Using Voice Recognition Technology and a Modified Cursor to Improve Usability of Hand-Held Computers

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Overview

- Purpose and Method
- Key Usability Issues
- Cursor movement and Difficulty
- Alternative Cursors
- Voice Recognition Technology
- Recommendations

Purpose and Method

Purpose: To identify usability issues with Handheld computers (HHCs).

Method: Conduct literature review to identify remedies using

- cursor techniques
- voice recognition

Three kinds of HHCs available

BlackBerry Bold

Mini-trackball

Treo 680

stylus pen

IPhone

finger(s)

Key Usability Issues

Users must have a steady hand when using a stylus pen.

Compact on-screen keyboard challenging.

Small displays affect pointing performance.

Users known to write data on paper or their own skin to enter later into device.

Stylus pens

(Wong, Starner, and McGuire, 2002)

Difficulty with the cursor and movement time are predicted by Fitts's Law.

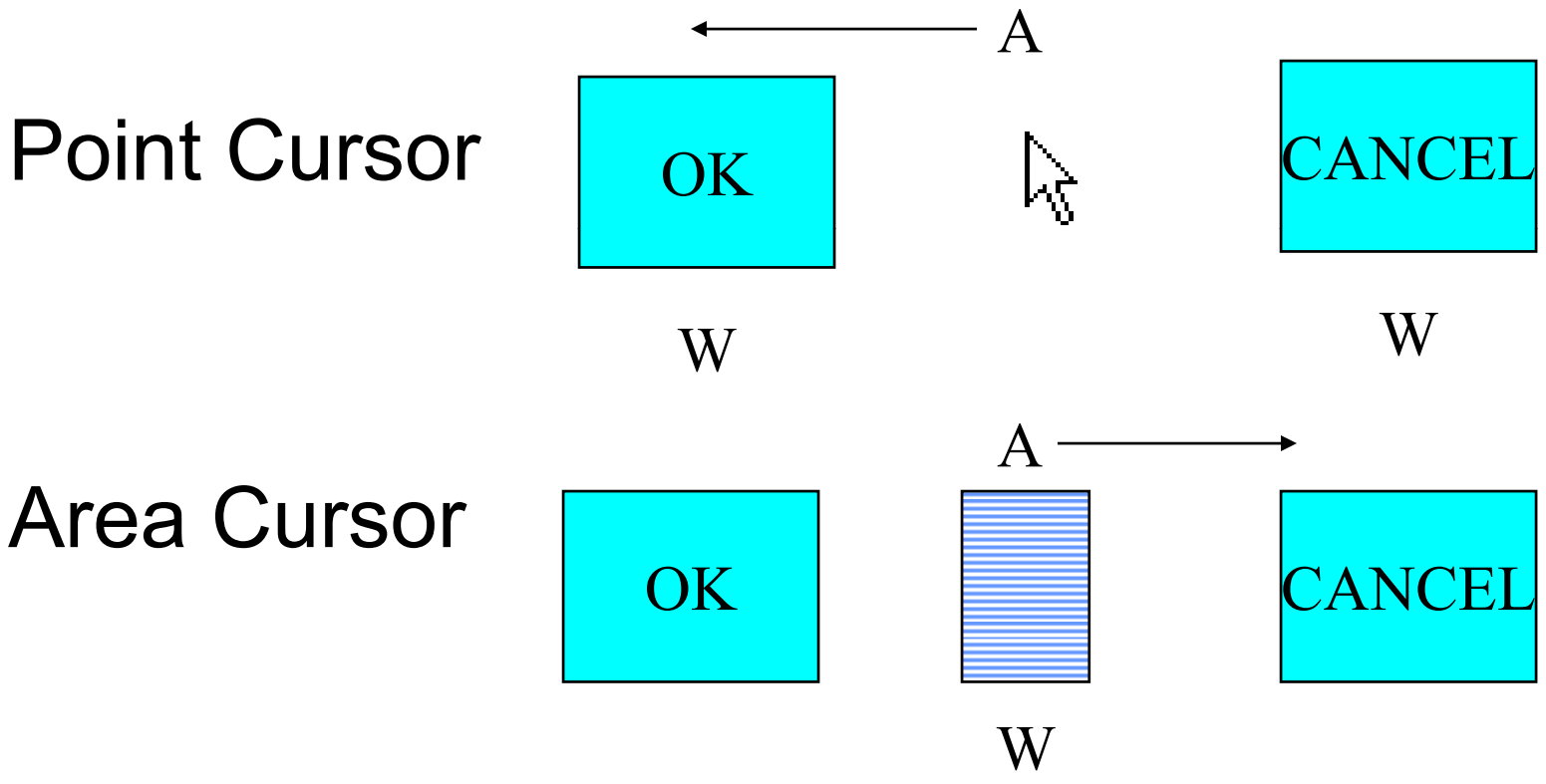
ID = log2(A/W + 1), where

A = Amplitude (or distance) between the target and the cursor.

W = Width of target.

ID = Index of Difficulty

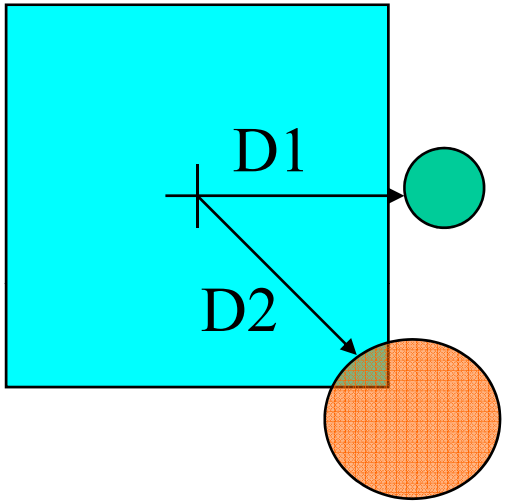
Area Cursor Method



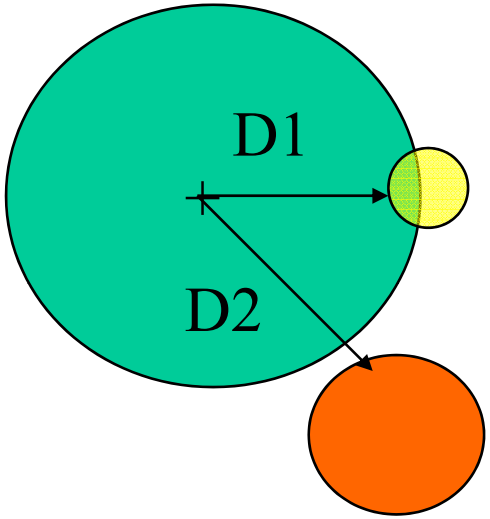
(Kabbash & Buxton, 1995)

Bubble Cursor Method

Area Cursor



Bubble Cursor



D1 < D2

The crosshair indicates the current location of the point cursor.

(Grossman & Balakrishnan, 2005)

Multi-finger Cursor Methods

Mouse cursor acts as a digital proxy for a finger on a graphical display.

Hands have 10 fingers and many degrees of freedom.

Graphical Cursors that use more of the hand's properties yields a more fluid interaction.

Cursor controlled by fingers on a multi-point touchpad.

Three different methods.

(Moscovich and Hughes, 2006)

Hand Cursor (Method 1)

Displays a set of points on screen corresponding to touchpad contact points

Allows simultaneous rotation and movement of objects

Can grab several objects at once

Two hand cursors can be used

(Moscovich and Hughes, 2006)

Similarity Cursor (Method 2)

Focus on a single target

Control position, rotation, and scale

Useful for drawing, 2D animation

(Moscovich and Hughes, 2006)

Adjustable Area Cursor (Method 3)

User controls activation area.

Users pinch their fingers to select an object in a crowded field.

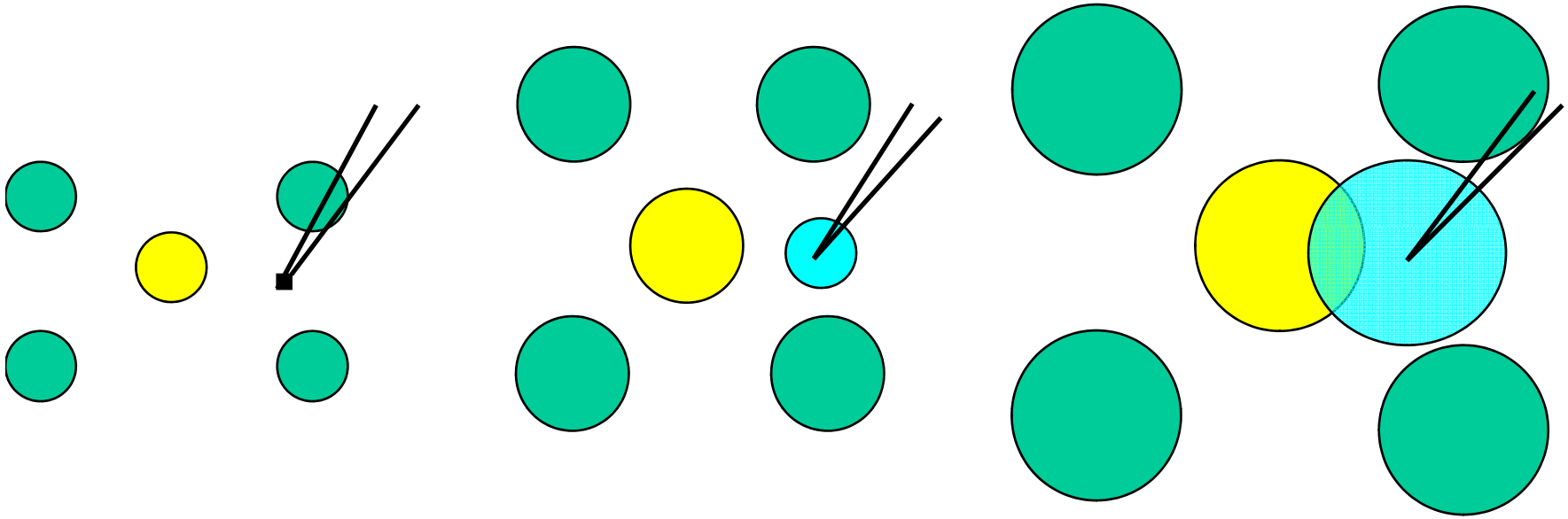
Further study needed to determine initial size of the cursor.

(Moscovich and Hughes, 2006)

Multi-finger Cursors Demonstration

http://www.youtube.com/watch?v=rlDqz0zYSWc

Adaptive Hybrid Cursor Method



Best for high density small targets

Manipulates background, target, and/or cursor

First to use pen pressure for target selection

Target is selected by lifting up the stylus pen

(Ren, Yin, Zhao & Li, 2007)

Voice Recognition Technology - Pros

- Mode independent of screen size.
- If an element is readable, it can be accessed.
- A highly usable alternative to an on-screen keyboard.
- Potential faster access to program buttons than with a stylus pen.

(Gartner, Inc., 2003)

Voice Recognition Technology - Cons

Loss of privacy.

Sensitivity to background noise.

Difficulty in diagnosing cause of poor accuracy.

Inability to work well with some speaking styles.

Additional cognitive load on the user if that task requires forming new memories.

(Gartner, Inc., 2003; Shneiderman 2000)

Relative Performance

AHC had best performance for cursors.

No data available for finger cursors

12 test participants for cursor comparisons.

Depending on the command, VR may take more or less time than the AHC.

Method	Access Time (ms)
Point Cursor	1429
Bubble Cursor	1177
AHC	1129
Voice Recognition	utterance + 150

(Ren, Yin, Zhao and Li, 2007; Schalkwyk & Fanty, 1996)

Feature Summary

	BlackBerry Bold	TREO 680	IPhone
Keyboard	Hardware buttons	Hardware buttons	On-screen
Pointing Device	Mini-trackball	Stylus pen	Finger(s)
Display (pixels)	480 x 320	320 x 320	480 x 320
Voice Recognition	Nuance, TellMe	Limited - Voice dialing	No

Recommend A Multi-Modal Data Entry Approach

VR offers easier navigation than a stylus pen.

VR a more conversational/natural interface.

Stylus pen necessary for mapping functions.

Hardware buttons most reliable for text entry.

Use the AHC for better visibility & accuracy.

Future Research

Mini-trackball vs. stylus pen vs. fingers.

Hardware buttons vs. on-screen keyboard.

AHC vs. stylus pen on HHCs.

Identify software requirements for the AHC.

Literature Review - Cursors

- The Adaptive Hybrid Cursor: A Pressure-based Target Selection Technique for PEN-based User Interfaces (Ren, Yin, Zhao, & Li, 2007)
- The “Prince” Technique: Fitts’ Law and Selection Using Area Cursors (Kabbash & Buxton, 1995)
- The Bubble Cursor: Enhancing Target Acquisition by Dynamic Resizing of the Cursor’s Activation Area (Grossman & Balakrishnan, 2005)
- Multi-finger Cursor Techniques (Moscovich & Hughes, 2006)

Literature Review – Voice Input

Gartner, Inc. reports IGG-05072003-04, AV-19-9410, and T-19-8224

Towards Conversational Speech Recognition for a Wearable Computer Based Appointment Scheduling Agent (Wong, Starner & McGuire, 2002)

CSLU-C Toolkit for Automatic Speech Recognition (Schalkwyk & Fanty, 1996)

The limits of speech recognition (Shneiderman, 2000)