
ClipWorks: A Tangible Interface for Collaborative Video Editing

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Abstract

We introduce a simple, tangible interface for sequencing digital videos that combines the intuitiveness of physical film editing with the flexibility of current digital video editors. Users interact with the interface by moving around physical clip and effect blocks, with options to preview their built video, save videos, and import new videos. This project aims to engage users in basic video editing, foster collaboration, and build digital storytelling literacy.

CCS Concepts

•Human-centered computing → Collaborative content creation; •Applied computing → Interactive learning environments;

Author Keywords

Tangible user interfaces; digital video editing; collaborative learning; storytelling

Introduction

Compared to traditional physical film editing systems like Moviola, current digital video editing software provide powerful non-linear editing abilities, such as the ability to quickly duplicate and undo actions. However, they lose certain physical affordances of traditional editors and have minimal support for collaborative editing. We aim to present a tangible interface that combines the intuitiveness of phys-

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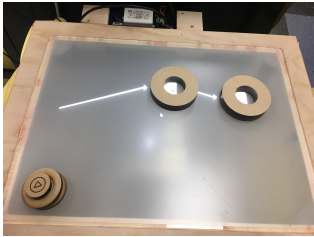


Figure 1: Our basic setup on a low-cost interactive tabletop, with two video clips.



Figure 2: Interface design showing white arrows that delineate ordering of clips, different colored effect rings indicating different effects applied to each clip, and a “play” functionality to preview the complete edited sequence.

ical editing with the flexibility of digital editing. Users build videos through manipulating physical video blocks and physical effect blocks, all of which are designed to allow for non-linear play. To encourage personalization, we enable users to upload their own videos. Our interface is primarily intended for use by late elementary school to middle school students, to engage younger learners in basic video editing, collaboration, and storytelling.

Related Work

We focus on three main dimensions of related work.

Video Editing for Children

Digital storytelling offers students methods of shaping their own learning and enhancing comprehension, particularly by integrating visuals into subject areas that are traditionally text-only [4]. Through the video editing process students are freed to think more critically about the content of clips as they pass through the “multiple levels of reflection that naturally take place throughout the production process” [2]. Vaucelle and Ishii’s [6] work in digital video editing models for children to capture storytelling focused on creating tools that leverage student’s natural expressions of play; while their devices afforded personal creation, their study admits their prototypes failed to connect the editing process to children’s spontaneity and led to some loss of connection to digital storytelling as a medium.

Tangible Interfaces

Tangible User Interfaces (TUIs) link physical play with the digital world. Research suggests that TUIs keep learners engaged in constructing a public entity and promote collaboration [3]. The tangible blocks bridge abstract concepts by creating a physical interaction and link between a student’s creative ideation and the process of editing video. For example, the act of deleting a video clip is more deeply

learned when represented by the physical motion of removing a clip than by a series of mouse clicks.

The tangible nature of our work draws most inspiration from the Tangible Video Editor (TVE) [7], a simple, tangible interface for sequencing videos in which users can rearrange videos (represented by interconnecting blocks) and add transition pieces between videos. Its creators had similar learning goals as ClipWorks; however, since all video clips are provided by the creators, the technology has quite narrow exploratory walls. In our work, we make sure to allow for user-imported video clips so that the video editor is not just an exercise in storytelling or collaboration, but also a way for learners to better engage with and reflect upon their own lived experiences.

Collaborative Storytelling

Storytelling and collaboration are inextricably linked, as “through storytelling, students...creat[e] meaningful connections with each other and with members of the community” [1]. “VideoPlay,” a tangible tabletop editing system intended to make video editing more collaborative and playful, used domino-style visual markers to reorder and edit video clips [5]. Like with the TVE, however, the video tiles do not afford easy physical manipulation or general usability by kids because of their larger size. The system also does not explicitly mention a component to actually promote collaborative play amongst users.

While much effort has been put forth in each of these categories individually, no existing video editor covers all dimensions. ClipWorks aims to fill in these gaps as a tangible and collaborative video editor for children.

Design

ClipWorks is designed for late-elementary-school as well as early-middle-school students. Our initial learning goals

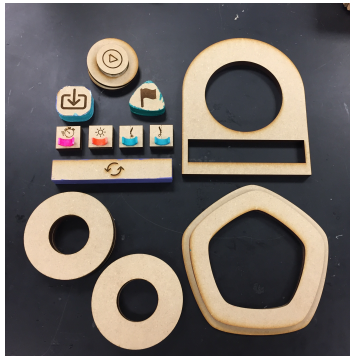


Figure 3: The tangible blocks. In the top left quadrant, clockwise from the top, are the Play Button, Seek Block, the five Edit Blocks, and the Save Block. In the top right quadrant is the Edit Panel. In the lower left quadrant are two Video Rings. The lower right quadrant is the Preview Block.

are to introduce students to basic video editing, provide a platform for storytelling, and facilitate collaboration.

Core Mechanics

The tangibles in ClipWorks consist of laser-cut MDF blocks with 1-3 unique fiducials attached to the bottom as seen in Figure 3. The student places the blocks on a low-cost, custom-built TUI table, which has underneath an infrared camera to read the fiducials as well as a projector to display the user interface. The program ReacTIVision processes the infrared input to collect information about the visible fiducials. We implemented the following features.

1. *Video Clip Sequencing.* Prior to running ClipWorks, the user uploads their videos into an "Imports" folder. When placed on the TUI table, the Video Ring block displays an imported video inside of the hole. This indicates that the video is in the video sequence. When multiple Video Rings are placed on the screen, white arrows appear between them to indicate the left-to-right video sequence order. When the Seek Block is placed on the TUI table, the video sequence starts at the video the green seek arrow points to.
2. *Play and Save.* Pressing the Play Button while on top of the TUI table plays the constructed video sequence. If the Preview Block is on top of the table, the concatenated video sequence will appear inside the Preview Block. If not, each video will play inside of its own video ring sequentially. To save the video, the Save Block is placed on the TUI table and will save the entire video sequence.
3. *Video Clip Editing.* To edit a clip, the user places the corresponding Video Block inside an Edit Panel with an Edit Block. There are four kinds of Edit Blocks:

Reverse (block), Change Brightness (slider), Change Speed (slider), and Trim Blocks (two sliders). When the Video Ring is separated from the Edit Panel, it retains the effect that was applied to it, indicated by a colored Effect Ring surrounding the Video Ring that matches the color of the applied Effect Block. Each Video Ring may have multiple effects applied, represented by multiple Effect Rings. There are multiple Effect Panels, which allow multiple users to edit different Video Rings simultaneously.

Design Philosophy

Our design of ClipWorks main features was informed by the following design decisions and principles.

1. *Tangibility.* Unlike a digital screen, a tabletop surface encourages students to physically move. Additionally, all blocks are made so that they can be easily shared amongst several students.
2. *Incorporation of Collaborative Elements.* There are multiple Edit Panels, which suggest that the students can collaborate and edit video clips simultaneously. However, we did not make duplicates of the Edit Blocks or the Play Button. The intention is that students must negotiate the use of these blocks to further increase collaborative discussion.
3. *Creation of a Public Entity.* The Preview Block and the Save Block allow the students to share a created public entity. With the Preview Block, students can share with whoever happens to be physically close to the table, while the Save Block allows the students to share with those not present for the editing process.
4. *Personalization.* Although the import functionality is not seamless, it allows students to upload their own

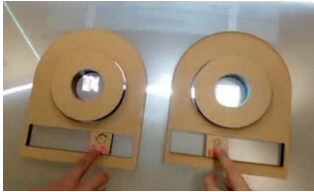


Figure 4: ClipWorks allows for collaborative video editing – this image shows two users editing different video clips simultaneously.



Figure 5: A young girl playing with ClipWorks at the project expo. After each action, she appeared visibly delighted and would sometimes jump up and down and clap.

videos. This lets students to post-process their own videos and create their own stories.

5. *Cultural Forms.* A tabletop encourages students to place the blocks upon it, with visual feedback informing that their actions have indeed affected the virtual environment. The shape and size of the holes in the Edit Panel informs the user to place the Video Rings and Edit Blocks inside.
6. *Feedback.* The sequencing arrows automatically update to point at the Video Rings in order, providing information for when the user swaps videos clips. The glowing rings match the single color of the Edit Block that was applied to a Video Clip, and the preview image also gives instantaneous feedback about Trim and Change Brightness edits.

Future Work

Our future plans center on expanding support for teaching digital storytelling literacy and exploring perspective or biases in video creation. We plan to streamline the process of importing personal videos, ideally so young users can directly import a video from a phone to ClipWorks, and curate sample pre-constructed videos for students to ‘deconstruct’ and note how the editing process changes the constructed story. With these added features, learners can use our tangible video interface to thoughtfully and collaboratively create narratives pertinent to their community, begin thinking about issues of screen representation, and more.

Conclusion

ClipWorks is a video editor that can introduce video editing to young students in a tangible, collaborative way. This is unlike most mainstream video editors, which are aimed at an older audience, are entirely digital, and provide no co-operative way to edit. Additionally, ClipWorks aims to allow

students to freely post process their own clips in order to encourage them to tell their own stories.

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