

CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: STOP-MOTION TOOLS FOR SCIENCE COMMUNICATION	
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Project Overview:

The rise of social media has created an enormous new medium and stage for sharing content with the world at large — a potential audience of billions of people. Creating video content that can compete in this arena of public influence can have great societal benefits, allowing a science-minded content creator to push back against the newly popularized waves of disinformation that are themselves carried by many slickly-produced and easy-to-consume viral videos. And simply put, videos are cooler.

NAU's Center for Ecosystem Science and Society (ECOSS) works to not only understand the many current threats to our world climate and environments, but to communicate those insights through visual storytelling (science outreach). Our Center's initiative in Science and Art aims to directly empower researchers and students to create world-class visual storytelling to share with a global audience.

So far, this means offering in-house talent to craft high-impact illustrations for journals, press releases, social media, and conferences, as well as providing classes to teach visual design skills to students and faculty so they can create their own science visuals. We are currently expanding this arm of outreach to offer our NAU classes as global workshops.

Our ECOSS outreach is well-known and admired, but missing from our current strategy is an effective way to host our content in sophisticated video as digital 3D animations. Animation is currently not among our sci-art course offerings because of the steep learning curve and long time frame needed to gain real proficiency in animation programs; our students are primarily science grad students who gain a quick survey-course exposure of graphic design approaches between their other classes and research duties. Simply hiring in-house animation talent to create content is very costly and does not really solve the problem of creating a bridge to educating our continuous flow of students and researchers with meaningful animation skills in the short term. Finally, most animation programs are extremely complex and require years of experience to master, especially since most programs are designed for a "pipeline" workflow built on a team of many workers in a studio.

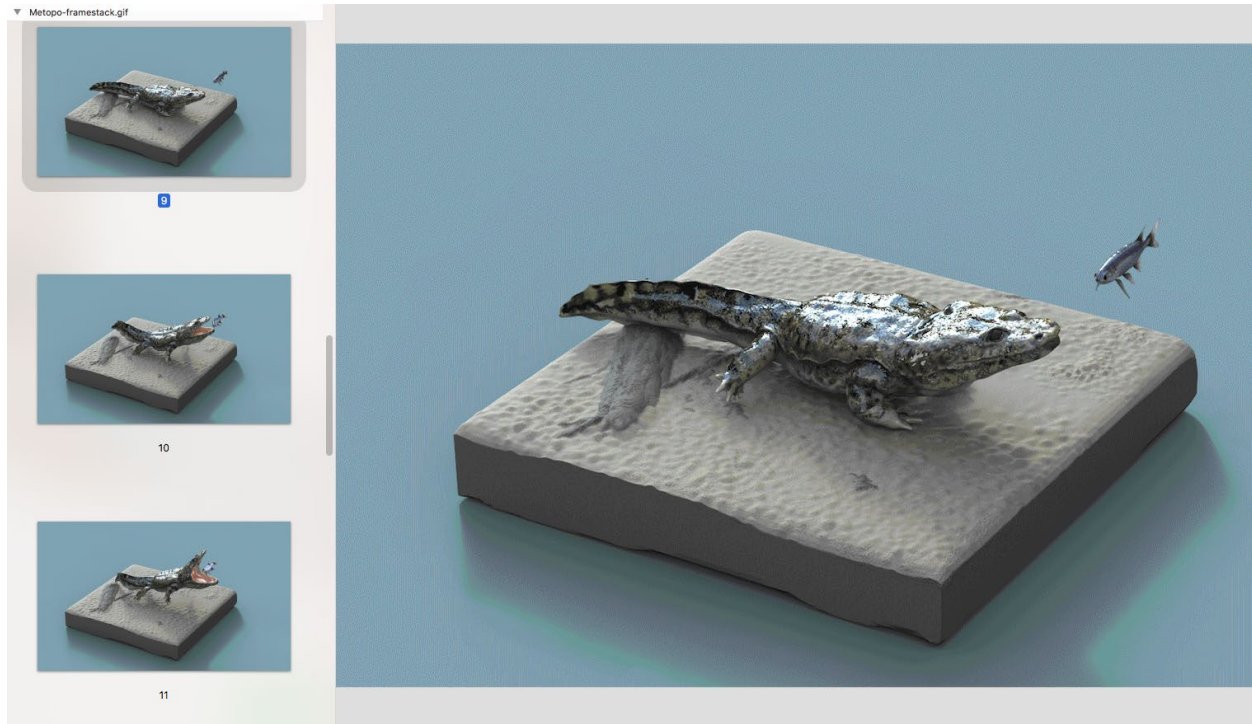
OUR SOLUTION is to create custom plug-ins to add simple STOP-MOTION and CHARACTER-RIGGING animation capacity to an existing popular and powerful 3D sculpting and modeling program, ZBrush, so that our students can be empowered to create limited high-end animations in the short time frame they are at NAU. Stop-motion is the earliest form of animation, and is extremely intuitive: the artist simply deforms a model in slight incremental steps to simulate motion over time. Modern digital animation tools add many layers of sophistication to this process to erase the “jerky” pauses between poses, but in so doing they create a very high barrier to entry for new users.

Zbrush plugins are written in a proprietary coding language (Zscript) and already exist as a diverse and growing pool of scripts written by the user community. Amazingly, this community has already produced a very promising plugin (“Zanimator”) that added inverse kinematic posing for character rigging and a stop-motion-style animation timeline to what is otherwise a modeling-only interface which produces static sculptures. However, it has not been made available to the public. However, demo videos of this plug-in exist online, such as this one: [Victor O. Leshyk on Twitter: "Just learned #TemnospondylTuesday is a thing! :\) Here's a stop-motion approach I've been developing using only sculpting tools, showing a metoposaur inhaling a passing fish... #paleoart #SciArt https://t.co/CXaktE0gt8" / Twitter.](https://twitter.com/VictorOleshuk/status/1088888888888888888)

As previously mentioned, there are high quality tools for implementing this animation but they require a significant amount of training and then experience. We are not looking to rival industry-standard moviemaking tools; we are looking to create a novel “low-end” tool that will be an enormous boon to a non-Hollywood-level demographic of individual creators. We want our students to create simple but effective animations without having to become professional animators.

The plug-in we wish to create might work with Zbrush’s existing rigging system (“Zspheres”), which currently allows only a single “pose” to be created for a model using skin-weighting and inverse kinematics. A plug-in interface which simply allows a user to save and modify successive rigged poses would effectively create an unprecedented digital tool for stop-motion animation, but the current controls make this a very difficult and laborious “workaround” process. Solving this interface problem would create a powerful “analog” tool that could open the door to the talents of many artists who are not yet skilled in digital animation and may never have the time to learn, adding a wide army of creators who can expand the field into many new forms of short film and video creations.

Shown below is a simple “stop motion” cycle created by painstakingly re-posing two models in Zbrush. The proposed plugin would maintain an editable virtual skeleton (“rig”) with which to adjust the model across multiple poses; currently, ZBrush offers only a



“single-use” rig whose positions are not updated/saved from one pose to the next.

Knowledge, skills, and expertise required for this project:

Students will need to gain an understanding of “Zscript” (Zbrush’s proprietary in-program scripting language), a working familiarity with the digital sculpting program itself, and some background understanding of the principles of digital animation. However, because this proposal specifically aims to “side-step” the cumbersome industry practices of large-studio animation, students are not expected to need any particular animation skills in any other program; rather, this project aims to harness EXISTING features within the ZBrush toolkit and combine them in an easy-to-use interface within ZBrush in the form of a plug-in.

Equipment Requirements:

A subscription to ZBrush running on a sufficiently powerful laptop or desktop, as per the official System Requirements: <https://pixologic.com/zbrush/system/>

Software and other Deliverables:

A loadable plugin script compatible with the latest version of Zbrush which allows the user to pose a model in ZBrush (using the inverse-kinematic toolkit of the existing “Zsphere Rig” functions within Zbrush) and by some means generate multiple intermediary poses

between distinct keyframes, all of which can be saved individually for export in the file format known as an “.obj sequence.”

- The plugin should allow for a reasonable number of simultaneous transformations to the pose, or, alternately, allow for a posed model to be easily saved with an updated “live” rig between poses, simulating the real-world setup of a physical model with a reusable jointed skeleton that does not itself deform
- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product and immediate and uncomplicated instructions for implementing the plug in with ZBrush.
- Complete professionally-documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive. 