

Input and Interaction Research

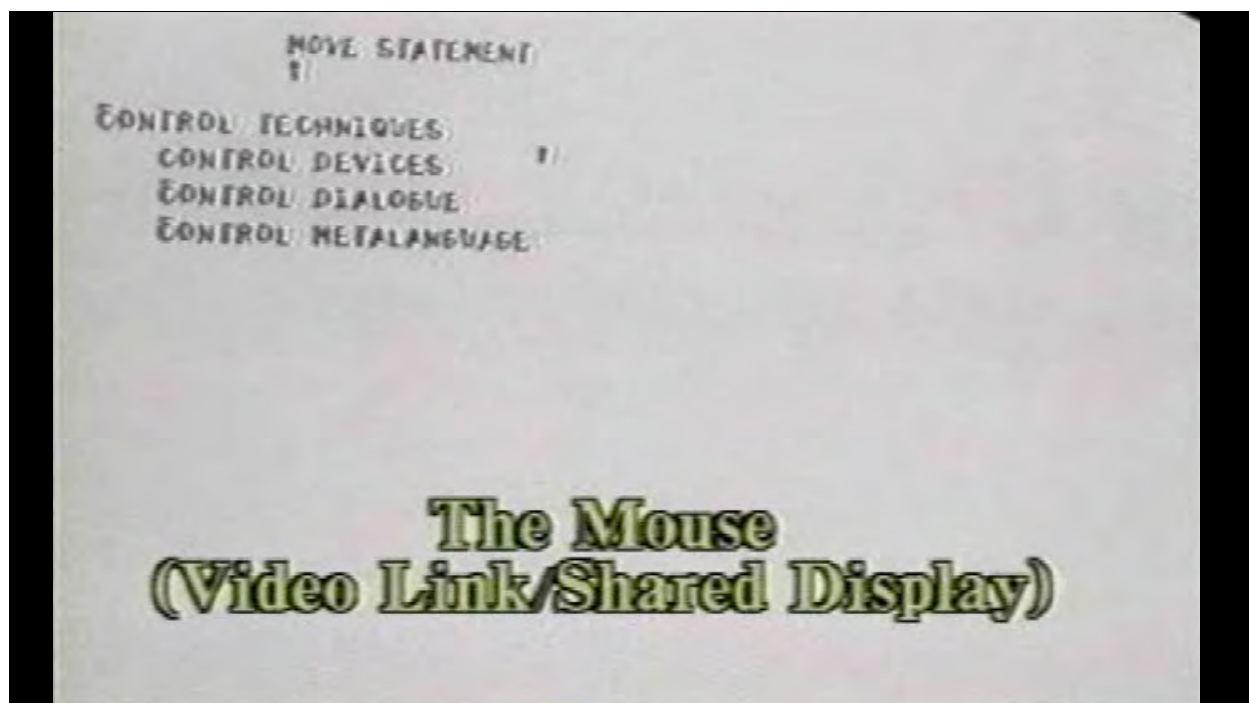
Daniel Vogel

Definitions and Background

Detailed Example: Pin-and-Cross

Other Examples: Conté, Doppio, Gunslinger, Siftor

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Gesture Recognition in Marking Menus

Gordon Kurtenbach, George Fitzmaurice,
Azam Khan, and Don Almeida



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Definitions

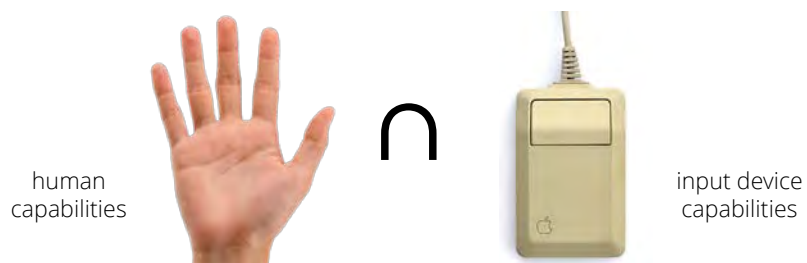
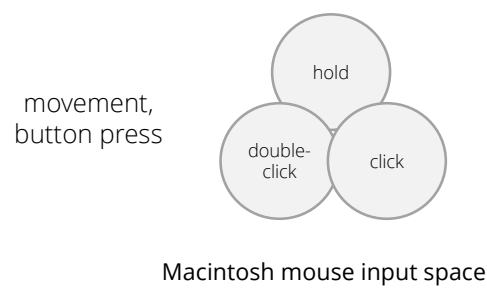
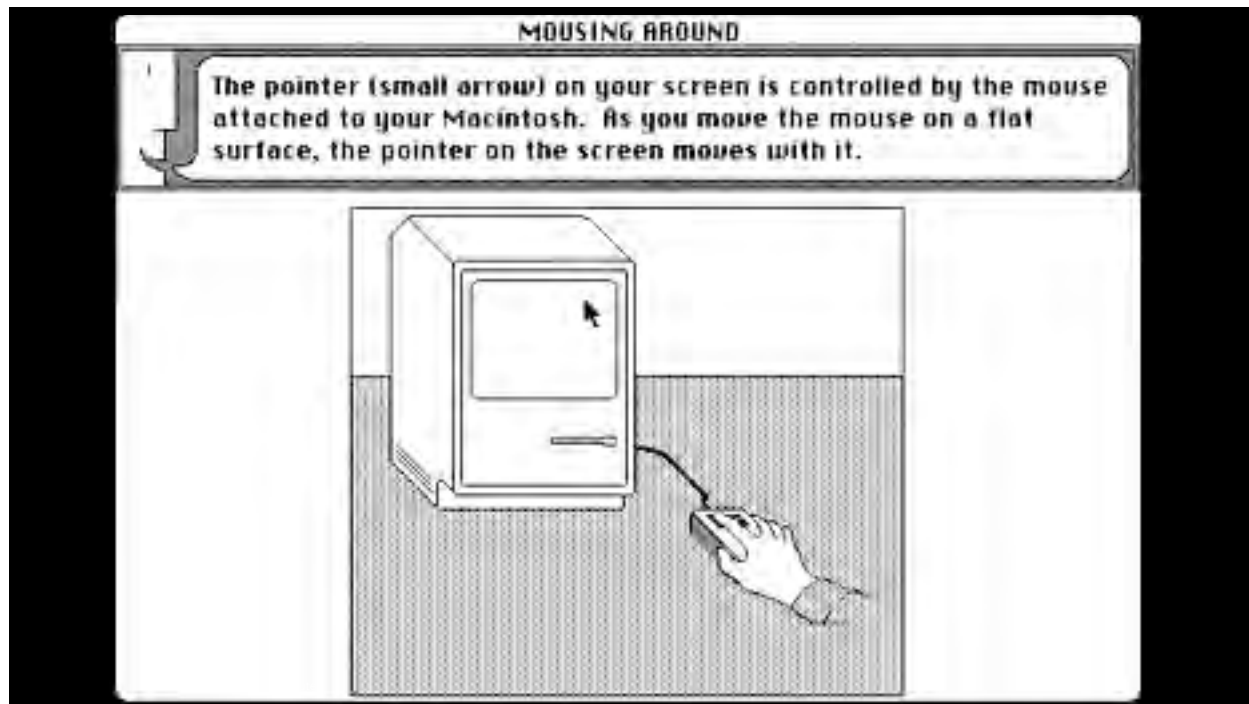
Input

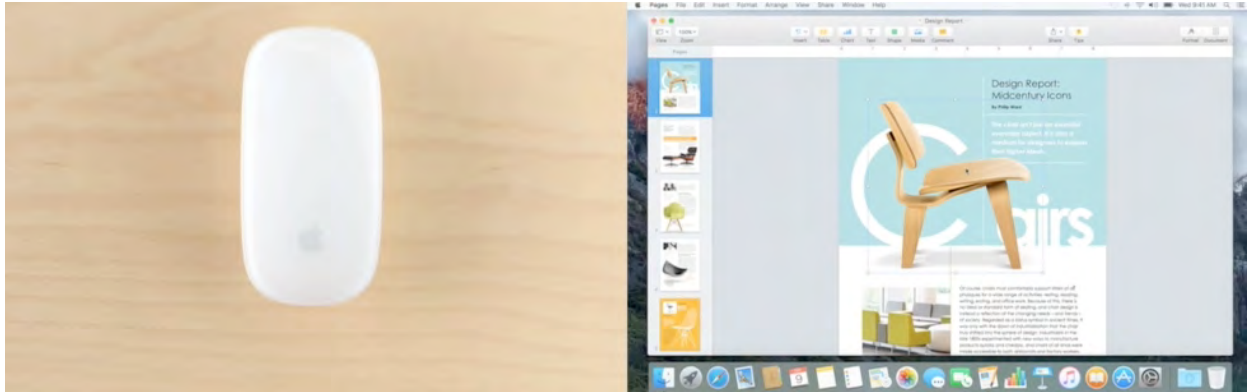
Sense physical properties of people, places, or things.

Interaction Technique

The combination of input with feedback to complete a specific atomic task.

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Credit: Apple Computer

Nicolas Villar, et al. 2009. Mouse 2.0: multi-touch meets the mouse.
 In *Proceedings of the 22nd annual ACM symposium on User interface software and technology* (UIST '09). ACM, New York, NY, USA, 33-42. DOI=
<http://dx.doi.org/10.1145/1622176.1622184>

Mouse 2.0: Multi-touch Meets the Mouse

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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 capabilities of a computer mouse with multi-

touch. With the emergence of multi-touch, we now have the opportunity to manipulate digital content with increased dexterity. But whilst multi-touch has been incorporated into

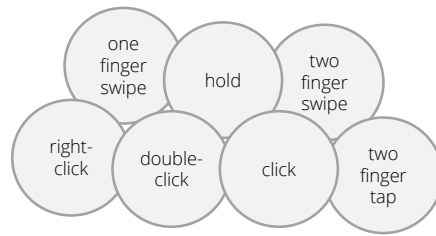


Microsoft ARC Touch Mouse
 Surface Edition

\$79.99

Microsoft Store

movement,
button press
number of
contacts,
touch location



movement
kinematics

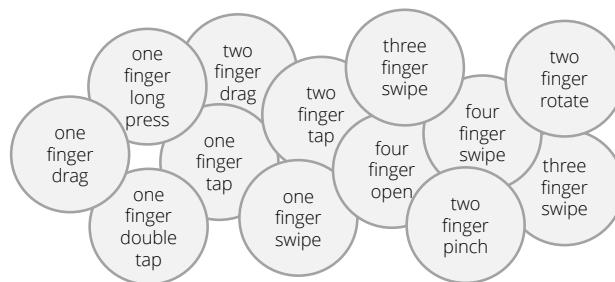
Magic mouse input space

human
capabilities



input device
capabilities

number of
contacts



movement
kinematics

multitouch input space

human
capabilities



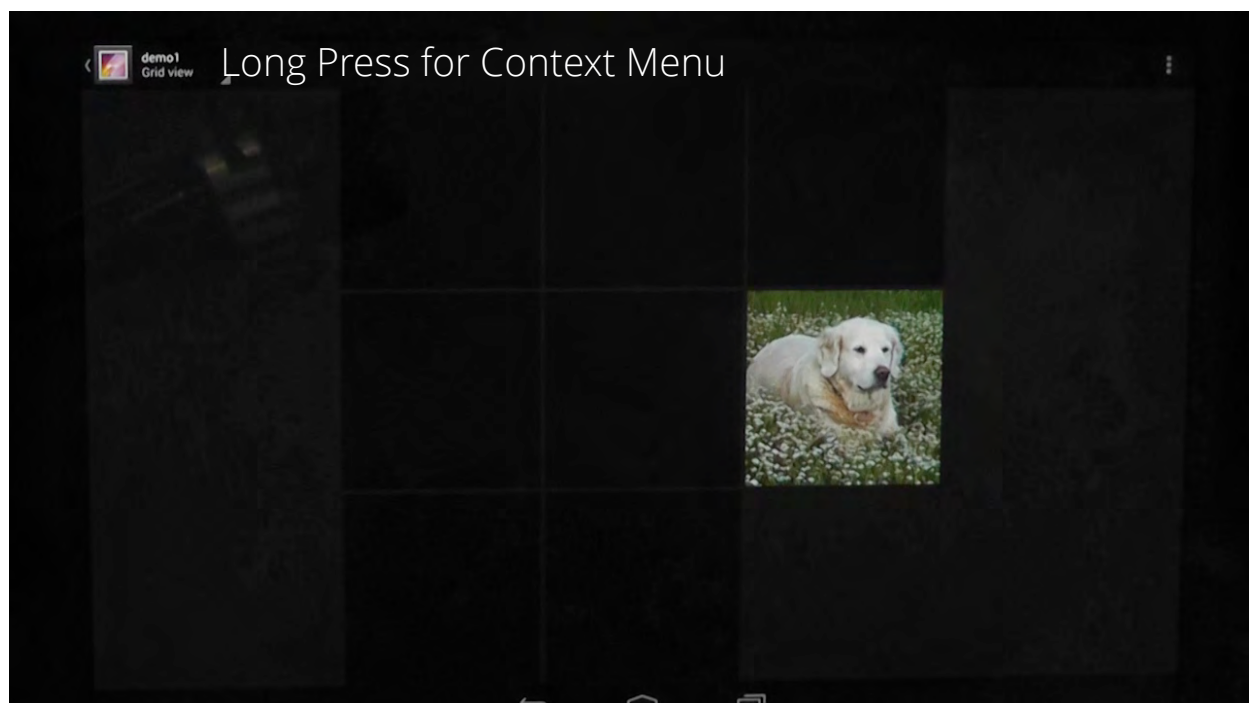
input device
capabilities

Contextual Commands with Touch

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



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Tapping



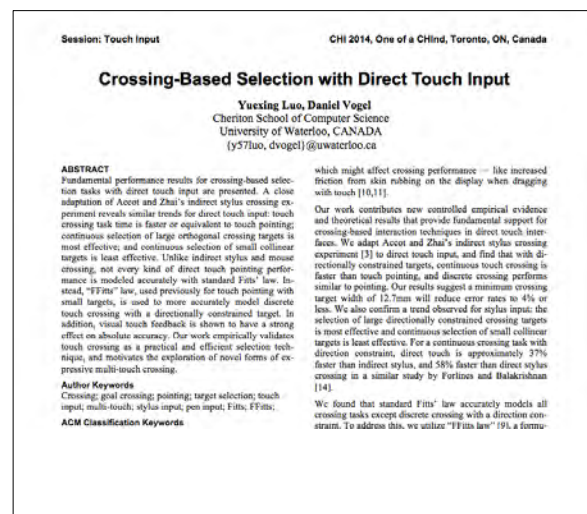
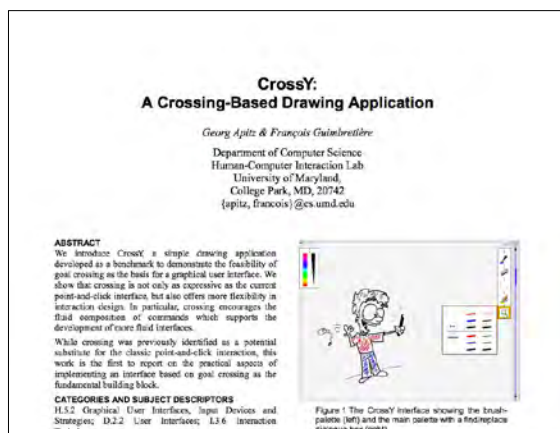
Crossing



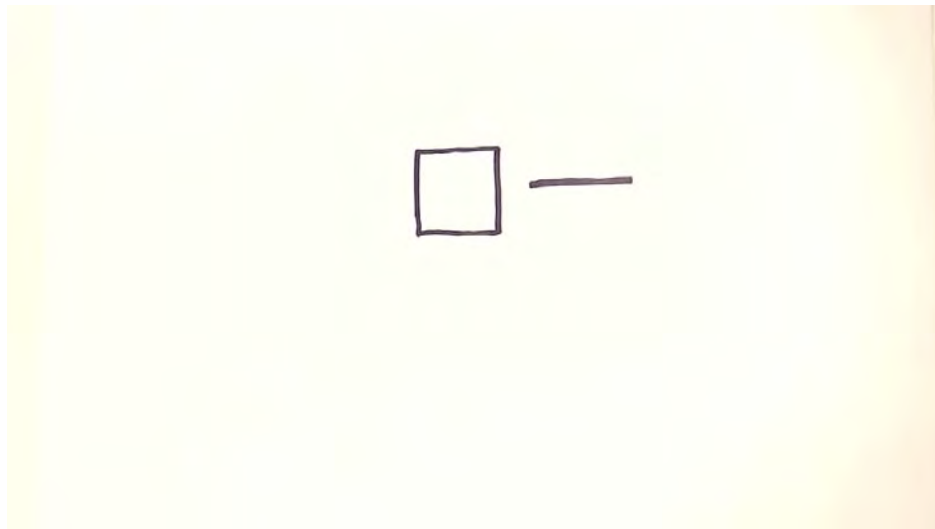
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Georg Apitz and François Guimbretière. 2004. CrossY: a crossing-based drawing application. In *Proceedings of the 17th annual ACM symposium on User interface software and technology* (UIST '04). ACM, New York, NY, USA, 3-12. DOI= <http://dx.doi.org/10.1145/1029632.1029635>

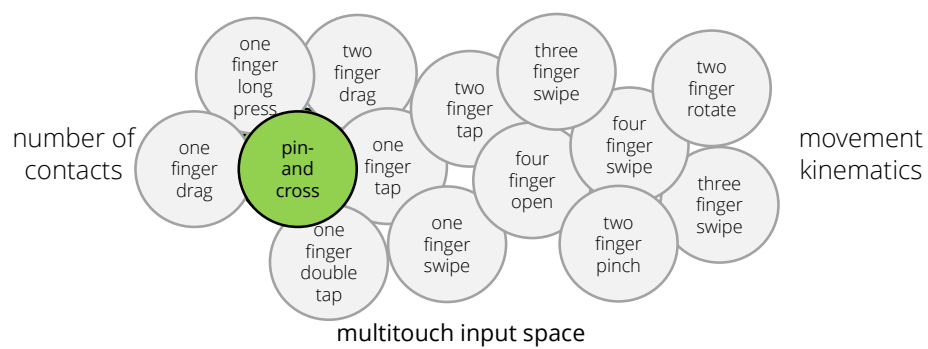
Yuexing Luo and Daniel Vogel. 2014. Crossing-based selection with direct touch input. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '14). ACM, New York, NY, USA, 2627-2636. DOI= <http://dx.doi.org/10.1145/2556288.2557397>

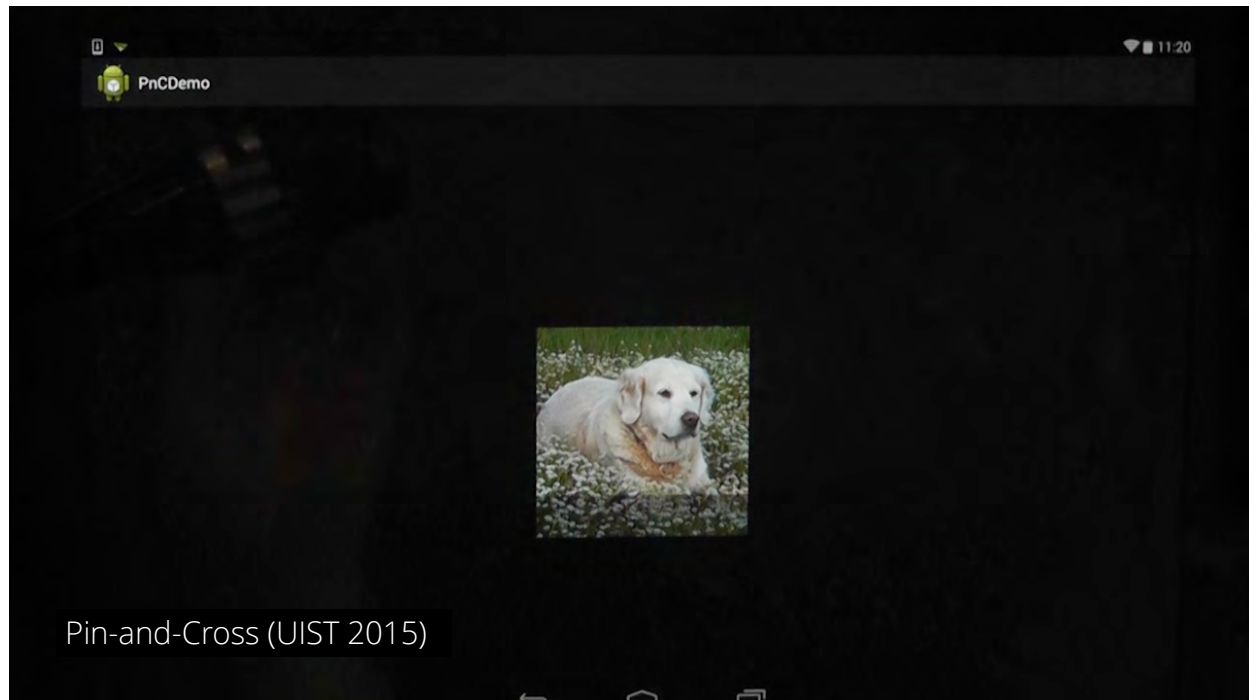


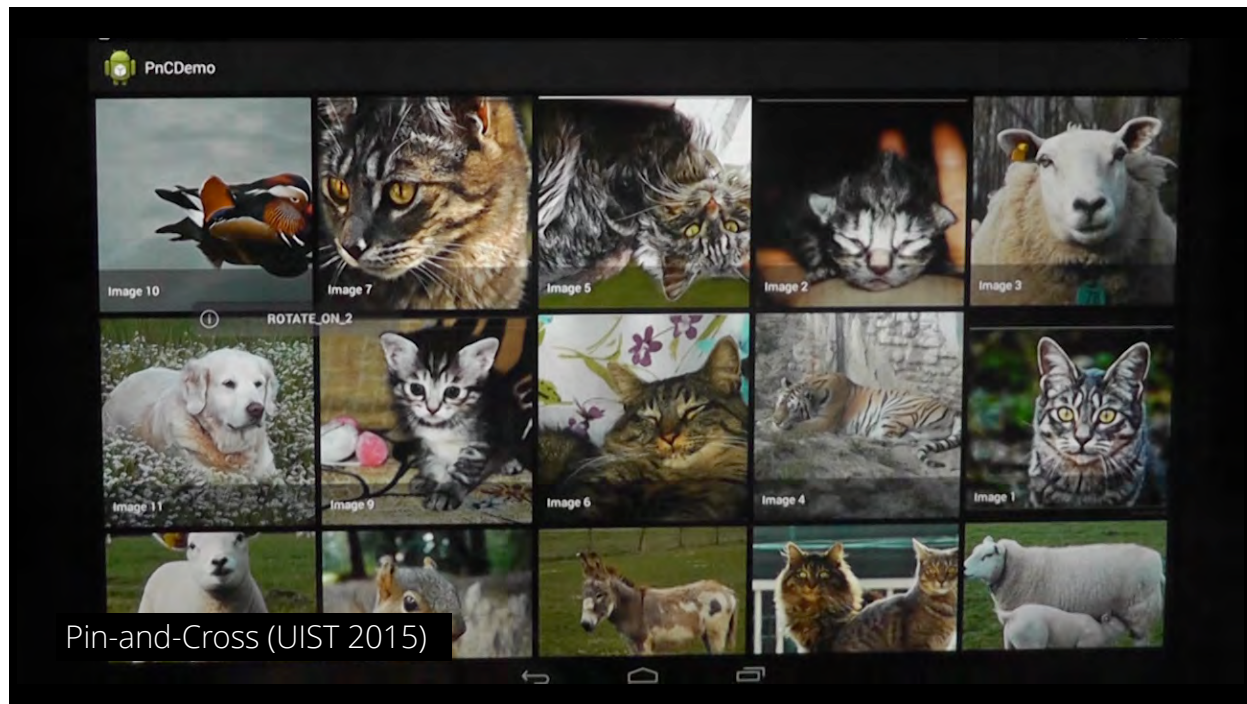
One finger “pins” the other “crosses”



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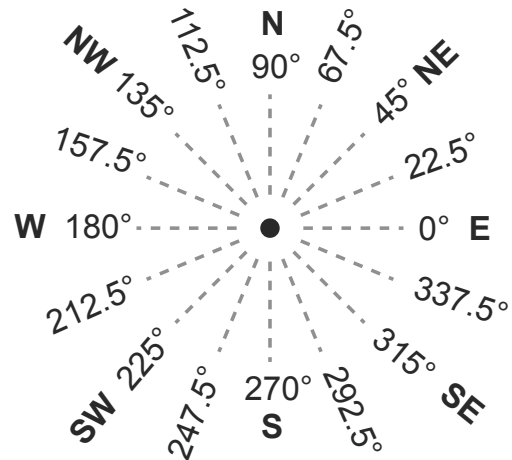
Potential design space

- 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

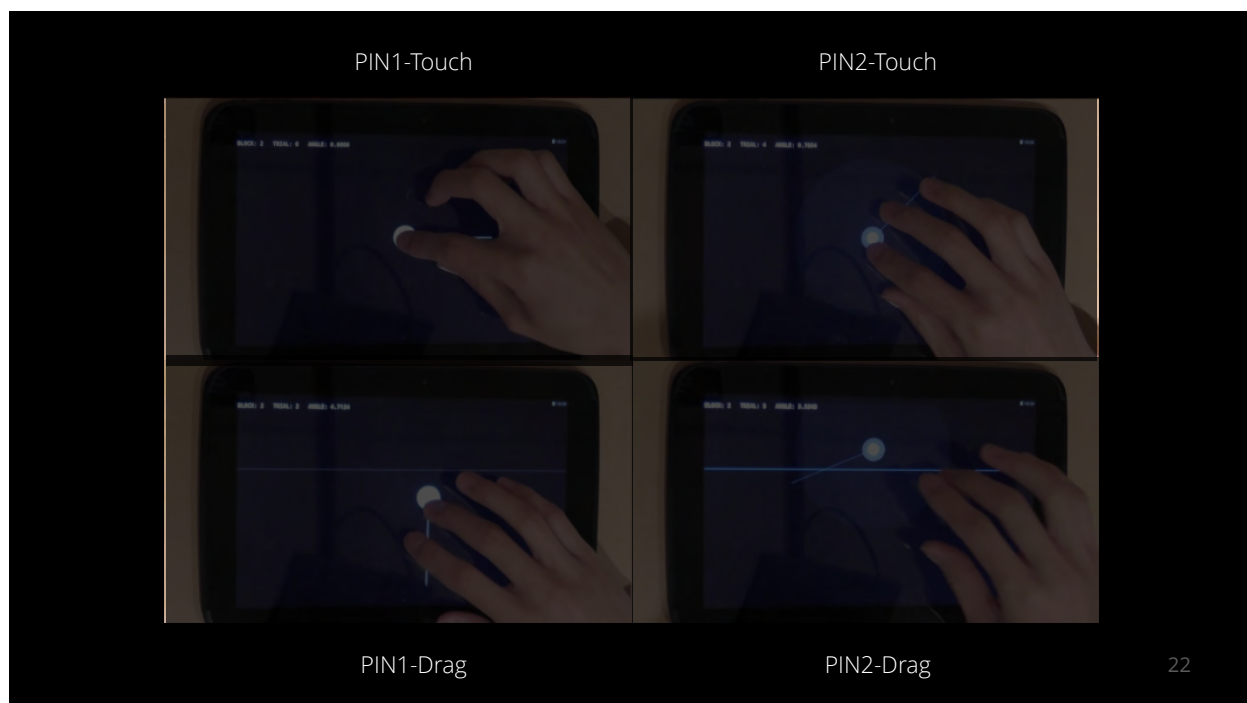
Formative Study

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

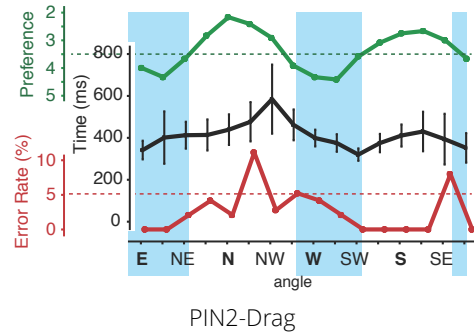
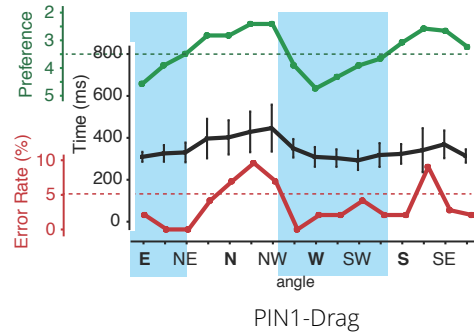
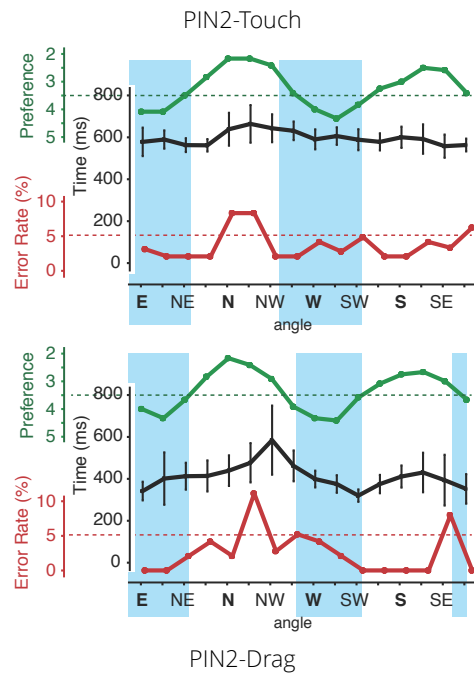
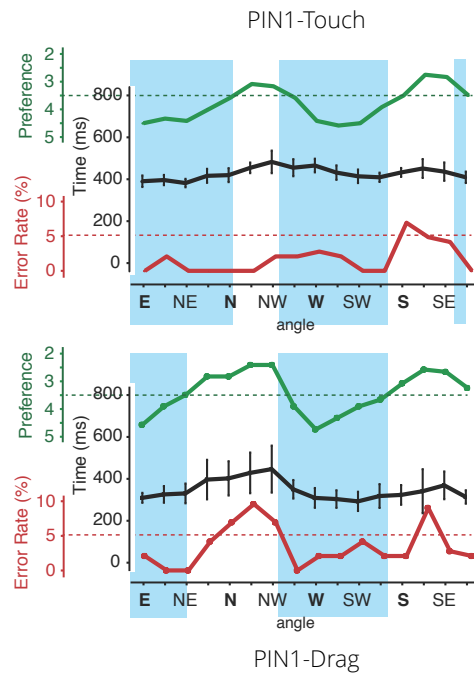
- 12 participants
- × 4 task variations
- × 3 blocks
- × 16 crossing target angles



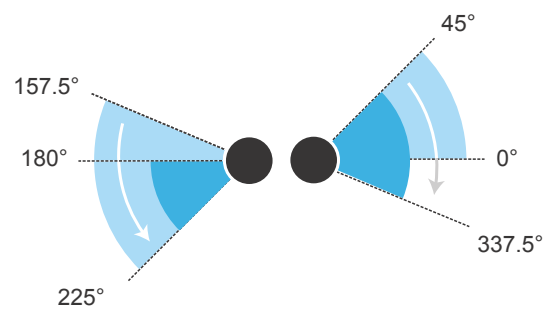
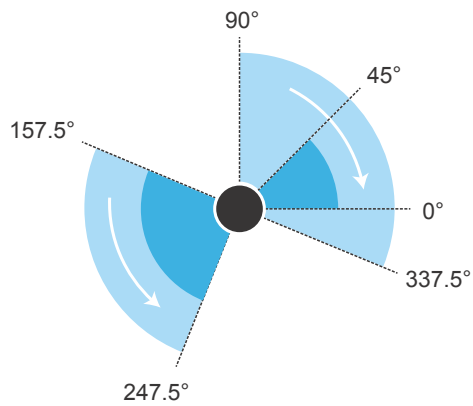
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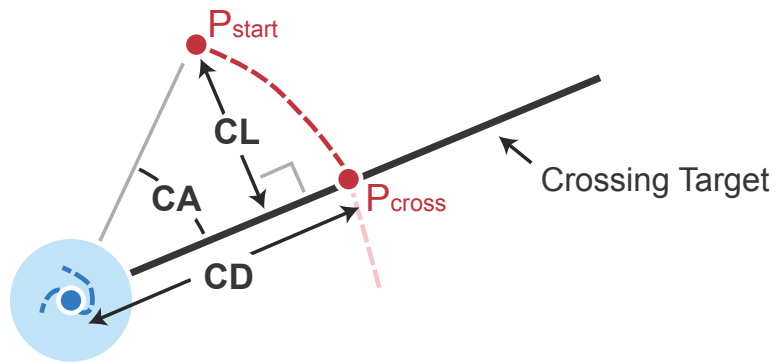
Design Implications for Target Placement



after touch after drag

Heuristic-based Recognizer

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



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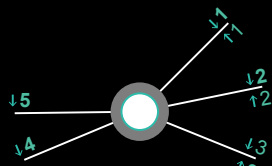
Performance Comparison Experiment

Compare to functionally equivalent menu techniques

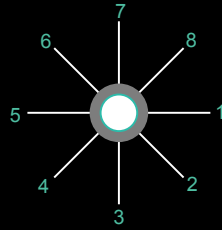
- 12 participants
- × 3 techniques
- × 4 blocks
- × 8 menu items

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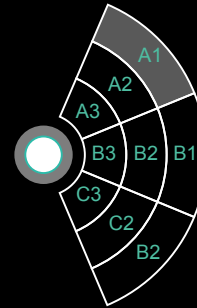
Pin-and-Cross



Marking Menu
(Kurtenbach et al.)



Pie Menu
(Banovic et al.)

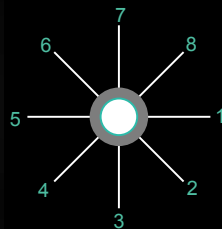


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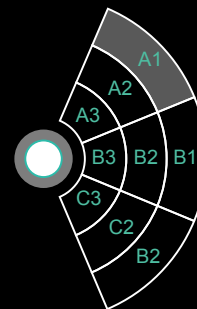
Pin-and-Cross



Marking Menu
(Kurtenbach et al.)

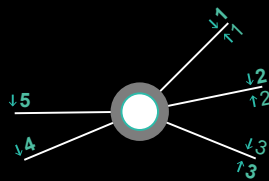


Pie Menu
(Banovic et al.)



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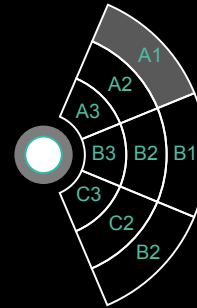
Pin-and-Cross



Marking Menu
(Kurtenbach et al.)

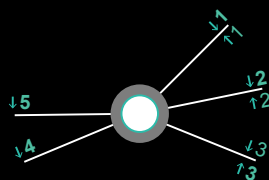


Pie Menu
(Banovic et al.)

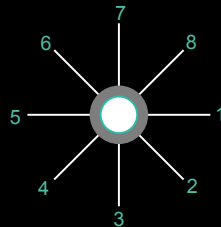


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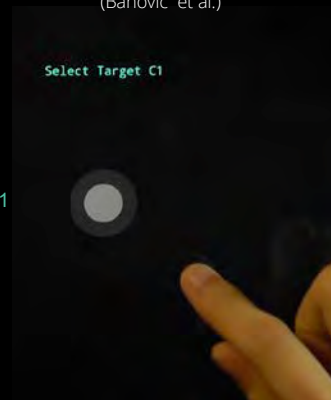
Pin-and-Cross



Marking Menu
(Kurtenbach et al.)

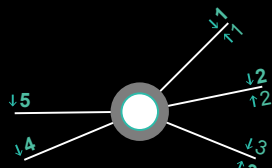


Pie Menu
(Banovic et al.)

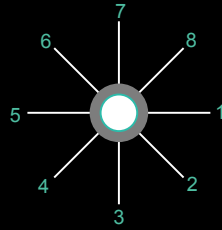


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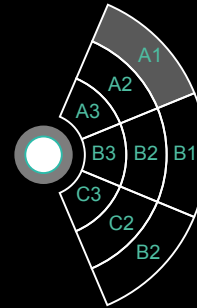
Pin-and-Cross



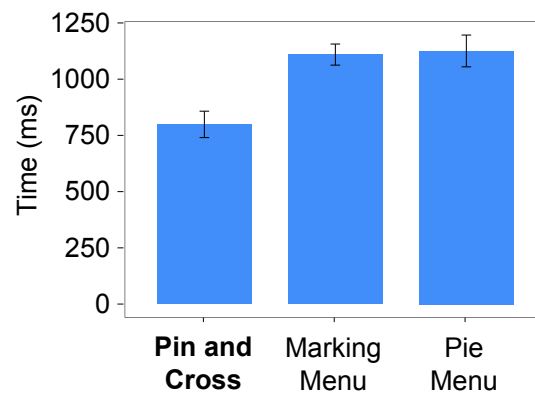
Marking Menu
(Kurtenbach et al.)



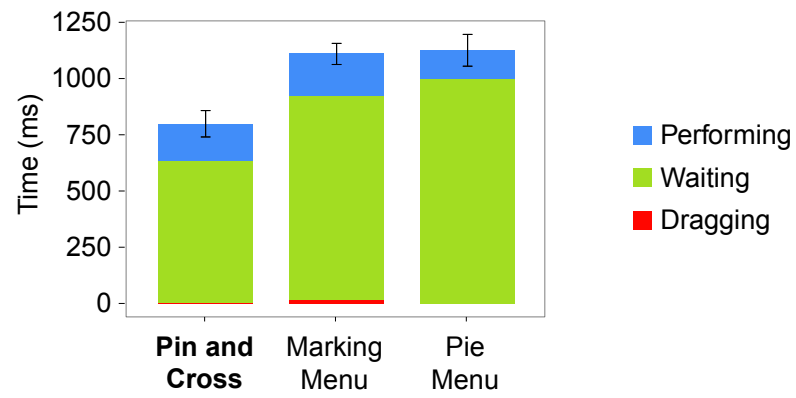
Pie Menu
(Banovic et al.)



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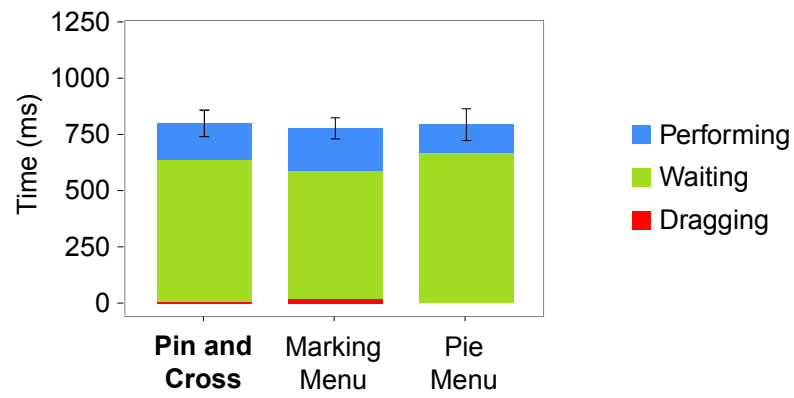
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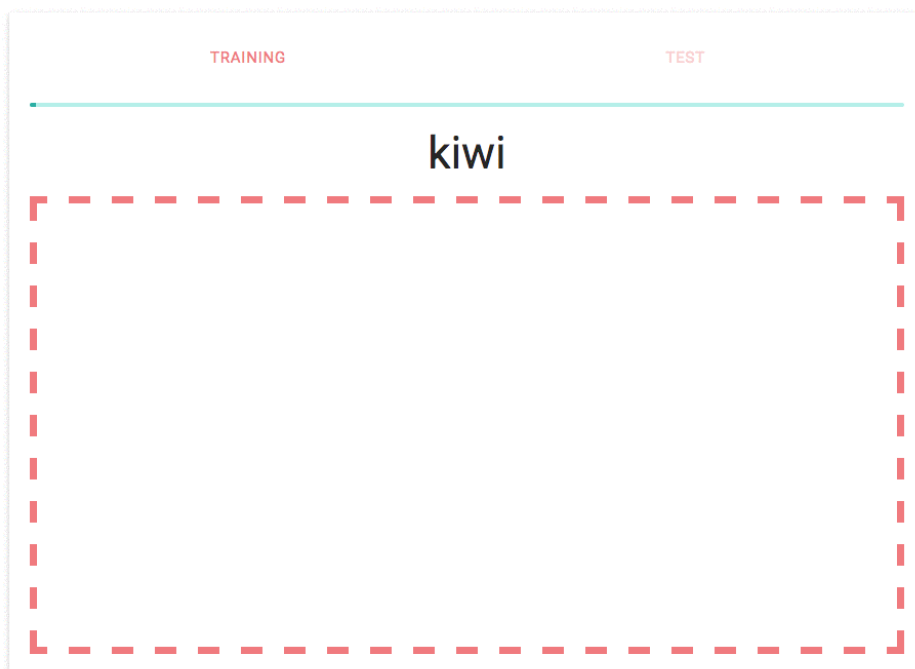
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Disambiguation Delay

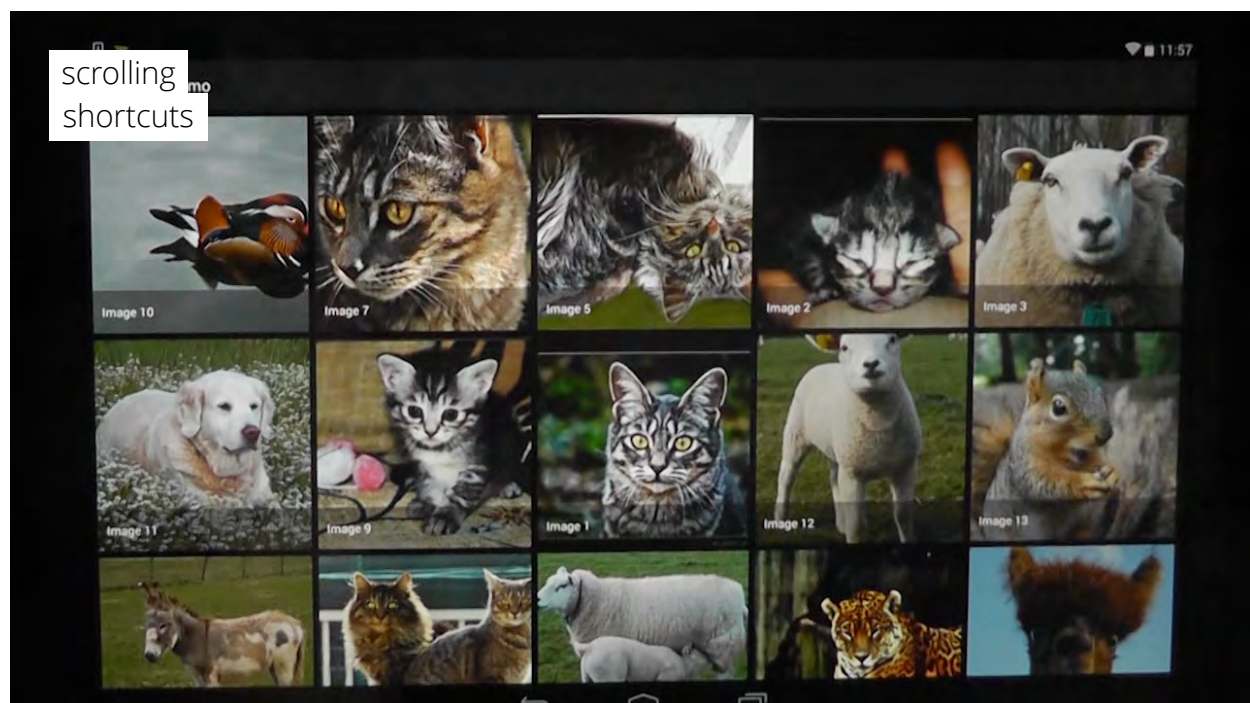
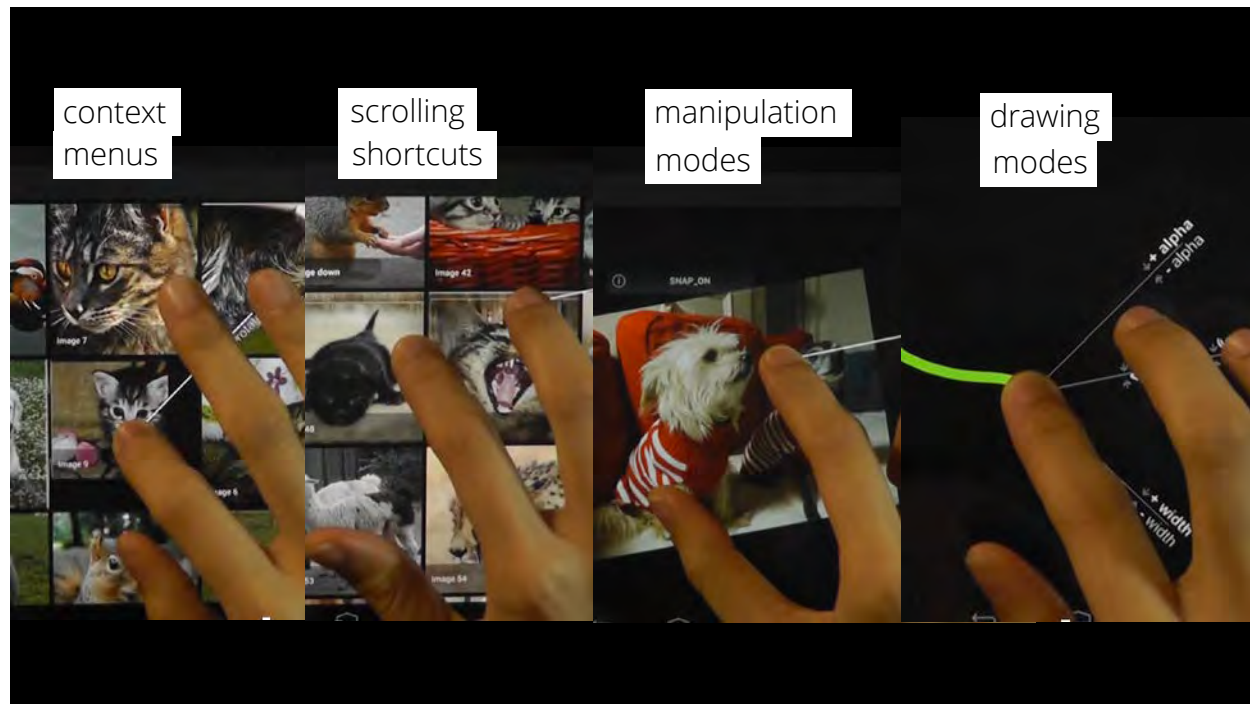


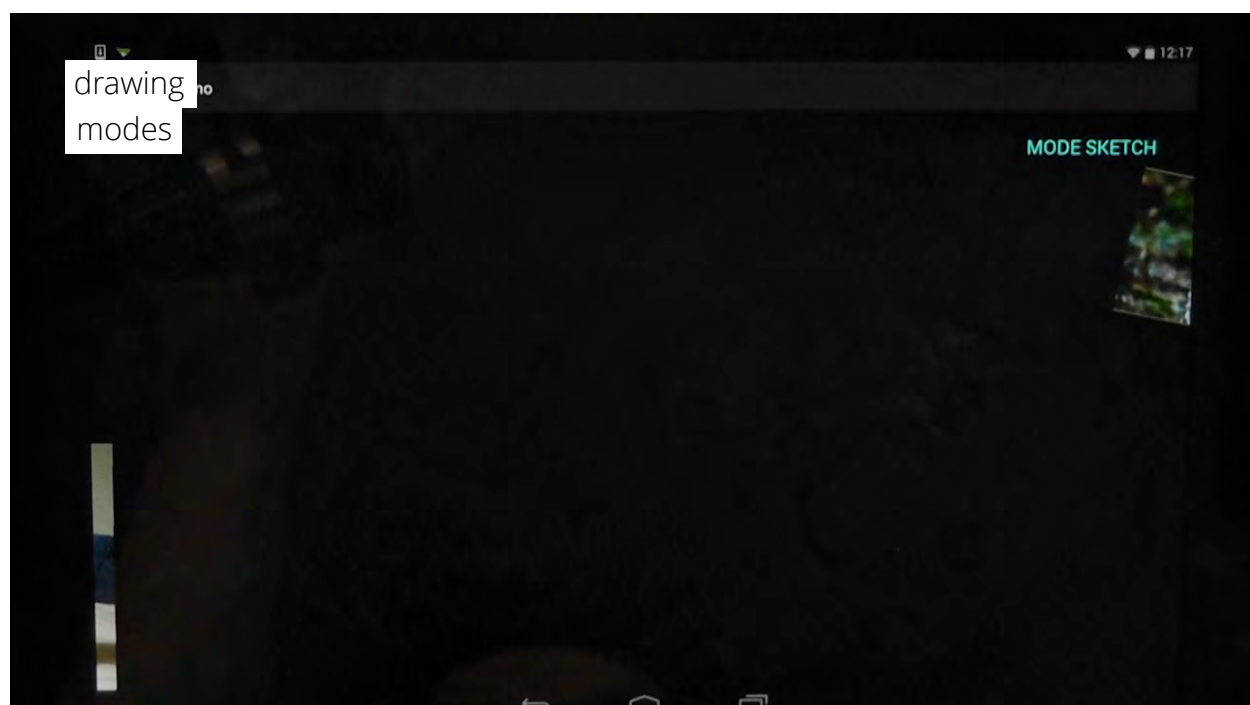


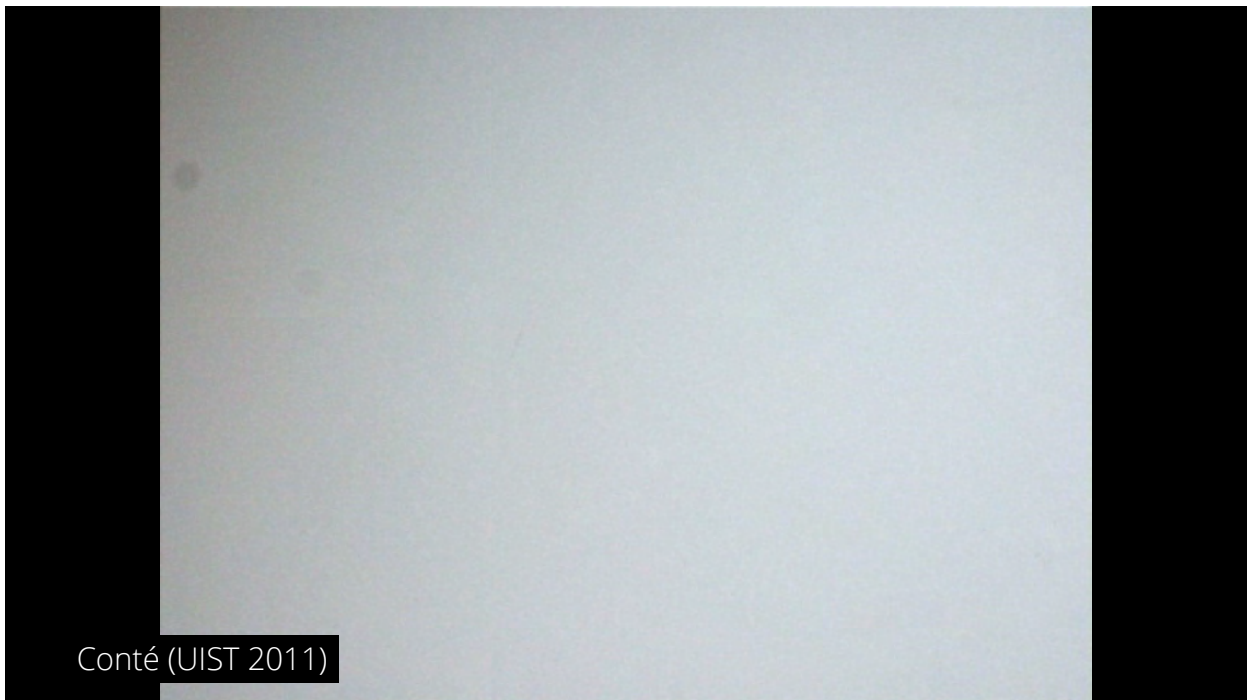
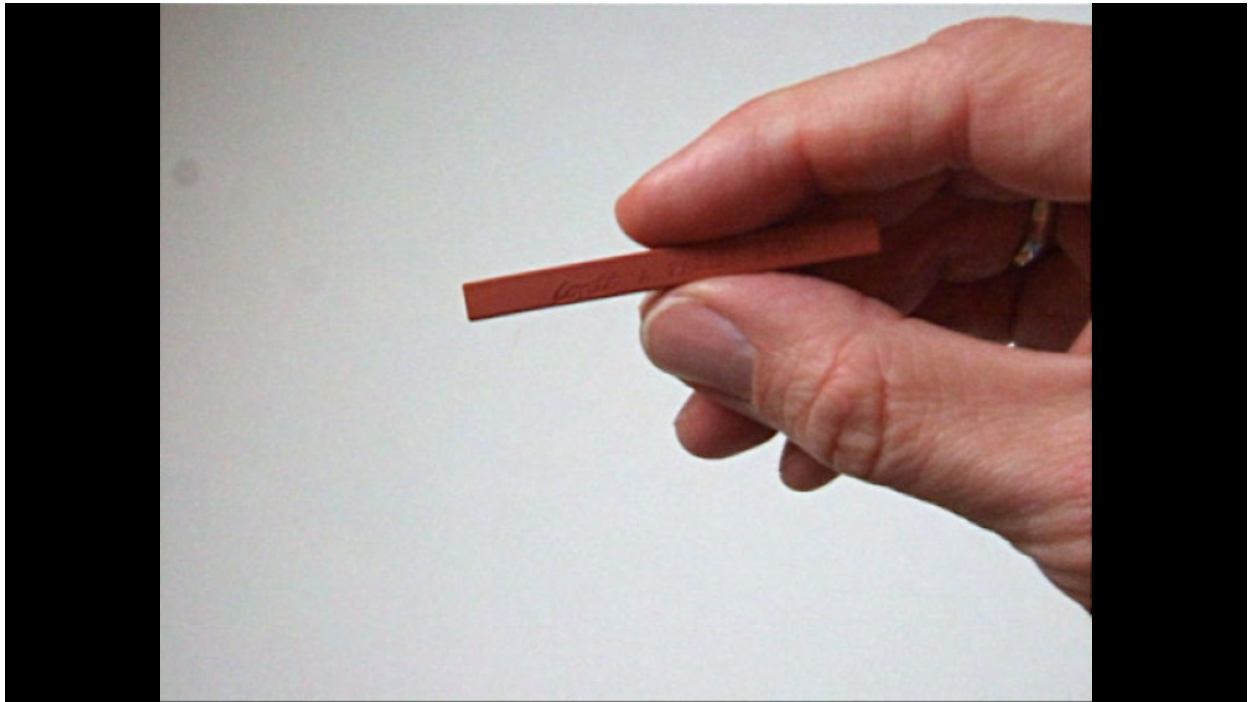
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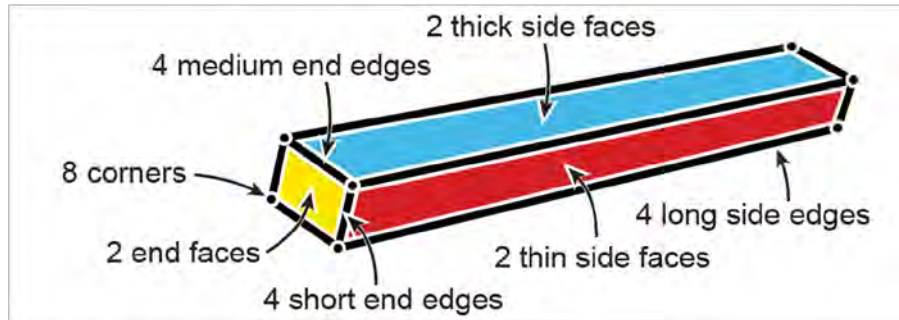


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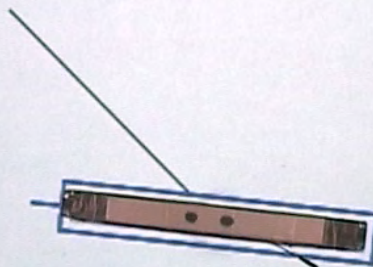


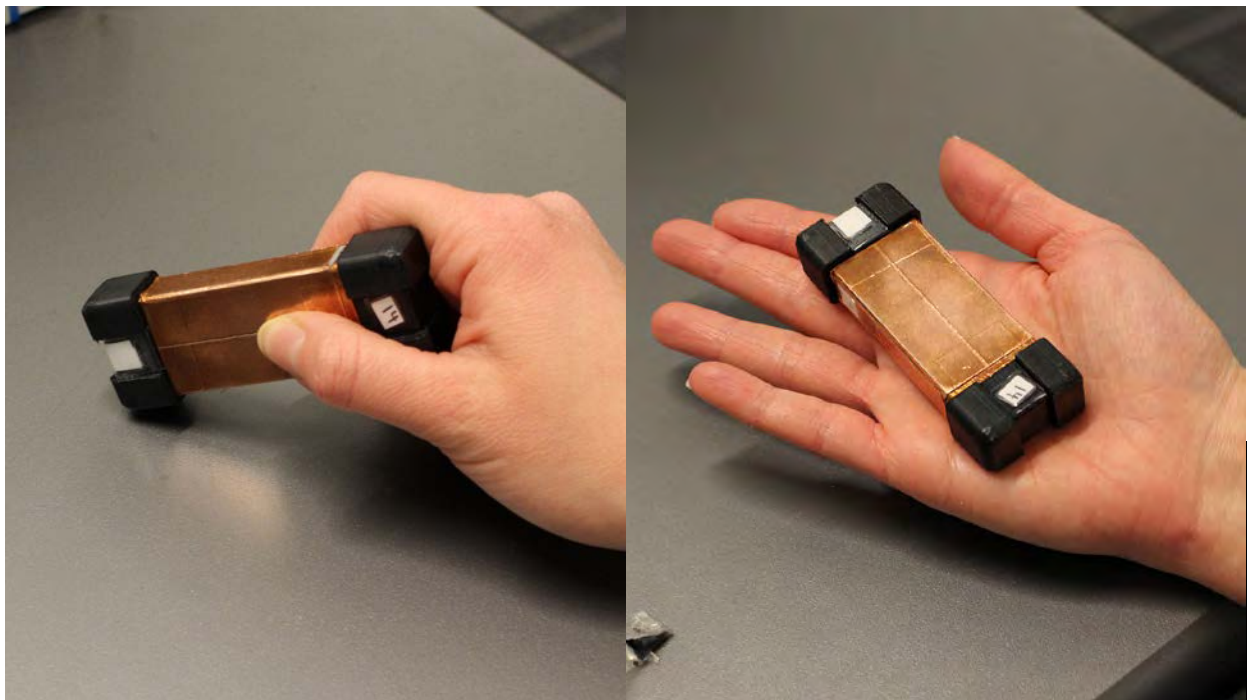






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ThinSide ID:1







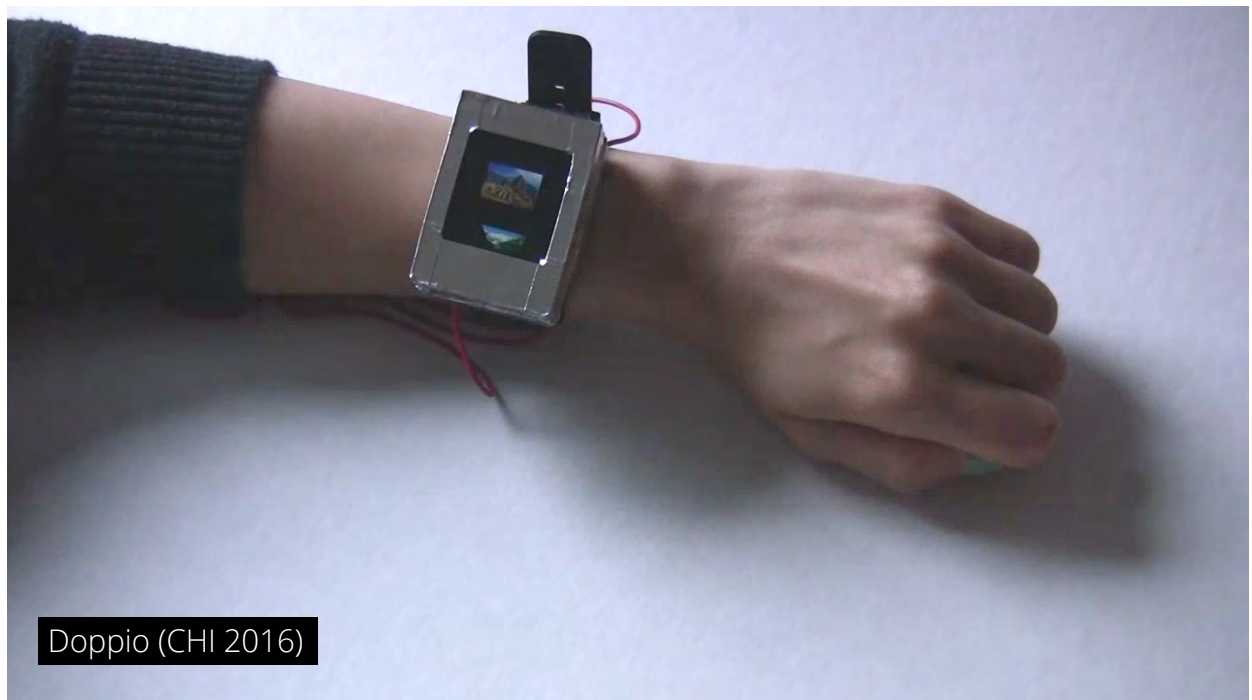
Piaget Altiplano Double Jeu



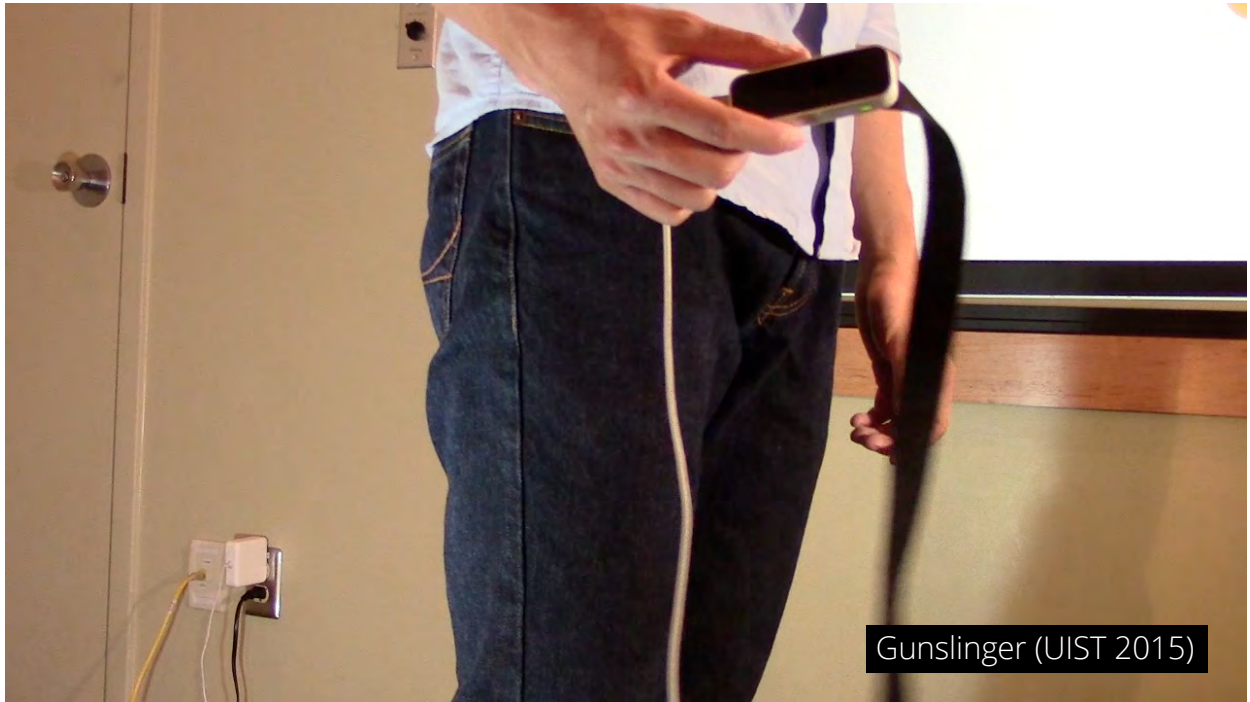
Doppio (CHI 2016)



Doppio (CHI 2016)

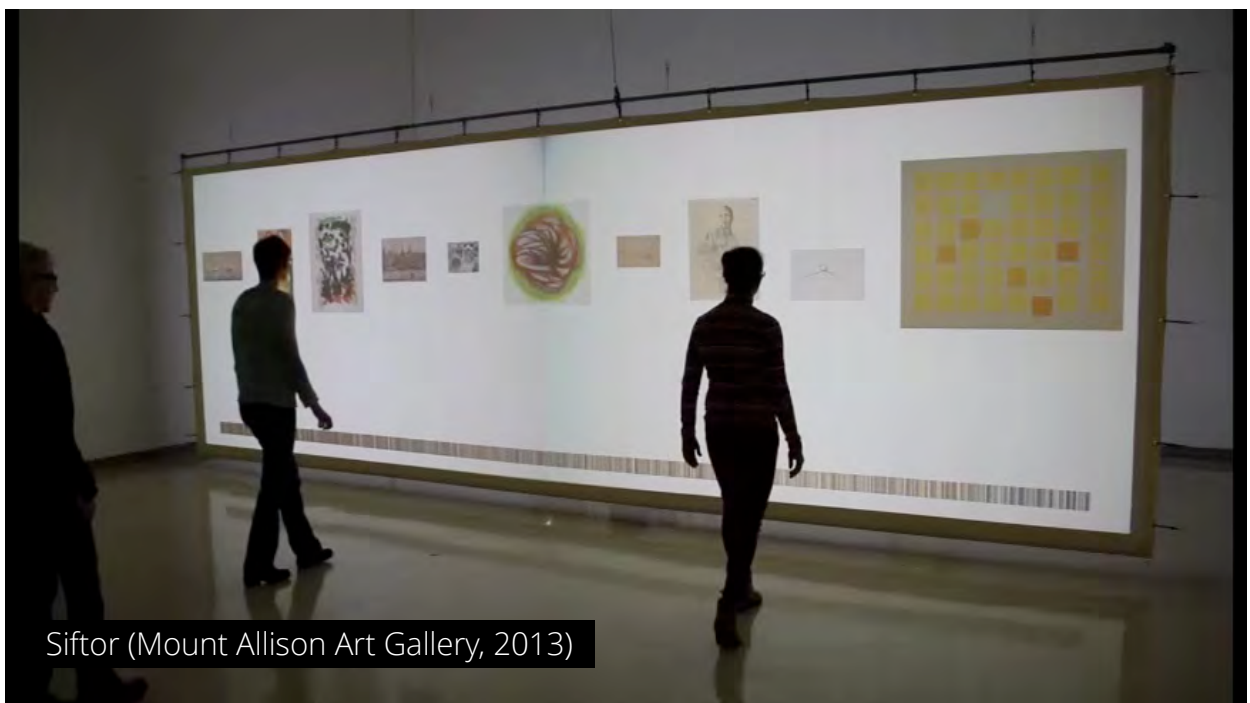
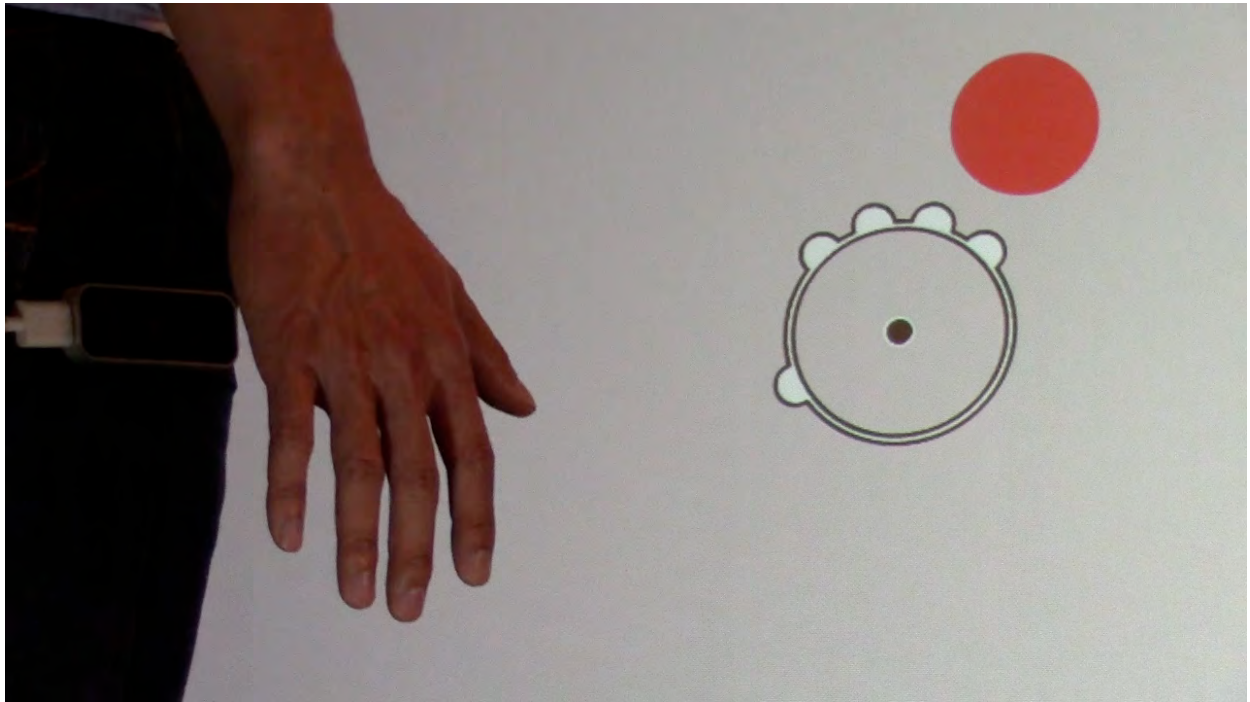


Doppio (CHI 2016)



Gunslinger (UIST 2015)





Siftor (Mount Allison Art Gallery, 2013)

More Information

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www.nonsequitoria.com

Yuxing Luo, Daniel Vogel (2015). **Pin-and-Cross**: A Unimanual Multitouch Technique Combining Static Touches with Crossing Selection. *Proc. of UIST'15, the 28th ACM Symposium on User Interface Software and Technology*. p. 323-324.

Daniel Vogel, Géry Casiez. (2011). **Conté**: Multimodal Input Inspired by an Artist's Crayon. *Proc. of UIST'11, the 24th ACM Symposium on User Interface Software and Technology*. p. 357-366.

Mingyu Liu, Mathieu Nancel, Daniel Vogel (2015). **Gunslinger**: Subtle Arms-down Mid-air Interaction. *Proc. of UIST'15, the 28th ACM Symposium on User Interface Software and Technology*. p. 63-71.

Teddy Seyed, Xing-Dong Yang, Daniel Vogel (2016). **Doppio**: A Reconfigurable Dual-Face Smartwatch for Tangible Interaction. *Proc. of CHI'16, the 34th Conference on Human Factors in Computing Systems*. p. 4675-4686.

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