KARA

Newsletter – Issue 002

Welcome to the KARA newsletter. These newsletters will keep you informed about the research and development that the KARA project team are undertaking.

Contents

In this edition we take a look at the ways generative AI can help with automatically texturing 3D models. We'll walk you through some of our early research that combines automation with GAI.

Pipeline Spotlight: Texturing 3D Building Assets
AI assisted with ComfyUI and Stable Diffusion

IMPORTANT: Inclusion of tools in this newsletter does not imply their clearance for use.

What is KARA?

In 2023, Project AVA took on the challenge of utilising Generative AI tools to assist in the design and development of a videogame from scratch. This applied R&D approach gave us the best insights into the true potential of AI for video game development.

The AVA team went to GDC in 2024 to report on their findings (watch the video).

KARA is the continuation of this effort. Using Electric Square's *Detonation Racing* as a case study, the team's plan is to remaster the game using pipelines infused with Generative AI tools.

The goal of KARA is to further enhance our expertise in Generative AI for game development. This includes a focus on how GAI tools can boost 3D art pipelines.

PIPELINE SPOTLIGHT

Texturing 3D Building Assets.

Introduction

Texturing a 3D game asset is a sophisticated blend of artistry and technology. Artists digitally paint materials onto the surface of the 3D asset, creating the illusion that the object is composed of various substances—from brick and metal to the weathered texture of ancient stone.

This intricate process involves carefully mapping 2D images onto 3D models through UV unwrapping and texturing. Using specialized software like Photoshop, Substance Painter, and 3D Studio Max, artists create "texture maps" that define properties such as colour, roughness, and reflectivity to achieve diverse visual results.

While texturing has traditionally been a hands-on artistic endeavour, recent AI advancements can now assist in generating and projecting game-ready textures. This innovation potentially accelerates production while maintaining high quality standards.

PIPELINE SPOTLIGHT

Texturing 3D Building Assets.

STANDARD PIPELINE

Standard pipeline

1 Preparation

Artists gather high-quality reference materials, including photographs, material samples, and concept art.

They then analyse surface properties, lighting conditions, and real-world wear patterns relevant to the asset.

2 Asset Creation

Using specialized software, artists create multiple texture maps for the 3D model.

These maps focus on realistic detail, material properties, and environmental influences.

Artists can then employ photorealistic techniques such as photo sourcing and procedural texturing to achieve the desired results.

3 Translating 2D to 3D

The model is unwrapped to UV coordinates. This allows a two-dimensional image to be stretched over the model.

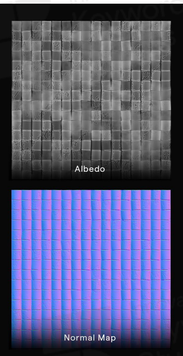
This process, known as UV unwrapping, is often accomplished through methods such as planar, cylindrical, or spherical projection.

To minimize image distortion, the UV coordinates are then carefully refined.

4 Integration

Completed models and textures are integrated into the game engine. Additional texture channels can be added to control the material properties. This is common in physically based rendering pipelines.

Artists test the asset in various in-game conditions, making final adjustments to perfect its appearance in the actual game context.



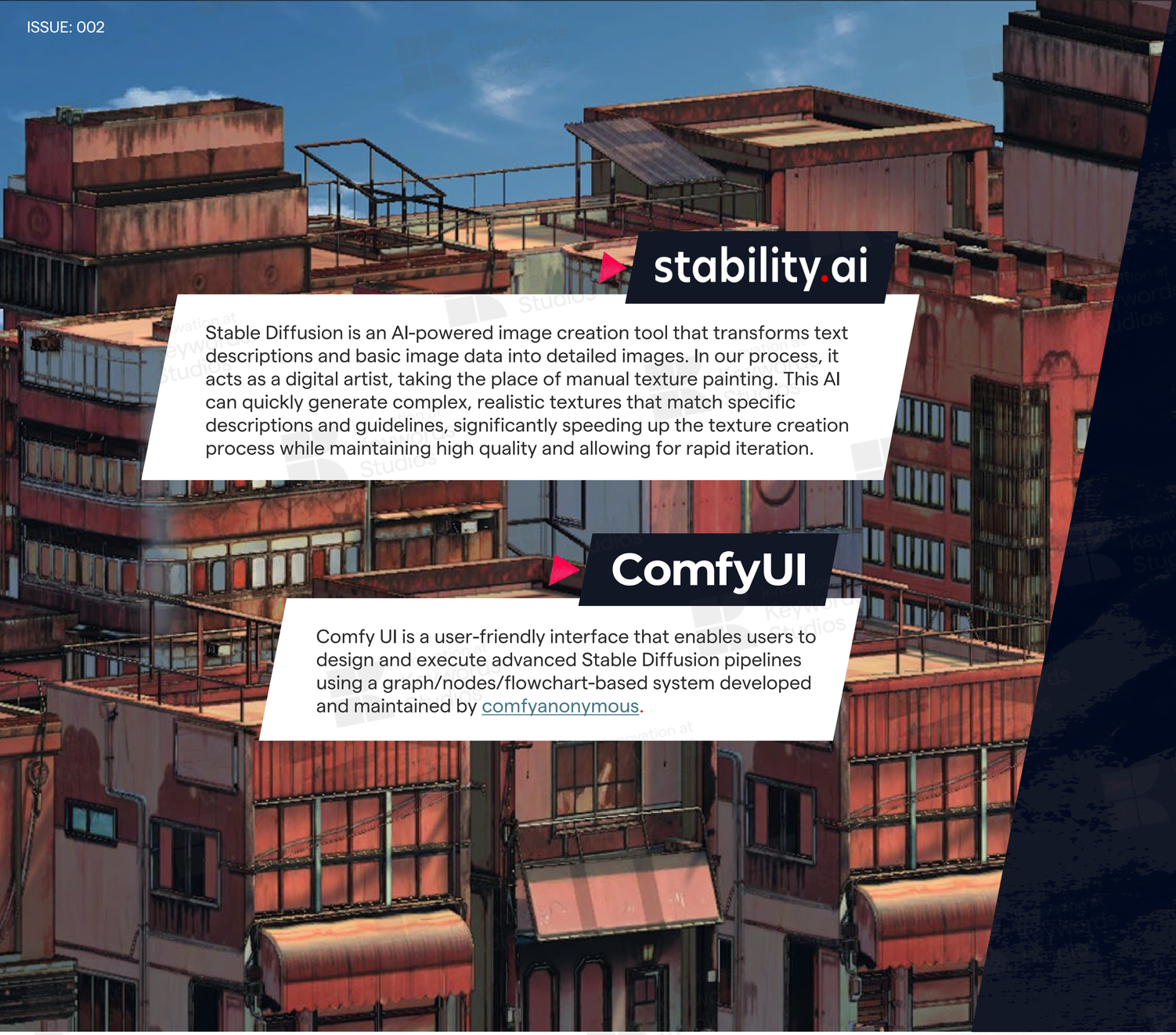
Considerations

Realistic PBR textures vs stylised textures

PBR texturing typically utilizes multiple maps, such as albedo, normal, roughness, and metallic, to achieve realistic material representation. Stylized texturing, while sometimes simplifying this approach, often still employs multiple maps but with differing priorities.

The albedo map (base colour) may carry more visual information, with normal maps and other channels serving to enhance the stylized look.

The key distinction lies in how these maps are created and combined to achieve a non-photorealistic, artistic style while still leveraging modern rendering techniques.



stability.ai

Stable Diffusion is an AI-powered image creation tool that transforms text descriptions and basic image data into detailed images. In our process, it acts as a digital artist, taking the place of manual texture painting. This AI can quickly generate complex, realistic textures that match specific descriptions and guidelines, significantly speeding up the texture creation process while maintaining high quality and allowing for rapid iteration.

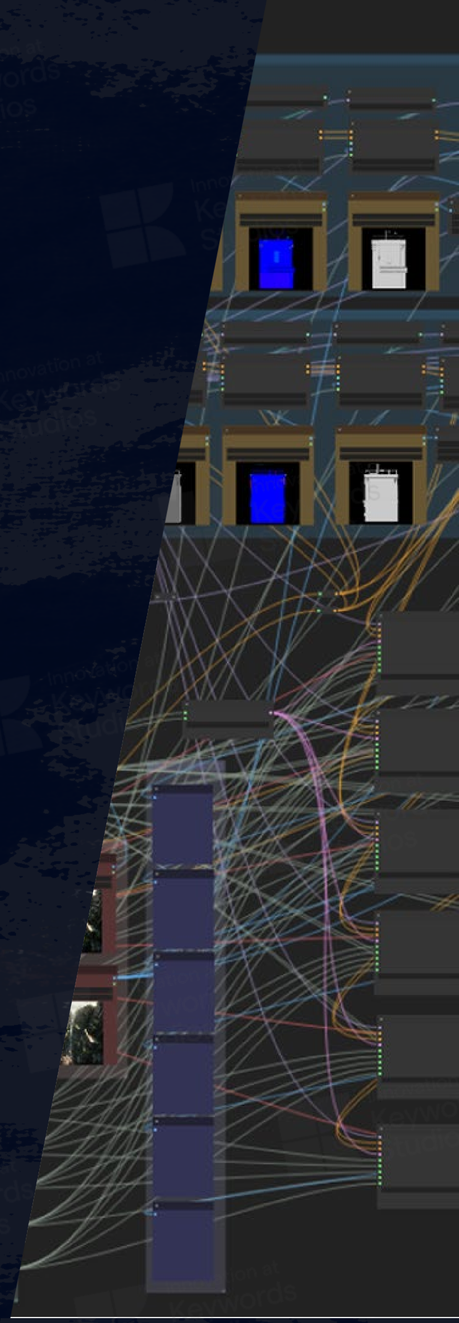
ComfyUI

Comfy UI is a user-friendly interface that enables users to design and execute advanced Stable Diffusion pipelines using a graph/nodes/flowchart-based system developed and maintained by comfyanonymous.

An introduction to GAI tools: ComfyUI and Stable Diffusion

Using ComfyUI and Stable Diffusion, we can incorporate community-trained models, often known as LoRAs (Low-Rank Adaptation) or fine-tuned models.

These specialized versions of Stable Diffusion have been further trained on specific datasets to produce particular art styles, subjects, or visual characteristics that the default Stable Diffusion model may not consistently achieve.



Tools used:

stability.ai ComfyUI

PIPELINE SPOTLIGHT

Texturing 3D Building Assets.

AI INFUSED PIPELINE

1 Model Preparation

Import the model into Unity.

Use the ‘Texture Generation Tool’ to bake essential textures required by the template setup in ComfyUI.

This process creates ‘data textures’ for the AI to interpret. These are distinct from the final game asset textures.

2 Art Direction and Reference Gathering

Collect mood boards, concept art, and reference images from the art team.

Analyse these materials to understand the desired style, colour palette, and specific details for the asset.

These references will be used later to guide AI generation.

3 AI Setup

Load the tool template and apply the ‘data textures’ to their respective slots.

Adjust base control parameters to fine-tune AI settings.

Input detailed positive and negative prompts describing the desired outcome, incorporating elements from the art direction.

Modify AI models, VAE, and LORAs to achieve specific art styles or inspired looks based on the gathered references.

4 AI Generation

Send the prepared queue to ComfyUI to initiate the image generation process.

Export and encode the generated images to a selected destination.

5 Texture Finalization

Import the AI-generated images back into Unity.

Use the 'Texture Projection Tool' to project and bake these images onto the model.

This process creates a single, usable texture that conforms to the model's flattened UV layout, resulting in a game-ready textured asset.

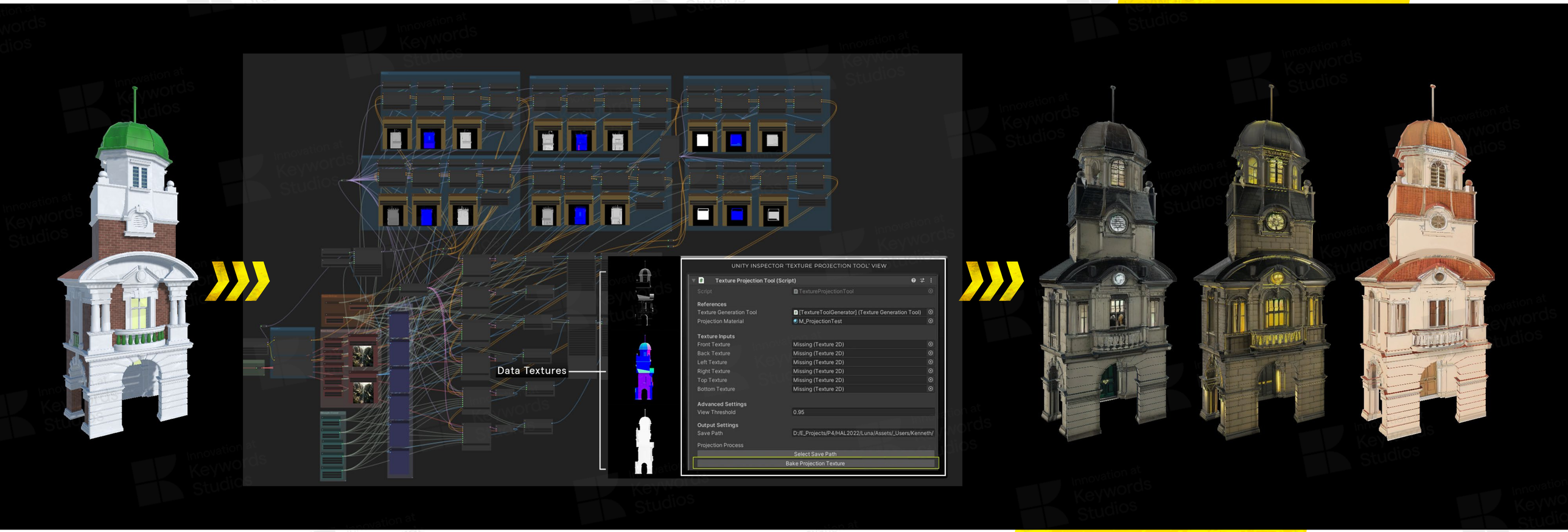
Tools used:

stability.ai | ComfyUI

PIPELINE SPOTLIGHT

Texturing 3D Building Assets.

For *Detonation Racing*, we put the existing building assets through this pipeline. This is an experiment of outputting varying styles:



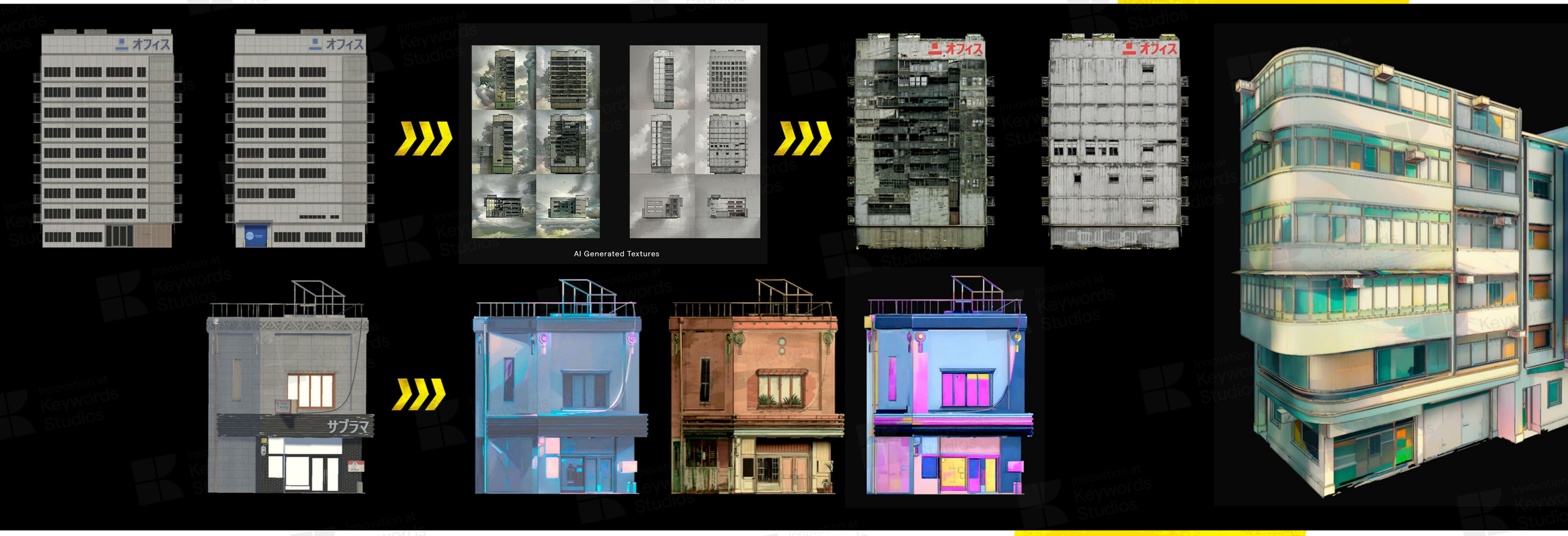
Tools used:

stability.ai | ComfyUI

PIPELINE SPOTLIGHT

Texturing 3D Building Assets.

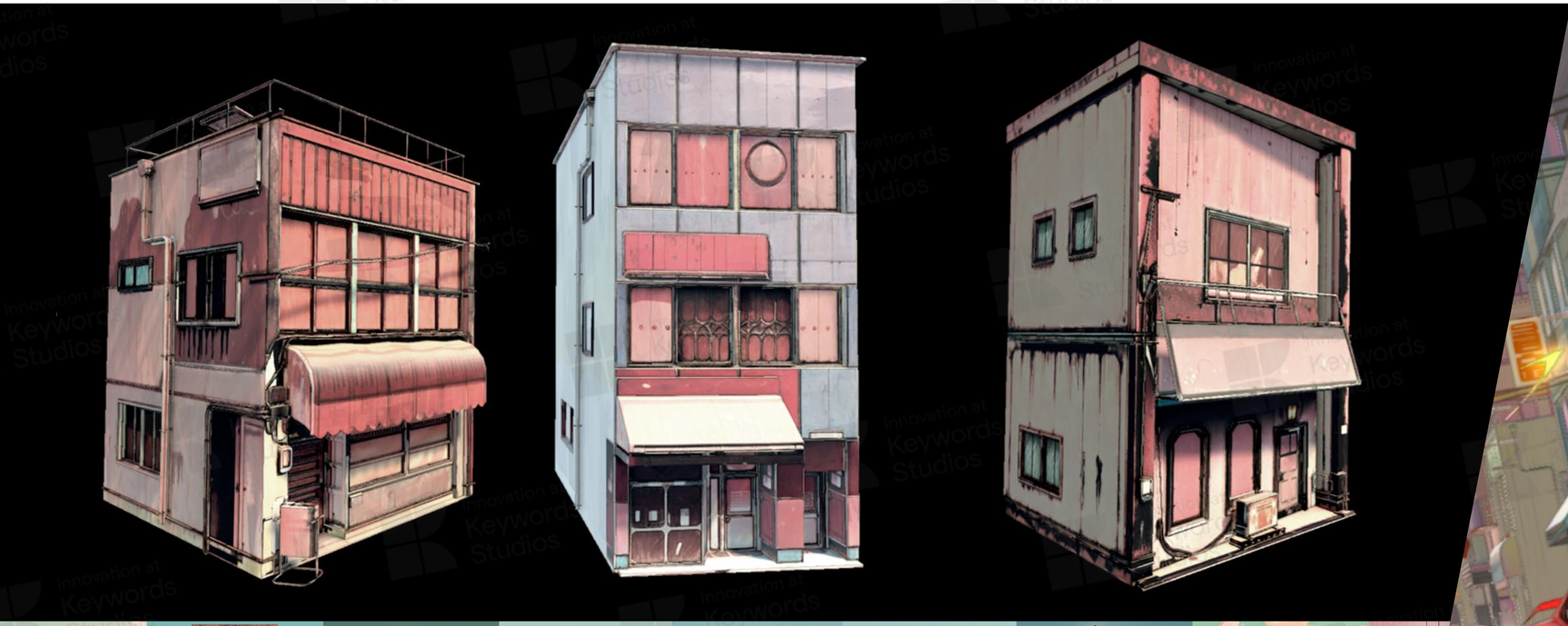
Results of re-texturing buildings in *Detonation Racing*.

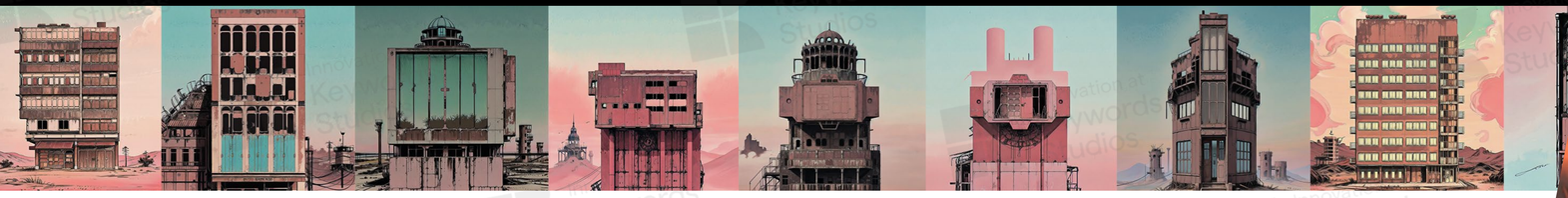


PIPELINE SPOTLIGHT

Texturing 3D Building Assets.

Assets generated for an artistic beauty corner created during post-production of Detonation Racing remaster.





Tools used:

stability.ai ComfyUI

Thank you.

Featured in the next issue:

Agent Swarms: Expanding the scope of chat bots