The Relation Of Vocal Emotions And Gender To Convey Urgency Of Verbal Auditory Warnings

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INTRODUCTION

One approach for attracting the attention of the aircrew to a dangerous situation and suggesting corrective action is to present a verbal warning. At present, to the best of the author's knowledge, voice messages in the cockpit of aircraft used by the Canadian Forces (CF) are spoken in a monotone voice, and the gender of the voice is male (except in the CF-118 and the AUP Hercules). The author's recent review of military standards pertaining to aircrew station warning signals revealed no rationale for the use of a neutral voice style, and the annunciator's gender was not specified.

Previous findings (1) have shown that subjects can elicit higher ratings of "carefulness" by responding to a female talker speaking in an emotional vocal style compared to a monotone voice. These results may have implications for voice warnings in the cockpit of high performance jets particularly when fast reaction time to auditory warnings is necessary, such as when performing combat maneuvers. In these instances, quicker response to an auditory warning may result in crash avoidance.

The present on-going study was undertaken to examine methods for improving aircrew reaction time to verbal auditory warnings. The "attention getting" of verbal auditory warnings that differed in both vocal style and gender was measured, while subjects were performing a visual tracking task.

METHOD

Subjects. To date 26 females and 26 males participated.

Stimuli. The stimuli were six verbal auditory warnings (Bingo, Caution, Climb, Gear, Lock, and Warning) presently used in the cockpit of some aircraft. Each warning was spoken by a female and male talker in an emotional, monotone, and whisper vocal style. These 36 warning combinations were digitally stored as single channel sound files on the hard disk of the host computer.

Apparatus. Testing took place in an IAC sound booth. The booth contained the host computer, monitor, 6-button response box (one button for each of the six warning names), and chair.

Procedure. Subjects were individually tested in the sound booth. The subject's task was to perform a visual tracking task; when a verbal auditory warning was presented over headphones he/she was to identify the spoken word by depressing the corresponding labeled button on the response box. Following a training session, the subject performed 72 tracking trials. Half of the 72 trials, selected at random, contained 1 cycle of a random ordering of the 36 warning combinations. The same visual tracking task was used in all 72 trials. The duration of each trial was 75 seconds. Half of the subjects were instructed to emphasize the auditory task, while the others were instructed to emphasize the tracking task.

RESULTS AND DISCUSSION

Data collection is presently on-going and thus the reported data constitute a preliminary analysis and are subject to change pending the outcome of the study. Subjects correctly identified the name of the warning in 97.3% of the 1872 trials.

A between- (instructional manipulation having two levels) and within-subjects (vocal style having three levels, talker having two levels, and warning having six levels) ANOVA on subjects' response times (RT) revealed that instructional manipulation and talker both had significant main effects on subject RT ($p < 0.03$). A Tukey pairwise comparison ($p < 0.05$) revealed that the auditory instructional manipulation, and the female talker yielded significantly quicker mean responses. The female talker significantly improved RT by 45 ms. This reduction in RT is approaching a practical significance of 60 ms, a time frame which may imply crash avoidance for a fighter pilot performing a nap-of-the-earth maneuver (2). The emotional voice style yielded the quickest mean RT but this did not significantly differ from the other two vocal styles.

In summary, the preliminary results of the present on-going study are encouraging. The final results may yield recommendations for improving aircrew reaction time to verbal auditory warnings, with the implication that accidents may be avoided.

REFERENCES

Barzegar, R.S., and Wogalter, M.S. (1998). Intended carefulness for voiced warning signal words. *Proc. Hum. Factors and Ergonomics Soc. 42nd Annual Meeting*, 1068-1072.

Haas, E.C., and Casali, J.G. (1995). Perceived urgency of and response time to multi-tone and frequency-modulated warning signals in broadband noise. *Ergonomics*, **38**, 2313-2326.