

# Pervasive and ad-hoc services

Pervasive/ubiquitous collaborative systems (3/3)

M2R MOSIG UIS

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# Content

- I. CSCW principles: Collaboration in space & time
- II. Building groupware**
- III. Collaboration and pervasive interactive surfaces
- IV. Multimodal and Multi-user interaction
- V. Collaboration in mobility & tangible interaction

# Outline

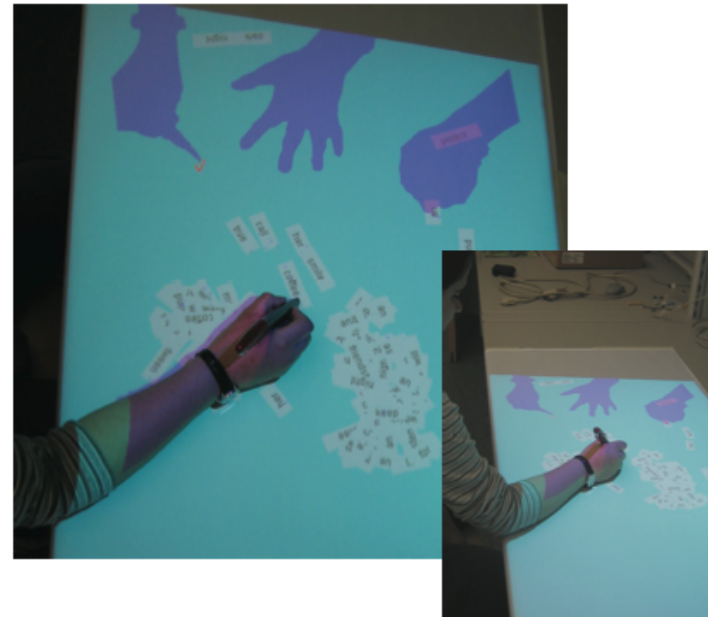
## Building groupware applications

1. Group task analysis
2. Design
3. Implementation
- 4. Evaluation**
  - ▶ Mechanics of collaboration

# Mechanics of collaboration

Support intentional communication

- ▷ Verbal conversations
  - ▷ Textual dialogs
  - ▷ Audio channels
- ▷ Gestures
  - ▷ Video channels
  - ▷ Avatars
  - ▷ Telepointers, shadows



# Mechanics of collaboration

## Support consequential communication

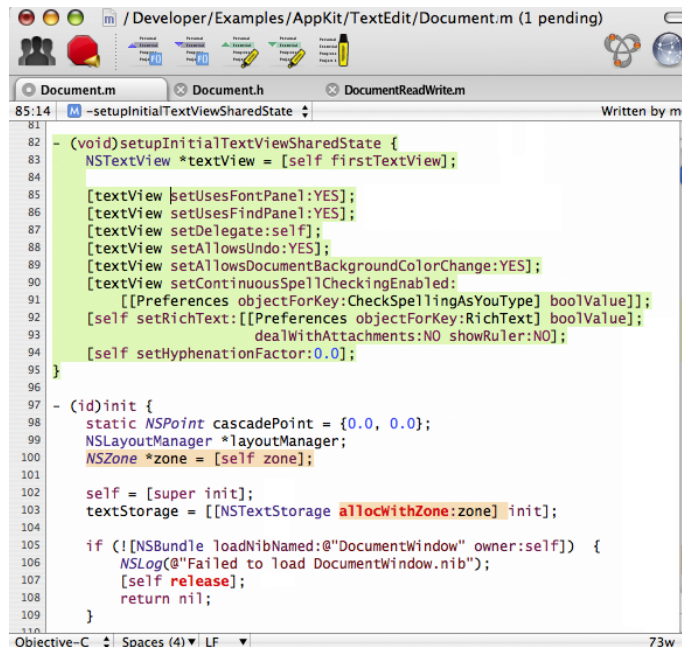
- ▶ Bodily actions: position, posture, movements, etc
  - ▶ Video
  - ▶ Audio channels
  - ▶ Eye gaze
  - ▶ Avatars (embodiement)
  - ▶ Telepointers
  - ▶ Spatial proximity



# Mechanics of collaboration

## Support consequential communication

- ▶ Feedthrough
- ▶ Artifacts as they are manipulated by others
  - ▶ WYSIWIS
  - ▶ Activity indicators (ex. colors)



```
85:14 Document.m Document.h DocumentReadWrite.m Written by me
81
82 - (void)setupInitialTextViewSharedState {
83     UITextView *textView = [self firstTextView];
84
85     [textView setUsesFontPanel:YES];
86     [textView setUsesFindPanel:YES];
87     [textView setDelegate:self];
88     [textView setAllowsUndo:YES];
89     [textView setAllowsDocumentBackgroundColorChange:YES];
90     [textView setContinuousSpellCheckingEnabled:
91      [[Preferences objectForKey:CheckSpellingAsYouType] boolValue]];
92     [self setRichText:[Preferences objectForKey:RichText] boolValue];
93     [self dealWithAttachments:NO showRuler:NO];
94     [self setHyphenationFactor:0.0];
95 }
96
97 - (id)init {
98     static NSPoint cascadePoint = {0.0, 0.0};
99     NSLayoutManager *layoutManager;
100    NSZone *zone = [self zone];
101
102    self = [super init];
103    textStorage = [[NSTextStorage allocWithZone:zone] init];
104
105    if (![NSBundle loadNibNamed:@"DocumentWindow" owner:self]) {
106        NSLog(@"Failed to load DocumentWindow.nib");
107        [self release];
108        return nil;
109    }
110
Objective-C Spaces (4) LF 73w
```

# Mechanics of collaboration

## Management of coupling

- ▶ Degree to which people are working together
- ▶ Strict WYSIWIS vs. Relaxed WYSIWIS
  - ▶ Views
  - ▶ Real-time, near real-time, asynchronous
  - ▶ Private conversations

## Coordination of actions

- ▶ Explicit communication
- ▶ Workspace awareness
- ▶ Social protocols

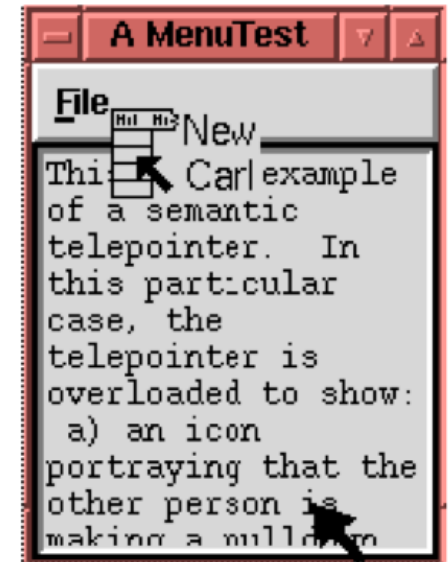
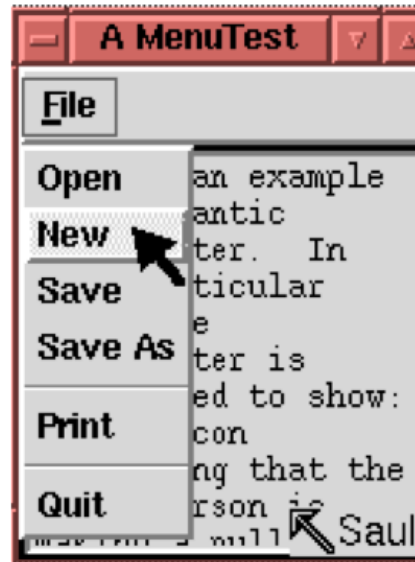


*[Gutwin 2002]*

# Mechanics of collaboration

## Simplification of communication

- ▷ Deictic references
  - ▷ "this" and "that"
  - ▷ Video channels
  - ▷ Remote pointers
  - ▷ Embodiement





# Mechanics of collaboration

## Assistance

- ▶ Assist people in understanding the context
- ▶ Opportunistic and informal
  - ▶ Annotations

## Protection

- ▶ Concurrency control
- ▶ Undo/Redo
- ▶ Floor control



# Conclusion

Building groupware applications

*Success or failure ?*

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# Interactive surfaces

## Disappearing computer

- ▶ No mouse, no keyboard
- ▶ Direct manipulation
- ▶ Support physical objects
  - ▶ Tangible interaction
- ▶ Additional devices
  - ▶ Smartphone, tablet

## Multi-user

- ▶ Face-to-face situation



# Collaborative tabletop: design guidelines

## Support Interpersonal Interaction

- ▷ Mediate collaborative interactions
  - ▷ Consequential communication
  - ▷ Intentional communication
- ▷ Impact of the form factor
  - ▷ Naturalness
  - ▷ Comfort

*Gloss project*



*Microsoft Surface*

# Collaborative tabletop: design guidelines

Support fluid transitions between activities

- ▶ Minimized overhead on switching
  - ▶ Writing
  - ▶ Drawing
  - ▶ Manipulating
- ▶ Back and forth on tabletop
- ▶ Specific or universal input device ?



*[Hartman 2010]*

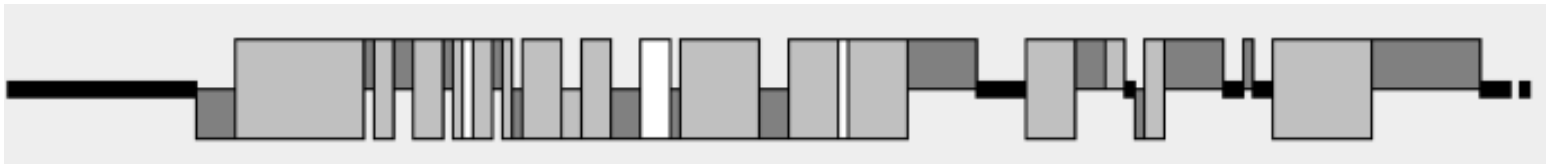
# Collaborative tabletop: design guidelines

Support transitions between personal & group work

- ▶ Group work is fragmented



a. Coupling Modes and their Visualization



# Collaborative tabletop: design guidelines

Support transitions between personal & group work

- ▶ Group work is fragmented
- ▶ Distinct areas

*[Blevins 2004]*

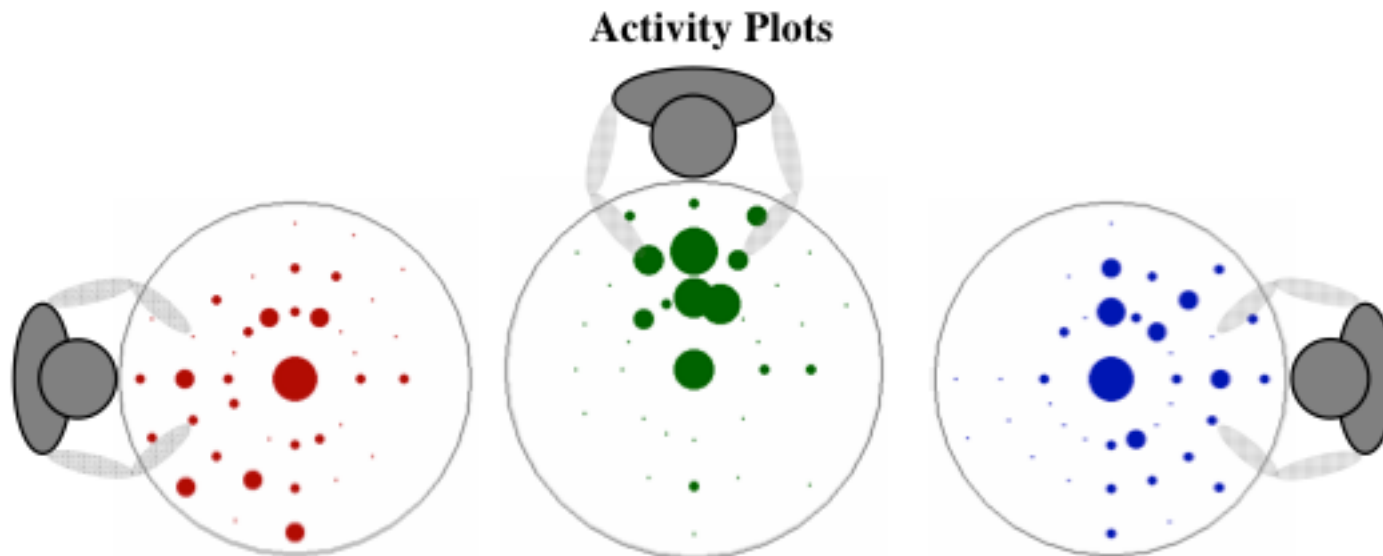




# Collaborative tabletop: design guidelines

Support transitions between personal & group work

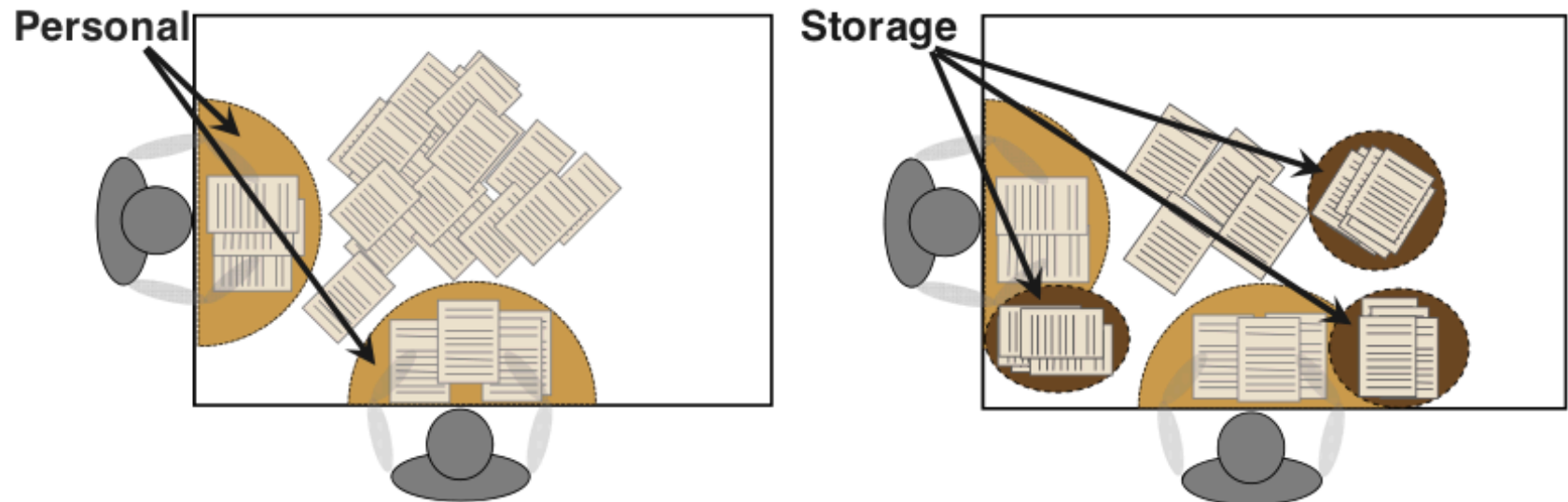
- ▶ Group work is fragmented
- ▶ Distinct areas



# Collaborative tabletop: design guidelines

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# Collaborative tabletop: design guidelines

Support transitions between personal & group work

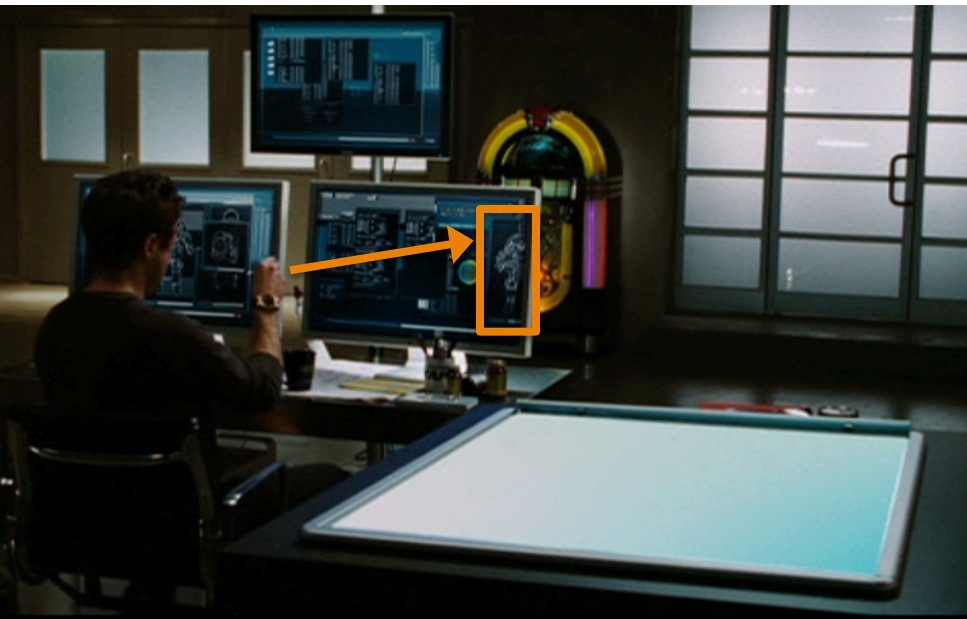
- ▶ Group work is fragmented
- ▶ Distinct areas
- ▶ Separate personal display



*[Rekimoto 1999]*

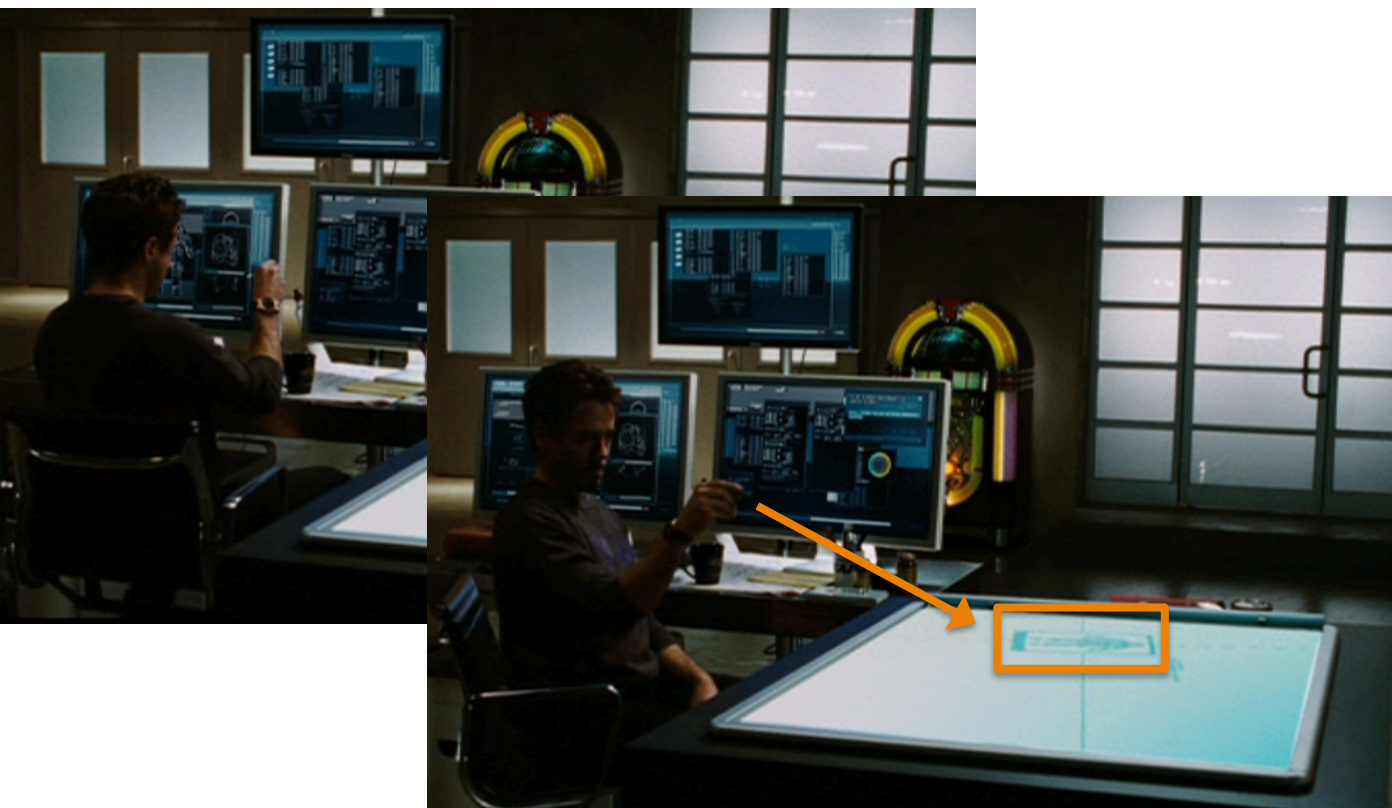
# Collaborative tabletop: design guidelines

Support transitions between tabletop collaboration & external work



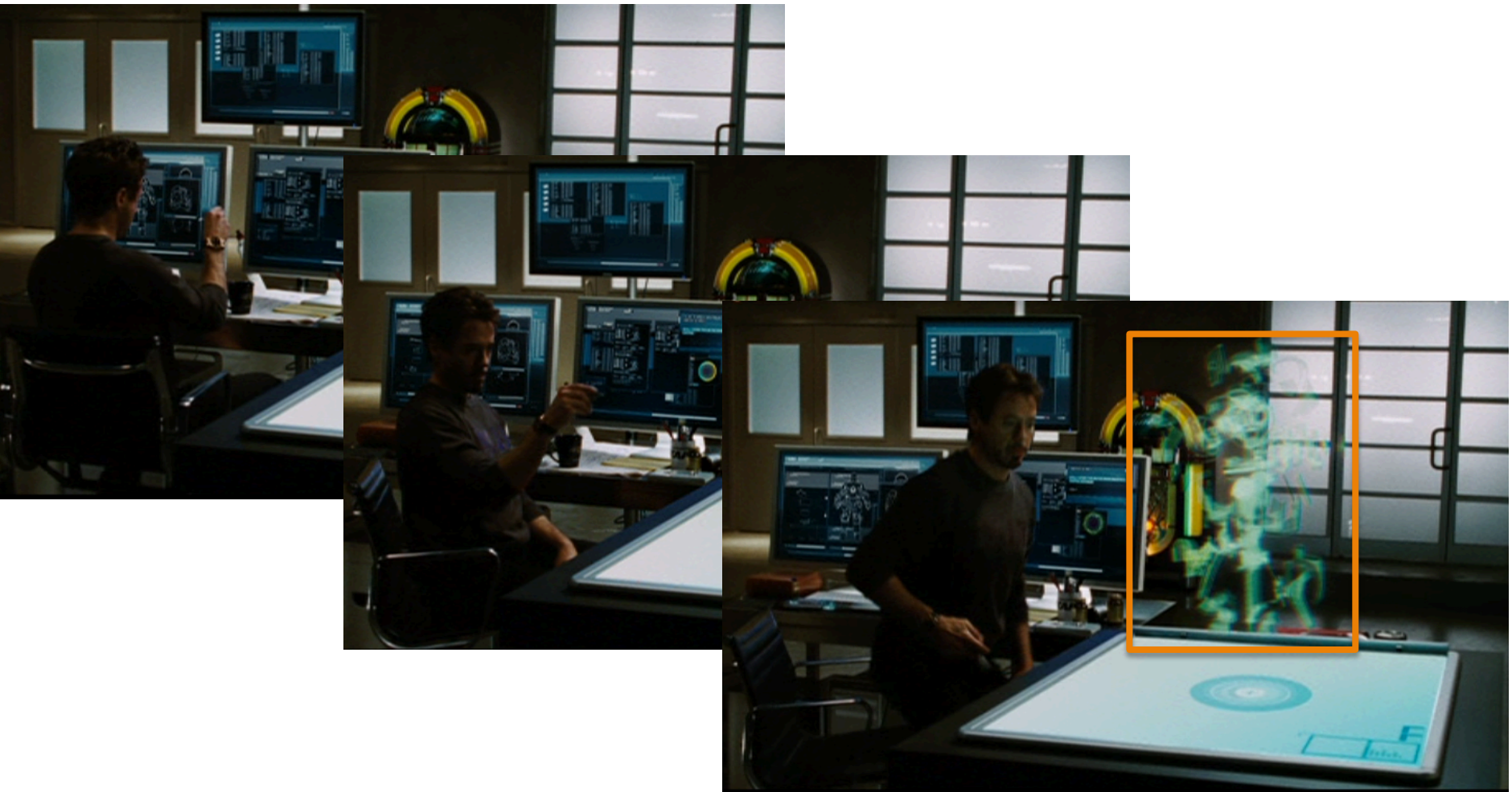
# Collaborative tabletop: design guidelines

Support transitions between tabletop collaboration & external work



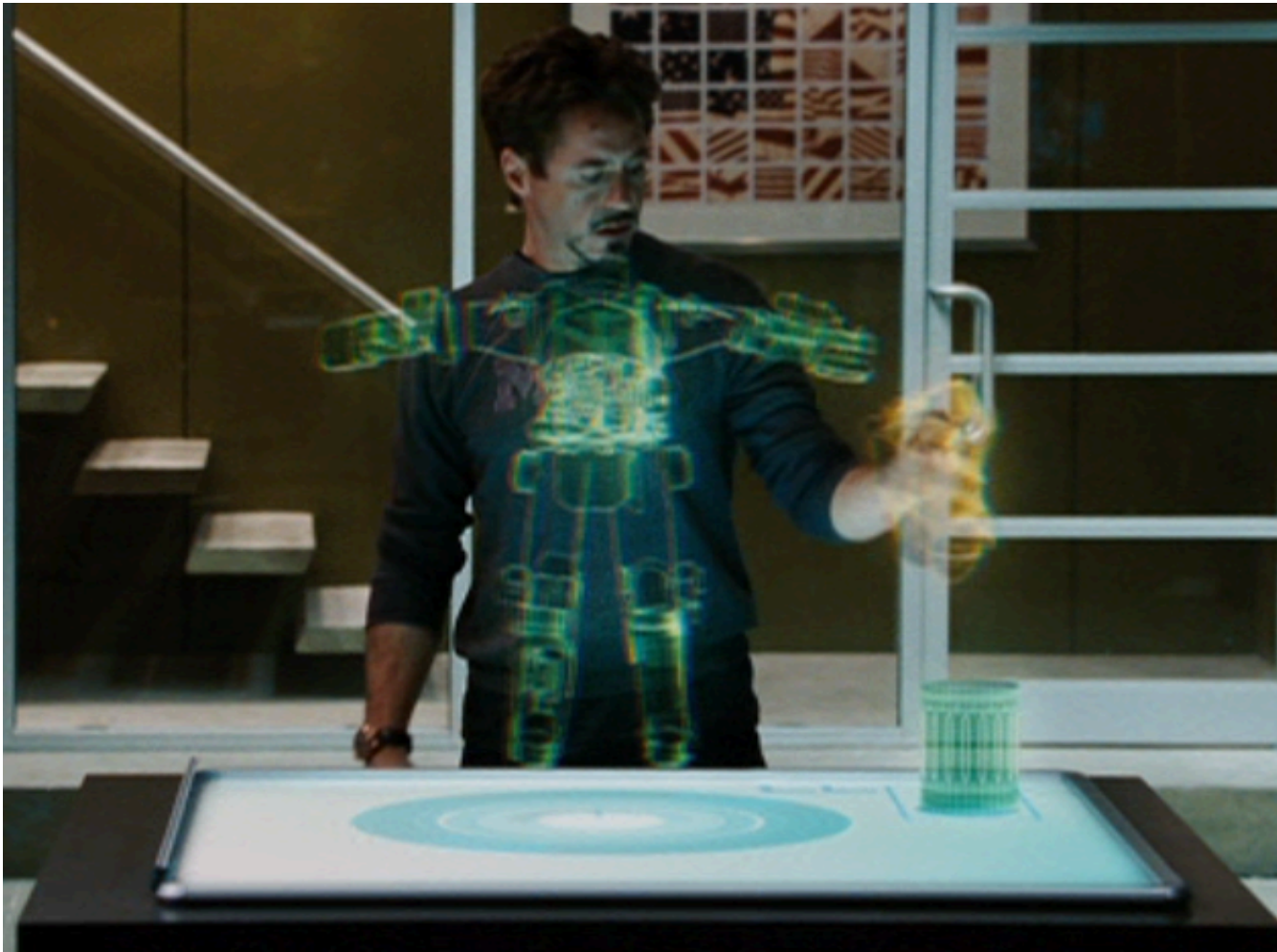
# Collaborative tabletop: design guidelines

Support transitions between tabletop collaboration & external work



# Collaborative tabletop: design guidelines

Support transitions between tabletop collaboration & external work



# Collaborative tabletop: design guidelines

Support transitions between tabletop collaboration & external work

- ▶ Digital data associated to objects
- ▶ Hyperdragging technique
- ▶ Tagged objects



*[Streitz 1999]*



# Collaborative tabletop: design guidelines

Support the use of physical objects

- ▶ Tangible user interfaces
- ▶ Recognition of objects
- ▶ Computer vision, RFID, QR codes, etc



*[Hartman 2010]*

# Collaborative tabletop: design guidelines

Provide shared access to physical and digital objects

- ▶ Communication and deictic gestures
- ▶ Seating and occlusion issues

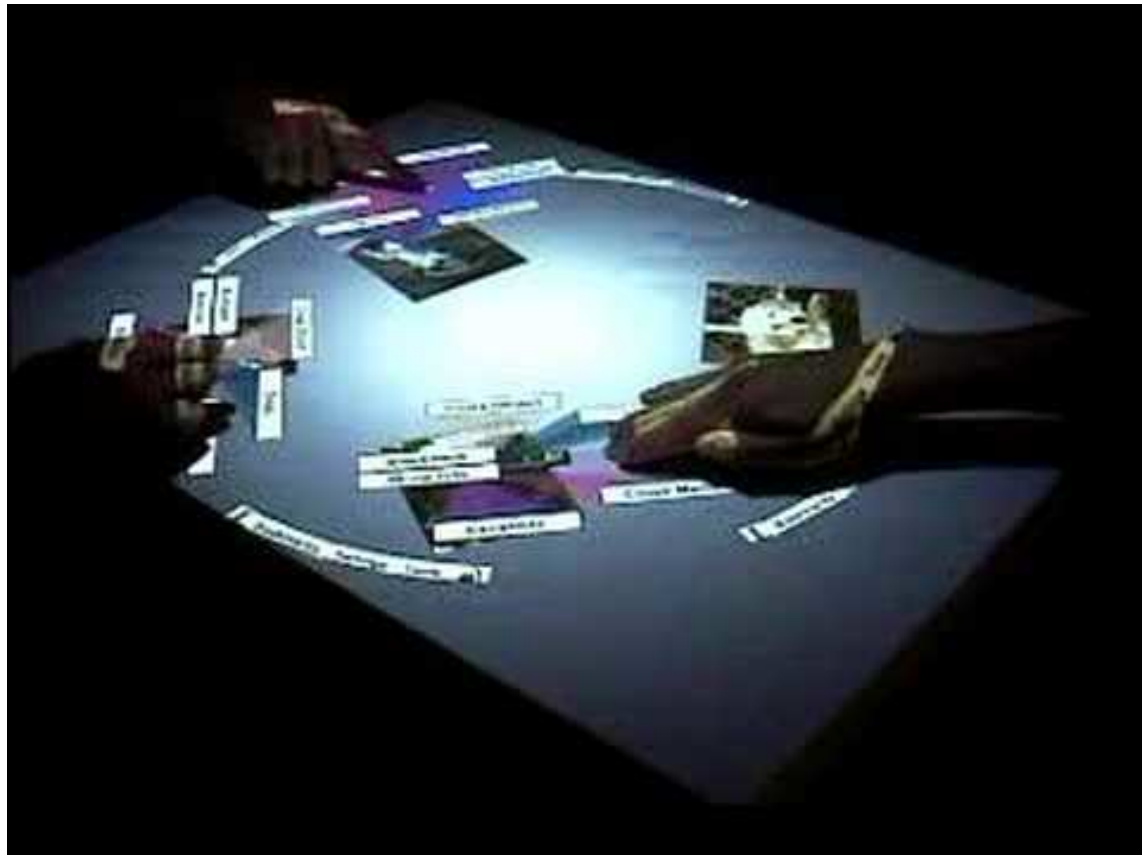


*[Tang 2006]*

# Collaborative tabletop: design guidelines

Consideration for the appropriate arrangements of users

- ▶ Oriented UI



# Outline

## Collaboration and pervasive interactive surfaces

Collaboration and tabletop

Morris : cooperative gestures

Pinelle / Morris (effects of group size) / Scott : territories

Tuddenham : distributed tabletops / shadows

Tang + Carpendale : collaborative coupling over tabletop displays

Pictionnaire

N. A. Streitz : Roomware / dynawall : the computer disappears

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1. XXX

2. XXX

3. XXX

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Multimodal / Tangible cooperative groupware

Edward Tse + Greenberg : multimodal tabletop

Hartmann + Wilson : pictionnaire

Coupling and Heterogeneity in Ubiquitous Computing (Chalmers)

S3 : Collaboration tables and walls (idToolkit,etc)

S4 : Multimodal groupware => + EMG

S5 : Collaboration in mobility/ tangible interaction (ex. musée augmentée / visite collaborative de musée)