

RELATIONSHIP BETWEEN CRITERION TASK SET PERFORMANCE  
AND THE PERSONALITY VARIABLES OF SENSATION SEEKING AND STIMULUS SCREENING<sup>1</sup>

Kirby Gilliland Robert Schlegel\* Sharon Dannels

Department of Psychology and the School of Industrial Engineering\*  
The University of Oklahoma  
Norman, Oklahoma 73019

ABSTRACT

The purpose of this study was to demonstrate the utility of the Criterion Task Set (CTS) as a method for personality theory testing. Subjects in a large CTS standardization study were administered the Sensation Seeking scale and the Stimulus Screening scale, two personality dimensions based theoretically on perceptual or biological processes that are believed to mediate task performance. Results indicated that high sensation seekers respond faster, but not necessarily more accurately, than low sensation seekers to central processing tasks. No differences were found for input/perceptual or motor/output tasks. Also, no differences were found between screeners and nonscreeners for any CTS tasks. The results of this study suggest that the CTS can be used profitably by personality researchers to test the basic assumptions of the theories of some personality dimensions.

INTRODUCTION

The Criterion Task Set (CTS) represents one effort to develop a standardized workload assessment task battery that will aid in the design and operation of complex systems (Shingledecker, 1984). The CTS has the distinction of being one of the few, if not the only, task battery based on current theoretical models of human information processing. The battery is composed of nine tasks, with each task designed to assess one of three primary stages of processing (perceptual/input, central processing, and motor/output). In addition, there are three workload levels for eight of the nine tasks. Thus, the CTS provides a theoretically relevant matrix of tasks (stages of processing by workload level) for human performance assessment.

The CTS has been applied as a test instrument to evaluate the relative sensitivity, reliability, and intrusiveness of a variety of available workload measures. It has also been used as a performance assessment battery to evaluate the effects of various stressors on individual components of the information processing system (Shingledecker, Acton, & Crabtree, 1983).

Another valuable application of the CTS is in testing the theories of personality dimensions believed to be related to task performance ability. For example, there are several personality variables that are known to relate to the manner in which a person processes information or to the processes related directly to performance capability. One such variable, Sensation Seeking (SS), is a measure of the degree to which a person actively seeks sensory stimulation. Since the introduction of SS (Zuckerman, Kolin, Price, & Zoob, 1964), many correlational studies have been performed establishing, for example, higher illicit drug use, more involvement in dangerous activities, and greater preference for foods with increased gustatory stimulation among high, as opposed to low, sensation seekers (Zuckerman, 1979). However, even though the sensation seeking dimension contains considerable relevance for such areas as perception and cognition, few studies of the relationship between SS and basic cognitive or task performance abilities have been reported.

Another relevant personality dimension, Stimulus Screening (SSCR), is a biologically and perceptually based dimension reflecting the ability to automatically screen irrelevant stimuli during information processing. Stimulus screening represents a heirarchic or patterned approach to information processing (Mehrabian, 1977). Mehrabian (1975) defines those high in SSCR as screeners, or individuals that effectively reduce the complexity or rate of information and therefore evidence a less extreme arousal response. Nonscreeners, by contrast, are less selective and therefore evidence greater arousal.

1. This research was sponsored by the Workload and Ergonomics Branch of the Armstrong Aerospace Medical Research Laboratory, United States Air Force, under Contract F33615-85-D-0514 through the Southeastern Center for Electrical Engineering Education (SCEEE-HER/86-9). The United States Government is authorized to reproduce and distribute reprints for government purposes notwithstanding any copyright notation hereon. The authors wish to thank Gary B. Reid and Dr. Thomas Eggemeier for their interest and support in the completion of this project.

Data collection has recently been completed for a large-scale standardization study that provides a comprehensive data base including CTS performance data, subjective workload assessments, and numerous measures of individual difference variables. Thus, this data base provides a unique opportunity for combining advances in basic human factors research with theory testing in personality psychology.

The purpose of this paper is to report on the initial examination of the relationship between each of the two personality variables, Sensation Seeking and Stimulus Screening, and CTS performance. Since each of the personality variables examined may mediate human task performance, each variable presents a unique opportunity to exercise the personality theory testing potential of the CTS. Because this is an exploratory effort only the most global predictions will be offered. First, High Sensation Seekers should perform faster and more accurately across all of the components of the CTS battery because of their higher need for stimulation and their higher correlation with impulsivity. Screeners, as opposed to nonscreeners, should perform more accurately (and faster) on the perceptual/input component of the CTS battery. The degree to which this differential performance in input/perceptual ability affects other components of the battery is not easily predicted. However, screeners are generally viewed as more efficient and should therefore be expected to be more accurate and faster across the other components of the battery, as compared to nonscreeners.

## METHOD

### Standardization Study

**Protocol.** A detailed description of the methodology used in the large-scale standardization study is reported elsewhere (Gilliland & Schlegel, 1986; Schlegel, Gilliland, & Schlegel, 1986). Briefly, the testing protocol consisted of regularly scheduled two-hour CTS testing sessions conducted once per day, for nine of ten days, over a two-week period. (The first of the ten days was used for orientation and personality testing.) Multiple workstations allowed for the simultaneous testing of four subjects during each two-hour session. Testing sessions were scheduled beginning at 8:00 a.m., 10:00 a.m., 1:00 p.m., and 3:00 p.m.

**Procedure.** Performance and Subjective Workload Assessment Technique (SWAT) data were collected for approximately 125 subjects (96 men and 29 women) performing all nine tasks of the CTS for nine days. Eight of the nine tasks were performed at three distinct levels of task difficulty for a total of 25 tasks each day. A SWAT rating was reported after the performance of each task. Five days were allocated for training, two days for baseline

testing, and two days for testing under various stressors. This paper will summarize the relationship between two of the personality variables and the performance data from the first day of baseline testing.

### Subjects

The upper and lower twenty-seven percent (see Cox, 1957) of the SS scale distribution for the 96 male subjects (ages 18-35 years) were identified as high and low sensation seekers, respectively (N=25 per group). Performance scores for the high and low SS groups were compared across each of the CTS performance tasks.

The upper and lower twenty-seven percent of the SSCR scale distribution for the same group of 96 males were identified as screeners and nonscreeners, respectively (again N= 25 per group).

### Apparatus

Again, the CTS apparatus is described in more detail elsewhere (see Shingledecker, 1984). Briefly, the battery is presented on a Commodore 64 microprocessor system and the subject responds by using one of three specially designed hand controllers.

The nine tasks are divided into three general types--each type representing a stage of information processing:

#### Input/Perceptual Type

1. *Probability Monitoring Task*

#### Central Processing Type

1. *Continuous Recall Task*
2. *Memory Search Task*
3. *Linguistic Processing Task*
4. *Grammatical Reasoning Task*
5. *Mathematical Processing Task*
6. *Spatial Processing Task*

#### Motor/Output

1. *Interval Production Task*
2. *Unstable Tracking Task*

## RESULTS

The most relevant MANOVA results revealed significant differences for the SS and the SS X Workload Level interaction for mean response time across the six tasks designed to assess central processing. The MANOVA test for SS and the SS X Workload Level interaction were nonsignificant for the percent correct measure for the same six central processing tasks. There was no significant difference between high and low sensation seekers on any dependent measures for the two motor/output tasks. Nor were there any significant

differences between the sensation seeking groups for speed or accuracy measures on the Probability Monitoring task. There were, however, highly significant MANOVA results for the Workload Level main effect for all task groups--which simply supports the validity of the distinct workload levels of the CTS.

The significant SS MANOVA tests were pursued by univariate analyses. The ANOVA results for the mean response time measures of the central processing tasks revealed that, as compared to those low on SS, high SS subjects responded significantly faster on three of the CTS tasks: Math Processing [ $F(1,52)=5.36$ ;  $p<.025$ ], Memory Search [ $F(1,52)=4.32$ ,  $p<.042$ ], and Grammatical Reasoning [ $F(1,52)=5.04$ ,  $p<.029$ ]. As the workload level of the tasks increased, the relative difference in performance between the SS groups increased resulting in a marginally significant ( $p<.06$ ) interaction for Math Processing and Spatial Processing.

MANOVA tests evaluating the relationship between SSCR and CTS performance yielded no significant differences (except, of course, for Workload Level).

#### CONCLUSIONS

The results for the SS groups suggest that high SS individuals are generally faster in some central processing abilities, but not in input/perceptual or motor/output ability. This could mean that sensation seekers are simply faster in overall responding in many ways, but no more accurate than low SS types. These results support the prior finding of higher levels of impulsivity in sensations seekers, but do not suggest a decided performance advantage with regard to accuracy in response.

Of particular interest is the lack of any significant differences between screeners and nonscreeners for the perceptual/input task, Probability Monitoring--a task well suited to test Mehrabian's theory of SSCR. In general, the lack of any significant findings suggests that this dimension does not appear to mediate performance in any robust manner.

It should be noted, however, that the results obtained and conclusions reached are limited by the nature of the CTS battery. While high SS types seemed to be faster in central processing responses, and showed no differences in accuracy, this can only be generalized to the domain of tasks assessed by the CTS. On the other hand the CTS was designed to assess a fairly wide range of task abilities. Thus, the results obtained can certainly be viewed as promising and helpful in proceeding toward more sophisticated tests of personality theories.

This study demonstrates the potential value of blending advances in human factors technology and personality psychology to arrive

at a method for more adequately exploring the influence of personality variables on performance. It seems particularly important that more sophisticated assessments of this type be undertaken. Fairly straightforward studies of a single task performance variable in isolation fail to give the wealth in information about the full domain of human task performance. By studying multiple tasks across workload levels we gain considerable perspective on complex human-task relationships.

#### REFERENCES

- Cox, D. (1957) Note on grouping. *Journal of the American Statistical Association*, 52, 543-547.
- Gilliland, K. & Schlegel, R. (1986) Evaluation of the Criterion Task Set for drug and stress research. Final Report for USAF Contract F33615-82-D-0627 through Southeastern Center for Electrical Engineering Education (SCEEE-ARB/85-62).
- Mehrabian, A. (1976) Manual for the Questionnaire Measure of Stimulus Screening. Unpublished manuscript. Available from A. Mehrabian, Beverly Hills, CA.
- Mehrabian, A. (1977) A questionnaire measure of individual differences in stimulus screening and associated differences in arousability. *Environmental Psychology and Nonverbal Behavior*, 1, 89-103.
- Schlegel, R., Gilliland, K., & Schlegel, B. (1986) Development of the Criterion Task Set performance data base. In the *Proceedings of the Human Factors Society 30th Annual Meeting*, Dayton, Ohio.
- Shingledecker, C. (1984) A task battery for applied human performance assessment research. *AFAMRL-TR-84-071*.
- Shingledecker, C., Acton, W., & Crabtree, M. (1983) Development and application of a Criterion Task Set for workload metric evaluation. *Second Aerospace Behavioral Engineering Technology Conference Proceedings*, Society for Automotive Engineers, 43-49.
- Zuckerman, M. (1979) *Sensation Seeking: Beyond the Optimal Level of Arousal*. Hillsdale, New Jersey: Lawrence Erlbaum.
- Zuckerman, M., Kolin, E., Price, L., & Zoob, I. (1964) Development of a Sensation Seeking Scale. *Journal of Consulting Psychology*, 28, 477-482.