Novel System for Composing High Impact Special Effects

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Abstract — **This paper presents a novel system for creating and managing high impact special effects by composing one or more elemental and/or composite special effects into one or more composite special effects wherein said composition is carried out on the basis of rules specifying the number, relative positions, relative durations and/or other relevant attributes/behaviors of the individual elemental special effects and/or any other attributes/behaviors required to support a desired level of creativity and flexibility. According to the principles disclosed in this paper, the composition of elemental special effects can be realized in a N-dimensional environment permitting composition in a non-linear fashion.**

Keywords **— augmented reality; high impact special effect; metaverse; non-linear composition; virtual reality.**

I. Introduction

Computer graphics and multimedia authoring tools and systems often provide in-built special effects that can be applied to transitions between elements such as two adjacent video clips in a video editing package.

It is well known that special or visual effects greatly enhance the aesthetics and communicative power of the multimedia productions in which they are employed. For the ever ubiquitous graphical user interfaces (GUIs or UIs for short) – in both three-dimensional (3D) and two-dimensional (2D) configurations, and especially on widely used mobile devices, Huhtala *et al*. [1] demonstrate that animated UI transitions can be utilized to improve their usability and user experience. This also applies to other devices such as workstations that harness graphical user interfaces in 3D or 2D.

Special effects in existing systems are generally isolated or very hard to combine into composite effects in a meaningful manner.

It is an object of the this work to overcome the limitations of the prior art set forth above by providing a powerful way for individual elemental special effects to be creatively combined into high impact composite special effects. The principles of the present invention permit greater power and creativity in the composition of high impact special effects than are is possible with the prior art by permitting an arbitrary number and type of elemental and/or composite special effects to be combined based on suitably defined rules in an N-dimensional environment, where N can be 1, 2, 3 or any desired number.

The rest of this paper is organized as follows. Section II presents the conceptual framework and representative illustration. In Section III, selected applications are discussed while Section IV contains concluding remarks.

II. Conceptual Framework and Representative Illustration

A. *Conceptual Framework*

Given a set of elemental special effects (transition effects for simplicity) labeled X in (1) below, we can generate a composite special effect y as a function of X and p where p is a set of parameters such as the numbers, relative positions, relative durations and/or other relevant attributes/behaviors of the individual elemental special effects and/or any other attributes/behaviors required to support a desired level of creativity and flexibility. The composition indicated in (1) can be specified by the function to effect realization in an N-dimensional environment and in a linear or non-linear modality as desired.

$$y = f(p, X) \tag{1}$$

B. *Representative Illustration*

Referring now to Fig. 1, an illustration of a simple embodiment of the concept, elemental special effects are indicated with bars and labels identifying the type of the effect. For example, the effect that specifies a fade-in transition between media elements is labeled "Fade In" in Fig. 1. Fig. 2 depicts the page curl elemental transition effect. The graphical user interface shown in Fig. 3 is designed to facilitate the composition of high impact special effects by combining available elemental special effects. It features a timeline window on which elemental special effects appear as horizontal slots on horizontal tracks. An arbitrary number of elemental special effects can be added simply by dragging the associated icon and dropping it onto the timeline window. Each slot on a track of the timeline window can independently be resized and re-positioned. The lengths and positions of the slots indicate the starting and ending of the special effects they represent as a percentage of the duration of the composite special effect they comprise. Fig. 3 depicts two elemental special effects positioned on the timeline window to create a composite special effect. For simplicity, Fig. 3 shows two elemental transition effects but in practice there could be an arbitrary number within the resource limitations of the host system. The illustrative example in Fig. 2 is a simple multidimensional composition with a potentially arbitrary number of tracks each of which may contain a

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potentially arbitrary number of arbitrarily positioned and sized slots each of which represents an elemental special effect. Fig. 3 depicts a graphical user interface that permits elemental special effects to be added and positioned by direct visual manipulation. Unwanted special effects can also be removed. The interface also features the ability to specify attributes (such as name, description, representative icon or video clip, and so on) for the composite special effect and to store and retrieve a representation of the composite special effect.

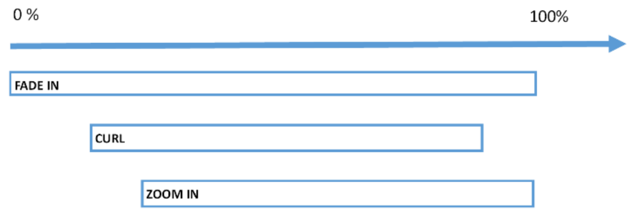

Fig. 1. Conceptual Illustration of Composition of Transition Effects using Elemental Effects.

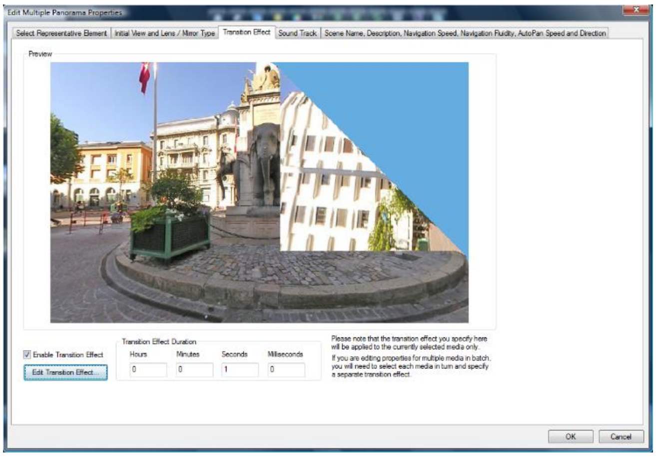

Fig. 2. Depiction of the Page Curl Elemental Transition Effect.

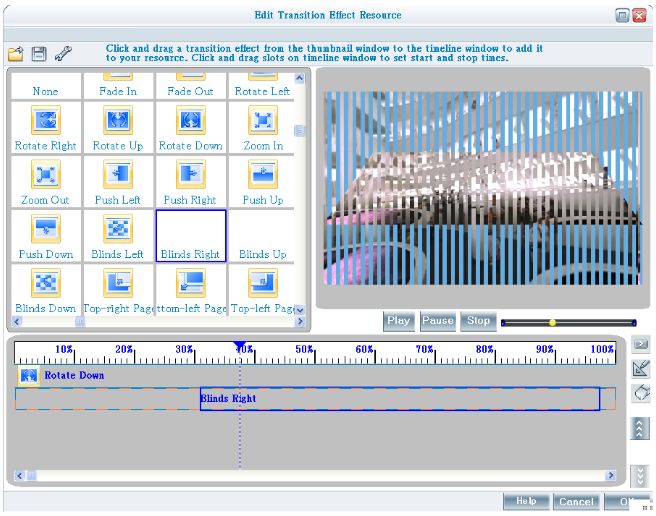

Fig. 3. Timeline-based Transition Effects Composer Dialog.

According to the principles of the present invention, rules could be defined to control the composition of special effects, the rendering of the individual elemental special effects within the composition and/or any other attributes/behaviors required to permit the desired level of creativity and flexibility. The principles of the present invention permit far greater creativity and versatility in the creation and management of high impact special effects than is possible with the prior art.

Using the dialog in Fig. 3, the user can edit composite transition effects as follows:

- Click a thumbnail image to select the associated source transition effect. Individual transition effects contained in your transition effect resource or composite transition effect are represented as slots or tracks on a multi-track timeline editor.
- To add a transition effect, click the desired source effect on the thumbnail window and drag and drop onto the timeline editor.
- Click a slot or track to select the associated transition effect. You can move and resize the slots/tracks of the timeline editor to visually re-position the transition effects they represent.
- Use the **Customize…** command to specify the rules for the composition of your transition effect resource.
- The Composite Transition Effect Editor dialog gives the user the power and flexibility needed to create compelling custom composite transition effects.

III. Selected Applications

Virtual Reality involves the synthesis of computer-generated environments that can incorporate representations of the real world such as images and video and the facilitation of user interaction with the synthesized environments with the goal of immersing the user in the real or simulated environments they represent. Augmented Reality involves the overlay or superimposition of informative computer-generated content on representations of the real world such as live video for enhanced user experiences. Virtual and augmented reality constitute an important component of the emerging Metaverse.

As explained by Dionisio *et al.* [2], the attainment of a successful transition from a set of independent virtual worlds to an integrated network of 3D virtual worlds or Metaverse is contingent on advances in four aspects, namely: immersive realism, ubiquity of access and identity, interoperability, and scalability. The effective application of the principles introduced here can significantly boost the immersive realism and user engagement of content generated for the Metaverse.

Suzuku *et al.* [3] introduced a learning system for analyzing devices in a virtual world and highlighted its significance for collaborative projects. The effectiveness of the collaborations engendered by the learning system of Suzuki et al. can be improved by applying the concepts described herein to create more engaging transitions between information ensembles in the system.

Virtual tours are an aspect of virtual reality that can be enhanced through the application of the immersive imagery and video offered by 360-degree panoramic environment maps. Ekpar [4] presented a framework for interactive virtual tours capable of harnessing the merits of 360-degree panoramic (including spherical) environment maps via perspective transformations as illustrated in Fig. 4.

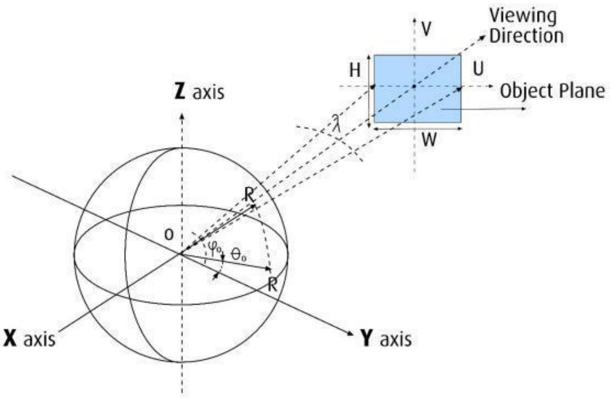

Fig. 4. Projection of a point on a spherical environment map onto a perspective-corrected point on the object plane.

In order to effect the desired perspective transformation in the framework introduced by Ekpar, the selected region of interest defined on the surface of the sphere is projected onto the object plane that represents perspective-corrected views. Details of the geometric transforms harnessed are accessible in Ref. [4]. In Fig. 4, U and V represent the coordinate axes of the object plane on which perspective-corrected views are generated, W and H are the width and height, respectively of the generated view on the U-V plane, R is the radius of the sphere – with origin O – holding the panoramic image or the spherical environment map with θ and φ corresponding to the lateral and azimuth viewing angle parameters while λ is the angular span of the specified view that is related to the magnification coefficient or zoom factor.

One application of the framework introduced by Ekpar [4] is a virtual tour authoring tool named Panorama Express featuring motion effects and scripted movements enhanced by transitions based on the concepts described in the paper. In Panorama Express, a motion effect is a controlled sequence of views created from a picture slide (2D motion effect) or a 360-degree panoramic image scene (3D motion effect) – both video and still images are supported – and rendered as frames in time while a scripted movement is a special kind of motion effect comprising a set of smooth transitions between multiple views on a panorama or standard 2D scene. The user can add as many views as desired and set the transition time between the views. The user can use this feature to create walk-through sequences in virtual tour packages. These features are accessible via the Movie Tab illustrated in Fig. 5.

Fig. 5. Movie Tab in Panorama Express.

The Movie tab contains all the commands needed to add stunning multimedia stories (in the form of navigation movies and scripted movements) to professional virtual tours. The thumbnail to the left of the view window contains the navigation movies. The user can select a navigation movie by clicking the associated thumbnail item. Each navigation movie can hold any number of navigation movie clips. The thumbnail at the bottom of the window holds the navigation movie clips in the currently selected navigation movie. The user can select a navigation movie clip by clicking the associated thumbnail item. The user can edit the properties (including composite transition effects generated as described herein) of the currently selected navigation movie or the currently selected navigation movie clip. The can also add new navigation movie clips to the currently selected navigation movie.

Additional applications of the concepts developed in this paper include engaging transitions between dynamically views predicted views in the framework introduced by Ekpar *et al.* [5] for visualizing very large image data sets at interactive rates. The novel system for processing user interfaces designed by Ekpar [6] could employ the concepts described here to enhance usability and improve the user experience. Furthermore, Ekpar [7] introduced a robust framework for enhancing navigation, surveillance, tele-presence, and interactivity that can benefit from the special effect composition algorithms and systems of this paper.

IV. Conclusion

The usability and user experience associated with graphical user interfaces can be significantly improved by harnessing the novel system elucidated here for creating and managing high impact special effects involving composition of one or more elemental and/or composite special effects into one or more composite special effects. This work demonstrated the application of the concepts to the creation of composite transitions in virtual tours within the fields of virtual and augmented reality which make up a component of the emerging Metaverse as well as a wide variety of additional applications. It should be understood that numerous alternative embodiments and equivalents of the work described herein may be employed in practicing the concept and that such alternative embodiments and equivalents fall within the scope of the concepts presented in this paper.

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