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# H-Studio: An Authoring Tool for Adding Haptic and Motion Effects to Audiovisual Content

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## ABSTRACT

Haptic and motion effects have been widely used for virtual reality applications in order to provide a physical feedback from the virtual world. Such feedback was recently studied to improve the user experience in audiovisual entertainment applications. But the creation of haptic and motion effects is a main issue and requires dedicated editing tool. This paper describes a user-friendly authoring tool to create and synchronize such effects with audiovisual content. More precisely we focus on the edition of motion effects. Authoring is simplified thanks to a dedicated graphical user interface, allowing either to import external data or to synthesize effects thanks to a force-feedback device. Another key feature of this editor is the playback function which enables to preview the motion effect. Hence this new tool allows non expert users to create immersive haptic-audiovisual experiences.

## Author Keywords

Authoring tool, haptic, audiovisual content, sensation of motion

## ACM Classification Keywords

H.5.2. Information Interfaces and Presentation: Haptic I/O

## General Terms

Human Factors; Design.

## INTRODUCTION

The cinema experience is traditionally limited to the stimulation of two senses, sight and hearing. Yet research in virtual reality has shown that the sense of touch (haptics) seems to be strongly connected to the feeling of immersion. Then numerous works and consortiums (e.g MPEG-V) have started to address this problem by developing new ways and standards

to combine haptic and motion rendering with traditional audiovisual experience [2]. Often referred as 4D cinema, this technology opens a new dimension for content creators.

However, despite this increasing interest for such effects in the context of audiovisual content, one main problem remains: how to design and when to insert haptic or motion effects in a given movie timeline so that the final effect may be relevant for the user? Even if the selection of effects is strongly linked to the content (explosions, fast motions, camera effects) and some of them may be automatically proposed and placed on the timeline on the basis of the audiovisual content analysis, the creative part of the author should provide a better final result, with optimal choice and placement of effects. It seems therefore necessary to provide content creators with authoring tools, easy-to-use and similar to their usual editing tools. This paper describes such a tool and introduces a novel user interface dedicated to the creation of haptic and motion effects. More particularly this article focuses on the creation of complex effects of motion thanks to a force-feedback device or the import of real-world data.

## RELATED WORK

The interested reader may refer to a survey published by our group on haptic-audiovisuals [2]. We have observed that few tools allow to associate haptic and motion effects to audiovisual content. Waltl et al. have developed an editor based on the MPEG-V format which describes various sensory effects to be rendered with a video (wind, vibrations, fog, motion, etc) [5]. But the authors have not implemented the edition of motion effects. Park et al. also described an editor based on MPEG-V which seems to support the creation of motion effects [3]. The creator has to manually specify the direction of the movement and the value of the acceleration or speed.

The edition of motion effect is discussed by Shin et al. who have described a framework for 4D movie theaters [4]. Motions are described by three linear accelerations and three rotational speeds, which are actually perceived by the human vestibular system. Besides, this description is generic and then compatible with various devices. But the authors have not considered an authoring tool to ease the creative process.

## THE AUTHORING TOOL: H-STUDIO

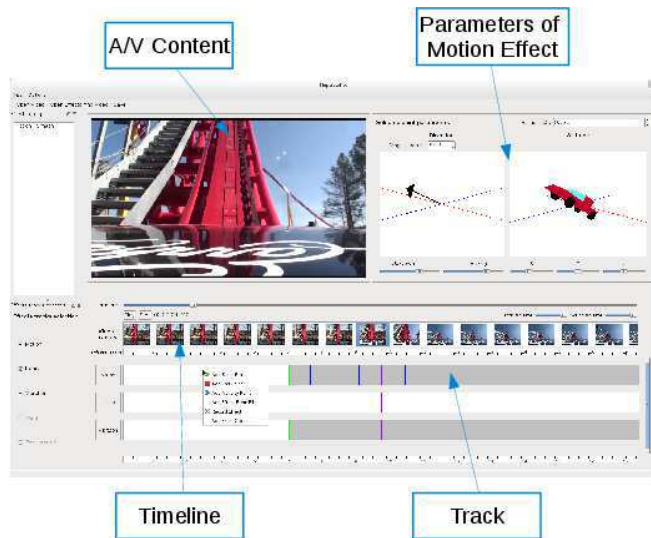


Figure 1. Screenshot of H-Studio. A motion effect is being edited: direction (represented by an arrow) and orientation (represented by a car) are defined at an instant  $t$ .

### Authoring tool overview

The GUI, inspired from traditional video editing software, is composed of three main parts: a preview of the video, a timeline for the synchronization of effects and a menu with the parameters of the current effect (see Figure 1). So far two types of effects are supported: vibrations and motion. Two tracks are displayed above the timeline, each one is dedicated to one type of effect. To create an effect, the user determines when it starts and stops on the track, then defines waypoints. An effect can be saved in order to be reused. The parameter menu allows to finely tune each waypoint, data are interpolated between them. Parameters for vibrations effects are quite simple to edit: amplitude and frequency. However the motion effect is less trivial to edit due to the 6 DoF which all have to be set at a time.

### Motion effect edition

Motion effects are described by three linear accelerations and three rotational speeds, editable in the parameter menu (see Figure 1). As it is not a simple task for the user to imagine a movement in 6 DoF, we propose three methods to edit motion effects.

#### *Waypoint edition using a force-feedback device*

We propose first to use a force-feedback device to edit motion parameters for each waypoint. The creator can directly manipulate the device to set a direction vector and an orientation. In our implementation we rely on a Novint Falcon, a low-cost 3 DoF force-feedback device. Only the direction or the orientation can be edited at a time. This approach should be easily extended to a 6 DoF device.

#### *Trajectory recording from a force-feedback device*

Creating a complex effect might be tedious with the previous technique as motion parameters must be edited for each

waypoint. The second method proposed is to record a trajectory thanks to the force-feedback device without using waypoints: the creator directly moves the device while the video is played. This solution is more intuitive although the synchronization with the video is less easy.

#### *Real-world capture*

Designing a motion effect as it would be felt in the real world is not straightforward. Then the tool allows to import real-world captured data, such as from an inertial measurement unit (IMU). Content may be easily created thanks to recording devices combining a camera and an IMU as exposed in [1].

### Motion effect preview

Once edited, the creator may want to preview the effect. But end-devices (such as motion platforms) are not always available or would not be convenient for a quick preview. Thus we propose to use a force-feedback device to preview motion effects. The creator can playback the video while holding the device and then feels the effects. This provides a preview of the dynamic of the movement and of the synchronization with the video.

## CONCLUSION

This paper introduced an authoring tool with a user friendly interface to create haptic and motion effects for audiovisual content. Three methods are proposed for the edition of motion effects: manual edition with waypoints, trajectory recording thanks to a force-feedback device and import of real motion captures. Besides the effects may be previewed, allowing an iterative design process. This new tool could simplify the creation of haptic-audiovisual content. As future work, a usability study should be conducted to evaluate the strengths and weaknesses of each edition method.

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