Tim Berners-Lee introduces the WorldWideWeb, the first web browser, and a WYSISYG HTML editor

- The first website goes online at CERN
- Sonic the Hedgehog is released, leading to popularity of 16-bit game console

Script: Mention the above, but also include the following to provide additional context:

- First color image scanner
- First Norton anti-virus Software released by Symantec
- Torvald completes work on Linux

Ubiquitous Computing

[yoo-bik-wi-tuhs kuhm-pyoo-ting]

“Technology that weaves itself
into the fabric of everyday life
until it is indistinguishable from it.”

Ubiquitous Computing (UbiComp): Technology that weaves itself into the fabric of everyday life until it is indistinguishable from it.

Visuals: Just a representation of writing: perhaps a pen over paper or something

”The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it” (Weiser 1). This was Weiser’s vision of ubiquitous computing—that one day computers would fade into the background of everyday life much like the development of writing has. There is writing in books, magazines, on street signs, billboards, candy wrappers—but the writing itself is unobtrusive, woven into daily life. Contemporary examples included light switches, thermostats, stereos and ovens –- devices which had small embedded computers that helped to activate the world without needing to be understood.

Embodied Virtuality: Not virtual reality, but the process of drawing computers out of their electronic shells. Virtuality of computer-readable data brought into physical world.

Visuals: Examples of Ubicomp beginnings in 1991— light switches, thermostats, stereos and ovens, which has computers that help to activate the world without needing to be understood

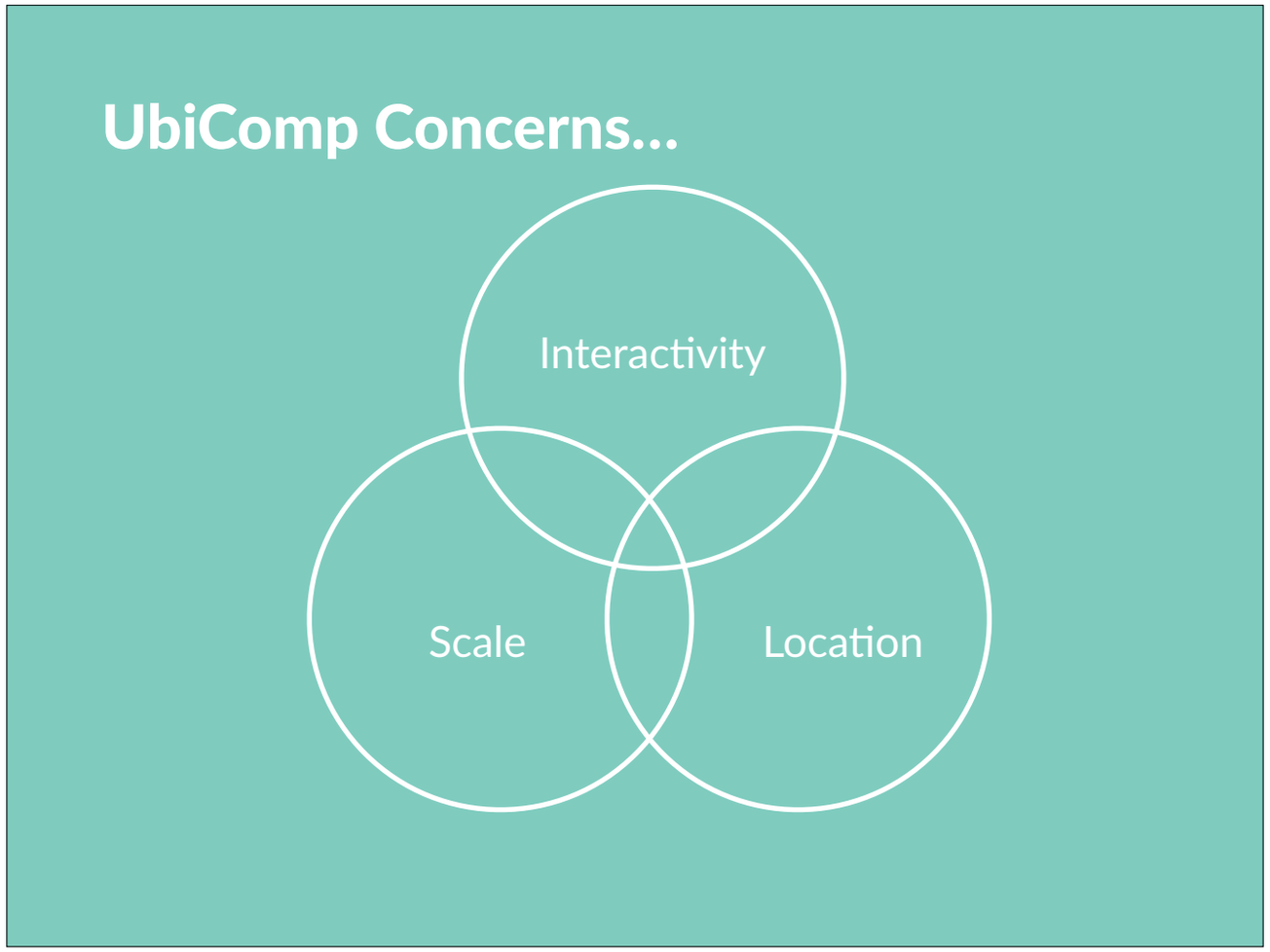
Script: Many people think of ubiquitous computing as virtual reality, but they are very distinct. Virtual reality does not focus on the real world that already exists. Instead, Weiser uses the term "embodied virtuality" to describe the process of getting a particular device to contribute to ubiquitous computing.

Pretty grand vision. But remember,

In 1991, computers:

- Required complex jargon to communicate with
- Large and clunky; difficult to move.

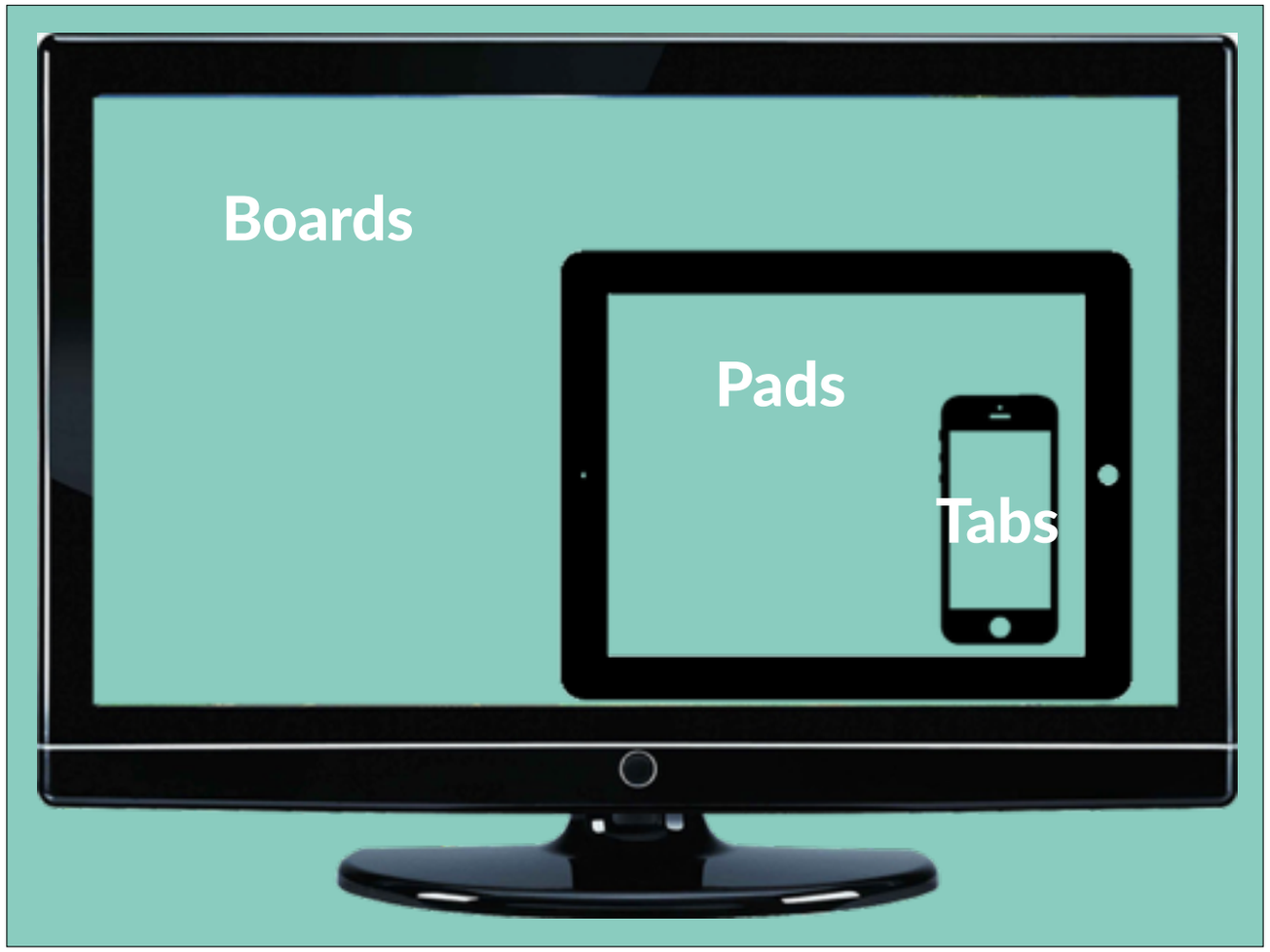
Script: Weiner;’s ideas had obviously not yet been realized at the time. Psychologically, computers only ‘vanish’ into the background when humans learn something so well that they cease to be aware of it. Called “compiling,” “tacit dimension,” etc. Things disappear only when we are free to use them without thinking and so focus beyond them on new goals. This was distinctly not the case with ‘91 computers, which were complex with jargon and had to be lugged around everywhere with great difficulty (they were very large). How did Weiner and his associates anticipate that this would change?



Weiser argues that ubicomp requires emphasis on three specific areas: Location, scale, and interactivity.

This will make more sense when we talk about their idea of ubicomp in the next few slides, but he believed that **because human perception is highly aware of physical juxtaposition**, the ability of ubicomps to know where they are would **allow them to adapt their behavior without needing AI**.

He envisioned ubicomps to be of different **sizes specific to their use cases**, and believed that all these **devices needed to be able to work interactively** in tandem to be most effective.



The paper manifested ‘ubicomp’ with three classes of devices: tabs, pads, and boards.
Tabs are inch-scale machines that approximate active post-it notes.
‘**pad**’: are sheet of paper x laptop x palmtop computer.
Yard –sized boards would be used in an even more **complex context**—as video screens or bulletin

general idea is that these devices
live with us in physical world, fluidly connected, flexible functions.
as we transition from context to context, location to location

These were the challenges Weiner foresaw would face Ubiquitous computing.

OS Design:

- Current (1991) OS's like DOS and Unix
- For ubicomps to work, we cannot shut down all computers in a room to install new software in any one of them

Display Systems: No solutions back then unless protocols changed for communication.

Network capacity: Most wireless network schemes could only support a small number of channels, and with limited range.

Security + privacy: Possibly dangerous if information is so readily accessible on pads, tabs, etc.

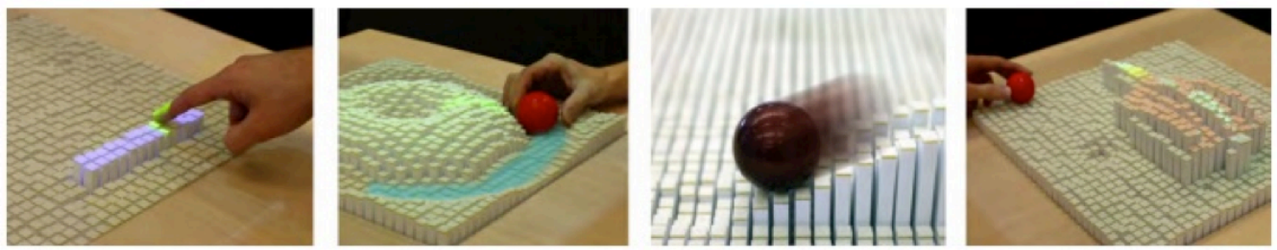
the paper ended on optimistic note.

Will emerge in the next 20 years. Obtaining information will be trivial.

Pushing computers into background makes individuals more aware of the people on the other end of their computer links. This will reverse the isolation that PC's have introduced into life.

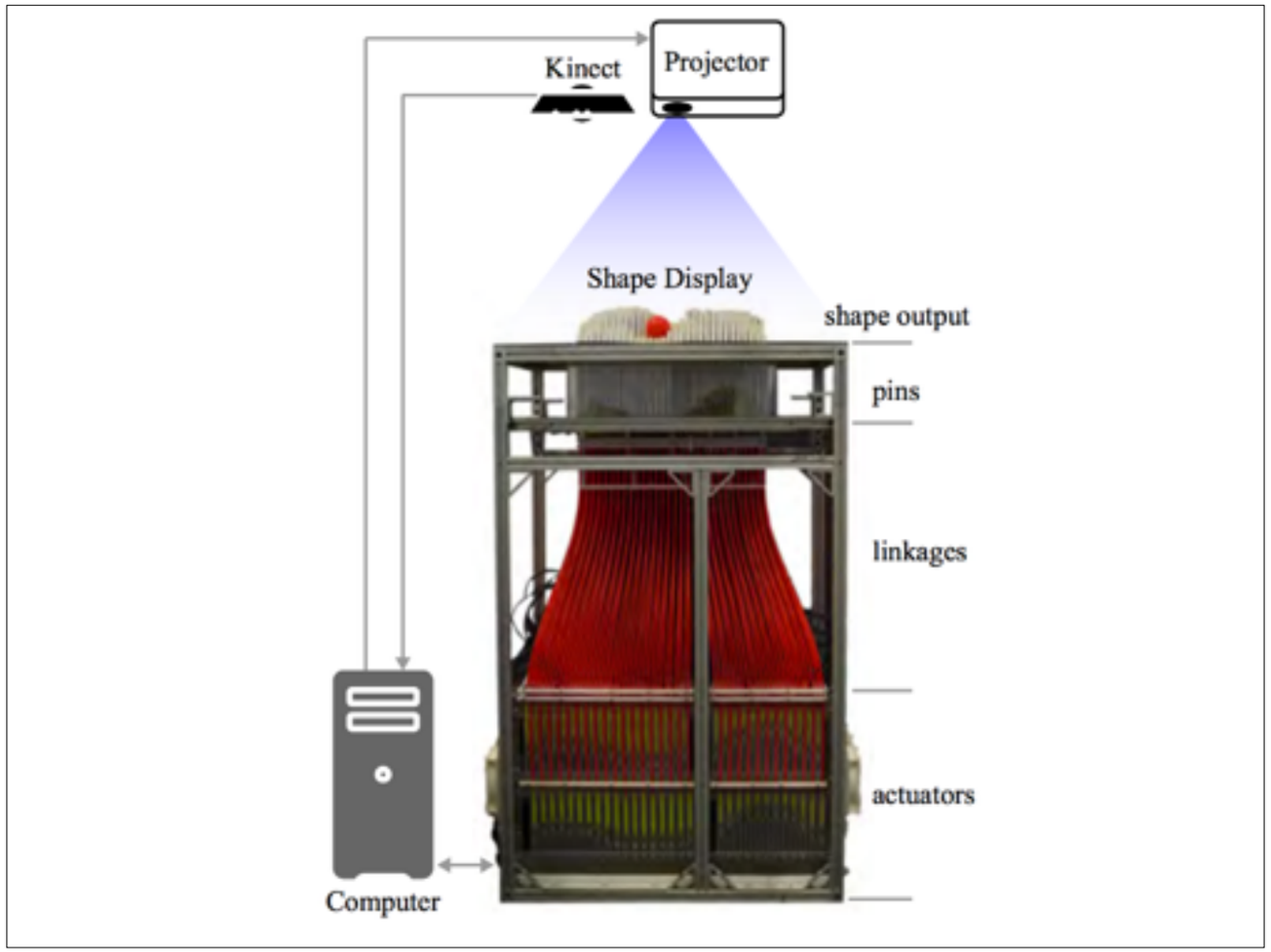
one manifestation of ubicomp in contemporary times is inFORM, take it away jimmy

Dynamic Affordances…



…with inFORM

Scriptish: inFORM is a 2.5D shape display designed and built by Sean Follmer and Daniel Leithinger et al. at MIT Media Lab to explore dynamic physical affordances and constraints. Essentially, the device is a matrix of pegs that may be raised and lowered computationally to render different shapes. Coupled with a projector to provide an image overlay and sensors to detect user interaction, inFORM is an exploration in a novel method of computer display.



Scriptish: inFORM is built to explore dynamic physical affordances and constraints, so it'd be a good idea to define what those are. An affordance is something that an object enables us to do, for example, wheels on car. Another important type of affordance is a "perceived affordance", which is when an object communicates to us what it can do, for example, a GUI button may use color and shading to appear to pop out, indicating that it is clickable.

Dimensions of inFORM functionality:

1 **Facilitate**
Dynamic affordances

2 **Restrict**
Dynamic constraints

3 **Manipulate**
Physical shape change

Scriptish: inFORM explores the capabilities of 2.5D shape displays along 3 dimensions of functionality: the facilitation of tasks via affordances, the restriction of input via constraints, and the manipulation of other objects via inFORM's ability to change shape. We will define each of these dimensions in more detail.

Affordance

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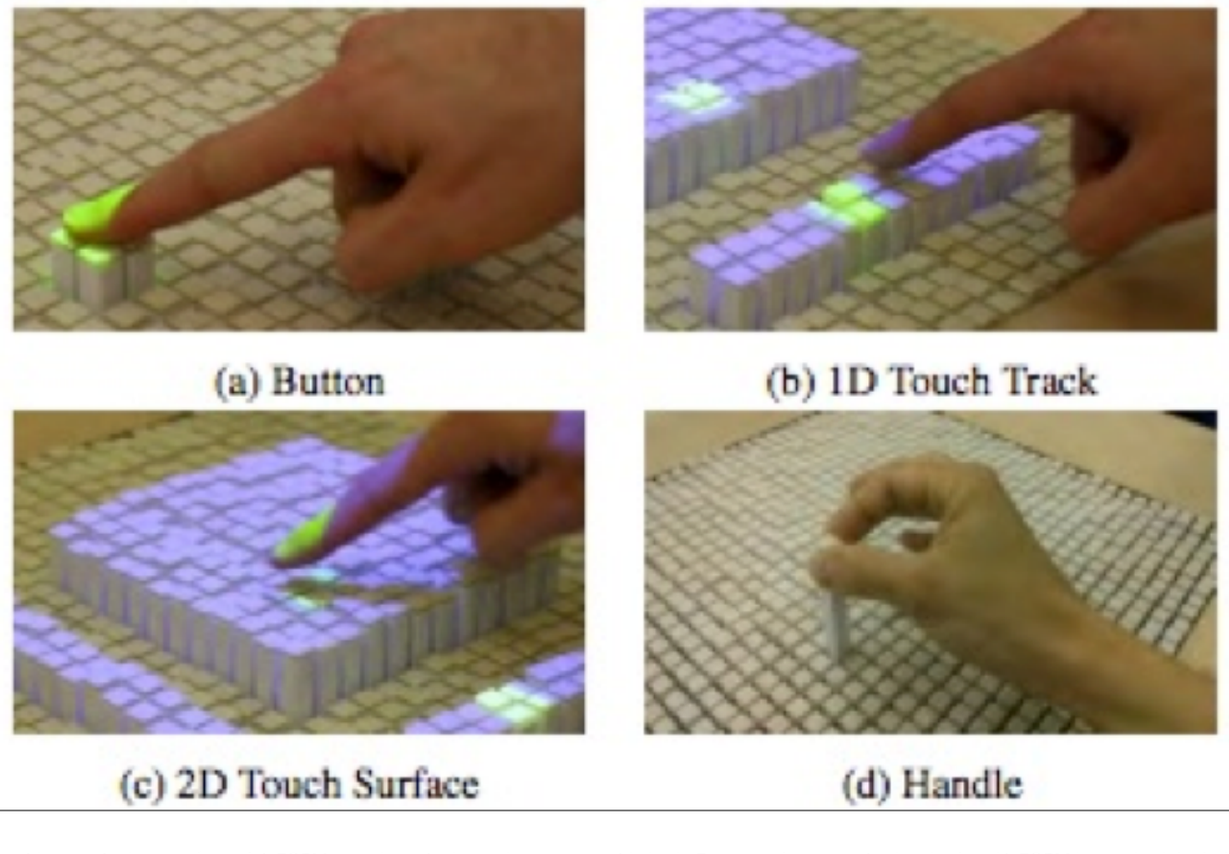
Facilitate



(a) Button

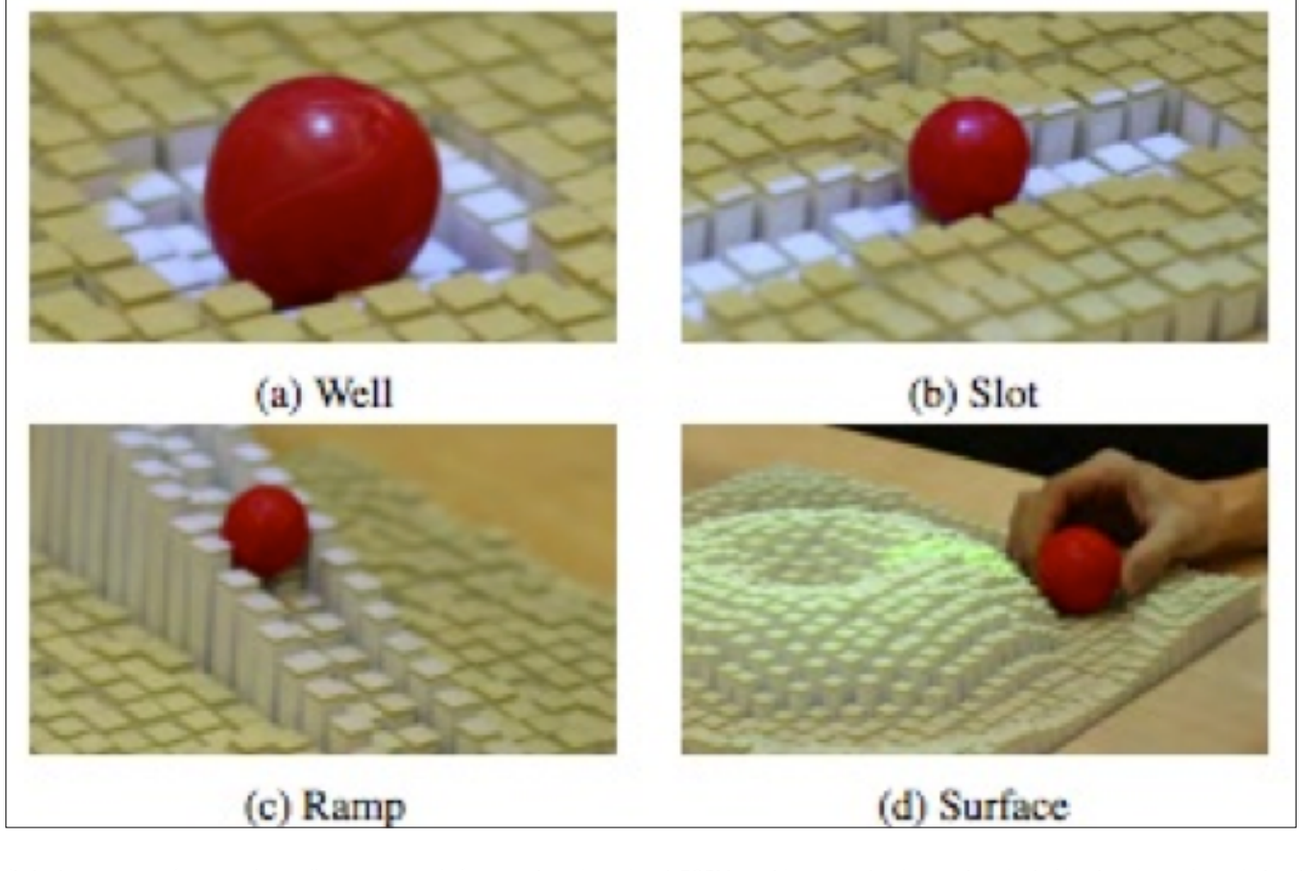
(b) 1D Touch Track

(c) 2D Touch Surface

(d) Handle

Affordances define an object's capability as a tool, and perceived affordances guide users in the use of a tool. inFORM uses dynamic shape change to provide both: For example, an upraised and colored inFORM button both looks like it may be pressed and actually allows the user to depress the surface to change the program state. Other types of input facilitation include allowing a user to slide their finger along a track or surface, or allowing them to physically move a peg up or down.

Restrict



(a) Well

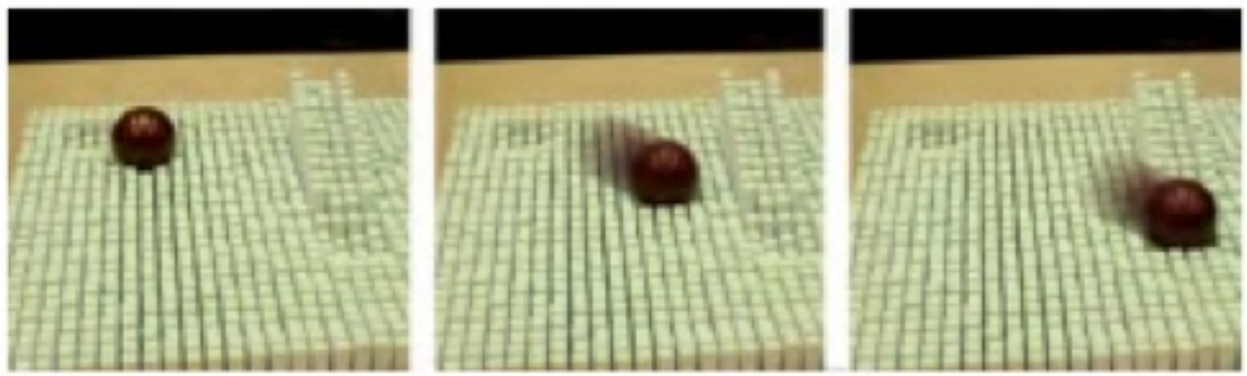
(b) Slot

(c) Ramp

(d) Surface

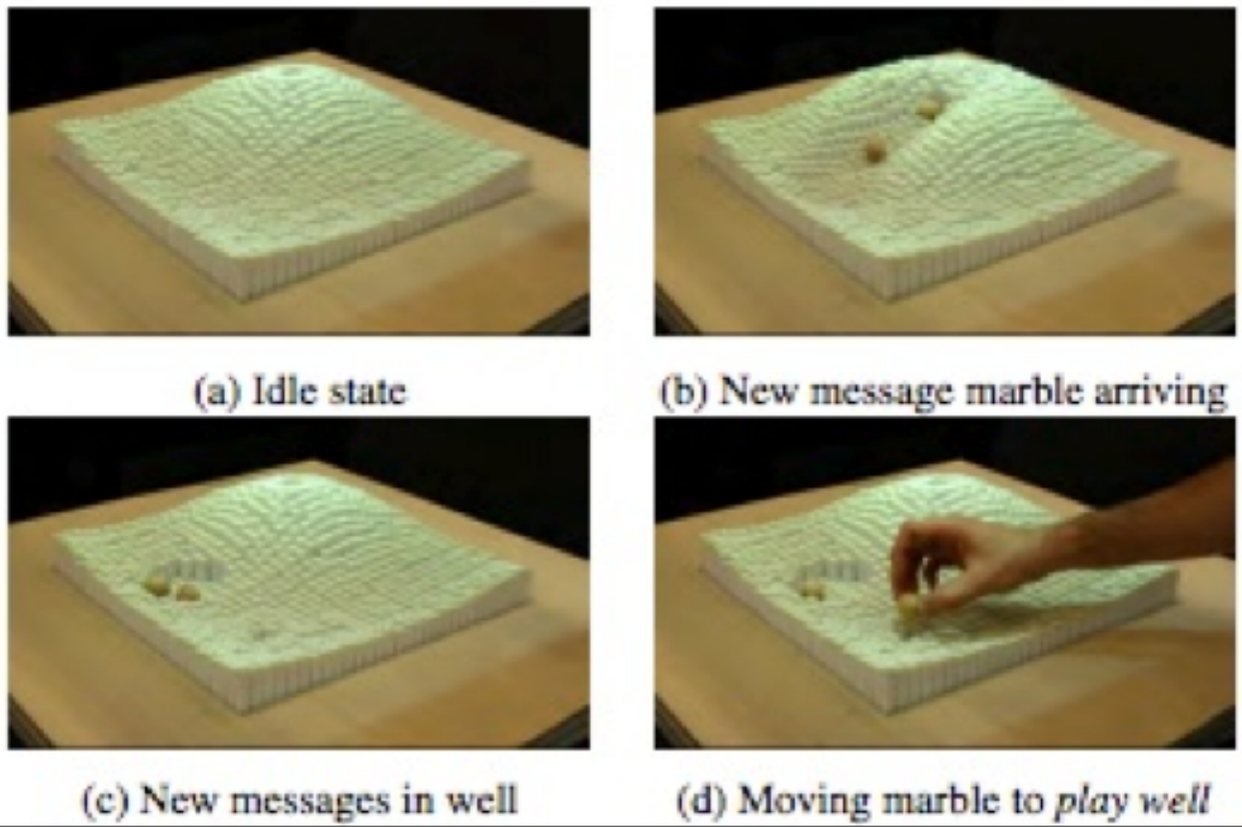
Scriptish: Constraints on the other hand are ways in which objects enforce limitations on users, for example a wall prevents people from passing a boundary. inFORM provides constraints by creating physical barriers that make undesired input difficult. For example, inFORM can place an object out of the user's reach, making them unable to move it.

Manipulate



Finally, inFORM allows the manipulation of other objects by changing its shape to push or roll objects around its surface. This is a part of inFORM's functionality that is particularly unavailable to purely visual displays.

Applications + Future work



(a) Idle state

(b) New message marble arriving

(c) New messages in well

(d) Moving marble to *play well*

Finally, inFORM allows the manipulation of other objects by changing its shape to push or roll objects around its surface. This is a part of inFORM's functionality that is particularly unavailable to purely visual displays.

Discussion Questions

"We already live in a world of near-ubiquitous computing, and so the ideas don't push us to envision an impossibly grander future..."

- Ted

"Weiser offers...a more optimistic view of the future of ubiquitous computing than the one we are currently living in...the way that they will permeate our lives is still in open question."

- Jess

Sal scenario is particular to only one person. not taking into consideration cultural social political

make sure to point out not only "connected devices" but CCTV's, RFIDs, broadband networks, things that make a city run.

monitoring and restricting car traffic, or centralized governmental control and regulation of infrastructure or content, or dense urban environments, or extended collective public living, or sensing urination in elevators, or electronic consultations about feng shui or ambient displays of prayer time

How is reality different from expectations in 1991?

Sal scenario is particular to only one person. not taking into consideration cultural social political

make sure to point out not only “connected devices” but CCTV’s, RFIDs, broadband networks, things that make a city run.

Does ubiquitous computing improve human interconnectedness?

If so, how exactly?

Singapore and Korea: Imaging ubiquitous computing as a collective practice, rather than a set of discrete individ- ual actions, is an important reframing of that techno- logical vision.

"Elementary schools have started incorporating courses on emotional learning and socialization **in response** to the **constant intrusion** that computers make into our lives"

- Chiara

"reflecting on Skype or FaceTime… I ask myself if technology nowadays has diminished the amount of personal interaction. I believe it hasn't, and **has instead** brought communities closer together"

- David

On a massive, intl scale. Singapore and Korea, they have country-wide interconnectivity,

These governments Imaging ubiquitous computing as a collective practice, rather than a set of discrete individual actions, is an important reframing of that technological vision.

looping back to inform as one example of the technological vision

Are shape displays like inFORM technologically feasible and economically efficient?

Would we want to use it?

... the increased physical effort required for navigation with inFORM in methods like moving a ball along a track, or moving objects to and from wells, seems generally **less convenient than the touchscreens** that we are used to.

- Stephen

no space for creativity or forming inForm the way the user wants

- Negar

inFORM is an inefficient use of space

- Miraj

Taking ideas from the inFORM paper,
what are some applications you envision
when computers take “shape”
and have physical affordances and constraints?

“Architects would be able to view 3D designs in a more conveniently physical sense.”

- David

“Although the [inFORM] technology itself was very interesting due to its novelty, I felt that it had limited practical potential as a user interface in its current form due to issues with ease of use.”

- Roger

“…this is great for blind people. Sure it’s great for people who still have their vision – it’s an extra dimension that designers can play with to display meaning”

- Sophia

Do our attachments to our personal devices render it impossible for them to ever fade into the background?

one of you mentioned “One aspect he may not have imagined is how these devices have become very personal devices or even accessories, and brand loyalty and product differentiation still make each mobile phone or tablet an individual ownership experience.”

Are there physical things or experiences that ubiquitous computing would never replace?

If so, what?

Will reality ever **not** be different from expectations?

Will we ever realize our expectations?

One of the biggest critiques of ubicomp is its “proximate future” perspective. things are always out of reach (yesterday’s tomorrow)

Why is it important to study HCI in the context of ubiquitous computing?

Ubiquitous computing
+
dynamic physical affordances
=

?