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INTRODUCTION:

Hello, and welcome to this small tech demo of my Custom VR Stage Lighting Shaders! This a collection of shaders, meshes, and scripts designed for VRChat and other Unity based VR games to simulate real time lighting that would be normally used in a concert or performance setting. The purpose of these shaders are to bring rise to extravagant and eye-catching experiences into VR without sacrificing on performance.

As stated before, these are a collection of meshes and shaders, meaning no realtime unity lights are ever used here. This is to combat the harsh draw call counts that realtime unity spotlights and point lights bring Forward Rendering platforms. The shaders are also properly GPU instanced, meaning the impact of the meshes and materials themselves are batched, bringing the draw call count even further down.

The other half of this package is the simulation experience. The meshes and shaders work together to simulate how proper stage lights would actually work and feature a large variety of settings and controls to fit different situations and needs. This includes proper HDR RGB color, global and individual intensity values, pan and tilt functions, focus controls,

GOBOS, DMX support, etc as well as VRChat specific features such as Udon support with networking. This demo is going to focus on the latter and how it can be used for small events and impromptu gatherings as the former, while a lot more feature intensive, relies on a stream panel which may not always be available or feasible for some worlds or events.

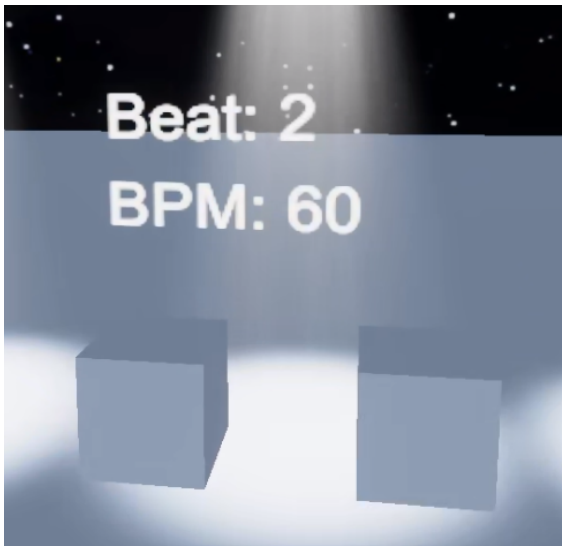
THE UDON DEMO:

This small demo will demonstrate how to control mover lights using the Udon based “Card” system. The card system is design for primarily musical events, but can be used for other events as well. This system can and will be applied to other types of lights, but this one will focus on the mover lights as they are the most complex in collection.

The card system is broken into 3 different parts and will discuss the significance of each:

1. **Global BPM Metronome**
2. **Light Groups/Zones**
3. **Cards**

GLOBAL BPM METRONOME:



The BPM Metronome is the literal “heart beat” of this system, and is where you’ll want to head first at the beginning of a performance. The system comes with a “global metronome”.

A metronome *“is a device that produces an audible click or other sound at a regular interval that can be set by the user, typically in beats per minute (BPM). Musicians use the device to practise playing to a regular pulse.”* (from Wikipedia). This can be used to measure the beats in a song and help keep the timing with the music. The first “beat” of every “bar” is synced globally to ensure that everyone in the world is on the same count at all times.

The main purpose of this metronome is to sync the lights and users with any music that may be played (either through a video or over a user’s microphone) in the world. By adjusting this metronome, the speed of the animations of the lights will also be adjusted accordingly.

The “global metronome” is controlled by two buttons (the cubes depicted in the image of this demo) and two displays.

The Top Display:

The first display shows what “beat” we are on. This metronome assumes all songs are on a 4/4 time signature (Meaning there are 4 beats per measure or “bar”) to keep things simple. If you want to know more about time signatures and measures, etc, look up info about “Music Theory”, otherwise, it essentially means this meter counts from 1 to 4 every bar.
I.E:
“1...2...3...4...1...2...3...4...etc”

The Bottom Display:

The second display is the BPM (beats per minute), which shows how many “beats” occur or :the number of times a number on the first display appears every minute. By default it’s set to 60 BPM, meaning there will be 60 beats every minute (or 1 beat every second). You can change this number to match the music with the first button on the right, called the “Tapper”.

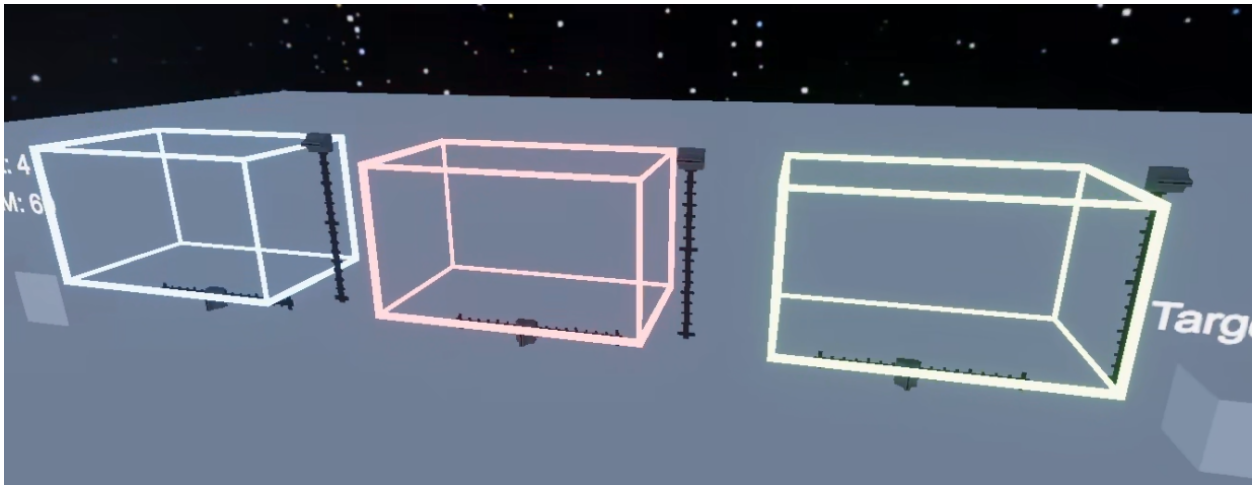
The Tapper:

The first button on the right, the “Tapper”, allows you to change the BPM by “tapping” (or clicking) on the button in rapid succession in time with the music you are listening to. It takes the average of every 4 taps you do and recalculates the BPM. The BPM is udon synced so it will update for everyone. This is where you will most likely head to first as most modern music is much faster than 60 BPM (example the average house song is around 128-130 BPM).

The “Sync” Button:

The “Sync” Button resets the metronome on to the first beat globally. This button is very important as it resolves two inevitable issues: Since tapping will succumb to both latency and human error, the metronome won’t always be perfectly in sync with the music (either due to the BPM being slightly off or lag). By hitting this button when the user believes the first beat of the music is occuring, it will reset it back to one and it will line the beats back up with the music. By hitting this button, it will do the same for everyone globally, so if someone falls behind due to latency or lag and ends up missing some of the auto-syncing, it can bring them somewhat back in sync.

LIGHT GROUPS/ZONES:



The Light Group/Zones are where the Cards in the Card System are to be placed to control the lights. Each Zone controls a group of lights that are pre assigned to it and sends whatever animations it reads from a card that is put into the zone to the lights. The groups can control as little as just one light to many many lights simultaneously. In this demo, the blue zone controls the middle mover light, the red zone controls the two inner mover lights, and the green zone controls the two outer mover lights.

The Zones:

The zones themselves work in a “scanning” mode, as in, they read and use the data from the last card that entered the zone. The card does not have to stay in the zone for it to be read, but the data will be overridden if a new card of the same type enters the zone. This allows for one card to be scanned by multiple zones, allowing multiple zones to be changed at once.

The Faders:

Each zone will have two faders (sliders) connected to it that control properties of the lights that cannot or are inefficient to be controlled by a card.

The fader on the right controls the global intensity or “Max Brightness” of the lights. No matter how bright an animation from the card

tries to make the lights, they will never go brighter than what this fader allows. This allows for things like “Blackouts” and fade ins/outs at the user’s discretion.

The fader at the bottom controls a “Miscellaneous property” of the light. In the case for mover lights, it controls the radius or “focus” of the beam. This makes the projection and volumetric cone bigger or smaller based on the position of the fader.

CARDS:

The Cards are the main ways of controlling the lights. By placing a card in a “Light Group/Zone”, the corresponding animation will begin playing for those lights in that group. These cards are Udon pickups and the position of the cards are synced, allowing for animations to be synced based on whether or not a card has entered a zone. The cards all have a title of the animation, an icon depicting what the animation does, and small other bits of information (like how many bars/measures and small hints for how to best use the card).

There are 4 types of cards and each controls a different aspect of the lights based on their color:

1. ***Intensity Cards (Red)***
2. ***GOBO Cards (Green)***

3. ***Color Cards (Blue)***
4. ***Pan/Tilt cards (Yellow)***

Not all lights support all cards (example: Non-moving lights like par lights don't support pan/tilt cards). Mover lights support all 4 and thus are featured in this demo.

EPILEPSY WARNING:

These cards can cause intense bright flashing lights in a users face and can be dangerous for those prone to epilepsy, the creator of this map and these shaders do not take responsibility for any injuries or incidents that may occur with the usage of these shaders or this system. User discretion is advised.

Intensity Cards (Red):

Intensity Cards animate the brightness of the lights. This allows for things like flashing in time with the music, strobes, fades, etc. In this demo, the majority of these cards have rhythmic flash patterns that flash with the beat of the global metronome. Mixing and matching these patterns can create interesting effects and can drive the flow of the show dramatically.

GOBO Cards (Green):

GOBO Cards control the images that the movers project on the ground. "A **gobo** is an object placed inside or in front of a light source to control the shape of the emitted light and its shadow." (From Wikipedia). These movers support up to 6 individual gobos at a single time during run time and can switch between them in real-time. The images themselves are simple black and white masks with custom ones being supported in the same manner with the ones featured here as the defaults.

Color Cards (Blue):

Color cards do as they say: They control the color of the lights. Most of the cards cycle through a collection of colors in a palette, while some only display one or two colors. More palette variations and lengths of the variations will be added in the future, but what is in this demo is a good start for most situations.

Pan/Tilt Cards (Yellow):

Pan/Tilt Cards control how the lights move around and what they point at. These cards breathe life into mover type lights and can add a lot of visual flair to a performance. The movers on the right side of this demo have their pan values “inverted”, so they will always do the opposite of what their left counterparts do and vice versa. There are a lot of different Pan/Tilt cards in this demo, so have fun trying them all out!

Cards (Cont):

-Some cards have special properties as well when you rotate them. They will tell you if they do so try them out when you can!

-The cards are in transparent spheres as spheres are easier to pick up (and have cheaper colliders) than actual cards in VR. The cards will also automatically face whoever picks them up to make them easier to read!

-When two cards of the same type end up in the same zone, the oldest card will get sent back to its starting position.

-If things get too messy, there’s a reset button on the right side of the Light Groups that will return all the cards to their starting position, allowing for easy cleanup.

-There is a special Pan/Tilt card that allows the movers to follow a player! All the way to the right side of the demo is a button that assigns the last person who clicked the button as the “target”. Whenever the “Follow Player” card is used, they will automatically follow whoever assigned themselves as the target last!

FINAL THOUGHTS:

-This is just a tech demo and things are still very much WIP, so bugs and other things are to be expected >.<.

-This demo showcases only one of the few ways to control stage lighting in VRChat. A much more sophisticated way involving streams is also in the works as well as plans for when MIDI/OSC is officially supported in VRChat!

-This system was designed with team work in mind! While solo usage is possible, this is the most optimal setup for the best experience:

1. One Person would play music for the event
2. Another person would control the global metronome and ensure things are in sync
3. Another group of 2 or 3 people would control the cards and faders.