Rampage: A Pipelined Approach to Managing Large Scale Character Driven Effects.

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Figure 1: *Rampage* required procedural and repeatable simulation workflows that allowed for large scale destruction with large and fast moving creature animation

ABSTRACT

We present the workflow and methodology for managing large scale destruction and volumetric simulations within Weta Digital's proprietary pipeline for the live action feature *Rampage*. Starting with character motion and a structurally accurate, highly detailed, geometric building model, we manage large asset data flow, simulate and render rigid body destruction and generate multiple material volumetric events.

CCS CONCEPTS

• **Computing methodologies** → Physical simulation;

KEYWORDS

simulation, pipeline, destruction, rigid body dynamics, volumetric

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1 INTRODUCTION

The scope of work that was considered for *Rampage* was massive in scale and heavily relied on creature driven interaction. The building assets that were generated for destruction by the look development departments also posed a simulation challenge given their geometric and shading complexity. This complexity was needed not only to replicate the structural integrity during simulation, but also to deliver the photo-realistic, client approved design.

The modeling detail required to replace their real-world counterparts within a scene made for slow artist iterations using previous FX workflows at Weta. Thus, a procedural and repeatable workflow was created to receive visual feedback on motion and simulation details while asset development and final looks were still in progress.

Rampage's requirements allowed us to find solutions as to how a heavy volume of diverse simulation work can live within an asset and creature centric pipeline, which can be difficult to achieve during fast paced and time critical production schedules. The workflow principles that we've developed gives in-practice insight to handling large scale FX products, which we call assets, from their upstream ingestion to their downstream delivery.

2 WORKFLOW

Weta Digital's pipeline is asset centric. This distinction comes with the benefit of re-using high fidelity assets in master-layouts for sequences and shot-specific additions. Updates on geometric models and look development are pushed automatically through these

Figure 2: Procedural workflows were created for the ingestion, simulation and replacement of assets within Weta Digital's *Atlas* scene description workflow.

master layouts and into shots via Weta's proprietary *Atlas* scene description and evaluation system. The high-fidelity assets used within these layouts make for extremely complex collections, and single shots can contain thousands of assets in addition to over 100,000 instances.

While this construct is great for fast delivery of large rendered cg environments across sequences, it poses a challenge for FX workflows that previously required an FX artist to load and parse massive amounts of data manually in a non-proprietary software package. *Atlas* allows us to handle these massive data-sets and now, with Weta's integration into *Houdini*, we are offered a way to inspect these highly complex shots and layouts without needing to load geometry into memory to sort through it.

Our *Rampage* FX pipeline's primary goal was to isolate destructible assets, i.e. buildings and their components, based on artist manageable criteria and ingest them at a low cost. These criteria include, but is not limited to; building floors, building sections or wings, internal dressing assets such as office furniture and plants, object material types, proximity to interacting objects and creatures. This multi-faceted "red carpet" reduced the amount of scene data that needed to be ingested into *Houdini* and reduced simulation overhead. Weta's previous workflow involved intensive manual selection within *Atlas* which hindered optimization.

After ingestion, we were able to utilize the hierarchy structure that is defined by the shading and texturing of assets to organize a material-based data flow and run optimized simulations. Procedurally, we separate building materials, apply fracturing looks, preset physical properties including mass and surface friction, and build glue and hard rigid body constraint networks between assets.

Post rigid body simulation, we were now able to replace the parent asset within the *Atlas* workspace with our simulated FX asset. This updated structure, which is ingested by other consumers of our pipeline, can be managed outside of FX for scene lighting requirements and animation refinement, as well as switched back to the original, non-simulated asset if required. This allowed us to preserve the upstream data, ingest any look development asset changes without re-simulating, and view our simulation work between different software packages, maintaining the integrity of the approved design.

Concurrently, we were able to generate various types of emission criteria using data collected during the simulation, such as velocity of objects in different states of duress and specific impact data between building material types. These criteria were used as source data for generating secondary debris and volumetric dust at no cost to the artist. Weta Digital's in-house simulation software *Synapse* was used to ingest this data to create multiple material volumetric simulations based on the properties of the building materials that were queried on the *Atlas* ingestion.

Figure 3: Secondary ridig body simulations and volumetric dust simulations driven by destruction were generated with Weta Digital's Synapse software using emission criteria driven by data collected during rigid body simulation.

3 CONCLUSION

Iteration speed and procedural workflows were a big requirement for *Rampage's* scale and creature interaction requirements. Properly ingesting assets and returning them to render-able assets with simulated motion required tools that would integrate properly within Weta's pipeline. Delivering physically based simulation data in a timely manner was paramount to achieve realistic and believable FX work within half the time of previous destruction heavy projects.

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