

# The Changing Meaning of the Word Hologram

Warsaw – Session 1: ‘Modern’ Holograms

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# Agenda

- What is a hologram?
  - Definition
  - Examples
- A Brief History of Holography
- A Paradigm Shift?
  - Shelf-life
  - Age
- Some New Terms & Examples of Where Holography Has Been Mentioned
  - Augmented, Virtual & Mixed Realities
  - Display Examples: Sat navs, phones, medicine and other
  - Digital Resurrection & Pepper's Ghost
- Conclusions



# What is a Hologram?

## Definition:

1. Dennis Gabor coined the term hologram from the greek words *holos*, meaning 'whole,' and *gramma*, meaning 'message.'
2. 'A complex diffraction grating which, when appropriately illuminated, generates an image of an object, usually with full parallax. This grating is record of the interference pattern generated by the wavefront from the object (object beam) and an unmodulated wavefront (reference beam) and is usually (though not invariably) recorded by a fine-grain photographic emulsion.'
3. 'A three-dimensional image formed by interference of light beams from a laser or other coherent light source.'

(Source: Graham Saxby, 1991, Manual of Practical Holography, Focal Press, p.181.)

(Source: Oxford English Dictionary)



# Examples of Holograms

OptoClones™ - Fabergé Coronation Egg & Easter Egg Clock

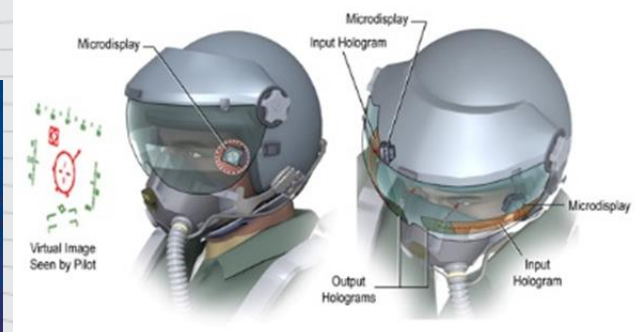
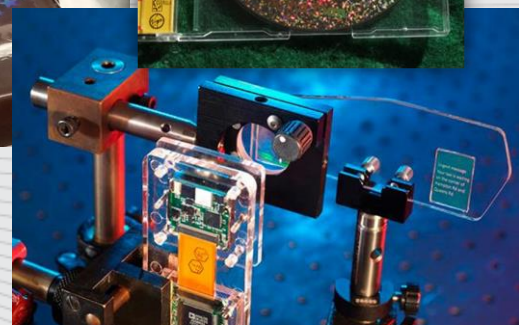


The Bowater collection of Fabergé OptoClones™ at The Holography Conference, Shanghai 2015 that won the Best of Year Excellence in Holography International Hologram Manufacturers (IHMA) Award.

Source: Hellenic Institute of Holography, Ultra Realistic Imaging ISDH 2015, ITMO University St. Petersburg.



The image is a composite of two parts. The top part shows a Barclaycard Visa credit card. The card is white with a dark blue band at the top containing the word 'BARCLAYCARD' in white. To the right is the Visa logo. The card number '4929 4929 981 427 678' is embossed. A green bird logo is visible on the right side. The bottom part shows a close-up of a mobile phone screen displaying a payment interface. The screen has a dark background with the text 'EAR FIELD COMMUNICATION' and 'NFC' visible. Large, stylized 'NFC' text is prominent in the foreground, and a green bird logo is also visible on the screen.



# A Brief History of Holography

Discovery of holograms by Dennis Gabor whilst working to improve electron microscopy. 1971 - awarded Nobel prize in Physics.



Yuri Denisyuk, a Russian scientist invented the first white light reflection hologram.



Steve Benton invented white light transmission holography that can be viewed with ordinary white light creating a 'rainbow' image. Mass production of embossed holograms possible.



Steve McGrew develops for mass production of surface relief holograms.



1<sup>st</sup> hologram on:

- Holographic coin(1983) re-issued 1996, Isle of Man



- Passport(1984)
- Pharma & banknote patch (Kinegram®) (1988),

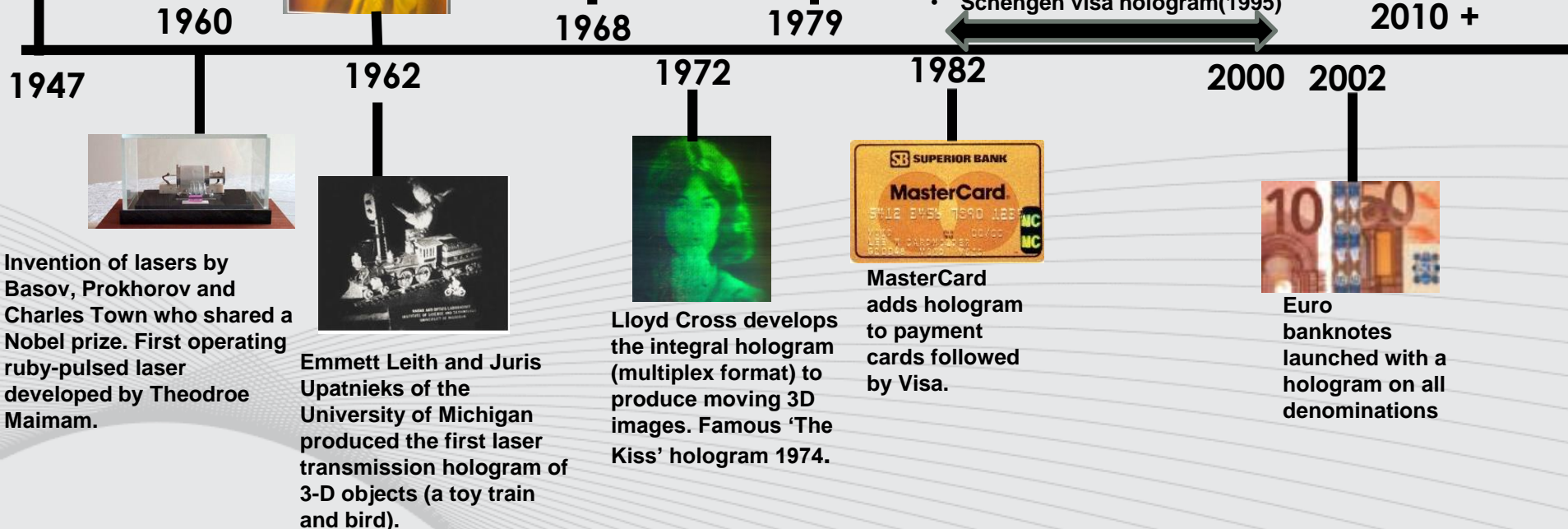


- Driver's license and event ticket (1990)
- All over HRI hologram on UAE passport & 1st b'note holographic thread (1992)
- 1<sup>st</sup> holographic b'note stripe(1994)
- Tax stamp (1995)
- Schengen visa hologram(1995)

Plasmon Technology Holographic Optical Effects (HOEs), Euro 2

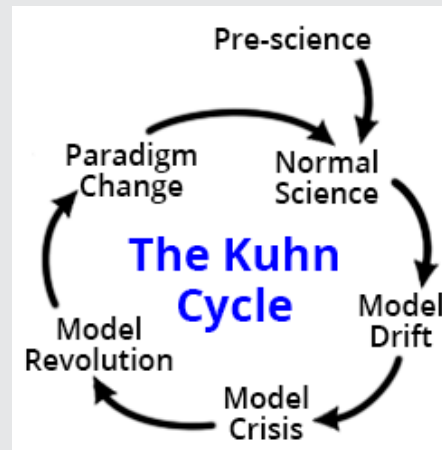


'faux'hologram – projection systems, augmented, virtual and mixed realities



# A Paradigm Shift?

A **paradigm shift**, as identified by American physicist and philosopher Thomas Kuhn, is a fundamental change in the basic concepts and experimental practices of a scientific discipline. (Source: Thomas Kuhn, *The Structure of Scientific Revolutions*, 1970 ed, p.150.)



Or

As identified by Martin Cohen as a kind of intellectual virus – spreading from hard science to social science and on to the arts and even everyday political rhetoric today. (Source: *Paradigm Shift: How Expert Opinions Keep Changing on Life, the Universe and Everything*, Imprint Academic, 2015, p.181.)



# A Paradigm Shift?

In short **NO**

‘It’s the imprecise use of the word hologram and misidentification of the use of other technologies as holograms.’

**Has the word hologram become a *meme* - an idea or ‘idea chunk’ , behaviour, or style that spreads from person to person within a culture that is capable of becoming a robust belief.** (Source: Dawkins, R., *The Selfish Gene*, Oxford University Press, 1976)

Example: **Hologram or the prefix holo is now used for anything remotely 3D-like.....**



# Shelf-Life & Age?

## Does the word hologram have a shelf-life?

As concepts shift, 'specialist' language follows, mutating the meaning of the term(s) that had initially clear categories or entities, eg. Xerox became the generic term for photocopy in the 1960's and the word 'hoover' became a common word in the UK for a synonym for vacuum cleaner.

## Does the word hologram mean something different to different age groups?

People born in the 60's: holograms identified as art or portraits;

People born in the 70's to early 80's: holograms identified as security patches or science fiction themes;

People born post 1995: holograms linked to virtual entertainment in live settings and recreations of dead artists/performers. (Source: Johnston S. F., *holograms a cultural history*, Oxford University Press, 2015)



# Some New Terms & Examples of Where Holography Has Been Mentioned



# Virtual, Augmented and Mixed Realities

- **Virtual reality (VR)** - is an artificial, computer-generated simulation of real life. The viewer wears a headset (such as Rift made by Facebook owned Oculus) that blocks out their surroundings and stimulates their vision and hearing.
- **Augmented Reality (AR)** – the technology superimposes computer-generated layers of visual and auditory information onto the viewer's surroundings. A device is worn that allows the wearer to see and hear the real world around them onto which additional sights and sounds are added.
- **Mixed Reality (MR)** sometimes called *world space* embraces both virtual reality and augmented reality to create mixed reality.

Difference between MR and AR?? MR maps your environment in order to populate it with computer-driven data. Because of that mapping, a present-day distinction between AR and MR is that MR can fix objects in your visual field.



# Virtuality Continuum

REAL  
ENVIRONMENT

VIRTUAL  
ENVIRONMENT

MIXED REALITY (MR)

## Tangible User Interfaces (TUI)

A TUI uses real physical objects to both represent and interact with computer-generated information (Ishii & Ullmer, 2001).



Using physical objects to create a virtual model (Ichida, Itoh, & Kitamura, 2004). As a user adds a physical 'ActiveCube' to the construction, the equivalent virtual model is automatically updated.

## Augmented Reality (AR)

AR 'adds' computer-generated information to the real world (Azuma, et al. 2001).

### Spatial AR

Spatial AR displays project computer-generated information directly into a user's environment (Bimber & Raskar, 2005).



The 'Bubble Cosmos' – 'Emerging Technology' at SIGGRAPH'06. The paths of the smoke-filled bubbles are tracked, and an image is projected into them as they rise.

### 'See-through' AR (either optical or video)

A user wears a head-mounted display, through which they can see the real world with computer-generated information superimposed on top (Cakmakci, Ha & Rolland, 2005; Billinghurst, Grasset & Looser, 2005).



See-through AR: the butterfly is computer-generated, and everything else is real (Fischer, Bartz & Straßer, 2006; Kölsch, Bane, Höllerer, & Turk, 2006).

## Augmented Virtuality (AV)

AV 'adds' real information to a computer-generated environment (Regenbrecht, et al. 2004).

### Semi-immersive VR

A semi-immersive VR display fills a limited area of a user's field-of-view.



Semi-immersive VR using the Barco Baron workbench (Drettakis, Roussou, Tsingos, Reche & Gallo, 2004).

## Virtual Reality (VR)

VR refers to completely computer-generated environments (Ni, Schmidt, Staadt, Livingston, Ball, & May, 2006; Burdea & Coffet 2003)

### Immersive VR

Immersive VR, which uses either a head-mounted-display or a projection-based system, completely fills the user's field-of-view.



Projection-based immersive VR. The users are fully immersed in the 'CAVE' (FakeSpace, 2006; Cruz-Neira, Sandin & DeFanti, 1993).

Source: Continuum of advanced computer interfaces, based on Milgram and Kishino (1994).

# Augmented Reality Device Examples



Epson's Moverio BT-200 and Pro BT-2000 smart eyewear offer 2D and 3D augmented reality applications



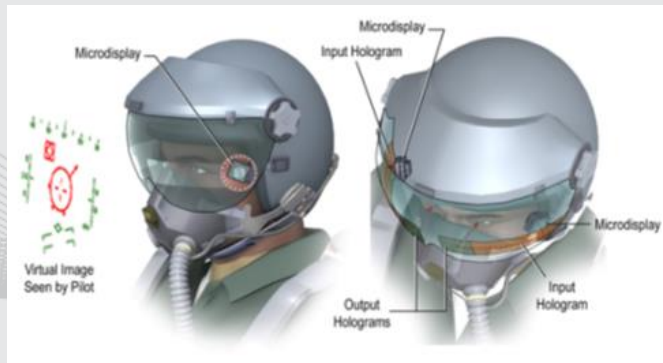
DAQRI Smart  
Helmet Augmented  
Reality Device

AIR GLASSES™  
ENTERPRISE READY SMART GLASSES



Atheer

Google Glass – uses prism based optics



Head up Displays eg. Luminet's holographic optical elements are embedded onto a thin, clear photopolymer film that can be applied to glass or acrylic surfaces such as a helmet visor or eye glasses.

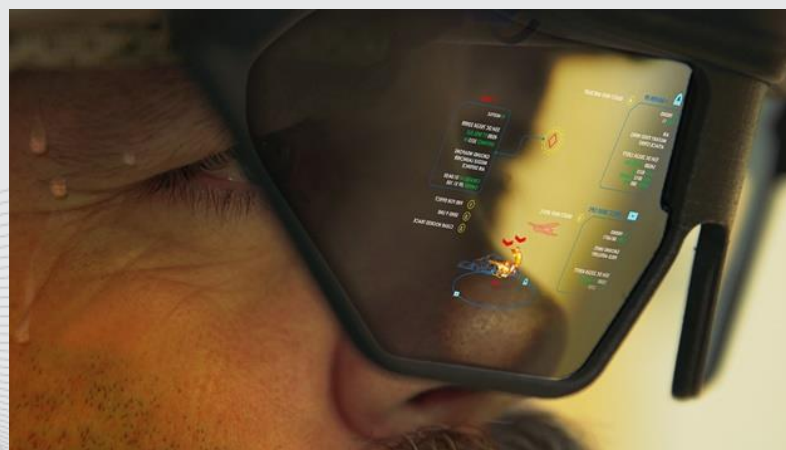


# Mixed Reality Device Examples



Microsoft' HoloLens headset announced in Jan 2015 ushers- in their words- 'holographic computing'.

HoloLens uses holographic waveguide optics to enable an operator to view computer generated 3D graphics superimposed onto their visual environment.



Rockwell Collins  
to launch  
Coalescence™  
mixed reality  
training system  
at ITSEC 2016

# Virtual Reality Device Examples



Oculus Rift



Samsung Gear



Google Cardboard

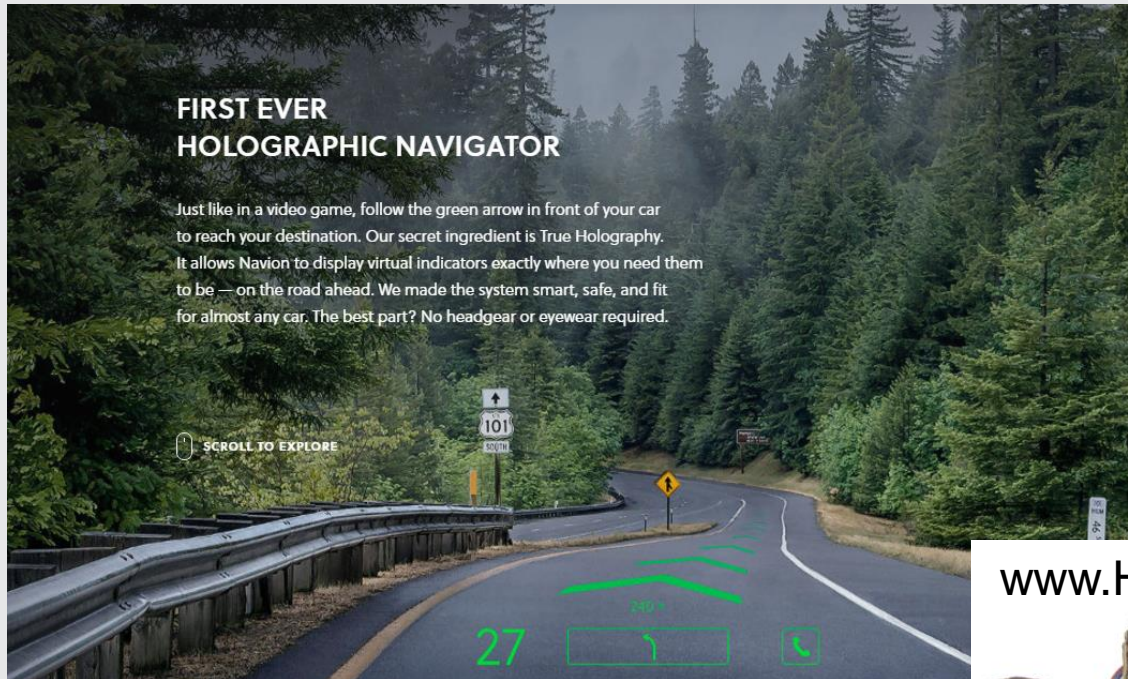


# Display Examples



# Sat Navs, Phones and Medicine

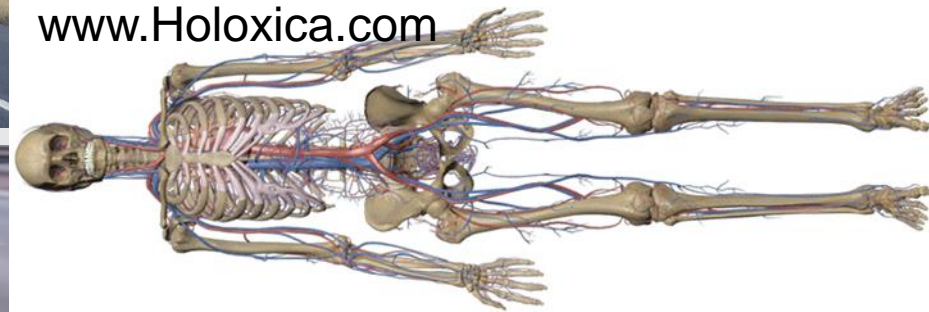
<https://wayray.com/navion>



[www.navdy.com](http://www.navdy.com)



[www.Holoxica.com](http://www.Holoxica.com)



# Other Displays



Holus



kno·mo

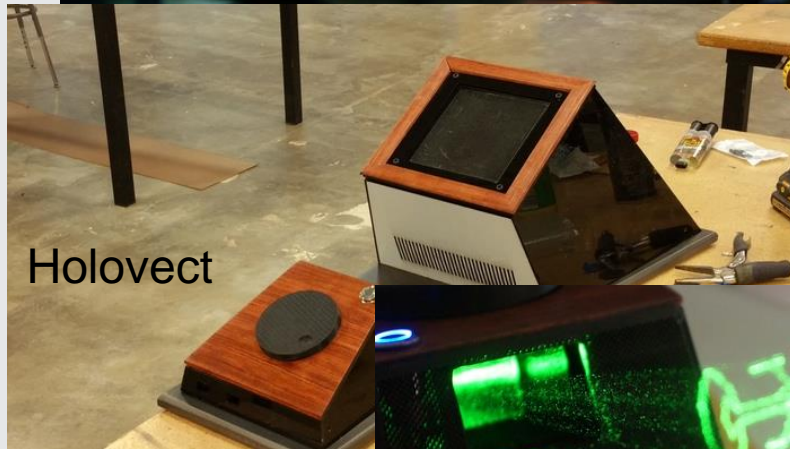


Kino-mo Holo Displays

Kino-Mo

Features Uses Size

Holovite



Holovect

Holovect



[www.leiadisplay.com](http://www.leiadisplay.com)



# Digital Resurrection & Pepper's Ghost



# An Example of Digital Resurrection

Tupac Shakur 2012 Coachella Valley Music & Arts Festival, California  
ITS NOT A HOLOGRAM IT'S AN ILLUSION

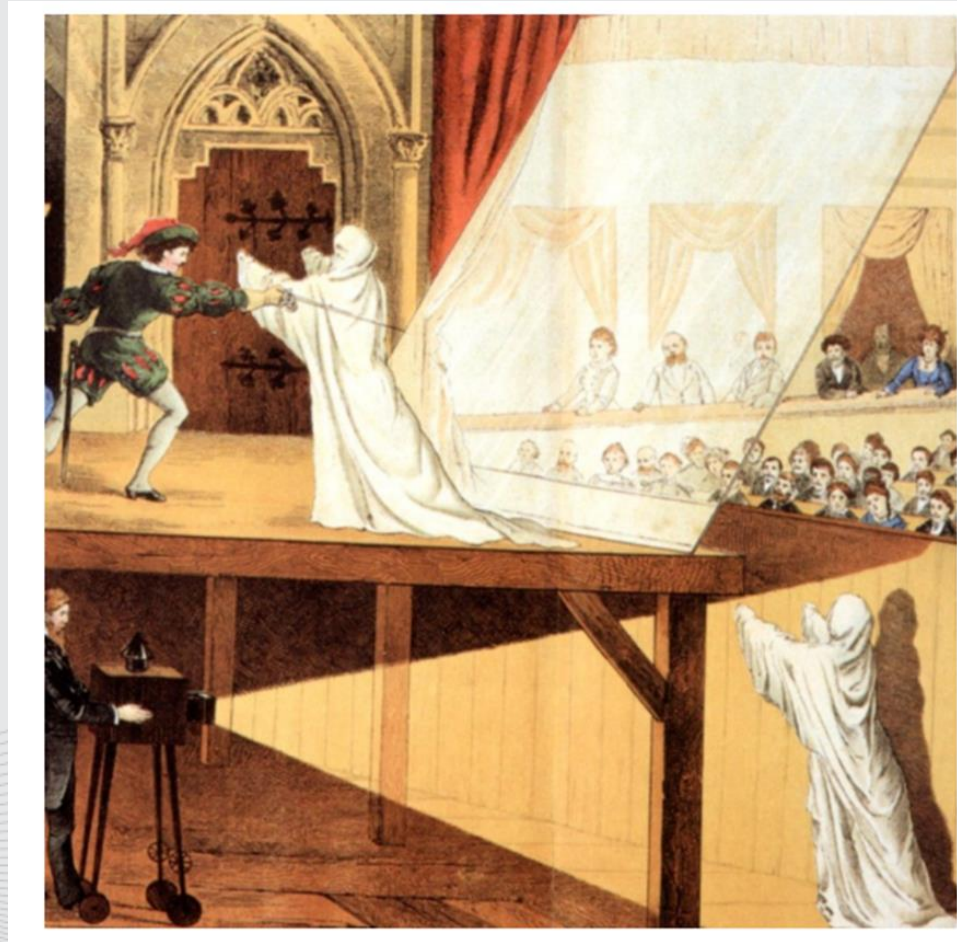


Credit:Musion

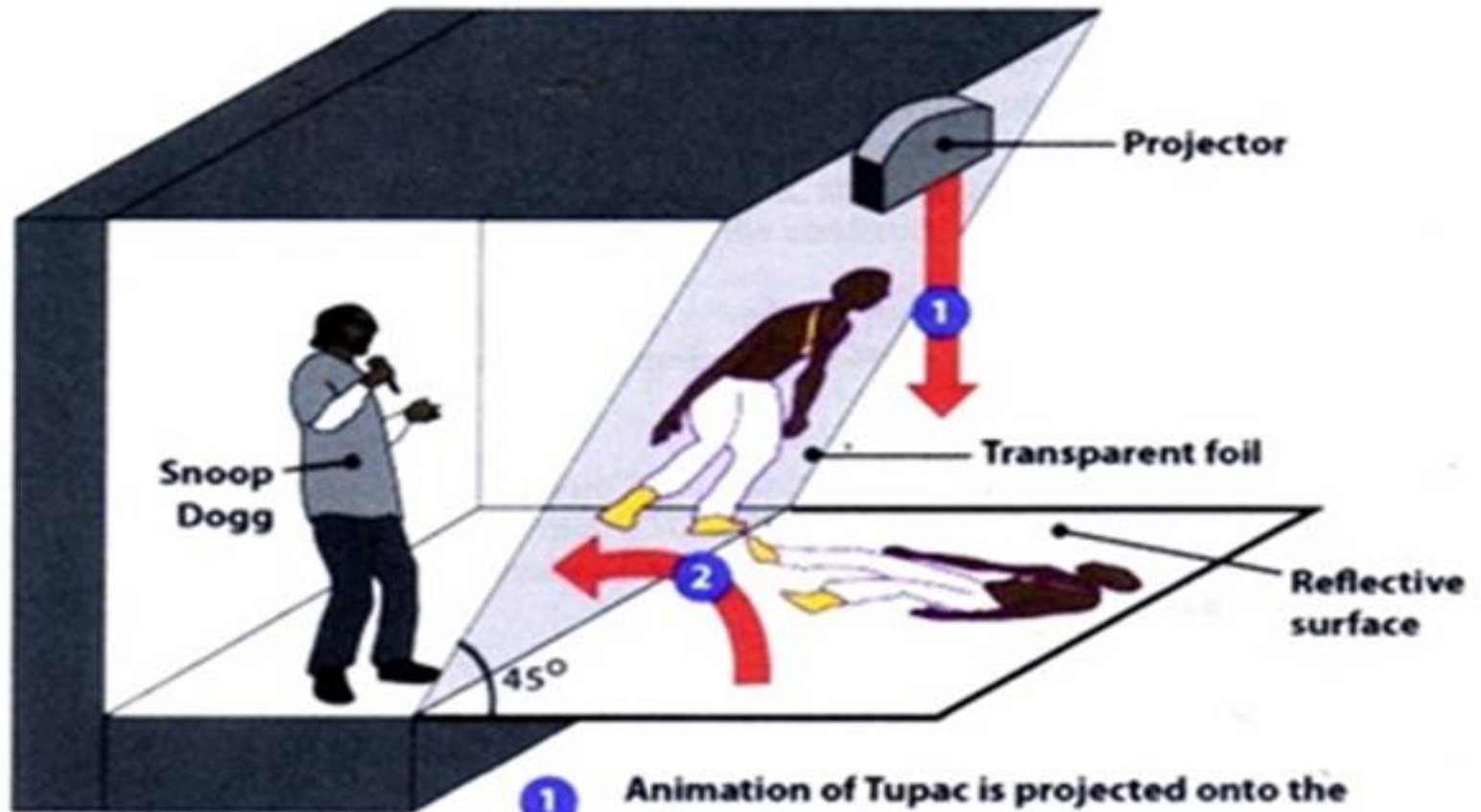


# How does Digital Resurrection Work?

It uses a modern version of the Pepper's ghost illusion named after John Henry Pepper in 1862. The effect is used to project a ghost so as to look as though it is interacting with those on stage.



# The Modern Pepper's Ghost



Source: Musion Eyeliner system patent (U.S. Patent No. 5,865,519, "Device For Displaying Moving Images In The Background Of A Stage"); Musion Systems Ltd.

- 1 Animation of Tupac is projected onto the mirrored surface
- 2 Image is reflected onto the transparent screen, which is angled such that the audience sees Tupac but not the foil.

# Digital Resurrection Companies

**HOLOGRAM USA**  
Powered by **Filmon TV**



RED KARAVAN



HOLOGRAMICA

SEEING IS BELIEVING

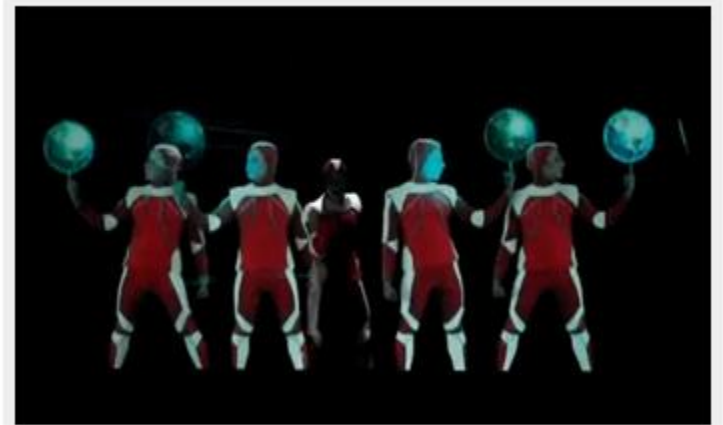
MUSION

THE WORLD LEADERS IN HOLOGRAPHIC TECHNOLOGY



VISUAL POKE

Holograms



**iC3DsFX**

# Conclusions

1. The word hologram has evolved to become generic for anything 3D-like including 2D projections even when there is no interference of light etc...
2. A paradigm shift has not taken place.
3. The change in hologram meaning as become virtually embedded in popular culture which is likely to stay as companies develop more innovative products and services in this area.

## What should the industry do?

## Redefine the word hologram?



# Thank you

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