PANORAMA ARCHITECTURE

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ABSTRACT

"Nothing is more precious than the view of a landscape that is open on every side. " -Louis-Antoine de Bougainville (France, 1972-1811)

The intersection of mankind and machine lies in the inherent nature of the display surface for televisions, computers, cell phones, ect. This exponential relationship is feverishly pursued with quantifiable results of connectivity, music, information, and visual display. With the reliance on surface display for information expression, arrives a vanity where the user/consumer has demanding desires: contrast ratio, luminance, gamut, speed, resolution, and size. [18] Surface display vanity stems from a relationship for the user/consumer to immerse within their information, interact with their information, or be their information.

"The basic aim of a panorama was to reproduce the real world so skillfully that spectators could believe what they were seeing was genuine. Although the techniques of trompe l'oeil painting had been known for centuries, they were never sufficient to create a total illusion of reality. An observer's gaze could always move beyond the frame, where the actual surroundings contradicted those of paintings, and lighting conditions usually failed to match as well. To achieve a perfect illusion, new techniques of painting were required, but above all a new environment in which paintings could be displayed. The painting had to surround observers and envelop them completely, so as to exclude any glimpse of their whereabouts. An entire pictorial environment was created for visitors to pass through." [20]

New interests and activities from viewers have increased the demands on production and construction of said environments. Such demands include a heightened stress on the communities of hardware development, software development, and budgetary constraints. This investigation pursues a catalog of popular contemporary display technologies in the form of hardware, progressive additions to the field of surface design, and the relevance of the expressed technologies for contemporary panoramas.

SOFTWARE

The progress for software presenting visuals has evolved beyond the pictorial illusion of painting panoramas, consumers desire the immersion into panoramic environments. Audiences aim to augment their reality, interact, and react for potentially greater understanding of new, old, and artificial surroundings.

Audience interaction and participation is a key asset to the experience in the video game industry, a commercial entertainment juggernaut that currently eclipses the previous centuries leader in entertainment revenues, the movie industry. Interactive technologies and augmented reality have made tremendous strides in these commercial gaming areas with interactive devices such as Nintendo's Wii remote, Viacom’s Rock Band interactive musical controllers, and the current release of the NATAL by Microsoft.

HARDWARE

In the area of hardware development within the last decade, technologists have competed within the industry of surface display with the creation of: Cathode Ray Tube, Cholesteric Liquid Crystal, Digital Light Processing, Electroluminescent, Field Emission Display, Laser TV, Light-Emitting Diode, Liquid Crystal on Silicon, Organic Light-Emitting Diode, Plasma Display Panel, Surface-Conduction Electron-emitter Display, and Vacuum Fluorescent Display. [17}

This analysis will focus on the hardware technologies of Digital Projectors, Liquid Crystal Displays, LED displays, and Pass-through display systems. The progressive desires stressed on surface display create a cadre of production issues related to the physical structure such as image quality, presentation flexibility, and cost. Based on data gathered as of June 2009, the following hardware technologies represent the previous standards, current standards, and likely successors in the area of panorama surface display.

CATHODE RAY TUBE DISPLAYS

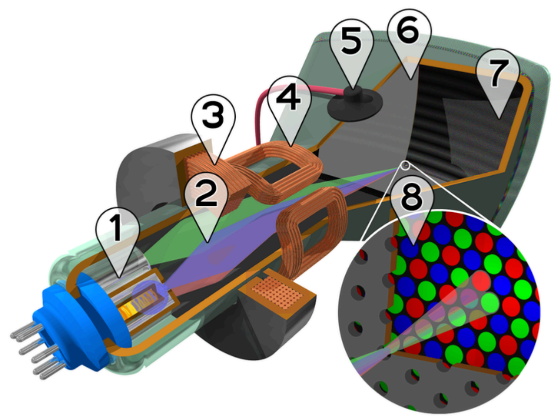
The Cathode Ray Tube “has evolved from the triode structure of the Braun tube, which was the first scanning version of the device in the late 1890’s.” [18] The Cathode Ray Tube, a light-emitting display, has been a highly successful commercial product, and provided a low price point for designers of panoramas based on lowered cost attributed to mass production in the global economy.

Cathode Ray Tube Displays, abbreviated CRT, “is a vacuum tube containing an electron gun (a source of electrons) and a fluorescent screen, with internal or external means to accelerate and deflect the electron beam, used to create images in the form of light emitted from the fluorescent screen. The image may represent electrical waveforms (oscilloscope), pictures (television, computer monitor), radar targets and others." [4]

"The CRT is able to use relatively simple architecture and control electronics to display high-performance video and data in a low-cost and highly manufacturable component." [18] Ironically the simple architecture and voluminous size that made the CRT an easily manufactured and distributed product also began to create industry trepidation because the breadth of distribution expenses accrued from the magnitude of shipping weight.

Cathode Ray Tube Displays lack flexibility because a rigid screen and housing volume needed to host the vacuum tube. "Various attempts to squeeze the traditional 3-D CRT into two dimensions or at least reduce the depth substantially have been unsuccessful to date." [18]

This inflexibility based on mere physical stature has led to the decrease of demand for commercial innovation and corporate backing with Cathode Ray Tube Displays. "In 2005 Sony announced that they would stop the production of CRT computer displays. Similiarly, German manufacturer Loewe ceased production of CRT TVs."[4] These trends lowered manufacturer confidence and increased enthusiasm for thinner housing for the viewing device and flexibility desired in residential and commercial environments.



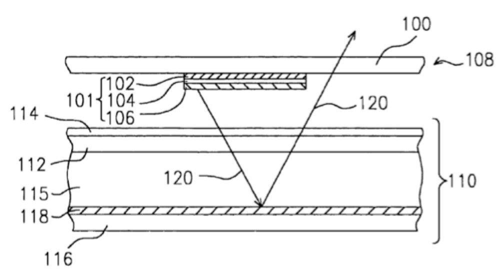
[4]

LIQUID CRYSTAL DISPLAYS of LCDs

Liquid Crystal Displays or LCDs are pervasive amongst computer monitors and thread through a vast array of digital devices in the home and office. James Fergason and the International Liquid Crystal Company produced a LCD watch, igniting a burgeoning race of manufacturers with intense focus to overcome the obstacle of contrast to addressable rows. [2]

The architecture of an LCD display incorporates a liquid crystal solution between two sheets of polarizing material. Electricity excites the solution and herds the crystals to form patterns. Each crystals opaque or transparent consistency form displayed numbers and text. [2]

“The liquid crystal display panel has a plurality of pixels, and each of the pixels has a plurality of corresponding color blocks. The regional light source is directly incident on the liquid crystal display panel, such that the light generated thereby is impinging on a reflection layer of the liquid crystal display panel to cause reflection. The allocation of the regional light source includes scattered dots distributed over the color blocks corresponding to the liquid crystal display panel. Alternately, the regional light source is allocated at an edge of each of the color blocks, or with an arrangement allowing the light to be incident uniformly.” [22]

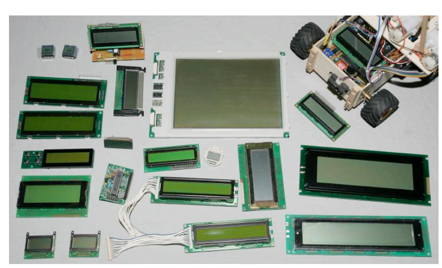


[2]

As seen in this image “ In this embodiment, the regional light source 108 is located on the liquid crystal display panel (110) to directly radiate a light thereon. The regional light source (108) includes a substrate (100) and a light-emitting structure (101). The substrate 100 includes a transparent material such as glass, while the light-emitting structure 101 includes an organic light emitting diode, for example.

The light-emitting structure 101 is disposed on one side of the substrate 100 to face the liquid crystal display panel 110. The light-emitting structure101is disposed on one side of the substrate 100 to face the liquid crystal display panel 110.

The light-emitting structure 101 includes a cathode 102, a luminescent layer 104 and an anode 106. The luminescent layer 104 is sandwiched between the cathode 102 and the anode 106. The material for forming the cathode 102 includes metal with good conductivity such as silver and aluminum. The luminescent layer 104 is made of luminescent organic material. The anode includes a transparent conductive material such as indium oxide (ITO).” [22]



[19]

Liquid Crystal Display

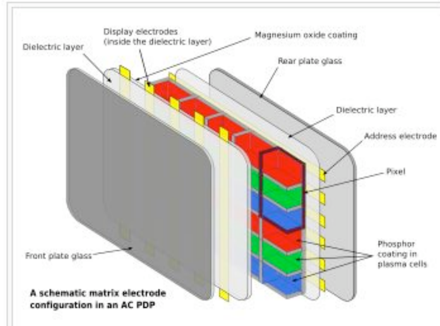
researchers overcame the limitations of operating life, contrast ratio, high power consumption and viewing angle limitations.

With these progresses, the LCD replaced CRTs as the popular surface solution for electronic instruments. "However, despite its impressive performance, the conventional color transmissive LCD architecture employs a convoluted electro optical path…This complexity has stimulated the search for a more intuitively simple approach to making flat panel displays."[18]

PLASMA DISPLAY TECHNOLOGY or PDPs

"In 1964, researchers at the University of Illinois developed the first ac-driven memory display that they called the 'plasma display panel'. As an emissive display technology, PDPs possess many of the advantages of the CRT, such as wide viewing angle and excellent color.

Furthermore, PDPs are true flat panels, so they do not suffer from the bulkiness of projection or CRT systems." [18]



Composition of plasma display panel

This gas-discharge display demonstrates an image when a sealed glass envelope is placed in contact to a high-voltage electric field that creates the ionization of the gas, better known as plasma. The glass is a hermetically sealed envelope with an inert gas mixture: helium, neon, argon, and xenon.[18]

[22]

While LCDs occupy the majority of the market for general and personal electronics, Plasma displays have provided visual performance similar to their predecessor the CRT.

LCD's and Plasma screens

provide the advantage of a relatively low cost and high performance display. Although they are a great viewing resource on the personal usage level, LCD’s and Plasmas may be a rigid and inconvenient alternative when scaling to the size of a Panorama level. Currently Video Projectors otherwise known as Digital Projectors provide a lower cost and flexible solution for larger scale demonstrations.

DIGITAL PROJECTOR OR VIDEO PROJECTOR

The Digital Projector “ takes a video signal and projects the corresponding image on a projection screen using a lens system. All video projectors use a very bright light to project the image, and most modern ones can correct any curves, blurriness, and other inconsistencies through manual settings. Projectors are widely used in many schools and other educational settings, connected to an interactive white board to interactively teach pupils. “[28]

[10]

The digital projector offers many advantages over the Cathode Ray Tube Displays, LCDs, and Plasma Screen Televisions. Projectors offer flexibility with screen size and small housing stature. Current expense of projectors is very competitive when assigning a ratio for cost to surface area. A projector’s beam, while consistent in the form of the signal that emanates from the housing, has the ability to grow and keystone based on distance that the device is placed from the desired viewing surface.

The varied location of a housing of the digital projector to the viewing area creates a variable image size and dimension. Overall surface display is decreased when the projector housing is physically close in proximity to the viewing area. Viewing surface increases as the distance increases in relationship with the housing and projected surface location.

An attribute for tailoring this

process to the desired surroundings is the keystone effect. The keystone effect “is caused by attempting to project an image onto a surface at an angle, as with a projector not quite centered onto the screen it is projecting on. It is a distortion of the image dimensions, making it look like a trapezoid, the shape of an architectural keystone; hence the name of the feature. In the typical case of a projector sitting on a table, and looking upwards to the screen, the image is larger at the top than on the bottom. Some areas of the screen may not be focused correctly as the projector lens is focused at the average distance only.” [28]

Keystone modification is an attribute that varies amongst projectors. Variable appearance results demonstrate an issue with projection, and “the problem arises from screen projectors that don’t have the depth of focus necessary to keep all lines (from top to bottom) focused at the same time. The problem can be solved by: Move the projector to the center of the screen, if this does not interrupt vision; Tilt the screen in a small angle; Use some type of software on the projector (or computer controlling the projector).” [28]

This method of image correction, while helpful, demonstrates an underlying disadvantage to digital projection environments. The beam of a digital projector can create awkward looking surface displays that distract the viewer from the underlying content.

Adjustment of the keystone correction, while helpful in achieving improved appearance, often provides results that are not optimal for professional display. As the directions state: to receive optimal results the projector is best housed in a position facing the center of the screen. In order to maintain an unobstructed surface, the projector cannot be displayed at eye level height amongst the viewing audience.

The beam in this position will be truncated by individuals obstructing the content.

[22]

In order to accommodate a panorama viewing audience, the edifice of the panorama needs customization based on the specific dimensions: multiple projectors beam, distance between the projector and viewing area, raised floor to project from underneath an audience, mounted housing above an audience, or additional distance in the rear of the panorama walls for rear projection display. This is a luxury for panorama environment builders, and promotes many considerations for individuals attempting to create a panorama environment.

LED DISPLAYS

An LED or light emitting diode display is a resource well known in the vernacular of cost effective purposing of contemporary lighting. Progress with the technological components of LED's has elevated its stature in the debate of contemporary surface displays for motion content. Currently there are two forms of LEDs, discrete LEDs and surface mounted device panels.

Surface mount device panels represent a paradigm similar to the LCD panel where there is a thin layer of silicon backing in the rear of the component. Surface mounted LEDs currently provide better reliability for picture and video content amongst LEDs.

Discrete are the more desirable variation of Light Emitting Diodes for investors peering into the future. Discrete LEDs are capable of illuminating individually without dependency to arrays of LEDs or a surface mounting. This autonomous nature of the LED opens the avenue for raising and advancing the flexibility of surface display devices.

The most common variants of progressive LED technologies are the field-emission related technology or SED LED (surface-conduction electron-emitter display) and polymer related OLEDs (Organic Light Emitting Diodes). While the Field-Emission SED is intriguing based on display capabilities similar to a CRT television, they have lost significant confidence from the LED investment community.

The majority of attention in the LED community is dedicated to Organic Light Emitting Diodes "regarded by many as the next generation of lighting and display technology, but it is the display market which tends to get more publicity. OLEDs are capable of high resolution pixel patterning, producing high contrast displays of good color gamut, extremely wide viewing angle and low power consumption. Their rapid response – atleast a thousand times faster than liquid crystal displays (LCDs) – is a major factor in their likely replacement of LCDs in applications such as television and cell phones."[13]

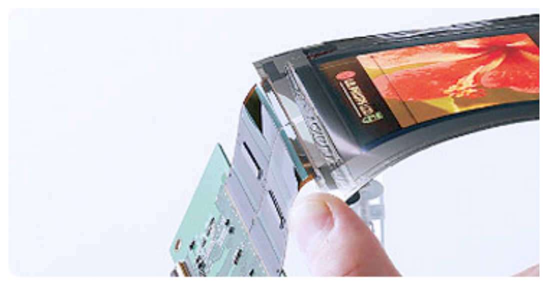
POLYMER-LED, ORGANIC ELECTRO LUMINESCENCE (OEL), OR ORGANIC LED

"Organic and polymer light emitting diodes (LEDs) have been investigated for a number of years for possible use in backlighting and display applications. Recent advances in both small molecule and polymer based LED technology have led to dramatic increases in device lifetime, which have paved the way for their commercialization. Attention has also been paid to addressing issues of high information content display based on such LEDs." (Organic Smart Pixels, Dodabalapur).

OLED technology is advantageous based on the aspect that there is no backlight needed for the image to function and "simple printing process".[16] The lack of backlight creates avenues where the product may be flexible, transparent, and mold to desired parameters.

[21]

"LEP materials offer several key advantages. LEP materials are themselves light-emitting and thus do not require a costly backlight or suffer from LCD filter losses. This aspect alone means they require less power, are thin, light-weight and offer a superior viewing angle. Second, P-OLEDs used in high-resolution RGB displays are now demonstrating impressive display performance including high brightness capabilities (> 10,000 Cd/m2), long operating lifetime (>1,000,000 hours at 100 Cd/m2 for some colors), wide color gamut (RBG), low DC voltage operation, video-enabling switching speeds, and power efficiency on par with inorganic lighting technologies."
[24]



[21]

"You can never be too thin and you never can be too light, and the technology that we are looking at give you a very lightweight display. A very bright display, but also gives you a thin display that should cost less to manufacture because this technology is much less complicated than existing LCD technology or plasma technology." [23]

While long developed as a protypical display surface, the OLED has been utilized in cell phones, PDAs and digital cameras since 2004 from Kodak and Sony. In October 2007, Sony launched the XEL-1, an 11-inch OLED Digital TV with an contrast ratio of 100,000,000:1. Amazon lists this product at a price of $2,500 with a 36" expected in 2011.[26]

PASS THROUGH DISPLAYS

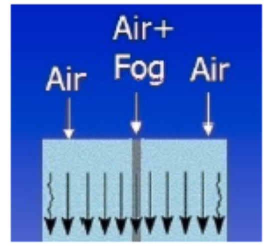
Displays that have appropriated immaterial properties have been documented and viewed since the Ornamental Fountain of the 19th Century. While performing water displays are more recently recognized from Water Dome, Aquatique Show, and Disney Fantasmic. [6]

(Figure 2, support for dual-sided projection allows two independent images to be projected on each side, such that a 3D application can render two interactive views for a pseudo-3D effect (Olwal et al, 2006))

[6]

Fog Screen

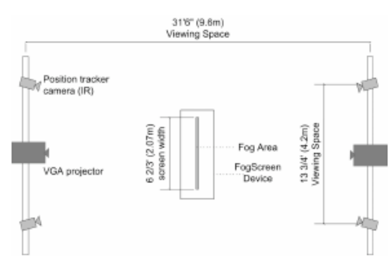
"FogScreen is just that, a 2D projection screen, but not a common opaque screen like hundreds of others in the market, rather an immaterial screen. The word immaterial in relation to display systems refers to those that create that sense of imagery floating in mid-air, usually created using water, smoke or fog."[9]



(Figure 1, principle of the FogScreen, Rakkolainen, 2006)

[6]

The fog screen "harvests humidity in the air by condensing it into water, which is then broken into fog…The basic principle is the use of a large non-turbulent airflow to protect a flow of, for example dry fog particles inside it from turbulence. The outer airflow may get slightly turbulent, but the inner fog layer remains thin and crisp, enabling high-quality projections and the walk-through possibility. Ordinary tap water is broken into fine fog droplets and trapped inside this non-turbulent airflow. Even though the fog is made of water, it appears dry to the touch, just like air." [6]



[6]

Results of the fog screen are most vivid when the air flow of the fog are less turbulent (tightly passed and quickly emitted by the device). Such attributes are being enlisted by the Heliodisplay.

Helio-Display

The Heliodisplay utilizes similar technology to the Fog display in respect to the production of a dry to the touch water particle for viewable purposes. The Heliodisplay presents an image with less fidelity because of a compact surface area for viewing (28 inches and 30 inches). [9]

For panorama architecture and for presentation elegance, the Helio-display provides a more advantageous directional emittance of the water particles and housing location. The housing of the Heliodisplay is floor bound and water particles rise rather than descend. For future panorama displays this provides an opportunity to create a screen emitter that is embedded in the floor, leaving the housing out of the consciousness of the viewer.

While presenting attributes unique to the display category, the Fog screen and Helio-display provide numerous complications for creating panorama environments. Initial expense from the purchase of multiple fog screens or a singular modification in the form of panorama environment greatly eclipses current projector and surface expenses. Currently pricing for an individual Helio-display is around $19,000.[24] Additional expenses can be attributed to the space needed to house the device (capabilities to supply water to the fog screen, custom construction for mounting the housing, lighting). Secondary considerations to the fog screen are: imperfect fidelity, sound distortion from housing of the projector and fog emitting device, segmented and variable visual content, large overhead device to house fog emitter, and affected by wind and bright lights.

CONCLUSION

Based on the information provided and researched, the Organic LED Displays offer the most possibility for future panorama displays. As the display technology creates a manufacturing infrastructure, similar to LCDs and CRTs, the economic and exhibition possibilities will gain a larger audience.

Pass-through displays, while providing significant promise with a possibility for floor embedded housing and walk through screens, lack many of the more significant attributes needed in the vanity of screen presentation: gamut, resolution, and overall fidelity. The expense of entry and the issues outlined above should provide caution to individuals looking to create a panorama with the Pass-through displays currently manufactured.

Projectors are the current choice for overall relevance in the consumer marketplace, flexible image placement, and quality of image. If care is taken in the construction and choices for the environment, projectors can provide a very good solution for the creation of a panorama environment.

Lastly, one must truly consider the content of the image they will be displaying in a panorama environment. With the knowledge gained from understanding the different displays, different presentation styles may benefit the overall appearance of the panorama being displayed.

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REFERENCES

[1] Amatriain, Hollerer, Kuchera-Morin, Pope. Immersive Audio and Music in the Allosphere, Immersive Audio and Music in the Allosphere. Available at http:heaveneverywhere.com/stp/PostScript/ICMC2007_allosphere.pdf

[2] Bellis, Mary. Liquid Crystal Display – LCD, LCD Inventors James Fergason, George Heilmeier, Available at: http://inventors.about.com/od/lstartinventions/a/LCD.htm

[3] Burroughes, Bradley, Brown, Marks, Mackay, Friend, Burns, and Holmes. Light-emitting diodes based on conjugated polymers, Nature Publishing Group, 539-541, 1990.

[4] Cathode Ray Tube – Wikipedia, the free encyclopedia Available at http:en.wikipedia.org/wiki/Heliodisplay

[5] Current and Future OLED Applications, Available at http:buyoledlaptop.net/?p=29

[6] DiVerdi, Rakkolainen, Hollerer, Olwal, A Novel Walk-through 3D Display. Proceedings of SPIE 2006 Electronic Imaging, Vol. 6055, 428-437, January 2006.

[7] Dodabalapur, Bao, Makhija, Laquindanum, Raju, Feng, Katz, and Rodgers. Organic Smart Pixels, Applied Physics Letters, Vol. 73, No. 2, July 1998.

[8] Fog Screen. Science and Technology News, Available at http:www.impactlab.com/2006/02/03/fog-screen/

[9] Firmin, Rodger. The Immaterial FogScreen, Future and Emerging Technolgies., 2008

[10] Film projector stock photos and images, INMAGINE, imagine the difference, Available at http://www.inmagine.com/searchterms/film_projector.html

[11] Heliodisplay- Wikipedia, the free encyclopedia, Available at http:en.wikipedia.org/wiki/Heliodisplay

[12] IO2 Technology: Heliodisplay/ Interactive Free-Space Display, Available at http:www.io2technology.com/faq

[13] Jafri, Hassan, and Shahzad. Current Trends in Electronic Display Technology. Jour. Of Information and Communication Technology., Vol. 2, No. 1, 68-75, Spring 2008.

[14] Kahn, F.J. Projection Display Technology and Product Trends, IS&T/SPIE Conference on Projection Displays, SPIE Vol. 3634, 1999.

[15] Kataoka and Kasshara. Method and Apparatus for a Fog Screen and Image-
Forming Method Using the Same. U.S. Patent 5,270,752, Dec. 1993.

[16] Light–emitting diode - Wikipedia the free encyclopedia
Available at http://en.wikipedia.org/wiki/Led

[17] Liquid Crystal Display-Wikipedia, the free encyclopedia
Available at http:en.wikipedia.org/wiki/Lcd.

[18] Mentley, David E. State of Flat-Panel Display Technology and Future Trends,
Proc. IEEE , Vol. 90, No. 4, 2002.

[19] My name is Craig Limber and this here is my web page. http://members.shaw.ca/climber/images/lcds.jpg

[20] Oettermann, Stephan. The Panorama – History of a Mass Medium,
Zone Books, New York 1997.

[21] OLED Marketplace- OLED Displays
Available at http://www.universaldisplay.com/default.asp?contentID=579

[22] Panasonic PH11 Series Plasma Display for Germany
Available at http://www.itechnews.net/2008/11/05/panasonic-ph11-series-plasma-display-for-germany/

[23] Passey, Ryan. IO2 Technology Delivers Three Dimensional Displays,
Available at http://www.pcmech.com/article/io2-technology-delivers-three-dimensional-displays/

[24] Pioneerting fully-printed flexible OLED Display Technology
Available at http://www.add-vision.com/faq.php#faq02

[25] What is a Plasma Television, Plasma Television
Available at http://www.plasmatelly.com/

[22] Presentation Technology, What is Keystoning?
Available at http://www.presentationtek.com/2008/08/24/projector-keystone-correction-the-facts/

[23] Rosenblatt, Sidney. "Interview: The New Edge". Universal Display Corporation, CNET, 2007,
Available at http://www.youtube.com/watch?v=VoxaMAA1jjM

[24] Johansen, Rune Skovbo, The real thing, Rune Vision.
Available at http://runevision.com/3d/anims/hologram.asp

[25] Shinoda and Awamoto. Plasma Display Technologies for Large Area Screen
and Cost Reduction, IEEE Transactions on Plasma Science., Vol 34, No. 2,
2006.

[26] Sony XEL-1 11-inch OLED TV Available at http:www.amazon.com/Songy-XEL-1-11/

[27] Summet, Somani, Abowd, and Rehg. Interactive Walls: Addressing the challenges of large-scale interactive surfaces, College of Computing and GVU Center, Georgia Institute of Technology.

[28] Video Projector – Wikipedia the free encyclopedia Available at http://en.wikipedia.org/wiki/Video_Projector

[29] Wang, Setlur, Lauerhaas, Dai, Seelig, and Chang. A nanotube-based field-emission flat panel display, Appl.Phys. Lett., Vol 72, No. 22, 1998.

[30] Welcome to www.FogScreen.com!. U.S. Patent 6,819,487, Available at http://www.fogscreen.com/en/home/index.html

[31] Wu. And Yu. Reflective Liquid Crystal Display. U.S. Patent Application Publication 0141106 A1, July