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16. Abstract The State-Trait Anxiety Inventory (STAI) was used to assess the anxiety of air traffic controllers who had experienced difficult and easy work shifts. Eighty volunteers completed the STAI before and after two or more eight-hour work shifts. Controllers relatively high in anxiety proneness tended to report higher levels of anxiety in association with control work than those relatively low in anxiety proneness. The mean A-state score after shifts was higher than the mean score before shifts. It was also determined that the increase in anxiety during shifts was greater for difficult shifts.		13. Type of Report and Period Covered OAM Report	
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SUSCEPTIBILITY TO ANXIETY AND SHIFT DIFFICULTY AS DETERMINANTS OF STATE ANXIETY IN AIR TRAFFIC CONTROLLERS

I. Introduction.

In research on the affective responses of air traffic controllers,^{e.g., 2, 4} it has been shown that controllers tend to be relatively low in such traits as anxiety proneness, at least in comparison to normal college undergraduate students. However, even though, as a group, controllers tend to be non-anxious, they still demonstrate significant increments in anxiety during air traffic work shifts. It was the purpose of this study to consider the effect of difficulty of work shifts on anxiety levels experienced by controllers during work periods, the expectation being that controllers should show significant increases in anxiety in association with shifts judged difficult, but not in those judged as easy shifts. It was also a concern of this study to determine the degree to which level of experienced anxiety in air traffic control work is a function of the relative susceptibility of controllers to experience anxiety. It was expected that controllers relatively high in trait anxiety (anxiety proneness or A-trait) would have higher levels of experienced anxiety during work shifts and would also show greater increments in anxiety during difficult shifts than controllers who are comparatively low in A-trait.

II. Method.

A. Subjects. A total of 81 controllers from three air traffic control facilities was surveyed. Each controller had volunteered to participate in a multidisciplinary study of physiological and psychological consequences of air traffic control work.²

B. Procedure. Each controller completed questionnaires before and after at least two regular eight-hour work shifts. On each of these occasions, the A-State Scale of the State-Trait Anxiety Inventory (STAI)⁶ was administered to measure anxiety level at the moment. In addition, the controller answered the A-Trait Scale of the

STAI, which measures susceptibility or proneness to anxiety; the scale was completed before the first work shift under consideration. After each shift, in addition to the STAI A-State Scale, each controller rated the shift for difficulty. A five-point scale was used which required the controller to select the most descriptive terms for his shift from the alternatives of "very difficult," "difficult," "neither difficult nor easy," "easy," and "very easy."

The controllers were divided into a High A-trait Group and a Low A-trait Group of 40 controllers each. The division was made on the basis of the scores obtained on the STAI A-Trait Scale; controllers with scores above and below the median of 28.5 were placed into the High and Low groups respectively. One controller was deleted from the sample by random selection to provide an equal number of persons in each group.

After assignment to one of the two A-trait groups, the controllers were further subdivided into Difficult Shift and Easy Shift Groups comprised of 20 individuals each. The assignment was made on the basis of the most extreme rating of shift difficulty made by each controller. This was done in order to maximize the differences in ratings between the two groups. Each controller was assigned to only one shift group because some individuals gave the same rating to all the surveyed shifts, and thereby eliminated the possibility for within-subject comparisons on this variable. Thus, if a controller was surveyed on three shifts and rated one "very difficult," one "difficult," and one "easy," he was assigned to the Difficult Group and the scores from the shift rated "very difficult" were used. If the controller made equally extreme "difficult" and "easy" ratings for different shifts (e.g., at least one shift rated "very difficult" and one rated "very easy"), the group assignment was determined by chance.

If two or more shifts were given the same rating (e.g., two shifts judged "very difficult"), the shift used to provide the scores for analysis was determined by chance. Each controller contributed only the set of scores from one shift to the data analysis.

III. Results.

The mean A-Trait Scale score for the high A-trait controllers exceeded the mean for the controllers relatively low in A-trait as expected (Table 1); the difference was significant ($p < .01$). Similarly, the mean A-State Scale scores for these two groups (i.e., the overall mean score derived from all pre- and post-shift administrations of the STAI for high and low A-trait controllers) showed corresponding significant differences ($p < .01$). It should be noted that although normative data for normal adult groups are not available for the STAI, a comparison to college undergraduate norms indicates that the A-Trait Scale means correspond to the 40th and the 8th percentiles of the student group, respectively. Thus, even those controllers relatively high in A-trait do not tend to score as high on the A-Trait Scale (anxiety proneness) as the average college student. With respect to the A-State Scale, the means represent the 48th and 30th percentiles for college students, respectively. Thus, for both groups, A-state levels reported during control work were substantially higher than would have been predicted from the A-trait levels and approached average college student levels for the High A-trait Group.

TABLE 1

Mean A-Trait and A-State Scale raw scores for air traffic controllers relatively high and low in anxiety proneness (A-trait).

Group	A-Trait Scale	A-State Scale
High A-trait	33.37	34.61
Low A-trait	25.50	30.33

TABLE 2

Mean A-State Scale raw scores and mean differences in raw scores between the A-Trait Scale and the A-State Scale obtained prior to air traffic control work shifts for controllers relatively high and low in anxiety proneness (A-trait).

Group	A-State Scale	A-State—A-Trait
High A-trait	31.40	-1.97
Low A-trait	27.85	+2.35

The responses of controllers to anticipation of air traffic control work also varied as a function of A-trait level (Table 2). Prior to working a shift, controllers relatively high in A-trait had lower A-state than A-trait scores ($p < .01$) while controllers low in A-trait had higher A-state than A-trait scores ($p < .05$). Thus, the prospect of undertaking an air traffic control work shift apparently tends to result in some energizing of anxiety for low A-trait controllers, while it tended to have a somewhat relaxing effect on controllers more prone to experience anxiety.

Both the relatively high and low A-trait controllers reported significant ($p < .01$) increases in anxiety as a function of completing a work shift (Table 3). This increment in anxiety from before to after shifts also varied as a function of the judged difficulty of the shift as indicated by the significant ($p < .01$) interaction between these two variables. Thus, while both the Difficult and Easy Shift Groups showed a significant ($p < .01$) increase in A-state across shifts, the increase was significantly greater ($p < .01$) for the Difficult than the Easy Shift Group. The two groups began shifts with equal A-state levels; however, after shifts, the group which had experienced what they judged to be a difficult shift had the higher mean score.

TABLE 3

Mean A-State Scale raw score for air traffic controllers obtained before and after work shifts judged difficult and easy.

Time	Easy Shift	Difficult Shift
Before Shift	30.17	29.07
After Shift	33.10	37.55

IV. Discussion.

In general, the findings indicate that there is a definite relationship between the judged difficulty of shifts and the amount of anxiety reported by controllers. Controllers experiencing what they considered to be difficult shifts showed a greater increase in anxiety during these shifts than did controllers who reported a relatively easy shift experience. However, it is noteworthy that even shifts judged "easy" were anxiety arousing to some degree, albeit to a lesser extent than "difficult" shifts. Thus, air traffic control work, even at its least demanding, is still some-

what anxiety arousing. Whether or not this is a characteristic unique to air traffic control work and most demanding occupations, or is associated with work or work load in general remains to be determined.

With respect to anxiety proneness, it was determined that scores on the measure used in this study, the A-Trait Scale of the STAI, were predictive of the general A-state level of controllers, but were not predictive of the degree of anxiety experienced under the stress of difficult shifts. Both relatively high and relatively low A-trait controllers showed increases in A-state under these conditions, and the increases were essentially equal. These findings are thus consistent with research^{4,5,1} in which it has been shown that A-state responses to "objective" threats, such as pain, are not predicted by A-trait level.

The finding that A-state scores were lower than A-trait scores prior to shifts for controllers relatively high in A-trait, while the reverse was true for controllers relatively low in A-trait, suggests that the impact of undertaking this kind of activity may differ for such persons. On the one hand, the relatively low A-trait controller may feel some degree of arousal and anticipatory stress prior to undertaking what can be a demanding job. In contrast, the relatively high

A-trait controller shows what may be a slight decrease in anxiety arousal from general states. This suggests the possibility that becoming involved in demanding activities may serve as a distraction for high A-trait persons. In other words, such persons may be diverted from concern over threats to "self-esteem" by involvement in demanding activities. This would be consistent with the report by Smith³ that student aircraft pilots high in A-trait showed lower A-state than A-trait scores when undertaking flight instruction (even though physiological indicators suggested substantial levels of arousal), and with the observation by Spielberger⁵ that patients with high A-trait may show reduced A-state by engaging in non-esteem threatening tasks.

Finally, it should be noted that susceptibility to anxiety, as measured by the A-Trait Scale, is relatively low in the air traffic controller group. Even those controllers included in the relatively high A-trait group averaged below the 50th percentile for collegians. Furthermore, while A-state levels were elevated during air traffic control work, again the scores were lower than average scores for normal college students. These results are thus consistent with those previously obtained using the STAI with a smaller group of controllers,² as well as with findings from the use of a composite mood adjective checklist.

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