

STRESS AND HUMAN INFORMATION PROCESSING: A DESCRIPTIVE FRAMEWORK PRESENTED IN A NOVEL MANNER

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INTRODUCTION

Understanding the effects of stressors upon human performance and how these effects differ as a function of task, information process and/or mediator has been a long-standing endeavor of the scientific community. Research that has attempted to collectively address some of these issues has examined the relationship between a range of stressors, such as anxiety, heat, and noise, upon task performance assessing, for example, alertness and short term memory, with the aim of revealing common features that apply across tasks (e.g., Hockey & Hamilton, 1983). More recently, research has examined the stress-performance relationship and has identified a number of potential factors which may moderate this relationship, such as social support, locus of control, perceived control, trait anxiety, self-efficacy, self-control, and experience (e.g., Weaver, Morgan, Adkins-Holmes, Hall, 1992; see also Bowers, Weaver, & Morgan, 1996). To date, research on stress and performance has been concerned with specific sources of stress in particular contexts with tasks that require specific forms of information processing. A broad based comprehensive descriptive framework has yet to be formulated. The current work aims to develop such a framework, building upon earlier work by Hockey and Hamilton (1983) and Bowers, Weaver and Morgan (1996).

A difficulty in describing the effects of stress on performance is that such effects depend upon features of the environment (including the task) and of the individual operator. The transactional theory of stress addresses this issue by defining the construct in terms of person-environment interactions. Within the framework of a transactional model, stress states may be viewed as abstracted representations of the relation between individuals and the external demands placed upon them (Matthews, 2001). Lazarus and Folkman (1984) defined psychological stress as a case in which individuals appraise their environment as taxing or exceeding their resources and/or endangering their well being. The negative effects of stress are most likely to occur when individuals view an event as a threat, and when they assess their coping skills as inadequate for handling the stressor.

A second difficulty in creating a descriptive framework is that the effects of various sources of stress are not uniform across all forms of information processing. Indeed, Hockey's (1984) cognitive state model relates particular sources of stress in the environment to specific *patterns* of cognitive activity and performance change. Thus, different environmental stressors are associated with different patterns of change in information processing. Moreover, such changes can be associated with either the structure of these processes (e.g. working memory demands; rate of information transmission) or the strategies individuals employ in response to stress (e.g. allocation of resources; decision criteria; Hockey & Hamilton, 1983). Strategy and structure effects seem to reflect different aspects of cognitive function, and as such, should show different performance outcomes in the presence of particular stressors.

The descriptive framework we propose would incorporate both theoretical perspectives, as well as that of Hancock and Warm (1989), who pointed out that the tasks that operators perform are themselves sources of stress. Our framework defines a three dimensional matrix. Along one dimension will be forms of information processing, including information processing requirements for perceptual and cognitive tasks. The second dimension will be sources of stress (e.g. noise, temperature, social stressors, etc). Finally, the third dimension consists of moderators of stress and performance. These are variables that influence the relation between the sources of stress and the information processing for task performance, and will likely depend to some degree upon the transaction between the operator and the task.

At first glance, this project provides a vast empirical resource from which the effects of different stressors across a variety of information processing tasks can be examined. Moreover, the current program will identify shortfalls in the literature base highlighting potential avenues for future research. At a statistical level, the matrix also serves as the basis for a meta-analytic review providing the impetus for meaningful data to drive theoretical developments and to test existing models of stress and performance.

An objective in the development of the matrix was to inform current evaluatory processes used to model soldier-system performance under stressful conditions and to examine the taxonomic classification (taxons) used in performance prediction within IMPRINT (Improved Performance Research Integration Tool) (see O'Brien, Simon, & Swaminathan, 1992; Allender, Kelley, Archer, & Adkins, 1997). The current system within IMPRINT used for deriving taxons is mainly adapted from Berliner's (1966) task taxonomy with some attempt made to incorporate Wickens' (1981) structure for processing resources (see O'Brien et al., 1992). The matrix will provide both a theoretical and empirical basis for supporting or modifying the existing taxonomy used for task prediction, or for creating a new taxonomy with greater capability for predicting task performance.

SUMMARY

Our framework describes a three dimensional matrix with types of information processing along the first dimension, stressors along the second, and moderators of the stress-performance relationship along the third. The purpose of the matrix is to provide a comprehensive review of the extant literature which will not only identify avenues for future research but will provide empirical support for addressing current models of soldier-system performance under stressful conditions.

ACKNOWLEDGEMENTS

This research was supported by a grant from the Army Research Organization, P.A. Hancock, principal investigator. (Grant# DAAD19-01-1-0621). The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Army, Department of Defense, or the US Government. The authors wish to thank Dr. Sherry Tove, Dr. Elmar Schmeisser, and Dr. Mike Drillings for providing administrative and technical direction for the Grant.

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