HCIN720
Designing User Experiences for Internet-Connected Devices

Dr. Daniel Ashbrook

Today

- Discussion & lecture
  - origins and principles of ubicomp
  - scales of computing
  - design exercises

But first…

- Accept the invitation for #announcements in Slack
- Right now.

Also:

- Thursday class will be in the lab, ORN-1385

Plus!

- Office hours this week on **Friday** 2:30–4:00 (in the lab)
- Not on Thursday

ok

Attribution

- These slides were inspired by or directly copied from several sources:
  - Derek Reilly's Ubicomp course at Dalhousie University
  - Theory and Practice of Tangible User Interfaces at Berkeley
  - Jeremy R. Cooperstock's Ubicomp lecture in HCI at McGill
  - Bill Buxton's slides for Microsoft TechFest 2013

Prehistory:
Tangible User Interfaces
(TUIs)

1992: Marble Answering Machine

http://player.vimeo.com/video/19930744

SIMON & IMOGEN'S HOUSE

1995: Bricks

https://www.youtube.com/watch?v=V-TGEe-Imro

Bricks:
Laying the Foundations for Graspable User Interfaces

George W. Fitzmaurice
Hiroshi Ishii
William Buxton

University of Toronto

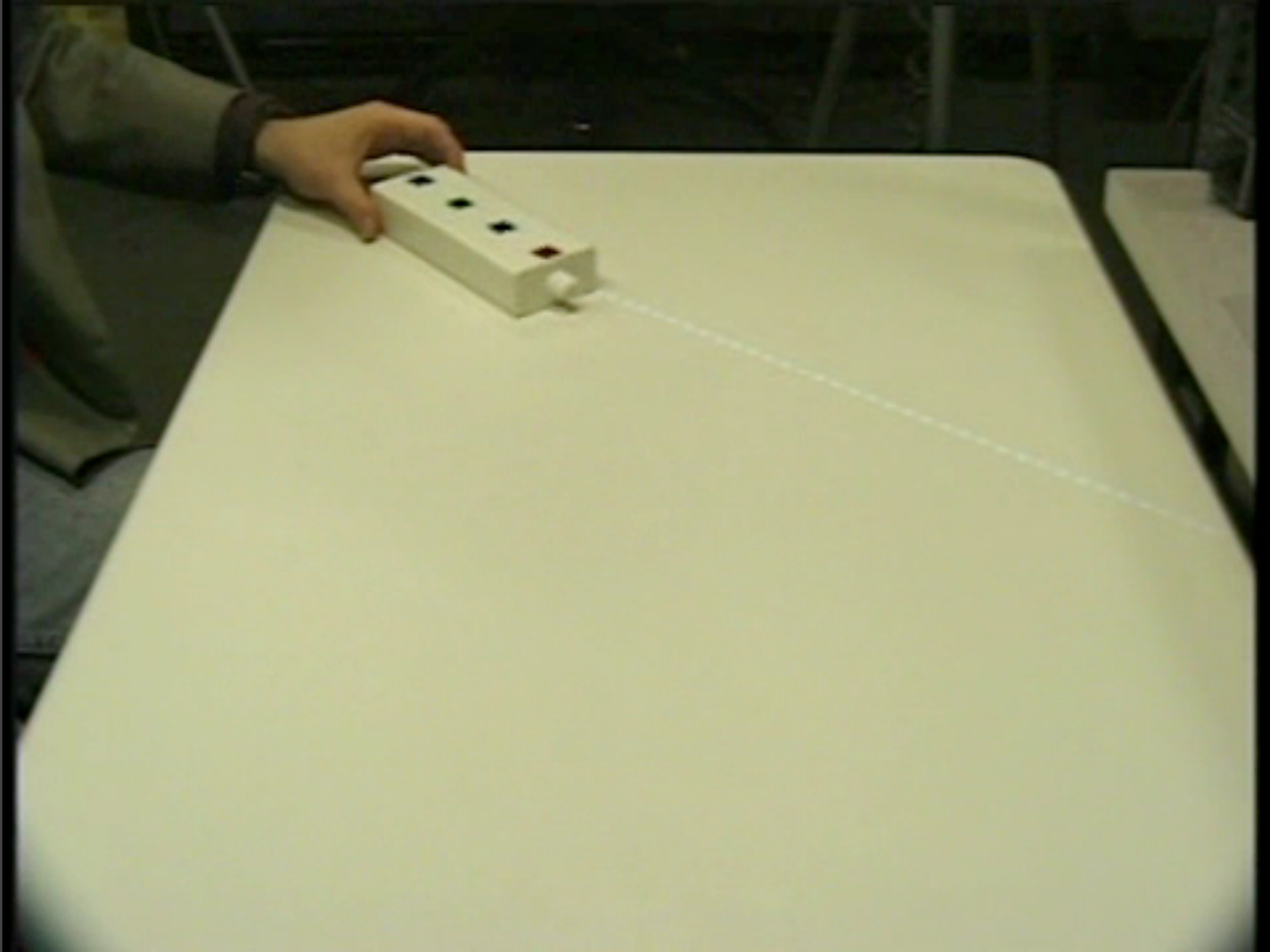
2004: I/O Brush

https://www.youtube.com/watch?v=V-TGEe-Imro

Many other examples…

- Illuminating Light
- Music Bottles
- Beyond

http://tangible.media.mit.edu



jazz

Beyond

A Collapsible Input Device for Direct 3D Manipulation beyond the Screen

Jinha Lee, Hiroshi Ishii
MIT Media Lab, 2009

Ubiquitous Computing

Mark Weiser
(1952–1999)
Chief Technologist, Xerox PARC

"The most profound technologies
are those that disappear.
They weave themselves
into the fabric of everyday life
until they are indistinguishable from it."

— The Computer for the 21st Century

Design exercise!

- 10 minutes
- Pair with the person nearest to you
- Design an improved light switch
- Sketch your ideas
- Hints
  - What are the problems with standard light switches today?
  - What kind of computation and sensing abilities could help?
  - Can your light switch be a Weiser “profound technology”?

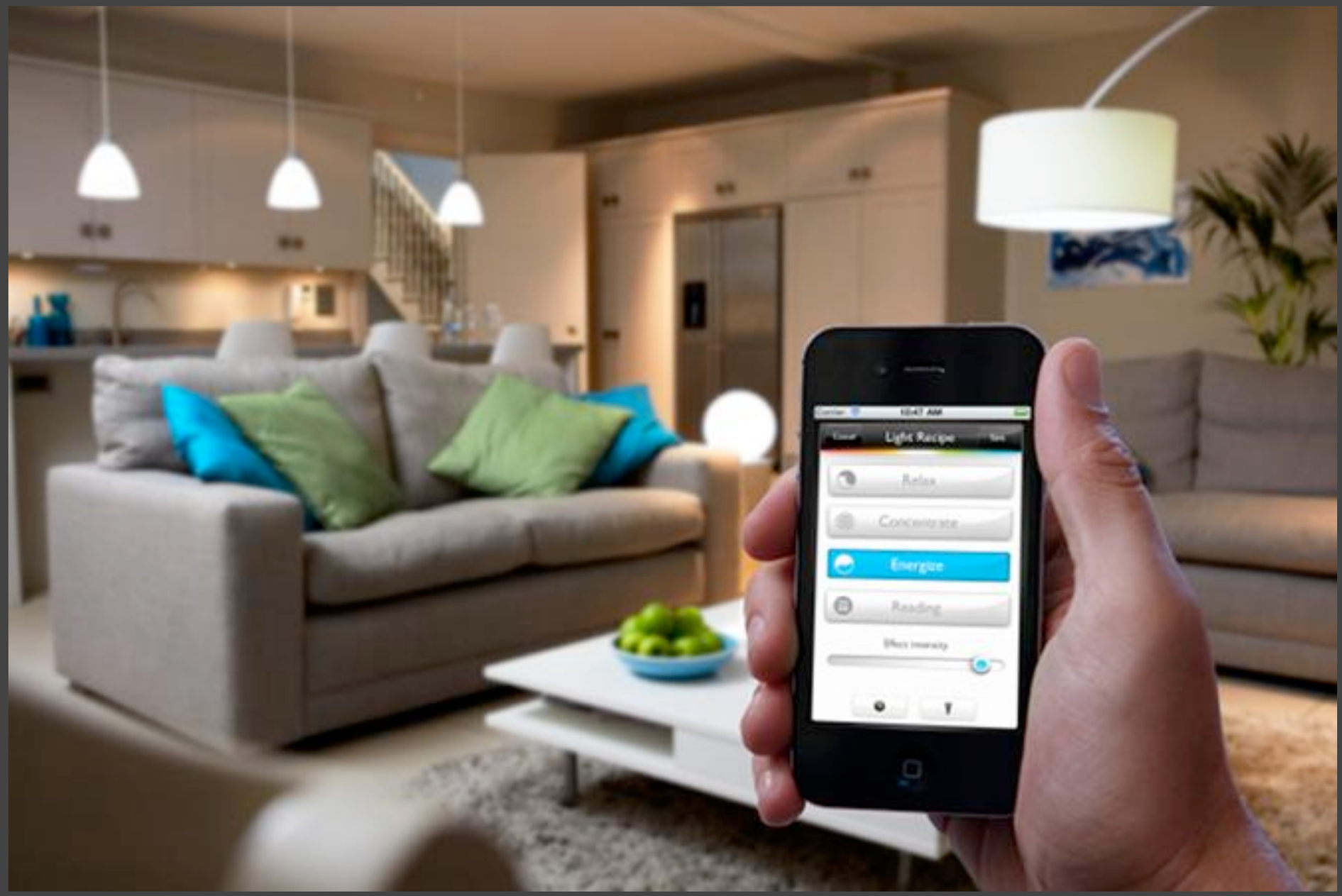
Time's up!

Solutions?

Commercial solutions

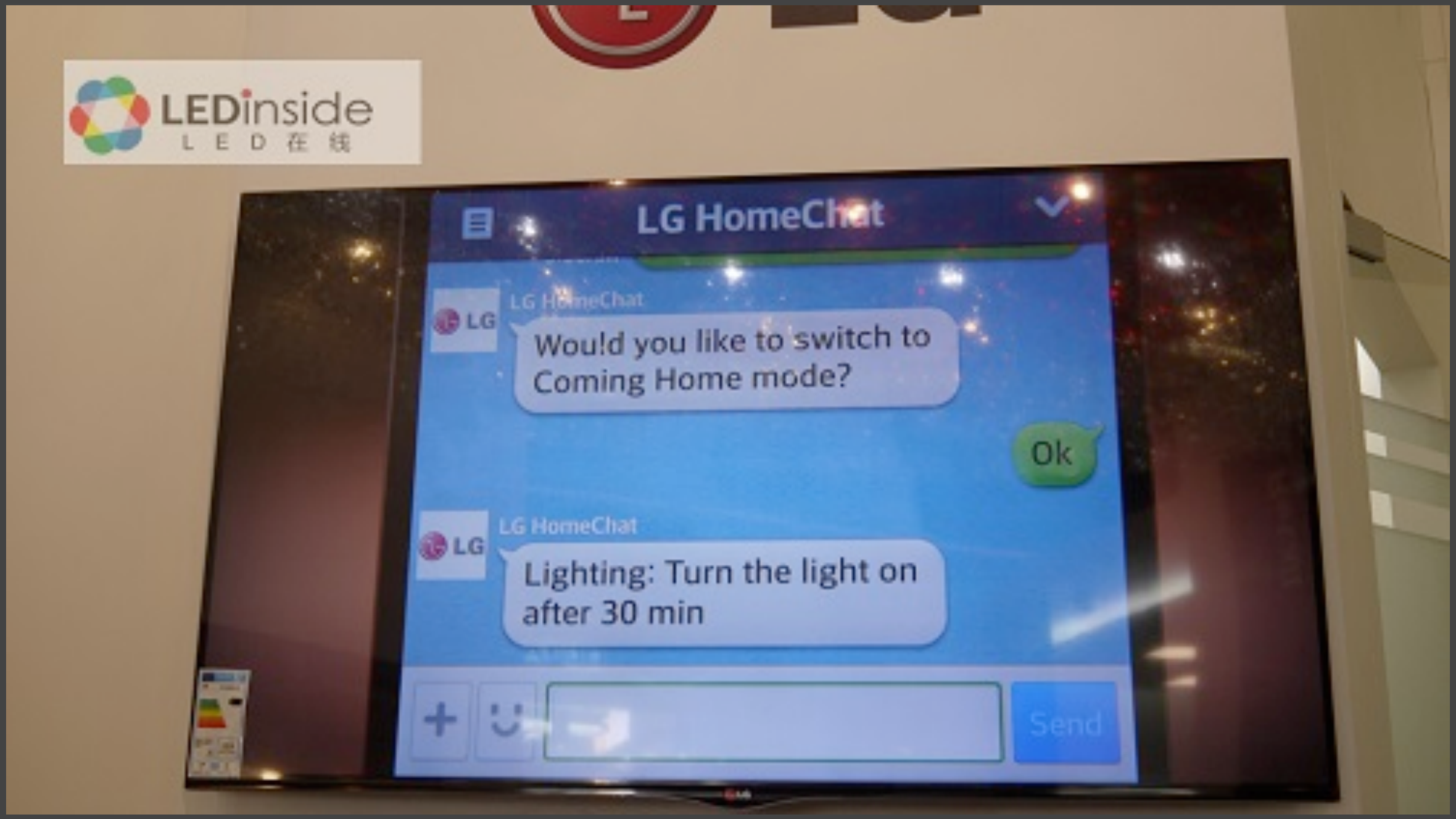
http://www.doneo.com.mt/showPage.aspx?pageName=Lighting_Control

Commercial solutions



https://recombu.com/digital/article/smart-lighting_M11044.html

Commercial solutions

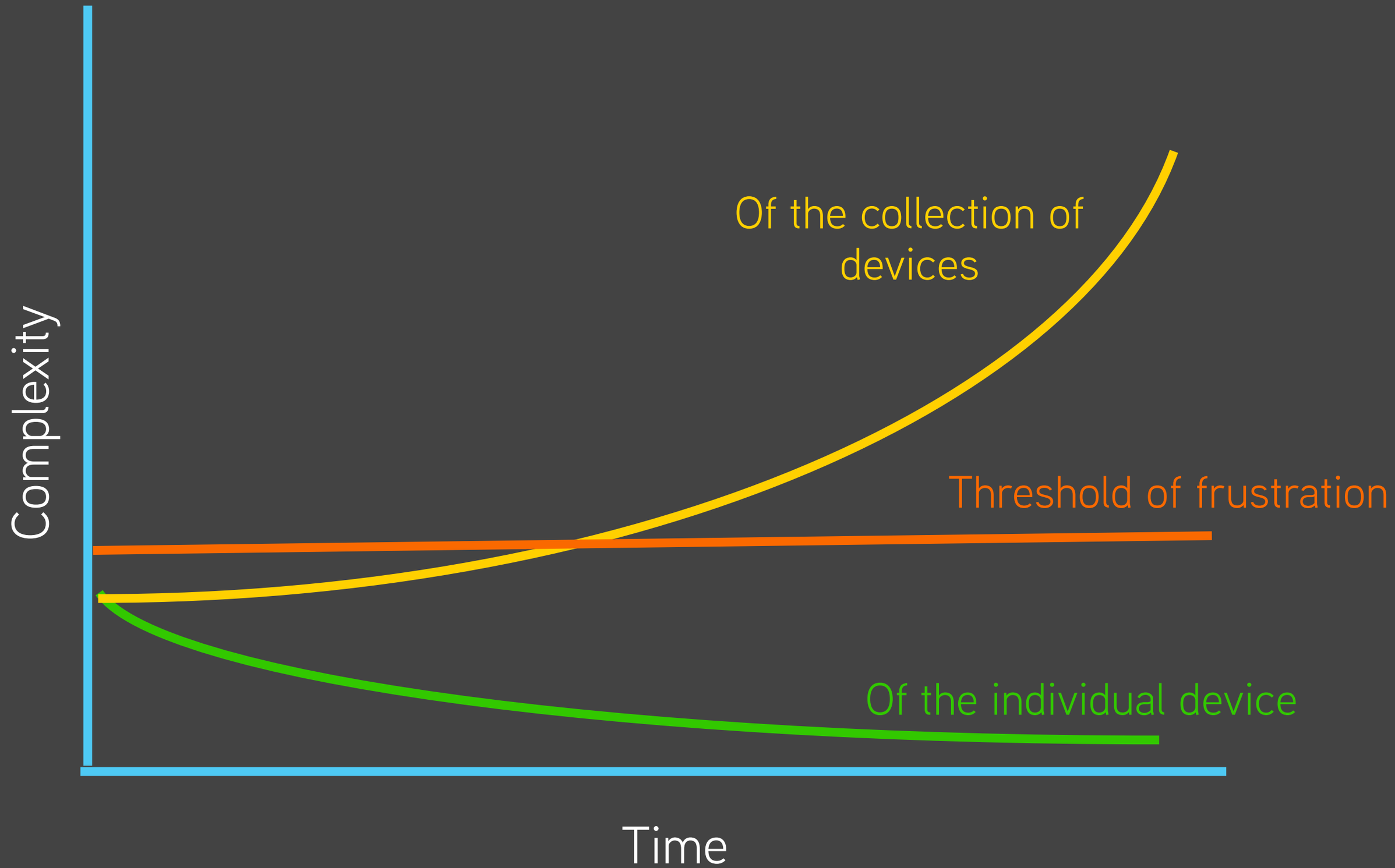


http://www.ledinside.com/showreport/2014/4/all_eyes_on_smart_lighting_at_light_building_2014

"...rather than being a tool through which we work,
and thus disappearing from our awareness,
the computer too often remains the focus of attention."

—Mark Weiser, CACM, July 1993

Bill Buxton on frustration



...ok, I need to turn on the lights...
which menu was that again??

"Ubiquitous Computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user."

—Mark Weiser, CACM, July 1993

The missing piece

- We have ubiquity! What are we missing?
- Transparency: technology everywhere but **non-intrusive**

Some design principles

- Buxton's rules
  - Every new product and service must provide great experience and excellent value: it works and flows.
  - But each must also reduce the complexity and increase the value of all of the others. Things work together.

2001/15

3 Phases

3 Miracles

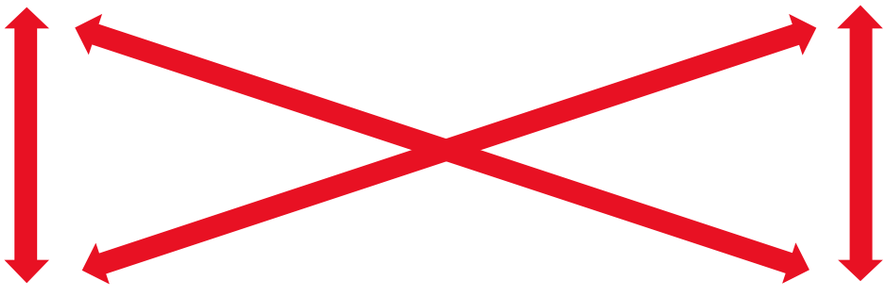
It Works!

It Flows!

They Work Together!

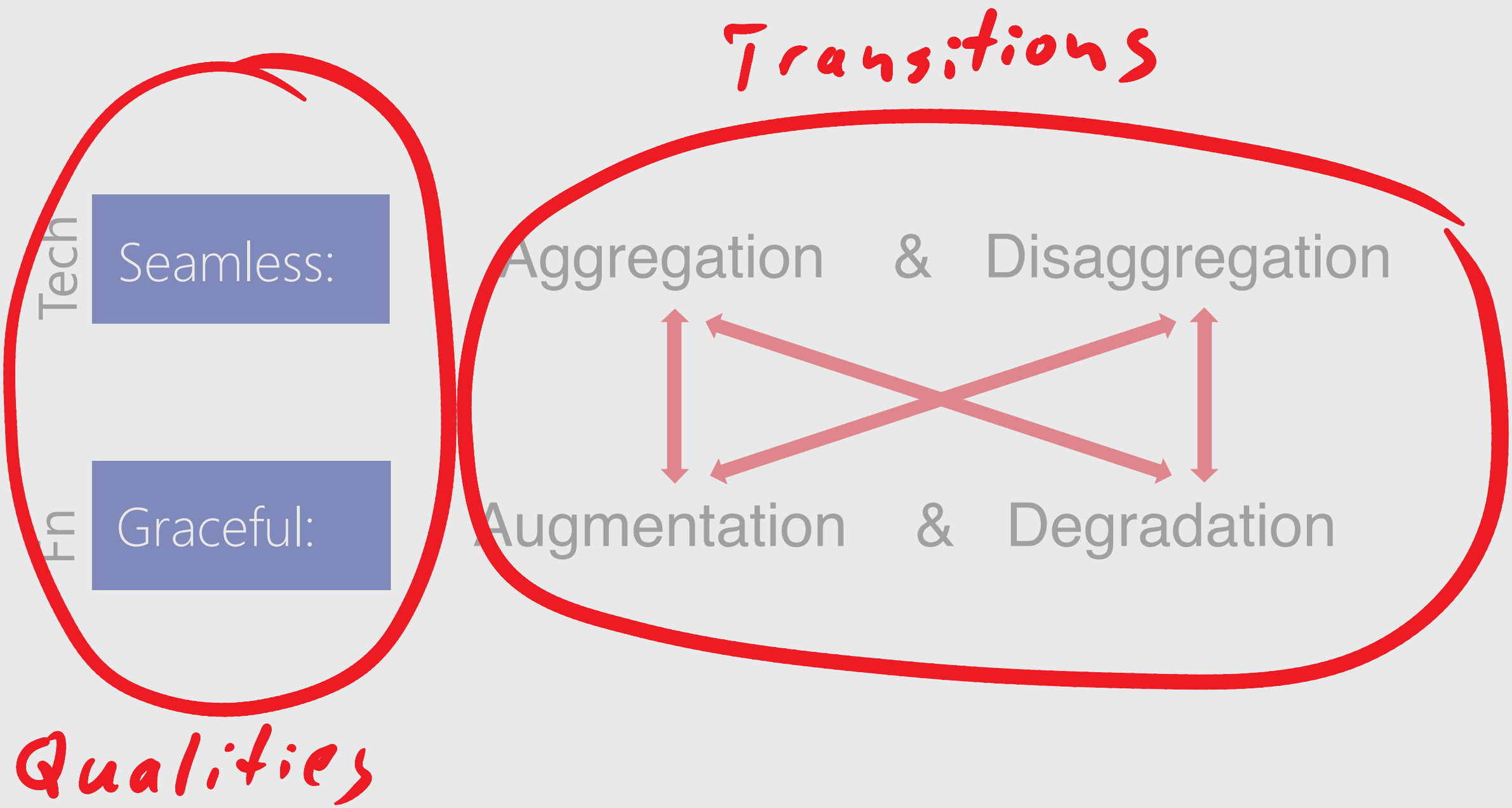
[Buxton, Microsoft TechFest 2013]

Tech **Seamless:** Aggregation & Disaggregation



Fn **Graceful:** Augmentation & Degradation

[Buxton, Microsoft TechFest 2013]



[Buxton, Microsoft TechFest 2013]

"In the future, quality of experience will be determined by how products work together, in concert, with the rest of the eco-system, not just by the quality of experience of any product on its own—no matter how good that individual experience will be."

—Buxton, Microsoft TechFest 2013

Design exercise!

- 10 minutes
- Pair with the person nearest to you
- Design an improved light switch
- Sketch your ideas
- Hints
  - Take into account Buxton's design principles
    - Every new product and service… works and flows.
    - …each must also reduce the complexity and increase the value of all of the others. Things work together.
  - How can interaction disappear?

Time's up!

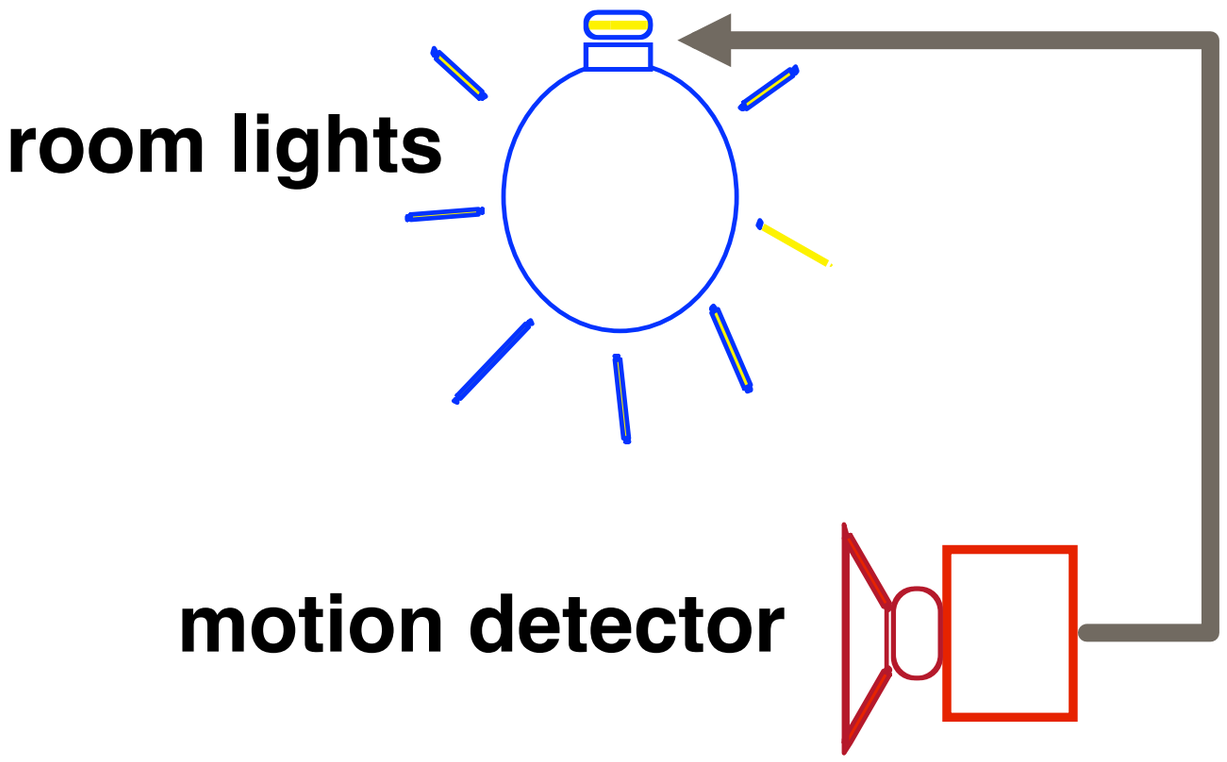
Solutions?

More design principles

- Invisibility
- Manual override
- Feedback
- Adaptability

[Jeremy Comstock's Ubicomp lecture]

Invisibility

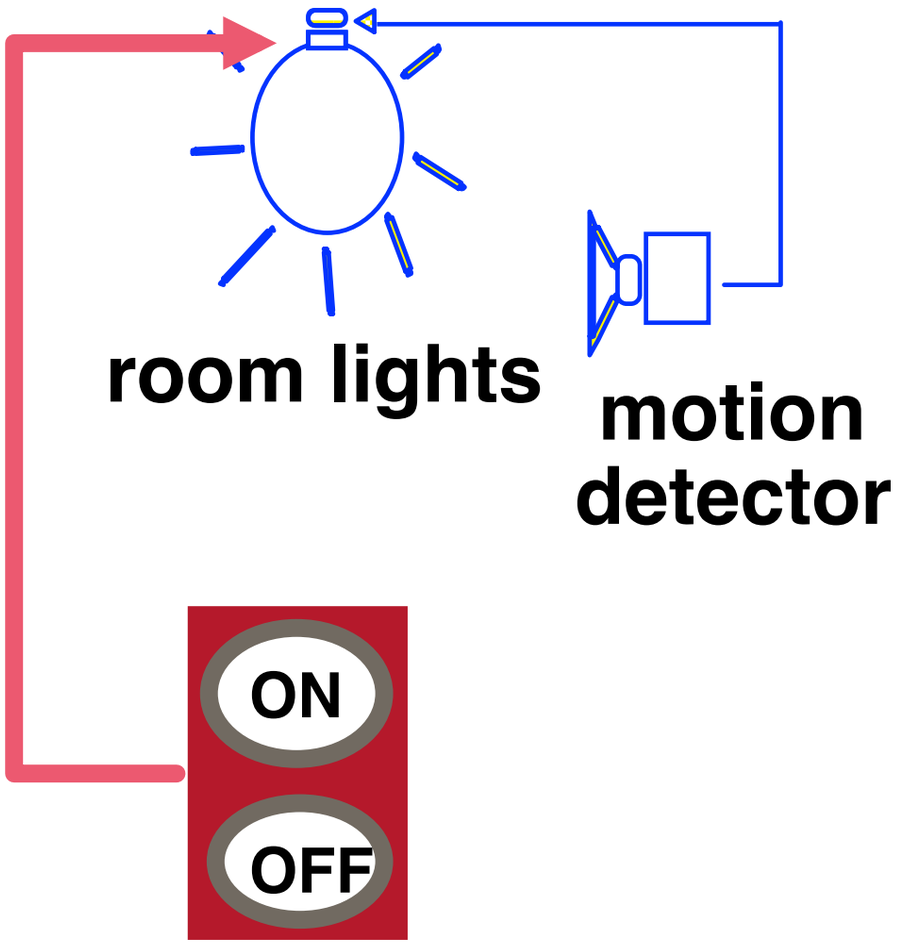


Users must not perceive themselves to be involved in a two-party communication.

The goal is to achieve the most effective kind of technology, that which is essentially invisible to the user.

MARK WEISER, CACM, July 1993

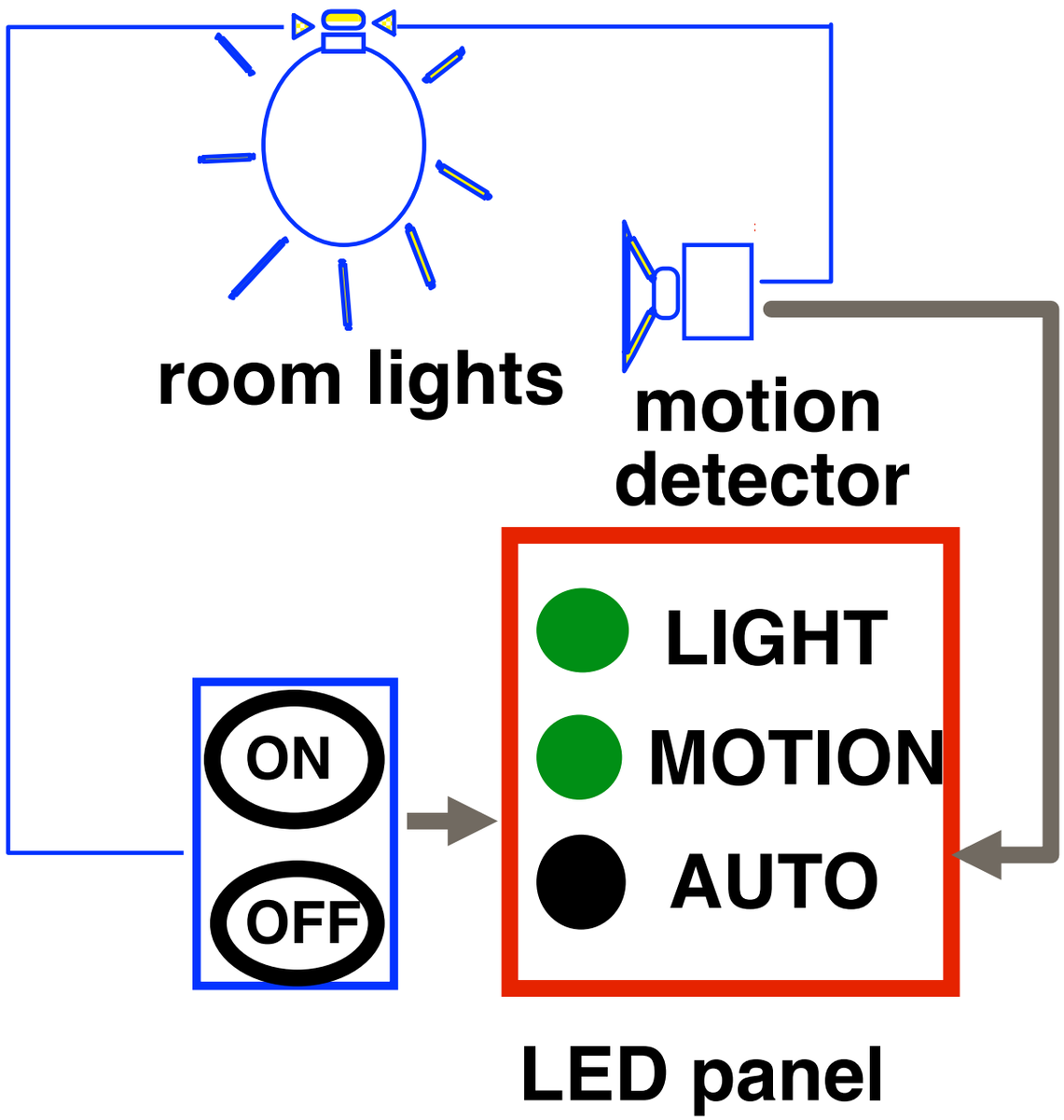
Manual Override



manual light switch

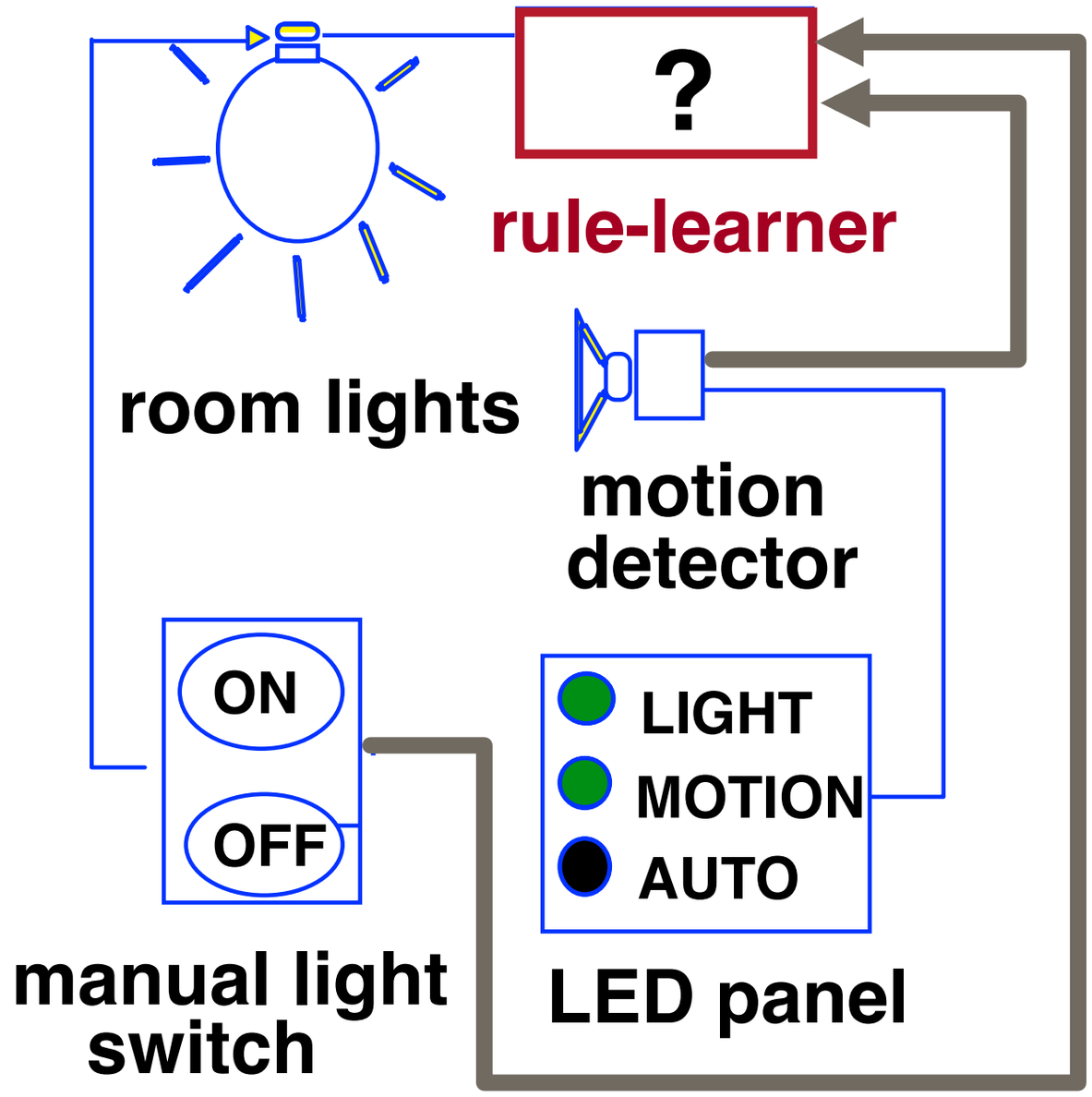
A seamless, easy-to-invoke override mechanism.

Feedback



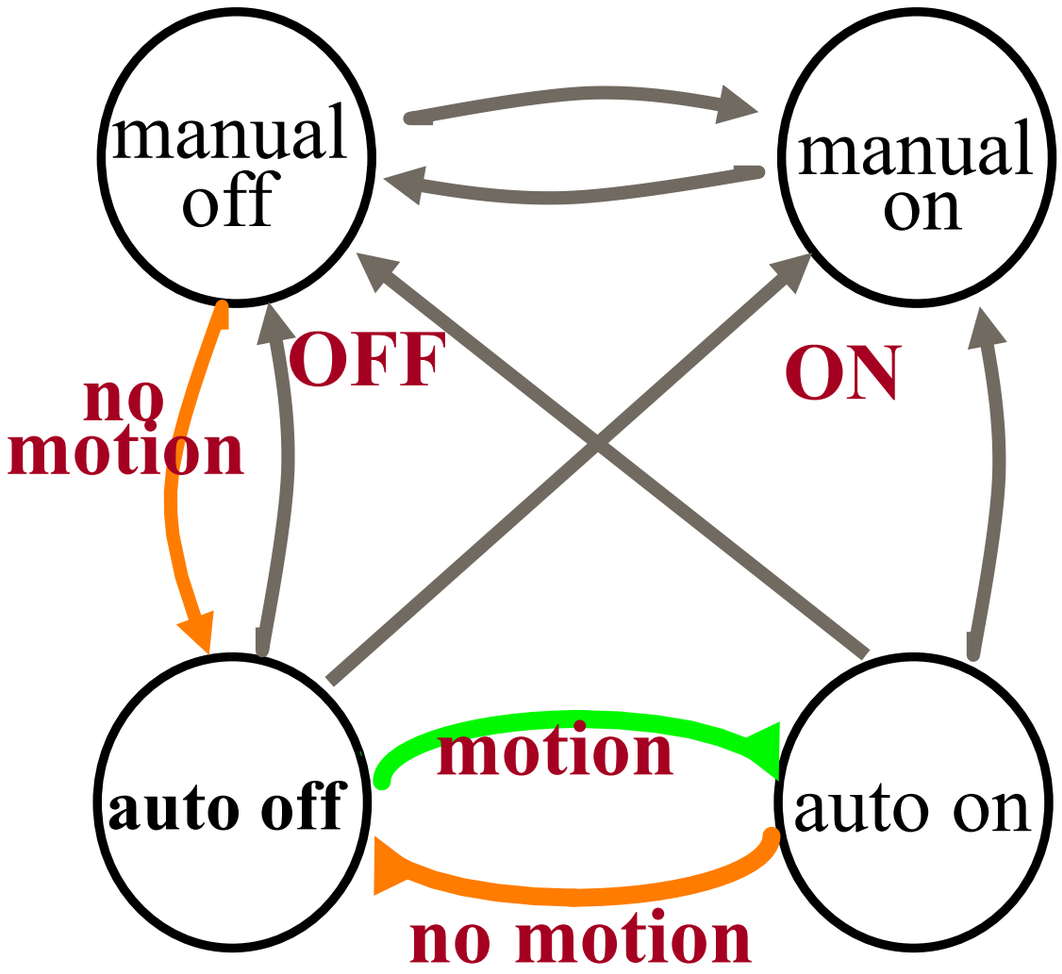
There must be an obvious way to find out the current state of the system.

Adaptability



The system should learn from its mistakes and adapt to new users and conditions.

Smart Light Switch



automatic mode

- lights turn on and off in response to motion

manual on mode

- lights remain on until turned off manually

manual off mode

- lights remain off while room is occupied

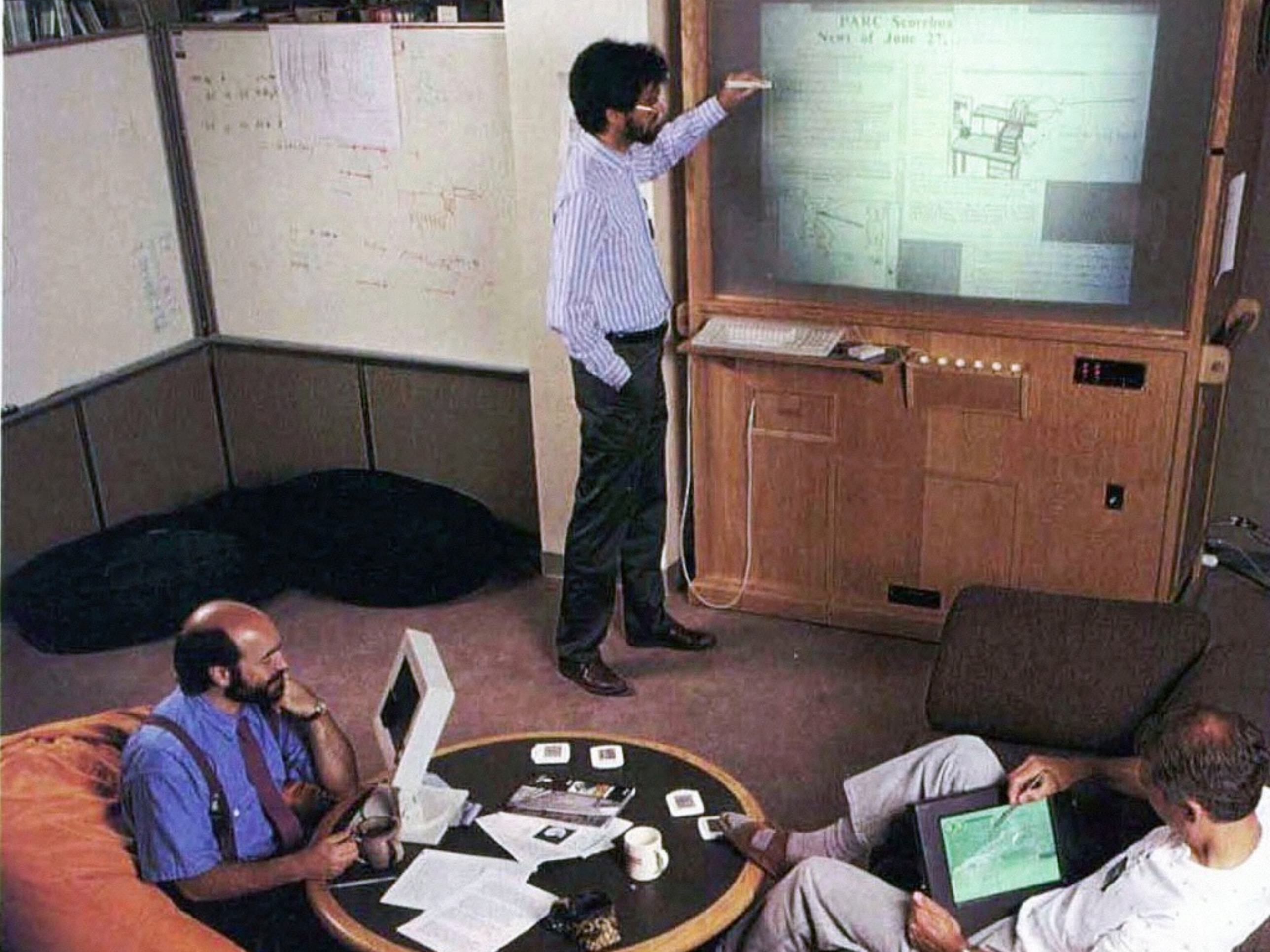
Challenges in designing ubicomp systems

- Revealing interaction possibilites
- Directing actions
- Establishing connections
- Providing feedback
- Avoiding and correcting mistakes
- Managing privacy and security

Greenberg, S., Marquardt, N., Ballendat, T., Diaz-Marino, R., & Wang, M. (2011). Proxemic interactions: the new ubicomp?. interactions, 18(1), 42-50.

Scales of Ubicomp

- Weiser & PARC: tabs, pads, boards


PARC Scorebox
News of June 27,

Scales of Ubicomp

- Weiser & PARC: tabs, pads, boards
- What other scales?

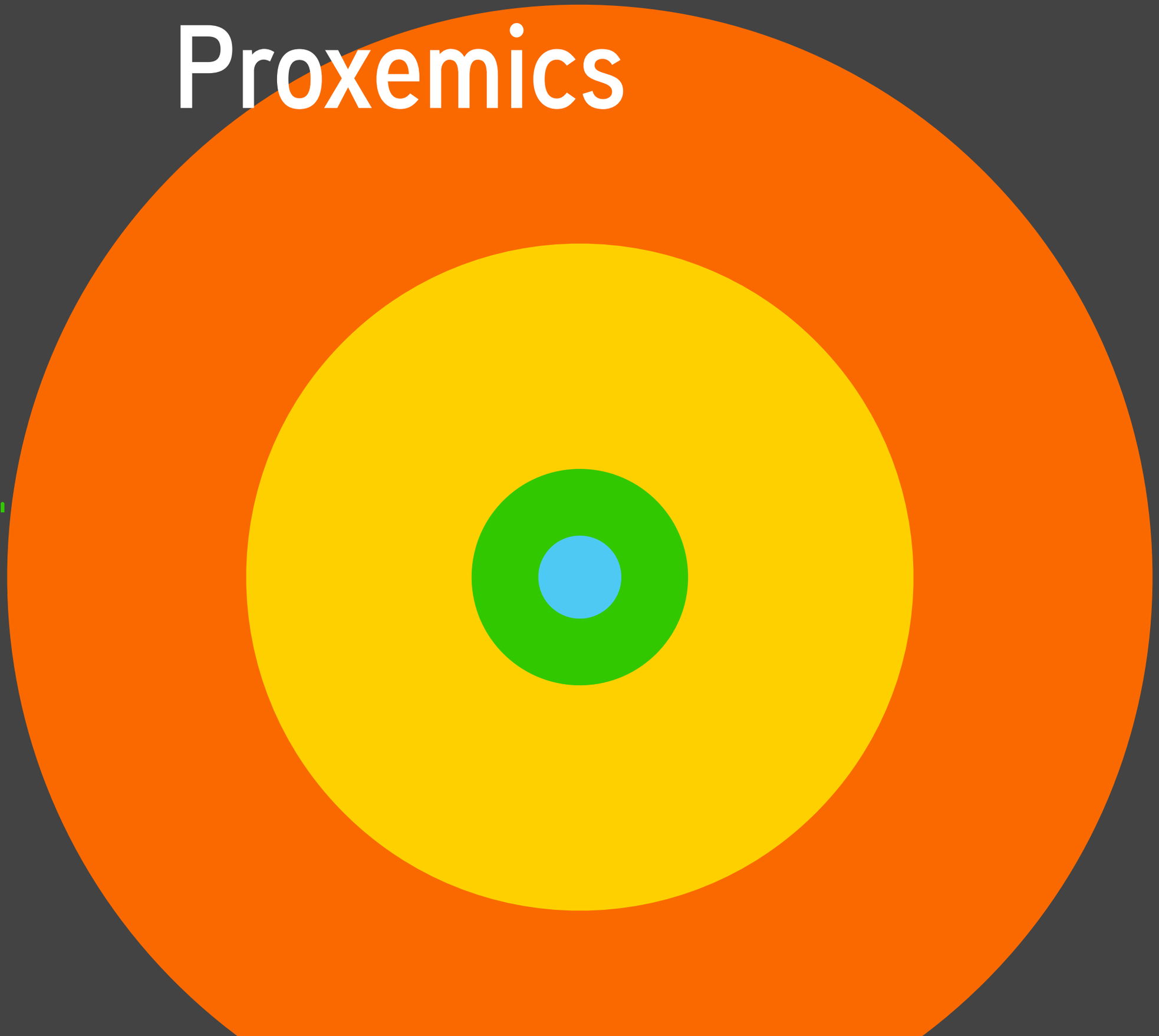
Proxemics

Intimate: 0–1.5'

Personal: 1.5–4'

Social: 4–12'

Public: 12'+



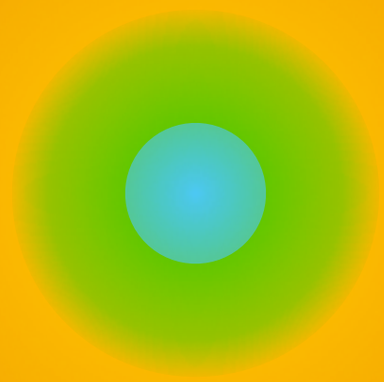
Proxemics

Intimate

Personal

Social

Public



What falls on this spectrum?

Intimate Personal Social Public

Coming up

- IA1 due in 1 week
- Thursday: basic electronics, principles of Photon