Technical Report

Futuristic Modeling

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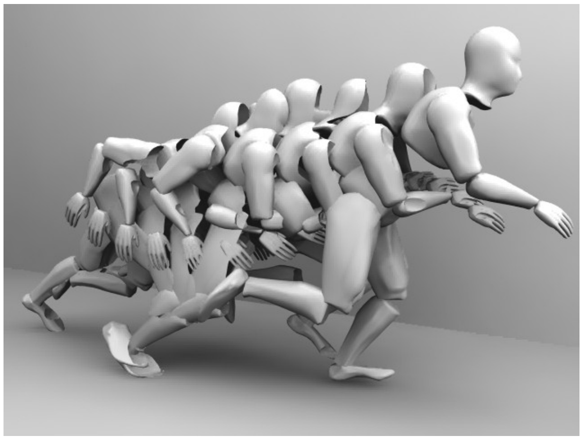

Figure 1: An example of adaptive snapshot.

Figure 2: An example of exploded snapshot.

Introduction and Motivation

Motion exists in four dimensions, since it is defined in both a three-dimensional space and in a time. Consequently, to describe motion one needs to capture time, which has been accomplished in time-based media, like film and animation. We present an innovative approach that enables modeling a static three-dimensional representation of time and motion. We named it Futuristic Modeling, to honor the fact that its concept originated from interpretation of Futurist paintings, emphasizing dynamism, energy and speed.

Methodology

Futuristic Modeling follows a simple, yet effective algorithm. Our method requires an input animation and sculpts a 3D model representing motion. Since animation is four-dimensional, while the output is purely three-dimensional, all implementations of Futuristic Modeling ”flatten” four dimensions to compress them into three. We developed three techniques automating the process of Futuristic Modeling: adaptive snapshot, exploded snapshot, and animation deformer. Each one of them models a unique representation of motion, even if they are given the same input animation.

1. **Adaptive snapshot** is a method that in a way analogous to the strobe-light photography captures copies of the animated object at various instances in time. These copies, or ”snapshots”, visualize motion as a progression of steps and reveal its rhythmic nature. Adaptive snapshot has two variations, isochronic and isotropic, defined by choice to keep either time or space frequency constant. Since this approach is based on the object’s position, it is most appropriate for translating rigid objects. In cases where the objects are animated mainly through the use of deformations other techniques should be used.

2. **Exploded Snapshot** overcomes the limitations of the basic Adaptive Snapshot and is capable of modeling coherent representations of both rigid and deforming objects. It is a two stage process, first ”exploding” the selected object into pieces and then applying adaptive snapshot to each piece. For the method to be successful two criteria need to be satisfied. First, all of the ”exploded” pieces need to retain the animation of the original object. Second is an assumption that the pieces are small enough, so that the deformations are negligible. If both conditions are met, then we can apply the adaptive snapshot technique to each piece independently. The result is a representation of motion which resembles sampled space, revealing parts of the object at different instances in time.

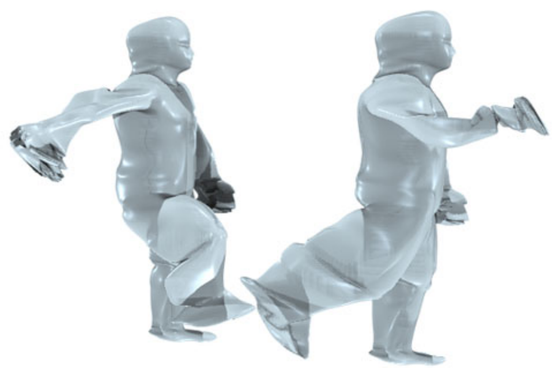

Figure 3: An example of animation deformer.

3. **Animation Deformer**, compared to the previous two techniques, provides a completely different approach. Its results describe smooth and continuous nature of motion. This method interprets movement as a volume which the object occupies during a given time slice. To achieve a better visualization of the deformed model we increase the inertia constant. The animation deformer is a function of motion, since it stretches in the direction of motion and its length is based on speed. The final result has a look of long-exposure photographs or the squash-and-stretch animation approach.