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COPING WITH STRESS, COPING WITHOUT STRESS, AND STRESS WITH COPING: ON INTER-CONSTRUCT REDUNDANCIES

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SUMMARY

It is proposed that a proliferation of construct usage is risked by the routine separation of the constructs of 'stress' and 'coping', commonplace in the literature. Instead, stress, considered to be 'an undesired state of the individual', is seen as a byproduct of the 'expenditure of energy in transacting coping responses'. The concepts employed in the preceding statement are elaborated upon and operationalized. A consequence of this position for stress measurement is that the latter becomes addressed to the stated properties of coping. Such properties can occur in various temporal locations *vis-a-vis* some 'untoward event'. They may take place in advance of the event, in connection with 'prophylactic coping'; during the event; or in connection with coping impelled by the aftermath of the event. Implications of the stated proposition for the structure of measurement devices are noted.

KEY WORDS—Measurement, control, energy.

A general principle of measure construction is that development of the measure's items should proceed according to a specific theoretical framework.[1] Among other advantages, following this principle subsequently facilitates the interpretation of measurement values according to certain 'theoretical constructs'. Theoretical constructs relate the obtained values to a 'nomological network', which is the body of logical-deductive propositions constituting the adopted theoretical framework.[2,3] In this way, theoretical constructs endow measurement scores with their substantive significance. Furthermore, desired byproducts of this process include certain leads as to where previously untapped areas of the measure's predictive utility may lie.[3]

In this brief paper, the constructs of 'stress' and 'coping' are considered. Attention is given especially to our common usage of these constructs, with particular focus on their overlap. Implications for measurement strategies are suggested.

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A PROVOCATIVE PROPOSITION

Implicit in most discussions of stress and coping is that coping presupposes the presence of stress, or at least the prospect of its presence. The principal proposition of this paper, on the other hand, states essentially that stress presupposes the presence of coping. More formally, stress results from a *subset* of responses of a larger *set* of responses labeled 'coping'. Such a proposition may seem at first blush to be idiosyncratic, to say the least. Supporting rationale for the proposition hopefully will ease suspicions of idiosyncracy, though perhaps not those of 'radicalness'. However, it is comforting to observe that in the history of science, radicalness is far from antithetical to progress.[cf. 4,5]

If, with relatively few qualifications, a certain equivalency characterizes the constructs of 'stress' and 'coping', a degree of increased parsimony can be struck. Furthermore, identification of inter-construct overlap can refine the theoretical underpinnings of measurement interpretation.

Can the above proposition be defended and the preceding assets realized? Perhaps not in the proposition's original, rather extreme form. However, our tactic is to begin with the extreme form, and then to pinpoint necessary qualifications, thus distilling a version of the proposition as close to the initial version as possible.

ELABORATION

The current proposition is expressed schematically in Figure 1. A subset of coping responses, represented by the smaller enclosed circle, generates an 'undesired state of the individual'. An undesired state is one that, given such option, would be prevented, terminated, or reduced. This category of organismic state is considered to bear a (net) positive relation to the amount of physical or cognitive energy expended in transacting the coping response.[6,7,8,9,10,11]* Thus, the subset of coping responses generating the undesired organismic state may take on various formats (e.g., instrumental behaviors, decisional operations, cognitive redefinition of external events and/or their potency); the responses have in common, however, a similar range of energy expenditure necessary to their transaction.

The subset of coping responses giving rise to stress may occur in various temporal positions, *vis a vis* some untoward occurrence (e.g., a physically or socially stressing event.[cf. 12,13] These positions are depicted in Figure 2. A 'prophylactic' response, preceding the 'event-epoch', may involve avoidance of the event, its prevention, or its reduced likelihood and/or severity. The response instead may occur in the wake of the event, in order to affects its aftermath.

In-between these two temporal locations, coping may take place during the event, in an effort to reduce its intensity and/or duration.

The categories of coping evinced during these periods are apt to differ (see Figure 2). In the present treatment, categories of coping are identified as 'types of control'. This terminology resembles that used in past writings about responses resembling those currently being considered.[14,15,16] Second, it implies that there is an 'object of control', be it some external agent of stress, or the stress arousal experienced by the individual (elaborated upon, below). Thus, energy is expended in the 'task' of bringing an 'object under control'. In this sense, the term 'control' is especially compatible with the concept of energy expenditure.

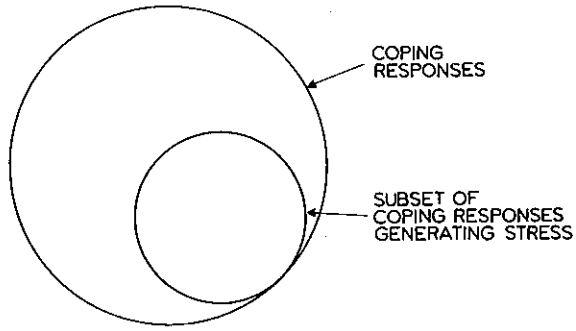

Fig. 1—Stress as a product of a subset of coping responses

Types of control figuring most prominently in prophylactic coping include instrumental (or 'behavioral') and decisional control.[14,15,16] The former involve overt acts designed to affect one's encounter with the untoward event. The event may be avoided, eliminated, or diminished in magnitude. The second entails the selection of available options (e.g., physical locations, social contacts, etc.) intrinsically that harbor lower likelihood/severity values.*

Ascendant types of control in the wake of the untoward event, given its occurrence, are labeled 'recuperative', 'palliative', and 'restorative'. Recuperative control involves covert efforts to reinstate somatic and subjective homeostasis. A 'subtype' of recuperative control that may be involved here is 'cognitive control'.[14,17] The individual may redefine the event and its aftermath into more favorable terms; or, the individual's preconceived ideas may be changed so that the event and its aftermath as they stand now fall into a more benign category of experience.[18]

Restorative control is instrumental in nature, instrumental in that it entails overt behaviors designed to influence the environment or one's relation to the environment. In particular, restorative control is directed toward mending the

*For a discussion of energy expenditure in carrying out elementary cognitive operations, see Townsend and Ashby.[35]

*Intriguing discussions on affecting event probabilities, first through directly influencing factors determining such probabilities, and second, through selecting available environmental conditions judged to house more favorable probabilities, have been presented by Jeffrey,[58] and by Braithwaite.[59] Especially interesting are the tacit assumptions about act–event–probability relations logically essential to the instigation of an act.

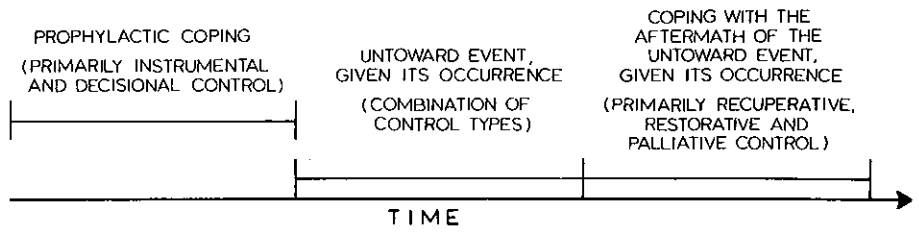

Fig. 2—Temporal relations among types of control, and some untoward event

disrupted status of contextual variables. Restorative control can be directed toward physical or social objects.[see, eg. 19,20]

The interim between the untoward event, and supposedly successful recuperation/restoration, may be occupied in part by 'palliative control'. Palliative control can be thought of as mitigating 'subjective aversiveness', and in that sense, as making more bearable the period of recuperative/restorative control. Palliative control, for example, may entail certain autonomic responses; cardiac acceleration and electrodermal reactions, in the wake of disturbing stimulation, have been considered to reflect in part covert interference with 'felt aversiveness'.[e.g. 21,22; see, e.g. 23, for a brief review] This form of control would appear more or less to be automatic, involving minimal deliberate effort. At the same time, it is possible to construe the present examples as involving a certain energy expenditure at the level of psychophysiological responding.[cf., 24,25]

Note that much of the aftermath of some untoward event to which coping is directed comprises perseverating effects on the individual him(her)self. These effects essentially represent the target of recuperative and palliative control. Dealing with one's own reactions toward some untoward event initially was referred to by Leventhal[26] as 'fear control'. Subsequent descriptions of control resembling fear control include 'emotion-focused coping'[27; see also 28] and effortful 'compensating' for arousal levels inappropriate to an existing situation.[6]

To complicate matters, certain processes necessary to effective coping may suffer in the wake of the event. Recuperative control, for example, may be undermined by reduced efficiency (speed/accuracy) of cognitive processes.[29,30] Furthermore, as mentioned above, restorative control may involve social transactions; thus, such control may be adversely affected, in this case through reduced 'sensitivity to others'.[see, e.g. 29]

Consequently, energy theoretically is expended not simply on activity aimed at the so-called objects of control (e.g., perseverating effects on the individual, and disrupted contextual physical and social variables); it is expended also in compensating for reduced efficiency of cognitive and other processes composing the object-directed activity.

Of course, coping is expected to occur during the untoward event, as well as before and after. The specific types of control efforts taking place during the event may be some composite of those already described. For example, instrumental acts such as escape, rebuttal or negotiation may be invoked during a social confrontation. These may be accompanied by somatic and cognitive renditions of control.

Observe that the present proposition, as elaborated above, designates an event as stressing, principally because of the coping that the event compels. An individual may reduce the load of coping with the event's aftermath, for example, by focusing efforts on prophylactic coping. Forfeiting prophylactic coping, or somehow being barred from its use, in turn, should lead to an increased load of coping elsewhere (e.g., that addressed to the event's aftermath). The aftermath of the event, once again, is considered stressing by virtue of the coping to which the individual is constrained — recuperative, palliative, and restorative control. Moreover, given similar availability, coping to a greater degree at one time than another, in relation to the event's epoch of occurrence, and the type(s)/subtype(s) of control adopted, should be negatively related to their associated levels of requisite energy expenditures.

A corollary of the present proposition, as elaborated, is that stress is minimally, if at all, experienced when successful prophylactic coping consumes minimal energy expenditure. Examples might include simple avoidance responses, such as steering clear of an obviously threatening physical location or social contact, in favor of an obviously benign location or contact. Furthermore,

encountering the event and its aftermath may instigate less stress than engaging in prophylactic coping, if the collective expenditure of energy associated with the latter exceeds that associated with the first combination.

On balance, while coping can be relatively stress free, it is not free of stress appraisal. That is to say, coping may be associated with a minimal amount of stress that actually is experienced; but the occurrence of coping presupposes at least the appraisal of experienced stress, or greater experienced stress, should coping not occur. Situational factors giving rise to the appraisal of pending stress have been elaborated upon elsewhere.[31] Also, the dissociation between the existence of coping and the occurrence of significant stress arousal has been demonstrated from decision-theoretical perspectives.[32,33]

Interestingly, the present proposition appears not to be discordant with Hans Selye's[34] prominent definition of stress, notwithstanding its biological emphasis. As proposed here, stress essentially is identified with a subset of *coping responses*, while Selye referred to a '... specific syndrome which consists of all the *nonspecifically induced changes* within a biologic system[34] (italics added).' Selye considered the said changes to be a manifestation of stress, whereas here it is held essentially that stress stems from coping. Nonetheless, the similar emphasis on adjustment, change and adaptation as attendant to stress is apparent.*

QUALIFICATIONS

Clearly, in light of the above elaboration, the initial proposition that stress is a function of coping, in its raw form, oversimplifies the actual position that is being taken. Stress, as an undesired state of the organism, is not produced by a subset of coping responses, *per se*, as indicated in Figure 1; rather, it is a byproduct of the expenditure of energy transacting the responses.

What, then, is energy expenditure; can it be measured independently of a subjectively or otherwise-monitored 'undesired-organismic-state'? Perhaps more to the point, what is the energy-expenditure threshold when an 'undesired organismic state' sets in?

First, formal quantitative indexes of energy expenditure are quite readily available. For example, in the area of cognitive-task performance, energy expenditure has been quantified in terms of the rate of completing circumscribed tasks, or task segments.[35] Such quantification bears a certain likeness to formal definitions of energy expenditure on physical tasks (e.g., work completed by a variable force acting on an object over a given time interval).[36]* Thus, at least in principle, objective quantification of energy expenditure in cognitive as well as physical activity is possible. Within the domain of psychological stress proper, energy expenditure on decisional control, for example, might be approximated as follows.[9] It may be estimated simply as the number of predictive judgments, over a given time interval, necessary to ensure selection of the 'safest option' (e.g., physical location, social encounter, etc.) from among those available within a stressing situation.

The above indexes incorporate variables largely that reside outside the individual (e.g., time intervals, task or task-segment magnitude, etc.). A second category of indexes of energy expenditure involves individuals' responses — responses, however, that in and of themselves are not synonymous with an 'undesired state', as described earlier. These responses largely are psychophysiological, such as changes in heart rate, skin conductance, respiration rate, pulse volume, and electromyoactivity of selected muscle groups. Such responses have been considered as correlates of mental and/or physical effort.[37,38,25,10,11] In that sense, indexes falling onto the current category might be viewed roughly as analogous to thermal byproducts of mechanical work. Note that correlation of the present indexes with those from the first category[e.g., 9] should enhance their validities mutually.

The tentative indexes of energy expenditure

*The current formulation concerning energy expenditure and stress is distinct from certain economic formulations of stress, as follows. Several investigators have viewed stress as being a function of the imbalance between task demands emanating from the environment, and resources for meeting these demands.[e.g. 60,61,7] Energy expenditure associated with an undesired organismic state may be correlated with, but does not depend on, such imbalance, or imminent imbalance. Requisite levels of energy expenditure may occur in the midst of substantial spare resource-capacity, and the opposite. An individual with potential resources for negotiating demands considerably in excess of those at hand nevertheless may undertake stressing levels of exertion. On the other hand, the imbalance easily may be approached or exceeded for an individual with highly limited resources (e.g., due to physical or mental handicap), with little opportunity for energy expenditure and associated stress.

*Thanks are expressed to David Vollick for drawing my attention to this similarity.

described above may be mapped onto evidence of the so-called undesired state of the individual. Inclination to prevent, terminate, or reduce cognitive/physical activity is expected to increase with associated levels of energy expenditure. Where behavioral evidence of such tendency is unavailable, self report of 'behavioral intent' may suffice.

The above represent empirical tactics taken toward the current reductionistic theoretical perspective on stress and coping. These tactics resemble somewhat those of traditional psychophysics, as follows. Put simply, in traditional psychophysics, stimulus parameters (e.g., units of liminence) are plotted against subjective experience (scaled reports of brightness), and a psychophysical function expressing relations between the two variables is established. In the present domain, indexes of energy expenditure ideally would be mapped against quantified evidence of 'state undesiredness'. Interestingly, a call for this type of approach was put forth nearly two decades ago by Joseph McGrath,[39] who recommended the establishment of a 'psychophysics of response to stress (p. 53)'. Clearly, energy expenditure should be considered a 'construct', whose presence or degree potentially is expressed on multiple indexes.[e.g., 2,40,3] Assessing the importance of this construct, with respect to the amount of variance in evidence of experienced stress accounted for, also will require a multivariate approach.[41]

A word on why energy expenditure may generate an undesired organismic state may be in order. Speculatively, this combination may carry 'survival value', as follows. As expenditure levels increase, presumably so does the risk of physical exhaustion and/or the depletion of attentional resources subserving cognitive activities.[cf., 42,43,44] Consequently, resources devoted to coping with some untoward event(s) may leave insufficient supplies for negotiating more routine, but necessary, environmental demands. The subjective aversiveness, associated with investing to increasing degrees energy in a given direction may have a certain protective function: its offset is reinforcing, in deference, at least temporarily, to other demands.[see also 34,55]

A legitimate objection to the foregoing layout concerns the stated positive association between levels of expended energy and evidence of an undesired organismic state. There may be an optimal range of energy expenditure/activation where the 'undesiredness' of organismic state is minimal; increases then occur below and above the optimal range. The present deliberations are not addressed to those levels that hypothetically precede such an optimal range.

IMPLICATIONS FOR MEASUREMENT

The psychophysics-like 'bootstrapping' research strategy outlined above provides for a solid empirical footing for the stated approach to stress and coping. The successful execution of such a strategy should issue in rather direct implications for monitoring of stress. At the moment, it is recognized that the idealized fruits of such research labors lie in the future. Certain implications for the composition and evaluation of measurement devices nevertheless are available in the interim.

Both situation and organismic factors are implicated by the above development, as follows. The availability of a particular type of control is subject to opportunities afforded by the situation, and amenability of the individual to the cognitive/physical processes dispatching the particular version of control. Regarding the situation, for example, there may be considerable opportunity for instrumental and decisional control in an occupational setting, but not in a medical setting.[e.g., 45,46] In turn, an individual may be given to activities expediting instrumental control,[33] and to the cognitive operations underlying the appropriation of available decisional control.[9] The net energy expenditure, and consequently stress arousal, expected in a given situation should reflect the following combination of factors: opportunities for specific types of control afforded by the situation, and degree of facility with the types of control that are available.

This combination obviously applies to those types of control more or less that depend on situational opportunities for their existence — for example, prophylactic and restorative instrumental control, and decisional control. In these instances, the individual supposedly influences the environment or his/her relation to the environment. There are, however, numerous examples of situations where differential amenability toward such types of control is likely to affect minimally levels of expected energy expenditure and associated stress.

As hinted above, medical settings tend to represent one such example. Another example is that of waiting in queues to be served.[47] Given relatively constant situational constraints in such settings, cognitive, somatic and palliative control presumably come to the fore. Energy expenditure, and

corresponding stress then, primarily should parallel individual amenability to the processes underlying these types of control.

In the medical setting, while instrumental and decisional control may be highly limited by the imposed treatment regimen, manipulations designed to activate differentially cognitive and somatic control may be available (e.g., the provision of disorder- and treatment-relevant information; autogenic relaxation procedures). Interestingly, such manipulations may interact with individual dispositions toward the aforementioned types of control, with respect to treatment-tolerance and recovery-related variables.[e.g., 45,48,49] The latter variables have been considered to reflect at least in part prevailing stress arousal.

Combinations of situational and organismic constraints regarding control can be expressed more systematically, as follows. To simplify the expression, we restrict our consideration to two types of instrumental control — prophylactic instrumental control and restorative control. Furthermore, we postulate two levels of situationally-determined opportunity for exercising the respective types of control — presence and absence of opportunity. Finally, two levels of individual amenability are put forth, high and low amenability. Clearly dichotomizing the latter two variables violates their dimensional quality, as they occur naturally. At the same time, the essential points to be stated to all intents and purposes extend quite directly to dimensional formats of these variables, provided the chief conceptual alteration lies in the shift from a categorical to interval (continuous) expression of magnitude.[see, e.g., 50,51]

It is relatively straightforward to construct the combinations that result from superimposing the current situational and organismic factors onto one another. Specifically, 16 combinations develop from the crossing of a) the presence-absence of availability of prophylactic instrumental control, with b) presence-absence of availability of restorative control, with c) high-low amenability to prophylactic instrumental control, in turn, with d) high-low amenability to restorative control.

Those combinations, from the above set of 16, where types of available control are those to which the individual is amenable, are expected to be associated with less energy expenditure than other combinations. The latter include combinations of situation and organismic factors, where type(s) of control to which the individual is amenable is(are) not available; and, second, where the individual is not amenable to the type(s) of control that the situation affords. In the latter instance, the individual even may opt for recuperative/palliative control. Such a selection may occur if the energy expenditure associated with these types of control is exceeded by that effecting prophylactic or restorative instrumental control — types to which the individual may be ill-suited.

As indicated at the outset, the above layout is very much simplified for purposes of presentation within the present space constraints. An important simplifying assumption, for example, is that high- *versus* low-amenability toward one type of control represents a magnitude of difference comparable to high- *versus* low-amenability toward the second type of control.

Suffice it to say that the initial proposition, regarding stress as a function of coping, points to certain situational and organismic factors impinging on stress measurement. Measure development and evaluation can lend profitably from the backdrop provided by such factors. Moreover, at least a tentative conceptual framework for resultant levels of expected stress is available, in terms of the 'by-product of energy-expenditure' formulation.

CONCLUDING COMMENTS

This paper began with the statement of a proposition potentially having implications for stress measurement. Before educing such implications, however, the defensibility of the proposition was examined. Following several points of elaboration and qualification, a positive verdict was tendered, and suggestions regarding measurement procedures issued.

It might be contended that the defence of the proposition was inadequate on the following grounds. The initial effects of some events, that apparently precede any evidence of coping, may be identified with stress. Examples might include the 'primary appraisal of threat' — evaluation of the personal significance of the event, and its potential for inflicting harm;[52 see also the updating of this construct in 27] the detection of pain stimulation, prior to an individual's reaction, including his/her cognitive interpretation of the stimulation;[53,54] and certain initial portions of the alarm response of Selye's General Adaptation Syndrome.[see, e.g., 55]

In turn, it might be countered that each of these instances can be viewed in large part as representing

individual 'orienting' or 'alerting behavior'; in this sense, each instance still might be construed as falling within the domain of coping.

The rejoinder may be that the preceding reply is fraught with tautology: any occurrence that can be labeled 'stress' also can be construed as falling into the class of occurrences labeled 'coping'. The rejoinder, however, essentially attests to the extant proliferation of construct usage — the labels seem interchangeable — and to the potential parsimony couched in the current proposition — stress is a function of coping.

The position espoused here is essentially compatible with certain of those proposed by others. Both McGrath[8] and Cox,[56] for example, have postulated that stress involves a mismatch between potential harm and counter-harm resources; stress may be enhanced, however, when the mismatch is small enough to compel some action on the part of the individual.

Also, the present paper is not the first to suggest that concepts such as 'energy expenditure' may be helpful in elevating our accounts of stress to a more formal status.[cf.,57] In describing the stress of waiting (e.g., standing in a queue), Osuna[47] has employed mathematical functions not dissimilar to those employed by Townsend and Ashby[35] in their quantification of congitive-task energy expenditure.

Finally, as indicated at the outset, an effort would be made to retain at the end of the paper a version of the stated proposition as close to the initial version as possible. The emergent version is less succinct than the initial one, but hopefully this sacrifice is made up for by increased comprehensiveness: Stress is an undesired organismic state associated with a *subset* of a *set* of responses labeled coping; the undesired organismic state, in turn, is a byproduct of the expenditure of energy in transacting the subset of responses.

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REFERENCES

1. Jackson, D. N. The dynamics of structured personality tests. *Psych. Rev.* 1971; **78**: 229–248.
2. Cronbach, L. J. and Meehl, P. E. Construct validity and psychological tests. *Psych. Bull.* 1955; **52**: 281–302.
3. Messick, S. Constructs and their vicissitudes in educational and psychological measurement. *Psych. Bull.* 1981; **89**: 575–588.
4. Hawking, S. *A Brief History of Time: From the Big Bank to Black Holes.* Bantam, New York, 1988.
5. Richards, R. *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior.* University of Chicago Press, 1987.
6. Cox, T. and Mackay, C. The measurement of self-reported stress and arousal. *Br. J. Psych.* 1985; **76**: 183–186.
7. Lazarus, R. S. *Patterns of Adjustment.* McGraw-Hill, New York, 1976.
8. McGrath, J. E. Stress and behavior in organizations. In: *Handbook of Industrial and Organizational Psychology*, Dunnette, M. D. (Ed.). John Wiley & Sons, New York, 1976, pp. 1351–1395.
9. Morrison, M. S., Neufeld, R. W. J. and Lefebvre, L. A. The economy of probabilistic stress: Interplay of controlling activity and threat reduction. *Br. J. Math. Statist. Psych.* 1988; **41**: 155–177.
10. Solomon, S., Holmes, D. and McCaul, K. Behavioral control over aversive events: Does control that requires effort reduce anxiety and physiological arousal? *J. Pers. Soc. Psych.* 1980; **39**: 729–736.
11. Wright, R. A. Motivation, anxiety, and the difficulty of avoidant control. *J. Pers. Soc. Psych.* 1984; **46**: 1376–1388.
12. Endler, N. S. Interactionism: A personality model but not yet a theory. In: *Nebraska Symposium on Motivation 1982: Personality current theory and research*, Page, M. M. and Dienstbier, R. (Eds.). University of Nebraska Press, Lincoln, 1983.
13. Mothersill, K., Dobson, K. and Neufeld, R. W. J. The interactional model of anxiety: An evaluation of the differential hypothesis. *J. Pers. and Soc. Psych.* 1986; **51**: 640–648.
14. Averill, J. R. Personal control over aversive stimuli and its relationship to stress. *Psych. Bull.* 1973; **80**: 286–303.
15. Miller, S. M. Controllability and human stress: Method, evidence, and theory. *Beh. Research and Therapy* 1979; **17**: 287–304.
16. Thompson, S. C. Will it hurt if I can control it? A complex answer to a simple question. *Psych. Bull.* 1981; **90**: 89–101.
17. Lazarus, R. S. and Averill, J. R. Emotion and cognition. With special reference to anxiety. In: *Anxiety: Current Trends in Theory and Research*, Spielberger, C. D. (Ed.). Academic Press, New York, 1972.

18. Sarbin, T. R. Schizophrenic thinking: A role-theoretical analysis. *J. Personality* 1969; **37**: 190–206.
19. Averill, J. R. Grief: Its nature and significance. *Psych. Bull.* 1968; **70**: 721–748.
20. Costello, C. G. Depression: Loss of reinforcers or loss of reinforcer effectiveness? *Beh. Therapy* 1972; **2**: 240–247.
21. Gaines, L. B., Smith, B. D. and Skolnick, B. Psychological differentiation, event uncertainty, and heart rate. *J. Human Stress* 1977; **3**: 11–25.
22. Roessler, R. Personality, psychophysiology and performance. *Psychophysiology* 1973; **10**: 315–327.
23. Lefave, M. K. and Neufeld, R. W. J. Anticipatory threat and physical-danger trait anxiety: A signal-detection analysis of effects on autonomic responding. *J. Research in Pers.* 1980; **14**: 283–306.
24. Martin, I. and Venables, P. H. *Techniques of Psychophysiology*. Wiley, Toronto, 1980.
25. Obrist, P. A. *Cardiovascular Psychophysiology: A Perspective*. Plenum, New York, 1981.
26. Leventhal, H. Findings and theory in the study of fear communication. In: *Advances in Experimental Social Psychology*, Vol. 5, Berkowitz, L. (Ed.). Academic Press, New York, 1970.
27. Lazarus, R. S. and Folkman, S. *Stress, Appraisal and Coping*. Springer, New York, 1984.
28. Pearlin, L., Menaghan, E. G., Lieberman, M. A. and Mullan, J. T. The stress process. *J. Health and Soc. Beh.* 1981; **22**: 337–356.
29. Cohen, S. Aftereffects of stress on human performance and social behavior: A review of research and theory. *Psych. Bull.* 1980; **88**: 82–108.
30. Fisher, S. *Stress and Strategy*. Lawrence Erlbaum Associates Ltd., London, 1986.
31. Paterson, R. and Neufeld, R. W. J. Clear danger: The perception of threat when the parameters are known. *Psych. Bull.* 1987; **101**: 404–416.
32. Neufeld, R. W. J. On decisional processes instigated by threat: Some possible implications for stress-related deviance. In: *Psychological Stress and Psychopathology*, Neufeld, R. W. J. (Ed.). McGraw-Hill, New York, 1982.
33. Neufeld, R. W. J. and Paterson, R. J. Issues concerning control and its implementation. In: *Advances in the Investigation of Psychological Stress*, Neufeld, R. W. J. (Ed.). John Wiley & Sons, New York, 1989.
34. Selye, H. *The Stress of Life*. McGraw-Hill, New York, 1978.
35. Townsend, J. T. and Ashby, F. G. Methods of modeling capacity in simple processing systems. In: *Cognitive Theory*, Vol. 3, Castellan, J. and Restle, F. (Eds.). Erlbaum, Hillsdale, N.J., 1978.
36. Sears, F. W., Zemansky, M. W. and Young, H. D. *University Physics*. Addison-Wesley, Massachusetts, 1978.
37. Cacioppo, J. T., Petty, R. E. and Marshall-Goodell, B. S. Electromyographic specificity during simple physical and attitudinal tasks: Location and topographical features of integrated EMG responses. *Biol. Psych.* 1984; **18**: 85–121.
38. Lacey, J. I. Some cardiovascular correlates of sensori-motor behavior: Examples of visceral afferent feedback. In: *Limbic Systems Mechanisms and Autonomic Function*. Hockman, C. H. (Ed.). C. C. Thomas, Springfield, Ill., 1972.
39. McGrath, J. E. Major methodological issues. In: *Social and Psychological Factors in Stress*. McGrath, J. E. (Ed.). Holt, Rinehart & Winston, New York, 1970.
40. Embretson (Whitely), S. Construct validity: Construct representation versus nomethic span. *Psych. Bull.* 1983; **93**: 179–197.
41. Neufeld, R. W. J. and Gardner, R. C. Data aggregation as an analytical option: Multivariate and logical-deductive considerations. *J. Math. Psych.*, in press.
42. Hasher, L. and Zacks, R. T. Automatic and effortful processes in memory. *J. Experimental Psych.: General* 1979; **108**: 356–388.
43. Kahneman, D. *Attention and Effort*. Prentice Hall, Englewood Cliffs, New Jersey, 1973.
44. Mandler, G. *Mind and Body: Psychology of Emotion and Stress*. W. W. Norton, New York, 1984.
45. Ludwick-Rosenthal, R. and Neufeld, R. W. J. Stress management during noxious medical procedures: An evaluative review of outcome studies. *Psych. Bull.*, 1988; **104**: 326–342.
46. Neufeld, R. W. J. and Kuiper, N. Stress-relevant deviance and sources of stress-negotiation difficulties in the medical setting. *Can. J. Beh. Sci.* 1983; **15**: 334–350.
47. Osuna, E. E. The psychological cost of waiting. *J. Math. Psych.* 1985; **29**: 82–105.
48. Cromwell, R. L., Butterfield, E. C., Brayfield, F. M. and Curry, J. J. *Acute Myocardial Infarction: Reaction and Recovery*. C. V. Mosby, St. Louis, 1977.
49. Dance, K. A. and Neufeld, R. W. J. Aptitude-treatment interaction research in the clinical setting: A review of attempts to dispel the 'patient uniformity' myth. *Psych. Bull.* 1988; **104**: 192–213.
50. Meehl, P. E. and Golden, R. R. Taxometric methods. In: *Handbook of Research Methods in Clinical Psychology*, Kendall, P. C. and Butcher, J. N. (Eds.). John Wiley & Sons, New York, 1982.
51. Rozeboom, W. W. *Foundations of the Theory of Prediction*. Dorsey, Homewood, Ill, 1966.
52. Lazarus, R. S. *Psychological Stress and the Coping Process*. McGraw-Hill, New York, 1966.
53. Beecher, H. K. The measurement of pain. *Pharmacol. Rev.* 1957; **9**: 59–209.
54. Clark, W. C. Quantitative models for the assessment of clinical pain: Individual differences scaling and sensory decision theory. In: *Handbook of Chronic Pain Management*, Burrows, Elton, and Stanley

(Eds). Elsevier Science Publishers, Amsterdam, 1987.
55. Gray, J. *The Psychology of Fear and Stress*. McGraw-Hill, New York, 1971.
56. Cox, T. *Stress*. University Park Press, Baltimore, 1978.
57. Staddon, J. E. R. Social learning theory and the dynamics of interaction. *Psych. Review* 1984; 502–507.
58. Jeffrey, R. C. How is it reasonable to base preferences on estimates of chance? In: *Science, Belief and Behavior: Essays in Honour of R. B. Braithwaite*. Cambridge University Press, 1980.
59. Braithwaite, R. B. Report on Analysis problem no. 7: Can I decide to do something immediately without trying to do it immediately? *Analysis* 1955; **16**: 1.
60. Caplan, R. D. Person-environment fit: Past, present and future. In: *Stress research: Issues for the eighties*, Cooper, C. L. (Ed.). Wiley, New York, 1983.
61. French, J. R., Rodgers, W. and Cobb, S. Adjustment as person-environment fit. In: *Coping and adaptation*, Coelho, G. V., Hamburg, D. A., and Adams, J. E. (Eds.). Basic Books, New York, 1974.