Microsoft® Research
Faculty Summit 2010

Collaborative Visualization, Tabletop Touch

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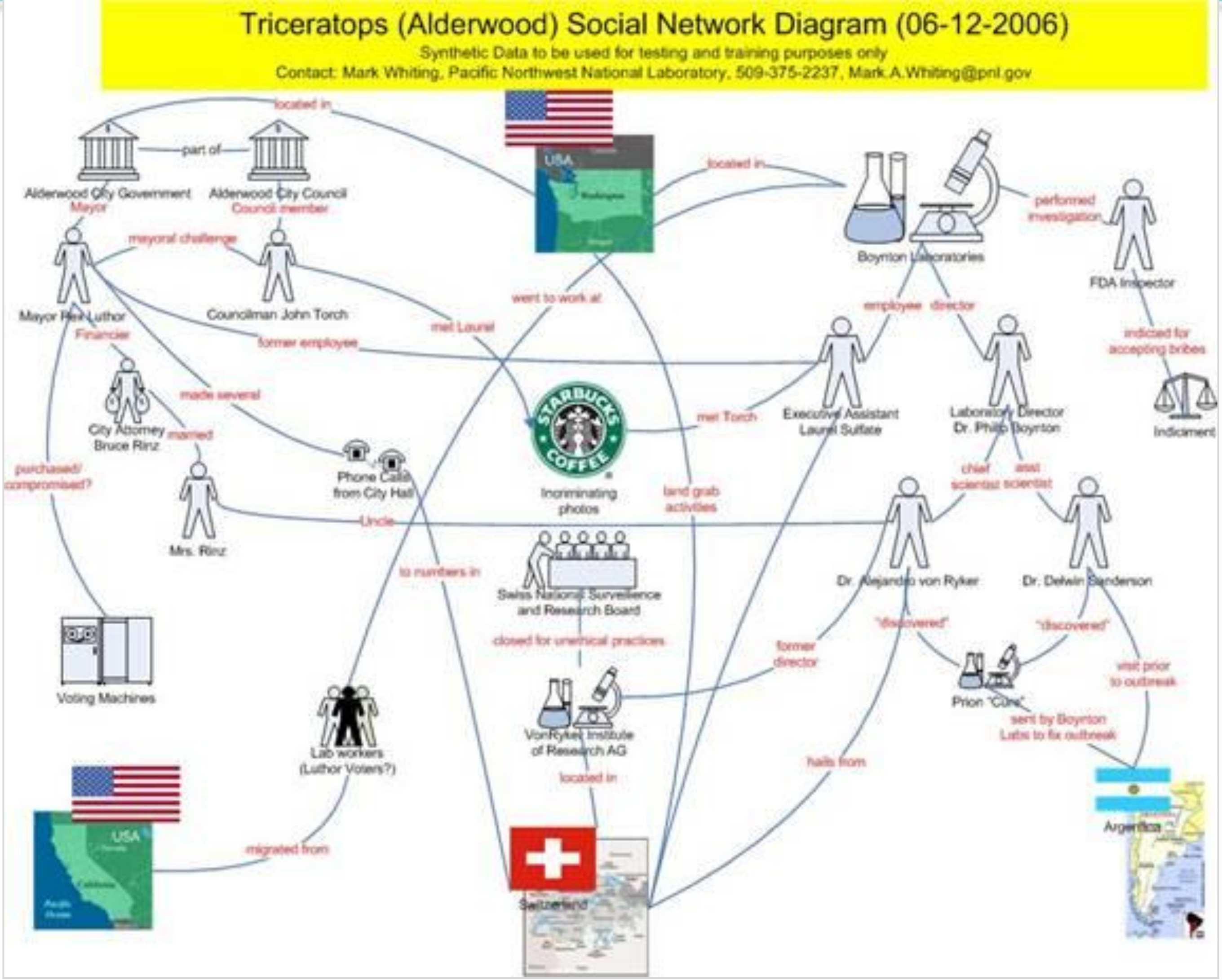
Collaborative Text Analysis

The Cambiera Project

Design Data and Tasks

- 310 newspaper articles
- Find relevant articles
- Form hypotheses, connections



Research Problems

- Follow separate hypotheses (correct or incorrect)
- Capitalize on the group effort

Research Problems

"It's confusing when everybody has a pointer."

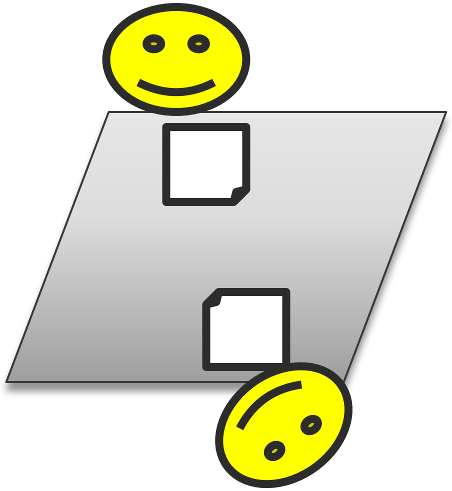
Follow separate hypotheses (correct or incorrect)

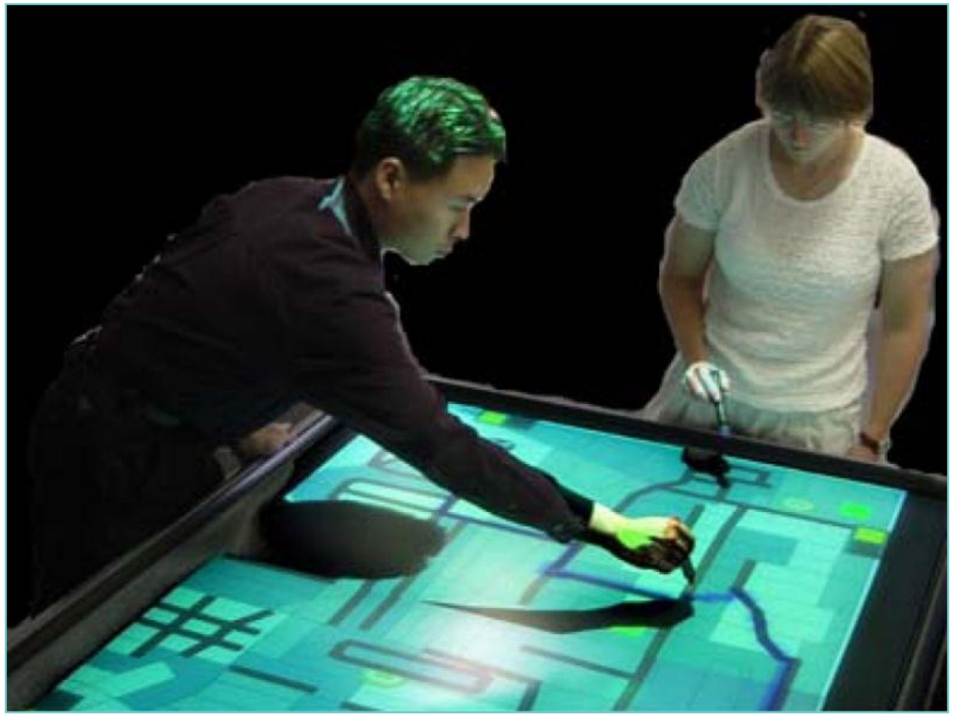
Capitalize on the group effort

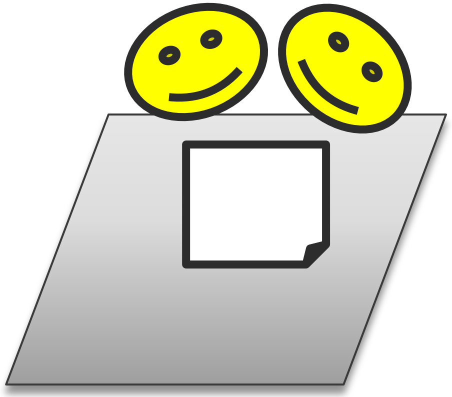
Related Work

Related Work

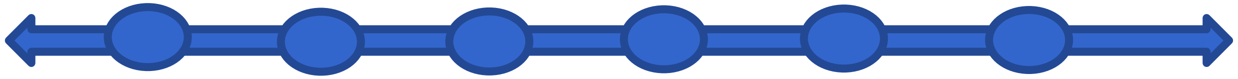
Mixed-focus collaboration







Loosely Coupled Work

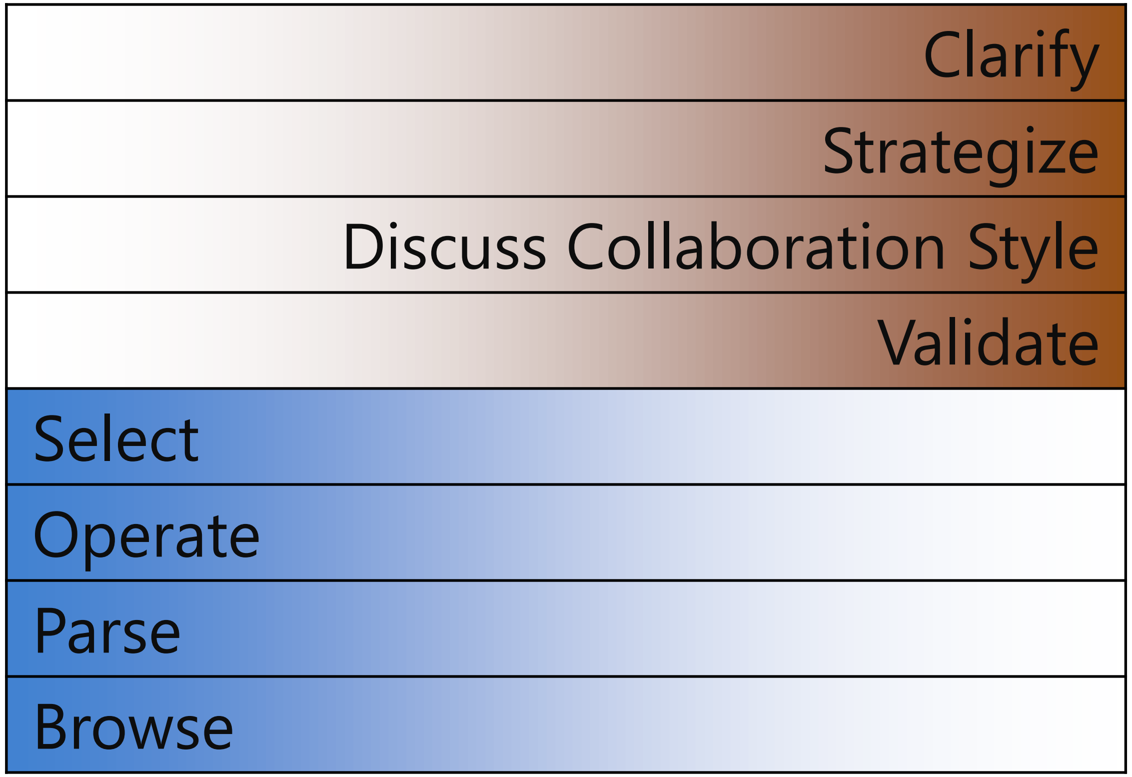


Closely Coupled Work

Tang et al., CHI 2006

Related Work

Collaborative Information Analysis Processes



Loosely Coupled Work ⟷ Closely Coupled Work

Isenberg et al., CHI 2008

Design Goals

Support individual & group

- Surface application with parallel input
- Provide peripheral awareness information of others' work

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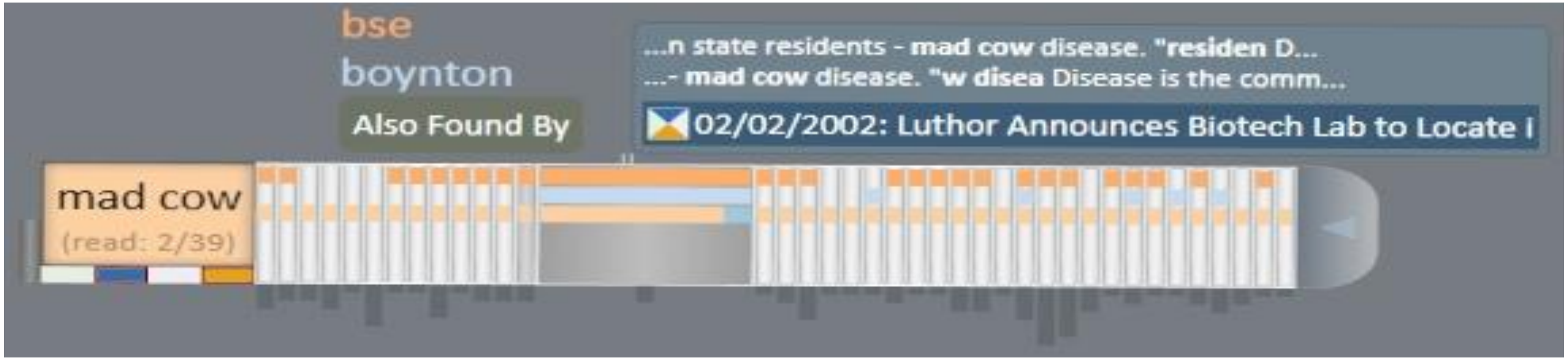
Cambiera

video

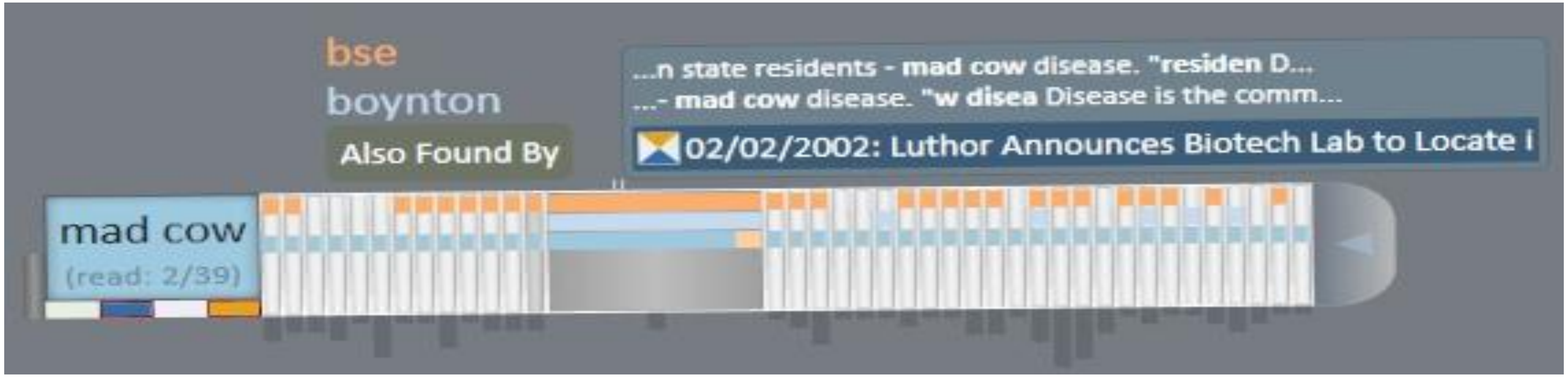
Awareness Overview

Related searches | Search order | Who read | Read Frequency

Who searched



Collaborative Brushing and Linking – the other view:



Collaborative Brushing and Linking

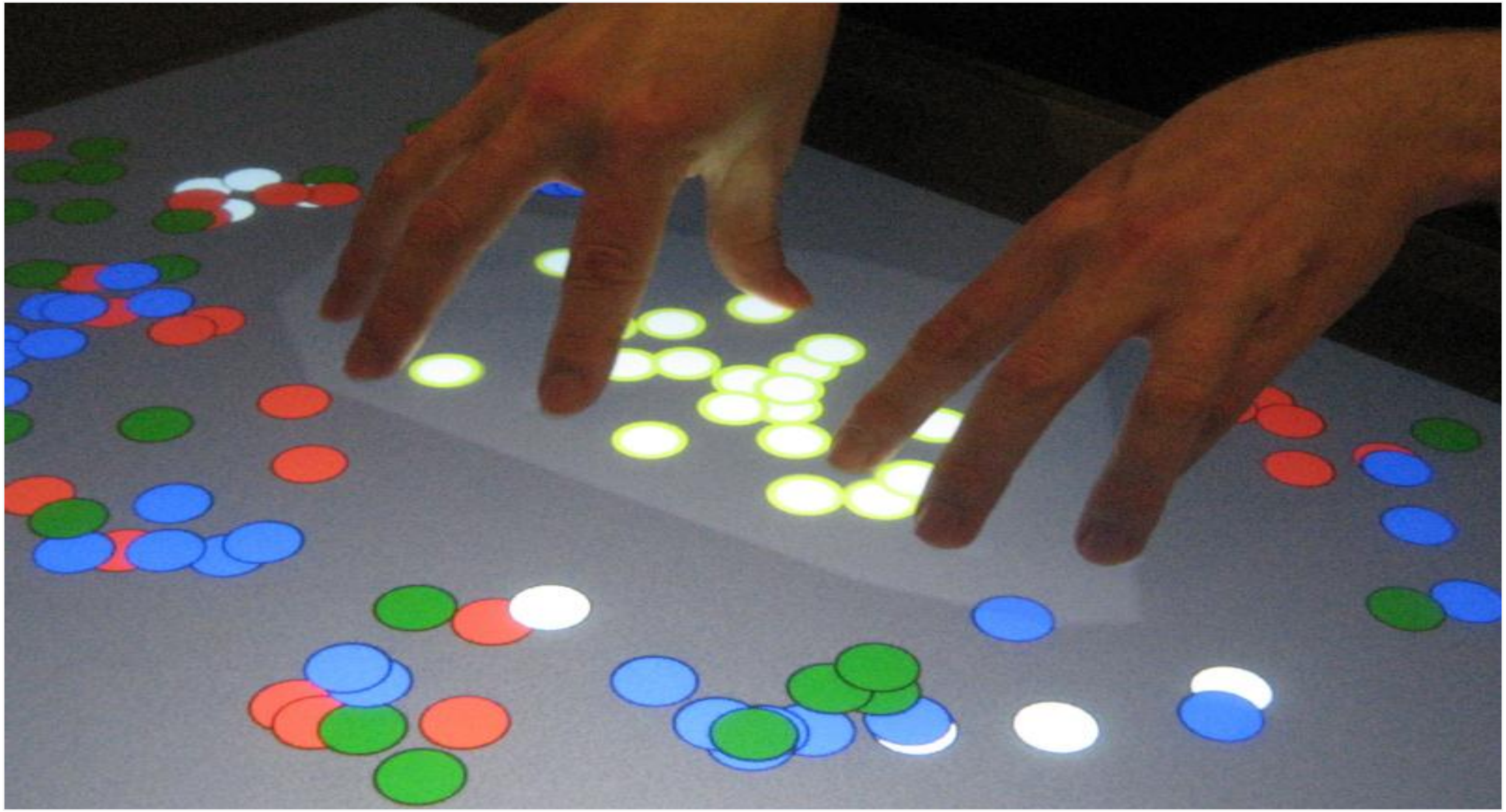
Awareness information

- Did another search also find my document?
- Has someone else issued my search?
- Has someone extracted the same document?
- Has someone read the same document?

Handling Many Objects

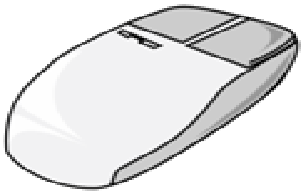
Research Questions

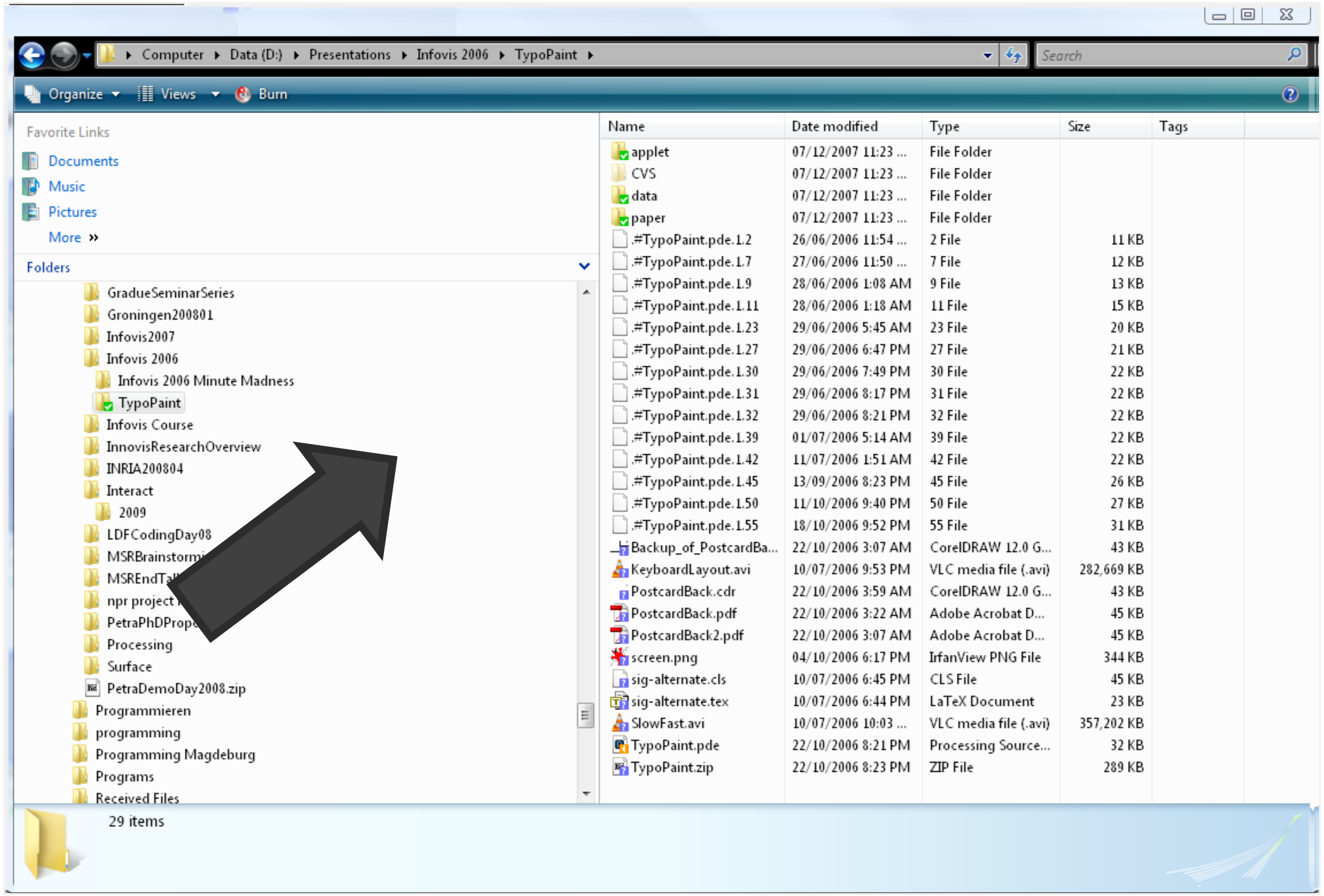
How to design multi-object operations?



Research Questions

How to design multi-object operations?





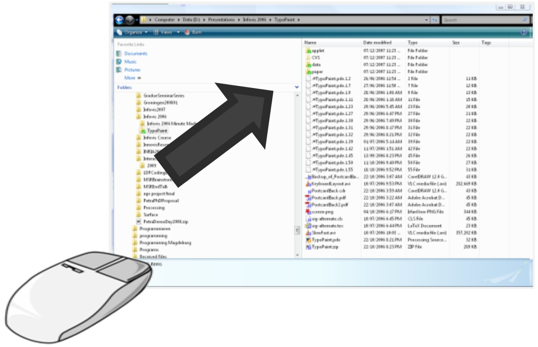
Research Questions

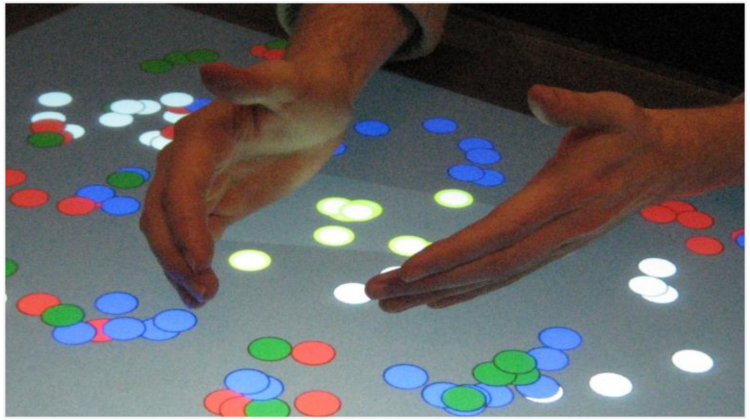
How to design multi-object operations?

By [benwatts] on flickr

Research Questions

- How do virtual and physical techniques carry over?
- How will people use hands and fingers?
- How dextrous will they be?
- Will they focus on single objects or groups?





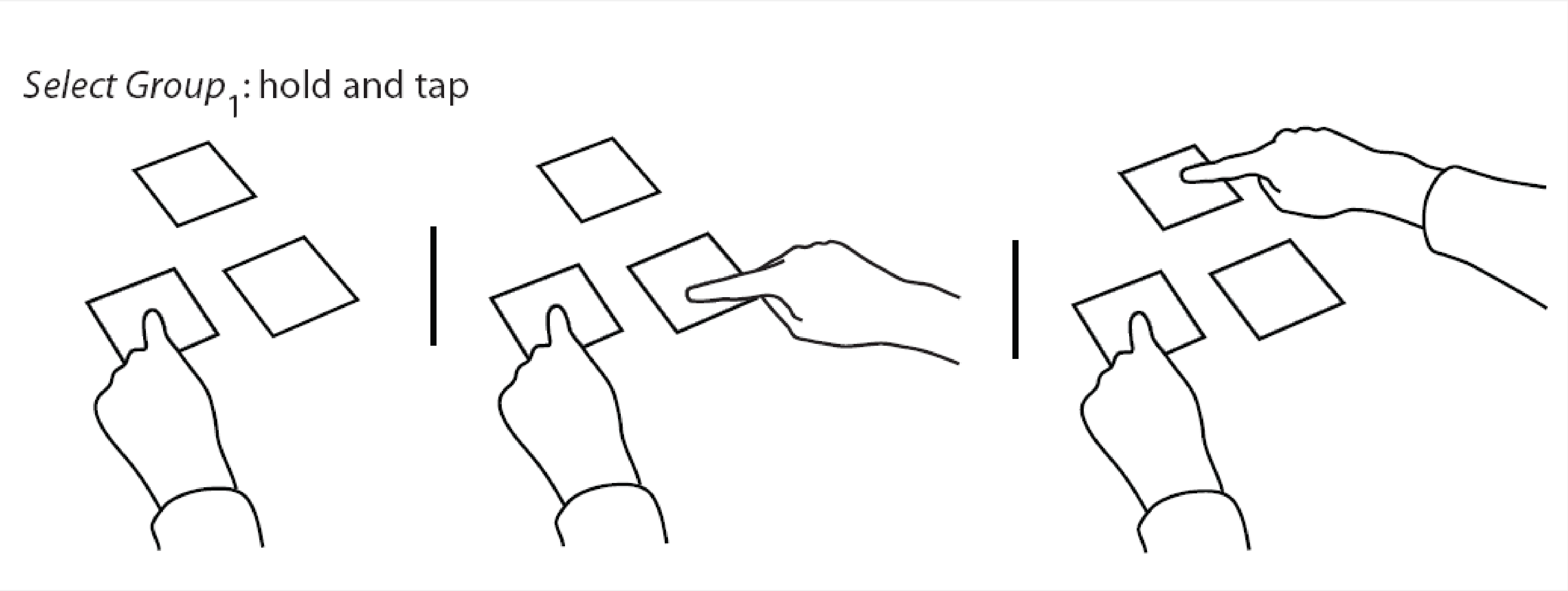
Related Work

Pile-N-Browse

From (Wu et al., 2006)

Related Work

Studying gestures



From (Wobbrock et al., 2009)

User Study

Goals

- Study tasks with manipulation of large number of small objects
- Compare gestures from physical/mouse to surface
- Derive gesture vocabulary

Conditions

Mouse (M)

- 24″ Desktop Screen
- Single click, marquee selection, ctrl+shift click
- Rendered circles

Physical (P)

- 24″x18″ MS Surface Screen
- Any physical interaction
- Game chips

Surface (S)

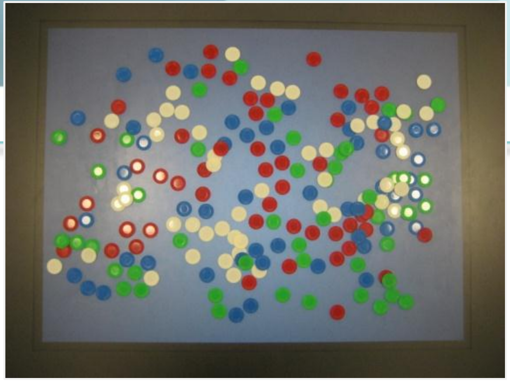
- 24″x18″ MS Surface Screen
- Single finger touch, convex hull
- Rendered circles

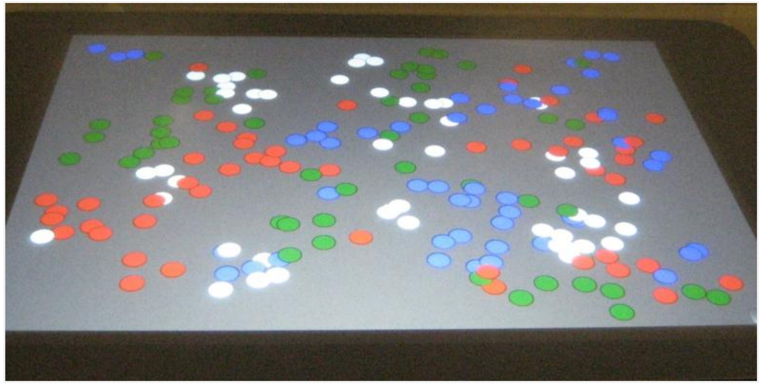
All

- Physical circle sizes matched
- 200 circles total, 4 colors (50 circles per color)

Participants

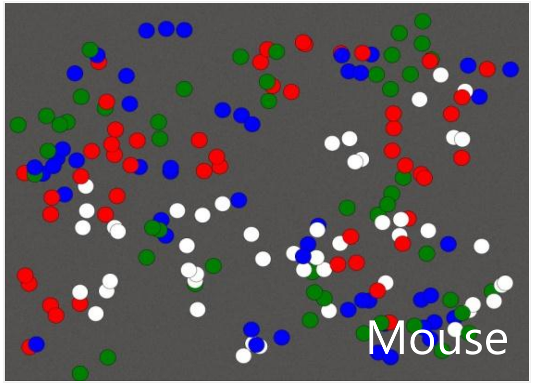
- 32 (25 male, 7 female)
- All users do the Surface, and *either* mouse or physical





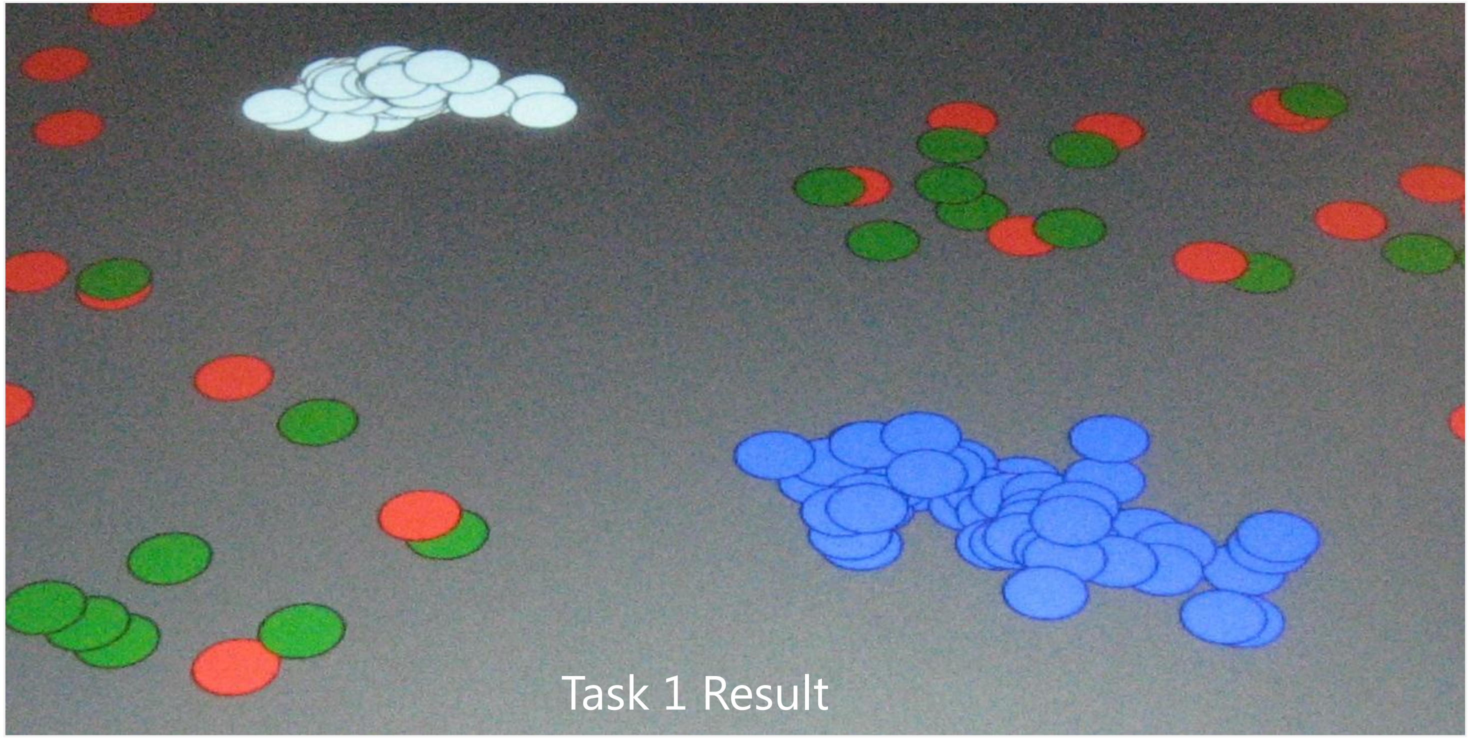
  - Mouse + Surface (MS)
  - Surface + Mouse (SM)
  - Physical + Surface (PS)
  - Surface + Physical (SP)

Data for 32 Surface, 16 Mouse, 16 Physical



Tasks

1. Separate blue and white chips into clusters
2. Spread blue cluster so no 2 circles overlap
3. Timed clustering



Task 1 Result

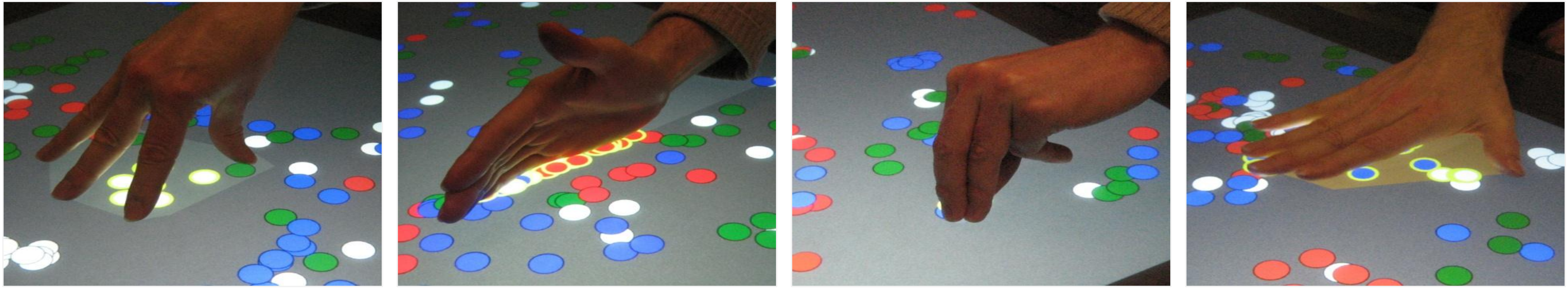
Results

1. Gesture sets from Task 1 & 2
   - From video analysis in physical & surface condition
   - Both successful & unsuccessful gestures
2. Timing results from Task 3
   - Analyzed with a 2x2 mixed Anova
3. Participant comments

Gesture Classes

1. One handed – applied to a group

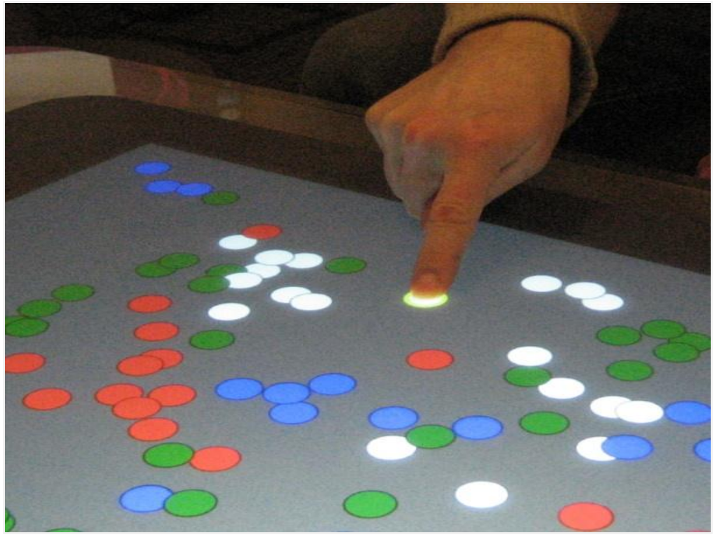
- Splayed hand pushes pieces
- One hand shove
- Pinch
- Hand and palm

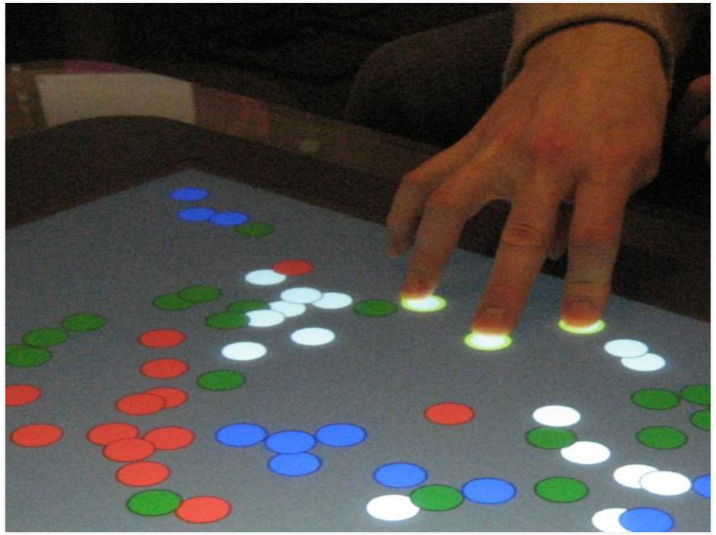


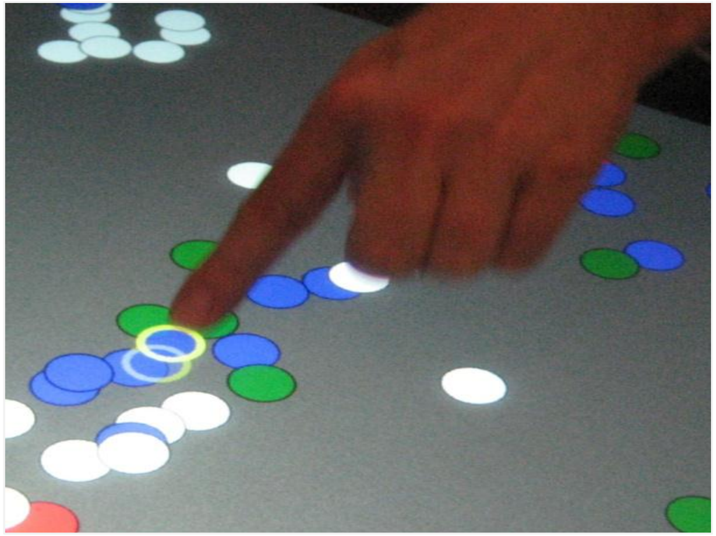
Gesture Classes

2. One handed – applied to single item

- Drag single item
- Select single items with multiple fingers
- Toss single object



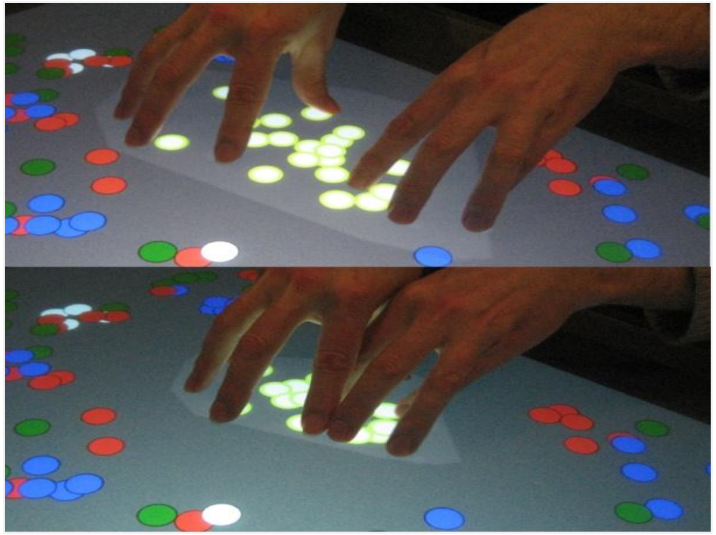


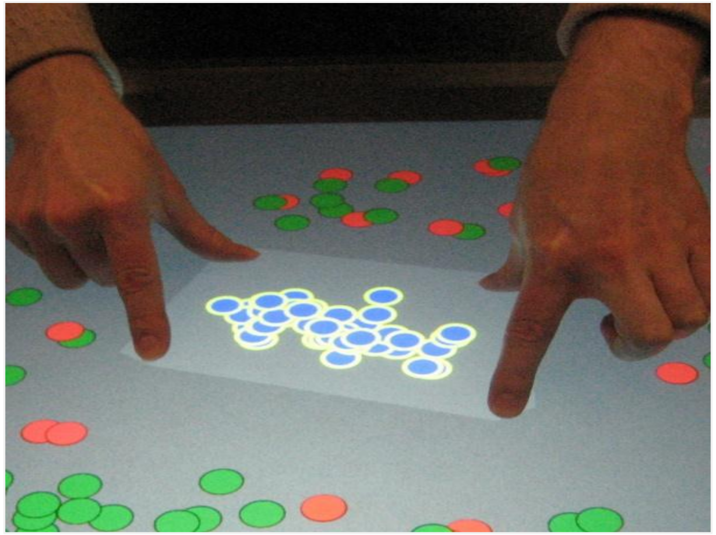


Gesture Classes

3. Two handed – applied to single group

- Both hands coalesce large group to small
- Two-hand transport
- Add/remove from selection

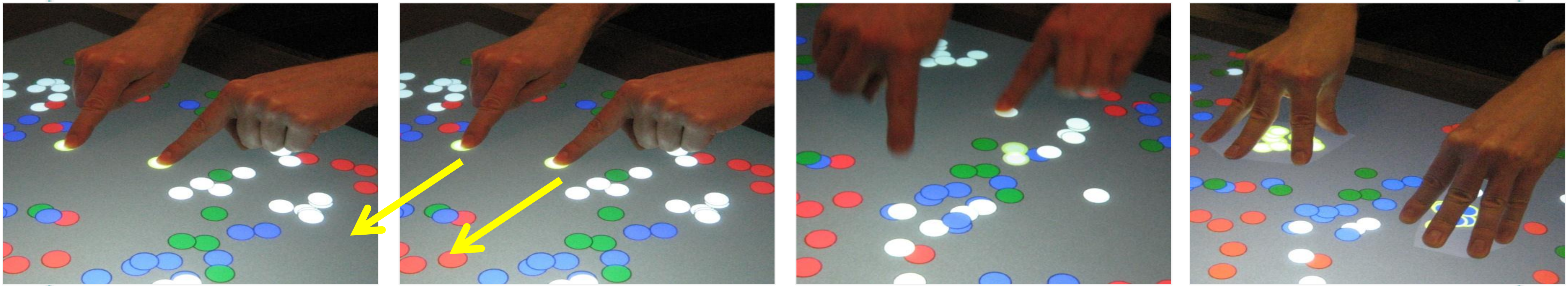




Gesture Classes

4. Two handed – applied to > 1 group

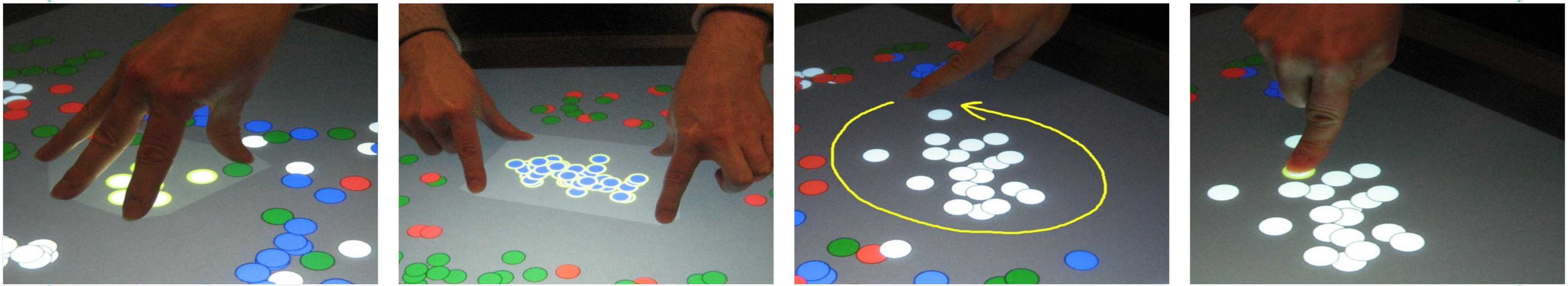
- Drag two objects with pointer fingers
- Two hands grab points in sync
- Rhythmic use of both hands
- Two hands grab groups



Gesture Classes

5. Surface Only

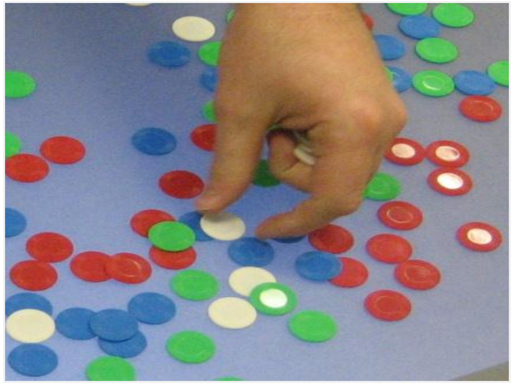
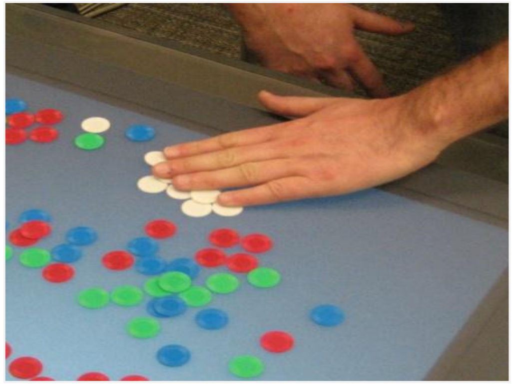
- One hand hull manipulation
- Two-hand hull manipulation
- Treat finger like a mouse
- Push hard to multi-select



Gesture Classes

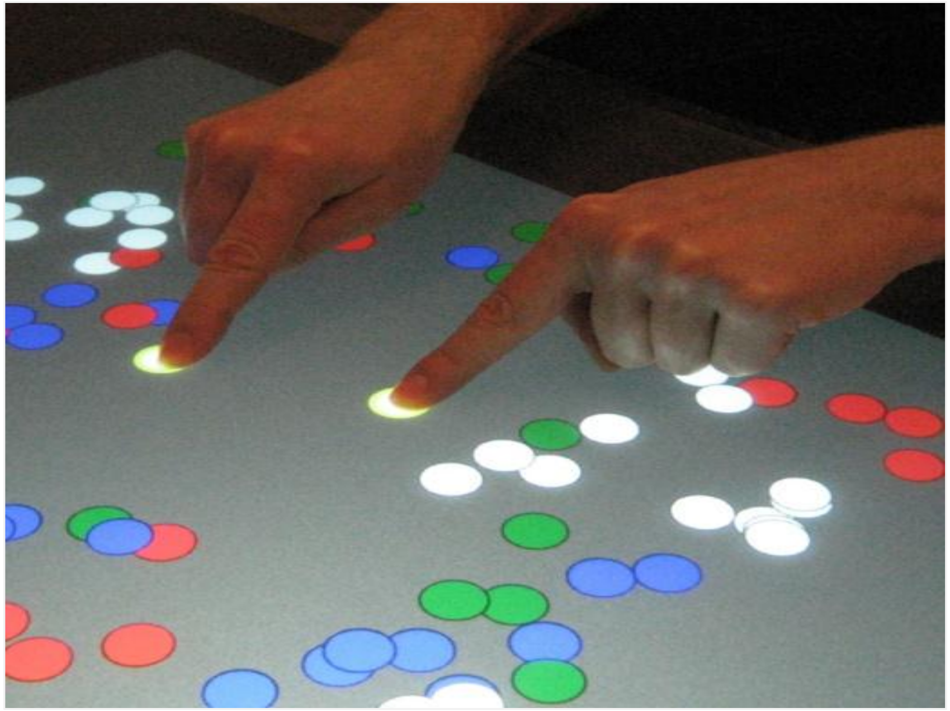
6. Physical Only

- Lift up
- Go outside the lines
- Slide around objects
- Texture-based
- Toss chips between hands
- Drag and drop some chips on the way


Gesture Use

- Fingertip-based most popular
- Difference based on starting condition
  - Starting in physical: 88%
  - Starting in mouse/surface: 56%/50%
- 70% used multiple hands for >1 group
- On Surface many used fingers as a mouse
  - Starting in mouse: 50%
  - Starting in physical: 25%



Timing Results

Surface is sign. faster than Mouse

- Surface: 116s, Mouse 134s, ($F_{1,14}$=6.10, p=.027)
- No effect of cond. order ($F_{1,14}$=9.28, p=.352)

Physical is sign. faster than Surface

- Physical: 89s, Surface: 120s ($F_{1,14}$=11.96, p=.004)
- Sign. effect for cond. order (PS < SP) ($F_{1,14}$=11.482, p<.001)

Impact of first condition

- Participants starting in Physical sign. faster on Surface (PS < MS) ($t_{1,2}$=2.38, p<.035)

Participant Comments

Surface perceived as sign. easier than Mouse

- No effect between Physical/Surface

88% preferred clustering task on Surface compared to Mouse

- 44% preferred Surface to Physical

Perceived advantages

- Physical: tactile feedback
- Surface: drag over circles, two handed interaction
- Mouse: select dispersed circles

Discussion

- Participants showed influence of previous condition
  - Gestures sets and work speed influenced
- Multi-touch grouping was common
- Two-handed interaction common
  - Wide variety of co ordinations (in sync, in parallel, …)

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