

research of diablo4

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**Production Management Research
Report
for *Diablo IV***

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Declaration of Own Work

I, Wang Jinglong, confirm that the work for the following term paper with the title:

**" Production Management Research Report
for *Diablo IV* "**

was solely undertaken by myself and that no help was provided from other sources as those allowed. All sections of the paper that use quotes or describe an argument or concept developed by another author have been referenced, including all secondary literature used, to show that this material has been adopted to support my thesis.

Place / Date 13/12/2023

Signature Wang Jinglong

Abstract

In this post I discuss some of the key steps in the development process of *Diablo IV*, which includes their story design, engine usage and more.

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Introduction

Diablo IV is an online-only action role-playing game developed and published by Blizzard Entertainment in 2023. It is the fourth major instalment in the *Diablo* series.

Similar to the main tunes of the previous entries in the series, the focus is on replayable, procedurally-generated dungeons and loot-centric character builds, while also featuring new mechanics for the series, including open-world and player-versus-player combat.

Diablo IV received generally favourable reviews from critics who praised the game's narrative and atmosphere. The game generated \$66.6 billion in revenue within the first five days of its release.

Sebastian Stepien, Creative Director, explains.

The goal was to create a more "grounded" story than *Diablo III*. In order to achieve this, the plot revolves around the simple folk of Sanctuary rather than "politics, kings, or another high-fantasy theme."

Working in Pre-Production

Story

Diablo IV takes place 50 years after *Diablo III: Reaper of Souls* in the Sanctuary world of the Diablo series. The cultists have summoned the main antagonist, Lilith, daughter of Mephisto. After the events of the previous games, the demons and angels have run out of power, which provides an opportunity for her to establish her power in Sanctuary.

Thousands of years before the events of the game, Lilith and the angel Inarius created the Sanctuary to provide refuge for those who wished to escape the eternal conflict between the High Heavens and the Burning Hells. This demonic-angelic relationship led to the creation of the Nephalem, the race to which the protagonist belongs; it is neither angelic nor demonic, but a unique combination of the two. The people in the Sanctuary believe that this power will bring attention to their sanctuary, so the inhabitants speak of destroying them. Lilith, not wanting her children to be killed, destroys all who oppose her, causing Inarius to banish her into the Void.

Joe Shely said of the story's plot that

The plot of the fourth generation is darker and deeper than in the past, and the R&D team has put a lot of thought into it, hoping that players will be able to relate to and be touched by the story as they experience it. Through the complexity of the characters' minds and backgrounds, we hope to experience the endlessly sad and earth-shaking plot of Lilith and Inaris. This is the darkest story they've ever told, and players will meet many characters, such as the Hradim "Loras", the new Hradim, and the scholar "Dornan".

When the media asked in the third generation of the game, the player character itself seems to be very powerful, but the fourth generation of the game has become ordinary people, the R & D team for the fourth generation of the design of the plot of the direction of when to consider, Paul Lee said.

Diablo 4 takes place fifty years after the third instalment, and with the aftermath of Marcel's attempt to conquer Sanctuary, players will see some familiar characters in the fourth instalment, as well as new ones, and they want to give players a new way of looking at the world of *Diablo*.

He pointed out that they wanted to emphasise the importance of choice in the design of the storyline. In the fourth generation, the player character is not a powerful hero, but closer to a human being struggling to survive, and they wanted to show players the world being ravaged by different forces such as demons through this perspective. Lilith's painful decision to watch her children and grandchildren make choices and her change of heart, the R&D team hopes to bring out the importance of these feelings, so that players can feel the importance of choices, and what will happen after making

choices.

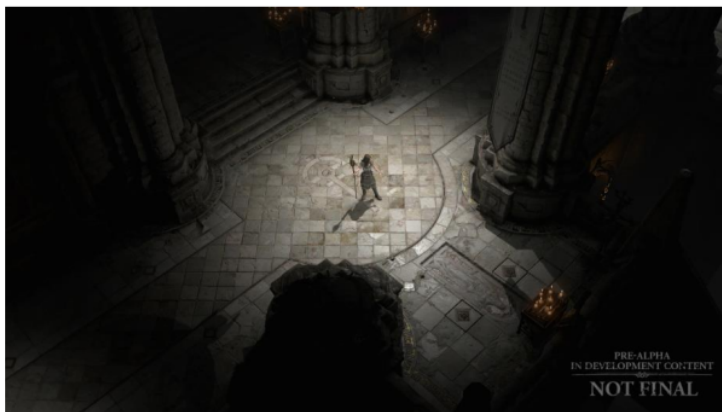
Joe Shely then mentioned that

A good story is one in which the player can think about something after experiencing it through their own thoughts and perceptions. For producers, if the moral of the story is too clear, it may limit what the player can experience from the story.

Pre-visualization

In the process of game development, visual effects related elements are usually only roughly drafted first, so that the game team can test and improve various ideas and concepts. If the game content is not interesting enough, the game team can choose to adjust or abandon the "draft" without consuming too much development resources.

In the case of the game's dungeons, for example, early playtests would only simulate the general environment with simple low polygons to test for bugs and interactions that didn't work as expected during play. It is only after these tests are passed that refinements are made.



Design

Game designer Jesse McCree said that the

The game's aesthetic was inspired by heavy metal. Their art direction attempted to achieve an aesthetic between the second and third games in the series that included the darkness of *Diablo II* and the hand-drawn feel and medieval art of *Diablo III*.

John Mueller, art director for *Diablo IV*, has stated that

Ancient masters such as Frank Frazetta and Gerald Brom, as well as more modern artists, were inspirations for the game.

In *Diablo IV* Blizzard has created a vast and fluid game world, and therefore had to take a different approach to building the worldview and telling the backstory. Blizzard believes that it is the key to making St Hugh's Array feel like a flesh-and-blood town to the player. The established richness of the terrain, from the quiet blue bays to the bloody bowls of hell, had a huge impact on the design of the monster iconography.

Blizzard has redesigned every monster through a darker, more realistic art style. Every creature you're likely to see in the game has been meticulously crafted by the game's team, including: demons, NPCs, chapter leaders, and even small creatures you might inadvertently stomp into a puddle. Certain classic game designs have been retained as a nod to them, though most of the content has been redesigned.

In order to make these creatures feel more refined and vivid, the team used a mechanic called "monster clans" and different character types to design them. Each clan has a different fighting style and brings a different feeling to the player. For example, there are five members of the Sea Corpse Clan, and their character types are very diverse, including: Fighter, Long Range Attacker, Melee Combatant, Swarmer, and Dungeon Leader.

WORK IN
PROGRESS





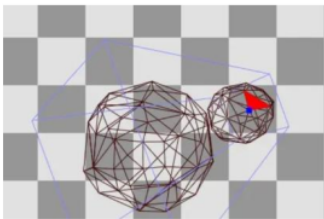
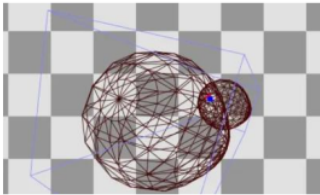
Working in Production

Modeling & Texturing

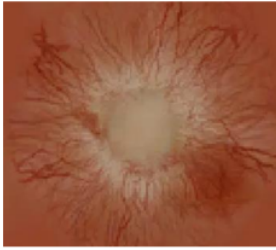
Take the Barbarian character model as an example

A distinction has been made between the character creation interface and the in-play eye model. The model for the character creation interface is more accurate with a total of 1920 vertices. However, the eyeballs in the character creation interface do not have parallax effects, but they are created in the TimeLine.

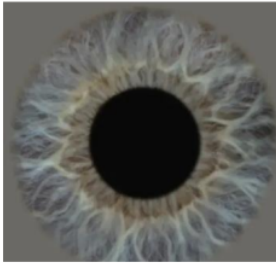
The eye mapping is different from the model, and is basically the same for both the character creation screen and the playthrough, just doubled in size for the playthrough.



BaseColor



Base Color for blood filaments



Base color for pupillary



Roughness



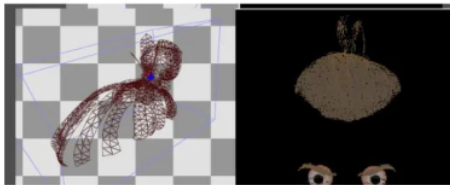
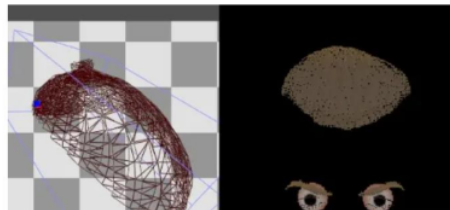
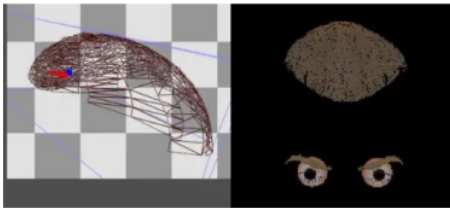
A graph of the overall brightness of the pressure eye

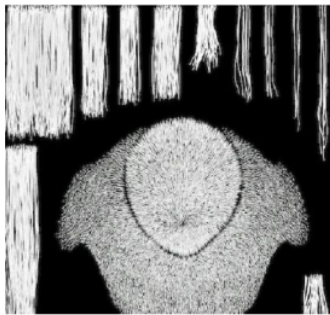
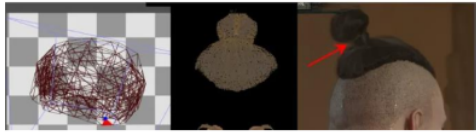
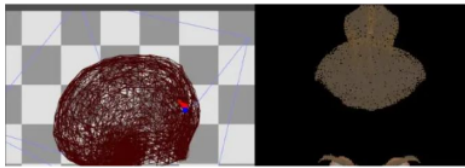


Normal

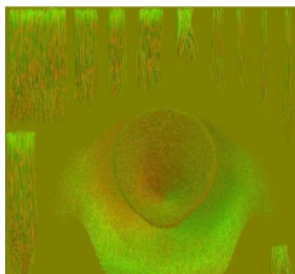
The hair model is also the traditional insert method, the hair is divided into several parts, one layer for the base, two layers superimposed on each other, the top layer is used to make the base structure of the braid, and in order to increase the saturation of the hair band on the top to add a circle of mesh. the back of the hair is made with a circle of the insert of the mesh of the hair band, which is used to soften the excesses of the hair and the hair band.

The mapping is nothing special, it's just the scalp and hair part merged into one.

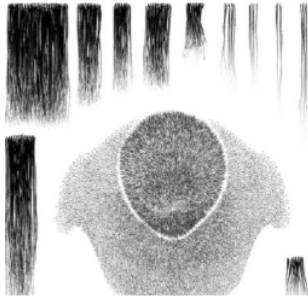




Alpha



Normal



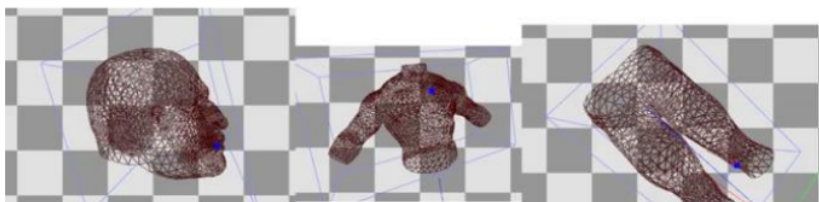
BaseColor



AO

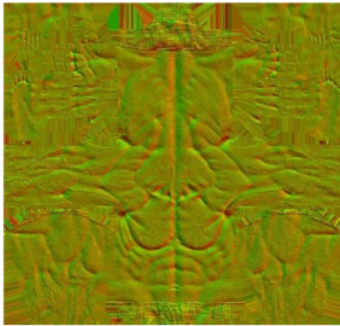
The body model was split into three main parts, the upper body, the lower body and the head. The head is naturally modelled with the inside of the mouth made out.

The mapping is also the regular mapping of the sections, but what's special is that Blizzard has drawn the sweating effect directly into the Roughness mapping.

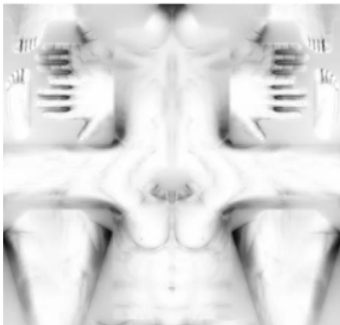




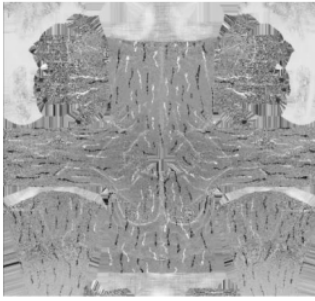
BaseColor



Normal



AO



Roughness



Tattoo Map

Lighting/rendering

While great textures can set the stage for game art, lighting and shadows are also important for life-like art. Just like the textures, *Diablo IV*'s lighting and shadows are based on realistic physics concepts.

The darkness of *Diablo* is supported by the Physically Based Rendering (PBR) technology, which makes game objects look a little more realistic. As the name of the technique suggests, real-world physical concepts are used to build modules for interaction between light and matter in the virtual world. In the game, you can encode your own perceived reality, but images can be confusing when they are completely out of touch with reality. As a result, Blizzard chose to set the technology to match the physical view of the real world, and will only decouple it from reality when necessary to fit the theme of the game.

For example, there is no such thing as a 'negative light source' in the real world. However, in the game, it is designed to create dark magic that sucks light out of the world.

In order to perfect the physics-based textures, the art team reviewed a lot of new information that allowed the graphics engine to indicate how light and shadow should interact with in-game objects. For example, the art team determined how many wavelengths of light would be scattered when a given in-game material was illuminated, how detailed and rough the tiny details would be, how metallic the surface would be, and other aspects.



Below is an illustration of the computational requirements for shadows created by separate light sources. In order to speed up the process, Blizzard has chosen to use deferred rendering to work with different light sources and complex materials.



Overriding the delayed rendering is a system that Blizzard built from the ground up to calculate, store, and overlap shadows. Because geocities are randomly generated, it's impossible to know the exact geocities grid in advance. Not every part of a dungeon changes after it's generated, though. As the player moves through the Citadel, the light and shadow system tries to process and organise the shadow calculations, so the system doesn't do all the calculations at once. The shadow system is built to make use of static objects, mostly storing the results of static objects and then stacking dynamic objects on top of those stored results.

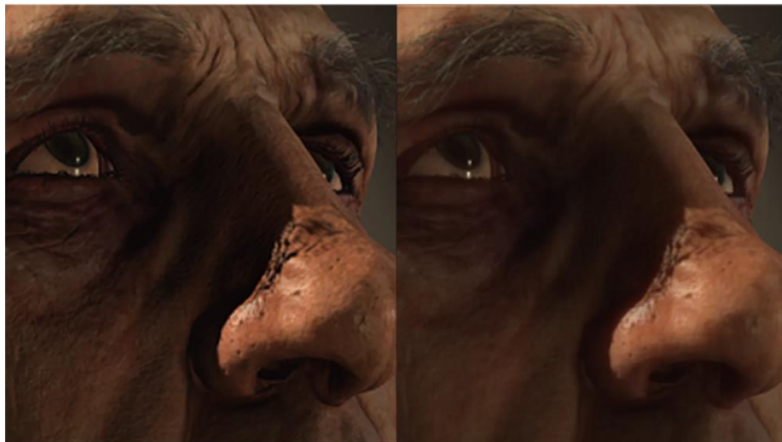
Complex technical details like these can easily overstress an art team that's trying to show off the tone of the art, so Blizzard has buried these details in a series of awesome art tools that allow the art team to focus on their talents. To do this, Blizzard has created a new set of powerful art tools for *Diablo IV*. These tools incorporate a number of physics elements, as well as the ability to adjust things like lumens, radiation levels, glow intensity, and more.

The importance of space during development cannot be overstated. In order to bring the darker tones to life in a world that is both real and alive, Blizzard created modules for the dust and tiny particles between light and objects. This technique is called stereoscopic rendering, and it's a key component in bringing the art of *Diablo IV* to life.

In the past, simulating dust and smoke through particle systems, placing images on rectangular frames and stacking them in front of the camera, has produced rough results. In real life, light interacts with heavy solid structures and scatters around. But this light passes through dust and tiny particles in the air, and this process transforms the physical properties.

Blizzard built modules for air in *Diablo IV* so that tiny particles in the air are illuminated. Light is scattered and absorbed around as it travels through this space towards the virtual camera in the in-game world. This all uses a realistic view of physics. Even the stained glass windows themselves emit light into the air.

One of the features of *Diablo IV* is that the story is told through in-game animations. When the camera is close to a character, it's important to accurately represent the character's skin texture. In the real world, light also enters the skin of a person, scatters within the body, and then scatters out of the skin in other locations. As it moves, the light is affected by flesh and bone, a physical phenomenon known as subsurface scattering. Creating a module for this complex phenomenon allows the details of the character's face to be more realistic, rather than looking like a piece of plastic cushion.



Working in post- production

Visual effects (VFX)

In *Diablo IV*, Blizzard used a PBR light module, meaning that the material looks and reacts to light realistically. This approach can greatly improve rendering results.

For example: campfires should look boring in broad daylight, and dust or smoke should be barely noticeable in the middle of the night. To address this situation, Blizzard built the game engine and graphics database to refine the PBR ruleset in a more aesthetically pleasing way. This ensures that important gameplay content is rendered as clearly as possible, while still maintaining the PBR integrity of immersive elements so that they can realistically react to light.

Previous tweaks to *Diablo* have used a special type of particle, one that is unaffected by ambient light. These particles assist in controlling the appearance of the artwork, which is depicted in the final rendering. The downside of these particles is that the artwork may look too bright in a dark-toned dungeon, or the colour scheme of the visuals may not blend in with all the backgrounds.

In *Diablo IV*, Blizzard used bright visual effects to blend into the light of the background environment to create a more immersive gameplay experience. Take the Whirlwind Slash for example, in broad daylight, the blade will reflect the sun's rays. In a dimly lit dungeon, the blade will reflect a dimmer light source, such as a torch. The dust raised by the skill is also lit up by the environment, so it blends into the artwork of the game world.

If you rely solely on the operation of ambient light and follow the original rules of PBR to the letter, gameplay becomes blurry and indistinguishable, especially in dimly lit environments where wielding a weapon is essentially hard to see. To counteract this, many of the visuals are capable of glowing on their own and casting light on the environment. And many of the in-game moves now even have the ability to change the climate and light of the surrounding environment over time.

<https://youtu.be/HJmyY7dO3No>

DIABLO

VFX
Lighting

Sounds

One of the main goals of a sound designer is to create the highest quality sound effects that are triggered by the real-time calculations of the game, and at the same time adjusted to the player's current gaming experience, so that the sound effects are realistic enough to immerse the player in the game world.

For gameplay-related dimensions, the randomness of sound playback is of the utmost importance. In the real world, every sound is unique because your surroundings and the location of the sound's source are different every time. The sound pressure level of each sound is unique, as sound reflections due to the environment and other influences of the surroundings change all the time.

Real life is full of tiny influences that cause the sounds you hear to be different every time. As a result, Blizzard's sound designers are also working to create subtle and random differences, and this is not limited to the sound design itself, but also has to do with what the player actually hears in the game. If the sound design is successful, players won't notice anything special because they'll naturally be immersed in the game world, enjoying the sensory-impacting visuals, storyline, and gameplay experience.

When designing the sound effects for *Diablo IV*, one of the main focuses was to give everything on the game screen a sound effect. Whether it's the ambient sounds of the game world, the loud noises of monsters idling off-screen, or the sounds made by players destroying objects that cause blocks of wood to hit walls.

Sound designers spend countless hours and effort to make everything sound, even things that are visually invisible to the player, while managing the right balance of not making these sound effects so prominent as to cause distraction.

However, just because everything has sound effects doesn't mean you have to listen to them all the time. The game's sound engine follows a strict setup and ground rules, so that there are not too many sound effects playing at the same time. The game uses an isometric camera view, and there is a lot of content on the screen at the same time, so you have to limit the number of sound effects you can play at one time. If the sound

effects are designed properly, the player won't notice that some of them are missing from the beginning to the end of the game, which helps to make the sound mix clearer. When the game is in full swing and the screen is full of stuff, it's important to keep the number of sound effects in check.

The main thing need to talk about is the isometric camera view within the game. The presence of an isometric perspective created several interesting challenges when combining various elements of the game's sound mix. Because the player will be seeing the battlefield from a specific angle and distance, we had to make sure that the monsters on screen had sound effects, but that the overall mix wasn't too loud or hollow. The game's system uses the player as a benchmark, calculating in real time which sound effects to play based on priority and importance.

Diablo IV's real-time algorithmic sound mixing has been taken a step further than ever before. Because of the isometric camera perspective, everything on the screen must produce sound effects, but at the same time must focus on the most important sound effects for the player. To address this aspect, Blizzard has continued to break down the sound mixing state and the system for determining the importance of sound effects so that specific monster sound effects can be set off when necessary. In this game, several heroes and a large number of monsters may appear on the screen at the same time, so it is relatively difficult to create a clear sound mix, and if you want to create a detailed ambient sound, it is necessary to design a number of different mixing states depending on the situation.

At the end, a game of *Diablo's* type inevitably has to have some element of flame. *Diablo IV's* gameplay team went out into the desert to record the flames before the COVID-19 outbreak, and it was a massive recording job.

<https://youtu.be/oaU4f6mzpU>



Color correction

With more and more HDR-enabled monitors joining the market, this technology has become a hot topic.

In the past, monitors could only display a specific range of brightness. Strictly speaking, the lowest-order displays had about 0.1 nits. A nit is a unit used to express the brightness of a flat surface, and 1 nit is the brightness of a candle in one square metre. The oldest displays were 80 nits, which is not particularly bright. This makes for a very unsatisfactory picture. With the introduction of HD TVs into the market, display manufacturers wanted their products to look their best. So they started to increase the brightness of their displays to 300 nits. Because of the Hunter effect, bright colours look more saturated. This makes the colours of the screen look more accentuated and more vibrant on HD monitors, and these are benefits that we all want to see when we play games.

The HDR monitor standard further increases the range to the current upper limit of 10,000 nits, while OLED technology allows true blacks to be displayed anywhere on the screen. These advances mean that the game engine's internal rendering can be sent directly to the display without having to compress the brightness range due to the SDR standard. This doesn't just mean brighter images, but more importantly for Diablo IV, it means that the darkest of dark tones can be displayed as well.

Another important change Blizzard made between the public Beta and the server stress test was the addition of a new tone adjustment curve specifically for HDR. The new tone adjustment curves give you the contrast and colour saturation that HDR monitors display. It's perfect for desert scenes.

The first image is without tone adjustment.



Next is the same scene, but with tonally adjusted images.

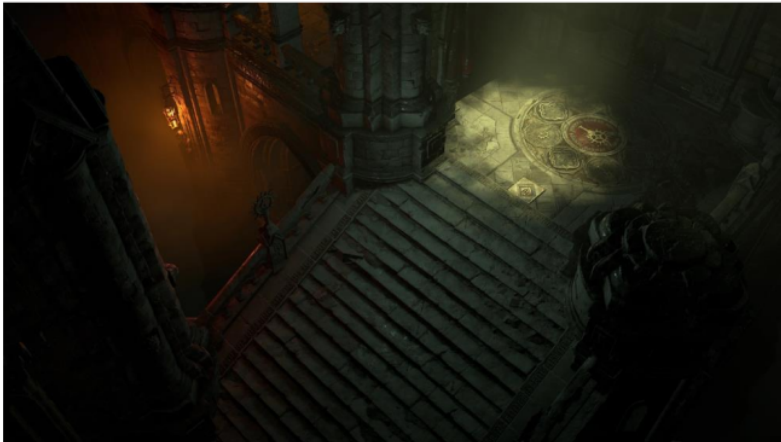


The difference is small, but when reviewing these images back and forth, the hue-adjusted images have a higher contrast and the sand looks less grey and more like sand.

Curves like this also have a small but significant effect on colour saturation. Look closely at the two light sources in this scene.



The light source on the right side of the image looks more natural, but there is less contrast in the brighter areas. Now this is the same scene, but with tonally adjusted images.



Once again, although the effect produced a very small impact, it was significant. The orange-red fire on the left becomes more reddish, and the area illuminated by the light on the right is a little more saturated. These changes are important to maintain the same visual style and feel of the game in both SDR and HDR.

Conclusion

While there are many parts that have not been covered, the new engine that Blizzard used in the making of *Diablo IV* did bring a lot of ease to their production, as well as better quality artwork.

All in all, the artwork in game development has a lot to do with the engine used, but the hard work of the rest of the designers can't be denied.

Reference

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<https://youtu.be/IB1JZwVIYkI>



<https://youtu.be/lzo-Fa-cYZQ>



[Making of - Diablo 4 \[Behind the Scenes\] - YouTube](#)



research of diablo4

GRADEMARK REPORT

FINAL GRADE

74/100

GENERAL COMMENTS

This document gives a comprehensive overview of the game, setting the stage for what readers can anticipate.

Pre-Production:

The narrative about the story is thorough, offering insight into the game's background. However, breaking down the text into smaller paragraphs could enhance readability. Quotes from Sebastian Stepien and Joe Shely enrich the content by providing insights into the development philosophy.

Pre-visualization:

The explanation of the pre-visualization process is clear and informative, providing readers with a good understanding of game development progression.

Design:

Detailed descriptions of the game's aesthetic, inspiration, and monster design are provided. Quotes from game designers lend credibility and insight. Breaking down the information into smaller paragraphs would improve readability.

Production:

A detailed breakdown of the modeling and texturing process is beneficial for readers interested in the technical aspects of game development. Incorporating images and diagrams could improve understanding, particularly when explaining specific details of character creation.

Lighting/Rendering:

The comprehensive explanation of the lighting and rendering process effectively communicates the technical aspects of creating realistic lighting in the game. Including images or illustrations alongside the text would aid in visualizing complex technical details.

Post-Production:

The section on visual effects (VFX) provides informative insights into how Blizzard addressed rendering challenges. The inclusion of a video link offers readers a visual demonstration of the effects.

Sounds:

The detailed explanation of the sound design process is valuable, providing readers with an understanding of the efforts invested in creating a realistic and immersive audio experience. Adding a link to a video of the flame recording enhances the presentation.

Color Correction:

Insights into adapting the game for HDR monitors are provided in the section on color correction. The use of examples helps readers grasp the impact of these adjustments.

Conclusion:

The conclusion summarizes the document well, highlighting the role of the new engine in enhancing the game's production quality.

General Suggestions:

Break down large paragraphs into smaller ones to improve readability.

Consider adding relevant images, diagrams, or videos to enhance visual understanding.

Ensure consistent formatting and spacing for a polished presentation.

Overall, the document is well-structured and informative, offering a detailed exploration of the various stages of Diablo IV's development.

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