

The HPI logo consists of three overlapping squares: a red square at the bottom left, a yellow square at the top right, and an orange square in the center. The letters 'HPI' are written in white on the orange square.

HPI

The background image shows the lower legs and feet of several people standing in a line. They are wearing dark blue jeans and dark brown or black sneakers with white laces and white soles. The scene is dimly lit, with a bright light source from the right creating a strong highlight on the floor and the lower leg of a person in the foreground.

Bootstrapper


recognizing tabletop users by their shoes

Stephan R. Richter | Christian Holz | Patrick Baudisch

one possible scenario: **multiple** students interact with the same tabletop...

$$9 = 2$$

Math: 2 Point **+** **1**



Stephan

$$2 * 2 = 4$$



allow teacher to monitor progress
per-student to support them best





kinect

approach: identify user **by their shoes**

walkthrough





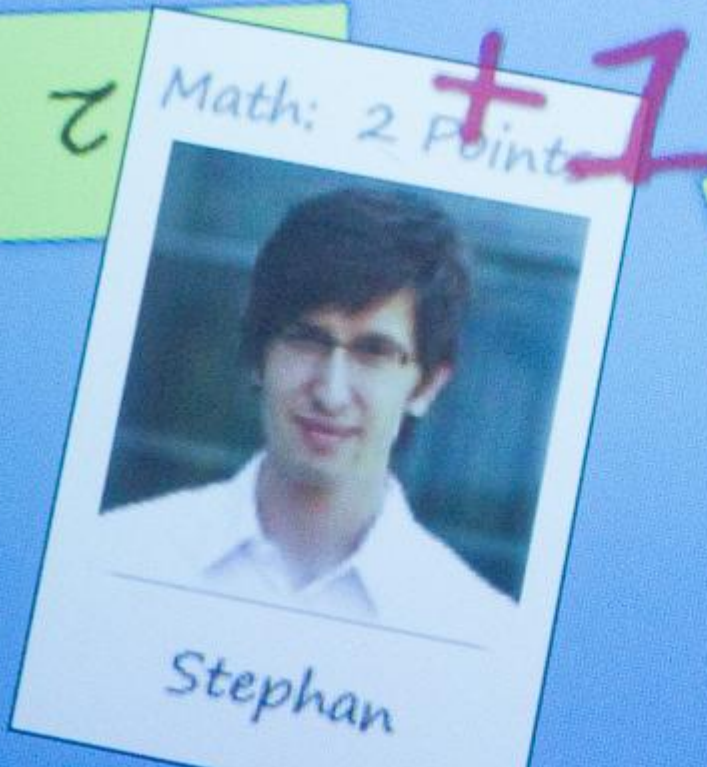
Bootstrapper recognizes me by my shoes

...displays my badge...



...and now adds my achievements to it

$$9 = 2$$
$$2 = 6$$



$$2 * 2 = 4$$



later, my teacher checks our progress...



already got it

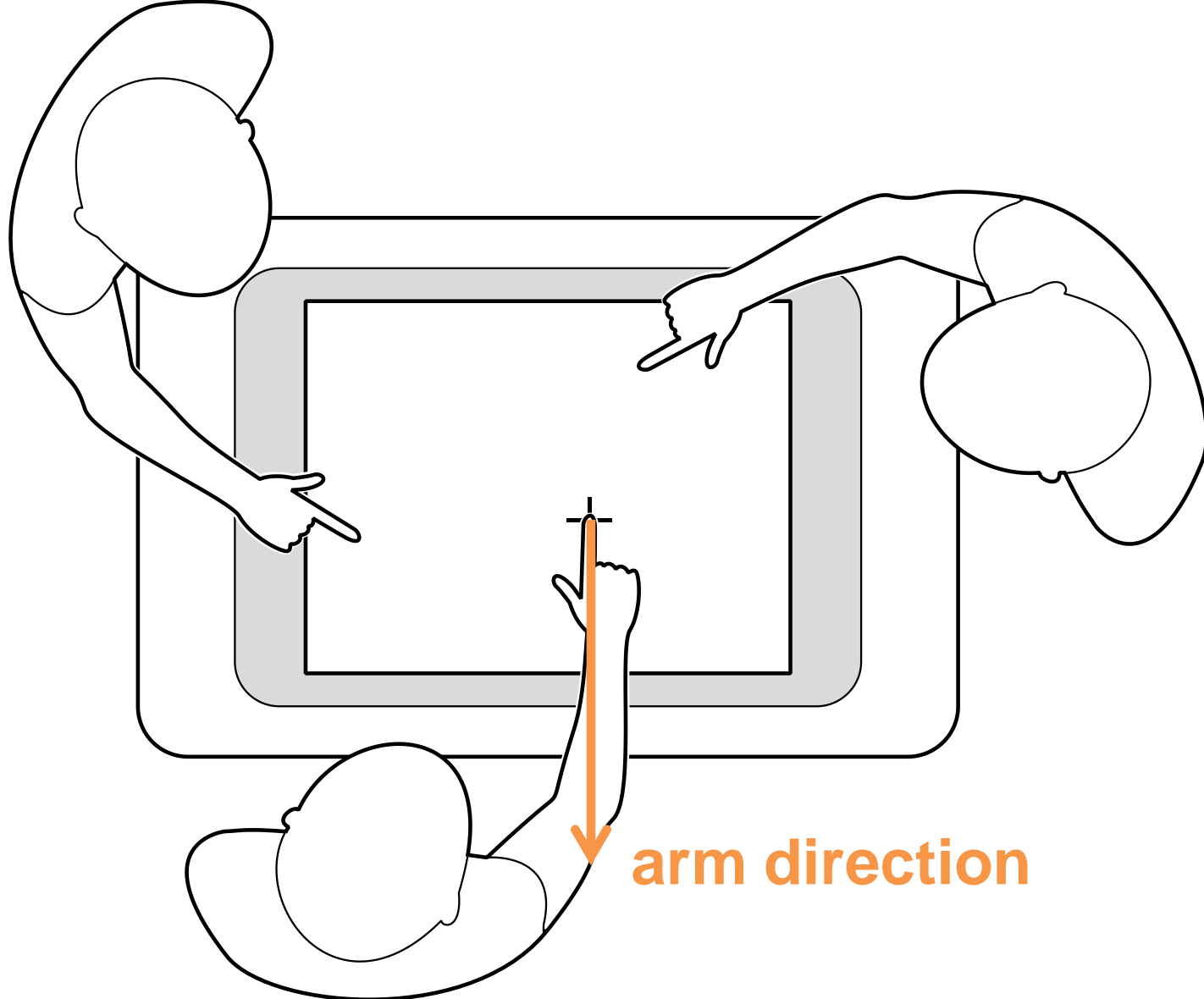


need extra help





for multiple **simultaneous** users...



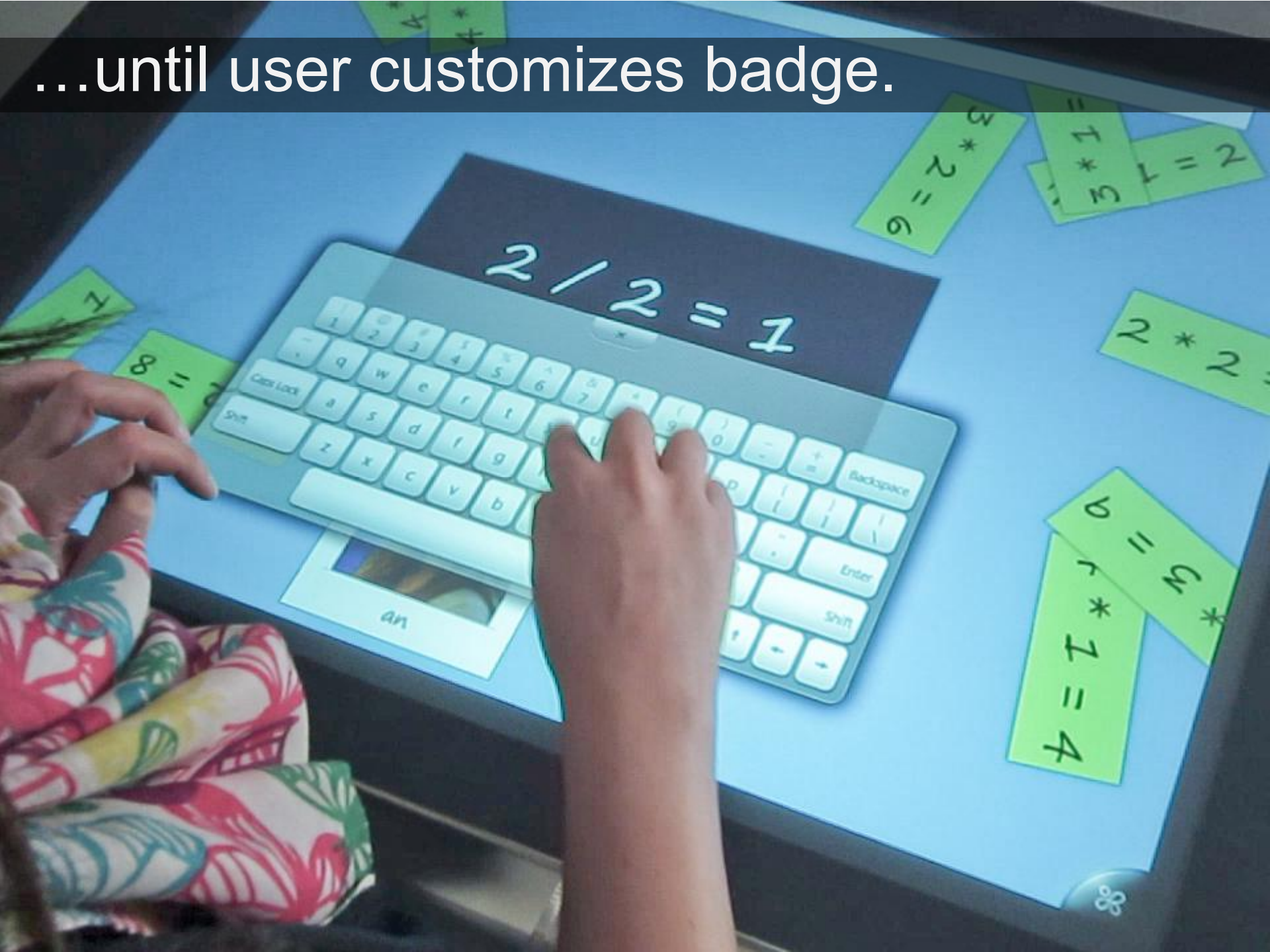
we **trace** arm reflection to the user

new user...

shows up as placeholder badge...



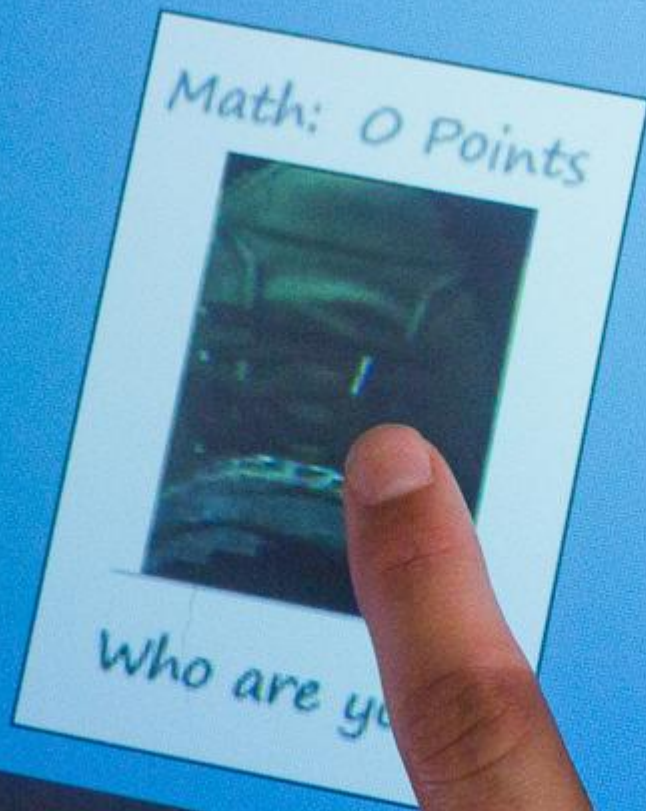
...until user customizes badge.



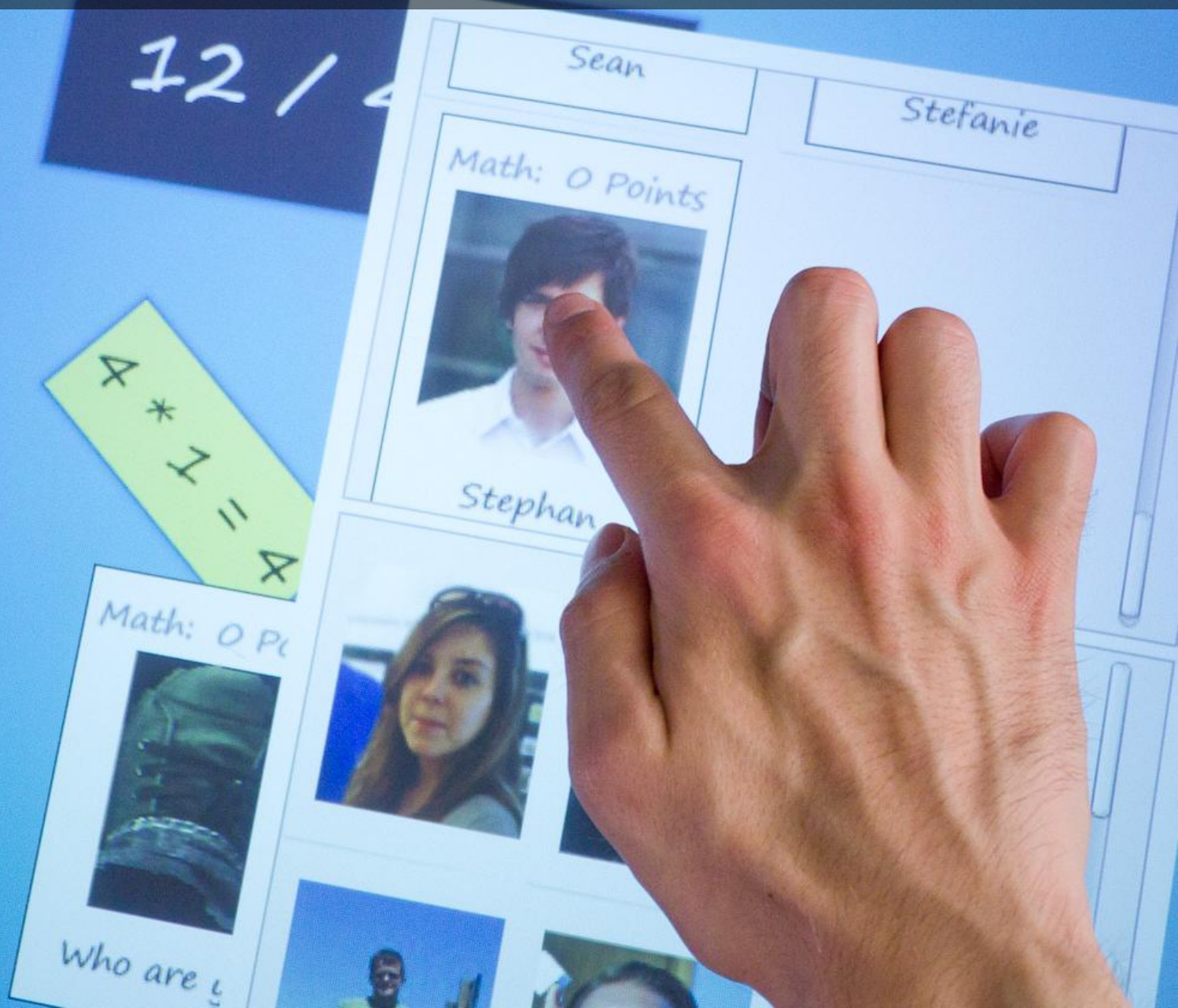


same with new shoes...

...placeholder badge...



...until user selects himself from db.



vs. related work

RFID badge...



Fishing Boat
[Boat]
[Red]
[Water]

Wedding
[Bride]
[Groom]
[Wedding]

Alex Olwal

AMNH N
[Museum]
[Natural]
[History]
[America]

EMPLOYEE
ALEX
OLWAL
319115



...ID wristband...



...or IR Ring.

Roth et al. 2010



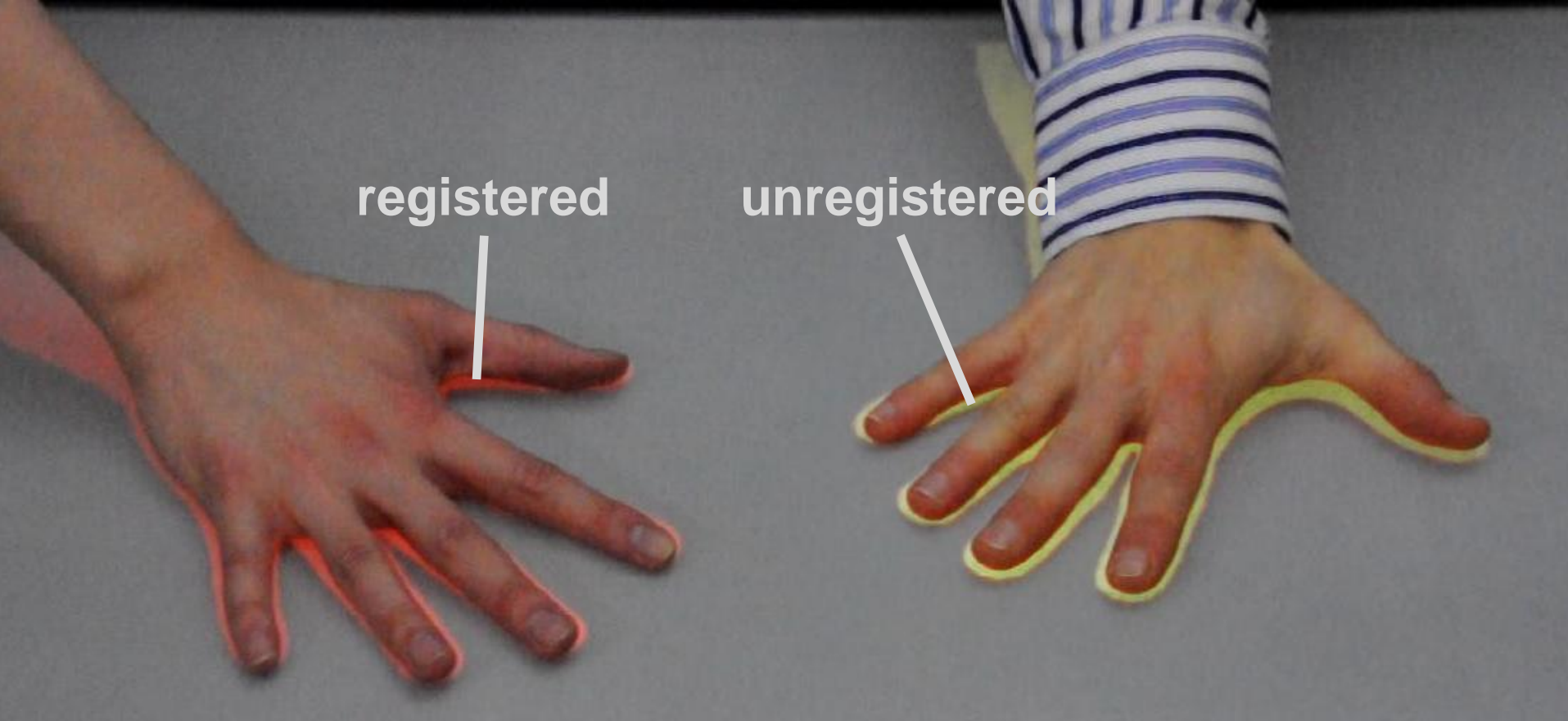
based on the **chair** they sit in...

DiamondTouch Dietz & Leigh 2001

biometrics, such as fingerprints...



Sugiura & Koseki 1998



registered

unregistered

...or shape of hands.



bootstrapper is different:

1. requires no keycard or ring
2. allows users to move around freely
3. keeps hands free to interact

...might even work in a kindergarden.



why bootstrapper works

1. shoes have more salient features than hands





2. feet align with the ground:
solve as a simpler 2D problem

A photograph showing the lower legs and feet of four people sitting on a stone ledge. They are all wearing identical blue denim jeans and dark blue Converse sneakers with white laces and white soles. The person on the far right is holding a green can of Heineken beer. The scene is outdoors with some greenery and a metal railing in the foreground.

Limitations: can be fooled
same shoes, same profile



thus we would not use for authentication

...but for **logging**

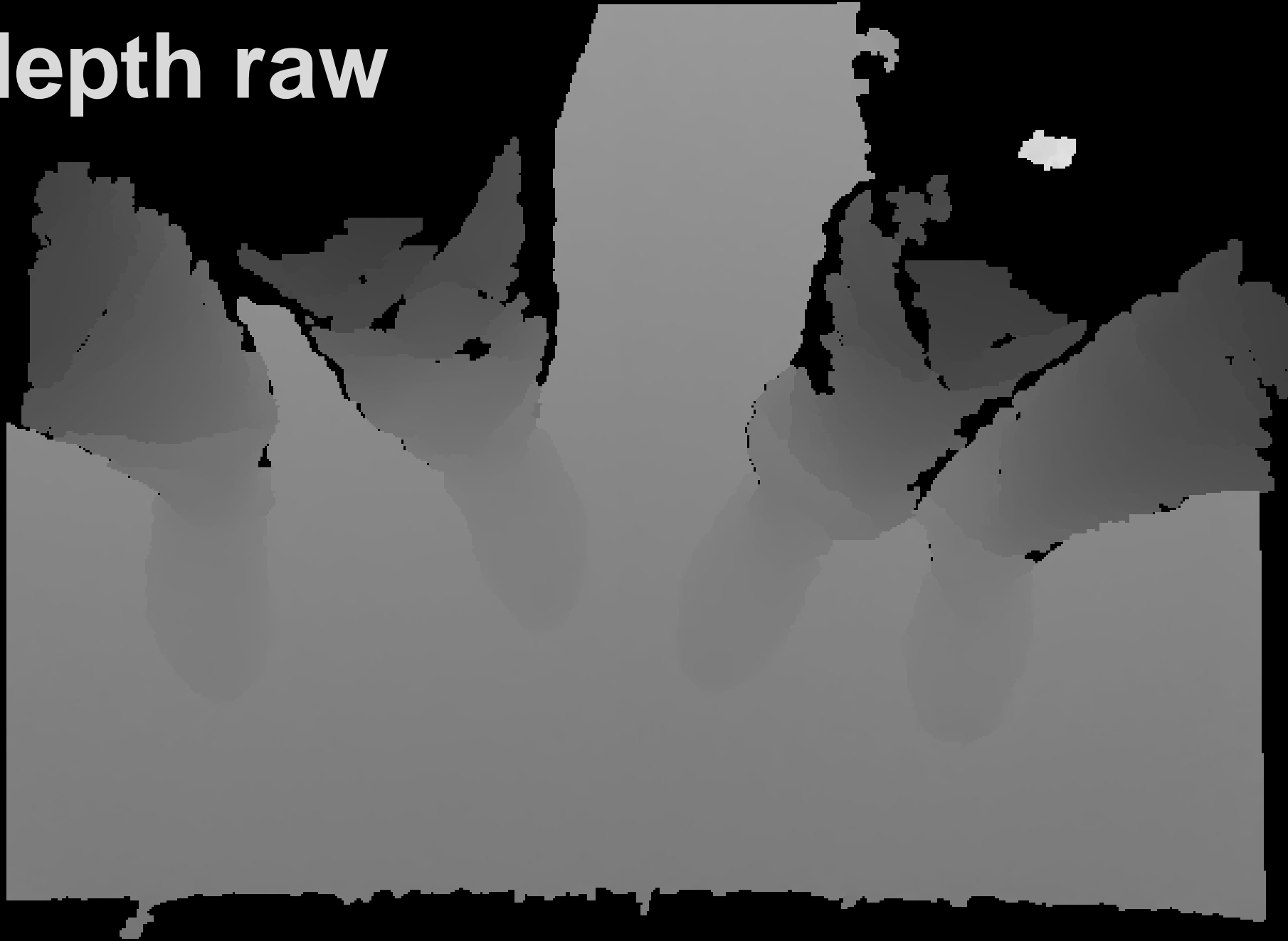


algorithms #1: identifying users

rgb raw



depth raw





subtract background



mask

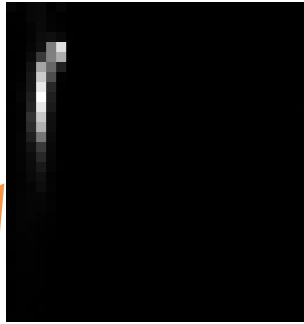


extracted shoes



feature extraction

hsv histogram

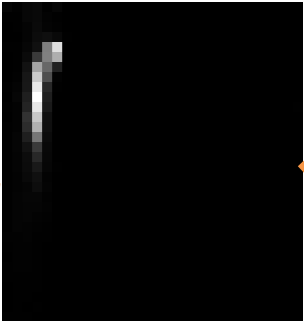


surf features



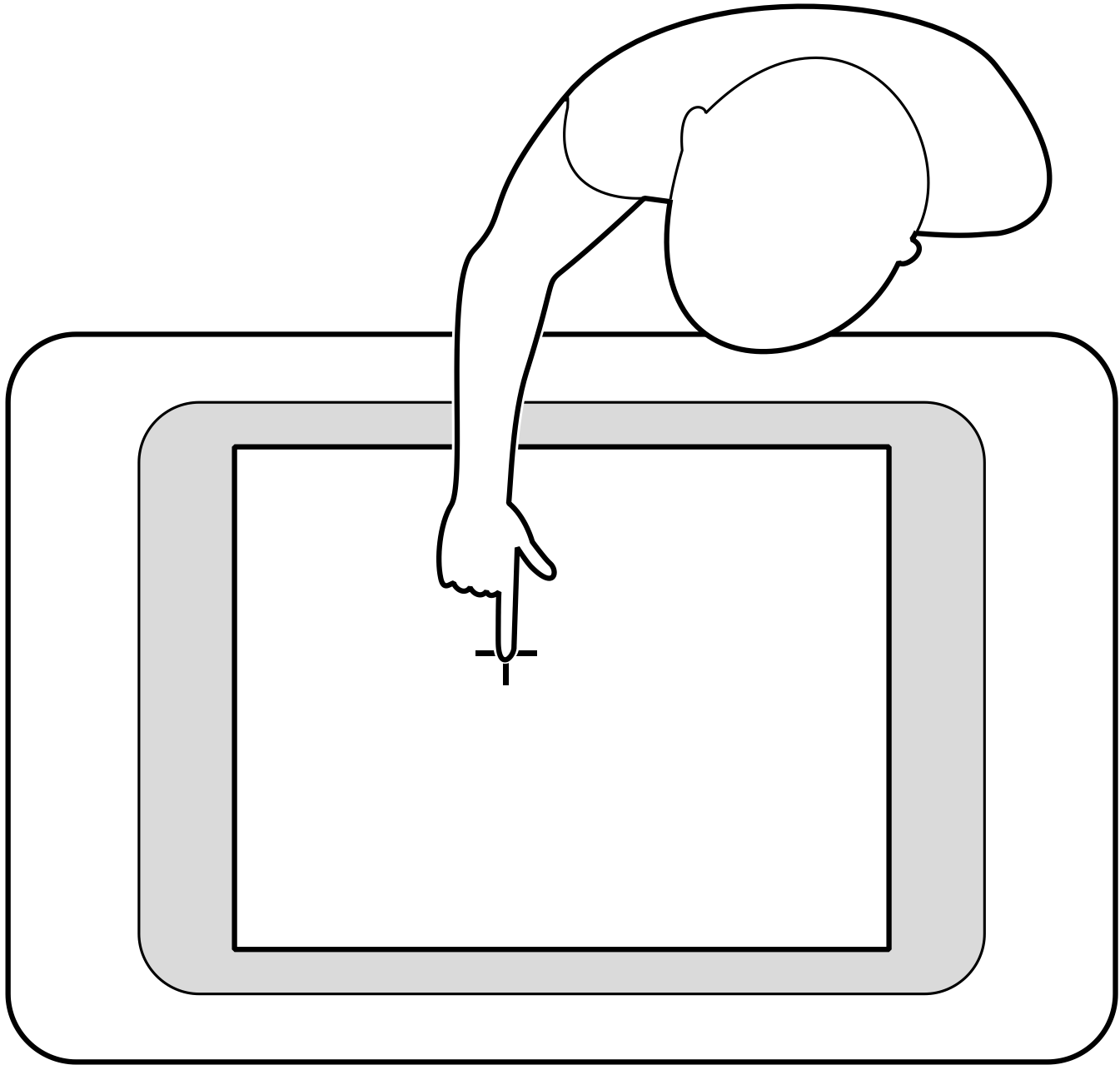
matching

hsv histogram



surf features

algorithms #2: associating touches



raw di



raw di



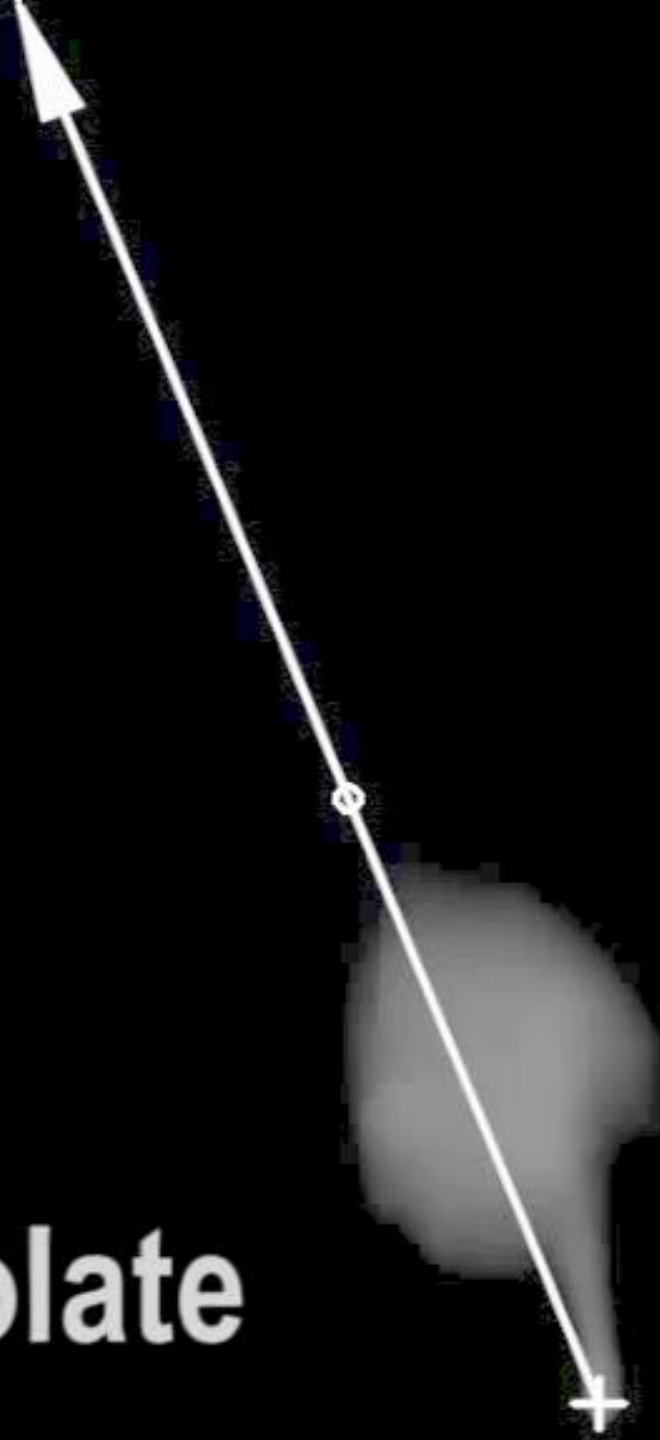
threshold



**farthest
point**



extrapolate



offset



evaluation #1
recognizing shoes



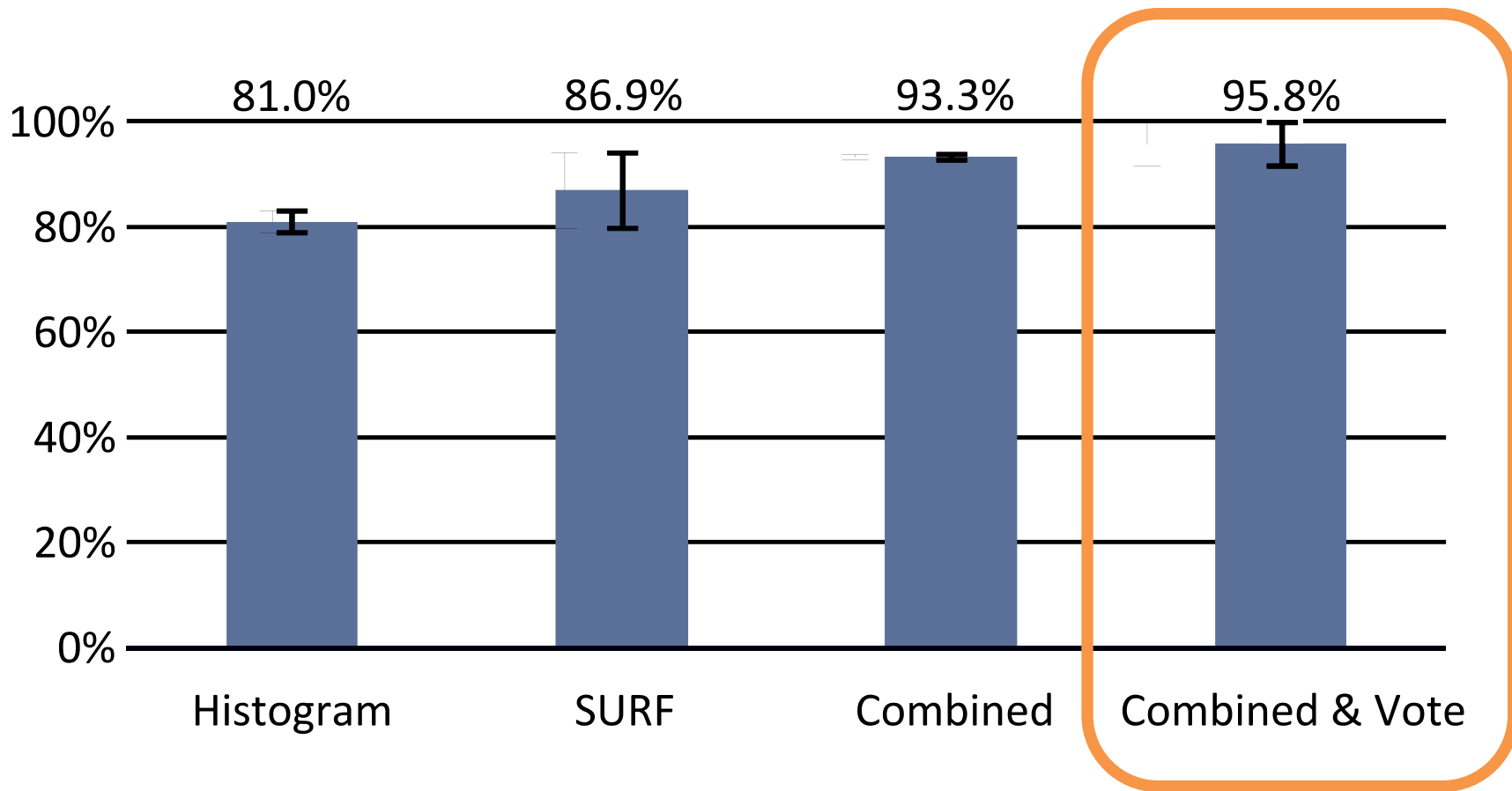
interact with table

task

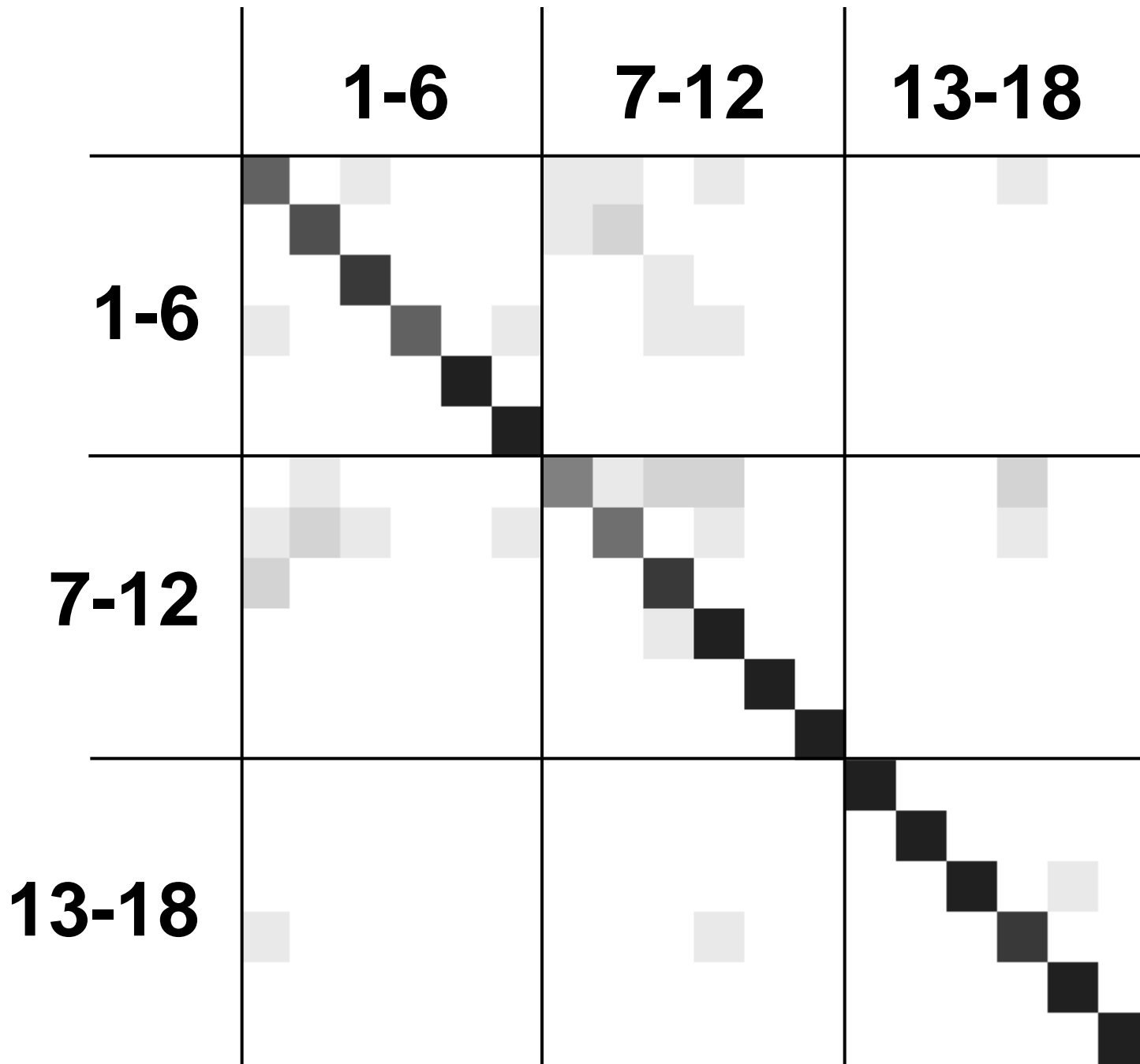
**camera
recording shoes**

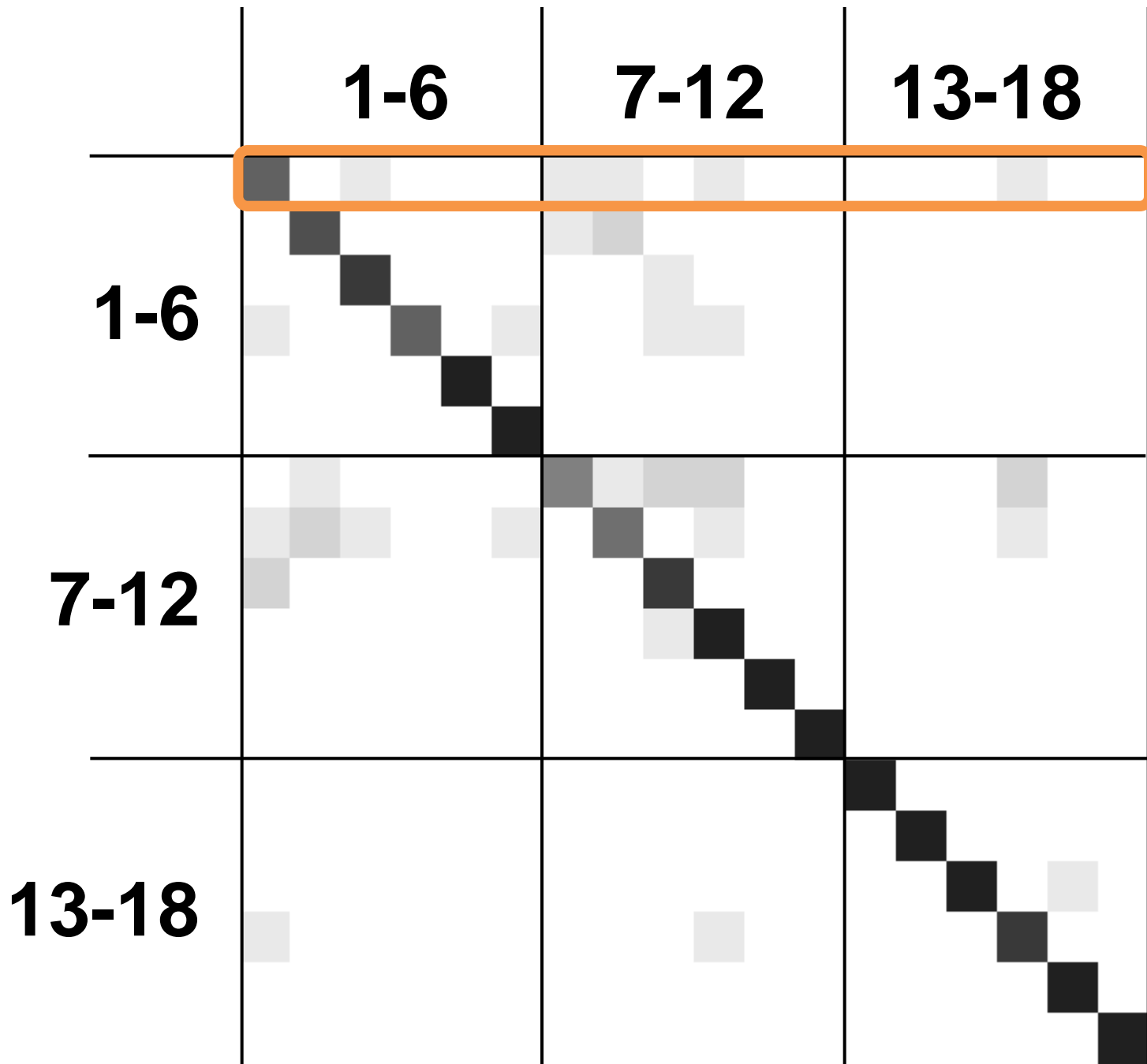






recognition rates





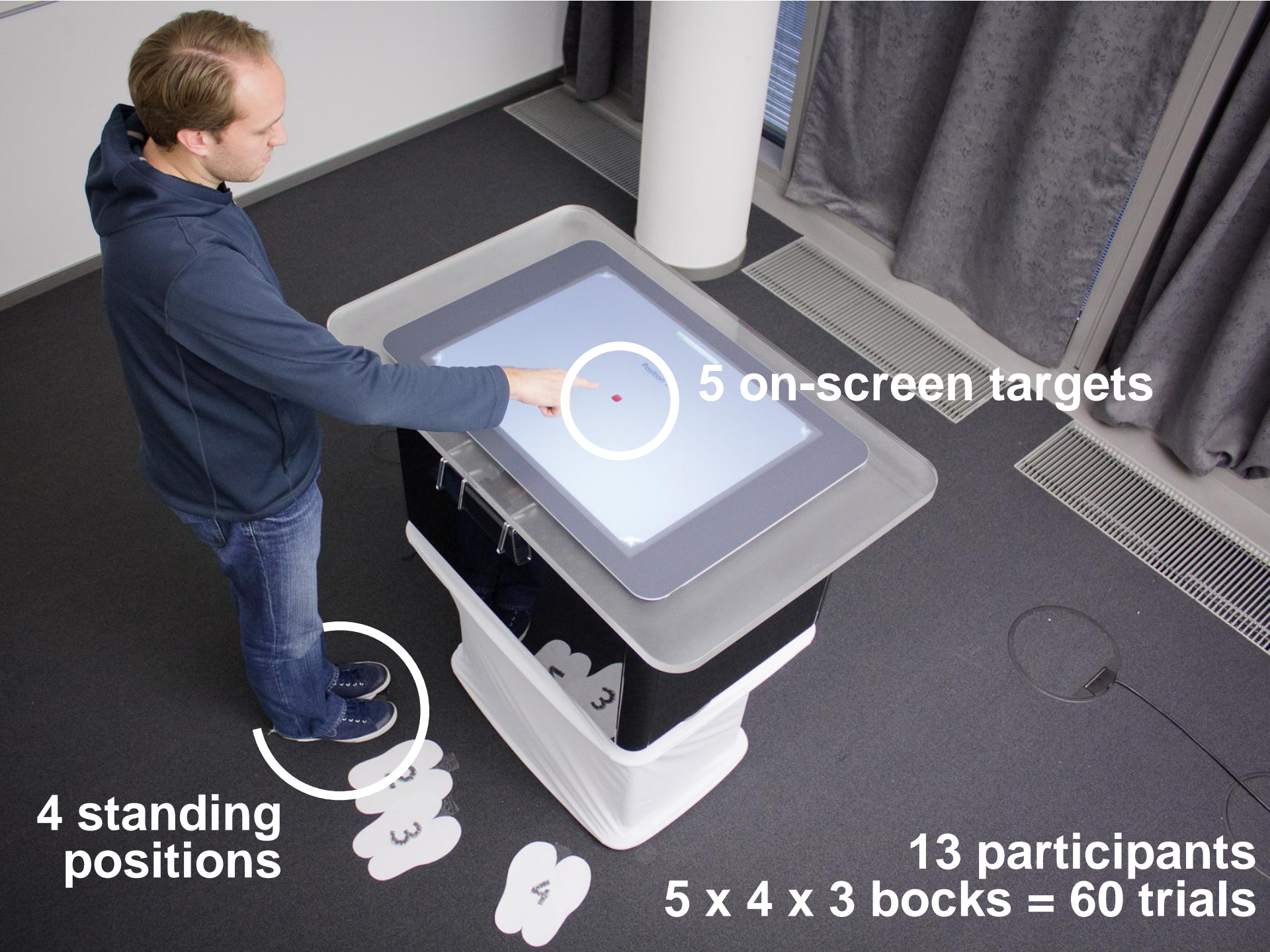


evaluation #2
associating touches



task





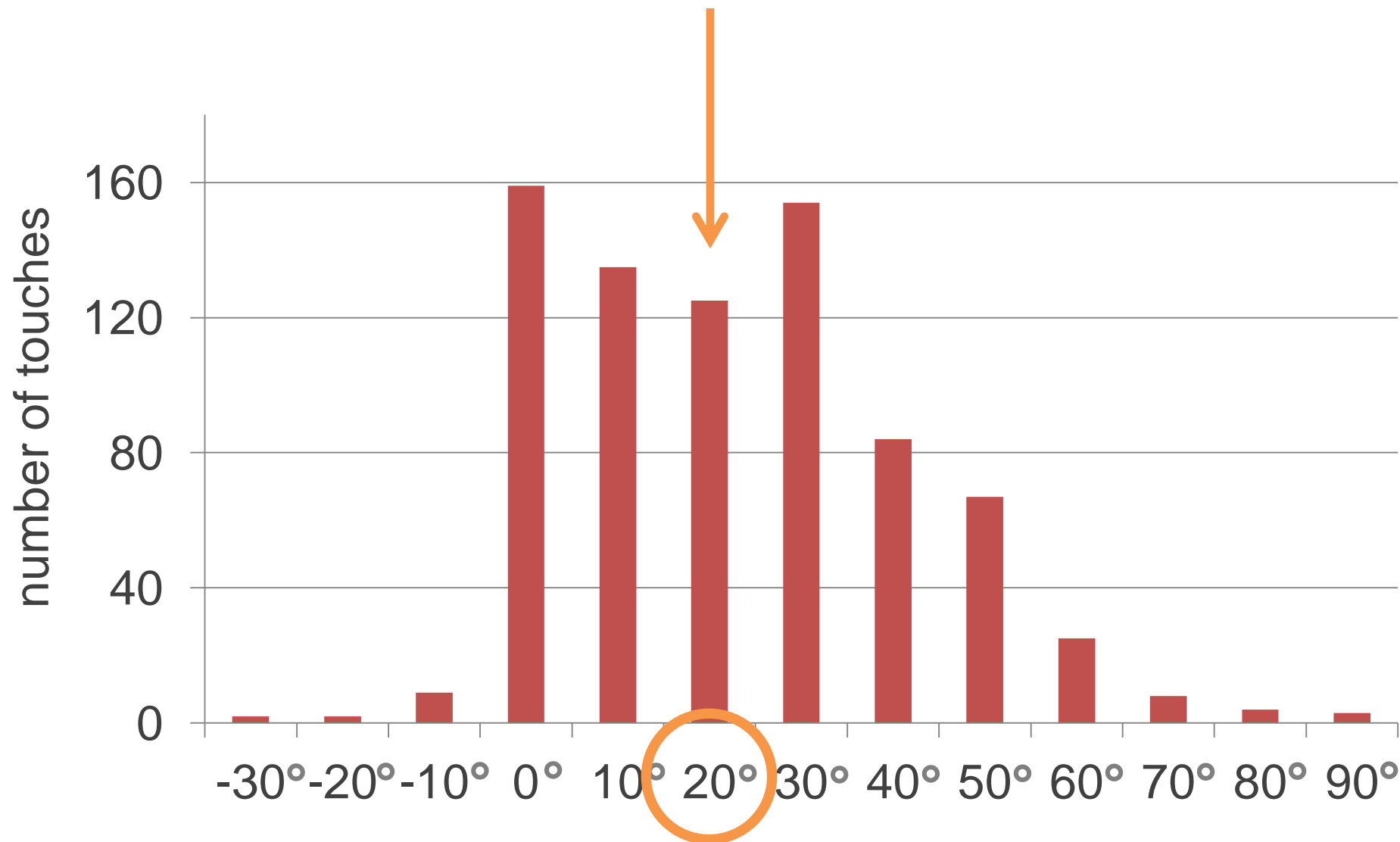
5 on-screen targets

4 standing positions

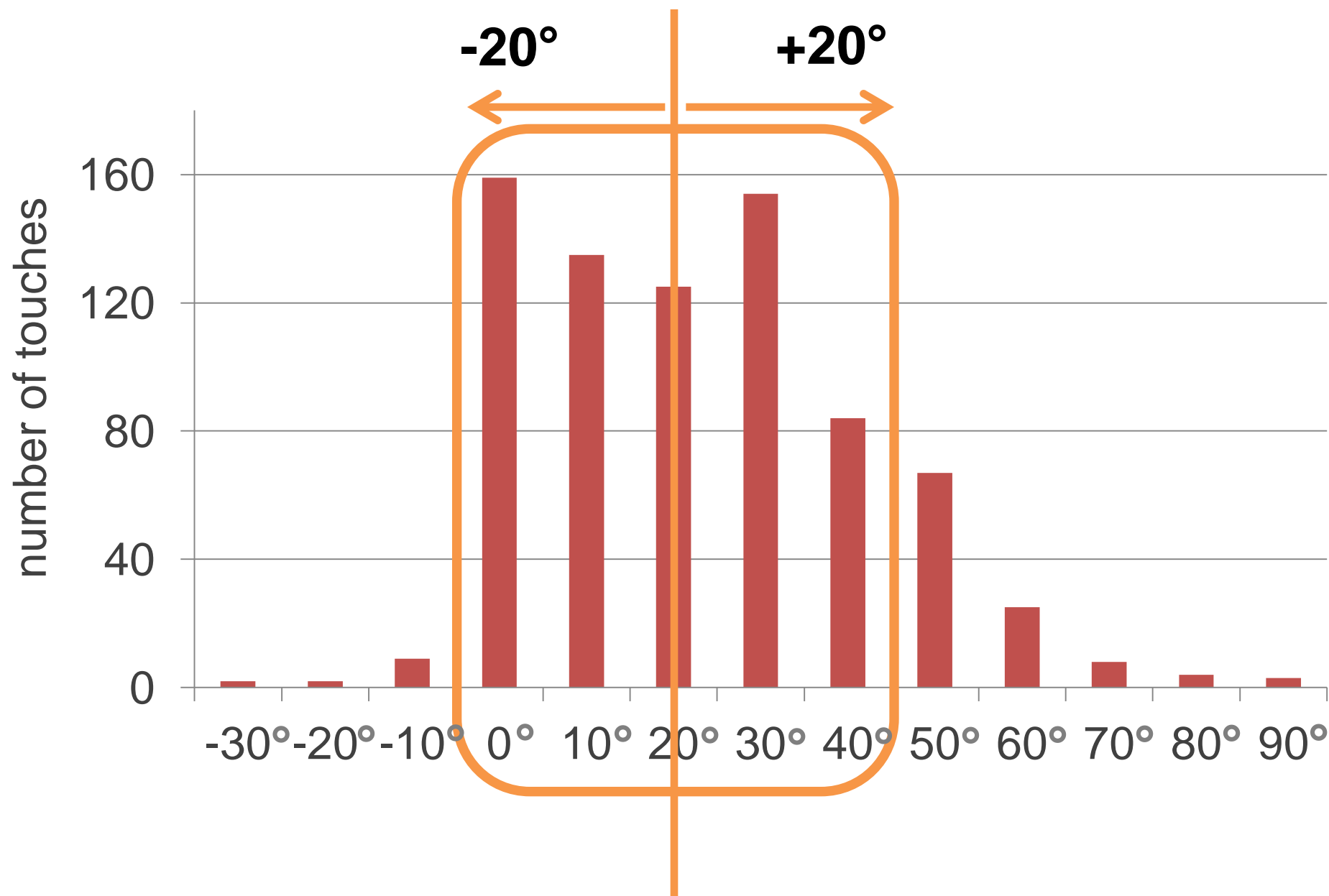
13 participants
5 x 4 x 3 blocks = 60 trials

error

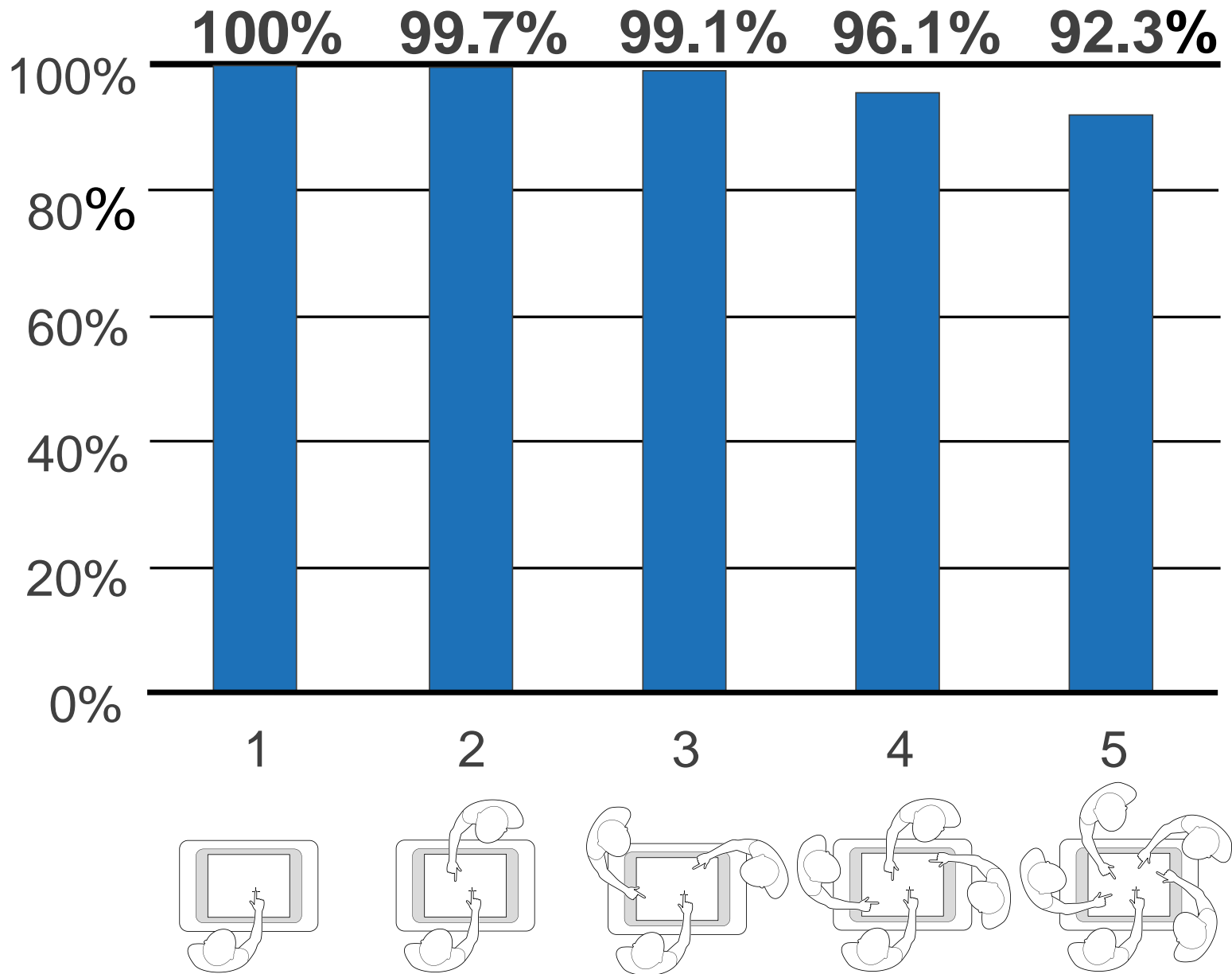
offset



error

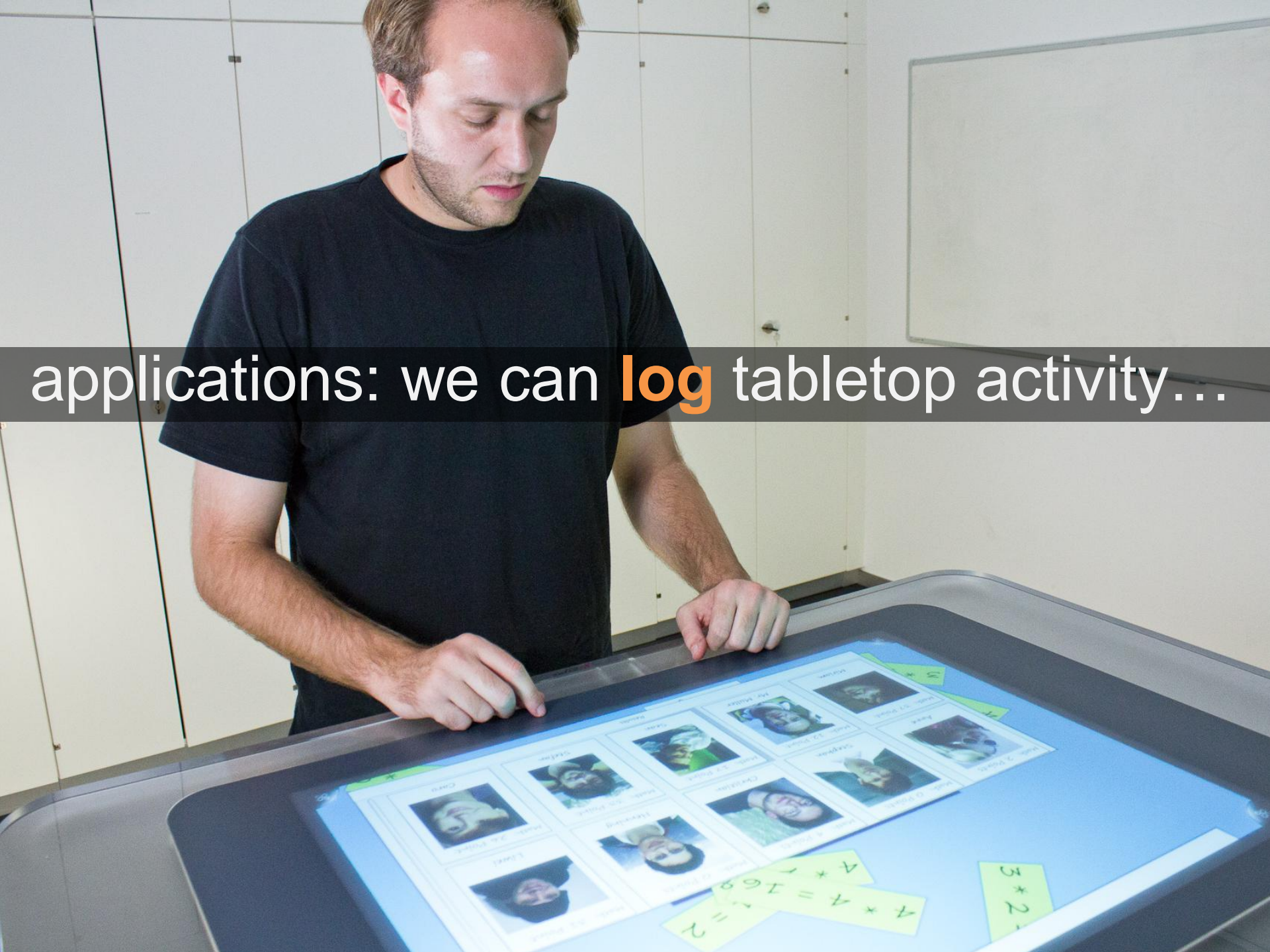


correct association

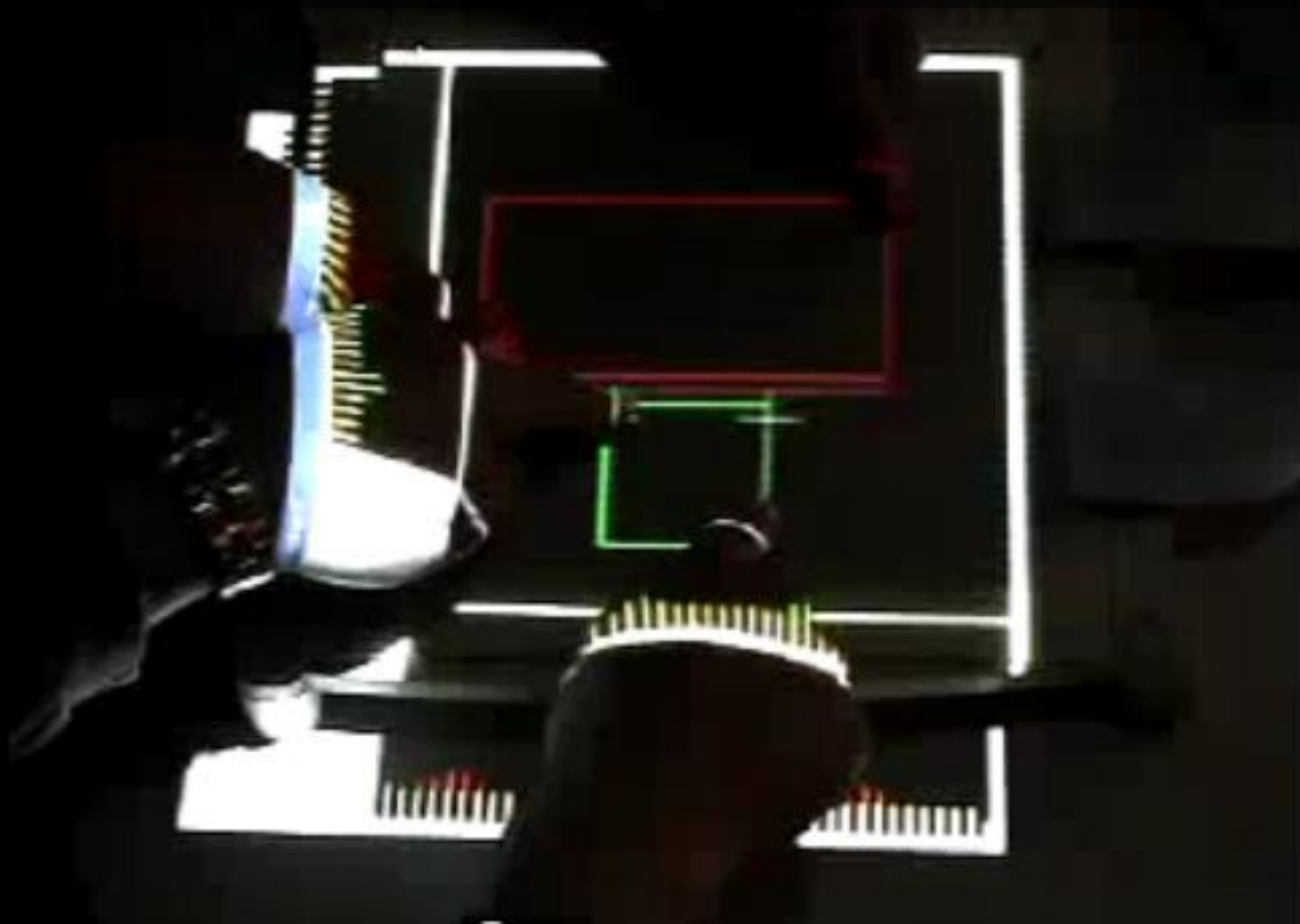


conclusions

applications: we can **log** tabletop activity...



...or **personalize** interaction, etc.



DiamondTouch, Dietz Leigh 2001

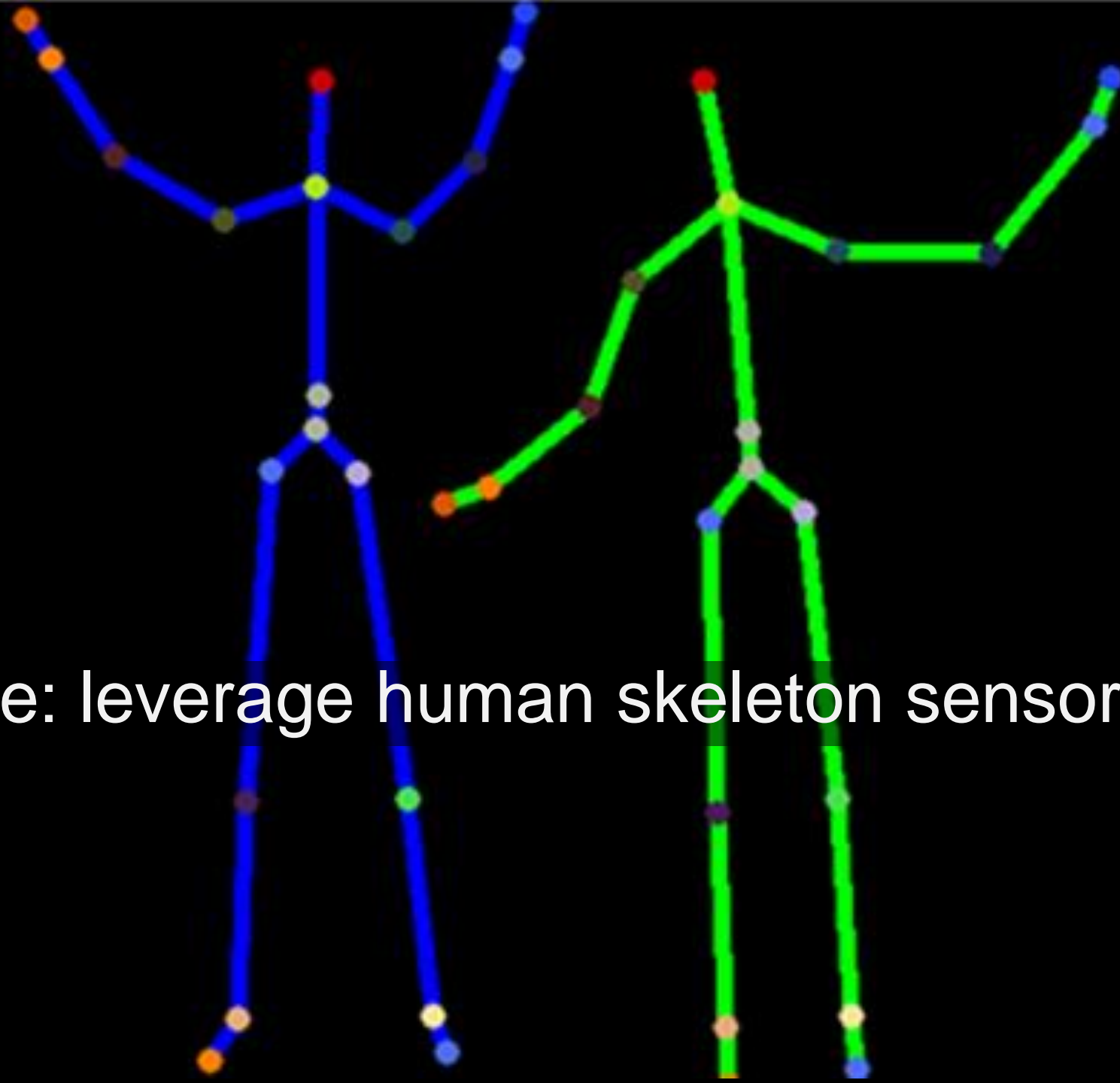
on a technical level



traditionally: identify touch → identify **finger**



bootstrapper challenges this



future: leverage human skeleton sensors...



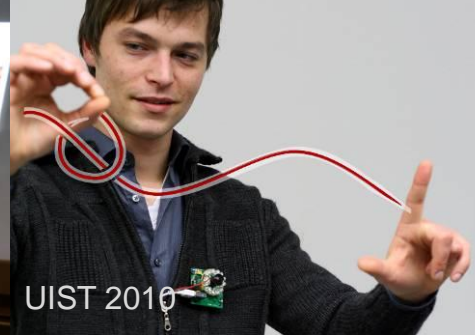
authenticating any part of the body
authenticates the **entire rest of the body**



CHI 2009--nominated



CHI 2010



UIST 2010



CHI 2011



UIST 2009



CHI 2010



UIST 2010

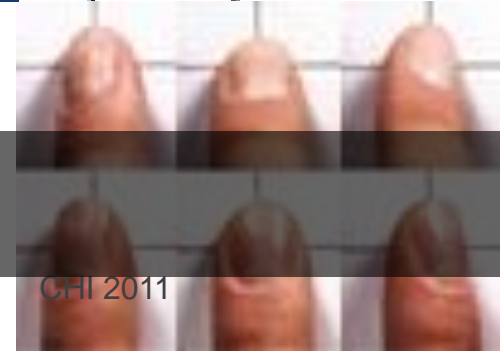


CHI 2011



questions?

CHI 2010—best paper



CHI 2011



berlin

we have one open
PhD/postdoc position



Hasso
Plattner
Institut



patrick baudisch