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# CROSS-VALIDATION OF A BRIEF VESTIBULAR DISORIENTATION

## TEST ADMINISTERED BY A VARIETY OF PERSONNEL

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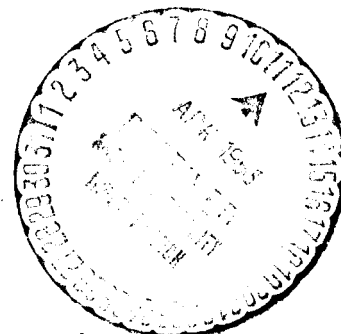
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## SUMMARY PAGE

### THE PROBLEM

A Brief Vestibular Disorientation Test (BVDT) has been developed that involves observer assessment of subjects' reactions produced by head movements in a rotating chair. Promising validity coefficients have been reported for a criterion of pass versus separation from pilot training. The purpose of this study was to cross-validate the BVDT under observer conditions approximating field use.

### FINDINGS

Cross-validation was considered successful because significant relationships were found between sensitivity scores on the BVDT and four dichotomous criteria:

1. Students separated from flight training for all causes versus completed.
2. Tension separations versus all other students.
3. Airsick separations versus all other students.
4. Tension and/or airsick separations versus all other students.

High sensitivity scores on the BVDT were related to membership in all four separation groups. The addition of the BVDT significantly augmented the magnitude of the multiple correlations of the existing selection variables with the criterion.

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## INTRODUCTION

The Coriolis vestibular reaction, which can be elicited by tilting the head during simple whole-body rotation, has been of interest to aviation examiners since the time of World War I. Early attention centered mainly around identifying and describing the phenomenon. More recently, efforts have been made to assess the total behavior associated with the Coriolis vestibular reaction and to correlate these assessments with some external criterion (1-6). Evaluations of individuals experiencing this Coriolis vestibular reaction have been compared with their subsequent performance in flight training in the Netherlands (5) and Canadian (6) Air Training Commands. Results were encouraging in that the evaluations appeared to predict success and also occurrence of motion sickness in flight training. Performance in a rotating environment also has been found to be predictive of susceptibility to airsickness and seasickness (4).

At Pensacola a Brief Vestibular Disorientation Test (BVDT) has been developed that involves an assessment of subjects' reactions produced by head movements in a rotating chair. A structured rating procedure was introduced to permit brief and objective administration of the test by personnel who have only a modicum of training for the task. Reliability of measurement has been demonstrated by substantial agreement among several types of observers using the BVDT technique for the same subjects and by substantial agreement of the observers' BVDT ratings with the subjects' self-ratings of sensitivity. These data have been reported previously (3). Promising validity coefficients also have been reported for an over-all criterion of pass versus separation from naval pilot training and for a specific criterion of separation for airsickness (1). The purpose of this study was to cross-validate the BVDT under observer conditions approximating field use.

## PROCEDURE

The test was administered to 239 naval pilot trainees during the twelfth week of the 16-week pre-flight syllabus. With the rotatory Stille-Werner chair stationary, each subject was asked to practice slow head movements of 45 degrees with his eyes closed and without mechanical aids. After instructions, the chair was accelerated at 15 deg/sec<sup>2</sup> to a constant velocity of 90 deg/sec (15 rpm). After 30 seconds the following positions were assumed: head right, upright, left, upright, right, upright, left, upright, forward, upright. Each position was maintained for 30 seconds. The chair was stopped by a 15-deg/sec<sup>2</sup> deceleration upon completion of this sequence. The subject was instructed to open his eyes after the sensation of movement stopped. Observers made independent ratings of each subject during the sequence. Rater estimates of pallor, sweating, facial expression, unsteadiness, speed of recovery, and over-all performance were recorded on a ten-point scale. The low point on the scale represented low sensitivity, or no effect. An individual rater's score was obtained simply by summing his judgments on the six factors. The BVDT score for a given subject was the mean of these individual ratings. Raters were told not to make relative judgments of subjects but to judge each man separately. For example, a rating of 10 on sweating would mean that the man was sweating as profusely as possible. The number of observers per subject varied from two to four, with a mode of three. A total of 13 observers with

The means and standard deviations for the various criterion categories are presented in Table II to demonstrate the magnitude of the differences among these criterion groups.

Table II  
BVDT Score Descriptive Statistics for Various Criteria

Criterion Groups		First Study	Cross-validation
Completions	$\bar{X}$	12.09	13.66
	$\sigma$	4.67	5.68
	N	168	170
Separations (all causes)	$\bar{X}$	14.09	15.91
	$\sigma$	7.92	8.00
	N	58	69
Tense separations	$\bar{X}$	14.12	19.22
	$\sigma$	5.40	8.48
	N	22	25
Airsick separations	$\bar{X}$	23.11	20.12
	$\sigma$	13.68	7.21
	N	10	9
Tense and/or airsick separations	$\bar{X}$	16.81	18.91
	$\sigma$	10.14	8.47
	N	27	26
Total	$\bar{X}$	12.64	14.23
	$\sigma$	5.76	6.46
	N	226	239

The significant coefficients for two successive samples suggest that the BVDT is a useful selection instrument. It was necessary, however, to determine whether it augmented existing selection procedures. Research at the Naval Aerospace Medical Institute has developed multiple regression equations for predicting subsequent separation from flight training (7). Separate equations are available for various critical points in training; the predictor variables entering into these equations are drawn from the aviation selection tests and all performance data available up to that given point in training.

study samples there were no students with FAR scores of 3 and only eight with scores of 4. The data for both samples are combined in Table IV. Although the number of cases involved is small, the data in Table IV support the inference that extreme reactors on the BVDT (42 or above) cannot complete flight training. Furthermore, there appears to be a significant interaction between the BVDT score and the FAR score in the upper score ranges of the BVDT (15 to 42.9). Students who had BVDT scores in this range and who scored 4 or 5 on the FAR had an attrition rate of 50 per cent while those with a FAR of 6 or above had a somewhat lower separation rate of 32.5 per cent.

Table IV

Separation Rates for Various BVDT Score Levels and Flight Aptitude Ratings

BVDT Scores	FAR 4 or 5		FAR 6 to 9	
	Input	% Separating	Input	% Separating
6.0 - 8.9	17	17.6	51	19.6
9.0 - 14.9	69	24.6	208	22.1
15.0 - 42.9	36	50.0	80	32.5
43.0 - or above	1	100.00	3	100.0
Total	123	31.7	342	24.9

RECOMMENDATIONS

It has been demonstrated that this relatively simple method of assessing the Coriolis vestibular reaction in human subjects has significant implications for aviation personnel selection. The evidence supports the recommendation that the BVDT procedure be incorporated into flight student selection. Consideration should be given to the exclusion of all applicants who score 5 or below on the FAR and who also have BVDT scores in the upper ranges. This recommendation is not meant to imply that this avenue of research has ended. Increased reliability, validity, and objectivity in assessing the Coriolis vestibular reaction are the next goals.

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