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Prototyping Video Games with Animation

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***Abstract*—This paper outlines a proposed design for StorySketch, a new video game storyboarding system. StorySketch borrows ideas from the K-Sketch animation sketching system, which allows short animations to be created in minutes or seconds. We build on K-Sketch in four ways. key frame animation capabilities, a branching timeline view, microphone and web-cam support, and hooks to connect to online game design documents.**

Keywords—storyboard, animation, sketching, video game, pen based user interfaces

I. INTRODUCTION

Video game designers must generate better ideas faster to compete in the increasingly competitive game market. Current game prototyping methods may have been sufficient in the past, but new prototyping methods have been discovered that could revolutionize the game design experience. Animation sketching systems make it possible to create animated prototypes in minutes or seconds, even during design meetings. These prototypes are malleable enough that they can be modified quickly during discussions with other designers. We are building an animation-based storyboarding system that will improve the video game design process. This tool will allow game designers to incorporate high-quality graphics and audio, work with complex, branching timelines, and produce better design documents to guide game development.

Currently, many game designers begin their work with paper prototypes. By acting out sequences of game play with small paper cut-outs, a group of designers can develop a rough idea for a game. Often, this results in a pitch document (also called a high concept document or a one-pager) that gives a brief overview of the game and describes any important features. Over time, this document evolves into a more detailed game design document that gives a longer synopsis of the game and goes deeper into the characters, goals, game play, and user interface. It may also describe the music and sound effects in the game. The game design document is continually revised and sent to the technical team, which uses it as a reference for development.

To flesh out the game design document, many designers will create storyboards, which are sequences of sketches (often with accompanying text) that explain how the game unfolds. Small scale storyboards may focus on the play-by-play of the game in chunks of about 30 seconds. Larger scale storyboards will describe higher-level aspects of the game that take place over longer periods of about five minutes. By showing these storyboards to others, designers can get feedback and modify their design. Storyboard frames can also be modified during meetings or re-arranged quickly (if they are kept on separate sheets) to evaluate different possibilities.

Storyboards are a powerful tool, but they have two significant limitations. First, they are static, and they cannot effectively communicate many design details for a dynamic video game. This limitation prompts many designers to create animatics, which are storyboard frames presented with a sound track and some simple animation. The motion and sound in these animatics communicate game design ideas much more effectively than drawings and text. Some designers even advocate producing interactive prototypes, because they are more enticing and communicate game ideas better than either storyboards or animatics [7]. However, animatics can take hours to produce, and interactive prototypes can take days. Consequently, they lack the malleability that makes storyboards so powerful.

The other disadvantage of storyboards is that they are linear. Time in a storyboard always advances in a straight line, but the timeline of a game can branch depending on the player's actions. Designers need to explore these branches and work out story details together. Some designers will use flowcharts for this purpose, but these are hard to re-arrange on the fly, especially when storyboards become long and timelines become complex. Plus, flowcharts share storyboards' limitation of being a static medium.

Because storyboards are static and linear, they can often be misinterpreted by a development team. It may take several storyboard frames and a page of text to explain how the art, motions, and sound combine to create a single game event. Such events can often be explained quickly and more effectively with a single animation or short interactive prototype, but producing these prototypes for every game event is too costly. Designers need a prototyping tool that combines the advantages of storyboards, animatics, and interactive prototypes to produce more effective game design documents.

Our storyboarding system, StorySketch, will preserve the malleability of storyboards, but it will use animation to make storyboards dynamic, and it will support branching timelines. This will give professional game designers a powerful new way to get ideas out of their heads quickly and into a group's consciousness where ideas can be refined. Furthermore, designers will be able to embed these animated storyboards in online game design documents and replace rough graphics and audio with high-quality versions as the design evolves. Animated storyboards will therefore serve as a reference for

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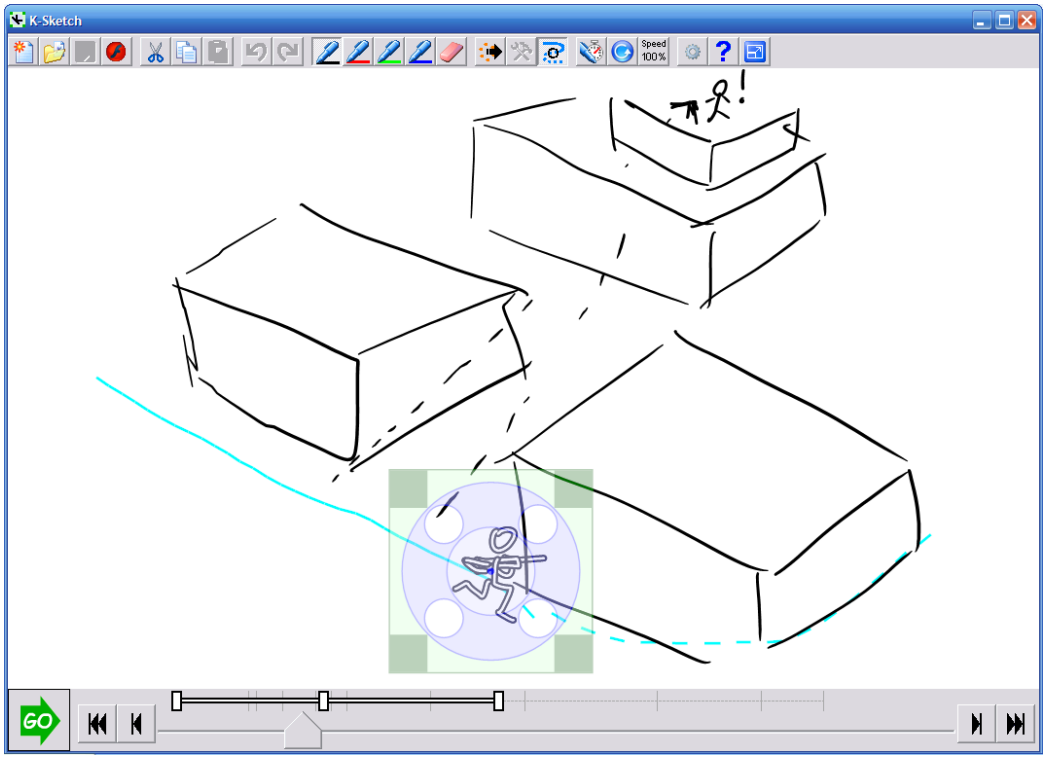


Figure 1: The K-Sketch User Interface. Users sketch and move objects in the center canvas. The slider bar at the bottom indicates the current moment in time. The symbols above the slider show the time span of motions applied to the selected object. Users create animations with a series of instantaneous movements or by demonstrating motions in real time. The blue lines show a demonstrated motion path for the character.

both designers and developers, reducing errors in the game development process. This paper presents a preliminary design for StrorySketch.

II. Related Work

Storyboarding has long been regarded as an important skill in the entertainment industry [10], and researchers have made other attempts to enhance storyboards. Some take advantage of traditional storyboarding behavior to speed up the production process (for example, by generating animations from storyboards [5]). Other researchers have sought to improve the process of creating storyboards for interactive systems. DEMAIS is a pen-based system with a visual language for designing multimedia content [3, 4]. StoryCanvas is a more conventional system that helps designers produce storyboards for interactive dramas with complex story lines [9].

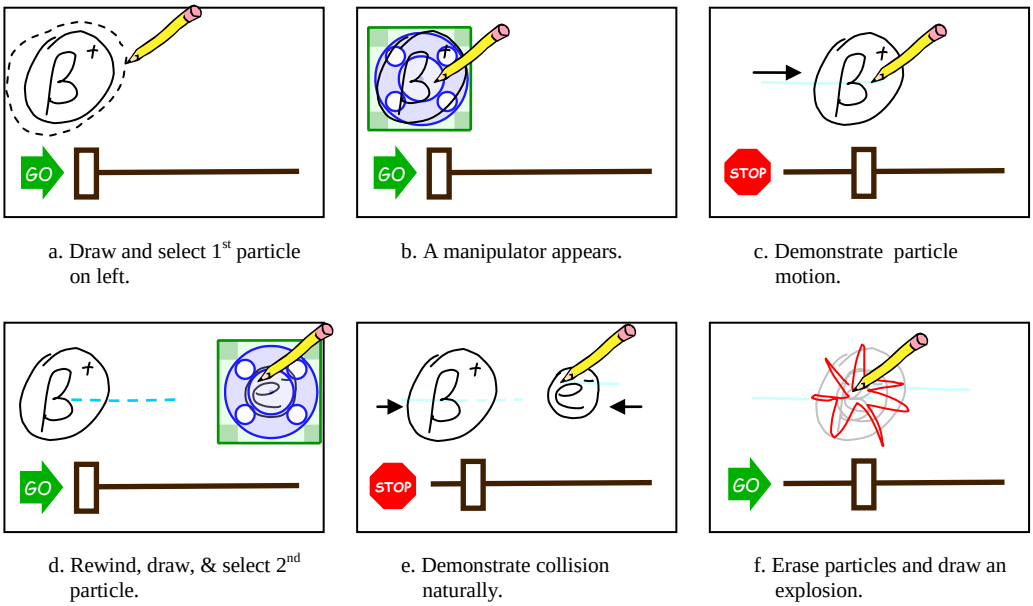
Like DEMAIS and StoryCanvas, our StorySketch system seeks to improve the storyboarding process for interactive systems. Like DEMAIS, StorySketch is a pen-based system, but StorySketch uses demonstrated animation rather than a static visual language, making it better suited to the action sequences found in video games. Our focus on action sequences also distinguishes StorySketch from StoryCanvas, which focuses on plot lines. Like StorySketch, however, StoryCanvas does seek to manage the non-linear structure of interactive stories.

Animation sketching systems speed up the animation process by allowing designers to quickly specify rich motions with simple commands or gestures. Such systems have existed for over forty years [2], but they are receiving increased attention due to the wider availability of powerful computers with pen or multi-touch display surfaces. Some, like ASSIST [1], use physical simulation to generate motions. Others capture real time demonstrations of motion, as in K-Sketch [6] or As-rigid-as-possible shape manipulation [8]. Our system is based on K-Sketch, and we explain how this system works in the following section.

III. Animation Sketching with K-Sketch

K-Sketch is the animation sketching system that forms the foundation of StorySketch. With K-Sketch, designers can make short, rough animations in seconds by drawing objects on a tablet computer and demonstrating their motions in real time. K-Sketch uses fluid pen input and is highly tuned to make common operations easily accessible. With as little as 30 minutes of practice, animating with K-Sketch can feel as natural as drawing.

The K-Sketch interface is shown in Figure 1. Designers begin by drawing a scene in its initial state. The animation is then created through a series of editing steps. Some edit operations move objects instantaneously at the time indicated by the time slider bar, and other operations demonstrate



a. Draw and select 1st particle on left.

b. A manipulator appears.

c. Demonstrate particle motion.

d. Rewind, draw, & select 2nd particle.

e. Demonstrate collision naturally.

f. Erase particles and draw an explosion.

Figure 2: Creating a particle collision animation with K-Sketch. The animation is built up with a series of editing steps. Motions are recorded in real time.

motions in real time (see Figure 2). This simple interface allows rough but complex animations to be prototyped very quickly.

Conventional animation tools have complex timelines that show all the transformations applied to each object over time. In contrast, K-Sketch has a simplified timeline that shows only the most important events, highlighting those related to the currently selected object. In addition, a motion path appears when designers record a motion. This motion path serves as a reminder of how an object moves and helps designers manage and coordinate objects' motions. The path is a selectable entity that can be moved to change the trajectory of an object or copied and applied to other objects. These timeline and motion path tools help designers quickly modify animations as they evolve.

K-Sketch has been released to the public and can be downloaded online from www.k-sketch.org. It is already proving itself as a prototyping medium. One research study has already shown that children can use K-Sketch to prototype video games [1].

IV. StorySketch Modifications

StorySketch will be implemented on top of K-Sketch by adding key frame animation capabilities, a branching timeline view, microphone and web-cam support, and hooks to connect to online game design documents. Key frame animation, was requested by designers during our exploratory research. Some designers are uncomfortable using K-Sketch because the interaction is so unfamiliar. These users are more comfortable using key frames to define some types of motion. Merging the real-time animation approach of K-Sketch with the key frame approach was a major challenge. We are currently preparing another publication that will explain how StorySketch merges these two ways of conceptualizing animation.

The most visible addition to K-Sketch will be the branching view, shown in Figure 3. The view will show one or more scenes, which contain a progression of thumbnails moving from left to right, branching or merging at various points. The thumbnails in this view represent scene fragments, which are short animations that can be edited independently (or semi-

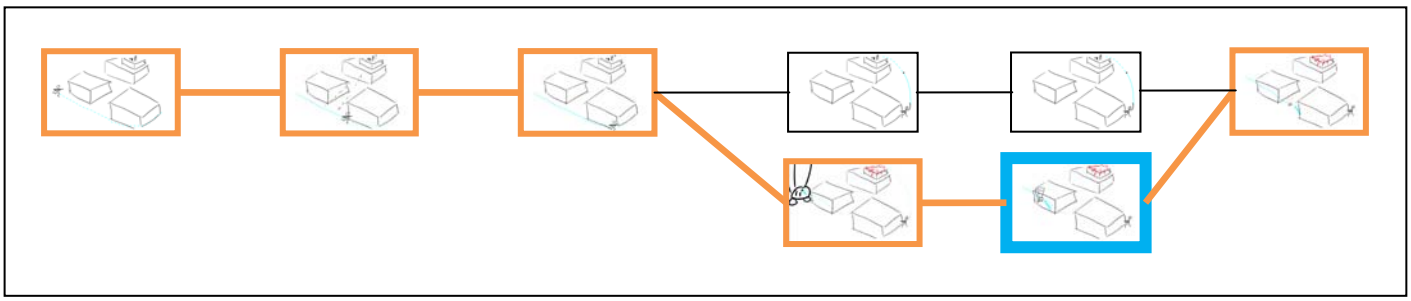
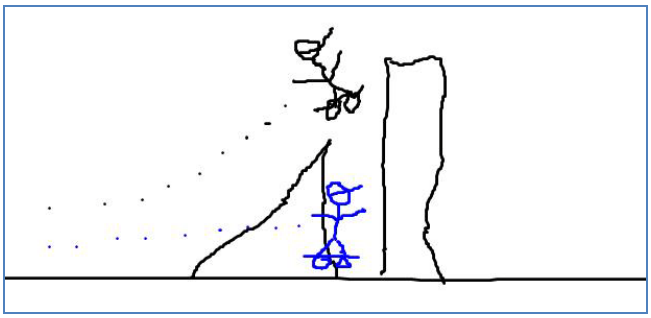
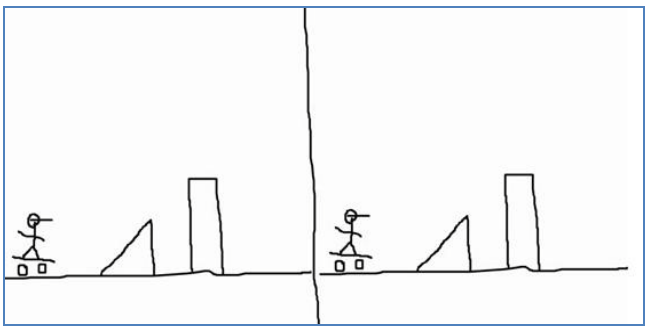


Figure 3: A rough sketch of the StorySketch branching view. The current scene fragment is highlighted in blue. Designers can use pen strokes to quickly select paths through the network of fragments (highlighted in orange). Playing the storyboard advances through a particular path, allowing designers to evaluate that path or show it to colleagues.



a. Overlay approach



b. Split-screen appraoch

Figure 4: Two approaches to viewing timeline branches. Both were suggested by designers during our exploratory research.

independently) from others. Selecting a fragment in the branching view will cause it to become editable in the main canvas. Branches can then be created by issuing a *Branch* command within an existing fragment. This will split the current fragment into two at the branch point (if necessary), create a copy of the fragment after the branch point, and add branch and merge connectors before and after the new fragment. Other operations, such as merges and deletions, will be done through direct manipulation of the thumbnails and connectors in this branching view.

Branches can serve both as a memory for design alternatives and as a repository for different story paths. It is therefore essential to provide easy ways to view different paths through the story. With a stroke of the pen, designers will be able to select a sequence of fragments for playback. During our exploratory research, some designers also requested the ability to view different sequences simultaneously for comparison. We are considering two approaches to simultaneous viewing, an overlay approach and a split-screen approach (see Figure 4).

Since audio is such an important part of animatics, StorySketch will also allow audio tracks to be associated with scenes. Using their computer's microphone, designers will be able to record vocal sounds while demonstrating motions. They can also hum a background tune that plays throughout a scene. As a design evolves, audio designers can replace these vocal sounds with more polished audio tracks.

StorySketch will also allow designers to take quick snapshots of pen-and-paper drawings (or other objects) using the computer's web cam. Some designers find that no computer interface can compete with the pleasing feel of physical tools. With automated tools for importing snapshots, adjusting light levels, and removing backgrounds, this process could be about as fast as drawing directly in StorySketch.

Finally, StorySketch will make it easy to incorporate storyboards into online game design documents. Our current plan is to make a StorySketch plugin for the open-source XWiki platform[1]. This will make it easy create and distribute game design documents with StorySketch storyboards to a design team. It will also make it possible to evolve game design documents collaboratively over time, capturing refinements gradually as they are made and distributing them instantly to the team.

V. CONCLUSIONS

We have presented a preliminary design for StorySketch, a new prototyping tool that preserves the malleability of storyboards, but uses animation to make them dynamic. StorySketch also supports branching timelines to better support the needs of video games designers. We are basing StorySketch on the K-Sketch animation sketching tool and adding key frame animation, branching timelines, audio support, web-cam capture, and wiki support.

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