Autostereoscopic lenticular prints for data visualisation

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Introduction

Visualisation practice often employes novel display technology in an attempt to leverage the various capabilities of the human visual system. The most common characteristic is our depth perception arising from steropsis. It has been well established that the ability to interpret geometrically complicated structures and relationships is enhanced by being able to present geometry with 3D depth cues. While 3D displays are available in the laboratory and increasingly more accessible via stereoscopic capable televisions, there are limited options to create printed material that conveys depth.

The goal with any stereoscopic presentation is channel separation between a left and right eye image and there are a number of options one can choose from. The simplest way to achieve channel separation is by encoding the images by colour and the viewer wears matching colour filtering glasses. These are called anaglyph prints and suffer from poor colour fidelity especially for high contrast and highly saturated images. Another approach explored by the author some years ago were synthetic holograms, while these solved the colour problems of anaglyph and additionally did not require glasses (autostereoscopic) they were relatively expensive to produce and since, they rely on large format film, their future was not assured.

Presented here is an exploration of an alternative approach, namely lenticular prints. These are not new and indeed can be found as gimicy merchandise ranging from sports players to religious deities, new age symbology to wolves heads.

Brief history

Barrier strip:

1692 the French painter G. A. Bois-Clair created paintings consisting of a pair of images with a grid of vertical slats in front.

Photographic possibility was discussed by Auguste Berthier in 1886.

First evidence of actual barrier strip construction was by Frederic Ives in 1901.

Lenticular:

One-dimensional arrays of cylindrical lenses patented by Walter Hess in 1912.

Popular from the 1940s to create “flip animations” in the advertising industry.

Popularised again in the 1960s, for example, cover of the Rolling Stones: “Their Satanic Majesties Request”.

2002: Sharp manufactured switchable 2D/3D displays barrier strip displays.

Lots of autostereoscopic displays peaking around 2008.

Philips created the WOWvx screens in 2009.

Motivation

Give researchers the ability to present work at conferences and exhibiitons as autostereoscopic prints.

Avoiding the need to take display hardware to conferences for poster sessions.

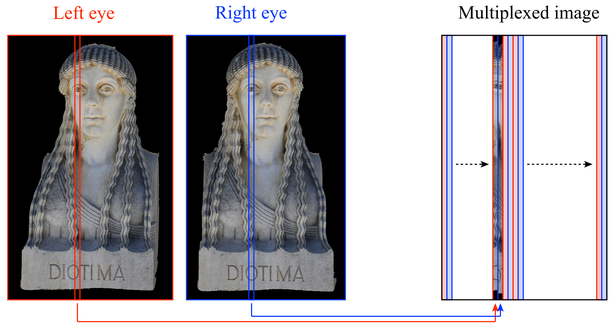
Avoids the high cost (factor of 10) of holographic panoramagrams investigated in 2009-2010 (http://paulbourke.net/miscellaneous/hologram/).

Do not require special lighting. Generally have better colour reproduction than laser based holograms and even better than holographic panoramagrams.

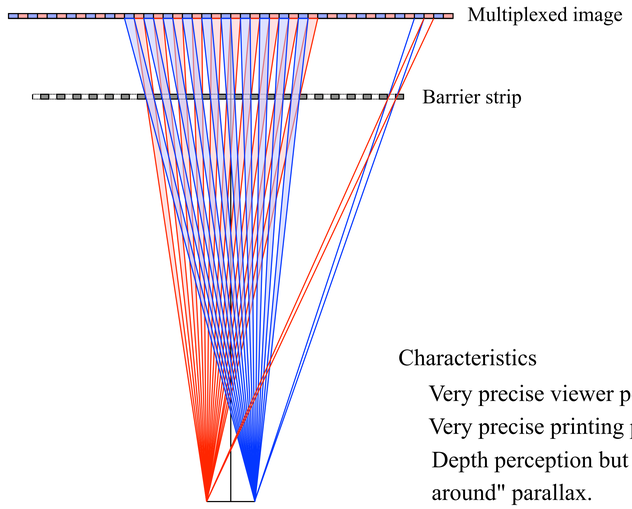
Personal: Employing commodity technologies used for “frivolous” marketing to the visualisation process.

Parallax barrier strip

A barrier strip stereo3D image is the easiest to understand. Consider forming a column-wise multiplex image from a stereo3D image pair.



If a barrier strip is placed in front of the multiplexed image at the right distance and spacing then the left eye will only be able to see the left image columns and the right eye will only see the right image columns.



Characteristics

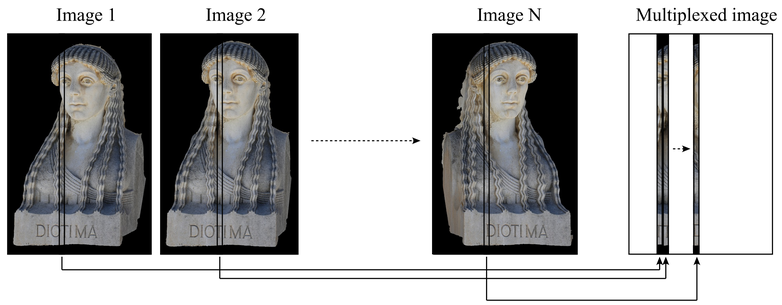
Very precise viewer position.

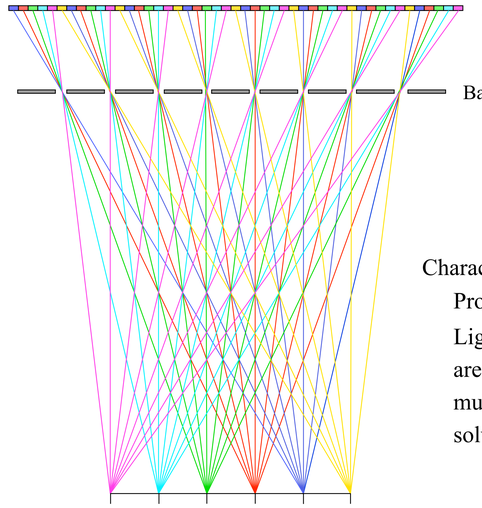
Very precise printing process.

Depth perception but no "look around" parallax.

Multiview parallax barrier strip

Instead of just two images as in the parallax barrier strip, imagine multiplexing N images to form a composite column multiplexed image. The images are recorded/ rendered along a linear track such that each image pair forms a valid stereo pair.





Characteristics

Provides look around parallax

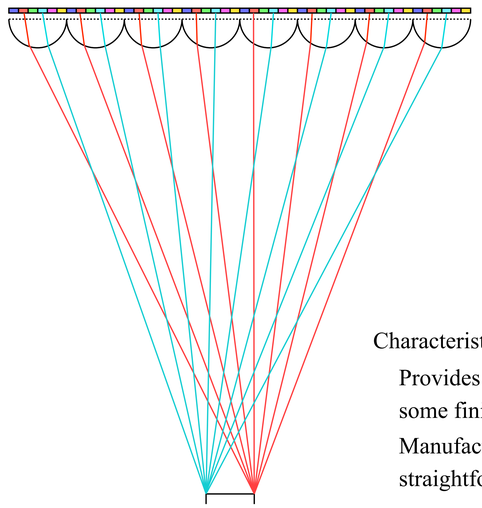
Light inefficient since the barriers are much greater than the multiplexed columns. Can be solved by backlit panels.

Each viewing position observes a valid stereo pair

Lenticular

Lenticular = pertaining to lenses, lenticule = plastic lens.

Barrier strip is replaced by a cylindrical lens.



Characteristics

Provides multiple viewing zones over some finite range.

Manufacturing lenticular lens is straightforward and low cost.

References

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