Landscape Forms: Machine Learning, 3D Form and Figuration

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Abstract

It is hard to predict just how much Machine Learning will transform creative processes in the arts and humanities. Improved denoising applications (Kaur, Singh, and Kaur, 2018) demonstrate how existing creative processes can be optimised and generative applications such as StyleGAN (Karras, Laine, and Aila 2019) demonstrate a new pathway to the creation of form and figuration. As new approaches transition from computer science into APIs, plugins and embedded functions, generations of artists will metabolise possibilities and make new entries into our collective cultural database. This abstract presents initial results from the project *Collaborative Artistic Production With Generative Adversarial Networks* underway at Hong Kong Baptist University's Augmented Creativity Lab. In this artwork and academic presentation, we investigate how Generative Adversarial Networks (GANs) can be used to create three-dimensional forms. We created a dataset of 27,000 .obj models of trees and are training multiple configurations of a voxel-based GAN to generate new 3D models of trees. The architecture of our system is based on the 2017 paper by Wu et al, but where their GAN was trained on geometrically predictable forms such as chairs and tables, we want to see how these systems handle less predictable forms such as trees. The term 'predictable' here is paradoxical. Lindenmayer systems have been used to procedurally generate trees for over 50 years (Lindenmayer 1968) and were used to generate our dataset, so our dataset is predictable from this algorithmic standpoint. However, the results of our voxel-based tree GAN suggest that the geometric simplicity by which a chair occupies a three-dimensional volume is in dramatic contrast to the geometric complexity by which the branching of trunk, branch and branchlet occupy the same volume. Put simply, it has been harder for us to use a 3D GAN to produce trees than to produce chairs, but the 3D forms we see along the way offer a fascinating glimpse of how the GAN learns the process of form and figuration. In this conference, we will present this process as an academic talk as well as a 3D animated artwork, which presents our

results in the context of Romantic and Chinese literati landscape composition.

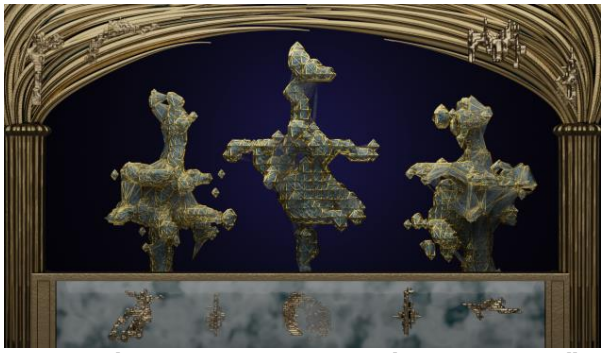

Fig. 1. *Landscape Forms*, 2021, Peter Nelson, animation still. Copyright Peter Nelson 2021.

Our academic presentation will be divided into three parts. First, we will describe how we produced our dataset of 3D trees. Second, we will summarise our various optimisations of the voxel GAN approach. Third, we will introduce the animation that we propose to present at the conference exhibition. The animation uses the 3D models generated in our research and shows the process of our GAN learning the form of trees through various epochs, composed using a combination of Romantic and Chinese literati landscape paintings. This visual paradigm was selected to contextualise our exploration of aesthetic form within the historical paradigm of using landscape and trees as a form of poetic allusion. The animation will be combined with GAN-derived music, created by another member of the *Collaborative Artistic Production with Generative Adversarial Networks* team, with special reference to the musical influences of Romanticism and the Chinese literati.

References

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Biography

This artwork is an output of the project *Collaborative Artistic Production with Generative Adversarial Networks* underway at Hong Kong Baptist University's Augmented Creativity Lab and relies on systems developed by the team comprising **Peter Nelson**, **Roberto Alonso Trillo**, **Daniel Shanken**, **François Mouillot**, **Mathis Antony**, **Ryan Au**, **Maya Duan** and **Jianming Mai**. Peter Nelson is the lead artist on this work. He is a visual artist and academic working at the intersection of landscape theory, computer games and computer graphics. He examines the history of landscape images, how they are remediated by technological shifts, and how these shifts absorb and reflect changes in our relationships with the physical environment.