Protocol: Shatter

Environmental destruction for player immersion

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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.

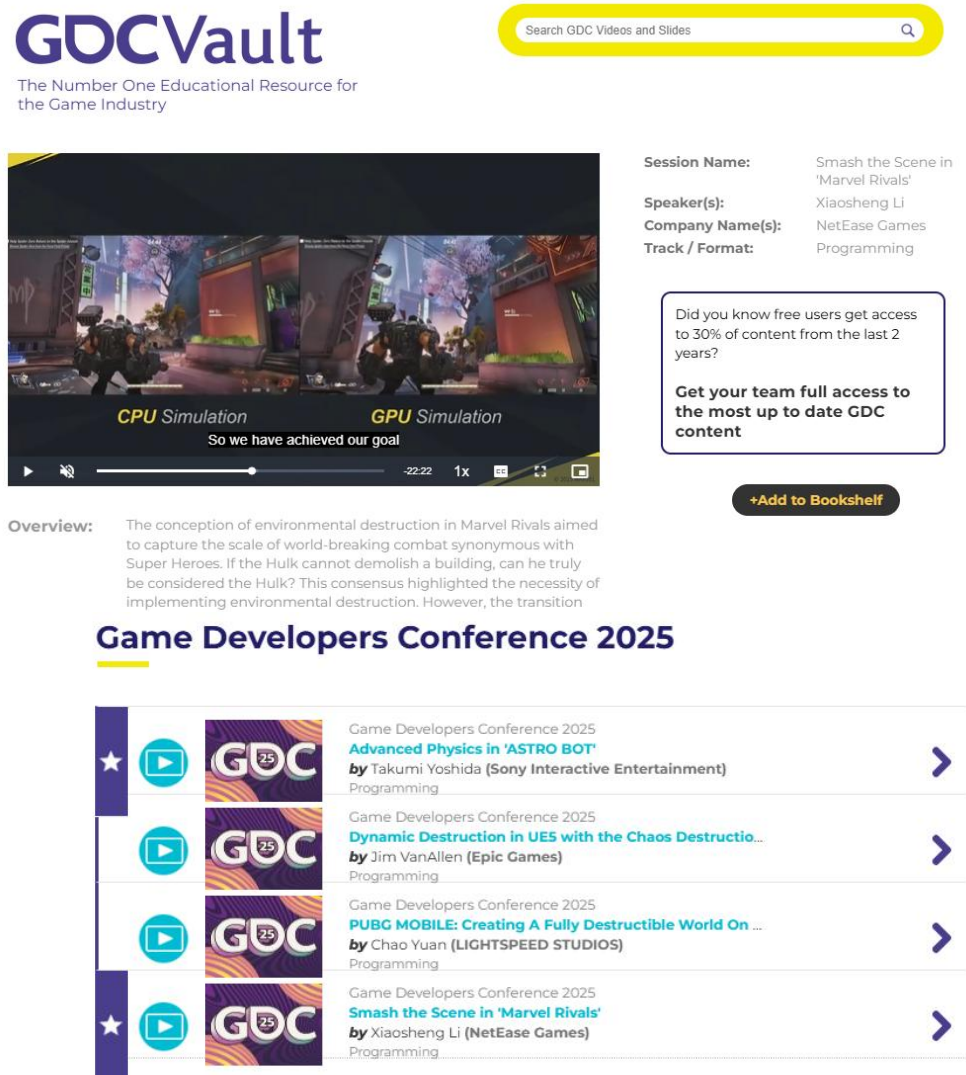
Research Methodologies

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.



Research Methodologies

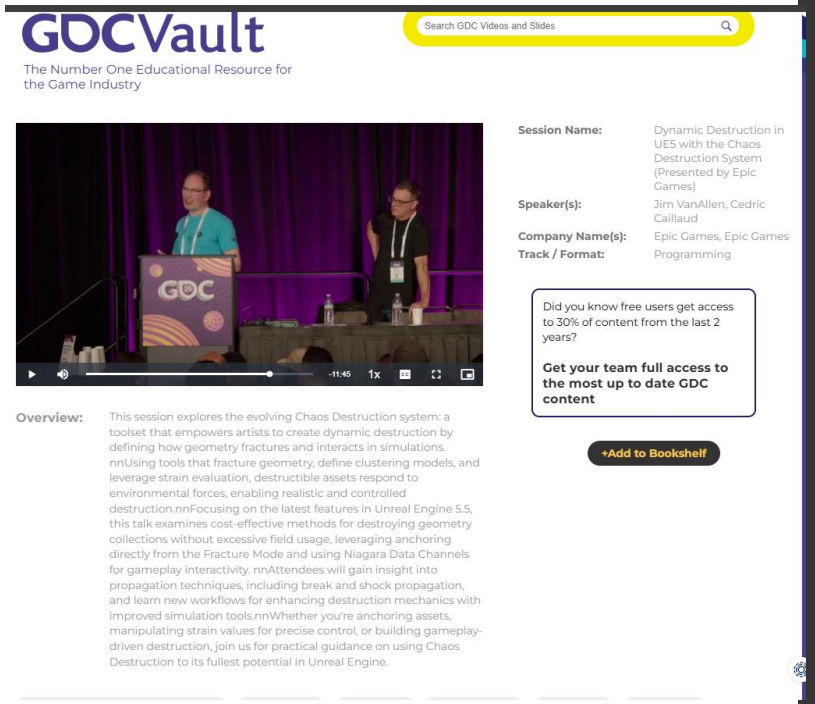
•**Data Gathering:** Used a forum-based testing process to record and analyze development progress.

•**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.

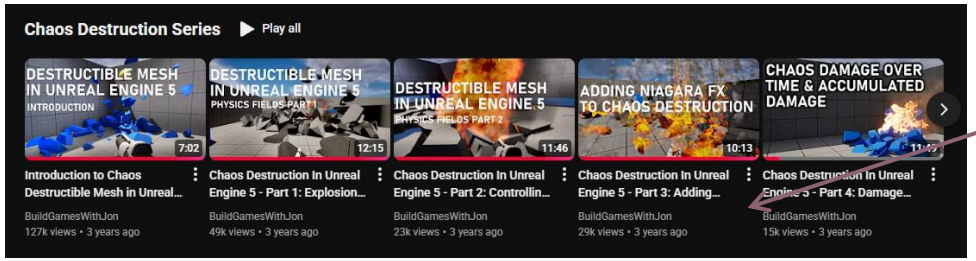
•**Gameplay Integration:** Validated that the arena feel supports the core loop of destroying buildings to find keys



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



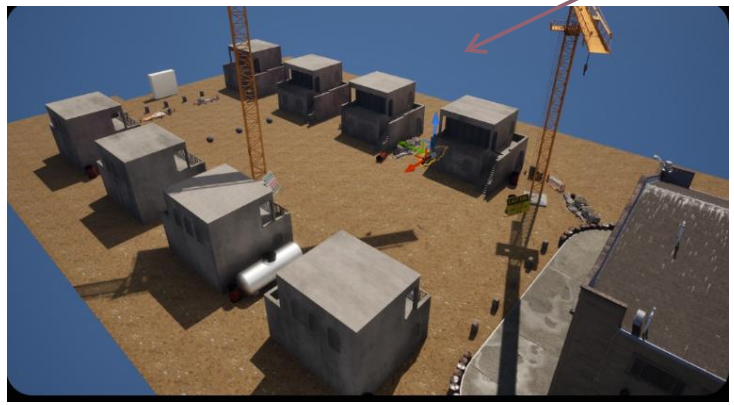
Tech research. 7-part tutorial going through chaos physics and fracturing

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

Games that have implemented it well.

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

Impact the damage would leave to buildings

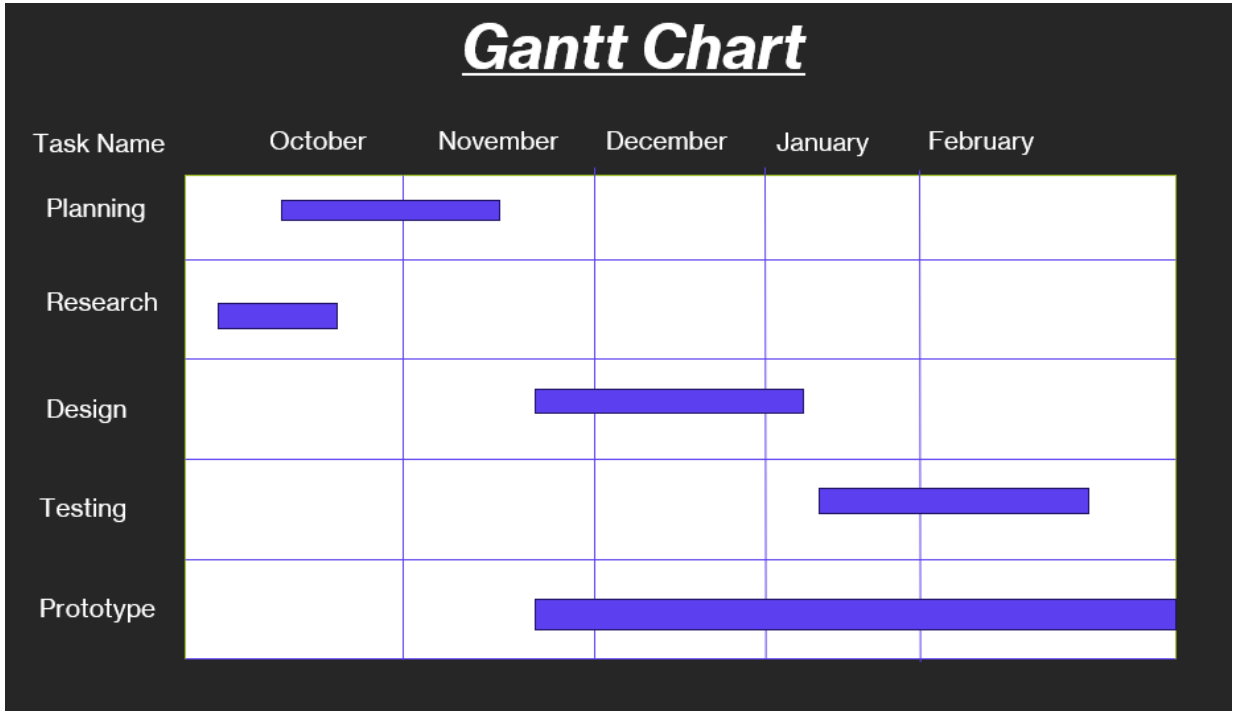


Details inspirations

Colour Pallet

Researching how concrete creates realistic debris

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

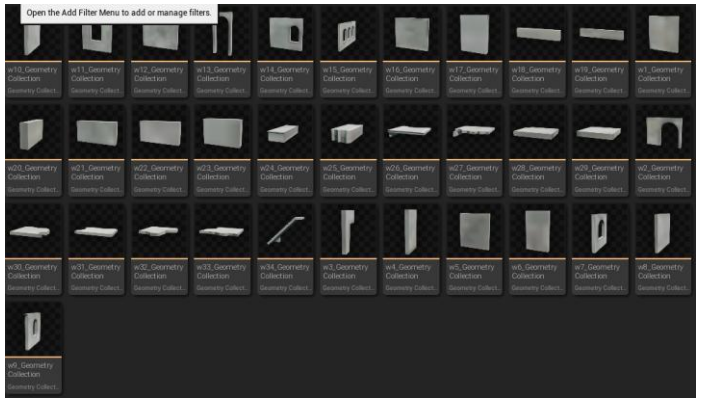
Technical Workflow

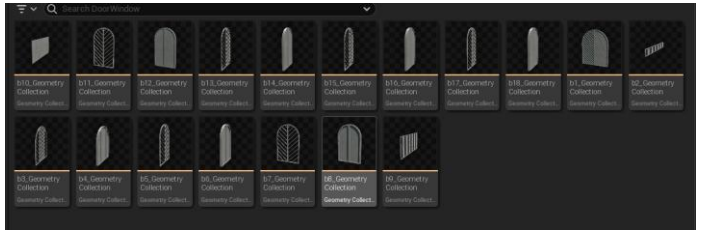
- **Chaos Destruction Pipeline:** Followed a specific sequence of fracturing meshes and layering.

- **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.

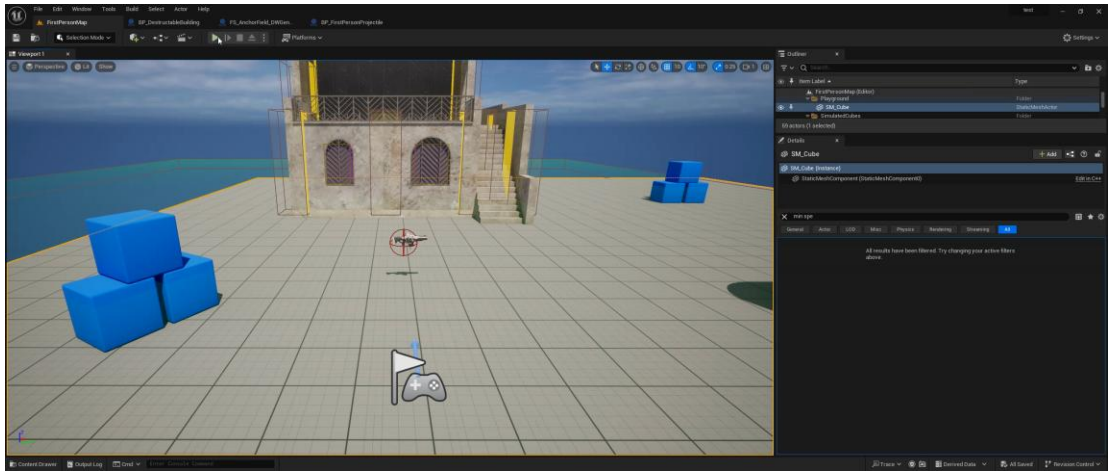
- **Visual Matching:** Matched inner materials with exterior concrete to hide engine-specific material errors.

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

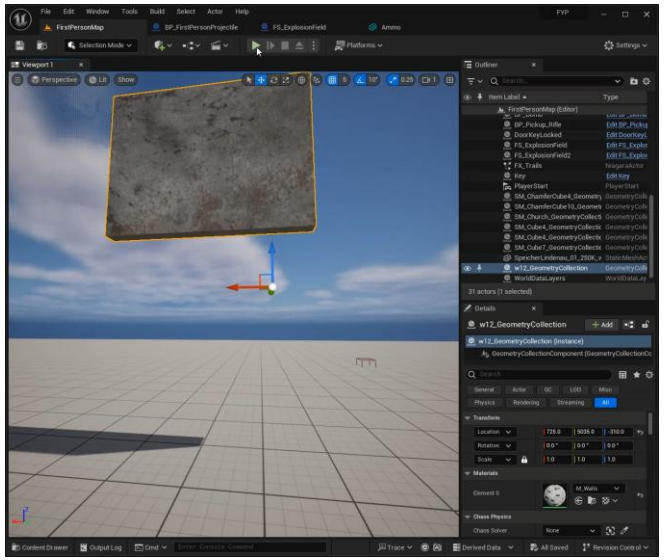
- **Goal Achievement:** Successfully created a fully destructible arena using UE5 Chaos Destruction.
- **User Experience:** Achieved 100% agreement from testers that broken parts were easy to distinguish from intact ones.
- **Immersion:** Successfully implemented camera shake and Niagara smoke VFX to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

Challenges

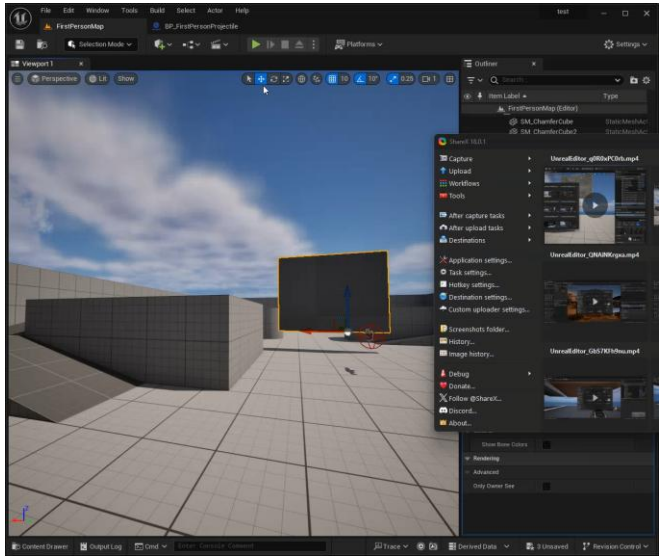
- **The Texture Hurdle:** Discovered meshes weren't textured on both sides, requiring a pivot to "dollhouse" styled houses for realistic depth.

- **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

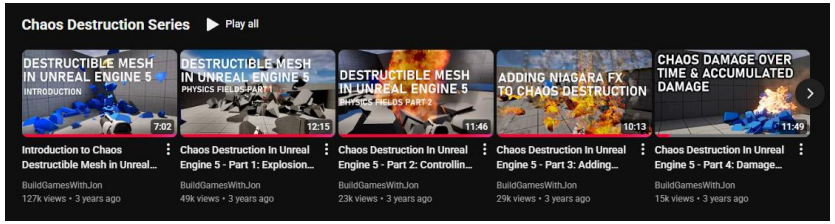
YouTube Tutorials

Intro to Chaos

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

Explosion using Physics Fields

https://www.youtube.com/watch?v=i5f1DevgDUs



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

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