INSTITUTO DE INFORMÁTICA UFRGS
COMPUTER GRAPHICS IMAGE PROCESSING AND INTERACTION GROUP

Towards "calm interfaces" using a network of sensors and actuators

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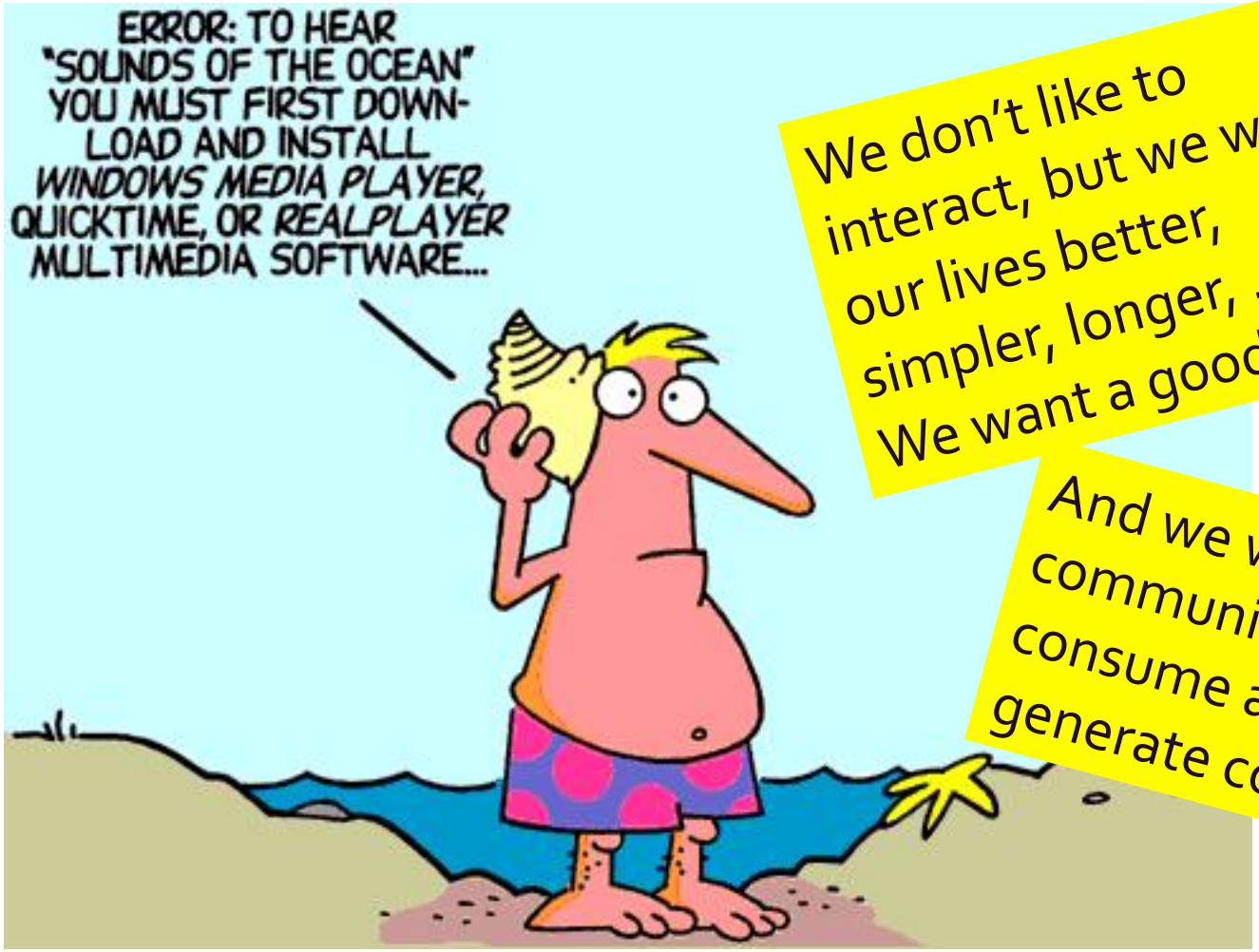
Motivation

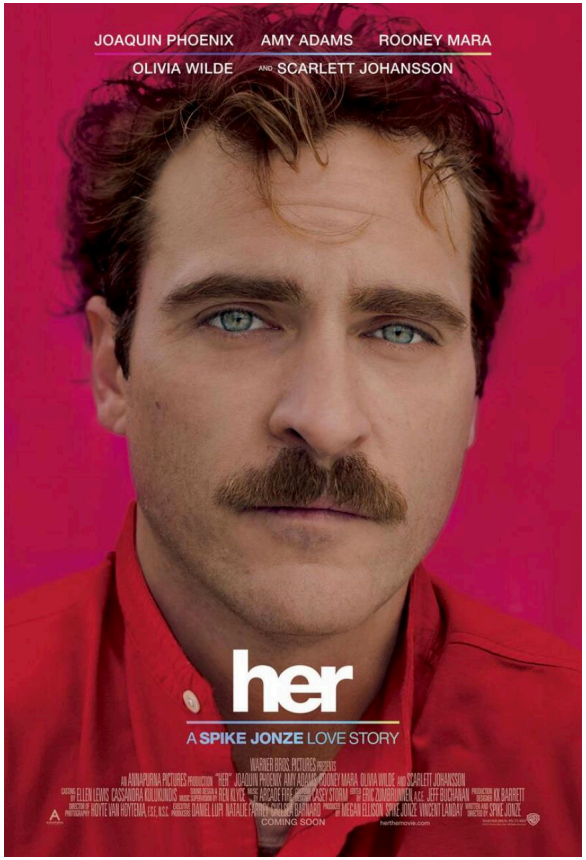
Nobody wants to use a computer!

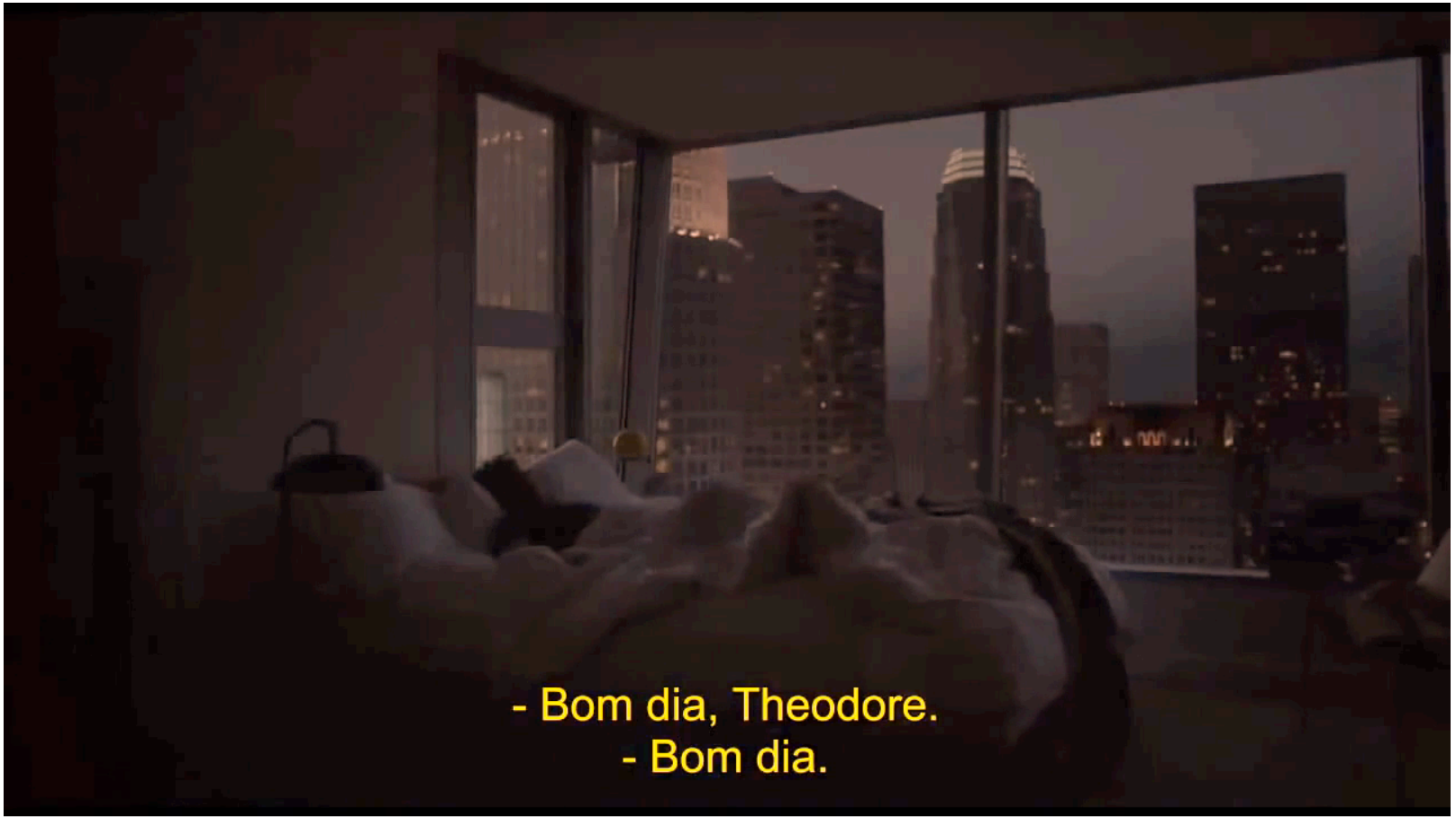


We don't like to interact, but we want our lives better, simpler, longer, ... We want a good life!

And we want to communicate, to consume and to generate content!

Motivation


JOAQUIN PHOENIX
AMY ADAMS
ROONEY MARA
OLIVIA WILDE
AND SCARLETT JOHANSSON
her
A SPIKE JONZE LOVE STORY
COMING SOON


- Bom dia, Theodore.
- Bom dia.

How to achieve this?

- We need to collect data about the user
- We need to reason on these that
- Everything in real time

- Very difficult…

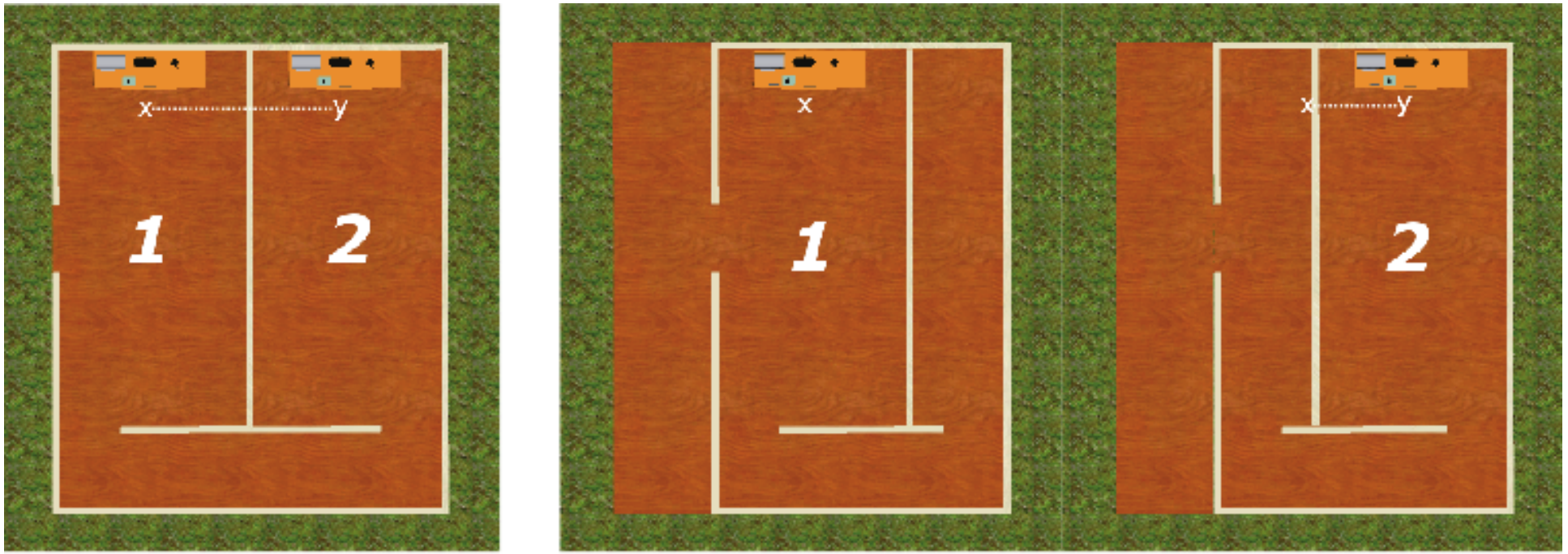
How may we take advantage of this?

- Useful for individuals
- Collectivities
- And disabled persons

How may we take advantage of this?

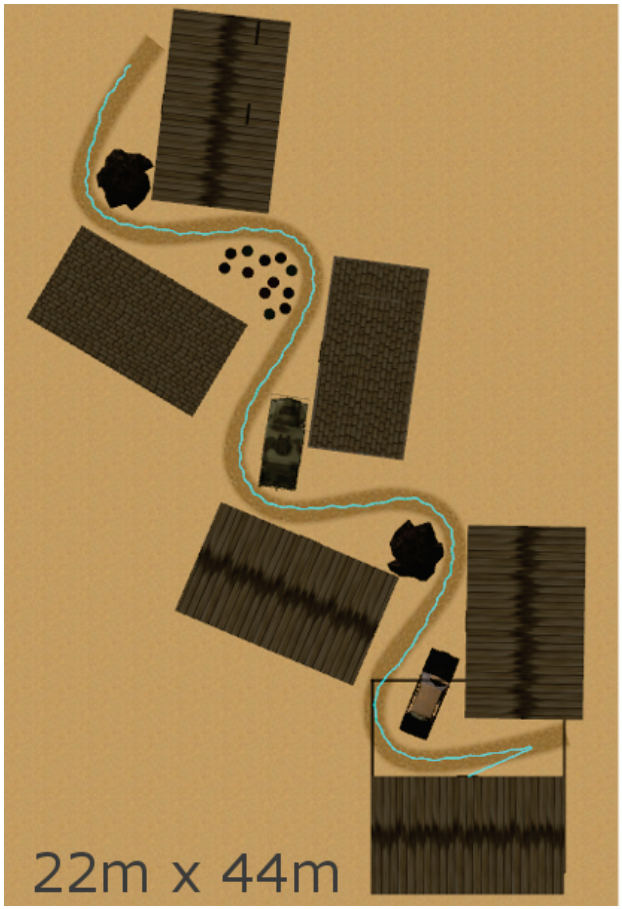
- HCI is fully related to human factors and user experience
- It's about people and computers
- To understand the human brain and perception system is mandatory for the future interfaces
- Example: redirection for navigation

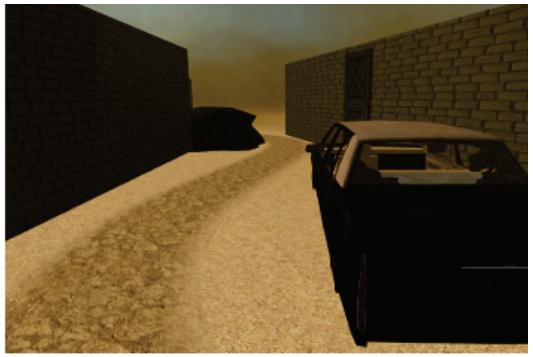
Example: Impossible spaces

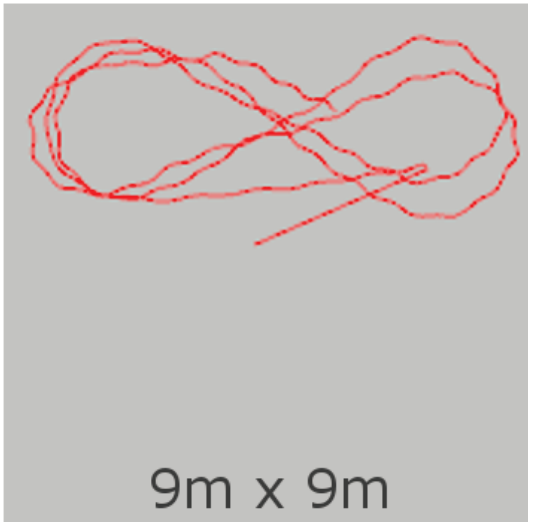


[Suma 2012]

Example: Impossible spaces

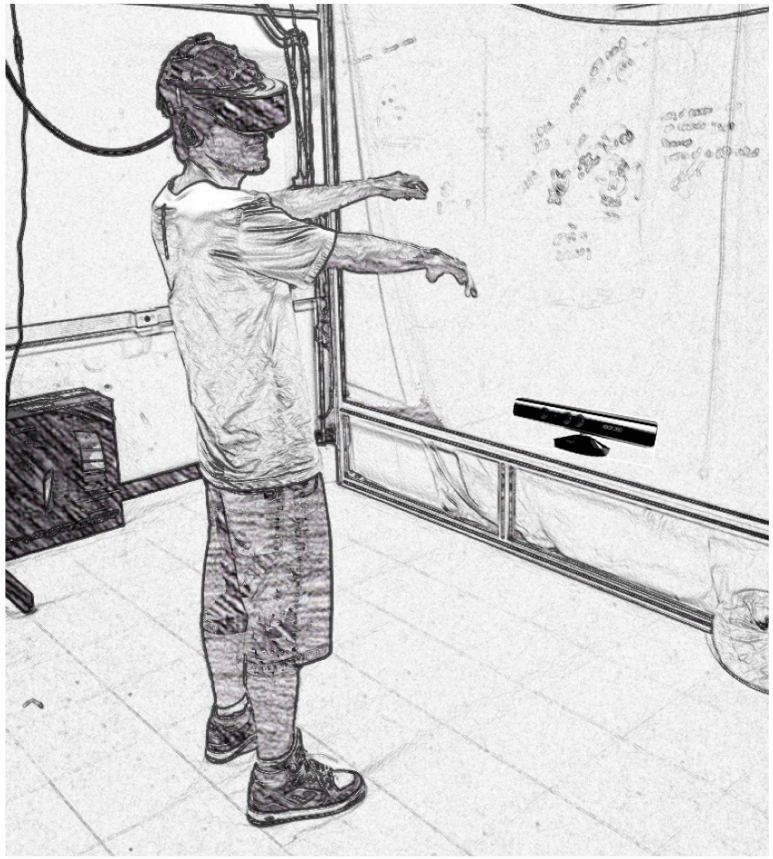


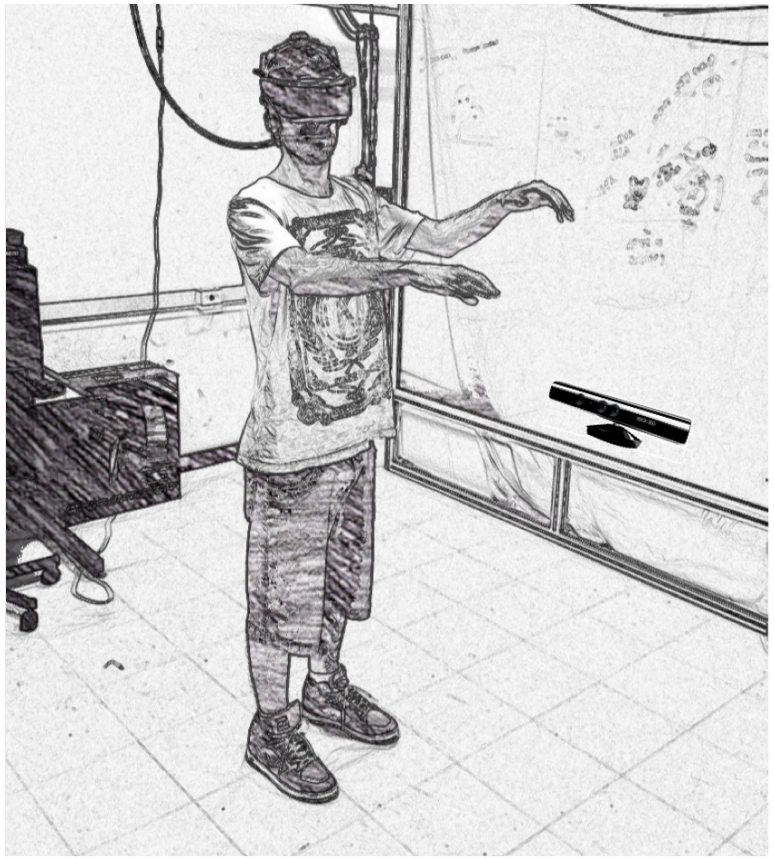




[Suma 2012]

Example: Comfortable pose





REUS, V. ; MELLO, M. ; NEDEL, L. P. ; MACIEL, A. . Correcting Drift, Head and Body Misalignments between Virtual and Real Humans. SBC Journal on 3D Interactive Systems, v. 4, p. 55-65, 2013.

Agenda

- Calm and persuasive interfaces
- Sensors
- Actuators
- Some results on natural interaction
- On-going work
- Final comments

Calm interfaces

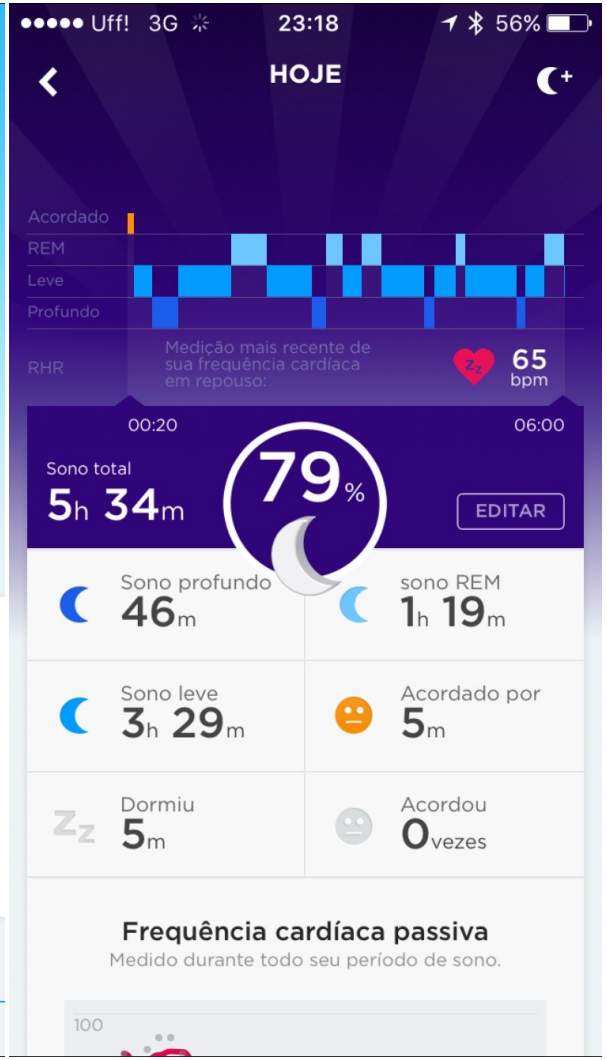
- Invisible interfaces [Mark Weiser]
- Computer is everywhere
- Interface like an intuition (less stress situations)
  - The interface observes the user
  - Perceives patterns
  - Give to the user the information he/she needs
  - Like a personal assistant

Persuasive interfaces

- The user is monitored through sensors
- Collected data is processed and analyzed
- Results are displayed and change the way people behave

Jawbone UP3


Uff! 23:18 56%
68bpm
23:12
79%
5h 34min
44%
4.453 passos
HOJE
23 DE SET
Vá em frente
Recentemente, você teve uma média de Pontuação de alimentos verde de 10.00/10. Quando você ingere os nutrientes que seu corpo precisa, o fluxo de sangue para o cérebro aumenta e as células cerebrais ficam mais protegidas. Continue assim!
Saiba mais
Todas as ativid


Uff! 3G 23:18 56%
HOJE
Acordado
REM
Leve
Profundo
RHR
Medição mais recente de sua frequência cardíaca em repouso:
65 bpm
00:20
06:00
Sono total
5h 34m
79%
EDITAR
Sono profundo
46m
sono REM
1h 19m
Sono leve
3h 29m
Acordado por
5m
Dormiu
5m
Acordou
0vezes
Frequência cardíaca passiva
Medido durante todo seu período de sono.
100


Uff! 23:18 56%
Saúde do coração
HOJE
TENDÊNCIA RHR
68bpm
Frequência cardíaca passiva
23:12
MAIS RECENTE
110
75
65
00:00
10:44
23:59
HR em descanso
HR passiva
65bpm
HR em descanso
Hoje
70bpm
HR passiva
Média de hoje
A frequência cardíaca passiva é medida durante todo o dia quando seu corpo estiver parado. Ajuda você a entender como a hidratação, o sono, o estresse e outros fatores afetam seu coração.

Ford Fusion Dashboard

Sensors and actuators

Sensors

- Environmental sensors
- Context sensors (determine user's activities)
- Physiological sensors (determine user's affect)

The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies …
edited by Andrew Sears, Julie A. Jacko

Sensors

- Environmental sensors
  - Air temperature
  - Lighting quality
  - Air pressure

Sensors

- Context sensors (determine user's activities)
  - Absolute location (GPS)
  - Inertial sensors (accelerometers, magnetometers, gyroscopes)
  - Microphones
  - Images
  - Eye trackers

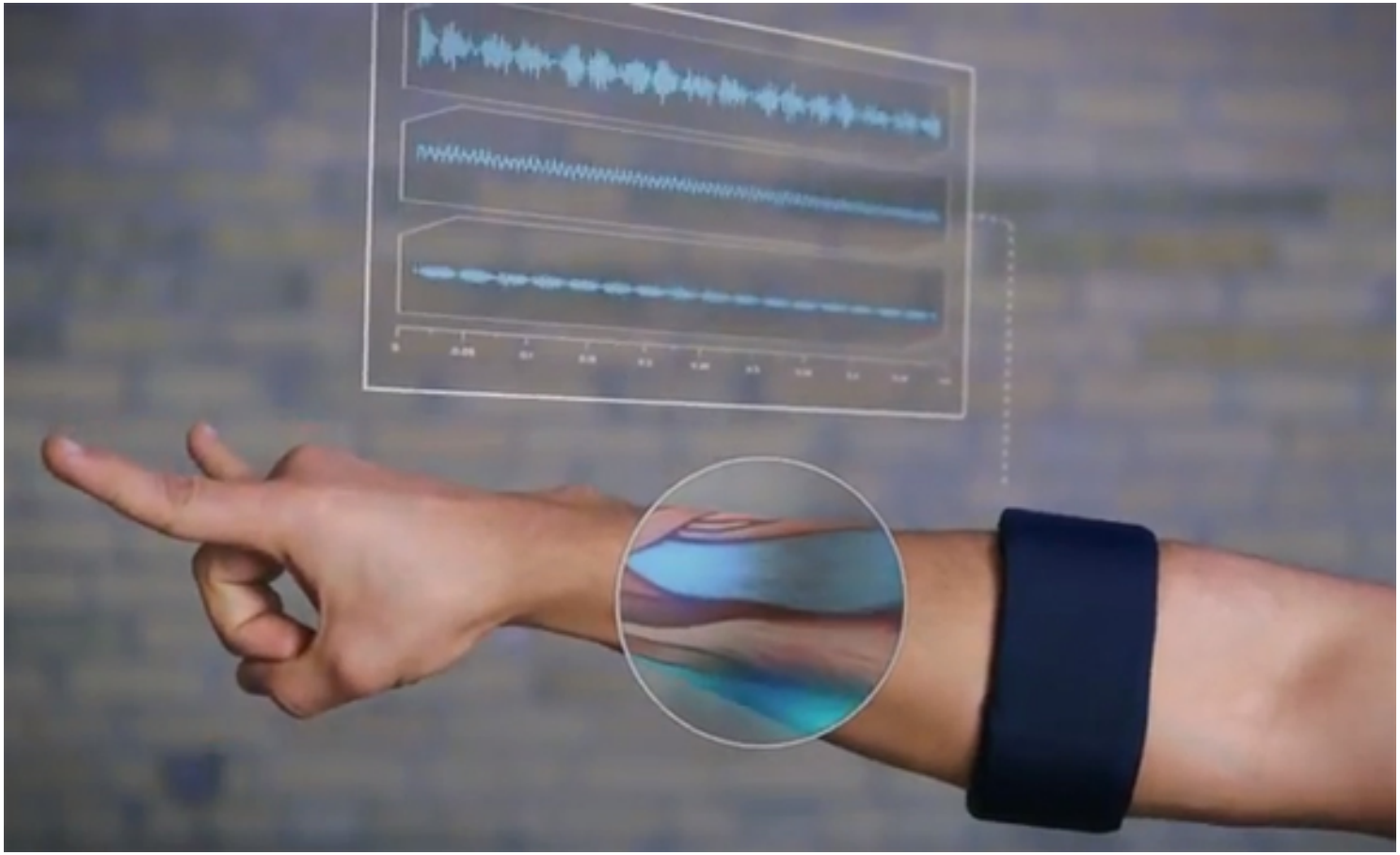
Sensors

- Physiological sensors
  - Galvanic skin response (GSR)
  - Blood volume pulse (BVP)
  - Respiration rate
  - Eletromyogram (EMG) – muscle's activities
  - Electrocardiogram (ECG) – heart rate
  - Electroencephalogram (EEG)

Sensors: examples

- Kinect 2
  - Much more precise
  - Work on dark spaces
  - Detects 25 joints from 6 different persons
  - Estimates cardiac frequency
  - Interprets 2 persons talking at the same time
  - Maps a human face with 1.4 k points
  - Still not available for PCs

Sensors: examples

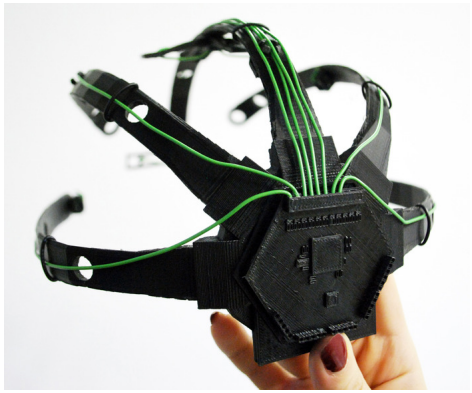


Myo - https://www.thalmic.com/en/myo/ (U$ 149,00)

EEG devices

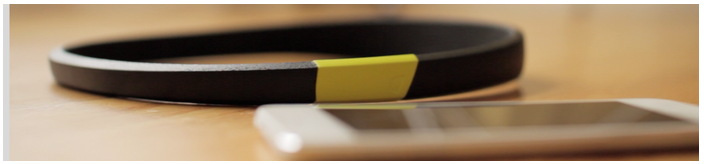
NeuroSky

Emotiv



OpenBCI

Necomimi



Melon


Replicator
MakerBot

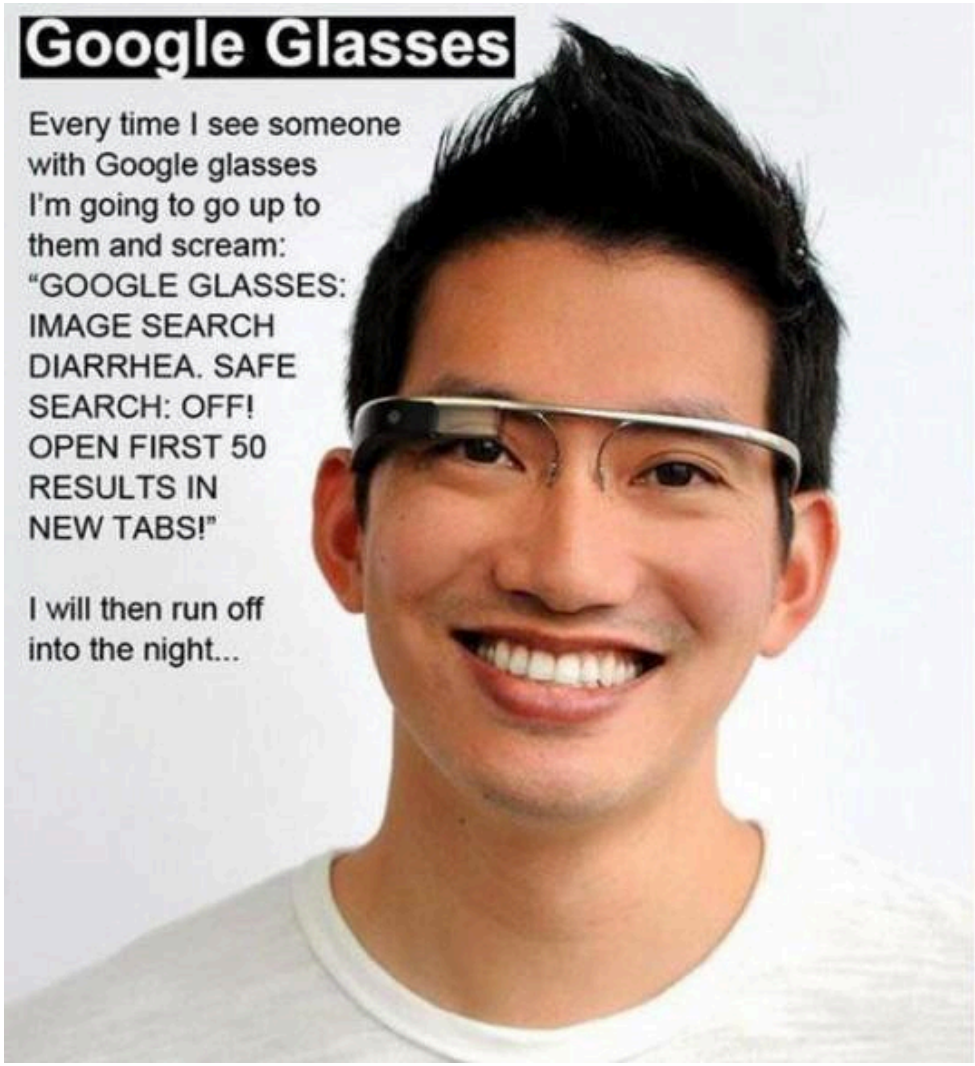
Walk again project

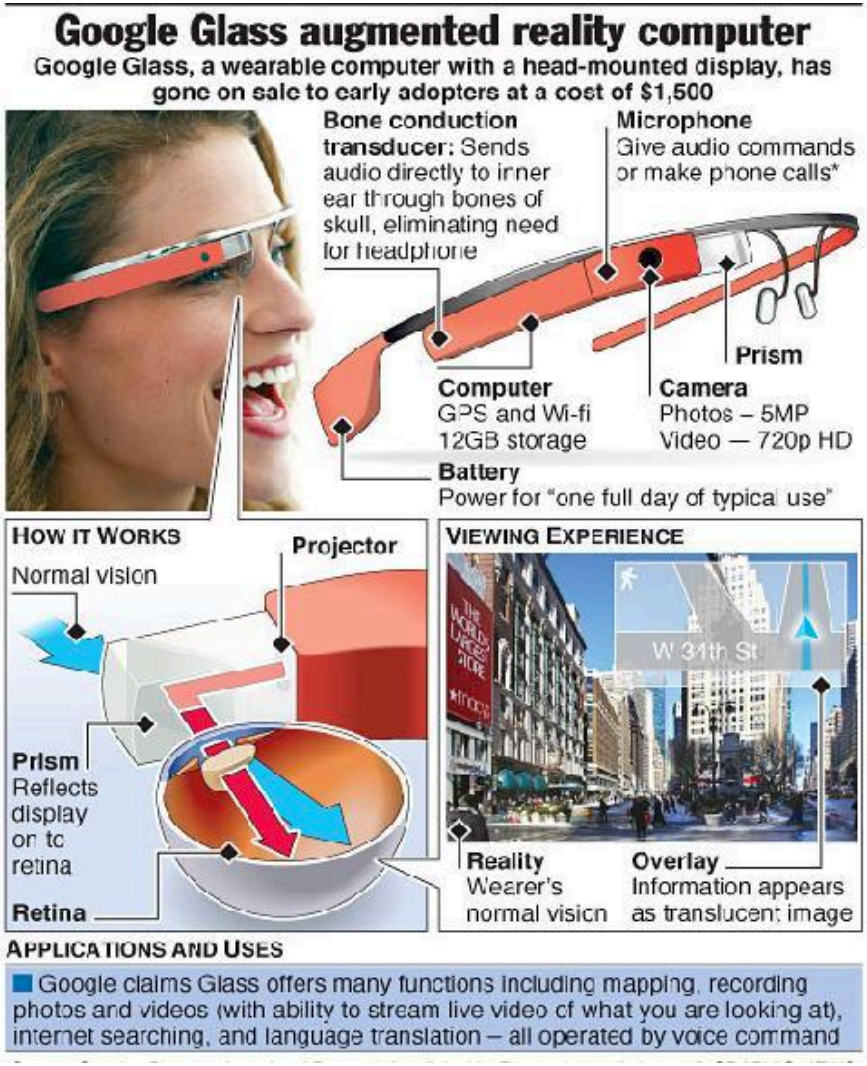
http://www.nicolelislab.net/

Actuators

- Display
- Sound
- Vibrotactile displays

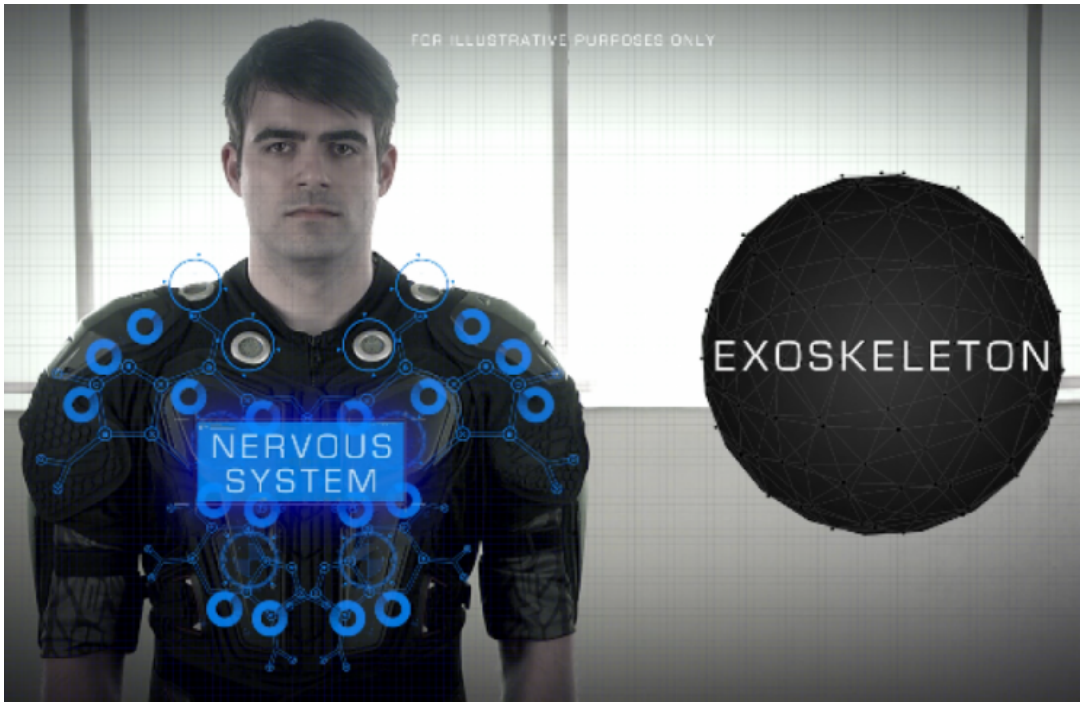
Actuators example: Google Glass (where is it?)



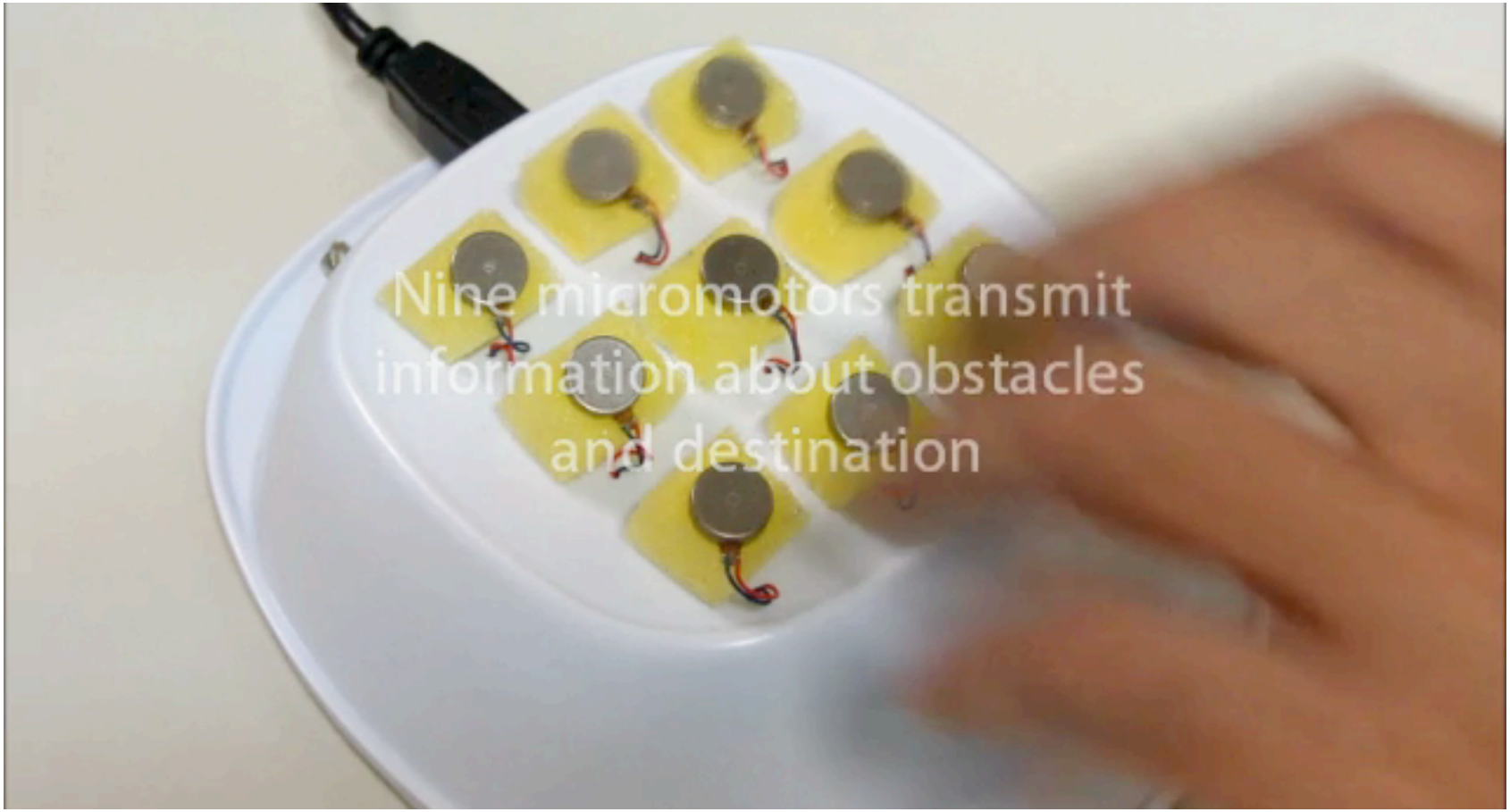


Actuators example: Haptic feedback suit

- ARAIG (As Real As It Gets)
- http://www.kickstarter.com/projects/141790329/araig-as-real-as-it-gets



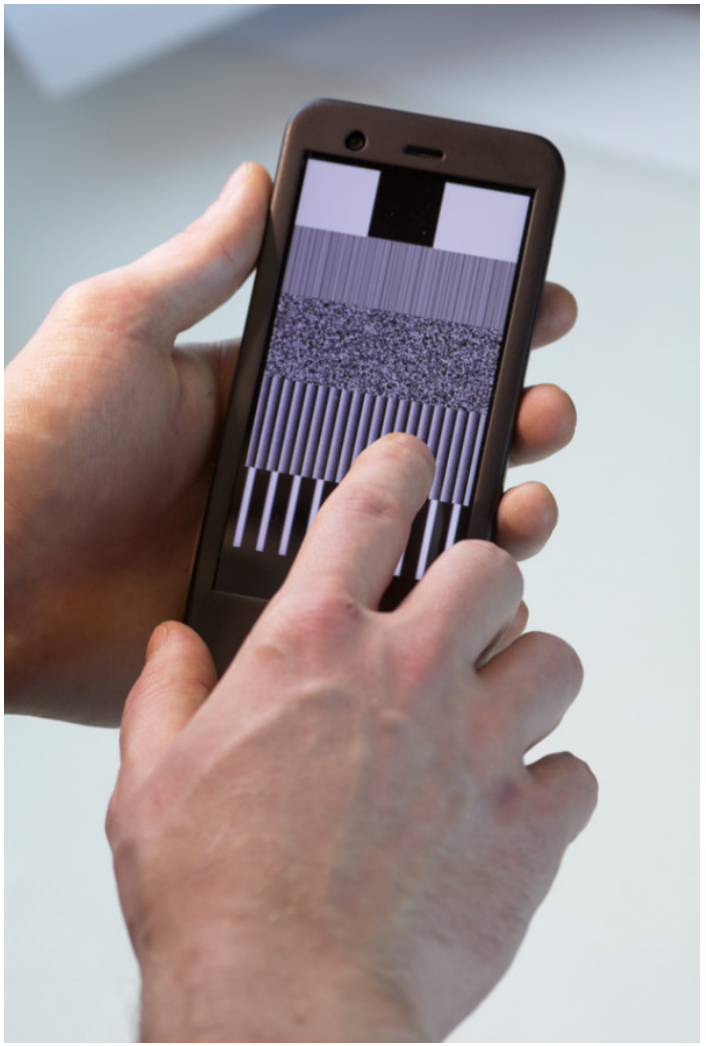
Actuators example: a tactile language



OLIVEIRA, V. A. de J. and MACIEL, A. Assessment of Tactile Languages as Navigation Aid in 3D Environments, EUROHAPTICS 2014.

Actuators example: Apple Watch

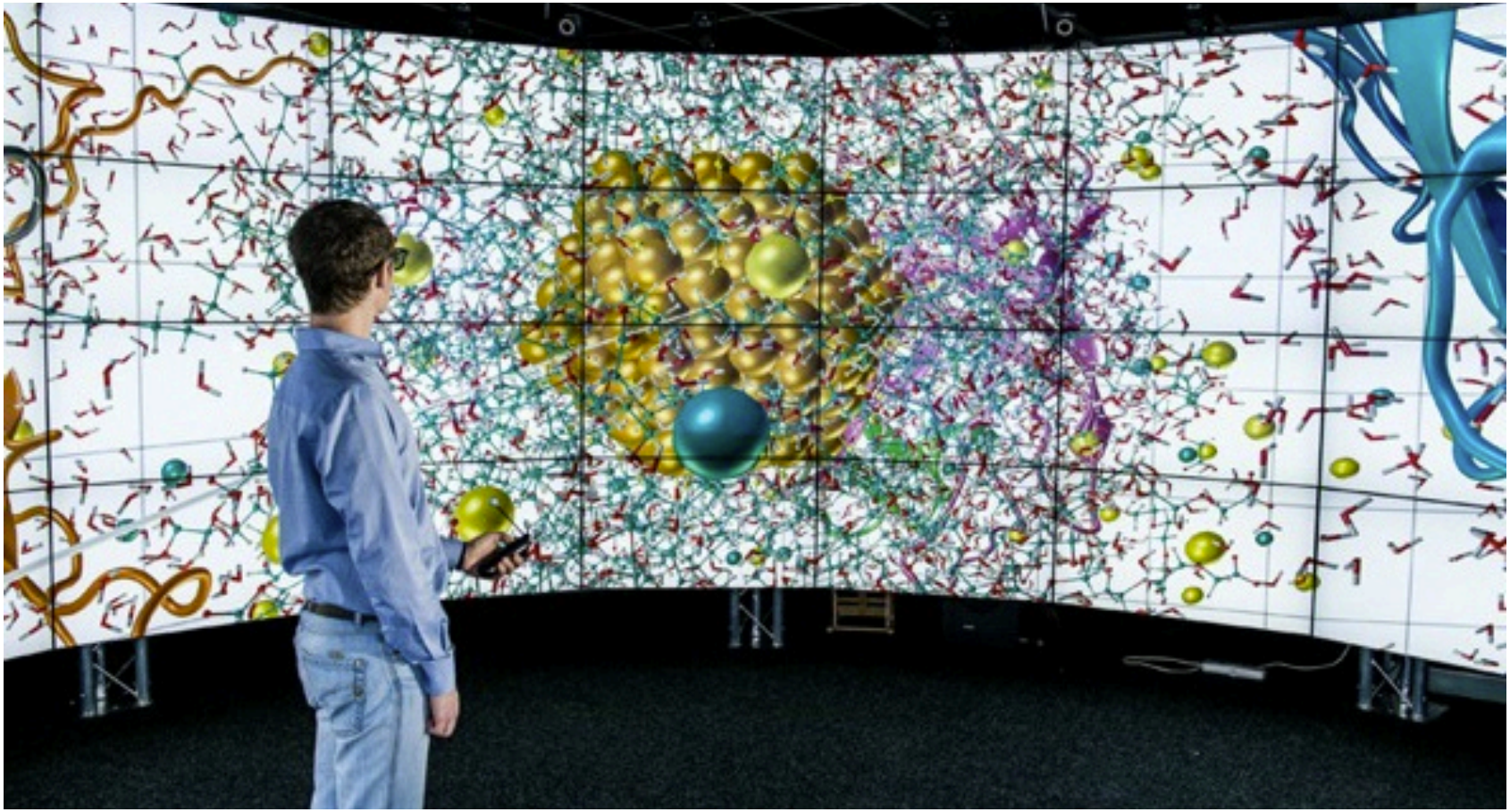
T-Pad



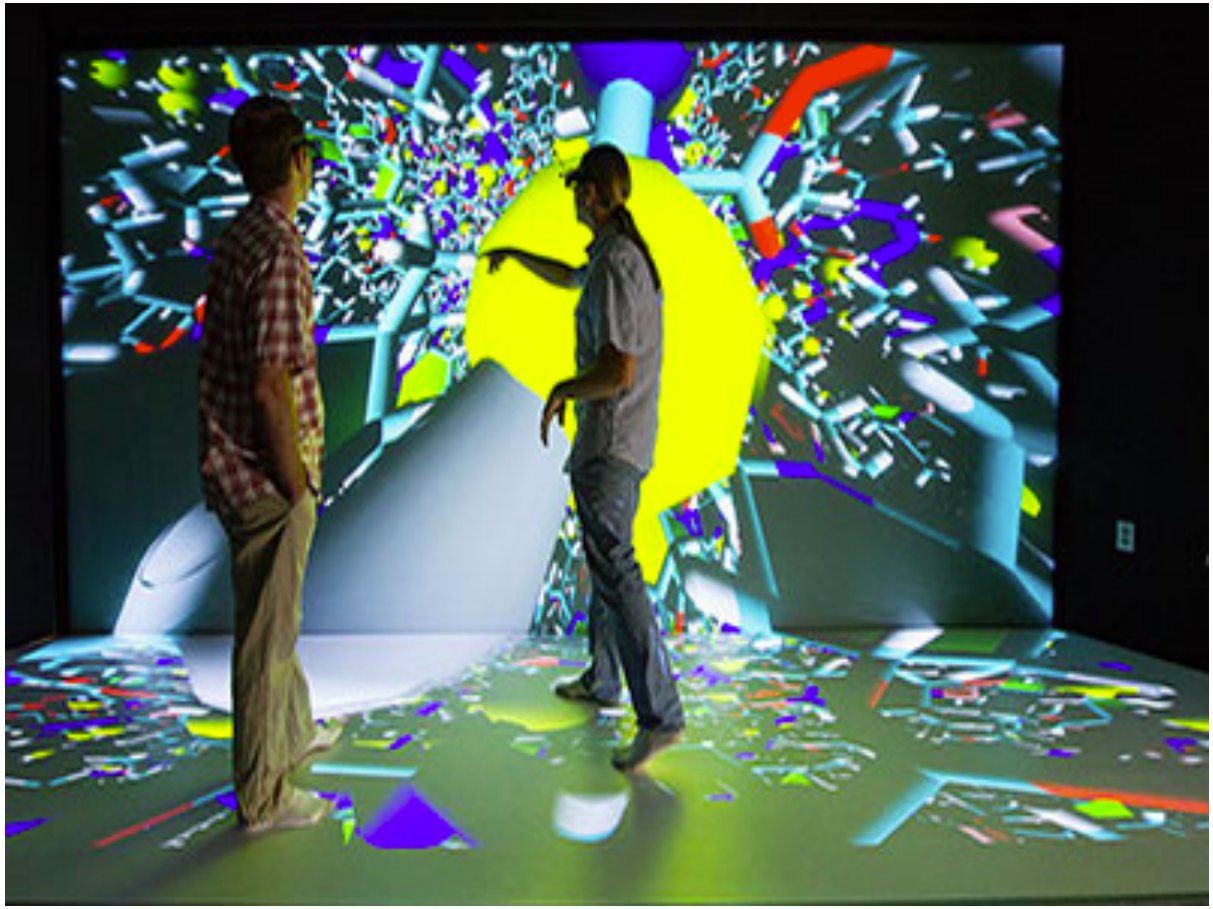
Northwestern University, Chicago

Some results on natural interfaces

More resolution...

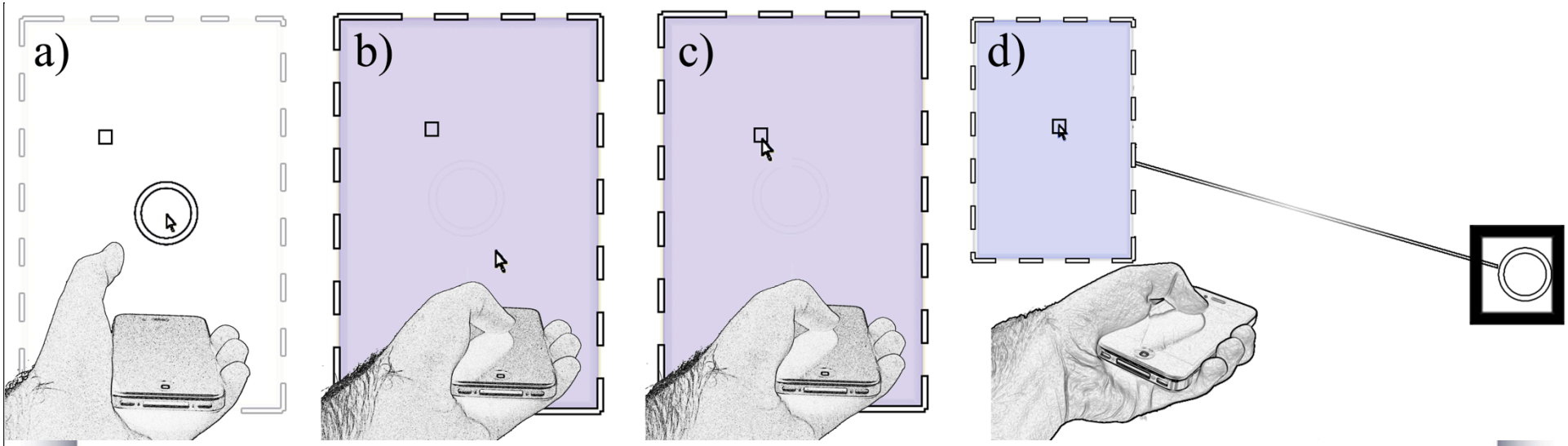


Be there...



Work hypotheses

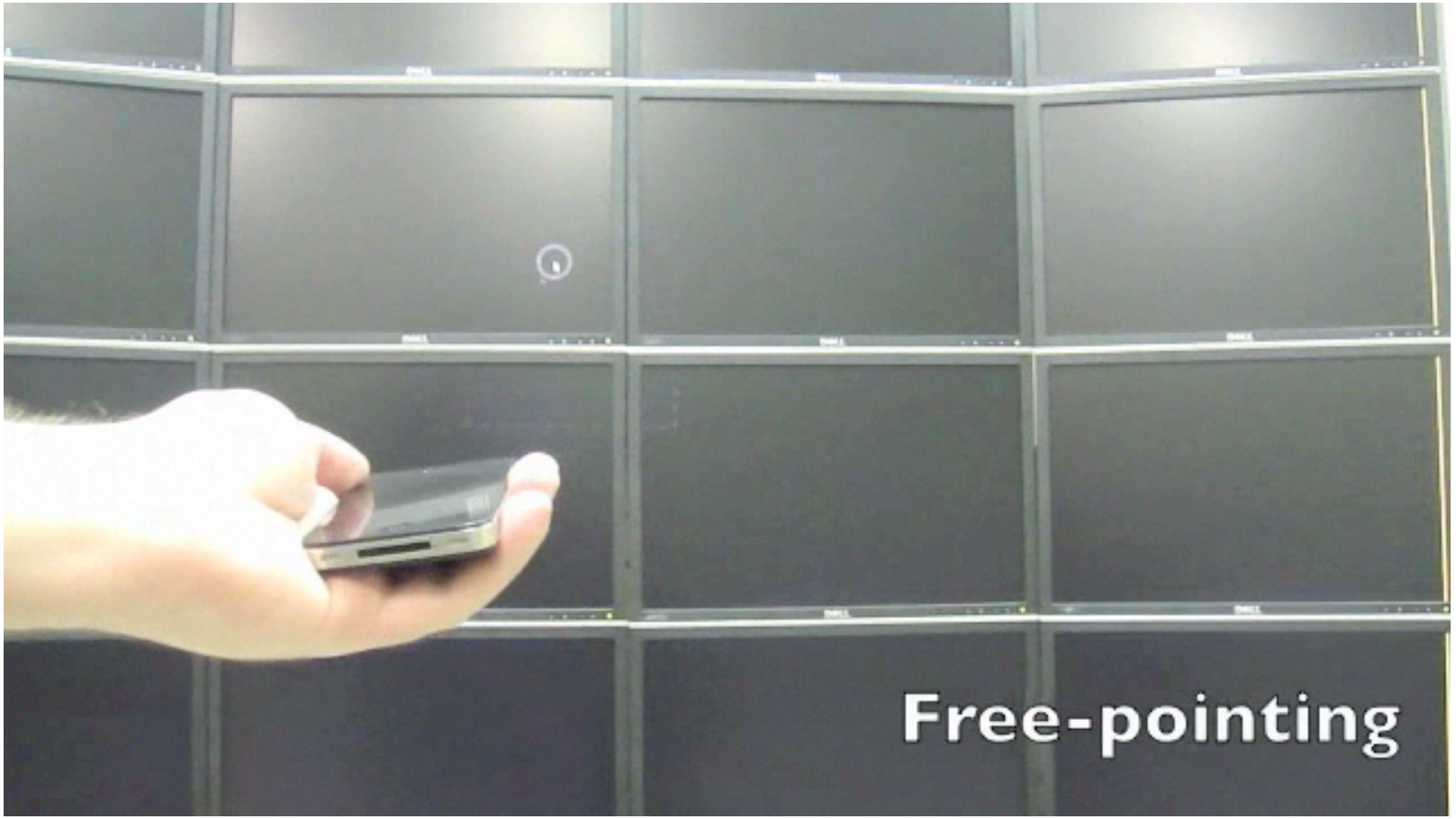
- The more resolution we have for visualization, the more resolution we need for interaction
- Immersion and natural interaction may be a solution
- "We are a human-machine civilization. Everybody has been enhanced with computer technology"
  Ray Kurzweil



Lop-cursor: Fast and Precise Interaction with Tiled Displays Using One Hand and Levels of Precision

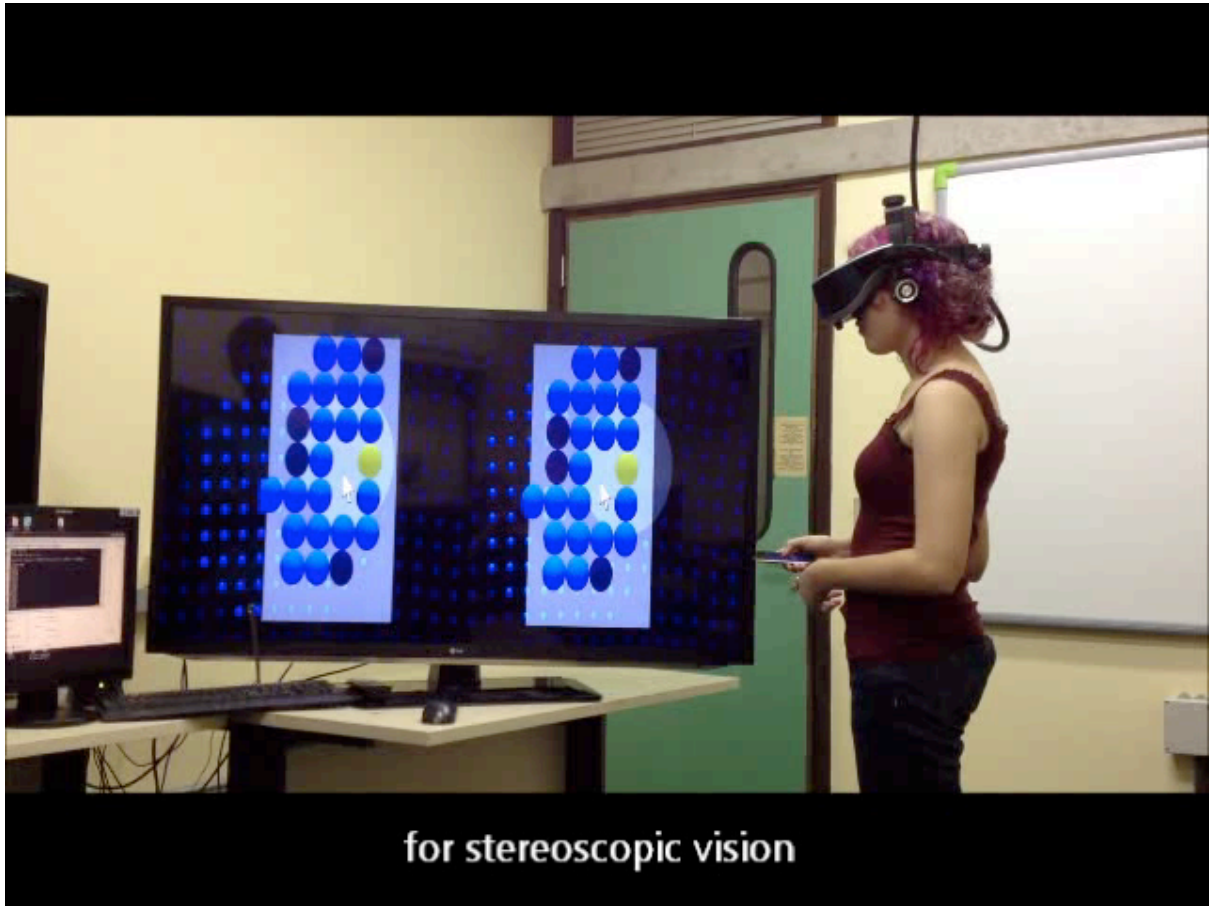
- Levels of Precision Cursor (LOP-cursor)
  - Technique for high precision and fast pointing
- Two-legged cursor metaphor
  - Simultaneous control over 2 cursors

Lop-cursor



Debarba, Henrique, Nedel, Luciana, Maciel, Anderson. *Lop-cursor: Fast and Precise Interaction with Tiled Displays Using One Hand and Levels of Precision* In: IEEE 3DUI 2012

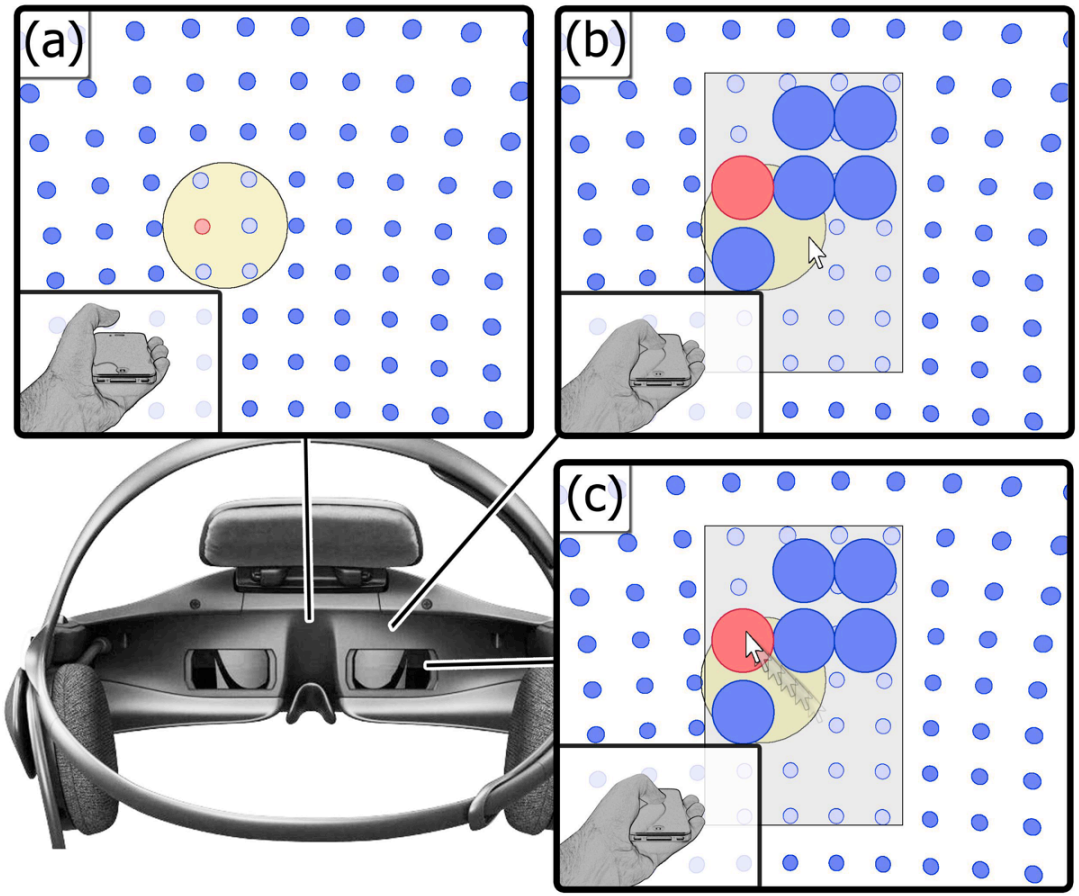
Disambiguation canvas

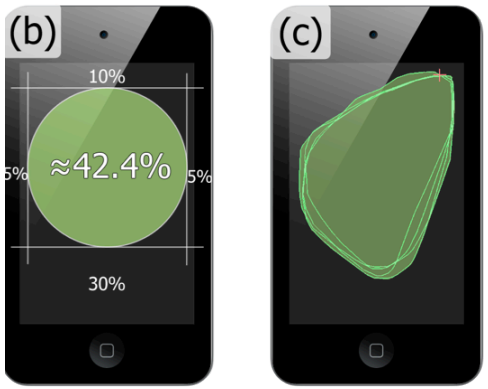


Debarba, Henrique, De Grandi, Jerônimo, Boulic, Ronan, Maciel, Anderson, Nedel, Luciana. *Disambiguation Canvas* In: IFIP Interact 2013

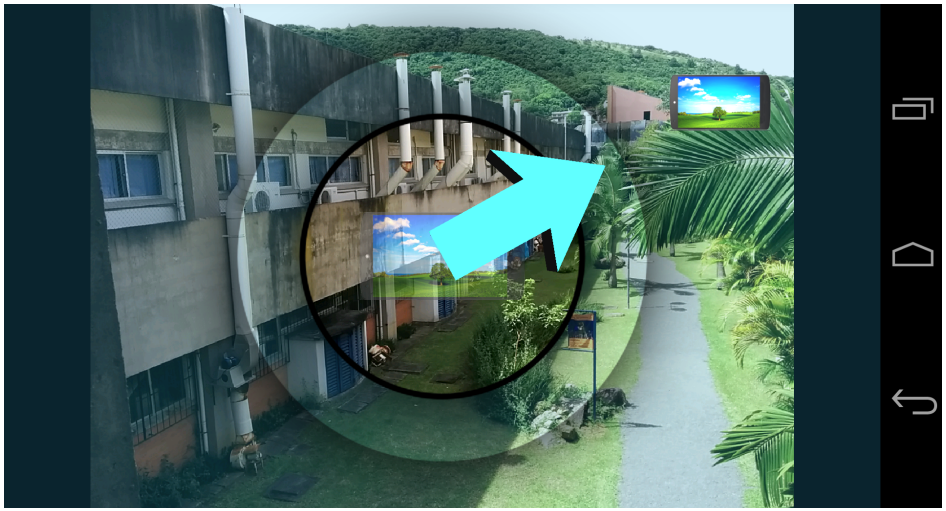
Disambiguation canvas

- Selection by progressive refinement
- Using a mobile device (smartphone) (a)
- Two steps
  1. Volume-casting (b)
  2. Disambiguation (c)





Instant Rephotography

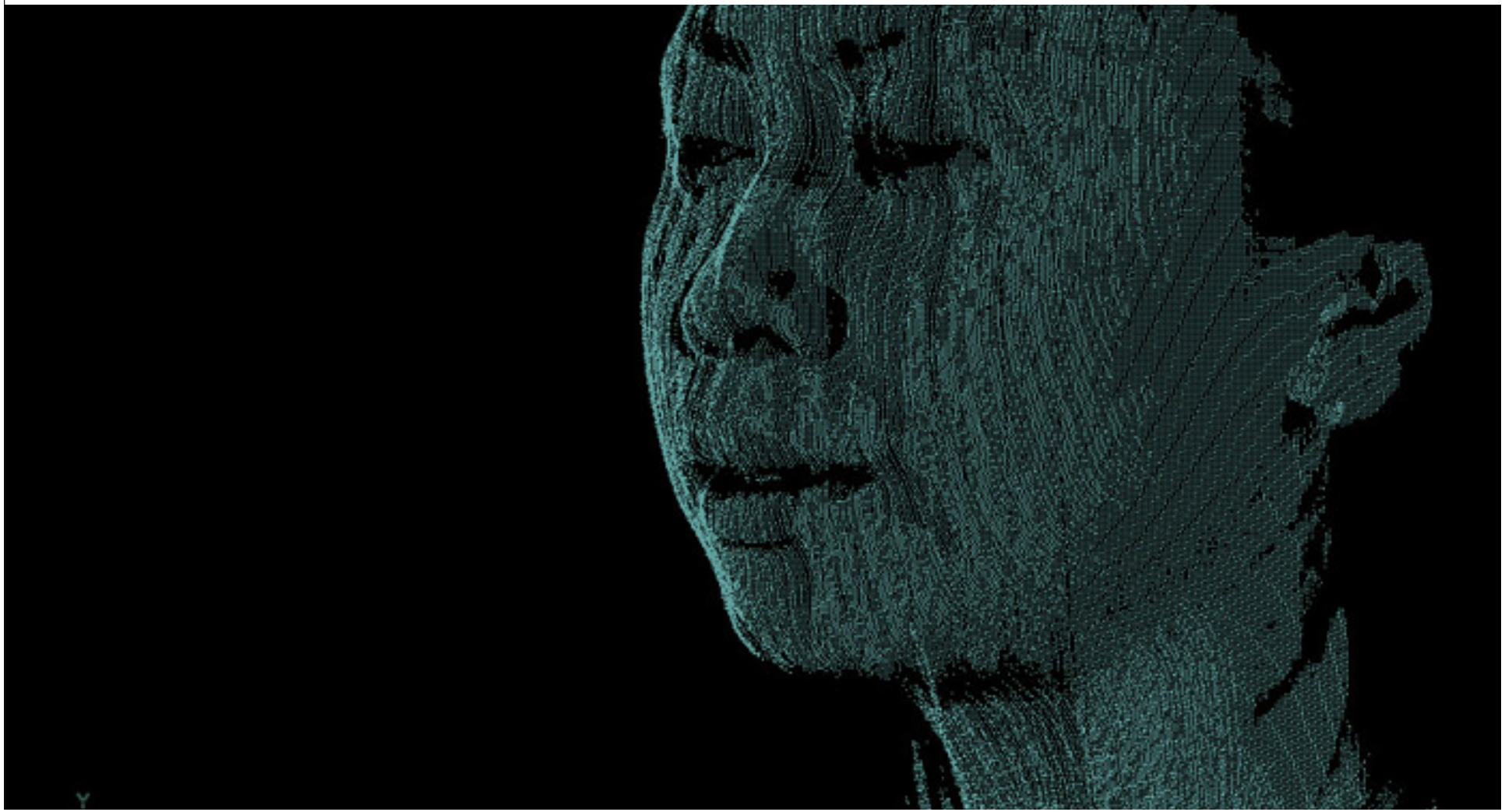


Instant Rephotography

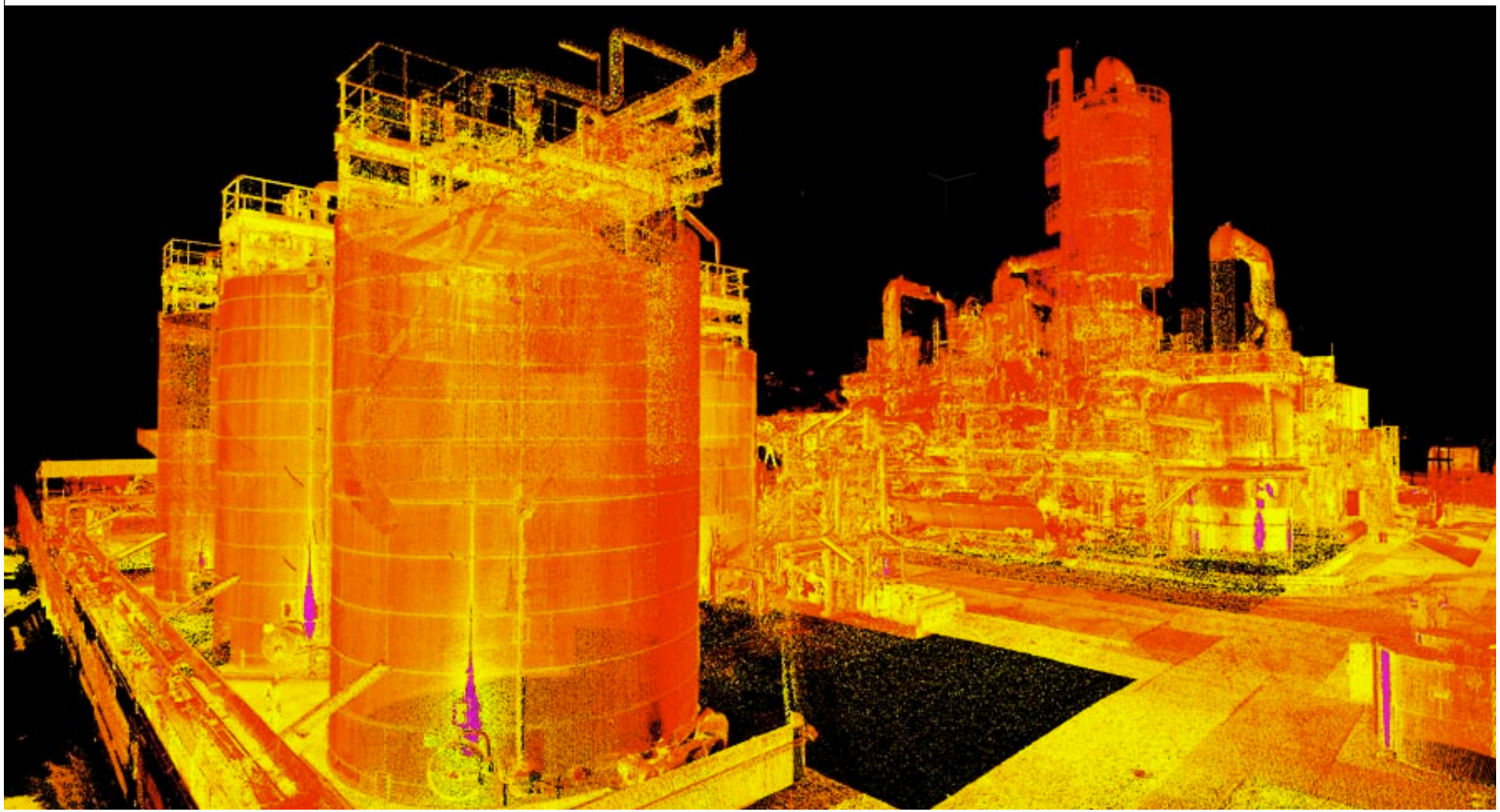
Interacting with unstructured data

- The problem (IEEE 3DUI Contest 2014)
  - Build a system that allows users to annotate 3D point clouds obtained from 3D scanners
  - An annotation must not just apply to a single point
  - The system must support the accurate labeling of sets of points
  - The set of tools provided by the system must be versatile enough to support the authoring of overlapping hierarchies of annotations at varying scales

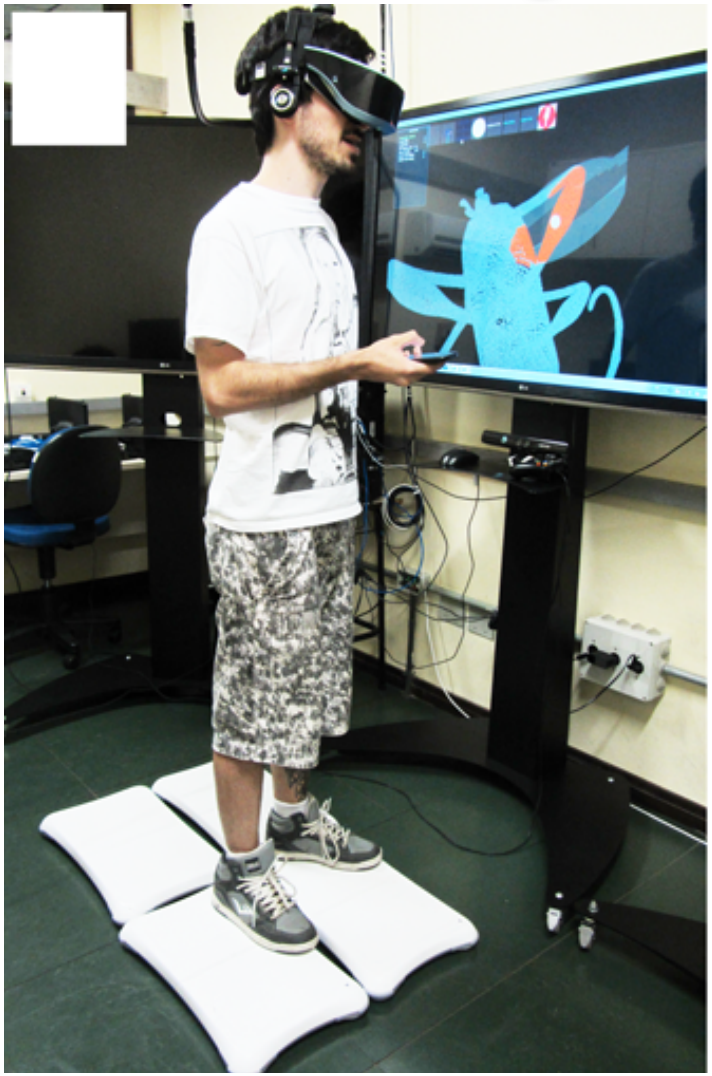
3D point clouds

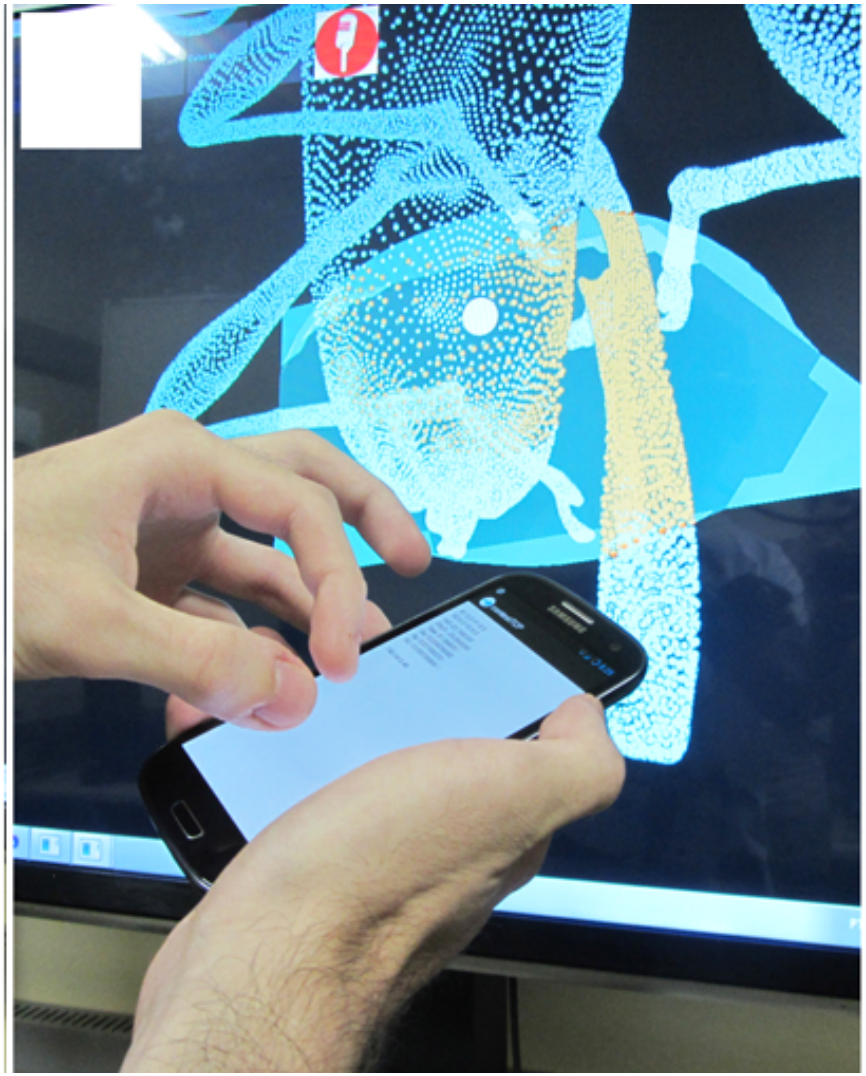


3D point clouds



Interacting with unstructured data

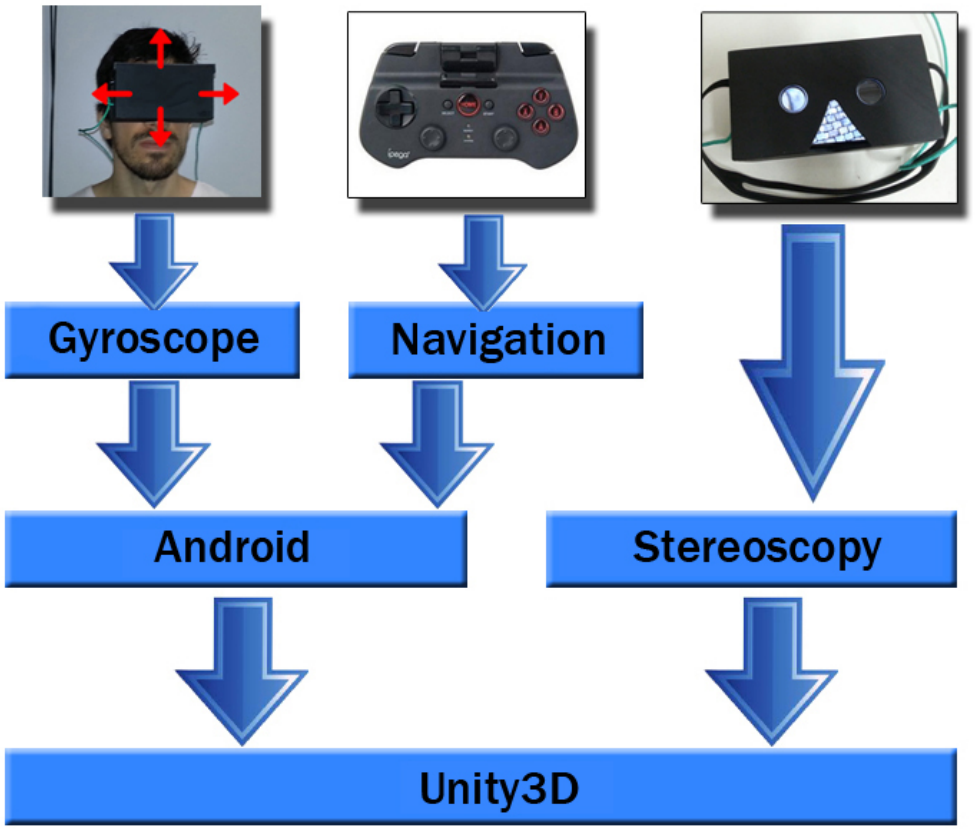




And we need to move freely...


UFRGS

Mobile HMD



First conclusions...

Some comments

- The concept of "calm interfaces" is still new and under definition
- We know where we want to go, but not exactly how to do this
- The solution seems to involve a fusion of sensors
- And a fission of the results, stimulating different human senses in a multimodal way
- There is a lot of work to do...
- And we should go step by step

On-going work

- Everyday visualization (personal vis)
- Environmental visualization

Everyday visualization

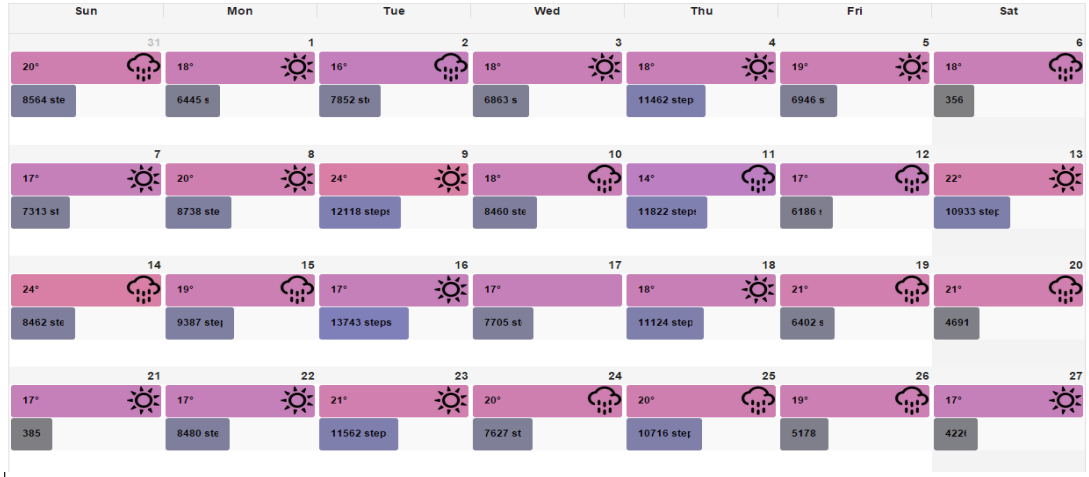
What to do?

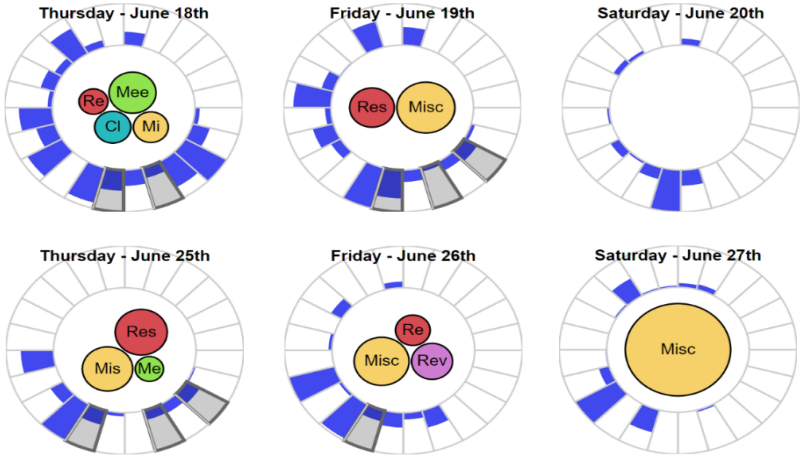
- Collect all the data we can about one single user (myself)
- Save all these data in a cloud service
- Visualize these data
- Reason on the data

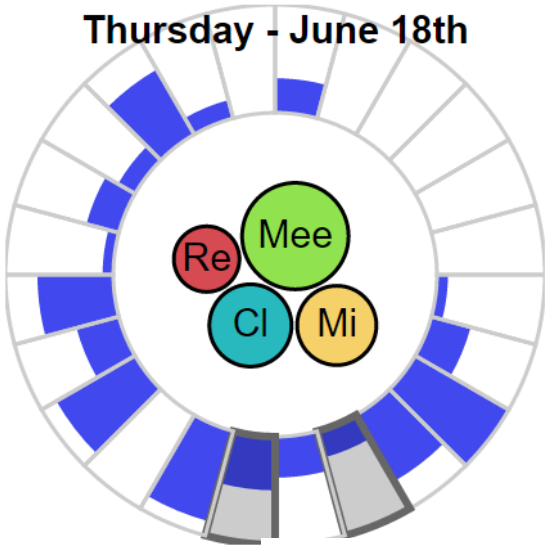
Collecting data about one individual

- **Steps:** captured using a Jawbone Up3 tracker.
- **Sleep:** also captured from the Jawbone Up3 tracker. The sleep quality is logged according to the period (wake, light, deep, and REM)
- **Location:** captured from Foursquare (timestamp, coordinates, the name of the city and country)
- **Climate:** gathered from the OpenWeatherMap API (temperature and climate)
- **Emails sent/received:** collected from Gmail through Tic- Trac app (timestamp, subject and text of each email sent and received by the user)
- **Tweets:** timestamp, the "@mentions" and the text of the Twitter messages sent by the user
- **Appointments:** collected from the Apple iCal app (start and end time of the appointment, title, and description)
- **Work:** obtained from Hours app and RescueTime (timestamp of each activity and time spent on it)

Visualizing these data



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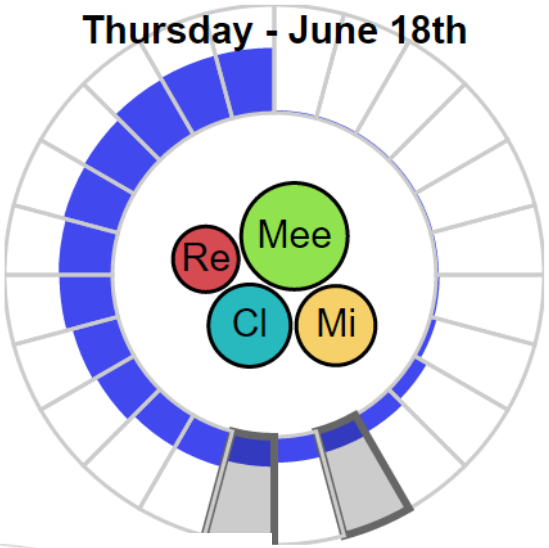
Mee
Re
Cl
Mi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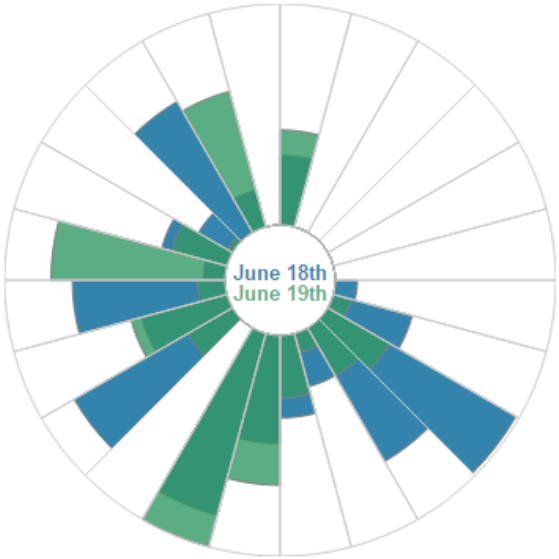
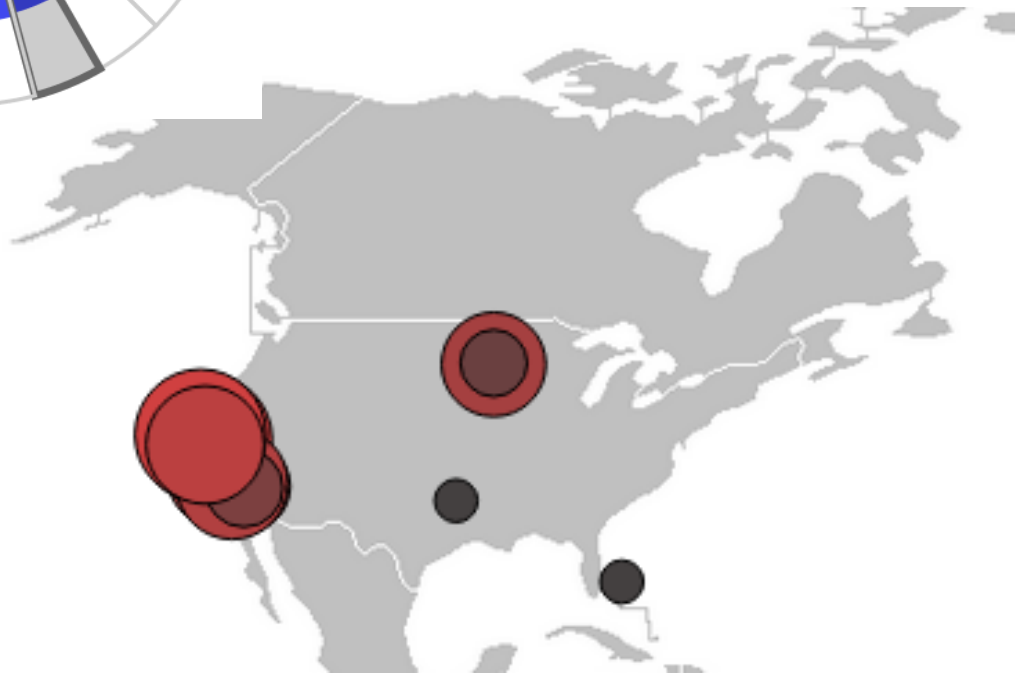

June 18th
June 19th



Environmental visualization

A system to monitor terrains and environmental conditions to prevent disasters

Motivation

In Brazil

In Japan

In Colombia

Our proposal

- To spread wireless sensors in the area

Collecting data

- Atmospheric pressure (Pa)
- Relative humidity (%)
- Temperature (°C)
- Rain level (mm)
- Wind velocity (km/h)
- Wind direction (0-360°)
- Luminosity (lux)
- UV radiation
- Concentration of CO_2
- Concentration of NO_2
- Particulate matter
- GPS coordinate

How to use these data?

- To prevent disasters
- To map the environment and help to reason about an individual
- As a personal station

Conclusions

Conclusions

- We need to collect all the data we can
- To process it
- To reason on these data
- And to give a feedback to the user in a natural way
- … in real time

- There is still a lot to do!

Thanks for your attention!

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nedel@inf.ufrgs.br