Computer Supported Cooperative Work
An Overview

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Skamania Lodge
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Two Part Harmony

- General overview of CSCW (Gary)
- Important relevant aspects (Judy)
  - Radical Collocation
  - Trust
  - Challenges of Remote Teamwork
General Overview of CSCW
Pre-History of the Field

Organization

Internal development

Product development

PC Applications

Human factors, human-computer interaction (1980)

Mainframe Systems

Data processing, management information systems (1965)

Individual

Adapted from Grudin (1994)
History of the Field

- Contract and internal development
- Product and telecommunications development
- Minis, networks, GDSS, workflow
- Computer-supported cooperative work (1985)
- Networked PCs, computer-mediated communication
- Software engineering, office automation (1975)

Adapted from Grudin (1994)
Fields that CSCW Draws On

- Software engineering + computer science
- Human-computer interaction
- Social psychology
- Ethnography
- Smattering of other disciplines
  - Economics
  - Organizational behavior
Examples of Research Areas

- Communication Tools
  - E-mail
  - Conferencing – voice & video
  - Instant messaging, chat, MUDs, virtual worlds
- Coordination Support
  - Meeting support
  - Workflow
  - Group calendars
  - Awareness
- Information repositories
  - Repositories of shared knowledge
  - Capture & replay
- Sociality
  - Social filtering
  - Trust of people via the technology
- Integrated systems
  - Media spaces
  - Collaborative virtual environments
  - Collaboratories
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Conferencing Tools

- Communication space
  - person space
  - interpersonal, personal space

- Shared workspace
  - task space
  - object sharing
Many Systems

- Communication
  - chat
  - audio
  - video

- Shared workspace
  - application sharing
  - shared whiteboard
  - other special purpose tools
Video Conferencing Today

- Lots of video conferencing centers
- Elaboration of desktop conferencing as well
- What issues remain?
  - Technical difficulties, esp. in set-up
  - Quality of audio & video better, but still frustrating
  - Still has not cut back on travel -- but more ambitious things are being attempted
  - Thought to be killer app for Internet2
  - A change since 9/11?
Stanford Video Auditorium (Chen)
Chat, Instant Messaging

- Chat technology is very old
- Has been part of research systems for a long time
- Only recently has become extremely popular
  - Pew report on IM use
- Text messaging on mobile phones (SMS)
What UARC Scientists Talk About: FTF vs CMC
Participation

Many more participants possible
Babble and Loops

- Socially translucent systems
  - Addressing the tension between privacy and visibility

Social Proxy

User List

Topic List

Active Topic

conflict with design that is beautiful. It just takes more work (of course).

=== Thursday 27 Aug 98 2:20:30 PM EDT  From: Wendy in the lab
Anyone know what the thing on the side of the monitor is on the
iMac? It's a kind of rectangle with another piece of plastic
with a tool-lined hole coming over the rectangle, kind of like a
lab? John was around earlier today looking at the
picture on our wall & wondering...

=== Thursday 27 Aug 98 2:29:00 PM EDT  From: John in the lab
It is the cable port.

=== Thursday 27 Aug 98 2:30:06 PM EDT  From: Jason (Sorry, no
beige)
This conversation sure would be easier if there were an iMac here
Babble

- Bradner, Kellogg & Erickson
  - ECSCW ‘99
  - Field study of chat in the workplace
    - 6 groups: varying sizes, remote & collocated
    - Usage: Staying in the loop (+), Waylay (-)
    - Social Affordances:
      - “The relationship between the properties of an object and the social characteristics of a group that enable particular kinds of interaction among members of that group.”
Examples of Research Areas

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  - Collaborative virtual environments
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Media Spaces

- PARC/EuroPARC’s RAVE
- “Engagement not estrangement”

Bly, Harrison & Irwin, Media spaces: bringing people together in a video, audio, and computing environment, CACM, 1993, Vol 36 Issue 1; Fish, Kraut & Chalfonte, The VideoWindow system in informal communication, CSCW 1990; Dourish & Bly, Portholes: supporting awareness in a distributed work group, CHI 92
Media Spaces

- Portholes: application running on a PC. Images updated every ~5 seconds
- Social Browsing!

Bly, Harrison & Irwin, Media spaces: bringing people together in a video, audio, and computing environment, CACM, 1993, Vol 36 Issue 1; Fish, Kraut & Chalfonte, The VideoWindow system in informal communication, CSCW 1990; Dourish & Bly, Portholes: supporting awareness in a distributed work group, CHI 92
Media Spaces
Features of Media Spaces

- **Ubiquity**
  - spatial -- all places linked
  - temporal -- “on” all the time
- **Lightweight**
  - easy to use
  - human mediation
- **Flexibility**
  - adapt the technology as needed
- **Suite of tools**
  - awareness
  - calendar
  - workspace sharing
  - conferencing
- **Not copresence**
  - a new set of tools
MUDs and MOOs

- MUDs (MultiUser D*s) and MOOs (MUDs Object Oriented)
  - Multi-user text-based virtual worlds organized as an interconnected set of “rooms.”
  - Most are games emphasizing social interaction
  - They provide environments for communication and building new rooms and objects

- Extending MUDs as collaborative work environments
  - Churchill and Bly, WACC 1999, Group 1999
    - Field work over 2 years
    - Persistence is central to a feeling of “place”
    - Activity awareness and waylaying
    - Conversations around content
3D Graphical CVEs

- Graphical, “inhabited” virtual environments
- People embodied, represented as “avatars”
- Persistent environments
- Information, gatherings and informal social encounters
- Many technical and social research issues
- No real world uptake
- Expensive/labour intensive to produce, require large bandwidth
- Individuals need a lot of technology
- No long term studies but many “events”

Greenhalgh & Benford, Virtual reality tele-conferencing: Implementation and experience, ECSCW’95
Hindmarsh et al, Fragmented Interaction: Establishing Mutual Orientation in Virtual Environments, CSCW 98
Virtual Worlds

- Second Life
The Collaboratory Concept

- **Collaboratory** <-- Collaborate + Laboratory
- W. Wulf -- “… a ‘center without walls,’ in which the nation’s researchers can perform their research without regard to geographical location” (1989)
- Many collaboratory initiatives
  - NSF, NIH, DOE, NASA, etc.
A collaboratory is an organizational entity that spans distance, supports rich and recurring human interaction, oriented to a common research area, and provides access to data sources, artifacts and tools required to accomplish research tasks.
UARC -- 1993

Sondrestrom, Greenland
UARC Multi-Instrument Screen Shot
SPARC Scope: 1998
(99/05/05 15:45 UT)

A Shock Has Been Detected by ACE at 15 UT
Today, 99/05/05

Initial effects of the solar disturbance should be seen at Earth at ~16 UT. Compression Effects Are Apparent in the GOES Satellites Magnetic Field Measurements

LATEST DEVELOPMENTS

ACE RTSAW (Estimated) MAG & SWIMAP

UT = 16h, 00m Pressure Level = 1.0

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NEESgrid Collaboratory

- George E. Brown, Jr. Network for Earthquake Engineering Simulation
- NSF program
  - Major Research Equipment (MRE)
  - System Integration (NEESgrid collaboratory)
    - 2000-2004
  - Consortium development
    - 2004-2114
NEESgrid
Taxonomy of Collaboratories

- **Research focus**
  - Distributed Research Center
  - Shared Instrumentation
  - Community Data Systems
  - Open Community Contribution System

- **Practice focus**
  - Virtual Community of Practice
  - Virtual Learning Community
  - Expert Consultation
Distributed Research Center

- Functions like a University research center, but at a distance.
- Most communication human-human
- Project is unified by a topic area of interest, and includes a number of joint projects in that area.
- No single product as the focus

- Alliance for Cellular Signaling
Open Community Contribution System

- Micro contributions to a project
- Modeled on open source software development

- NASA Ames Clickworkers
- Stardust@Home
Open Source Beyond Software

- Oxford English Dictionary created in essentially this way
- Wikipedia
  - http://en.wikipedia.org/wiki/Main_Page
- Open content
  - http://www.firstmonday.dk/issues/issue8_8/cedergren/
- Open design
  - http://www.thinkcycle.org/
Emerging Area: Multi-player Games

- MMPORPG – Massively Multiplayer Online Role-Playing Games
  - EverQuest
  - Star Wars Galaxies
  - World of Warcraft

- Social venues
  - Second Life
  - Many others now

- New venue for learning?
Grudin’s 8 challenges

- Disparity in work and benefit
- Critical mass and Prisoner’s dilemma problems
- Disruption in social processes
- Exception handling
- Designing for infrequently used features
- Difficulty of evaluation
- Failure of intuition
- The adoption process
Palen & Grudin – an update

- Earlier Grudin analysis as background
- Deployment vs. adoption
  - 1980s – deployment but no adoption
  - 1990s – both
- Why?
Palen & Grudin – success

- Managerial mandate for expensive enterprise-wide systems
- Discretionary groupware
  - Example of calendaring systems in two organizations
- Why successful?
Palen & Grudin – why success?

- Better products
  - Good functionality
  - Ease of use
  - Integration with e-mail

- Changed organizational culture
  - Good infrastructure
  - Peer pressure
Important Relevant Aspects

- Radical Collocation
- Trust
- Challenges of Remote Teamwork
  - Theory of Remote Teamwork (TORC)
What Does Collocation Give You?

- Study of dedicated war rooms for software development teams
  - two sites:
    - large auto company
    - large computer company
  - followed seven teams
  - collocated for several months
  - observation, interview, diaries
Results

- On standard software productivity measures
  - half the time to market
  - triple the function points per unit time

- This caught their attention
What produced this?

- Immediate availability of co-workers
  - Awareness of their state
  - Awareness of what they are working on
- Overhearing
- Spontaneous meetings
What produced this?

- Visible shared artifacts
- Living in their information environment
Results

- Much less disturbed by interruptions than they initially thought
- If disturbed by interactions, move to quiet location temporarily
  - but need access to the artifacts
- Special properties of collocation
  - missing from current technologies
  - very powerful
Radical Collocation
How do we achieve *virtual collocation*?

- When there is tightly coupled work:
  - Awareness
  - People “at hand”
  - Information needed is “at a glance”

- When there is learning by observation
  - Mentoring
  - Trust development
Definition of Trust

- You believe that another person will not take advantage of you when you put yourself in a position of vulnerability.

- You believe that someone will look out for your best interests when you cannot control the situation.
Various kinds of trust

- Emotional
- Cognitive
- Reliability
- Benevolence
- …
How do we measure trust?

- Responses on questionnaire
  - Baseline
  - Situational
  - Reputation
  - Trust of a particular entity after experience with it

- Behavior
  - Make yourself vulnerable in a situation in which you could lose big if the other person took advantage of you.
A global team at Lucent

- 400 person organization
- Work consisting of
  - requirements analysis
  - testing
  - project management
  - coding
Trust requires touch

Laboratory Studies of Trust

- What factors promote or impede the formation of trust?
- Measure of trust – the extent to which people cooperate in a social dilemma game
  - Has been used widely in the field
  - Validated by other measures (e.g., questionnaires)
How do we measure trust?

- Social dilemma

<table>
<thead>
<tr>
<th>Player 1</th>
<th>Action A</th>
<th>Action B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action A</strong></td>
<td>Moderate win for both</td>
<td>Big win for 2, Big loss for 1 (sucker)</td>
</tr>
<tr>
<td><strong>Action B</strong></td>
<td>Big win for 1, Big loss for 2 (sucker)</td>
<td>Big loss for both 1 and 2</td>
</tr>
</tbody>
</table>
Details of Moore et al

- Exchange Personal Info: Cooperation
- No Exchange: Cooperation

University:
- Same: Cooperation
- Different:
  - Cooperation
  - Impasse
Details of Rocco

- **First phase**
  - if you communicate by email, self-serving behavior
  - if you communicate by face-to-face, cooperative behavior

- **Second phase**
  - if you meet face-to-face beforehand, but communicate by email, cooperative behavior
Studies at UM building on Rocco (1998)

- Social dilemma
  - Repeated trials – blocks of 5 followed by discussion
- Groups of strangers
- Several conditions
  - Various media for discussion
  - Different activities beforehand
- Convergent measure via questionnaires
Study 1: Bos, Gergle, Olson & Olson (2001)

- 45 groups of 3 strangers
- 30 rounds of social dilemma, with conversation after each 5 rounds
- Daytrader game (the social dilemma):
  - Each player has 30 tokens to divide between individual and group investments
  - The group investment has a higher yield, but is split evenly regardless of individual contribution
  - Individuals who don’t trust the group, or want to exploit the group, will hold back
  - Bonus system rewards competition
Different conditions for discussion

- Face-to-face
- Video
- Audio
- Text chat

Round 1-5 Discuss
Round 6-10 Discuss

Meet #1
Meet #2

etc…
Results by condition

1) Significant differences overall ($p<.01$)

2) Video and audio almost as good as face-to-face
Results by round

Amount invested (trust) vs. Round

- FTF
- Video
- Audio
- Text
Study 2: Zheng, Bos, Olson & Olson (2001)

- Varied what they did prior to game
- Used text chat during social dilemma task
  - 30 rounds, chat after every 5
- 100 pairs of strangers
Different conditions beforehand

- Face-to-face
- Social text chat
- Seeing a photo of the other person
- Seeing a brief resume of the other person
- Nothing

Round 1-5
Discuss
Round 6-10
Discuss

Meet #1

Meet #2

Round 1
Round 2
Round 3
Round 4
Round 5

Round 6
Round 7
Round 8
Round 9
Round 10

eetc…
Results: Zheng, Bos, Olson & Olson (2001)

- Face-to-face
- Social text chat
- Seeing a photo of the other person
- Seeing a brief resume of the other person
- Nothing

Trust

Mistrust
Does Trust Take Touch?

- Some interventions promote trust at a distance
  - Richer communication channel
  - Social interactions through a lean channel
- But questions remain
  - How permanent?
  - Lab extend to field?
At the highest levels, Distance Matters

- Success depends on
  - Loosely coupled, routine work
  - High readiness, motivation to collaborate, “collaboration readiness”
  - Establishment of common ground
  - Appropriate technology (user-centered) & support infrastructure
  - Effective management
At the highest level: Distance Matters

- **Success depends on**
  - Loosely coupled, routine work
    - Appropriate **division of labor**, with associated allocation of resources
  - High readiness, motivation to collaborate, “collaboration readiness”
    - Alignment of **goals** and **incentives**
    - Creation of mutual **trust** among participants
  - Establishment of **common ground**
    - **International** issues
  - Appropriate technology (**user-centered**) & support **infrastructure**
  - Effective **management** plan
    - Including **Legal** & **regulatory** issues
Summary

- Basic aspects of CSCW
  - Communication Tools
  - Coordination Tools
  - Information Repositories
  - Sociality
  - Integrated Systems

- Important specific aspects
  - “Virtual collocation”/radical collocation
  - Trust
  - Success depends on a number of factors, many of them social.