Technology Series Webcast

SMPTE Enabling Global Education

Adventures in Volumetric Cinema (a work in progress!)

V. Michael Bove, Jr., MIT Media Lab
in collaboration with David Levine, Harvard University

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Your Host

Joel E. Welch

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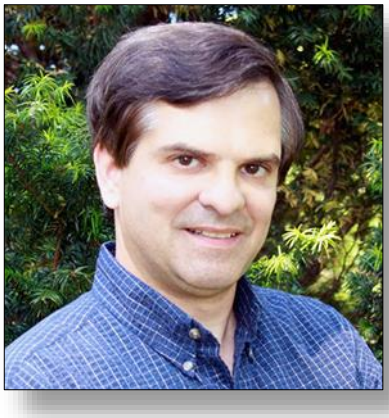
Today's Guest Speaker

V. Michael Bove, Jr.

Head of the Object-Based Media Group
MIT Media Lab

Massachusetts Institute of Technology



First, what *is* a volumetric display?

- It physically positions light emitters at locations in space, rather than just creating the illusion that they're there

Those little LED USB fans are the cheapest and most ubiquitous example!

In popular culture…

- The fictional 3D displays pictured in films like *Star Wars* and *Paycheck* are most closely approximated in current technology by volumetric displays (since photons don't just take a sudden turn toward the viewer unless they reflect off something!)

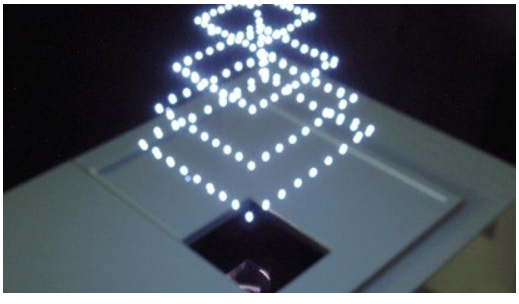
Can move light sources across space, or can project onto surfaces in space

Voxon VX1
(the system we're primarily using)

Catleytech Globe display

Lightspace3D

Some of the stranger approaches

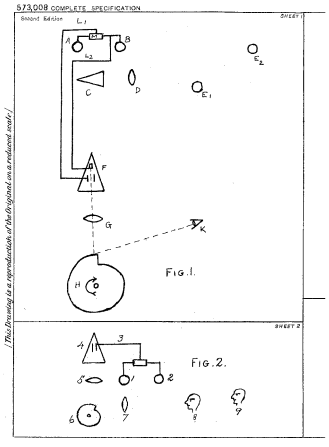


IR-laser-induced plasma discharge, Keio University, 2006

Projection onto particles optically trapped and moved by a UV laser, BYU, 2016

As with so many other things, John Logie Baird got there first

- Patent application GB573008 (1945)
- “Television receiver adapted to receive image signals and range signals…means for causing the cathode ray screen to move…so that a person viewing the screen will see an image in three dimensions corresponding to the object transmitted.”



Retro volumetric display: “Atmopragmascope” (Lawson, 2018)

Literally, “steampunk”

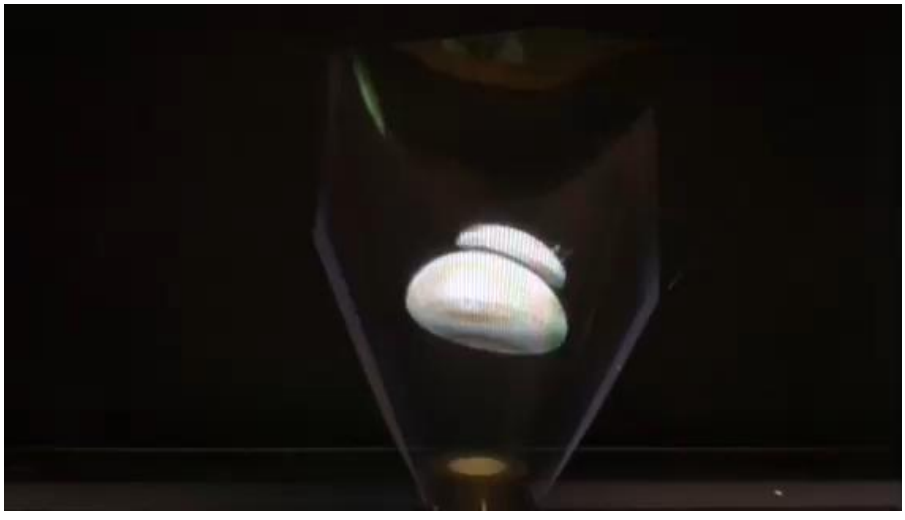
More generally, there are three categories

- “swept-volume”: rotating or translating emissive displays or projection surfaces
- “fixed-volume”: project onto a static volume at different depths
- “free-space”: cause light emission in free air, or project onto particles in air

Advantages and disadvantages

- Pluses:
  - Accommodation and vergence match perfectly
  - Huge view angle (up to 360 degrees)
  - Excellent motion parallax
- Minuses:
  - Moving parts (typically)
    - Reduced robustness
    - User can’t reach into light field
  - Imagery is restricted to a bounded physical volume (no virtual image points)
  - Occlusion is difficult or impossible (imagery is see-through)

Pseudo-volumetric display: “Funnelvision” (MIT Media Lab, 2018)



Volumetric Cinema

- The current tremendous amount of interest in digital storytelling has focused mostly on VR, which offers a immersive experience—you’re inside the story
- Volumetric Cinema offers an opposite but equally radical departure: the story inhabits a particular physical space and you can move around it

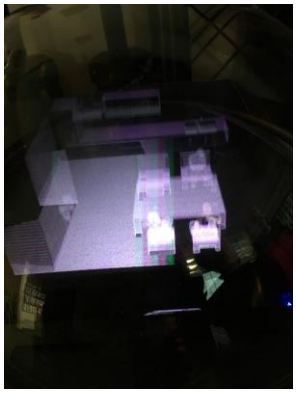
Some design questions

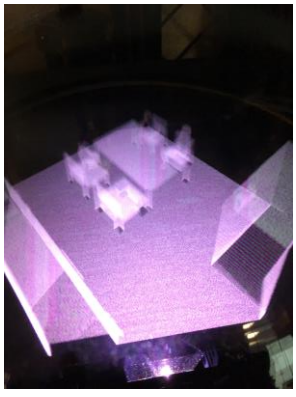
- How to fit all action into a limited view volume
- How do cuts, fades, other transitions look, and do they make sense to the viewer
- What's the visual effect of different camera moves
- Interplay between viewers' ability to stand anywhere and director's ability to drive viewers to a particular physical viewpoint
- How to handle scene lighting design
- Sound design
- Where will characters come from: rigged body scans with motion capture data applied, animated synthetic characters, dynamic point cloud capture, etc.
- How to make characters and objects appear more solid rather than see-through

How we're exploring all this

- One-month hands-on workshop for a group of MIT, Harvard, and Wellesley undergrads and grad students
  - Animators, programmers, filmmakers, game developers
- Subset of the group is continuing to work with us this semester on follow-up experiments
- A series of shorts will explore the cinematic affordances of the VX1 display and will debug the production and post-production process
- Summer and fall 2019 will bring production and post-production of a longer (~20 minute) piece for exhibition

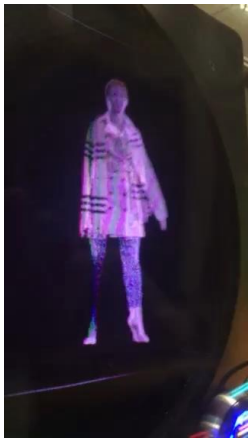
How we're exploring all this





Lessons so far

- Some of the quirks of volumetric displays can be quite charming
  - VX1 sounds like a 16mm film projector and the color dithering looks a bit like film grain



Lessons so far

- Some of the technical limitations (like lack of occlusion and oddly-shaped view volume) are a good creative stimulant
- A stable, relatively-bug-free software environment is essential for a project like this!
- Game engines (we're using Unity) are a wonderful thing
  - Tools used by game developers to make "cutscenes", like Unity Timeline and Cinemachine, provide the beginnings of a production and post-production environment but there's a lot more needed
- The audience may need a little while to understand the visual storytelling language of a volumetric display, so structure the production in a way that supports this

Questions?

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