SKOAR!*

LIVE TO GAME

INSIDE

REEVU
Ratchet & Clank Rift Apart

TEARDOWN
Backbone One

PHEACHUR
Mesh Shaders - What are they?

GAMES THAT CHANGED GRAPHICS FOREVER

Games would look and play nothing like they do today without these games





RIP SINGLE PLAYER?



Manish "Trigger-Happy" Rajesh
SKOAR! Overlord | feedback@skoar.in

In a recent column I spoke about how something had changed about the way I approached gaming. Choosing to go for quick and short bursts of gaming over the long gaming sessions that I used to have back in the day. For the most part, that still holds true. I had also brought up something along the lines of games themselves evolving, and as we get older, we're simply no longer the target audience. I concluded at the end of the column though that I didn't think it was my love for gaming that had dwindled, but simply the way I wanted to experience games.

Why am I bringing this up again? Well, I recently played through the Mass Effect Trilogy again, and I had no problem spending hours at a stretch, immersed into the game. This made me wonder, we don't really see games like Mass Effect all too often anymore. A lot of the newer single player experiences (rare as they are), simply pale in comparison. Why is that? Well, the answer in my opinion is quite simple. Money. It's always money. Video games, especially the "AAA" kind, take years to make, and millions of dollars to develop. Finally, we get our hands on the game for $60, or around INR 4000 over here. In order to make bank on their investment, publishers are starting to move on from selling just individual copies to games as a service, and microtransactions.

As the ecosystem stands right now, these are primarily always online, mostly multiplayer-focused experiences, designed to ensure players keep coming back for more. It's a system that works, one that works really well. So well in fact that even free-to-play games can come out the other side with some serious bank. Single player games on the other hand are expensive to make, arguably don't bring in anywhere near the amount of money you could make from following GaaS or MT

models, and even the expansions are expensive and take time to make. If you were the owner of a business, you would obviously go for the model that costs the least for the most profit.

So where does that leave single player games? It's been said many times that single player games are dying out. I don't think they are, but they will certainly have to evolve in order to better fit into the ecosystem. Ubisoft took steps in this direction with Assassin's Creed, where they would provide more content over a period of time, to keep people coming back. They also had an MTX shop in a single player game (a grievous sin for some people), which was purely cosmetic for the most part and completely optional. But an avenue for them to make more money nonetheless. Like it or not, that's probably the future of single player experiences. What do you think? *

CONTENTS

JUNE 2021



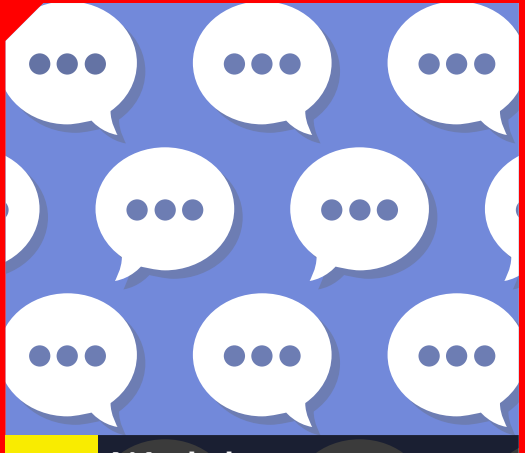
28 **GAMES THAT CHANGED GRAPHICS FOREVER**
Games were never the same after these titles came out



10 Reevu – Ratchet & Clank: Rift Apart



20 Reevu – Mass Effect Legendary Edition



38 Workshop – BetterDiscord



54 Teardown – Backbone One



60 Pheachur – Mesh Shaders: What are they?



70 Mobile Monthly

SKOAR!*
LIVE TO GAME

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Manish "Trigger Happy" Rajesh

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What's New



MOBILE GAMERS HAVE SPENT NEARLY $45BN IN 2021 SO FAR

According to Sensor Tower estimates shared with GamesIndustry.biz, there is a 17.9% increase when compared to the first six months of 2020. Apple's App Store made up for more than half of this at about $26 billion, which is an increase of 13.5% year-on-year, while games spent on Google's Play Store rose 24.7% to $18.7 billion.

The highest grossing games for 2021 so far were Honor of Kings, PUBG Mobile, Genshim Impact, Roblox and Coin Master respectively. PUBG Mobile revenues include those of Game For Peace, which is the iOS version released specifically for China.



EA IGNORED VULNERABILITIES FOR MONTHS

EA allegedly ignored warnings from security researchers that could have prevented intruders from gaining access to its systems which resulted in a massive data breach. Earlier this month, hackers were able to gain access to EA's corporate network and steal about 780GB of source code, SDKs and other proprietary tools.

Israeli cybersecurity firm Cyberpion has revealed to ZDNet that it had reached out to EA last year and cautioned the company about ten times that several of its domains could be subject to takeovers. EA did not do anything to address the issues the firm had discovered even after it sent over a detailed report.



MASS EFFECT DIRECTOR FORMS A NEW GAMES STUDIO

Mass Effect director Casey Hudson has now founded his own studio to develop games independently. Despite the fact that some big IPs are currently in development like Dragon Age 4 and Mass Effect 5, the former BioWare General Manager, Casey Hudson, left the studio last year and has now gone on to form his own games studio.

Humanoid Studios founded by Hudson includes, according to him, talented developers from around the world and the company is also currently advertising for several job openings including a Senior Gameplay Programmer, Senior Creative Director, 3D Artists and more. "Today we are announcing a new independent video game company built to unleash the creative freedom of developers—bringing innovation and artistry to players through an all-new IP," stated Hudson.



SONY FACES BACKLASH FROM INDIE DEVELOPERS

Iain Garner - the co-founder of Neon - Doctrine started a twitter thread about Platform X where he criticized the platform for their bias against Indie developers and their poor backend services.

Garner obviously did not name the platform but said the following to describe the platform – "... it's the operator of a very successful console and does not have Games Pass!". At this point, it was pretty clear that Garner was talking about Sony and specifically, the PlayStation.

Garner stated that Sony practically gives no attention to small Indie developers like him. He also accused Sony of apparently taking $25,000 from the developers to get featured on their store. He wrote this : "Oh but don't worry. There is a way to guarantee you get featured! All you need to do is spend a VERY reasonable minimum of 25,000 USD to get featured. Oh and then 30% of your subsequent earnings...."



THE ELDER SCROLLS 6 STILL IN THE DESIGN PHASE ACCORDING TO TODD HOWARD

Bethesda Game Studios upcoming games are some of the most anticipated of the single player RPG genre. Recently, Todd Howard revealed that the hugely-anticipated Skyrim sequel, The Elder Scrolls 6, is still in the design phase at the moment despite having been announced back in 2018. He added that It will also be running on the new Creation Engine 2, the same technology that's powering Bethesda's next big title called Starfield which is launching next year.

"It's good to think of The Elder Scrolls 6 as still being in a design [phase]," Howard stated, "but we're checking the tech: 'Is this going to handle the things we want to do in that game?' Every game will have some new suites of technology so Elder Scrolls 6 will have some additions on to Creation Engine 2 that that game is going to require."



CYBERPUNK 2077'S STABILITY HAS REACHED "A SATISFACTORY LEVEL"

CD Projekt Red has reportedly stated that the stability of its plagued RPG Cyberpunk 2077 has now reached a "satisfactory level" in terms of stability of the game.

The launch of Cyberpunk 2077 last year was tormenting, especially for console players. Since then, CDPR have released multiple updates and patches in order to improve the stability and performance of the game, and now they feel it has reached a point to be good enough to start working on other issues.

During the WSE Innovation Day conference, CEO of CD Projekt Red, Adam Kicinski, said that the game's performance and stability has now reached a point where the developers can start focusing on other common complaints by players that aren't directed at performance, and get the game back to the quality they initially promised.

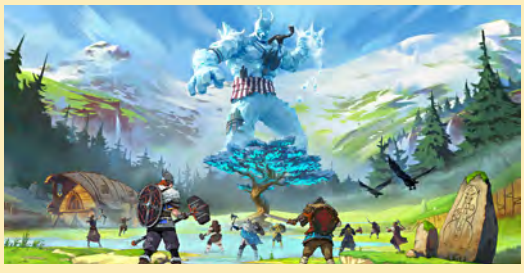
UP AND COMING



BLACK SKYLANDS

Black Skylands is a skypunk indie game that combines elements of Open World, Sandbox, Top-Down Shooter and Action/Adventure games. The game features plenty of content and is about 50 percent complete. It hits Early Access this month.

Release date – July 9



TRIBES OF MIDGARD

The first impression of indie game Tribes of Midgard is Valheim with an isometric view, but Tribes of Midgard has plenty going for it that makes it stand apart. Best enjoyed co-op, the game features plenty of exploration, combat, and epic boss fights.

Release date – July 27



ELDEST SOULS

Don't let the name fool you. Okay, wait, yes, this is also a game with challenging combat and boss fights but still! Not in a way you might be expecting. Eldest Souls is an indie game featuring pixel graphics with complex build customization and fast-paced gameplay.

Release date – July 27



A SWASHBUCKLING ADVENTURE PANNING DIMENSIONS

BY SAMEER "PSYCHOMANTIS" MITHA

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Ratchet and Clank: Rift Apart is a beautiful game giving you the feeling of being in a swashbuckling animated movie. But then again, I said the same thing about Ratchet and Clank: Into the Nexus on the PS3 and the PS4, which was a reimagining of the original Ratchet and Clank. Ratchet and Clank: Rift Apart dials the visuals up to 11 by implementing features like ray-tracing and in HDR the game looks stunning. It is a brilliant adventure, one that fans of the franchise will definitely enjoy. But is it the quintessential Ratchet and Clank experience?

STORY

The story of the game takes place after the Future Saga, which was released for the PS3 and if you haven't played those games, it's OK. While there is a small recap in the form of a celebration at the beginning of the game, it doesn't do justice to the legacy of the franchise. It is also a slight disappointment that one of my favourite characters in the game, Captain



Copernicus Leslie Qwark, has a very very small role to play. But that said, the story has a lot of heart and will appeal to newcomers and veterans of the franchise alike. The story is simple, Clank has rebuilt the Dimensionator so that Ratchet, the lone surviving Lombax can find his kin. However, things don't go according to plan and the evil Dr. Nefarious steals the Dimensionator causing massive chaos across the dimensions.

During the chaos, Dr Nefarious opens a rift to an alternate dimension where we are introduced to a female Lombax - Rivet and she is my new favourite Lombax in the franchise. Not only does she have heart, but the voice acting and animation of Rivet is spot on to make you fall in love with the character. She has a metal arm and the history behind her losing her arm is well explored in the story. She also has trust issues and shares the same loneliness of being the only Lombax in her universe - one which we have explored with Ratchet in past games. She also has some of the best one-liners in the game, which will make you chuckle.

In addition to Rivet, there are callbacks to some beloved characters in the franchise that have a slightly different story in this new dimension. The plot of the game is simple and considering the target audience, rightfully so. It has good lighthearted humour, some interesting plot twists and is definitely a story



the family can enjoy together. It has messages like believing in yourself, the virtue of forgiveness, and above all, the power of friendship.

GAMEPLAY

Familiar; yet new, is the best way to describe the gameplay in Ratchet and Clank: Rift Apart. Strafing, jumping, the weapon select wheel and some of the traversing all feel familiar. But there are some new elements here as well. A dash that makes you temporarily invulnerable, new weapons in your arsenal, and some new traversal tricks, help make the gameplay feel fresh. Let's break it down.

At its heart, the gameplay is the same we have come to love from previous entries in the franchise. It is a third person action-adventure game. You play the game as both Ratchet and Rivet and their gameplay mechanics, abilities and weapons are identical. So, when one character gets a new ability, weapon or upgrade, the same is reflected with the other character. Whether this is a good or a bad thing is entirely up to you. Considering the variety in weapons on offer, the gameplay is pretty diverse.

Speaking of weapons, in true Ratchet and Clank fashion we have an interesting mix of some old and new weapons on offer and the weapons make use of the Adaptive Triggers on the



DualSense controller. The Burst Pistol, for example, will fire slow, but accurate, rounds when the trigger is half pulled. When pulled completely, the gun will fire rapid but less accurate rounds. The same for the Enforcer (the game's version of a shotgun). Pull the trigger halfway for a single barrel shot or pull it completely for a double barrel shot. The NegaTron Collider charges up as you half pull the trigger and fully pulling it lets out a charge. This makes the adaptive triggers quite useful for these weapons. In some weapons, like the grenade launcher, half pulling the trigger brings up the aiming reticle, which can also be achieved by holding down the left trigger. Some weapons are traditional in their firing mechanism (like the sniper rifle) and only use the added tension in the trigger for an immersive experience.

There are a bunch of new weapons at your disposal this time around. There is the Ricochet, which as the name suggests, ricochets on enemies a few times. There is also the Topiary Sprinkler that freezes enemies in place by converting them into plants. And the you have Mr Fungi who hovers around you and fires a swarm of fungus spores. In the heat of battle, Mr Fungi can also distract enemies and draw fire away from you.

There are more than 20 weapons that are in your arsenal for you to mix up the gameplay. Like traditional Ratchet and Clank



games, the more you use your weapons, the more powerful they get. You can also visit Mrs. Zircon who is the weapons vendor and not only can you buy weapons from her, but also upgrade them.

The level design in Ratchet and Clank: Rift Apart has seen some changes. To begin with, there are vast open areas you will explore with multiple quest objectives along with some side objectives and collectables. There are also the standard cinematic set pieces that will keep you at the edge of your seat. The new highlight here is the ability to jump from one level to the next by using a rift and the SSD loads a new level in a matter of seconds making the game feel truly next-gen. While these rift jumps are scripted, their implementation is very impressive. Once you boot up the game, it doesn't take more than a second or 2 to load it from the save menu or even when you die. It's truly amazing.

The game is filled with some truly frantic battles and while you can choose a set of favourite guns and stick to them for the duration of the game, I highly recommend giving each weapon a chance as they truly diversify the experience.

The only downside to the gameplay is the boss battles. While there are diverse planets to explore and some truly epic bat-



tles, most of them culminate with the same four large enemies making the boss battles quite repetitive. Think of these as the same Trolls recycled as mini boss fights throughout 2018's God of War. Sure, the Dr Nefarious battles are a standout highlight, but the game could do with some more varying boss battles.

You also have pocket dimensions you can visit which are platforming challenges and usually end with some reward. You also take control of Clank for some puzzle sequences and a small hacking robot for some action-packed hacking sequences and all these are a fun distraction from the main game. Overall, the gameplay of Ratchet and Clank: Rift Apart is frantic and fun with the only downside being the lack of varying boss battles.



GRAPHICS

Ratchet and Clank: Rift Apart looks like a Pixar movie. For a large part of our review, we played the game in 4K 30FPS with Ray-Tracing enabled and the experience was cinematic and sublime. Considering the number of effects on screen, large groups of enemies and your weapons firing all over the place, I did not notice the game stutter at all - an incredible technical achievement. From the neon-lit Nefarious City to vast open

deserts the game has a lot of diverse environments you can traverse and each looks amazing.

The effects your guns produce are also a sight to behold. From the flashing muzzle of the Enforcer to the lightning generated when you shock an enemy, and even flash of the grenade, on a good HDR TV, you can truly enjoy the dynamic range the game brings to the table.

The character models deserve special attention too, especially Ratchet and Rivet. From their fur looking realistically wet in the rain to the Lombax's ears fluttering when grinding on a rail or using hover boots, there are many small touches that add to the immersion. Animation movies have a lot of physical comedy and the same is expressed in the game, especially in a lot of sequences involving Dr. Nefarious. Eagle eyed gamers will also notice the ray-tracing effects implemented on Clank's shiny body. The devil lies in the details, and the details here are very impressive.

The load times also deserve special mentions and if you skip a cinematic, the game loads in a heartbeat eliminating the era of loading screens being hidden behind cutscenes. Jumping through Rifts is a highlight where the PS5's SSD gets to flex its muscles.



During our review of the game, we played it in the 4K 30 FPS mode with Ray-tracing enabled as that was the only mode available. But the developer has unlocked the 60 FPS mode and the 60 FPS + RT mode as well. We've started a new game using the 60 FPS + RT mode and so far, its performance is at par with what we experienced in Spider-Man Miles Morales which has the same modes.

SOUND

Moving over to sound, once again, you can expect Pixar level production with the voice acting, background score and sound design. Ratchet and Clank bring their friendly voice with quirky one-liners. But the voice actor of Rivet deserves a special mention. She has done an outstanding job creating a character who is vulnerable, yet has her guard up. She is also approachable and has a caring side to her, even if she doesn't trust Clank the first time, she meets him.

The game makes use of the PS5's 3D audio capabilities as well and with a good headset on, you can make out the bullets whizzing by you and once the action gets intense, the sound can get quite immersive.

As much as I enjoy the 3D audio capability of the game, I recommend you play it with your speakers. That's because the



game also utilizes the speakers on the DualSense controller to add either environmental sound effects, effects from your weapons and more. This combined with the haptic feedback on the controller makes for an immersive gaming experience.

MOAR!

DEVELOPER:
Insomniac Games

PUBLISHER:
Sony Interactive Entertainment

PLATFORMS:
PS5

PRICE:
Rs 4,999

VERDICT

Ratchet and Clank doesn't stray far from the formula that made it a great platformer action game. I miss the fact that Rift Apart doesn't have the double innuendo titles like Going Commando, Up Your Arsenal, and Quest for Booty the franchise started out with. It's more straightforward and takes calculated risks the developers know will pay off. It is a visually stunning game with a diverse arsenal of weapons. The game definitely highlights the abilities of the PS5. The story of the game is full of heart. We would have loved to see more diversity in the boss fights, but the package on offer is one that will definitely appeal to gamers old and young. *



AN UPGRADED AND STREAMLINED EXPERIENCE FROM START TO END

BY MITHUN "BARBARIAN_MONKEY" MOHANDAS
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Reliving what can be termed as BioWare's magnum opus, is a privilege. The Mass Effect trilogy (we're not counting Mass Effect Andromeda or the toss-up with ME3's ending) is a space opera centered around humanity's battle for survival in the galaxy and you play the role of Commander Shepherd who's in the midst of this murky battle. The game's been out for close to a decade, so we all know who the Reapers are and where they emerge from, so spoilers be damned.

Mass Effect: Legendary Edition is simply a remaster of the first three games with updated textures and visuals, a few improved game mechanics and some quality of life changes. And they've thrown in all the story DLCs as well as the cos-



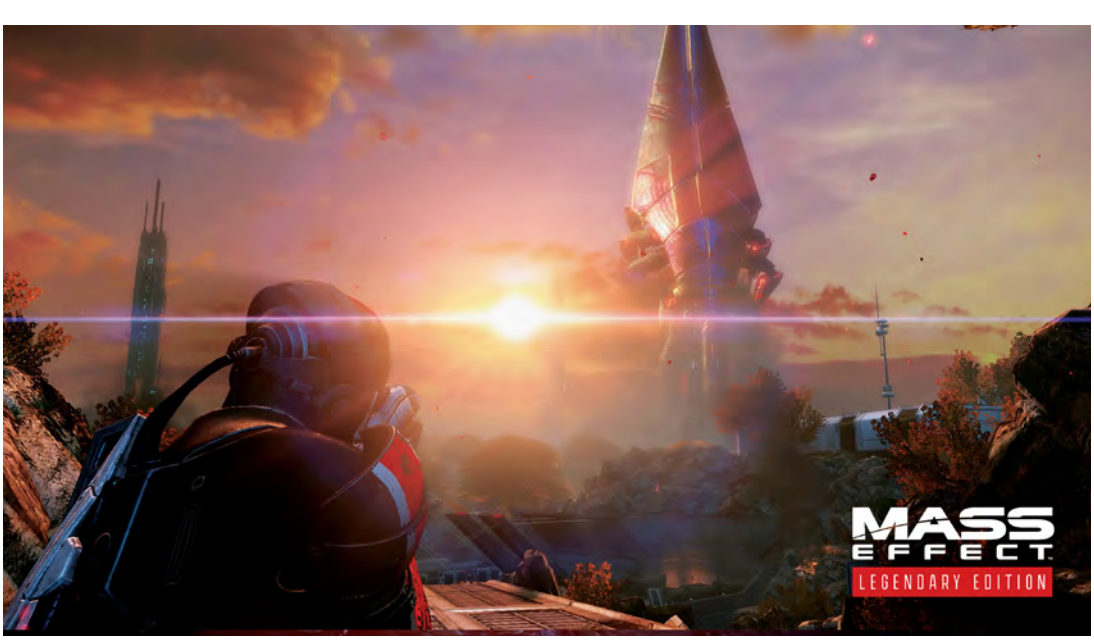
metics. The developers were careful to not completely change the look and feel of the game. Aside from being ridiculously time-consuming, that would have been a completely unnecessary step. Instead, the changes are subtle and if not, they've been made to make the game feel more contemporary. We're not reviewing the story since we're already done



that in the past and you can read them on our website. Instead, we're going to focus on what's new.

GRAPHICS OVERHAUL

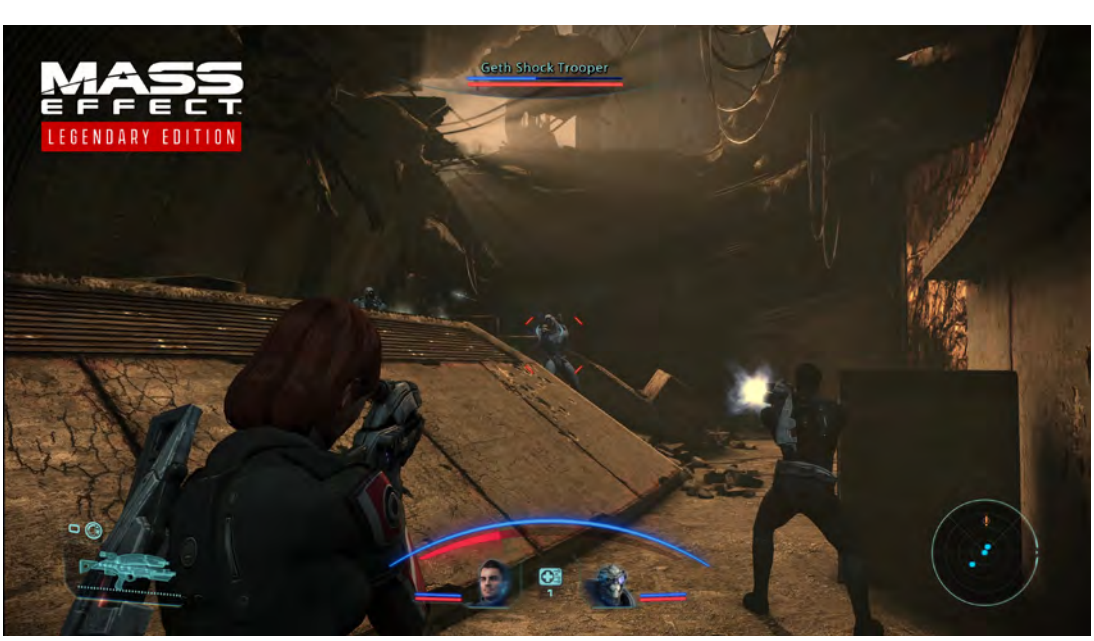
With the Legendary Edition, we see a lot of improvements have been focused on the visuals. Firstly, the game has been remastered for current gen consoles which are all capable of running 4K resolution so all visuals have been upscaled. On top of that, all models have gone under the brush to get detailed textures and decals. All primary characters that you deal with have been spruced up to add more detail. The faces are more distinguishable and FemShep has been reworked a little bit. Skin textures are quite distinct for the alien races. The Asari's freckles and Drell's leathery green skin are good examples to look out for. Also, clothing feels like clothing and not like body paint.





Character creation has been tweaked a little. You have additional skin tones, hairstyles and the character creator is the same across all three games. You can even use the character creator code across all three games.

The world has also been polished. We have a lot more sun flares so the game gets that J. J. Abrams look and feel. Game levels that were usually drab and lacklustre have received additional detailing. The original games had a lot of mist or haze no matter which world you went to or whether you were indoors or outdoors. It was as if you had a case of the cataracts. That's been done away with and you'll find a lot more sharper textures on models in the world. Aside from that, there are minor changes to vegetation, placement of objects and additional world detailing.



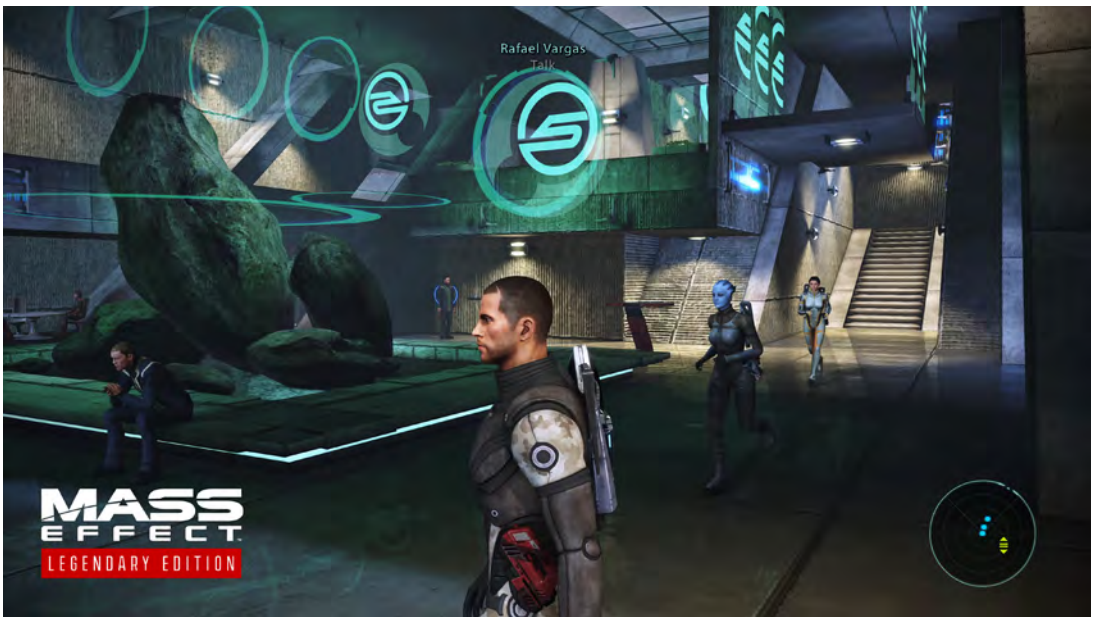


Lighting has improved by a huge margin. We now have multiple sources of lighting and global illumination that makes all the textures and improved visuals come to life. Whether you're in the Normandy or on an underground level, the lighting feels more natural.

GAMEPLAY IMPROVEMENTS

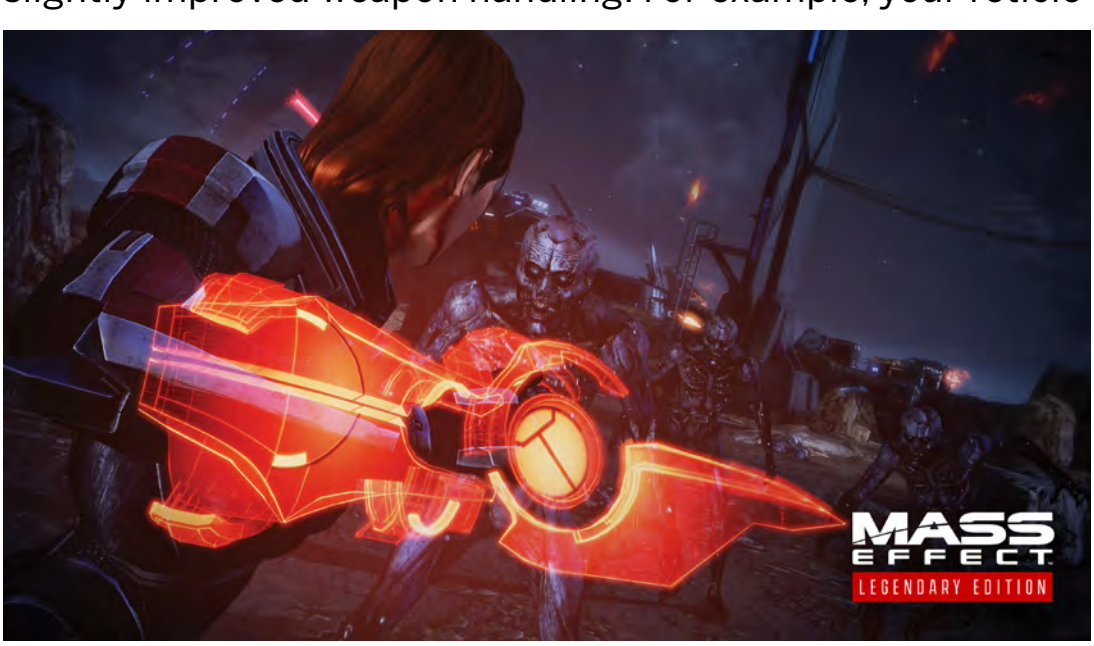
Aside from the visuals, the largest amount of improvements to the Legendary Edition have been with the gameplay. These have mostly been quality of life improvements. In the pre-launch session, we were shown how the elevator scenes were used by the developers to obfuscate level load times. Since game levels were massive, you'd end up spending a lot of time in elevators. With the advent of SSDs, the need to have long elevator rides has gone away.





The Mako or the off-world terrestrial vehicle had some really wonky controls. The Mako felt way too responsive in the original games, as if the ground textures and gravity didn't exist. That's changed with the Legendary Edition. Driving the Mako feels similar to driving a car in any other contemporary RPG. For those who'd miss the wonky-ness, the game does give you an option to roll back to the original controls.

Then there's the combat system. All enemy and friendly AI has been improved. You will now see a few smarter enemies in the game and your Krogan buddies won't be blindly running into the enemies without cover every two seconds. The original game was made primarily for the console and later ported to PC, so the weapon controls were ... for lack of a better phrase "dumb". In the Legendary Edition, you get slightly improved weapon handling. For example, your reticle



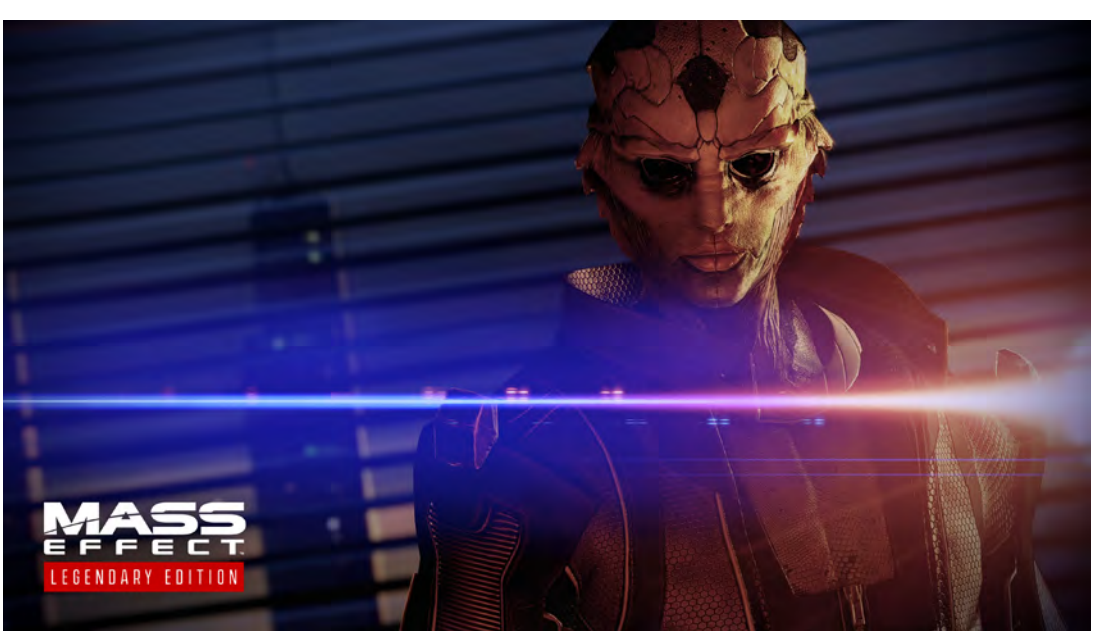


will not bloom to take up a massive chunk of the screen and will be compact. Most enemies will take additional headshot damage so accuracy is rewarded. Moreover, any class of characters can use all weapons in the game without accruing any penalties.

You could play Mass Effect in a tactical manner by commanding your squad mates to perform a set of actions while you went about taking another route, or you could storm into battle guns blazing. For the tactical players, you'll now get to command each squadmate independently. Also, certain boss fights have been tweaked for newer players.

MULTIPLAYER AND PARAGON

Barely anyone remembers Mass Effect for the multiplayer aspect of the game. The story was so good that it's the only thing that you associate with the Mass Effect series. So with



the Legendary Edition, BioWare has done away with the multiplayer aspect.

The Paragon system saw improvements from one game to the other, so in the Legendary Edition, all of those chronological improvements have been unified. Now, whether you're playing the entire game in a sequential manner or if you're jumping directly into the second or third installment will net you a more unified experience. Skipping the first or second installment will mean that you will find the third installment a lot more difficult to complete but if you take the completionist approach, you'll find it easier.

MOAR!

PLATFORMS
Windows, XB1, PS4

PLAYED ON
Windows

DEVELOPERS
BioWare

PUBLISHERS
Electronic Arts

PRICE
₹3,999

VERDICT

Mass Effect Legendary Edition is definitely worth your money, especially if you've been holding back from starting with the game. It's the same great story being recreated to match current gen graphics and sensibilities. As for fans, reliving the saga of Commander Shepherd is something every Mass Effect fan would like to do and with the Legendary Edition, it's like you're remastering those good memories. *



GAMES THAT CHANGED GRAPHICS FOREVER

Games would look and play nothing like they do today without these games

BY MANISH "TRIGGER-HAPPY" RAJESH
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Here we go again with the "video game graphics have come a long way". Well, they have, leave us alone. They've come a long way really fast though, if you think about it, in the last 20 years video game graphics have improved exponentially. If you asked anyone 20 years ago what games would look like today, we're pretty sure nobody would have thought they would look this good. Of course, in order to get there innovation was needed. Graphics didn't improve overnight, it was the effort of various different teams of developers working on different games that slowly pushed the boundaries of gaming graphics, the culmination of which we can see today. So here we have some games that introduced or perfected the graphics and mechanics that we take for granted, for the first time.

STAR WARS DARK FORCES

Looking up and down

Looking up and down doesn't seem like a big deal, does it? Well, in 1995 it was a huge deal. This was the first FPS game where you could do just that. Compared to every major FPS



that was out at the time, we're talking Wolf, and Doom, and... um let us know if you think of others, but yeah, this was the only game at the time where you could look up and down. Something as simple as that was a huge leap for FPS games.

DOOM

3D!

Doom was the first game to truly emulate a 3D environment for you to explore. It wasn't true 3D, the devs achieved it by using some very neat tricks, but what they accomplished definitely left you feeling like you'd just played a proper 3D game. Even if you were to return to the original Doom now,



you'd still think you were playing a 3D game. The game was actually just extrusion maps, flat 2D maps that had been stretched out to look 3D. This meant that you couldn't even have a room on top of another in Doom, but that didn't really stop them from delivering.

DESCENT

True-3D

1995's Descent was the first truly 3D game. Don't confuse that with the first 3D game, that's different. What we're getting at here is that in Descent, instead of using 2D sprites, all the models in the game were 3D models made with polygons. You might ask, wait, even Doom was 3D. Well yes, but not true 3D. Doom was made using heightmaps, not polygons. Being the first polygon-oriented 3D game is a pretty big deal, but that wasn't all. Descent also offered six degrees of freedom,



meaning you could point and shoot in any direction, in a time where the norm was simply up, down, left, or right.

CRUSADERS OF MIGHT AND MAGIC

Dynamic Shadows

Crusaders of Might and Magic had quite a bit of hype surrounding it. On release it turned out to be a pretty mediocre game. It received a pretty meh reception. However, it is the first game to have dynamic or volumetric shadows. This means it was the first game to be affected by light sources. Meaning, if your character was near a light source, it affected how you saw shadows. You might be thinking, "pfft, big



deal". Well yes, for 1999, a very big deal. At the time, there were no games around that had dynamic shadows, or proper shadows at all. They were either static images, or blurry

patches. This was one of the features about the game (in addition to being true 3D, also a big deal at the time), that created a lot of hype surrounding it. Unfortunately, the game itself was pretty bleh.

MESSIAH

Tessellation

GPUs today are crazy powerful, 20 years ago, not so much. Unsurprisingly, games had polygon budgets. Meaning the amount of polygons objects could have in a game were capped. Exceeding this budget meant the hardware could no longer support the game. This is where tessellation came in. With a rather weird game called Messiah. Let's just say the only thing the game is remembered for is tessellation. Tes-



sellation figures out how many polygons can be used by the hardware and brings the engine up or down to that number. Nowadays with GPUs becoming increasingly powerful we don't really need it as much, but 20 years ago this meant that you could play some fairly intensive games on weaker rigs. It was also a boon to designers and artists, who would no longer need to make several different versions and resolutions of models and assets.

HITMAN: CODENAME AGENT 47

Verlet Integration Ragdoll Physics

The first video game to ever use ragdoll physics was Jurrasic Park: Trespasser, but the first game to use them properly would have to be the first Hitman. Hitman used something called Verlet integration. Character models in Hitman (or any



game with ragdoll physics nowadays, for that matter) used something we call a skeleton, and this skeleton was connected together via, well, its bones. These attached bones also acted as weights or constraints for the skeleton, so it wouldn't go crazy from impact or fly off in some odd direction. Various points on the model's skeleton could store velocity data; this meant that impact was felt more realistically, although the result would often be more hilarious than realistic. It worked though, at least at some level, there was a successful simulation of realistic ragdoll physics. Ultimately, the techniques that were used in the first Hitman laid the foundation for the ragdoll physics we use in games to this day, including the latest Hitman games.

FAR CRY

Weather and Procedural, Regenerative Vegetation

Far Cry was one of those games that set the benchmark for a lot of things when it was released. It also introduced a bunch of new graphical features that would go on to become a staple in the gaming industry. The game's vegetation reacted realistically to the environment around it, meaning you could destroy the vegetation. Not much of a big deal today, but at the time we were used to trees being indestructible. That's not all though, you see, you're not the only destructive element in the environment, the vegetation in Far Cry also reacted to the weather. For this to work, all of the vegetation



needed to have its own physics and animation. It doesn't seem like much, but you could see the vegetation gently swaying in the wind. It doesn't end there though, the wind could even break the flora in the game, and it was procedural breakage, not scripted fixed animations at set periods time. The damaged plants would then also regenerate over time.

Far Cry also procedurally generated fire, fire which could be affected by the wind. On a windy day in the game, fire would spread farther and catch quicker. That's some pretty crazy attention to detail for 2004, stuff we'd normally take for granted.

RED FACTION

Truly destructible environments

Destructible environments were already a thing when Red Faction came out. However, Red Faction revolutionised the

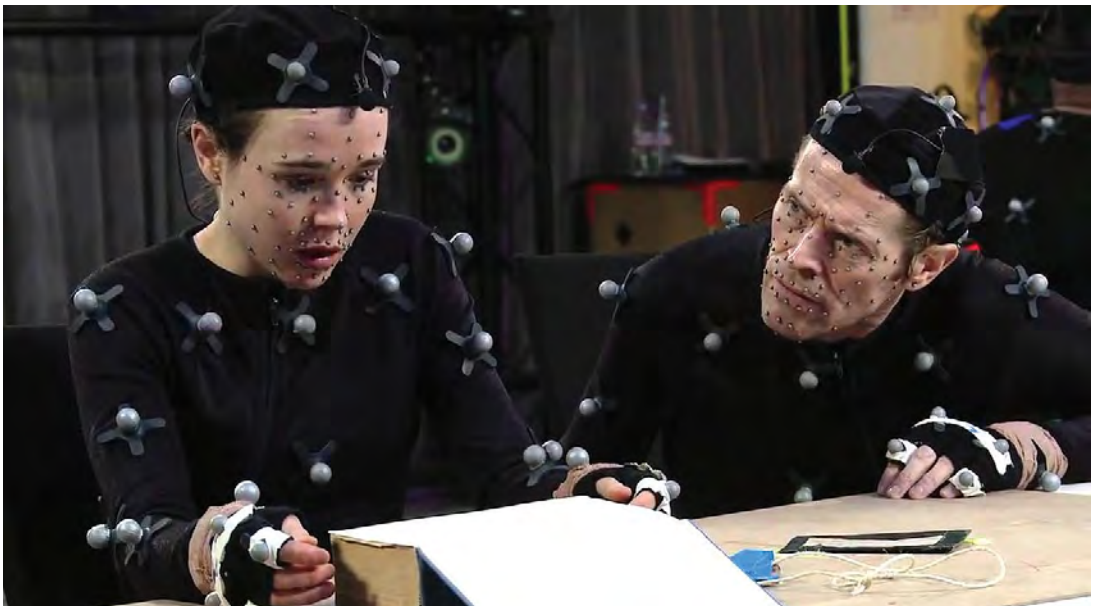


way you could destroy the environment, with what they called “Geo-mod” technology. Until this point, destructible environments meant that only certain parts of the environment were actually destructible, and even if they were, they could only be destroyed in a certain way at certain points. This meant the destruction was all pre-rendered and pre-scripted beforehand. In Red Faction, everything was fair game. All the buildings were actual, destructible, physical structures, and the devs put a lot of detail into the structures to ensure that the destruction felt realistic (and satisfying), which they managed to pull off. This also meant that you could probably destroy it in a whole different way the second time you came around.

LA NOIRE AND BEYOND TWO SOULS

Performance Capture

Motion capture had already existed by the time LA Noire and later, Beyond Two Souls came out. For that we can credit the arcade game Virtua Fighter 2. However performance capture is a whole different beast. In LA Noire, it helped push the game’s facial animations to a whole new level of realism at



the time. However, as with all things that are attempted for the first time, it was equal parts realistic, and equal parts hilarious. Beyond Two Souls one could say was the first to somewhat perfect performance capture. Unlike LA Noire which did it only for facial capture, Beyond Two Souls would employ performance capture for, well, everything. Meaning just about all the action you see in the game was motion captured, meaning it was all acted out by real people with

green screens behind them. Talk about dedication to accuracy. Of course, this level of mocap isn't something everyone can just start doing. While it's employed to some extent in a lot of games, it's not feasible considering the room and equipment you'd need to pull it off.

QUAKE 3 ARENA

Curved surfaces

Before Quake 3, it was reasonable to assume that everything in a game could probably stab you. You see, before Quake 3 Arena came along, it was the norm for everything, environments, enemies, objects etc to have sharp angled edges. Quake 3 would introduce curved geometry and surfaces to



the game, which did quite a few things. For one, things just looked better and more aesthetically pleasing. Second, curved surfaces made things look smoother, smoother things looked nice, even if the textures on said surface weren't as detailed as its flat and sharp counterpart. In a way this meant less effort or time spent on textures, and more on gameplay, which as we all know, Quake 3 aced that department. Less effort while still looking better is a win-win, not just for Quake 3, but the future of gaming.

Interestingly, Quake 3 was also the first to tease Ray Tracing in a concept demo waaay before RTX cards were ever a thing. It needed a bunch of CPUs to run, we're talking something like 30 Pentium 4s. This was still just a concept demo, Quake's levels weren't designed with ray tracing in mind, or at least, the finished product wasn't. Still pretty neat.

There are probably (definitely) more games out there that made significant contributions to pushing video game graphics to the next level. Heck there are games that are doing it right now. Simply seeing how far gaming has come in such a short time only makes us excited for the future of gaming and graphics. *



BRING ACCORD TO DISCORD

With BetterDiscord

BY KSHIPRA 'FAAFDAAJALEBII' JADAV
FEEDBACK@SKOAR.IN



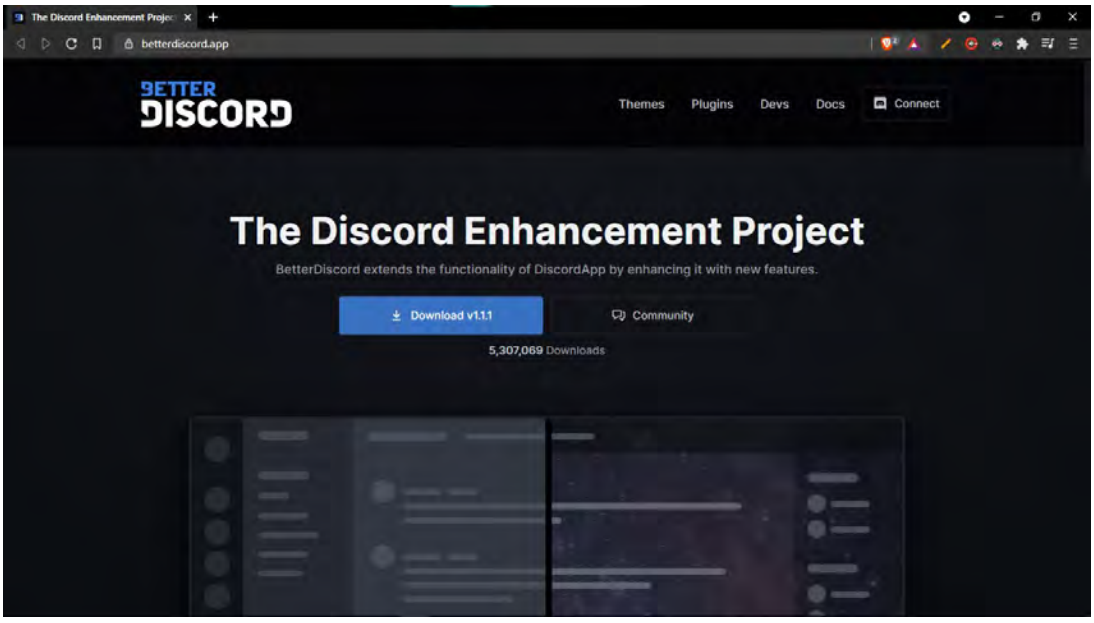
iscord is pretty much the “go-to” platform for many gamers out there. Ever since it became popular as a platform where you can hangout with your friends – talk to them via text, voice or video, people from many communities aside from gaming have been using Discord as their main mode of communication. We see a lot of discord servers being made for Crypto discussions, Art Discussions and we might even see some schools using Discord as their main mode of online teaching.

The reason why Discord is so popular is very simple. It takes literal minutes to make a server, invite your friends and start having fun. That’s it. No complicated setups, form filling, or tinkering with settings required. Of course, a lot of Discord servers that we see today are customized to their best extent. There are text channels, audio only channels, NSFW channels, people with multiple roles on the server and many more. Hence, the true nature and power of Discord as a platform can only be brought out by customizing the heck out of your server. But one thing people often overlook is customising their client itself. People just look at the default dark theme and use it because it is “good enough”. But what if we say that you could change that. You could change the way Discord looks and feels. You could change the way Discord handles animations. You could change the background of the whole client to whatever you like. You could bring a pure black AMOLED theme to your Discord! Don’t worry. We’re here to show you the power of BetterDiscord. An addon that will completely change the way you use and see your Discord client.

INSTALLATION

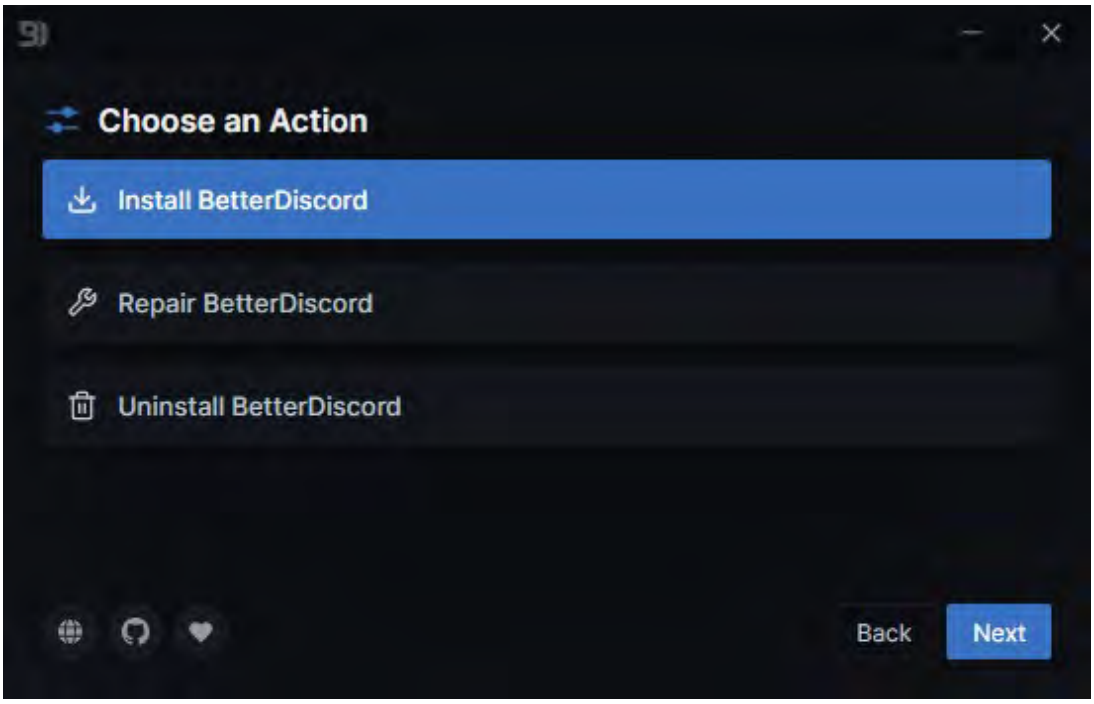
First of all, head over to https://betterdiscord.app. Download the latest release. At the time of writing this article, it is 1.1.1, hence we’re gonna download this. Don’t worry, if you’re reading

and following this guide in the future, aside from one or two steps here and there, no major changes should be there.

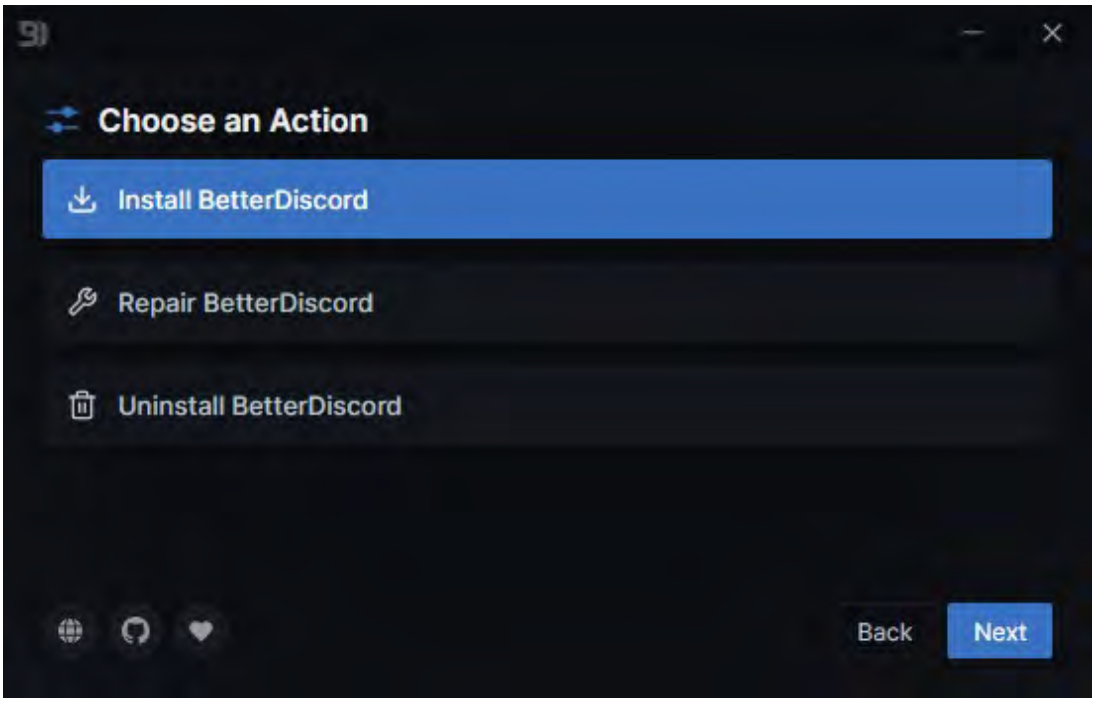


It is important to note here that BetterDiscord is completely free and open-source. Hence, the plugin support and theme support is community driven and you can find some very beautiful themes for it out there.

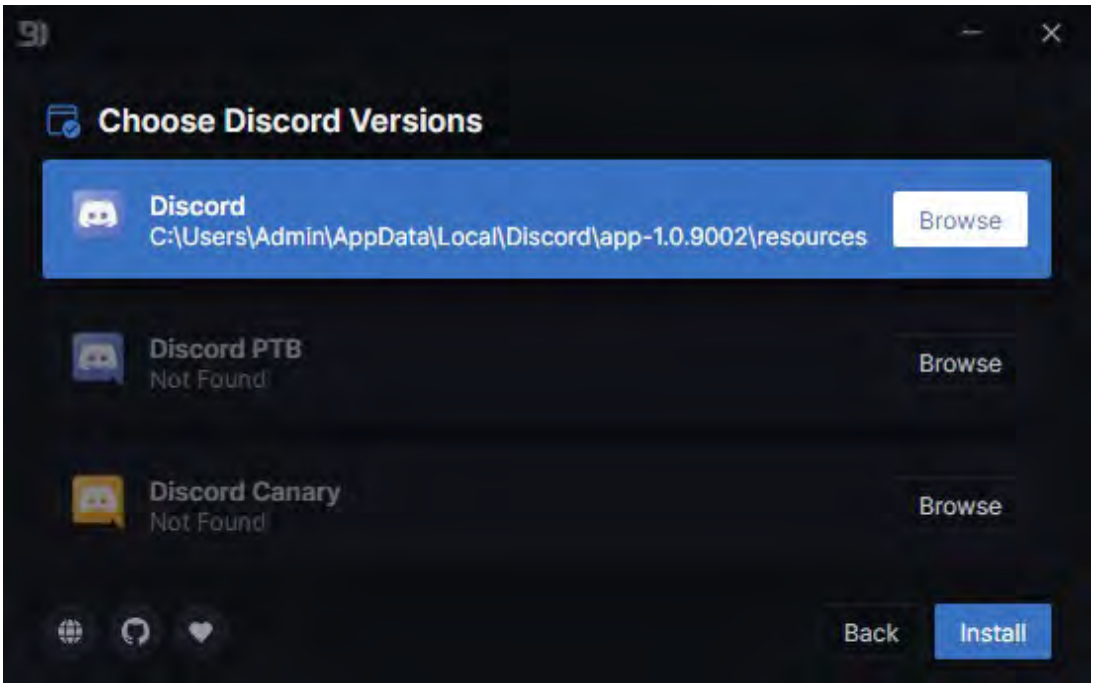
Anyways, once you have downloaded the installer for the application, open it, accept the license agreement (who reads those things anyway ¯_(ツ)_/¯) and you'll be greeted with this screen.



The options here are pretty self explanatory. You can choose to either Install, repair or Uninstall BetterDiscord. If this is your first time installing BetterDiscord then choose Install, press next and you'll be greeted with this screen.

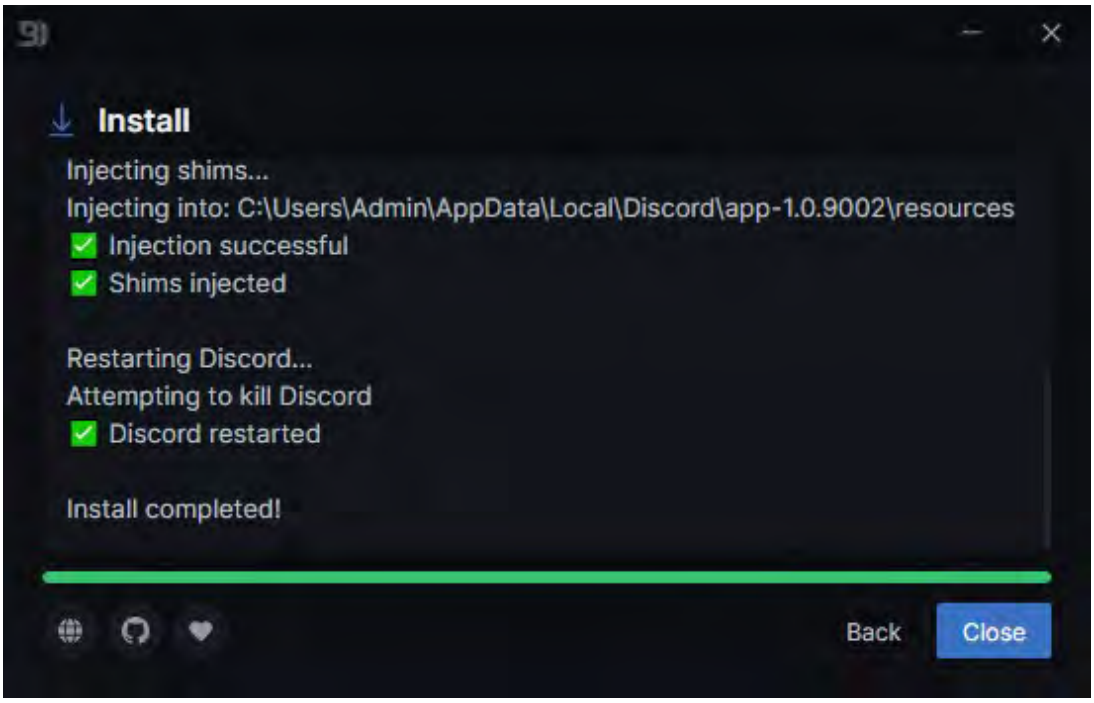


If you're running anything other than the stable build of Discord i.e. Public Test Build or Canary then you'll have to select that option accordingly. There's another issue that we've seen a lot of people face is that even though you have Discord installed on your device, BetterDiscord doesn't detect it. In that case, click on Browse and navigate to this path : C:\Users\Admin\AppData\Local\Discord\app-1.0.9002 and select the



resources folder. Click on Select Folder and now the same path should appear below the first option.

If not highlighted automatically, click on the version you're going for and it will be highlighted in blue color. Click on the Install button to proceed further.



After it is done installing, if you have the Discord client running in the background, it will be killed and then relaunched.

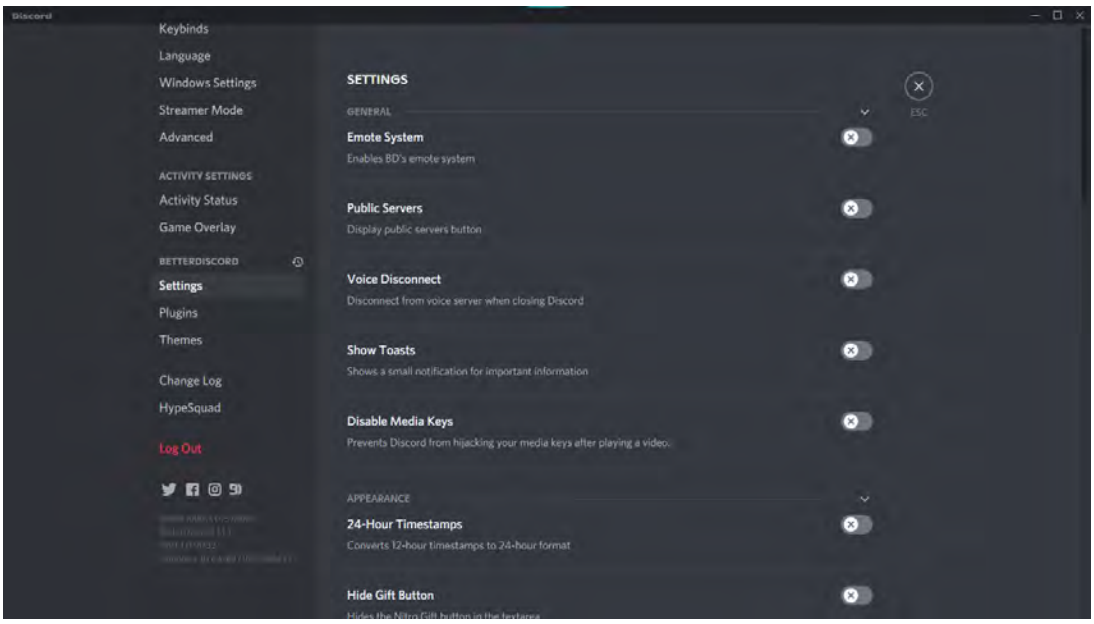
Boom. You have now installed BetterDiscord and linked it up to your Discord client successfully. It will seem pretty uneventful at first as you'll not notice any changes in the client after it's installed.

Let us now tinker with the settings and change some stuff to make your experience better.

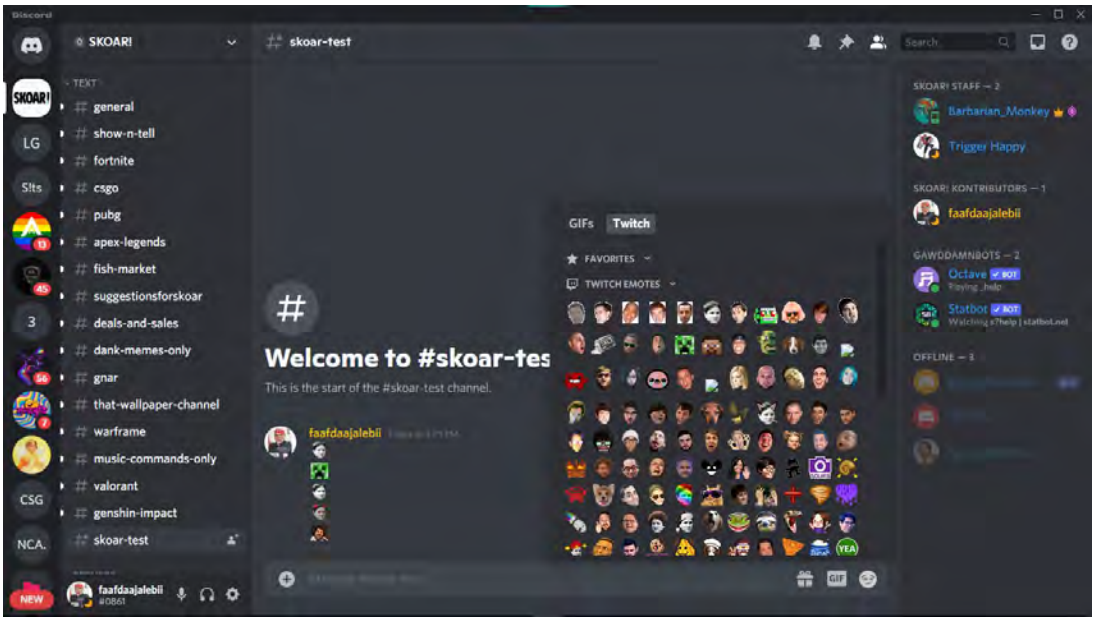
TINKERING WITH THE SETTINGS

Once you're done installing BetterDiscord, go to Discord's settings. If you scroll all the way down, you will find a new section, aptly named - BETTERDISCORD. Go to the Settings section there.

Let us run you through our favourite settings and what they do one by one.

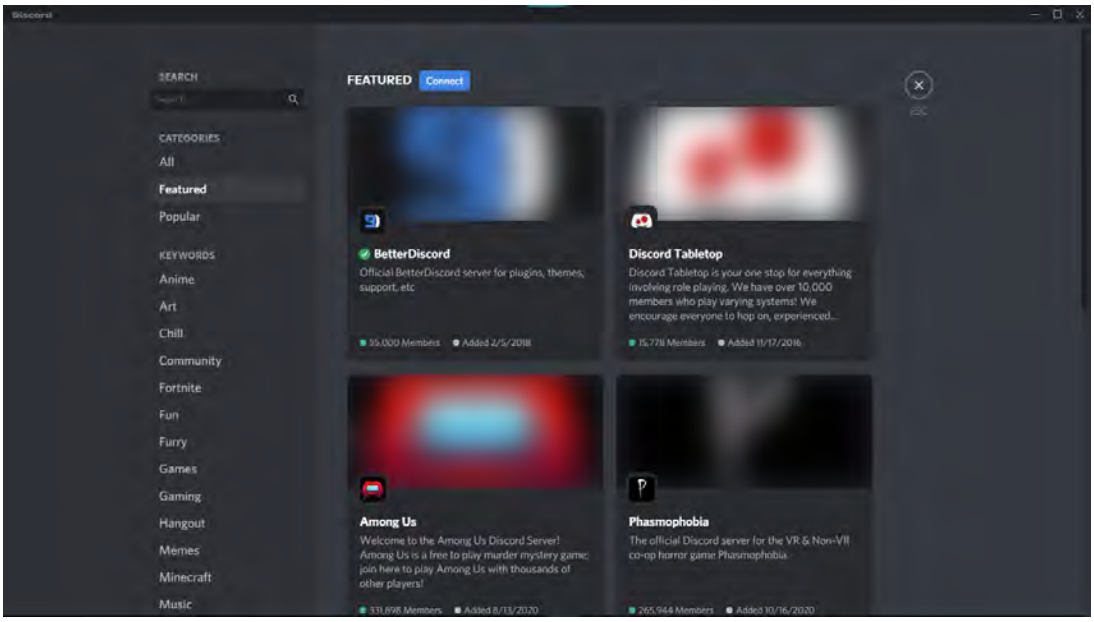


1. **Enable Emotes** - This will allow you to use all of Twitch's emotes right into any text field. You may be texting your friend or you may be chatting on a server. You can use them anywhere. There will be some emotes there by default but if you want to increase your emote library, then just link your Twitch account to your Discord and you'll be able to use all the emotes from the channels that you've subscribed to. Once you enable this option, you should see a new EMOTES option right under the SETTINGS option. You can go there and customize stuff to your liking. Now, go to any text channel and click on the GIF icon or the emoji icon and you should see a new TWITCH menu right beside that. Click on it and you'll find a ton of Twitch emotes to choose from. Pretty POGGERS isn't it?



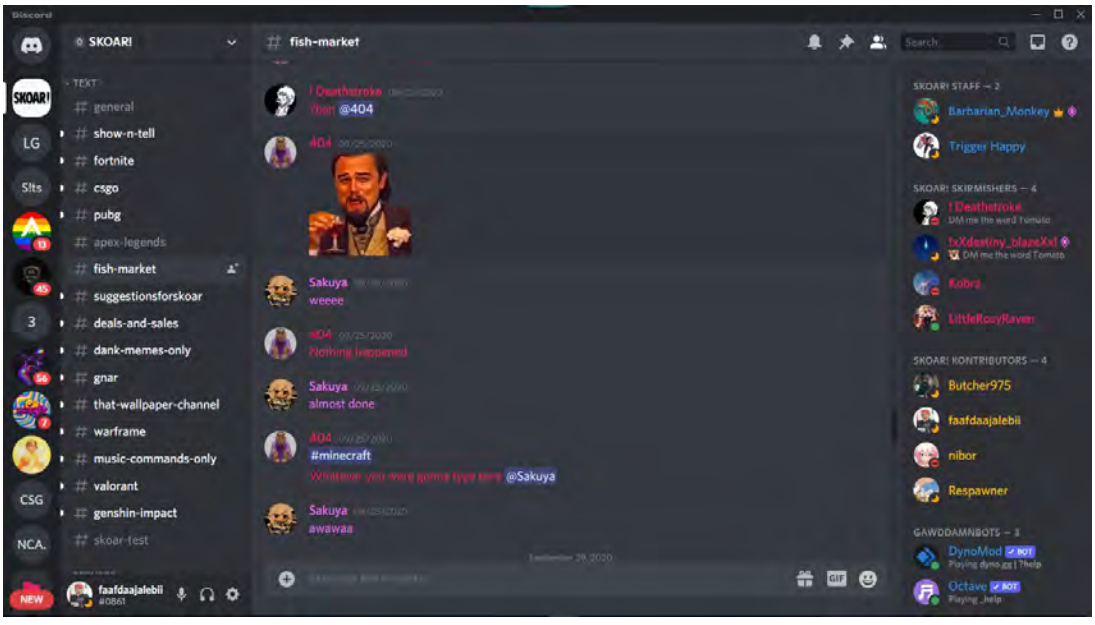
If you don't see the new menu or if the emotes don't load for you, just kill Discord and restart it. They should pop right up.

2. **Public Servers** - This will make a "Public" button appear under the Discord's home button. Clicking on it will take you to the Explore section of Discord where you can find some public servers to join.



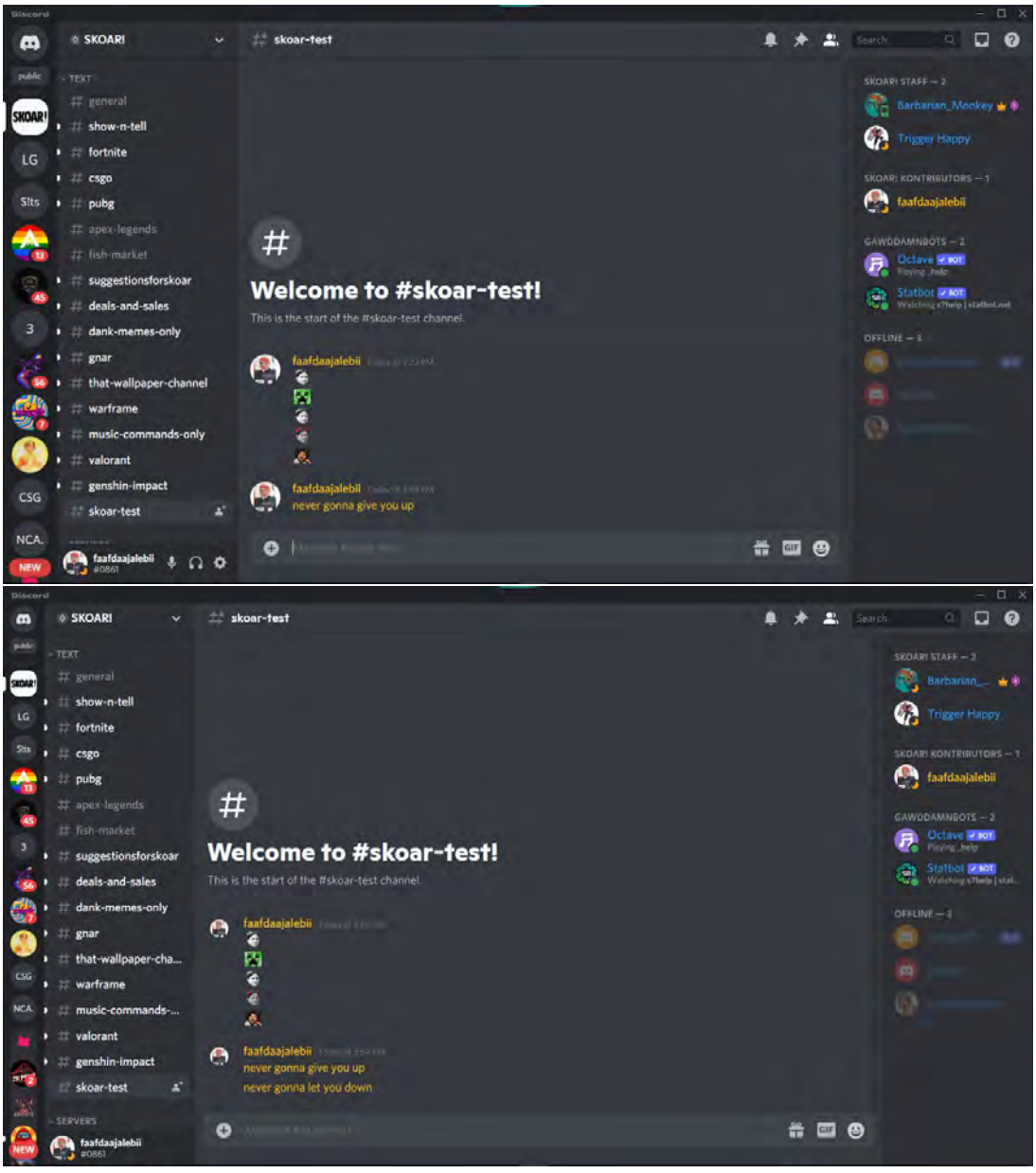
3. **Hide GIF & Gift button** - Self explanatory. This will hide the GIF and the Discord Nitro Gift button in any text area.

4. **Colored Text** - This one looks pretty cool. This changes the color of the text to match with the user's role's color.



5. **Minimal Mode** - Turning this one will stretch everything out

and reduce the size of the text. It'll look weird at first but it will eventually grow on you.

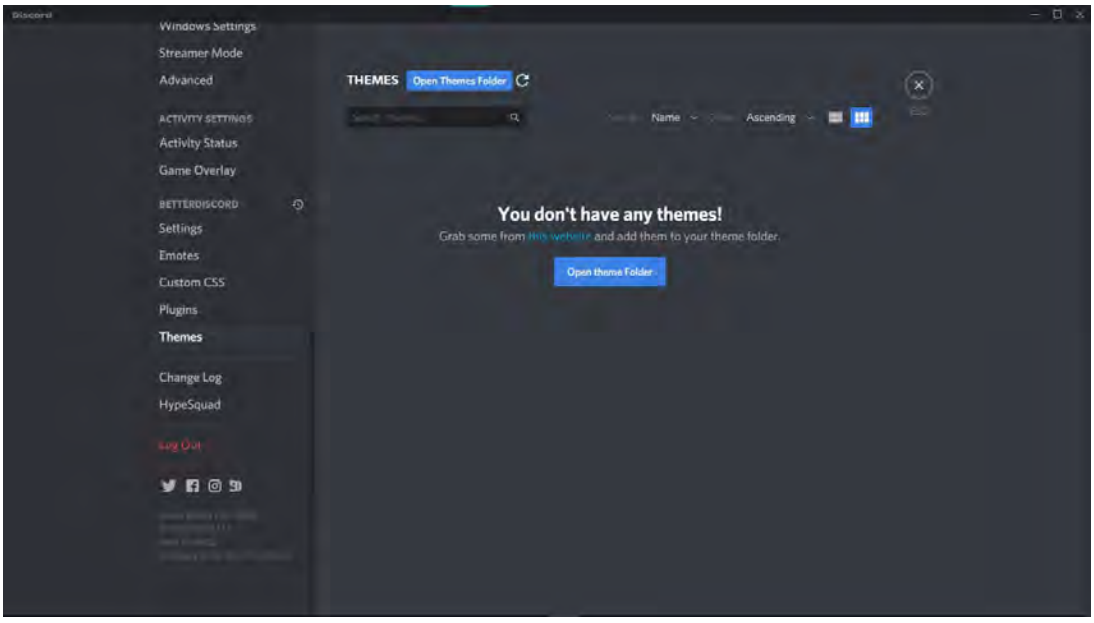


6. **Custom CSS** - Turning this on will add another option called CUSTOM CSS. If you go there, you can tweak Discord as per your liking. Hence, if you're a CSS geek and into customization, this one is a must!

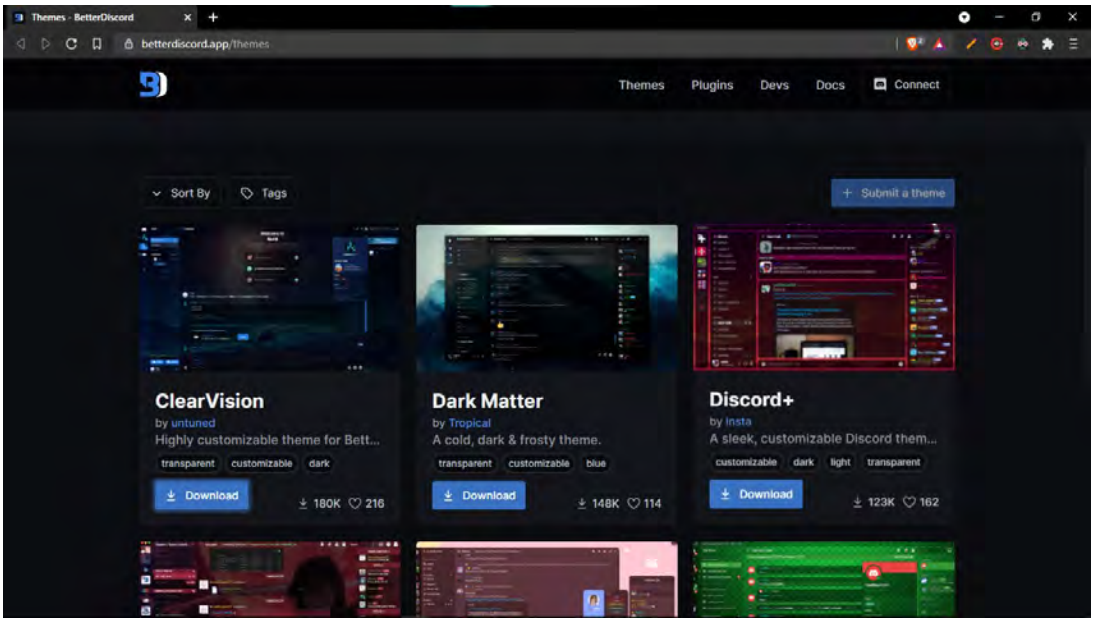
THEMES

Now comes the fun part! Well, what if you aren't the CSS expert you thought you were or you don't even know CSS to begin with. Don't worry. Themes have got you covered. In its essence, Theming Discord is making a CSS file and fiddling with it and in this case, people will do the fiddling for you. You just have to copy and paste the CSS file to a certain location.

Now, to get started with themes, go to your client's settings and scroll all the way down to the BETTERDISCORD section. Here, you'll see an option called Themes. Click on it and you will be greeted by the following page.



Ofcourse, at the start you're not gonna have any themes installed. But you will build up your theme library gradually. See the 'this website' hyperlink in the text? Click on it and it'll take you to this webpage.

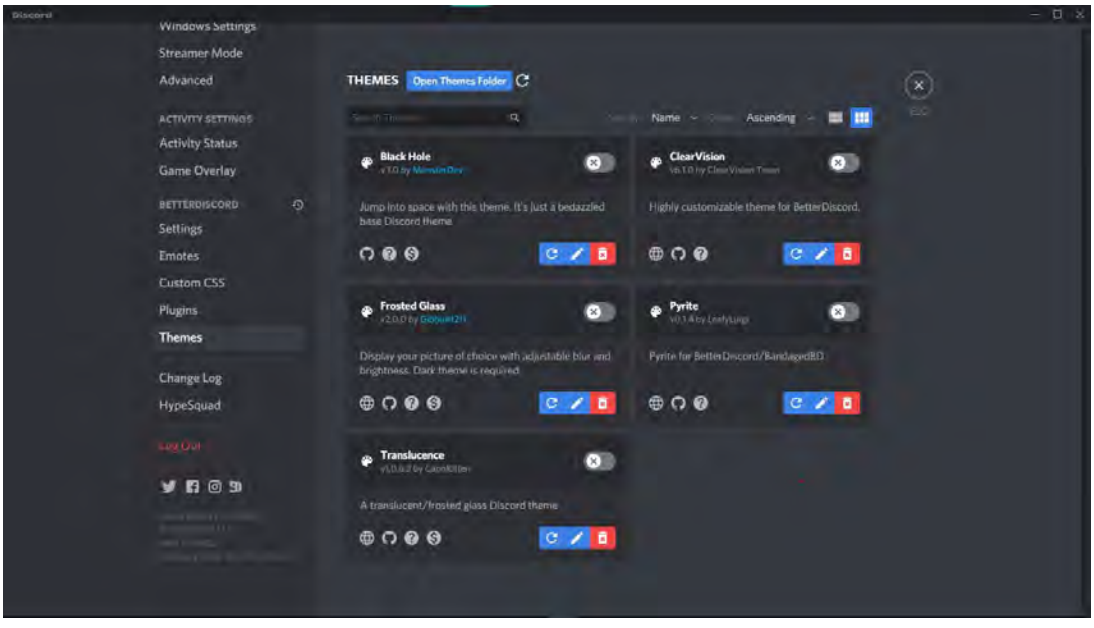


Before you start clicking on any of the themes, hop back into Discord and click the Open Themes Folder in the upper left corner or on the center of the screen. You're gonna have to save all the theme files in that folder otherwise you won't be able to apply them. It is usually going to be this path : C:\Users\

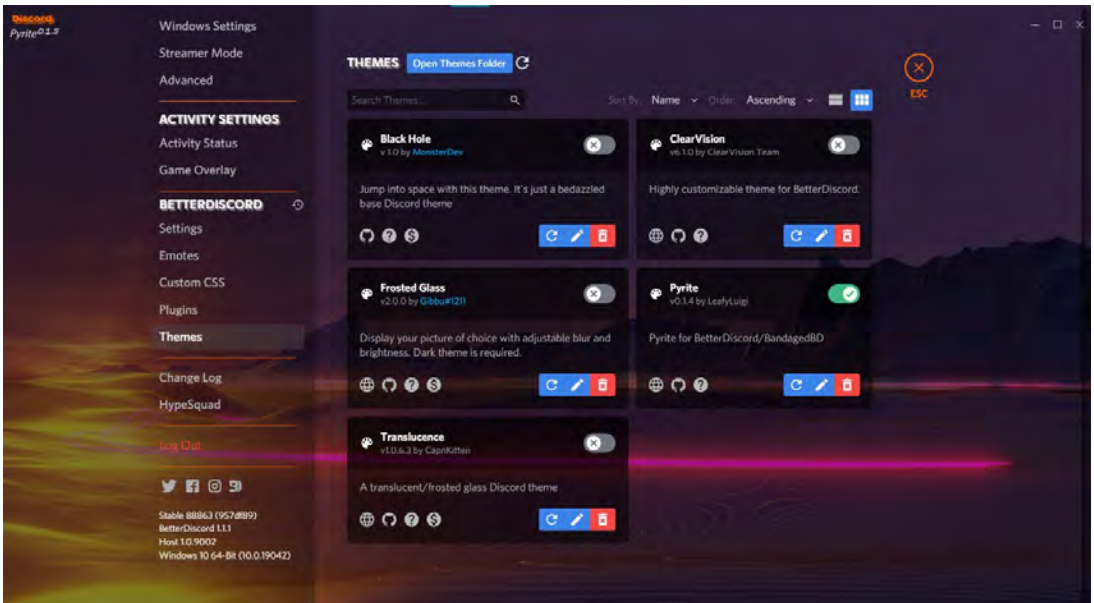
Admin\AppData\Roaming\BetterDiscord\themes. Copy the path from the file explorer and now open your browser.

Now we can browse themes to our heart's content. Pick ones that you really like and click on the Download button to download and save them in the specified path. Some of our favourites are : ClearVision, BlackHole, FrostedGlass, Translucence and Pyrite.

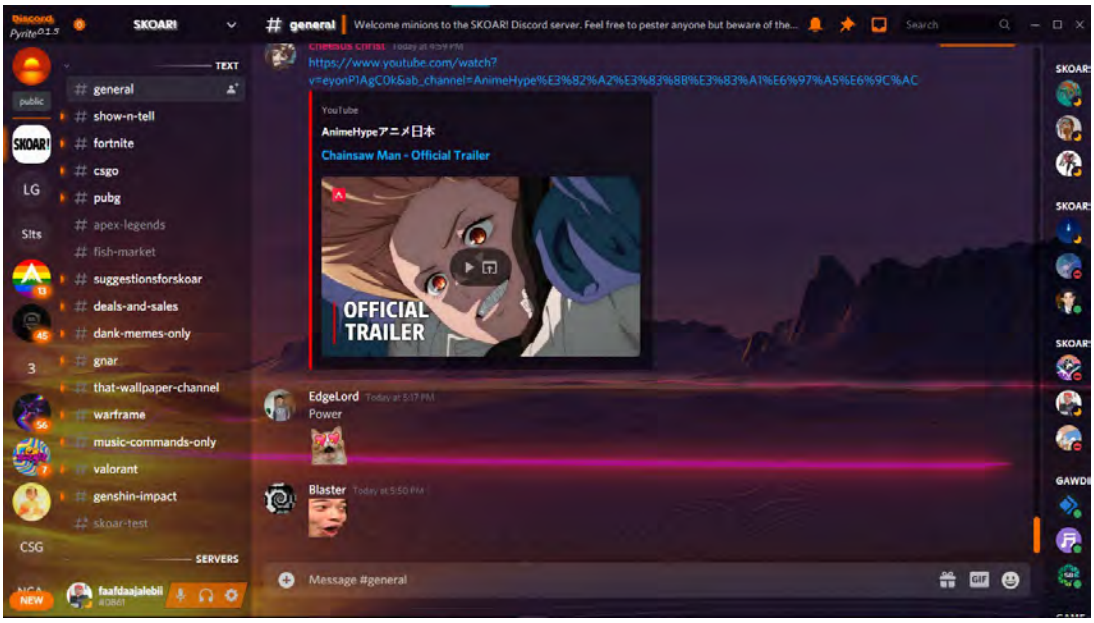
Once you have downloaded all of the themes you want, open Discord again and navigate to the Themes section again. If you don't see all of the themes you downloaded, then you can do two things. Check the folder in which you downloaded them. If the path is correct then click the little Refresh button on the upper left corner and the themes should appear.



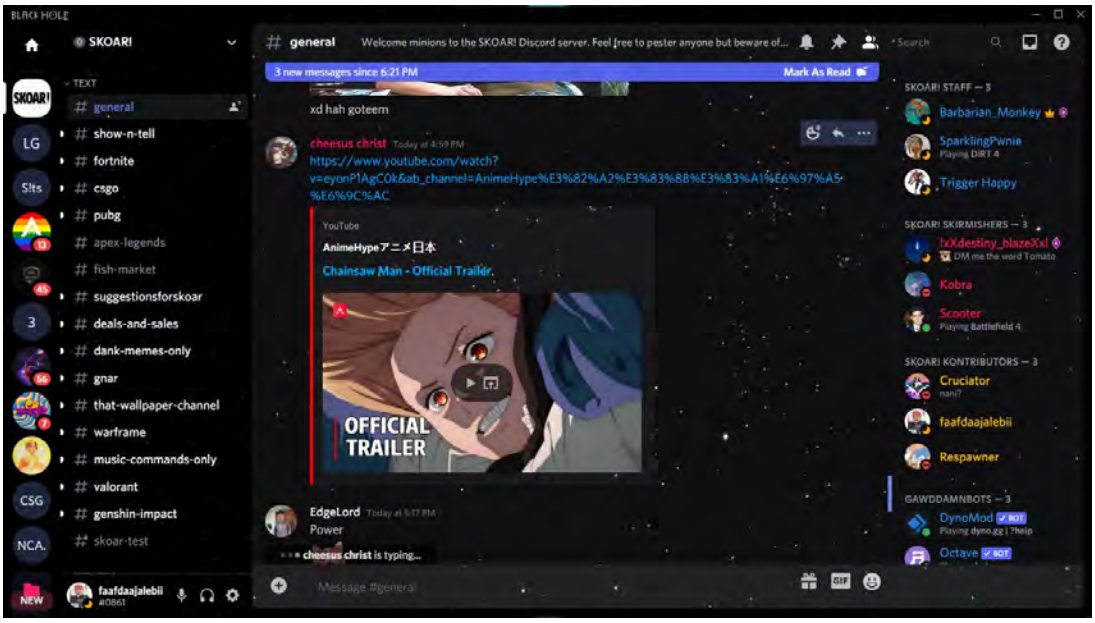
To toggle a theme on or off, just flip the switch corresponding to that theme. Let's turn on Pyrite first and see what happens.



Boom! Your Discord will instantly transform into something much much better and prettier. Even the text channels look damn good!

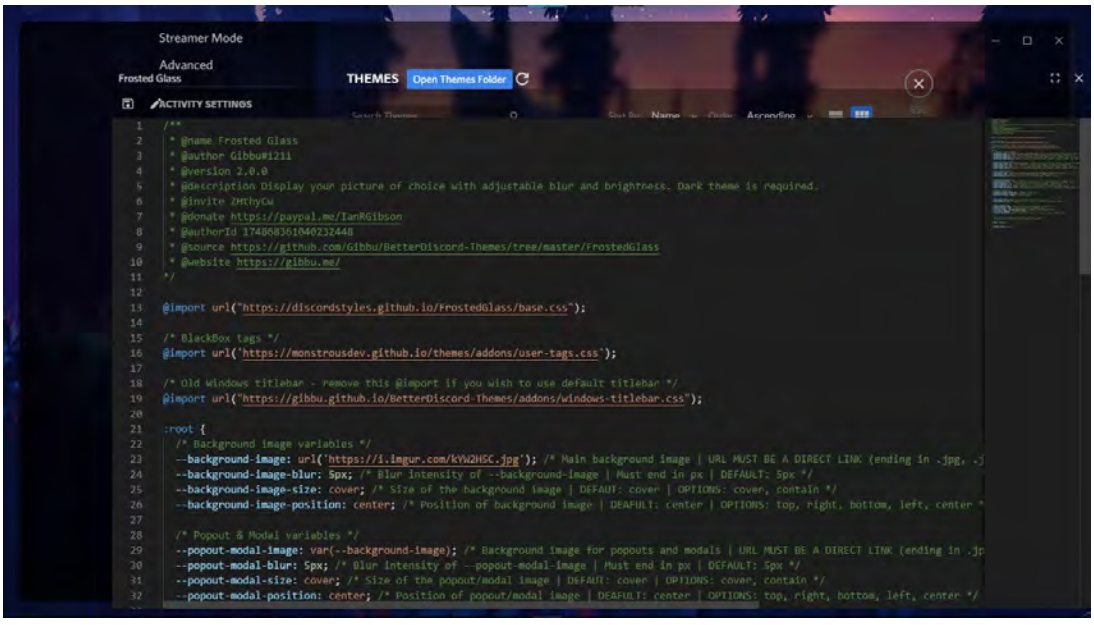


Gosh, isn't it beautiful! If you're a dark mode / AMOLED fan then turn on the BlackHole theme and see what happens.

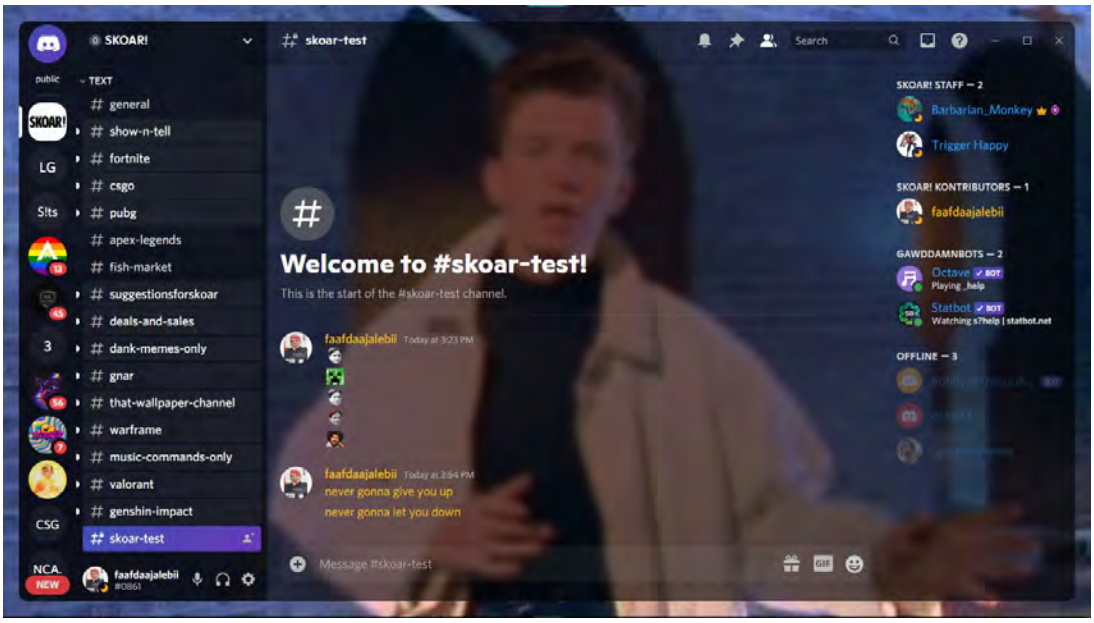


We'd choose this anyday over Discord's default dark theme. We'll leave the rest of the tinkering and exploration for you to do but before that we'll let you in a handy tip. All of the themes that you see use CSS and can be edited too. Hence, if you don't like a particular color or a background image then you can always change it. See that little Pen icon beside the refresh icon? Press that and a CSS editor will open. The best thing about these themes is that the CSS written is very well docu-

mented and a lot of comments are written within so that even a non technical person can tinker around and change stuff.



Find the line that says ‘background-image’ and change it’s URL if you want to change the background image. For tutorial purposes, we’ve changed it to a picture of Rick Astley. Please note that you will not be able to use any images that you’ve stored locally in your system. You’ll need to upload them to an image sharing service like Imgur or just fetch them from Imgur directly.

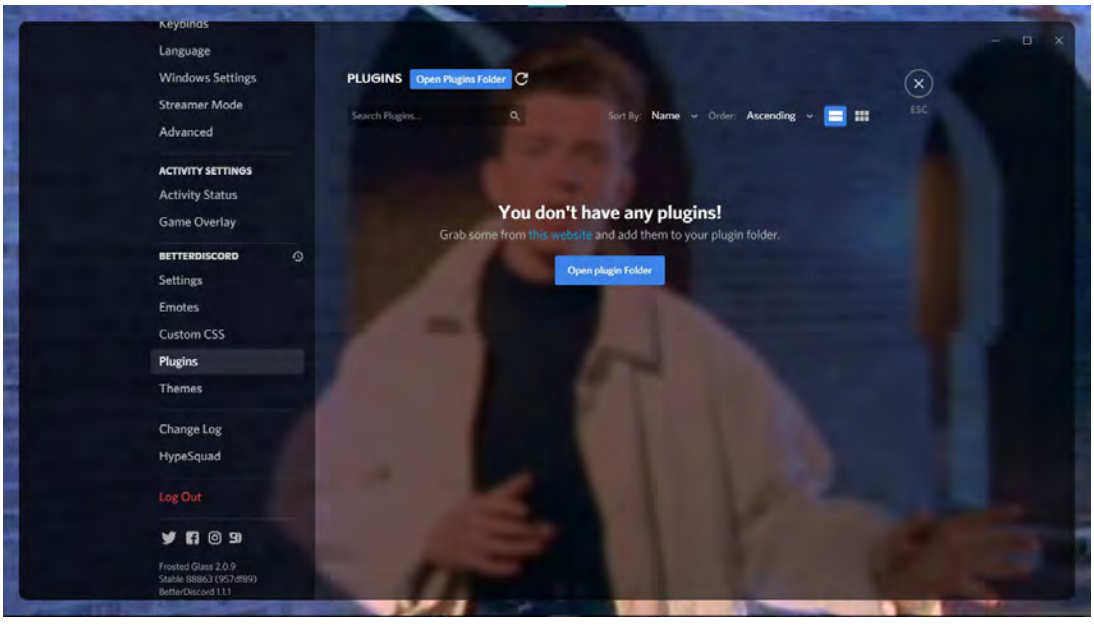


PLUGINS

Once we’re done customizing the look and feel of our client, let us now add a bit more functionality to it. Introducing Plugins.

They'll add small but noteworthy functionality to your Discord client which will make your overall experience much better.

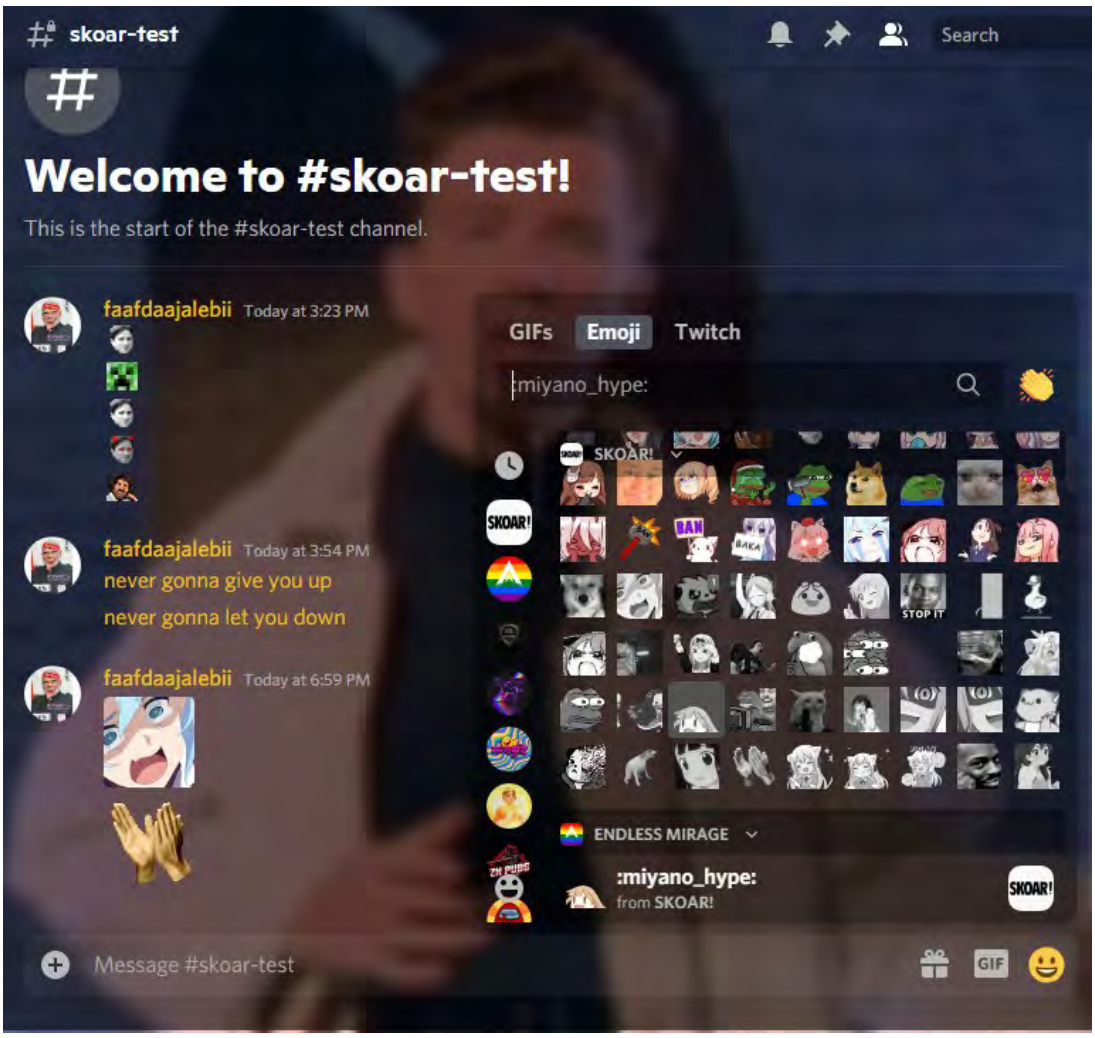
To install plugins, go to the settings of your client, scroll down till you find the Plugins option and click on it. You'll be greeted with a similar menu like Themes. Just like we did before, click on the Open Plugins Folder, copy it's path and then click on 'this website' to go to the Plugins website. Here, you can download the plugins and all the titles are self explanatory in what they do.

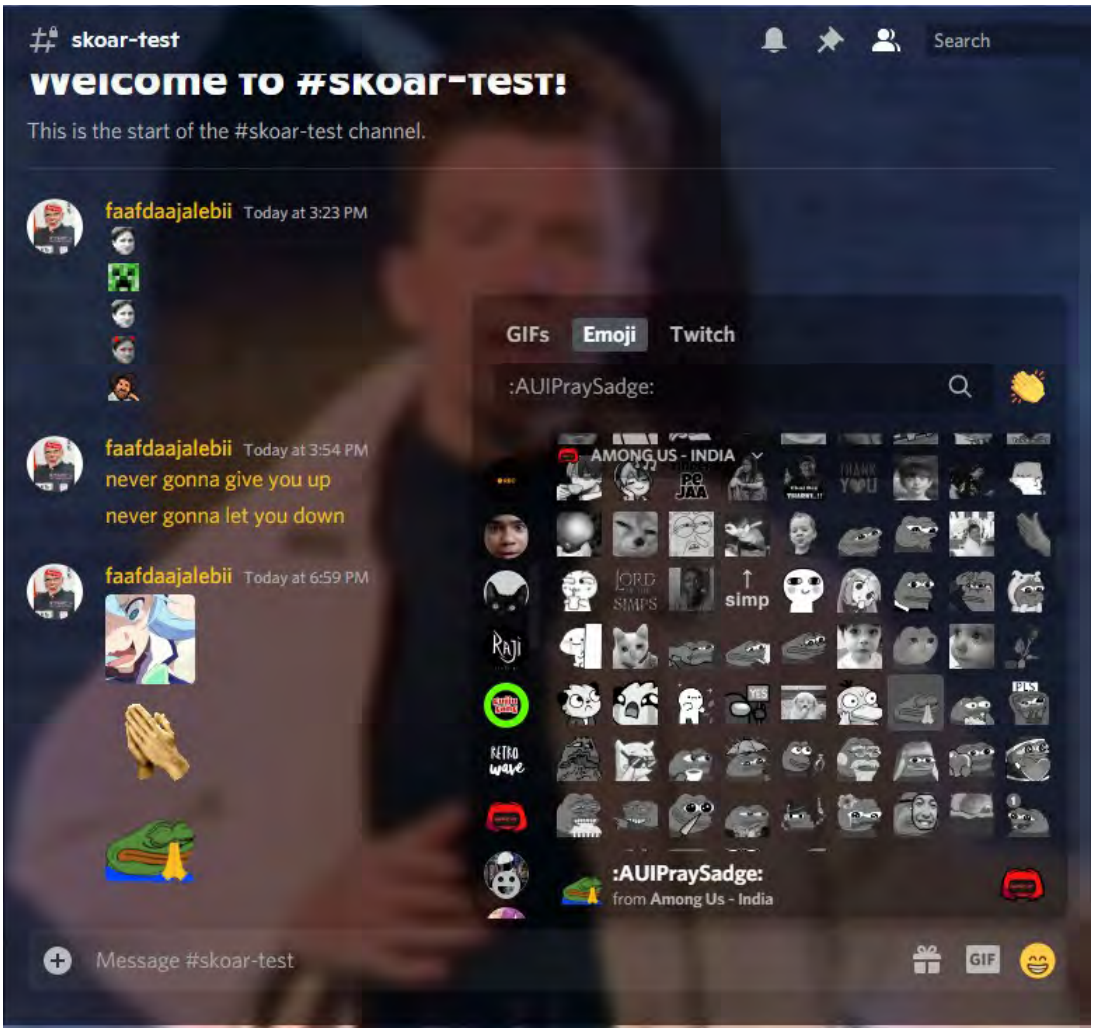


Some of our favourite plugins are :

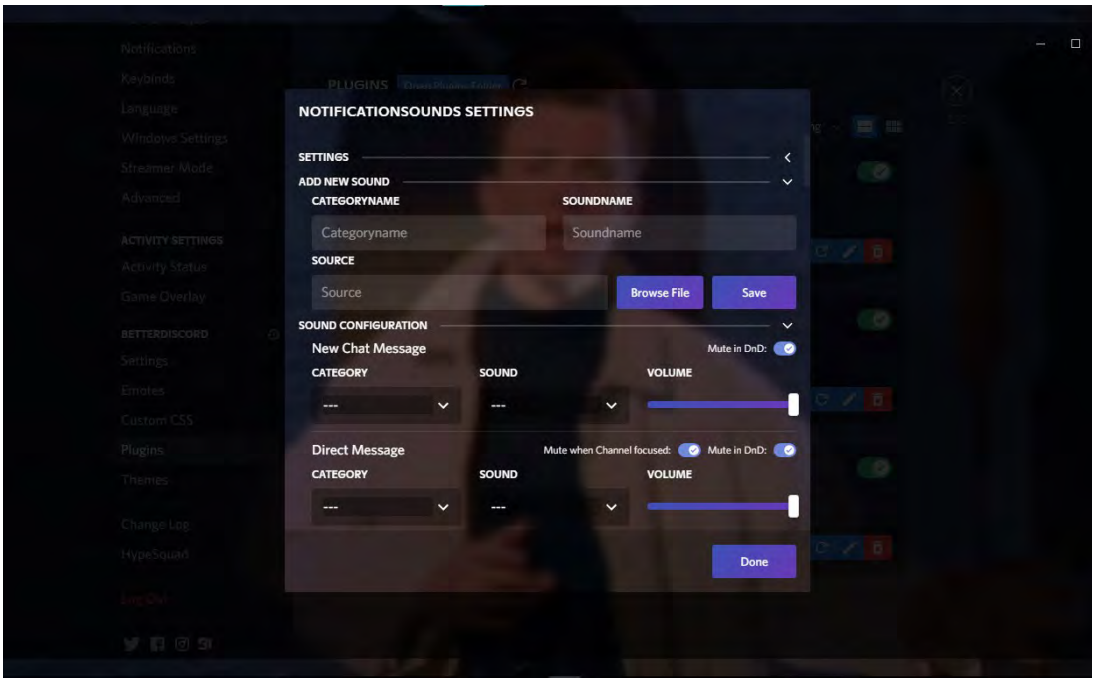
1. **FreeEmojis** - This one HAS to be at the top. This will allow you to use ANY EMOJI from ANY DISCORD SERVER! This completely bypasses the Nitro requirement to do that! Just download the FreeEmojis Plugin, put it into the Plugins folder and enable it in the settings. Now you have access to all the emojis from all Discord servers! For example, let's first use the animated gif emojis from SKOAR's Discord server. As you can see, the account does not have Nitro and hence the GIF emojis are greyed out. But what happens if we click on them? A link gets pasted to the text area. And what happens if we hit send? IT WORKS!

   Now, let us try emojis from Among Us - India's Discord Server. As you can see, the emojis are greyed out. But if we click on them and hit send, they get sent like any normal emoji!


skoar-test
Search
Welcome to #skoar-test!
This is the start of the #skoar-test channel.
faafdaajalebii Today at 3:23 PM
faafdaajalebii Today at 3:54 PM
never gonna give you up
never gonna let you down
faafdaajalebii Today at 6:59 PM
GIFs
Emoji
Twitch
:miyano_hype:
SKOAR!
ENDLESS MIRAGE
:miyano_hype:
from SKOAR!
Message #skoar-test
GIF


skoar-test
Search
Welcome to #skoar-test!
This is the start of the #skoar-test channel.
faafdaajalebii Today at 3:23 PM
faafdaajalebii Today at 3:54 PM
never gonna give you up
never gonna let you down
faafdaajalebii Today at 6:59 PM
GIFs
Emoji
Twitch
:AUIPraySadge:
AMONG US - INDIA
simp
:AUIPraySadge:
from Among Us - India
Message #skoar-test
GIF

2. **NotificationSounds** - This plugin will allow you to change Discord's default notification sounds to whatever sound you wish them to be. Download the plugin, and turn it on. Click on the little Gear icon and you'll be presented with a list of options. You can tweak and customize it to your liking

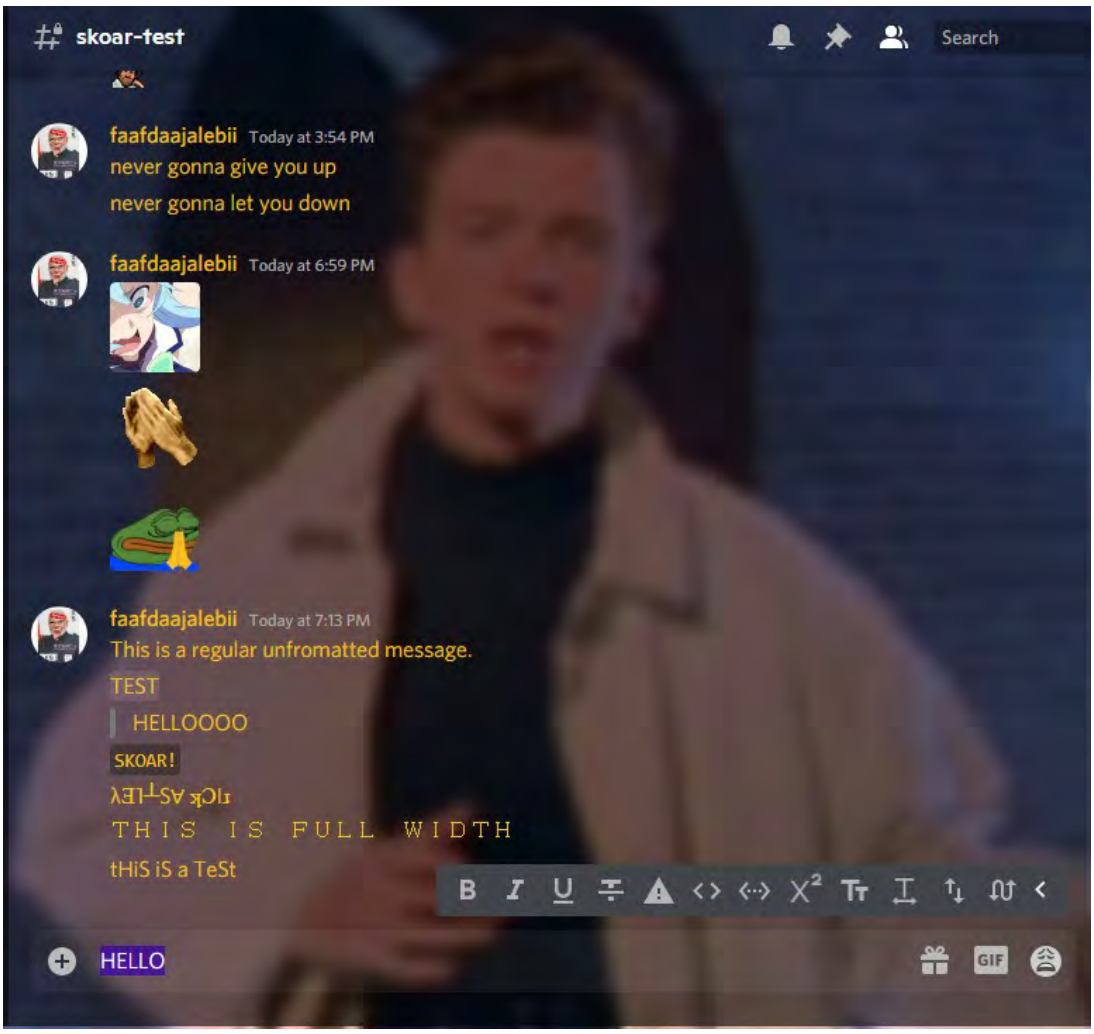


3. **UserVolumeBooster** - This will be a boon if your friends have a crappy mic. It's pretty self explanatory, this plugin will allow you to increase someone's volume more than Discord allows you to.

4. **BetterFormattingRedux** - This plugin will allow you to change the formatting of your messages. Download it, enable it - if you get a popup saying "Another Plugin is Required" just click on download, wait for a few seconds and refresh the list. Once you see the BetterFromattingRedux option, enable it and the other downloaded plugin and kill + relaunch your Discord Client. Now, whenever you go on a text channel or a DM, type a message, select it and click on a small arrow above the emoji button. This will bring up a lot of options on how you can customize your text. Select any one of them and hit send.

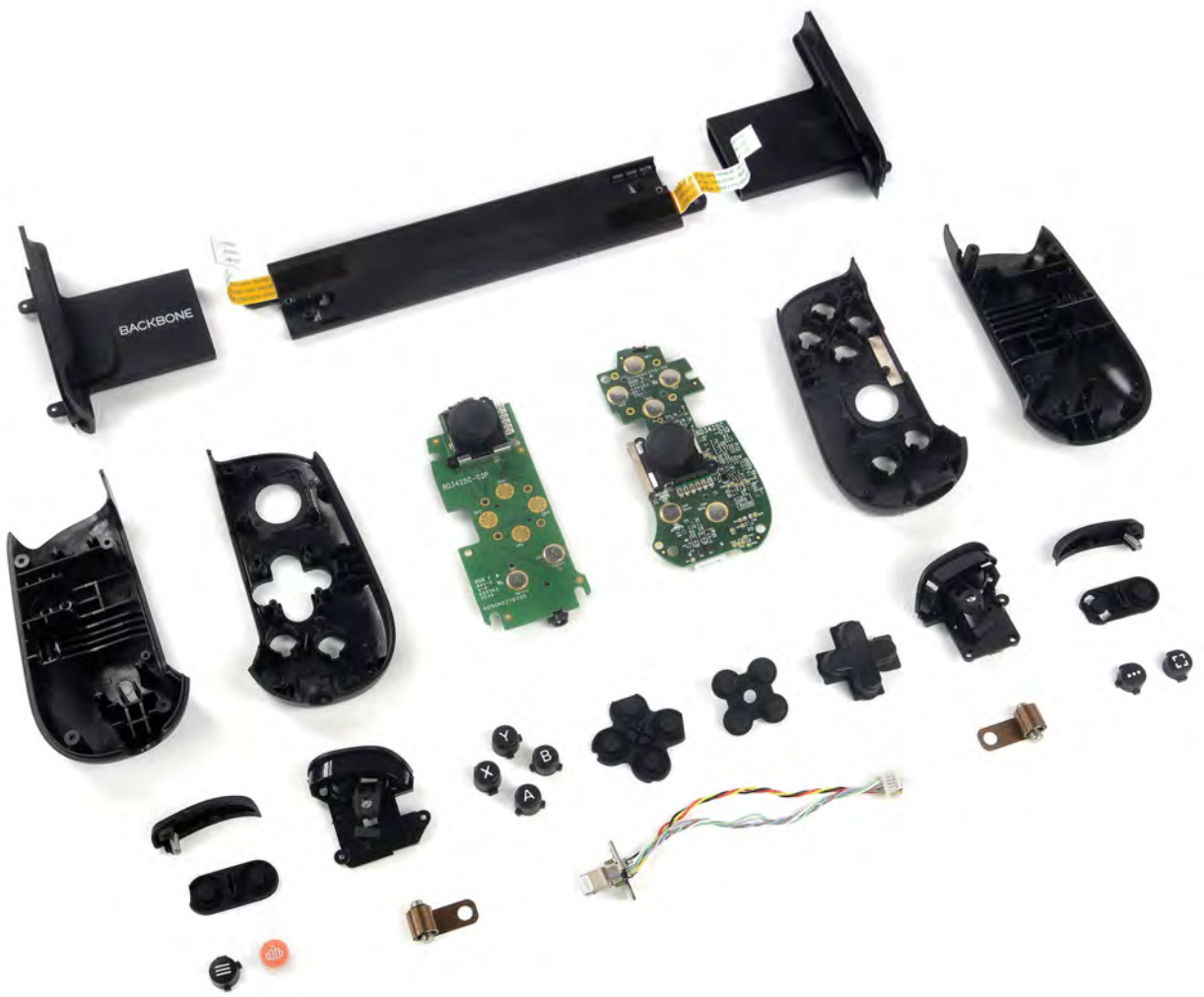
CONCLUSION

All in all, BetterDiscord is a really powerful utility for those who want to tinker around and customize their Discord client and truly make it unique. With BetterDiscord and it's large



library of Themes and Plugins, we're sure you'll find the one that you'll like.

We encourage you to customize your Discord client and send screenshots at feedback@skoar.in. *



BACKBONE ONE

IPHONE CONTROLLER FOR GAMING ON THE GO

BY DHRITI "DEEDEE" DATTA
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IMAGES COURTESY: IFIXIT



INTERESTING FEATURES

The Backbone One may seem like any other mobile controller on the market, but it does pack some interesting features including a passthrough Lightning port, a headphone jack, some dedicated controls such as gameplay recording, launching Backbone app and instant muting. The controller also



houses standard controls including a D-pad, two thumbsticks on either side, A-B-X-Y buttons, and shoulder and trigger buttons. There's no internal battery and the device draws power from your iPhone directly.

NO GLUE, ONLY SCREWS

Disassembly is relatively easy to start off with since the device is held together with some Philips screws on the outside and not glue. Beneath the plastic shell of the controller, you'll find



some colourful cables. The interconnect cable can be freed from its ZIF connector claw and two Lightning connector cables can be unplugged from the motherboard with relative ease. Extracting a few more Philips screws can free the shoulder button, trigger, and PCB.

CHIPS AND CONTROLS

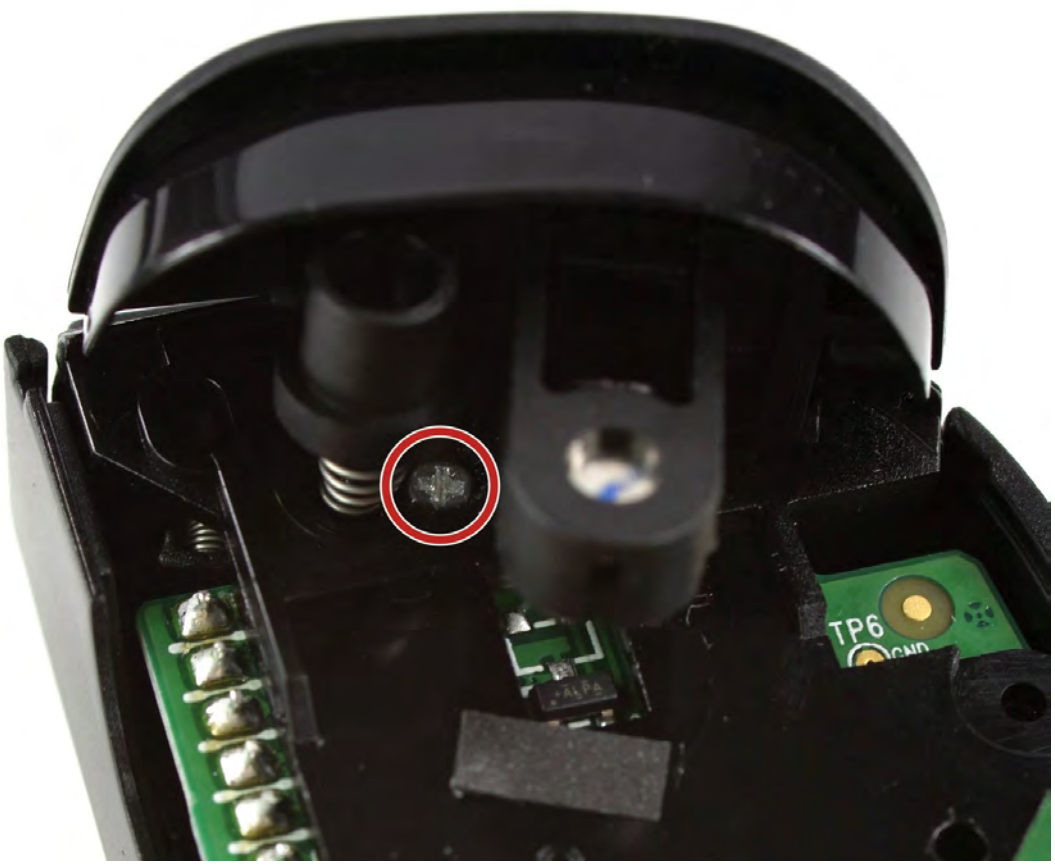
The board houses a few controls and chips, these include - the joystick that is, unfortunately, soldered on the motherboard, six



clickable contacts for the A-B-X-Y buttons, app button, and option button, Skyworks SKY52101-11 IoT SoC, and Avnera AV3425C single chip analog SoC. There's also a soldered-on bumper button and Hall-effect sensor for the trigger button. You also have a soldered-on passthrough Lightning port to connect to your phone. The soldered-on components don't bode well for repairability.

TRICKY SCREW PLACEMENT

On the left side of the device, you have an almost identical setup, down to the Philips screws and ZIF connector. There are



a few screws that are stuck in tricky to access areas such as the one that disconnects the trigger button. The screw is difficult to find but twists out safely.

LEFT BOARD

The left board has a lot to offer too including another soldered-on joystick, similar to the Razer Kishi. It also has four gold contacts for the direction pad and four corresponding holes to keep its silicone cover safely in place. There's also two clickable contacts for the screenshot/record button and the options buttons. Finally, you have a few more soldered-on components



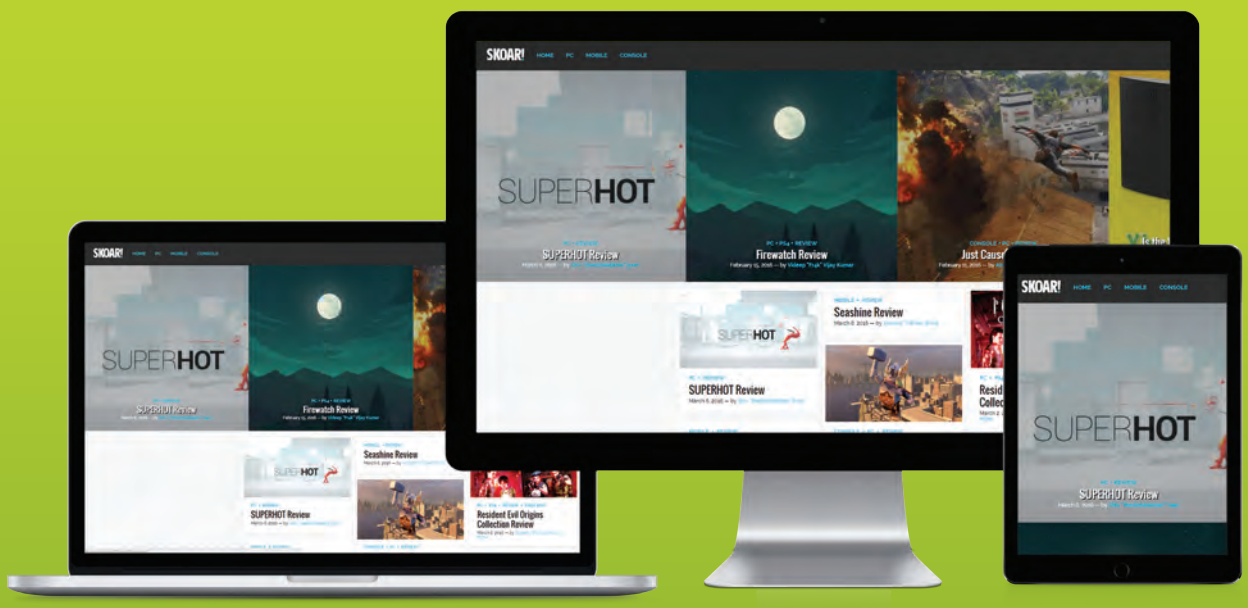
including a 3.5mm headphone jack, a bumper button, and a Hall sensor for the trigger.

THE "BACKBONE"

The "backbone" of the device or the sliding clamp mechanism that opens up the controller uses a pair of flat spiral springs



that unroll when you pull the device apart. This provides a tighter grip than the Razer Kishi that uses helical extension springs.*



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MESH SHADERS

WHAT ARE THEY?

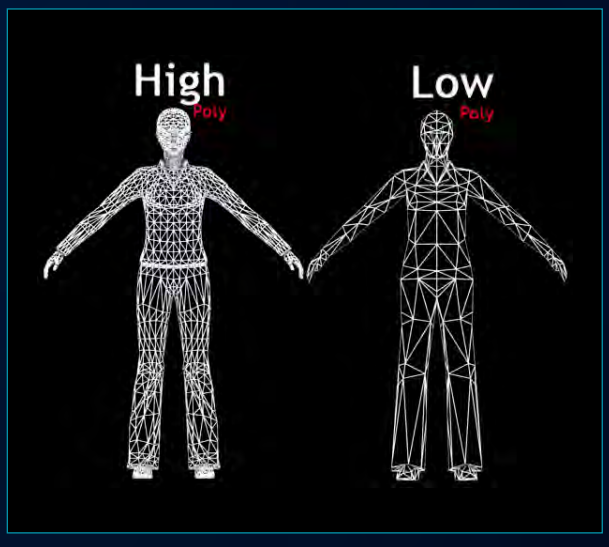
"MESHLETS" IS A CUTE TERM - CHANGE MY MIND.

BY KSHIPRA "FAAFDAAJALEBII" JADAV
FEEDBACK@SKOAR.IN

GPUs. All of us have them in our PCs. They're pretty much the whole reason why your games run at high frame rates and if it weren't for them, we'd still be seeing power-point presentations on our screens. But have you ever wondered what exactly goes on behind the scenes? How is that gigantic piece of plastic responsible for getting good frame rates? Infact, why do we even need them in the first place? Can't we just spec up our CPUs and call it a day? You'll have answers to all of these questions by the end of this article and you'll have the knowledge of what is coming up next in terms of GPU technology. Mesh shaders. They're the new kid on the block. They were released with DirectX 12 and they could potentially double your framerate! At no extra cost! Trust us, we won't tell you to buy a 3090 if you want to double your FPS. We're better than that. But before we learn about this magical thing called "Mesh Shaders" we need to first understand what is currently being carried out inside our GPUs and why is it being replaced in the first place.

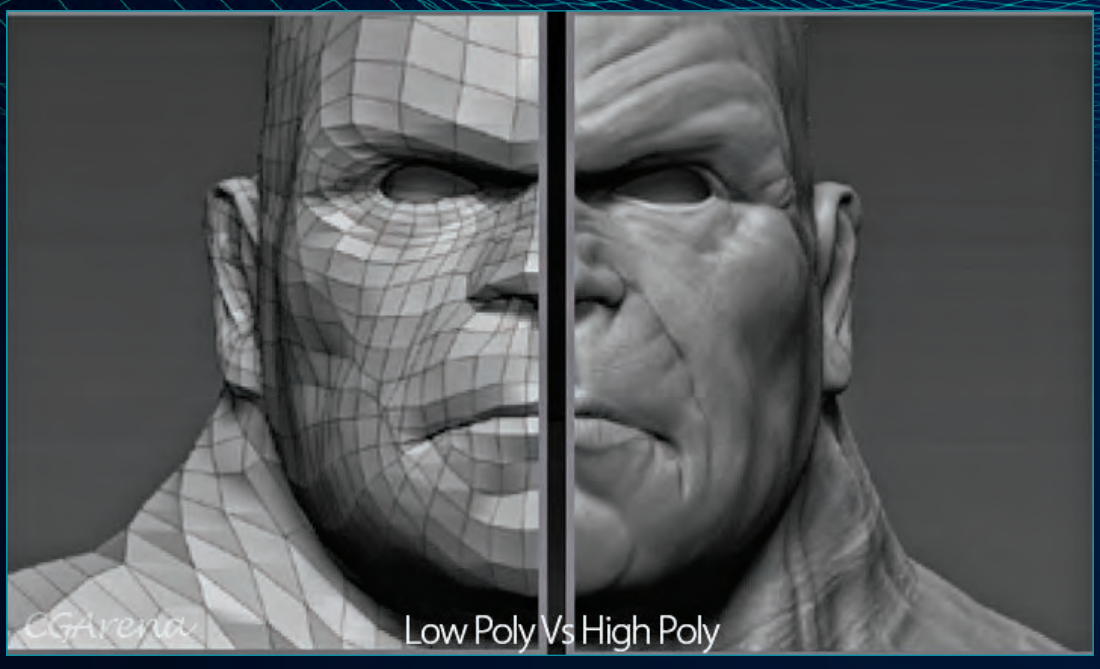
The Current Graphics Pipeline

Before we delve into the inner workings of the graphics pipeline i.e. how an image actually shows up on your screen, we need to first understand how the data is interpreted by the GPU. You see, the pixels that you see on your screen while playing a game, they're not actual pixels from the start. Infact, they're converted to pixels in the last stage of the graphics pipeline. So, what are they in their most basic form? Triangles. Yes, the most basic form of anything you see on a screen – be it your character or a scenery, a gun or even the mountains they are all triangles at the start. Well, polygons to be precise but all triangles are polygons but all polygons aren't necessarily triangles. To keep things simple, let us refer to triangles as polygons. So, to make up an image the character or the mountains are wrapped in a sheet of connecting polygons. So, when you say something is "low-poly" it simply means that the number of polygons used to construct the image is low. And when you say something is "high-poly" or when you see a highly detailed character model it simply means that the number of polygons used to construct the image is significantly high.



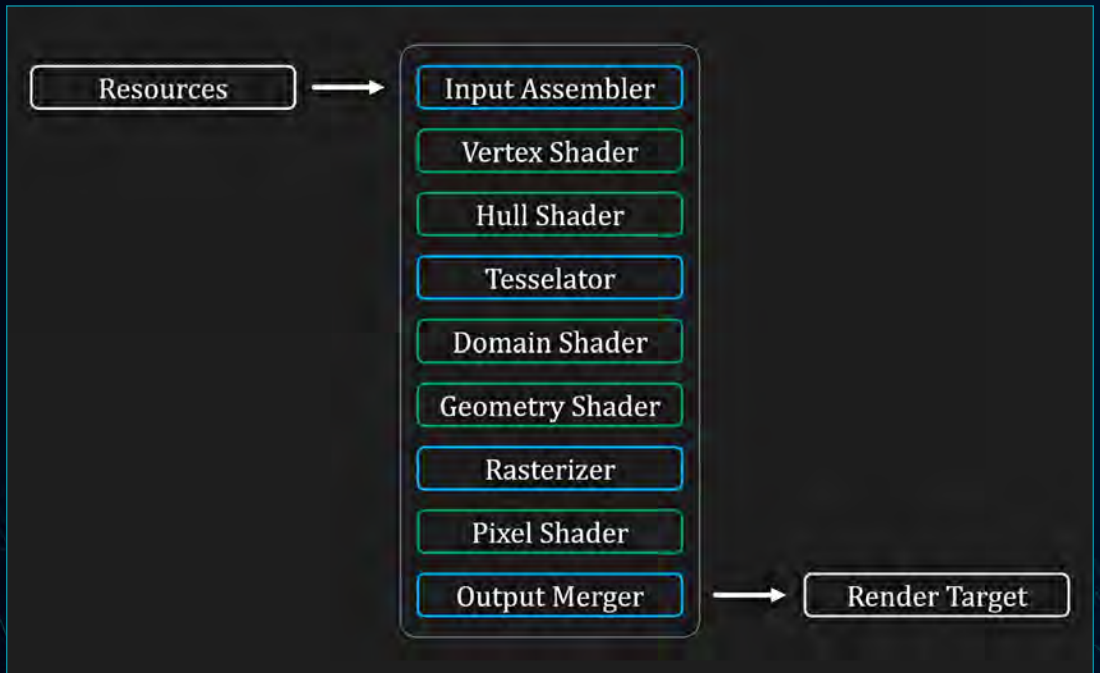
As you can see in the image, the person is made up of a sheet of triangles. Of Course they are not perfect equilateral triangles and they aren't expected to be. Because, to capture the curves of a surface, we need skewed triangles. On the left side you can see that the character is made by a significantly less number of polygons than the right side. Now this can have a lot of impact on the final image's quality. Example :

It is very apparent that the image with higher poly count is more detailed and is of higher quality. But it comes at a cost. You see, actually doing the math behind a polygon is quite complex but that is what our GPUs do the best. Math. They solve millions of complex math equations and most are in the form of matrix algebra and hence, GPUs are used for rendering



graphics because they are just so good at doing math. There is also another reason but that will be revealed later in the article.

Now, to actually render these polygons and make them into pixels that we can see and adore, there are particular steps that need to be followed. Because, obviously we don't just want to see a sea of triangles on our screens we actually want to see the game and hence, the polygons need to be processed by the GPU. The polygons are processed through a "Graphics Pipeline" which contains a set of fixed stages which they need to go through in order to get converted to pixels. Let me introduce y'all to the "Fixed Function Pipeline" which was introduced back in 2006 and is being used till date.



Now, depending on where you look the names of some of the stages can be different but the job they do remains the same. To understand the topic of this article we first need to understand about the stuff we have right now. Only then, we would be able to understand the things that they solve, i.e., we need to understand the problem inorder to understand the solution. So, let me give you a brief idea about all the stages in the current pipeline and how they function.

Input Assembler

Takes in raw data – lines, triangles, points, etc. and assembles them in such a way that they can be used by the other stages efficiently. For eg. Before cooking a sabji, you have to fetch the raw vegetables required for it (potato, tomato, etc.), cut them into the required pieces and make them ready for cooking. Input assembler does the same job. Takes in the raw data from the CPU – does not process it – just arranges them in such a way that other stages like the vertex shader, geometry shader, pixel shader, etc. can use them efficiently.

Vertex Shader

The triangles received by the input assembler are handled by this guy. This stage handles the size, shape and the overall look and manipulations of the triangles. It can stretch, change positions, make big, small, etc. and do all kinds of size + shape manipulations on a triangle and it does that via matrix multiplications and matrix algebra

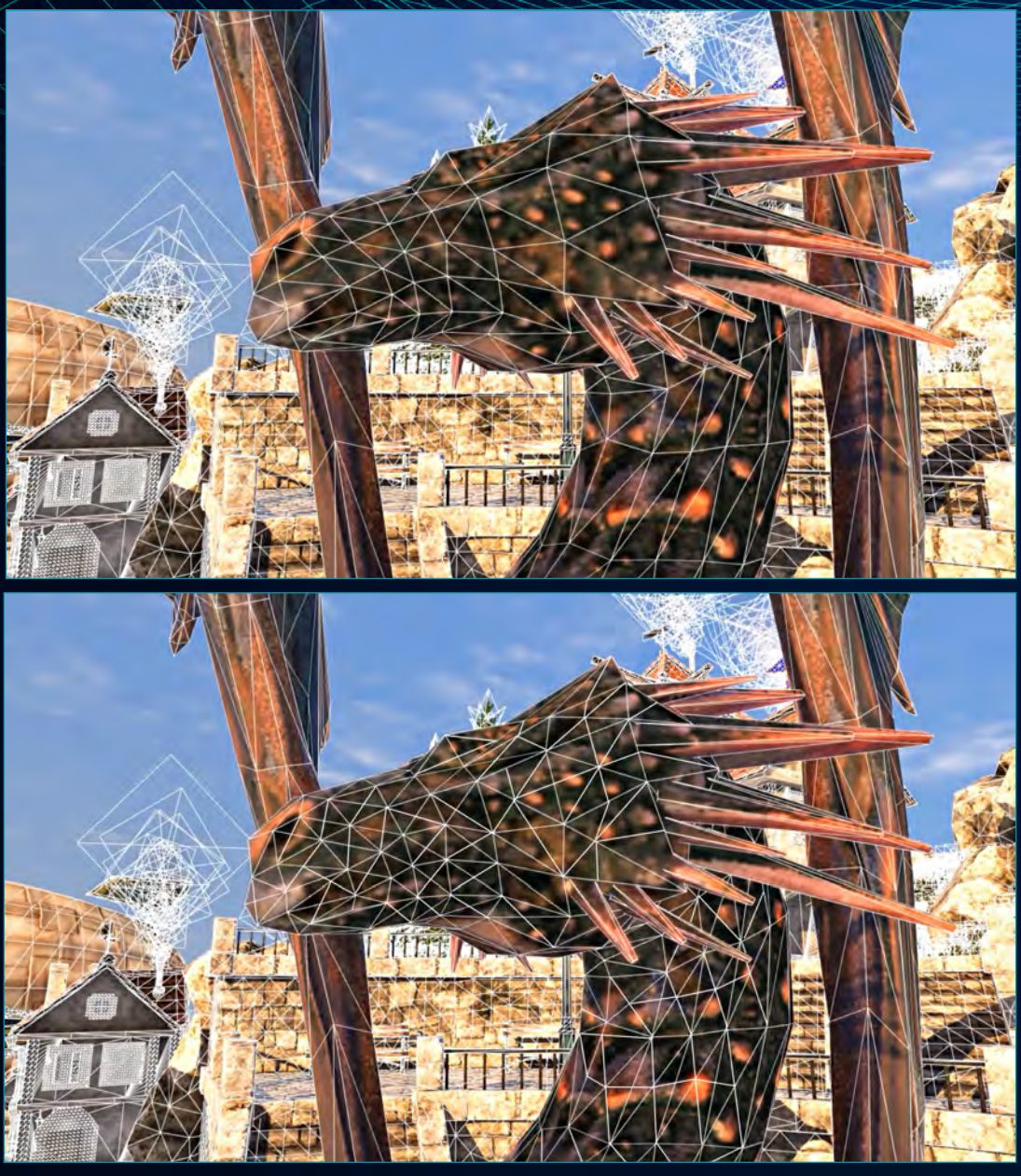
Hull Shader

A hull shader is for a tessellator what the input assembler is for the pipeline. Basically it takes input data and converts/transforms it so that the next stage – tessellator stage can properly understand it. It also does some other complicated stuff but that is not within the scope of this article.

Tessellator

This is the literal translation of giving you more for less. Tessellation basically doubles the amount of polygons in your scene. But just doubling them won't be enough. You're just adding more complexity in the calculations without any actual difference.

Also, there is a thing called the 'Tessellation factor' which



determines how complex the chopping of polygons will be. So a higher tessellation factor may even triple or quadruple the amount of polygons in your scene. But still, just increasing the complexity of your scene DOES NOT mean that the level of detail will increase.

Domain Shader

This is the math guy. A domain is just a group of polygons which was created by the tessellator. This one works and computes on all the vertex positions of any given point in the scene or in a domain.

Geometry Shader

A geometry shader is useful when you have to create hair/fur in a scene or create a particle system. What a geometry shader

does is essentially take a point and expand it either horizontally or vertically with a given texture. This is way faster than creating a bunch of new polygons and that too in a big number because the fur/hair has to be made dense enough. This is extra work for the GPU and geometry shaders are much faster, quicker and resource efficient for this job.

Rasterizer

This is the main guy. The star of the show. This stage is responsible for converting that math data into pixels. Yes, actually squares of light that you can see! The rasterizer converts the 3-D geometry that was processed by the above stages to the simple 2-D image that can be displayed on the screen. It also handles and changes the image according to the position of the camera, the FOV and the lighting of the scene. Rasterization determines how much of an object will actually be displayed if it is behind another object i.e. if object A and B are overlapping each other, A is on the front and B is behind A, rasterization determines how much of B will be visible in the scene. This is done through some real complex algorithms which is beyond the scope of this article but just know, if it weren't for the rasterizer you'd be seeing literal matrices and binary on your screen instead of a beautiful scene from (X game).

Pixel Shader

This one does exactly what it says. It shades pixels! As simple as that. It is responsible for how the sunset looks or how the gun looks or how the character model is lit up in a particular lighting situation. It shades or colors each individual pixel so that it matches the current lighting situation and makes sure that we don't have any overly bright or overly dim pixels which look out of place.

Output Merger

The last stage in the pipeline. This one takes everything, arranges them in their respective order and displays them onto your screen and viola! You've got your image.

Mesh Shading And How It Is Different

Now that you've got a clear idea of what we have currently, let us look at the future of this graphics pipeline. But before that, let us understand why we can't just tell our CPUs to do this task. Well, CPUs are designed to be serial, i.e., they take inputs

one by one and process it one at a time but GPUs on the other hand are designed to be of parallel nature i.e. they can work at a number of things simultaneously. Ah good, then why don't we just use GPUs instead of CPUs? I mean, Intel and AMD are clearly ripping us off by offering this low core count clearly inferior product while we just need one 3080 to run our whole system. Right? Wrong. You see, GPUs are dumb. They cannot look at the tasks at hand and solve them as efficiently as possible while CPUs can do that. You can visualise CPUs and GPUs as horses and donkeys respectively. A horse works smartly and uses it's intelligence to do work while a donkey just uses brute force to accomplish every task it is given which is, of course, less efficient. Hence, CPUs and GPUs both are needed to run a system.

Let us dive into the future of the graphics pipeline - Mesh Shading! Mesh shading solves a lot of problems that we had with this pipeline. Although the current fixed function pipeline is very optimised it just falls short on some tasks. After understanding how the current pipeline works, let us now look at its shortcomings.

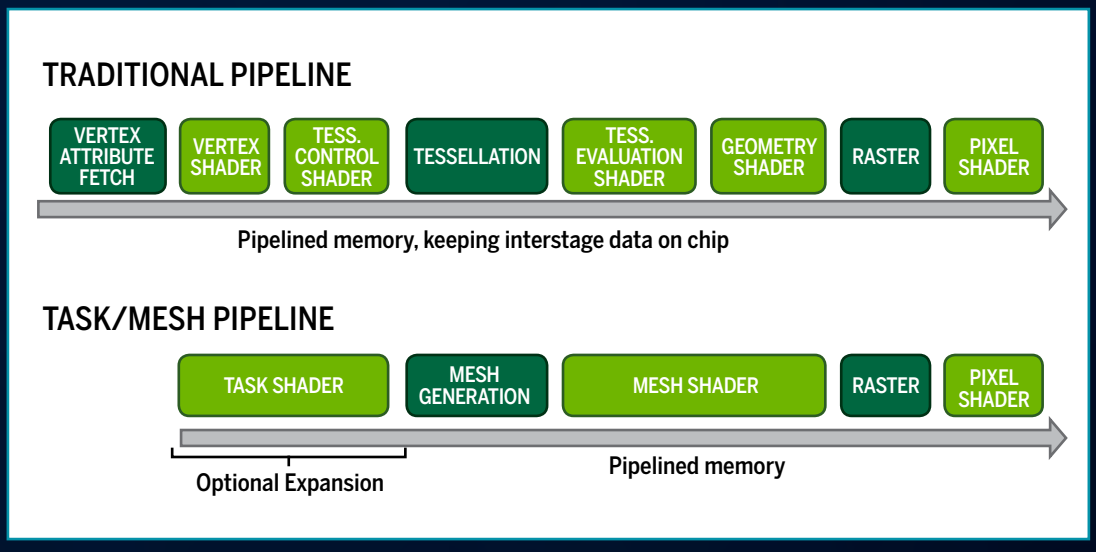
1. Did you notice the name of the pipeline is "Fixed Function"? This is because a lot of the above mentioned stages aren't flexible at all. Sure, they have some amount of flexibility attached to them but looking from a bird's eye view, they have very stringent rules on what they take as an input and what outputs they give.

2. Culling. This means cutting out the part that is unnecessary. For example, if you are looking at a particular scene, it is obvious that the world behind you is outside your FOV and it is not being displayed. The way culling works is that, at the final stage, before the picture gets displayed to your screen, the rasterizer looks at the image and then figures out where the camera is pointing and it's FOV. Then it just deletes everything that is outside the FOV because it is unnecessary information. See the catch here? The whole image was rendered by the earlier stages but only a part of it was displayed onto the screen. This is very inefficient as the GPU has to render the whole image without knowing which parts to cut off. If it knew which parts to cut off, it wouldn't have rendered them in the first place!

3. Inflexible data layout. The vertex shader in particular only takes index buffers and vertex buffers. But what if you want to feed in multiple sets of indices or even better, compressed geometry data? This type of input is simply not possible in the current fixed function pipeline.

These were just some of the problems in the current fixed function pipeline. Now, don't get me wrong. The current pipeline is still the best way you can render graphics and it's been around for so long, it has been optimized a lot too. All I am saying is that mesh shaders do the exact same thing as the current pipeline but in a more optimized and flexible way.

To get started on mesh shaders, let us compare the traditional pipeline with the new mesh shading pipeline :



As you can see here, the new pipeline is a lot smaller than the original pipeline. The only two familiar stages that we see are the rasterizer and the pixel shader. Other than that, everything is new. Finally, the answer to the question we've all been waiting for. What are mesh shaders? Well, mesh shaders are compute-like shaders or programmable shaders? And what are compute shaders or programmable shaders you ask? To put the technical definition - "A Compute Shader is a Shader Stage that is used entirely for computing arbitrary information. While it can do rendering, it is generally used for tasks not directly related to drawing triangles and pixels." and the reason why mesh shaders are "compute-like" shaders and not just "compute-shaders" is because of the last line. Mesh shaders are a stage which can take any kind of input and play with it as the

dev has programmed them to be and output a certain set of triangles (which I will get to later).

As you can see, right off the bat this solves our first problem which was that in the fixed function pipeline, the stages couldn't be programmed at all. Here, mesh shaders can do the work of all those stages (except the raster and pixel shader) while being highly programmable. If a dev wants the geometry shader or a vertex shader to work in a certain way or to output a certain thing, they can definitely do it in the mesh shader. This will allow the dev to best optimize their game regardless of the hardware it is being played on as the control is in the hands of the dev now.

The task shader which is the optional stage in the pipeline generates work for the mesh shader to do. It generates it in the form of points, primitives or indices. Then why is it optional? Because of the flexibility of the mesh shader. Since it can take any type of input, if the dev wants, he can make the mesh shader take input directly from the CPU or else he can let the input pass through the task shader, make it a bit more streamlined and then pass it on to the mesh shader.

There is an obvious question here. If combining the stages is all that a mesh shader can do, how is it different from the current pipeline? When you see the current pipeline, although GPUs are parallel in nature, the pipeline they work on is kinda serial. The Current pipeline has each stage where X stage runs per Y (X = vertex shader, geometry shader, etc. and Y = vertex, primitive, etc.). Mesh shader solves this by parallelizing all the stages. Modern GPUs have thousands of cores and Mesh shaders can run everything in parallel threads getting the work done faster than the regular pipeline.

Let's talk about culling now. As mentioned before, the culling that we have now is practically a waste of effort for the GPU. Since the stages are parallelized in the mesh shader, it can figure out at a very early stage what parts of the image to cull and what parts to keep. This helps save time and resources and inturn means faster processing of all the data.

The third problem we had with the current pipeline was the inflexible data layout. Since the mesh shaders are compute-like

shaders, they benefit from all the pros that compute shaders have and one of those pros is taking in data in any form. Compressed geometry, a set of indices, vertex points, primitives, etc. Hence, mesh shader solves the problem that we earlier had and make the Input Assemble obsolete.

When a mesh shader is done doing its job, the next step in the process is to raster that data and convert it to pixels. So, when the mesh shader is done, it outputs a small indexed triangle list that will go to the raster. This list is called a meshlet. Meshlets are just collections of triangles which can have anywhere from 32 to 200 vertices. These meshlets then go to the raster to get converted to pixels.

Conclusion

Mesh shading is revolutionary in the gaming industry. It will allow dev to code in whatever stage they want and redact whatever stage they don't like. And remember how we mentioned potentially doubling your frame rate at the beginning? Well, if it isn't blatantly obvious by now, mesh shading does work faster and smarter and hence let's say in a very ideal scenario, if the traditional pipeline (which is still very efficient btw) renders a particular frame in 1 second, the mesh shading pipeline can get the same work done in half a second.

Although, it is not as easy to implement as it sounds. Microsoft has already introduced Mesh shaders in the new DirectX 12 Ultimate, but there is still a good 2-3 years before we see this thing getting implemented in actual games.

To conclude, we'd like to end with a quote from Sean Hardreaves from Microsoft - "One of these things that come along pretty rarely in the evolution of programming models. It's a simpler diagram than what we had before but can actually do way more stuff." *



MOBILE MADNESS

YOU HAVE TO TRY THESE GAMES OUT ON YOUR SMARTPHONE!

BY TEAM SKOAR!
FEEDBACK@SKOAR.IN

Ni no Kuni: Cross Worlds

Cross Worlds is a break from Ni no Kuni's prior games, which took place in a classic fantasy setting and rather presents a science-fiction twist. This time, the player is a regular person who is beta-testing a new virtual reality game called Soul Diver that transports them to Ni no Kuni which turns out to be the genuine world of Ichi no Kuni (meaning one-nation). Cross Worlds appears to be on par with previous console releases and while being 3D, the characters resemble 2D sketches from anime, giving it a nice little interesting appearance.

The player is able to choose from five different classes - Rogue, Destroyer, Witch, Engineer, and Swordsman; each with its own set of configurable traits of customization from haircut, to eye colour. You take on the role of a character who enters the virtual reality world and is immediately pushed into a battle you have no knowledge of. When you are finally forced removed from the scenario, the game properly begins, as the tutorials kicks



off. The combat is skill-based too with each skill housing varied cooldowns. You'll also be able to accompany a "Imagen" or companion dogs, who will automatically deliver damage to your opponent in battle.

The game, being a MMORPG, also offers large-scale PVP with up to 100 additional players, dubbed in the Battlefield of Relics for the time being. Two teams will compete for territories that will earn points for them. There are monsters that can appear on the map that you must defeat. Otherwise, you can use barriers to obstruct your opponents' paths. There are also co-op raid battles with up to five individuals in a party, and four difficulty levels to choose from. You can check how much DPS you've done at the end of a successful combat. It should be noted that the game isn't available yet to play in India, and is only available on iOS devices with accounts in Taiwan and China.

Sword Art Online Black Swordsman: Ace

SAO:BSA is characterised as a full-fledged MMORPG based entirely on the SAO virtual MMO. It follows the anime's plot, particularly the Aincrad Arc, in which players are stuck inside the game, where if they die inside SAO, they die for real, and the only way to exit the game and survive is to fight Aincrad, the iconic sky fortress with 100 storeys. The game is situated in an open-world environment, and sets off in a similar setting as SAO:IF, but with gorgeous graphics in a more cartoonish touch. The UI is familiar too, where the attack and skill buttons are



on the right, your movement is on the left, and a menu option to the right.

Your main goal is to traverse a hundred floors in an open environment while completing tasks/quests and conquering the floor bosses native to the floors. In addition, each floor will introduce you to new challenges and characters, including the ones from the original SAO series, with whom you can interact with. Overall, it settles as a nice improvement over SAO:IF in terms of both the gameplay and graphics, though we felt like the story could be delivered a bit better. Also, it would have been a nice addition if they offered to migrate data from Integral factor for the players switching to Black Swordsman Ace.

Mad Skills Motocross 3

Mad Skills Motocross 3 is a side-scrolling arcade racing with easy-to-use controls. The goal is to maintain your orientation over jumps so that you don't wipe out when you land, and maintaining a smooth and fault-free run is how you get to the podium.



It begins with the biker at the start line sprinting at full speed towards the right, striving for first place. Accelerate, stop, and weight shift buttons are displayed on the screen (and may be customised), and you use them to keep your rider upright and moving as quickly as possible. Failure results in a restart and the loss of XP and cash to spend on the bike and personalization. It has an extensive campaign in about 8 regions around the world offering a wide variety in terms of tracks.The difficulty curve gradually increases which is accompanied by a bike upgrade system. Upgrading the different elements of your vehicle is done with the coins you gather, and depending on what you want to accomplish, you can spend silver or gold. You may spend more easily acquired silver coins and the pieces will open over time, or you can pick the rarer gold coins and spend less and the parts will unlock instantaneously. The game is engineered to make the players shed money for upgrades with over the top freemium practices baked into the game polluting not only the gameplay but the UI experience as well. The cash grabbing nature of the game makes it hard to recommend.

Ice Scream 4

Ice Scream 4 is the fourth installment of the Ice Scream series developed by Keplerians Horror Games. The story with the main antagonist Rod taking you and other children he kidnapped to his factory where he intends to turn them into ice cream. Your mission is to break out of the cage and rescue all the children during the course of the game. This involves sneaking your way quietly through the facility and solving puzzles without attracting attention from Rod and his staff. The game explores Rod's past with subtle clues than the entries in the franchise.

There are four difficulty levels that you can choose from. The first one is Ghost mode which allows you to become a ghost making you invulnerable as you can roam around freely and solve the puzzles without any sense of dread and repercussions, thus becoming a boring experience. In addition to this there are a lot more ads in ghost mode than other modes. So definitely avoid Ghost mode if you want to have a good time. Start with the Easy mode in which enemies can see and hear you but are not so fast in catching you if you end up in front of them. Ramp up the difficulty after your playthrough if you feel



like you can handle it. Enable the "Darker" option and put on your headphones for an even more dreadful experience.

If you get stuck not knowing what to do, there's a hint system that you can rely on, although it comes with ads. One major issue that could be a letdown for some players is that if you quit in the middle of your campaign, it starts from the beginning next time you initiate the story. Overall, Ice Scream 4 is a good horror adventure game that involves puzzle solving, avoiding your masked antagonist and his helpers as you make your way through the campaign.

Gun Fungus

Gun Fungus is a perma death platform based shooter game. As soon as you start the game, you'll be taken through a very informative tutorial and the game keeps and sticks to the basics very well. That's what we like about this game. You have one jump button and if you tap it in mid air you double jump. We have a joystick on the other thumb for movement in all directions. The main aim of the game is simple. You'll be teleported into a stage, you have to kill all the enemies without dying. If you die, you go back to the main menu and start from level 1. There are three types of enemies. Two types of enemies are ground based and one is air based. Out of the two ground types, the first one just moves around and does nothing. The second one fires green fungus at you which of course, reduces your health. The air based one does the same but while floating



in mid-air. Throughout the game there are various power ups which will enhance the gameplay. They'll either apply to your gun or to yourself. They're a must to take if you want to clear the whole game. There will be 'Health' stages too where you will be presented with an option to either heal yourself or to increase your maximum health. You must choose wisely. All in all, this game is a must play for those who just want to pass some time on their phone without getting into some hardcore gaming.

PAKO Rumble

PAKO Rumble, is a randomly generated racer where it will be your duty to stick to the road on a procedurally generated track. So, in essence, this game is an infinite runner in which the route varies as you race, which is what makes the game



hard. Your aim is to get as far as you can without dying.The game does spawn power ups at random locations to ease off the difficulty at times. It has relatively simple controls with a left and right steer on either bottom corners of the screen and a jump button. However, the game is hard to master and players will spend a lot of the time trying to master survival on the track. Pako rumble is a hyper casual game and there isn't much depth to the gameplay loop. It's a fun little game but doesn't match upto the standards of older PAKO games from Tree Men Games.

Cosmic Challenge Racing

Cosmic Challenge Racing is just another sci-fi racing games in a sea of games that belong to the same genre. You maneuver your ship which hovers on the racetrack while racing through the courses to get the first position. The one thing we liked about the game is it's sound effects. They are really immersive and even though we did not have headphones on while playing this game, we were pretty immersed in the race. The overall UI is okay-



ish. We felt that it was a bit unresponsive at times because we had to tap a button several times to trigger it. There is an in-game purchase system where you can purchase different ships with different statistics or you can unlock them as you progress through the game. Coming to the controls, they are a bit complicated. You can use your gyroscope or on screen buttons to steer your ship and you can have auto acceleration turned on (but don't turn it on please.) but then there is an option of "rolling your ship" while mid air. See, that's where things get complicat-

ed. If you don't steer your ship properly mid air then it will start leaning one way and go completely off course resulting in you resetting your position and getting the last place. The graphics of the game were good and pretty immersive. Overall, it is just a game to pass some time on your phone but we'd still advise you to look for better games out there.

Spacelanders: Sci-Fi Shooter

Spacelanders starts with a simple tutorial which seems to resemble League of Legends in a lot of ways. This has got to be one of the first games we've played which is supposed to be played in portrait mode after Subway Surfers from back in the day. You can move your character around with a joystick in the



lower part of the screen and in order to shoot, all you need to do is stop moving and the character shoots automatically at the enemies. The real challenge in the game is to move at the right time to avoid the multiple projectiles being shot at you by the sometimes overwhelming number of bots. The game is the right amount of challenging right from the start and it gets very enjoyable the more you get into it.

The game gives you multiple upgrades throughout the levels which only last for that level itself but it does help out a lot. Upgrades like Ricochet which make your bullets ricochet from one enemy to another can be very useful at times when you are facing against a ton of them. Or upgrades like simple damage boosters or health boosters which increase you max health by 10% and grant you some health at the same time.

What we didn't like about the game was the graphics at certain instances and the lack of health being dropped by the enemies. For such a well built game, they could've invested a bit more time and effort into the model of the spaceship you get into once the level is over. It becomes very clear once you see it that the spaceship might not even be a complete model judging from the textures on it. On the other hand, it gets really annoying when you're trying to clutch out a level at 3 HP and none of the enemies are dropping any health points (true story). *

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