E. COMPLEMENTARY LIMITATIONS AND INTERPRETATIONS

It seems wise to emphasize that both of these new theories of safety complement each other as well as existing proneness theory. In the goals-freedom-alertness theory it must be recognized that (a) even under an optimal opportunity climate, individuals who lack the characteristics necessary for the work probably will continue to have accidents; (b) excessive physical stresses can cause accidents in any psychological climate; and (c) psychological stresses relative to adjustment to changing life aspirations, family and marital affairs, etc., still will carry over into the workplace psychological climate and cause accidents.

In the adjustment stress theory it must be admitted that individual differences do exist in ability to withstand what ordinarily would be stress-inducing situations. Yet, such individual differences account for less than one-fifth of the variance in individual accident rates; therefore, the limitations on the accident proneness theory appear to be much more severe than those on the adjustment stress theory. The fact is that both employer judgment and job applicant judgment operate to prevent the operation of any great amount of accident proneness. While all of us are accident prone for one task or another, we don't ordinarily apply for or allow ourselves to be engaged in such tasks—and we probably couldn't get hired for such tasks if we tried.

On the basis of the evidence summarized and the author's own estimates, the variance in accident rates among industrial personnel probably distributes in terms of theoretical causation according to the following pattern:

Accident proneness	1% to 15%
Individual goals-opportunity-alertness	30% to 40%
Adjustment stress	45% to 60%
Total Variance	100%

Constructive thinking about the individual goals opportunity climate and about adjustment stresses should assist industry to escape the defeatism of the overly-emphasized proneness theory and better understand and control accidents.

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