

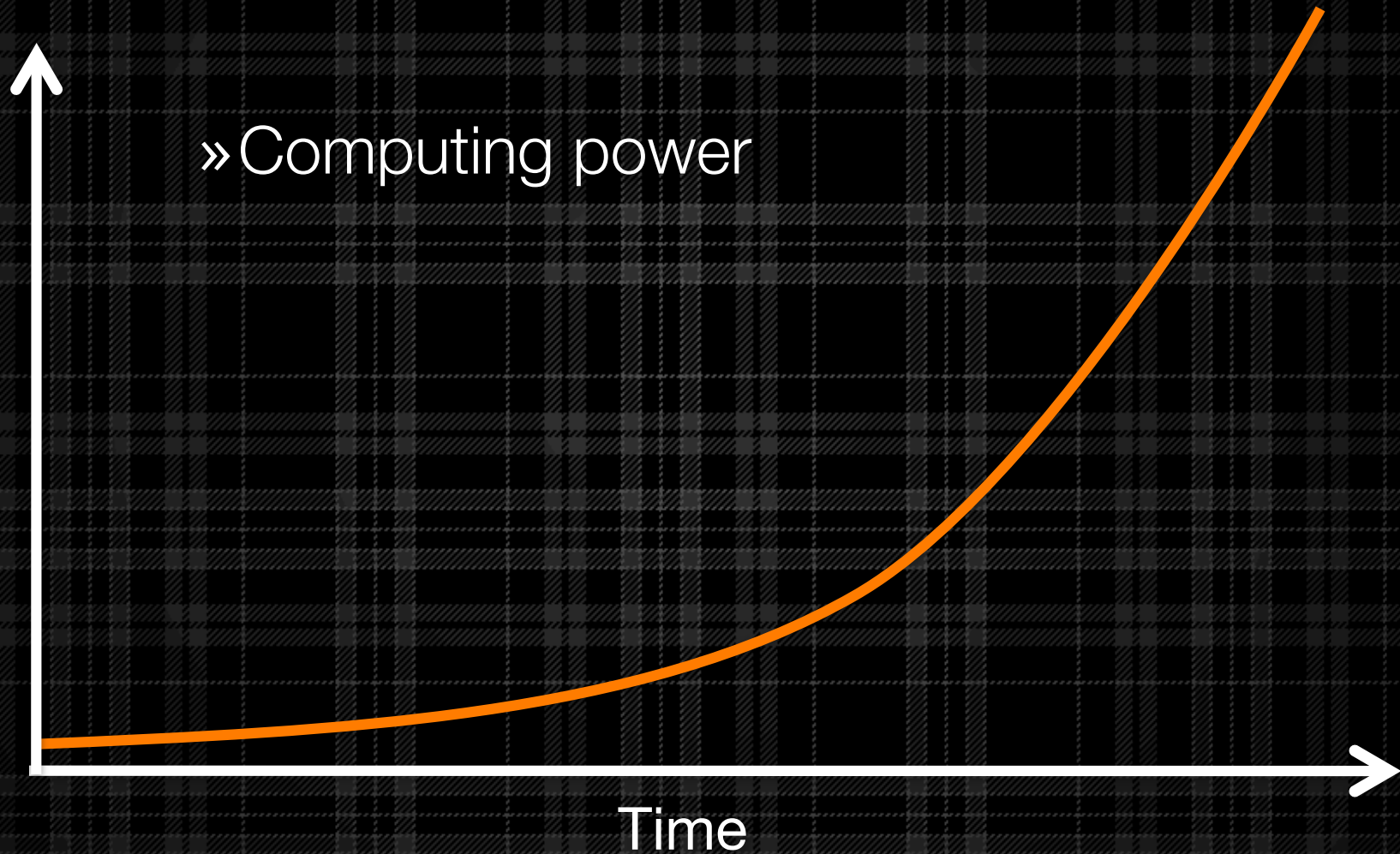
# Interacting with Small Devices in Big Ways

**Chris Harrison**

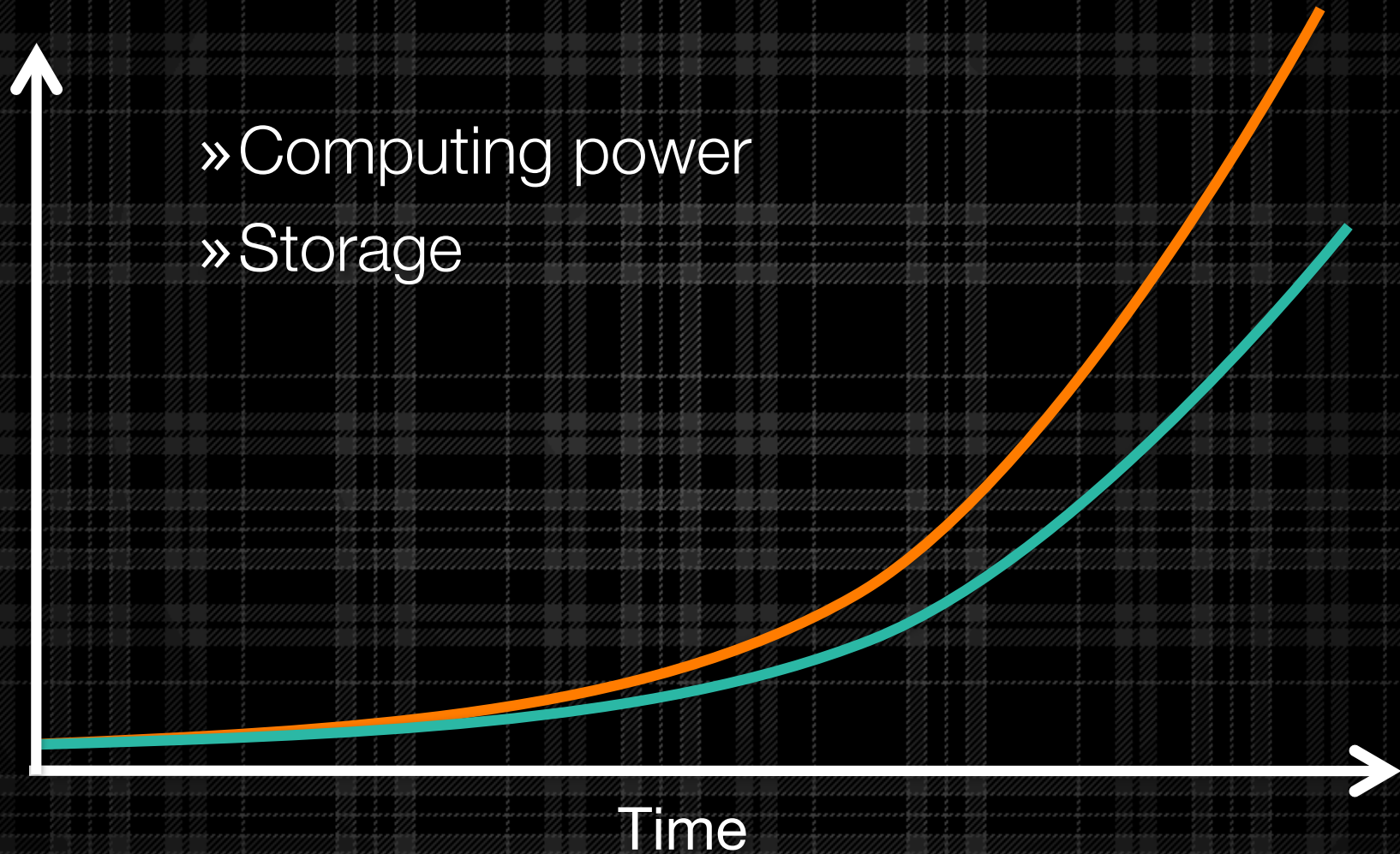
# Small + Powerful



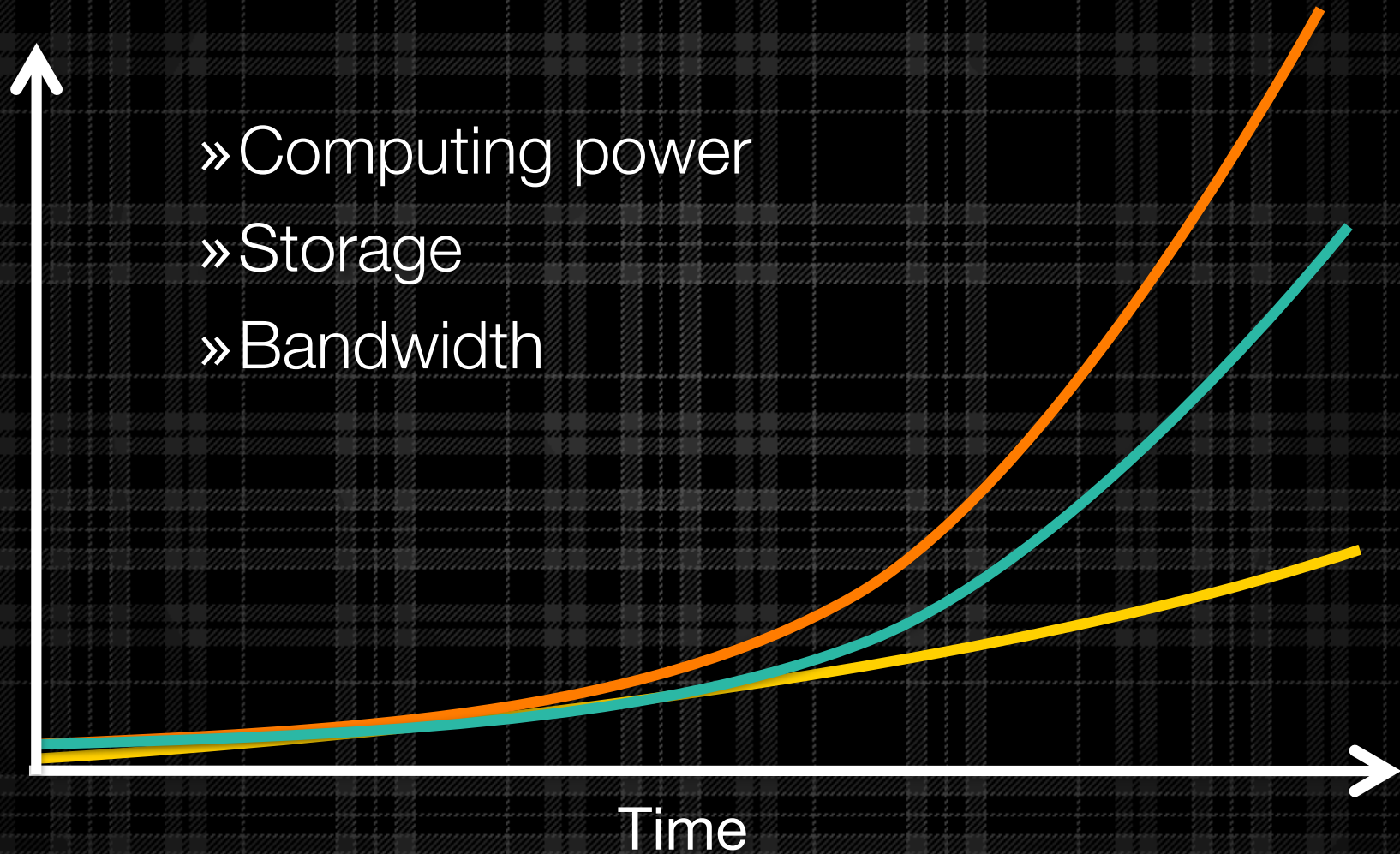
# Computing Factors



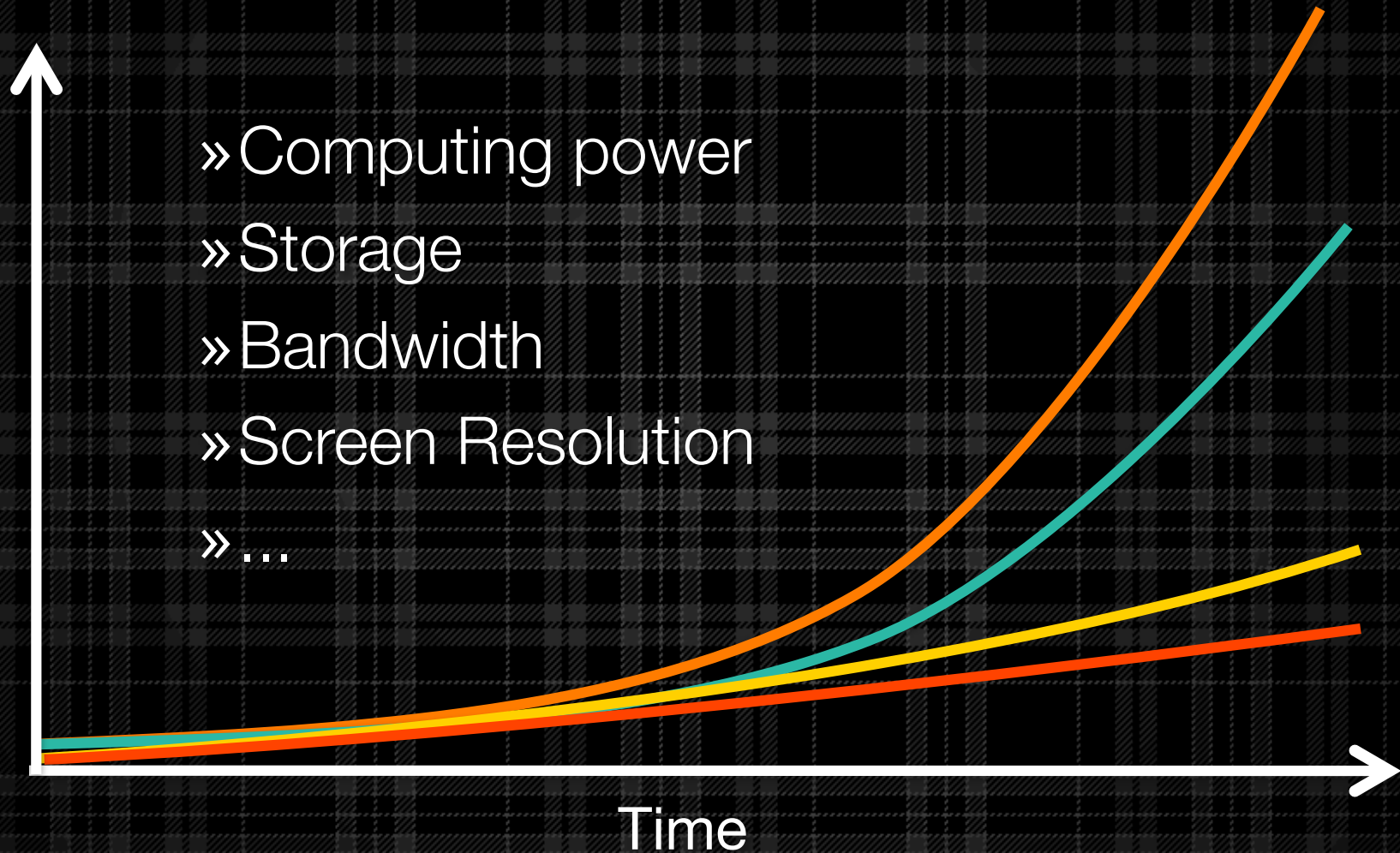
# Computing Factors



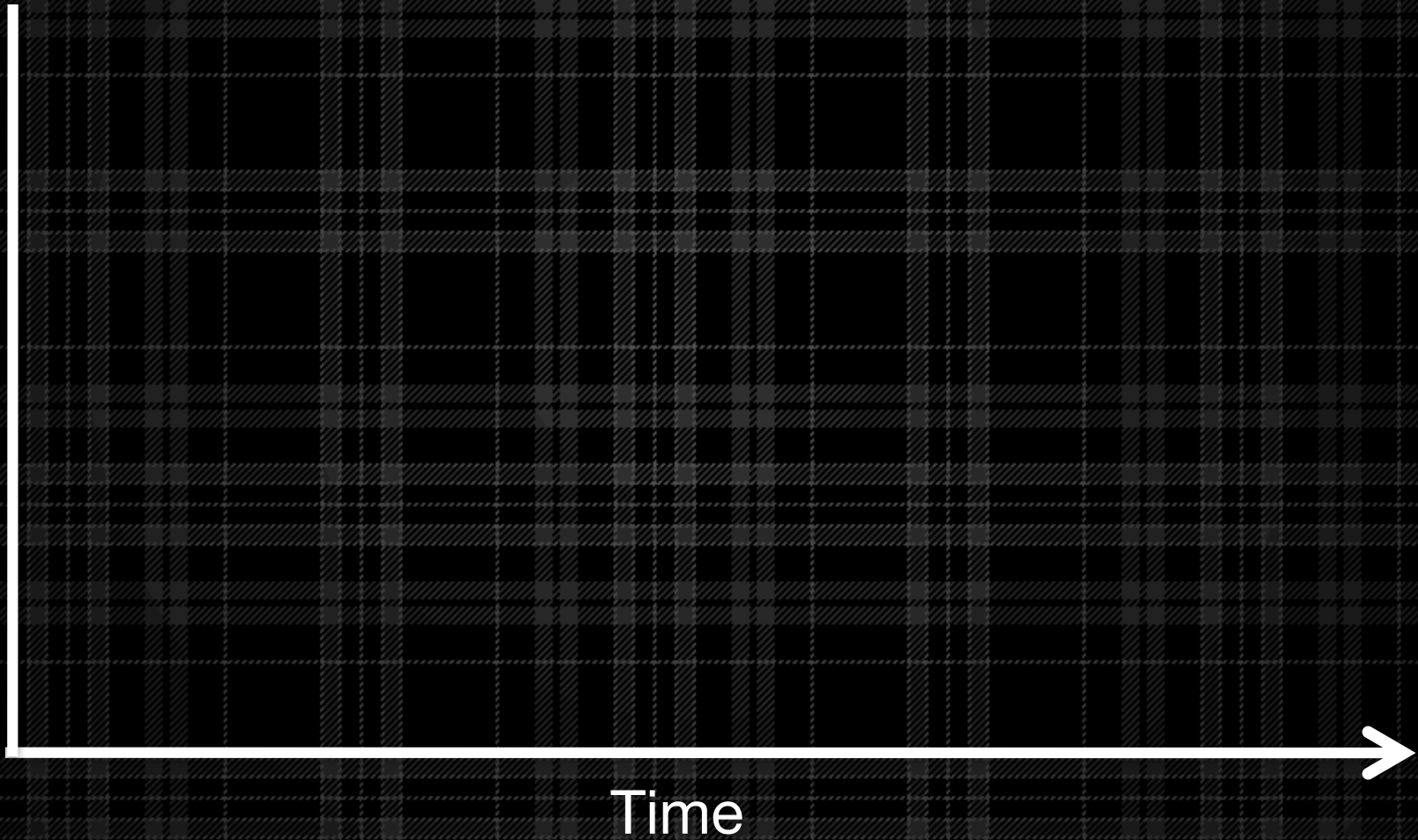
# Computing Factors



# Computing Factors



# Human Factors



# Human Factors

» Finger size

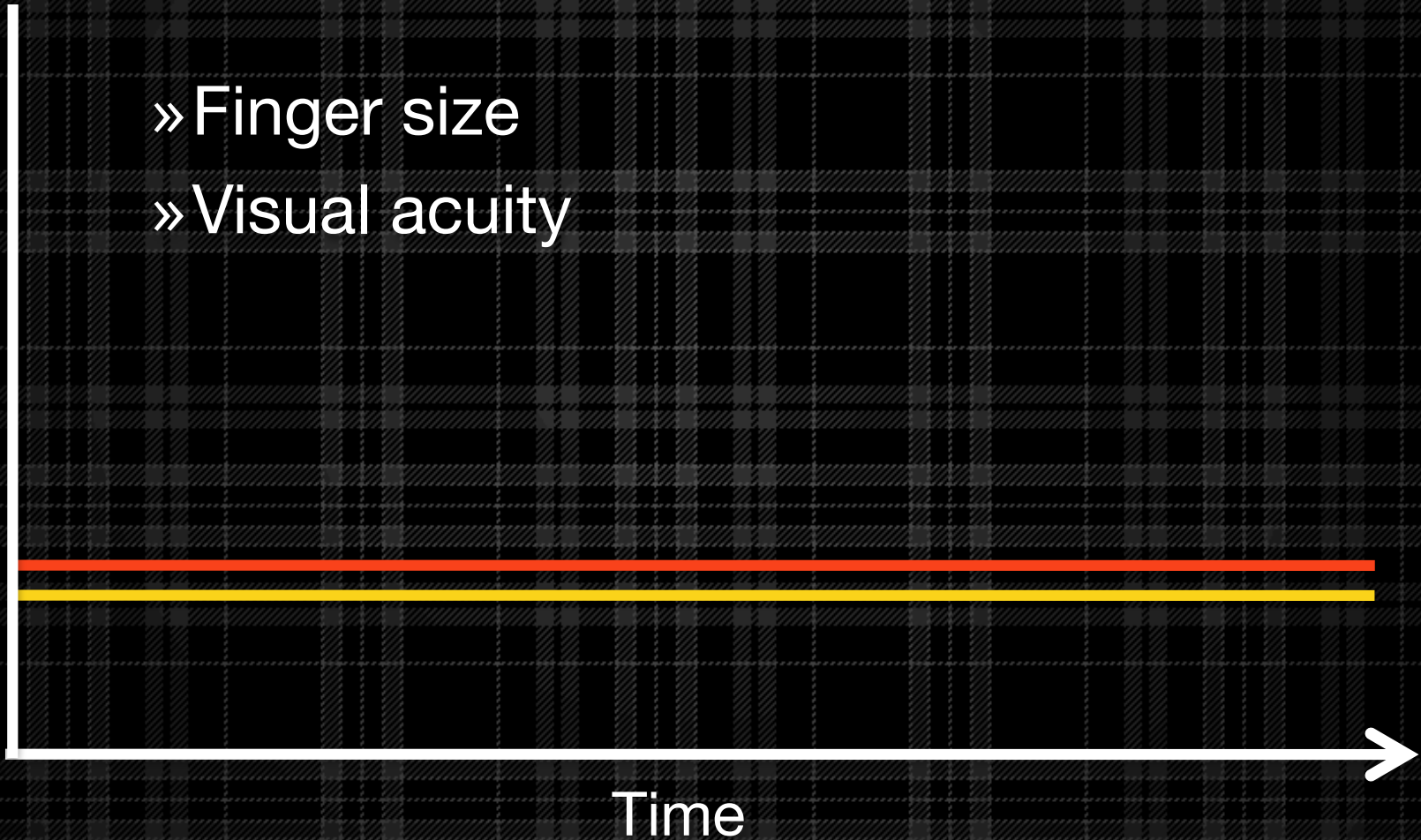
A graph with a vertical y-axis and a horizontal x-axis. The x-axis is labeled 'Time' and has an arrow pointing to the right. A horizontal red line is drawn across the graph, indicating a constant value over time. The text '» Finger size' is positioned in the upper left area of the graph.

Time



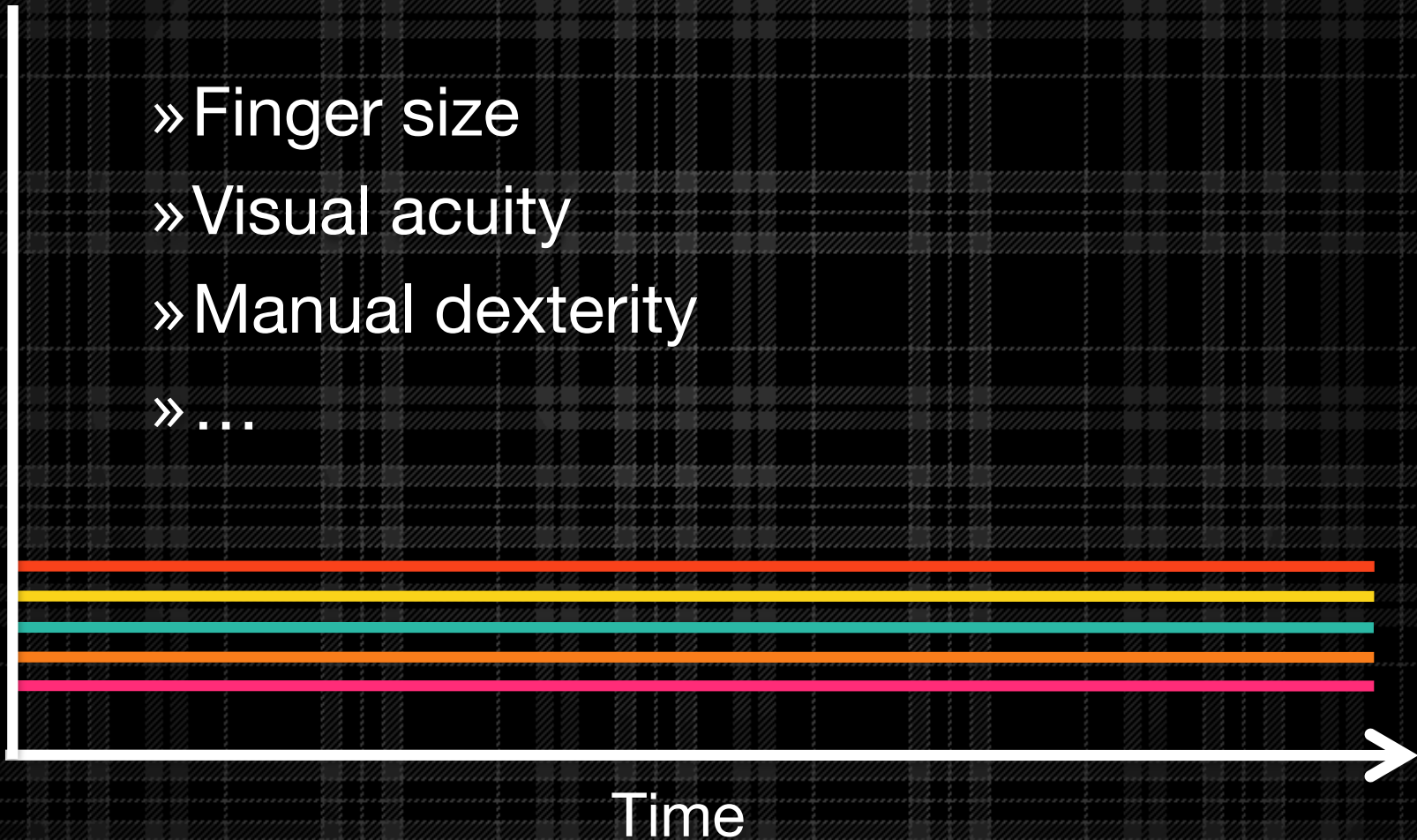
# Human Factors

- » Finger size
- » Visual acuity

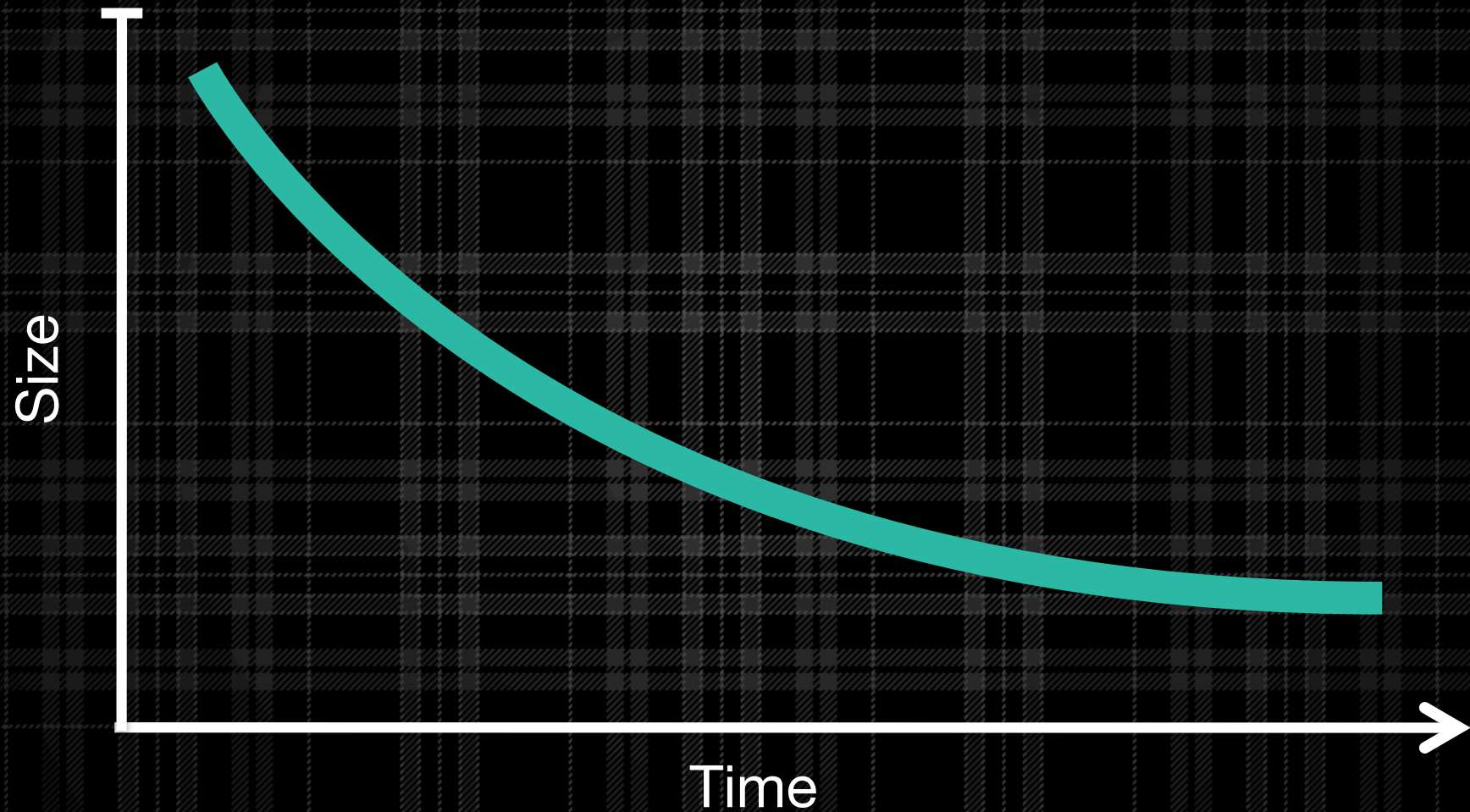


# Human Factors

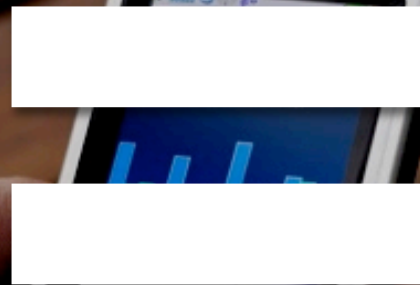
- » Finger size
- » Visual acuity
- » Manual dexterity
- » ...



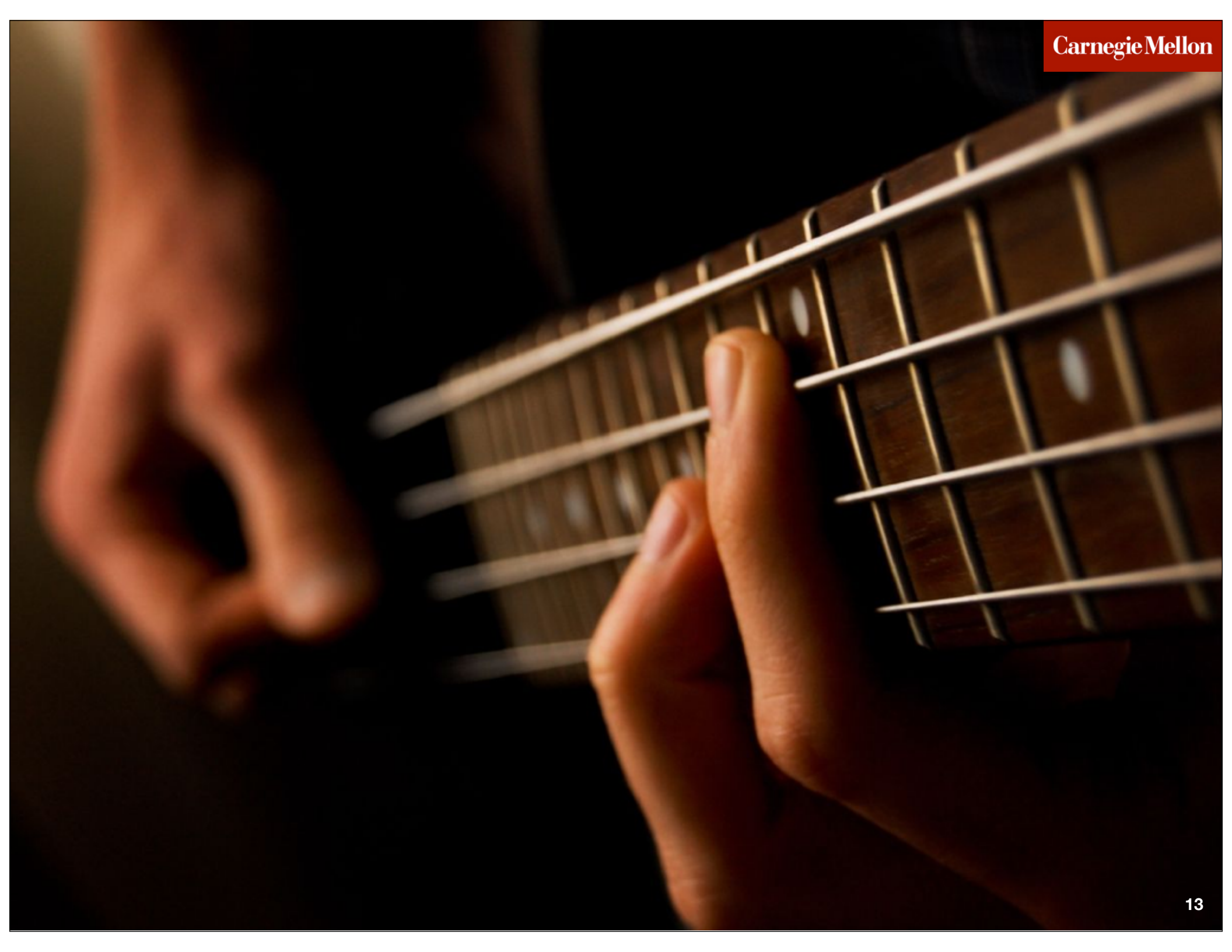
# Mobile Device Size

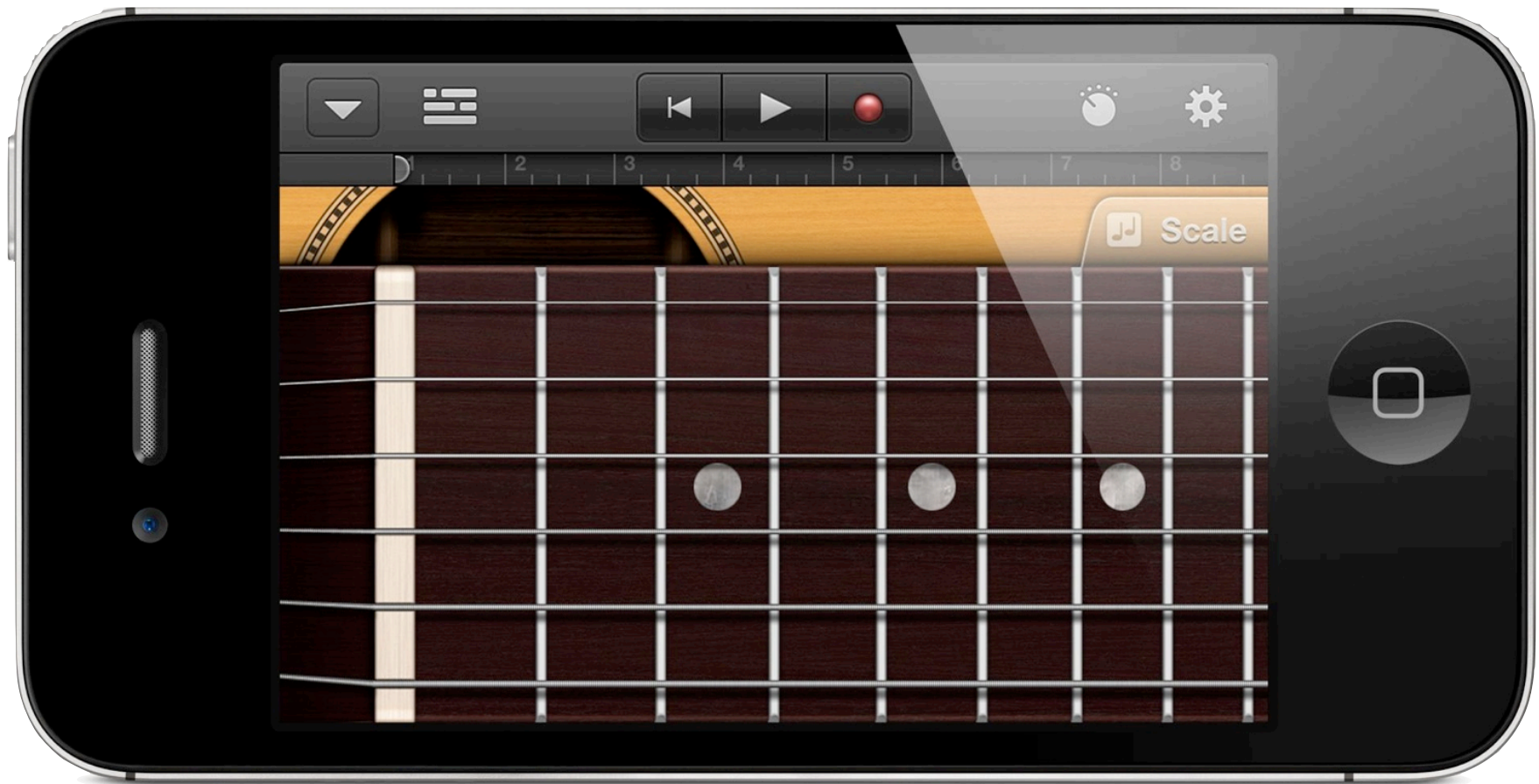


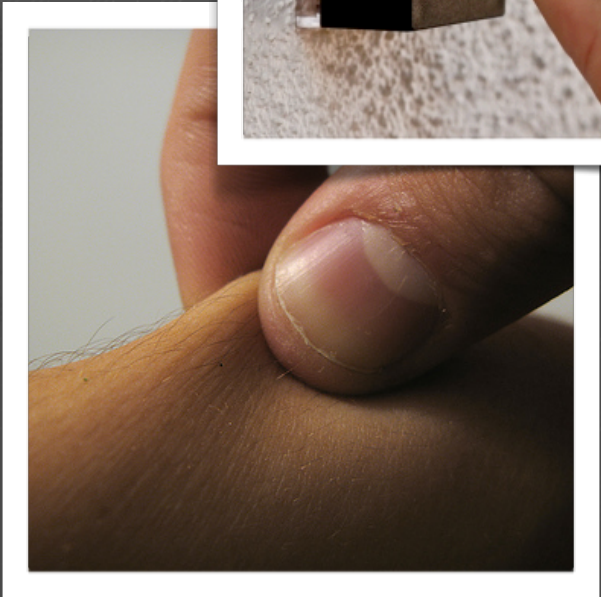
# mobile device



# limited surface area







# mobile device

A close-up photograph of a hand touching a smartphone screen. The screen displays a social media-style interface with a search bar, a profile card for 'Julia J', and a list of items. Two white rectangular boxes are overlaid on the screen, one above the other, highlighting a specific area of the interface. The background is dark and out of focus.

# limited input richness



# Scratch Input++

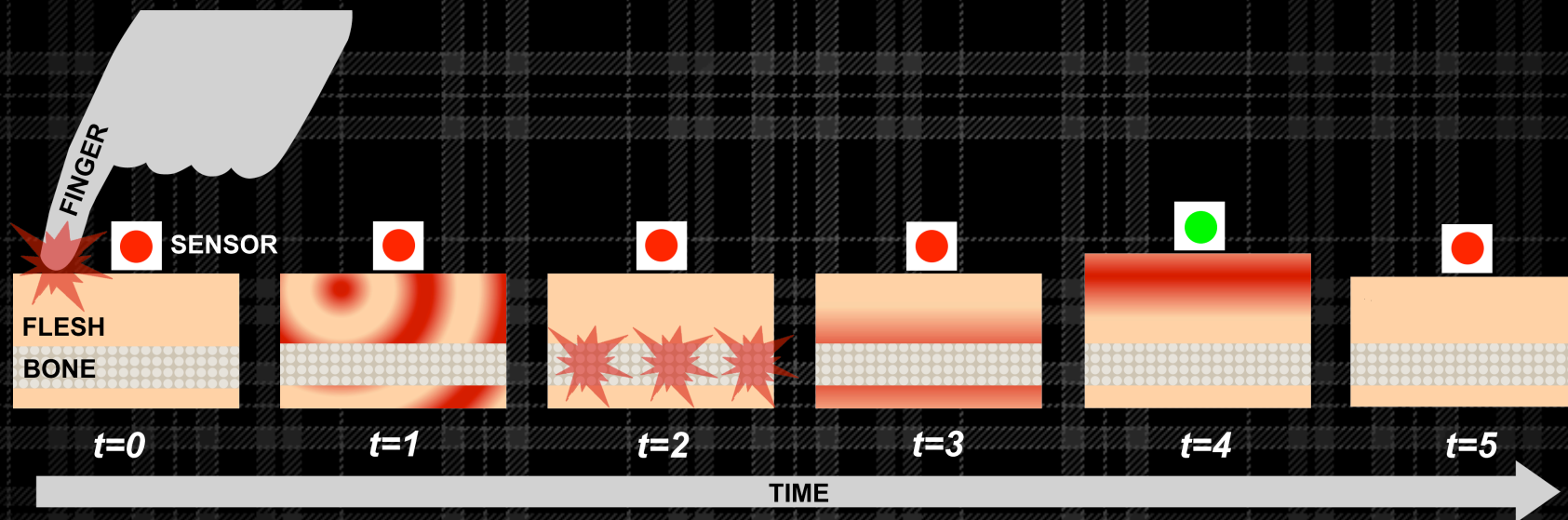
# Scratch Input

# Project Idea

- ✦ One or more microphones on underside of device
- ✦ 1) Localize taps around the device on an ad hoc surface
- ✦ 2) Listen and classify gestures being performed (non-spatial)
- ✦ Some combination of the two above
- ✦ Possible uses: Laptop, smartphone, kitchen, light switch
- ✦ Reach goal: couple with projector for interactive graphics
  - ✦ Oblique from smartphone
  - ✦ From lid of laptop

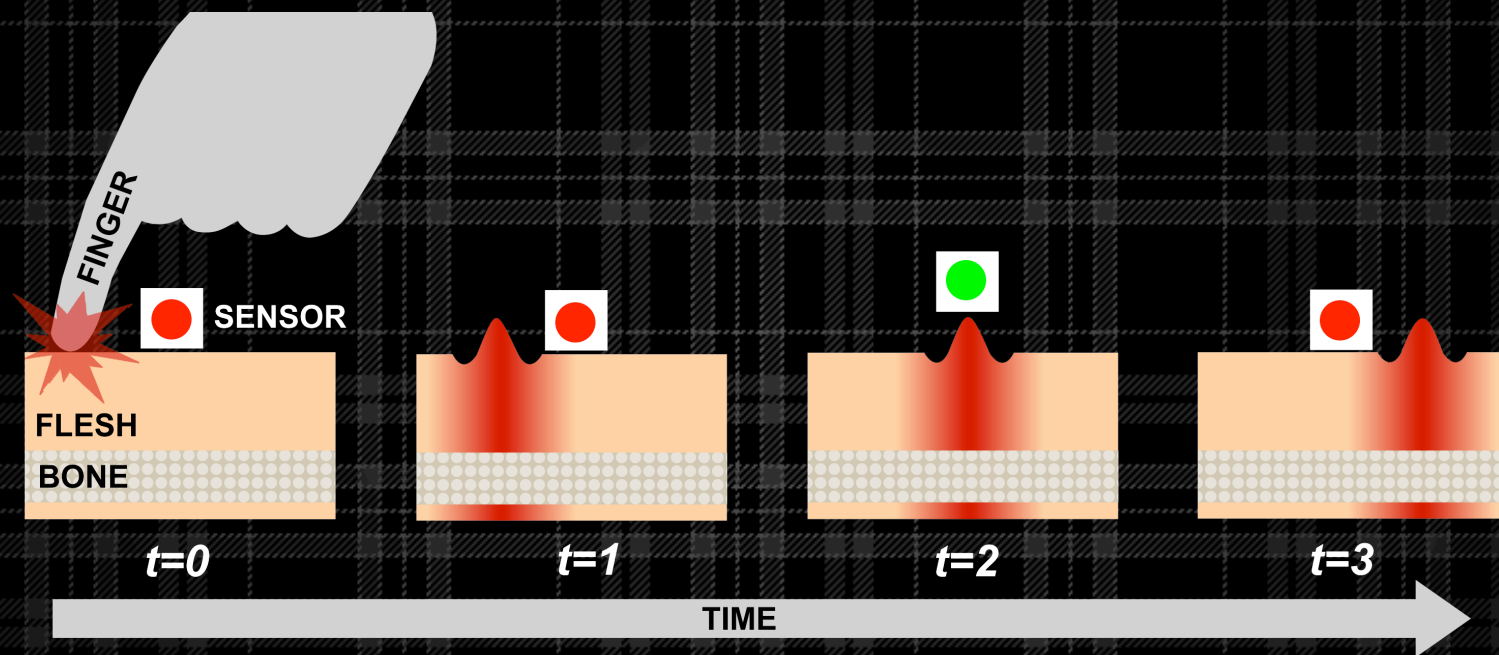
# On-Body Interfaces

# Acoustics on the Body



Longitudinal (compression) waves

# Acoustics on the Body



Transverse surface distortions (ripples)



**Pico-Projector**



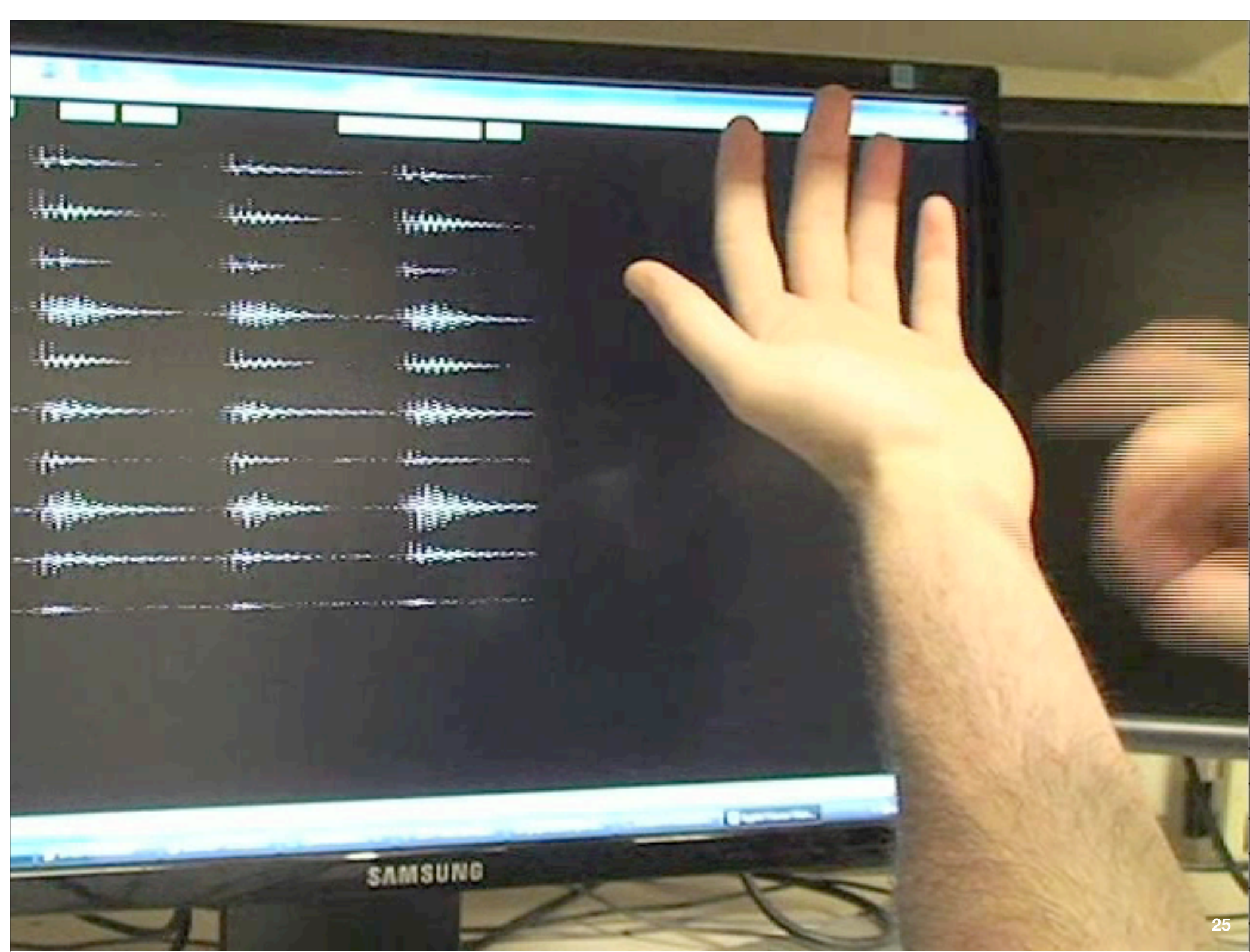
**Projected Interface**



**Sensing Armband**









# Project Idea

1. Skinput++ Entirely passive approach; better signal processing and machine learning
2. High resolution Skinput on the wrist (perhaps using accelerometers on wrist bone assembly)
3. 1D (along arm) time of flight.
4. Add active elements to the skin, look at e.g., reflected signal, attenuation of particular frequencies.
5. Phase offset (receiver/transmitter pair on upper arm/wrist)

# Warning!

- ✦ Not for the feign of heart!
- ✦ These projects need research, not just engineering
- ✦ Self motivated team
- ✦ I can advise project, but will be traveling a lot
- ✦ Expected end result is a publication

# Analyzing Calls for Closeness

# Project Idea

- Large corpus of phone calls
- Mine calls for acoustic features
- See if personal closeness of the two individuals can be predicted
- Example app: bootstrapping sharing/privacy settings on social networking sites

# Thank You

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