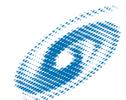


# An Overview of IP-based Video: Technical and Social Considerations

Erik C. Hofer

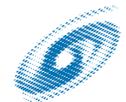
Collaboratory for Research on  
Electronic Work (CREW)

University of Michigan



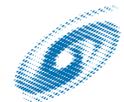
# Some motivation

- Why this talk?
  - Virtual control rooms
  - Collaboration in support of future design
- My background
  - Collaboratory builder and evaluator
  
  - Relevant affiliations
    - Internet2 Commons
    - Internet2 WG on Remote Instrumentation
    - ViDe: Video Development Initiative

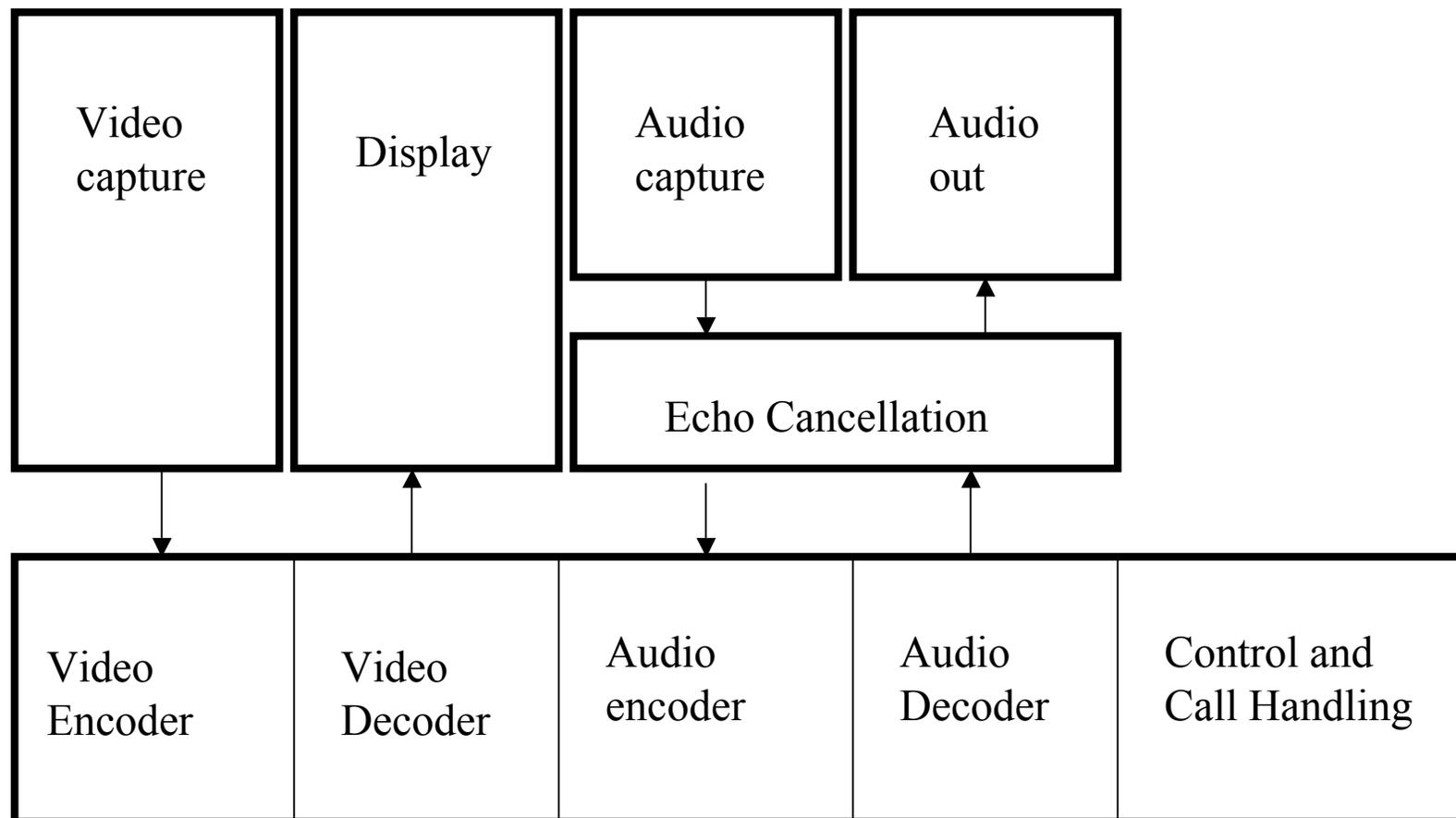


# Talk overview

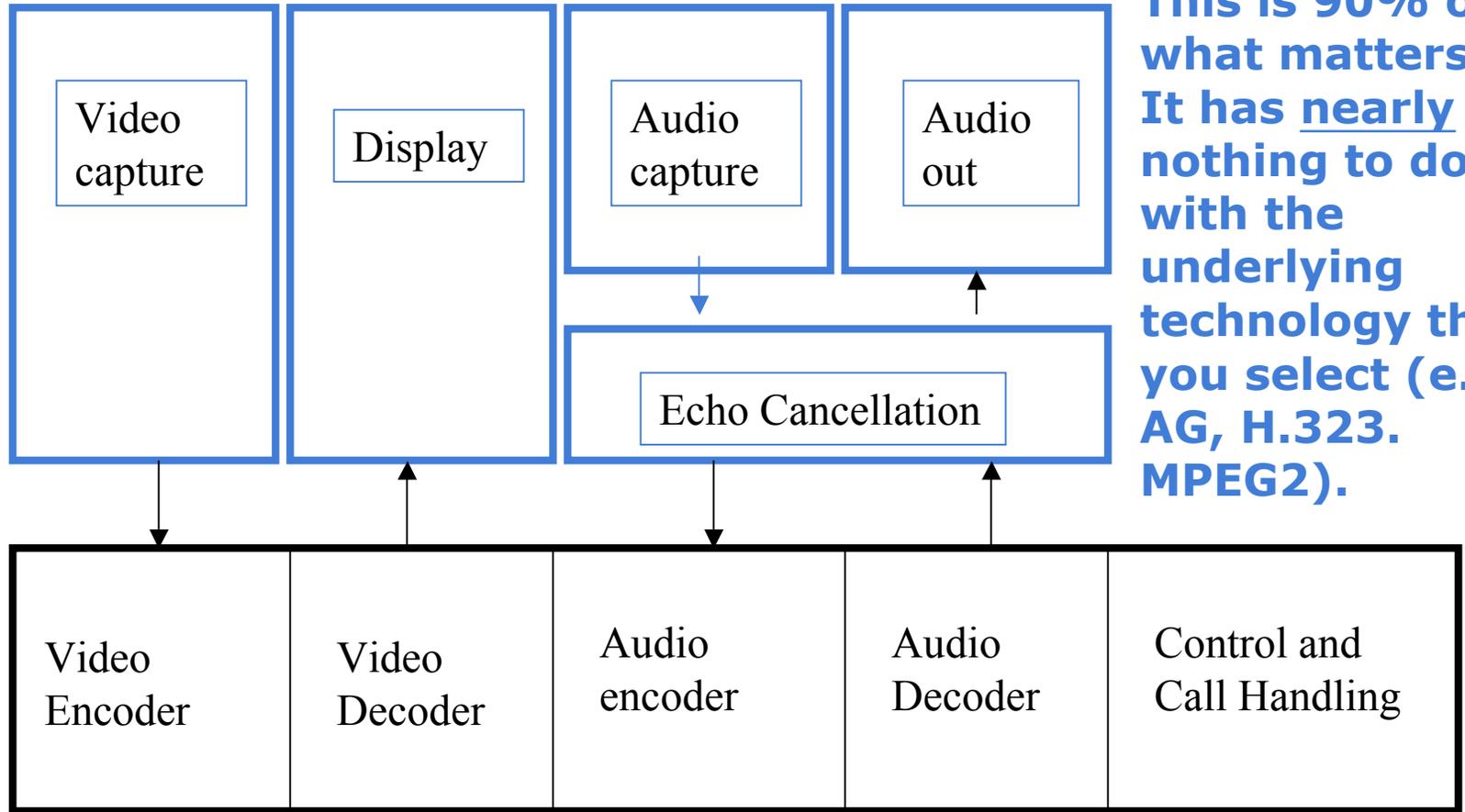
- Technical overview
  - Recipe for video communications
  - Survey of technical landscape
- Social Overview
  - Problems we know the answers to
  - Problems with have an idea about
  - Problems we're really not too sure about



# Ingredients of a VTC System



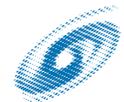
# Ingredients of a VTC system



**This is 90% of what matters. It has nearly nothing to do with the underlying technology that you select (e.g. AG, H.323, MPEG2).**

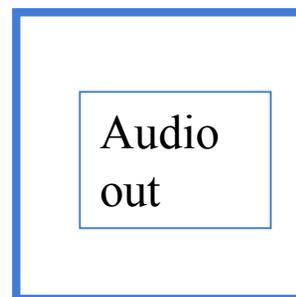
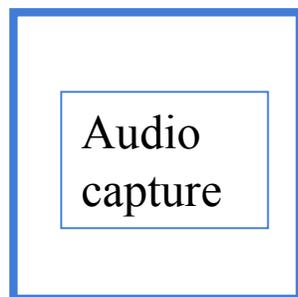
# Concrete example: H.323 vs. Access Grid

- Access Grid users tend to report much more satisfaction with audio quality
- But...There is not a dramatic codec-level difference in audio
  - 16 Khz for AG
  - 7 Khz for H.323
  - 3.5 Khz for phone
- Why the difference



# Audio subsystem matters

AG: Many mics professionally placed, mixer



AG: Custom room speakers, mixer

H.323: TV

H.323: Single table mic assembly

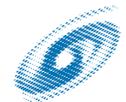


AG: Gentner (\$5000)

H.323: Internal (included)

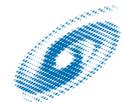
# Where are the differences?

- Despite the importance of low-level subsystems, codec differences still matter
  - Potential audio quality
  - Potential video quality
  - Bandwidth & network requirements
  - Multipoint capability
  - Cost
  - Ease of use
  - Speed to deployment



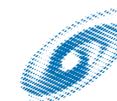
# Access Grid

- Research tool developed at ANL
  - Pretty good penetration worldwide
  - Uses vic / rat for media
  - Multicast-based
- 
- Good tool for multipoint meetings
  - Expensive to setup
  - Expensive to administer
  - Dedicated room



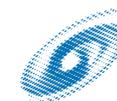
# H.323

- Commodity class video conferencing
- Very good penetration worldwide
- Hardware-based audio / video coding
  - Better video than AG
- Unicast, point-to-point tool
  - Need additional infrastructure for multipoint
  
- Cheap (\$400 - ~\$6000)
- Easy to setup, use
- Mobile



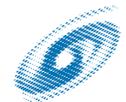
# MPEG-2

- Used for applications where quality matters a lot
  - Telemedicine
  - Remote orchestra performances
- Not used to meet general conferencing needs
- Very high quality video and audio
  
- Moderate codec price (\$5K)
- Need to purchase audio and video subsystems separately



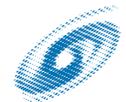
# MJPEG

- Used primarily for custom applications
- Broadcast (or better) quality video
- Few solutions exist for integrating audio and video well (e.g. clocking, sampling rates)
  
- Cheap
- High quality picture
- Doesn't eat many computer cycles



# Compressed HDTV

- Really, really nice quality
- Wait 5 years
- Camera: \$50K
  - Very sensitive to poor video production practices

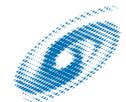


# Video comparison

Codec	Bandwidth	Quality	Price
AG	288K - 692K	CIF (H.261)	\$7K
H.323	288K -692K	CIF (H.263)	\$3K
MPEG2	2-10 Mb/s	D1	\$7.5K
MJPEG	10-20 Mb/s	D1	\$1.5K
Cp. HDTV	19 Mb/s	HDTV	\$20K
Raw DV	30 Mb/s	D1	\$Cheap

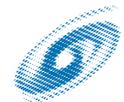
# A few words about VRVS

- VRVS: Virtual Rooms  
Video**conferencing** Service
- Chat, application sharing
- Many gateways to other video tools
  - MPEG2, H.323, Access Grid



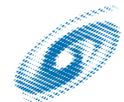
# Social Overview

- Getting the technology right is not the end of the road
- Must give attention to the social ergonomics of a video-mediated interaction
  - Small differences in physical setup can elicit large changes in behavior
  - e.g. lie detection (Horn, 2002)



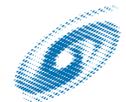
# Deployment

- Where you deploy video conferencing matters
- Observation from corporate world
  - VTC systems end up in very nice conference rooms
    - Hard to reserve room
    - Only for “important” work
    - Only for “meetings”



# Gaze awareness

- Knowing where someone is looking in a video conference is not easy
- Manipulations of eye contact can alter power relations of a conference
  - Huang et al. (2002)



# Eye Contact

- Sort of a tricky problem, but some solutions exist
- Easiest is to leverage how we perceive eye contact
  - Chen (2002)
- Recommendation
  - Mount camera above screen

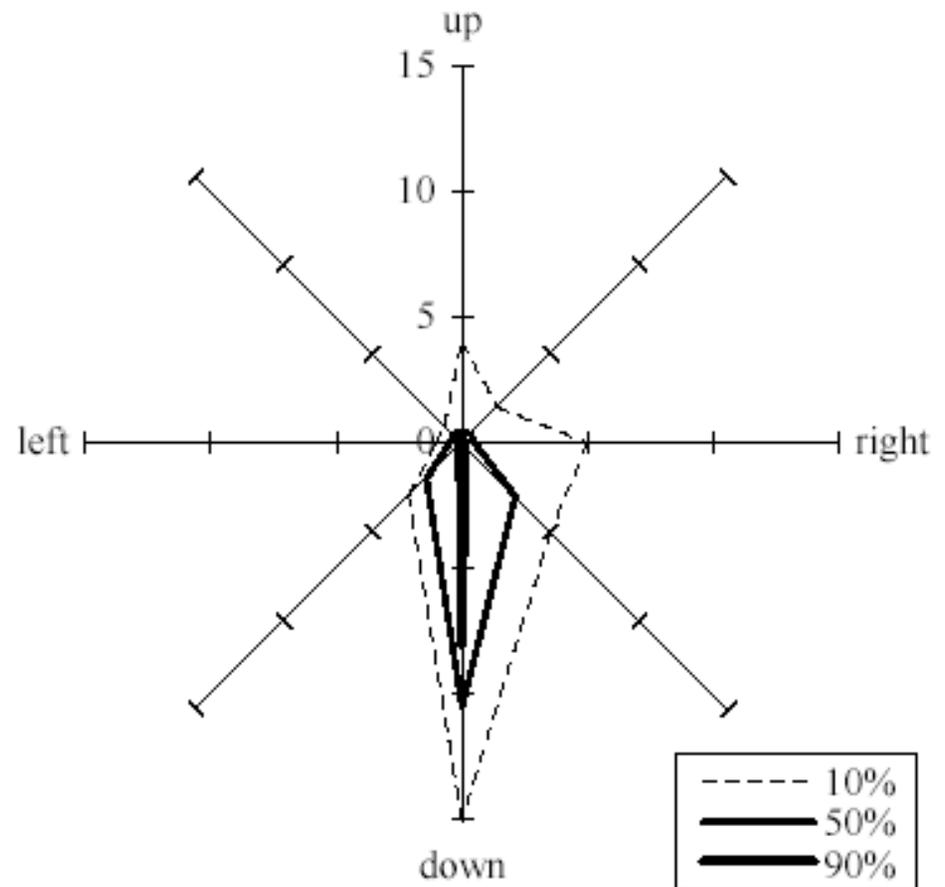
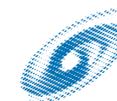


Figure 2. Sensitivity to gaze direction, experiment 1.



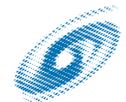
# Social conventions

- Auto-answer problem
- Schedule video conferences or initiate with phone / IM
- Establish:
  - Time
  - Who calls
  - Alternate contact info



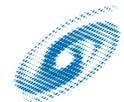
# Supporting non-meetings

- Many efforts have been made to support “natural” interaction over video over distance
  - Bellcore Video Window
  - Bellcore Cruiser
  - Xerox Portland Experiment
- These have all enjoyed mixed success
- Why

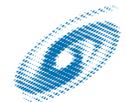
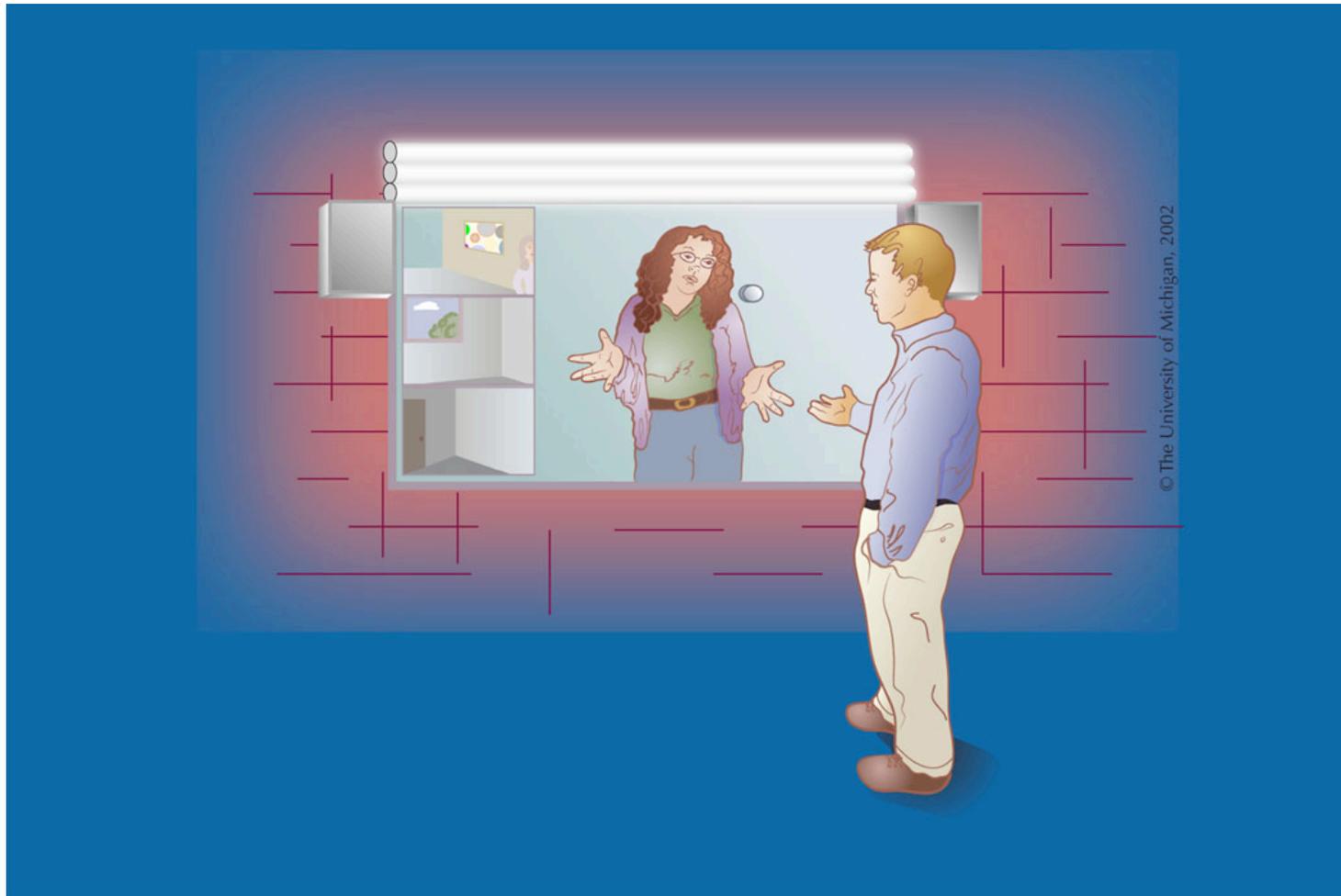


# Choreography of collaboration

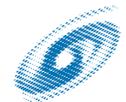
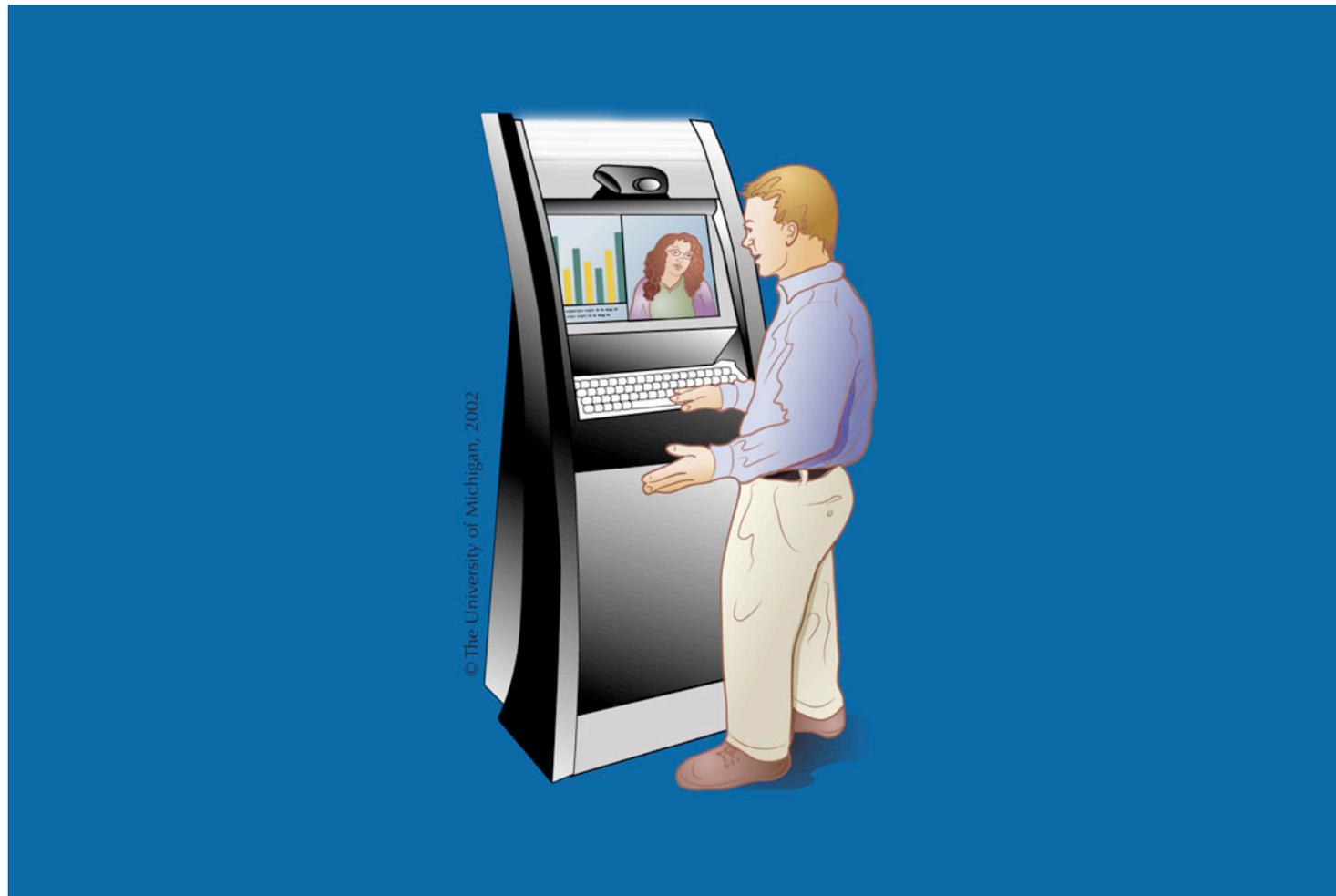
- One reason for shortcomings may be that a single, open audio and video channel does not adequately support the “choreography of collaboration”
  - Public encounter ->
  - Semi-private discussion ->
  - Private meeting



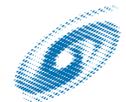
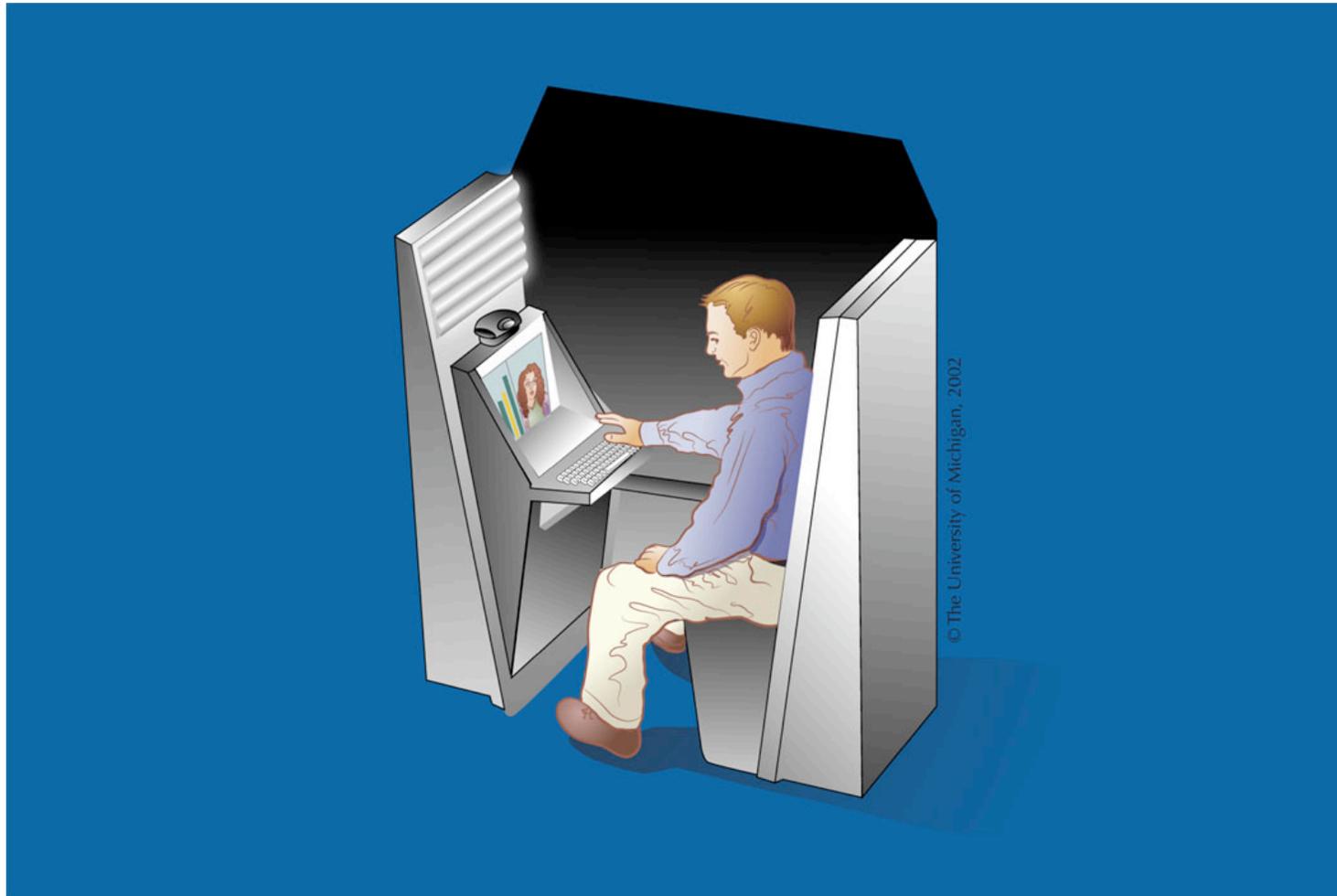
# Encounter via a video wall



# Migration to a kiosk...

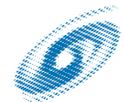


...or a booth

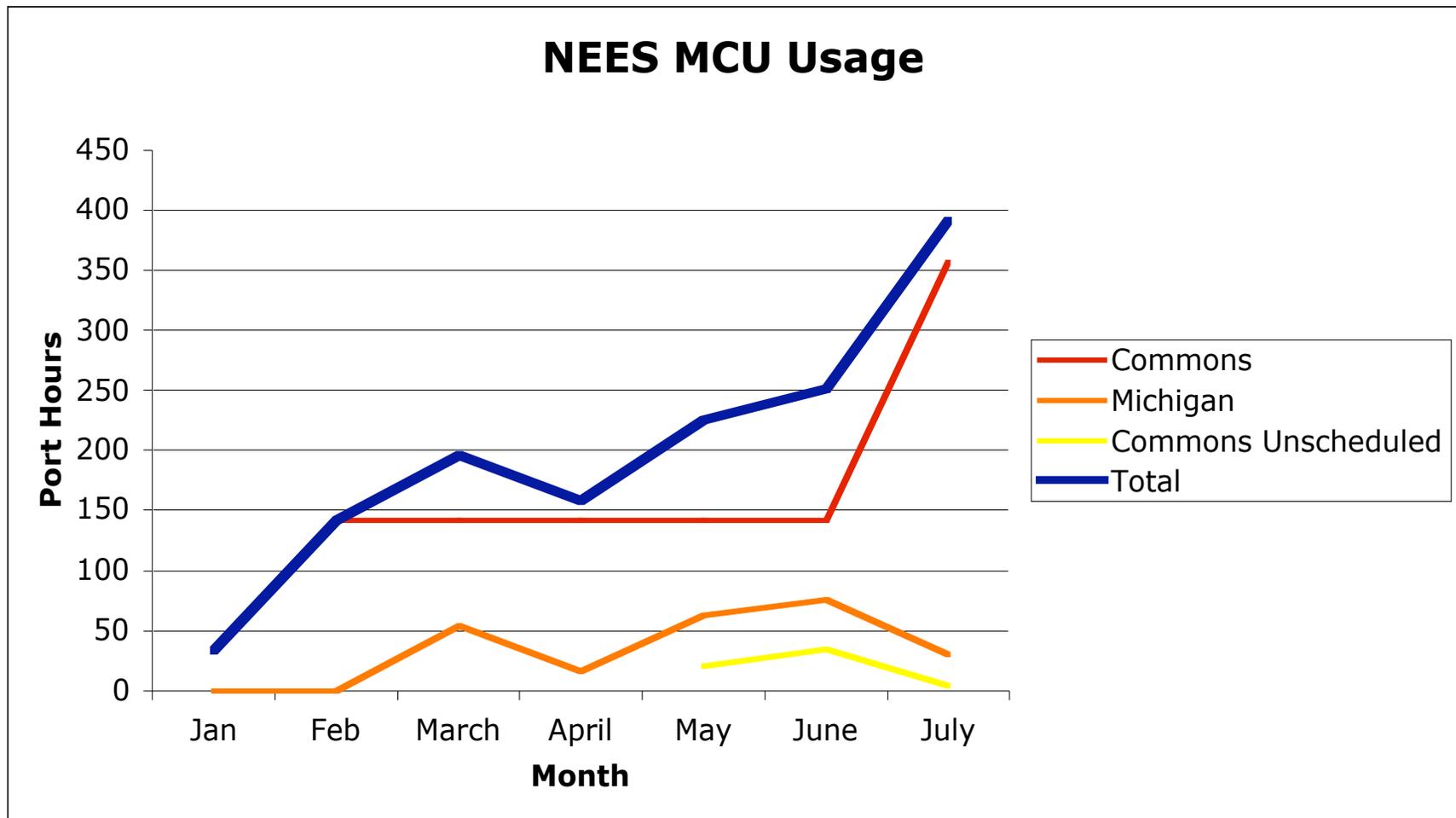


# Does video really matter?

- Some question whether video is really better than audio
- Answer is clearly yes in some situations
- Negotiation between individuals who do not have a common background
  - Veinott et al. (1999)

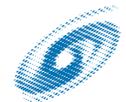


# Experience in EE Community



# Could we do \*this\* over video?

- Good question (I think)
- How do we do breakouts?
- Is there a place we could try it but not commit?



# Contact

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