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HUMAN OPERATOR TRACKING PERFORMANCE WITH A VIBROTACTILE DISPLAY

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Vibrotactile displays have been designed and used as a sensory aid for the blind. In the present work the same 6 x 24 "Optacon" type vibrotactile display (VTD) was used to characterize human operator (HO) tracking performance in pursuit and compensatory tasks. The VTD was connected via a microprocessor to a one-dimensional joy stick manipulator. Various display schemes were tested on the VDT, and were also compared to visual tracking performance using a specially constructed photo diode matrix display comparable to the VTD.

Optimal performance, measured as minimal rms error between input and output signals, was achieved by dividing the VDT matrix into two 3 x 24 fields. On one side,l the reference signal was presented and on the second half the target position. The axial position on either half was generated by cycling between two adjacent 3 pin lines at 40Hz, moving up and down with the target, or reference signals. Pseudo random bandlimited signals, DC to 0.4HZ were used testing the performance of four subjects.

Results:

1. Very little training was needed by the subjects to learn to use the system and there was little improvement with time after the quick initial learning phase.

2. No significant differences were measured between pursuit and compensatory tasks, in contrast to the visual tracking experiment.

3. The calculated coherence function for both tasks was close to 1.0 at the above dynamic range.

4. The HO transfer function, after the exclusion of a fixed time delay, was a constant gain and constant phase at the above range.

5. An average of about 420 msec. time delay between the input and output signals was exhibited by three subjects while the fourth subject had almost double this delay.