

Lessons from the WILD room

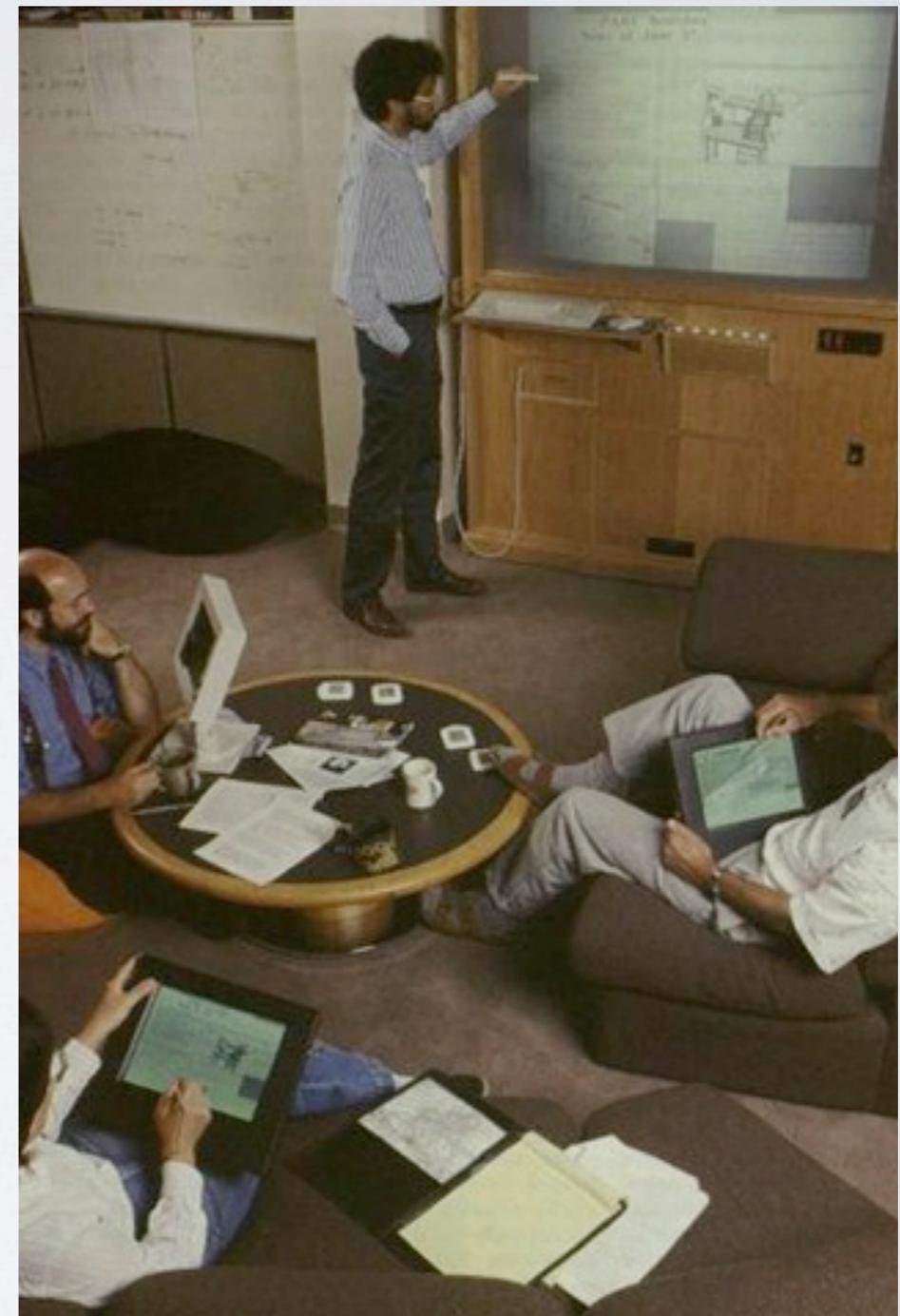
An Interactive Multisurface Environment

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Ubiquitous Computing

- Mark Weiser's vision, 1991
- “The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are undistinguishable from it.”



Is the UbiComp vision realized?

- At the hardware level? **yes**
- At the software level?
- At the interaction level?



Is the UbiComp vision realized?

- At the hardware level? **yes**
- At the software level? **not really**
- At the interaction level?



Is the UbiComp vision realized?

- At the hardware level? **yes**
- At the software level? **not really**
- At the interaction level? **NO**

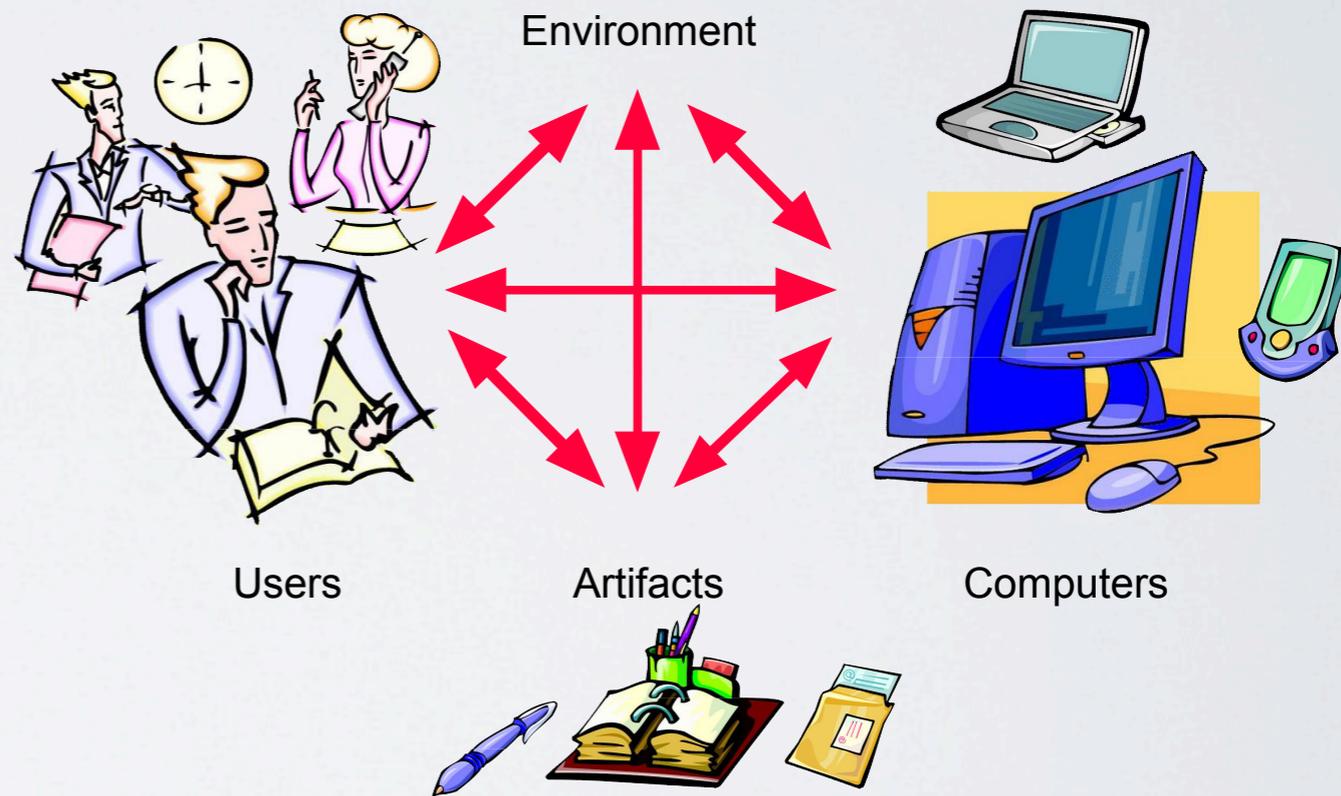


Rekimoto, 1997

Interaction in UbiComp

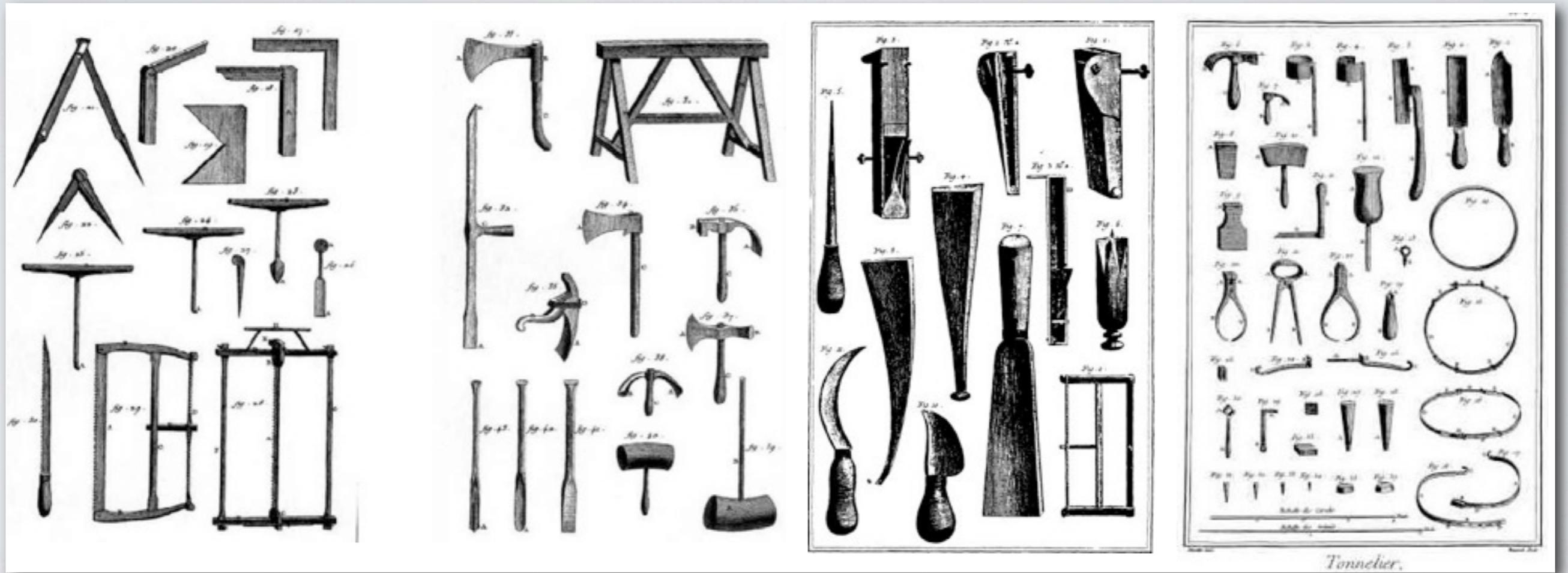
- Multi-device interaction
- Collaborative interaction
- Situated interaction

- Need new models and tools





Tools and Instruments



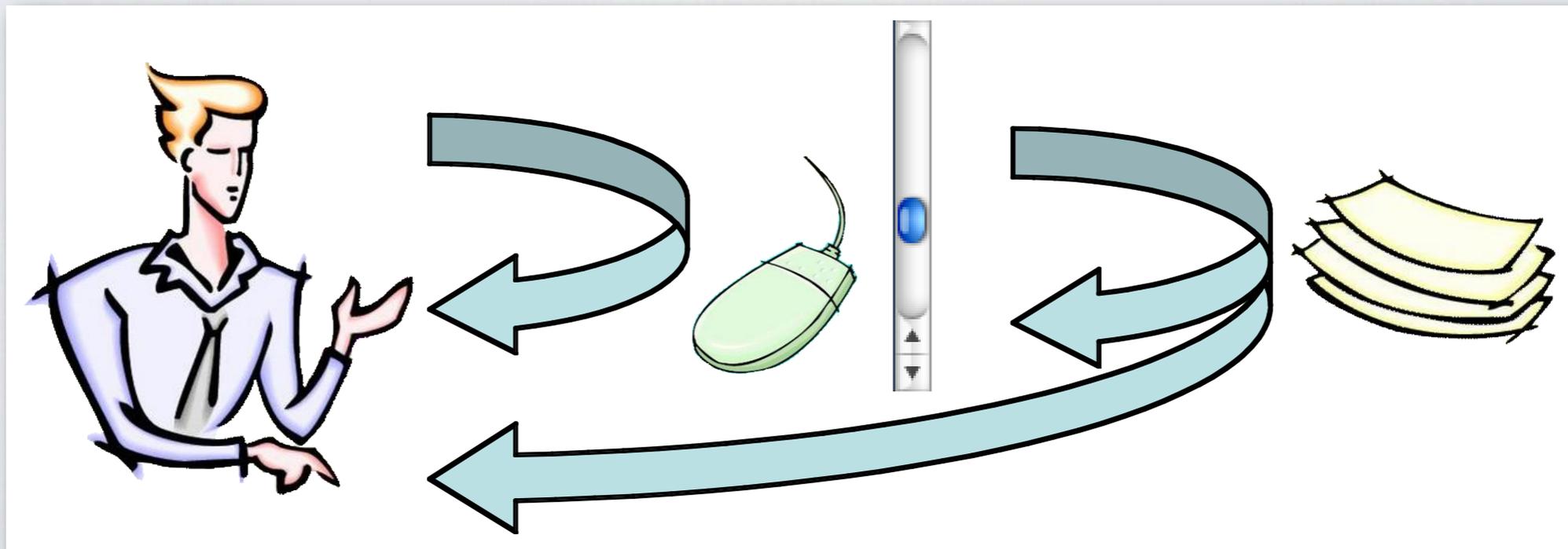
L'encyclopédie - Diderot & d'Alembert, 1751-1772

The power of tools

- Gibson's Ecological Theory:
 - Affordances = possibilities for action in the environment relative to the capabilities of the subject
- Tools redefine the affordances of the environment because they change the capabilities of the subject
 - Holding a pen creates affordances for writability

Instrumental Interaction

- Mediated interaction: user - instrument - object of interest
- An instrument **reifies** a command
- Use the same instrument with different objects (polymorphism)



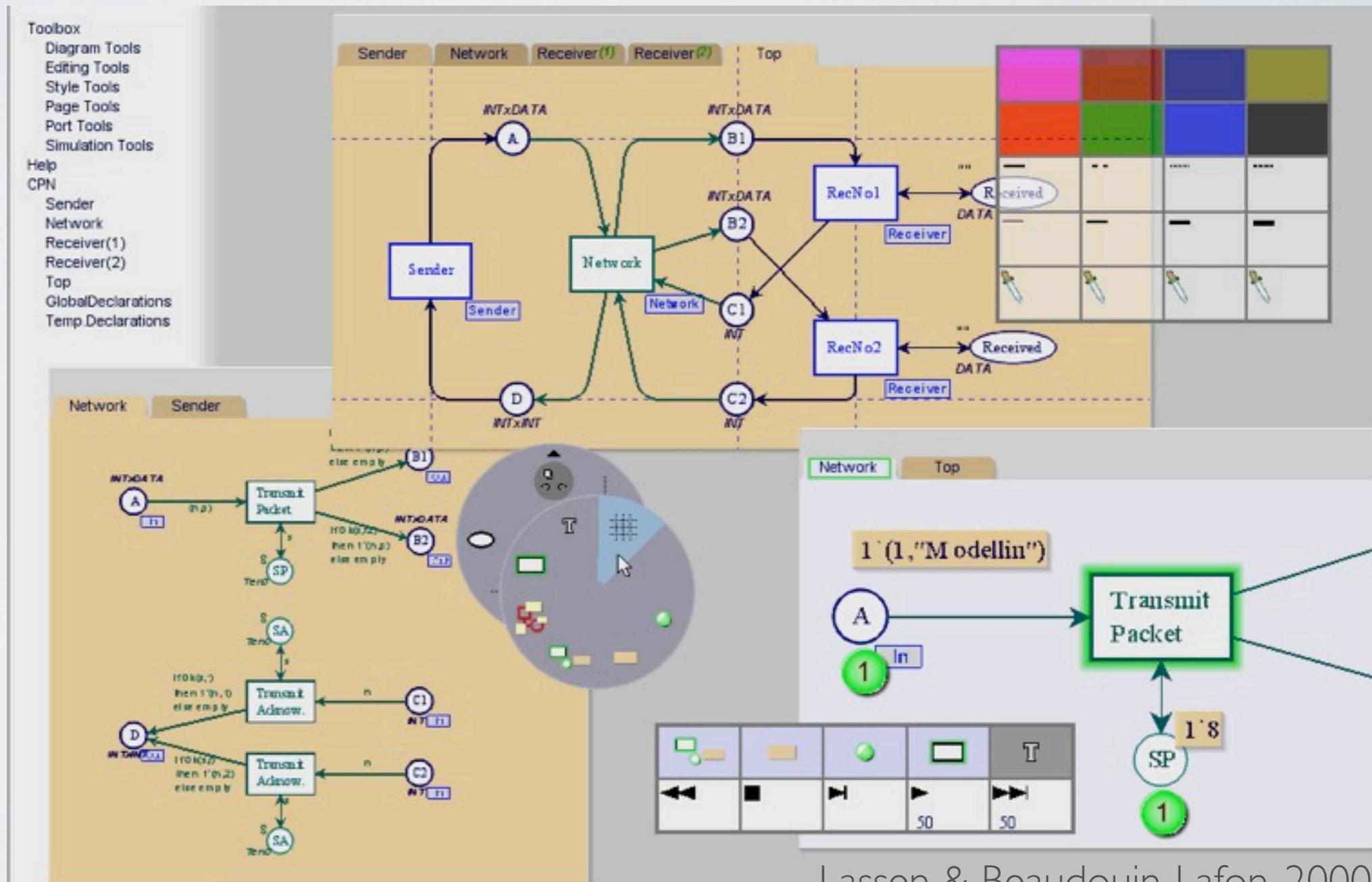
Beaudouin-Lafon, 2000

Proof-of-concept: CPN2000

- Bi-manual interaction, Marking menus, Toolglasses

- Combine power and simplicity

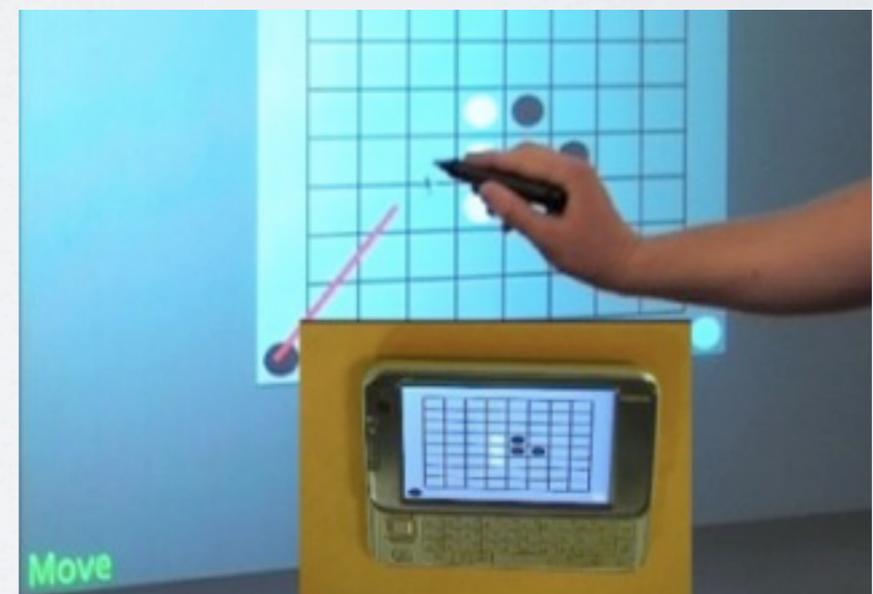
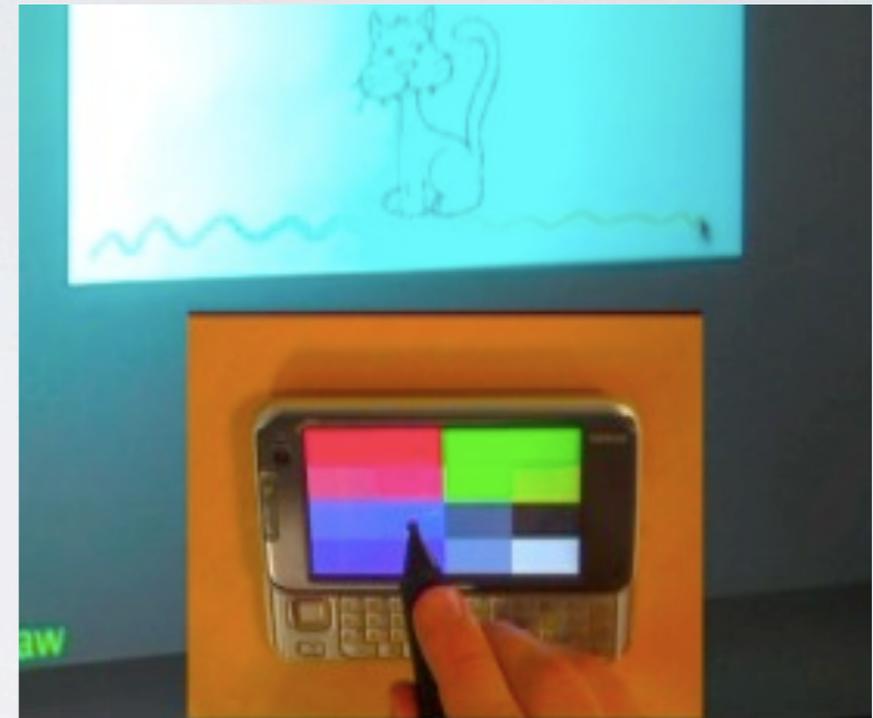
- 40 000+ downloads



Lassen & Beaudouin-Lafon, 2000

Ubiquitous Instrumental Interaction

- Detaching instruments from the objects of interest ... and from applications
- Instruments spanning multiple interaction surfaces
- **Multisurface interaction**



Klokrose & Beaudouin-Lafon, 2009

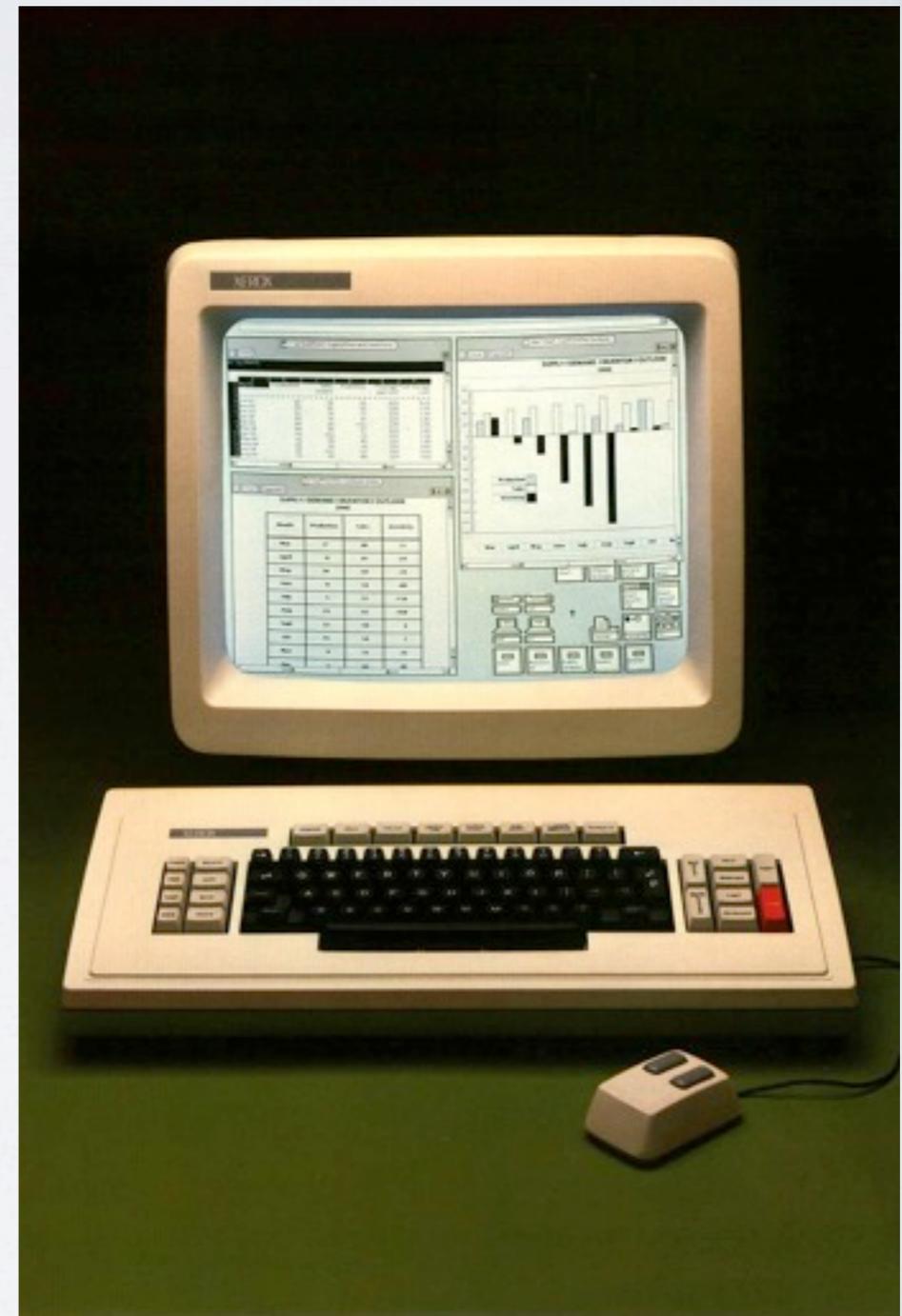
The WILD Room

Exploring multisurface interaction



Integrative Research

- Xerox Star, 1981
- First commercial GUI
- Created from the ground up:
 - Hardware
 - Operating System
 - Application software
- Target population:
 - Executive secretaries



WILD: A Unique Platform

- Wall display
- Interactive table
- Motion/Object tracking
- Mobile devices
- Visualization cluster



Wall Display

- 32 monitors, 30" each, 5m50 x 1m80 (18 x 6 feet)
About 20 000 x 6500 pixels, or 130 million pixels
- Reconfigurable structure



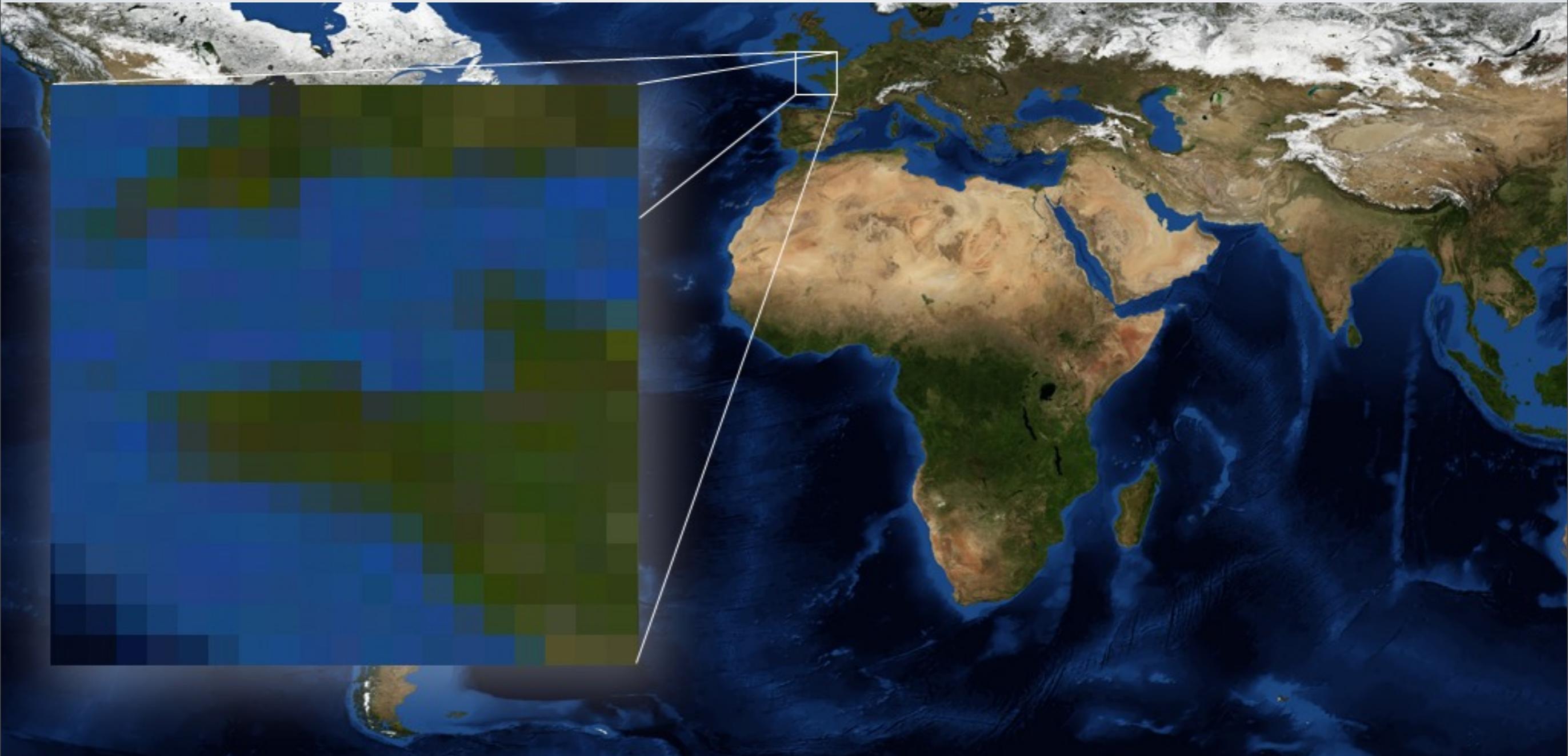
Wall Display

- Trade-off: ultra-high resolution vs. french-door effect



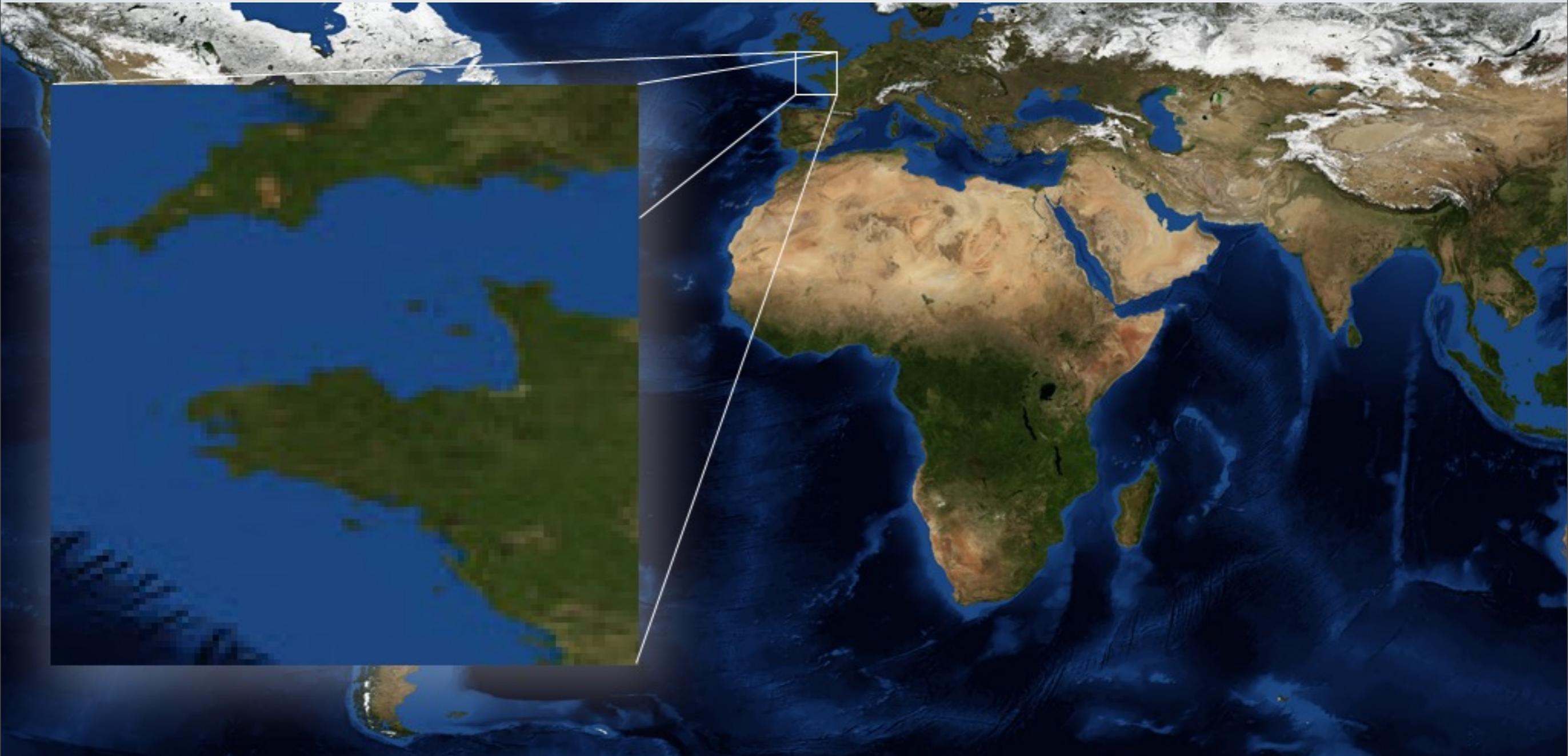
Low resolution

- 1280 pixels, standard projector



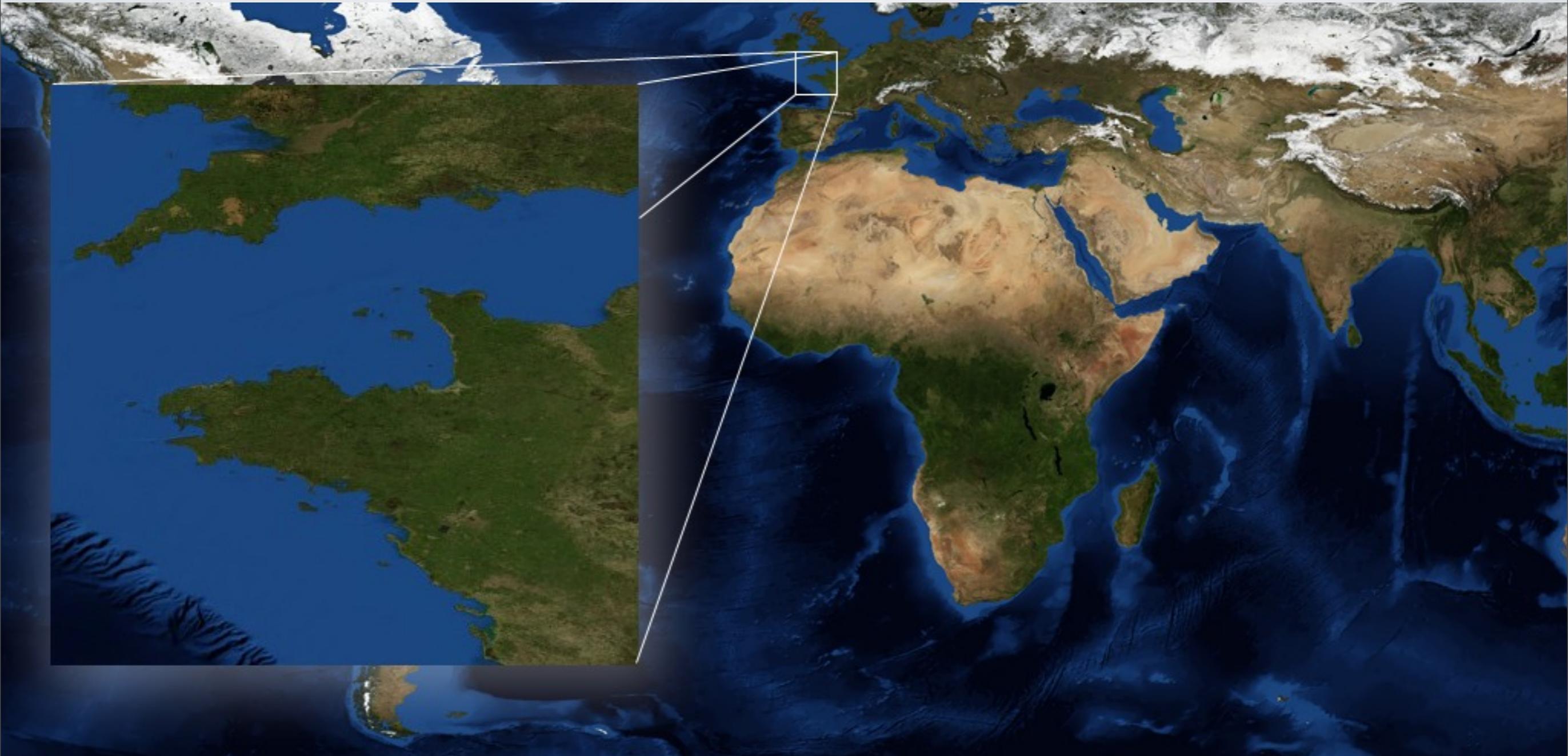
High resolution

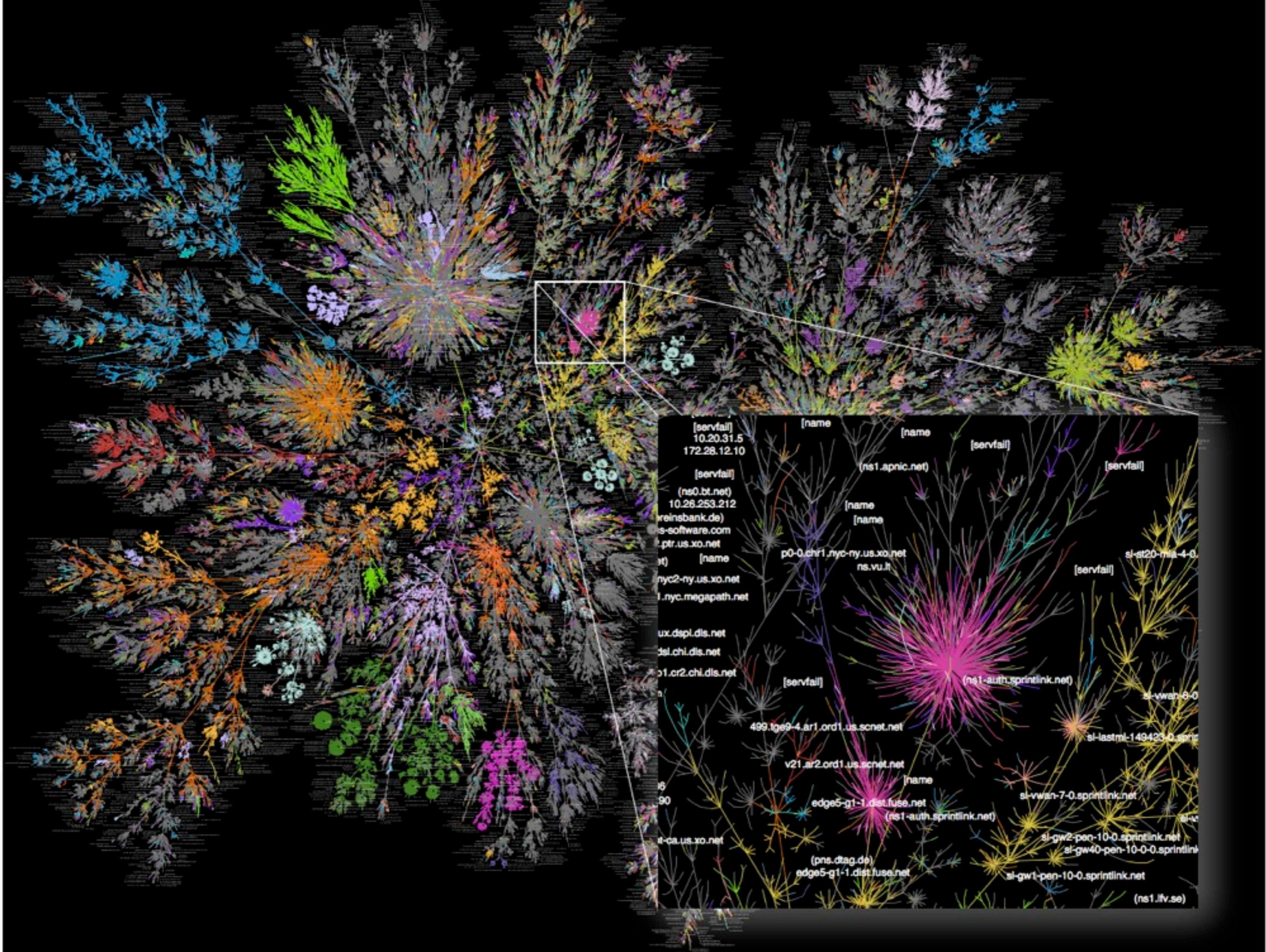
- 6144 pixels, projector array (U.Toronto)



Ultra-high resolution

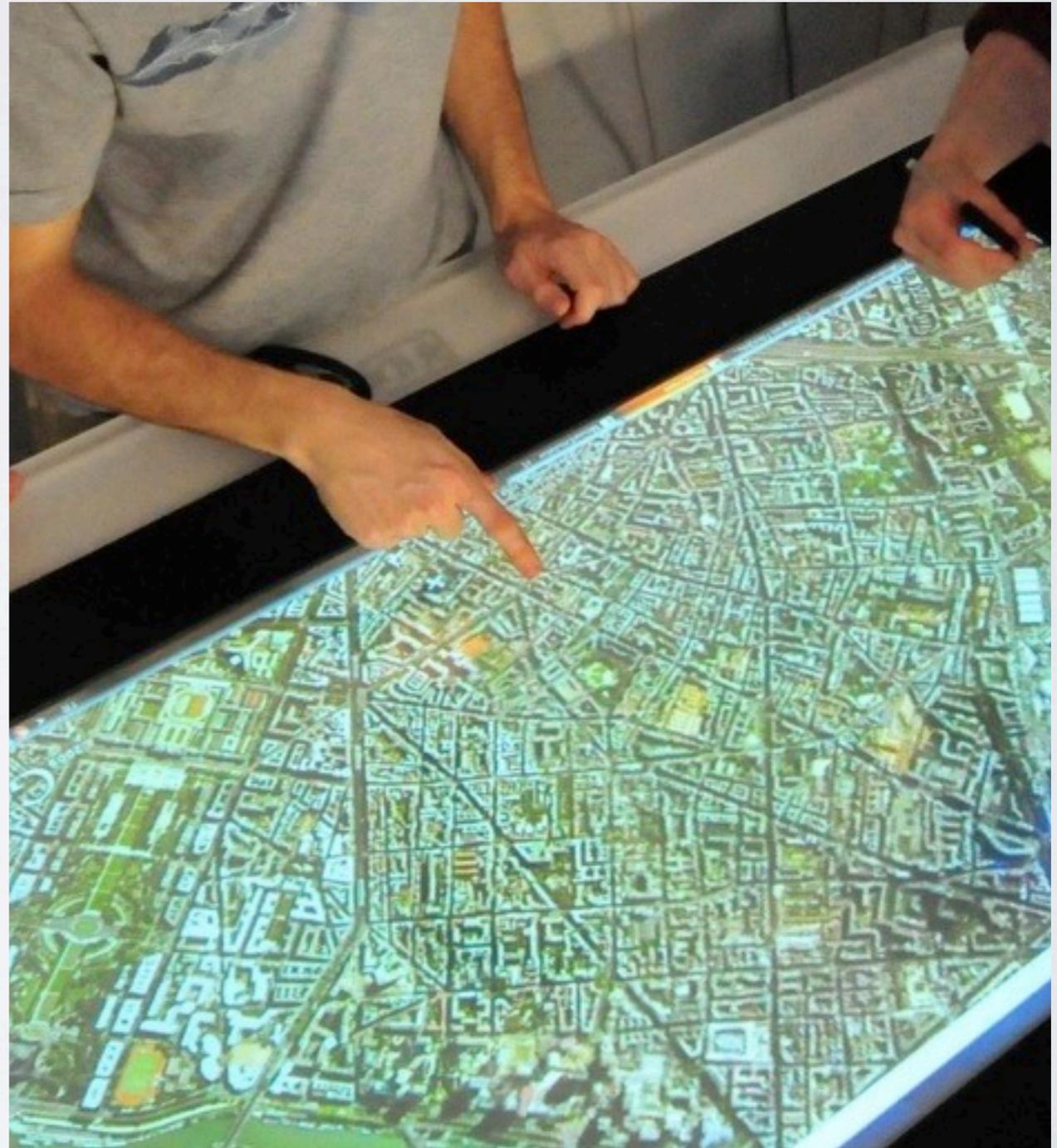
- 20480 pixels, LCD array (WILD)





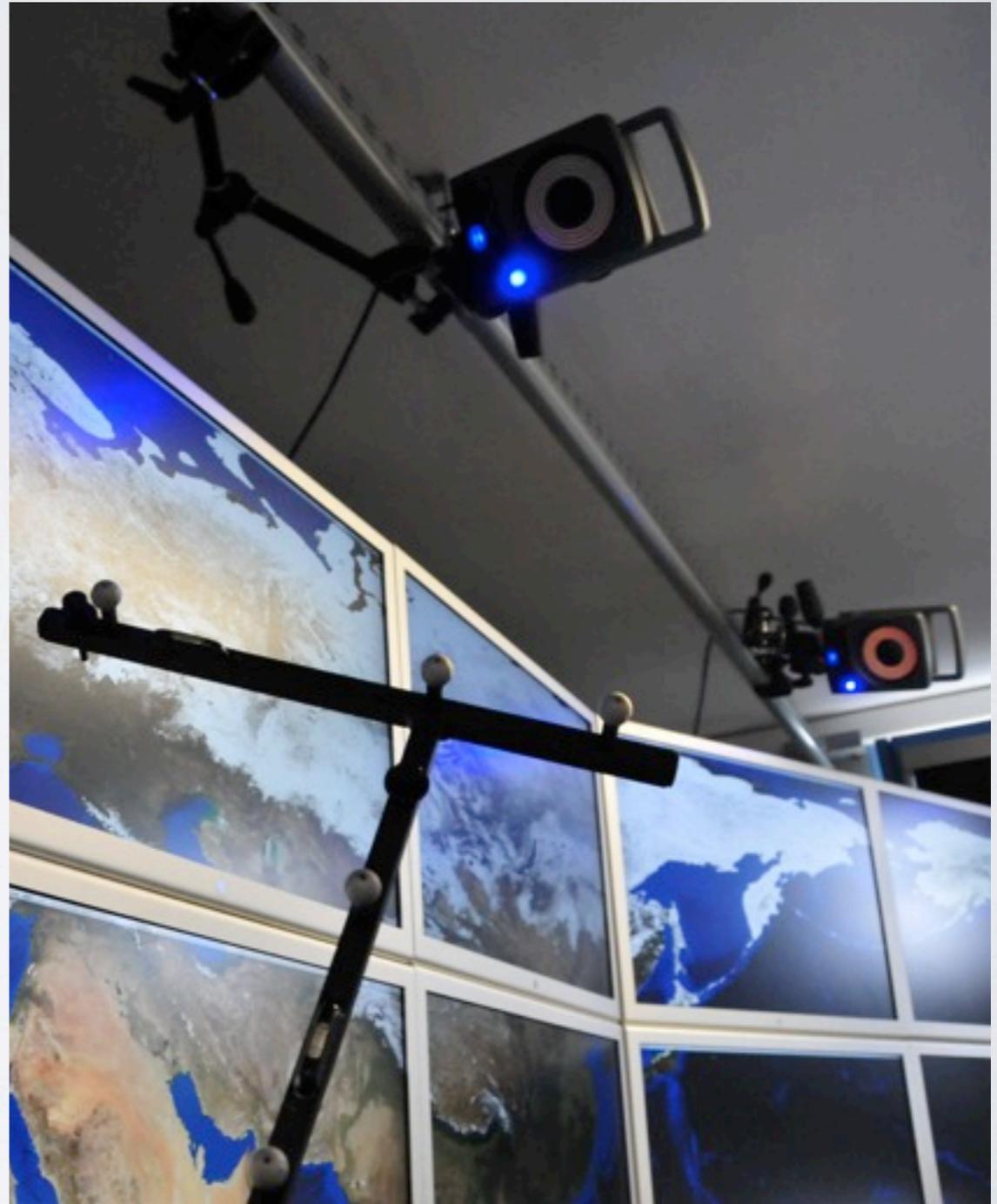
Interactive Table

- Multitouch table
- 1280 x 1024 resolution
- FTIR technology
- RFID tag reader



Motion/Object tracking

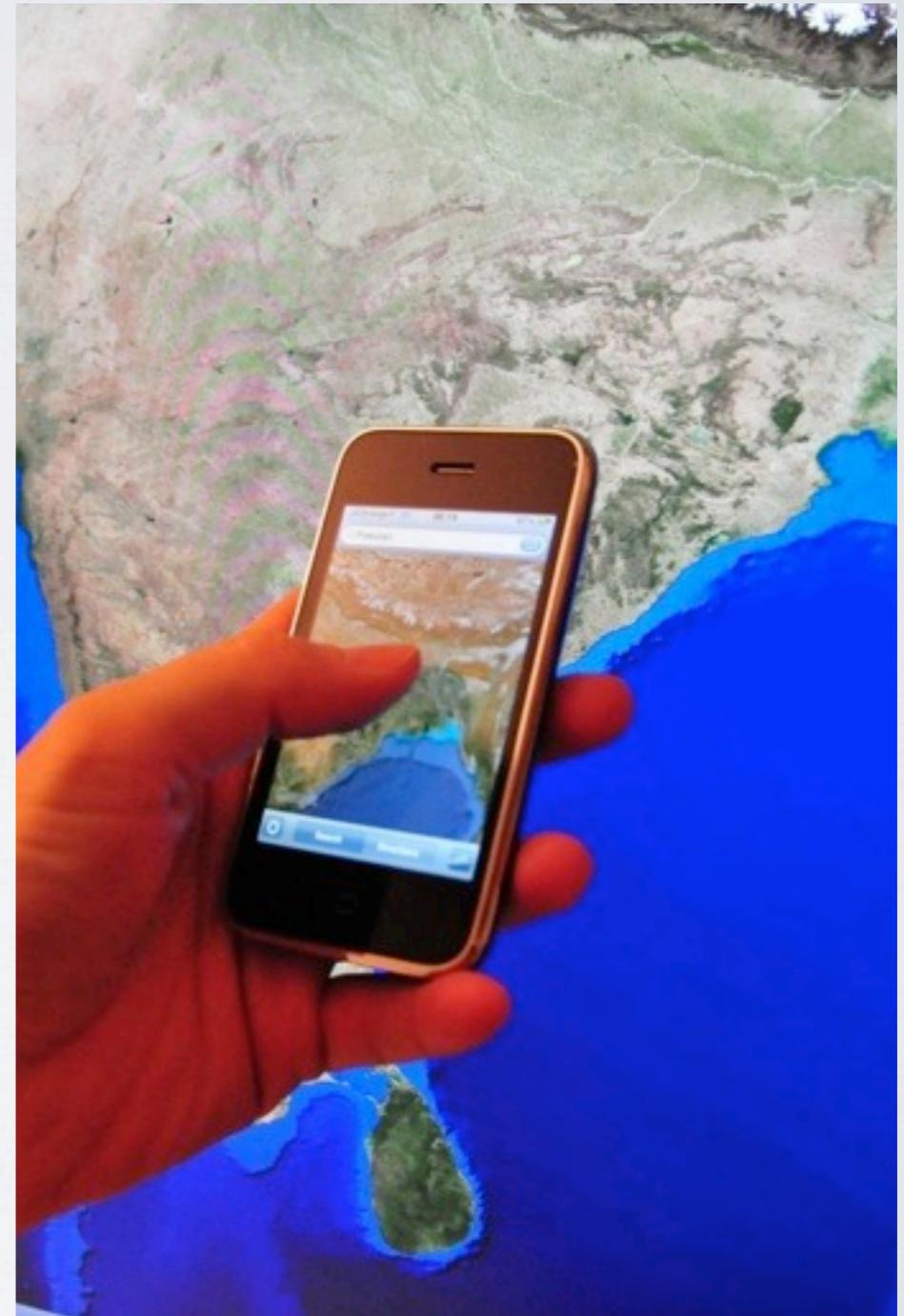
- 10-camera VICON system
- .5 mm resolution across the whole room, very low lag
- Object tracking, People tracking, Gesture tracking, ...



Mobile Devices

- iPod Touch, iPhone, iPad
- Gyroscopic mouse
- Custom-made devices

- Wifi or Bluetooth,
OSC (Open Sound Control)



Visualization Cluster

- 16 computers + 2 front-ends, Mac OSX/Linux/Windows
- 2 graphics cards, 10 Gb RAM, 2 Tb hard drive per computer
- Gigabit network
- Connected to a computational cluster



Key points

- Focus on Interaction & Collaboration (rather than rendering)
- Very large size + Ultra-high resolution + Multiple surfaces = Unique affordances
- Off-the-shelf components



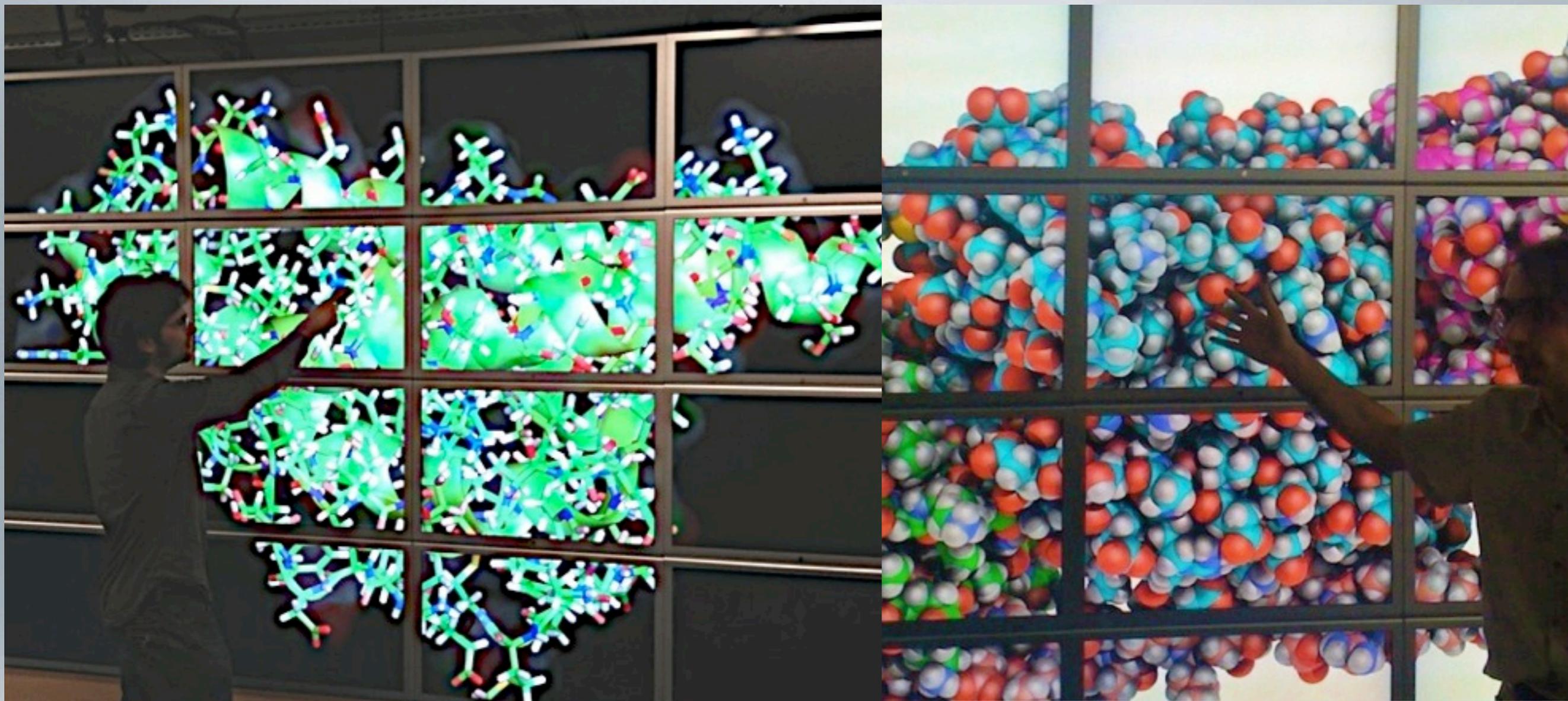
Our extreme users: Scientists

- Scientific Discovery
- Large & complex data
- 8 partner labs

- Astrophysics (IAS)
- Particle physics (LAL)
- Chemistry (ICMMO)
- Biochemistry (IBBMC)
- Biology (IGM)
- Neuroanatomy (Neurospin)
- Mechanical engineering (LIMSI)
- Simulation (MAS)



Astrophysics



Chemistry, Biology



Neuroanatomy

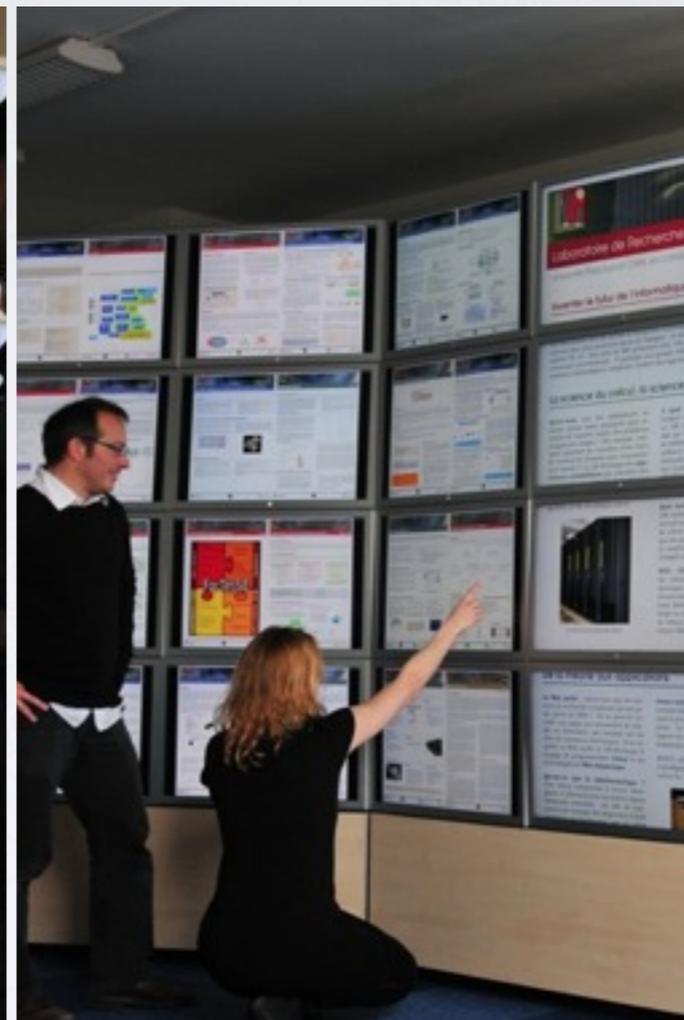
Interacting with complex data



Navigate



Compare



Aggregate



Communicate

Participatory Design

- Create new ways to interact with complex data

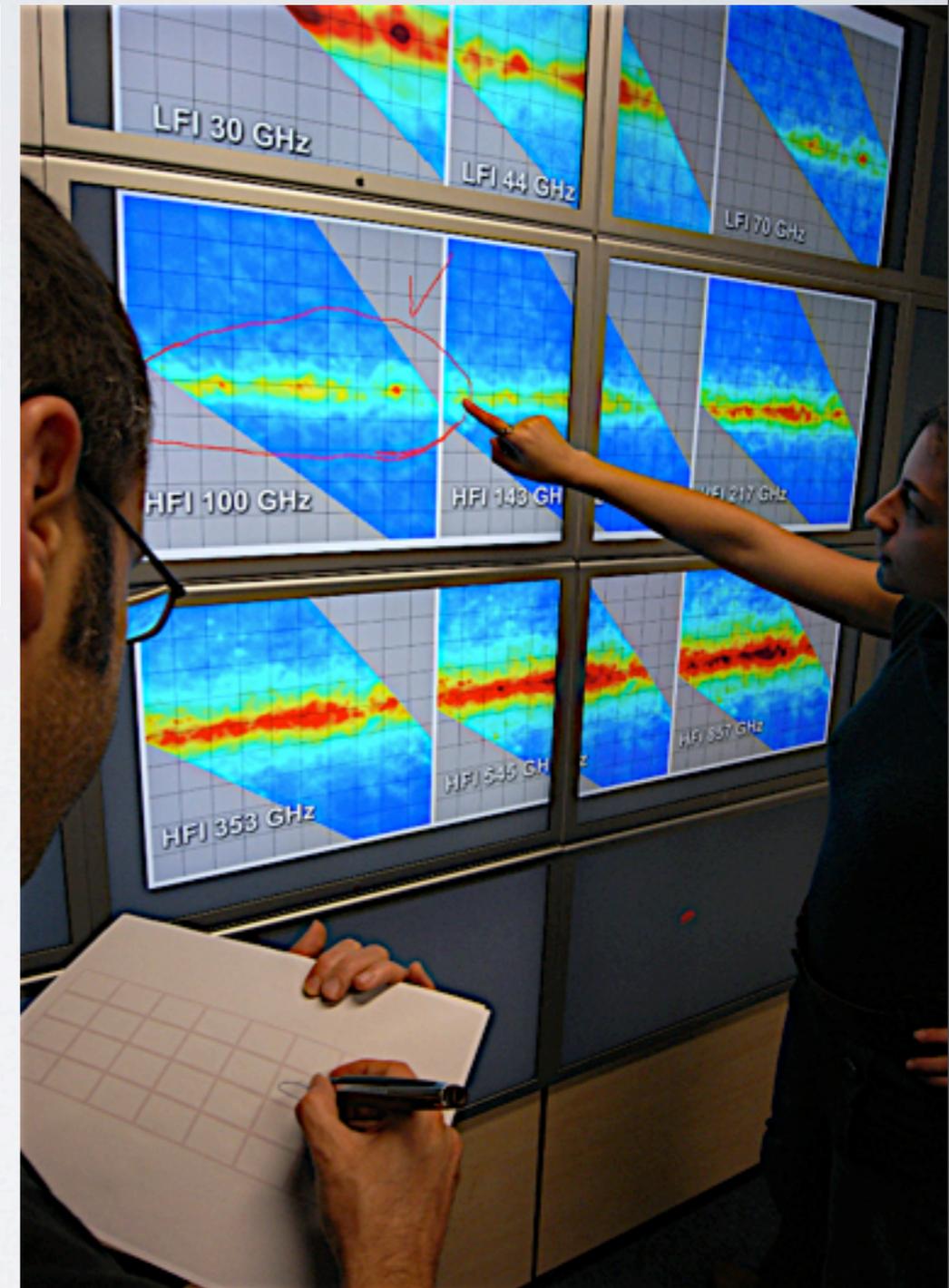
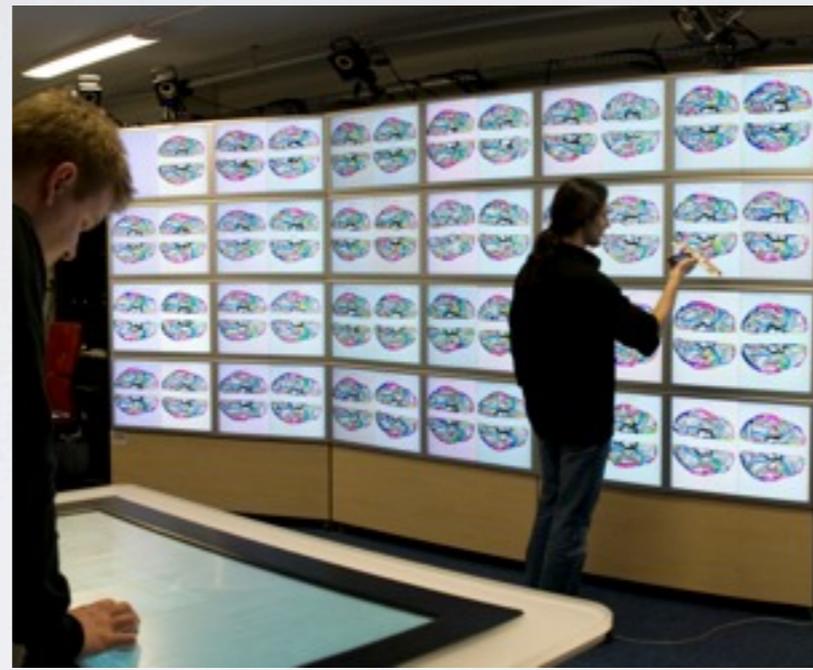




Prototyping with Neurospin:
use 3D props

Multisurface Interaction

Use instruments to move/edit content seamlessly across surfaces

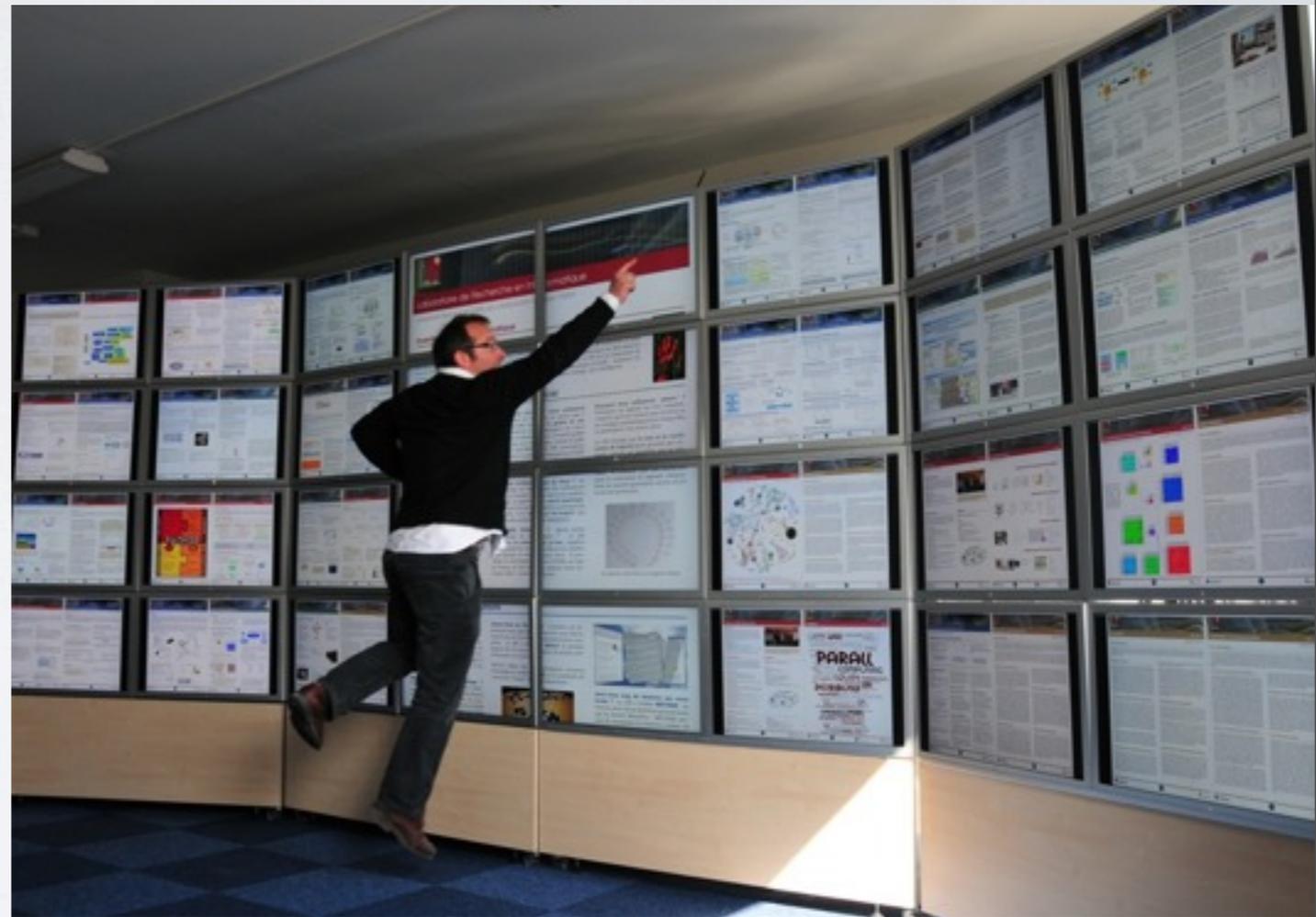


Prototype



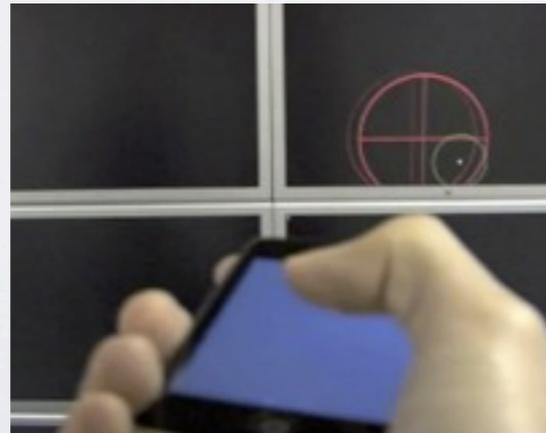
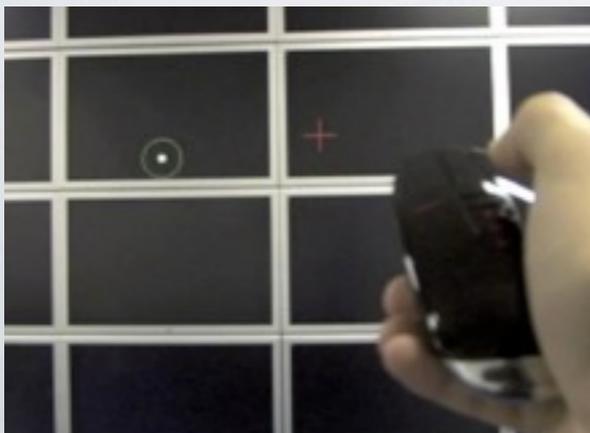
Interaction

- Reinvent the basics:
 - Pointing
 - Navigation
 - Menu selection
 - Window management
 - ...

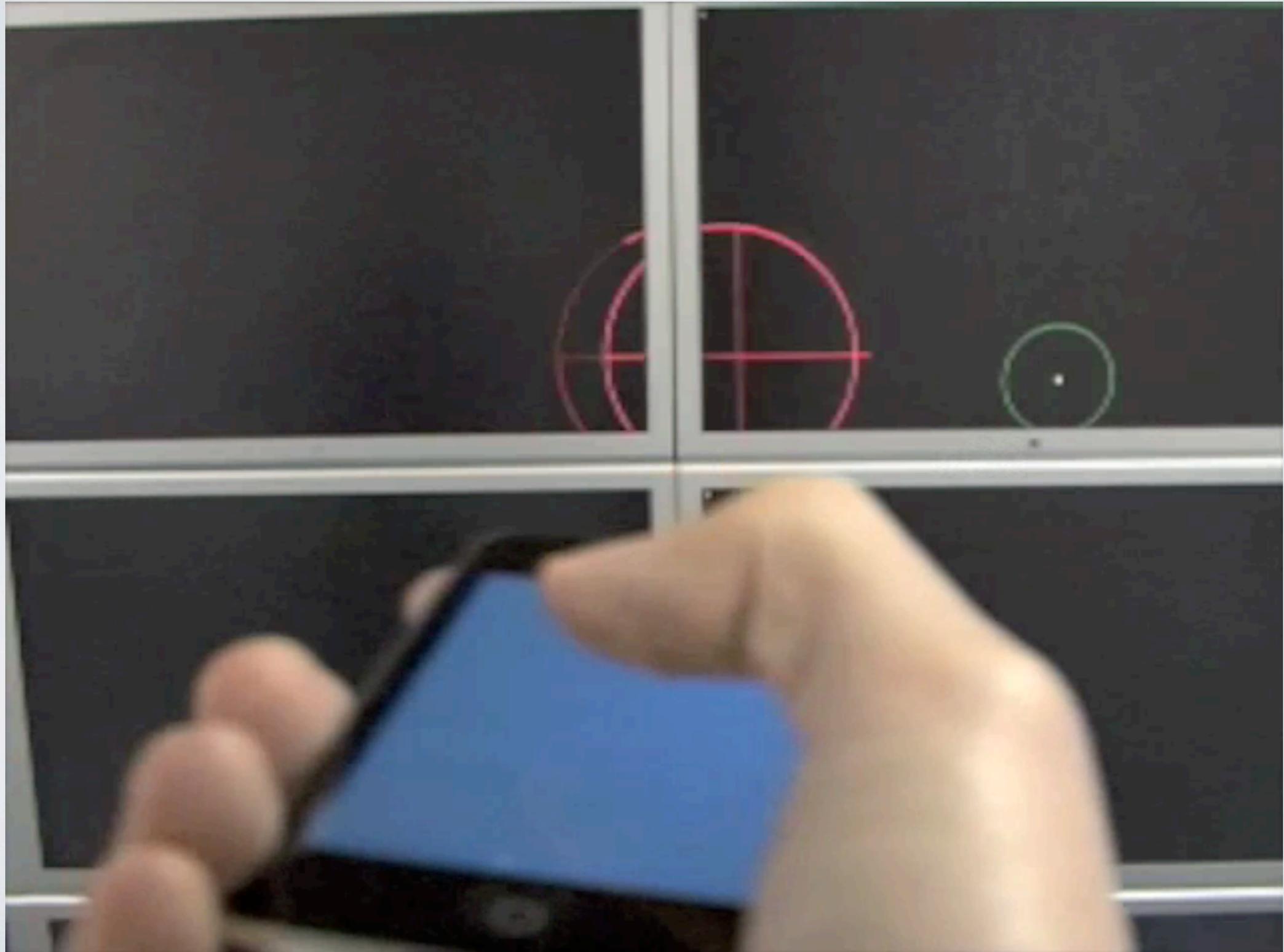


Basic Interaction: High-precision Distant Pointing

- Pointing at a distance
- Combine large size and ultra-high resolution
- Dual-mode techniques:
absolute mode (coarse)
+ relative mode (precise)

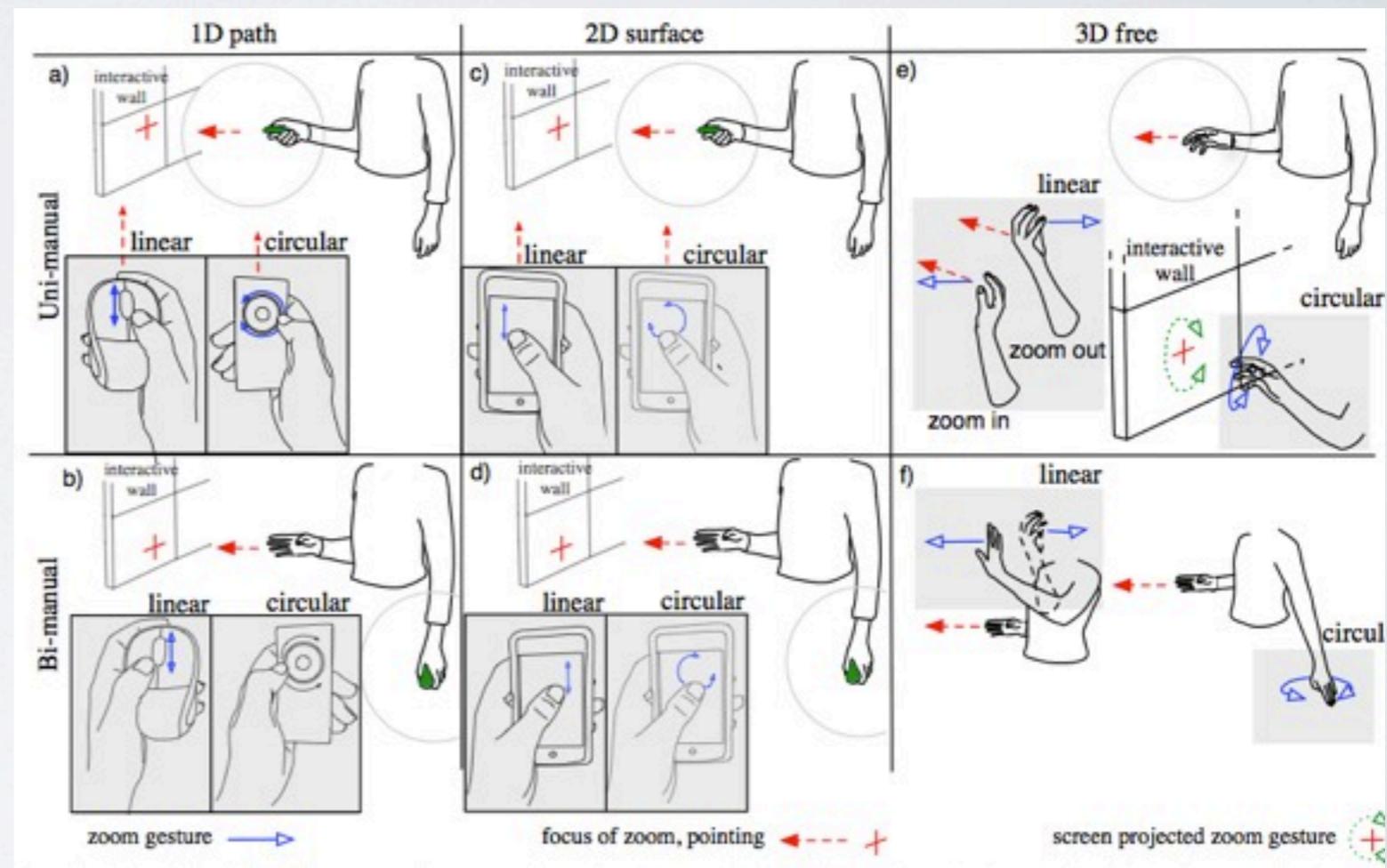


Dual-mode pointing



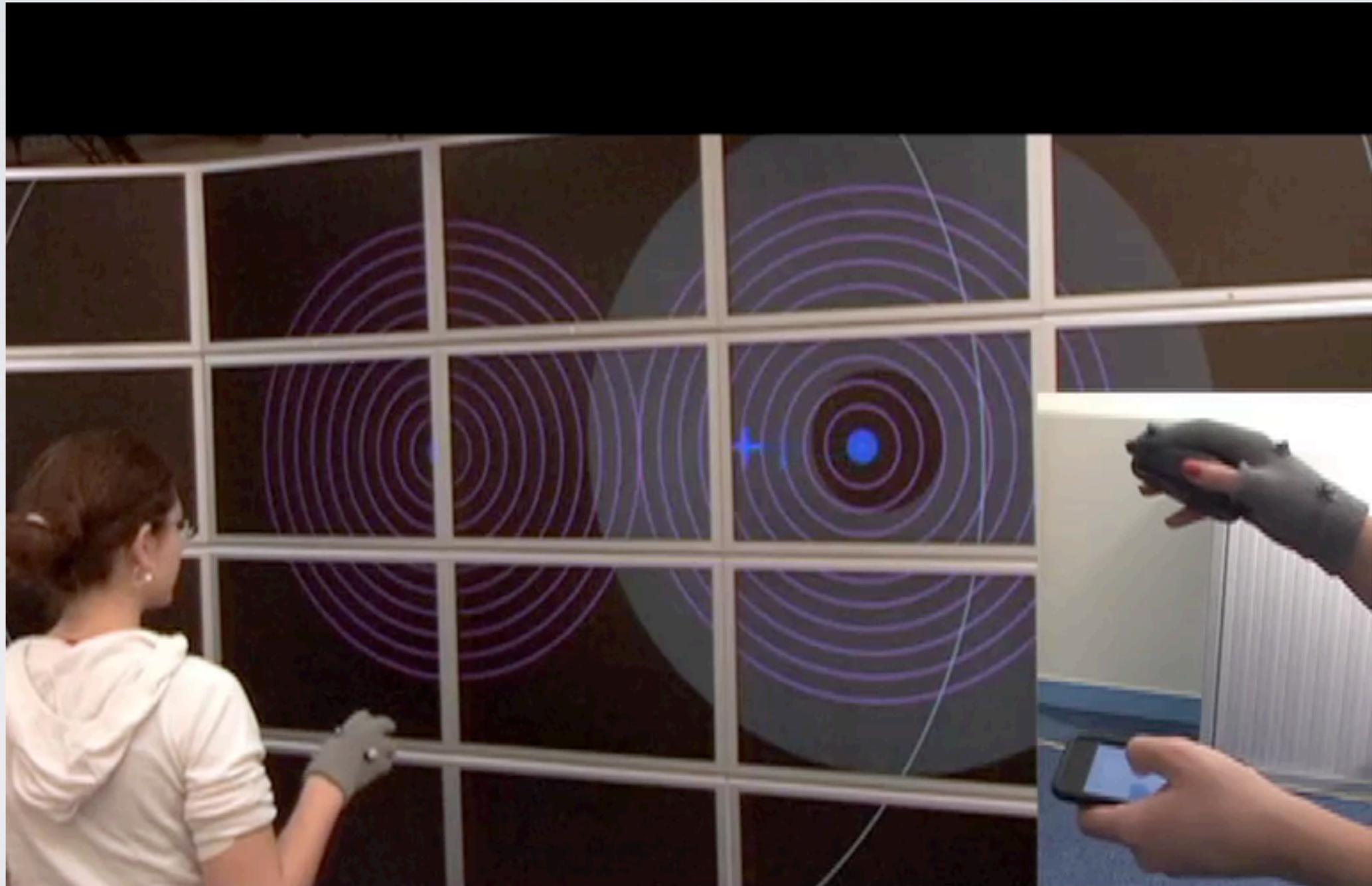
Basic Interaction: Pan & Zoom Navigation

- Compare 12 interaction techniques
- Free-hand vs. device, one-hand vs. two-hand, linear vs. circular gestures
- “Minority Report”, i.e. free-hand gestures, loses



Nancel et al., 2011

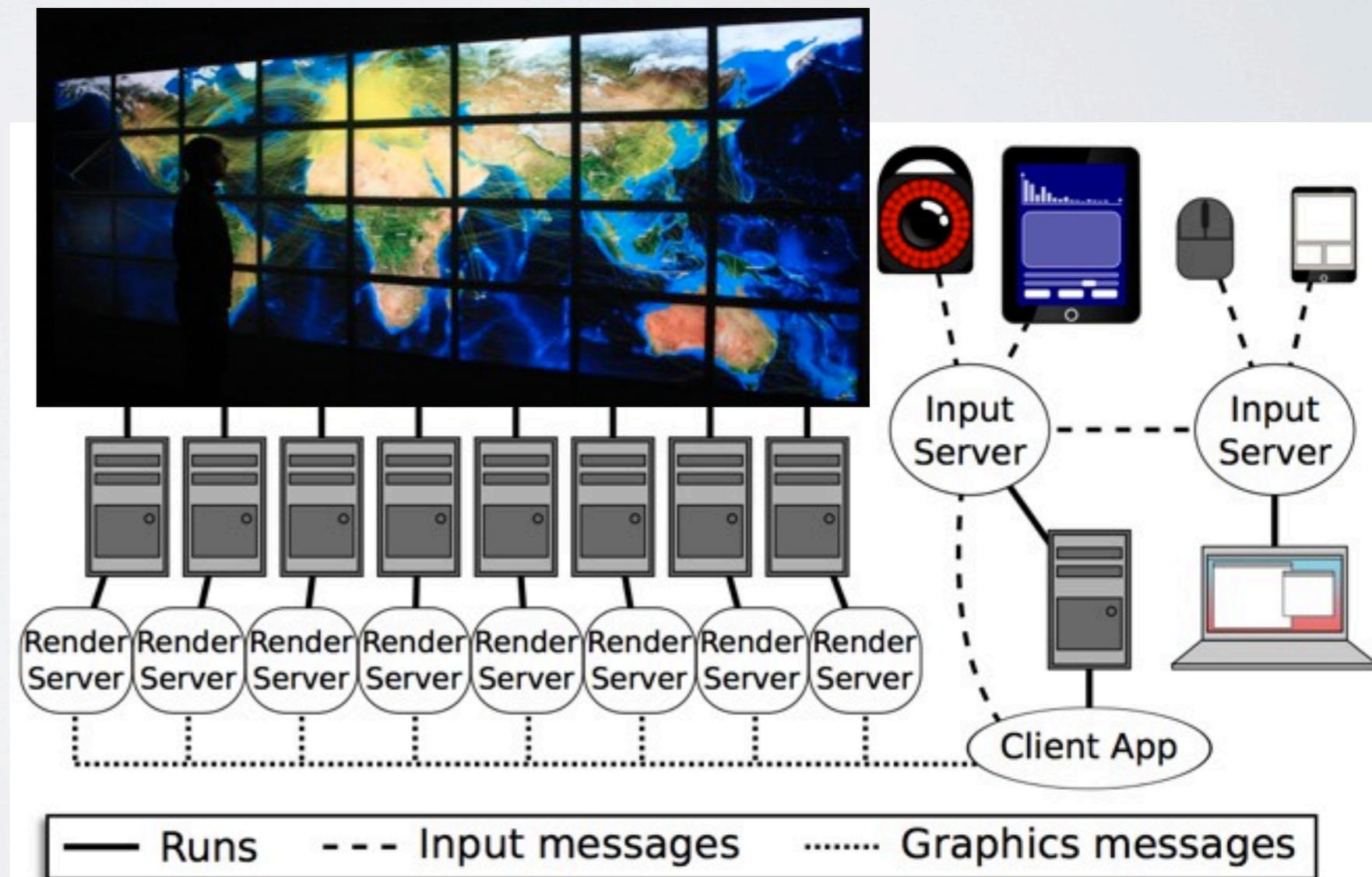
Mid-air Pan & Zoom



Bimanual – Linear – 2D Surface

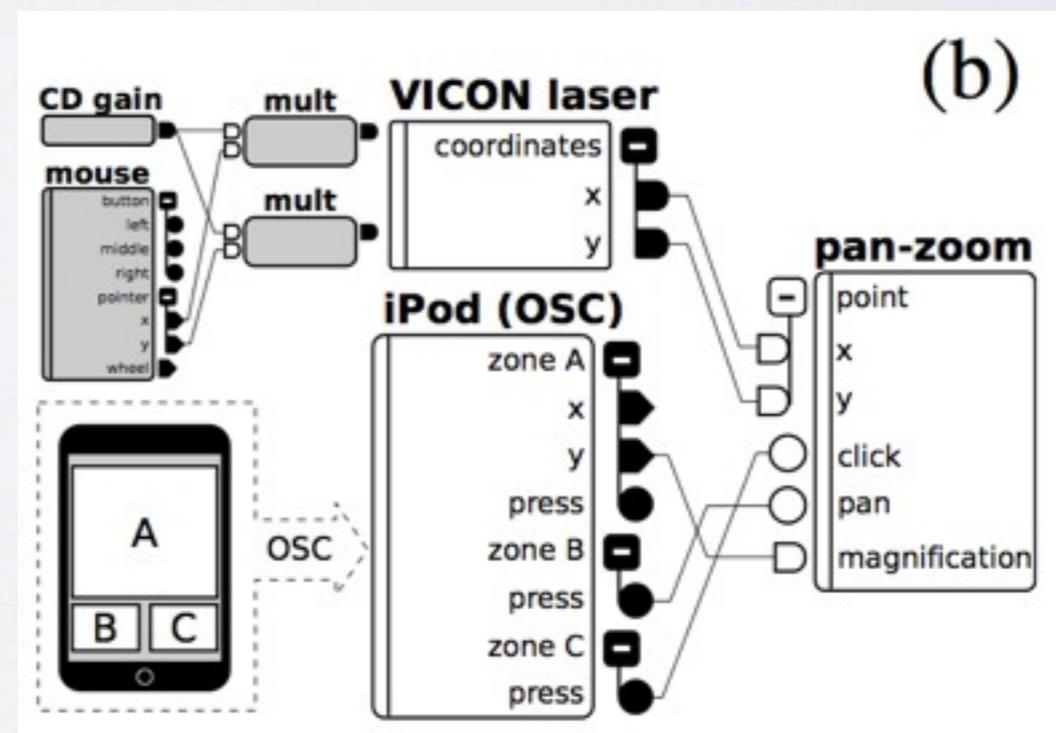
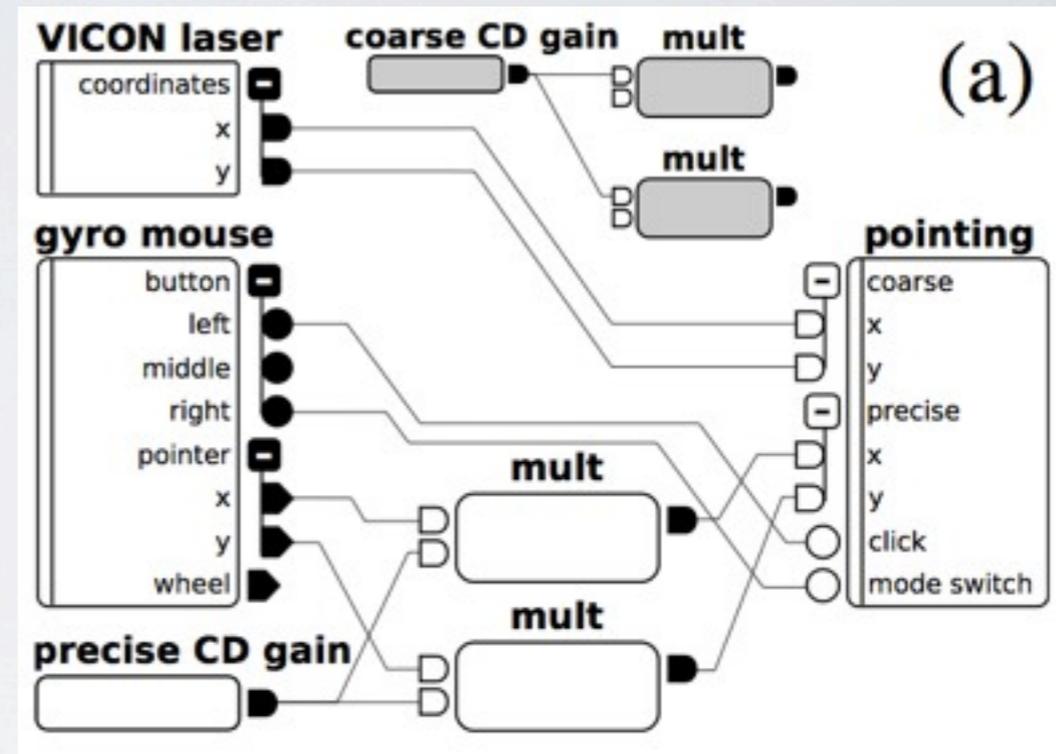
Software

- Implement from scratch, incorporate legacy applications
- Rendering: replicate the full application on each node
- Interaction: aggregate and distribute input



Software: Wild Input Server

- Aggregate input from multiple devices, e.g. touch input on iPhone + 6D position of iPhone
- Easily reconfigure input
- Ability to prototype in desktop environment
- Uses the OSC protocol and the Input Configurator



Software: ZVTM

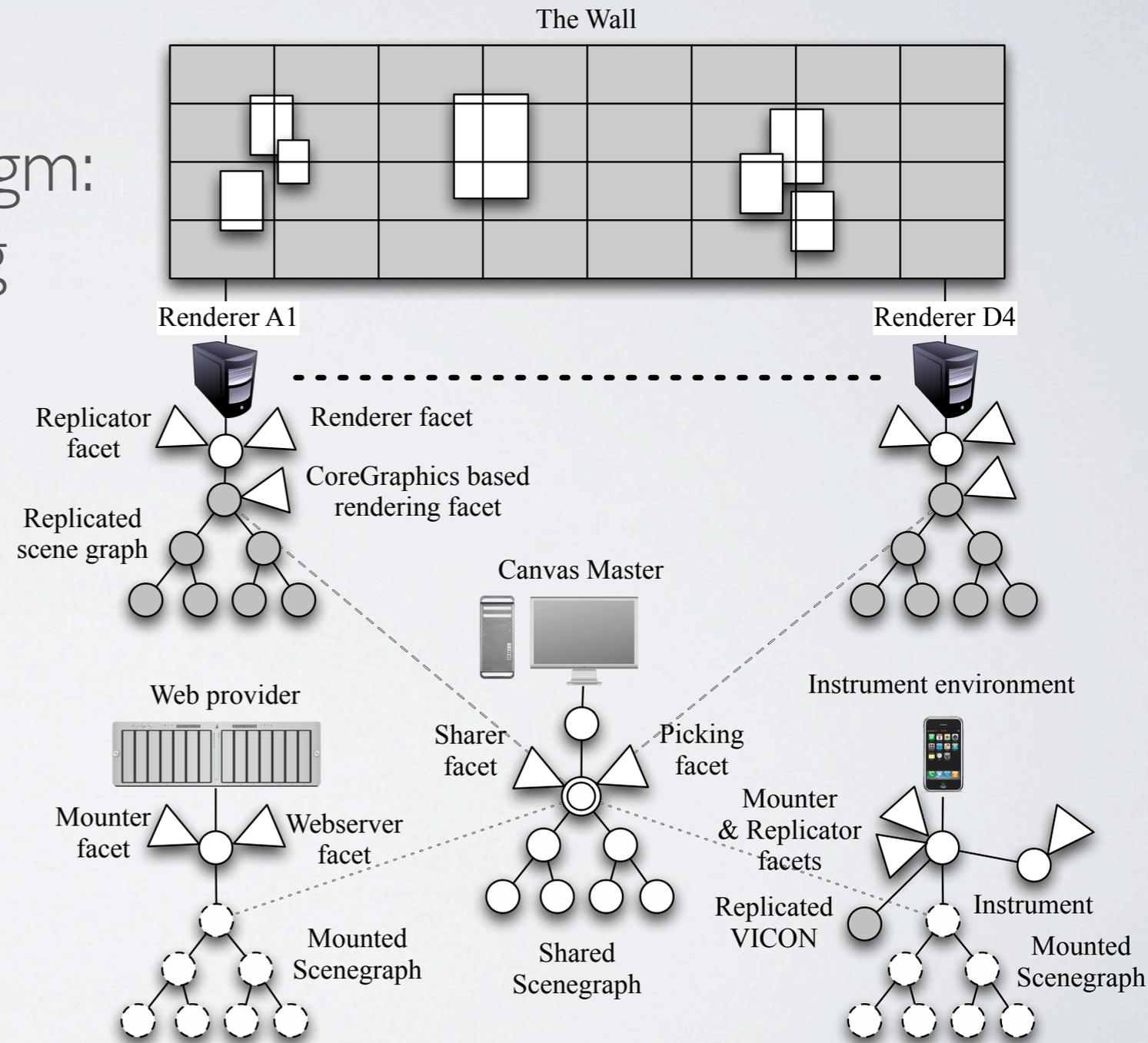
- Zoomable User Interface toolkit
- Distributed over the cluster
- Manage gigapixel images and complex multiscale scenes in real time



Pietriga et al., 2011

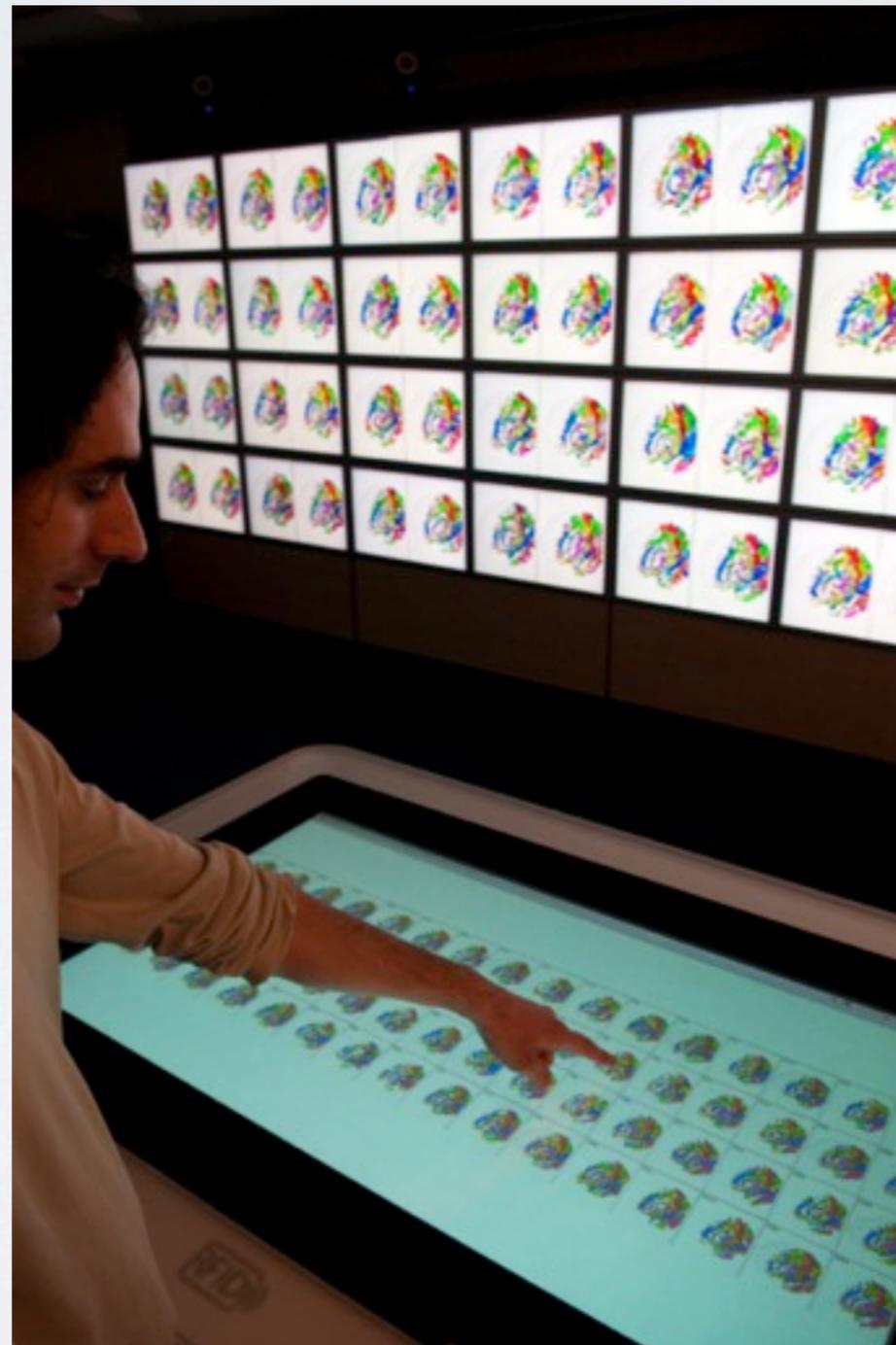
Software: Substance

- Novel programming paradigm: data-oriented programming
- Separate data (nodes) from behavior (facets)
- Sharing nodes and facets: replication or mounting
- Multisurface instrumental interaction

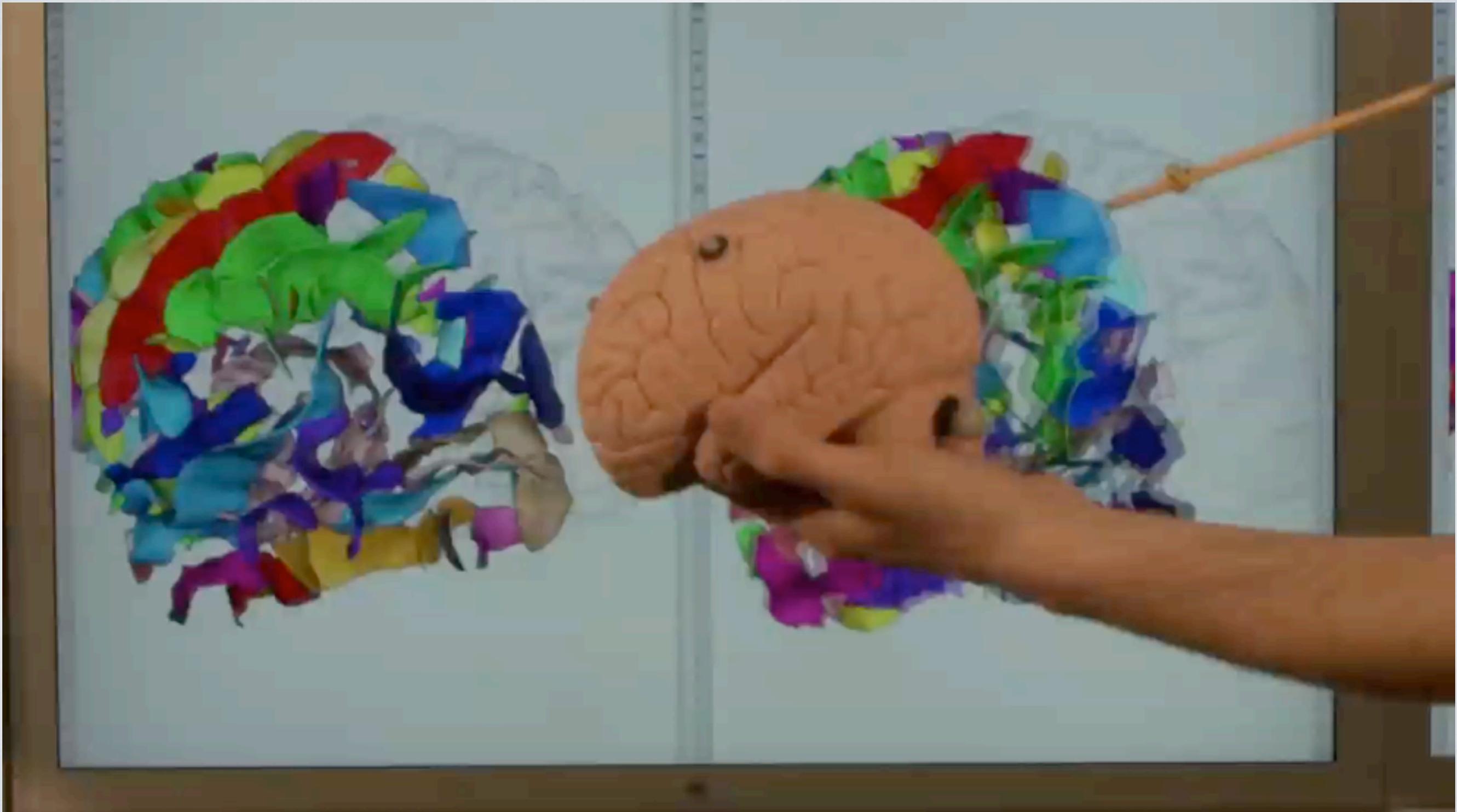


Software: Substance Grise

- Display 64 3D brain scans with VISA/Anatomist
- Organize them on the table
- Control their orientation in real time through a prop



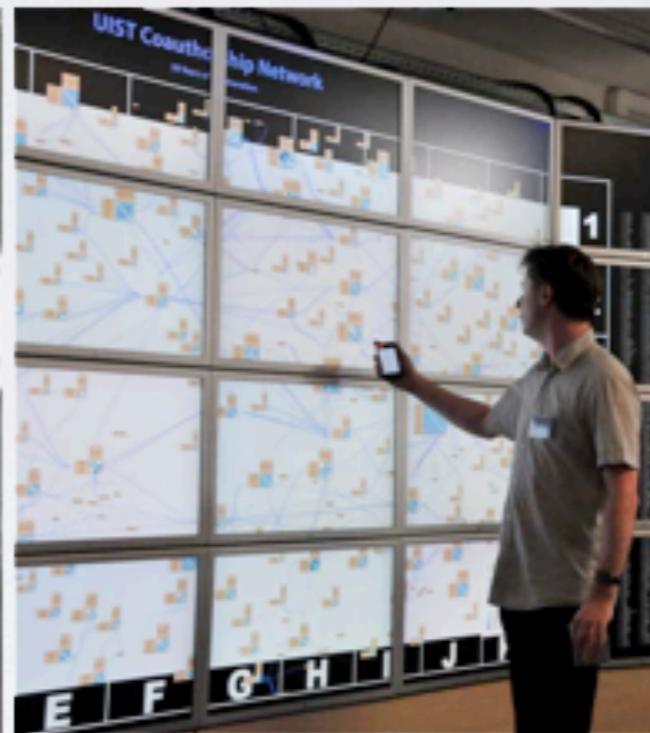
Substance Grise



Summary: Lessons Learned

- Hardware
 - ▶ Off-the-shelf components, Flexibility
 - ▶ Focus on interaction
- Applications
 - ▶ Engage with real users through participatory design
 - ▶ Identified four needs
- Interaction
 - ▶ Affordances of the platform + interaction model
 - ▶ Use of personal devices
- Software
 - ▶ Build from scratch & be lazy: Use Moore's law
 - ▶ Use of OSC as glue

Next Step: Digiscope



- 9 rooms interconnected by telepresence in the Paris area
- Remote collaboration
- Open to external partners



<http://insitu.lri.fr/Projects/WILD>

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