

Narrowcasting for Stereoscopic Photospherical Cinemagraphy

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Abstract

We have developed an application which blurs the distinction between static and dynamic imagery in a stereoscopic omnidirectional browser. A “cinemagraph” is a living picture, interpolating between a still photo and a video. A stereo omnidirectional camera can capture stereographic contents. Combining such functionality yields a photospherical cinemagraph. Runtime control of activation fields allows selective alternation between frozen and animated scene elements. Narrowcasting, a user interface idiom for selective activation, is used to alternate between static and moving imagery. Presentation includes stereoscopic display (binocular channels) and spatial sound.

CCS Concepts

• **Human-centered computing** → Graphical user interfaces; Auditory feedback;

1. Introduction

Panoramic imagery, popularly known as “360°,” is characterized by being able to look in any direction, as in VR-style experiences. A cinemagraph, or “living picture,” interpolates between still and video imagery. We have developed an interface for a specific kind of omnidirectional stereoscopic imagery, namely photospherical stereoscopic cinemagraphs, featuring narrowcasting control of articulated animation. Like a “bullet time” photo, part of a displayed scene is frozen (static), but selected aspects are animated (dynamic). Narrowcasting is a user interface idiom for selectively enabling separate channels of a composite control or display, allowing information streams to be filtered [RCF15]. In its general form, it organizes controls for exclusive enabling and non-exclusive disabling, respectively analogous to `solo` and `mute` operations in digital audio workstations (DAWs). Runtime control of activation fields allows selective alternation between frozen and animated scene elements. Detailed aspects of our system are described following.

2. Implementation

We used Unity to develop an interface for panoramic cinemagraphs, making a stereographic photospherical [Qii] browser with narrowcasting. Many photospherical cameras can capture video as well as still imagery, but most of them are not stereoscopic. We use the Humaneyes Vuze camera to capture stereographic panoramic imagery [Mal], and the supporting Humaneyes VR Studio editor to prepare such omnidirectional contents for deployment.

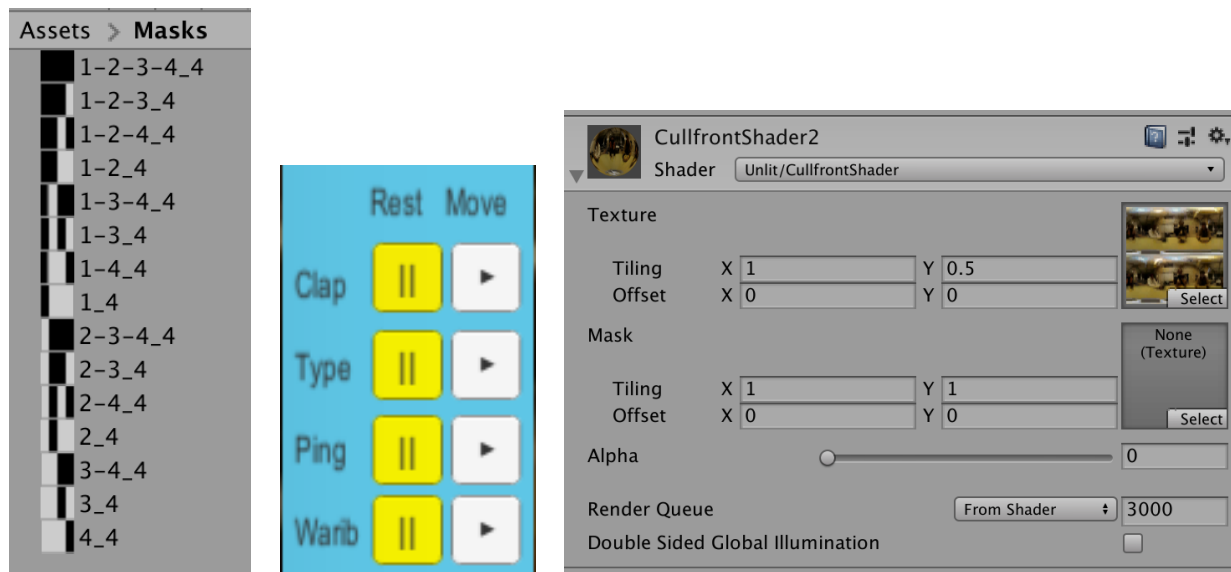
For browsing panoramic imagery, we deploy captured stereo photos and videos in Unity scenes [Uni]. We arranged two pairs of

concentric spheres to implement a stereoscopic photosphere: two concentric spheres for the left view and two concentric spheres for the right, with the centers separated by an interocular or interpupillary baseline. The normal shader draws texture-mapped imagery only on the exterior of decal surfaces, so-called “back-face culling.” We disabled back-face culling in a special shader, so imagery can be viewed from behind, and photographs and video textures mapped onto spheres can be viewed from the objects’ interiors. By mapping static and dynamic textures to separate spheres on each side of the stereo pair, exposure of underlying video content can be controlled by transparency of overlying static imagery [Sta].

At runtime we modulate translucency of the inner spheres programmatically according to interpreted narrowcasting attributes. A bank of masks, as seen in Figure 1(a), are used for selective transparency. Each sector of the inner, static texture map is transparent or opaque according to α value (transparency) in the mask. By changing the pixel-masking mask, any combination of narrowcasting-activated sectors can be animated.

The demonstration photospherical scene is captured from a fixed standpoint, in the middle of an inwardly facing ring of people, articulated into four azimuthal quadrants, each showing a particular animated gesture by one of the actors. The gestures are: clapping (“Clap”), typing on a laptop computer (“Type”), bouncing a ping-pong ball (“Ping”), and separating *waribashi* disposable chopsticks (“Warib”), as seen in Figure 1(b).

We use narrowcasting to control cinemagraphs, allowing selective activation and deactivation of animated video quadrants: `Rest` (`pause`) freezes action for static display (still imagery) and `move` (`play`) allows action for dynamic display (video animation). `Rest` is applied locally, but assertion of `move` for a channel implic-



(a) $2^4 = 16$ masks for selective translucency of quadrant-based still imagery to reveal underling video

(b) Narrowcasting commands Rest and Move applied to four quadrant-situated gestures

(c) Since the stereo video is arranged as an “over-under” pair, the shader has been configured to show respective halves of the composite texture. (The inspector shows the offset for the right view, on the bottom of the vertically stacked pair.)

Figure 1: Unity-deployed scene components for narrowcasting among stereographic photospherical cinematographic elements

itly freezes the complement of the selection set, as formalized by $\text{active}(x) = \neg \text{rest}(x) \wedge (\exists y \text{ move}(y) \Rightarrow \text{move}(x))$. As a natural default for imagery would be to be animated even without explicit `move` attribute being asserted, the application starts-up with all channels frozen, via launch-time assertion of `rest` attribute for each.

We implement stereoscopic display and spatial sound for immersive experience. Stereoscopic display is realized by displaying imagery for left and right eyes to pairs of virtual cameras with corresponding displays. Selection of the respective half of the stereo pair is parameterized by changing the tiling and offset (SDM: space-division multiplexing) of the texture for acquisition, as seen in Figure 1(c). After the virtual camera pair apprehends the binocular view, the final stereo display is composited. The binocular view was originally and analogously juxtaposed side-by-side (“SBS”) via “Viewport Rectangle,” but the demonstrated implementation, engineered to allow stereographic pairs to be displayed flexibly, uses camera “Target Display” and culling masks (layers) to separate lateral views, including for HMD deployment.

Each sector of the scene has a distinctive characteristic gesture and sound, enacted and directionalized whenever the channel is animated. Arranging the corresponding audio tracks (`Audio Sources`) around the equator of the left sphere (without loss of generality) with the notional sink (`Audio Listener`) at the center of that sphere enables egocentrically spatialized sound. Perspective can be rotated horizontally (azimuth) and vertically (elevation), panning the stereographic (binocular) and spatial sound (stereophonic) displays.

3. Conclusion and Future Work

“Easter eggs,” objects that react when provoked or triggered, have long populated adventure-style exploration games, and cyclopean (monocular) media, including photospherical imagery, can be automatically converted to stereographic channels, photos & videos. However, perhaps ours is the first natively stereographic photospherical cinematograph browser, at least with such naming, and it is certainly the first with a narrowcasting user interface. In the future we plan to explore interpreting gaze and head gestures as narrowcasting commands.

References

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