

Accuracy of Tracking of Tactile Signals on a Multichannel Display

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OBJECTIVES

- To explore the ability to accurately localize stationary stimuli in a dense tactile array on the abdomen. Stimulus parameters such as tactor type and vibration frequency were manipulated to evaluate tracking accuracy and information transfer. Unique stimulus patterns provided virtual “anchor points” to which other loci could be referred.
- To examine the accuracy of localization of dynamic tactile stimuli in a pursuit tracking task in which a virtual target, presented as a moving site on the vibrotactile array, was followed in real time by the user using another vibratory signal, the cursor.

ACCOMPLISHMENTS 6/2002 - 9/2004

- Tested over 155 subjects in 12 conditions;
- Designed and developed tactor software and hardware system for interactive tracking of tactile apparent motion with vibrotactile stimulation on two types of dense tactile arrays on the abdomen;
- Studied localization accuracy for stationary stimuli within the array, finding optimal performance for sites near the abdominal midline, regardless of the absolute location of the array. Neither the tactor type nor stimulus frequency affected localization of stationary stimuli;
- Studied the effect of training, finding accuracy of localization improves over ten practice sessions but only by c. 2%/session.
- Showed performance improvement at frequency-tagged vibrotactile sites;
- Studied pursuit tracking over a linear array, showing that performance accuracy was a function of spatial frequency;
- Two international presentations, one resulting in a proceedings paper.

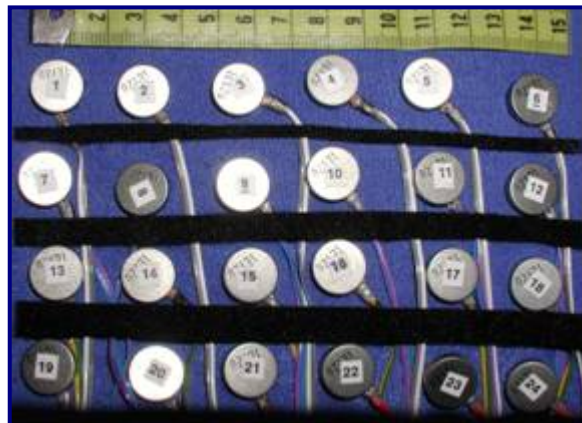
PUBLICATIONS/ PRESENTATIONS

- Cholewiak, R. W., & Beede, K. (2003). *Tracking of Tactile Stimuli On a Dense Multidimensional Array I. Vibrotactile Localization*. Presentation to the Tactile Research Group, Vancouver, BC, Canada.
- Cholewiak, R. W., & Beede, K. (2005). *The Representation of Space through Static and Dynamic Tactile Displays*. Proceedings of the Virtual Reality International Conference with the Human Computer Interaction Meeting, Las Vegas, NE.

ASSOCIATE:

Research Assistant: Kristen Beede

Tactor Arrays:



Project Title: Accuracy of Tracking of Tactile Signals on a Multichannel Display

**Roger W. Cholewiak, Ph. D., P. I.
with Kristy Beede**

Accuracy of Tactile Tracking	2002		2003				2004			
	3	4	1	2	3	4	1	2	3	4
Milestone (including Studies, Presentations)	3	4	1	2	3	4	1	2	3	4
<i>Initial IRB Submission/Approval</i>	X	X	X							
<i>Stationary localization software & hardware preparation</i>	X	X	X	X						
Localization w/ pager tactor @ 80 Hz, dense spacing, 3 sites (Left, Center, Right of abdomen midline) (10 Ss)				X						10
Localization w/ C2 tactor @ 250 Hz (LCR) (15 Ss)				X	X					15
Localization w/ pager tactor @ 80 Hz, C2 sep'n (C) (14 Ss)				X	X					14
Presentation to ONR Board of Visitors					X					
Localization w/ C2 tactor @ 80 Hz (LCR) (14 Ss)					X					14
Localization w/ pager tactor @ 80 Hz, C2 sep'n (12 Ss)					X	X				12
Localization learning w/ C2 tactor @ 250 Hz (L) (20 Ss)					X	X				20
Localization w/ anchor point w/ C2 tactor @ 250 Hz (80 Hz anchor) (No anchor, loci 4 & 22 or 10 & 16) (14 Ss)						X	X			14
Presentation to Psychonomic Tactile Research Group							X			
Localization w/ anchor point w/ C2 tactor @ 80 Hz (250 Hz anchor) (No anchor, loci 4 & 22 or 10 & 16) (12 Ss)							X			12
Localization w/ anchor point w/ C2 tactor @ 80 Hz (250 Hz anchor) - repeat: earlier defective tactor2 (12 Ss)							X	X		12
Localization w/ C2 tactor @ 250 Hz w/ inactive surround (L) (12 Ss)								X		12
Localization w/ C2 tactor @ 250 Hz w/ inactive surround & repeating stimulus (L) (12 Ss)								X		12
<i>Dynamic Tracking software & hardware preparation</i>						X	X	X		
Tracking on one-dimensional 16-tactor array w/ C2 tactors @ 250 Hz (C) (8 Ss)								X	X	8
Implementation of EAI Tactor controller to improve temporal resolution of display									X	
Total number of subjects tested (not including c. 12 whose data were unusable)										155