

THE
CHANGING
MEANING
OF THE
WORD
HOLOGRAM

The Holography Forum

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Seoul, South Korea

Dr Mark Deakes - General Secretary of the
International Hologram Manufacturers
Association (IHMA)



AGENDA

- International Hologram Manufacturers Association (IHMA)
- 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

International Hologram Manufacturers Association (IHMA)



IHMA Chairman: Dr Paul Dunn
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www.ihma.org

Fast Facts

- A not-for-profit industry association founded in 1993.
- Represents the interests of hologram manufacturers and the global hologram industry.
- Members are of the world's top-tier hologram producers.
- Members are strictly vetted prior to acceptance.
- Code of Practice for members.

Member Benefits

- The Hologram Image Register (HIR)
- IHMA Patent Bulletin.
- Tender Alerts & Sales Leads.
- Holography News® (monthly).
- Holography News® Digital Archive
- Publicity & Education.
- Discount to the The Holography Conference™.
- Demonstrates commitment to ethical business practices and quality products.

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.'

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



3. 'A three-dimensional image formed by interference of light beams from a laser or other coherent light source.'

(Source: Oxford English Dictionary)

EXAMPLES OF HOLOGRAMS

OptoClones™ - Fabergé Coronation



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.



Philippe GENTET, Yves Gentet, Seung-Hyun LEE

EXAMPLES OF HOLOGRAMS

Banknotes



ID Laminates



A BRIEF HISTORY OF HOLOGRAPHY

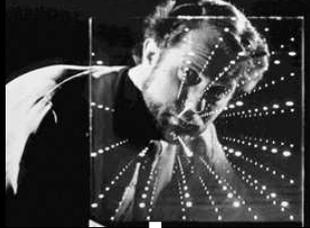
Discovery of holograms by Dennis Gabor whilst working to improve electron microscopy. 1971 - awarded Nobel prize in Physics.



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.



1st 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)
- 1st 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



1947



Invention of lasers by Basov, Prokhorov and Charles Town who shared a Nobel prize. First operating ruby-pulsed laser developed by Theodore Maiman.

1962



Emmett Leith and Juris Upatnieks of the University of Michigan produced the first laser transmission hologram of 3-D objects (a toy train and bird).

1972



Lloyd Cross develops the integral hologram (multiplex format) to produce moving 3D images. Famous 'The Kiss' hologram 1974.

1982



MasterCard adds hologram to payment cards followed by Visa.

2000



Euro banknotes launched with a hologram on all denominations

2002

2010 +

1960

1968

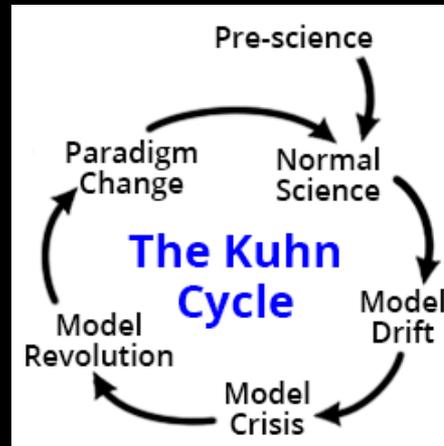
1979



2010 +

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.)



As identified by Martin Cohen as a kind of intellectual spreading from hard science to social science and on arts and even everyday political rhetoric today.

(Source: *Paradigm Shift: How Expert Opinions Keep Changing on Life, the Universe and Everything*, Imprint Academic, 2007)

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.

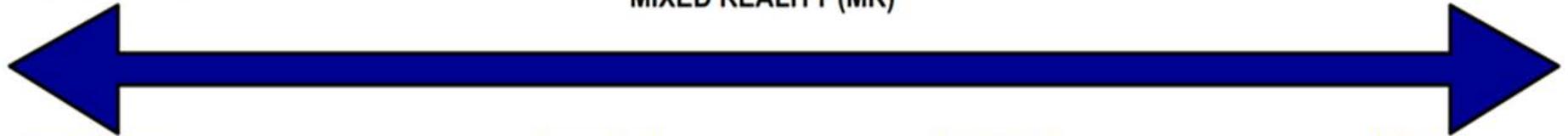
Difference between MR and AR?? MR maps your environment in order to populate it with computer-driven data. Because of that mapping, a present-day distinction between AR and MR is that MR can fix objects in your visual field.

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.

Projection Augmented models (PA model) are a type of Spatial AR display, and are closely related to TUIs

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).



AUGMENTED REALITY DEVICE EXAMPLES



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



MagicLeap

Google Glass – uses prism based optics



DAQRI Smart
Helmet Augmented
Reality Device

AIR GLASSES™
ENTERPRISE READY SMART GLASSES



Atheer

Head up Displays
eg. Luminit'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.

North Focals



4:15

Rockwell
Collins
Coalescence™

in 4 min
Get home for 5:15
132 → Willow
Lincoln Ave/East Ave



Virtual Image
Seen by Pilot

MIXED REALITY DEVICE EXAMPLES

HoloLens Jan 2015

HoloLens 2, Feb 2019



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. HoloLens let's you see, hear and interact with holograms within an environment such as a living room or an office space.





The future is now. His daughter is not actually in the room.

actual footage shot
through HoloLens

VIRTUAL REALITY DEVICE EXAMPLES



Oculus Rift



Samsung Gear



Google Cardboard



DISPLAY EXAMPLES

SAT NAVS, PHONES AND MEDICINE

<https://wayray.com/navion>

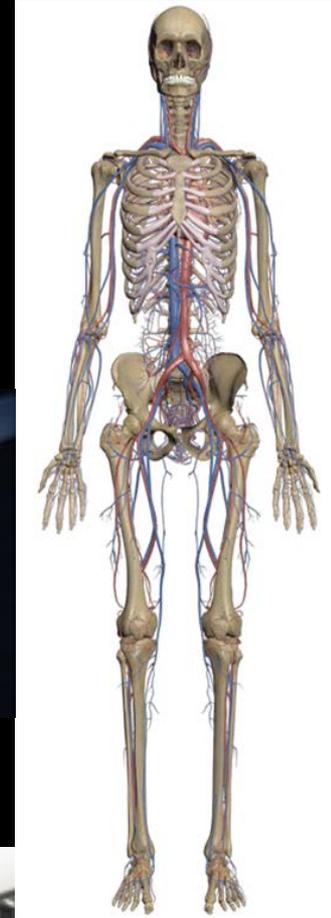
www.navdy.com

www.holoxica.com

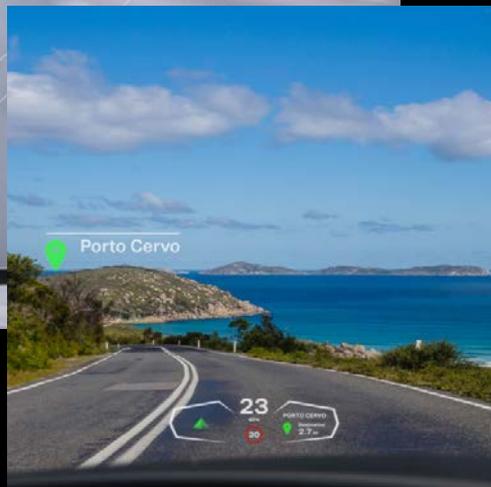
FIRST EVER HOLOGRAPHIC NAVIGATOR

Just like in a video game, follow the green arrow in front of your car to reach your destination. Our secret ingredient is True Holography. It allows Navion to display virtual indicators exactly where you need them to be — on the road ahead. We made the system smart, safe, and fit for almost any car. The best part? No headgear or eyewear required.

SCROLL TO EXPLORE



Holoscope
www.realviewimaging.com



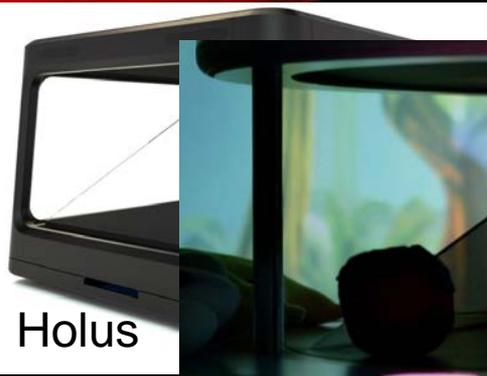
www.envisics



www.leia3d.com

JLR Laser
Holographic Sat Nav
from Cambridge
University

OTHER DISPLAYS



Hokus



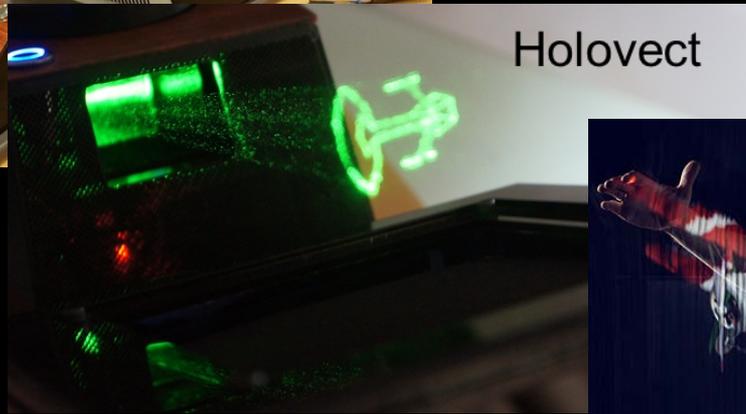
Kino-Mo



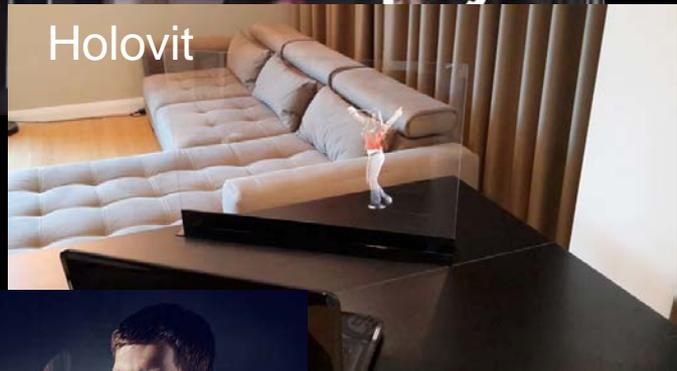
Kino-mo Holo Displays



HoloVect



HoloVect



HoloVit





DIGITAL RESURRECTION & PEPPER'S GHOST

AN EXAMPLE OF DIGITAL RESURRECTION

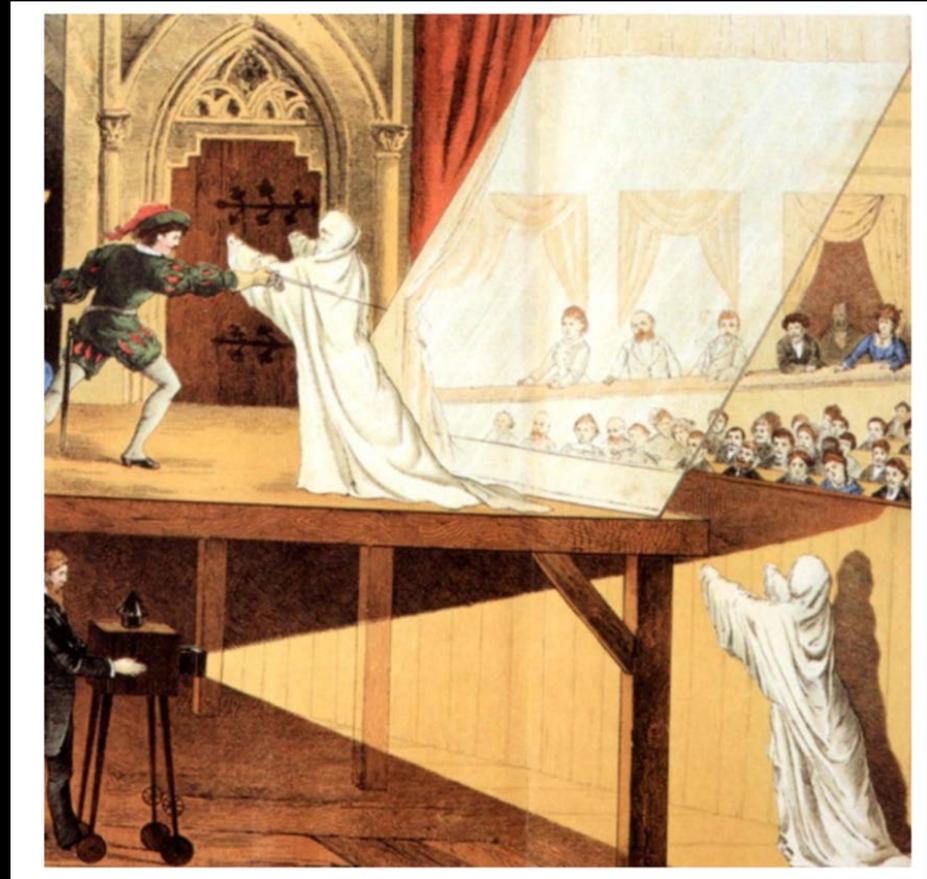
Tupac Shakur 2012 Coachella Valley Music & Arts Festival, California
ITS NOT A HOLOGRAM IT'S AN ILLUSION



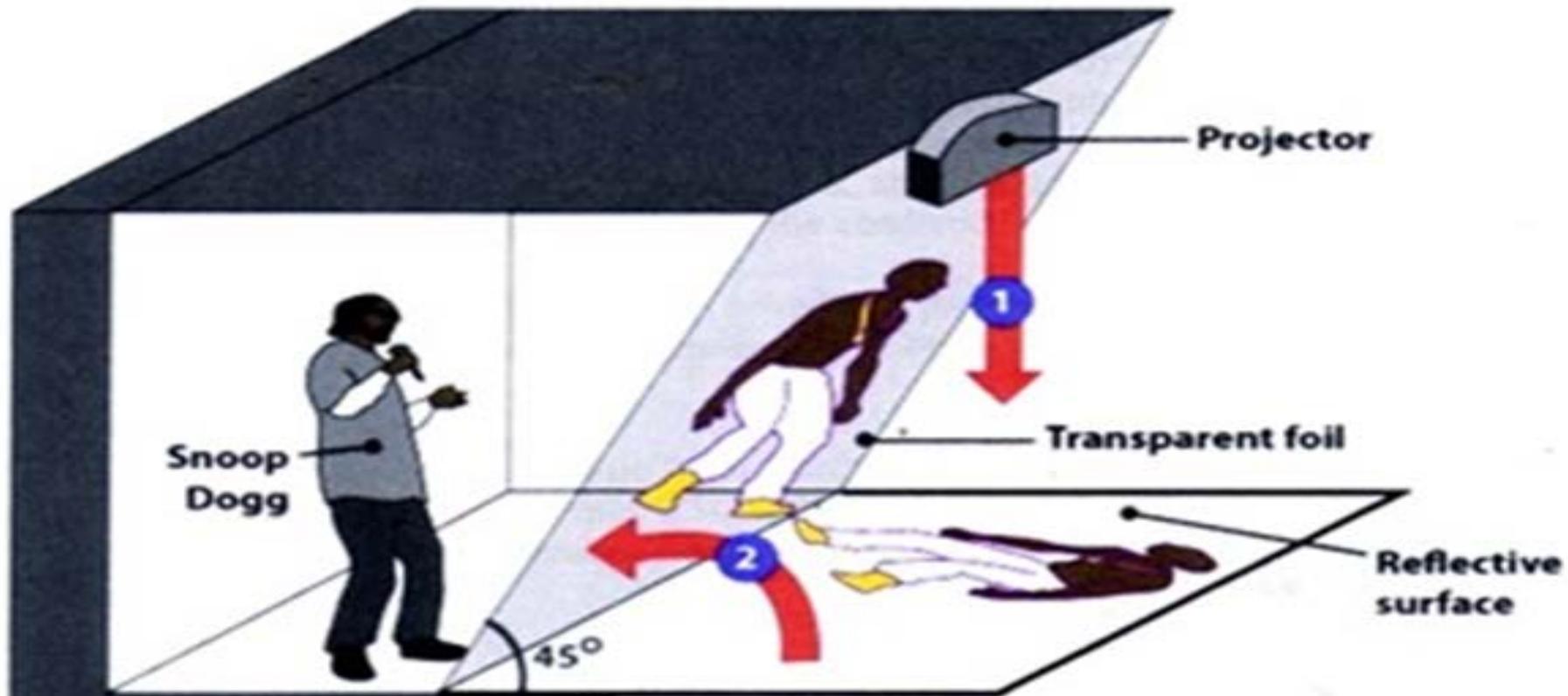
Credit: Musion

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



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.

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.

DIGITAL RESURRECTION EXAMPLE



RED KARAVAN



DIGITAL RESURRECTION COMPANIES

HOLOGRAM USA
Powered by **FilmOn.TV**



RED KARAVAN



HOLOGRAMICA

SEEING IS BELIEVING

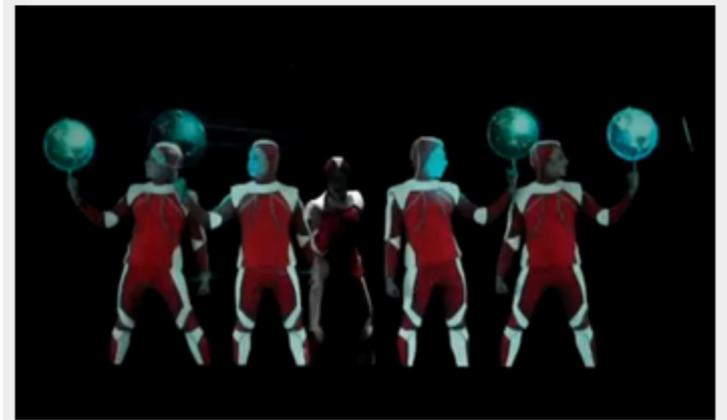
MUSION

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 and embrace the evolution?



THANK YOU

Dr Mark Deakes
International Hologram Manufacturers Association