3D Telemedicine and Video Conferencing Using High-Speed Networks

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Introduction

- IBES (Institute for a Broadband Enabled Society)
- VeRSI (Victorian e-Research Strategic Initiative)
- ITS Research Services
- University of Ballarat
- University of Melbourne MDHS
- Northern Health, Epping
- Heritage Valley Aged Care Facility, South Morang
- Ballarat Health Services
- Grampians Rural Health Alliance, Ballarat
- Ballarat District Nursing and Healthcare
- Dental Health Services Victoria
- Ballarat Oncology and Haematology Services
- Grampians Integrated Cancer Services, Ballarat
- Western Wimmera Health Group, Horsham and Nhill
- AARNet
- VERNet

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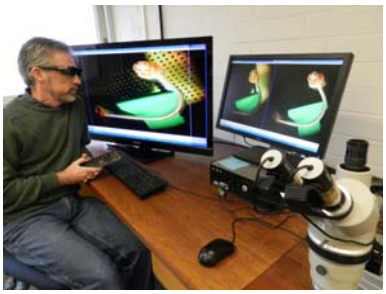
Background

- cIIF Grants (Collaborative Internet Innovation Fund)
- National Broadband Network trial applications
- Tele-medicine
  - Rural medicine
  - Community Emergency Response Teams (CERTs)
  - Tele-oncology
  - Tele-psychiatry
  - Remote wound management
  - Remote stereo microscopy
- Tele-dentistry
  - Aged care facilities



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Videoconferencing in Telemedicine

- Quality considerations
- Bandwidth considerations
- ADSL limitations
  - Upload speeds
- HD Skype and Messenger
  - Camera limitations
- HD H.323 software codecs (Mirial, Ekiga)
- HD H.323 hardware codecs
  - Easy to use
  - Very low bandwidth requirements
  - Very low encoding latency (<60ms)

Image credit: http://www.lifesize.com/Products/Video/LifeSize_Team_Series/Team_220.aspx

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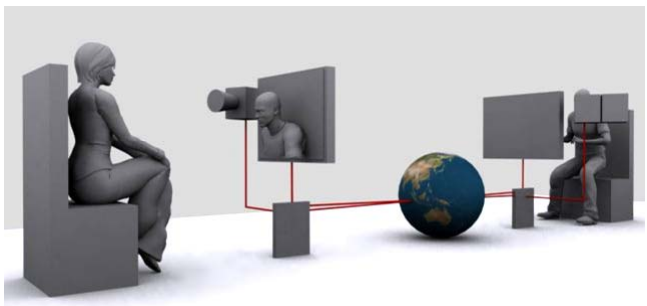
3D Videoconferencing

- Provides enhanced spatial sense
- Increased sense of co-location
- Improved engagement with the patient
- Better appreciation of wound extent, motor-skills, & gait analysis.



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Technical requirements

- 3D video cameras
  - Panasonic (>$20k)
  - JVC (<$2k)
  - 2 x HD cameras with multiplexor (e.g. AJA)

Image credit: http://www.jvc.com.au/cameras/everio-video-cameras/gs-td1

- H.323 videoconferencing hardware
  - Full HD capable (1920 x 1080 @ 30fps)
  - Typical side-by-side configuration => (960x1080)
  - 720p60 also works very well for motion sensitive applications
- 3D capable TV
  - Active, passive, autostereo

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Standards and pricing

- Standards
  - H.323 for videoconferencing
  - Side-by-side MPEG2 stereo
  - Stereo frames produced in-camera
- Pricing
  - Camera ~$1,700 (JVC)
  - Stereo LCD TV ~$2,000 to 3,000 from 42 to 55 inch
  - Standard LCD TV ~$500
  - VC Codec ~$8,000 x 2 = $16,000
  - Total ~ $21,000

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Usage scenarios

- Tele-dentistry
  - Aged Care facilities traditionally underserved
  - Central Practitioner can direct Health-care nurse to perform examination to identify dental problems
- Tele-oncology
  - Observational follow-up can be conducted in home
- Remote wound management
  - CERTs can be more effective with limited resources
  - Patient can remain at home
- Tele-psychiatry
  - Rural/ remote (emergency) diagnosis and monitoring
- Remote stroke assessment for drug administration

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Remote device control

- Camera Pan, Zoom, Tilt
- Stereo Convergence
- Additional equipment
  - Remote digital stethoscope
  - Secondary video feedback for clinician
  - Camera rig for camera repositioning
  - haptics in future? E.g. Assess patient strength & limb rigidity etc.

Image credit: http://www.trylifesize.com/lifesize_camera.html

Image credit: http://www.sensable.com/documents/images/LargePHANTOMOmniImage.jpg

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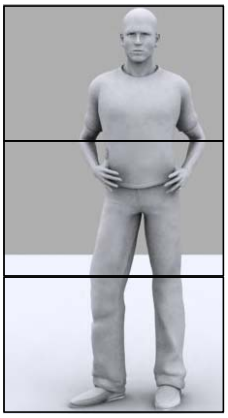
Full body videoconferencing

- 2D via vertical tiled display
  - Provides improved assessment of certain motor functions
  - Ultra-thin bezels (<7mm combined)



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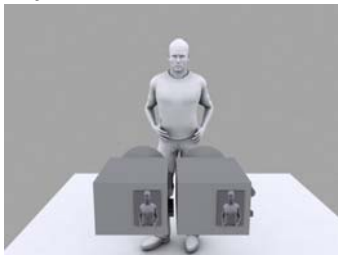
Full body videoconferencing

- 3D via large (>60”) LED/LCD TV in portrait mode
  - Unable to tile effectively due to screen bezels
  - Not compatible with auto-stereo screens
  - Circular passive and active stereo should work
  - Not compatible with off-the-shelf stereo cameras
    - Cams must be rotated 90º independently.



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Eye contact in videoconferencing

- Common complaint with all video-conferencing systems
- Extremely important when dealing with patients, especially psychiatric patients
- Placing the camera as close as possible to the screen
- Limit the angle of offset
- Large screen in limited space provides the worst offset

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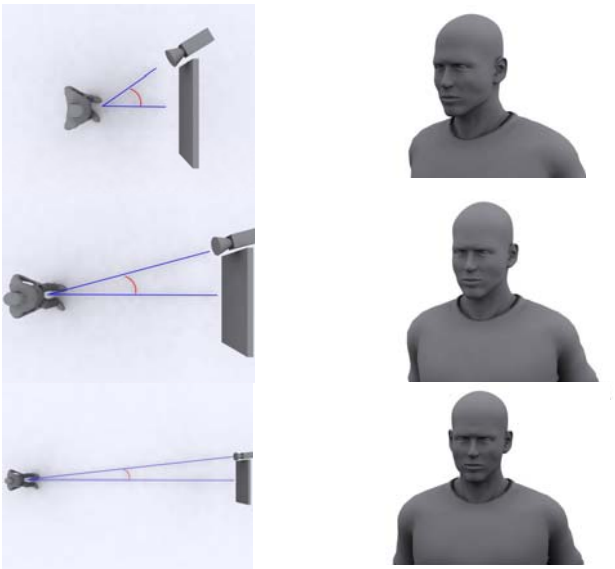
Eye contact in videoconferencing



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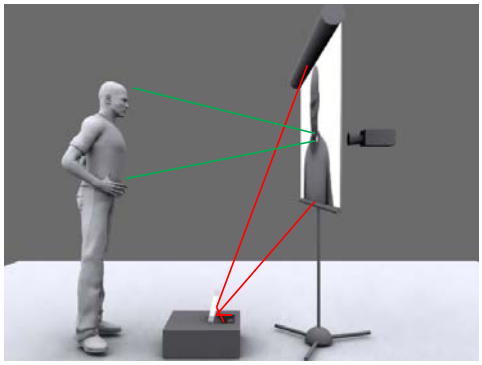
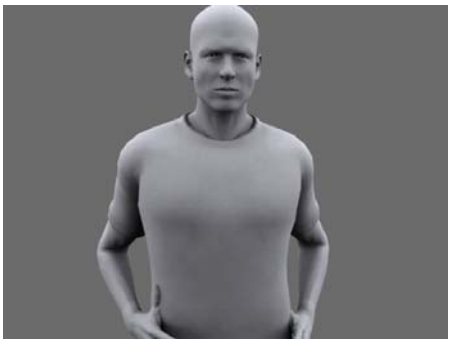
Eye contact in videoconferencing

- Small lens in the centre of the screen (projection reqd.)
- Requires short-throw projectors
- Small lens cameras produce lower quality images





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Eye contact in videoconferencing

- Adapting teleprompter methodology using a two-way mirror.
- Additional light required to compensate for transmission loss

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