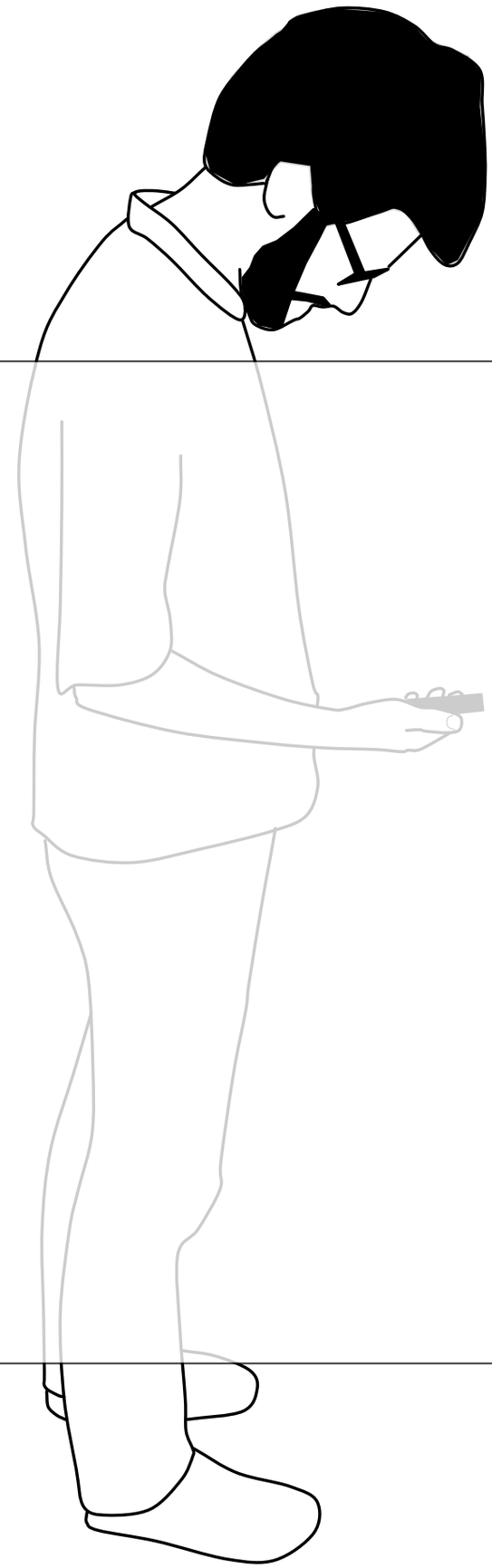
Advertising block

- Open Lab Day MI/MMI: Monday, Dec. 1st, 6pm
  - Amalienstr. 17

- Open Lab Day LRZ: Tuesday, Dec. 16th, 6pm
  - LRZ Garching

- Opening video:
  - https://www.youtube.com/watch?v=oDAw7vW7H0c 10.09.2013
  - http://www.engadget.com/2014/11/07/google-modular-smartphone-project-ara/

Mobile Technologies



context and task

theory

interaction techniques

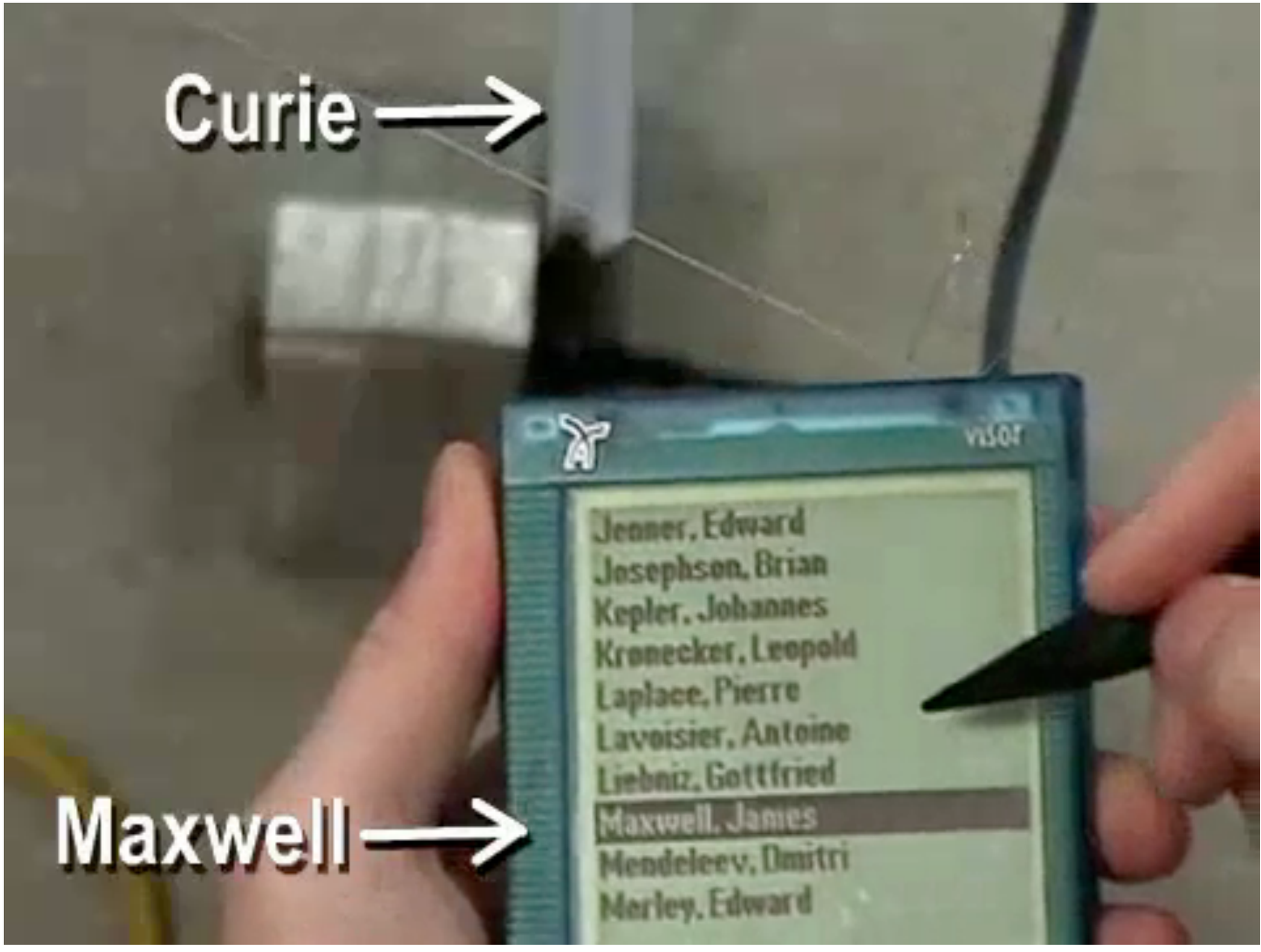
in/output technologies

Dealing with small screens

- imagine a bigger space around the screen
  - peephole displays
  - Halo & Wedge
  - techniques from InfoViz
- imagine different form factors in the future
  - xpaand, Gummi
- use other parts than the screen
  - back-of-device interaction
- imagine the interface entirely ;-)
  - imaginary interfaces

http://www.youtube.com/watch?v=b3tIlGwgTzU
http://staff.www.ltu.se/~qwazi/reading/papers/yee-peep-chi2003-paper.pdf

Peephole displays (Ka-Ping Yee, CHI 2003)



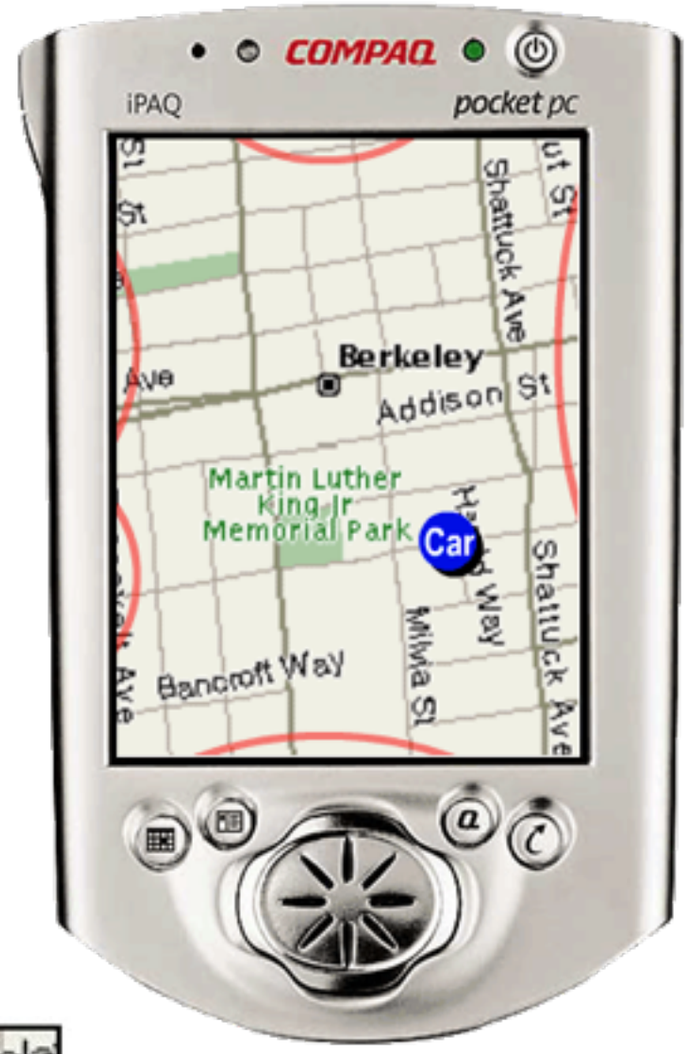
Halo (Baudisch & Rosenholtz, 2003)

Baudisch, Rosenholtz: Halo: A Technique for Visualizing Off-Screen Locations. CHI 2003.

Source: Patrick Baudisch

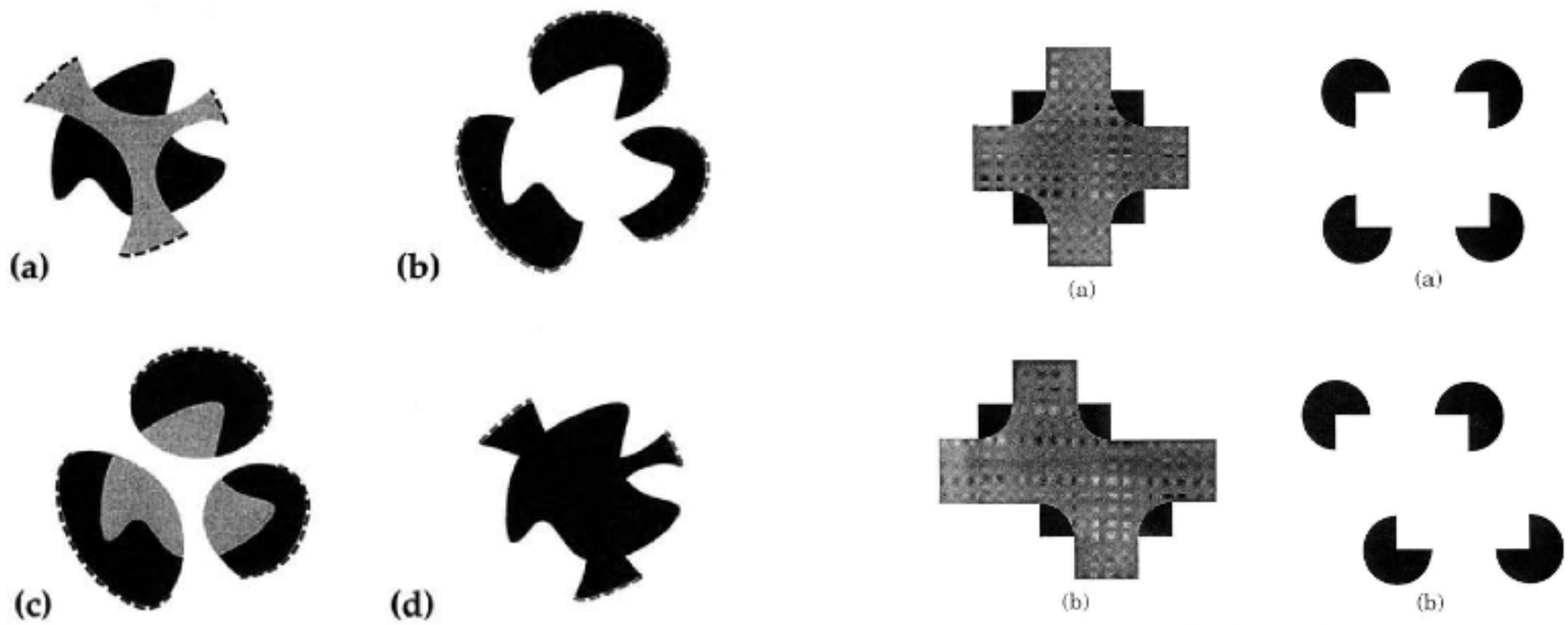
Streetlamp Metaphor

- Aura visible from distance
- Aura is round
- Overlapping auras aggregate
- Fading of aura indicates distance

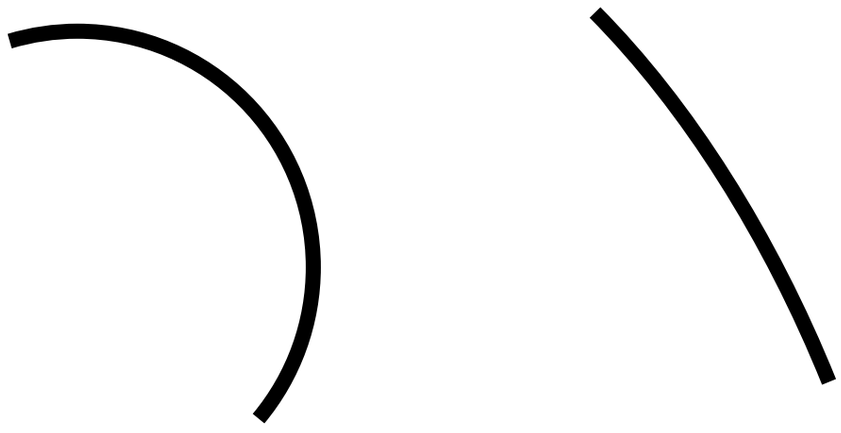


Source: Patrick Baudisch

Gestalt Laws: Perceptual Completion



Shipley and Kellman 1992



Source: Patrick Baudisch

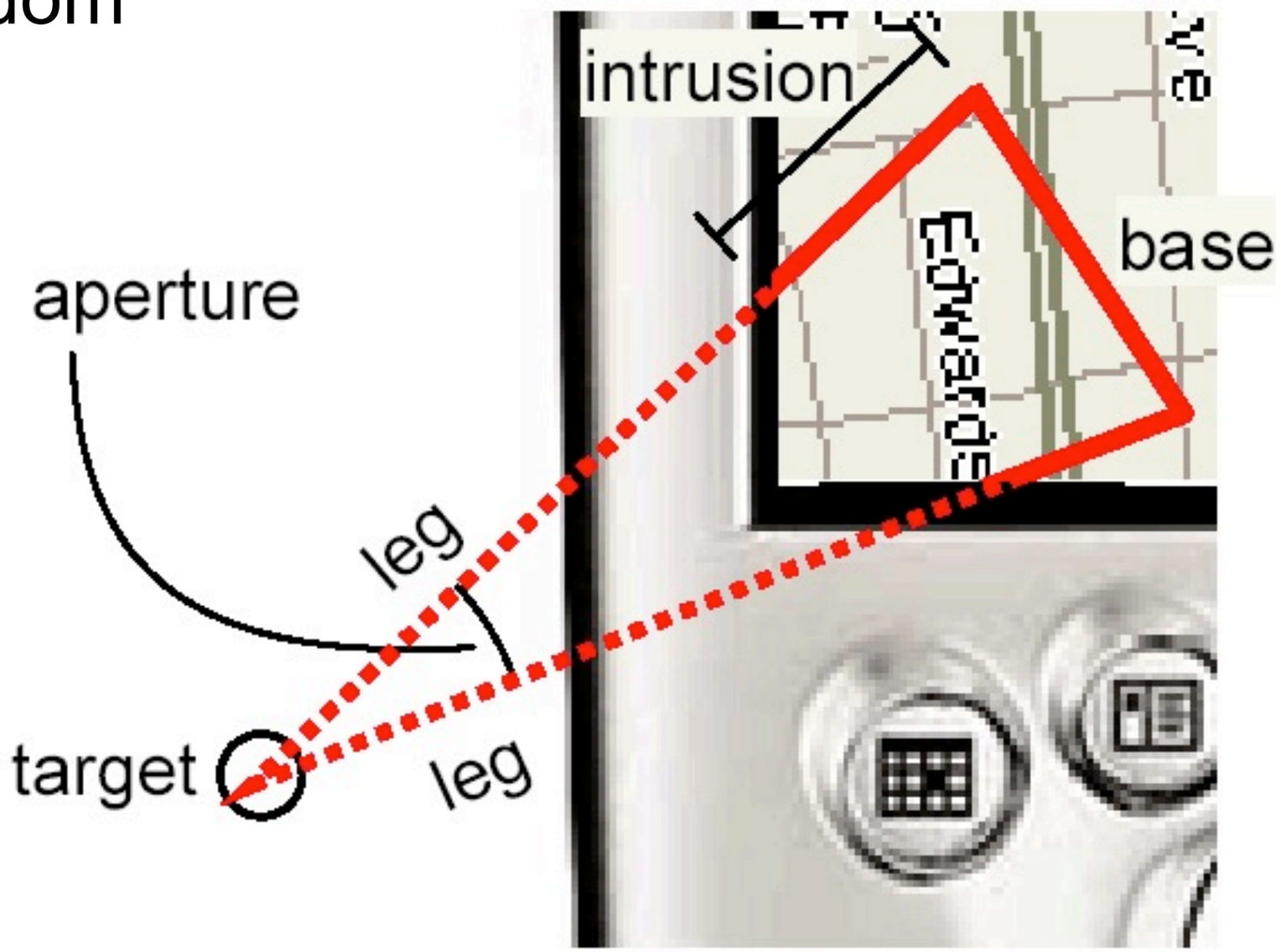
Limitation of Halo: Clutter

- Clutter from overlapping or large number of halos
- Wedge: Isosceles triangles
  - Legs point towards target
  - Rotation, aperture
- No overlap
  - Layout algorithm adapts rotation and aperture

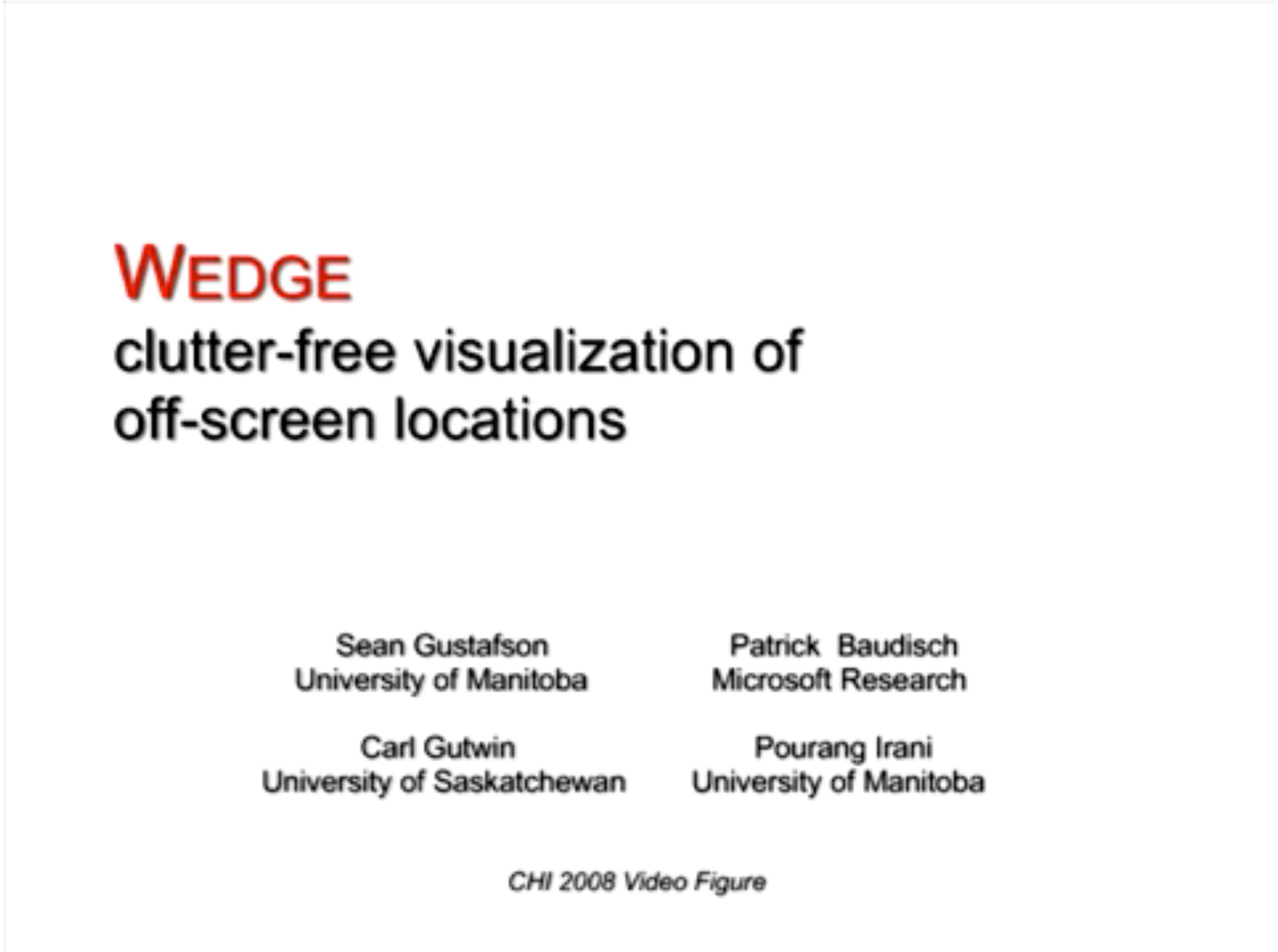
Gustafson, Baudisch, Gutwin, Irani: Wedge: Clutter-Free Visualization of Off-Screen Locations. CHI 2008.

The Wedge

- Degrees of freedom
  - Rotation
  - Intrusion
  - Aperture

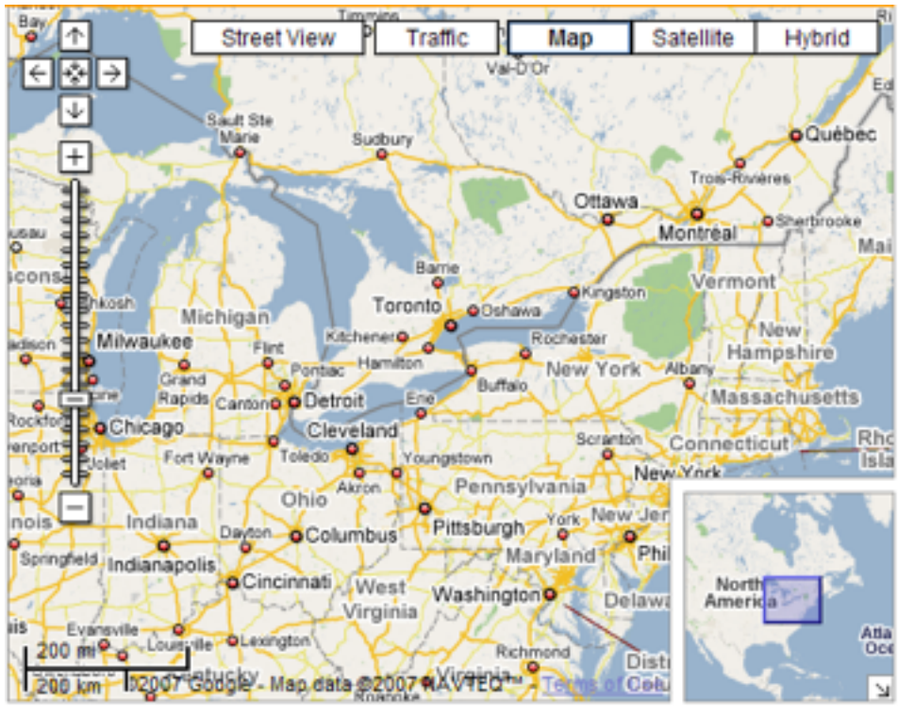


Halo & Wedge: Video

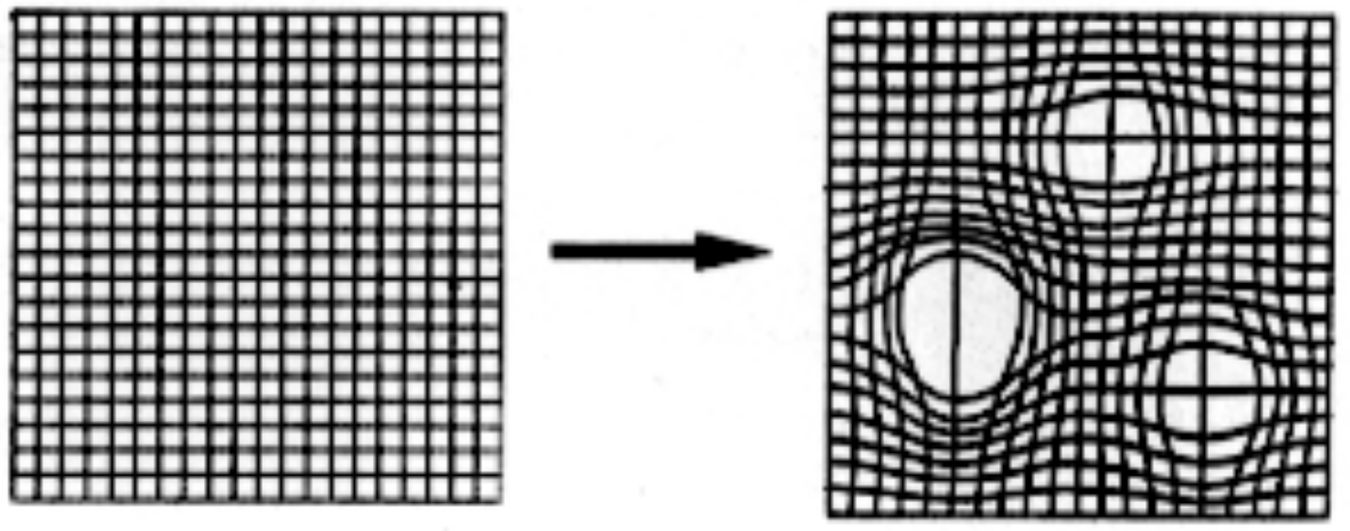


AppLens & LaunchTile

- Using visualization techniques known from InfoViz
  - pan & zoom
  - overview & detail
  - fisheye distortion
- Thereby display more information on a small screen
  - known problem in InfoViz for ages!!



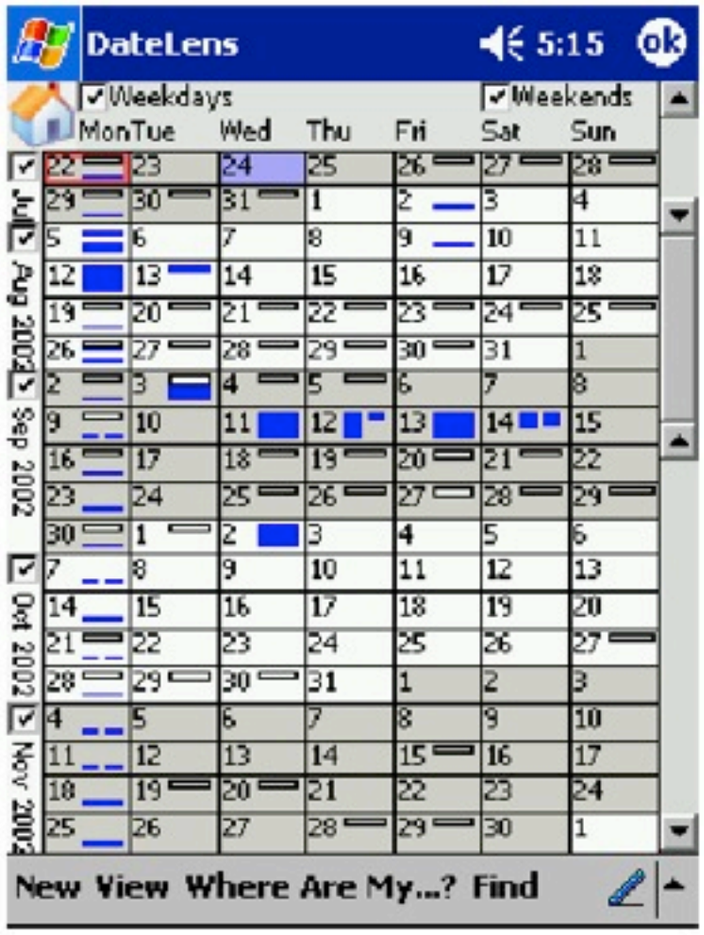
http://www.infovis-wiki.net/images/9/96/Fisheye_grid.gif

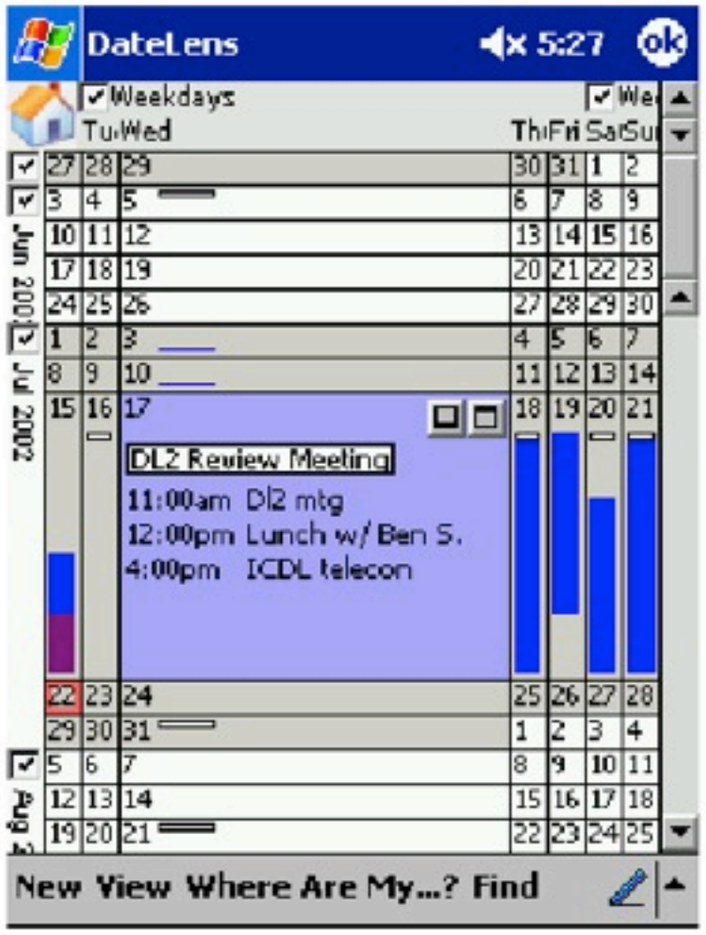


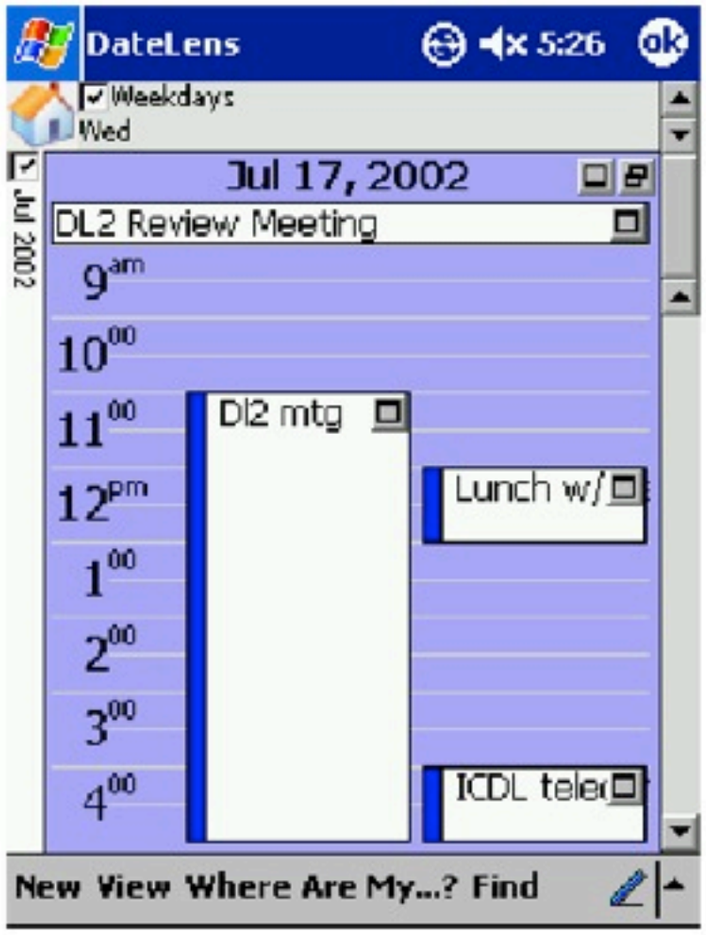
http://quince.infragistics.com/Patterns/857942c9-9397-4007-bae3-5e2364f2489a/rId9.png

Focus + Context: DateLens

- Calendar with fisheye view and semantic zoom
- Integrate context and detail, distortion





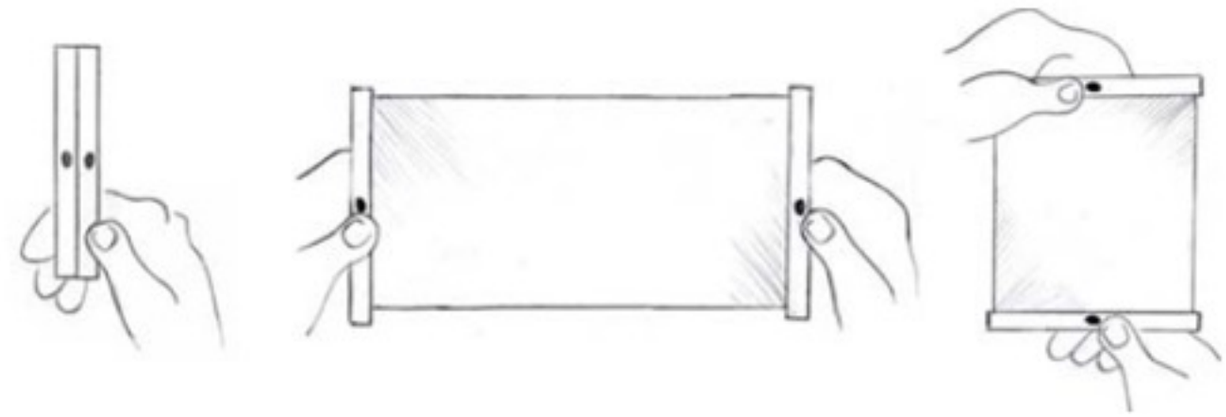


Bederson, Clamage, Czerwinski, Robertson: DateLens: A Fisheye Calendar Interface for PDAs. ACM TOCHI, 2004.

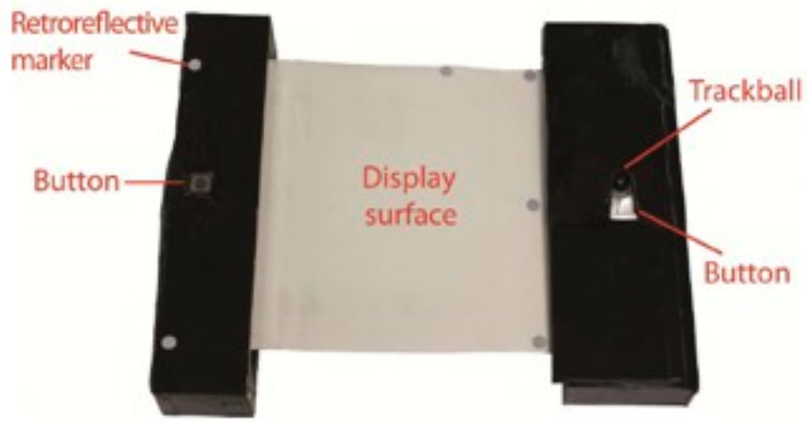
https://www.youtube.com/watch?v=QCaCFCOAb7Q

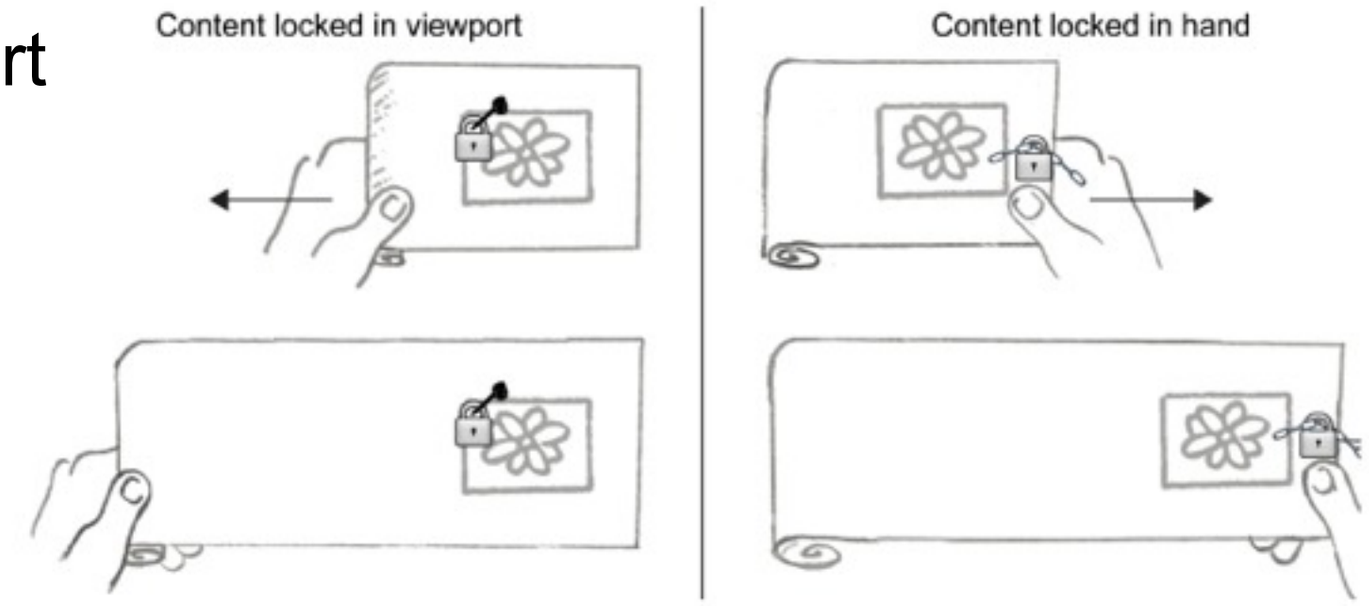
LaunchTile & AppLens (CHI 2005)

Xpaaand: Interaction Techniques for Rollable Displays



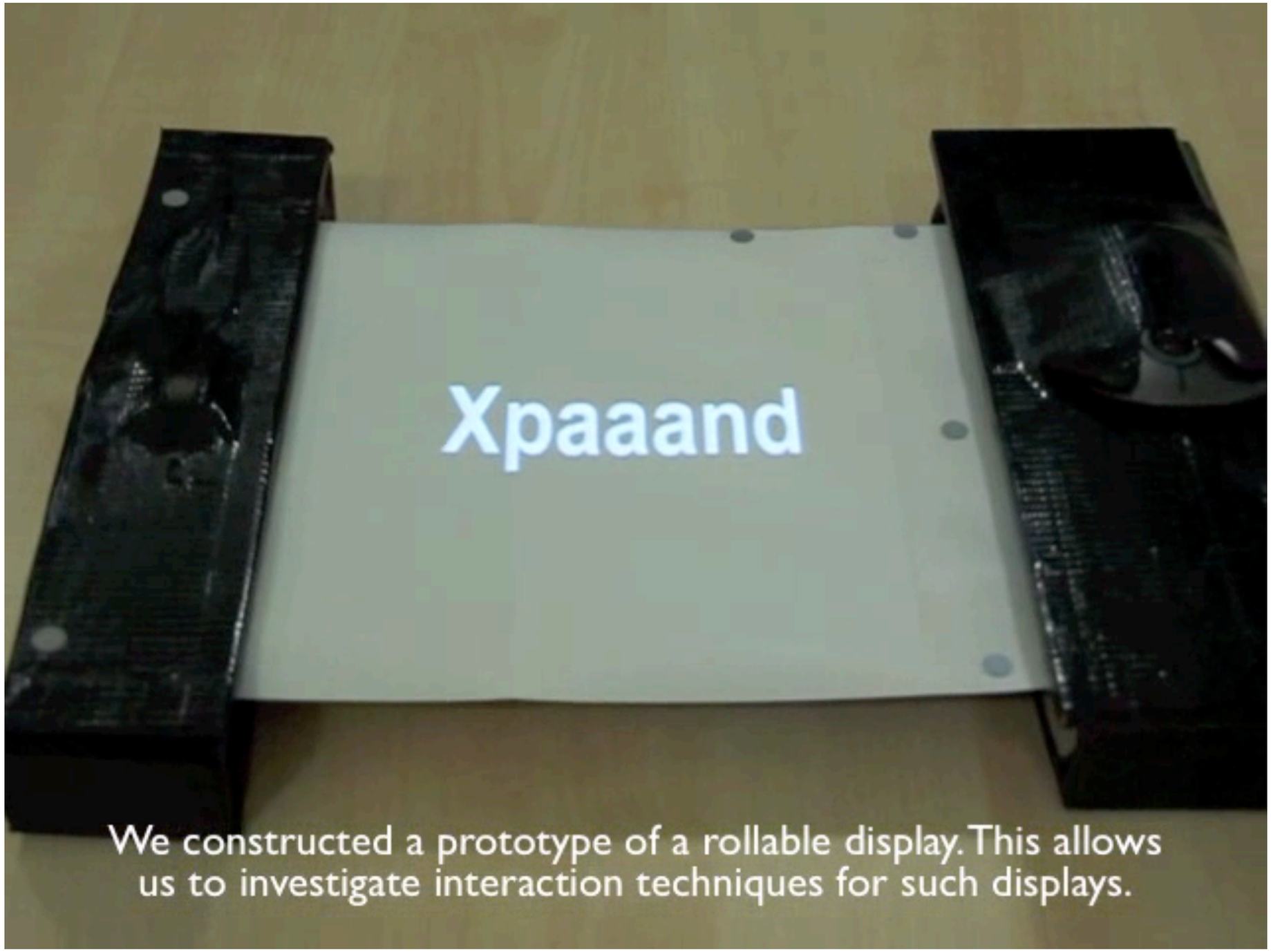
- Concept of a future rollable display
  - Physical resizing of the display as an interaction technique
  - Semantic zooming
- Metaphors
  - Content locked in viewport
  - Content locked in hand





Khalilbeigi, Lissermann, Mühlhäuser, Steimle. Xpaaand: Interaction Techniques for Rollable Displays. CHI 2011.

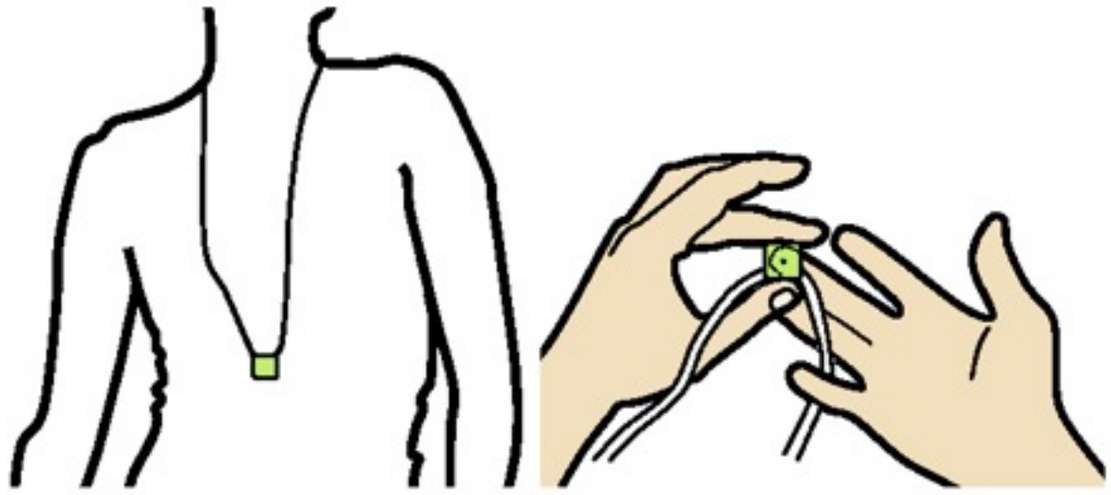
Xpaaand: Interaction Techniques for Rollable Displays



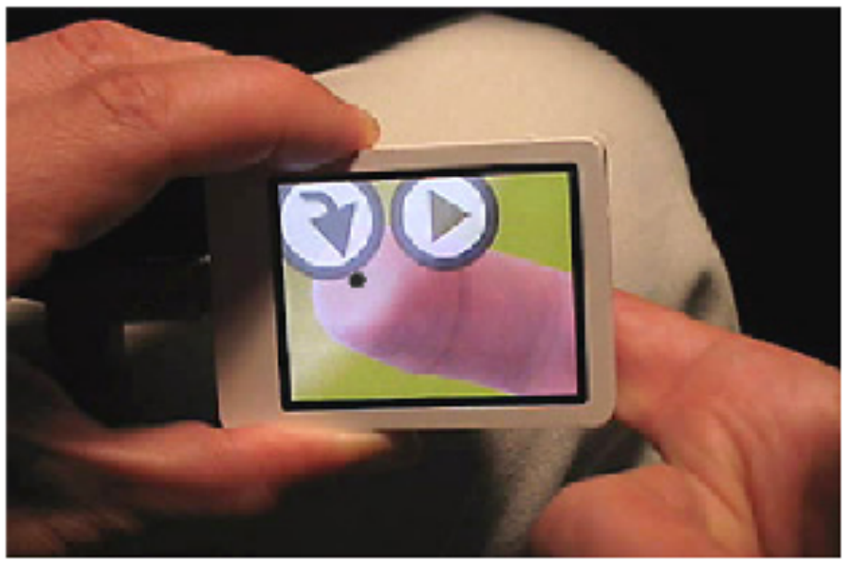
Khalilbeigi, Lissermann, Mühlhäuser, Steimle. Xpaaand: Interaction Techniques for Rollable Displays. CHI 2011.

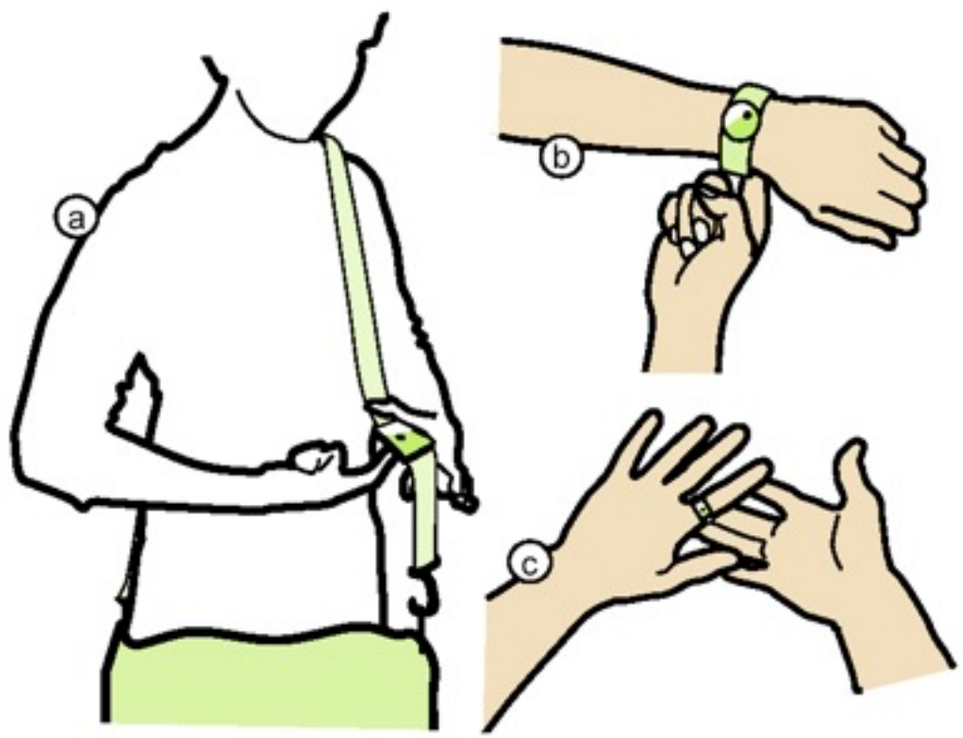
Back-of-Device Interaction Works for Very Small Screens

- Jewelry, watches, etc.



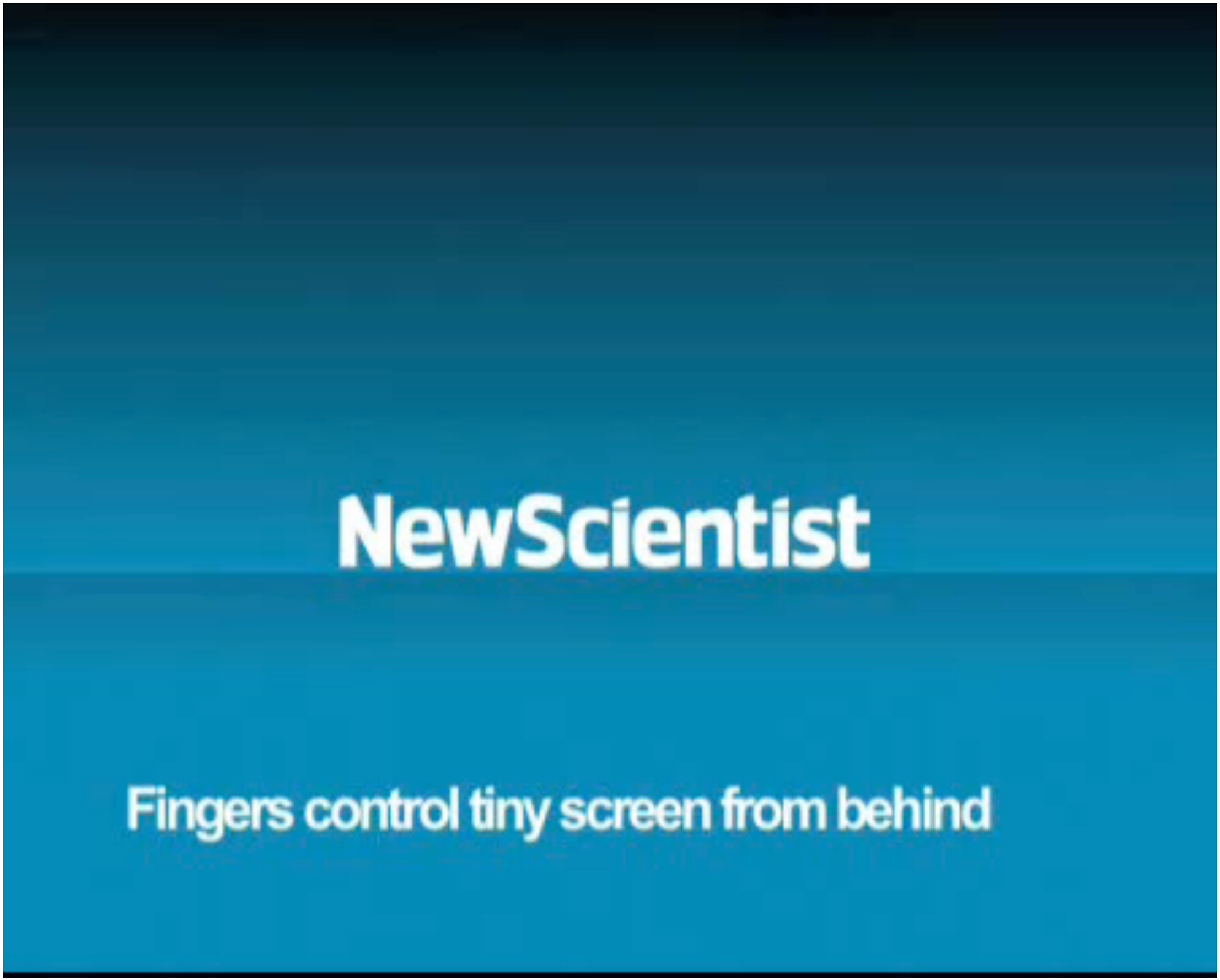
- Pseudo transparency
  - Capacitive touch pad
  - Clickable touch pad



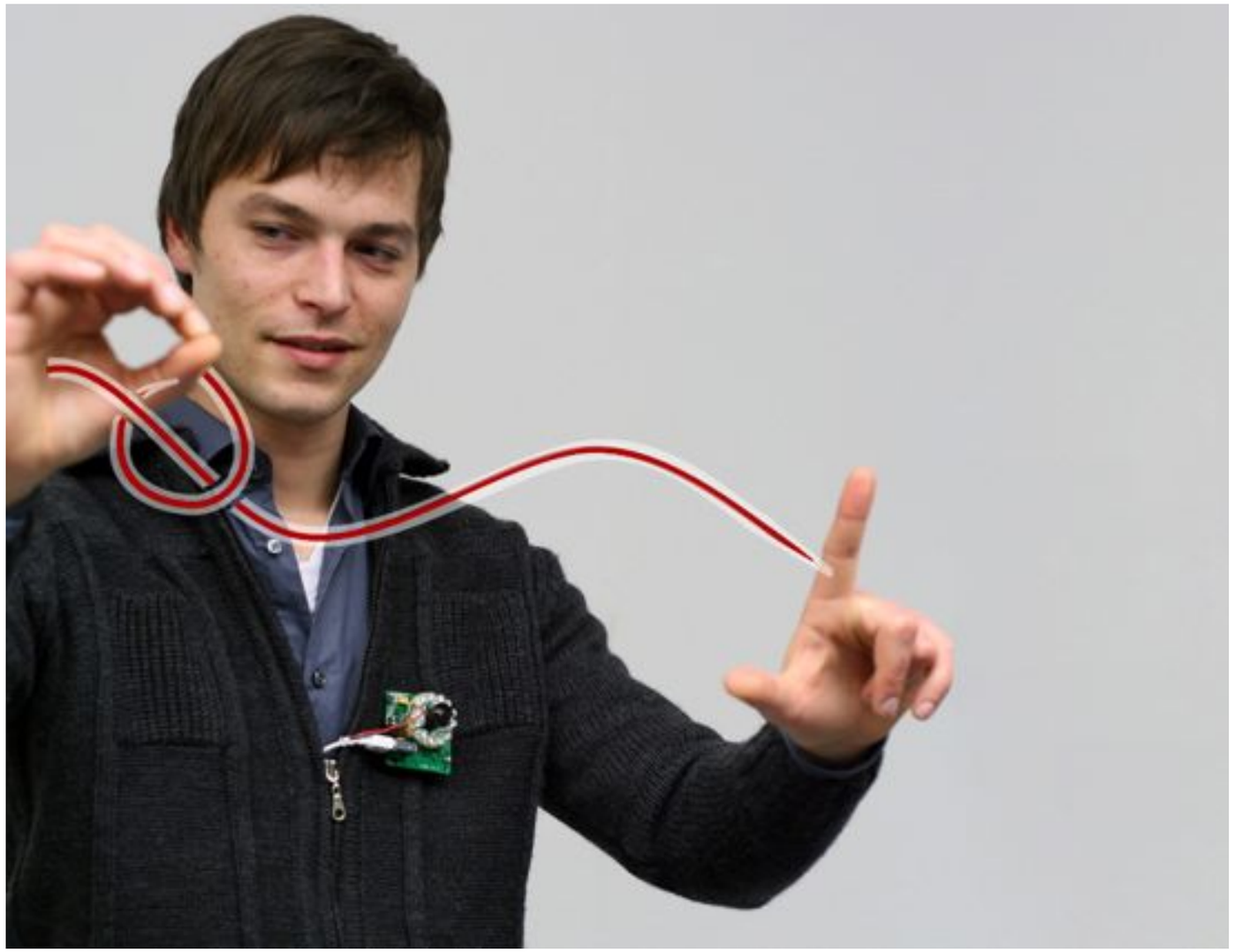


Baudisch, Chi. Back-of-Device Interaction Allows Creating Very Small Touch Devices. CHI 2009.

http://www.youtube.com/watch?v=4xfgZy2B5ro



Imaginary interfaces



- Get rid of the screen altogether
- imagine a large area for interaction
- interpret gestures to act on it

- Sean Gustafson, Daniel Bierwirth and Patrick Baudisch. 2010. Imaginary Interfaces: Spatial Interaction with Empty Hands and Without Visual Feedback. In *Proceedings of the Symposium on User Interface Software and Technology (UIST '10)*, 3-12.
- http://www.hpi.uni-potsdam.de/baudisch/projects/imaginary_interfaces.html https://www.youtube.com/watch?v=718RDJeISNA

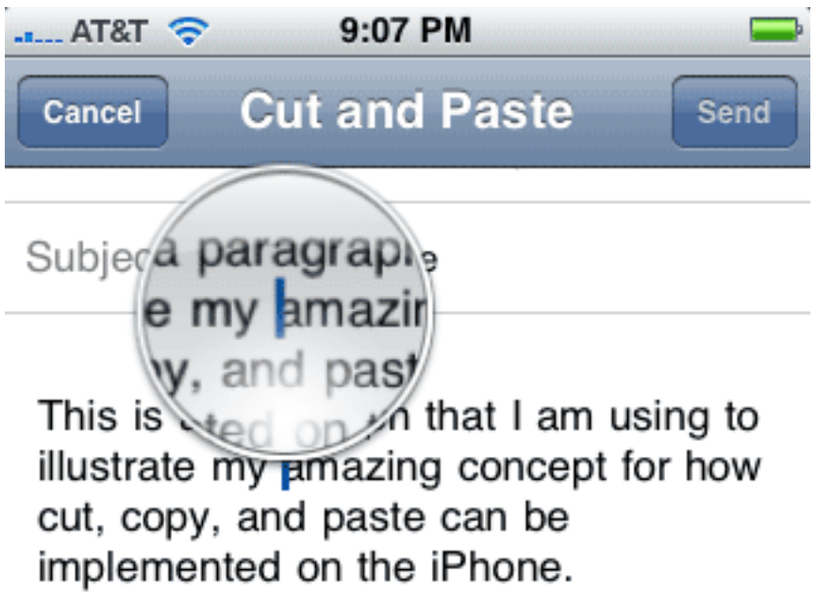
Imaginary Interfaces

Dealing with imprecise touch

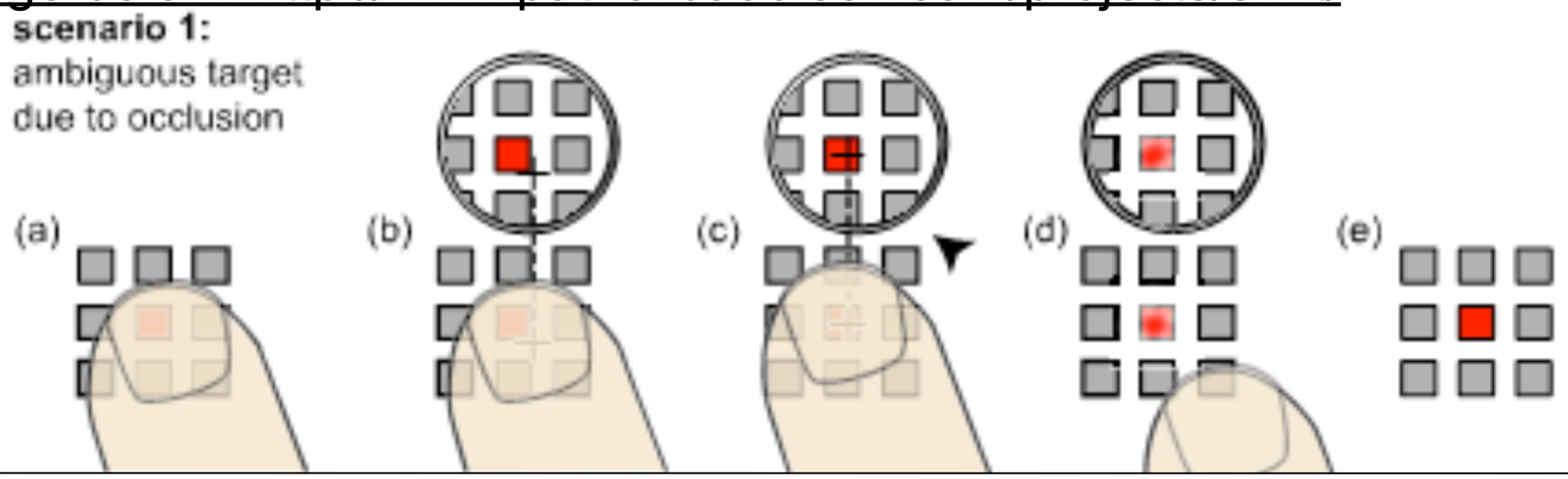
- Precision input techniques
  - Offset Cursor / Shift
  - Tap Tap / MagStick

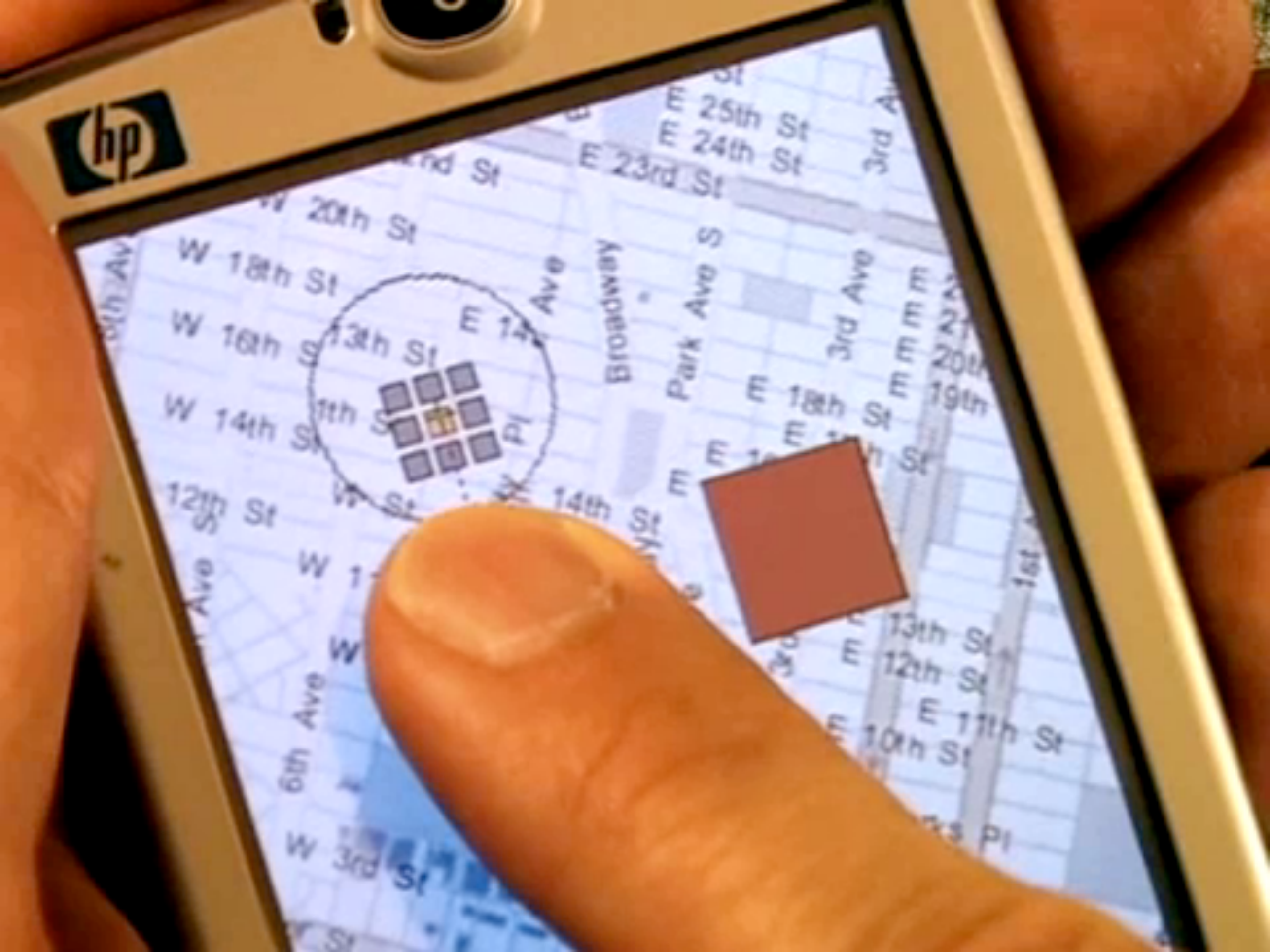
Offset Cursor & Shift

- Problem: fat finger occludes small target
- Idea: enlarge the area under the finger and display it next to the finger
- Currently used e.g. in iOS
- Problems??



next slide: https://www.youtube.com/watch?v=kkoFIDArYks
image left: http://www.ironicsans.com/images/cutpaste02.png
image below: http://www.patrickbaudisch.com/projects/shift/




E 25th St
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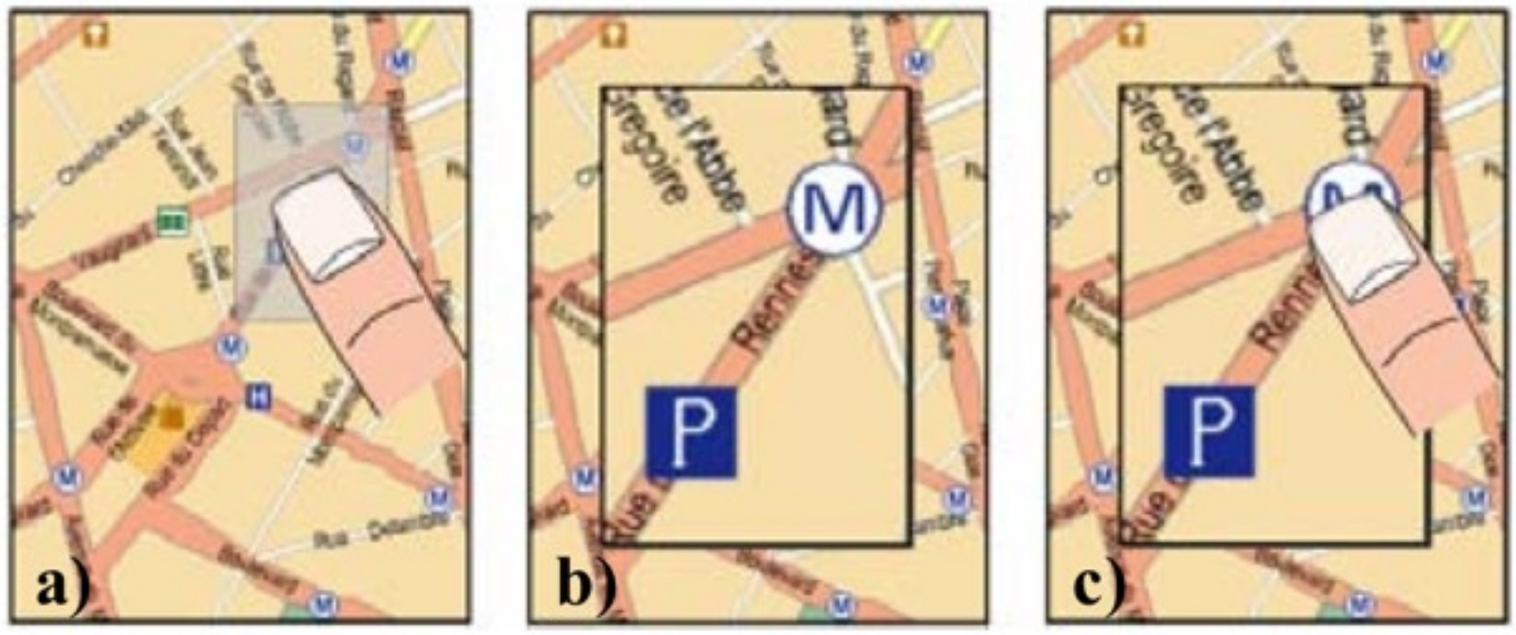
Park Ave S
3rd Ave
E 18th St
E 13th St
E 12th St
E 11th St
E 10th St
6th Ave
Ave
Pl

Precision Touch Input: TapTap and MagStick

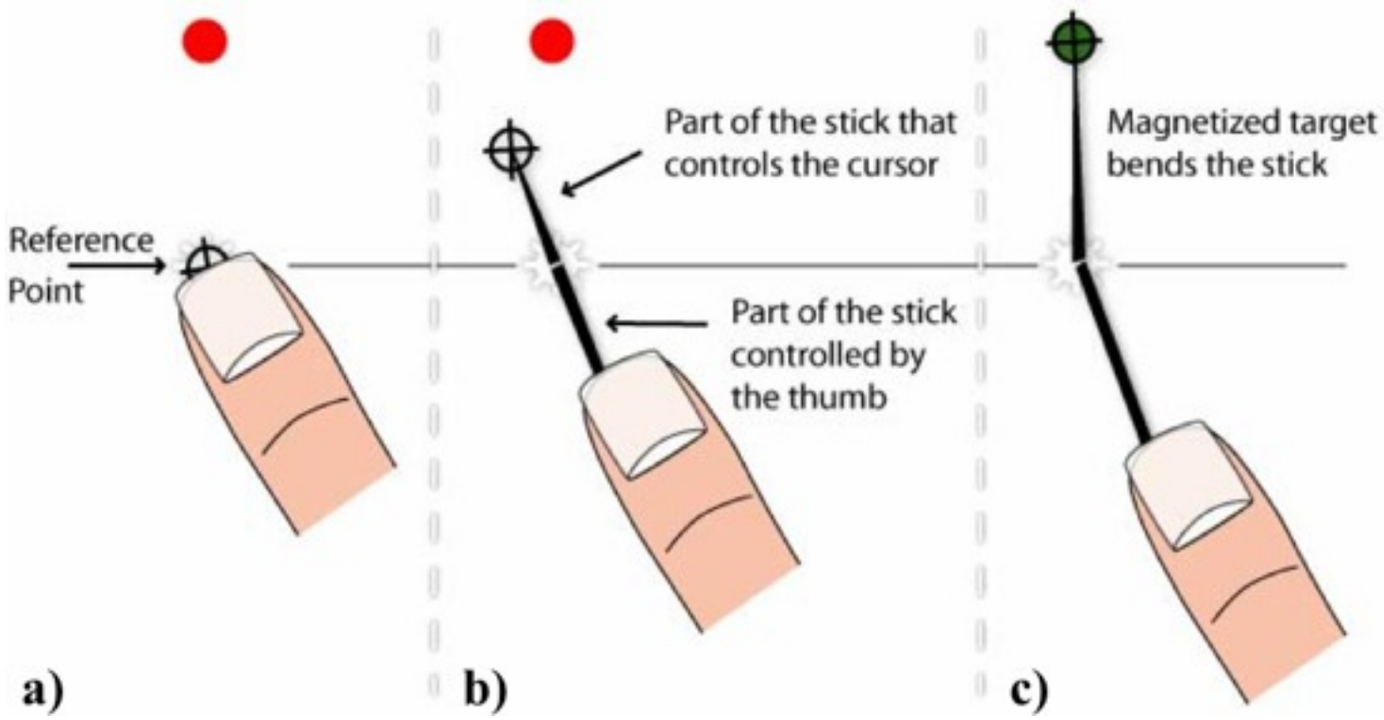
- TapTap: Tapping the screen twice
  - tap 1: select area of interest
  - area zooms in, centered on screen
  - tap 2: select magnified target
  - zoomed target typically close to finger: fast selection
  - works in border areas (cf. Shift)



Roudaut, Huot, Lecolinet. TapTap and MagStick: Improving one-handed target acquisition on small touch-screens. AVI 2008.

Precision Touch Input: TapTap and MagStick

- MagStick: “magnetized telescopic stick”
  - Initial touch position is reference point
  - Moving away from target extends stick in opposite direction
  - End of stick is “magnetically” attracted by target



Is moving away from the target intuitive?

Is MagStick better than simple Offset Cursor?

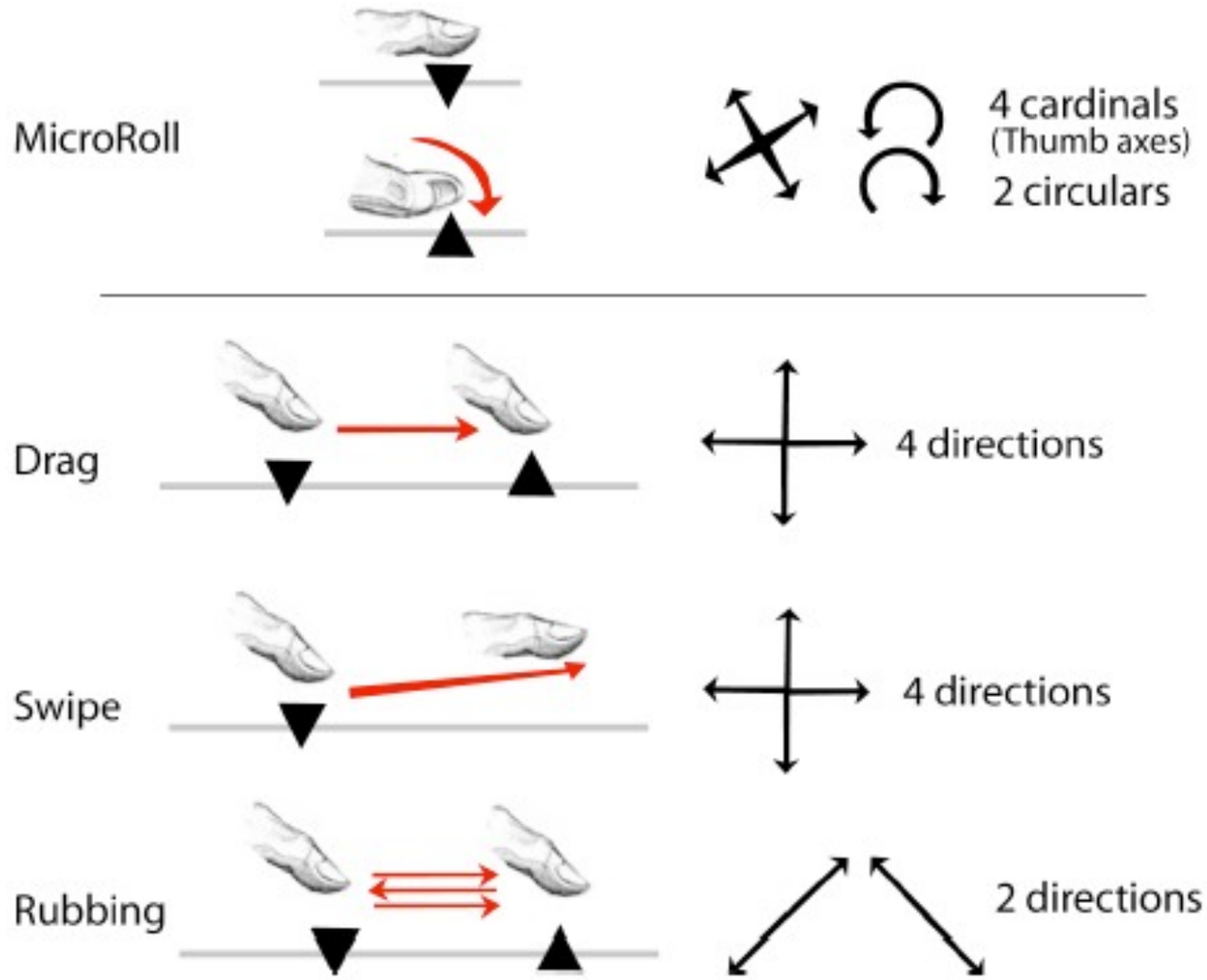
Roudaut, Huot, Lecolinet. TapTap and MagStick: Improving one-handed target acquisition on small touch-screens. AVI 2008.

Touch input as Gestures

- PrecisionRolls
- BezelSwipe

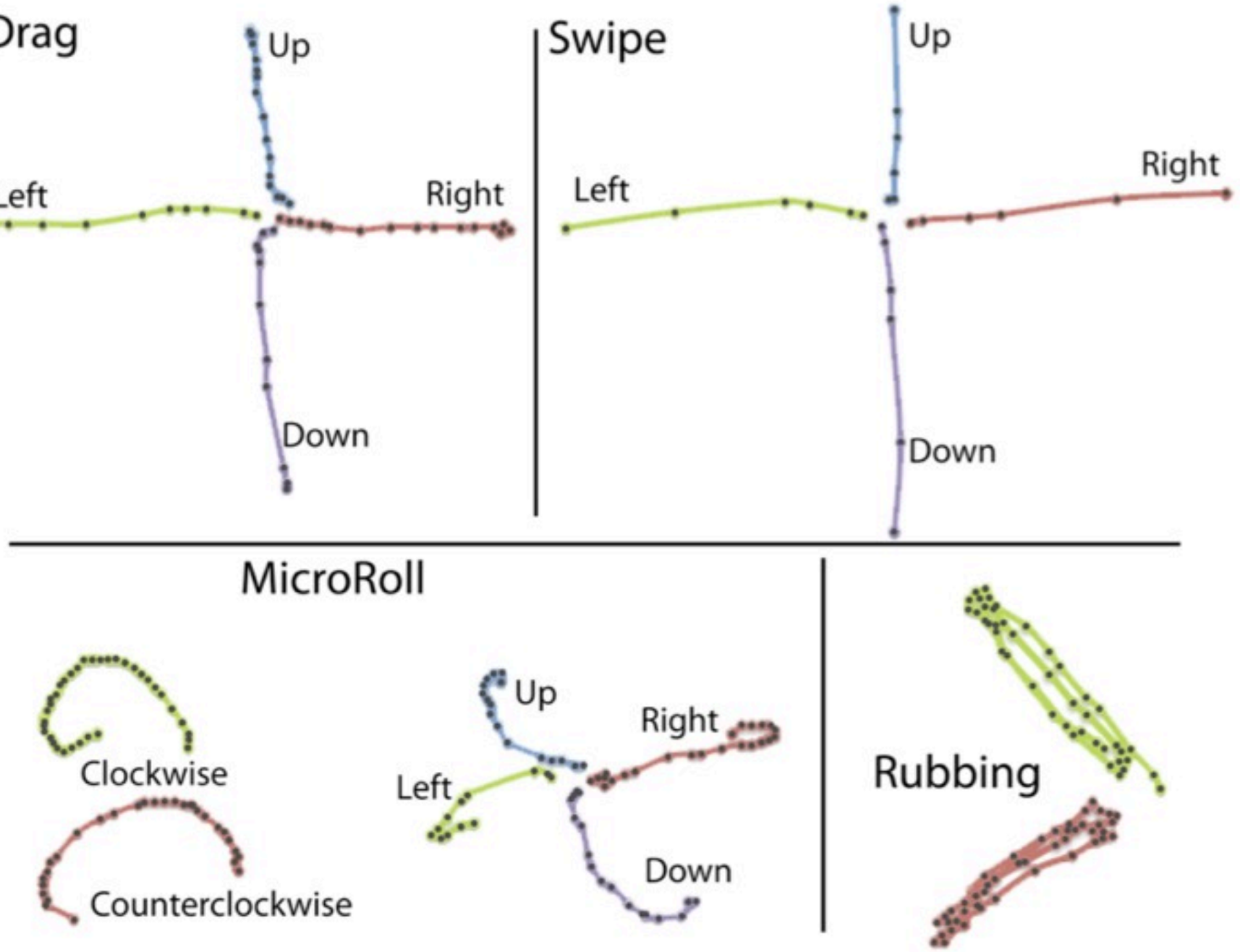
MicroRolls: Expanding Touch-Screen Input by Distinguishing Rolls vs. Slides of the Thumb

- Input vocabulary for touchscreens is limited
- MicroRolls: thumb rolls without sliding
  - Roll vs. slide distinction possible
  - No interference
- Enhanced input vocabulary
  - Drags, Swipes, Rubbings and MicroRolls



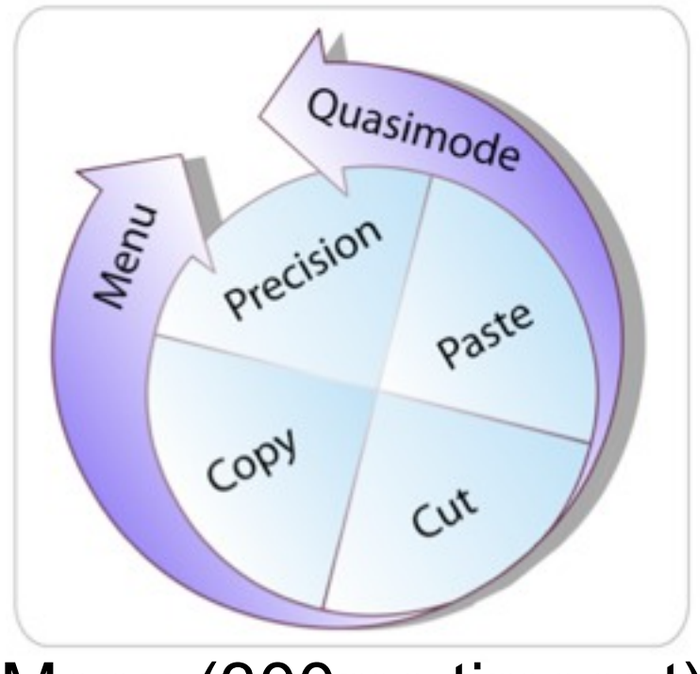
Roudaut, Lecolinet, Guiard. MicroRolls: Expanding Touch-Screen Input Vocabulary by Distinguishing Rolls vs. Slides of the Thumb. CHI 2009.

Kinematic Traces of Different Touch Gestures

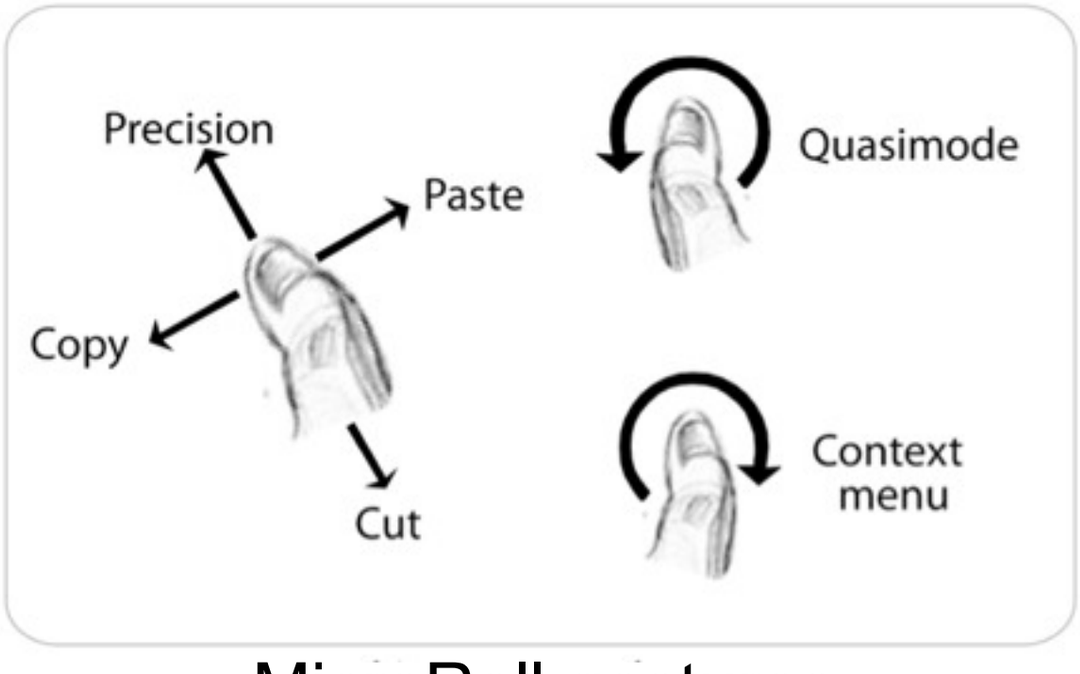


Roudaut, Lecolinet, Guiard. MicroRolls: Expanding Touch-Screen Input Vocabulary by Distinguishing Rolls vs. Slides of the Thumb. CHI 2009.

Mapping MicroRoll Gestures to Actions



Menu (300ms timeout)

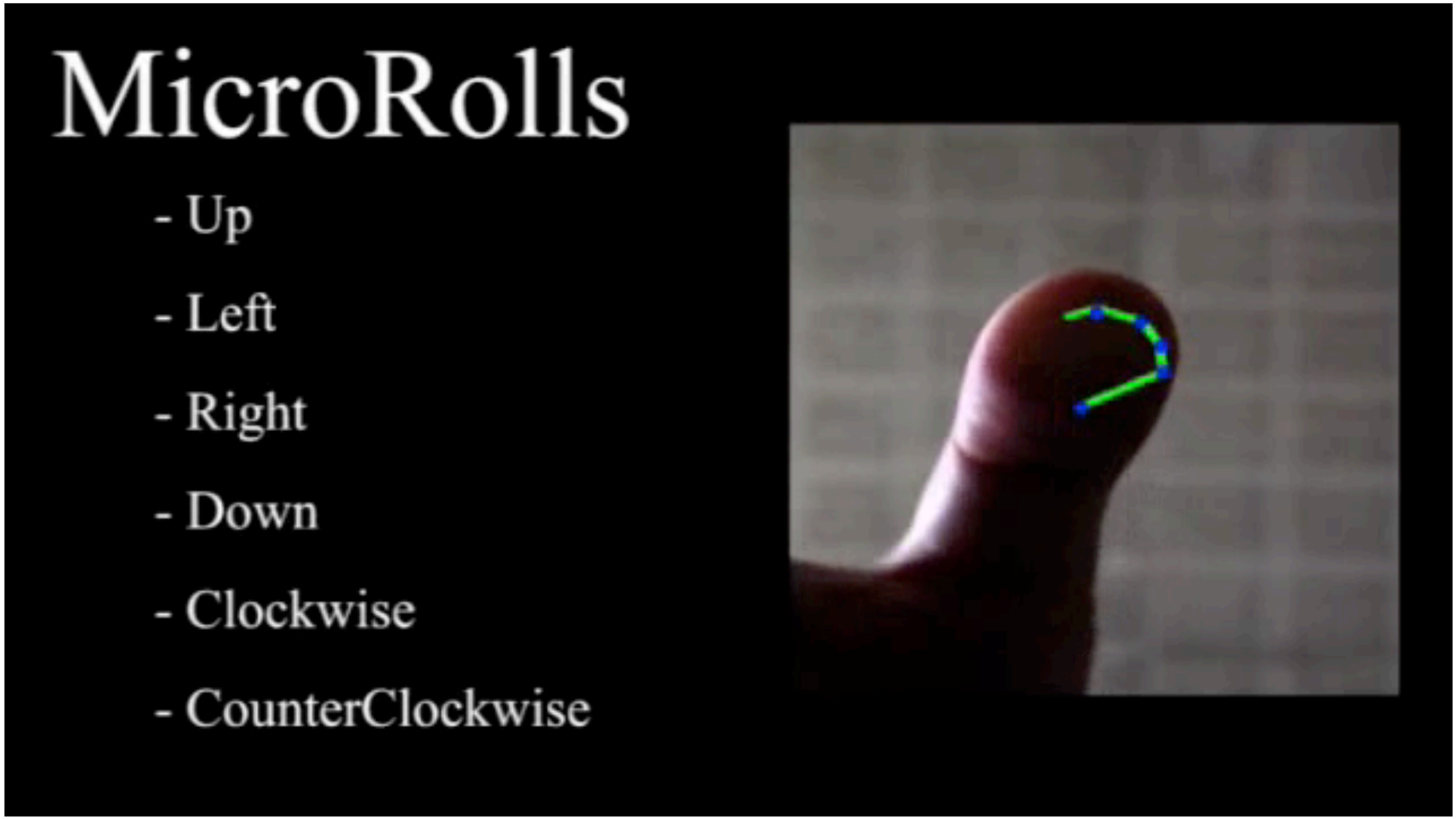


MicroRoll gestures

- Menu supports gesture learning
  - Menu only appears after 300ms timeout
  - Experts execute gestures immediately
- Precision: selecting small targets
- Quasi-mode: modify subsequent operation

Roudaut, Lecolinet, Guiard. MicroRolls: Expanding Touch-Screen Input Vocabulary by Distinguishing Rolls vs. Slides of the Thumb. CHI 2009.

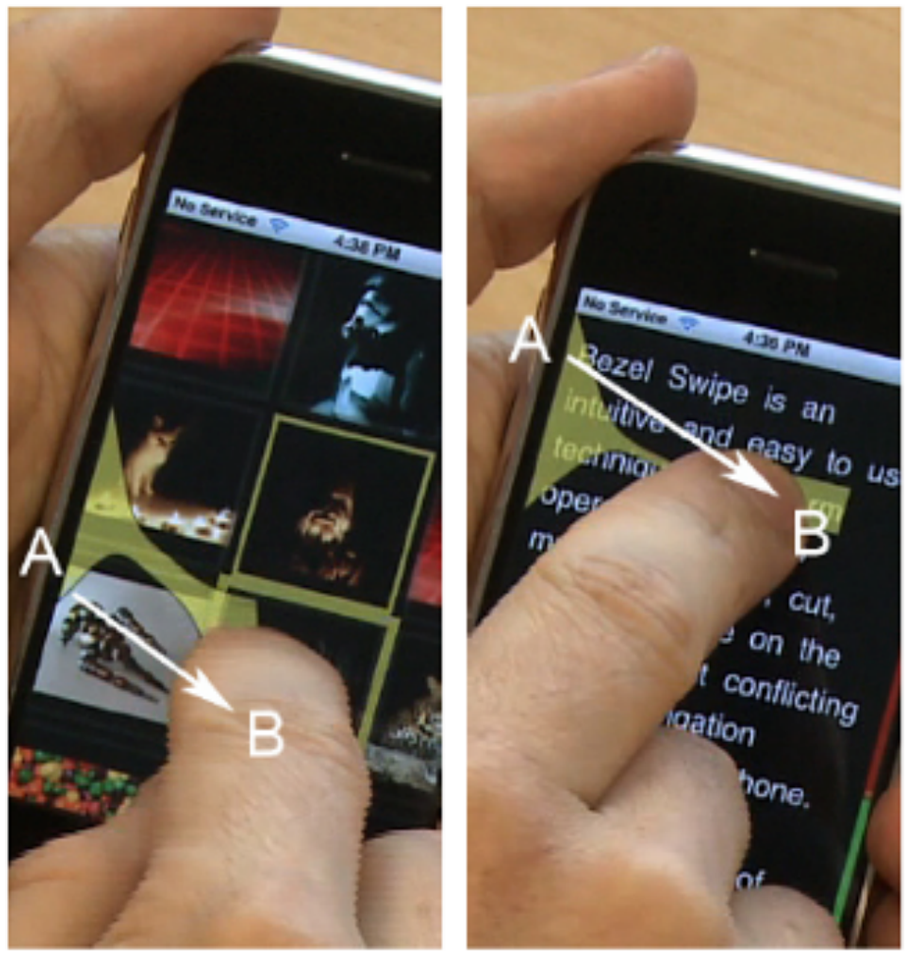
MicroRolls: Expanding Touch-Screen Input by Distinguishing Rolls vs. Slides of the Thumb

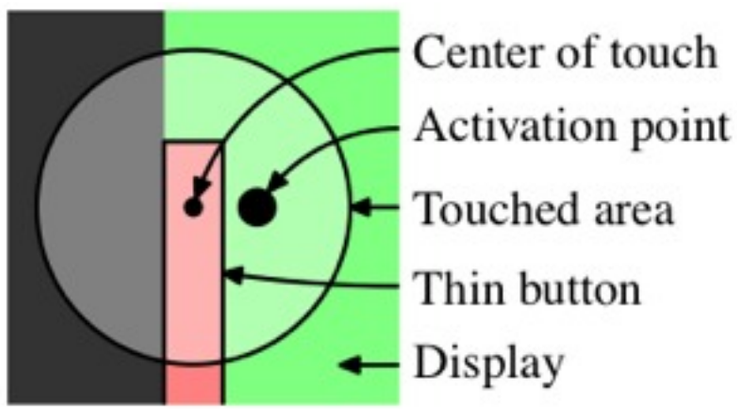


Roudaut, Lecolinet, Guiard. MicroRolls: Expanding Touch-Screen Input Vocabulary by Distinguishing Rolls vs. Slides of the Thumb. CHI 2009.

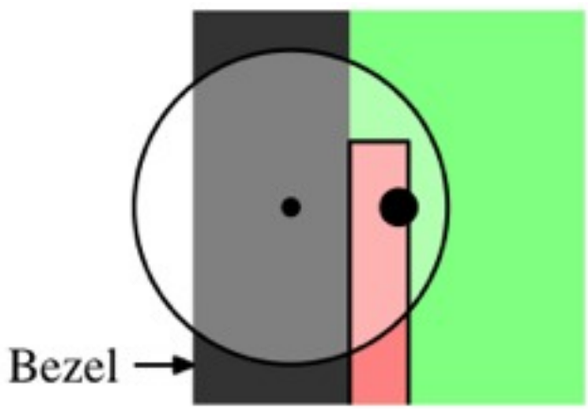
Bezel Swipe: Conflict-Free Scrolling and Selection on Mobile Touch Screen Devices

- Drag from screen edges through thin bars
- Edge bar encodes command
- Multiple commands without interference
  - Selection, cut, copy, paste
  - Zooming, panning, tapping





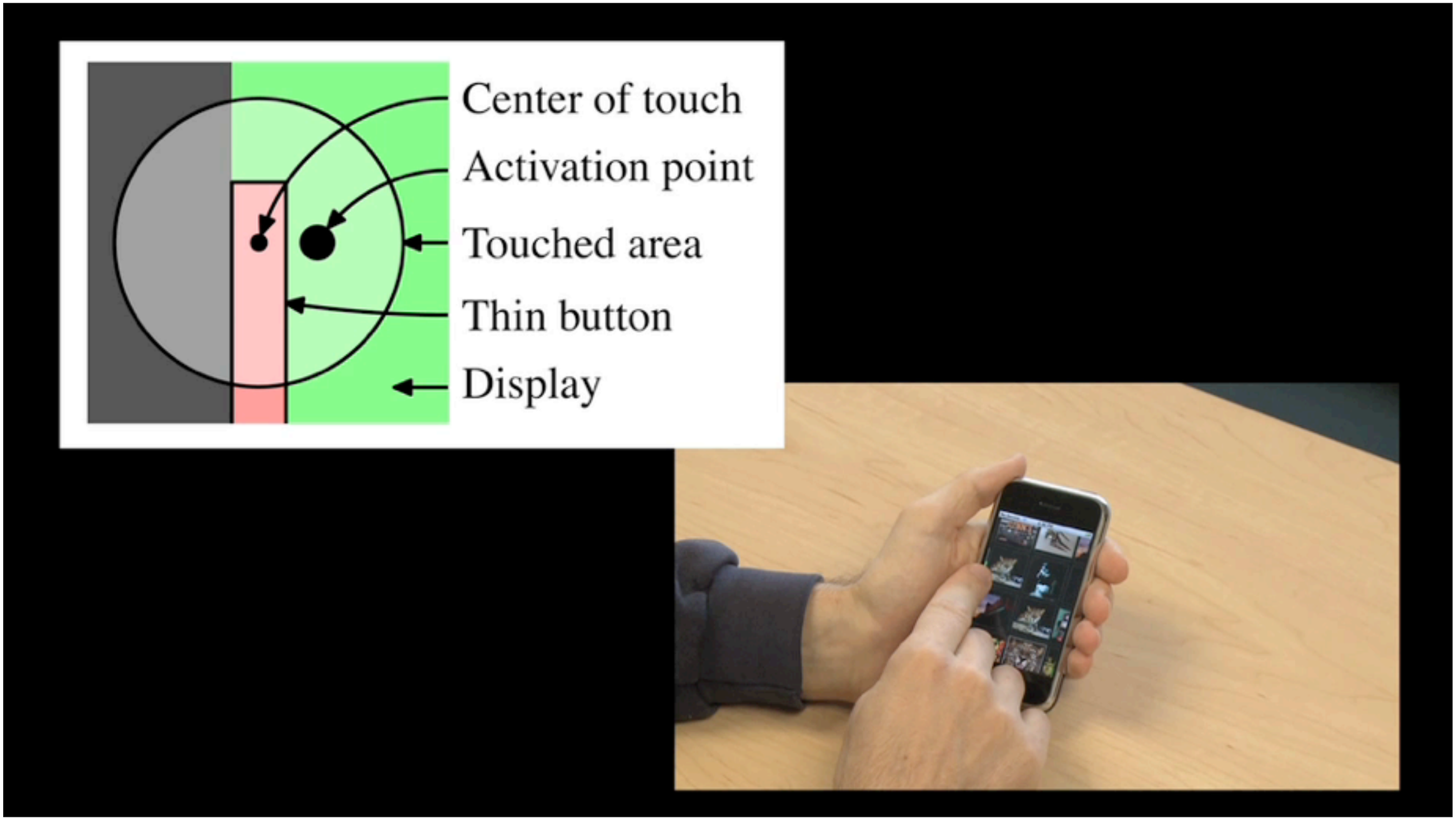
touch on bar:
no activation



touch on bezel:
activation

Roth, Turner. Bezel Swipe: Conflict-Free Scrolling and Multiple Selection on Mobile Touch Screen Devices. CHI 2009.

Bezel Swipe: Conflict-Free Scrolling and Selection on Mobile Touch Screen Devices



Roth, Turner. Bezel Swipe: Conflict-Free Scrolling and Multiple Selection on Mobile Touch Screen Devices. CHI 2009.

iOS 5 Notification Bar

Image source: http://www.macstories.net/stories/ios-5-notification-center/

Gestural Input

- has become commonplace with Kinect and Leap Motion (both stationary)
- Shoesense: on the move
- Myo: directly on the body

Shoesense

- Idea: attach a gesture sensor to your shoe
  - MS Kinect
- detect gestures from below
- short recap: what do we need for gesture recognition?
  -
  -
- what types of gestures might one want?
  -
  -
- http://www.gillesbailly.fr/publis/BAILLY_CHI12a.pdf
- https://www.youtube.com/watch?v=htN6u7tWbHg

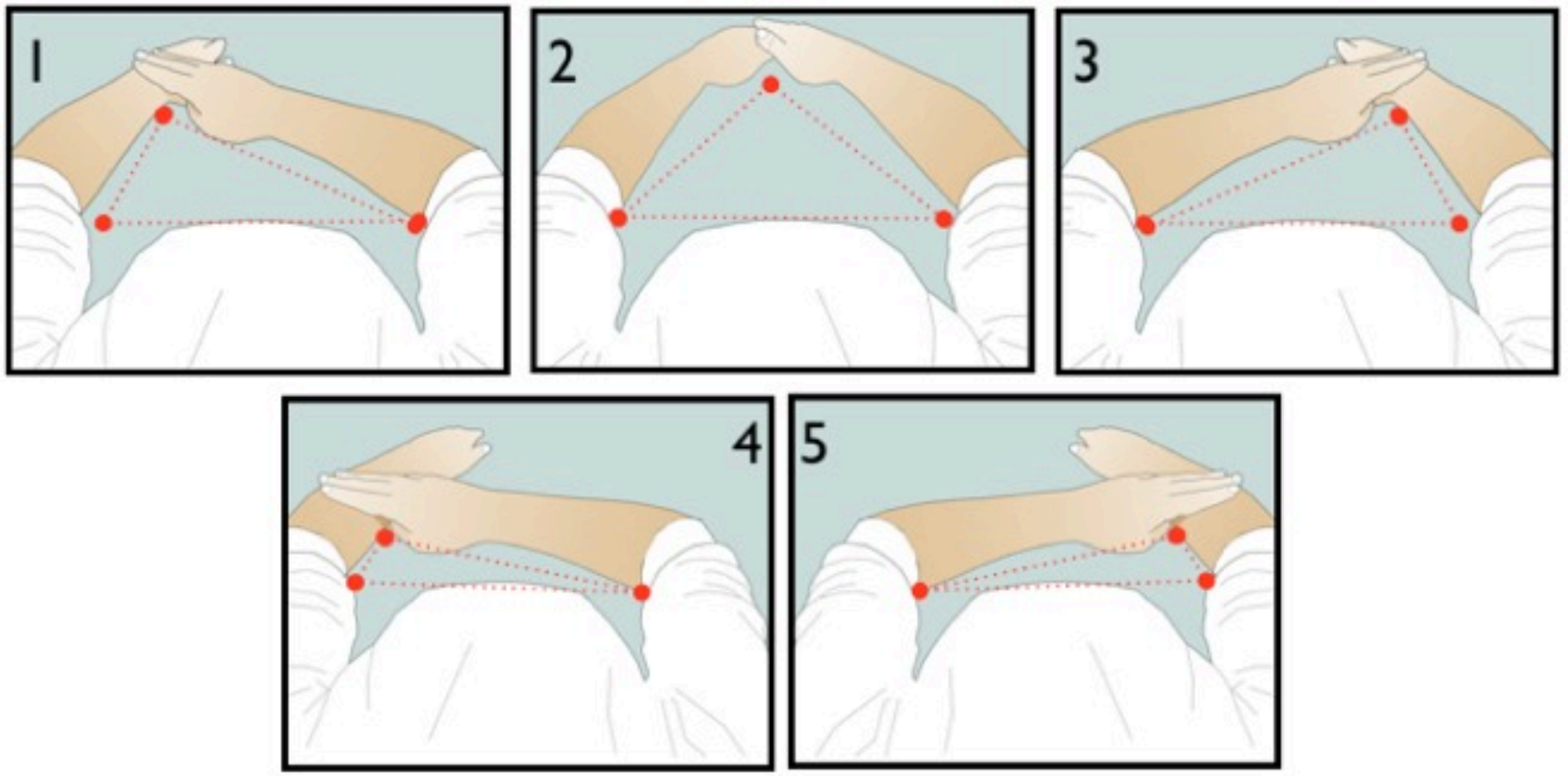


Figure 2: Triangle gesture set. Apex of each triangle is the wrists (1,3), hands (2), and arms (4,5) respectively.

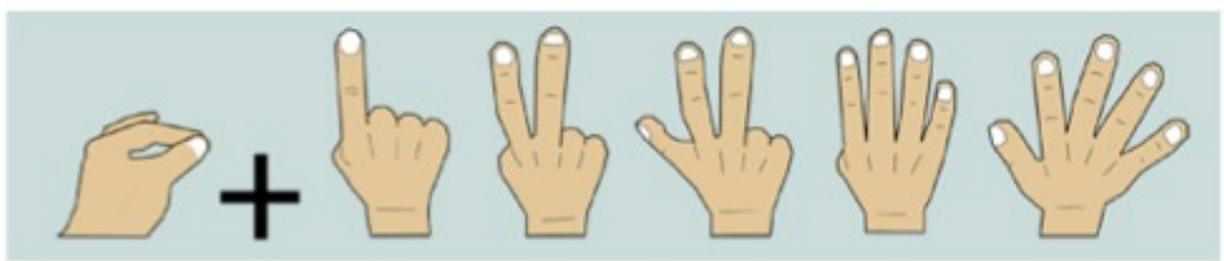
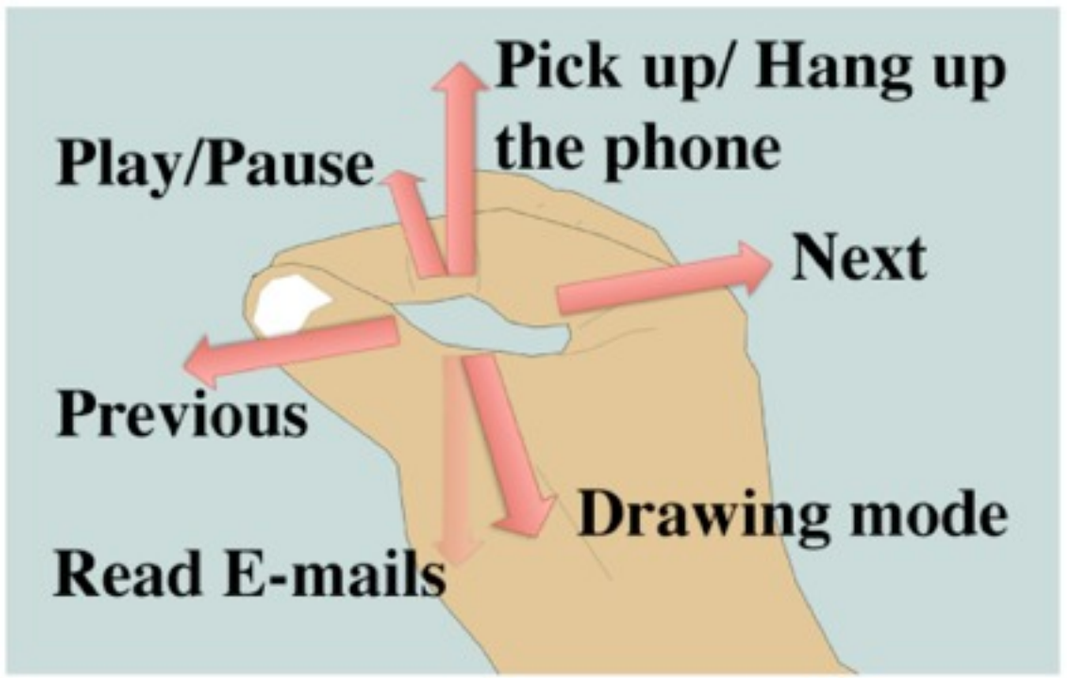


Figure 4: Finger-Count gesture set. Pinch on one hand (registration) and extended fingers on the other hand.



Myo: gesture sensing via electric currents

- https://www.youtube.com/watch?v=oWu9TFJjHaM
- Mini-discussion: what types of gestures are shown?

Some Take-home messages

- Be creative with small screens!
  - use known visualization techniques
    - lack of space is well known in InfoViz!!
  - think of good mental models
    - street lamp metaphor, imaginary interfaces...
  - imagine future form factors to be different
    - Xpaaand ...

- Don‘t get stuck with imprecise input
  - use novel visualization techniques
  - look closer at the sensor output data
  - imagine future sensors to be elsewhere ;-)