# Asking the Impossible on SSX: Creating 300 tracks on a ten track budget

Caleb Howard
Electronic Arts Canada
choward@ea.com

Carlos Lemus
Electronic Arts Canada
carlosl@ea.com

## Abstract

The world created for the latest release of the snowboarding game SSX posed the challenge of delivering massively increased volumes of content over previous releases without increasing the budget.

The success of the game depended on drawing a new audience into an experience equal in scale and quality to the current generation of gaming console, while remaining true to the expectations of a large existing fan base.

To retain the essential flavor of the game for the fans, while generating ten-to-twenty times the content required not only a new pipeline for content generation, but a whole new way of thinking about how content is created. To accomplish this, we implemented an evolving procedural pipeline. This type of approach is still relatively uncommon in game production, and so it required an educational process in parallel to the technical development.

This talk discusses the technical, cultural, and production challenges faced in the creation of the massive world of SSX.

## 1. An evolving pipeline

A key advantage available in building procedural production tools is that of quick turnaround. Using the rapid-prototyping capacity of Houdini to iteratively build and deploy a modular system of integrated tools has allowed us to respond to the changing needs of the Art Directors, and at the same time to harness the growing understanding of the level designers as they gained experience with a more analytic way of planning their work.

Our approach was to deploy a simple model of a full pipeline as quickly as possible, while planning for continual revision. Putting this initial toolset into the hands of the designers early in development allowed them to identify needed enhancements right away. At the same time, by fostering a rapid deployment, and tight communication between the designers and the tool-builders, the designers were quickly educated to the analytic mindset most conducive to conceiving and implementing procedural tools. As their skills grew, the tools evolved to match their growing facility with procedural thinking. With each iteration, they were better able to track the changing demands of Art Direction, and the evolving requirements of the gameplay engine.

## 2. Improving terrain representation

The first pipeline was the simplest possible implementation. Built in a matter of days from the proof-of-concept used to pitch a procedural approach, it initiated the development of the pipeline at the same time as priming the pipeline to start generating content immediately. Initially, the pipeline was based on 2D manifolds conformed to global elevation maps from N.A.S.A. together with a straightforward set of tools which allowed designers to sculpt


**Figure 1***: Procedurally generated terrain and instances*

the terrain manifolds into playable surfaces. This allowed for an immediate source of a lot of real-life data to test gameplay against, but was topologically limited to plane-homeomorphisms.

As the game engine was developed, requirements for more complex topological features in the terrain suggested a Signed Distance Function (SDF) represented in a uniform, voxel-based volume representation. This was implemented with a suite of tools patterned on the familiar and mature workflow of image composition, applied to voxel arrays, rather than pixels. These second generation tools were developed to the designers' specification while they worked uninterrupted on the First generation tools. With a volume representation, we implemented Boolean operators, and swept-path operations to allow for the introduction of creative elements like ledges, crevasses and tunnels. As a last stage to this pipeline, the SDF was transformed to a mesh for export to the game engine.

Once the switch to a volume-based pipeline was made, the representation and tools were able to evolve without interruption. Resolution limitations of uniform voxel sets led to the development of hierarchical voxel sets to define features at various scales. This led to the need to develop a novel surfacing algorithm to transit the voxel set boundaries. Finally, memory constraints led to the implementation of a nonuniform point cloud representation with the challenges of implementing Boolean operations in that paradigm. Throughout this ongoing process of deployment and upgrade, the designers' work was uninterrupted.

## 3. Results

SSX delivered more than ten times the content of previous releases of the game. We faced challenges with dramatic production changes, while implementing a entirely new development and production pipeline, and facing the need to educate an entire team to a different way of thinking about production. We now have a pipeline, and expertise in the hands of tool builders and artists. In addition, we have proven the efficacy of procedural methods sufficiently to have seeded broad interest across all domains of game production at Electronic Arts.


SIGGRAPH 2012, Los Angeles, California, August 5 – 9, 2012.
ISBN 978-1-4503-1435-0/12/0008