Lightning Artist Toolkit
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Context: Microsoft’s Kinect, the first consumer depth camera, arrived in 2010. In 2015, developer preview versions of the HTC Vive VR headset introduced the first mass-market six-degrees-of-freedom (6DoF) controllers—wands tracked in 3D space—for wrangling the media that we collectively refer to as “XR” (a catchall acronym for “virtual reality + augmented reality + mixed reality”). Combined, these two developments enable an unprecedented new approach to creating hand-drawn XR animation with 6DoF drawing tools, which my research develops as the Lightning Artist Toolkit (Latk): a complete pipeline for frame-by-frame volumetric animation, as far as I know the only open-source example of its kind.

Problem: We now need a way to integrate live-action volumetric video with hand-drawn volumetric animation. Importing and manipulating photographic images has been a core feature of 2D image editing and animation tools since at least Richard Shoup’s SuperPaint in 1973. But applying raster capabilities to moving images remained mostly theoretical in real-world animation production for another decade. (Peter Foldès’ Hunger, the first hand-drawn 2D computer animation, was also made in 1973 but used only vector strokes.) Today, operating naively on 3D voxels similarly requires too much compute power to scale up for even a three-minute short film. However, at Google Creative Lab in 2015–16, I was part of the team that designed the machine learning (ML) game Quick, Draw!, which involved the recording, parsing, and manipulation of hand-drawn artwork as JSON files. The Quick, Draw! project identifies an available shortcut via the nature of human perception: that we “do not understand the world as a grid of pixels, but rather develop abstract concepts to…express a sequential, vector representation of an image as a short sequence of strokes.”

Method: An applied ML solution requires a collection of data, and prior approaches have primarily relied on 2D drawings. Fortunately, we now have large collections of suitable 3D data available via public archives such as Sketchfab and Google Poly. Using a dataset of over 4,000 drawings and in consultation with faculty advisors Graham Wakefield and Matthew Kyan, I will automate the segmentation of points within a dense cloud and translate them into sparse brushstrokes. Once this system generates the brushstroke information, it will be saved in a compressed JSON format readable by industry-standard content creation software such as Blender, Maya, and Houdini. The latter two are developed primarily in Toronto—by Autodesk and SideFX, respectively—and thus a unique opportunity for me to build research partnerships.

Evaluation: The test case for this research is the generation of a collection of brushstrokes from a single RGBD image that approximates what an artist might draw in XR. In particular, Google’s Tilt Brush, a 3D light-painting application promoted alongside the Vive hardware in 2016, has become popular enough with the general public to provide meaningful quantities of 3D drawing data for comparison. Point cloud segmentation is a computer vision challenge, but my application of it here is also one of human vision: the drawing process records only information from a scene that was subjectively important to an individual artist. The results may serve as a database usable in research on human vision, just as the dataset of 50 million Quick, Draw! drawings has sparked new projects.

Qualifications: I have sixteen years’ experience as a professional artist working in animation, games, and live performance; my career highlights includes winning Best Animated Short at SXSW 2010 for The Orange and leading development for the Engadget Alternate Realities Prize-winning XR game Mapper’s Delight in 2017, alongside Fulbright and Eyebeam fellowships and grants from the Canada Council for the Arts and the arts councils of Ontario, Pennsylvania, Toronto, and West Virginia. My commercial development roles require a comprehensive knowledge of the standard VFX pipeline; my skills encompass game design, technical direction, mobile and desktop app development, binaural sound design, image processing, applied ML, and motion capture supervision.
References


