Bauhaus-
Universität
Weimar

Shared interactions beyond the desktop

How new interface types can support sociable user experiences

Prof. Eva Hornecker
– Human Computer Interaction Group –
Bauhaus-Universität Weimar 2014

Kassel ITeG 2015


How can novel interfaces and interface technologies support social and shared experiences?

Overview

- Background: Developing a Framework/Model for Shareability
  - Embodied Facilitation (TI framework CHI'06)
  - Shareability - access and entry points (DPPI '07)
- Case Studies
  - Tabletop study: Effects of Access Points on Awareness and Equity of Participation
  - Case Studies of Shareable Interfaces (and more background theory)
    - Museums, Musical Improvisation, Urban Media-Façade Interventions

Shareability

A design principle

how a system, interface or device engages a group of co-located users in shared interactions around the same content (or object)

(abstracts from specific technology)

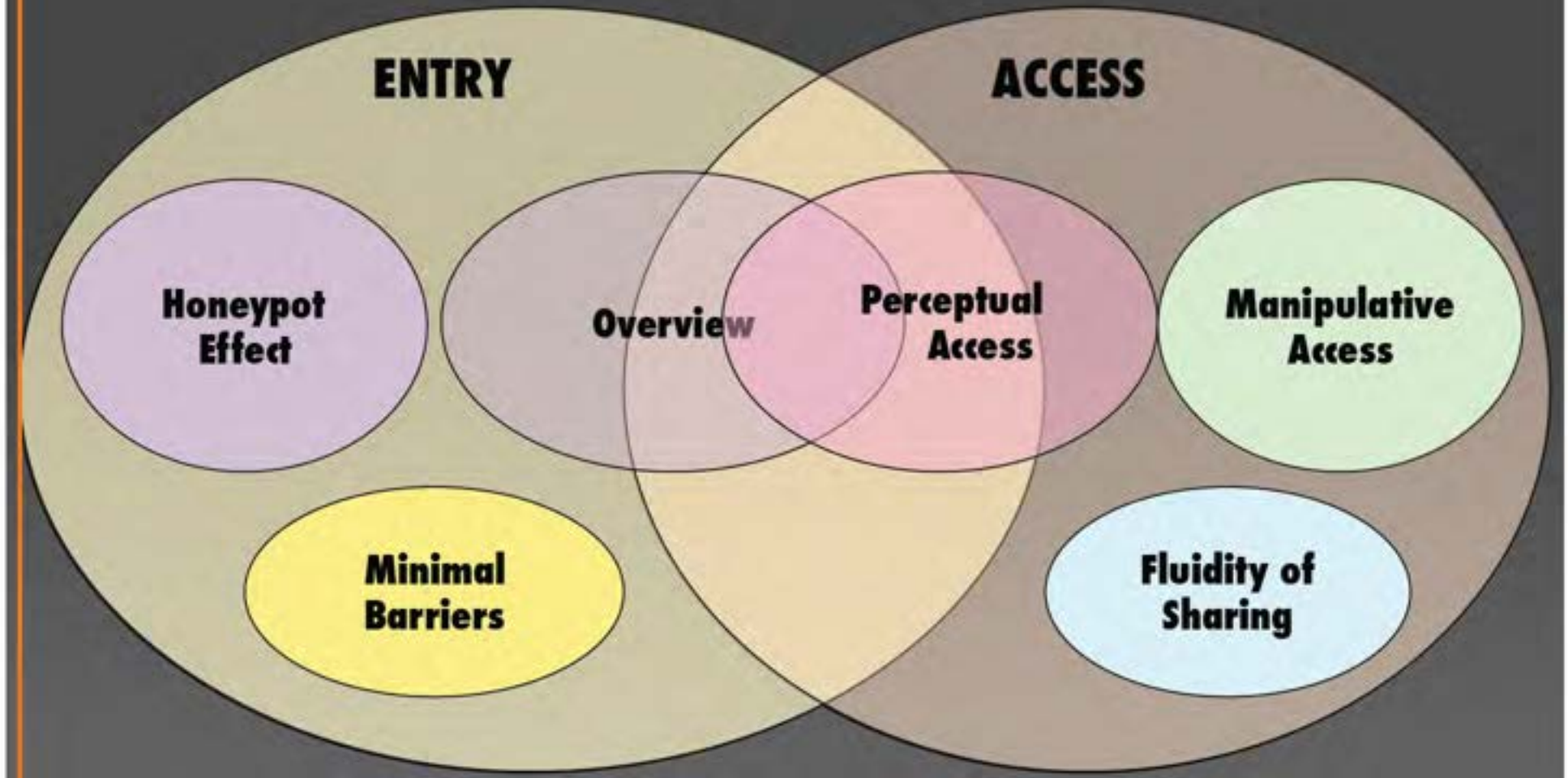
Need for knowledge on how to support sharing

Shareable Interfaces

provide multiple inputs and support interaction by a group of users

support people working, learning, playing, and discussing together, focusing on the same content while physically co-located and co-present

Aspects of Shareability



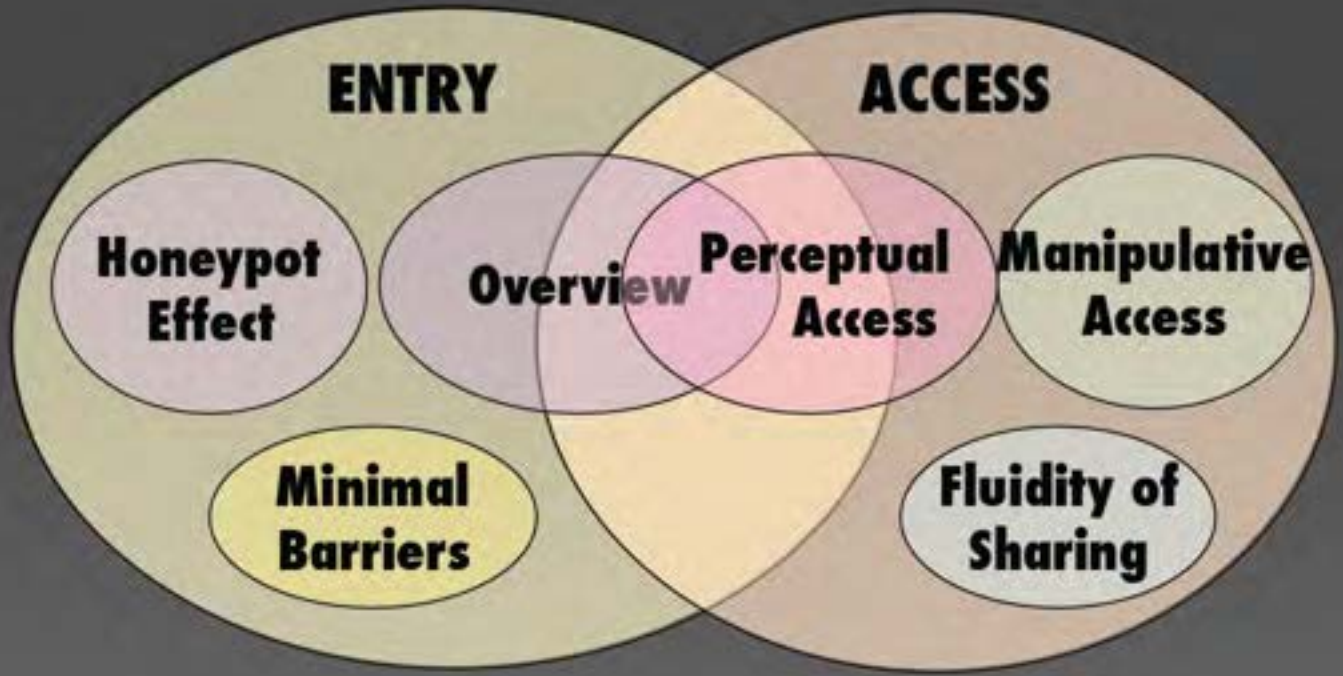
Hornecker, Marshall, Rogers *Entry and Access – How Shareability Comes About*. Proc. of DPPI'07

Entry Points

Invite people into engagement with group activity and entice to interact

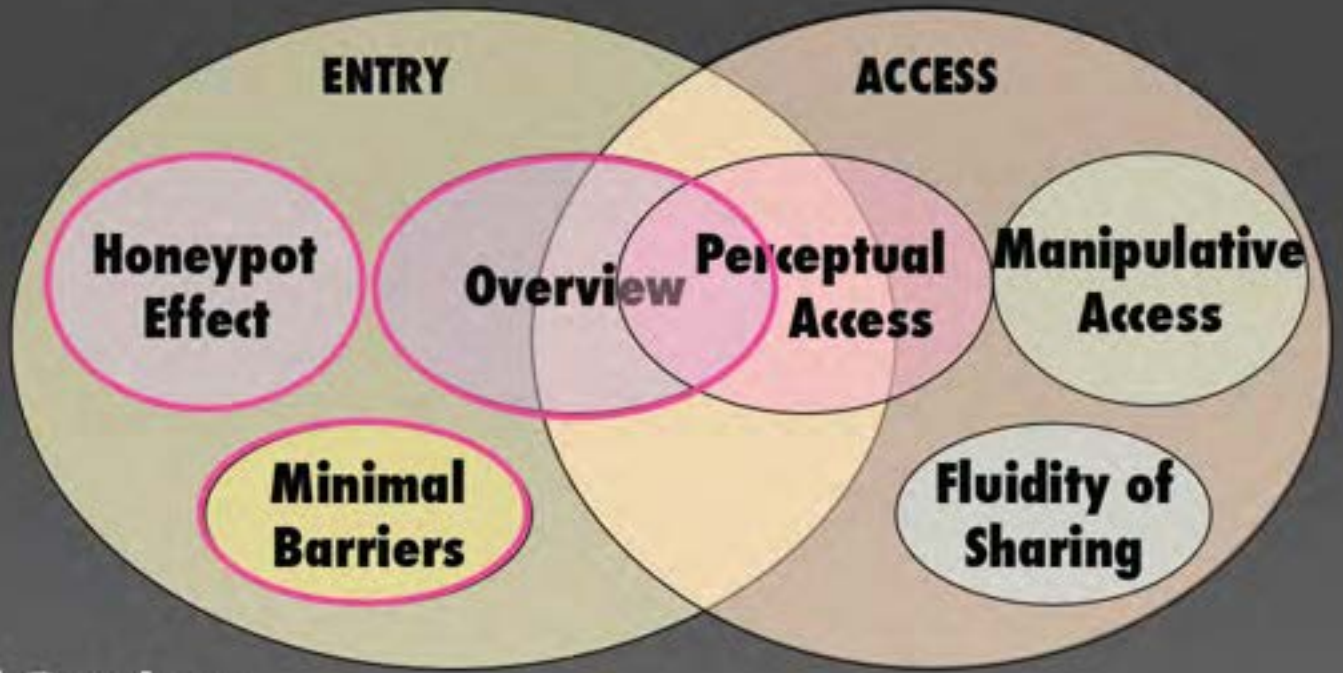
Access Points

Enable users to actually interact and join a group 's activity



Honeypot & Progressive lures
Drawing people in
Series of promises and rewards
Observing other people acting
congregate in vicinity
Stages of engagement

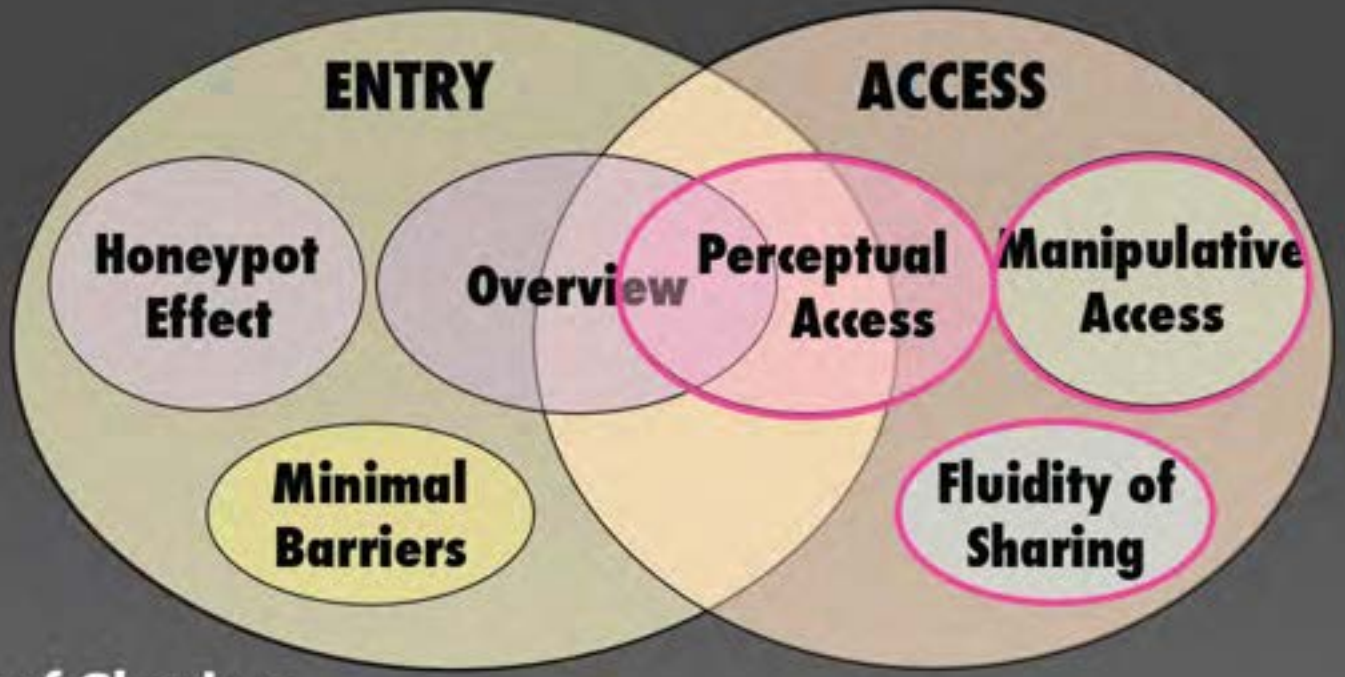
Points of prospect and overviews
See what space contains.What
can you do? (and why?)
Visibility in context and from
distance



Minimal Barriers
Physical, aesthetic barriers, illegibility ...
Appropriateness for user group, time and opportunity to interact

Perceptual Access
Cues: body movement, feedthrough, object changes....
Observability & Legibility

Manipulative Access
Who can interact and when?
Number & type of input
Location of input, Size and form
Ease of acting

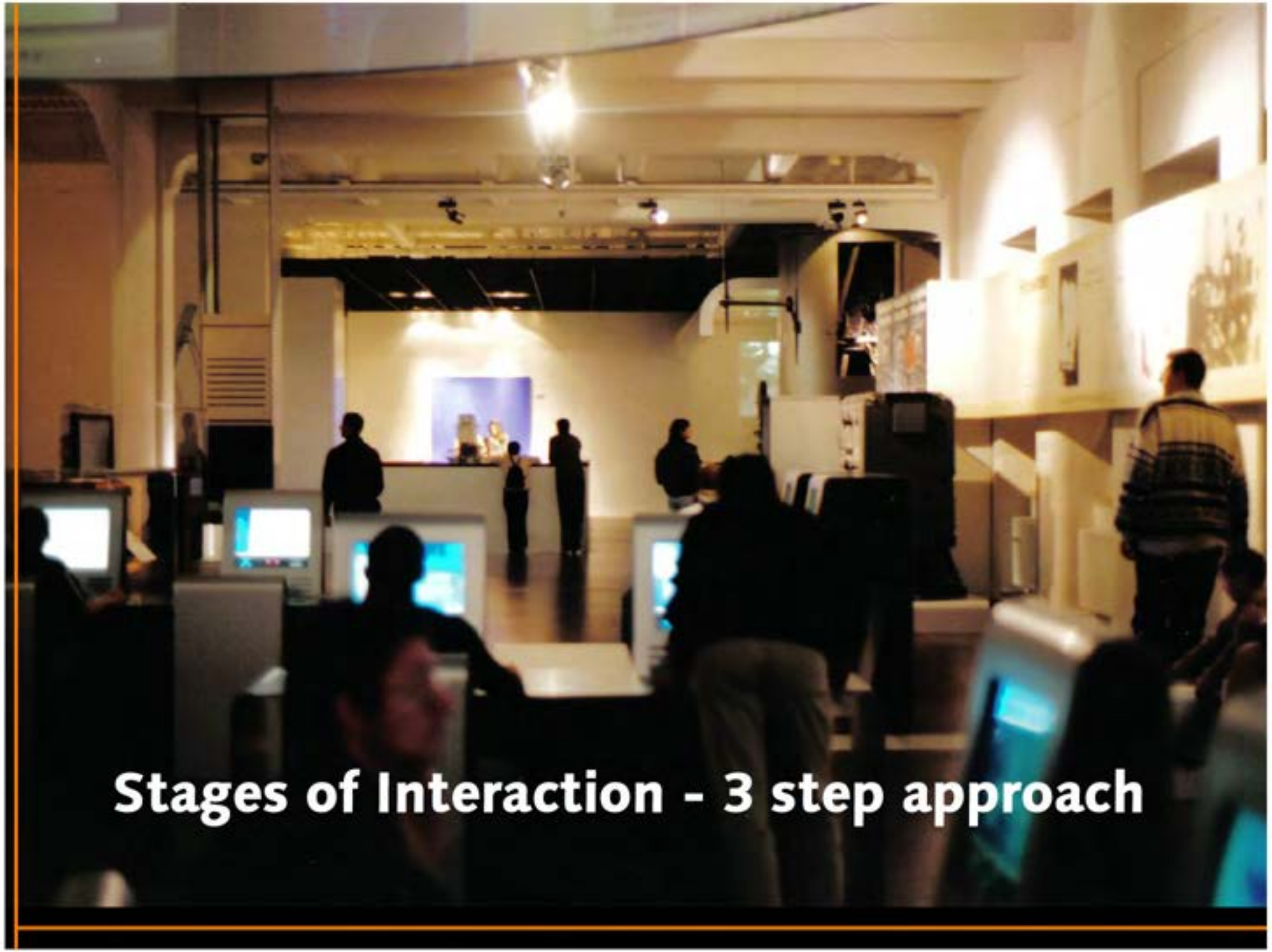


Fluidity of Sharing
Ease of switching roles or interleaving actions - handovers (of object, action, control), shared ownership

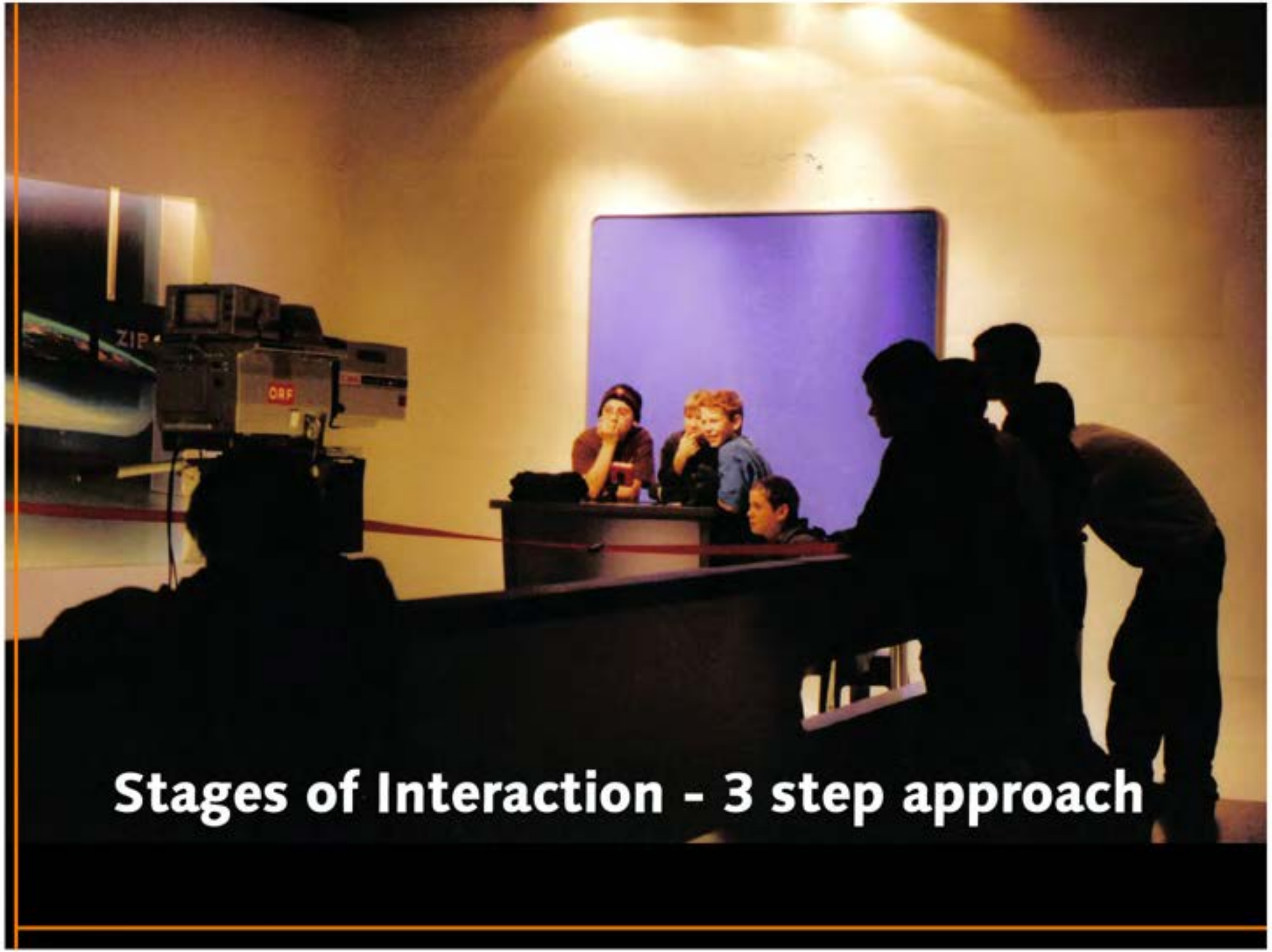

ORF


Point of
prospect


Shared
Focus
Honeypot
Threshold/
Barrier


Stages of Interaction - 3 step approach

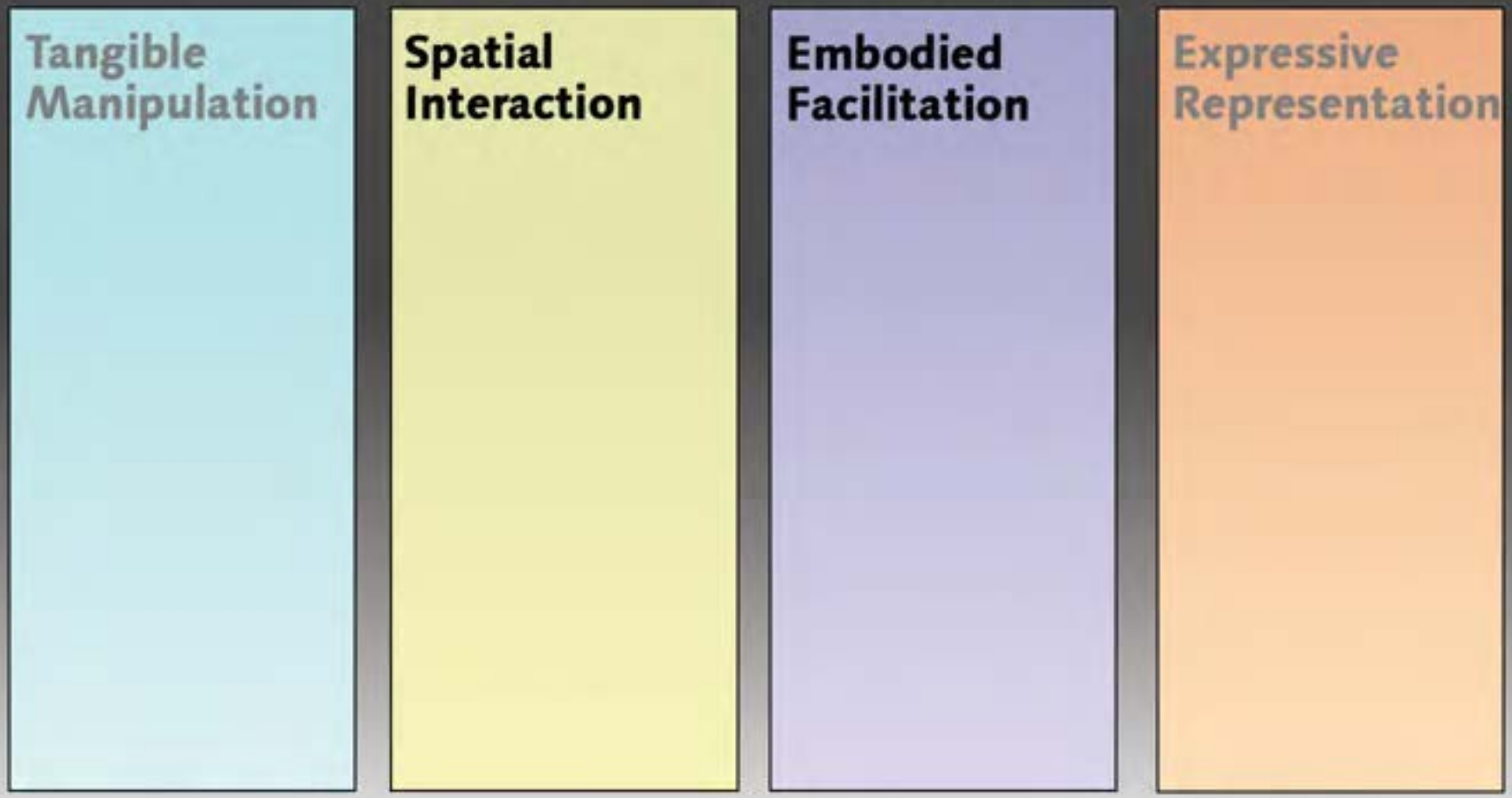

Stages of Interaction - 3 step approach



Stages of Interaction - 3 step approach

Shareable Interfaces – Part of a longer standing research agenda

Shareability – builds on TI framework on physical space and social interaction



Hornecker & Buur, CHI 2006

Relevant Themes

- **Spatial Interaction**
  - spatial nature of tangible interaction setup, consequences of interaction occurring within space, ability to engage in full-body interaction
- **Embodied Facilitation**
  - highlights how physical, spatial, and programmed configuration of system affect group interaction patterns
  - Physical (and software) design defines structure that facilitates, prohibits or hinders actions, allowing, directing, and limiting behaviour

Spatial Interaction

Can everybody see and follow what's happening?

Perceptual Access

Spatial Interaction > Visual Access

Can you use your whole body?

Bodily interaction is enlivening, expressive, observable, performative.

Spatial Interaction > Full-Body Interaction

Can you communicate through your body movements while doing what you do?

Flip:'Actors enhancing legibility of actions for other's perceptual access

Spatial Interaction > Performative Actions

Are actions publicly available?

Spatial Interaction > Performative Actions

Embodied Faciliation

Can all users get their hands on the central objects of interest?

Access points!



Embodied Facilitation > (Multiple) Access Points

Can you hand over control anytime, and fluidly share an activity?

Fluidity of sharing


Embodied Facilitation > (Multiple) Access Points

Does the representation build on users' experience and connect with their skills?


Embodied Facilitation > Tailored Representations

What is the entry threshold for interaction?

(Can you provide a simple syntax of interaction regardless of the semantics?)

Embodied Facilitation > Tailored Representations

Embodied Faciliation

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Embodied Facilitation > Tailored Representations

What is the entry threshold for interaction?

(Can you provide a simple syntax of interaction regardless of the semantics?)

Embodied Facilitation > Tailored Representations

Embodied Faciliation

Related to Honeypot effect + Perceptual Access (F-formation idea)

Does the physical set-up lead users to collaborate by subtly constraining their behavior?

Embodied Facilitation > Embodied Constraints

Is there a physical focus that draws the group together?

Embodied Facilitation > Embodied Constraints

Relation of the two frameworks/models

- TI framework focuses on representations and **interaction modalities**
- Entry & Access Points model ignores these, focus is on the **trajectory of interaction**
  - But includes some aspects from TI framework (multiple access points, lightweight interaction, visual/perceptual access)

- TI Embodied facilitation theme includes enforcing collaboration
- E&A model concerned with encouraging and enabling collaboration

Generating more detailed research questions

How do number and type of **access points** affect group interaction?

What exactly are the effects?

Can we operationalize access points?

Tabletop study with varying input conditions

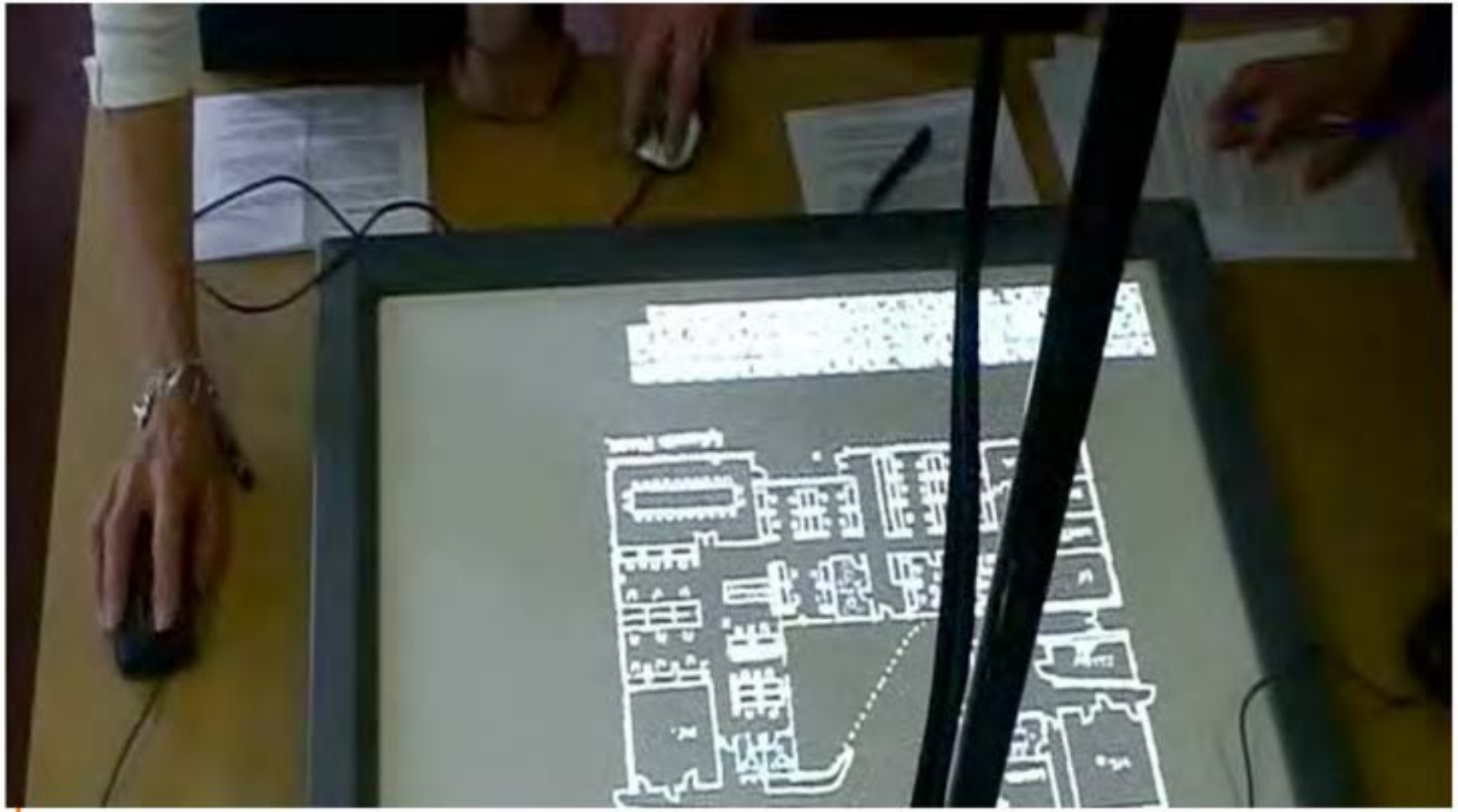
Hornecker et al. *Collaboration and Interference: Awareness with Mice or Touch Input*. Proc of ACM CSCCW 2008

Device: MERL multitouch table

allows multiple touches and distinguishes people

TASK:

Floor plan seating allocation



Mice

- Effects on perceptual access (visibility, legibility)?
- Different type of manipulative access

How to measure Awareness?

Comparative Experiment (Multi)Touch vs. (Multi)Mice

3 types of Awareness Indicators

- Positive: Awareness presence
  - Awareness helps achieve coordination, anticipation, mutual help
- Negative: Awareness absence/lack
  - Breakdowns of coordination:
- Or people investing effort to maintain awareness!
  - Awareness work

Fluid interaction

handover without words

Fluid interaction

handover without words

Fluid interaction

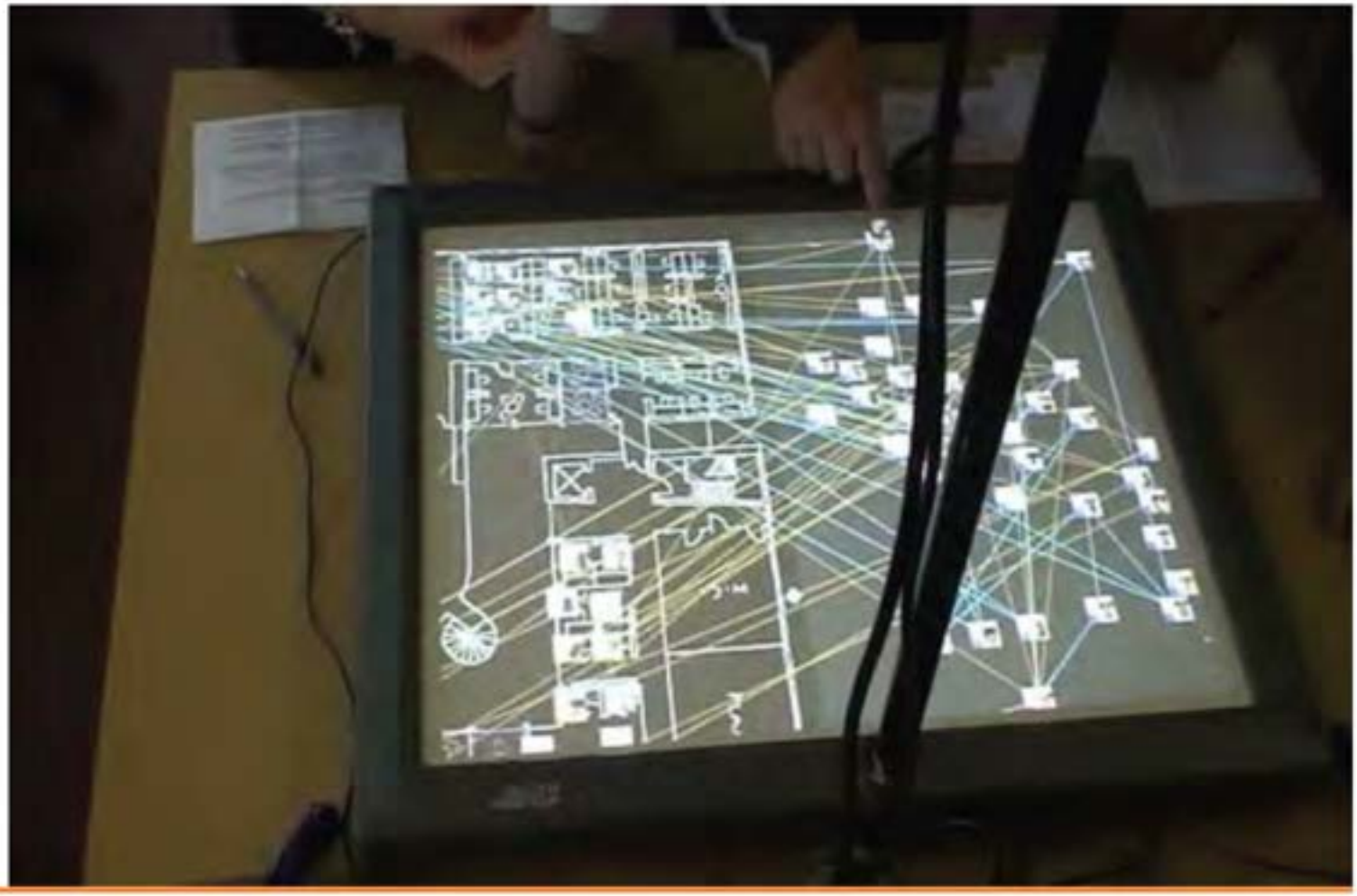
handover without words

Fluid interaction

handover without words

Negative awareness indicators

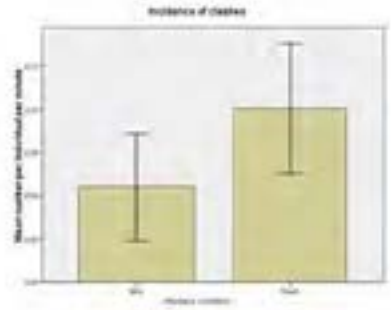
1. negative interference between users' actions

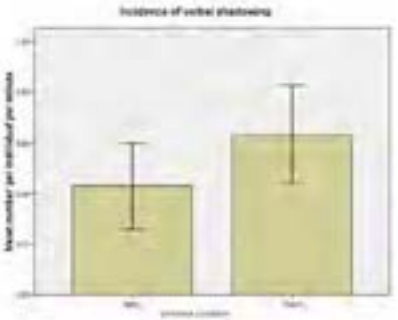


Findings

Unexpected

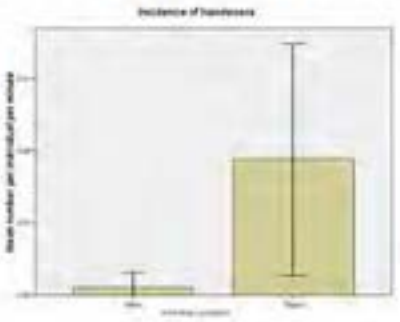
- Negative Indices: more interference w. touch
- More effort: more verbal shadowing w. touch

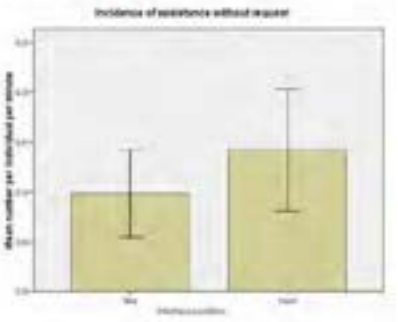




As Expected: Positive Indices

- More implicit reactions/assistance w. touch
- More handovers w. touch





How to reconcile?

Re-analysis and Re-coding

1. Interferences result only in slight glitches and are quickly resolved (often nonverbal)
2. Most groups resort to sequential interaction with mice

Touch encourages more dense interactions

-> notion of **fluidity of interaction**

Fluid role swapping and shifting of control

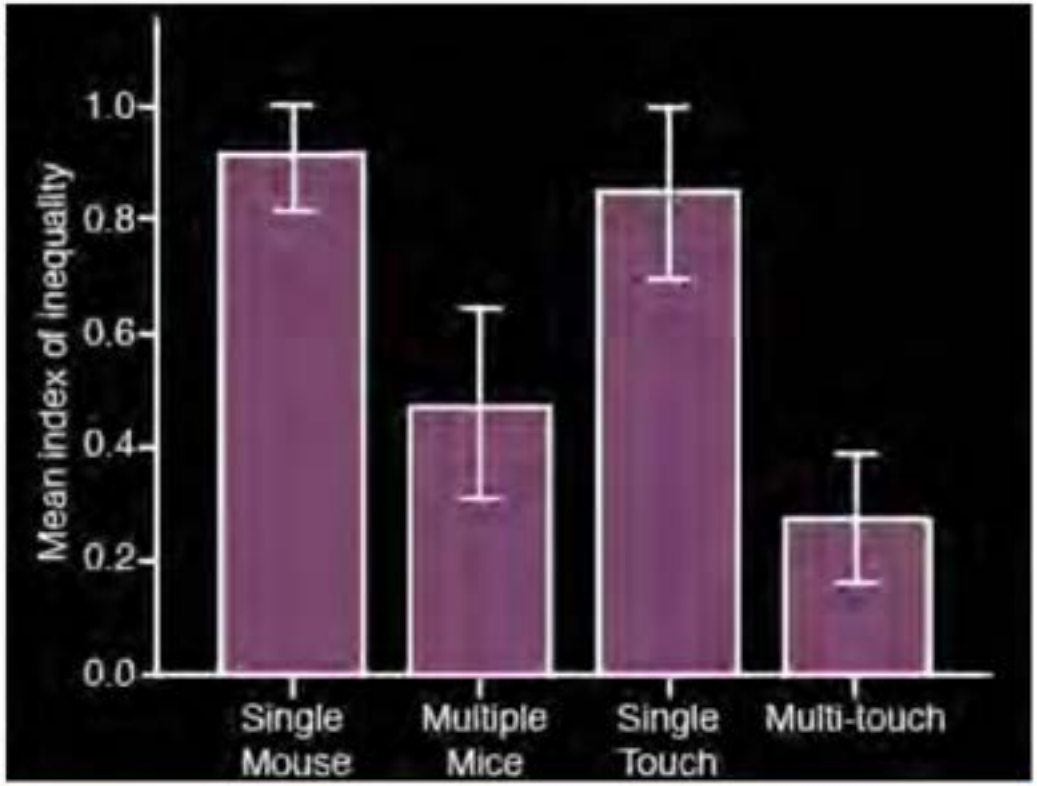
Simultaneous activity, people do not try to avoid interferences but just do it…

Manual Equity of Participation

Do more access points and touch interaction ease access and increase participation?

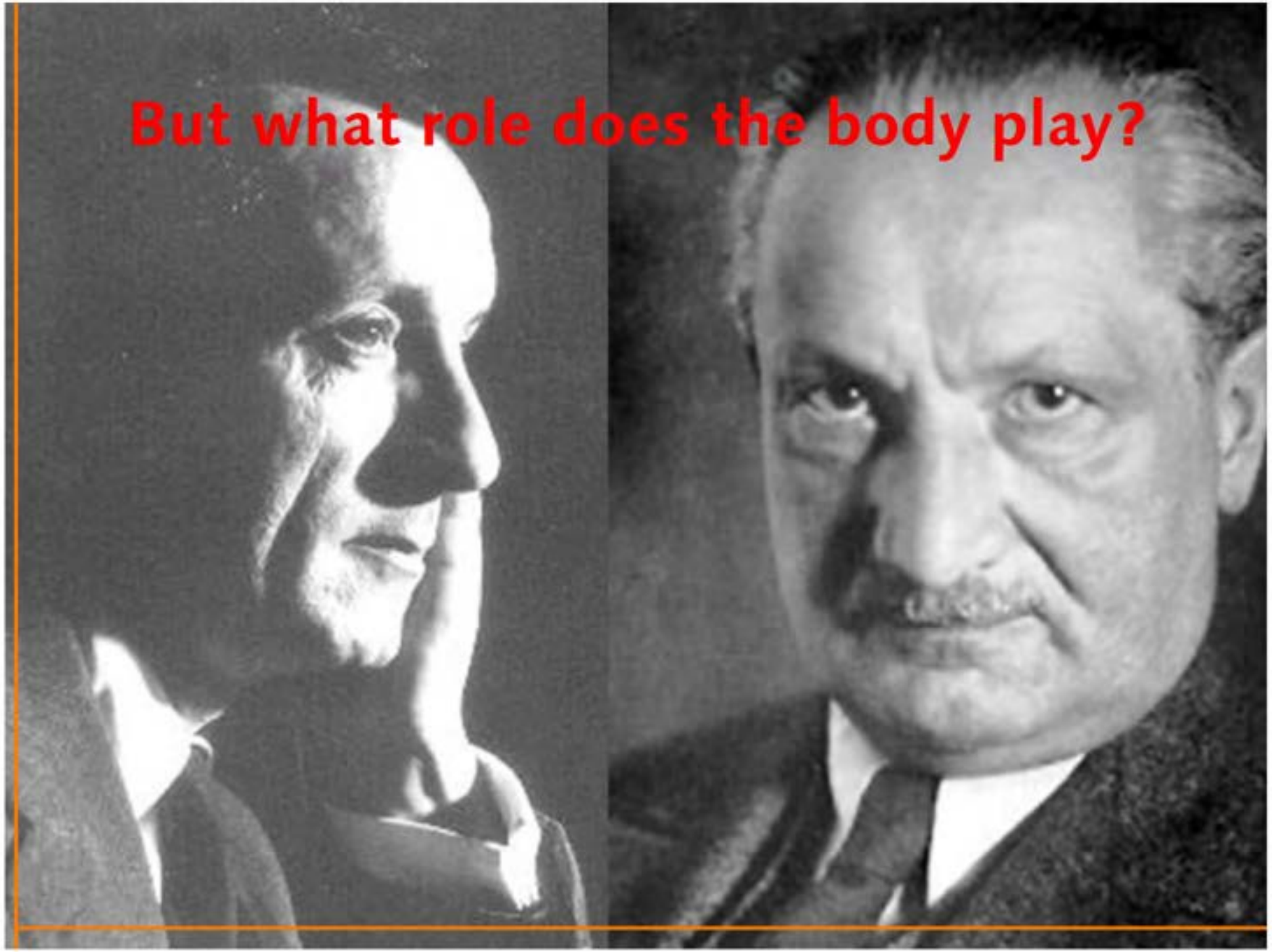
index of inequality (Hiltz et al.)

(0 = optimal equity,
1 = absolute inequality)

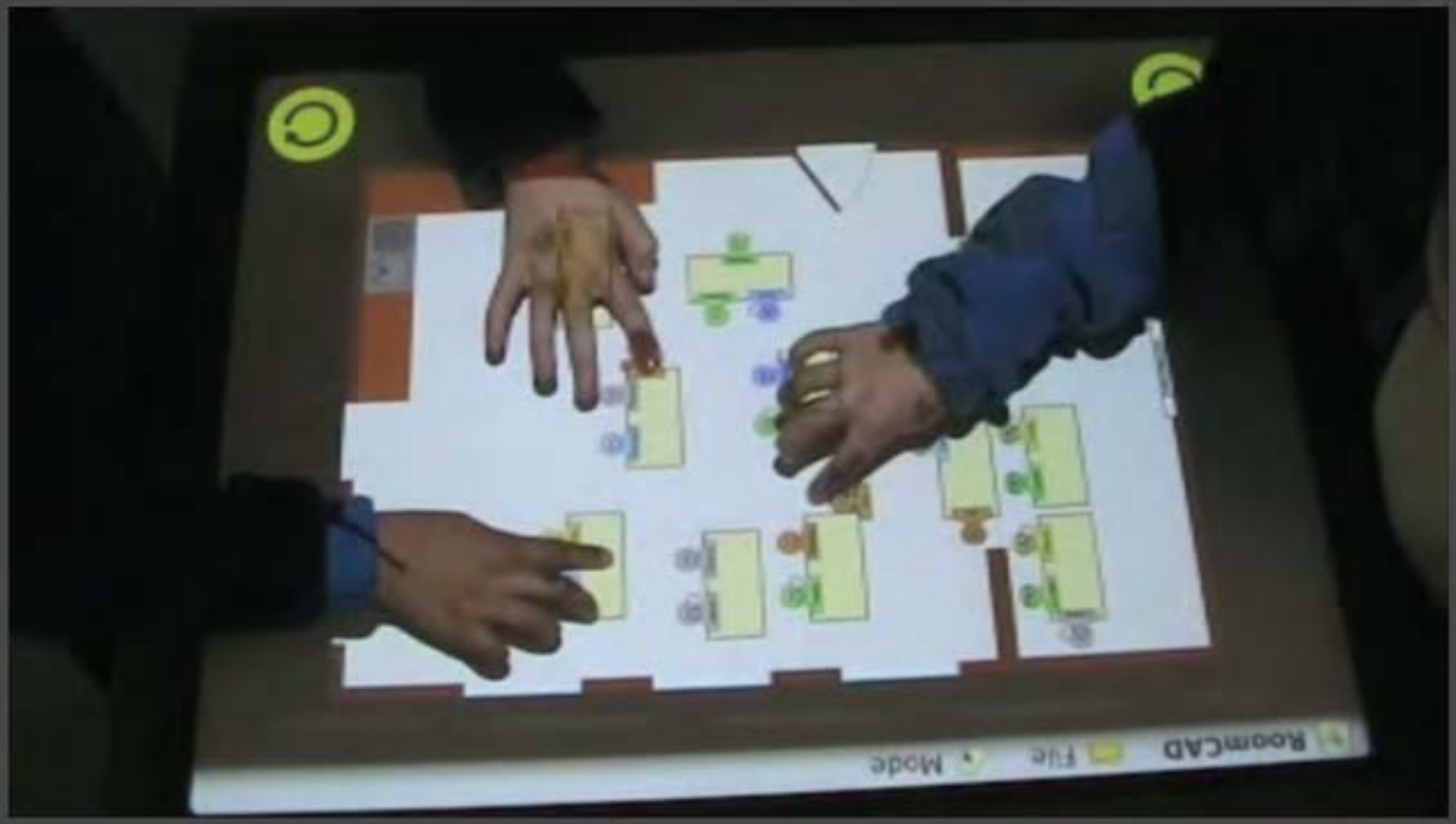


Case Studies of Shareable and less shareable Interfaces

- How the physical structure of the body and the orientation of multiple bodies in a collaboration interact with the technology set-up
- Differences in interaction patterns and user experience that result from physical setup and interaction mechanisms with identical content
- Rich ecologies of (social) interaction around 'open systems'
- Limited access points are not always negative
- Role of tangible access points for negotiation of control
- Interaction and Spatiality
- Moveable versus static input interfaces


But what role does the body play?

Marshall et al. Fighting for Control. Embodied Negotiation of Access to Digital and Physical Representations. Proc. of ACM CHI 2009



Marshall et al. Fighting for Control. Embodied Negotiation of Access to Digital and Physical Representations. Proc. of ACM CHI 2009

Early Study: Technical Museum Vienna






Groups vs. solitary usage

Sharing activity

Like being active (not info push)

Creative appropriation & challenge

F-formation Theory as Inspiration for HCI

Is there a physical focus that draws the group together?

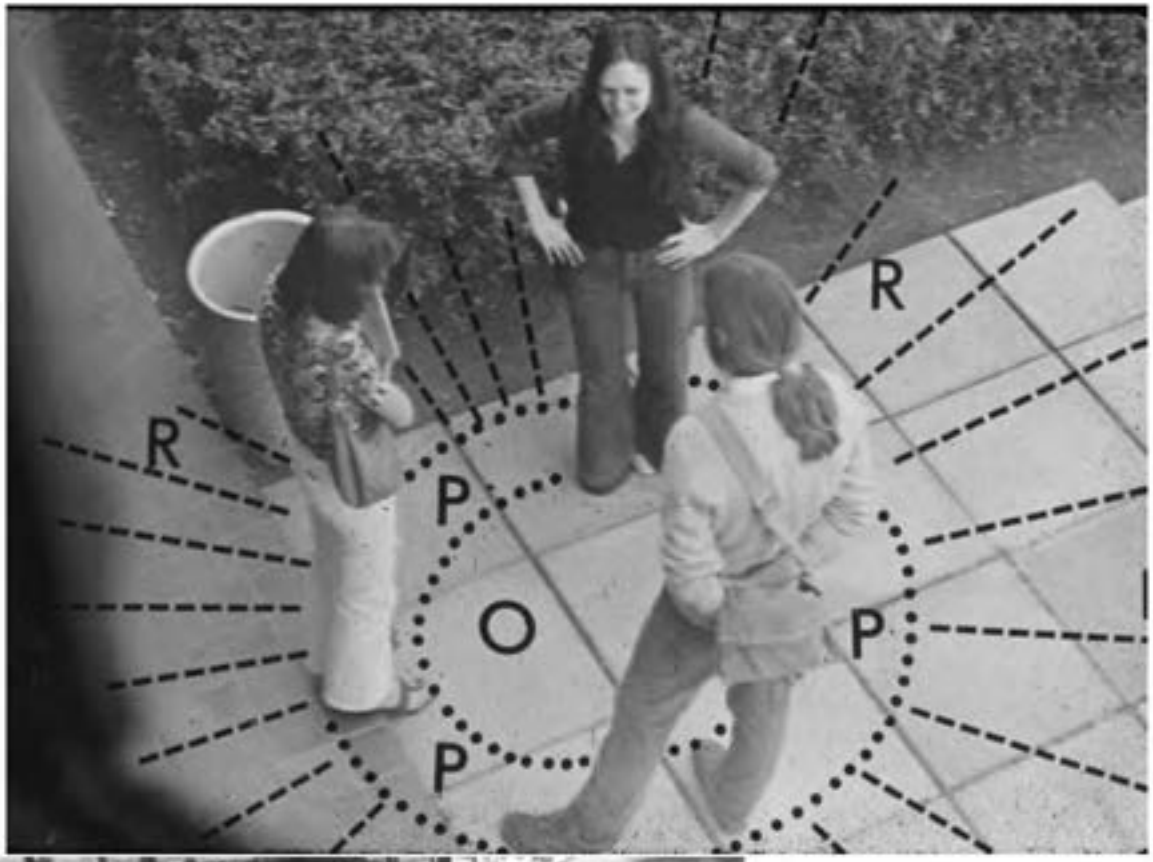
Being able to

- surround the installation
- see what each other is doing
- have a shared focus of attention

Size of space affects potential size of group

Installation design can create this space

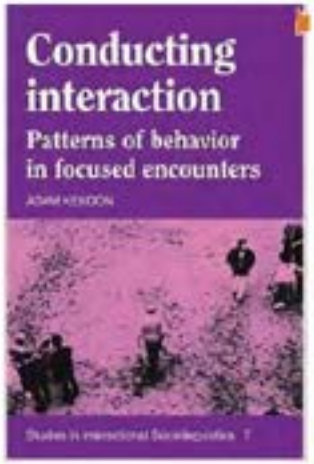
Theory Background: Adam Kendon on Spacing and Orientation: F-formations



O-space: shared space that all are oriented to, actively maintained

P-space: 'holding area' for bodies and objects

R-space: buffer zone



Kendon: Different types of configuation

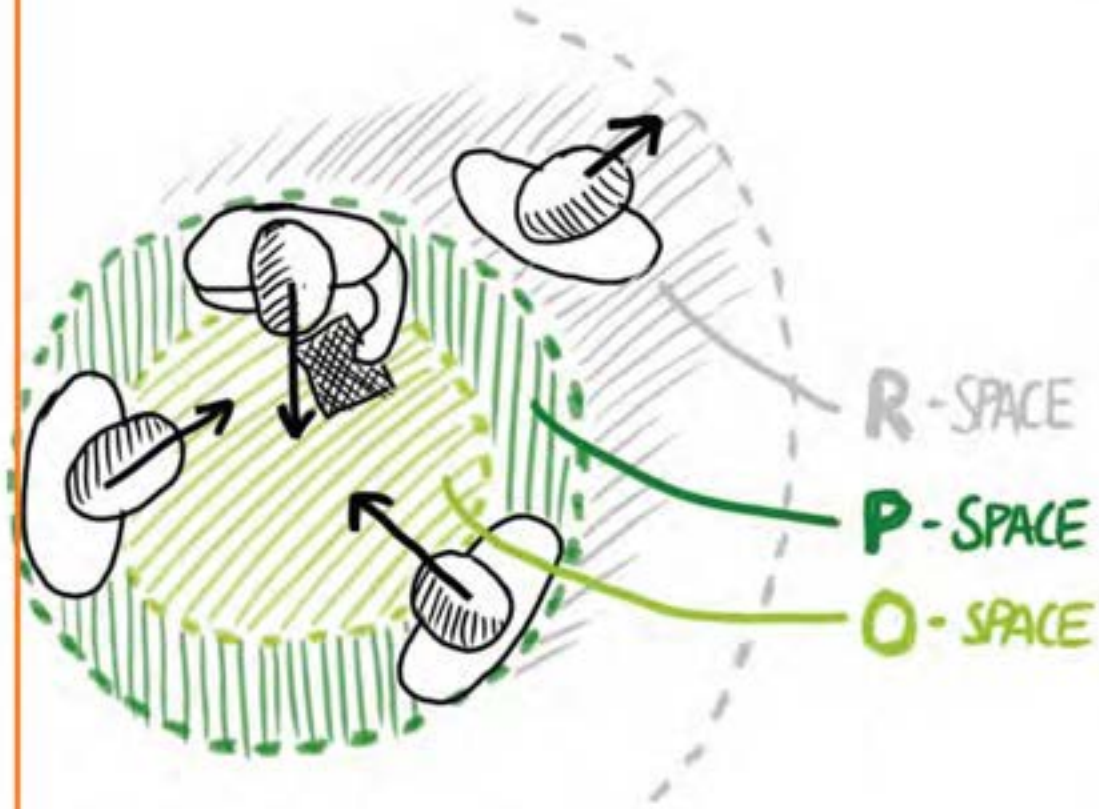
Face-to-Face: relationship focused
(greetings, fights)

Side-by-side: shared focus in outside world
(compromise with attempt for mutual awareness in conversation)

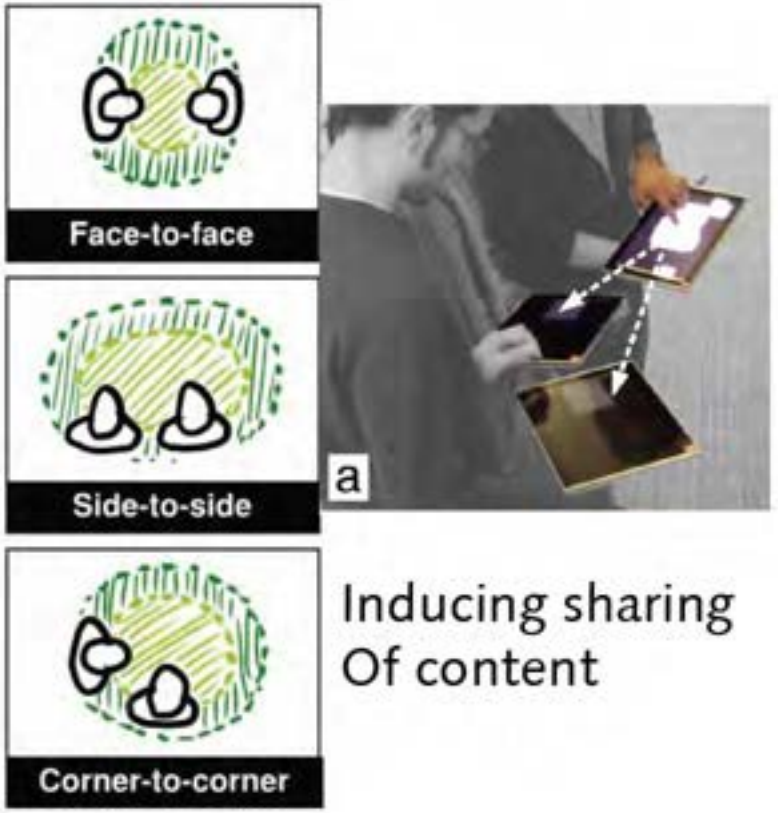
L-Shape: disembodied, abstract topic

(Images from: Marquardt, Hinckley, Greenberg (2012): Cross-Device Interaction via Micro-mobility and F-formations. Detecting formations to support colocated interactions. UIST'12

Use of F-formation theory in HCI



Tracking bodies and devices



Inducing sharing
Of content

Marquardt, Hinckley, Greenberg (2012): Cross-Device Interaction via Micro-mobility and F-formations. Proc. of UIST 2012

F-formations in HCI ethnography and design

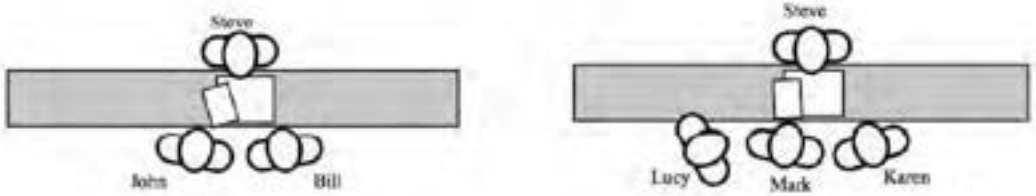
Tourist Office Study

- "Quick and dirty" scoping study
- Focus on joint decision making and information sharing

- ➢ Found very little joint decision making for groups larger than 2
- ➢ Influence of the physical environment!

Marshall, P., Rogers, Y. and Pantidi, N. 2011. Using F-formations to analyse spatial patterns of interaction in physical environments. CSCW '11 .

Spatial Configurations



At the Counter

- No more than 2 talk to staff
- Others excluded, leave

Around the Center

- Groups split up and forage
- One person often goes to the counter
- reports back the plan
- Gathering around wall display

Designing FOR F-formations

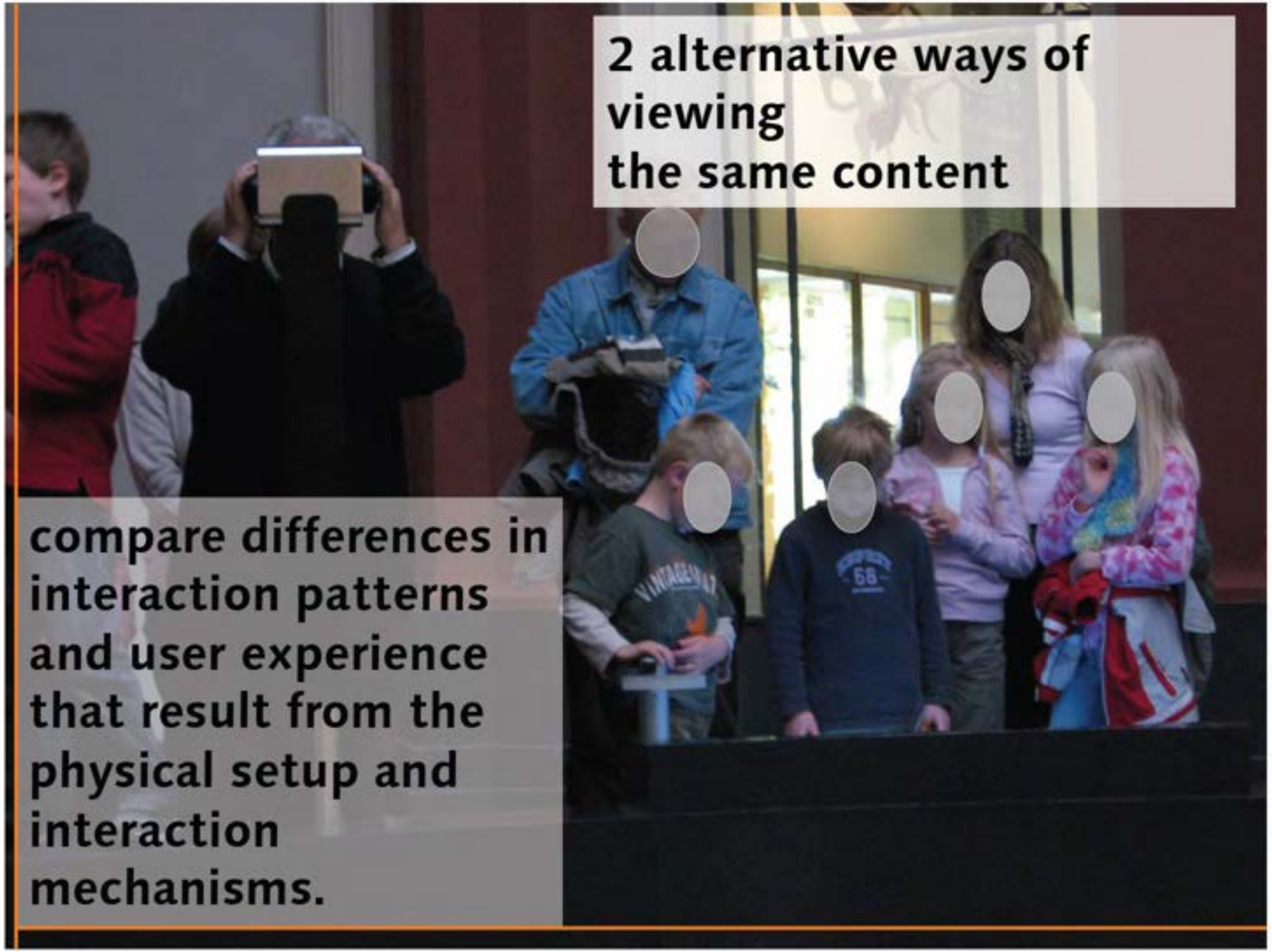
- built and installed an interactive table software for the tourist information center for families to plan their day
- Placed in tourist office for several weeks in-the-wild study

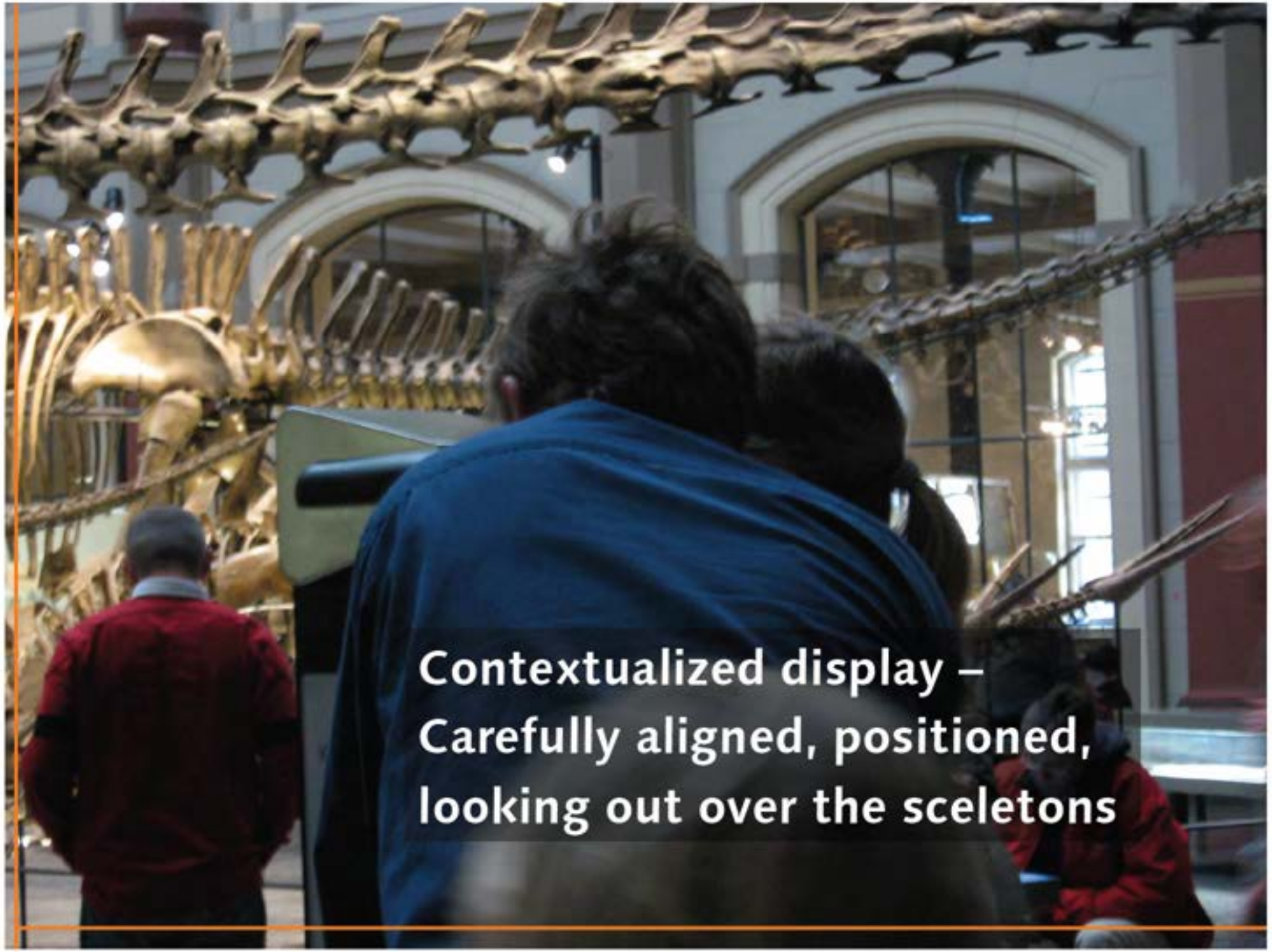
Paul Marshall et al. Rethinking '**M**ulti-**u**ser': an In-the-Wild Study of How **G**roups **A**pproach a **W**alk-**U**p-and-**U**se **T**abletop Interface. CHI 2011

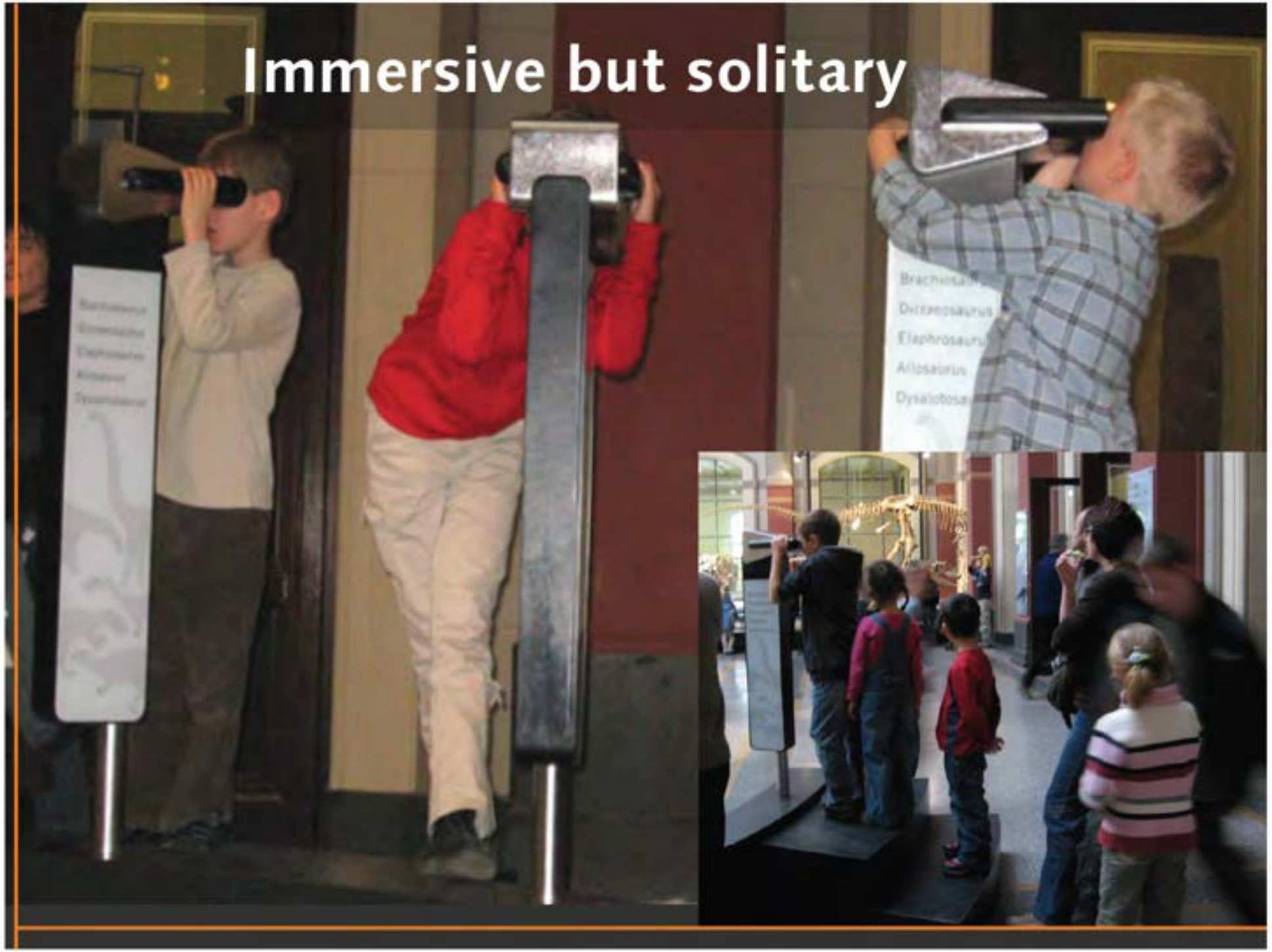
Social Encounters in the Museum Space

- Investigating what makes good museum installations that engage visitors
- Museums a good testbed for understanding what makes interaction engaging and fun, what sparks conversation and understanding
  - Interesting setting: inherently **social**
  - Multiple, conflicting goals (entertainment, education, … cognitive + emotional learning)
  - Often at forefront of utilizing novel interaction mechanisms in public spaces

Case Study: Jurascopes


2 alternative ways of viewing the same content
compare differences in interaction patterns and user experience that result from the physical setup and interaction mechanisms.


Contextualized display –
Carefully aligned, positioned,
looking out over the sceletons


Immersive but solitary

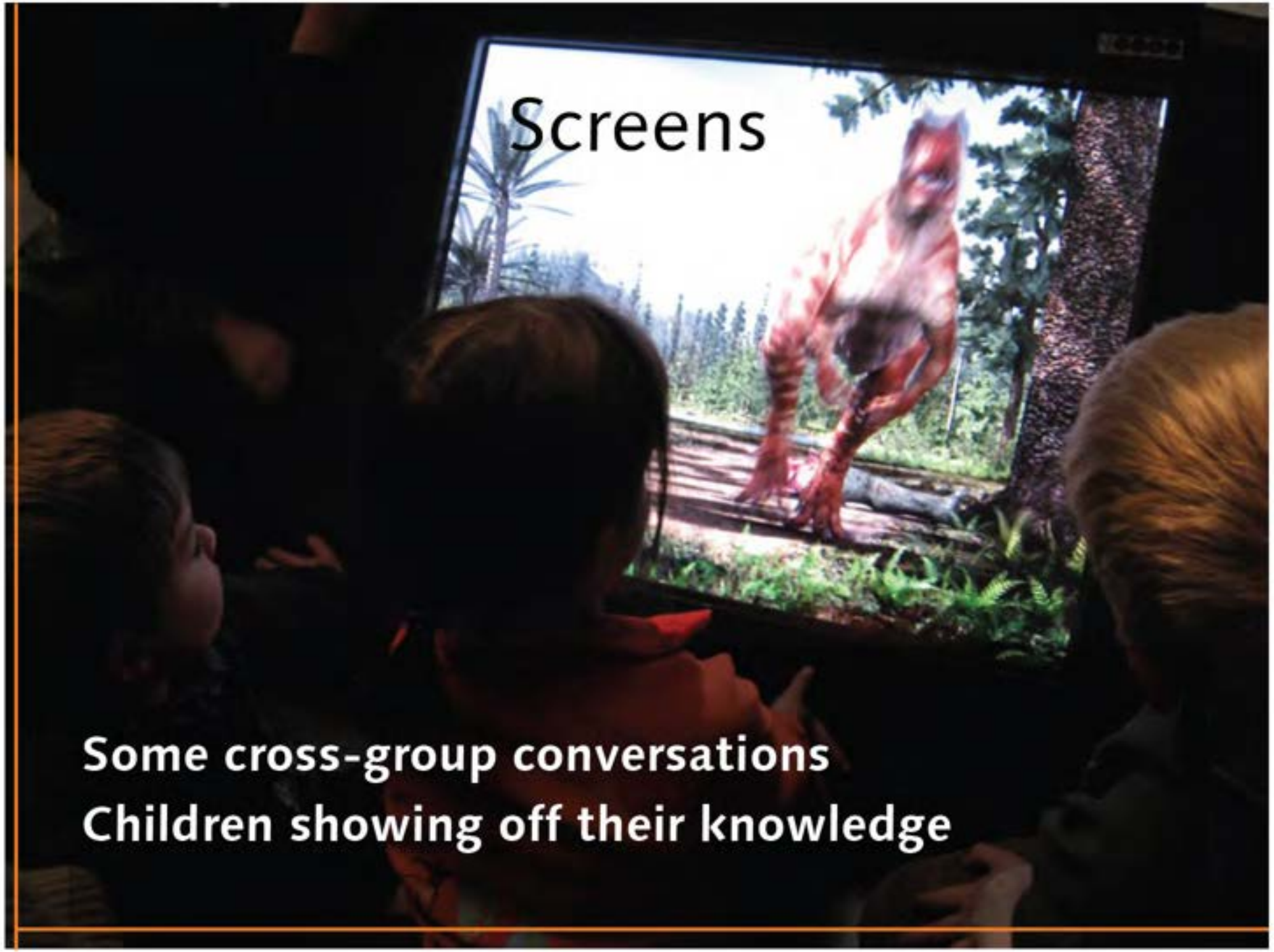
Solitary immersion

- "more direct"
- being inside the story
- But – can't be shared, no cues about what others see

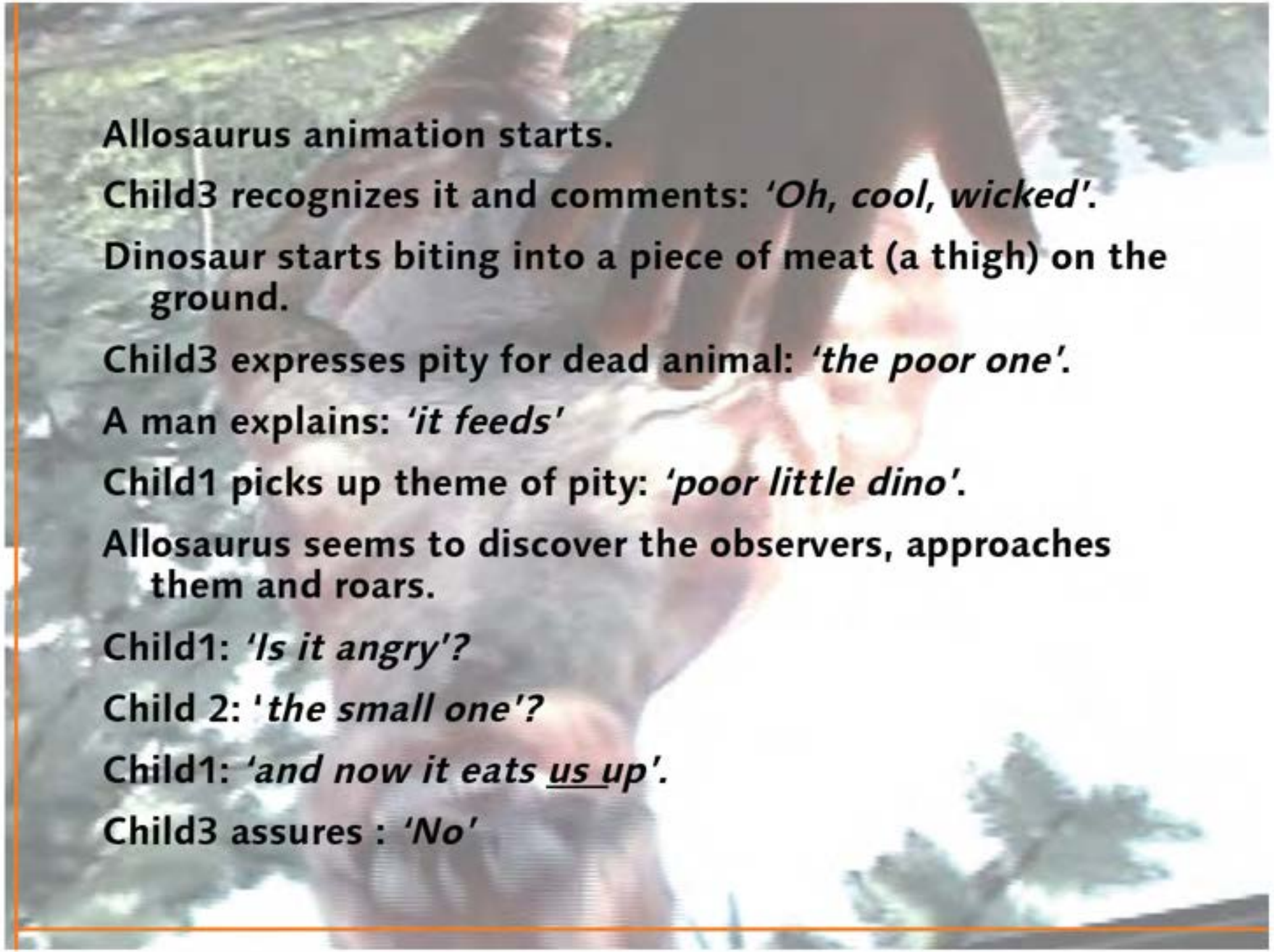
Communication attempts unsuccessful, no reaction

Parents can't facilitate children's experience (help, scaffold, explain)


essentially social and shared experience
Crowds – watching, commenting, scaffolding,
negotiating selections


Screens
Some cross-group conversations
Children showing off their knowledge


Children ‚interacting' with dinosaurs
– teasing, play
"bite me, bite me"



Allosaurus animation starts.

Child3 recognizes it and comments: *'Oh, cool, wicked'*.

Dinosaur starts biting into a piece of meat (a thigh) on the ground.

Child3 expresses pity for dead animal: *'the poor one'*.

A man explains: *'it feeds'*

Child1 picks up theme of pity: *'poor little dino'*.

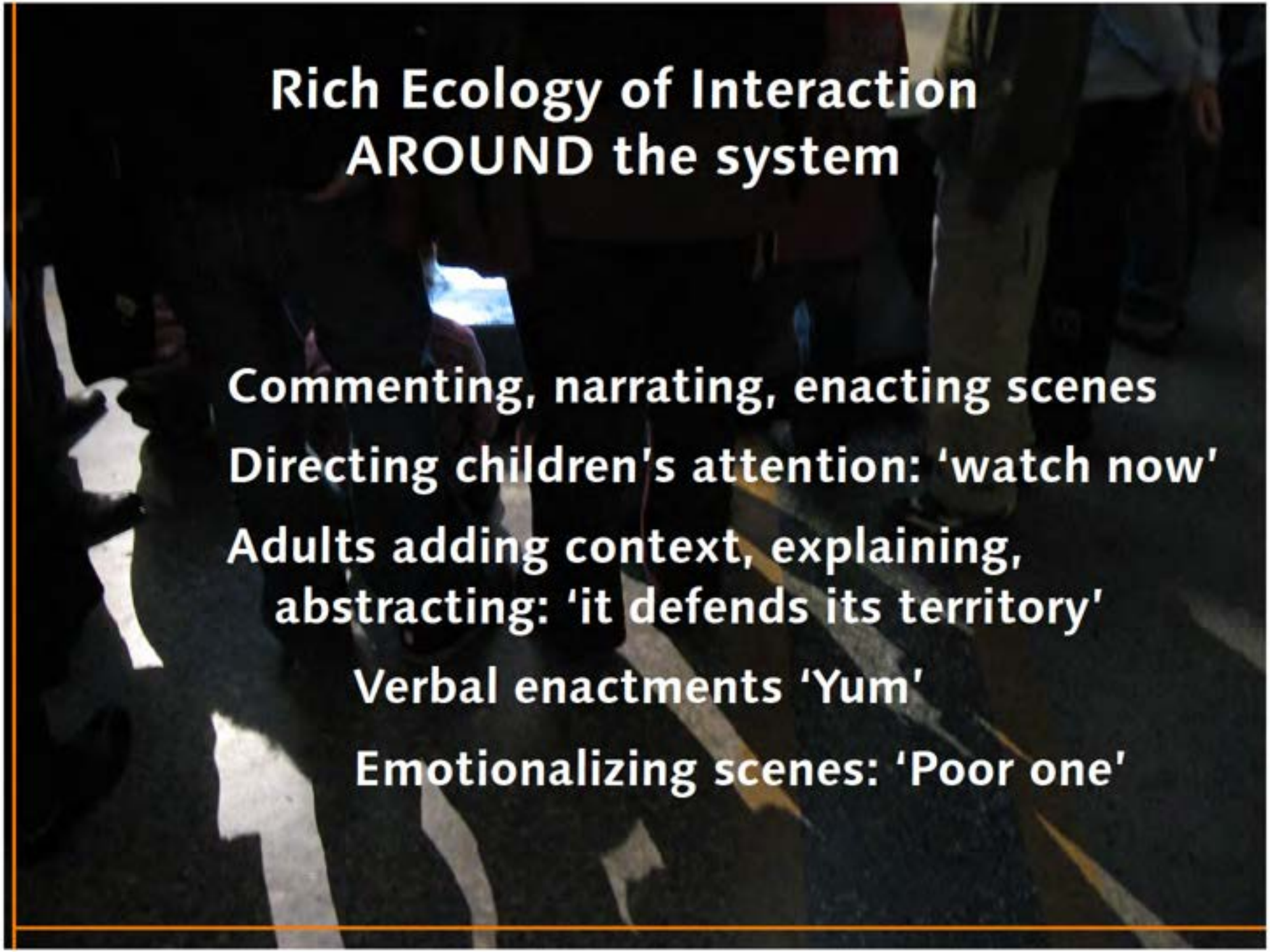
Allosaurus seems to discover the observers, approaches them and roars.

Child1: *'Is it angry'?*

Child 2: '*the small one'?*

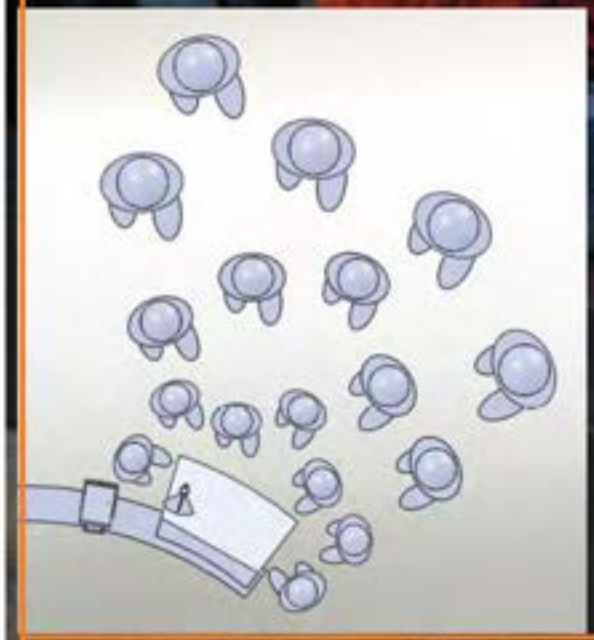
Child1: *'and now it eats us up'*.

Child3 assures : *'No'*


Rich Ecology of Interaction
AROUND the system
Commenting, narrating, enacting scenes
Directing children's attention: 'watch now'
Adults adding context, explaining,
abstracting: 'it defends its territory'
Verbal enactments 'Yum'
Emotionalizing scenes: 'Poor one'


Tangible Externalization
of Control

Emerging Physical Configuration: 3D-half-circle– A honeypot effect attractor



Insights

- Screens turned out to have richer ecology of interaction
  - Supporting shareability and co-experience
- Tangible and Embedded Interaction Design
  - need to consider the overall setup to create rich interactions around the system
- Interactivity a property of users (not systems...)
- Tangible control supports negotiation of use
  - (Limitation to ONE access point here useful)

The ARK- Painting Patterns for Nature (Loraine Clarke, University of Strathclyde)

Physical Resources for Planning Activities as a Parallel Process

Setup gave bystanders in group good visibility

Supports rest of group to discuss what to do next

Cards as a resource for discussion and negotiation

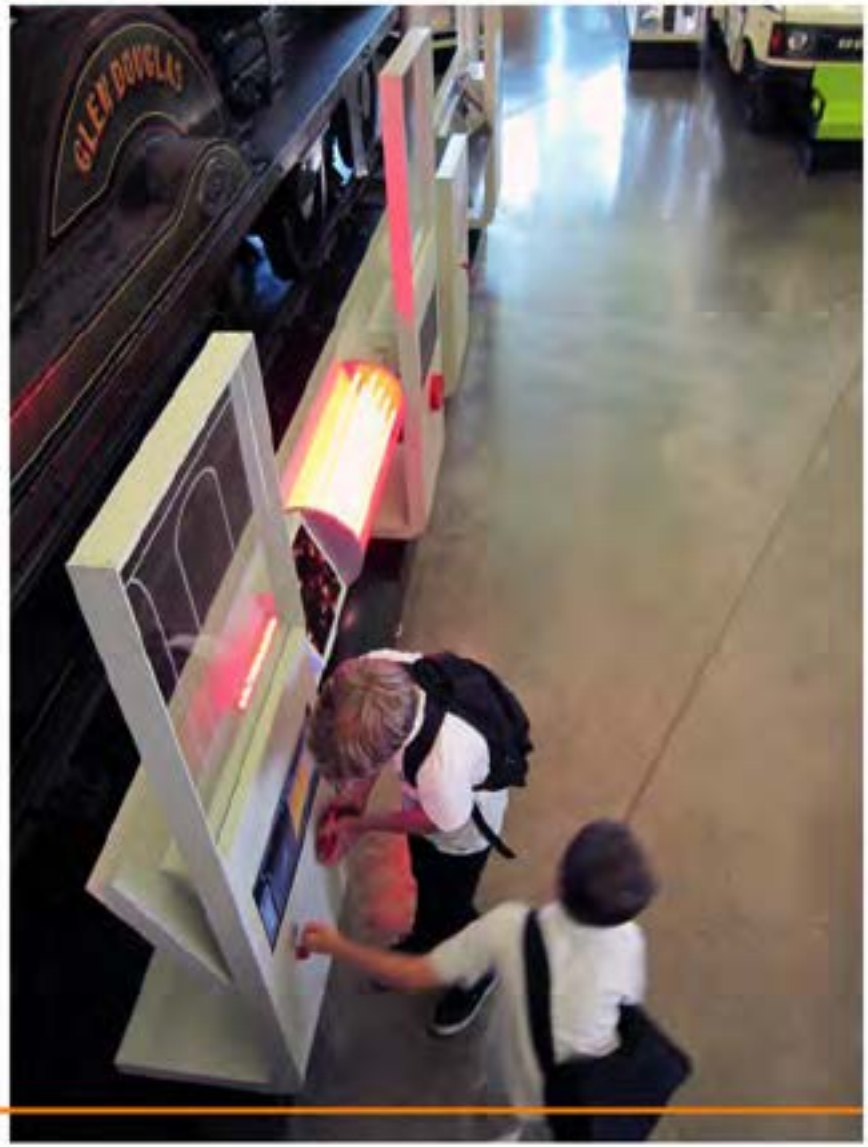
Painter undisturbed

Glen Douglas Steam Engine Installation, Riverside Museum Glasgow

Museum installation that cannot be used alone

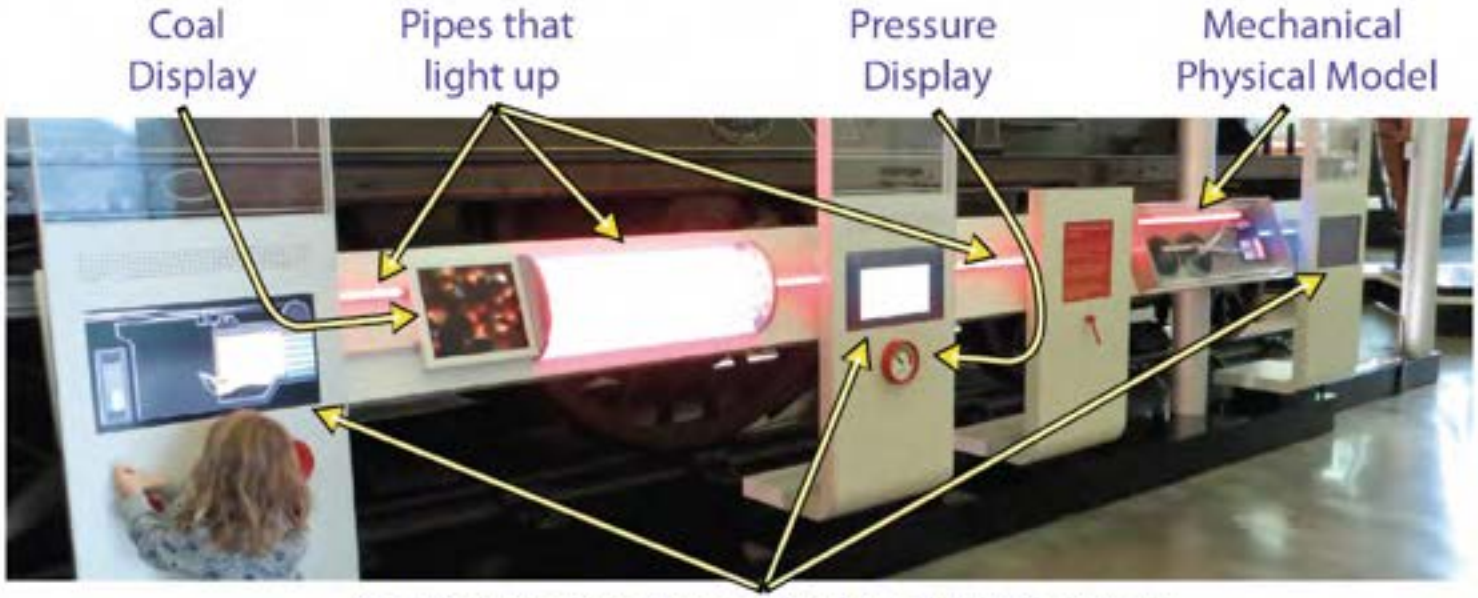
- explicitly requires a group to coordinate action
- Realizing this is the point of the exhibit!

Not explicitly communicated, but people get it after failing to get the engine running...



Clarke and Hornecker. ACM CHI 2013 WiP

Spatial distribution of displays and manipulation elements



Urban HCI

With Patrick Tobias Fischer

Media façades
Urban behaviour patterns
Interplay with architecture & urban design

How spatial configurations effect experience and social interactions

Fischer and Hornecker, *Urban HCI: Spatial Aspects in the Design of Shared Encounters for Media Façades*. Proc. of ACM CHI'2012


VR/URBAN
PRESENTS

Urban HCI: Fostering 'Shared Encounter'

[…] the interaction between two people or within a group where a sense of performative co-presence is experienced and which is characterized by a mutual recognition of spatial or social proximity (Willis 2010).

[…] a digital encounter is an ephemeral form of communication and interaction augmented by technology (Fatah gen. Schieck 2010).

A new agora

Street art style

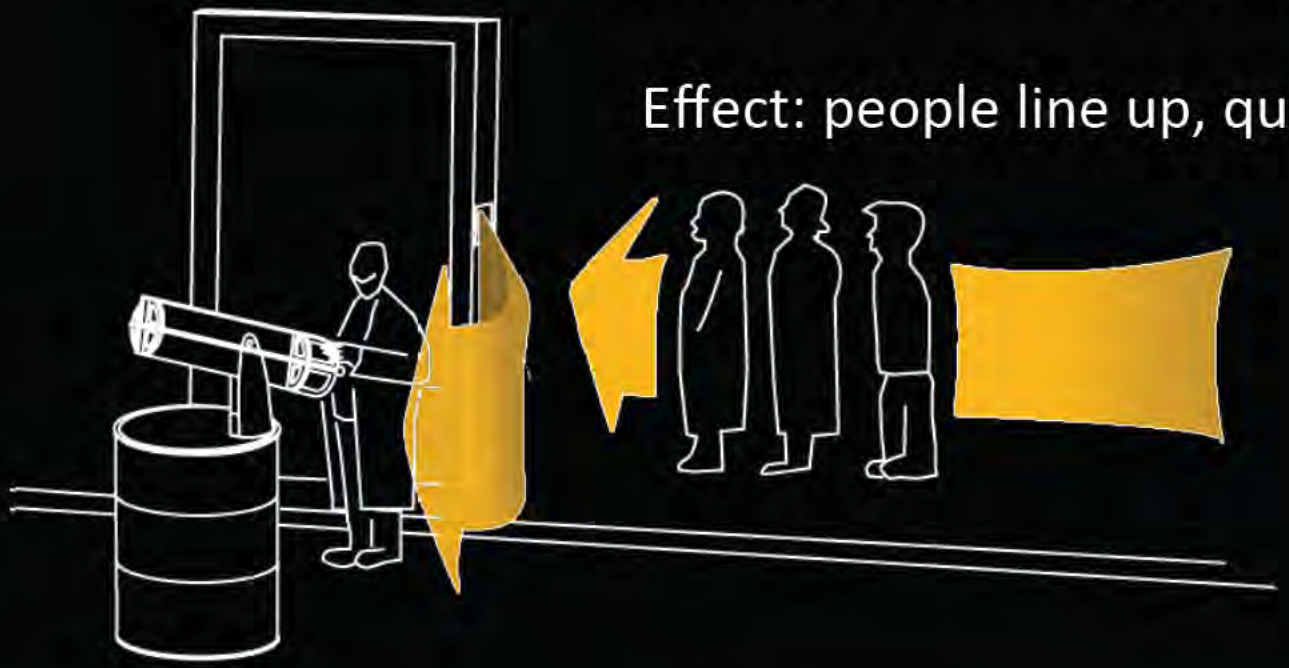
Public messages

ReClaim the Screens
SMSlingshot as research instrument

Very First System Version: spread.gun

Split into 2 fixed stations: typing messages + shooting with canon

Effect: people line up, queue



SMSSlingshot aims: more flexible, guerrilla-like, smaller, portable, less static structures and with more expressive gestures

Selection of Situations

Madrid 2010

- LED Media Facade
14,5x9,5m
- [illegible]n

Media Facade
Europe

Liverpool 2010

- Projection 21x13m
- Plaza Size 25x11m

Connected Cities

Marseille 2011

- Projection 10x13m
- Plaza Size 30x18m

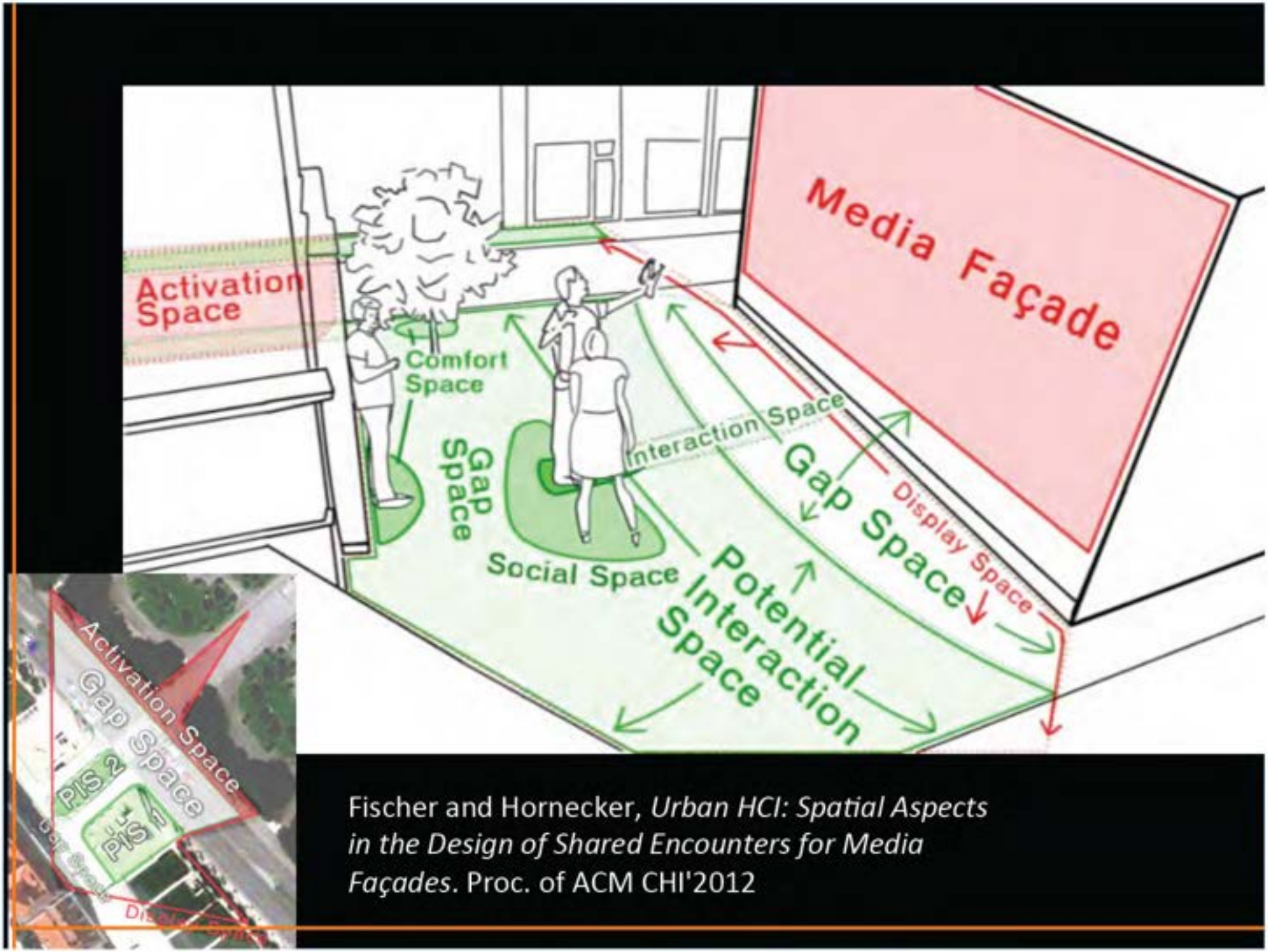
Music Festival

Plaza

- People have more time, want to relax
- Might need more narrative

- Constant flow of people
- ad-hoc, shorter interactions

Walkway



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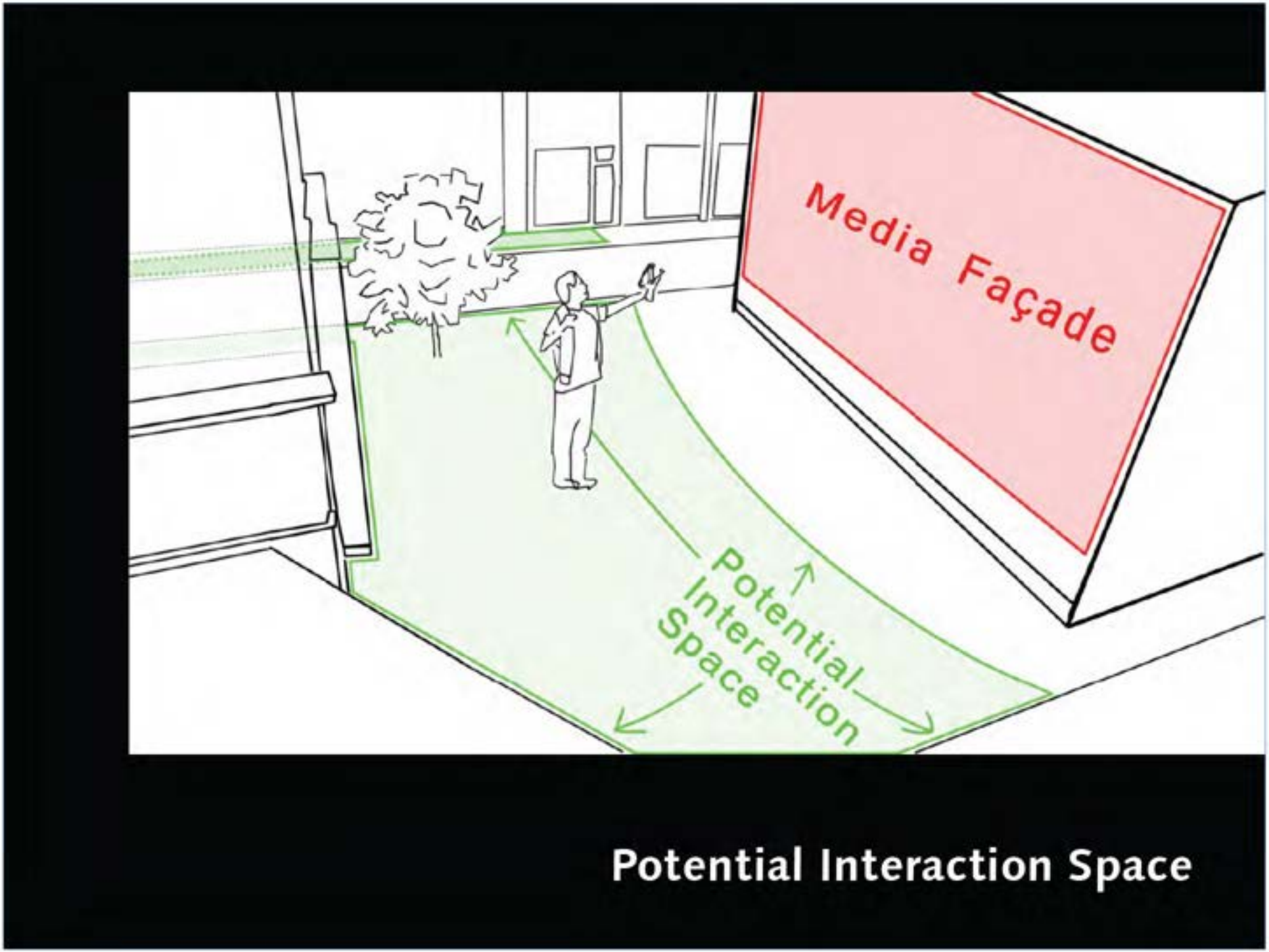
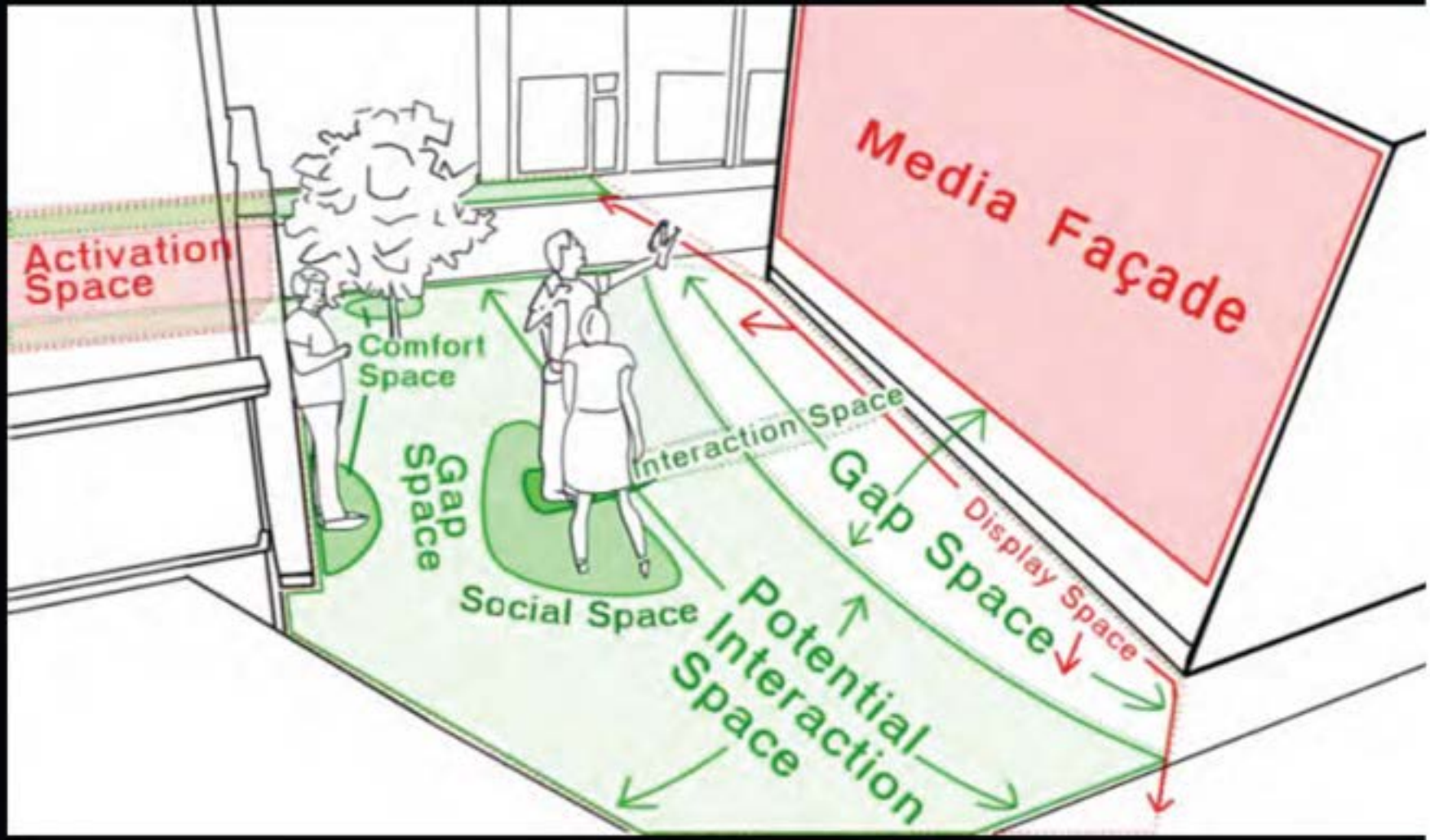


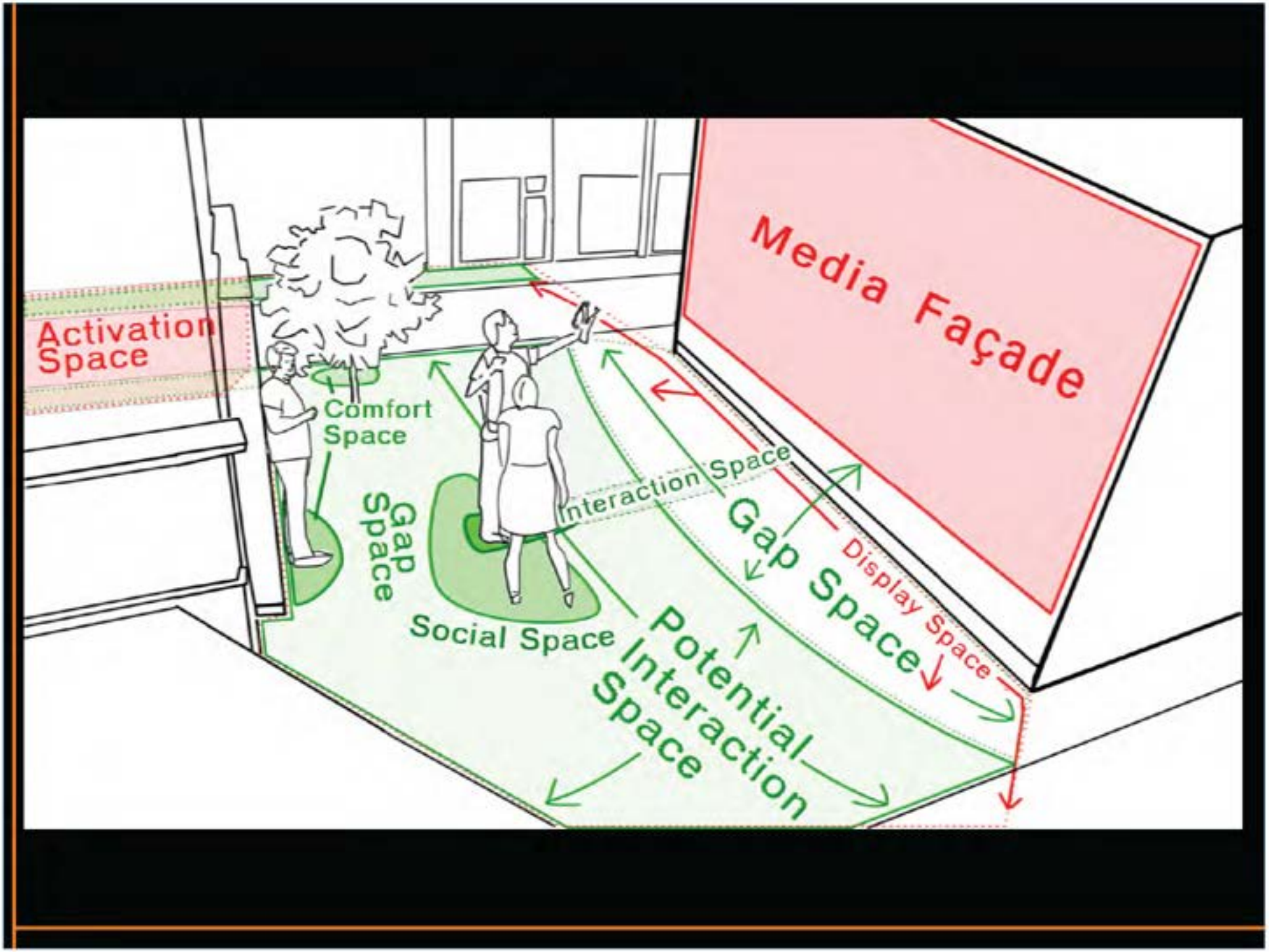
Potential Interaction Space

Potential Interaction Space


Media Façade
Activation Space
Comfort Space
Gap Space
Social Space
Interaction Space
Gap Space
Display Space
Potential Interaction Space


Social
Interaction
Space


Social
Interaction
Space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Physicality and Embodiment

- Untethered device – hand-overs
- Metaphor of slingshot easy to grasp
- Bodily experience of throwing
  - Slightly subversive, evokes feelings of unruliness, childhood play, playfool rebellion
  - Shooting is satisfying
- Typing is local, half-private
- Shooting is an expressive embodied action, public & performative

Concluding Thoughts

- Examples from variety of Activity Areas
- Museums, planning tasks, musical improvisation (jamming), Urban Art installation
- Adults and children

- HCI / Interaction Design needs to learn from (urban) sociology, architecture, urbanism, facilitation methods, kindergarden play methods etc.
- Lots of concepts and knowledge out there…

Need to learn about Spatiality

- Spatial configurations of technology and architectural design influence social interaction patterns
  - Is there 'space' for people (their bodies)?
  - Is there shared focus?
  - Is there space for more people? (Obstruction of line of sight)
  - Design with emerging configurations of people in mind!
- Rich (social) interaction can emerge around a simple system… design for interactive users!
- Human territoriality is fluid and self-regulated
  - do we need to automatize it?

Interaction Modalities Influence

- The visual access to ongoing activity
  - Easier/harder to join in
  - Effects on joint awareness – how fluid is collaboration, how fixed do roles need to be?
- Provide different affordances that affect amount of control (or how easy to negotiate control)
  - Where it is more difficult to remain in control, negotiation of control is harsher! (children)
  - Movable interfaces can support shifts of control (distribute activity, reduce threshold to interact)
- Physical interaction can increase performativity
  - Increased visibility (creates social control)

Questions?