Human-Computer Interaction
IS4300

Computer-Supported Cooperative Work (CSCW)

- Def.: "the study of how people work together using computer technology"
- Examples of systems that you use?
  - email
  - shared databases/hypertext
  - video conferencing
  - chat systems
  - real-time shared applications
    - collaborative writing, drawing, games

Groupware

- *Groupware* denotes the technology that people use to work together
  - "systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment."
- *CSCW* studies the use of groupware
  - "CSCW is the study of the tools and techniques of groupware as well as their psychological, social, and organizational effects."

How is this different from "Social Interfaces"?

CSCW Classification Schemes

CSCW apps
aka Groupware

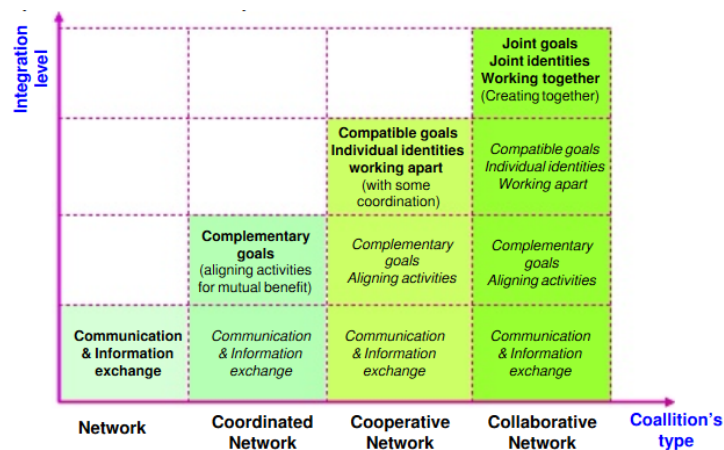|	same place	different place
synchronous communication	• smart meeting rooms • shared PCs/editors	• SMS, IM • MUDs • Shared work surfaces • Shared PCs/editors • Shared calendar
asynchronous communication	• argumentation • co-authoring (word) • PARC Tab	• email • bulletin board, USENET

Collaboration
Shuman & Twobly, The Real Power of Collaboration, 2009

- Collaboration is a purposeful, strategic way of working that leverages the resources of each party for the benefit of all by coordinating activities and communicating information within an environment of trust and transparency.

Taxonomy of Collaboration
Camarinha-Matos, et al, 2006

Integration level				
				Joint goals **Joint identities** **Working together** (Creating together)
			Compatible goals **Individual identities** **working apart** (with some coordination)	*Compatible goals Individual identities Working apart*
		Complementary goals (aligning activities for mutual benefit)	*Complementary goals Aligning activities*	*Complementary goals Aligning activities*
	Communication & Information exchange	*Communication & Information exchange*	*Communication & Information exchange*	*Communication & Information exchange*
	Network	**Coordinated Network**	**Cooperative Network**	**Collaborative Network** → **Coalition's type**

Grudin Chapter: Classification

	Real time	Asynchronous
Communication		
Information sharing		
Coordination		

Grudin Chapter: Classification

	Real time	Asynchronous
Communication	‣ Telephone ‣ Video conferencing ‣ Instant messaging ‣ Texting	‣ Email ‣ Voice mail ‣ Blogs ‣ Social networking sites
Information sharing	‣ Whiteboards ‣ Application sharing ‣ Meeting facilitation ‣ Virtual worlds	‣ Document repositories ‣ Wikis ‣ Web sites ‣ Team workspaces
Coordination	‣ Floor control ‣ Session management ‣ Location tracking	‣ Workflow management ‣ CASE tools ‣ Project management ‣ Calendar scheduling

Grudin Chapter
McGrath's Framework for Team Behavior

	Production	Group well-being	Member support
Inception	Production demand and opportunity	Interaction demand and opportunity	Inclusion demand and opportunity
Problem-solving	Technical problem solving	Role network definition	Position and status achievements
Conflict resolution	Policy resolution	Power and payoff distribution	Contribution and payoff distribution
Execution	Performance	Interaction	Participation

Types of Cooperation
Genres - *Dix*

- Focused partnerships
  - users who need each other to complete a task
    - often a document or image to work on
    - e.g., joint authors of a paper
- Lecture or demo
  - person shares info. with users at remote sites
    - questions may be asked
    - may wish to keep history and be able to replay

Types of Cooperation (cont.) Genres - *Dix*
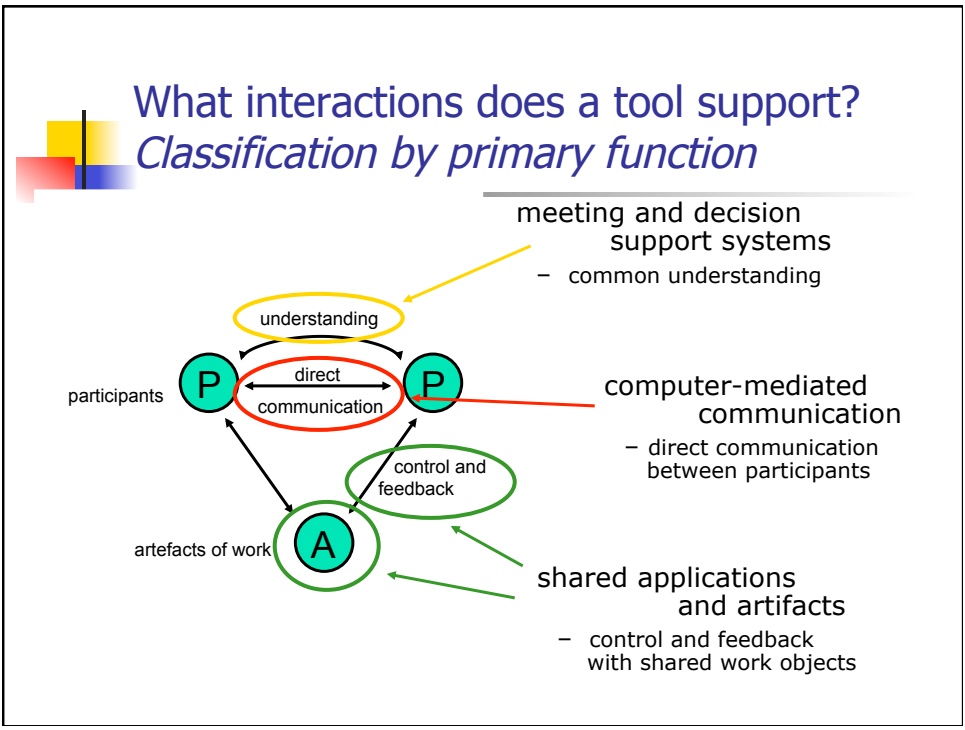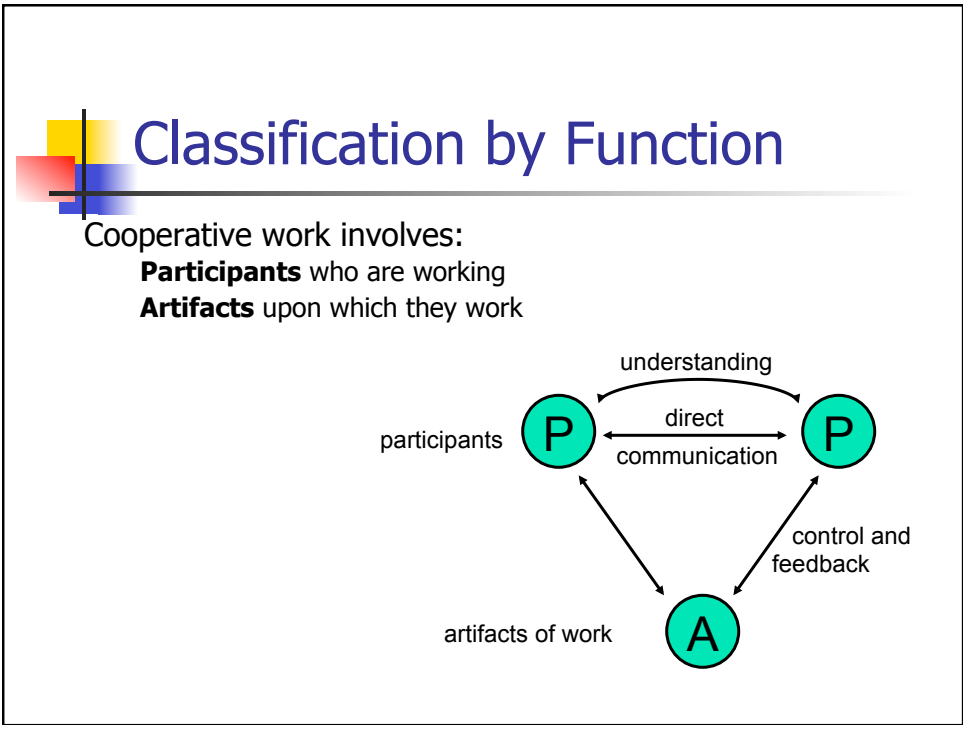
- Conference
  - group participation distributed in space
    - at same time or spread out over time
- Structured work process
  - a set of people w/ distinct roles solve task
    - e.g., hiring committee accepts applications, reviews, invites top for interviews, chooses, informs
  - aka "work flow" or "task flow"

Types of Cooperation (cont.) Genres - *Dix*

- Meeting and decision support
  - meeting w/ each user working at a computer
    - e.g., PDA Brainstorming tool

Classification by Function

Cooperative work involves:
    Participants who are working
    Artifacts upon which they work

understanding

participants   P   direct
       communication   P

control and
feedback

artifacts of work   A

What interactions does a tool support?
Classification by primary function

meeting and decision
    support systems
– common understanding

understanding

participants   P   direct
     communication   P

computer-mediated
    communication
– direct communication
    between participants

control and
feedback

artefacts of work   A

shared applications
    and artifacts
– control and feedback
    with shared work objects

Additional dimensions of CSCW

- Participation: Open/Closed
- Governance: Hierarchical/Flat
- Work Situation or Nature of Task: Routine/Planned/Novel
- Group type: Homogeneous/diversified; newly formed (adhoc)/working group

Awareness in Synchronous Remote CSCW

- What do you want to be aware of?
- Social
  - Who is here? What are their roles?
- Task
  - What do I know about the task and its structure?
- Workspace
  - What are others doing?

Workspace Awareness

- What information should be captured?
- How displayed to other users?

- Same task same view (WYSIWIS)
- Same task different view
- Radar view
- Multiple WYSIWIS
  - See what others see

Summary: some dimensions of CSCW classification

- Place/Time
- Collaboration
  - Basic, Coordination, Cooperation, Collaboration
- Function
  - Direct communication, shared understanding, control & feedback
- Participation: Open/Closed
- Governance: Hierarchical/Flat
- Work Situation: Routine/Planned/Novel
- Group type: Homogeneous/diversified; newly formed (adhoc)/working group
- Awareness (remote/sync): Social / Task / Workspace

Classification?

Classification?
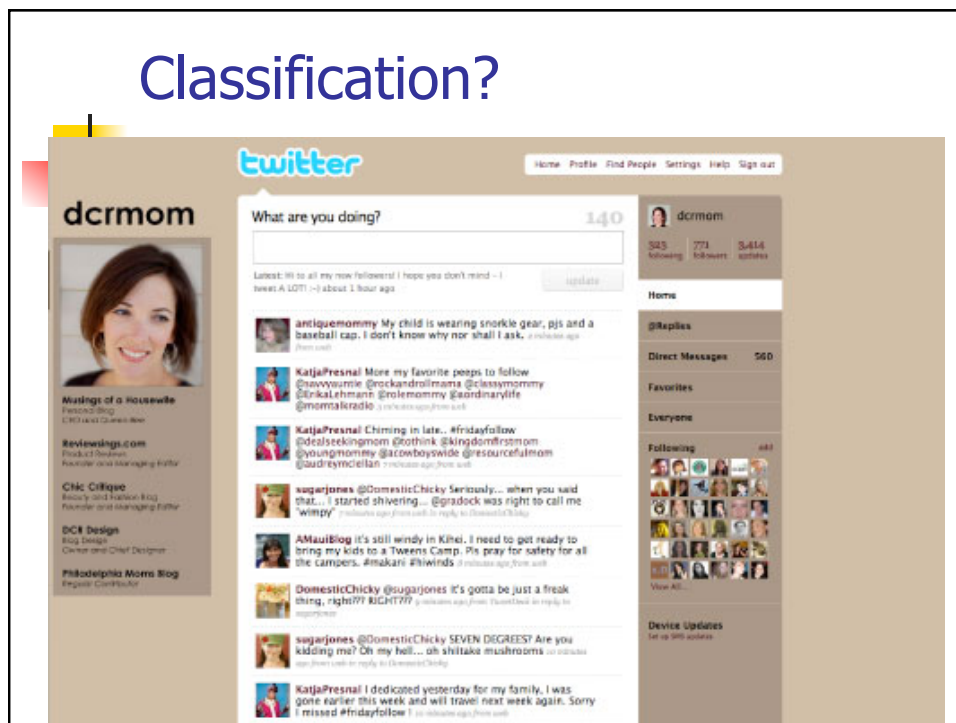
Classification?   *Coursera*
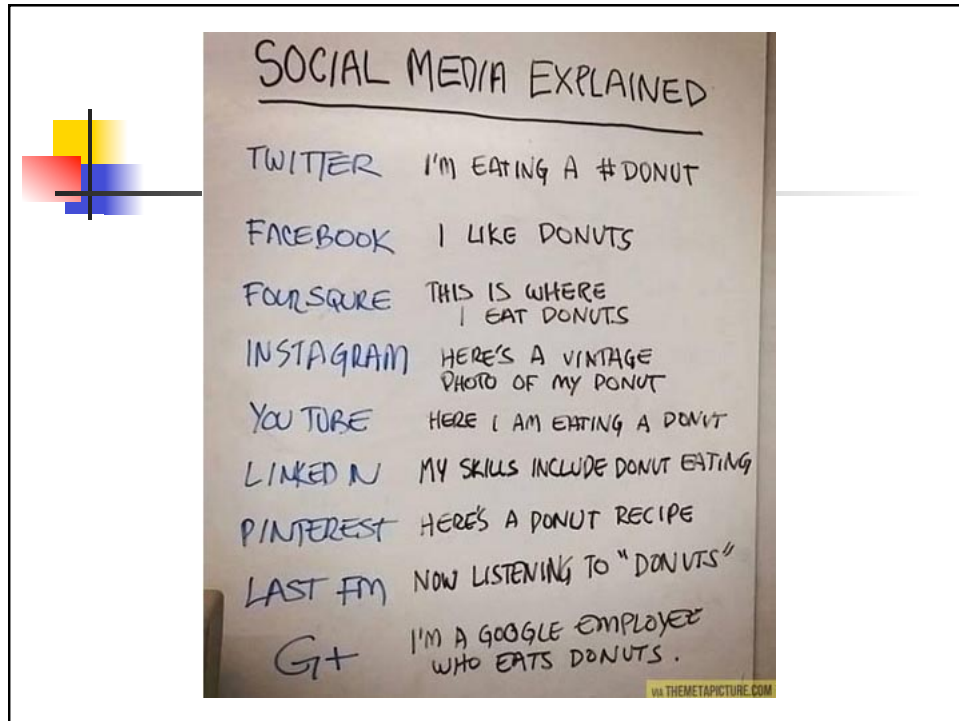

Classification? *Google docs*

Classification? Telepresence

From Left: AnyBots QB, RoboDynamics TiLR, Gostai Jazz Connect, Mantaro's Mantaro Bot, and VGo
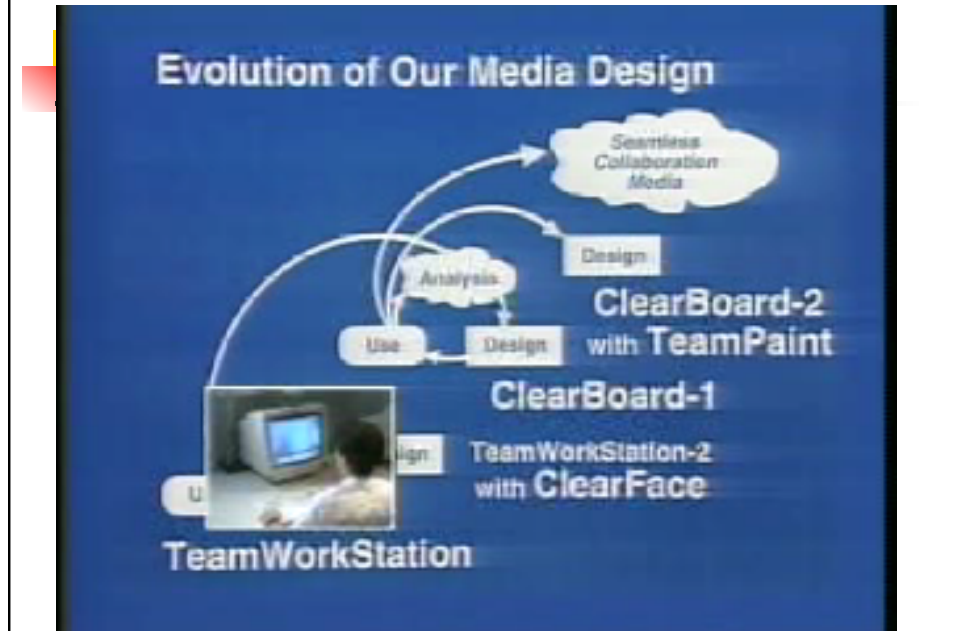
Classification?
Microsoft Surface

Meeting and decision support systems

argumentation tools
meeting rooms
shared work surfaces

Some early research – Clearboard


Issues for cooperation

Argumentation tools
- concurrency control
    - two people access the same node
    - one solution is node locking
- notification mechanisms
    - knowing about others' changes

Meeting rooms
- floor holders - one or many?
    - floor control policies
- who can write and when?
    - solution: locking + social protocol
- group pointer
    - for deictic reference (this and that)

Now ubiquitous examples of meeting support
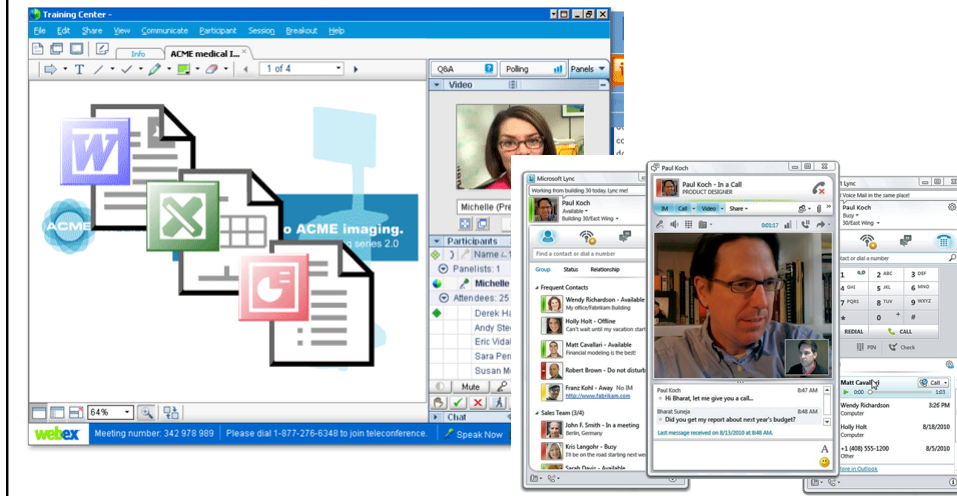
Shared applications and artifacts

shared PCs and windows
shared editors, co-authoring tools
shared diaries
communication through the artifact

Shared Applications and Artifacts

Compare purpose of cooperation:
- meeting rooms and decison support systems
  - develop shared understanding
- shared applications and artefacts
  - work on the same objects

technology similar but primary purpose different

many different modalities (time/space matrix)
- shared windows – synchronous remote/co-located
- shared editors – synchronous remote/co-located
- co-authoring systems – largely asynchronous
- shared diaries – largely asynchronous remote
- shared information – any, but largely asynchronous

Shared editors - multiple views

Options:
- same view or different view
- single or separate insertion points

Single view
$\Rightarrow$ scroll wars

Multiple views
$\Rightarrow$ loss of context with *indexicals*

loss of WYSIWIS …

We will look at some of the options and how they affect the style of cooperation.
Thinking about the shared view vs. different view options, it at first seems obvious that we should allow people to edit different parts of a document.
This is certainly true while they are working effectively independently.

your screen

More adaptable systems are needed to allow for the wide variation between groups, and within the same group over time.
We will look at some of the options and how they affect the style of cooperation.
Thinking about the shared view vs. different view options, it at first seems obvious that we should allow

your colleague's screen

'I don't like the line at the top'
'but I just wrote that!'

Communication through the artifact

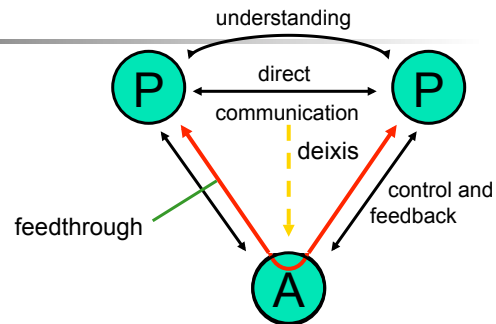When you change a shared application:

- you can see the effect – *feedback*

- your colleagues can too – *feedthrough*

feedthrough enables …
        communication through the artifact

Examples of feedthrough?

Integrating communication and work

understanding

P ←→ P

direct communication

deixis

feedthrough

control and feedback

A

Added:

deixis – reference to work objects

feedthorough – for communication through the artefact

# Classification by Shared information

Granularity of sharing

- chunk size

    small – edit same word or sentence

    large – section or whole document

- update frequency

    frequent – every character

    infrequent – upon explicit 'send'

Implementing groupware

feedback and network delays
architectures for groupware
feedthrough and network traffic
toolkits, robustness and scaling

Feedback and network delays

screen
feedback

user types

local
machine

network

remote
machine

remote
application
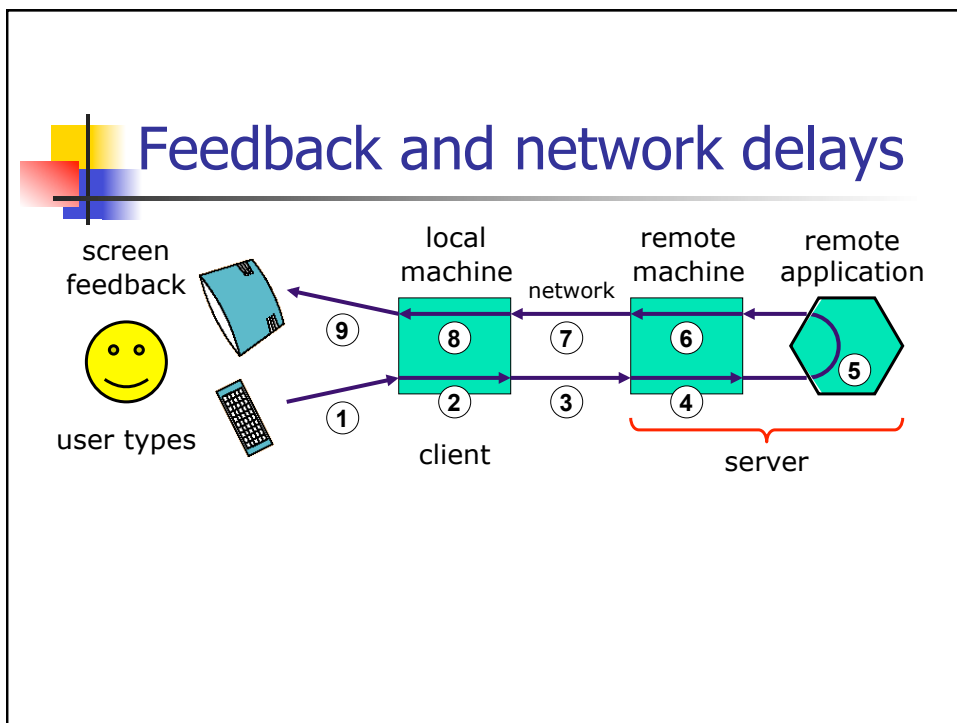
client

server

Types of architecture

centralized – single copy of application and data
- client-server – simplest case

replicated – copy on each workstation
- also called peer-peer
- + local feedback
- race conditions

Often 'half way' architectures:
- local copy of application + central database
- local cache of data for feedback
- some hidden locking

Example – Synchronous CSCW "Collaborative Virtual Environments"

- Second Life

Issues with Social Networking
SecondLife, FaceBook, etc.

- Can these technologies replace human-human interaction?
  - can you send a "handshake" or a "hug"
  - how does intimacy survive?
- Are too many social cues lost?
  - facial expressions and body language for enthusiasm, disinterest, anger
  - will new cues develop? e.g., :)

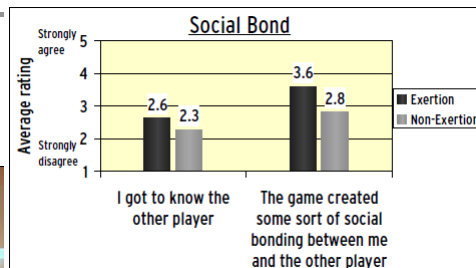# Trust in CMC (Olsens, UMich)

- Outcome:
  - social dilemma game
- Study 1
  - F2F best
  - VMC = f2f, but took longer
  - Text Chat never trust
- Study 2
  - CMC getting acquainted leads to higher trust
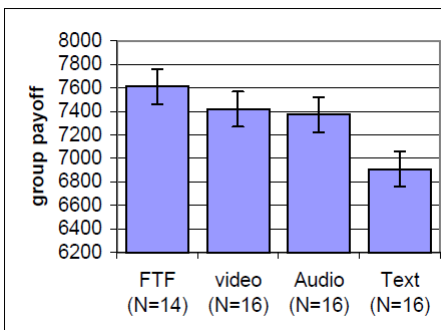
Exertion Interfaces (Mueller)

Exertion Interfaces (Mueller)

Social Bond

Qualitative self-report measures of social bonding – greater for exertion interface compared to desktop keyboard interface.

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Groupware Success & Failures

Grudin

Grudin's Chapter: Challenges

1.	Disparities in effort required and benefits for individuals
2.	Limits of informed intuition: Managers & designers beware
3.	Achieving Critical Mass and avoiding Prisoner's Dilemma
4.	Avoiding other social & motivational pitfalls
5.	Exception-handling: The bane of workflow & other systems
6.	Designing for low-frequency events
7.	The difficulty of evaluation
8.	Designing with an adoption process in mind

Success/Failure of Groupware

- Depends on competing alternatives
  - collaborators down the hall or across country?
- If users are committed to system, etiquette & conventions will evolve
  - tend to arise from cultural & task background
  - users from different orgs or cultural contexts may clash
- Synchronous systems that work well for 2 users may be less effective w/ more users

CSCW Exercise

- Project teams
- Brainstorm a new groupware extension for one of your projects
- Sketch the UI
- Classify it
- Identify particular challenges to implementation

Grudin's Chapter: Future?

To do

- Review
  - Nielsen Ch 6 – Usability Testing

- Finish I7 reviews (11/25)
- P7: Start responding to reviews
  - Group issues and order by priority
  - Report: how every issue was addressed
- P9: Start on final report