

# DIMENSIONAL



## Digital holography provides a unique palette for artists to explore their craft By Linda Law

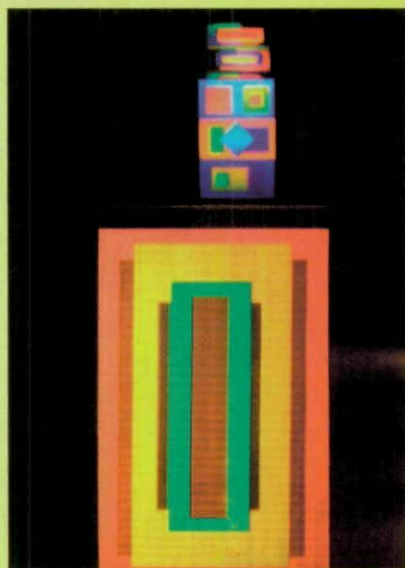
Part 2 of a two-part feature

*Last month, we explored the technology behind digital holography (see "Digital Holograms," pg. 28). This month, we look at the artists who are venturing into the brave new world of 3D imaging and the facilities where digital holography can be studied.*

**T**here are numerous places around the world where non-digital holography has been taught for many years—it was invented in 1948, and with the development of the laser, the first holograms were actually made in the early '60s. But the medium has been languishing for some time.

The magic of holography—the ability to capture light dimensionally, the possibility of showing interpenetrating dimensions, the ability to encapsulate time, the capacity to show fully 3D images projecting out into space—has, from the beginning, enchanted all who have laid eyes on even the most simplistic of these images.

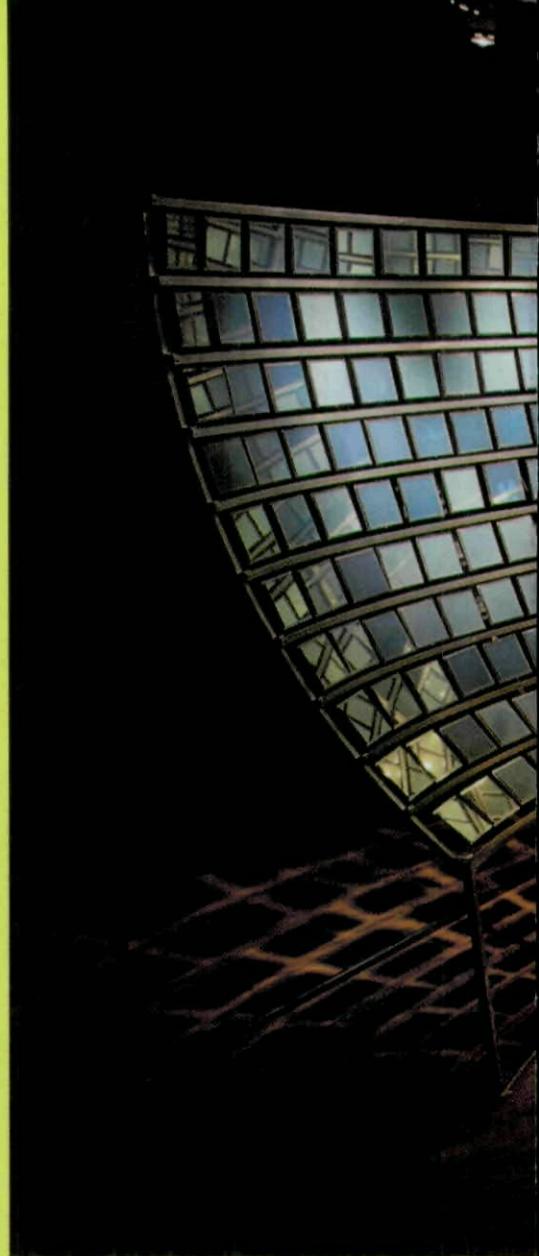
However, the promise of the creative exploration of this medium has always been limited by the difficulty in actually



**An image by Dieter Jung (made by Pro-nova in Germany) from the exhibition "The Garden of Light" in 2005 at the Kaohsiung Museum of Fine Arts in Taiwan.**

making holographic imagery. Stringent requirements for no vibrations make it necessary to record these images with either huge vibration isolation tables in dark basements or the use of an expensive and powerful pulsed laser (the holographic equivalent of a flash in photography). Then there is the need for very high resolution, fine-grain emulsions for recording them (commercial manufacturers have been steadily dropping out, as the predicted market has not manifested).

As a result of those challenges, only the most stalwart artists have managed to continue working in this realm. There is a hard core of dedicated and talented artists out there who are still working, but very little new talent has been entering the field.







This piece, titled "Holopublikum" from the artist Mioon, measures 3x2x1.7m and shows computer-generated stereograms of 400 clapping people. The hologram was made at KHM in Germany.

With the development of 3D animation and the evolution of digital video and digital photography, it was apparent by the 1980s that a digital form of holography was needed to open the creative potential that was clearly held within the virtual depths of this new medium. It took quite some time for holographic technology to mature to the point where this creative fusion could manifest. There needed to be a groundswell of artists with skills in these areas ready to jump to another level, and an audience hungry for 3D.

Today, we are at that point. There are a number of commercial systems—holographic printers—available to output 3D imagery. There are also several educational facilities worldwide that are teaching digital holography, and a few places

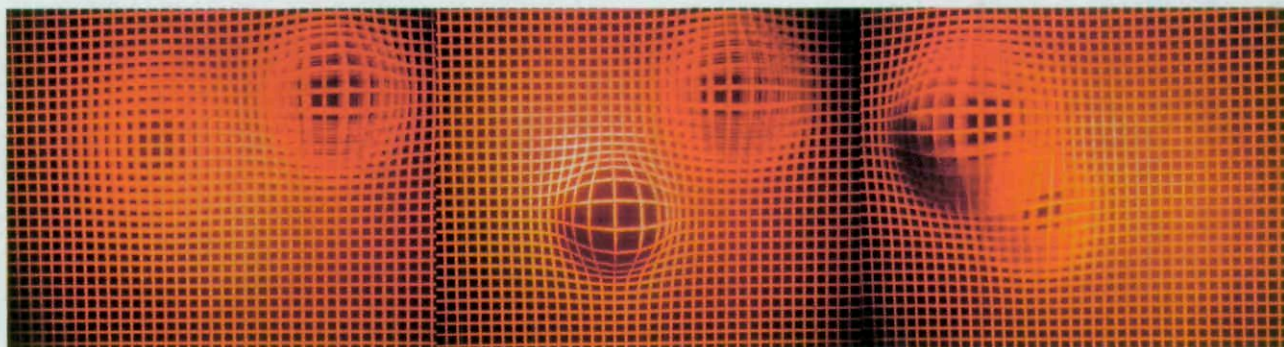
where artists can apply for residencies so they can create new work.

Indeed, there is a current interest surge in everything three-dimensional, and many hints at what might be developing in the growing digital holographic realm. It is apparent that digital holography is approaching a tipping point, and we are at a time when the door has cracked open and interest in digital holography is starting to push it wide. Without question, there is much promise for what is to come. To quote holographic artist Melissa Crenshaw, who will be curating an exhibition of holography (which will include digital holography) for the eighth International Symposium on Display Holography in China next July, "We are at the dawn of

a golden age in holography."

So, with that in mind, let's look at where these new directions are originating and the multiple dimensions that these artists are exploring. Last month's article delved into considerable detail about the commercial facilities throughout the world that have hologram production capabilities. Alongside the evolution of these companies, there have been a few far-thinking educational facilities that have been opening the door to artists to learn about digital holography. Providing non-commercial digital holography systems for experimental work, these facilities exist because of their affiliations with commercial companies that have built entry-level holographic systems with which artists can work.





Measuring 50x60cm, this hologram, titled "Beat," was created by artist Waldemar Matis-Teutsch and produced at Dutch Holographic Laboratories in Holland.

# KHM (Academy of Media Arts)

Dutch Holographic Laboratories (DHL), headed by Walter Spierings, a man who has always been sympathetic and supportive of holographic artists, developed a digital holographic system for the Academy of Media Arts, also known as Kunsthochschule für Medien Köln (KHM) in Cologne, Germany. Thanks to efforts spearheaded by holographic artist and university professor Dieter Jung, this facility has acquired three holography systems over the years from DHL.

The first, installed in 1991, used photographic slides in sequences of 200 images to create images from either 3D animation or photographic sources. These holograms were produced in a two-step process to make single-color, white-light reflection holograms. The second system, a dot-matrix printer, was installed around 2002 and makes holograms through a simpler process whereby images are not dimensional but have the shifting and brilliant color properties of rainbow holograms. A third and more sophisticated system was installed a year later; it uses a DLP projector to transfer digital sequences of images and employs three different laser wavelengths to make full-color, white-light reflection holograms.

Jung's holograms have always been focused on color. Using the shifting color qualities of the rainbow hologram to good effect, he has made images that contain dimensional fields of light, with colors contrasting or blending to give a glowing ethereal quality to his holograms. Jung has incorporated his latest images into mobiles, wherein the holograms

themselves reflect light onto the surfaces around them, as well as shift color as the viewer moves. He utilizes both of KHM's recent systems to create dimensional images as well as flat color-field images with an illusion of depth from the clever design and placement of the colors.

Recently retired from KHM, Jung has been showing his work extensively, with solo shows at such locales as the Museum of Modern Art in Shanghai, China, the Beijing Imperial City Art Museum in the Forbidden City, China, the Today Art Museum in Beijing, China, and a major retrospective at the Taipei Fine Arts Museum in Taiwan.

At KHM, holography is now available to all the media students regardless of department. The presentation and acceptance of a proposal defining the project gives them access to the digital holographic printers. Working with content from digital stills, video, 3D animation, or other potentially innovative sources, students can mix and match data from many sources to produce holographic images.

A technical staff headed by holographer Urs Fries oversees the holographic printers. Many students have utilized this facility, and some of their work can be seen at [www.holonet.khm.de/khm/index.html](http://www.holonet.khm.de/khm/index.html), along with work by many of the visiting artists who, over the years, have made holograms at this facility. DHL has been an invaluable entry point for many artists who otherwise had no access to these facilities. It also serves as a place where artists have frequented to commission pieces. Providing a willingness to work outside the box, DHL enabled

a numerous artists to create images that continue to evolve the medium.

Other artists working with DHL or KHM, or both, include New York City artists Sam Moree and Doris Vila, both with long histories in holography and who have stepped into the realm of digital imaging; another New York City artist, Ikuko Nakamura; Pepe Buitrago from Spain, whose work straddles both analog and digital holography; and Waldemar Matis-Teutsch from Bucharest, Romania, who has been working extensively with the dot-matrix process at KHM as well as CG-originated holograms at DHL.

"In my opinion, digital stereography is the best, the vastest, and the most beautiful form of expression that an artist can have from holography," says Matis-Teutsch. "This kind of holography is in constant development and change."



Paula Dawson's "Luminous Presence" was shown at SIGGRAPH last year. Measuring 1.5x1.0m, it was made at Geola uab in Lithuania and funded by a grant from the Australian Research Council.



### University of New South Wales

Australian artist Paula Dawson has always pushed the limits of holography. Having worked for many years in the more traditional approaches (making some of the largest holograms in the world at that time), she has moved very firmly into digital holography. Traveling around the world in order to create her images, she has worked with DHL to explore some experimental ideas, with Geola uab in Lithuania to create the large-scale hologram that was exhibited at SIGGRAPH in 2007, and an earlier work that was created with Zebra Imaging in Texas.

Future projects are in the works for later this year: creating a digital hologram with Holographics North (Burlington, Vermont), an experimental holographic video project at the MIT Media Lab (Boston) that uses SensAble's Phantom haptic device to create 3D drawings in real-time holographic space, and a pulsed hologram project at the Center for the Holographic Arts (New York City).

Dawson has received two grants from the Australian government for her research into holographic art, resulting in the digital holograms produced by Zebra Imaging and Geola uab. As an associate professor at the University of New South Wales's College of Art, she has also been developing an online course in holography. Using a small kit from Intergraf LLC, students will be able to make small holograms using the earlier analog approach to holography, and by creating animations in Autodesk's Maya, they will make a digital hologram for their final project by sending data to Geola uab and have their holograms mailed back to them.

### De Montfort University

Other holographic teaching facilities are coming online as well. At De Montfort University (Leicester, UK), Dr. Martin Richardson, a senior research fellow in the Faculty of Art and Design, is teaching digital holography as a part of the program for his master's degree and doctorate students in digital art. For the past four years, Richardson and his students

have been creating digital holograms with Geola uab. Most recently, the university acquired a motorized digital camera and track system from Geola uab, which allows students to create holograms from sequences of digital images. These sequences can be manipulated in post-processing and combined with 3D animation to create complex animated images.

The data created by the camera and the track system can be used to create lenticular photographs as well as holograms. To make a hologram, the final data is sent to Geola uab for processing. The finished hologram (or Synfogram, as Geola has branded them) is mailed back to the artists usually in a week or so. These students also have the option of creating holograms completely with CG.

Richardson, who has a doctorate in holography from the Royal College of Art in London, has had a long career in holography. His work has encompassed a large body of portraiture in pulsed laser holography and includes making holograms for David Bowie. With the facilities available to him, he has switched over to working 100 percent with digital holography. "We are heading into uncharted waters, and a paradigm shift is inevitable where holography is in the hands of many rather than just a few," he says.

Martina Mrongovius, a young Australian artist who also has a background in physics, has been traveling the world in order to study and create her art. Working in London with Richardson before he took up his position at De Montfort University, Mrongovius has been moving from lab to lab. She has made holograms with Geola uab in Lithuania, at KHM in Germany, and at the Center for the Holographic Arts in the US, where she is currently assisting in rebuilding a holographic printer originally built by holographic artist Ikuo Nakamura. Mrongovius brings with her the experience she gained by working with Juyong Lee and using his digi-

tal holographic printer at the Holocenter in Korea.

Another Australian artist, David Warren, has been seeking access to holographic systems and has had numerous residencies in optics facilities at various university engineering and physics departments to do non-digital holographic work. However, he has turned to John Perry, owner of Holographics North, in order to execute his ideas that require digital output.

"My current concerns and theme is the exploration of the use of personal technologies: cell phones, laptops, digital cameras, iPods, blog sites such as YouTube and MySpace, computer gaming,



In Martin Richardson's piece, made at Geola uab, is a scene from the movie *Vertigo* that was dropped into the holographic space using Final Cut Pro and Photoshop.

and virtual environments," says Warren. "I'm fascinated by the almost fetish and addictive need to communicate orally and visually; witness the decline in the quality of communication in favor of quantity. In all these cases, the use of this type of related imagery and the relevance in using digital imagery components becomes obvious."

### The Holocenter Korea

The Far East has its own wave of activity in digital holography. Juyong Lee teaches courses in Light and Holography as well as Space and Holography to third-year students enrolled in the School of Visual Art at the Korean National University of Art in Seoul, Korea. He has a class of 20 students with backgrounds in architecture, sculpture, painting, ceramics, com-





In the 30x30-inch "Cath," made at Holographics North in Vermont, Christine Remy shows portraits of a woman grieving.

puter graphics, video, and holography. In this facility, they are well equipped with two large labs containing large, continuous wave lasers capable of making very large analog holograms.

Lee's other laboratory is at the Holocenter, where he has a pulsed laser system and a newly constructed digital holography system. He recently launched a new artist-in-residence program at the Holocenter, where Mrongovius will be returning later in the year for her residency, as will New York City artist Mike Finegan, Guillermo Federico Heinze from Germany, Geumhyung Jung from Korea, Setsuko Ishii from Japan, and Ya-Ling Huang from Taiwan.

Lee's personal work encompasses a broad spectrum of hologram types, but his most recent work is in digital holography, which will be exhibited in July at the Metropolitan Museum of Art in Seoul.

#### Kun Shan University

Ya-Ling Huang is the dean of the College of Creative Media at Kun Shan University,

where she was charged with establishing a holography teaching facility. After much exploration and with some help from Jung and Richardson, she has worked with Walter Spierings of DHL to first obtain a dot-matrix system and, later, a more advanced DLP system. Working within the school's graphic arts program, she has been gradually expanding the scope of her facility and the range of projects that her students can undertake. She will also be expanding her skills through the residency she has been awarded in Korea at the Holocenter.

Mike Finegan, a photographer, has been exploring holography for some time and has established a working relationship with Yves Gentet in France. As discussed in part one of this article, Gentet has his own digital holography system and produces his own full-color holographic plates—with stunning results. He has been shooting sequences of still images and running tests with Gentet's system, and will also be going to Korea this year to participate in the residency he has been awarded.

Here in the US, no academic facilities are teaching digital holography or offering residency facilities to artists. However, The Holocenter in New York City (which predates the Korean Holocenter by many years) is developing an entry-level system with the help of Mrongovius.

As discussed in part one, John Perry at Holographics North has worked with many artists and continues to be a valued resource for this community. His flexibility and support for artists with little background in the technology has made him popular with a new wave of artists entering this medium. Most prominent among them is well-known light sculptor James Turrell, but some promising artists are stepping into this realm and experimenting with a wide range of approaches with his support.

Christine Remy, from San Francisco, has produced a series of large portraits that are planned as part of an installation. "The concept of this installation has

to do with grief; in particular, a mother's grief at the loss of a child due to war, urban violence or any type of violence, really," she explains. "The reason why I chose holograms for this installation is that they suggest other worldliness, a spirituality not encased in religion, and of a quality that transcends the material world. A hologram is there and it is not; spirituality is there and it is not. They are both there for human beings to experience in their own way and by their own choice."

Sam Saunders, an artist interested in architecture who also works in video, has created two pieces with Perry and plans to continue working with him. A large installation piece featuring his first hologram with Perry in an environment of large projected video works was shown in a gallery in Chelsea, New York.

#### ...And More

The Ontario College of Arts and Design (OCAD), the University of Toronto, the Photon League, and Photonix Imaging, all located in Toronto, are intimately linked together through the work of Michael Page, a holographic artist who has been immersed in holography since the early 1970s and who is committed to providing artists with access to digital holography.

Page has been teaching holography at OCAD since he ventured into the field, and has been collaborating on projects with scientists at the University of Toronto since 1974. In the early 1980s, graduates from his program at OCAD founded the Photon League, an artist-run center for holography. A decade later, when OCAD sold the building, the two facilities began sharing space, and the OCAD equipment was moved into the Photon League building.

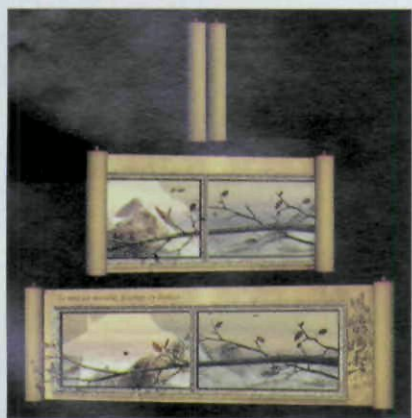
In 2000, Page, along with many others, formed Photonix Imaging as a research group, with the goal of accessing funding for projects through the Ontario Centers for Excellence. Now, OCAD, the University of Toronto, the Photon League, and Photonix Imaging are intimately linked: graduates from Page's courses at OCAD have become members of the Photon League;



Photon League members are researching projects and creating their own art; research results are shared with OCAD students; scientists from the University of Toronto assist in research projects and co-teach a course with Page that includes students from both institutions.

In 2000, a collaboration between scientists at the University of Toronto and workers from OCAD, along with Michael Page acting as principal investigator, built a digital holography system using a light valve, which was discussed in part one of the article.

Page is also on the advisory board of RabbitHoles Media and has support from the Ontario Centers for Excellence to build a digital camera and rail system of the same type that has been developed by Geola uab. The association with RabbitHoles aids his students on another level in that RabbitHoles has agreed to take the best project from each class at the University of Toronto and create a hologram (a RabbitHole) from the data. These groups all share the same facility with a time-sharing arrangement. Page points out that the overlap creates a rich environment of creative exchange that serves them all well.



**"The Broken Window" is a 140x47cm image created by Jacques Desbiens and made at RabbitHoles Media in Canada.**

Three artists—Ron English, Meats Meier, and Jacques Desbiens—have been working with RabbitHoles Media in Ottawa, Ontario, to create limited editions of their work, and are pushing the envelope in the creative expansion that

is occurring in digital holography. In his pre-holographic work, English has been teasing and taunting his audience, provoking them with controversial images and slogans. That aspect of his work has been enhanced by his move into digital holography. Experimenting with animating his controversial characters, he has created "Kathy Cowgirl" and a series of holograms from videos that encapsulate his in-your-face poster series.

Meier, a leading 3D animator with amazing skills in Pixologic's Zbrush, has also been developing a series of holograms. (We will be exploring his work—in particular, the hologram he has created with RabbitHoles for SIGGRAPH 2008, in the August issue.)

Desbiens is a digital artist working on his PhD at the University of Quebec in Montreal. Originally a part of the team at xyz Imaging (Montreal), which, along with Geola uab, created the systems used now by RabbitHoles and Geola, he possesses a wealth of experience with these sophisticated systems. In his time at xyz, he created a number of holograms, and most recently has created one that compares the portrayal of perspective in Chinese scroll painting with the exploration of perspective in digital holograms. Desbiens' extensive experience with the medium has given him a sophisticated view of the potential and largely unexplored creative possibilities of digital holography.

RabbitHoles Media is also commissioning 12 new limited-edition holograms by a group of respected 3D entertainment artists. These pieces will be shown in the Gallery of the Gnomon School of Visual Effects in Los Angeles, where the opening of the show will be timed to coincide with SIGGRAPH 2008 and will remain open for the following month. RabbitHoles Media has formed a collaborative relationship with Gnomon and is sponsoring a student contest in which winners will be able to make a hologram. The awards will be given in the following categories: character modeling, hard-surface modeling, environ-

mental interiors, environmental exteriors, and character animation.

## Opening Doors

Holography is not just a medium to explore 3D space. We now have a medium in which it is possible to explore our perceptions, the subtleties of human awareness. The potential for a deeper level of understanding of our relationship to the many dimensions of space has been hovering around holography since the first holograms appeared.

Quantum physicist David Bohm proposed theories that explored the idea of the universe being holographic in nature, and renowned neuroscientist Karl Pribram has talked extensively about the holographic nature of the brain. They both have intuited the importance of holography as a tool to help us to more fully perceive the underlying nature of our existence.

With the earlier forms of holography, a small group of holographic artists struggled to express these ideas in a difficult medium. With digital holography, we are opening the doorway to a flood of different perceptions, a rich tapestry of images expressing ideas that have the potential to change how we perceive our world. ❖

*Linda Law is a digital/holographic artist who has been working in holography since 1975. She is a fine artist who has also worked in holographic research, education, as curator for the Museum of Holography, as a 3D animator for digital holograms, and as a writer about 3D technology. She will be co-chairing the Digital Holography sessions at the eighth International Symposium on Display Holography in China in July 2009. She can be reached at [llaw@hvc.rr.com](mailto:llaw@hvc.rr.com); for more about Linda Law and her work, visit [www.greenwomanart.com](http://www.greenwomanart.com).*

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...for the URLs of the holographic artists mentioned in this piece and for the Web addresses of the educational facilities teaching digital holography and AIR programs.

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