Input and Interaction Research
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Definitions and Background
Detailed Example: Pin-and-Cross
Other Examples: Conté, Doppio, Gunslinger, Siftor
Definitions

Input
Sense physical properties of people, places, or things.

Interaction Technique
The combination of input with feedback to complete a specific atomic task.
The pointer (small arrow) on your screen is controlled by the mouse attached to your Macintosh. As you move the mouse on a flat surface, the pointer on the screen moves with it.

Macintosh mouse input space

human capabilities

input device capabilities

movement, button press

hold
double-click

click

Figure 1. Our multi-touch mice explore different touch sensing techniques, form-factors and interactive affordances.

ABSTRACT
In this paper we present novel input devices that combine the standard functionality of a computer mouse with multi-touch. With the emergence of multi-touch, we now have the opportunity to manipulate digital content with increased degrees of freedom. But until now, multitouch has been incorporated into

Microsoft ARC Touch Mouse
Surface Edition
$79.99
Microsoft Store
human capabilities \( \cap \) input device capabilities

Magic mouse input space:
- movement, button press
- number of contacts, touch location
- movement kinematics
- one finger swipe
- hold
- two finger swipe
- right-click
- double-click
- click
- two finger tap

multitouch input space:
- number of contacts
- movement kinematics
- one finger long press
- one finger drag
- one finger double tap
- one finger tap
- two finger drag
- two finger tap
- three finger swipe
- four finger swipe
- four finger open
- two finger rotate
- two finger pinch
- three finger swipe
- one finger double tap
- one finger tap
- one finger swipe
- two finger swipe
- one finger drag
- one finger long press

human capabilities \( \cap \) input device capabilities
Contextual Commands with Touch

- touch to open, select, copy, delete, rotate, ...
- touch to start dragging, start scrolling, ...

Long Press for Context Menu
Tapping Crossing


One finger “pins” the other “crosses”
Potential design space

- number of hands
  - one hand, two hands
- number of pin fingers
  - one finger, two fingers, three fingers
- crossing direction
  - "around" the pin, towards pin, away from pin
Formative Study

Develop pin-and-cross design guidelines and recognition algorithms from performance, preference, and kinematics.

12 participants
× 4 task variations
× 3 blocks
× 16 crossing target angles
Design Implications for Target Placement

PIN1-Touch

PIN2-Touch

PIN1-Drag

PIN2-Drag
Heuristic-based Recognizer

- Pin Distance
- Pin Speed
- Crossing Length
- Crossing Speed
- Crossing Start Speed
- Crossing Angle
- Crossing Distance

Performance Comparison Experiment

Compare to functionally equivalent menu techniques

12 participants
× 3 techniques
× 4 blocks
× 8 menu items
Pin-and-Cross Marking Menu (Kurtenbach et al.)

Pie Menu (Banovic et al.)
Pin-and-Cross Marking Menu (Kurtenbach et al.)

Pie Menu (Banovic et al.)

#### Graph

**Time (ms)**

<table>
<thead>
<tr>
<th>Menu Type</th>
<th>Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin and Cross</td>
<td>700</td>
</tr>
<tr>
<td>Marking Menu</td>
<td>900</td>
</tr>
<tr>
<td>Pie Menu</td>
<td>1100</td>
</tr>
</tbody>
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Disambiguation Delay
context menus
scrolling shortcuts
manipulation modes
drawing modes
scrolling shortcuts
manipulation modes
drawing modes


**Siftor** (2013). Owens Art Gallery, Sackville, NB.