

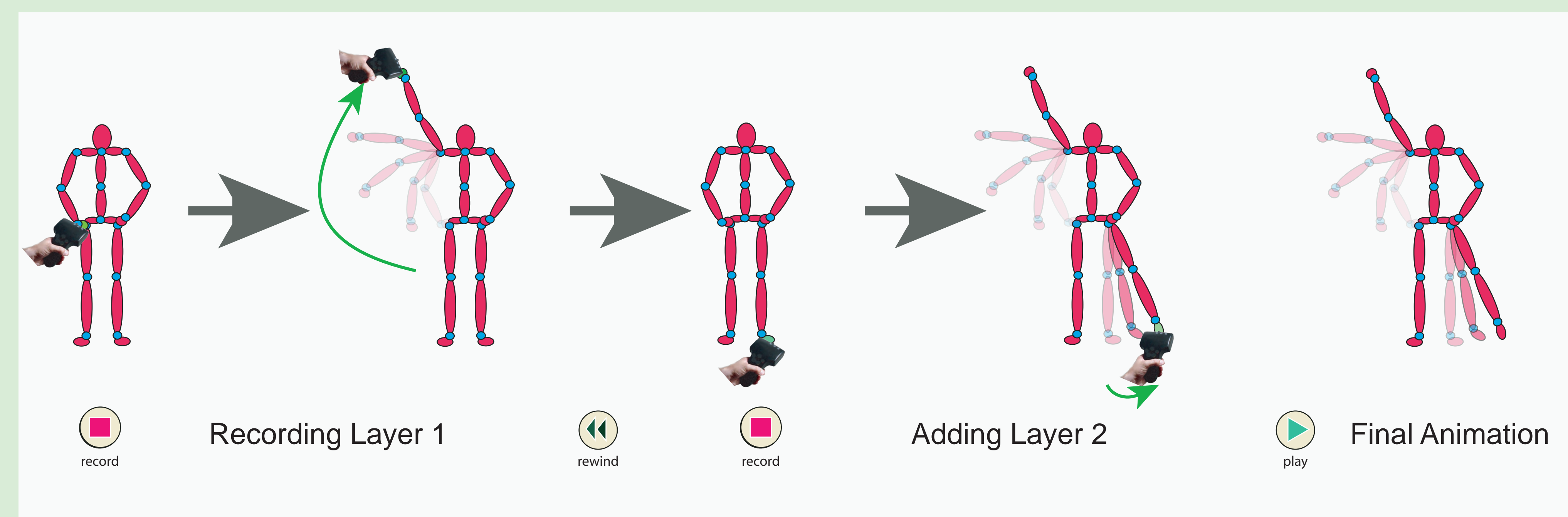
Introduction

We present a novel method for creating 3D animations by letting users act directly on 3D characters in a virtual reality Cave environment. Our system records the performance of the animator as she manipulates the character's joints and limbs using 3D trackers. By making multiple passes, animators can layer simple motions to create more complex animations. We believe our approach bridges the gap between animators and the characters they bring to life by making animators an integral part of the virtual world inhabited by their characters.

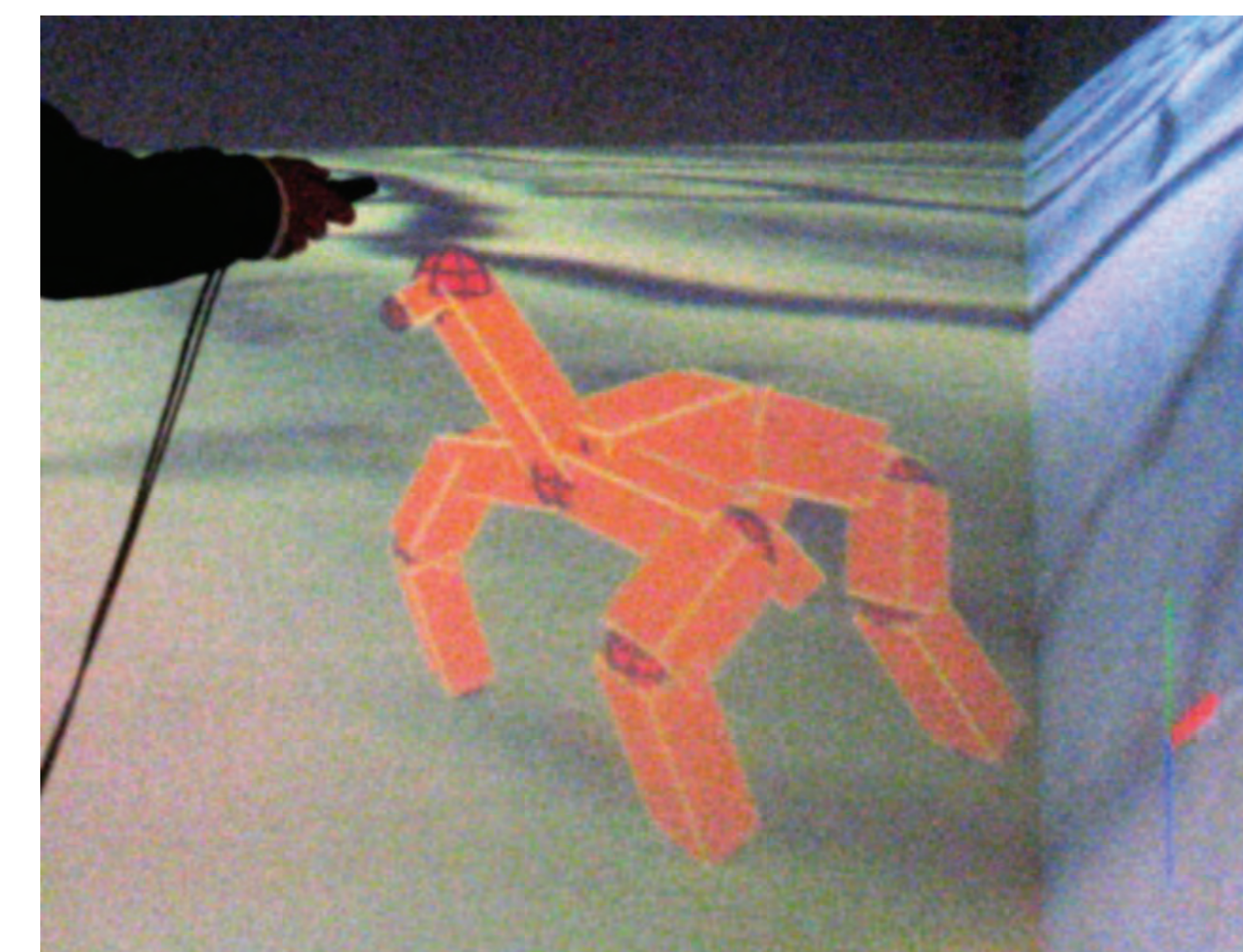
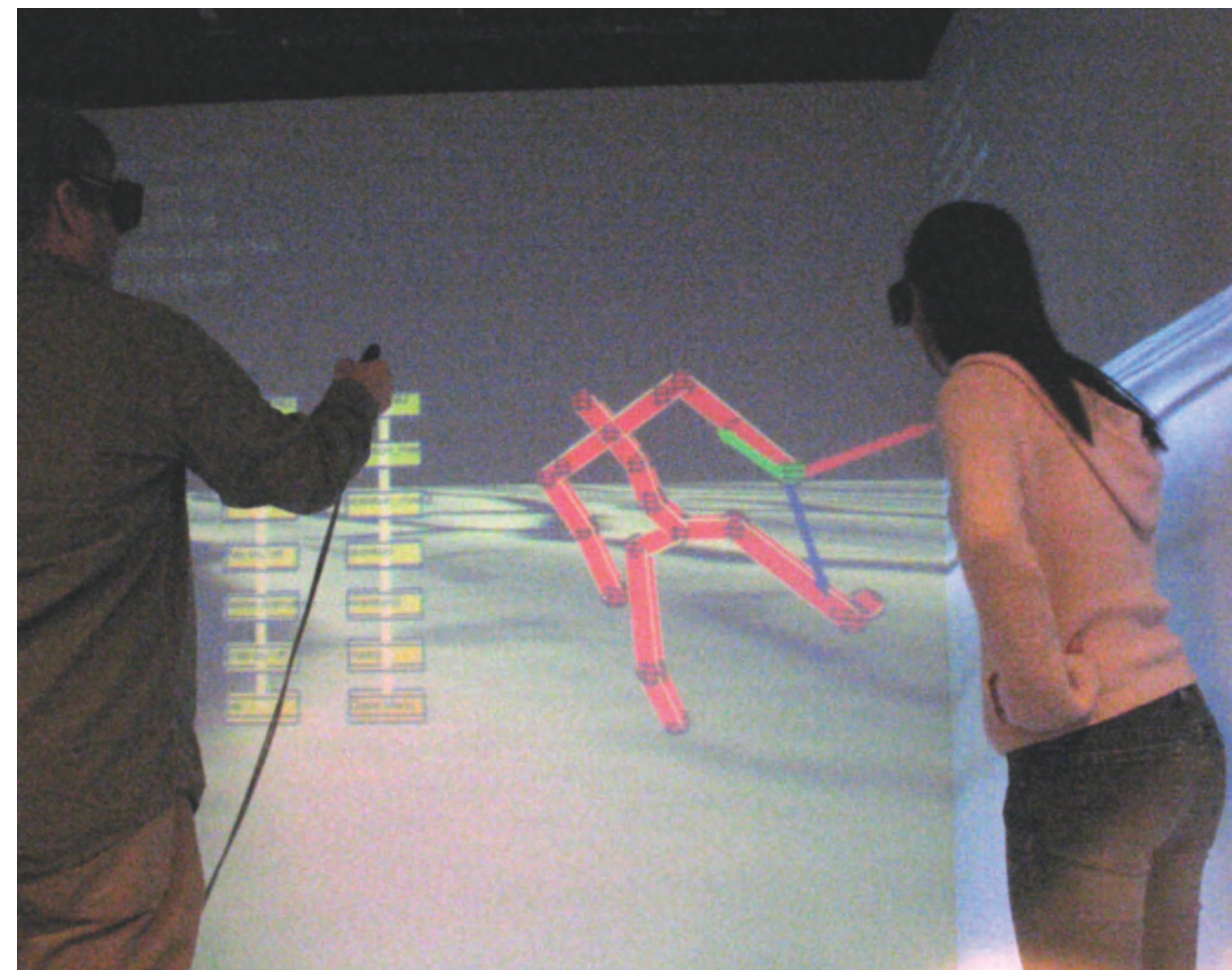
Methods

Our approach relies on physically simulated character models, which behave as puppets or armatures. Using 3D trackers, animators pick and move body control points along trajectories in space. As these points move, the rest of the character's body responds in a physically realistic manner.

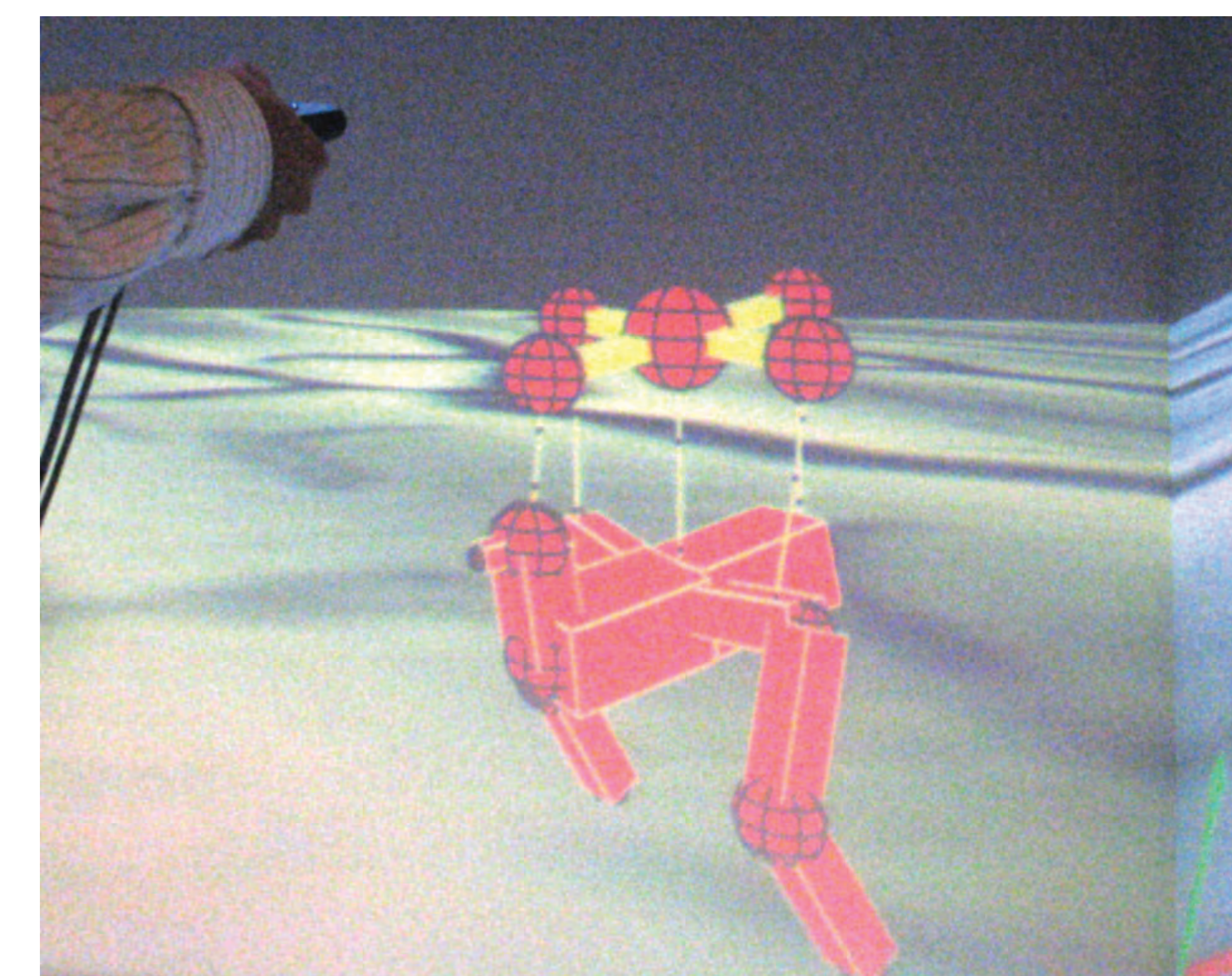
To produce more complex animations, our system allows animators to compose multiple layers of animation in a manner similar to that presented by Dontcheva et al. The animator controls a different constraint in each layer of animation, recording it while the previous layers are played back. During playback our system simulates the character response to all recorded constraints.



We rely on the Open Dynamics Engine to solve our physics-based kinematics. Consequently, our skeletons are modeled as joint-and-body constructs. To avoid problems (such as stretching a limb beyond its reach) caused by the lack of physical feedback from the character, we allow the control point to deviate from the user defined trajectory if there is no physically correct solution to the motion. This approach also allows us to add together conflicting layers of animation, since the ODE constraint solver will interpolate to find the solution that best describes all layers.



Perhaps the most desirable side-effect of using a physics based approach is that we can easily create “virtual marionettes” such as the one shown below. The advantage of virtual puppeteering is that after creating the base motion using the marionette control, the puppeteer can adjust aspects of the motion by layering additional constraints.



Discussion

This work presents a prototype interface for creating complex character animations that does not require extensive animation experience. Instead, our system relies on the animator's natural sense of timing and acting abilities. Since our technique runs the physical simulation during recording, the user always has a clear view of what the end result will look like.

Although we have only tested our system using a single tracking device, we expect a multi-tracker, and possibly multi-user, setup to be much more efficient in expressing complex motion that would be hard to achieve with layering alone. We hope to experiment with this idea in the future.

References:

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- DONTCHEVA, M., YNGVE, G., AND POPOVIC, Z. 2003. Layered acting for character animation. ACM Trans. Graph. 22, 3, 409–416.
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