
Computer-Supported Cooperative Work

— People-Oriented Computing —

28.10.2019

Agenda

- A fun thought exercise!
- Announcements

CSCW

- Background and History
- Technologies
- Frameworks
- (Challenges and barriers to success)

A Fun Example

- What do you know about machine learning?
- How would you get a computer to recognize and respond to facial expressions?



Teachable Machine

- Take 3 minutes to think about this interaction using the concepts we have covered in the class, work with a partner if you'd like
- What makes this interaction successful (or unsuccessful)?
- How is it lowering (or raising?) barriers to understanding concepts and executing tasks?

Announcements

- Lab on Wednesday, 30.10, exercise is posted on OLAT
- Lecture from Daniel Greenblatt is available on OLAT
- Assignment #1 due on November 4 at 23:59 on OLAT

Learning Goals

After this lecture you should have foundational familiarity with the topic of Computer-Supported Cooperative Work (CSCW), including:

- Basic definitions, terminology and history
- Categories and examples of technologies
- Models and frameworks for thinking about CSCW, as well as basic application
- Challenges to the success of CSCW

CSCW BACKGROUND AND HISTORY

Computers in the context of work



Computing for Individuals vs. Groups

Focus thus far has been on interaction between individual humans and computer systems



Much of current technology goes beyond a closed interaction between an individual and a technology – how does technology connect humans?

Computer-Supported Cooperative Work (CSCW)

A field of research concerned with understanding social interaction and technologies supporting social interaction in groups, organizations, and communities

CSCW Definitions

“In its most general form, CSCW examines the possibilities and effects of technological support for humans involved in collaborative group communication and work processes”

- Bowers and Benford, 1991

CSCW Definitions

CSCW is "computer-assisted coordinated activity such as communication and problem solving carried out by a group of collaborative individuals"

- Greif, 1988

CSCW Definitions

CSCW is "a generic term which combines the understanding of the way people work in groups with the enabling technologies of computer networking, and associated hardware, software, services, and techniques."

- Ellis, 1991

Computer-Supported Cooperative Work (CSCW)

Has dual focuses:

technology
in software
and
hardware

group work
and social
phenomena

Computer-Supported Cooperative Work (CSCW)

Technologies to support group work and processes

- How can computing technology be applied to support and enhance cooperative work and organizations?
- How should such technologies be designed to support the diverse roles and needs in groups and organizations?

Computer-Supported Cooperative Work (CSCW)

Understanding socio-technical aspects of work in groups and organizations

- What is the nature of cooperative work carried out in groups as opposed to by individuals?
- What are the various roles and relationships in organizations, and how do these affect and influence the work?
- What are the challenges to cooperative work?

Computer-Supported Cooperative Work (CSCW)

Present day computing technologies

- Make ample use of social features
- Are seldom purely for individual use
 - Spectrum of group/individual use, e.g. MS-Word change tracking vs. synchronous Google docs editing
- Often blur the distinction between work and leisure

Computer-Supported Cooperative Work (CSCW)

If (nearly) all software supports social interaction, what does CSCW do?

- Core understanding of group processes and work
- Explicit understanding of technology support for collaboration

Parallel to the notion that everything artificial is designed, but there is still a need to understand design

Rough Boundaries of Traditional CSCW

Number of Users

1 10 100 1k 10k 100k 1M 10M

Identify of Users

Small group Organization Strangers

Purpose

Work Hobby Family Entertainment

Time scale

Minutes Hours Days Years Open-Ended

Rough Boundaries of Social Computing/Social Media

Number of Users

1 10 100 1k 10k 100k 1M 10M

Identify of Users

Small group Organization Strangers

Purpose

Work Hobby Family Entertainment

Time scale

Minutes Hours Days Years Open-Ended

Groupware

Refers to the technical systems that arise from CSCW research and development

“Computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment.” – Ellis, 1991

“Software designed to run over a network in support of the activities of a group or organization. These activities can occupy any of several combinations of same/different place and same/different time.” – Olson & Olson, 2002

Early CSCW Efforts

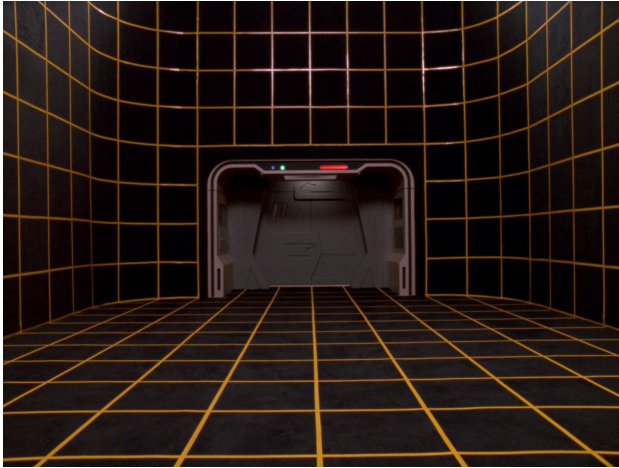
- Placed heavy emphasis on facilitating synchronous, remote communication
- “Holy Grail” goal of CSCW was to simulate “being there” or face-to-face communication

Early CSCW Efforts



Face to Face

(What is a Holodeck?)



(If You Prefer Star Wars)



Early CSCW Efforts

Focused extensively on improving the experience of videoconferencing to create the illusion of colocation



Early CSCW Efforts

Videoconferencing with more than two people becomes challenging

Hard for participants to keep track of:

- Eye gaze
- Deixis (pointing)

Early CSCW Efforts

- Olson and Olson (2000) identified several key reasons why videoconferencing experience can't match face-to-face:
 - Difficulty of establishing common ground (awareness of other people)
 - Different time zones
 - Cultural differences

Early CSCW Efforts

At the same time as research focused on videoconferencing, other tools were proving to be successful for supporting group work

- Wiki
- Instant messaging

“Beyond Being There”

Moving the focus away from trying to simulate face-to-face interaction, including

- Asynchronous communication
- Anonymous communication
- Automatic archiving of communication

“Beyond Being There”

Principle: The goal should be to support the *functions of collocation* rather than the **form** (Bob Kraut)

CSCW TECHNOLOGIES, A SAMPLING

Classes of CSCW Technologies

- **Computer-mediated communication** – systems that support the direct communication between participants
- **Meeting and decision support systems** – systems that capture common understanding
- **Shared applications and artifacts** – systems that support participant interaction with shared work objects – the artifacts of work
- **Awareness applications** – systems that promote awareness of individual and group status

Computer-Mediated Communication

CSCW systems that support direct communication

- Usually support remote communication
- Can be asynchronous (often text based) or synchronous

Asynchronous CMC

- The oldest forms of CMC
- Primary examples:
 - Email
 - Bulletin boards/online forums



Synchronous CMC

- Can support synchronous communication (though many can also be used asynchronously)
- Examples
 - Instant messaging/Chat
 - Video conferencing
 - Virtual collaborative environments (virtual reality, virtual worlds)



Conferencing Tools – Voice and Video

- Support for real time meetings via high bandwidth connections
- Sometimes allow for sharing of artifacts, e.g., shared documents, agendas, slides, electronic whiteboards
- Still difficulties with quality, interaction, turn-taking



Source: [uconn.edu](#)



Source: [wikipedia.com](#)

Meeting and Decision Support Systems

- Participants in shared work must establish a common understanding about tasks to be performed
- Often work involves generating and recording ideas
 - E.g. research, design tasks, management meetings, brainstorming sessions
- Systems can support idea generation and idea and decision recording

Meeting Support

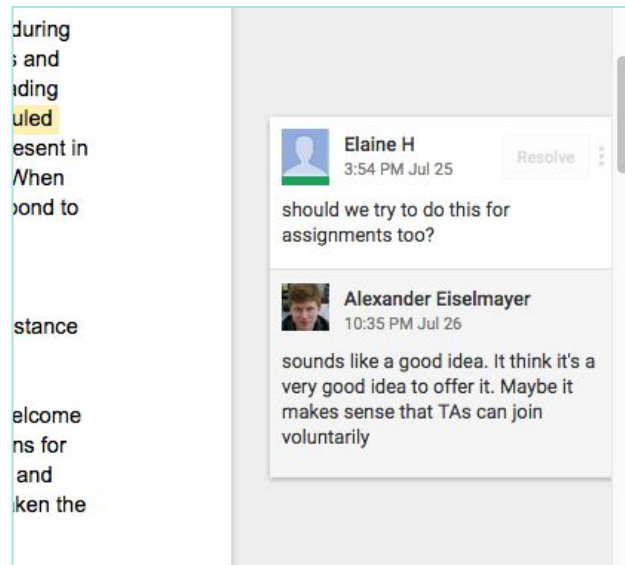
- May impose structure on the process of the meeting
- May support brainstorming and voting processes
- May provide support for group decision making, e.g., prioritization of projects, tracking of arguments
- May support shared editing of documents or artifacts
- May provide shared surfaces, e.g. electronic whiteboards, shared tabletops

Meeting and Decision Support Systems: Argumentation tools

Argumentation tools – record arguments used to arrive at a decision and often support asynchronous co-located teams

–

E.g. wiki change tracking, comments in shared document editors



Meeting and Decision Support Systems: Meeting Rooms

Meeting rooms – support face-to-face groups (synchronous, co-located) in brainstorming and management meetings



Meeting and Decision Support Systems: Shared Surfaces

- Shared surfaces – can be used for synchronous remote or co-located collaboration



Shared Applications and Artifacts

Systems in which the focus of sharing is the participants' work domain

- Shared computers used in work
- Shared documents used in work

Shared Applications and Artifacts: Shared Editors

- Shared editors
 - Editing applications (for text or other data) that are collaboration aware
 - Can be used synchronously or asynchronously
 - E.g. version control software, shared document editors, change tracking

Shared Applications and Artifacts: Shared Calendars

- Support viewing and editing of calendars among group or organization members
- Provides awareness among group members
- Met early resistance in organizations in 1980s but has since become widespread



Shared Applications and Artifacts: Workflow

- Support coordination of sequential steps of activities among team members working on a particular task
 - E.g. routing a travel reimbursement voucher from traveler to approving party to accounts payable to bank
- May allow for work monitoring and management
- E.g. bug tracking systems, code repositories

Shared Applications and Artifacts: Information Repositories

- Systems built for knowledge sharing among groups
- Aim to capture knowledge that can be reused by others
 - E.g. standard procedures, training, document templates
- E.g. Lotus Notes Domino, Wikis

Awareness

- Attempt to recreate aspects of face-to-face awareness among people who are distributed or remote
 - i.e., who is around, what people are doing, what activities are going on
- Video walls attempt to connect two remote spaces through video link
- Micro level awareness cues, such as status indicators on messaging clients



Early Media Space at Xerox PARC

CSCW FRAMEWORKS AND CONCEPTUALIZATIONS

CSCW Time/Space Matrix

	Same time synchronous	Different time asynchronous
Same place co-located	Face-to-face interactions	Continuous task
Different place remote	Remote interactions	Communication + coordination

CSCW Time/Space Matrix

Traditional Communication

	Same time synchronous	Different time asynchronous
Same place co-located	Face-to-face meetings	Post-its
Different place remote	Telephone	Letters (Snail Mail)

CSCW Time/Space Matrix

Where do the following technologies belong?

- OLAT forums
- Google Hangouts/Skype calls
- Shared electronic whiteboard
- Automatic recording of meeting minutes

	Same time synchronous	Different time asynchronous
Same place colocated	Face-to-face interactions	Continuous task
Different place remote	Remote interactions	Communication + coordination

CSCW Time/Space Groupware Matrix

Same time
synchronous

Different time
asynchronous

Same place
co-located

Face-to-face interactions

decision rooms, single display
groupware, shared tables, wall displays,
roomware

Continuous task

team rooms, large public displays, shift
work groupware, project management

Different place
remote

Remote interactions

video conferencing, instant messaging
chats, virtual worlds, shared screens,
multi-user editors

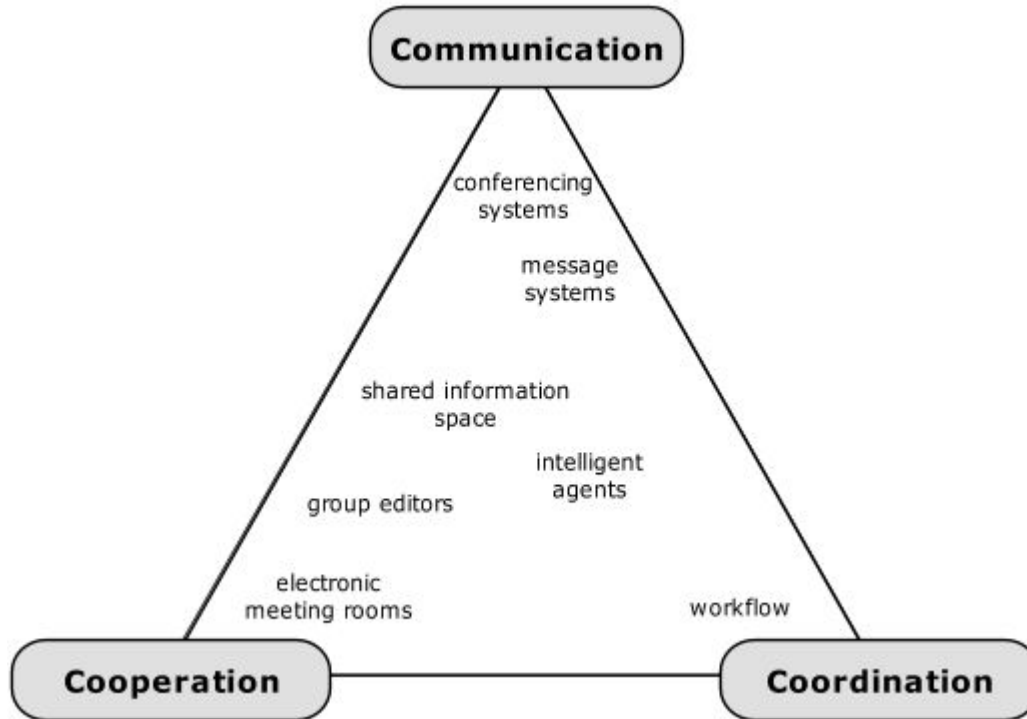
Communication + coordination

email, online forums, blogs, group
calendars, version control, wikis

CSCW Time/Space Matrix

- Considers groupware in terms of temporal and spatial parameters of use
- Does not classify based on intended function or purpose

Groupware 3C Model



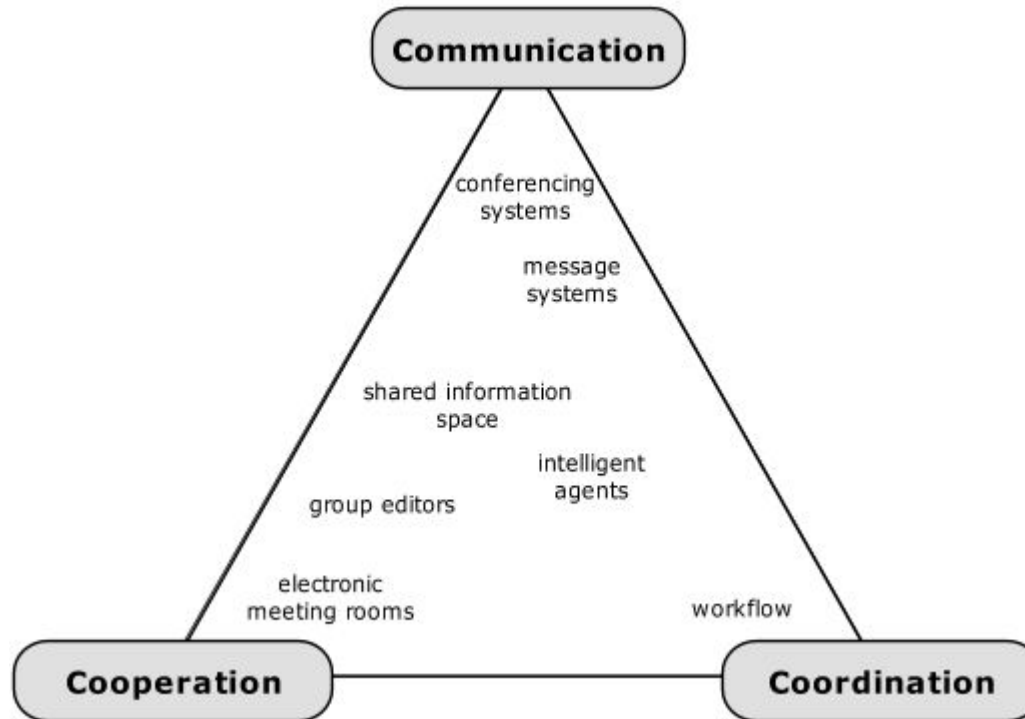
Groupware 3C Model

- Considers three dimensions of support
- Classifies groupware in space based on combinations of dimensions

Groupware 3C Model

- **Communication** – is the tool's primary purpose to provide channels of communication among group members?
- **Cooperation** – is the tool's primary purpose to support collaborative activities?
- **Coordination** – is the tool's primary purpose to facilitate the organization of joint work activities?

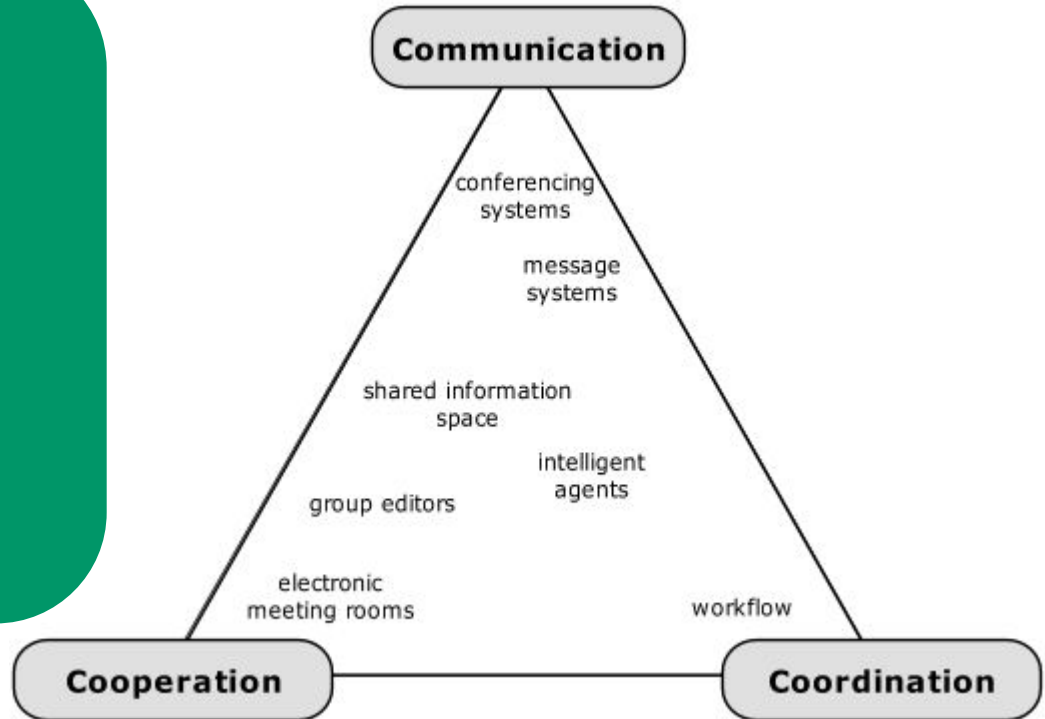
Groupware 3C Model



Groupware 3C Model

Where might these technologies fall:

instant messaging, shared electronic whiteboard, shared document editing, group calendars?



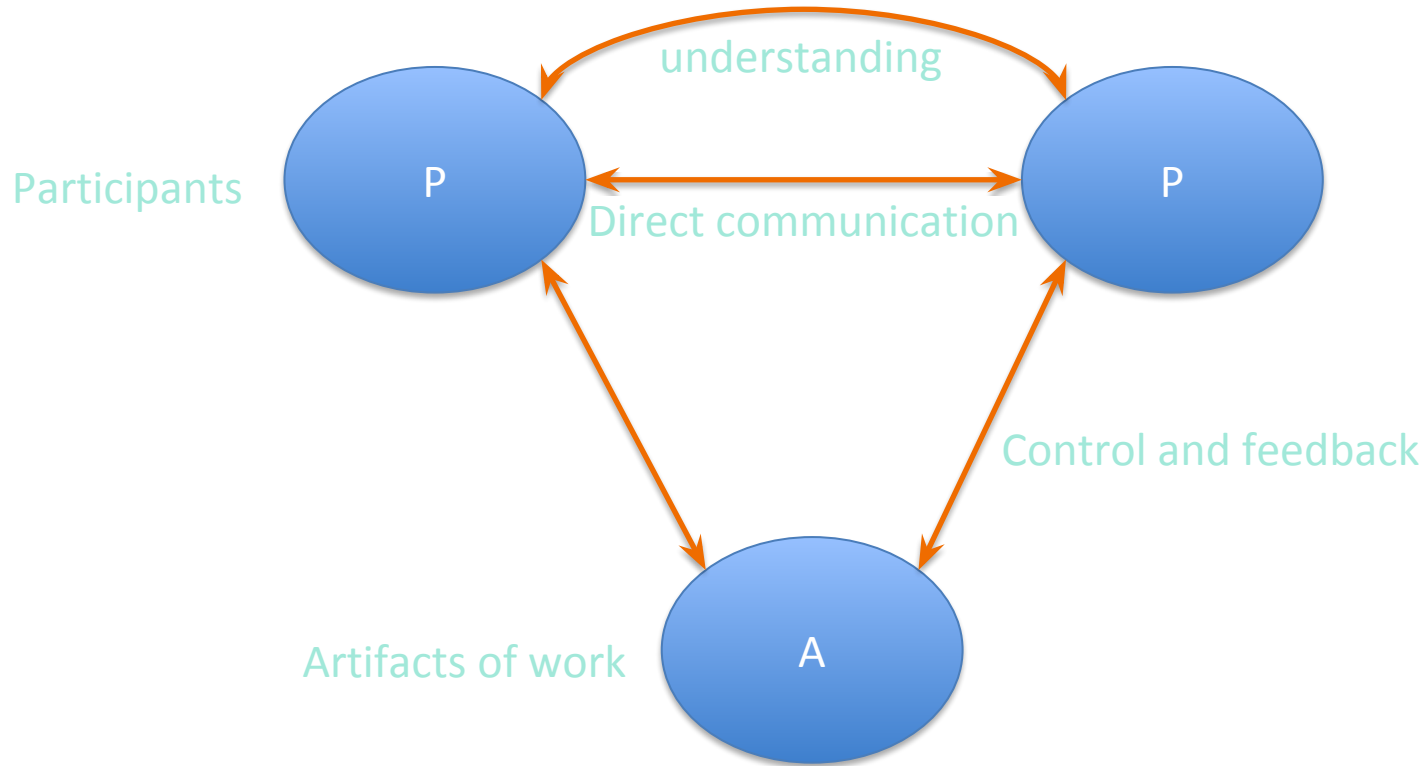
Cooperative Work Framework

- Also known as “People-Artifact Framework”
- Based on the entities involved in cooperative work
 - Participants in the work
 - Things upon which they work (artifacts)
- Participants are engaged in common work
- Participants interact with shared tools and products to do work

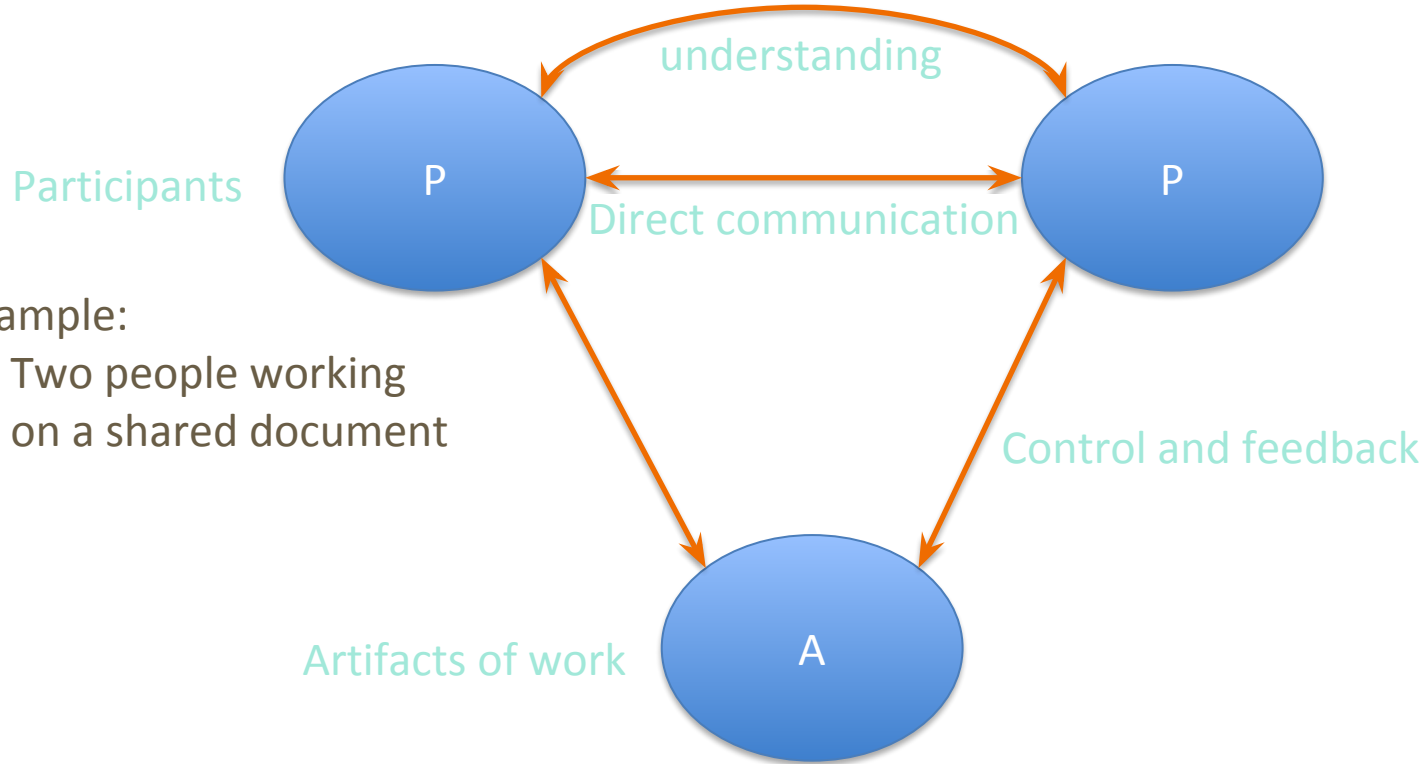
Cooperative Work Framework

- Participants communicate with each other as they work – “direct communication”
 - Face-to-face, writing letters, leaving messages, etc.
 - Communication serves to establish shared understanding of the task
- Participants interact with tools and work objects to perform job
 - Flow of control from participants to artifacts
 - Flow of feedback from artifacts to participants

Cooperative Work Framework



Cooperative Work Framework



Example:

- Two people working on a shared document

BARRIERS TO CSCW SUCCESS

Challenges for CSCW

Despite the ubiquity of CSCW tools in the workplace, many challenges still exist and a lot of potential is not yet fulfilled

- Collaborative surfaces and other meeting room technologies not fully realized
- Remote collaboration still impoverished compared to co-located
- Many failed systems – expensive for organizations in terms of time and resources

Challenges to CSCW

Groups and organizations are complex and dynamic

- Complicated to model in comparison to individual interaction
- Embody structures, hierarchies, and social rules that are not always explicit

Challenges to CSCW: Capturing Requirements

- When CSCW systems are introduced into an organization without a full understanding of how all people will be affected, problems can arise
 - E.g. Introduction of shared calendaring systems in hierarchical organizations
- Technology should be deployed to organizations only if it is done with an understanding of the context of use

Understanding Stakeholders

- End users of technology are not the only people affected by the introduction of the technology
 - E.g. who is affected by a change to OLAT?

Understanding Stakeholders

Stakeholders are anyone who is affected by the success or failure of a system

- **Primary stakeholders** – end users of the system
- **Secondary stakeholders** – people who do not directly use the system, but receive output from it or provide input to it
- **Tertiary stakeholders** – not in the first two categories, but directly affected by success or failure, e.g., someone whose profits increase or decrease as a result of the system's success
- **Facilitating stakeholders** – people involved with the design, development, or maintenance of the system

Understanding Stakeholders Example

Airline creates a system that allows associated travel agents to sell flights directly to the public

- **Primary stakeholders** – travel agency staff, airline booking staff
- **Secondary stakeholders** – customers, airline management
- **Tertiary stakeholders** - competitors, civil aviation authorities, customers' traveling companions, airline shareholders
- **Facilitating stakeholders** – design team, IT department staff

Understanding Stakeholders

- Good CSCW design aims to address the needs of as many stakeholders as possible, BUT
- Stakeholder needs are often in conflict with each other
- Stakeholder priority generally diminishes as you go down the categories

Disparity in Work and Benefit

Groupware applications often require additional work from individuals who do not perceive a direct benefit from the use of the application

E.g. Maintenance of shared calendars, systems for voice annotation of documents

Critical Mass

Groupware may not enlist the critical mass of users required to be useful, or can fail because it is never in any one individual's advantage to use it.

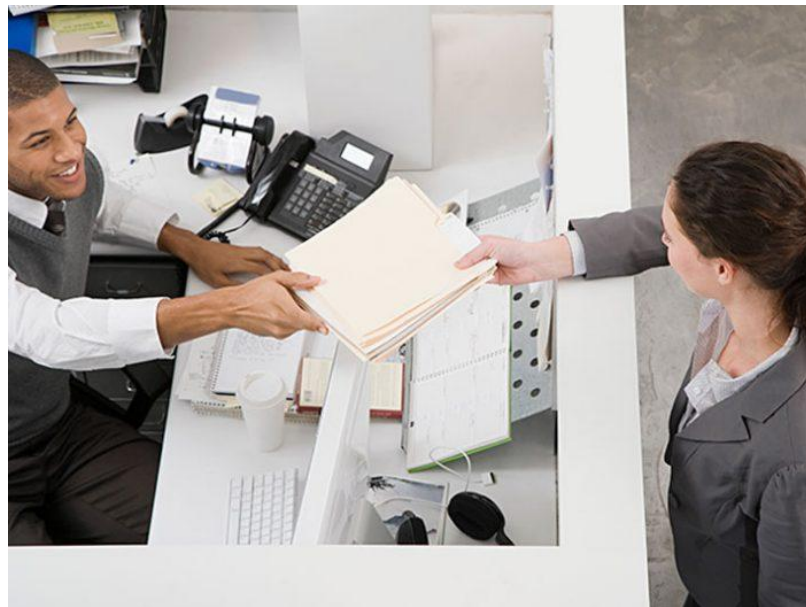
Early adopters may abandon system before critical mass is reached

E.g. document editing software, meeting scheduling systems, project management applications

Disruption of Social Processes

Groupware can lead to activity that violates social taboos, threatens existing political structures, or otherwise demotivates users crucial to its success

E.g., automatic meeting scheduling replacing scheduling through secretary; system for meeting arguments, counter arguments and decisions



[monster.com](https://www.monster.com)

Exception Handling

Groupware may not accommodate the wide range of exception handling and improvisation that characterizes much group activity

E.g. workflow management systems that require procedures be followed in a particular sequence



Unobtrusive Accessibility

Features that support group processes are used relatively infrequently, requiring unobtrusive accessibility and integration with more heavily used features

E.g., features for collaborative editing of graphics integrated into single-user editing software

Difficulty of Evaluation

Obstacles to meaningful, generalizable analysis and evaluation of groupware prevent us from learning from experience

Group interactions unfold over days or weeks, rather than hours

Evaluation often requires high levels of skill and resources, needs to consider multiple stakeholder groups

Failure of Intuition

Intuitions in product development environments are especially poor for multi-user applications, resulting in bad management decisions and error-prone design processes

Decision-makers in organizations are often drawn to applications that benefit management, and underestimate work costs to others

The Adoption Process

Groupware requires more careful and complicated implementation (introduction) in the workplace than product developers have confronted

E.g. individual user document authoring software vs. groupware for teams of nurses



hbu.edu

Upcoming

Lab on Wednesday, exercise posted on OLAT

Questions on Assignment #1?