Building a creative foundation for autostereoscopic and volumetric movies

Walter Funk

Existing technology is used to show new content to live audiences in an effort to develop a set of tools for creating 3D movies.

Autostereoscopic and volumetric displays, which provide three dimensional images that can be viewed without additional apparatus such as glasses, offer a huge potential for enhancing viewing experiences across the whole entertainment industry, not just in movies and television, but in music, arts exhibitions, and video games. However, this potential has not been realized due to roadblocks such as the inaccessibility of volumetric displays, the lack of content, the lack of standards for volumetric movies, and especially the lack of of volumetric content creation tools. Most volumetric display research is focused on innovation of the technical aspects. Very little attention has been geared towards innovation of volumetric content creation and experimentation with live audiences. In addition, autostereoscopic and volumetric displays are generally not suitable for large screen theaters as yet, and the expense may not be justifiable for small audiences. This greatly hinders creative exploration and advancement of volumetric displays. In order to address this, I avoided emphasis on developing new display technologies or mass-market media and instead decided to utilize existing volumetric display technology in 3D movie showings to small audiences.

I first developed multiple volumetric movie content creation tools, then generated extensive content, and finally showed the content to live audiences in various settings. The process of adapting traditional film and video techniques to the volumetric movie system through experimenting with and employing novel techniques allowed me to develop a flexible environment, called Hologlyphics, for autostereoscopic and volumetric content creation.

The first system used the parallactiscope display invented by Homer B. Tilton, The parallactiscope is an automultiscopic dynamic parallax barrier CRT display. It displays monochrome 3D images with full horizontal parallax within a 90° viewing range. All views are present within that viewing range. This is made possible by using an electro-mechanical moving virtual slit filter. There are no pseudo-scopic zones when viewing the parallactiscope. Audience members can ‘look around’ moving objects with great clarity.

I developed a system for a live performance of volumetric and autostereoscopic images along with music. All images are automultiscopic, the multiple true 3D views are seen by observers without 3D glasses. I created a family of real-time spatial image synthesis and processing algorithms for artistic use. Extensive and varied content has been developed and shown to live audiences in numerous settings using these tools.

Classic film effects such as traveling mattes, fades, and wipes were extended to video when television began. I have further extended these basic visual special effects to volumetric movies. Video wipes, originally developed in the television industry, are a process of graphically combining two video images with other video effects to generate the electronic equivalents of film

Continued on next page
wipes, fades, superimpositions, and traveling mattes. Volumetric image wipes work on the same principal as video wipes, except that they work in the spatial realm by combining two volumetric images and splitting along a whole plane rather than a line (see Figure 1). With the volumetric video wipe, you can either slide or rotate the splitting plane 360° along any of the three axes to create a horizontal wipe, forwards/backwards wipe, or diagonal wipes. You can also rotate the splitting plane while sliding to create a spinning wipe effect. Volumetric wipes can be cylinders, cubes, spheres, or other arbitrary 3D shapes.

Using real-time digital spatial image processing, dozens of other volumetric video effects have been created including spatial morphing, kaleidoscope transforms, volume bending and effects that interact with sound. With this large flexible family of spatial image processing and synthesis algorithms, a creative environment exists for the production of autostereoscopic and volumetric movies.

Multiple venues for the performance of volumetric movies have been explored. This summer three different festivals featured Hologlyphics. The first, a movie festival, had the audience viewing recorded volumetric movies. The next situation was for an international music festival with real-time generated volumetric animations controlled by live music as shown in Figure 2. The third was an art installation involving motion sensors controlling volumetric animations and sound, displayed at an international sound art festival. In all three situations, each with different content, audience feedback was extremely positive. By not limiting ourselves to waiting for technology or standards, we were able to obtain useful information that has greatly accelerated our development of volumetric movie techniques and content.

The adaptation of traditional film and video techniques to the volumetric movie system coupled with the development of new unique effects exclusive to multiview displays has resulted in compelling content shown to live audiences in multiple settings with great success. I am now working with larger scale displays in order to incorporate these techniques into projects such as a public art installation I developed in Hong Kong with artists Reid Johnston and Konstantine Baranov. It involves motion sensors inside colored cones hanging above a crowd (see Figure 3) that use the motion of the crowd to trigger sounds, and along with sensors already interfaced to the current Hologlyphics volumetric movie system, the foundation for these types of installations is laid.

As a result of experimentation with creating volumetric

Figure 2. An audience member views volumetric animation as live music plays.
movies for live audiences instead of working in a vacuum, the larger displays have a strong foundation of techniques, technology, and content to build upon.

Author Information

Walter Funk
Hologlyphics
San Francisco, California
http://www.hologlyphics.com

Walter Funk has been producing volumetric movies since 1994, exploring the artistic use of volumetric displays by bringing live volumetric entertainment to film and video festivals, art shows, and music events. Walter studied holography at The Holography Institute and music at Center for New Music and Audio Technology, UC Berkeley.

References