

# Pervasive and ad-hoc services

Pervasive/ubiquitous collaborative systems (1/3)

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# Topic

## Pervasive/ubiquitous collaborative systems



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## Pervasive/ubiquitous collaborative systems



# Collaborative systems

## Motivations

*Human beings are social animals [Aristotle ~350 BC]*



# Collaborative systems

## Motivations

Work with others



# Collaborative systems

## Motivations

Work with others



Communication

# Collaborative systems

## Motivations

Work with others

Entertainment



Communication

# Collaborative systems

## Motivations

Work with others

Entertainment



Communication

Socialization



# Collaborative systems

## Motivations

Ubiquity: computational resources everywhere



# Collaborative systems

## Motivations

Ubiquity: computational resources everywhere



# Collaborative systems

## Motivations

### Connected everywhere

- ▶ Wifi
- ▶ 3G, LTE networks
- ▶ LAN, xDSL
- ▶ Satellite
- ▶ etc



# Collaborative systems

## Consequently

People uses the computational resources to

- ▶ Work together
- ▶ Communicate
- ▶ Play with others
- ▶ Socialize
- ▶ etc

# Collaborative systems

## Consequently

People use the computational resources to

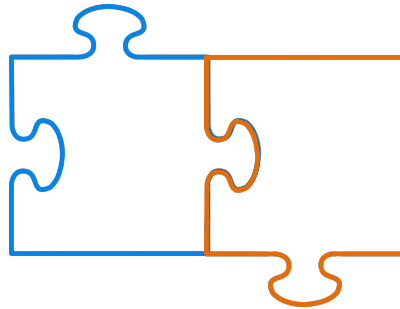
- ▶ Work together
- ▶ Communicate
- ▶ Play with others
- ▶ Socialize
- ▶ etc

⇒ Studied by the **CSCW** community

# Computer-Supported Cooperative Work

Two complementary visions, multiple research goals

- ▶ Multi-disciplinary research field

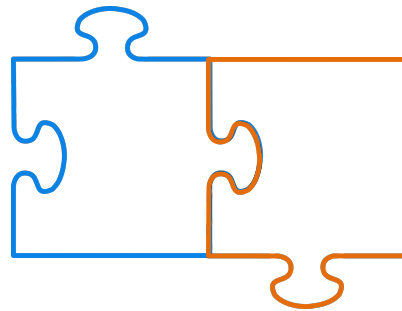


# Computer-Supported Cooperative Work

Two complementary visions, multiple research goals

- ▶ Multi-disciplinary research field

*science*



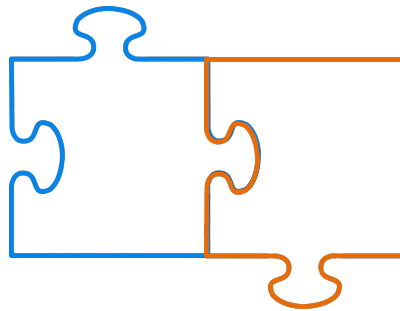
- ▶ To conceive software that supports

*group*

# Computer-Supported Cooperative Work

Two complementary visions, multiple research goals

- ▶ Multi-disciplinary research field

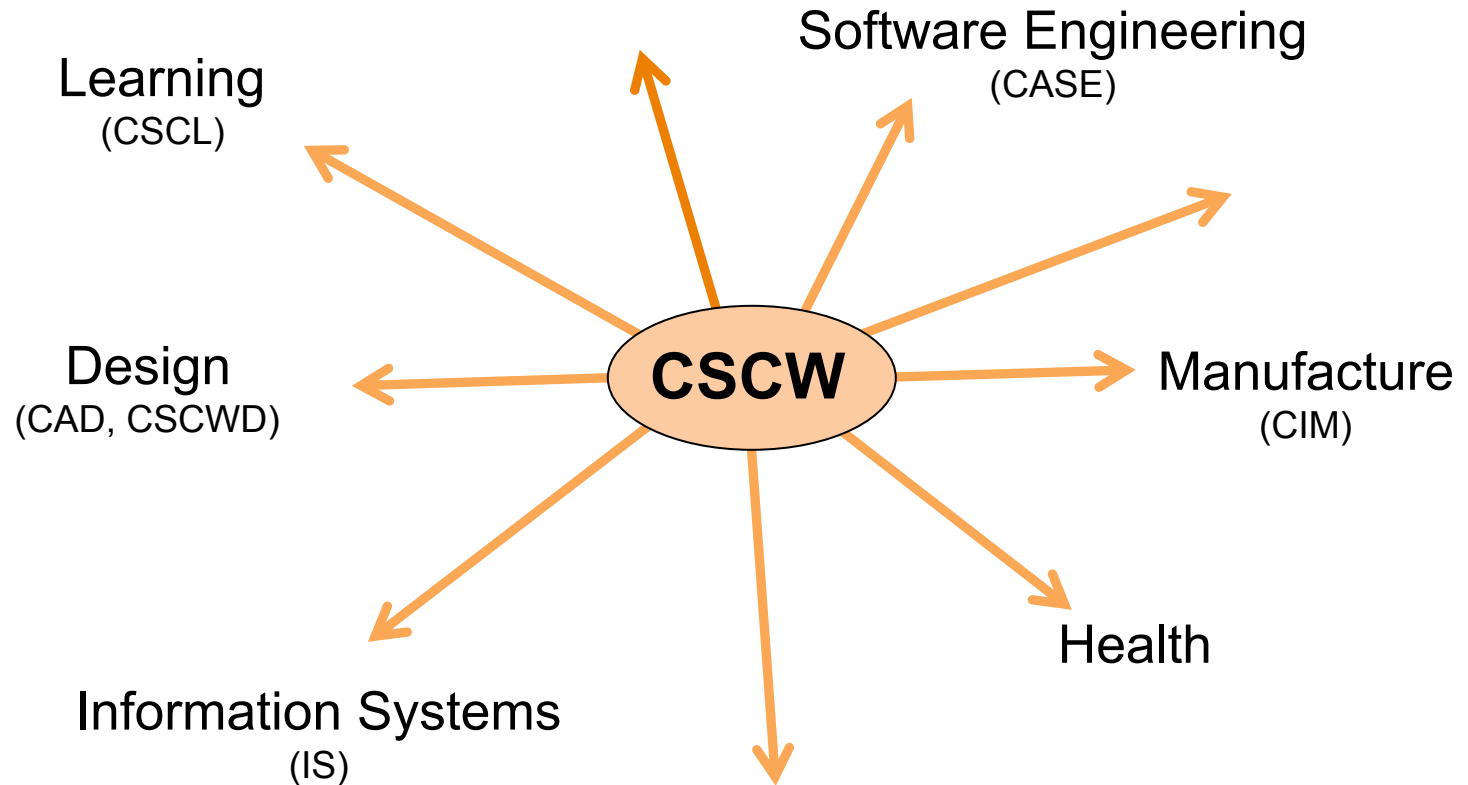


- ▶ To understand how groups work for groupware design group

- ▶ To conceive software that supports



# Application domains of CSCW



# Content

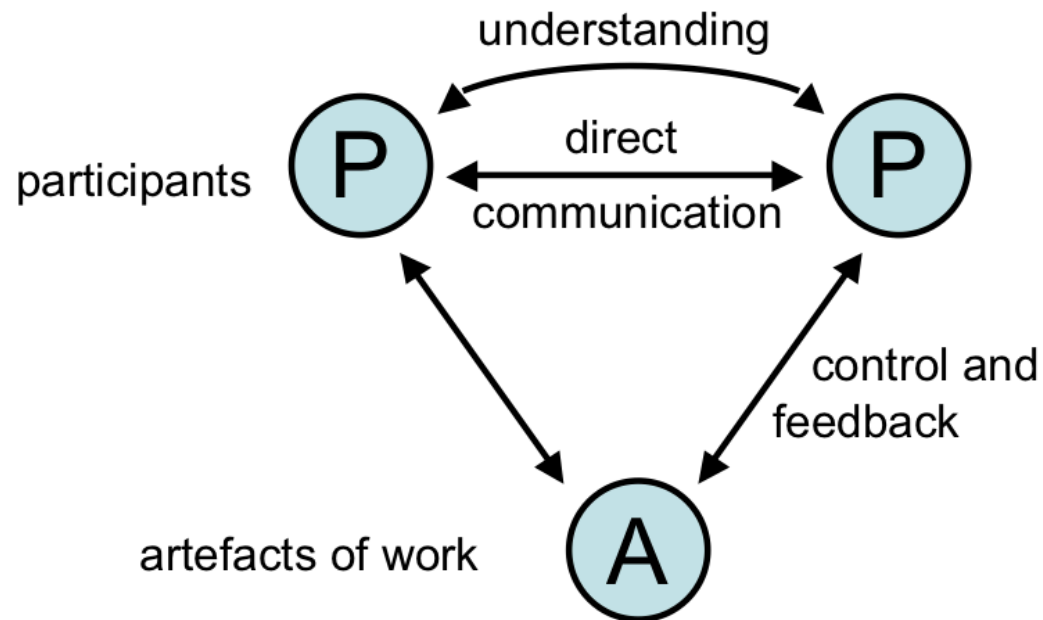
- I. CSCW principles: Collaboration in space & time
- II. Building groupware
- III. Collaboration and pervasive interactive surfaces
- IV. Multimodal and Multi-user interaction
- V. Collaboration in mobility & tangible interaction

# 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

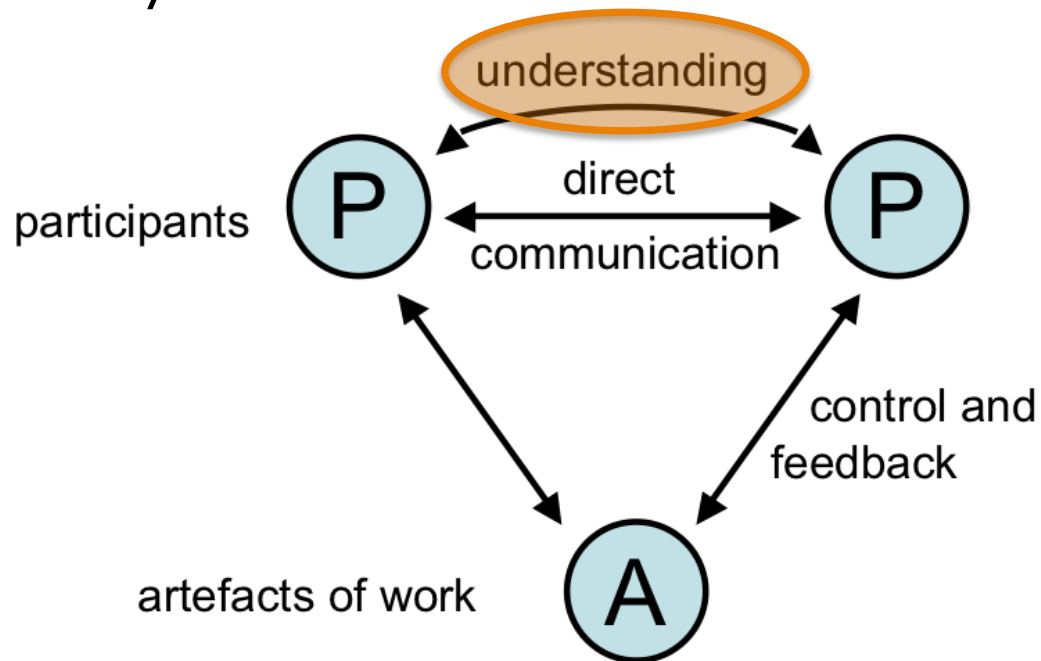
# Multi-user interaction

## Dix' taxonomy



# Multi-user interaction

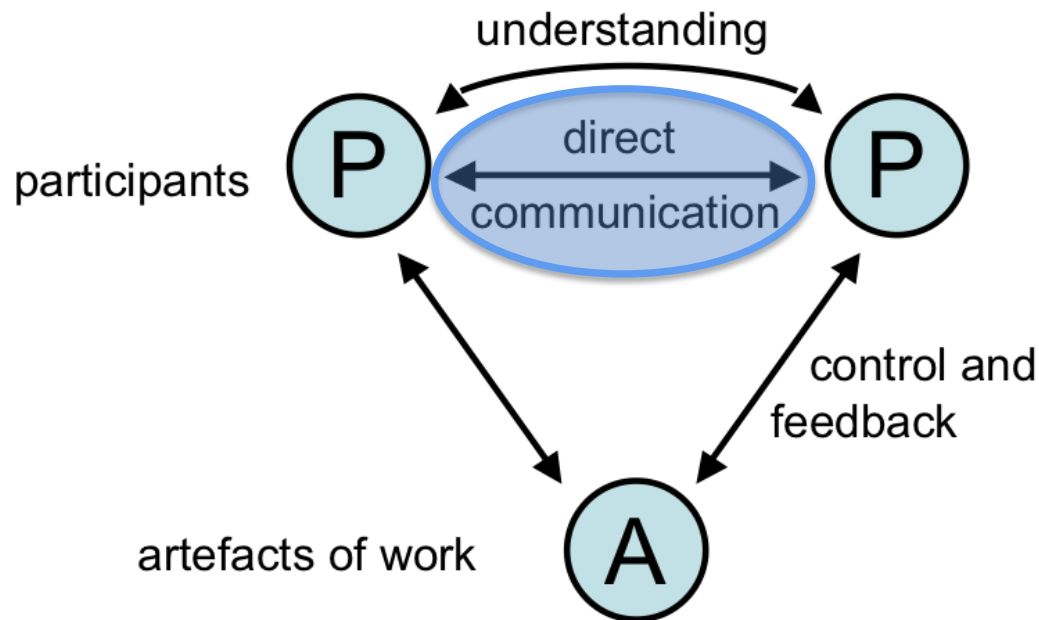
## Dix' taxonomy



- ▶ Meeting and decision-support system

# Multi-user interaction

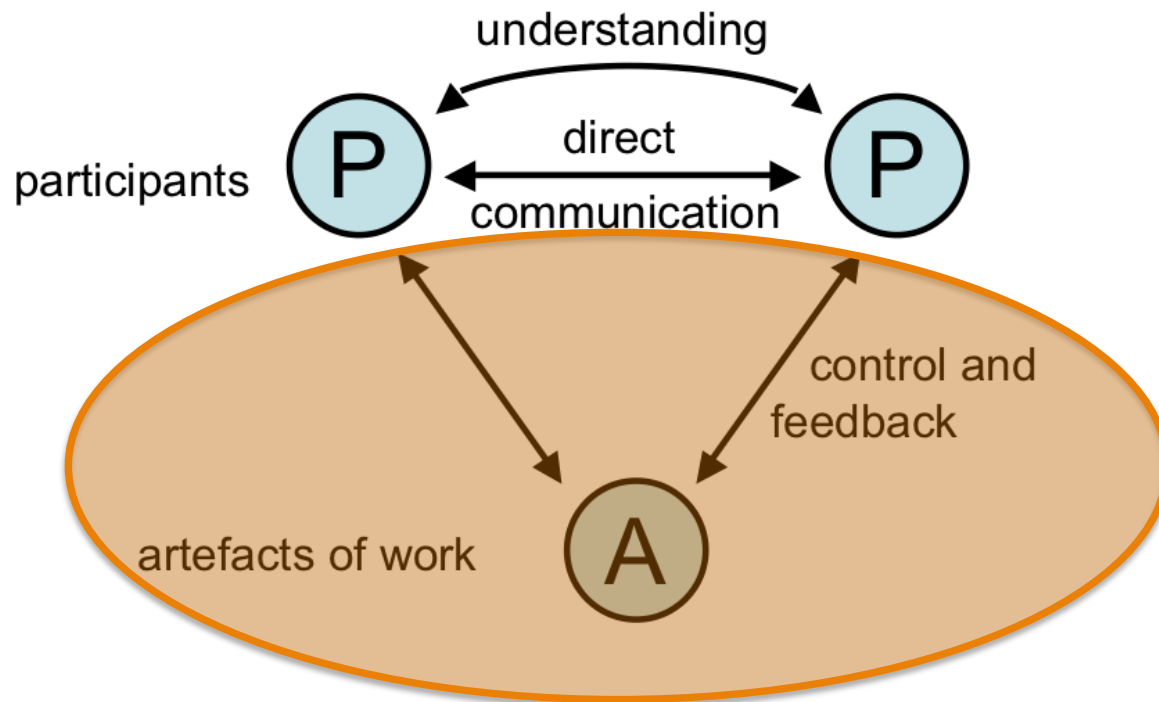
## Dix' taxonomy



- ▶ Meeting and decision-support system
- ▶ Computer-Mediated Communication

# Multi-user interaction

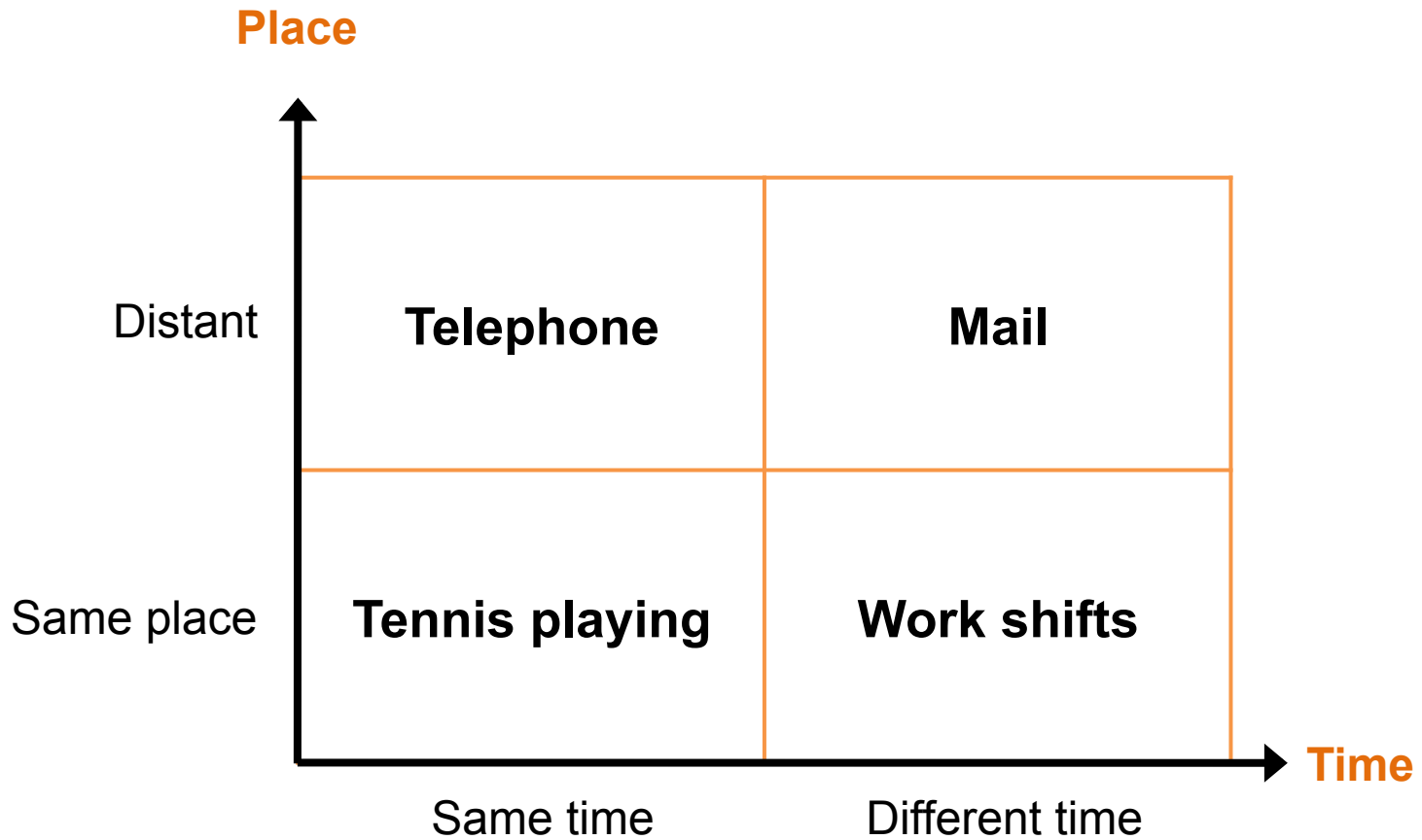
## Dix' taxonomy



- ▶ Meeting and decision-support system
- ▶ Computer-Mediated Communication
- ▶ Shared application and artifacts

# Space/Time matrix

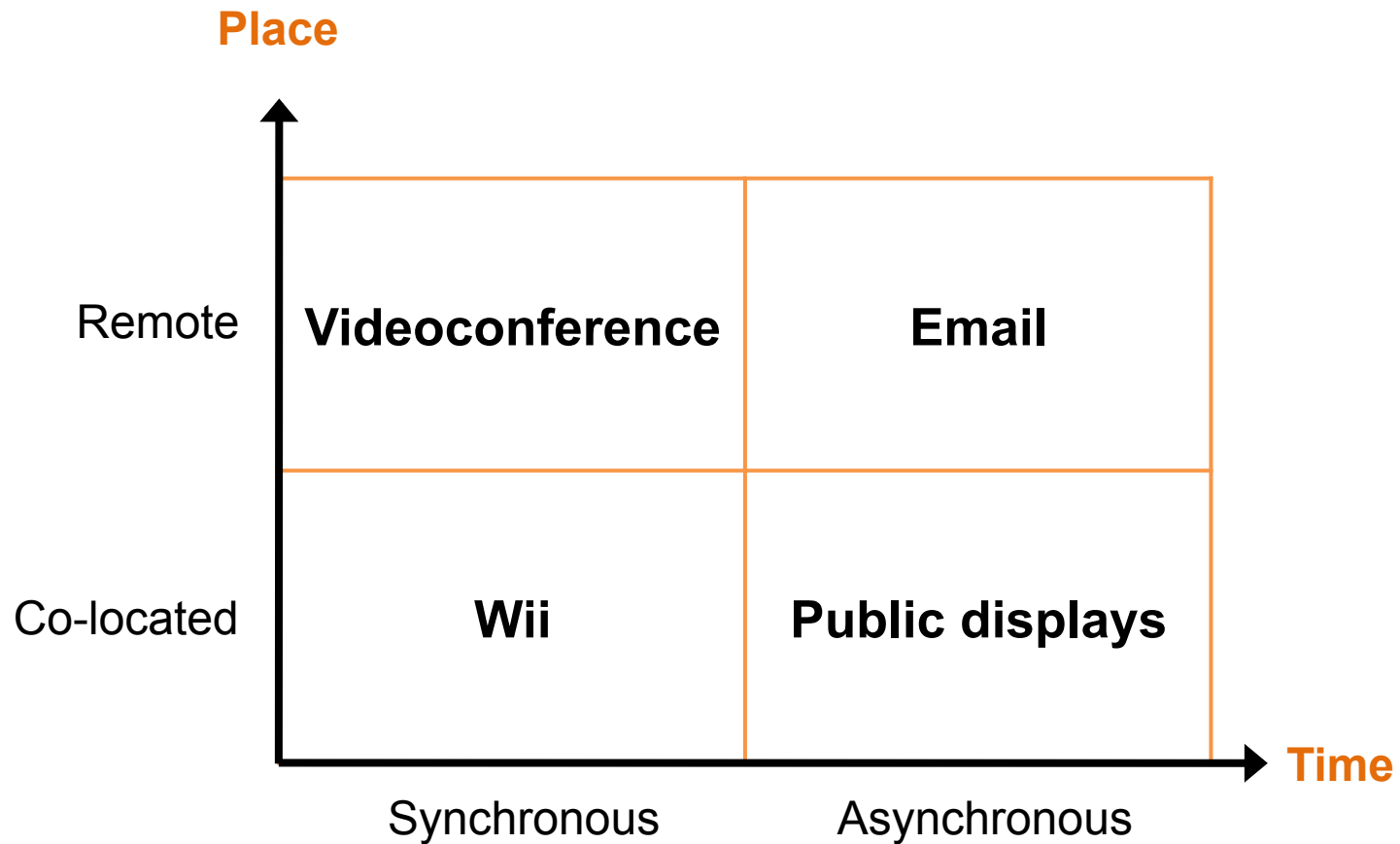
## ▷ Physical world





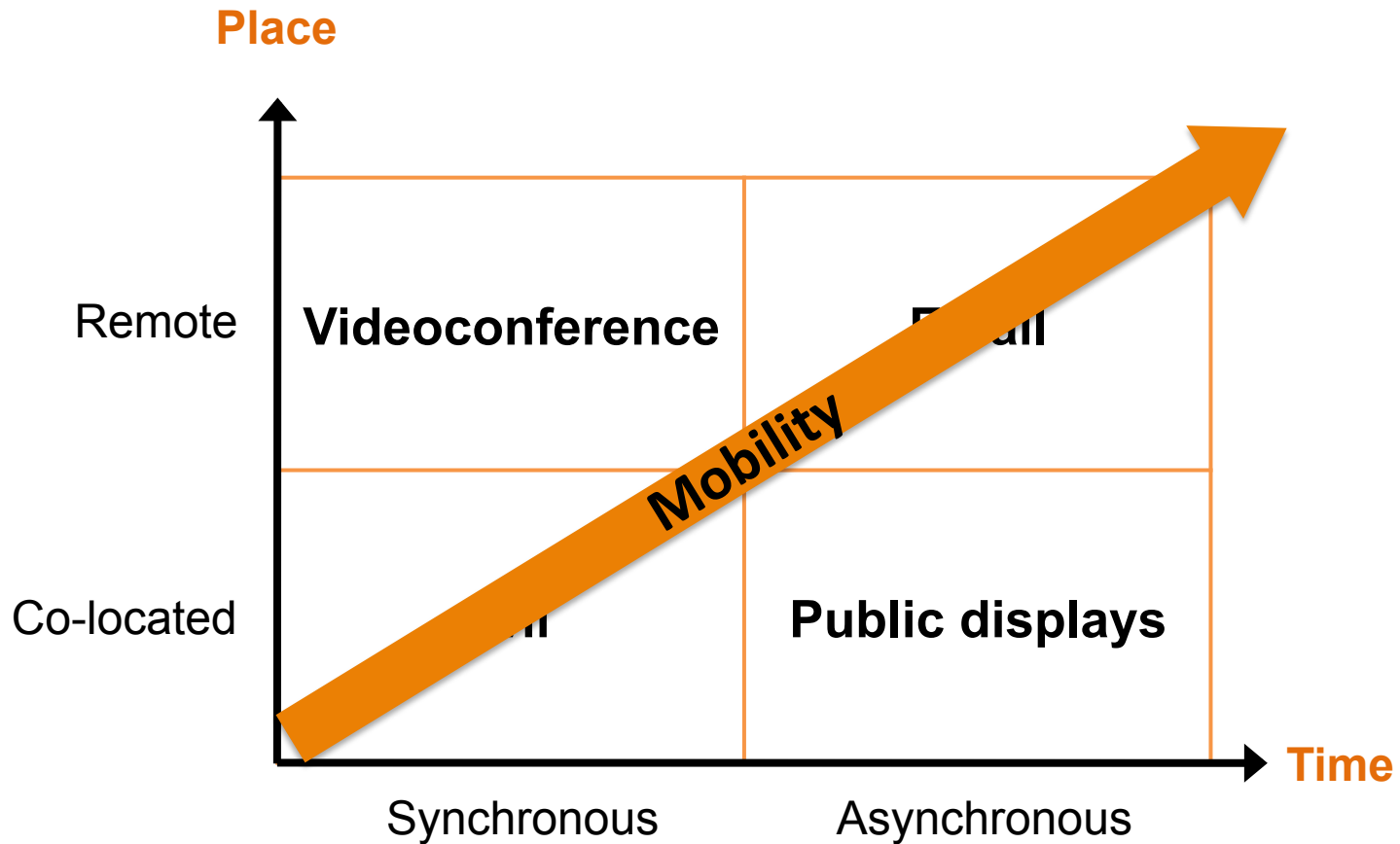
# Space/Time matrix

## ▷ Digital world

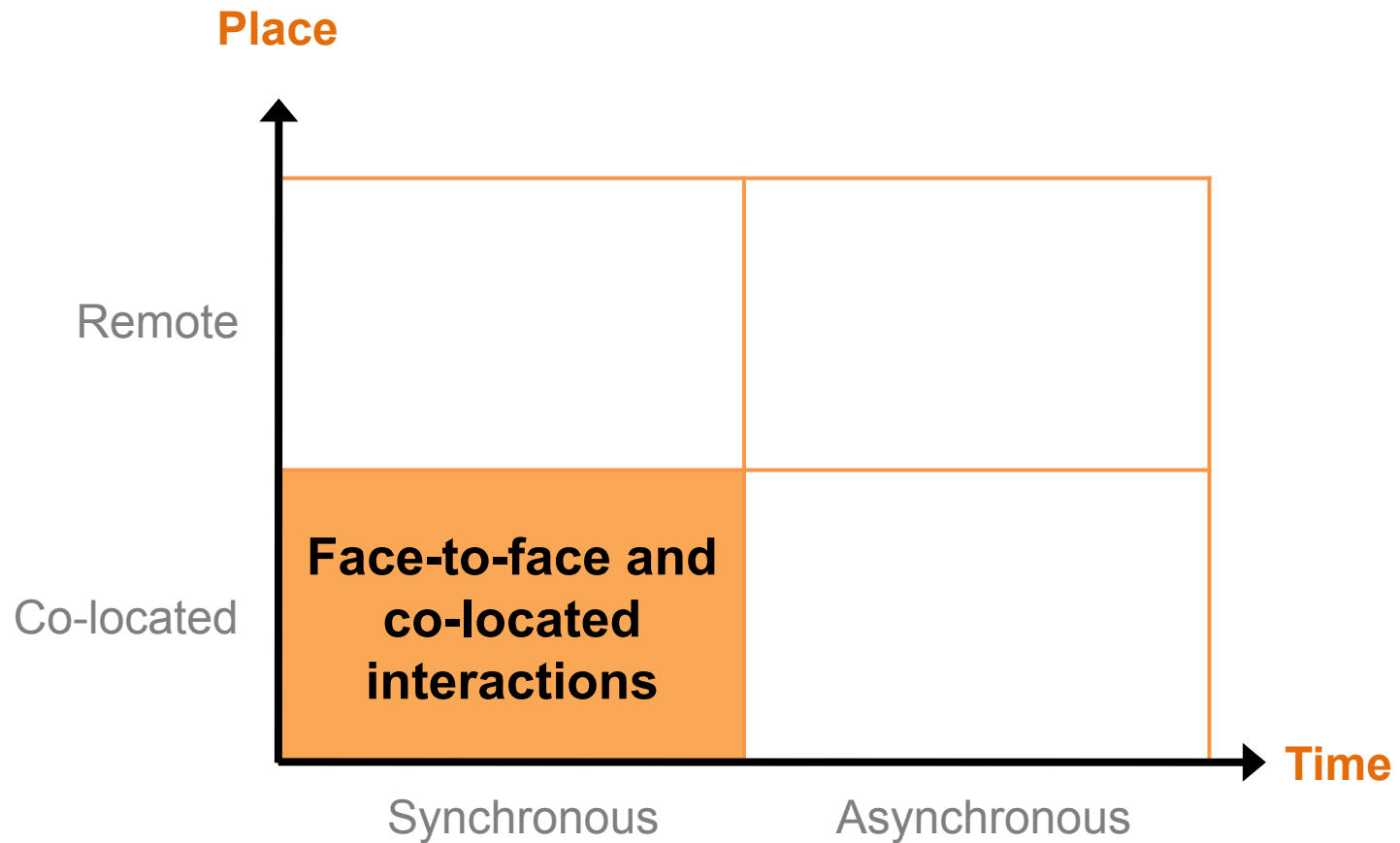


# Space/Time matrix

## ▷ Digital world



# Space/Time matrix



# Meeting rooms

*[Engelbart 1967]*



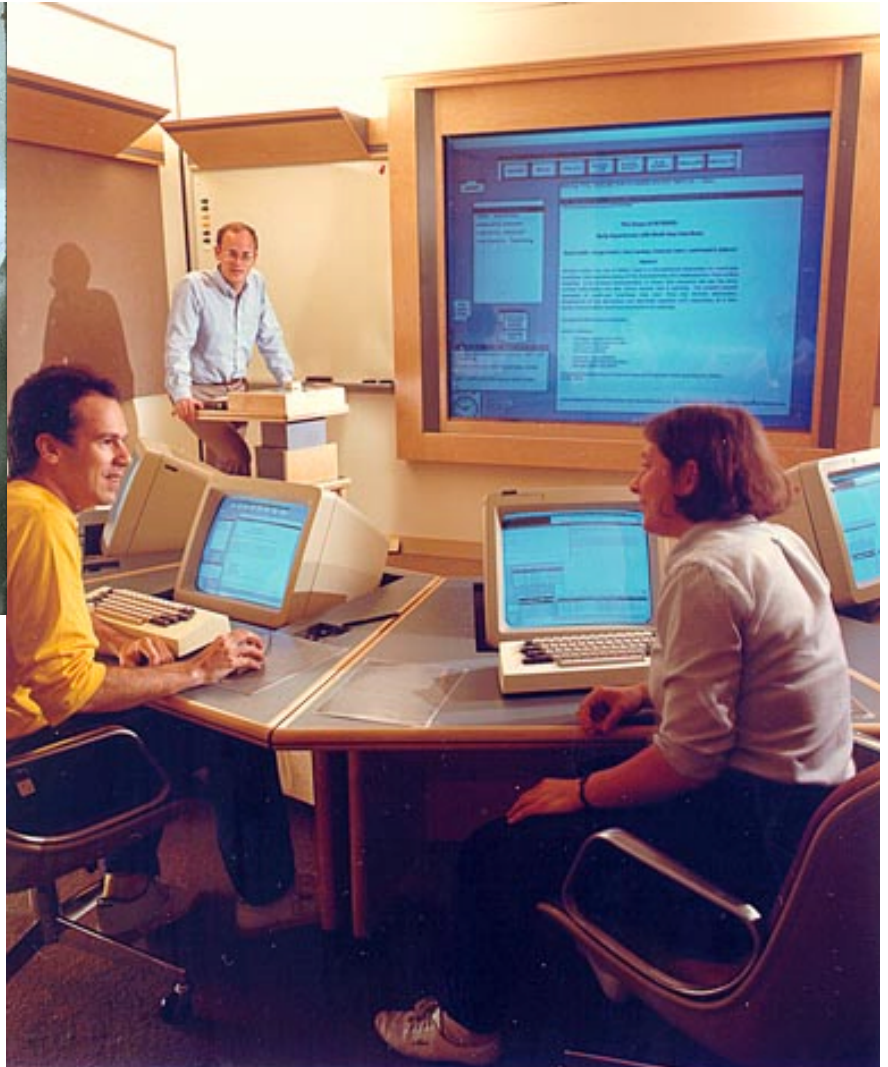
# Meeting rooms

F2F	

*[Engelbart 1967]*



*Colab [Stefik 1987]*



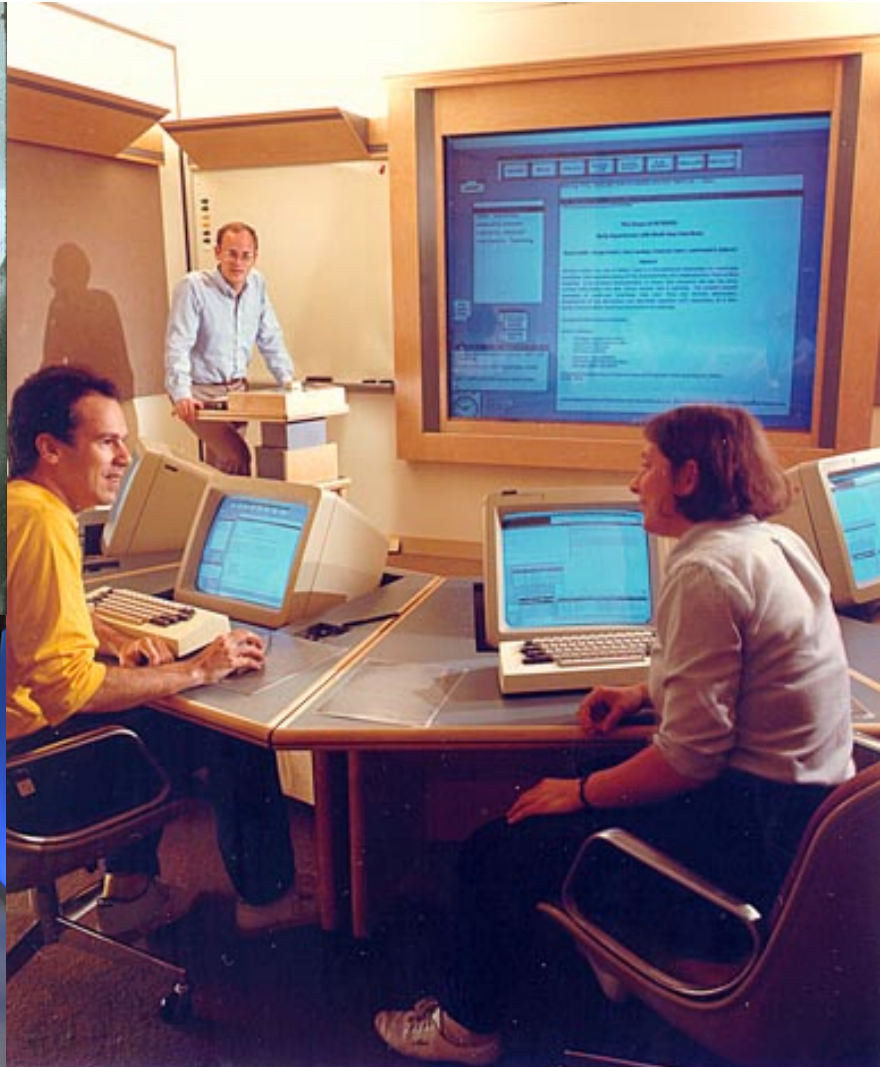
# Meeting rooms

F2F	

*[Engelbart 1967]*

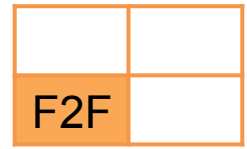


*Colab [Stefik 1987]*



*Tandberg T3 [Tandberg 2008]*

# Meeting rooms



## Goals

- ▶ Support production of ideas
- ▶ Assist decision-making and planning (GDSS)



## Functions

- ▶ Data sharing (e.g. shared workspace)
- ▶ Brainstorming tools (e.g. whiteboard)
- ▶ Organization and structuration tools
- ▶ Decision tools
- ▶ Communication tools
- ▶ etc



# Single Display Groupware

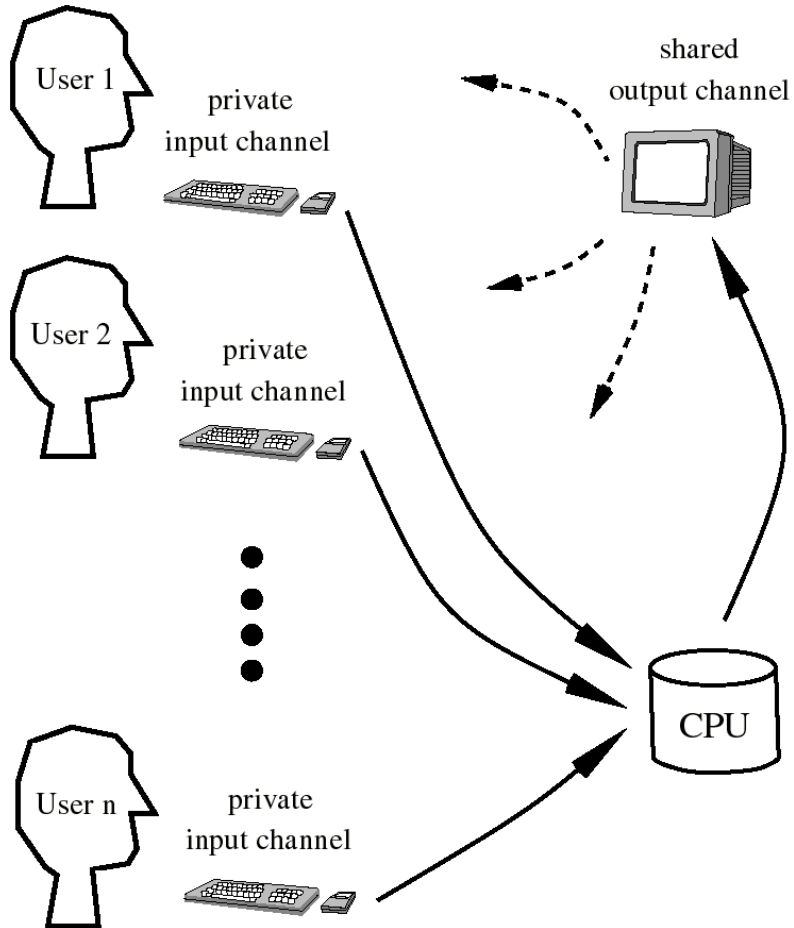
PC sharing



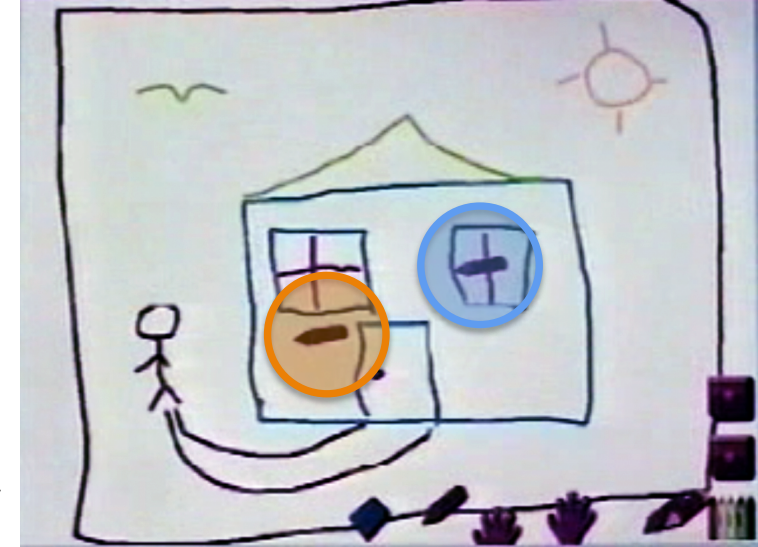
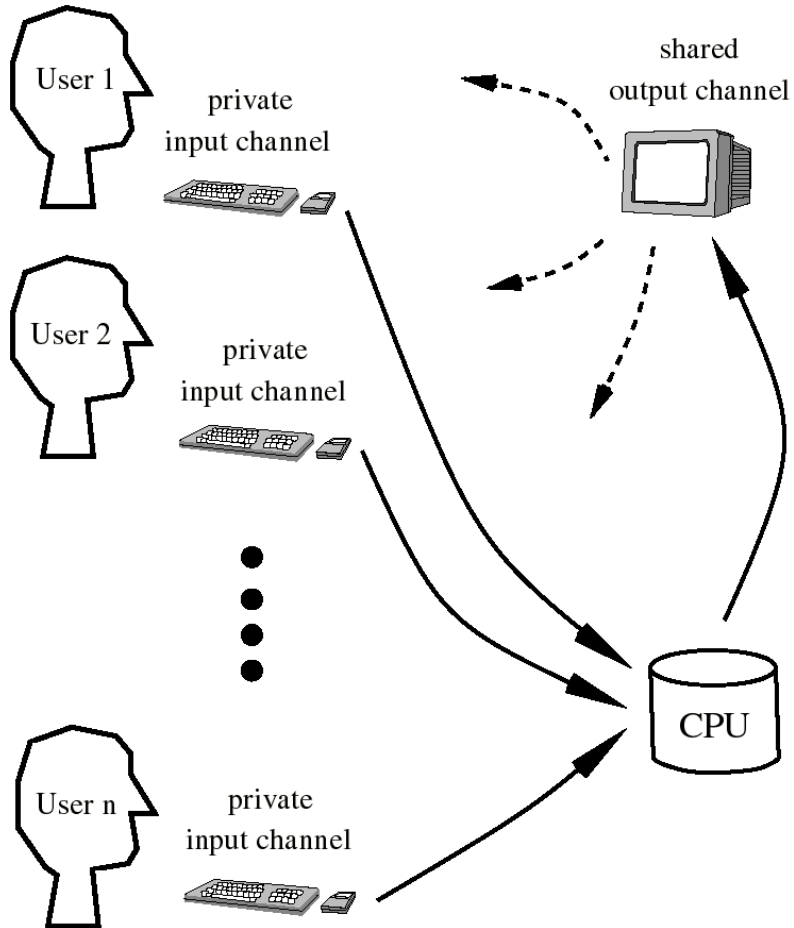
*[Tse 2004]*



# Single Display Groupware

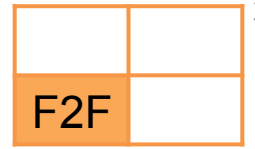


# Single Display Groupware



[Bederson 1999]

Kidpad [Bederson 1999]



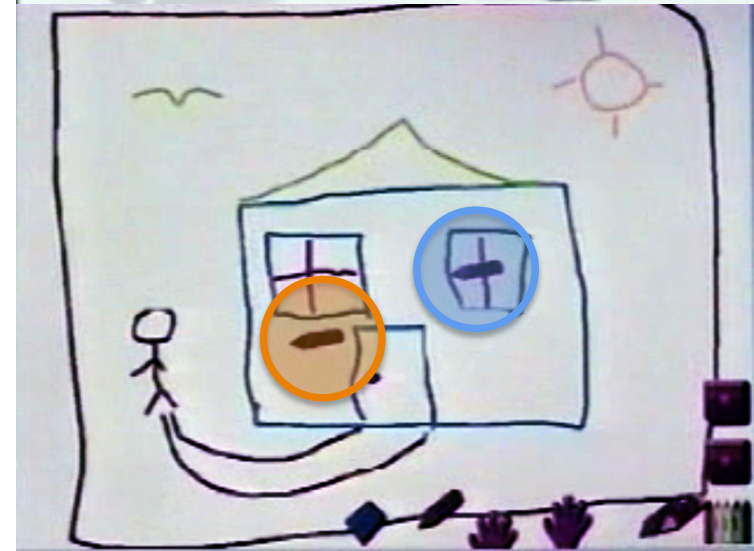
# Single Display Groupware

## Shared and private resources

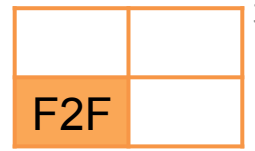
- ▶ e.g. one display, two mice
- ⇒ Restricted screen space

## Shared user interface

- ▶ One user at-a-time
- ▶ vs. simultaneous actions



*Kidpad [Bederson 1999]*



# Single Display Groupware

## Coupled navigation

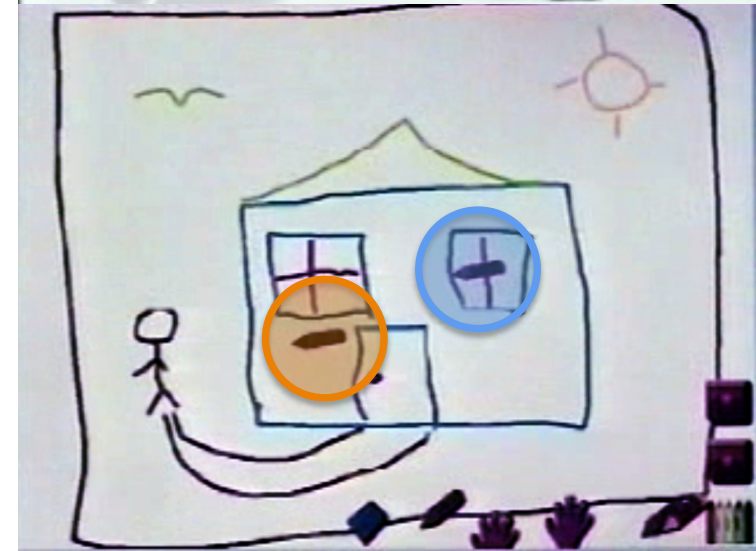
- ▶ Private space vs. public

## Shared feedback

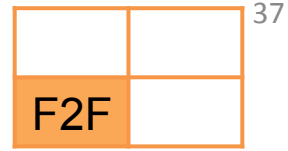
- ▶ Global state only
- ▶ No user differentiation

## Side-by-side interaction

- ▶ Non-verbal cues
- ▶ Social protocols



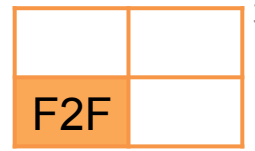
# Single Display Groupware



## User-differentiated UI

- ▶ Same widget, different behaviours

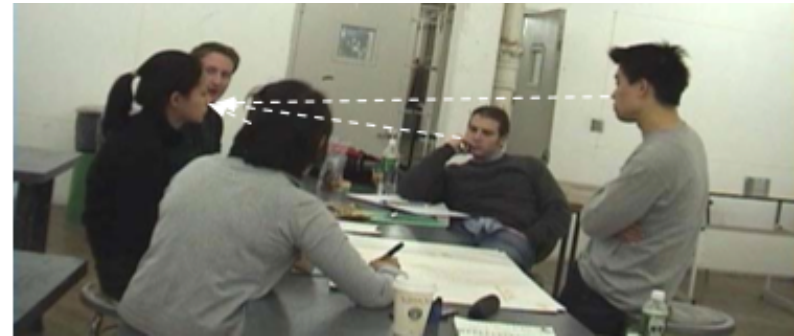




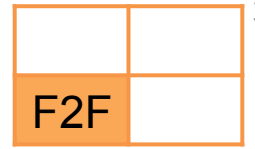
# Collaboration tables

Traditional tables naturally support collaboration

- ▶ Face-to-face collaboration
- ▶ Reaching on the workspace
- ▶ Simultaneity
- ▶ Physical objects
- ▶ Large work-surface



[Wang 2004]



# Interactive tables

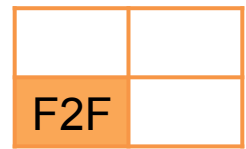
Allows direct manipulation of digital artefacts

## Properties

- ▶ Interpersonal interaction
- ▶ Fluid transitions
- ▶ Personal and group work
- ▶ External work support
- ▶ Physical vs. digital objects
- ▶ Arrangement of users
- ▶ Simultaneous users



*[Scott 2003], Digtible [LIG]*



# Interactive walls

Allows direct manipulation of digital artefacts

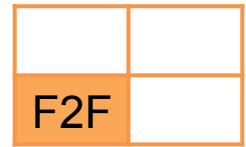
## Properties

- ▶ Orientation
- ▶ Very large work-surface
- ▶ Personal and group space
- ▶ Division of labor



*[Streitz 1999] [Seifried 2012]*





# Interactive walls

Allows direct manipulation of digital artefacts

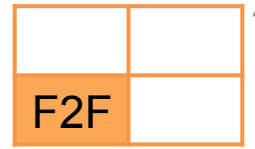
## Properties

- ▶ Orientation
- ▶ Very large work-surface
- ▶ Personal and group space
- ▶ Division of labor

⇒ Public displays



*[Streitz 1999] [Seifried 2012]*



# Single Display Groupware

PC sharing

Home video game console

- ▶ Multi-player games
- ▶ Embedded sensors
- ▶ Multi-modal

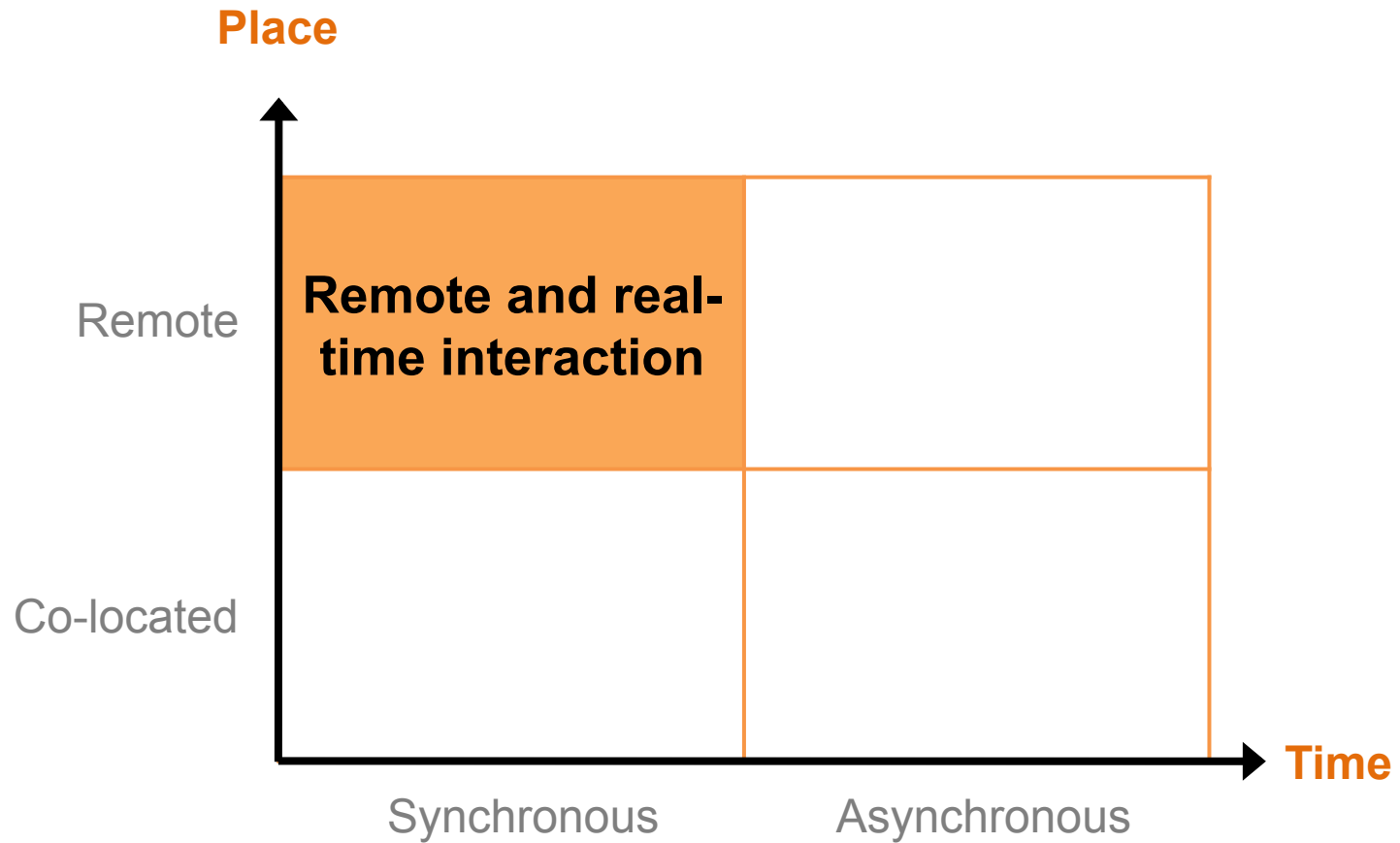
*Wii [Nintendo]*



*Kinect [Microsoft]*



# Space/Time matrix



RRTI	

# Communication systems

## Videoconference

- ▶ Image quality
- ▶ Latency issues
- ▶ Emotions
- ▶ Context ?
- ▶ Reciprocity ?
- ▶ Eye-contact ?



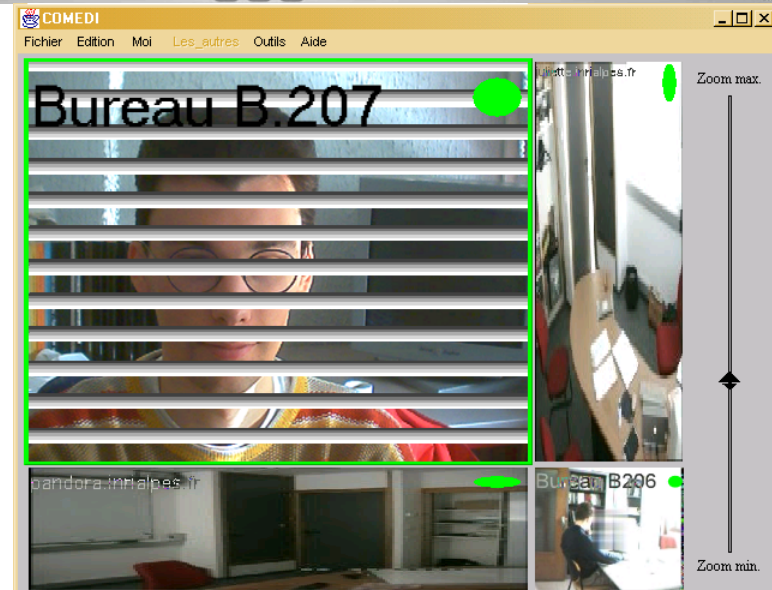
*iChat [Apple]*

RRTI	

# Communication systems

## Mediaspace

- ▶ Informal interactions
- ▶ Feeling of cohesion
- ▶ Activity indicators
- ▶ Intrusive ?



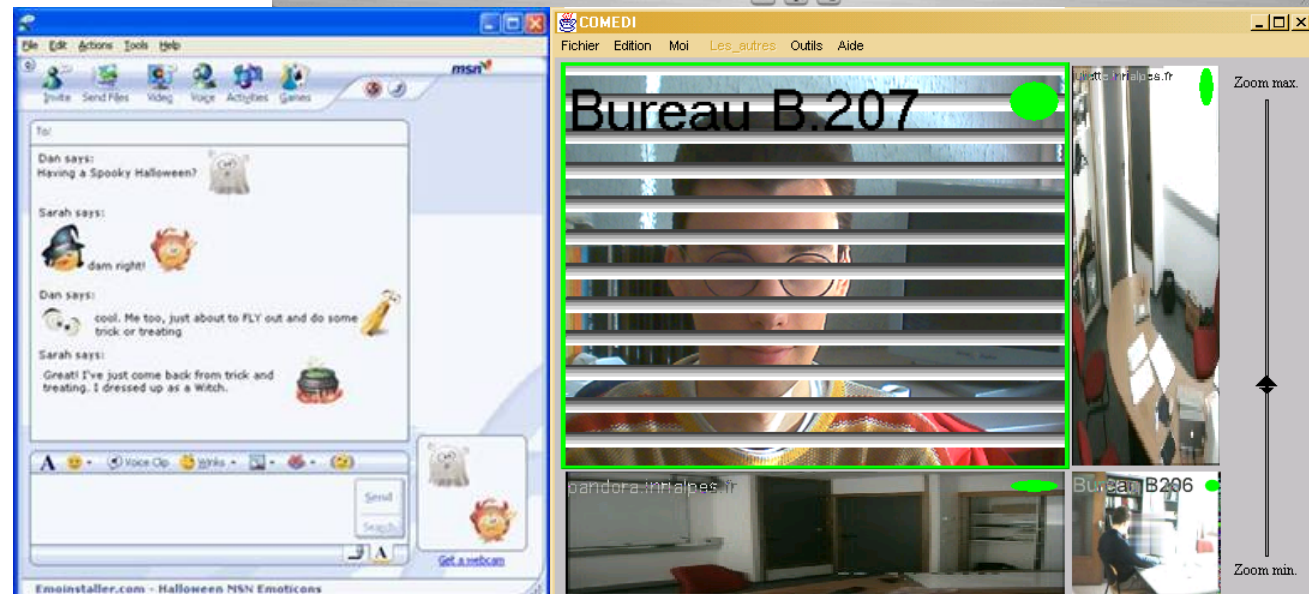
*COMEDI [Coutaz 1999]*

RRTI	

# Communication systems

## Online discussions

- ▶ Casual
- ▶ Communities
- ▶ Disturbance ?



*MSN [Microsoft]*

# Communication systems

## Virtual worlds

- ▶ 3D spaces
- ▶ Space and places
  - ▶ Rooms
- ▶ Embodiment
- ▶ Navigation issues



# Shared workspaces

The screenshot displays the TeamWave Workplace interface for a room named "brad's Room #2". The interface includes a menu bar (File, Edit, Room, Tools, Help, URLRef), a list of connected users (Sam, Brad Johnson, John), and a central workspace area. The workspace contains several windows: a text editor, a diagram with nodes and arrows, a painting application, a list of tasks, and a "To do's" list. A blue arrow points from the text "Here are a few tools." to the diagram window. The workspace also features a URL icon and a "TeleLearning Conference" icon. At the bottom, a chat window shows a conversation between Brad Johnson and John.

TeamWave Workplace - brad's Room #2

File Edit Room Tools Help URLRef

Now in (Brad, John) brad's Room #2

Other Connected Users

Sam (Idle 1m) - Case Based Learning  
Brad Johnson (Active)  
John (Idle 1m) - brad's Room #2

Foyer  
brad's Room  
irap

www.cpsc.ucalgary.ca/grouplab

Here are a few tools.

TeamWave Software Ltd.

TeleLearning Conference

Chat to Everyone Know of any others?

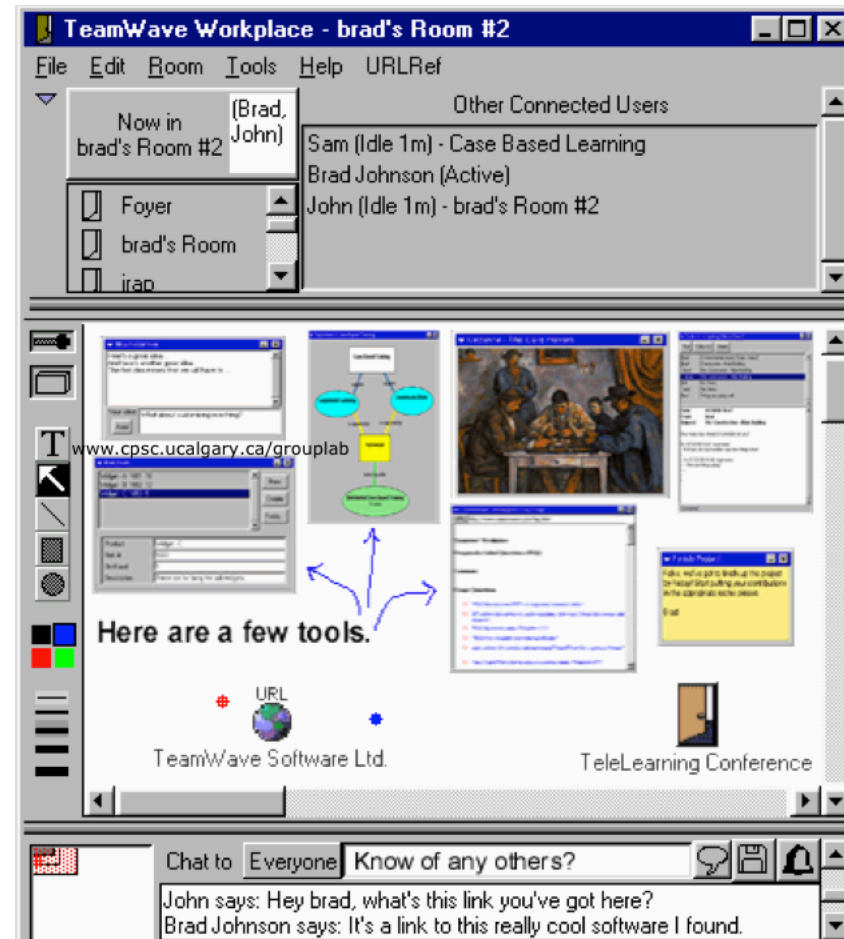
John says: Hey brad, what's this link you've got here?  
Brad Johnson says: It's a link to this really cool software I found.



# Shared workspaces

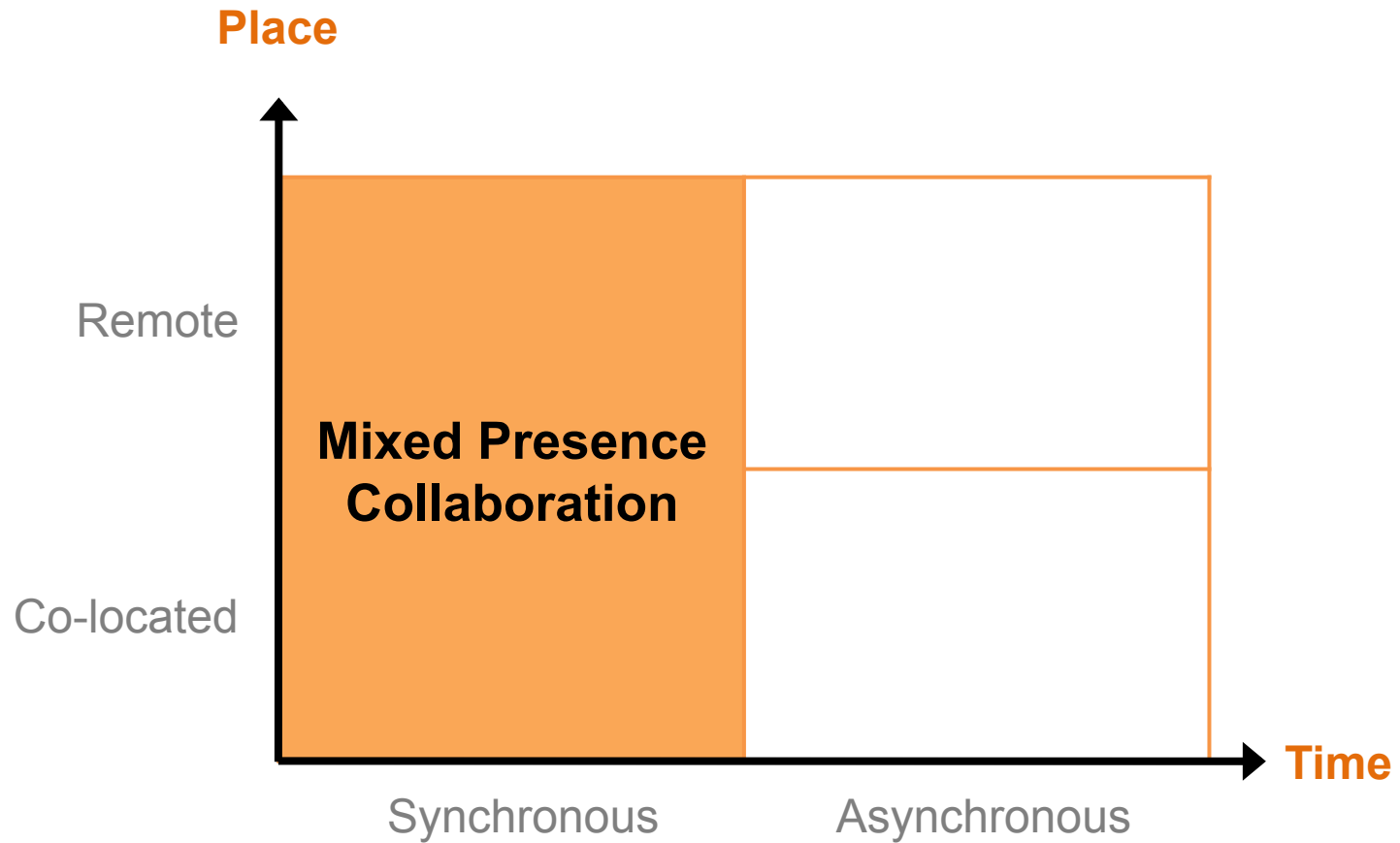
Work on same object

- ▶ One object, several users
- ▶ Multiple views
  - ▶ Group awareness
- ▶ Coupling
  - ▶ Loose vs. strict
- ▶ Division of labor
  - ▶ Roles



[Roseman 1996]

# Space/Time matrix

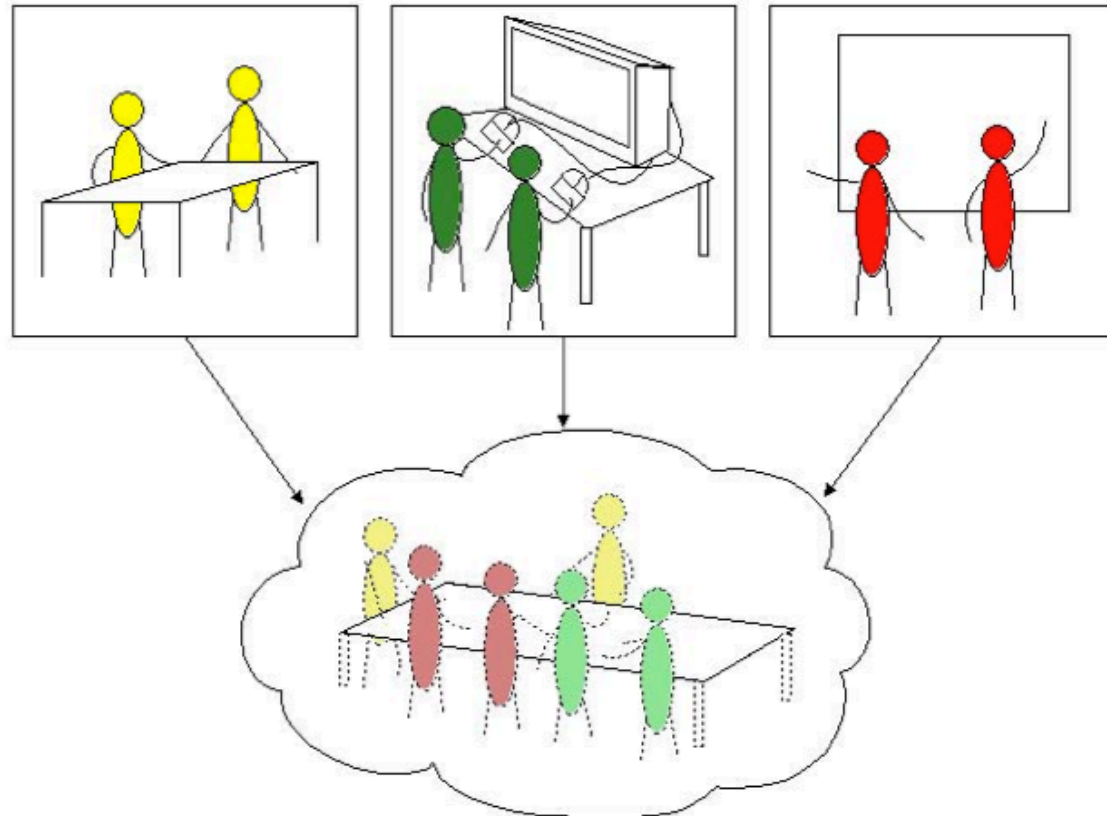


# Mixed Presence Groupware

Real-time

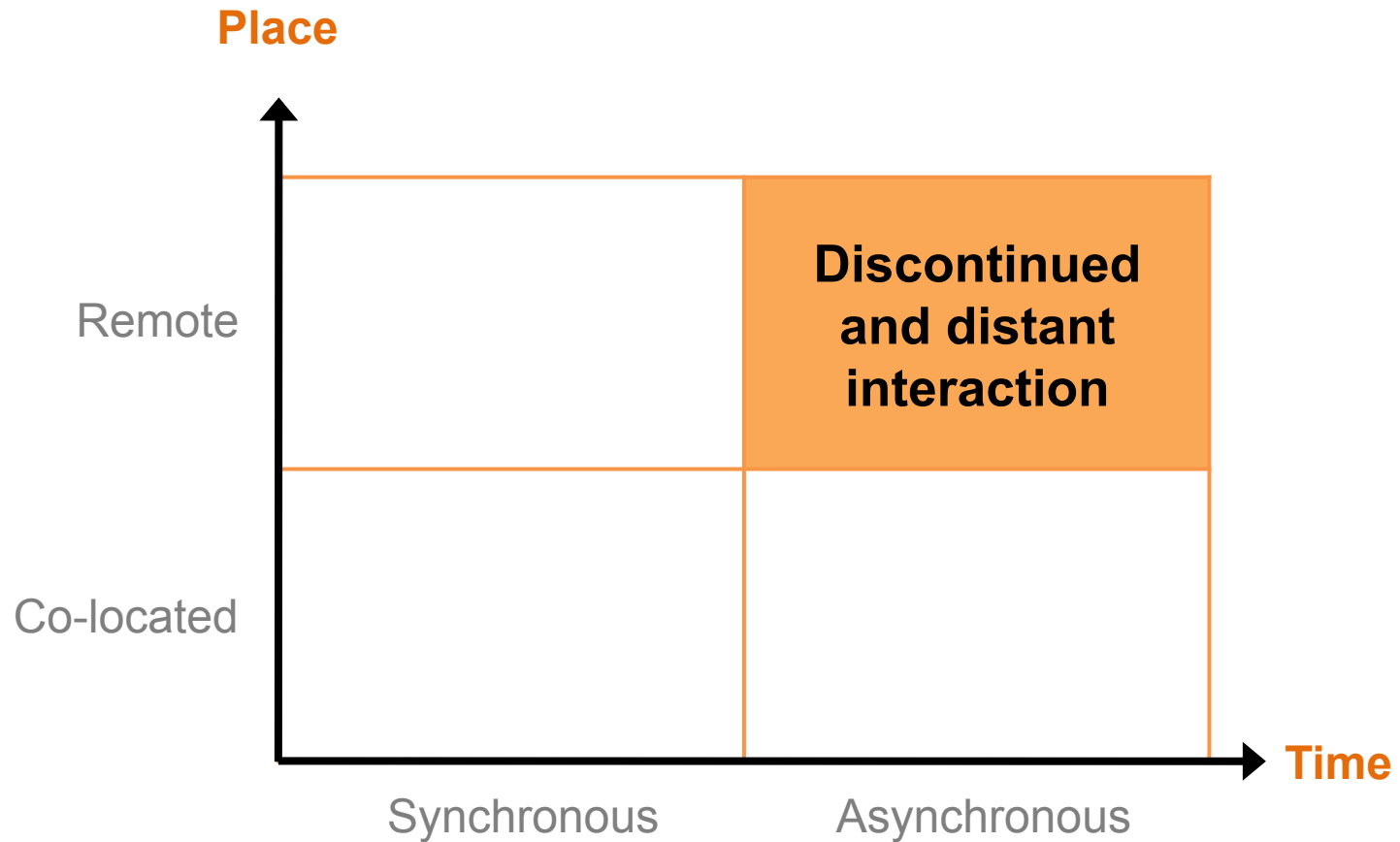
Shared visual workspace

- ▶ Support both remote and co-located
- ▶ Heterogeneity
- ▶ Seating rules
- ▶ Indicators of social presence



[Tang 2004]

# Space/Time matrix



	DDI

# Asynchronous communication

## Email

- ▶ one-to-one, one-to-many
- ▶ Social issues : intrusive
- ▶ Privacy ?
- ▶ Social engineering

## Blog, wiki

- ▶ Participative
- ▶ Communities
- ▶ Access control ?

## Social networks



# Shared calendars

	DDI	54

## Coordination management

- ▶ Sharing easier
- ▶ Automatic scheduling
  - ▶ Matching agenda
- ▶ Control ?
- ▶ Privacy ?

The screenshot displays the Google Calendar interface. At the top, there are navigation links for Google, Gmail, Calendar, Documents, Photos, Groups, Reader, and my services. The Google logo is prominently displayed with 'Calendar BETA' underneath. A search bar is visible on the right. Below the navigation, there are links for 'Create Event' and 'Quick Add'. The main calendar view shows a grid for April 2007, with the 26th highlighted. To the right, a detailed view for Sunday, April 29th, shows several events: 'Holy Week', 'April Fool's Day', 'Call to Arms: Arathi Basi', 'Palm Sunday', 'Stranglethorn Fishing Extr', '7:45 Church', 'Easter', 'Easter', 'EASTER!', 'Holy Week', 'Stranglethorn Fishing Extr', '7:45 Church', '5:50p depart from Chicagc', 'Car Insurance', 'Stranglethorn Fishing Extr', and 'Tax Day'. The sidebar on the left lists 'My Calendars' (Steve Beaudry, Aloma Baptist Church, Breakaway!, Kerusso Productions) and 'Other Calendars' (Brian Beaudry, Fran Beaudry, Jenni Beaudry).

	DDI

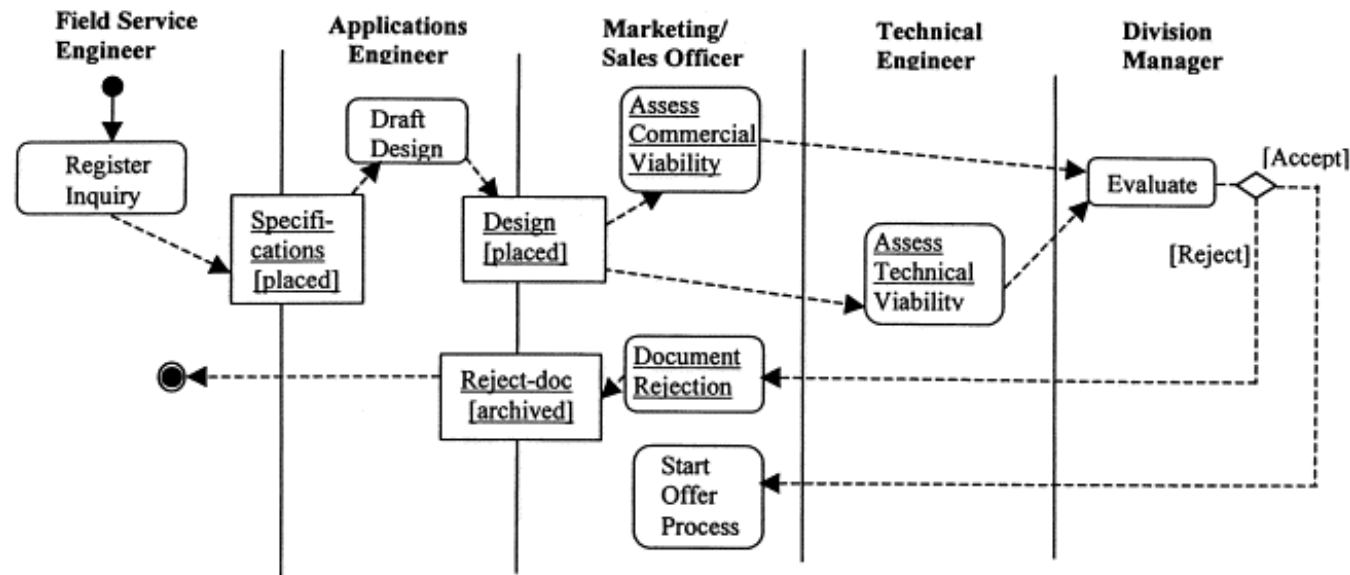
# Workflow

## Coordination of activities

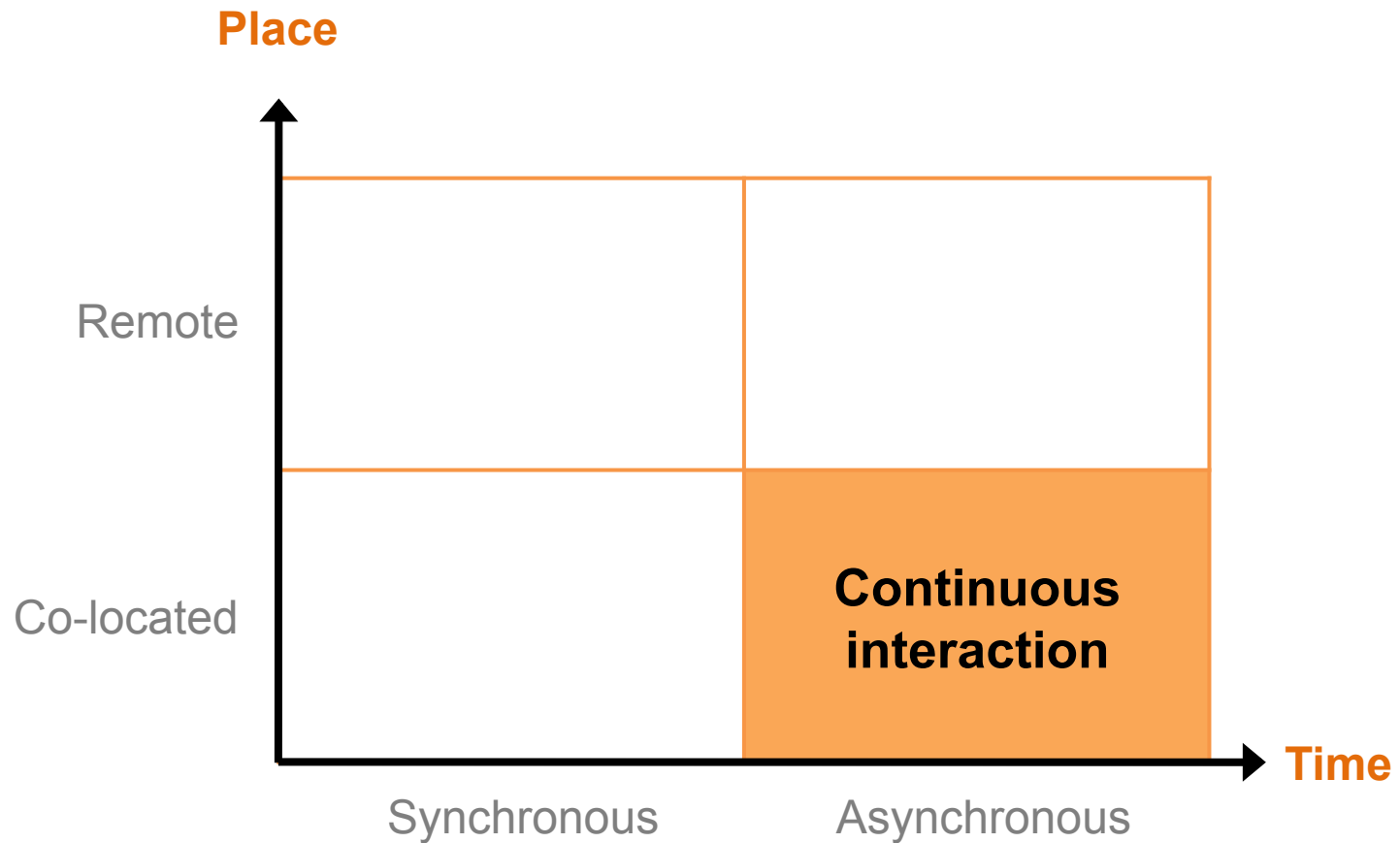
*Integration and harmonious adjustment of individual work efforts toward the accomplishment of a larger goal*

## Process management

- ▶ Sequence of connected steps
- ▶ Triggers



# Space/Time matrix





# Control rooms

## Work shifts

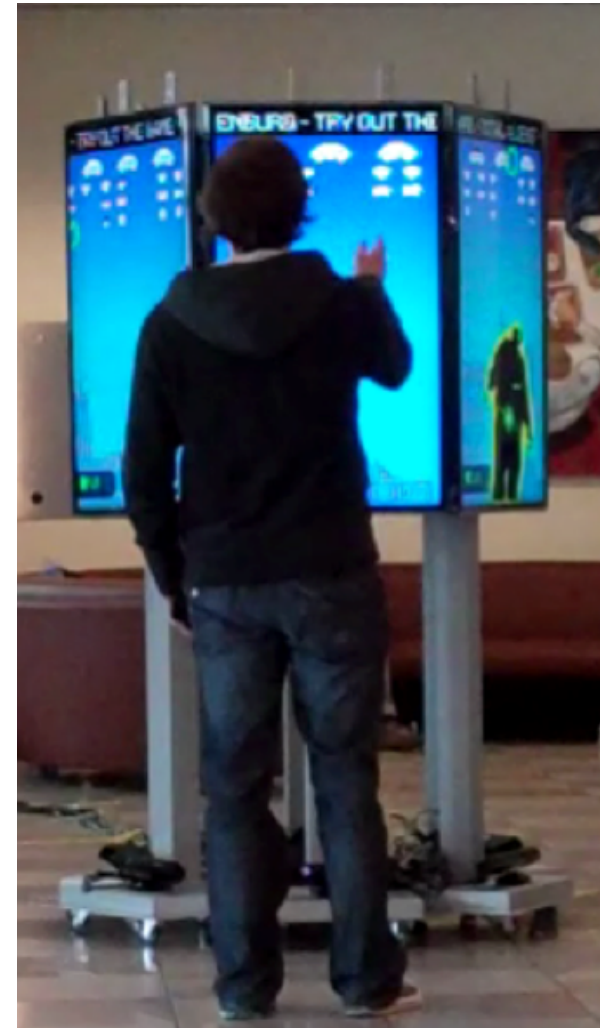
- ▶ Continuous task
- ▶ Information passing
- ▶ Traces of actions



*Power plant  
control room*

# Public displays

- ▶ Interaction history
- ▶ Social learning
- ▶ Social experience of gaming
- ▶ Honeypot effect



# Extended Space/Time matrix

