Gestural Interfaces

SWEN422

Human Computer Interaction

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Class Announcements

- Assignment 1 updates
- Assignment 2 and 3

SWEN 422 – Lecture Schedule

- Week 9 – Gestural Interfaces
- Week 10 - AR/VR
- Week 11 - AR/VR
- Week 12 - no lectures (work on project)

https://ecs.wgtn.ac.nz/Courses/SWEN422_2024T1/LectureSchedule

Assignment 3 Rubric

- **Team Project Code Grade: 15%**
  - Visualizations (60%)
  - Code Base (20%)
  - Video (20%)
- **Individual Final Report Grade: 25%**
  - Written Communication (25%)
  - Key Design Decisions (25%)
  - Justifications / Alternative Designs (25%)
  - Development Tools Critique (25%)

https://ecs.wgtn.ac.nz/Courses/SWEN422_2024T1/Assignment3

Assignment 2

- Essay
- Review one paper
- Topics:
  - Information Visualization
  - Gestural Interfaces
  - AR/VR
- Length: 3 pages
- Assessment Weighting: **30%** (Updated)
- Due: **2359 Friday 17 May**

https://ecs.wgtn.ac.nz/Courses/SWEN422_2024T1/Assignment2

Assignment 3

- Design (e.g. personas, paper, Figma) and Develop visualizations (e.g. D3 / Unity / Unreal)
- x3 visualizations minimum
- Work in teams 2-4 people
- No individuals
- Data set: COVID-19
- Assessment Weighting: **40%** (Updated)
- Due: **2359 Friday 14 June**

https://ecs.wgtn.ac.nz/Courses/SWEN422_2024T1/Assignment3

“I believe we will look back on 2010 as the year we expanded beyond the mouse and keyboard and started incorporating more natural forms of interaction such as touch, speech, gestures, handwriting and vision – what computer scientists call the ‘NUI’ or ‘Natural User Interfaces’.”

Steve Ballmer
(then-)CEO Microsoft

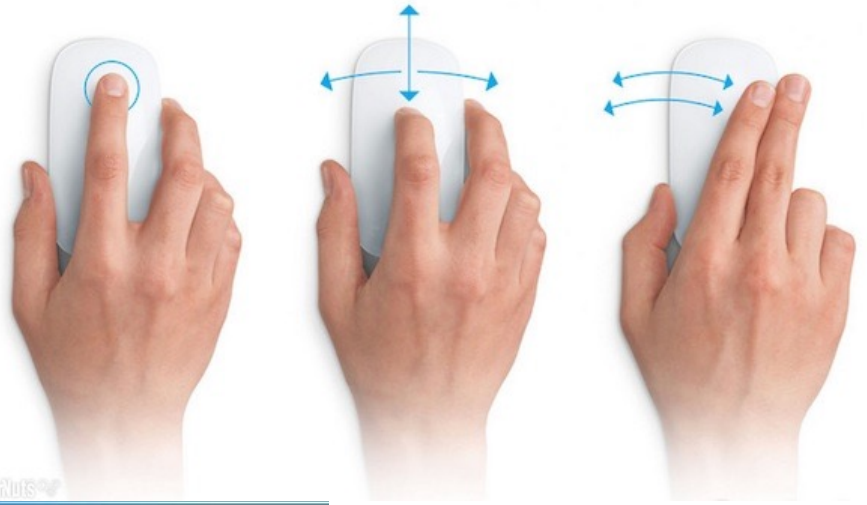
Gestures

- What is a gesture?
- Why use a gesture?
- Boundaries of gesture interaction.
- What is a useful vocabulary of gestures?
- How can we classify gestures?
- How can we recognise gestures?

Ease versus Expressiveness

- Keyboard – expressive but not easy?
- Mouse – easy but not expressive?
- ‘NUI’ – easy and expressive?

Mouse Gestures



Mouse Gestures

Navigation

- History Forward
- History Backward
- Reload
- Forced Reload
- Homepage
- New Document
- Duplicate Window
- Minimize Window
- Maximize/Restore
- Close (or)
- Up a Directory
- Scroll Up (200px)
- Scroll Down (200px)

Tabbed Browsing

- Duplicate Tab
- Next Tab
- Previous Tab
- New Tab

Image Functions

- Double Size
- Half Size
- Hide Image

Start over image

Links Functions

- Link in new window
- Link in new tab
- Horizontal Stack
- Open every link dragged over (window)
- Open every link dragged over (tab)

Drag at/over link

Finish with

Miscellaneous

- View Source (or)
- View Cookies
- View <META> Info
- Add Bookmark

Optimoz
http://optimoz.mozdev.org

Back Button Gesture Study

- Found gestures were more efficient than using back button.
- The Design and Evaluation of a Flick Gesture for ‘Back’ and ‘Forward’ in Web Browsers. Moyle and Cockburn, AUIC, 2003.
- http://www.cosc.canterbury.ac.nz/andrew.cockburn/papers/auic03.pdf

Gesture Limitations?

- Little relationship between operations.
- Commands must be sequential.
- Hard to refer to previous operations.
- Arbitrary order of operations.

  – Marsh et al. (Study at US Naval Research Lab)

Types of Gestures?

- Cassell's classification:
  - Conscious or spontaneous
  - Interactional or propositional
- Hummels and Stapers' classification:
  - Static versus dynamic

Types of Gestures?

Conscious / Witting

- Emblematic
- Propositional

Unconscious / Spontaneous

- Iconic
- Metaphoric
- Deictics
- Beat

Types of Gestures?

Gesture Styles

- Deictic
- Gesticulation
- Manipulation
- Semaphores
- Sign Language

Technologies

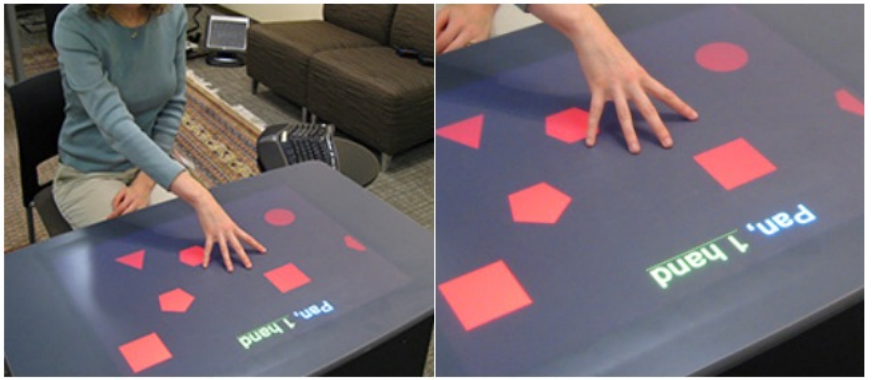
- Perceptual
- Non-Perceptual
  - gloves
  - pens
  - mouse
  - touch
  - tangible

Multi-touch User Interfaces

https://www.ted.com/talks/jeff_han_the_radical_promise_of_the_multi_touch_interface

Design of Touch Gestures

- Wobbrock et al. Wizard of Oz study.
- Present result of a command, request gesture.
- Determine agreement (or lack thereof).
- Microsoft Surface, 24in x 18in, 1024x768



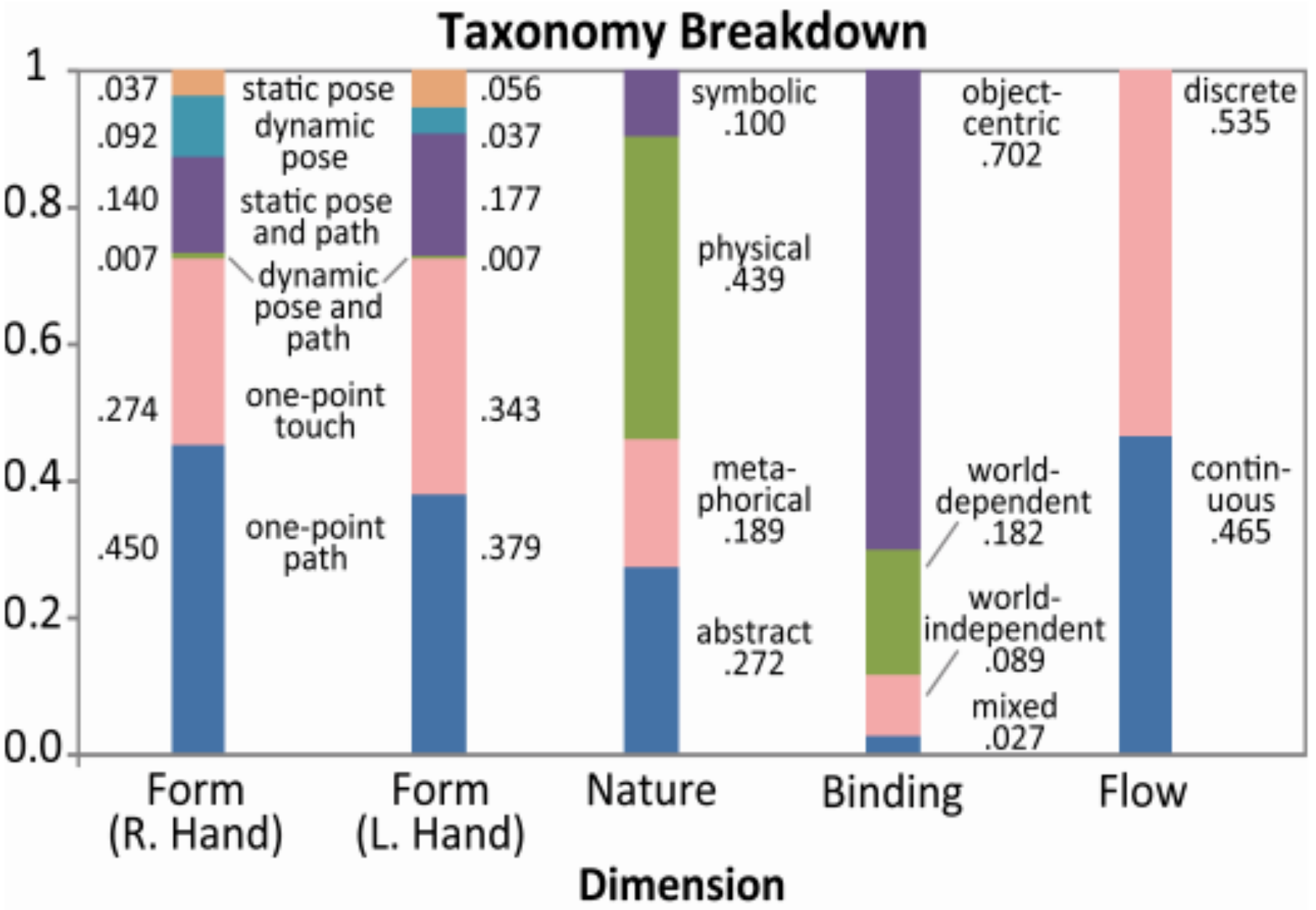
CHI 2009, “User Defined Gestures for Surface Computing”, Wobbrock et el.

REFERENTS	*Mean*	*SD*	REFERENTS	*Mean*	*SD*
1. Move a little	1.00	0.00	15. Previous	3.00	0.00
2. Move a lot	1.00	0.00	16. Next	3.00	0.00
3. Select single	1.00	0.00	17. Insert	3.33	0.58
4. Rotate	1.33	0.58	18. Maximize	3.33	0.58
5. Shrink	1.33	0.58	19. Paste	3.33	1.15
6. Delete	1.33	0.58	20. Minimize	3.67	0.58
7. Enlarge	1.33	0.58	21. Cut	3.67	0.58
8. Pan	1.67	0.58	22. Accept	4.00	1.00
9. Close	2.00	0.00	23. Reject	4.00	1.00
10. Zoom in	2.00	0.00	24. Menu access	4.33	0.58
11. Zoom out	2.00	0.00	25. Help	4.33	0.58
12. Select group	2.33	0.58	26. Task switch	4.67	0.58
13. Open	2.33	0.58	27. Undo	5.00	0.00
14. Duplicate	2.67	1.53	**MEAN**	**2.70**	**0.47**

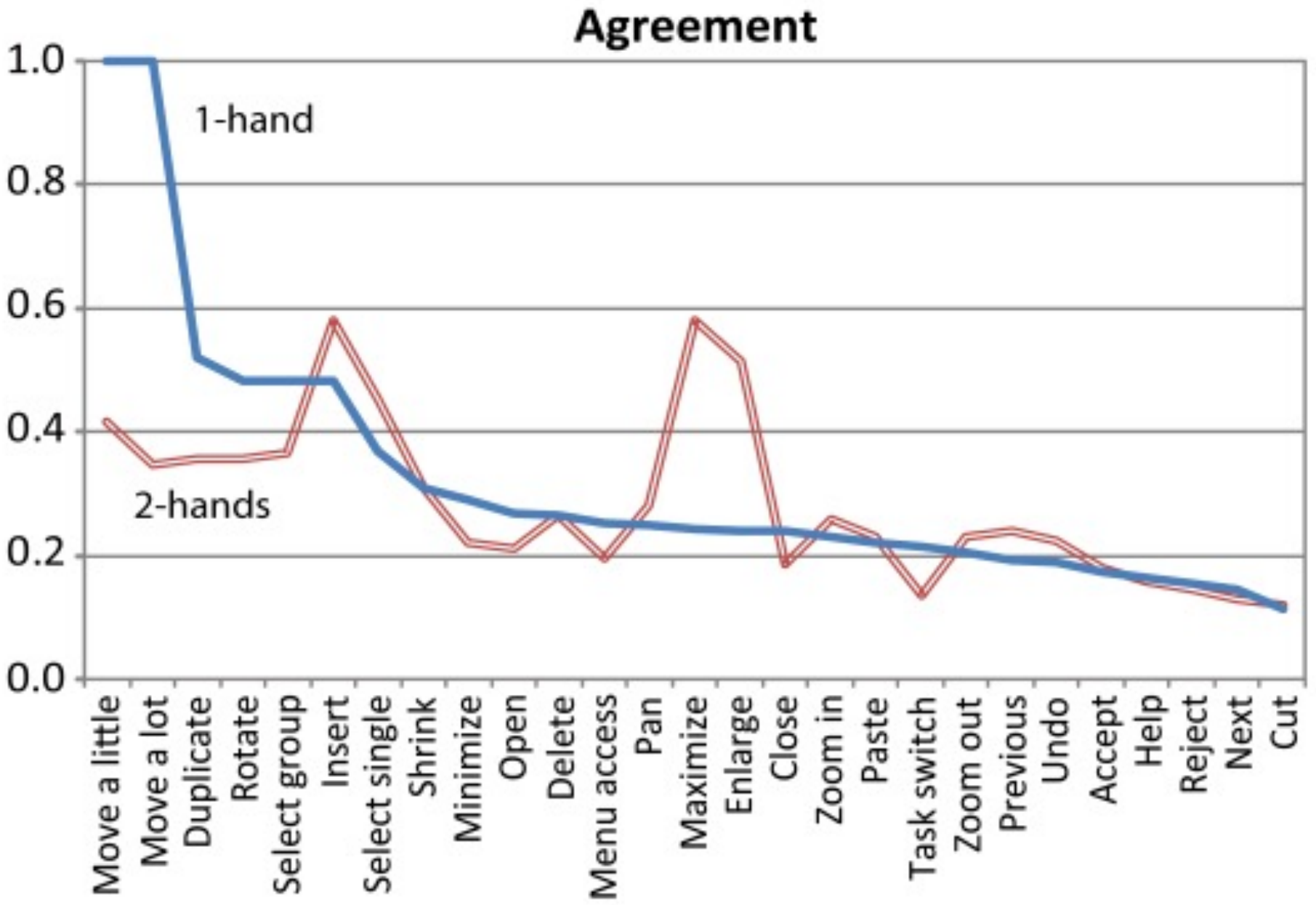
CHI 2009, “User Defined Gestures for Surface Computing”, Wobbrock et el.

TAXONOMY OF SURFACE GESTURES		
Form	*static pose*	Hand pose is held in one location.
	dynamic pose	Hand pose changes in one location.
	static pose and path	Hand pose is held as hand moves.
	dynamic pose and path	Hand pose changes as hand moves.
	one-point touch	Static pose with one finger.
	one-point path	Static pose & path with one finger.
Nature	*symbolic*	Gesture visually depicts a symbol.
	physical	Gesture acts physically on objects.
	metaphorical	Gesture indicates a metaphor.
	abstract	Gesture-referent mapping is arbitrary.
Binding	*object-centric*	Location defined w.r.t. object features.
	world-dependent	Location defined w.r.t. world features.
	world-independent	Location can ignore world features.
	mixed dependencies	World-independent plus another.
Flow	*discrete*	Response occurs *after* the user acts.
	continuous	Response occurs *while* the user acts.

CHI 2009, “User Defined Gestures for Surface Computing”, Wobbrock et el.

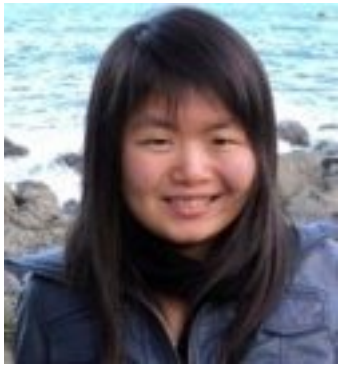


CHI 2009, "User Defined Gestures for Surface Computing", Wobbrock et el.



CHI 2009, “User Defined Gestures for Surface Computing”, Wobbrock et el.

Hand Gesture Variants on Touch Table

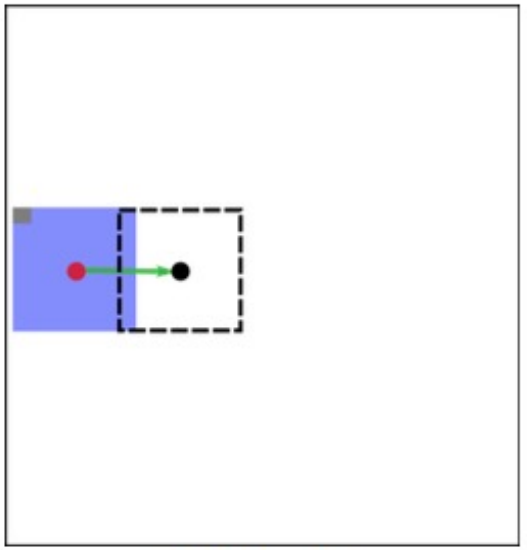


- MSc thesis: Yi-jing Chung, 2012

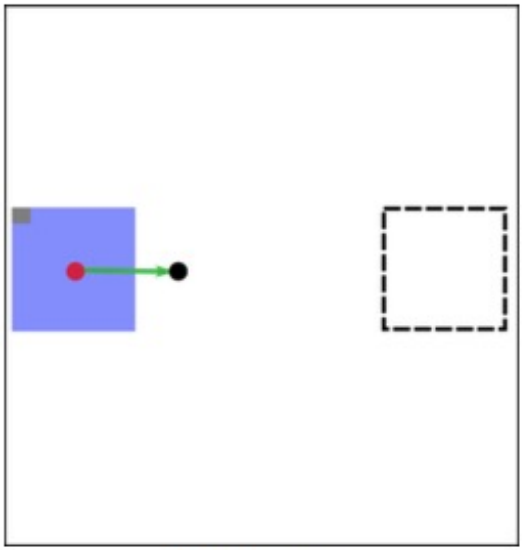
- Experimentally assessed:
  - three gesture variants (drag, rotate, zoom)
  - two devices (optical touch-table, touch phone)

- 20 users x 2 devices x 3 g-types x 20 gestures

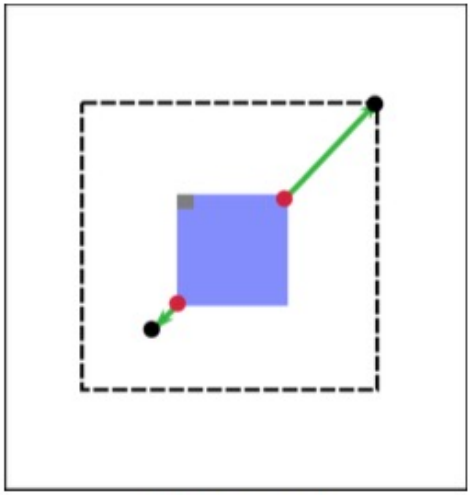
Drag



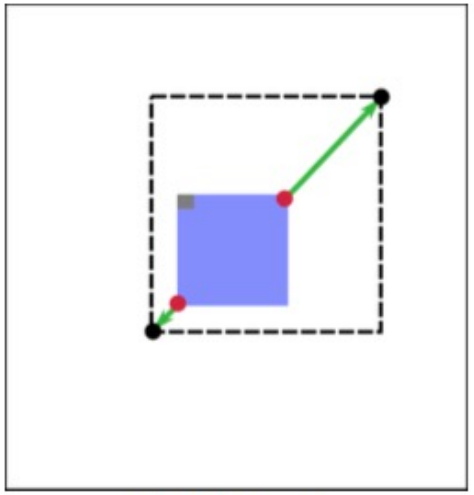
(a) Micro drag



(b) Macro drag



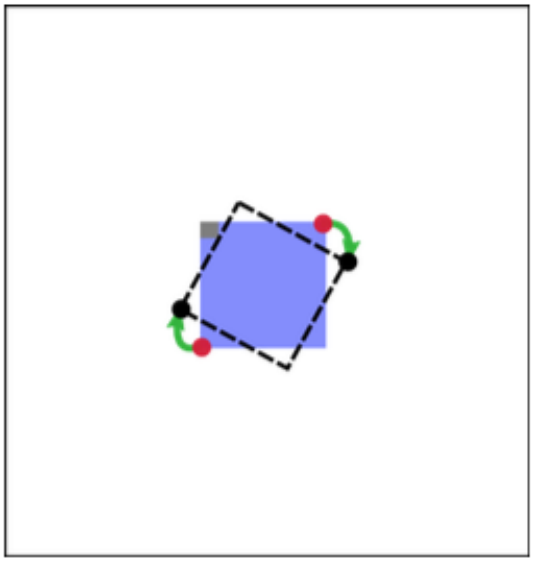
(c) Uniform scale



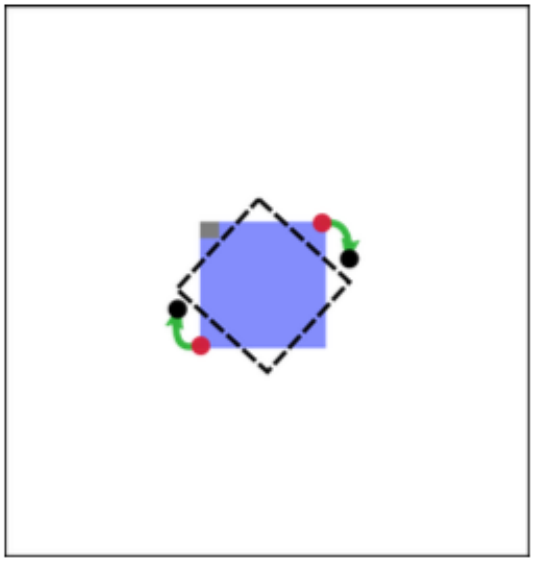
(d) Variable scale

Scale

Rotate



(e) Free rotation

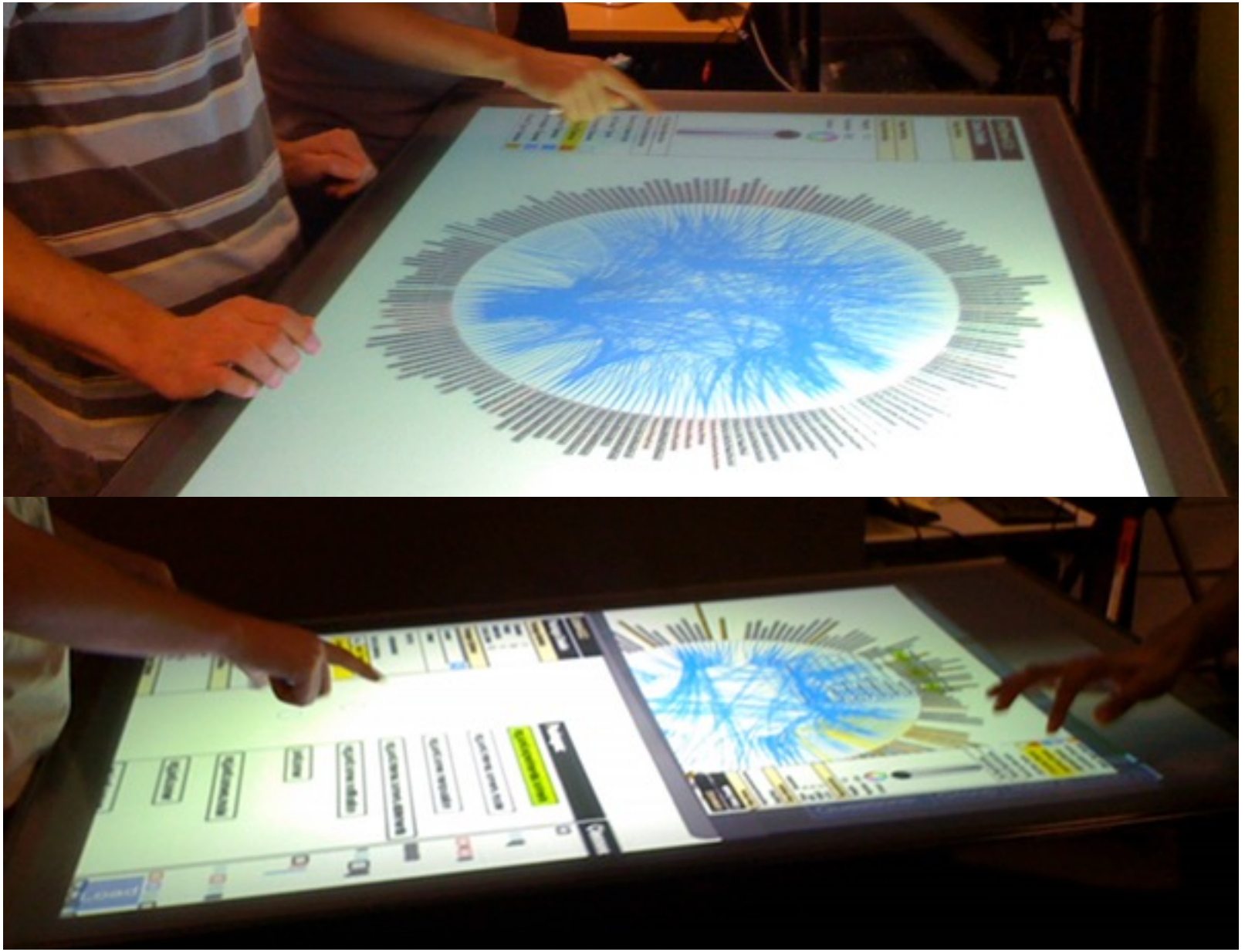


(f) Snap rotation

Effects of the Display Angle and Physical Size on Large Touch Displays in the Work Place

VALCRI - http://valcri.org
ACM ISS 2017

SourceVis: Collaborative SoftVis



Craig Anslow PhD, IEEE VISSOFT 2013

http://homepages.ecs.vuw.ac.nz/~craig/projects/phd/

Digital Collaborative Agile Cardwalls

XP 2017 / CMIS 2016

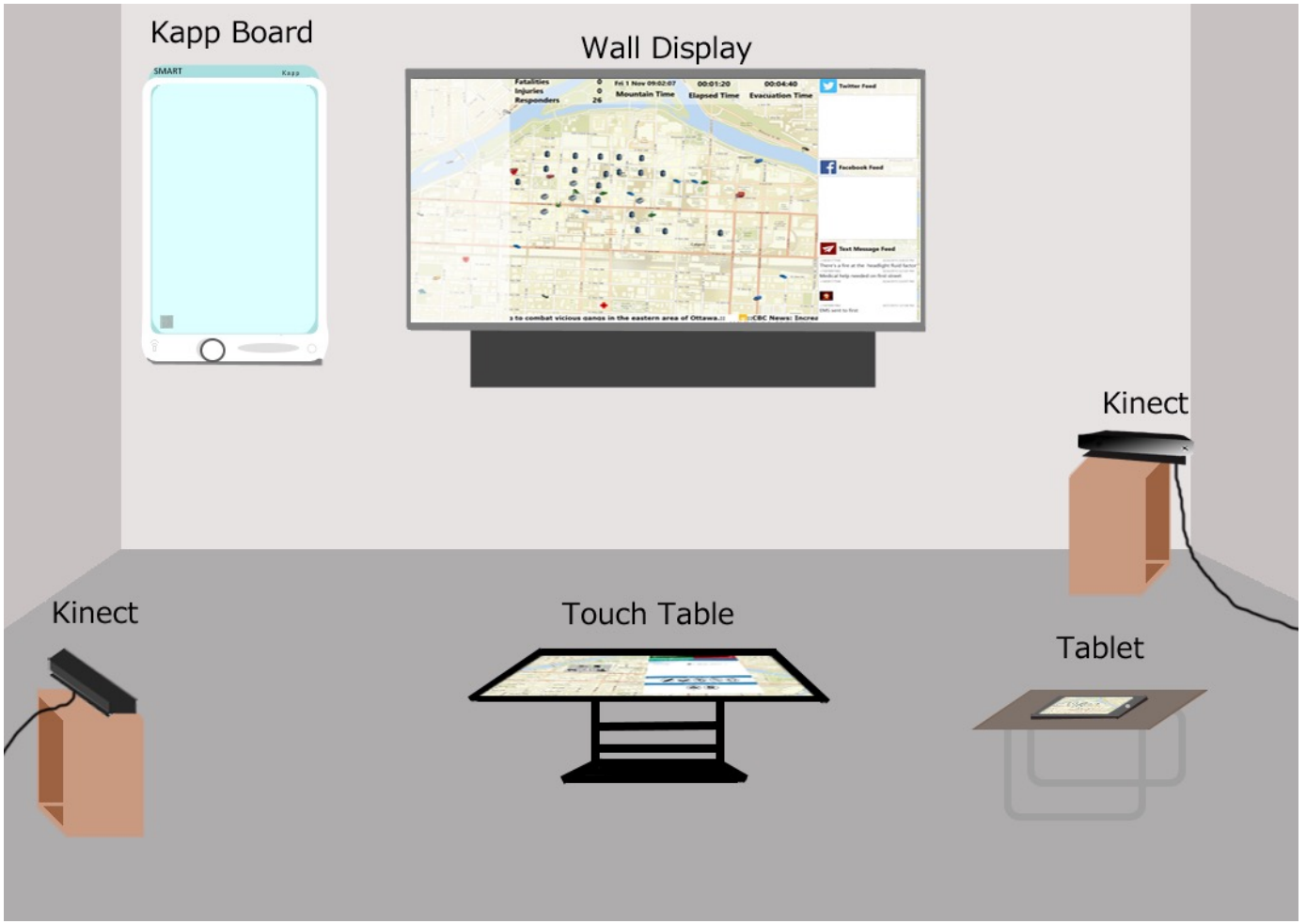
https://www.youtube.com/watch?v=fzCnjnpRiTI

Collaborative Business Process Modeling in Multi-surface Environments

CMIS 2016

https://www.youtube.com/watch?v=GFjj5sa3GvE

Emergency Operations Centers of the Future



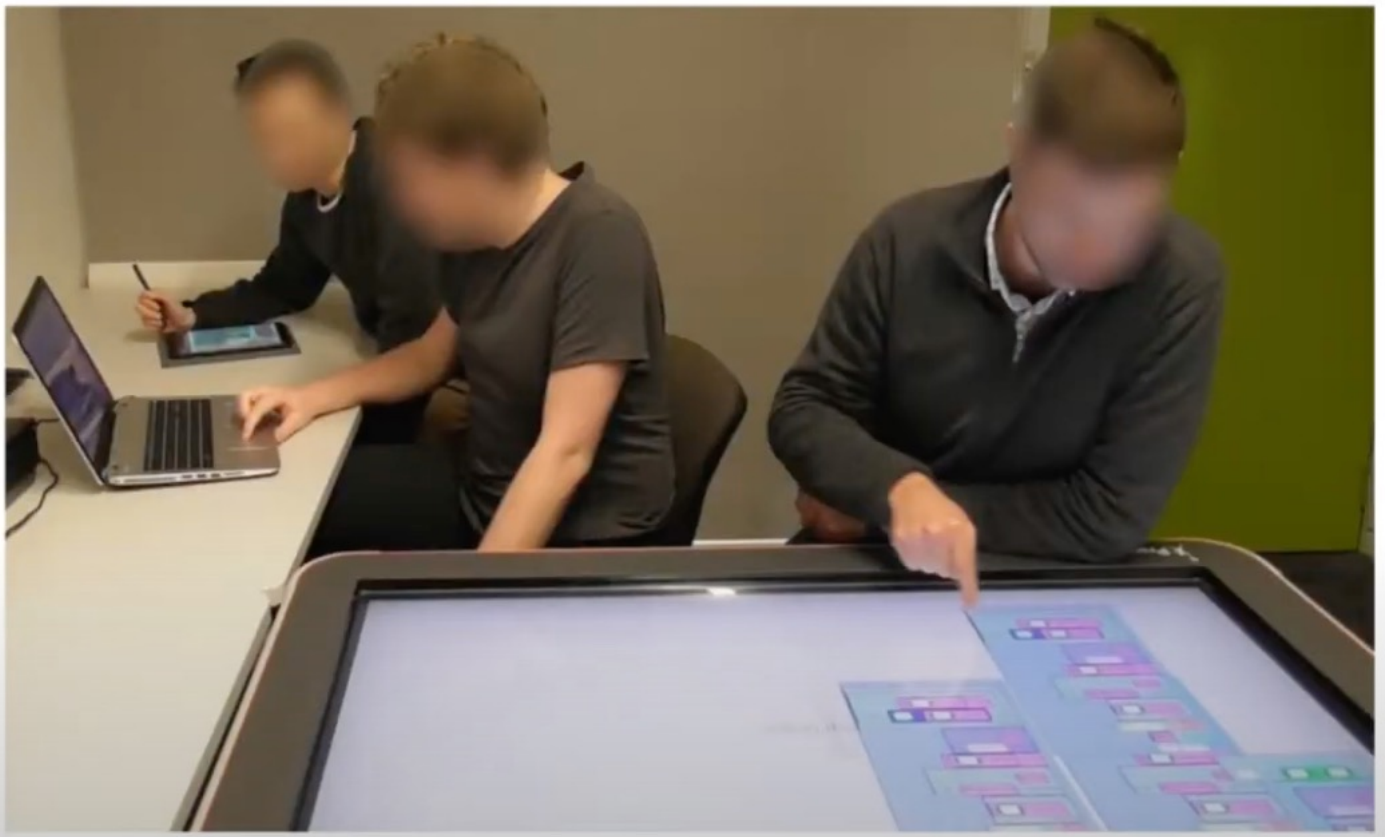
CMIS 2016

http://nsercsurfnet.ca/projects/129

https://ase.cpsc.ucalgary.ca/projects-2/emergency-operations-center-of-the-future/

Collaborative Blocks Based Programming

Multi-Device Grace



VL/HCC 2019

https://ecs.wgtn.ac.nz/Groups/HCI/CollaborativeBlocksBasedProgramming

Collaboration Meets Interactive Spaces

Springer - 2016

http://www.springer.com/us/book/9783319458526

Properties of Touchlessness

- Proxemic
- Transfer of Matter
- Momentum & Pressure
- Constraints on Movement
- Haptic Feedback

O'Hara et al. ACM Transactions on CHI, Vol. 20, No. 1, Article 5.

Haptic

Design:

- Uses sense of touch.
- Can be combined into virtual reality.
- User receives feedback via tactile sensation.

Issues:

- Sense of touch very complex
  - Different nerves have different functions
  - Pressure
  - Temperature
  - Muscle
  - Hair movement
- Texture of surface particularly difficult.

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

Novint's “Falcon”

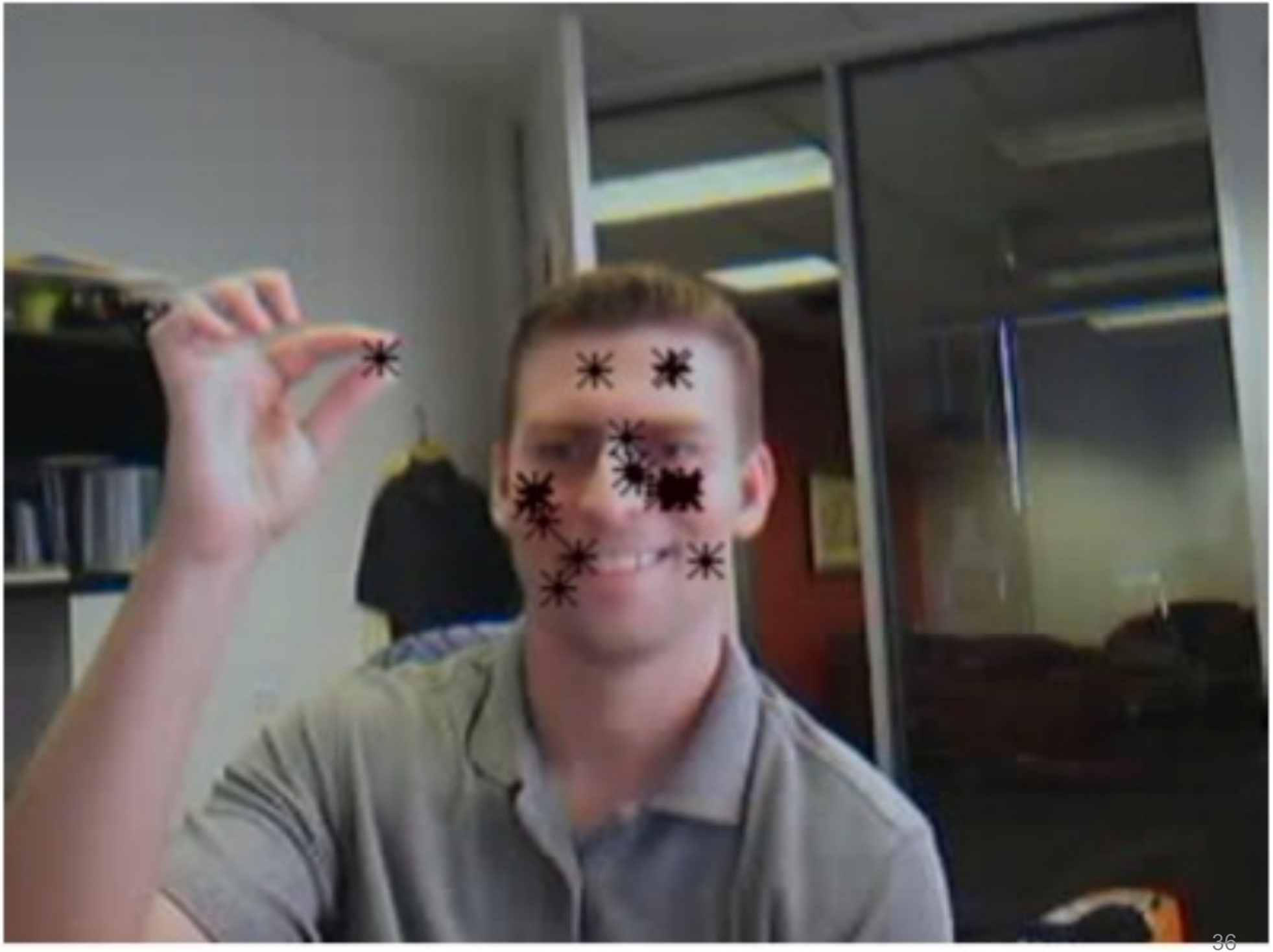
https://www.youtube.com/watch?v=gjAxGVH1JOM

PHANTOM

https://www.youtube.com/watch?v=-i9Wm2rTsao

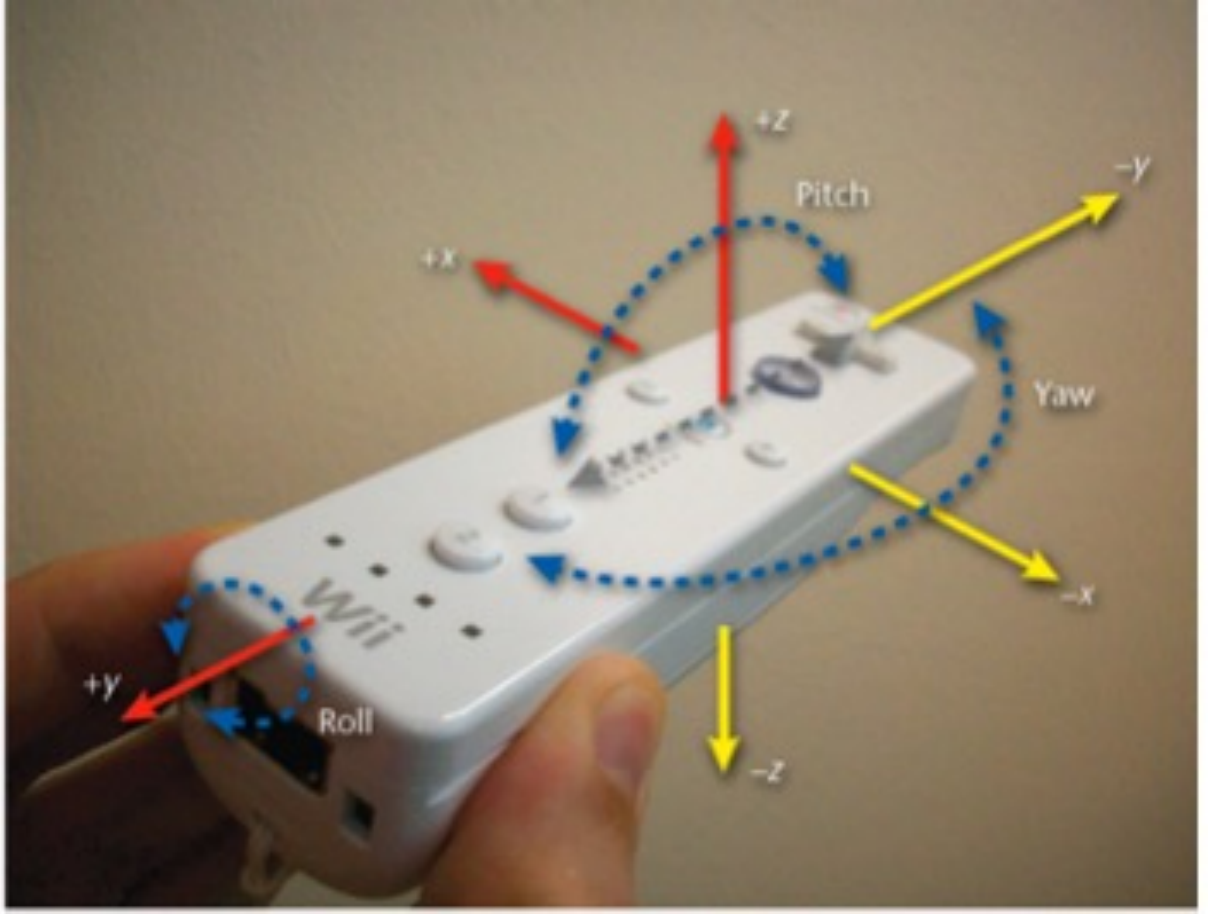
PlayStation EyeToy

- Launched in 2003
- 60 frames / second
- 56 degree diagonal field of view
  - Could view torso and outstretched arms at ~2m
- Motion mask for motion detection
  - Easier to spot “rubbing” in specific areas
- Collision detection limited to 2D due to how motion mask typically generated

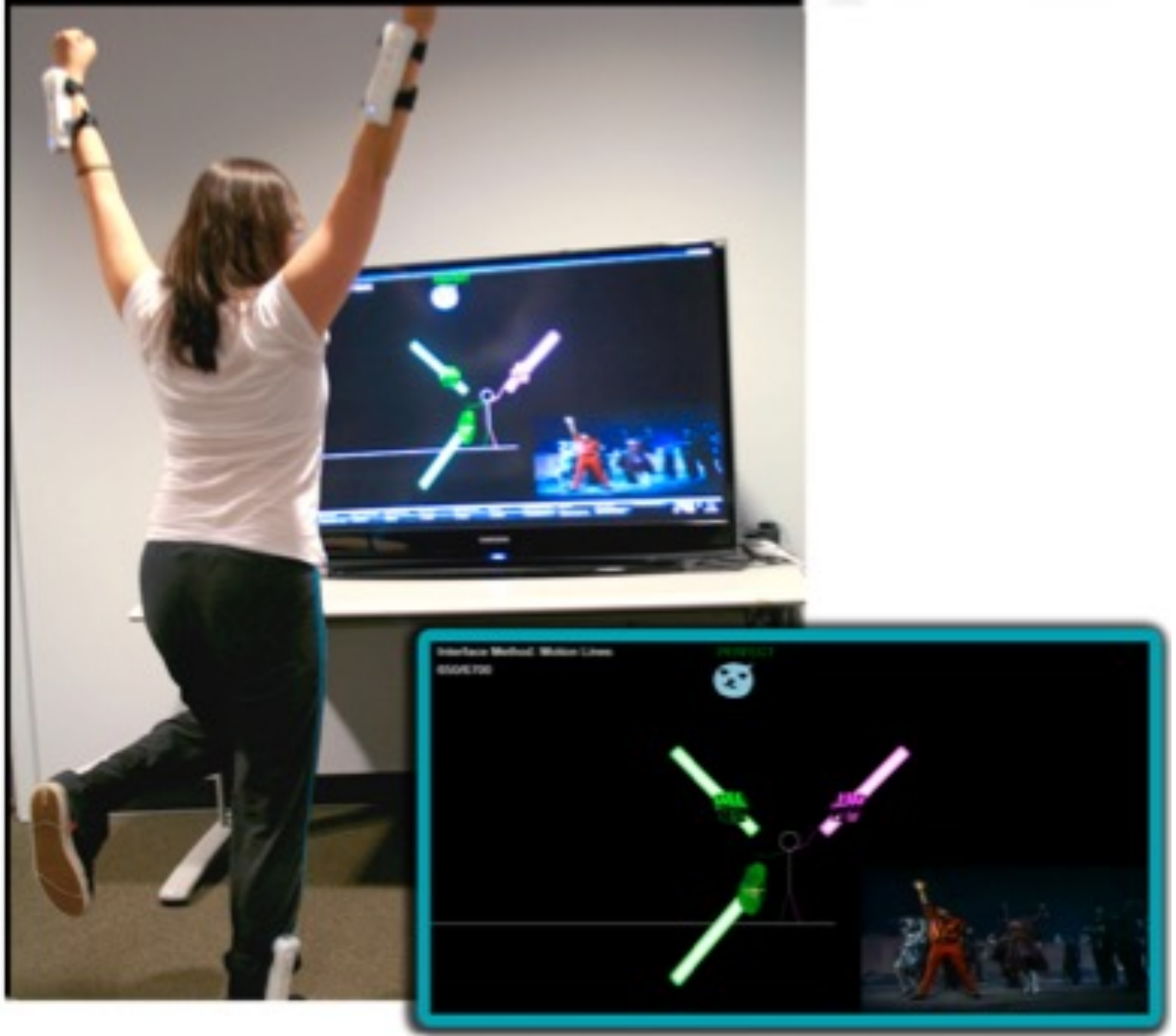


Nintendo Wii

- Originally 3 axes of acceleration
  - Wii MotionPlus gyroscopes added 3 axes of orientational change
- Sensor bar has 2 groups of IR LEDs
- Wiimote has camera that detects the two LED groups
- Detects acceleration, not positional change
  - Can lead to “waggle” “cheating”
  - Small movements interpreted as full movements



https://www.youtube.com/watch?v=QgKCrGvShZs
https://www.ted.com/talks/johnny_lee_free_or_cheap_wii_remote_hacks



PlayStation Move

- 3-axis accelerometer and 3-axis gyroscope
- RGB LED on top of motion controller
  - Used by Eye to determine controller position
  - Generates own light, reducing scene light problem
  - Light can be adjusted to suit scene
  - Eye captures the 2D ellipse parameters of the sphere – calculate
- 1-1 mapping of controller motion to virtual object?

3D Cameras and Gestures

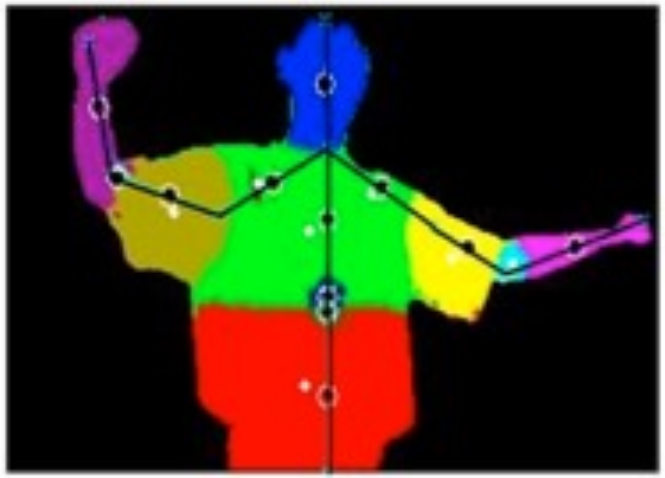
- 2D cameras can't handle arbitrary scenes
- 3D cameras incorporate Z-sensing
  - Powerful segmentation feature
  - Provides 3D spatial information
- Possible implementation:
  - Active infrared illumination and camera
- Possible alternative:
  - Pulsed light emitter with active shuttering of camera

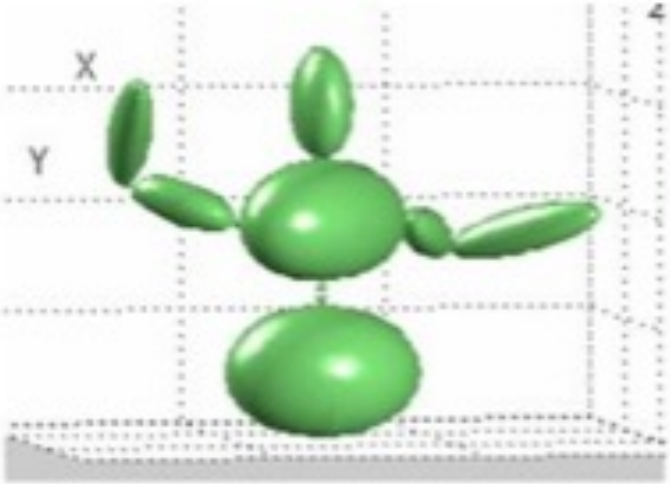
Kinect - 2010

https://www.youtube.com/watch?v=_d6KuiuteIA

Leap Motion - 2012


SP
0:00:27:05




X
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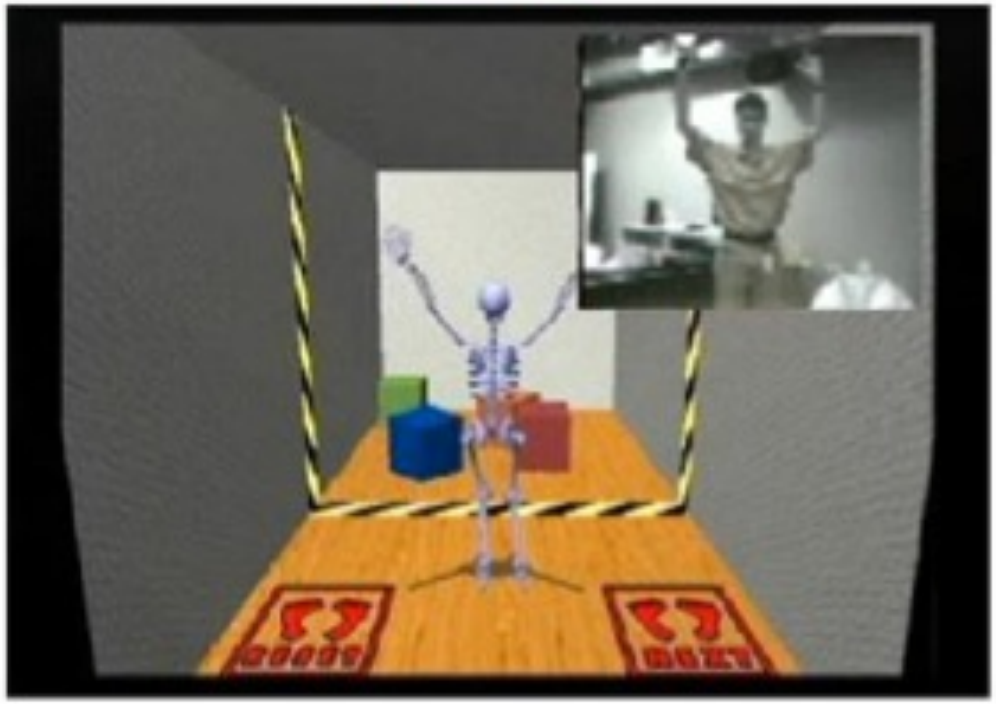

Ultra Haptics / Ultra Leap

https://www.youtube.com/watch?v=GDra4IJmJN0

GSpeak - Oblong Technologies

Minority Report - 2002

https://www.youtube.com/watch?v=fe0fHTHEL9w

https://www.ted.com/talks/john_underkoffler_drive_3d_data_with_a_gesture

https://www.youtube.com/watch?v=PJqbivkm0Ms