

Protocol: Shatter

Environmental destruction for player immersion

Introduction

- **The Problem:** Environments in modern games feel static and unrealistic, breaking player immersion.
- **Ludonarrative Dissonance:** A disconnect where player actions (shooting/attacking) do not match the environment's lack of response.
- **The Solution:** A fully destructible arena in UE5 inspired by *Battlefield* and *Marvel Rivals*.
- **The Impact:** Better player engagement by removing linear paths and allowing for emergent gameplay.

Research Methodologies

Literature Review: Analysed industry-standard destruction techniques to establish a technical roadmap.

Primary Source: GDC Vault session: *"Smash the Scene"* (Marvel Rivals).

Balanced Design: Used these insights to balance high-fidelity destruction without overloading player performance.

Goal: Moving from scripted events to fluid, reactive physics using Chaos Destruction.

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Session Name: Smash the Scene in 'Marvel Rivals'
Speaker(s): Xiaosheng Li
Company Name(s): NetEase Games
Track / Format: Programming

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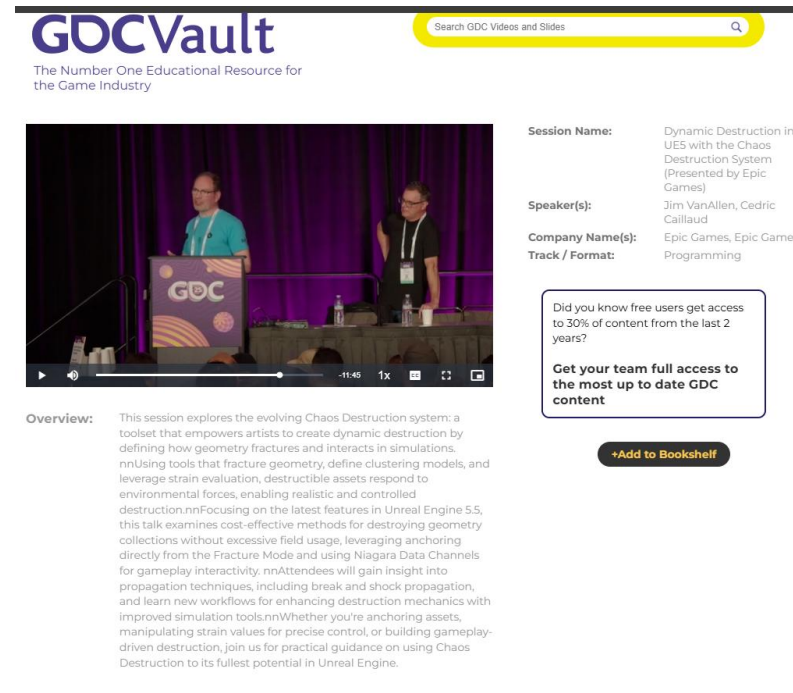
Overview: The conception of environmental destruction in Marvel Rivals aimed to capture the scale of world-breaking combat synonymous with Super Heroes. If the Hulk cannot demolish a building, can he truly be considered the Hulk? This consensus highlighted the necessity of implementing environmental destruction. However, the transition

Game Developers Conference 2025

★		Game Developers Conference 2025 Advanced Physics in 'ASTRO BOT' by Takumi Yoshida (Sony Interactive Entertainment) Programming	➤
		Game Developers Conference 2025 Dynamic Destruction in UE5 with the Chaos Destructio... by Jim VanAllen (Epic Games) Programming	➤
		Game Developers Conference 2025 PUBG MOBILE: Creating A Fully Destructible World On ... by Chao Yuan (LIGHTSPEED STUDIOS) Programming	➤
★		Game Developers Conference 2025 Smash the Scene in 'Marvel Rivals' by Xiaosheng Li (NetEase Games) Programming	➤

Research Methodologies

- Data Gathering:** Used a forum-based testing process to record and analyze development progress.
- Comparative Analysis:** Evaluated "game feel" by comparing prototypes against *Battlefield* and *Marvel Rivals*.
- The Texturing Problem:** Discovered that standard meshes lacked internal textures, making debris look "bland" and unrealistic.
- The Solution:** Pivoted to a "Dollhouse" style architecture with hollow, double-sided textured meshes for realistic depth.
- Gameplay Integration:** Validated that the arena feel supports the core loop of destroying buildings to find keys



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Session Name: Dynamic Destruction in UE5 with the Chaos Destruction System (Presented by Epic Games)

Speaker(s): Jim VanAllen, Cedric Caillaud

Company Name(s): Epic Games, Epic Games

Track / Format: Programming

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Overview: This session explores the evolving Chaos Destruction system: a toolset that empowers artists to create dynamic destruction by defining how geometry fractures and interacts in simulations. Using tools that fracture geometry, define clustering models, and leverage strain evaluation, destructible assets respond to environmental forces, enabling realistic and controlled destruction. Focusing on the latest features in Unreal Engine 5.5, this talk examines cost-effective methods for destroying geometry collections without excessive field usage, leveraging anchoring directly from the Fracture Mode and using Niagara Data Channels for gameplay interactivity. Attendees will gain insight into propagation techniques, including break and shock propagation, and learn new workflows for enhancing destruction mechanics with improved simulation tools. Whether you're anchoring assets, manipulating strain values for precise control, or building gameplay-driven destruction, join us for practical guidance on using Chaos Destruction to its fullest potential in Unreal Engine.

Project Aims & Final Deliverables

- **Primary Aim:** Create a fully destructible level arena where destruction is fluid and realistic.
- **Core Gameplay:** A collection loop where players must destroy buildings to find keys and unlock a final door.
- **Technical Objectives:** Mastering UE5 Chaos systems, iterative prototyping for "game feel," and clear level design.
- **Final Deliverables:** A playable environment with fractured real-time geometry.
- **System Polish:** Integrated Niagara VFX (fire and smoke) and a technical reflective journal.

Mood Board



Games that have implemented it well.



Blocked out Level. Using city references to create sense of scale in area

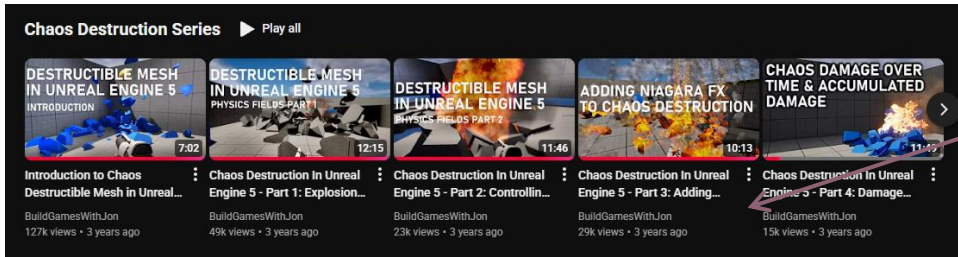
Details inspirations



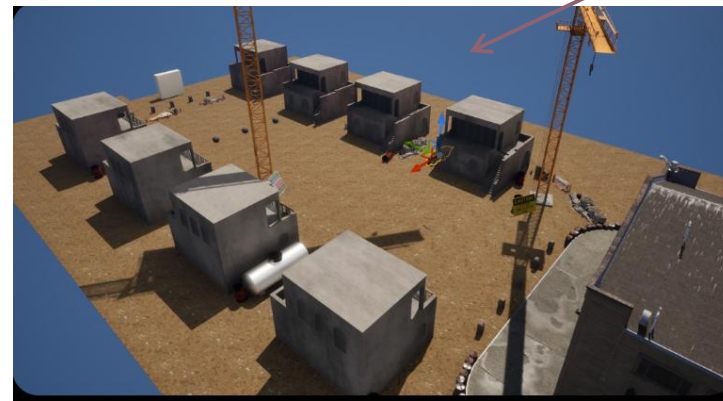
Researching how concrete creates realistic debris



Tech research. 7-part tutorial going through chaos physics and fracturing



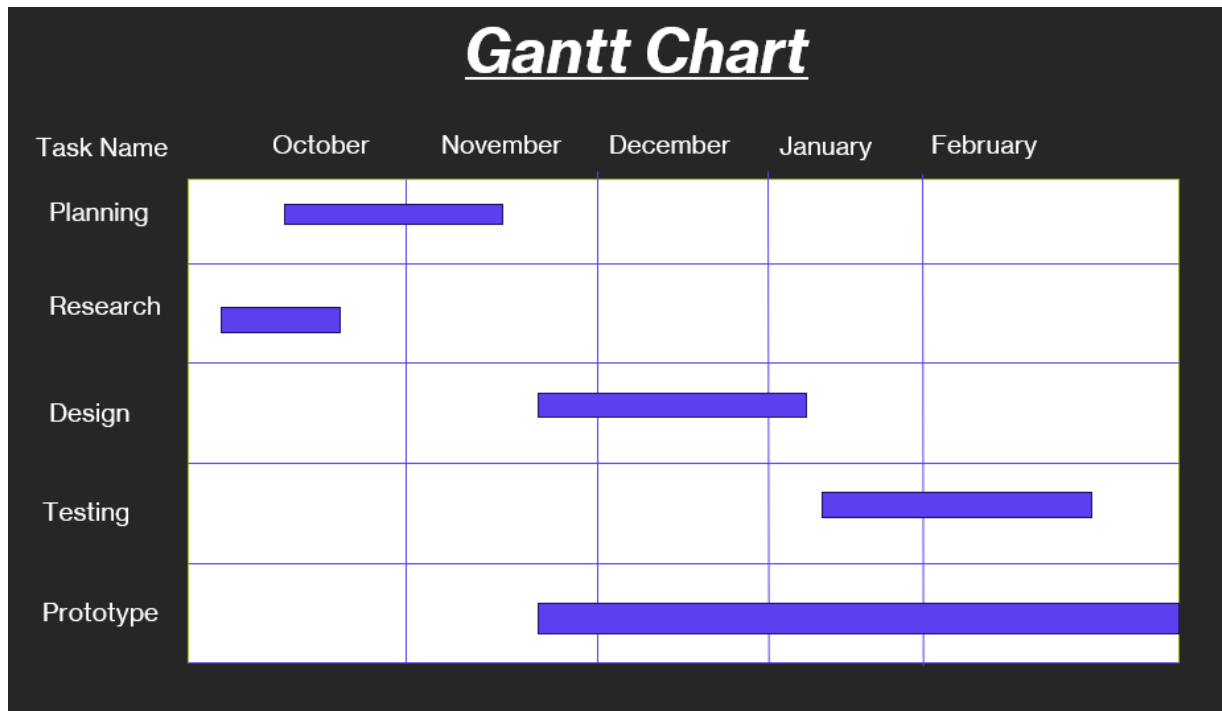
Impact the damage would leave to buildings



Colour Pallet



Documentation of Production Planning



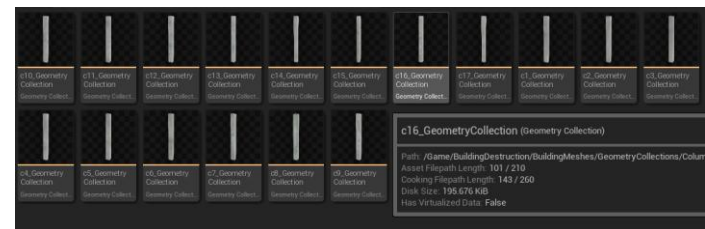
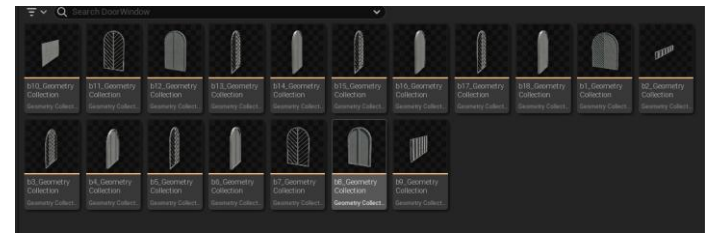
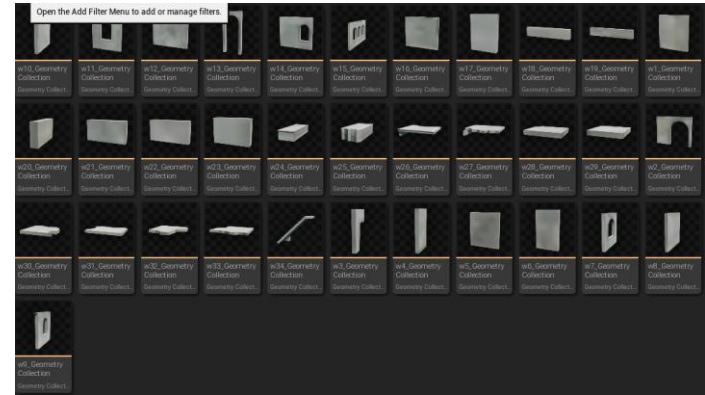
For time management stuck to the Gantt chart. Keeping research within start of October then continuing the prototype till February. For the testing

Asset List

- Buildings - Fully destructible
- Props (sandbags, cones, trash bag, bulk bag) Physics moveable
- Containers – Static Meant for blocking in player
- Warehouse – Static Player spawn
- Cranes – Semi Destructible

Technical Workflow

- **Chaos Destruction Pipeline:** Followed a specific sequence of fracturing meshes and layering.
- **Structural Integrity:** Implemented **Anchor Fields** to keep buildings standing until specific damage thresholds were met.
- **Physics Fields:** Utilized fields to create explosions and realistic crumbling effects rather than scripted animations.
- **Granular Control:** Each building component (columns, walls, doors) was fractured separately for unique physics accountability.



Iterative Prototyping

- **Throwaway Scenes:** Created multiple test environments to find the technical limits of the Chaos physics engine.
- **Scale Progression:** Moved from basic cubes to floor plans and finally full multi-story buildings.
- **Collision Customization:** Modified collision presets to ensure projectiles interacted correctly with the fractured geometry.
- **VRAM Management:** Addressed high hardware demands by using console commands like `$r.Streaming.PoolSize\ 4000$` during testing



The "Dollhouse" Implementation

- **Solving Thin Meshes:** Early prototypes looked unrealistic because walls lacked depth and internal textures.
- **Architectural Pivot:** Switched to a "dollhouse" style house to allow for textured interior surfaces.
- **Realistic Debris:** Used meshes with depth to ensure fractured pieces felt like heavy concrete/brick rather than paper.
- **Visual Matching:** Matched inner materials with exterior concrete to hide engine-specific material errors.



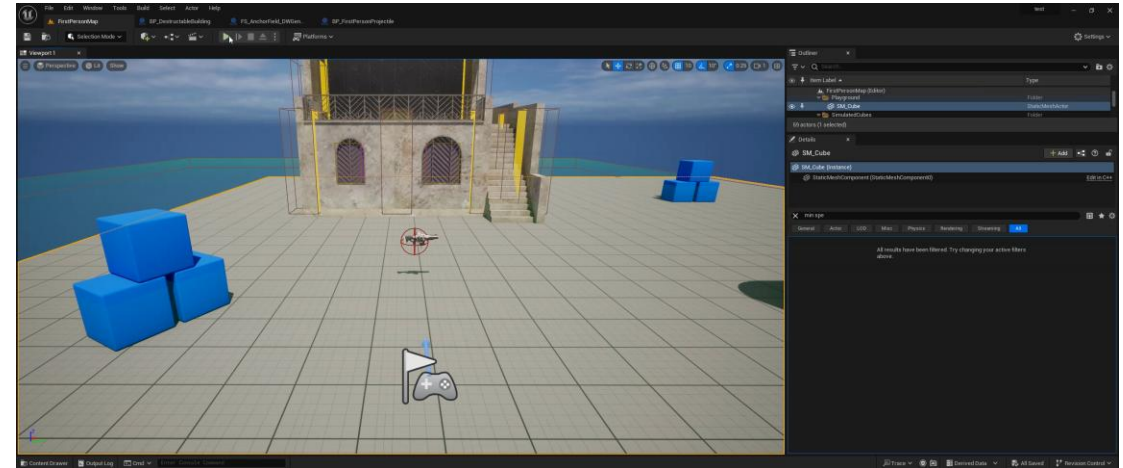
Level Design & Gameplay Loop

- **The Demo Arena:** Designed a construction site layout with container boundaries to keep the player within the play area.
- **Interaction System:** Integrated a door and key-finding mechanic to give the destruction a gameplay purpose.
- **Visual Polish:** Added post-processing and "polluted" sky lighting to enhance the atmosphere of the site.
- **Environment Density:** Balanced static containers with fully destructible buildings to manage performance.



Final VFX & Immersion

- **Impact Feedback:** Created Niagara systems for smoke and dust that trigger on building impact.
- **Camera Shake:** Implemented dynamic camera shaking to increase the weight and feel of the destruction.
- **Feedback Implementation:** Increased smoke duration and density based on initial forum tester feedback.
- **Optimization Fixes:** Solved a critical "standalone game" bug where anchor fields failed to initialize.



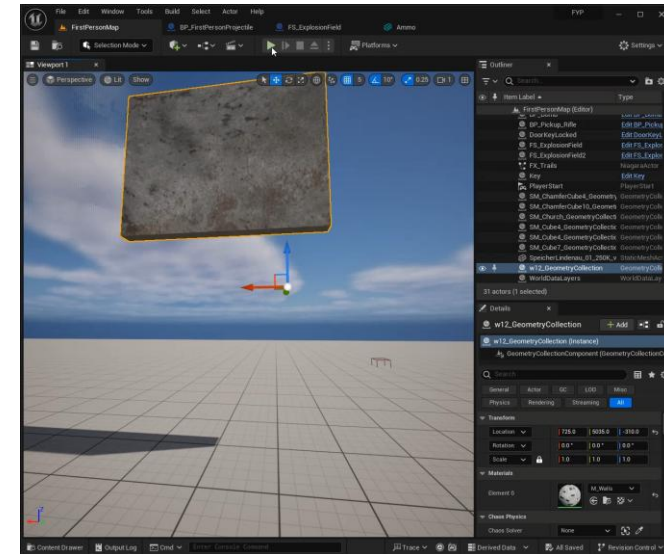
Technical Triumphs

- **Goal Achievement:** Successfully created a fully destructible arena using UE5 Chaos Destruction.
- **User Experience:** Achieved 100% agreement from testers that broken parts were easy to distinguish from intact ones.
- **Immersion:** Successfully implemented camera shake and Niagara smoke VFX to enhance the "game feel".

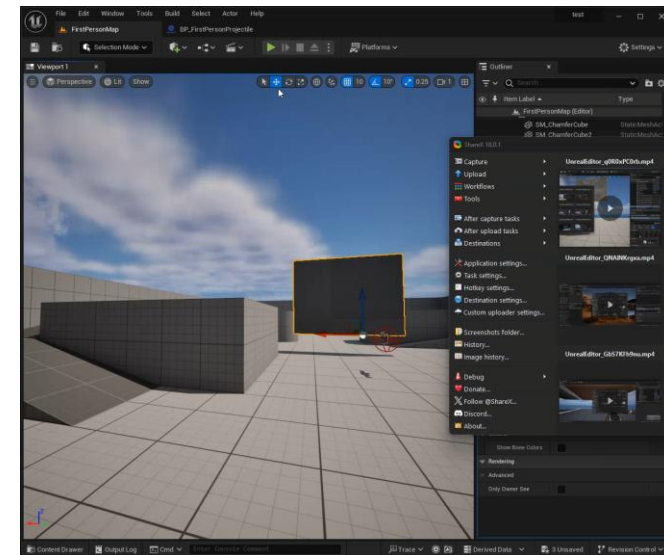


Challenges

- **The Texture Hurdle:** Discovered meshes weren't textured on both sides, requiring a pivot to "dollhouse" styled houses for realistic depth.
- **Hardware Constraints:** Managed high VRAM demands by implementing streaming pool commands and removing demanding props like explosive barrels.
- **System Bug:** Fixed a standalone game error where anchor fields wouldn't initialize properly outside the editor.



Different project settings.



Future Work

- **Current Status:** The project is a complete environment with a functioning gameplay loop (collecting keys to open the door).
- **Future Improvements:** Plans to develop custom shaders for concrete debris with broken edges.
- **Performance Scaling:** Intention to implement GPU simulation techniques to allow for even more complex destruction at scale.



Bibliography

YouTube Tutorials

Intro to Chaos

<https://www.youtube.com/watch?v=ThZPXbEtNsE>

Explosion using Physics Fields

<https://www.youtube.com/watch?v=i5f1DevgDUu>

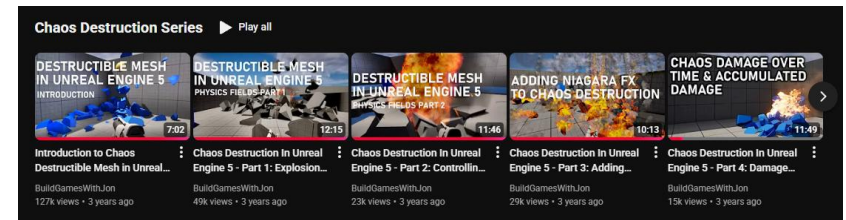
Controlling destruction with Anchor Fields

<https://www.youtube.com/watch?v=DbwCDz0zFBQ&t=513s>

<https://www.youtube.com/watch?v=9V5zqRLYESE>

<https://www.youtube.com/watch?v=Kr-zfGZF9AA&t=5527s>

<https://www.youtube.com/watch?v=hlz4WwIfRN8>



<https://www.youtube.com/watch?v=1-a5zDkZhA0&t=77s>



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Thank you for listening to my presentation

Researcher Harshiv Pankhania