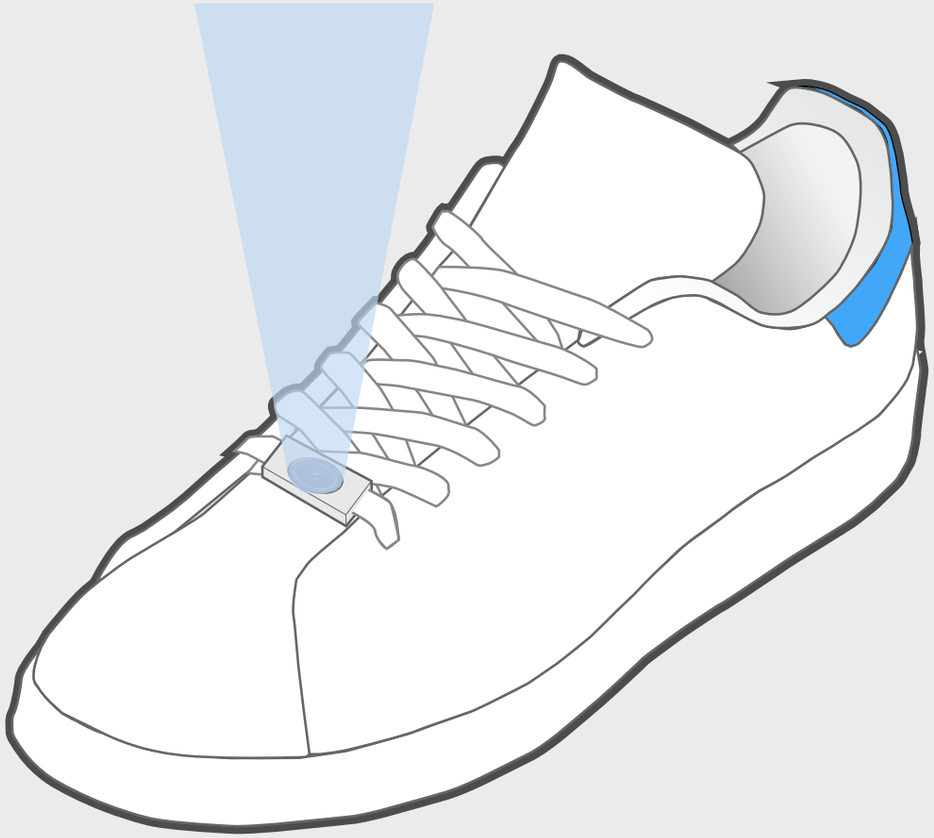
ShoeSense



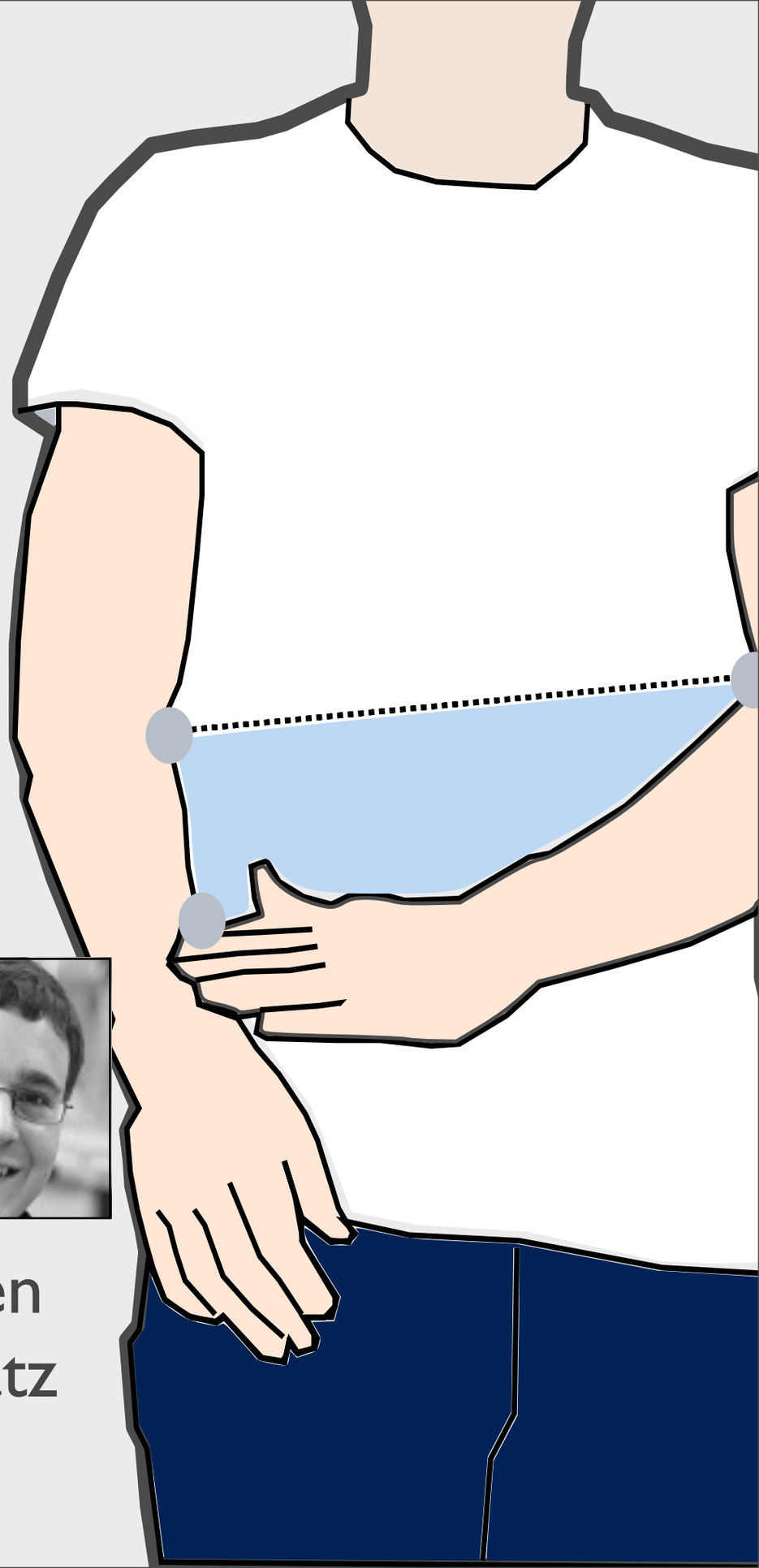
Gilles Bailly

Jörg Müller

Michael Rohs

Daniel Wigdor

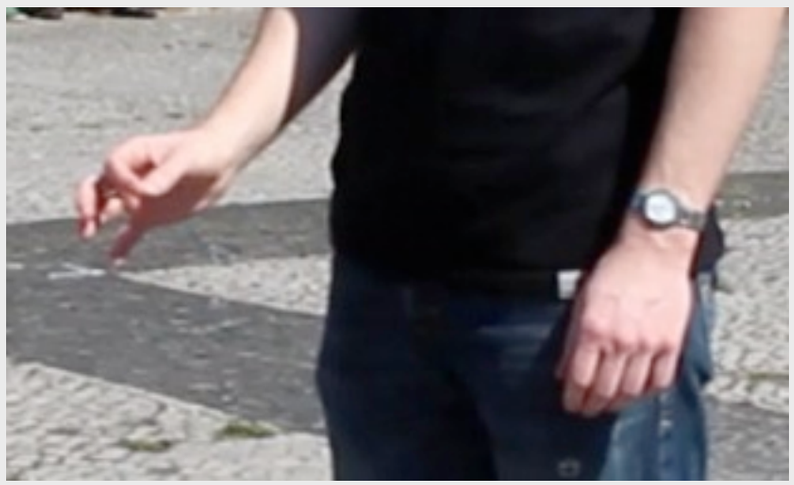
Sven Kratz



5s Video

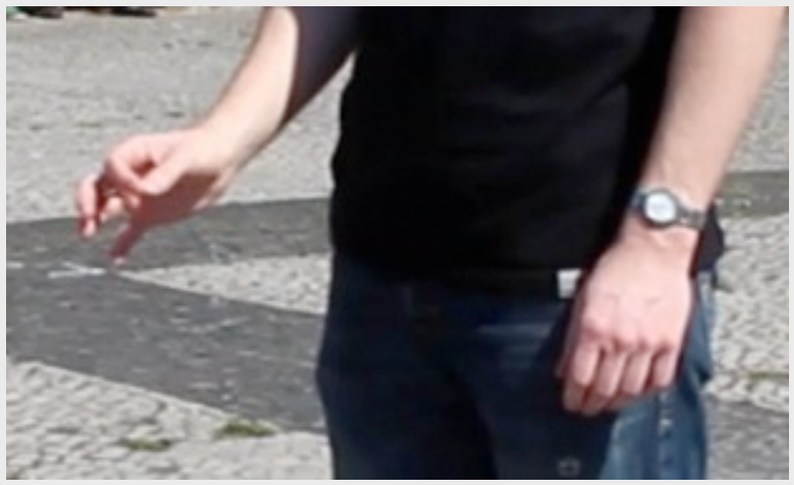
5s Video (with sound)

3 Gesture Sets

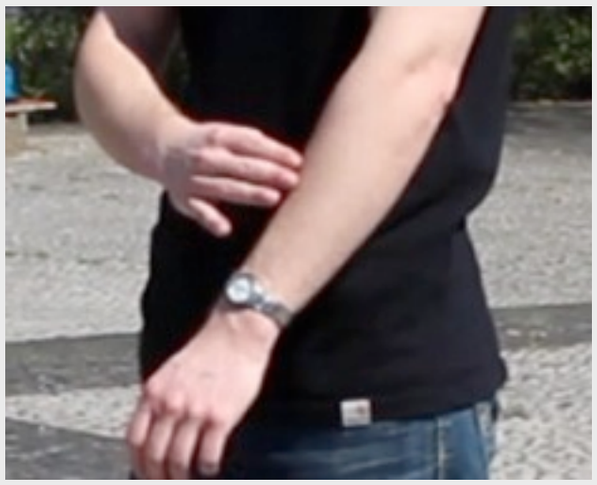


Next Song

3 Gesture Sets

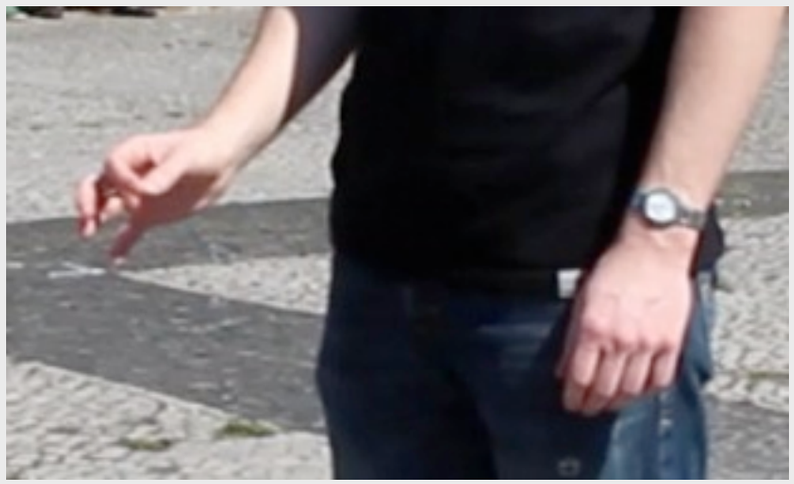


Next Song

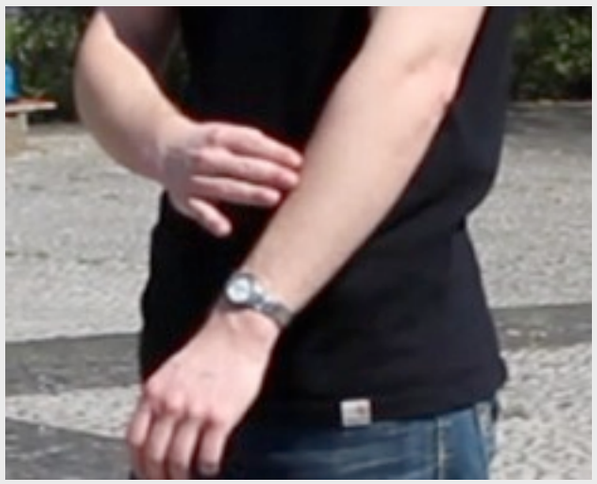


Volume +

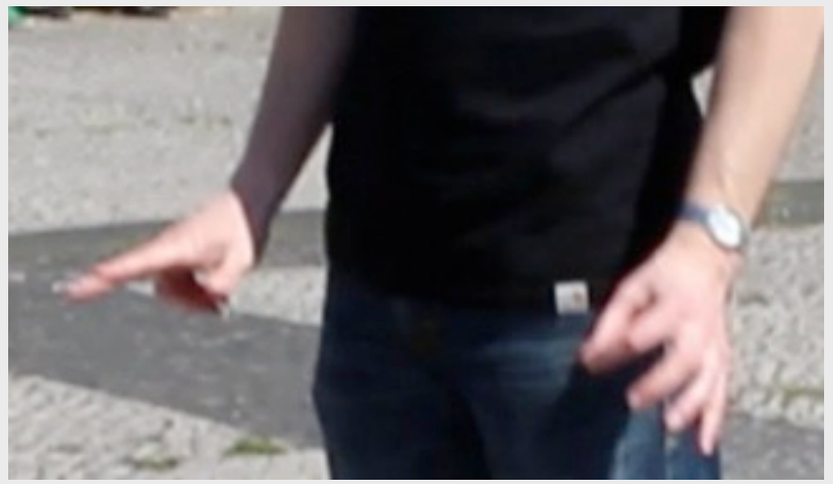
3 Gesture Sets



Next Song



Volume +

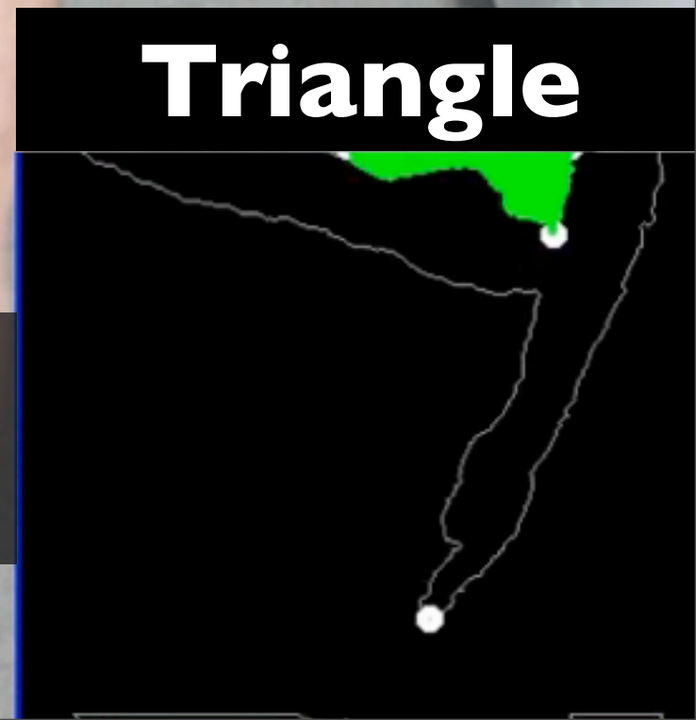


Send message

3 Gesture Sets

ShoeSense
Platform for Hand Gesture

Hand Gestures



Mobile Device Interaction

Shoes as a platform for interaction

Shoes as a platform for **Hand Gesture** interaction

Motivations

Mobile Device

Using a mobile device can be **inappropriate**

Using a mobile device can be **Difficult**

Reaching the Mobile Device

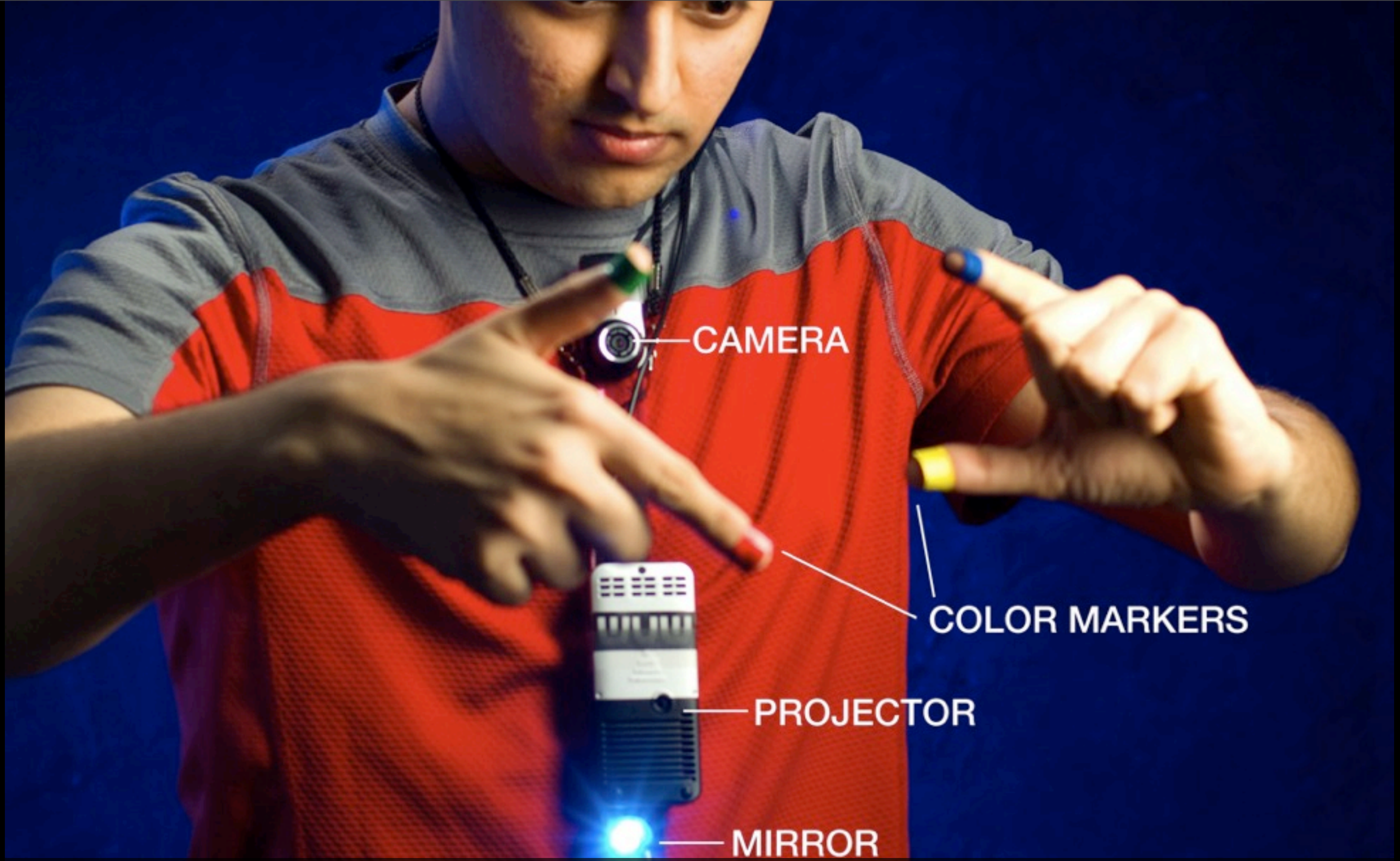
Wearable Computing

Hand Gesture System

Related Work

Gesture Pendant [Starner et al. 00]

Sixth Sense [Mistry 09]



Sixth Sense [Mistry 09]

Imaginary Interface [Gustafson et al. 10]

Brainy Hand [Tamaki 09]

OmniTouch [Harrison 11]

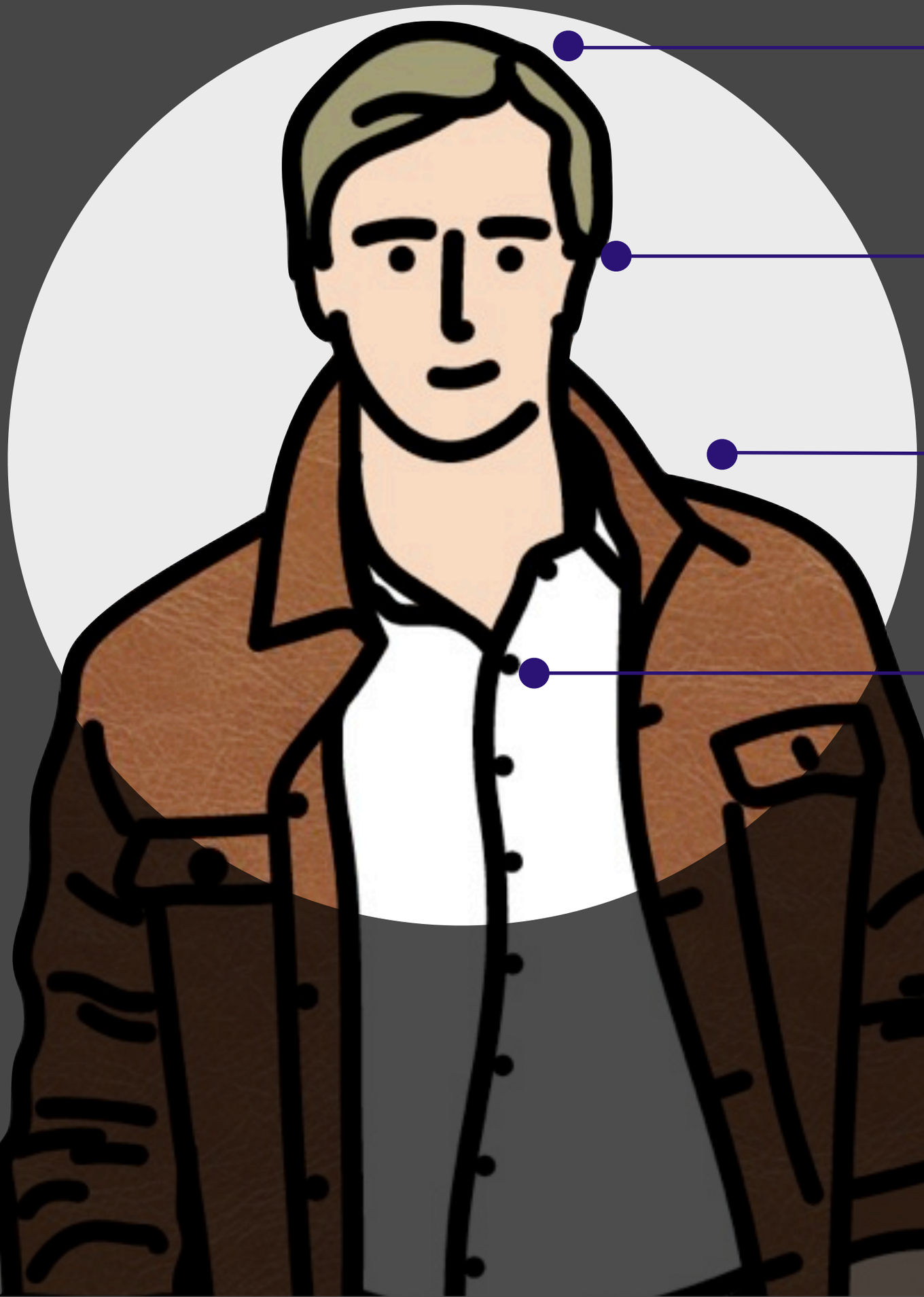
Where?

Head (Cap)

Ear

Shoulder

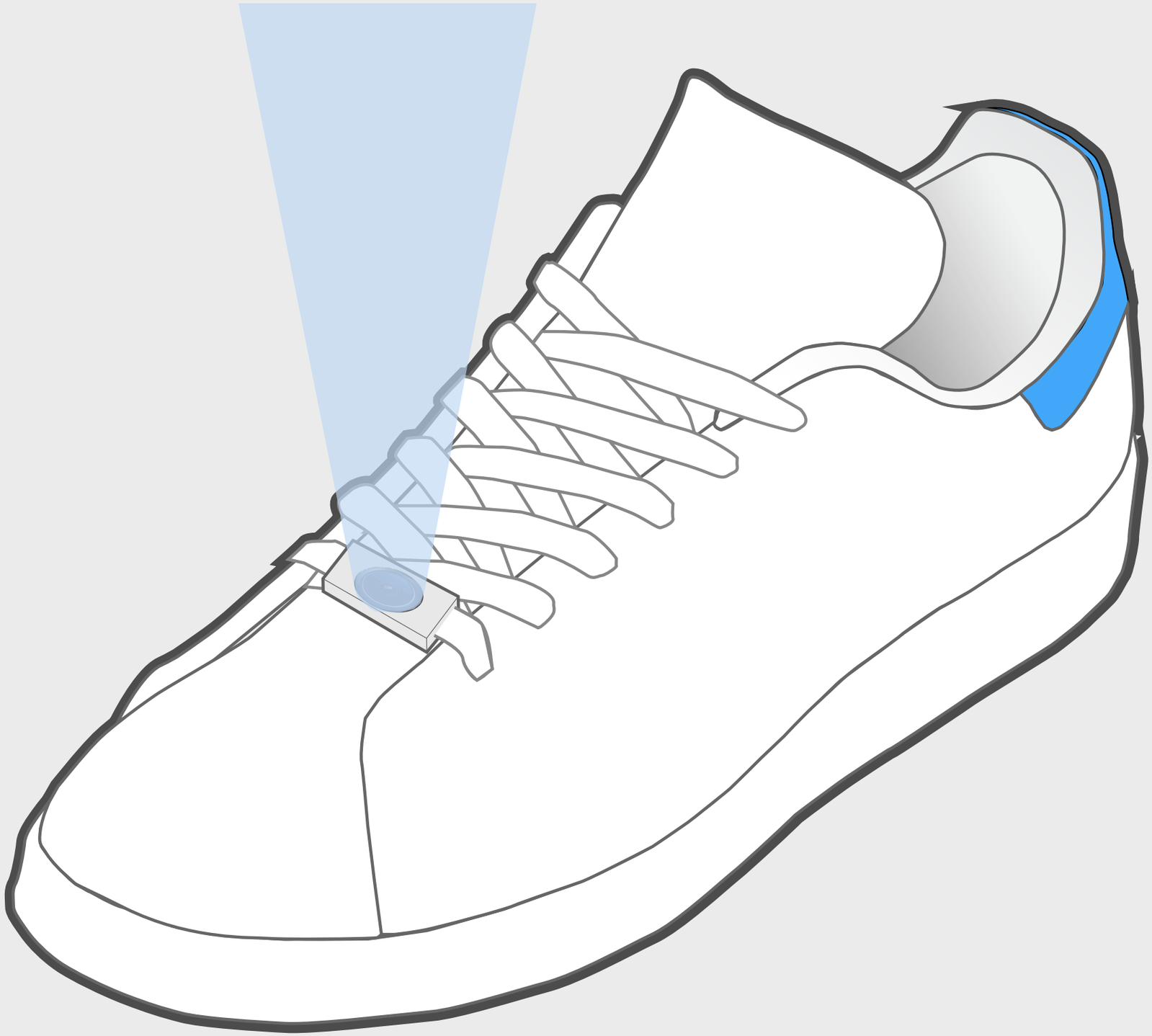
Chest


Head (Cap)
Ear
Shoulder
Chest


Foot

ShoeSense

Sensor located on the **shoe**



Claim

Shoes as a platform for interaction

Claim

Shoes as a platform for interaction

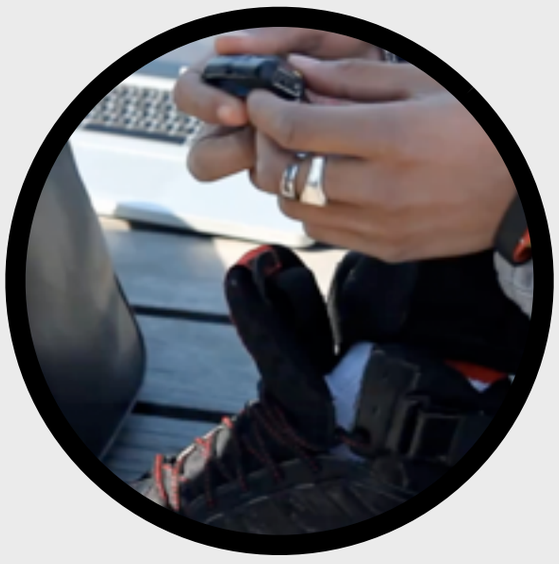
Shoes as a platform for **Hand Gesture** interaction

Claim

Platform
for Wearable computing


www.komikresim.com

Megalizer (Adidas)



Nike + iPod

How to Use the Nike+iPod Sport Kit

Step 1.

Step 2.

Step 3.

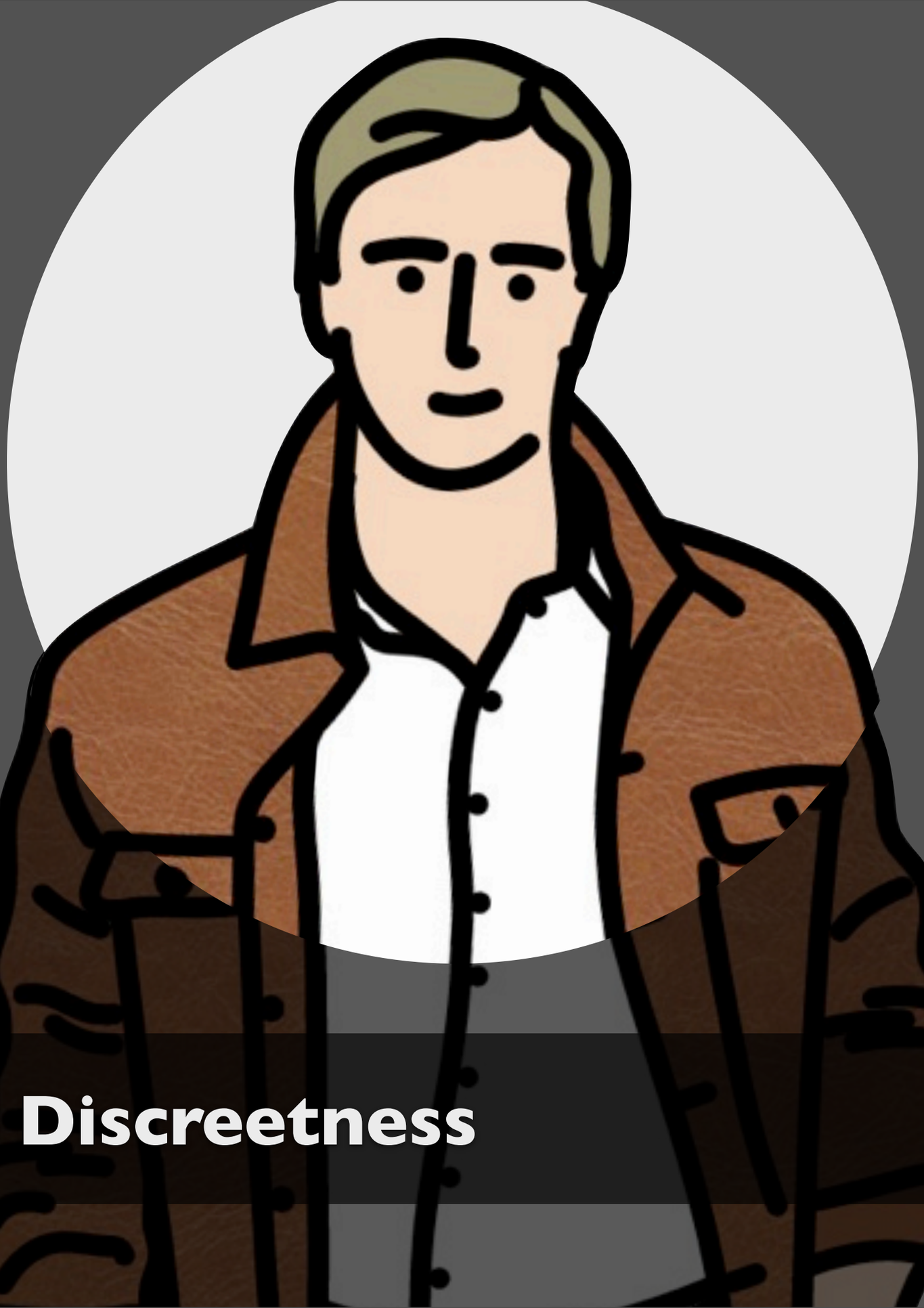
Advantages

Wardrobe Integration

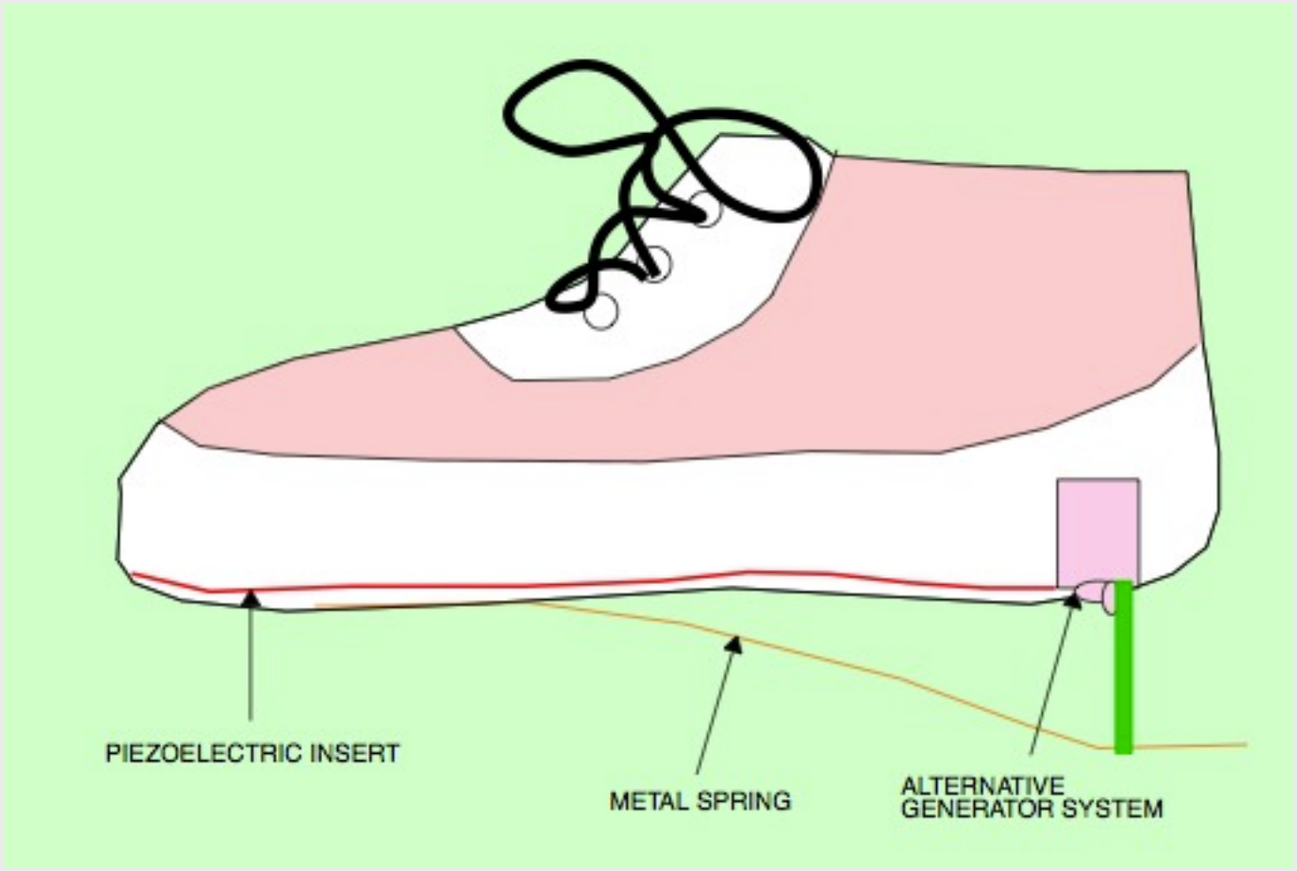
Reduced Occlusion

Low Maintenance

Stability



Discreetness



[Starner 96]

Human Powered

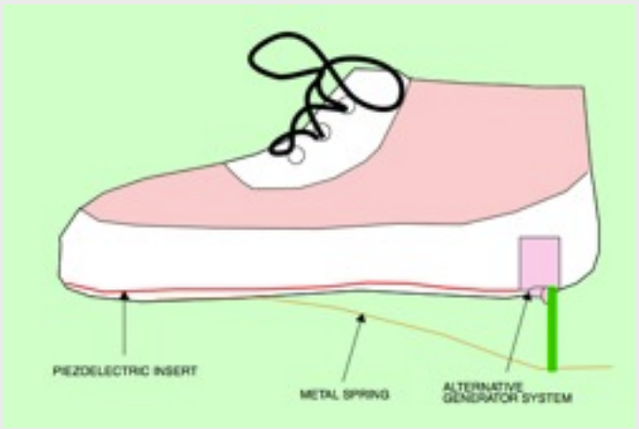
Wardrobe integration

Reduced occlusion

Low Maintenance

Stability

Discreetness



Human Powered

Drawbacks


EAGLE

Shoes as a platform for interaction

Shoes as a platform for

Hand Gesture interaction

Shoes as a platform for interaction

Shoes as a platform for **Hand Gesture** interaction

System

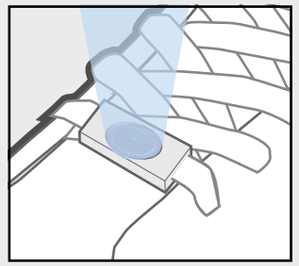
Envisioned
ShoeSense

Proof-Of-Concept

Bonus

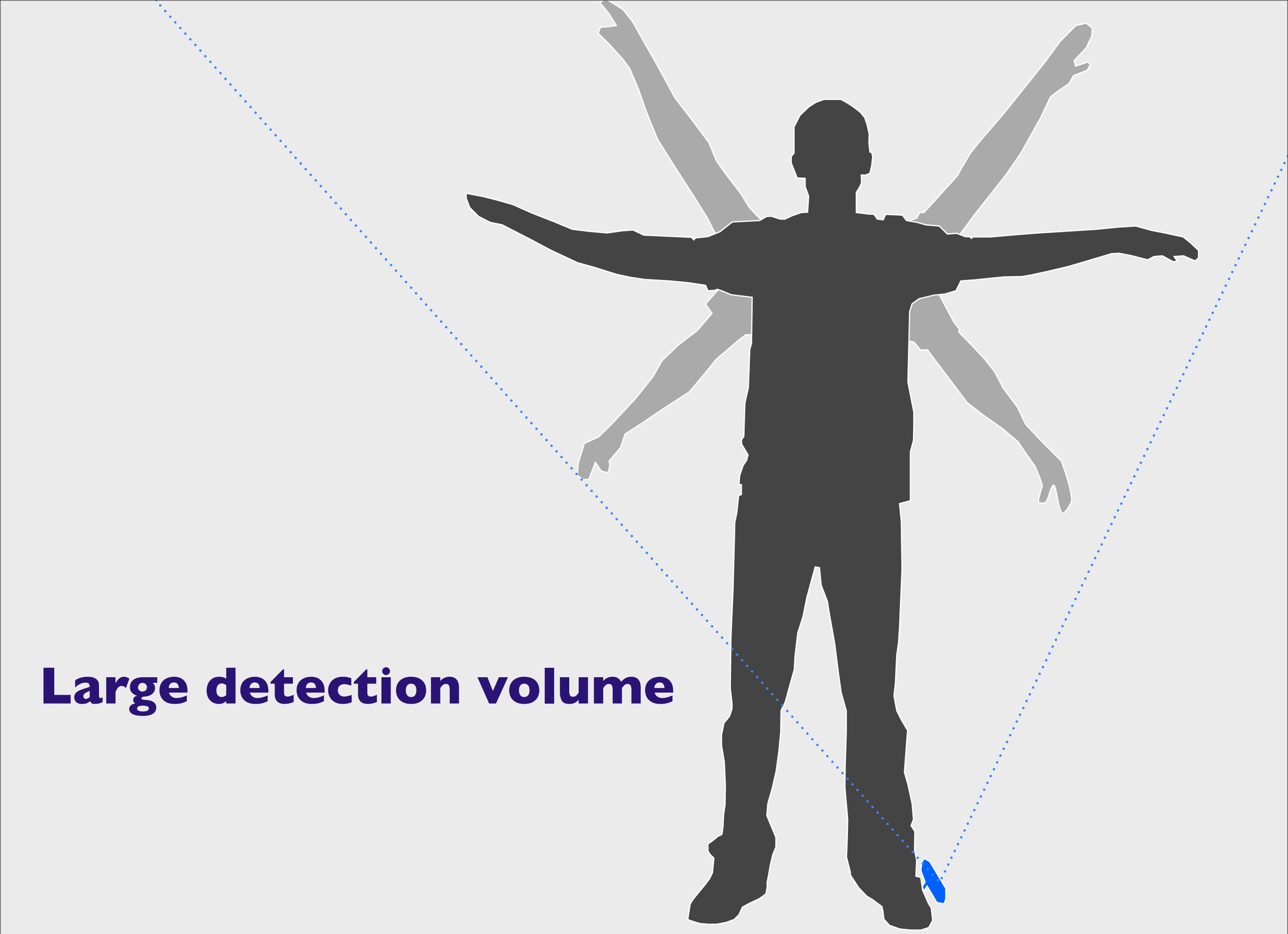
2010

2011



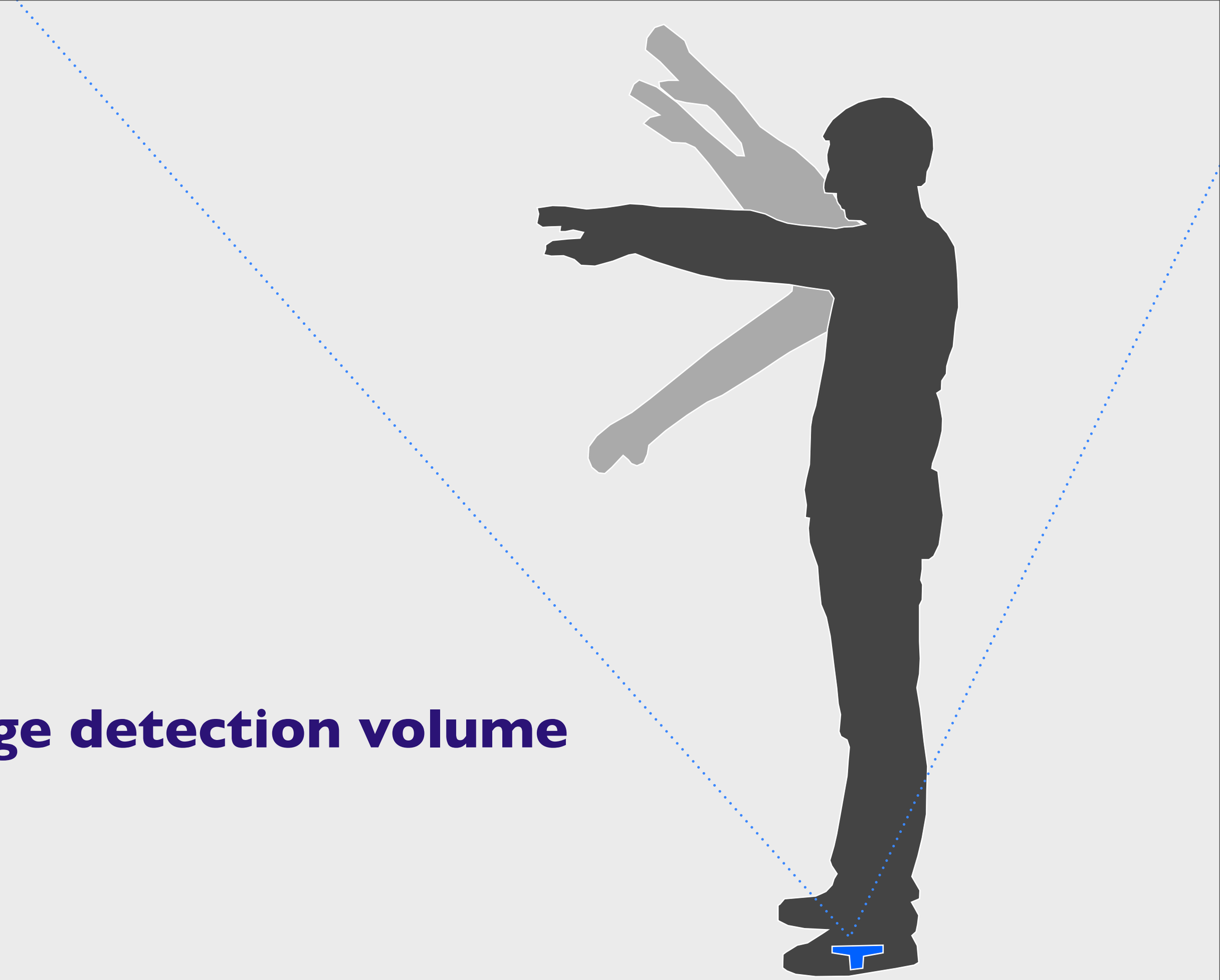
?

Gestural Interaction



Large detection volume

Large detection volume



Demonstrative Gestures

Applications

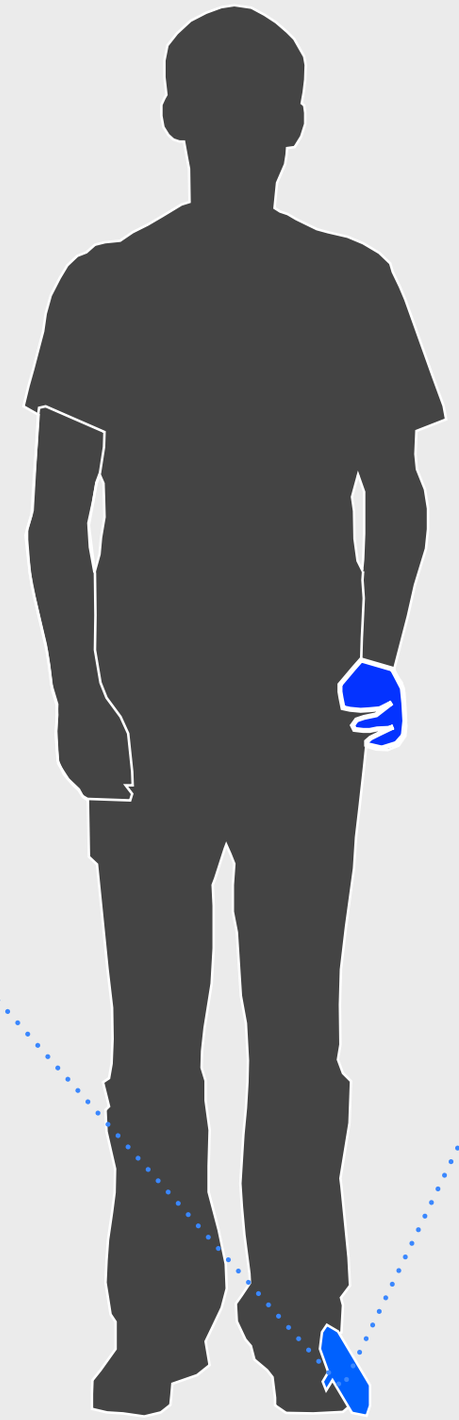
- Dancers
- Musical performers
- Stage actors
- etc.

Relaxed Gestures

No Superfluous arm movements

Close to the resting position of hands

- Comfortable
- Discreet



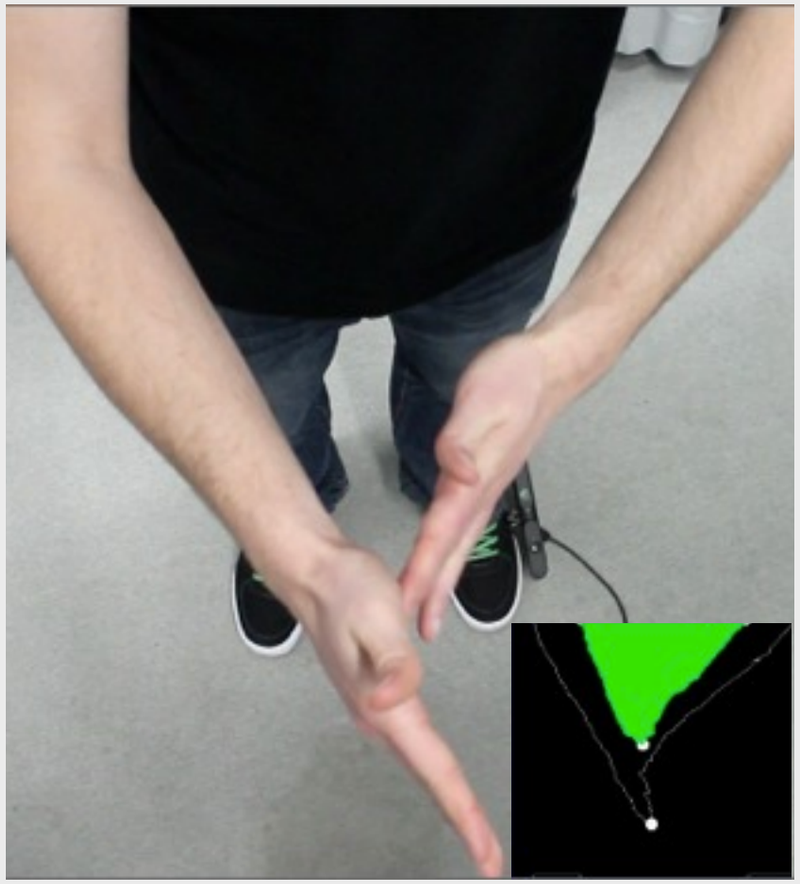
ShoeSense

Large and Demonstrative Gestures

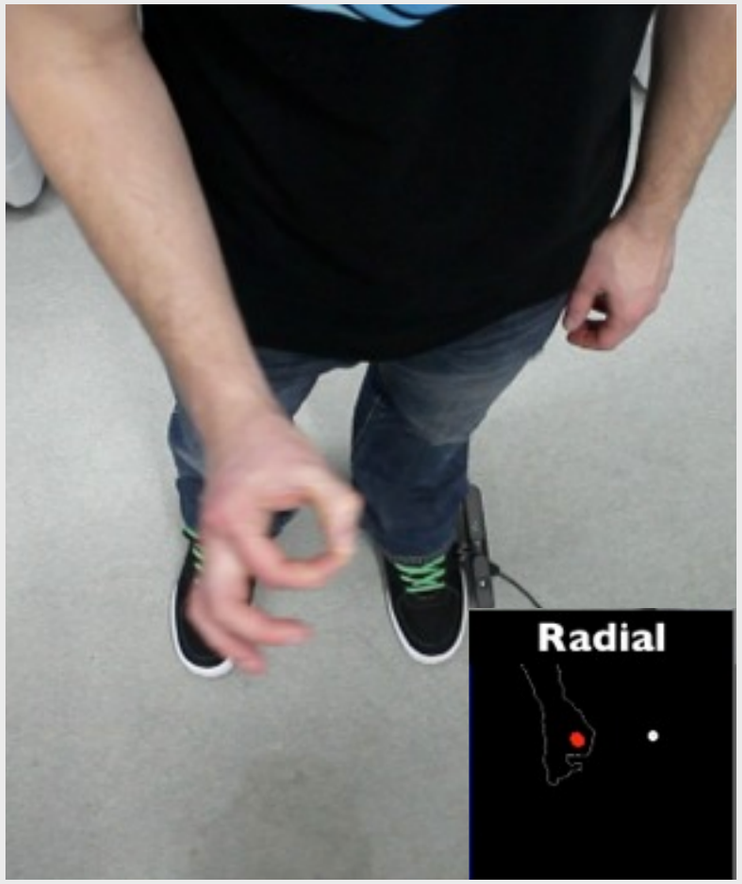
Relaxed and Discreet Gestures

Which **Gesture Vocabulary**?

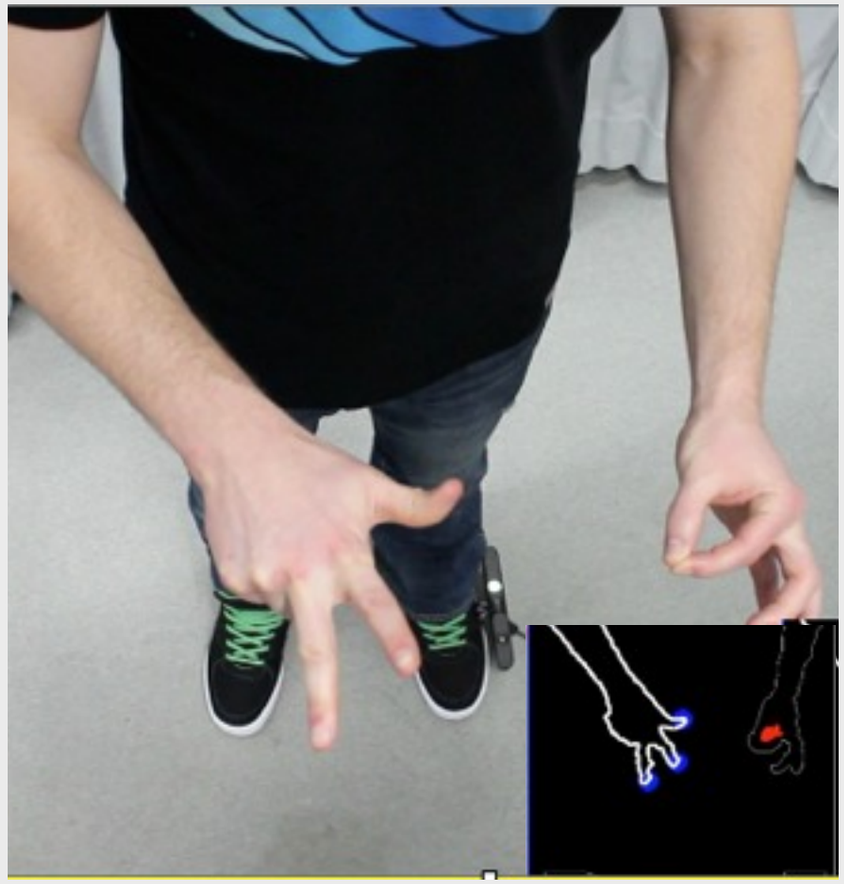
Vocabulary



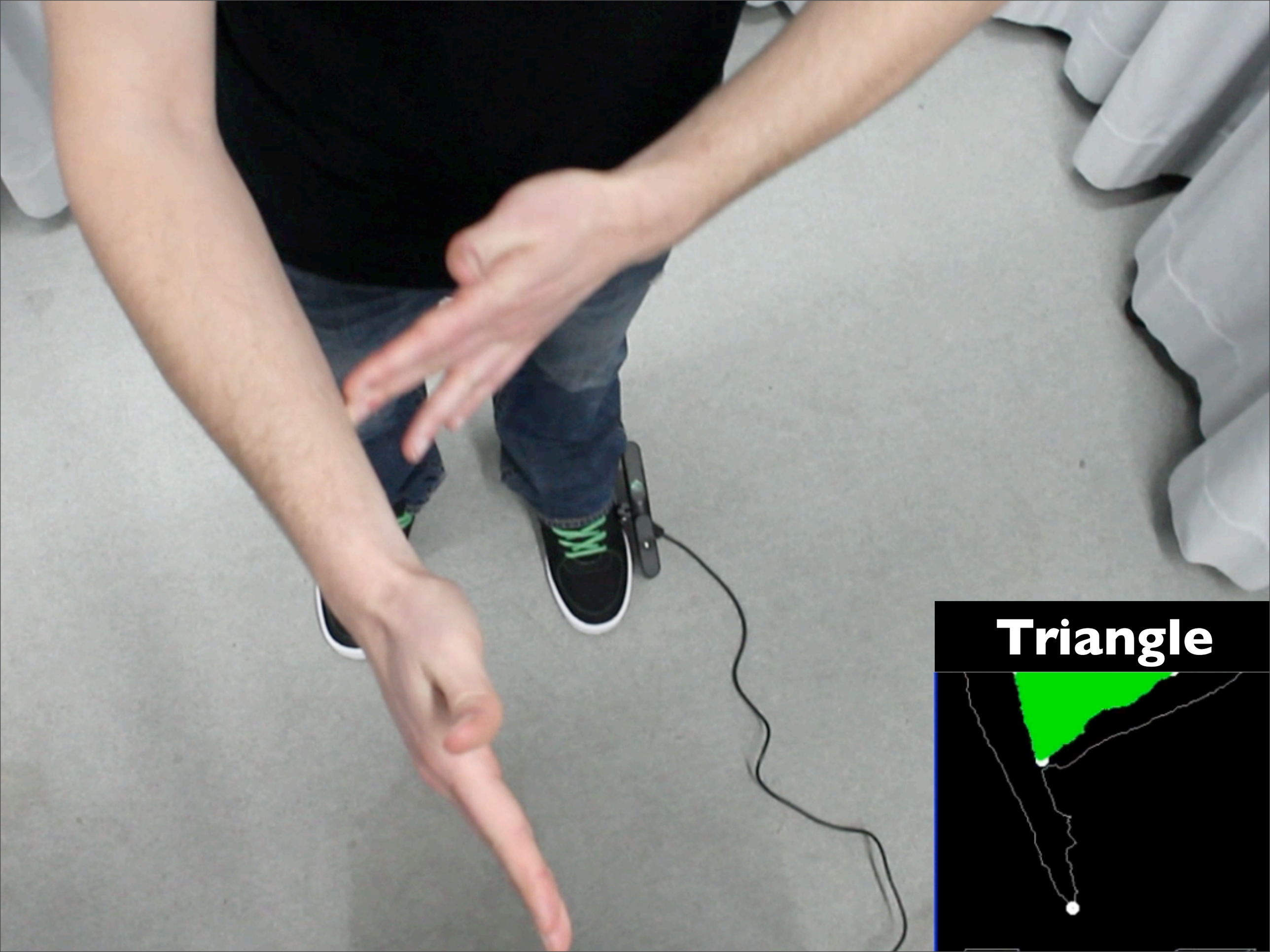
Triangle



Radial



Finger-Count


Triangle

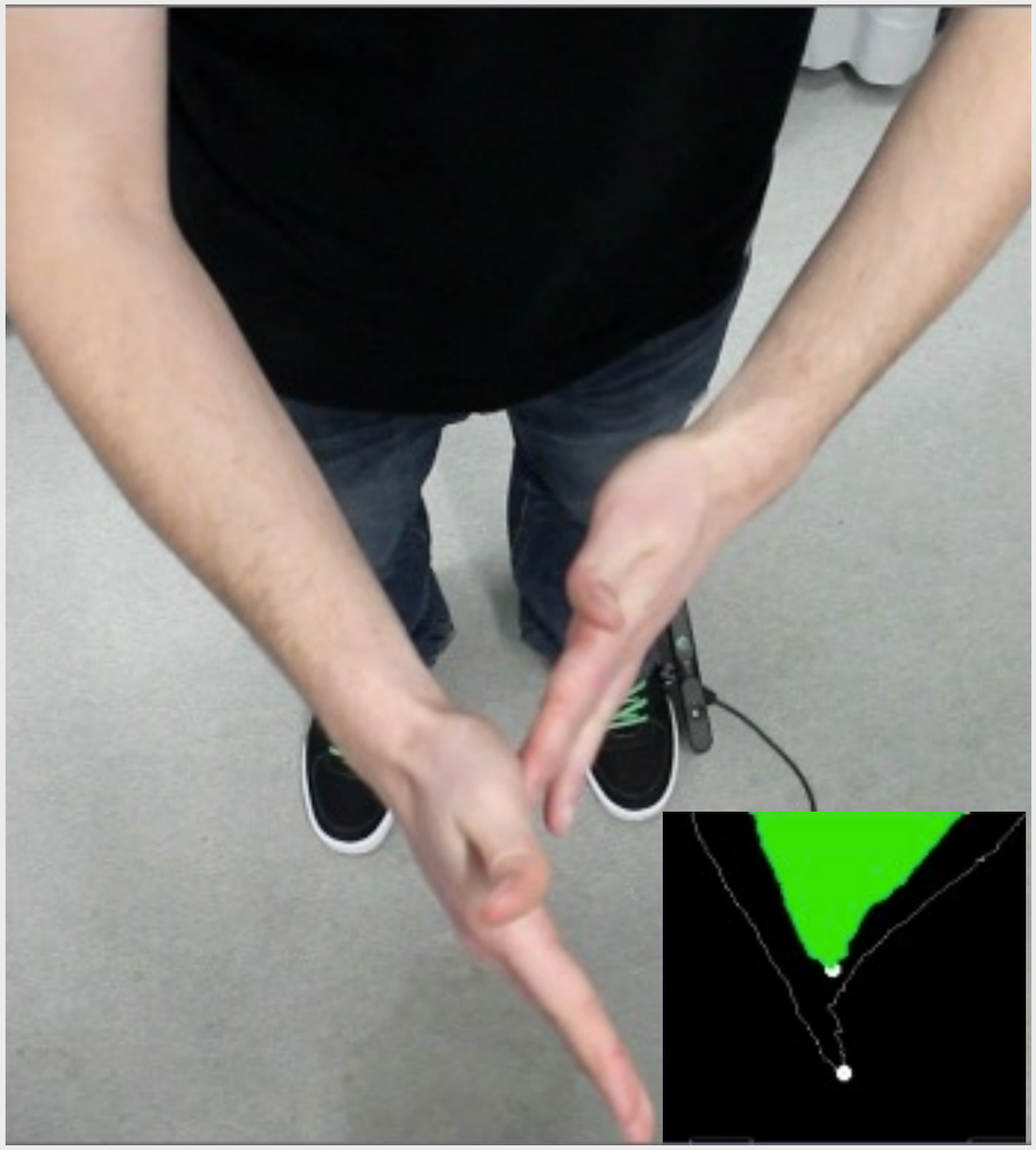
Triangle Gestures

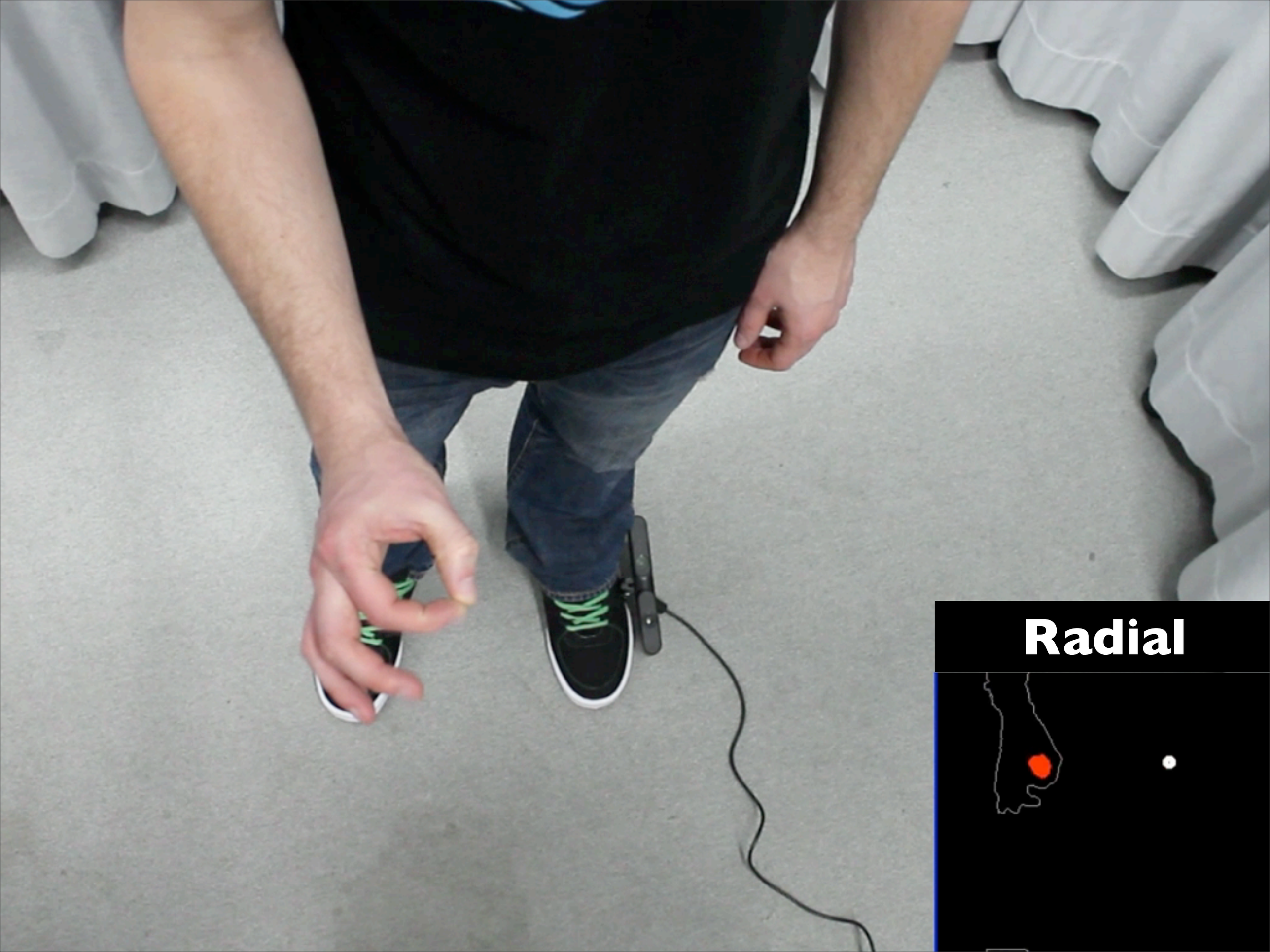
Two-Handed Gesture

Static Gesture (1 frame)

Absolute Reference

Continuous Control




Radial

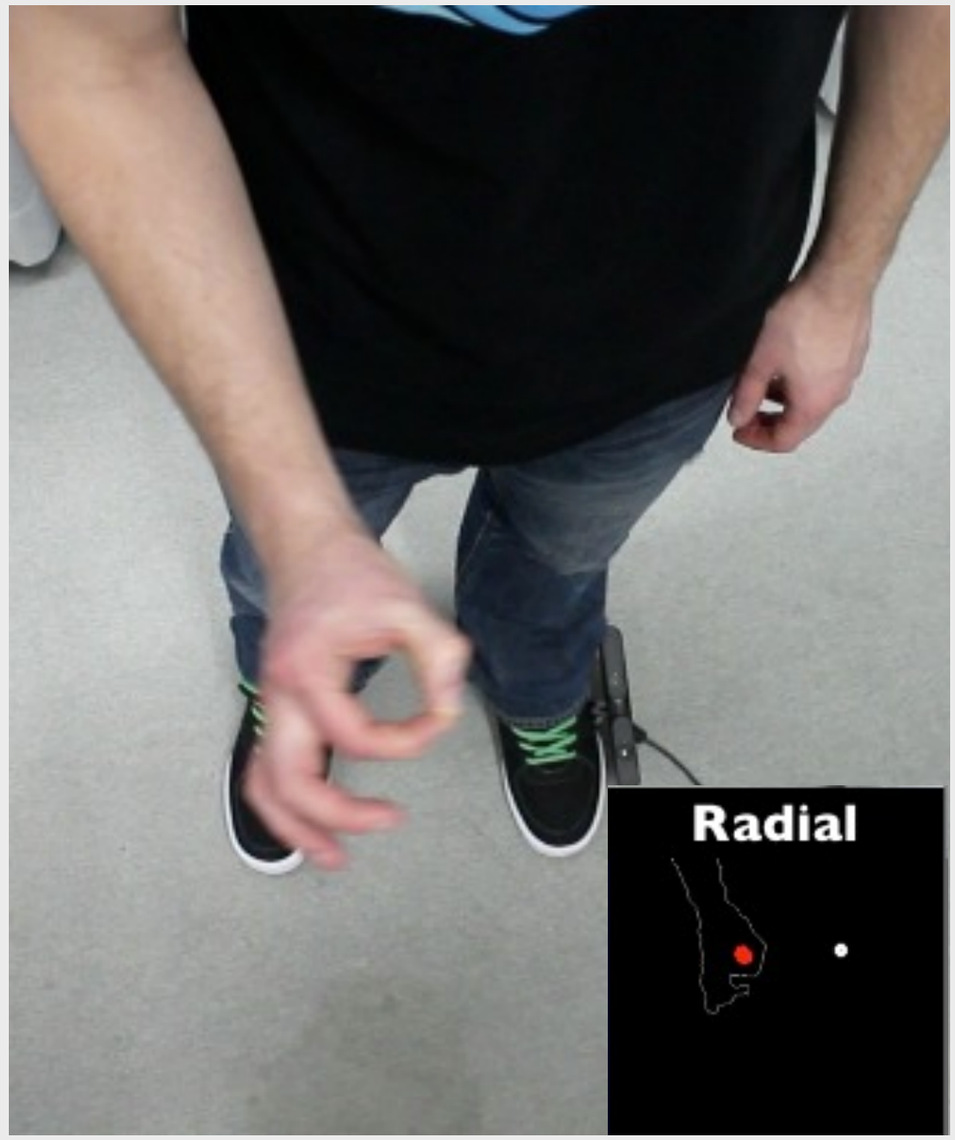
Radial Gestures

Pinch Delimiter [Wilson 06]

- Easy to perform
- Easy to recognize
- Different from daily life Gestures

Marking menus [Kurtenbach 91]

- Radial strokes



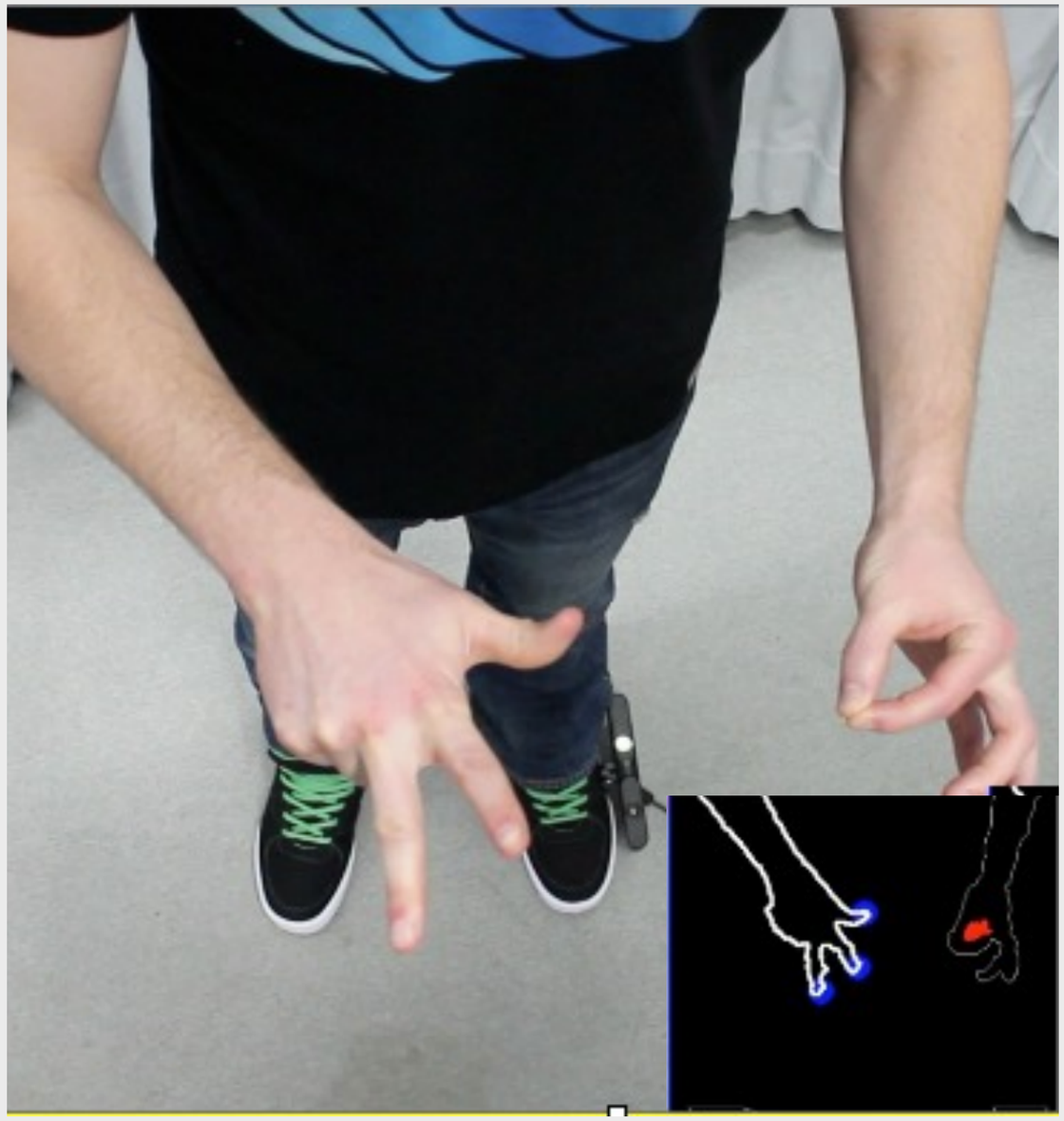

FC

Finger-Count Gestures

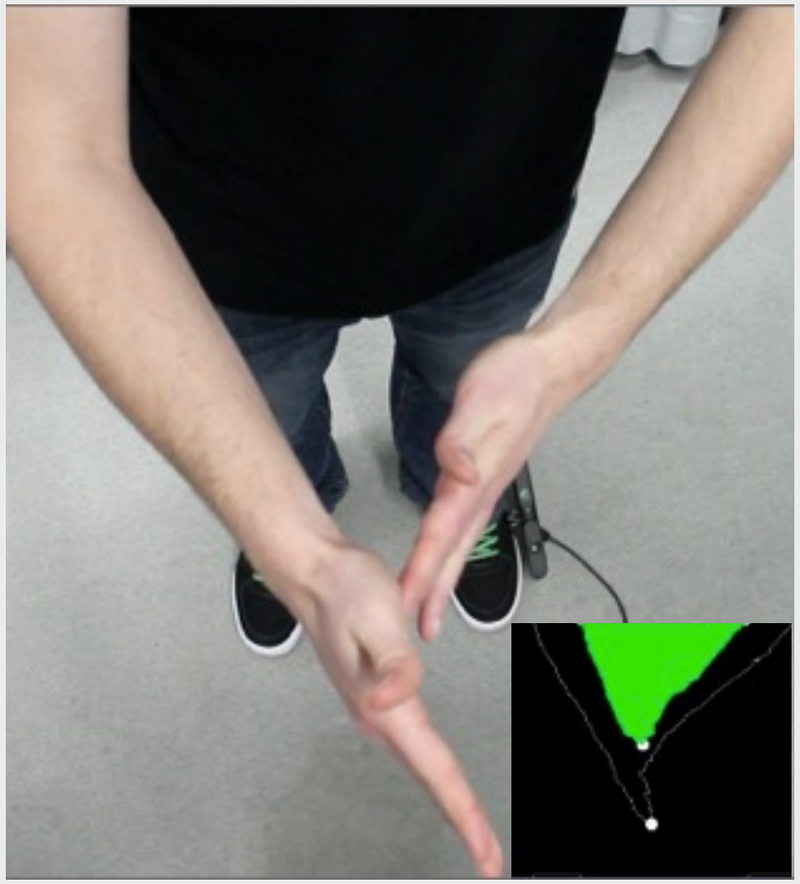
Finger-Count Menus [Bailly 10]

Static gestures (1 frame)

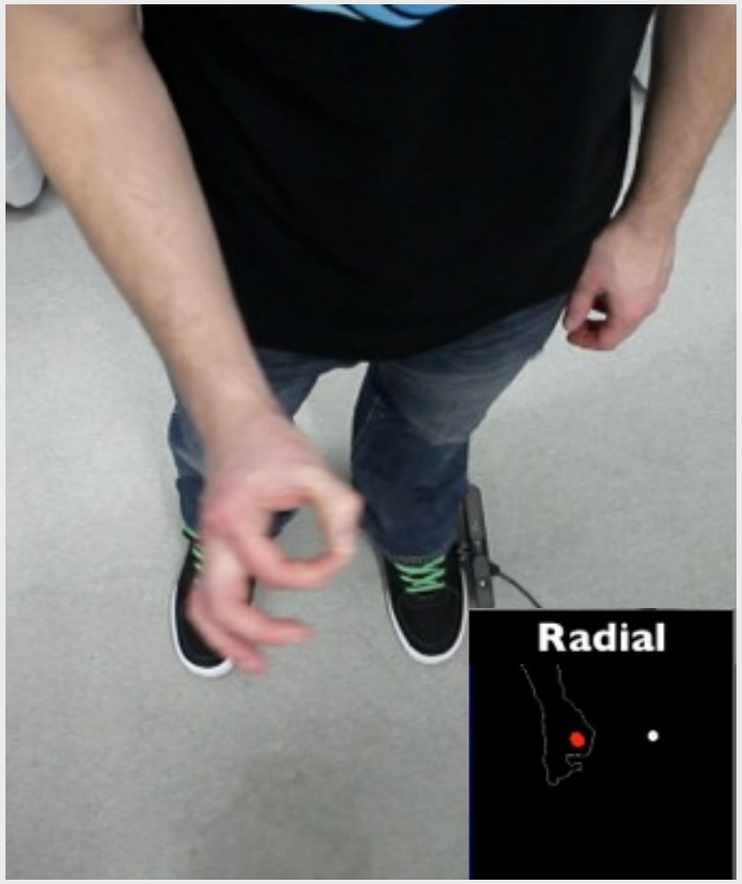
Easy to Understand [Bailly 10]



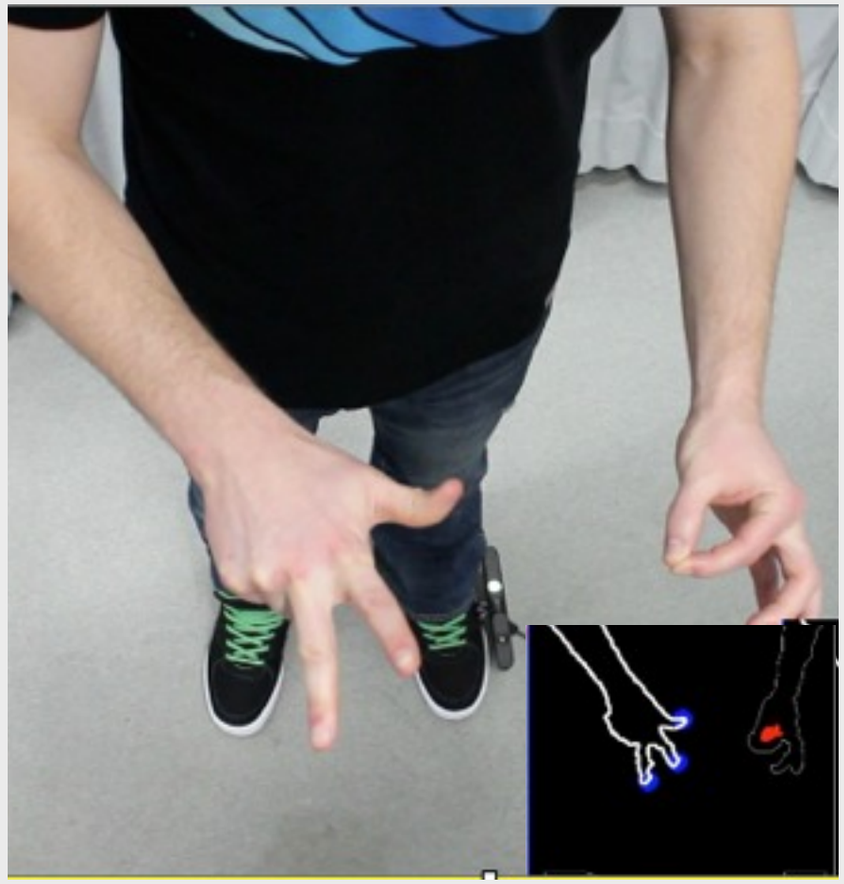
Vocabulary



Triangle

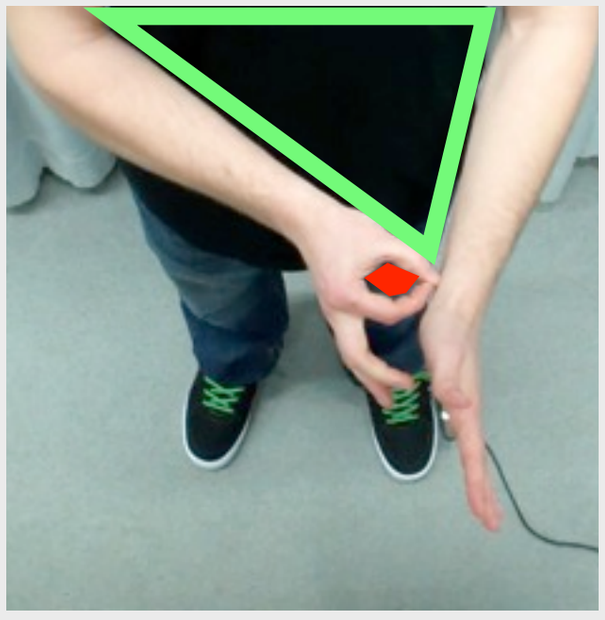


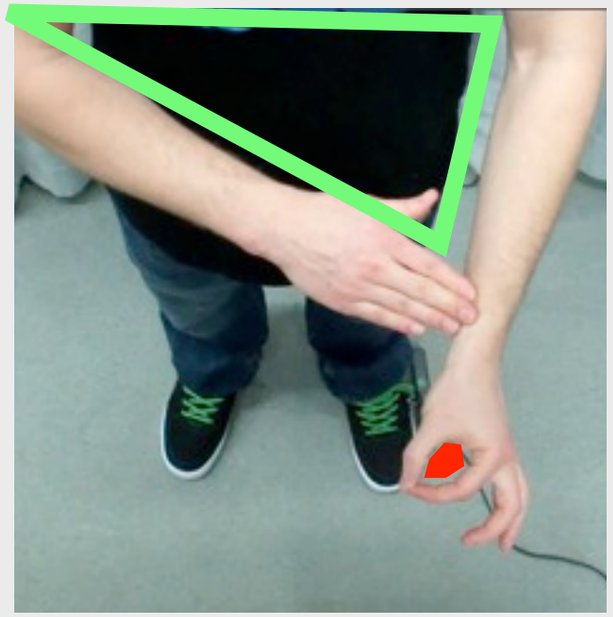
Radial



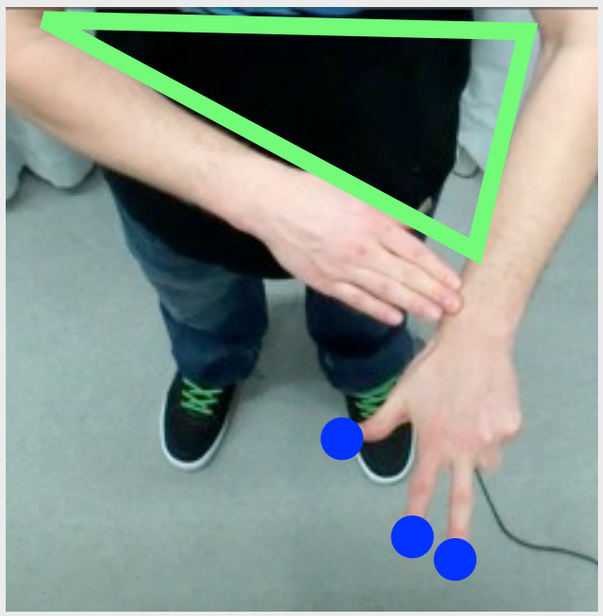
Finger-Count

Gesture Phrases

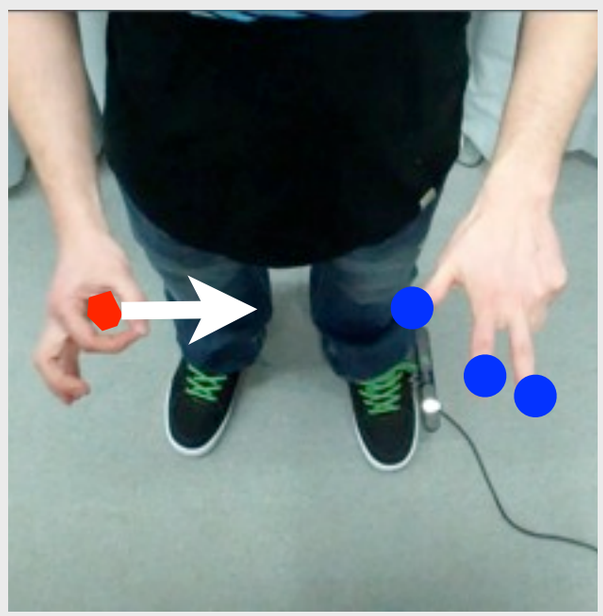




Triangle + Radial



Triangle + FC



Radial + FC

Implementation

Triangle

- **Our own algorithm**

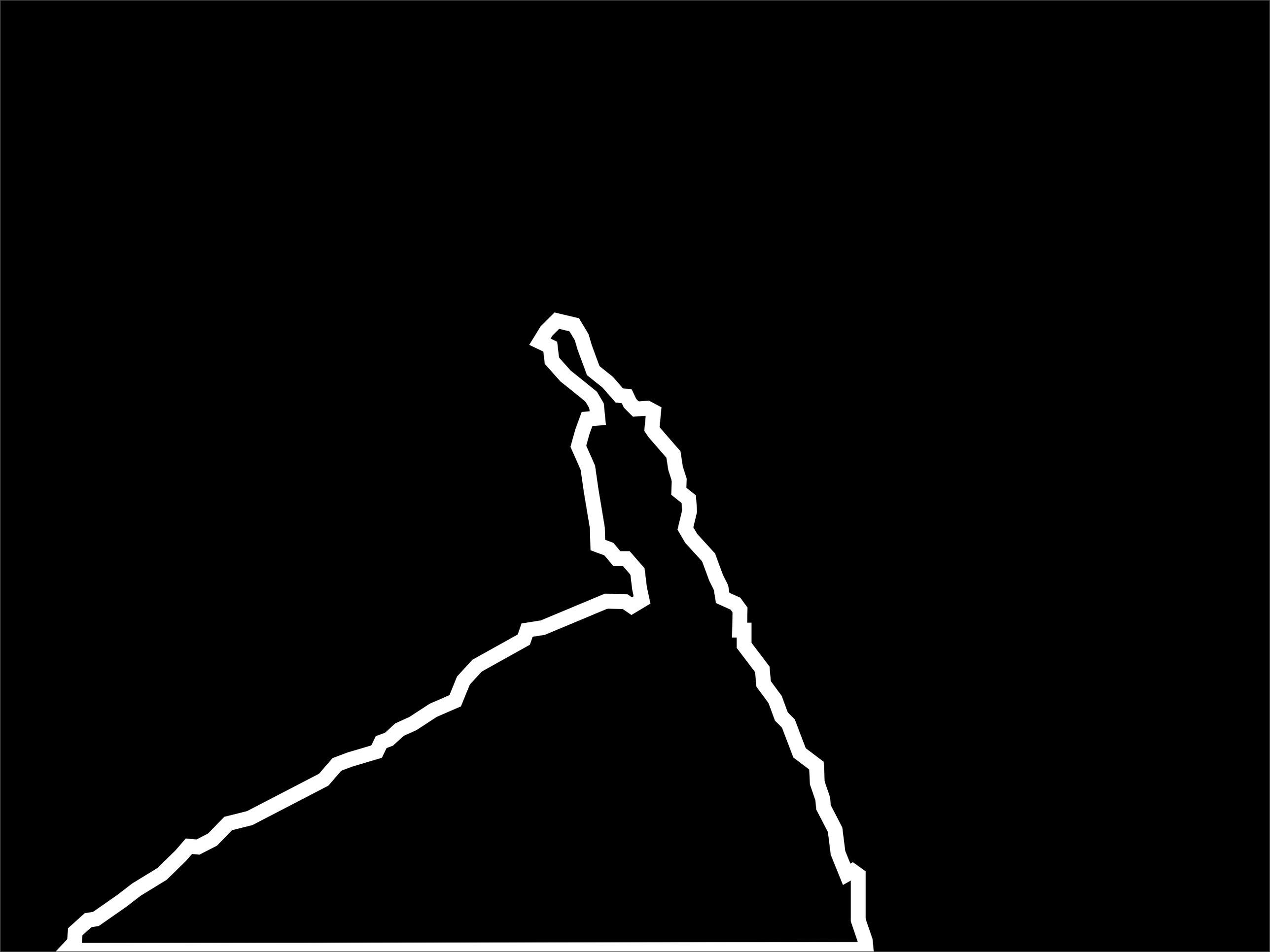
Radial

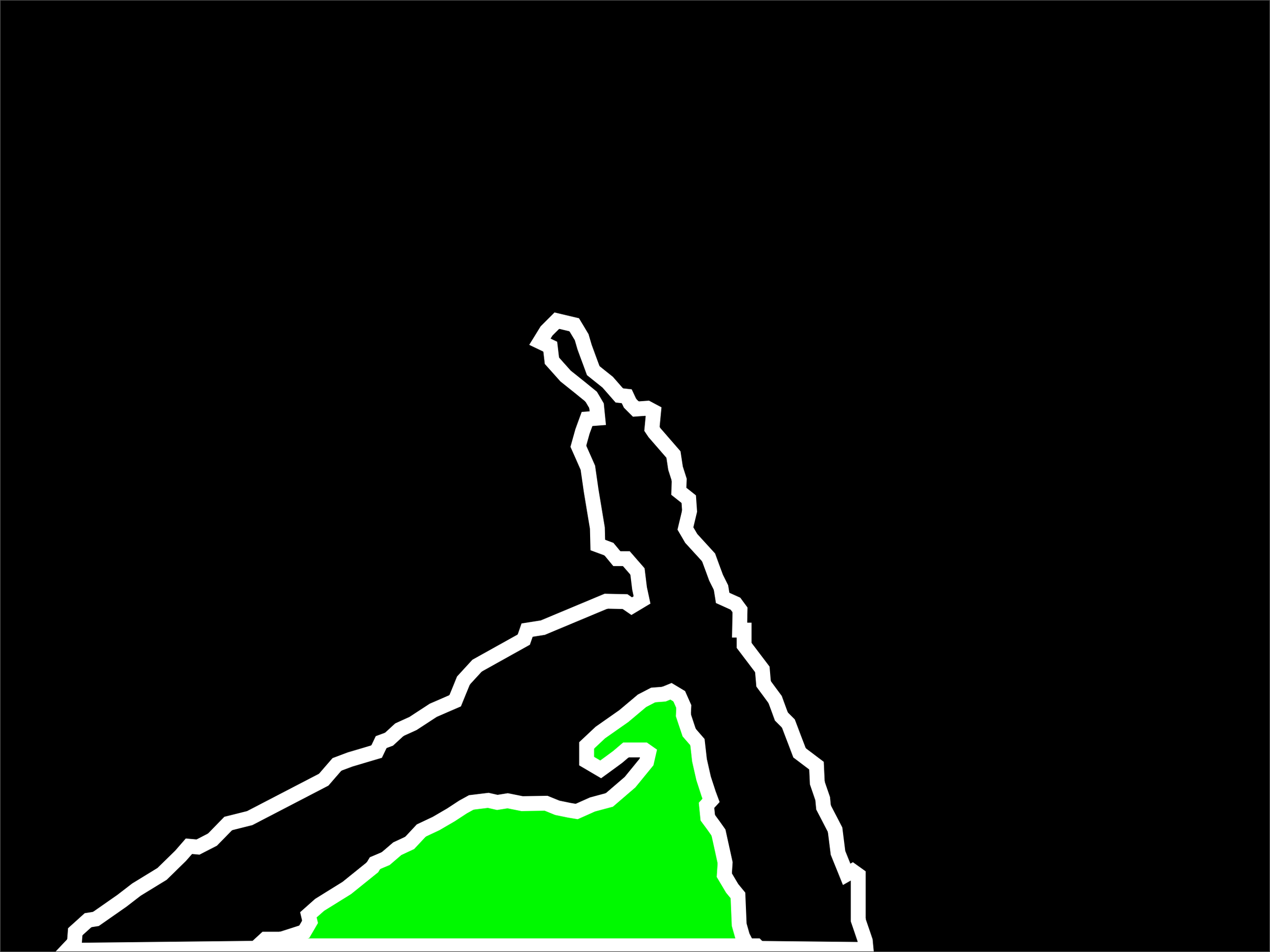
- Wilson 06

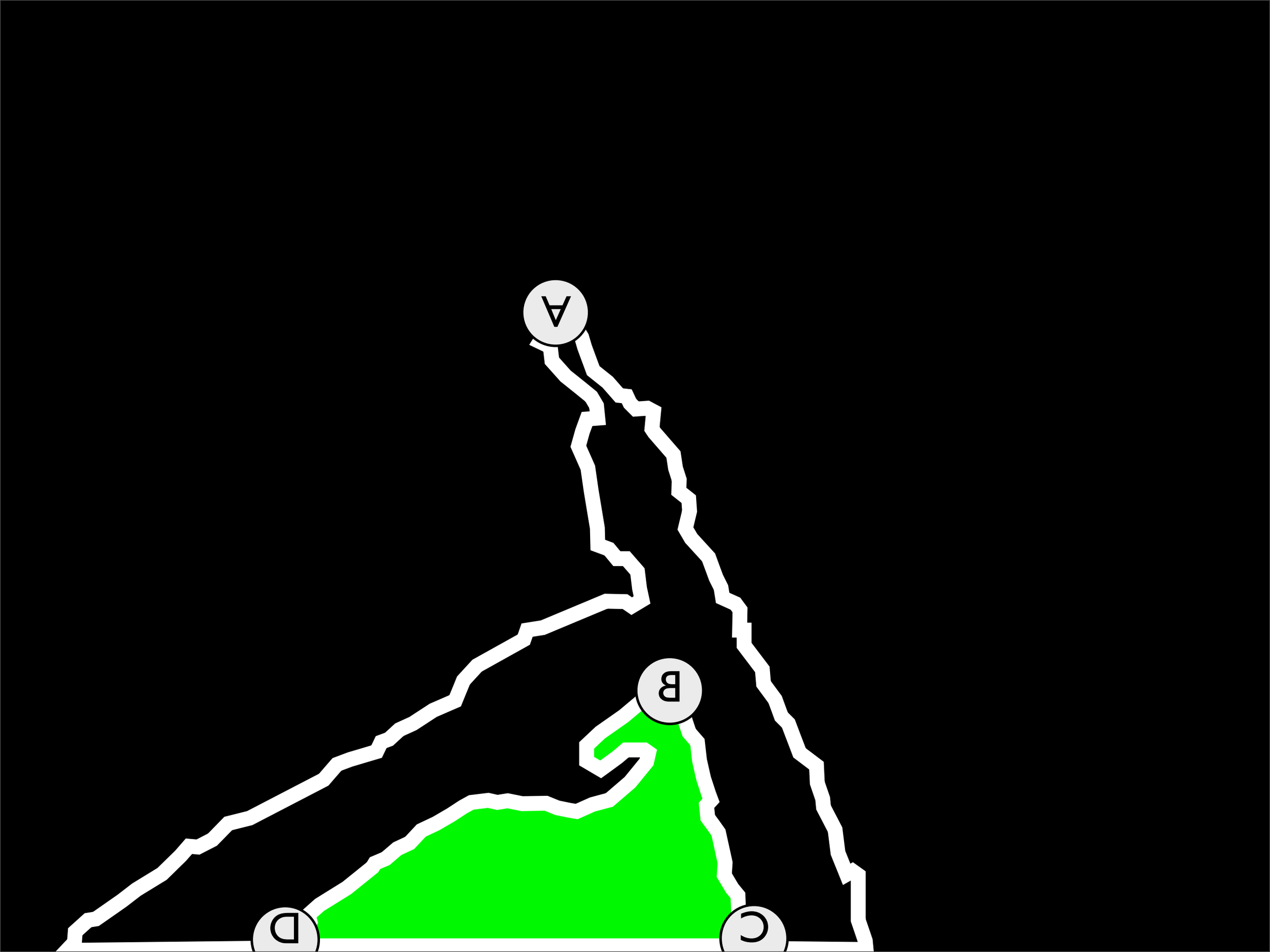
Finger-Count

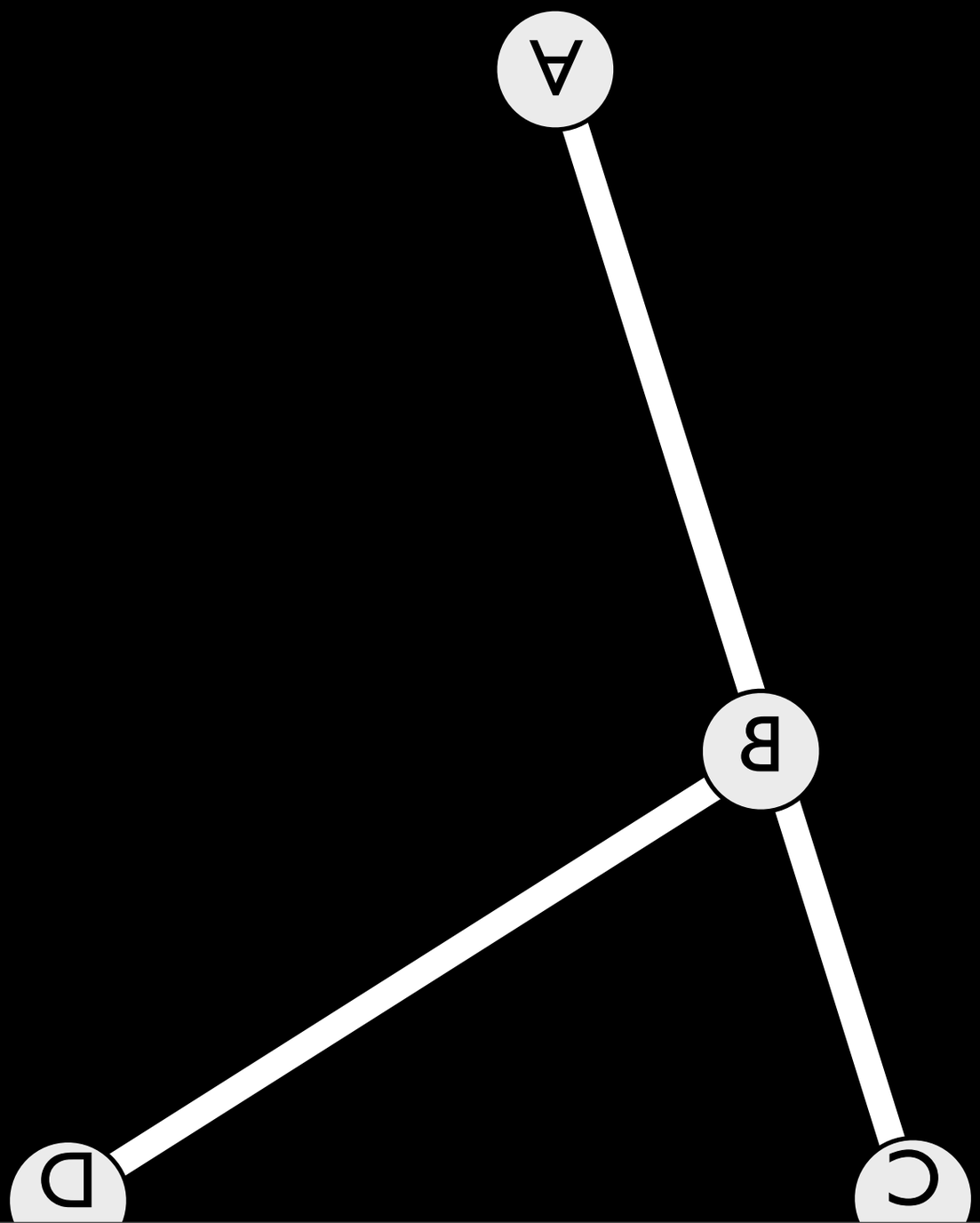
- K-curvature approach
  [Trigo et al. 10]
- k=5

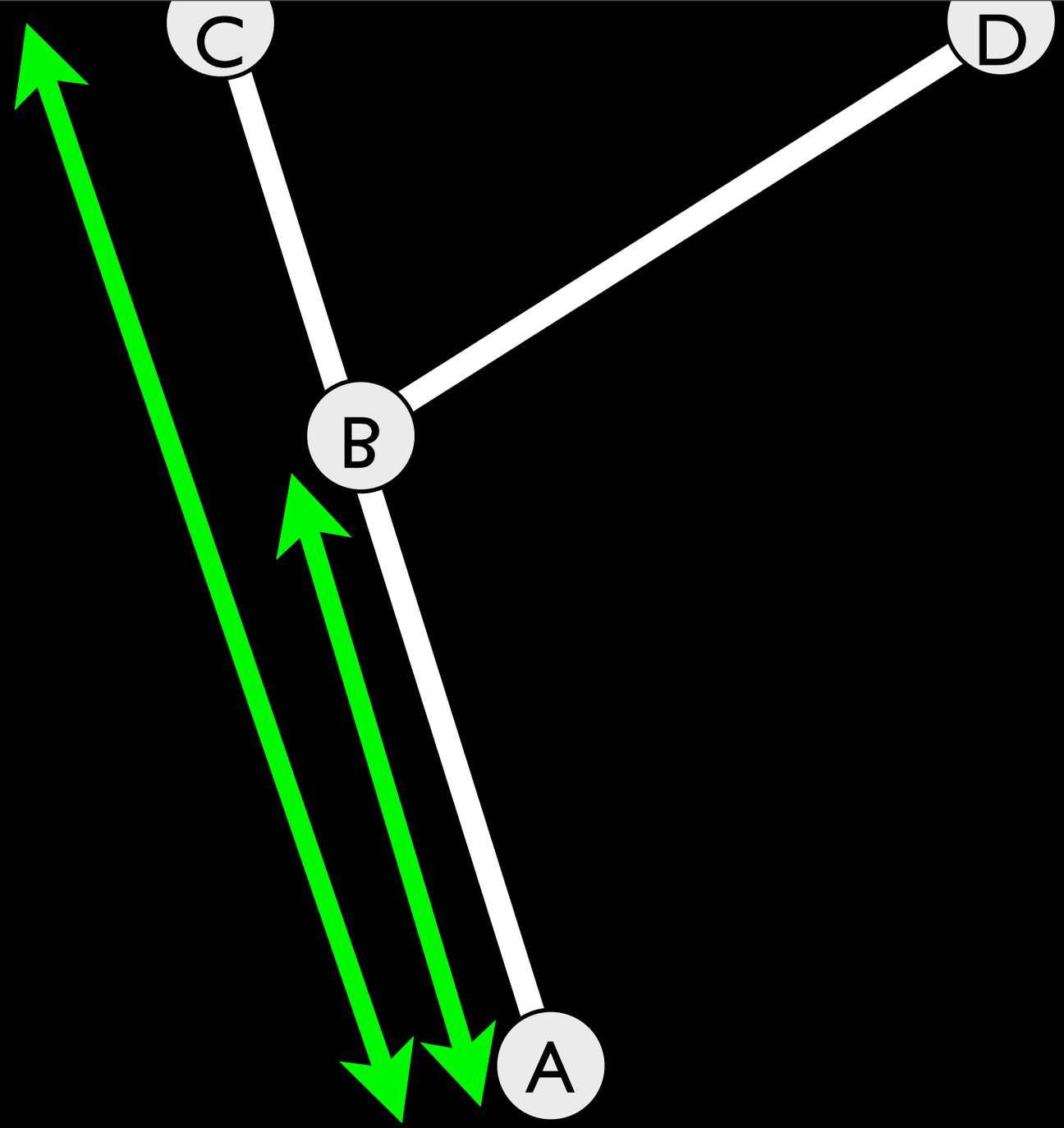
After
thresholding






A
B
C
D


A
B
C
D



Ratio: $\frac{AB}{AC}$

Orientation: $\overrightarrow{BD}$

Mobility

Standing

Sitting

Walking

Which **Applications**?

Frequent & Favorite Operations

Inexact & Inattentive interaction [Hudson et al. 10]

Inexact & Inattentive interaction [Hudson et al. 10]

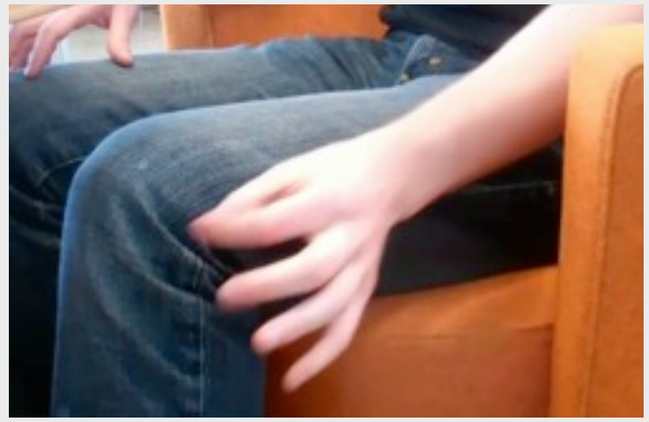
Fast & Eyes-free interaction

Examples:

- Activate silence mode
- Inform favorite recipients
- Ignore interruptions
- etc.

Feedback

- No feedback
- Tactile

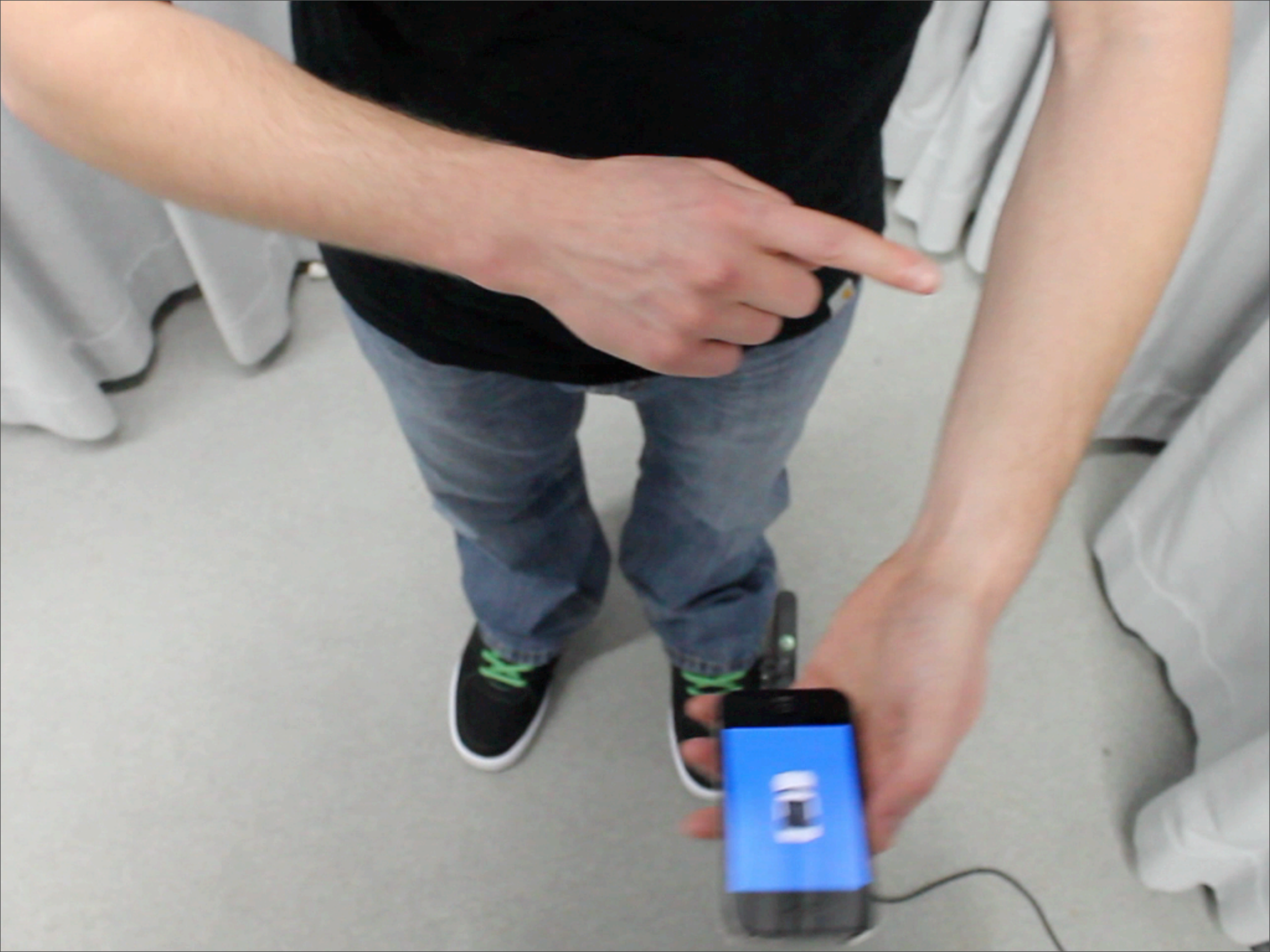


Activate
Silence mode

Inform of a
potential delay

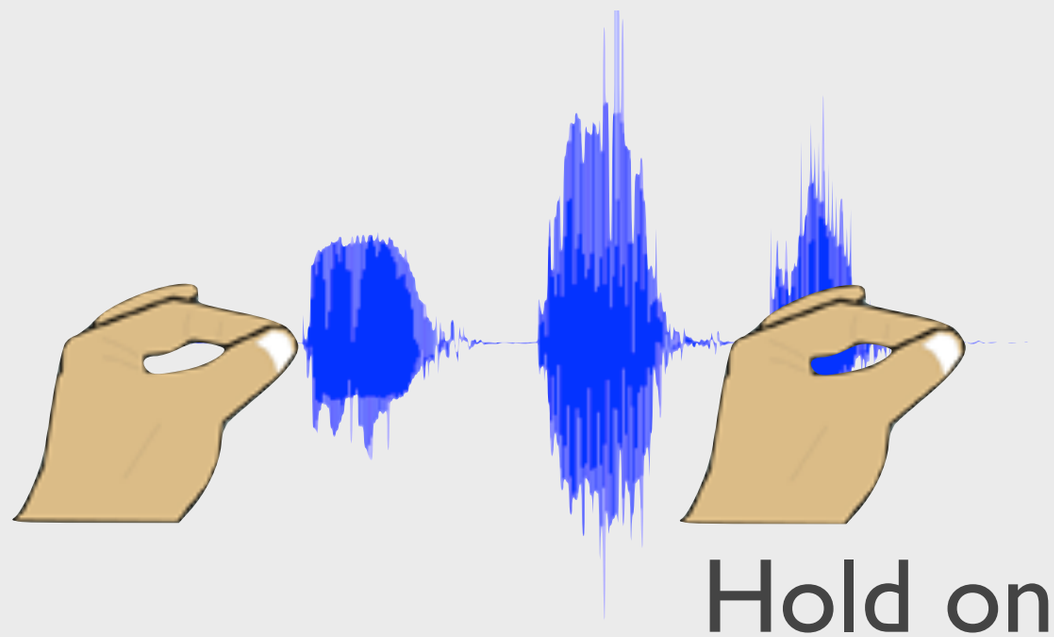
Inexact & Inattentive interaction [Hudson et al. 10]

Mobile Device Interaction



Simulated with a iphone on the wrist

Interaction with a Watch



Support for Accessibility


Demonstrative Scenarios

Gesture Evaluation

Lab study

Accuracy

Social acceptability

Mental Demand

Physical Demand

Preference

Main Findings

High level of accuracy (>94%)

- without visual feedback

Social acceptability

- High variability for Triangle

Low physical & Mental demand

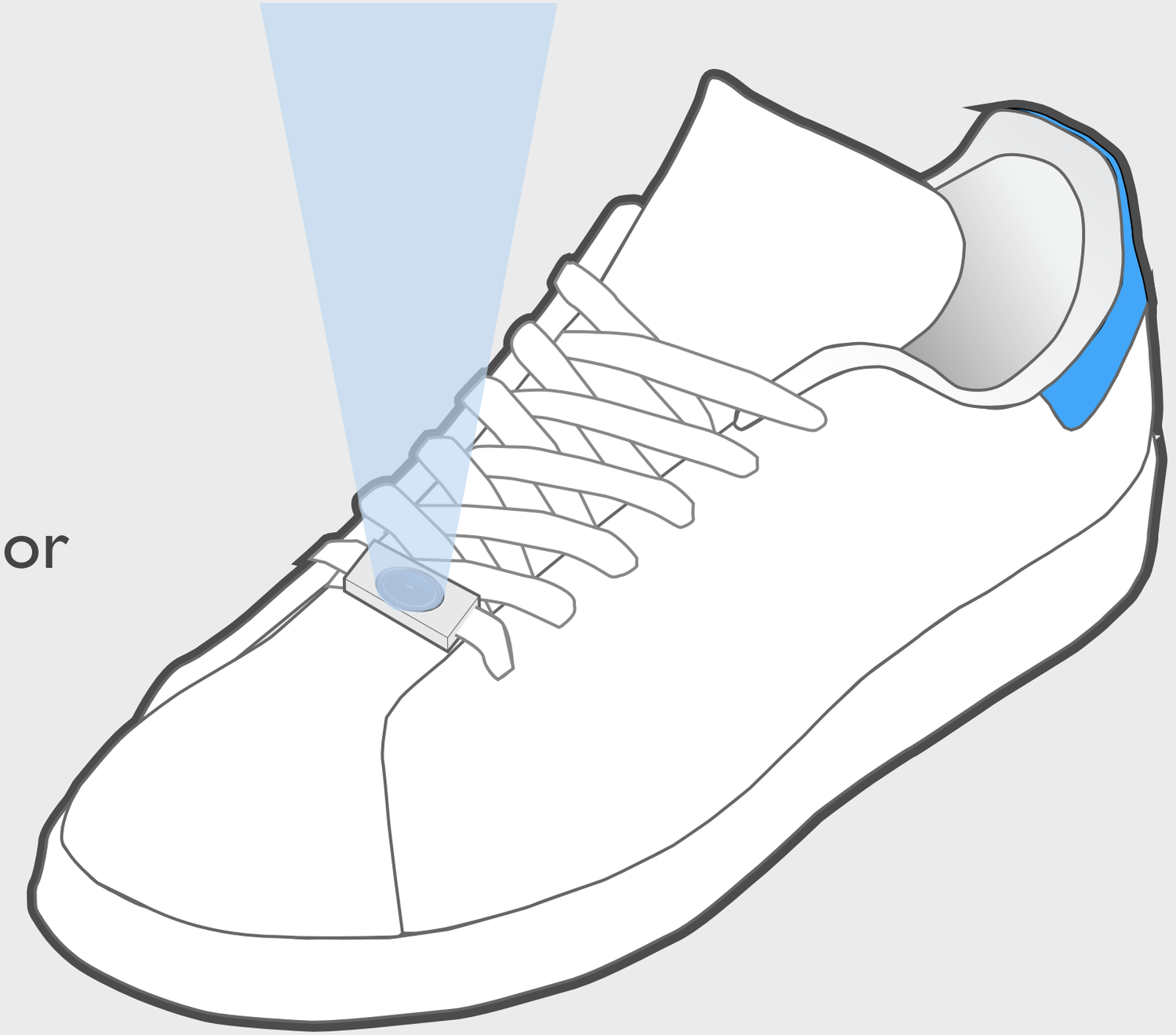
Radial gesture is the favorite gesture set

Conclusion

Conclusion

ShoeSense

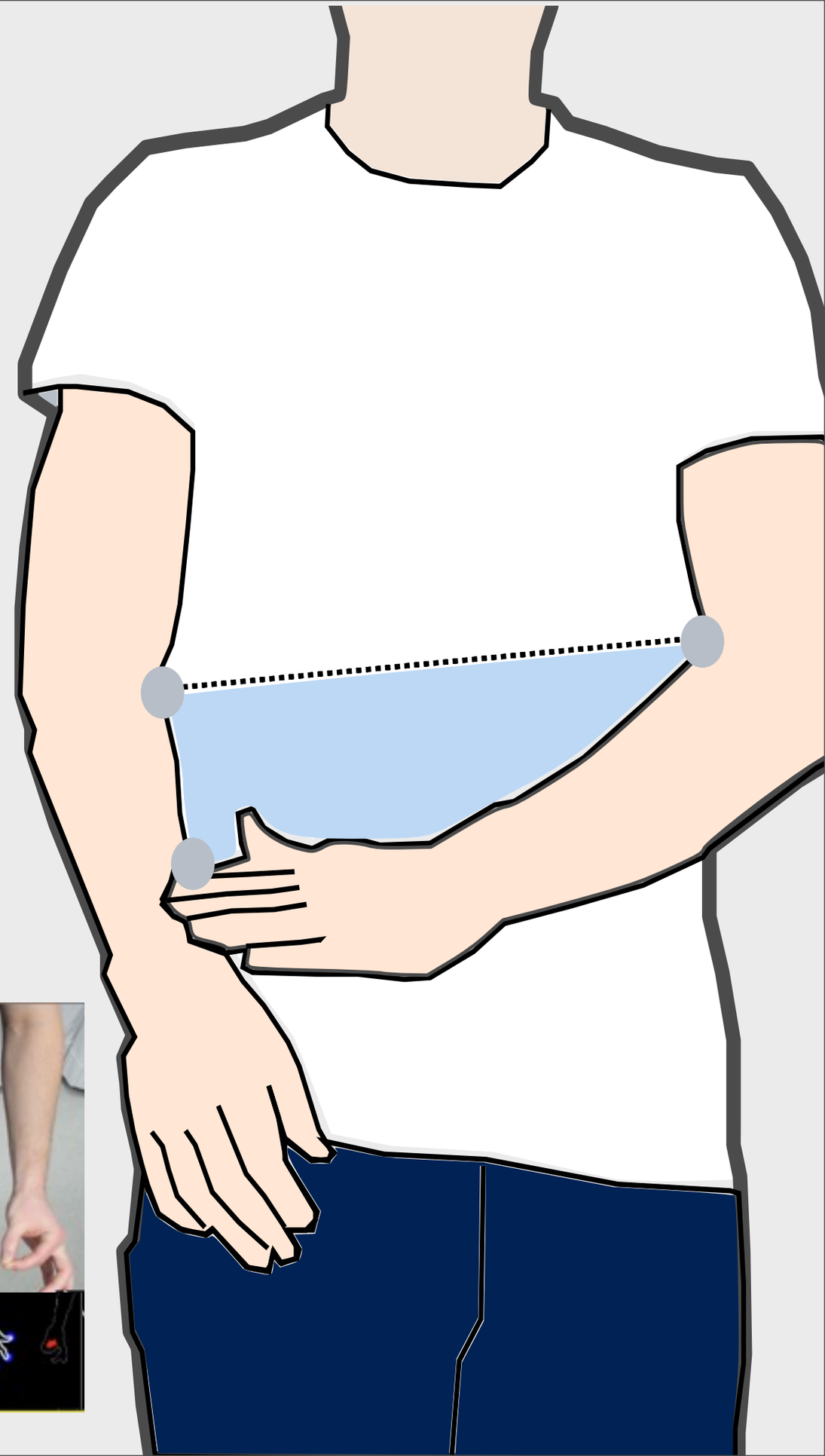
- Wearable system
- Shoe-mounted sensor

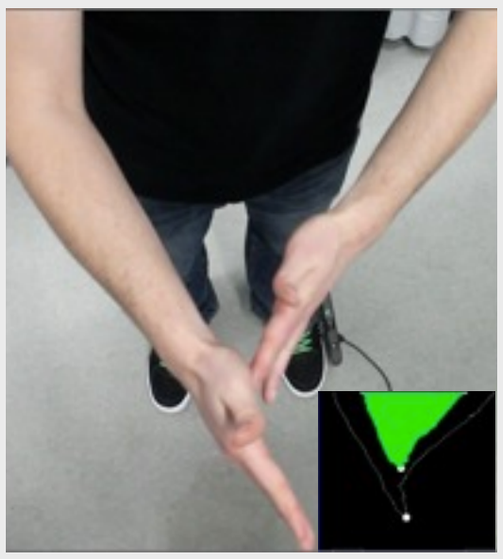


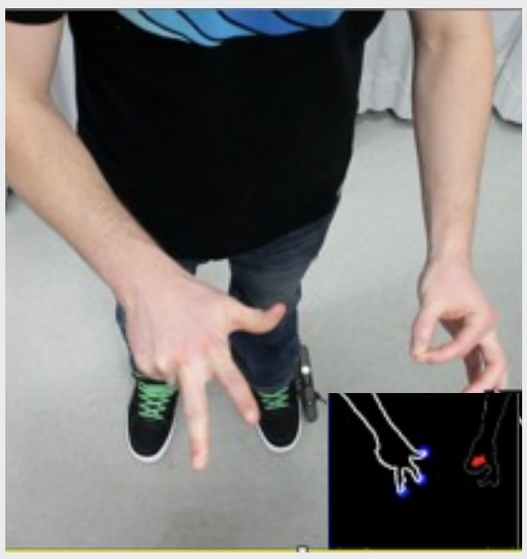
Conclusion

Novel Perspective for Gestural interaction

- Large & Demonstrative
- Discreet & Relaxed

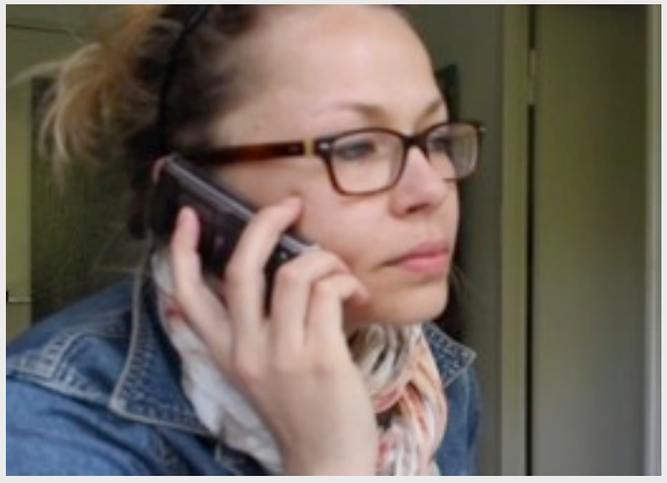






Conclusion

Several class of applications



Favorite & Frequent operations

Inexact & Inattentive operations

Mobile phone

ShoeSense

Gilles Bailly

www.gillesbailly.fr

T-Labs