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LOST WORLDS
DESIGN AND ANALYSIS

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TABLE OF CONTENTS

PROJECT INFO

Genre: Action Adventure

Engine: Unreal Development Kit
Setting: Sci-Fi, Futuristic, Ancient Ruins
Platform: PC
Number of Players: 1
Expected Rating: M (For Violence)
Project Duration: 9 Months (part time)

OVERVIEW

This document is a hybrid Game Design Document (GDD) and retrospective analysis document. It contains the design documentation of *Lost Worlds*, as well as the rationale, process, and methods I used to build it.

GAME OVERVIEW

Lost Worlds is a short action game built in the **Unreal Development Kit (UDK)** with a 3D isometric camera view. It combines exciting combat, environment puzzles, and a narrative that tells the story of a galaxy where humanity mysteriously and suddenly vanished 1000 years ago leaving everything they created behind. Humanity's robotic creations, the Mechlons, now rule the galaxy using their abandoned cities and ships.

You play as Max, a scrappy and emotional Mechlon who seeks to discover humanity's fate by searching planetary ruins before the profiteering Dominus Corporation can strip them of their clues and riches. After discovering an uncharted planet, Max and his trusty side-kick Proxy, set off to finally discover the first piece of the puzzle that will reveal humanity's fate and the future fate of the Mechlons.

Figure 1 - Lost Worlds Screenshot

GAME DESIGN GOALS

I created **Lost Worlds** primarily to be the "crown jewel" of my portfolio, and to practice game and level design techniques. I started by creating the following list of project goals, which I feel I ultimately achieved:

- Create a fun game in UDK using only the default UDK assets (not including voiceover & music).
- Demonstrate skills in level design, combat encounter design, environment puzzle design, cutscene placement, event scripting, and level pacing.
- Create an interesting game world and tell a compelling short story based on the default UDK assets.
- Make a game with a 3D isometric camera view to stand out from all of the first-person camera UDK levels.

CONSTRAINTS

I wanted to use only the UDK assets partly because game design is often about reusing limited resources in a creative way, and partly because I wanted to focus on game and level design instead of art asset creation.

STORY

PLOT

Lost Worlds takes place after humanity has colonized many planets, and 1000 years after humanity mysteriously and suddenly vanished from the galaxy. Billions of human beings were gone in a flash leaving behind entire worlds, cities, and space ships. Their created protectors and servants, the robotic Mechlons, now control the human technology and space. Mechlon society picked up where humanity left off and continues as usual with exploration, research, and trade.

Most Mechlons do not bother themselves with what happened to humanity, but some, like Max and Proxy, are trying to discover what happened. They search the *Lost Worlds* of humanity in order to find the truth to prevent it from happening again to the Mechlons. Others, like Zavvix and the vile Dominus Corporation, search for powerful lost human artifacts and technology to dominate the galaxy. No other intelligent race has been discovered yet in this universe.

The universe for *Lost Worlds* is inspired by *Mass Effect, Firefly, Star Wars: Knights of the Old Republic, Halo,* and the classic robotic stories of Isaac Asimov.

The fiction of *Lost Worlds* was created entirely around whatever UDK assets I had available!

CHARACTERS

Max
The main protagonist of *Lost Worlds*, Max is who the player controls. He is more intuitive than logical and has more emotions than other Mechlons. He is very intelligent also.
Max is often perceived as reckless and lucky since he approaches danger head-on and without fear. Max takes inspiration from Nathan Drake (*Uncharted* series) and Indiana Jones.

Proxy
(Not pictured in this level)
Proxy is Max's best friend and sidekick. He is smaller and a different model of Mechlon than Max. He is actually the same model as the Lab Bot found in *Lost Worlds.* He is logical, methodical, highly intelligent, and often a bit too careful. Proxy takes inspiration from C-3PO from *Star Wars.*

Zavvix, CEO of the Dominus Corporation
(Not pictured in this level)
The Dominus Corporation is company controlled by a powerful Mechlon named Zavvix. He is a rare model of Mechlon that is as large as a Titan (see Enemies), but far more powerful and intelligent. On the surface, the Dominus Corporation strips ancient ruins of humanity for anything of value for profit. Zavvix, however, has more nefarious goals and uses Dominus to find powerful human relics he can use to dominate the galaxy. Zavvix takes inspiration from countless powerful and evil antagonists in media such as Darth Vader (*Star Wars*) and Jean-Baptiste Emanuel Zorg (*The Fifth Element*).

Dominus Soldiers and Dominus Titans
See the "Enemies" section below for more information.

Lab Bot
This bot has been diligently awaiting Max's arrival to the Kepler-Prime laboratory since Dr. Song escaped the facility 1000 years in the past. It contains a message for Max that will guide him to his destiny.

Fun Trivia: The model used for the Lab Bot is actually a part for a Unreal Tournament vehicle that I inverted and "animated" in Kismet to make it look like it was talking...you have to work with what you are given!

Dr. Elizabeth Song
(Not pictured in this level)
Dr. Elizabeth Song was the galaxy's premiere human scientist in bioinformatics, neurology, and robotics. She created and led the enigmatic Phoenix Project that is spread between many of the human worlds. She left a recorded message specifically for Max contained within the Lab Bot at the secret Kepler-Prime Phoenix Project facility. Her fate is unknown, but she opened the space-time vortex portal at the Kepler-Prime facility and entered it. Dr. Song takes inspiration from Dr. Catherine Halsey and Cortana (*Halo* series).

ENEMIES

Using only the UDK assets tied my hands when it came to characters. There are only two rigged and animated models in the game: an average "Cathode" bot and a bulky "Iron Guard" bot. I used the Cathode bot for both Max and the Soldier class of enemy. The Iron Guard was used for the Titan class of enemy.

DOMINUS SOLDIER

The Dominus Soldier is the standard enemy of the game. They roam in squads of two or more and move as quickly as Max. Their standard weapon is the Link Gun, but if out of ammo, will occasionally pick up a Rocket Launcher out of necessity. They are not very accurate, but move from cover position to cover position to avoid Max's gunfire. The Soldier has average health and retreats when it is badly damaged. It often retreats into an area where reinforcements await to join the battle!

DOMINUS TITAN

The Dominus Titan is a large, hulking, enemy with high health and a Rocket Launcher that does massive damage with a knock-back ability. It is slow moving and tends to guard an important area, and never retreats. When the Titan arrives, its massive roar shakes the camera foreshadowing to players that something powerful is coming!

WEAPONS

As much as I wanted to create new and unique weapons, I really wanted to focus on game and level design more than importing new weapon assets. As a result, I decided to use the standard Link Gun and Rocket Launcher already in the UDK. I extended the UnrealScript classes for these weapons and modified them to be more appropriate for my game (since they are designed for a first-person shooter). Some of the adjustments included making the enemy bot weapons less accurate, moving the projectile start position, and reducing the sound effect volume to blend better with the isometric camera view.

Each weapon has a **Primary and Secondary Attack.**

LINK GUN

The Link Gun fires a normal projectile as the Primary Attack and is the main weapon of the game. The Secondary Attack fires a beam that attaches to an enemy and does damage over time. Max and the Dominus Soldiers start with this weapon.

ROCKET LAUNCHER

The Rocket Launcher is the weapon used by the Dominus Titans and can be picked up by Max either by finding hidden caches in the level or by defeating a Titan. The Secondary Attack loads up to three rockets over a brief charging period, then fires them in a cone shape from the launcher.

PICKUPS AND POWERUPS

Typical of a game with combat, *Lost Worlds* contains Ammo and Health Packs to aid the player succeed. The following pickups and powerups were placed throughout the level to reward and guide players:

LINK GUN AMMO

ROCKET LAUNCHER AMMO

HEALTH PACK

ARMOR

ROCKET LAUNCHER

PICKUPS AS BREADCRUMBS

I placed pickups like ammo, health packs, and armor in strategic locations to reward players, keep long battles flowing, and to provide clues to players as to where to go (breadcrumbs). For example, in the following screenshot, I placed an ammo pack on the bridge the player must walk directly beneath. They will see the ammo and know that they can eventually walk on that bridge (and that it is not just a decorative part of the environment). Another is placed near a Draggable Block to further reinforce that "this is the way to go." The green line in the screenshot indicates the player's path.
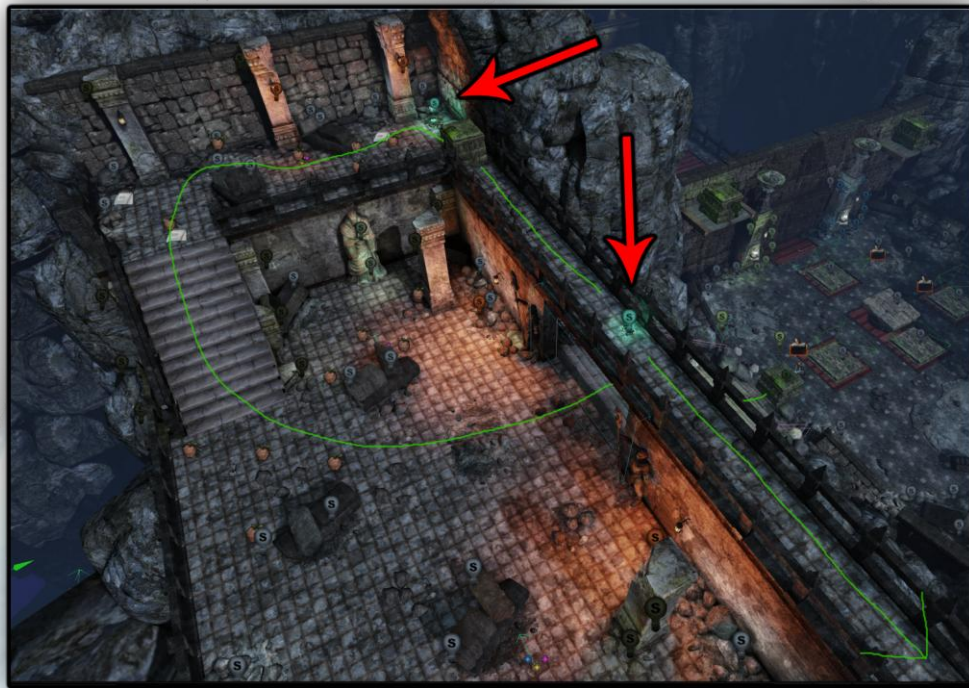

Figure 2 - Pickup placement guides player progression

HIDDEN POWERUPS

Games like the *Metroid* series have hidden powerups inside of the environment. Players shoot the environment, which is destroyed, to reveal the item.

Figure 3 - A hidden Missile in Metroid: Zero Mission (Gameboy Advance)

Leveraging the isometric camera angle, I placed the most powerful powerups and weapons such as Armor and Rocket Launchers behind camera-blocking environment objects. Players can destroy these objects to reveal the reward they hide. Perceptive players may notice the subtle glow of a colored light associated with the object coming from behind the environment object.

Figure 4 - Red glow hints at a powerup hidden beneath a destructible decoration

ABILITIES

MOVEMENT
Players control Max with the keyboard and mouse. The W-A-S-D keys move Max, and he faces the direction of an on-screen reticle that is controlled by the mouse.

JUMP AND DOUBLE JUMP
Max is able to jump with the player presses the SPACEBAR. While in the middle of a jump, Max will jump further with a Double Jump when the player presses the SPACEBAR again. Jumping and Double Jumping are used to reach new areas in the level, dodge enemy gunfire, and adds a light 3D platforming element to the game.

PRIMARY ATTACK
The LEFT MOUSE button fires the Primary Attack of the currently equipped weapon.

SECONDARY ATTACK
Each weapon has a Secondary Attack, and is fired by pressing the RIGHT MOUSE button.

DRAG OBJECTS
Players can have Max attach to a Draggable Block by pressing the F key.
He will stay attached until the player presses the F key again to release.

INTERACTING WITH OBJECTS
Players can interact with objects such as Touch Switches by moving Max near them and pressing the E key.

PUZZLES

Puzzles in *Lost Worlds* are based in the environment like many games such as *Uncharted* and the *Legend of Zelda* series. **The puzzles must appear interesting and difficult at first, but all of the information will be provided to players so that when they solve the puzzle, they feel smart.** I wanted to encourage that "ah ha!" moment where the puzzle solution clicks in the player's mind. Since this is the first level of a game, the puzzle difficulty is fairly easy, however.

Typically, these puzzles serve the purpose of gating the player's progression through the level, and provide bonus items (health, power-ups, etc.).

PUZZLE MECHANICS

The following basic puzzle mechanics are introduced, reinforced, and then combined with other mechanics to form environment puzzles in *Lost Worlds.* They are taught via on-screen tutorial text and voice-over hints from Max in a risk-free environment to remove an obstacle to ensure players know how to use them.

Touch Switch
Activates something in the level when the player touches it and presses a key.

Shoot Switch
Activates something in the level when the player shoots it.

Floor Plate Switch
Activates when the player or a heavy object is placed on it. Some do not stay down and require a heavy object to remain on them.

Draggable Block

Players can grab the heavy Draggable Block and move it around the level. It is placed to not only provide obstacles, but to hold Floor Plate Switches down in the activated position.

Springboard

The Springboard is lowered by the player stepping on the adjacent Floor Plate Switch. Then, the player moves onto the Springboard as it is rising and presses the Jump key to launch Max into the air.

Most of the puzzle mechanics in *Lost Worlds* were chosen for the following reasons:
- Players are familiar with them from other games.
- Ease of implementation in UDK.
- This level is intended to be the first level of the game, so simple puzzles are important.

One puzzle mechanic however, the **Springboard**, was discovered entirely by accident! I was working on the Spike Puzzle where the spikes are lowered into the ground and then raise back up when they are reset. I accidentally hit the Jump button while spikes were rising up, and it launched Max off of the map! After recreating the mistake multiple times for good laughs, I decided it was so much fun that I would incorporate it into the game itself. I redesigned the east wing puzzle to revolve around teaching the Springboard mechanic and redesigned the Secret Door Puzzle to use it as well.

SPIKE PUZZLE

This puzzle combines the Floor Plate Switch with the Draggable Block. The player must move two blocks between multiple Floor Plate Switches in order to lower a path through blocking spikes to obtain a key used to solve the Secret Door Puzzle.

LOST WORLDS
Level 1 - Spike Puzzle to Obtain Green Key

B1 - Draggable Block 1
B2 - Draggable Block 2
S1 - Floor Plate Switch 1
S2 - Floor Plate Switch 2
S3 - Floor Plate Switch 3
S4 - Floor Plate Switch 4
S5 - Floor Plate Switch 5

Green Key

Puzzle Solution:

1) Drag B1 to S1 which lowers spikes marked with 1.
2) Drag B2 to S2 which lowers spikes marked with 2.
3) Drag B1 to S3 which raises spikes marked with 1 and lowers spikes marked with 3.
4) Press E to obtain Green Key which completes the puzzle and lowers all spikes.

Figure 5 - Spike Puzzle

SPRINGBOARD PUZZLE

The springboard puzzle leverages the Springboard, Touch Switch, and Shoot Switch mechanics. The player must use the Springboards to jump between areas and use the switches to clear the way to jump through.
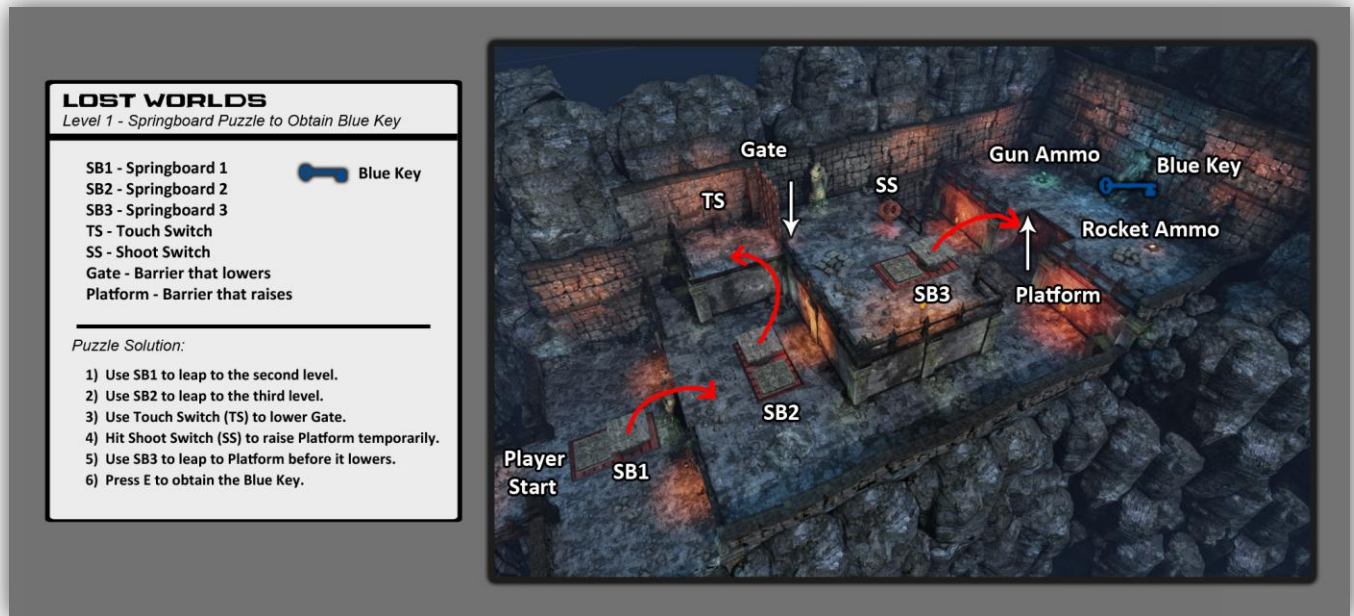

LOST WORLDS
Level 1 - Springboard Puzzle to Obtain Blue Key

SB1 - Springboard 1
SB2 - Springboard 2
SB3 - Springboard 3
TS - Touch Switch
SS - Shoot Switch
Gate - Barrier that lowers
Platform - Barrier that raises

Blue Key

Puzzle Solution:

1) Use SB1 to leap to the second level.
2) Use SB2 to leap to the third level.
3) Use Touch Switch (TS) to lower Gate.
4) Hit Shoot Switch (SS) to raise Platform temporarily.
5) Use SB3 to leap to Platform before it lowers.
6) Press E to obtain the Blue Key.

Figure 6 - Springboard Puzzle

SECRET DOOR PUZZLE

The secret door puzzle combines all of the puzzle mechanics into a single grand finale puzzle. It is introduced to the player via cutscene and voice-over to let them know they must go find the other keys the other two puzzles provide and return.

When the two keys are obtained, a second cutscene hints at what to do to solve it. The player places them in their slots and shoot switches are activated. Players must then use a springboard and fire while in the air to hit the shoot switches. Hitting the switches drops Draggable Blocks, which must then be dragged over floor plate switches. Solving the puzzle opens the secret door to the secret lab.
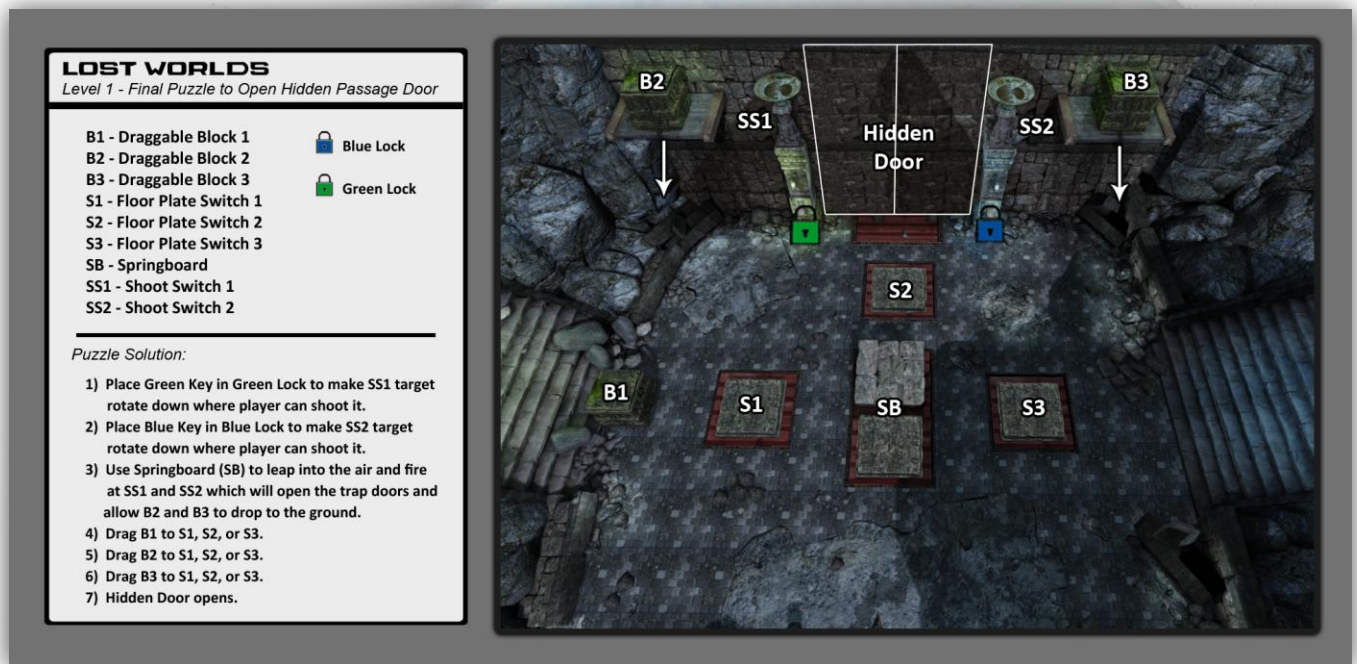

Figure 7 - Secret Door Puzzle

COMBAT

The combat went through multiple iterations during development of **Lost Worlds**. The default Unreal Tournament AI does not suffice since it is designed for a first-person shooter. I developed a cover-based AI and combat system like *Killzone: Liberation* for PlayStation Portable since that game has a similar camera angle. This proved to be fairly boring during playtesting, so it was scrapped. I ultimately developed a new AI and combat system that is more action-packed like *Lara Croft and the Guardian of Light.*

COMBAT PRINCIPLES

When designing the combat of **Lost Worlds**, I created a set of rules inspired by other games and various GDC talks I have attended. Here is the list of principles used to ensure a consistent and exciting player experience:

- **Establish** well-defined **combat fronts** for player and enemies.
- Keep **combat fast-paced** with lots of maneuvering between player and AI between destructible cover objects.
- Script new **waves of enemies** to appear before the current enemy wave is completely killed to keep the action going.
- **Enemies retreat** when critically damaged to pull player deeper into the level and into reinforcement enemies.
- **Place cover and path nodes** to ensure the player can **see the enemy at all times** with the camera angle.
- **Place ammo and health packs** in fair locations to ensure **player rarely run out** completely (this is intended as the first level of the game, so difficulty is adjusted accordingly).
- **Hide powerful items** such as Armor behind objects to **reward players** who explore, destroy environment objects, and are perceptive.
- **Place checkpoints** and player spawn points in regular intervals to ensure player does not need to run far to rejoin the combat.

COMBAT FRONTS

It is very important to establish fronts in combat encounters so the player knows what is a safe area and what is not. It establishes boundaries and allows players to push the enemy front back (which feels satisfying). In *Lost Worlds*, I used the destructible cover and bot cover nodes to establish player and enemy fronts. When the player damaged bots enough, they would retreat which would pull the player forward, trigger another wave of enemies, and establish a new combat front.

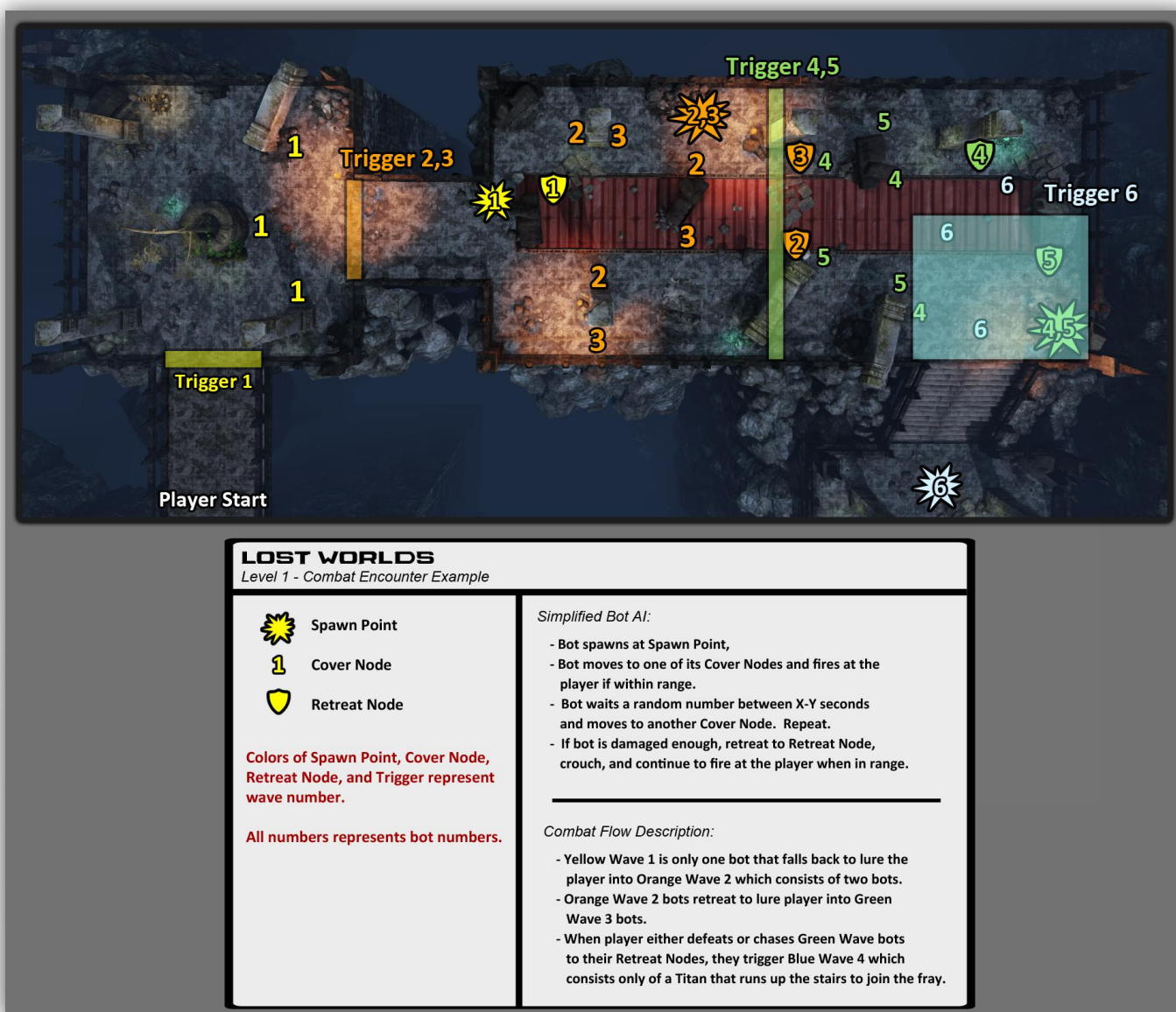**Figure 8 - Combat Zones and Fronts**

COMBAT ENCOUNTER EXAMPLE

Figure 9 - Combat Encounter Example

BALANCE AND FEEL

I based the enemy AI on the default *Unreal Tournament* bot AI. This AI proved to have far greater **accuracy** than players, so I adjusted their accuracy to hit the player only 25% of the time. The rest of the shots fly closely around the player creating the illusion of intense combat without the danger.

The default bot **firing range** was entirely too great. They would attack the player while off of the screen which is frustrating with the camera angle. The AI was adjusted to fire at the player only when they were on the screen (roughly 640 UDK units from the player).

The enemy bot **health** was balanced so that Soldier bots could take a few hits and retreat while the Titan would take many more hits to kill (and never retreat).

The **movement speed** of the player, Soldier, and Titan enemies were adjusted to feel good while allowing both player and bot to dodge shots and get behind cover.

LEVEL DESIGN AND BUILDING

My level creation workflow is a pretty standard iterative approach where you create a concept, design it on paper or Photoshop, build a white-box prototype level, playtest the prototype, and make changes to the prototype. When the level layout is satisfactory, the environment art assets, lighting, combat encounters, environment puzzles, camera cutscenes, scripted events, checkpoints, music, and so much more are added to the prototype level.
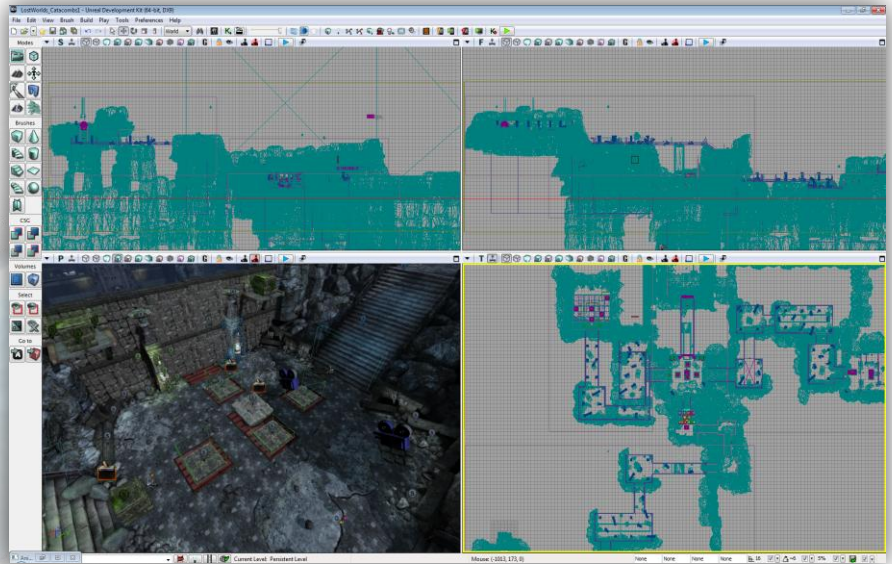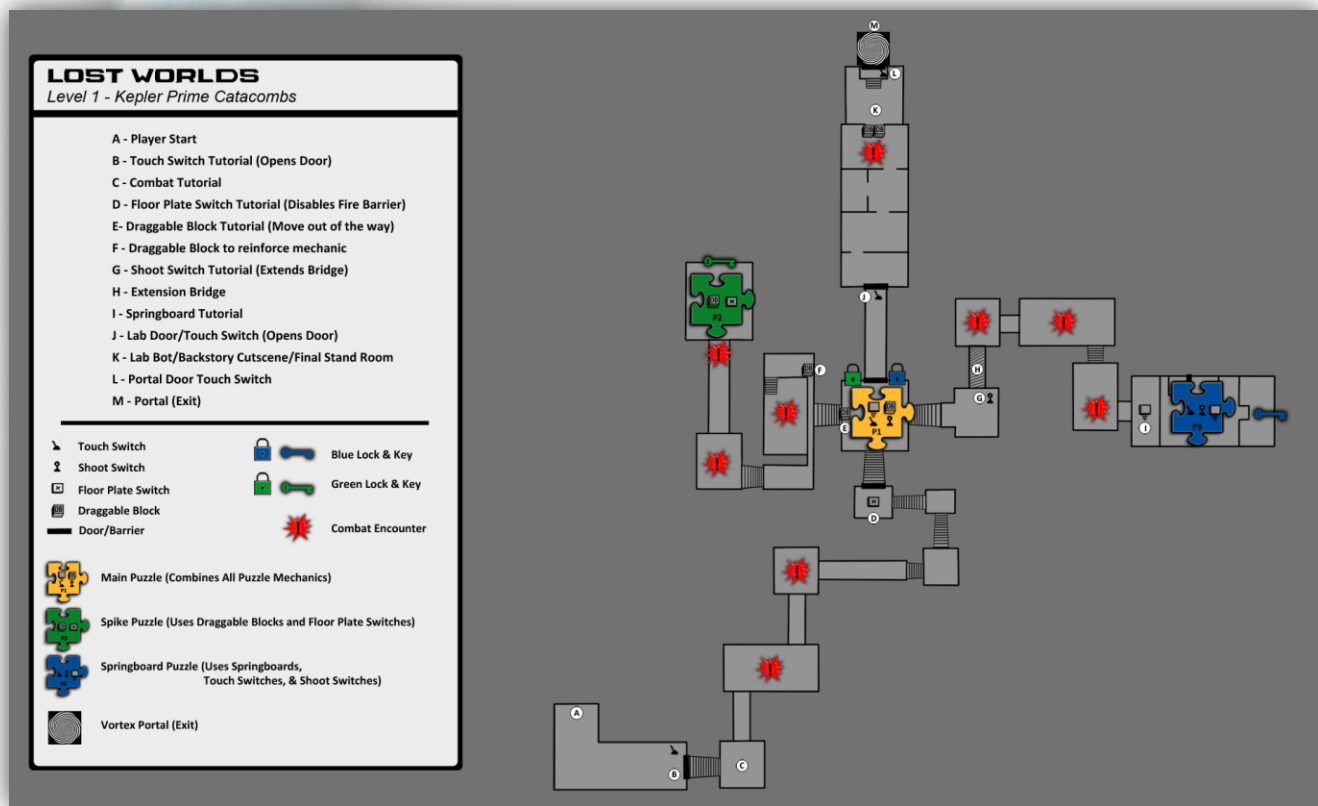

Figure 10 - Lost Worlds in UDK Editor

LEVEL MAP

Figure 11 - Level Map

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PACING AND THE INTEREST CURVE

The **Interest Curve** is a nice tool used to analyze whether your creative work can hook and maintain the interest of players. The basic idea is to have an initial "hook" that grabs their attention, then a combination of rising and falling interest, then a grand climax that leaves players wanting more, followed by a sharp drop in interest. The following diagram from Jesse Schell's *The Art of Game Design* is a great template to follow:
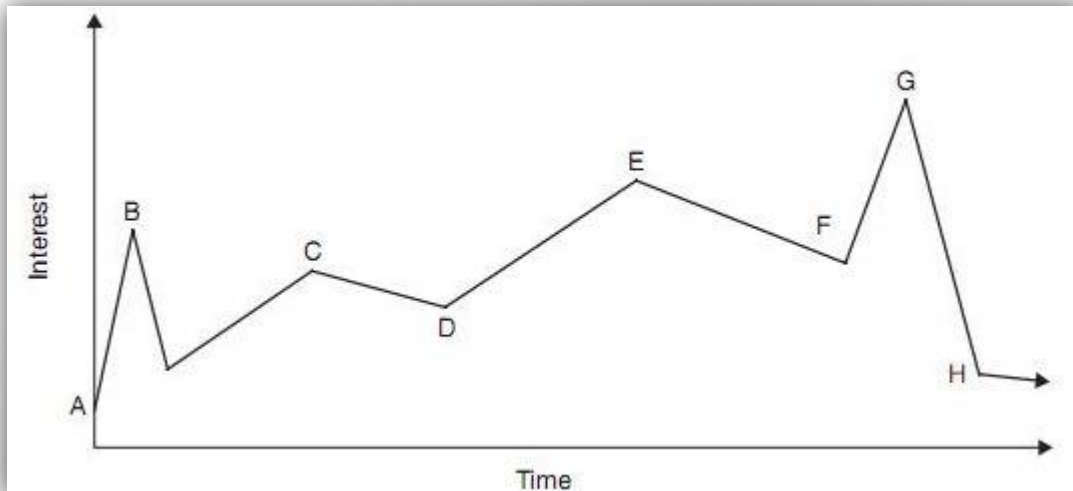

Figure 12 - Interest Curve example from *Art of Game Design*

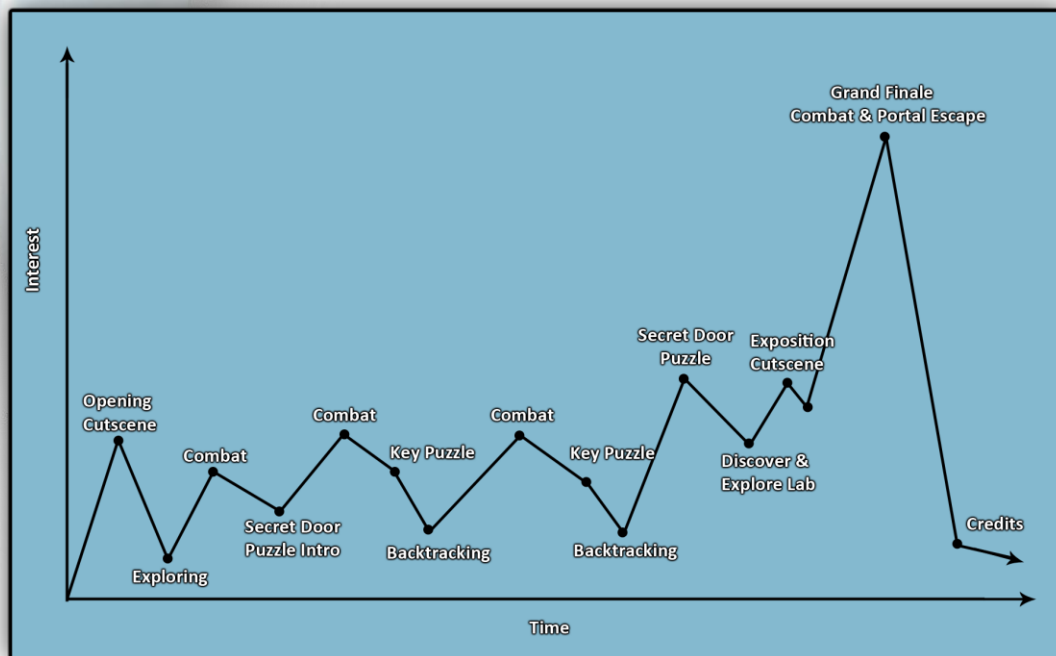Here is the interest curve for *Lost Worlds*:

Figure 13 - *Lost Worlds* Interest Curve

Combat and puzzles are spaced between exploration and backtracking to ensure players have some downtime to rest and think. I actually used a stopwatch to time how long it took to run between areas and adjusted their scale accordingly to ensure an even mix of excitement and downtime.

It takes approximately 15-30 minutes to complete the level, which was intentional since I wanted to create a game level that could come from a published game, not just a quick demo. This duration allowed me to pace the level between excitement and downtime.

Trying to follow a good interest curve was an intentional design choice. Had I been able to create a much more compelling opening cutscene (see Cutting Room Floor section below), I would have had a stronger hook, but overall, I am pleased and feel that the level paces well.

WHAT ALL DID I DO?

This section lists everything that I had to research, prototype, implement, incorporate, and balance into the game.

GAME DESIGN

- Narrative design (story, characters, locations, cut-scene and dialog scripts)
- Isometric level design, prototyping, and construction
- Level pacing
- Environment puzzle design
- Combat encounters (enemy composition, waves, retreating, etc.)
- Destructible Cover
- Cover placement
- Powerup & Health placement
- Weapon & Ammo placement
- Customized Unreal Tournament HUD
- Decoration and lighting
- Voice acting, recording, and sound design for robotic voice effects
- Hundreds of UDK issues, tweaks, and bug workarounds!

SCRIPTING

The scripting in **Lost Worlds** is a combination of compiled UnrealScript code and visual scripting inside of the Kismet editor. Several UnrealScript files were obtained from online sources like the UDK forums and heavily modified for the game.

Scripting (UnrealScript)
- Player input (WASD movement and player rotate/aim toward mouse cursor)
- Isometric camera
- Player Inventory with bindings exposed for access within Kismet
- Draggable Blocks
- Custom Soldier and Titan artificial intelligence

- Modified Unreal Tournament weapons

Visual Scripting (Kismet)
- Puzzle Mechanics:
  - Touch Switch
  - Shoot Switch
  - Floor Plate Switch
  - Draggable Blocks (combined with UnrealScript)
  - Floor Plate Switches that must be held down by a Draggable Block
  - Springboard
- Barriers:
  - Gates
  - Fire Barriers
  - Spikes
  - Extension Bridge
- Enemy AI
- Combat Waves/Encounters
- Checkpoint System
- Camera Cutscenes to preview puzzles and emphasize story
- Camera Shakes
- Intro and Outro cutscenes and scripted events
- Player Inventory Access (main system is UnrealScript)
- On-screen tutorial hints and contextual hints when near interactive objects
- Music, voiceover, ambient sounds, etc.

CUTTING ROOM FLOOR

During the development of any game, a lot of good stuff gets cut from the final build of the game. The following list includes features that were designed and some that were actually prototyped. All were cut for this release of *Lost Worlds* to make a more focused and polished experience.

- External jungle tutorial level leading up to entering the ancient ruin caverns (Cut to reduce scope. The tutorial was merged into this final level.)
- Cover-based combat system (Implemented and removed after playtests proved it was not fun.)
- Exploding barrels (Partly implemented but cut to reduce scope).
- Custom, non-Unreal Tournament weapons (Cut to reduce scope).
- Dramatic escape sequence where the cavern is collapsing all around you as you race to the exit (Cut to reduce scope).
- Adaptive tutorial that monitors player progress and has Max & Proxy mutter hints and ultimately displaying text on the screen with what to do. (Cut to reduce scope).
- Detailed Intro and Outro cutscenes to dive deeper into the narrative and setup the characters and story in greater detail (Cut to reduce scope).

FINAL THOUGHTS

Lost Worlds was a long side-project filled with research, development, and its share of troubles. I am a much stronger game designer as a result of the effort it took to create **Lost Worlds**. I hope you enjoyed this design and analysis document and if you have any questions, feel free to contact me at david.shaver@gmail.com or view my current portfolio at www.davidshaver.net.