SKUID: Sketching Dynamic Drawings Using the Principles of 2D Animation

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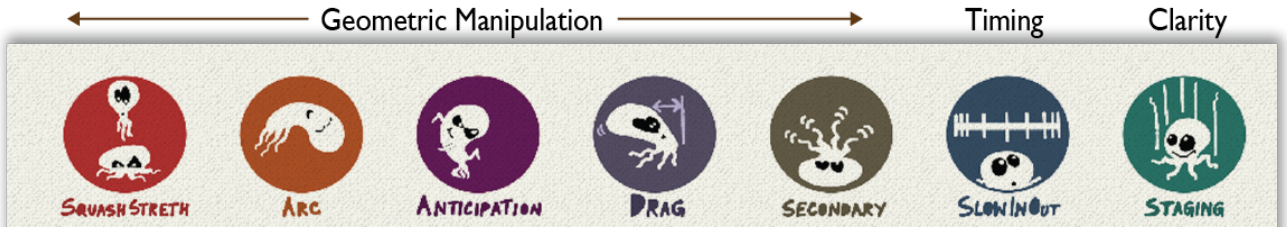

Figure 1: *We devised the principles of animation as a set of seven motion amplifiers. The amplifiers are independent from each other and can be arbitrarily mixed to design motion effects of an animated object. These tools correspond to the principles of animation that address the geometric manipulation, clarity, and temporal aspects of animation.*

Abstract

Skuid is a sketching tool for crafting animated illustrations that contain the exaggerated dynamics of stylized 2D animations. Skuid provides a set of motion amplifiers which implement a set of established principles of 2D animation. These amplifiers break down a complex animation effect into independent, understandable chunks. Each amplifier imposes deformations to an underlying grid, which in turn updates the corresponding strokes. Users can combine these amplifiers at will when applying them to an existing animation, promoting rapid experimentation. Skuid leverages the freeform nature of sketching, allowing users to rapidly sketch, record motion, explore exaggerated dynamics using the amplifiers, and fine-tune their animations. Practical results confirm that users with no prior experience in animation can produce expressive animated illustrations quickly and easily with Skuid.

Keywords: Sketching; motion amplifiers; principles of animation.

Concepts: • **Computing methodologies ~ Computer Animation**

1 Introduction

In the early days of 2D animation, crude technical limitations compelled master animators to push the limits of the medium by developing a number of expressive techniques [Thomas 1995]. By exaggerating the dynamics of the physical world, these techniques, known as the *principles of animation*, turned hand-drawn 2D animation into a communicative, sophisticated art form. The twelve principles of animation guide the motion design, visual design, as well as the clarity and communicative aspects of 2D animation. A master animator can compose the animation of a character by applying these principles to various extents.

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The importance of 2D animation stylization is well recognized, and it has been widely used in 3D animation. However, producing stylized 2D animations is tedious, even today, requiring specialized skill and manual key-framing. In the computer graphics community, researchers have explored a number of approaches to simulate cartoon-style animation. However, much of the focus of these works is to simulate a particular effect or a small subset of effects, and they provide little artistic freedom.

In this project [Kazi 2016], we adopt and expose the animation principles as a set of concrete, high-level motion design tools (Figure 1) displayed as icons (or visual metaphors). We refer to these motion design tools as *amplifiers*, since they enhance the communicative aspects of 2D animation. The design of these amplifiers conforms to the natural language of traditional animation and facilitates rapid exploration of the animation principles in a way not possible before. The result is Skuid, a sketching tool that enables amateurs, as well as experts, to sketch expressive 2D illustrations with looping animations using these amplifiers. With Skuid, users can sketch drawings and record motions through direct manipulation, and they can apply the animation principles by simply tapping on the corresponding *amplifier* icons. Each amplifier imposes deformations to an underlying grid, which in turn updates the corresponding strokes. Users can adjust the strength of the amplifiers and manipulate the motion profiles of the animation for finer artistic control. Our design enables users to define and control the dynamic simulation of an object through sketch-based interaction techniques. Our implementation is purely geometric and does not require skeletal information, connectivity, or pre-existing data, thus providing artistic freedom and expressiveness. Animated illustrations created with our tool exhibit the exaggerated dynamics of classical 2D animations, which are tedious for experts and almost impossible for amateurs to create with existing tools.

References

KAZI, R. H., GROSSMAN, T., UMETANI, N., FITZMAURICE, G. 2016. SKUID: Sketching Dynamic Illustrations Using the Principles of 2D Animation. In *Proceedings of ACM CHI 2016*.

THOMAS, F., JOHNSON, O., 1995. The Illusion of Life, Disney Animation. New York: Hyperion.