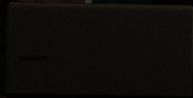


Visualization of Complex Medical Data using Next-Generation Holographic Techniques

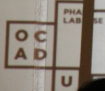
Presented by
Prof. Michael Page
OCAD University
Toronto, Canada



PHASE Lab

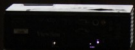
Prototype Holographics for Art & Science Exploration Lab

We are a team of creative researchers specializing in auto-stereoscopic 3D simulations which bring together 3D visualizations, digital holography, computational photography and interactive technologies such as haptics. Our research covers a wide range of applications, including medical simulation technologies, 3D gaming and mobile application





Digital Holography is about to take a quantum leap!



Medical Holograms

Medical Holograms translate data, from existing sources such as

DICOM

(Digital Imaging and Communications in Medicine) to hard copy dimensional visualizations, in order to better represent anatomical information for purposes of **analysis, diagnostics and healthcare records.**



Almost all Medical Data is Dimensional.
It is Most Often Viewed in 2D.



A Case for Hard Copy Holograms

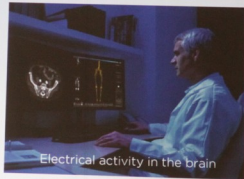
- A better sense of location and spatial relationship when dealing with the often critical and unfamiliar territory of anatomy.
- Hard copy holograms, reconstruct data in dimensional space, creating a simulation closer to how humans perceive objects in real life.
- In some circumstances, (i.e. courtroom presentations of forensic evidence) hard copy holograms would be perceived as an advantage.
- Permanent record that is not computer dependent.



Image courtesy of

Conventional 3D

- On-screen visualizations provide two-dimensional information,
- Full body scans require high-end computers with advanced GPUs to display. With a hologram one can store a large amount of image data.
- When viewing 3D models on digital displays, often normals will invert. Meaning: the image flips suddenly from front to back. The same data printed holographically, will **NOT** invert.

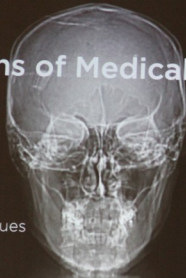


AR (Augmented Reality) & VR (Virtual Reality)



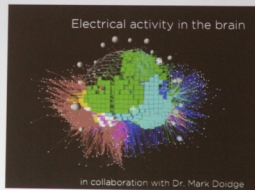
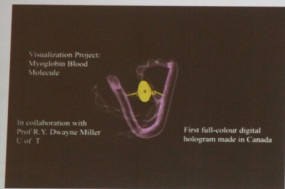
Applications of Medical Holograms

- 3D Visualization
- Medical Education
- Specialized Medical Processes and Techniques
- Diagnostic Tool
- Forensic Medicine

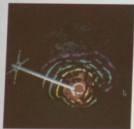


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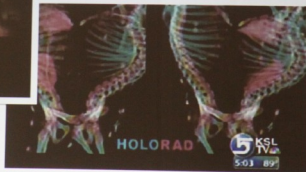
3D Visualization



Specialized Medical Processes and Techniques

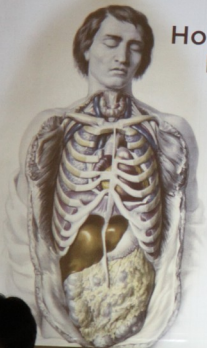


Voxel Surgery Planning/
Twins Separation



Lab Radiation Treatment
Planning Hologram,

Dr. Stephen Benton, MIT SPI Group, 1991



Holographic Diagnostic Imaging Presents the following Issues:

- Regulatory Agency Approval, FDA and others.
- Turn-around time from patient scan to service bureau to medical worker.

Forensic Medicine

Virtual Autopsies



CMIV

TED

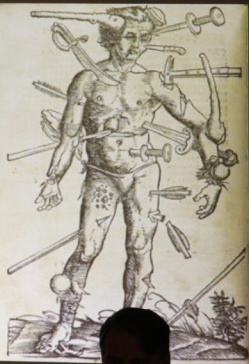


CMIV

From "Visualizing the medical data explosion"
Anders Ynnerman, 1991

Self-Diagnosis or Participatory Medicine

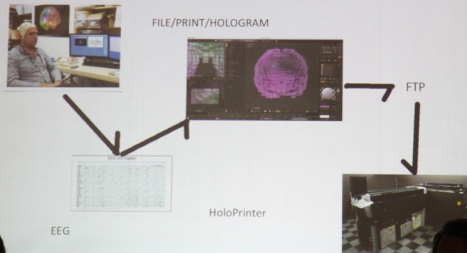
This new area of medicine provides patients, without access to sophisticated medical imaging technology, accessible data on their health.



Imaging Electrical Activity in the Brain



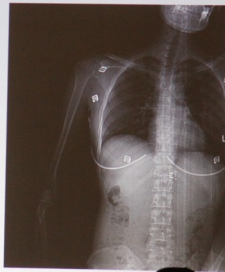
Pipeline to Direct Write Printer



Now on to Other MEDICAL IMAGING MODALITIES

- CT
- MRI
- PET
- Confocal Microscopy

From DICOM files



In 1999 it was projected that:

“in the future, post processing would be automated and integrated into a printer that could print directly from an echocardiogram machine within minutes after image acquisition”

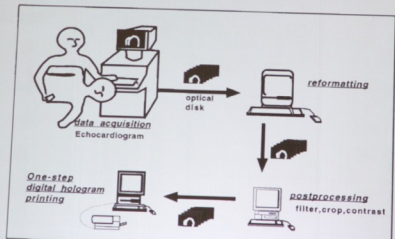
(Hunziker et al.,2)

Hunziker PR, Smith S, Scherrer-Crosbie M, Liel-Cohen N, Levine RA, Nesbitt R, Bergeron A, Picard MH
“Dynamic Holographic Imaging of the Beating Human Heart” in *Circulation* 100:e3 (1999).

They further state, **“A major limitation for broad application of the described technique at the present time is the availability of a holographic printing device”**

(Hunziker et al.,5)

Illustration of projected pipeline from Hunziker et al. article



Fauxlographic Video

What is Not Holographic

Examples:

Magic Leap

Electrolux

Holus

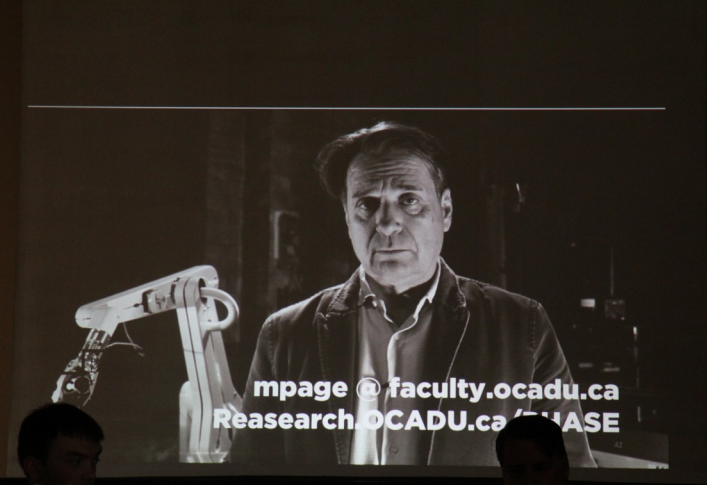
BLEENE

Problems with Conventional Holographic Imaging (Direct Write)

- As low as 70 Degrees Angle of View (HPO)
- Large Hogel Size
- Linear Path Recording Geometry
- Poor Recording Medium (Film)

The Future: From Our Collaborators, Ultimate Holography

- 200 Micron Hogels
- Close to 180 Degrees View Angle (Full Parallax)
- Circular Recording Geometry
- New Holographic Film, 4 NM Grain size (best quality silver-halide film in the world)



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Research.OCADU.ca / MASE

