Lecture

Mobile Interaction

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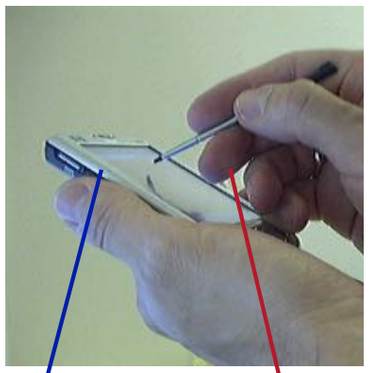
Fat finger problem

Direct => **occlusion**

Direct + Absolute => **lack of precision**

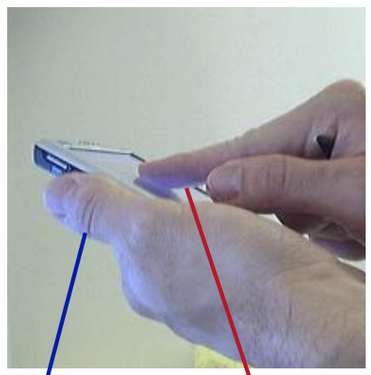
=> targets should be **large** (>= 9.2mm [Parhi 06])

=> can be improved with better **technology** [Holz 10]



unique contact point

remove hand from screen



ambiguous contact point

finger occludes target

From [Vogel et al. CHI 07]

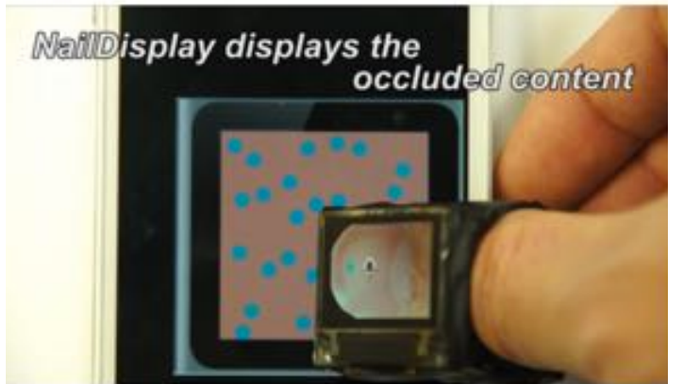
Other Strategies

Fingerprints: [Holz et al. 10]

- better touch model => better accuracy

Back-of-device touch input: NanoTouch [Baudisch et al. 09]

NailDisplay [Su et al. 13]

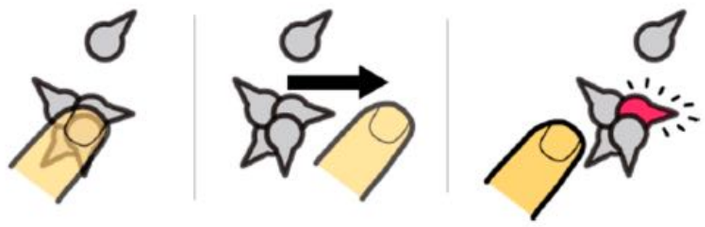


Gestures: Escape [Yatani et al. 08]

- directional gestures select small targets

Hover Cursor: [Osberg et al. 15]

- hover sensing over a touchscreen



Pre-Touch Sensing for Mobile Interaction

Ken Hinckley, Seongkook Heo, Michel Pahud, Christian Holz, Hrvoje Benko, Abigail Sellen, Richard Banks, Kenton P O'Hara, Gavin Smyth, William Buxton

https://www.youtube.com/watch?v=Y4KQVNpWu-s

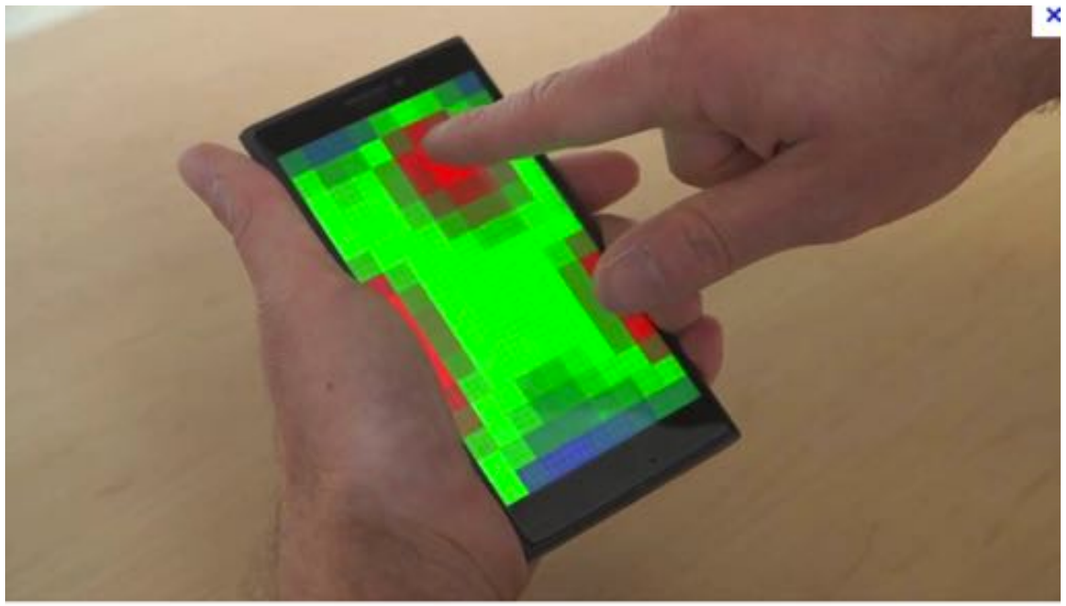
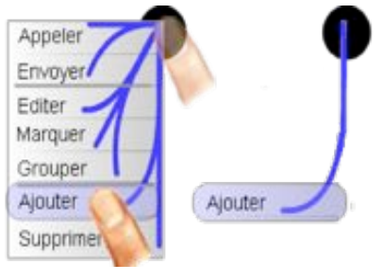


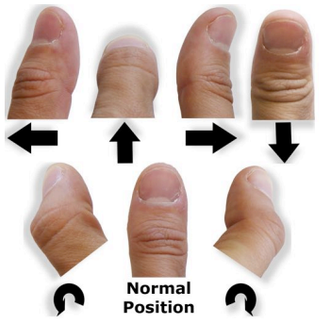
Figure 7. Our *calm web browser* reveals interactive affordances in a nuanced way that feathers off with the finger contours.

Gestures = a large resource deposit

Morphology

- Dimensionality (2D, 3D)
- Multitouch
- Shape
- Kinematics, temporal patterns
- Bumps
- With or without friction
- Pressure / pseudo-pressure
- etc.

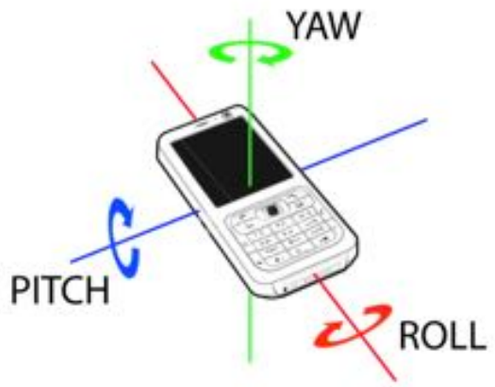




Gestures = a large resource deposit

Frame of reference

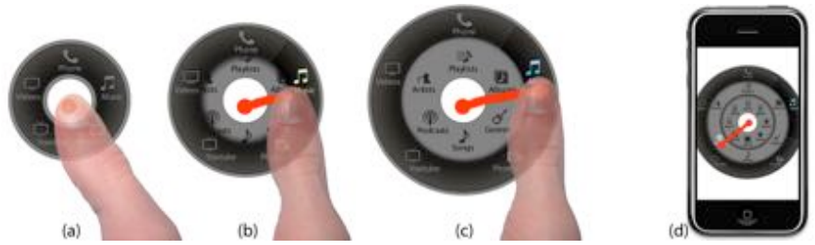
- 2D gestures:
  - movements **on** the device
    - on the screen
    - on the sides/back/bezels..
- 3D gestures
  - movements **around** the device
    - 3 translations
    - 3 rotations
  - movements **of** the thevice

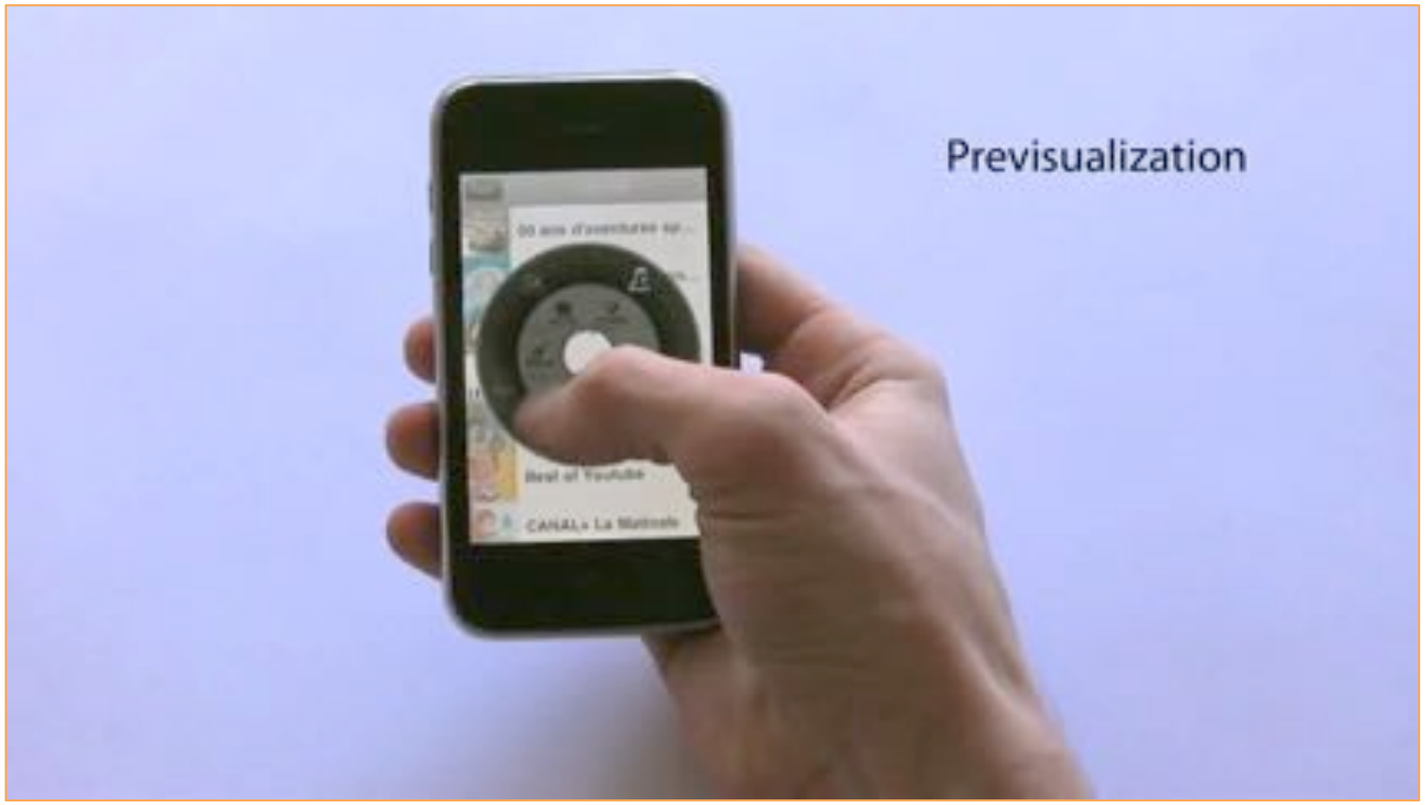


Wavelet menus

[Bailly et al. 10]

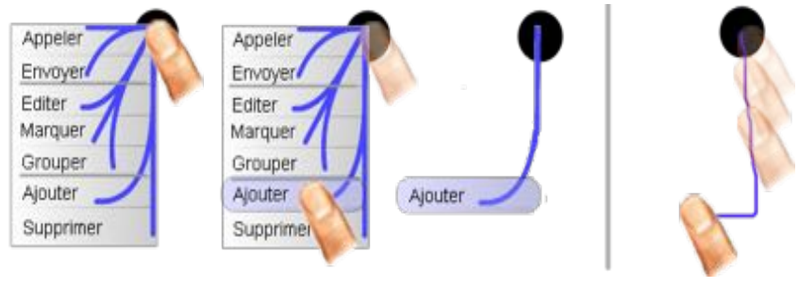
- novice mode: **inverted** rings
- expert mode: **superimposed** marks

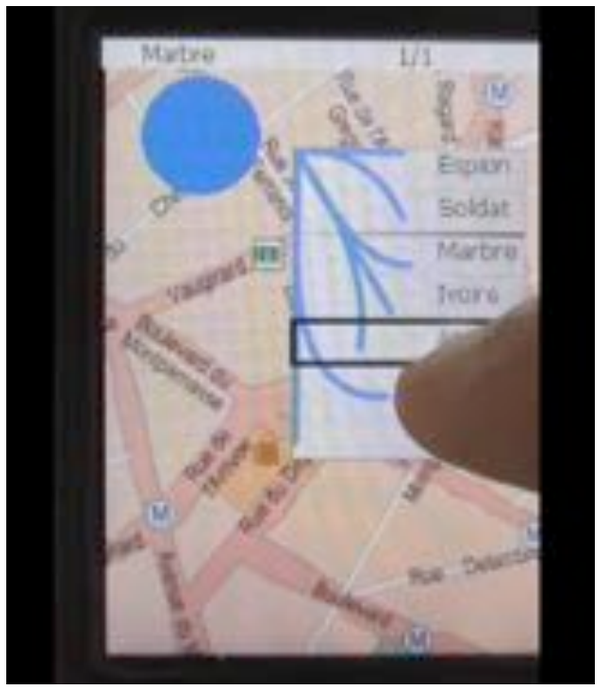




Using curvature

Leaf menus [Roudaut et al. 09]





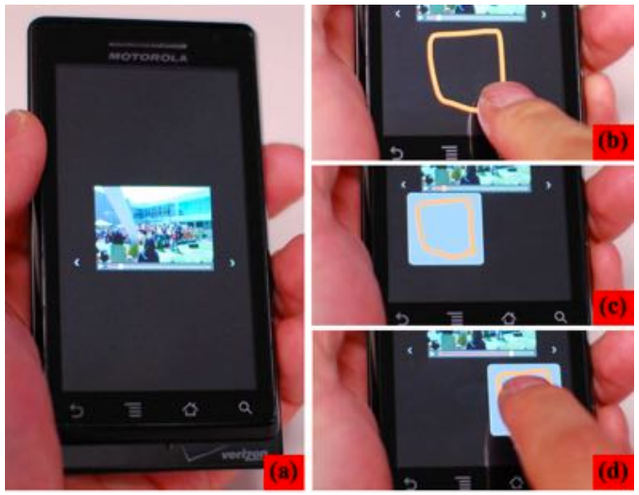
novice mode

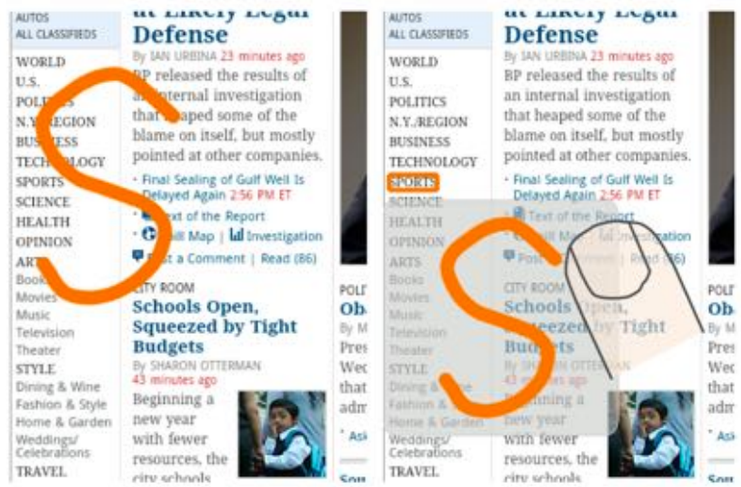
expert mode

Drawing & symbols

Gesture Avatar [Lu & Li 11],

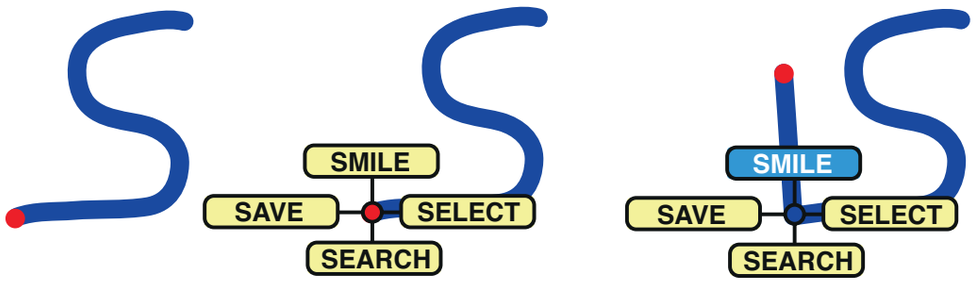
- the user can draw a letter or the shape of a widget
- less errors than Shift, faster for small targets (1mm)





Augmented Letters [Roy et al. 13]

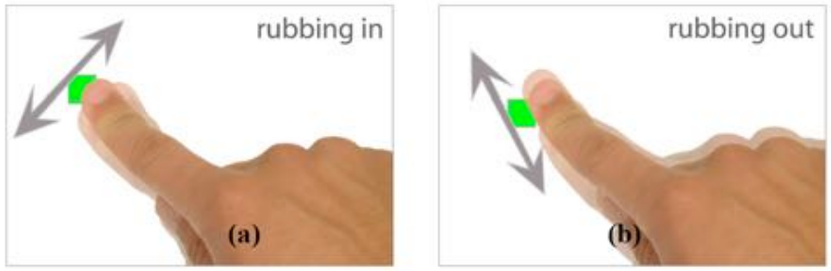
- symbols + Marking menus



Using the shape or kinematics

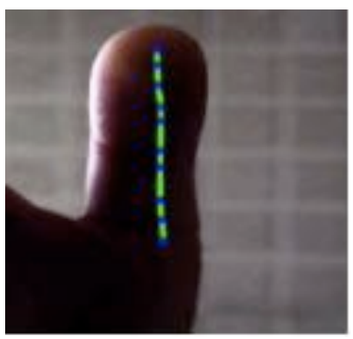
Rubbing gestures [Olwal et al. 08]

- to-and-fro diagonal gestures
- act as delimiters



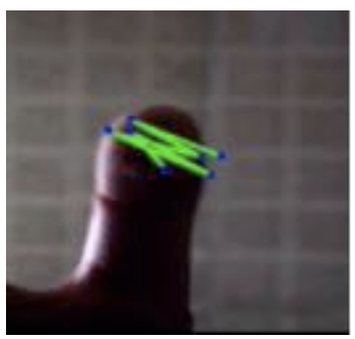
MicroRolls [Roudaut et al. 09]

- rolling gestures of the thumb



Drag

Flick /Swipe

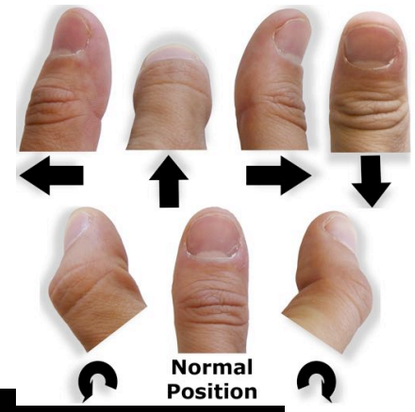


Rubbing

MicroRolls

MicroRolls [Roudaut et al. 09]

- do not conflict with ordinary gestures
- zero tangential velocity (no friction)



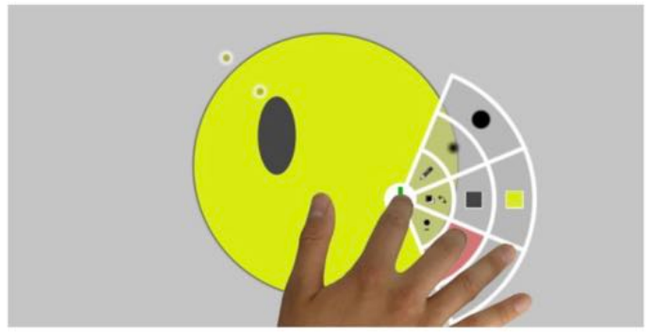
Multitouch: which fingers?

Hardware based

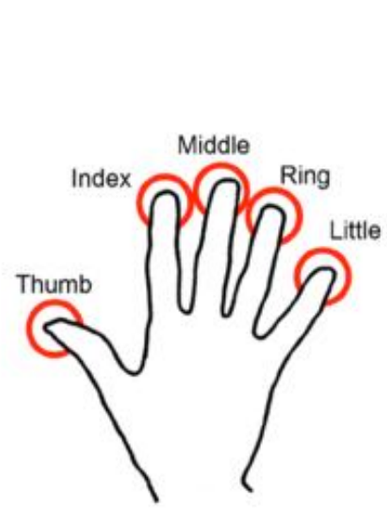
- vision-based, fingerprints [Holz et al. 10]

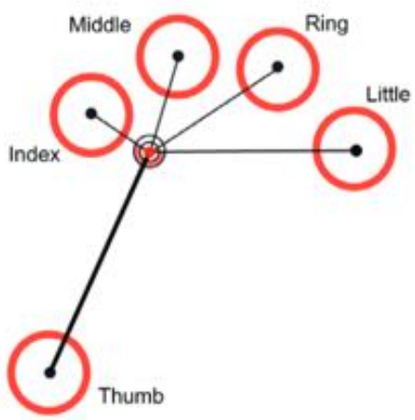
Sofware based

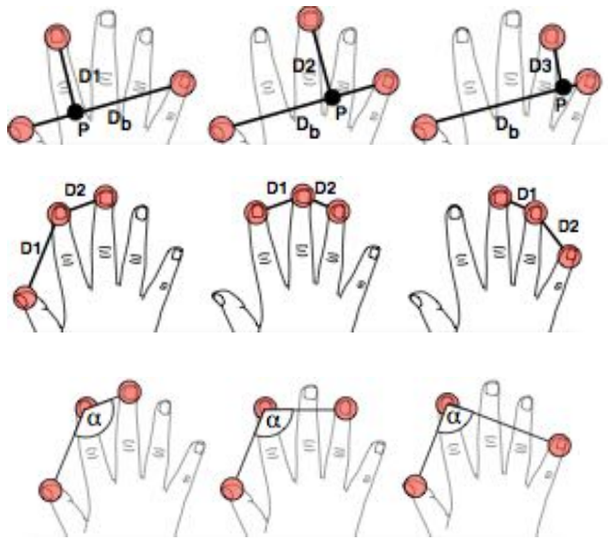
- Lift-and-stroke [Lepinski et al. 10]
- Multitouch finger registration [Au and Tai 10]
- Multi-finger Chords [Wagner et al. 14]



Multi-finger Pie Menu [Banovic et al. 11]



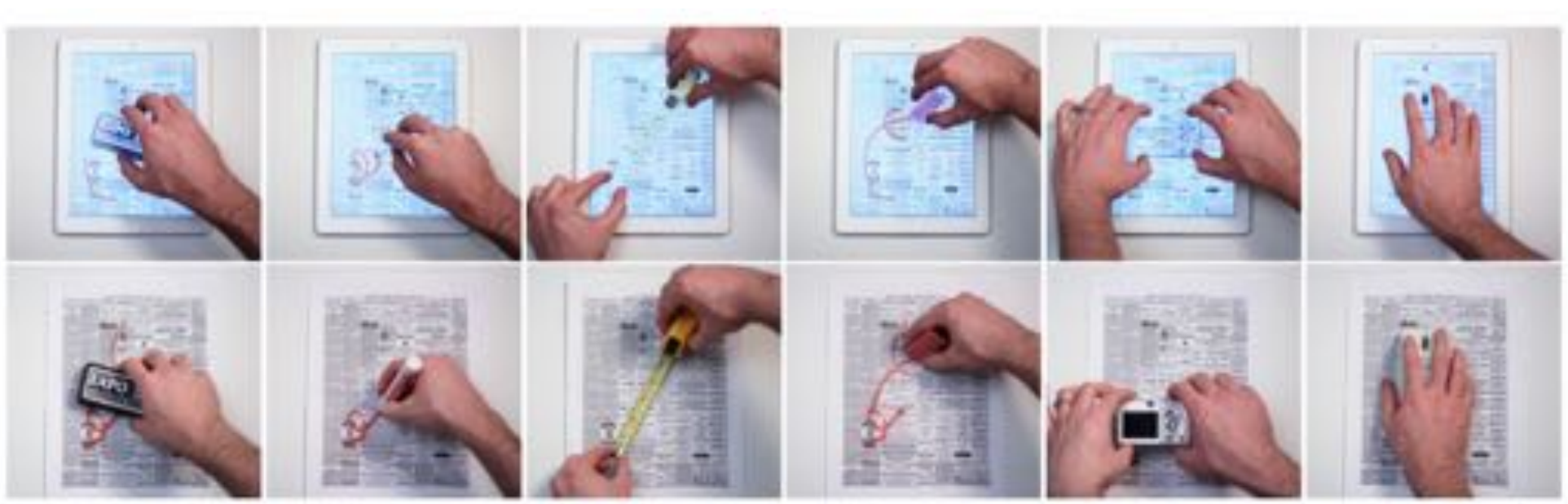




Multitouch: ways of touching

FingerSense (Queexo)

TouchTools [Harrison et al. 14]



whiteboard eraser, marker, tape measure, rubber eraser, camera, mouse, magnifying glass.

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Two-handed

BiTouch / BiPad [Wagner et al. 12]

- two-handed interaction
- special zones
- taps, chords, gestures

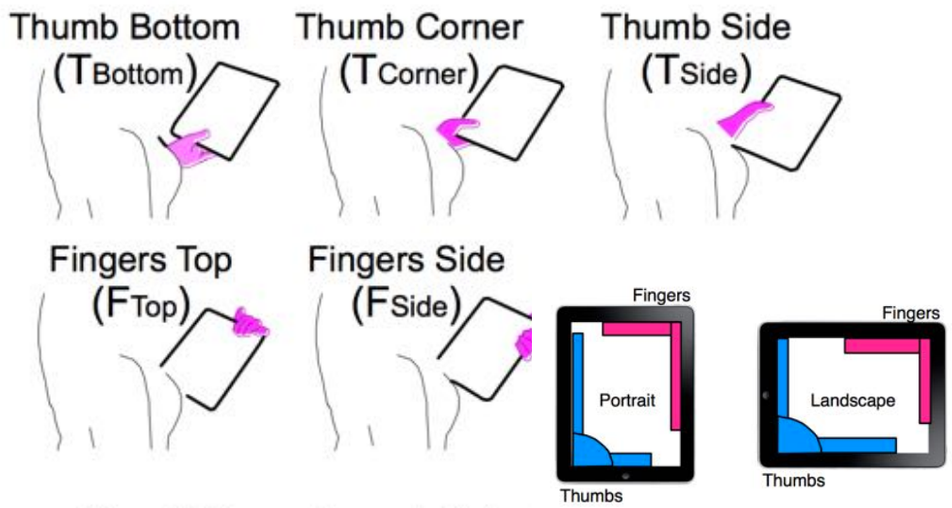
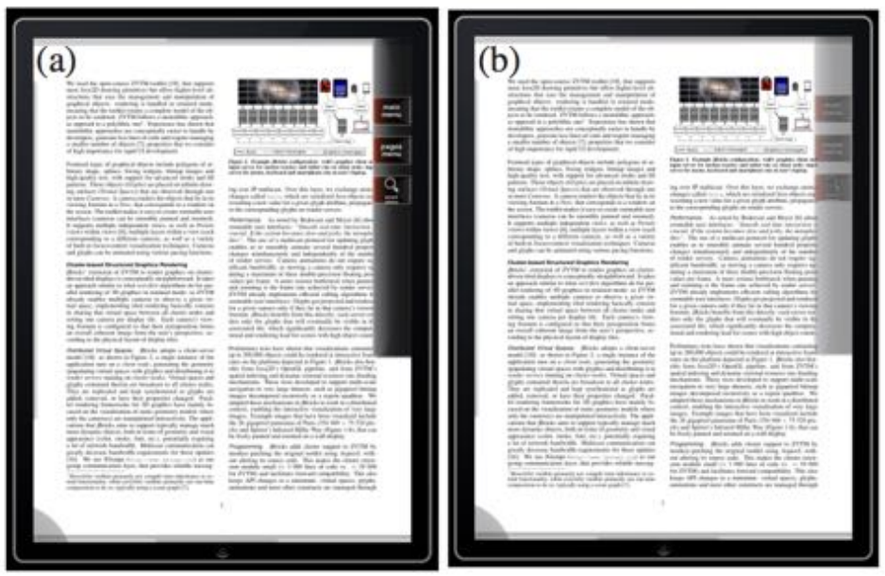


Figure 2. Five spontaneous holds (portrait orientation).



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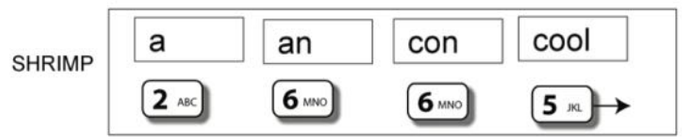
3D gestures

SHRIMP [Wang et al. 10]
- tilting the phone to disambiguate

TimeTilt [Roudaut et al. 09]
- tilt the phone to navigate between apps



Extending the device

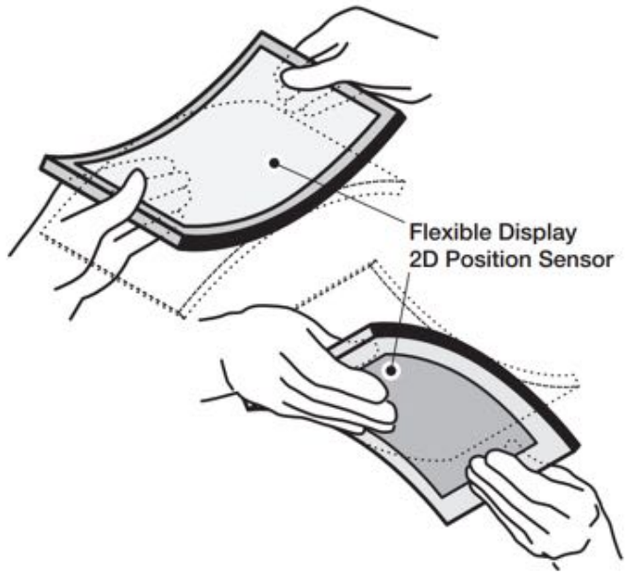
- Input

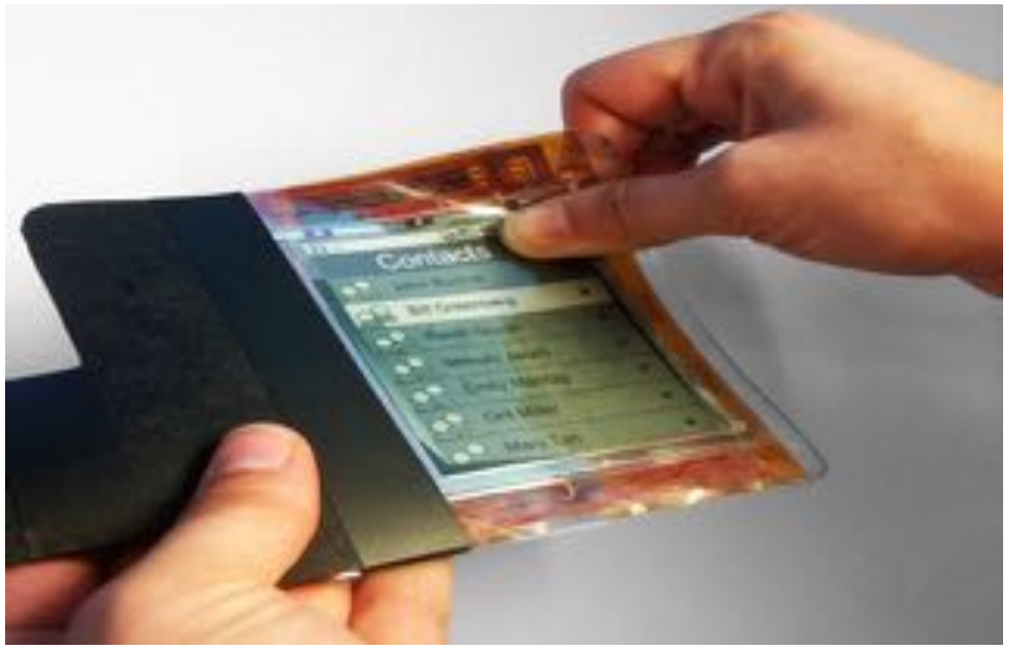
BezelTap https://www.youtube.com/watch?v=cwWJXU0AHdg

Bending the tablet

Gummi [Schwesig et al. 04]

PaperPhone [Lahey et al. 11]





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Output: Tactile feedback and Shape changing

TeslaTouch [Bau et al. 10]

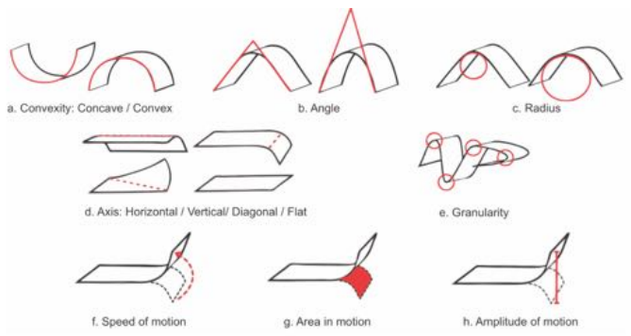
Haptic Edge [Jang et al. 16]

Morphees [Roudaut et al. 13]

TeslaTouch (Bau et al. Disney)

TeslaTouch (Bau et al, Disney)

Shapes and emotions [Strohmeier et al. 16]



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Haptic Edge Display for Mobile Tactile Interaction

Sungjune Jang, Lawrence H Kim, Kesler Tanner, Hiroshi Ishii, Sean Follmer

https://www.youtube.com/watch?v=R1InHeWsSMU

Sungjune Jang et al., CHI, 2016 (accepted)

Gestures on the body

Skinput [Harrison et al. 10]

Skintrack [Zhang et al. 16]

iSkin [Weigel et al. 15]

Body-centric Design Space [Wagner et al. 13]

Eric Lecolinet - Télécom ParisTech – CNRS LTCI

iSkin https://www.youtube.com/watch?v=Y4KQVNpWu-s

Mobile Augmented Reality

Here service

iOS App Metro Paris

Toolkits: Layar, Wikitude, etc.

Google Goggles

AR glasses

Google Glass

www.immersion.fr

Thad Starner

Head-Mounted displays

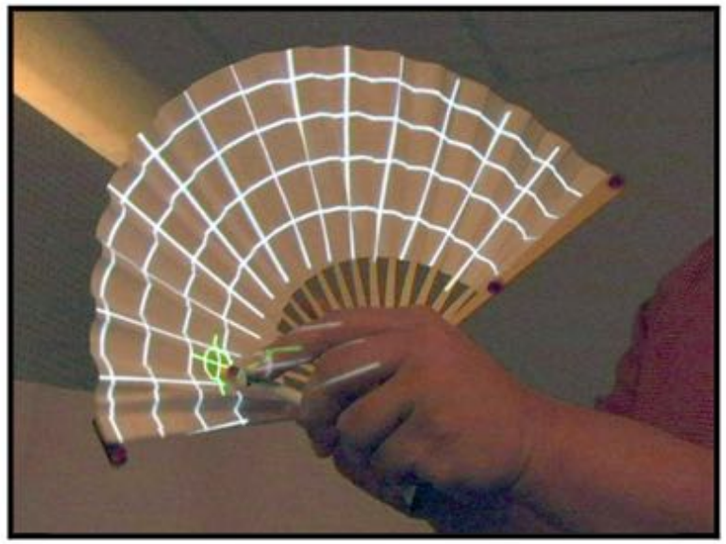
Eyeglasses

Contact lenses

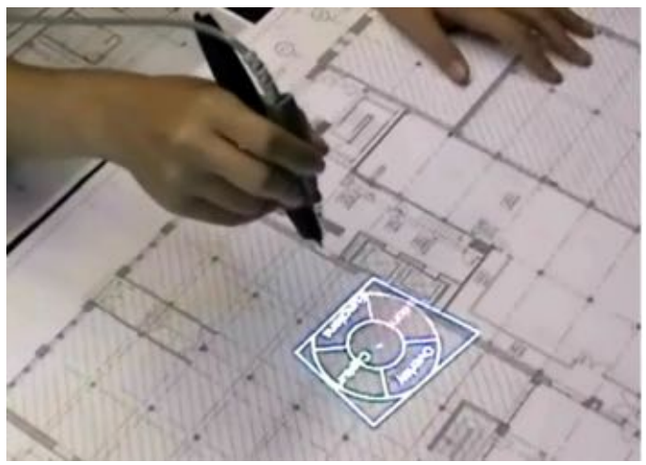
Virtual Retinal display

Picoprojectors

SixthSense [Mistry, Maes 2009]



Foldable interactive displays
[Lee et al. 2008]



PenLight [Song et al. 2009]

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