Hiding Spaces: a CAVE of Elusive Immateriality

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1. Introduction

Hiding Spaces is an immersive VR Cave artwork which pushes past the limitations of physical media by exploring the new ambiguities that can delight the viewer in the virtual world. By using innovative tools developed especially for creative work within the Cave environment, in combination with more established digital methods and artistic practice, the authors collaborated to produce a work which transgresses the usual borders of 2D and 3D, including those that are common even in VR environments.

2. Description

Engaging visual art depends on a rhythmic interplay of texture, color, and form to captivate the viewer and to create the sensation of movement. Many artists, particularly those working in static 2D media, employ these elements to create ambiguous spatial tensions. Artists love ambiguity, and 2D artists especially are enamored of spaces that are never defined but rather remain elusive, because spatial illusion is what makes traditional 2D imagery come alive.

In the Cave environment we have the opportunity to further the power of elusive space by incorporating the play of "real" space against the illusion of ambiguous space. In this work, the 2D spaces breathe not only because of the illusion of complex spatial relationships, but through the actual non-static nature of the projections. Rather than deny the limitations of the physical walls of the Cave, *Hiding Spaces* utilizes them as an integral part of the work.

Hiding Spaces is comprised of 2D painterly images in combination with virtual 3D objects, using software that runs in a 4-wall immersive virtual reality system (Cave). To experience the work, viewers wear stereo shutter glasses with a positional tracker. As the viewer moves around the space, the system detects each new position, thus triggering corresponding shifts in the imagery. While the 3D forms remain anchored at the walls, the 2D images, projected on the walls and floor, slowly shift by means of a soft cross-fade.

The entire human-computer-interaction is based on the familiar and natural activities of walking and looking. The viewer is drawn to a 3D object or a spot of 2D imagery, but in moving towards it, finds that this very action prompts a change. When something else catches the viewer's attention, the cycle repeats. The user is constantly compelled to explore, yet doesn't have to learn any complex interaction modalities. By simply walking around and exploring naturally, the viewer quickly learns that it is engagement and curiosity that cause the imagery to shift, and this in turn encourages more interaction with the system.

Hiding Spaces evolved from photographic sources manipulated in Adobe Photoshop and Corel Painter, first used in an earlier 2D printed digital image. As we discovered that projecting shifting images on walls was too jarring without slowly blending transitions, we developed a method for creating convincing digital color and texture in varying overlays. The proprietary software CavePainting[1] allowed us to create forms within the Cave itself in response to the imagery on the wall. As a result of our experiments with the juxtaposition of 2D and 3D elements in the Cave, we eventually developed textures for the 3D CavePainted forms out of image fragments of the projected 2D images.

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The images shown here depict views of 3D forms against one wall of the Cave. In the example above, we see a cluster of pink forms gathered at various angles in 3D space. In the image on the left, a tree-like 3D form with similar coloring is just fading away but still present. The pink forms relate visually to this 3D form, as well as to the rich pink-purple texture on the wall. As the viewer moves, the situation shifts slowly, so that by the time we get to the instance on the right, the cluster of 3D pink forms appears to be less intense, even though in fact the forms are still there. The clearer background, with an intense red spot, contributes to the changing perception, as does the disappearance of the pink tree form. In the examples below, we see more clearly how the changing background frames the reading of the 3D forms.

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3. Conclusion:

Engaging visual art, in the Cave as well as in static media, depends on a rhythmic interplay of texture, color, and form to captivate the viewer and to create the sensation of movement. But the Cave environment introduces new notions of materiality and non-linear space. Thus how we develop and apply innovative tools for creating within this environment, as well as how we use familiar tools, can be instrumental in developing a new aesthetic. Ultimately, we envision that the lessons learned through artistic work in the Cave will also be applied to problems of visual representation in scientific domains.

[1] Keefe, D., et al 2001 *CavePainting: A Fully Immersive 3D Artistic Medium and Interactive Experience*, Proceedings of ACM/ SIGGRAPH 2001 Symposium on Interactive 3D Graphics

Thanks to the Brown University Graphics Group, Scientific Visualization Group, and the Technology Center for Advanced Scientific Computing and Visualization, and to David Laidlaw and Sean Solley for their help in this project.