
COLIA

EOLIA - BETA

RELEASE NOTES

Eolia™ is a 5 hour single-player fantasy-adventure puzzle VR game made for Oculus Quest Hand Tracking. Play as Conga Dholak in a land that is on the brink of destruction from dangers brought on by climate change. Droughts plague the land. Extreme weather rages in the skies. What will you choose? Harmony or discord?

The following slides will provide a walkthrough of the BETA uploaded to Oculus Release Channel April 13th, 2022.

PLEASE NOTE THAT ART, DIALOG, AND OTHER ASPECTS OF EOLIA ARE IN DEVELOPMENT AND DO NOT REPRESENT FINAL PRODUCT.

Version 5.0

- Build Notes
- Video & Text Walkthrough
- Technical Notes

Click Image to Play Video

ANNOUNCEMENT TRAILER

PRESS RELEASE HERE

PRESS RELEASE

VR Fantasy Adventure EOLIA Debuts on Quest 2 Summer 2022

Drop the controllers and save a desert world with Hands First VR in the follow-up to award-winning IONIA

BOSTON — March 28, 2022 — *EOLIA*, the symphonic fantasy-adventure follow-up in the award-winning *Rhythm of the Universe* series, reveals a brand-new world of storytelling exclusively on Meta Quest 2 this summer.

Building upon the lore of *IONIA*, developer ROTU Entertainment's second title *EOLIA* uses handtracking to deliver more immersive mechanics and rewarding exploration. Explore desert ruins with hints of a bustling civilization around every corner. Uncover a moving narrative with a timeless conservationist message by absorbing musical lessons from the environment and solving puzzles that bring balance to the world.

Catastrophe looms for Eolia—droughts plague once-verdant fields and extreme weather cuts open the skies. Climate change weighs heavily upon the land, and only an empathetic embrace of the world's musical mythology can save it. As adventurer Conga Dholak, you set forth on a journey of healing to stop the storm. Physically climb, jump, ride, and play instruments, uncovering melodies to restore the rhythm of the universe.

Taking full advantage of Meta Quest 2's immersive Hand Tracking technology, *EOLIA* features dozens of interactions and intuitive controls designed for Hands First VR. Flick and pinch to play magical stringed instruments. Page through your journal to track your quests. Decipher and perform over a dozen flute melodies to unlock your powers. Collect items in your satchel for later use and view your inventory by just opening your palm. Climb ladders, ropes, and ledges, or take the reins of a mounted steed to break through obstacles and outrun storms—all with your hands. With Meta Quest 2, your body is your instrument in Conga's fight against climate change.

The *Rhythm of the Universe* series is dedicated to real-world improvement through in-game education, but proceeds from each game also aid important causes. The philanthropic filmmakers, musicians, and visual artists of ROTU Entertainment will dedicate a portion of proceeds from *EOLIA* to a non-profit organization dedicated to fighting climate change.

"Unlike the endless worlds we explore in gaming, in reality, we only have one planet to call our own," said Jason Parks, ROTU CEO. "Through VR's ability to truly transport us and instill a tangible sense of place, we hope to inspire people to see the beauty in our natural world and consider brave actions in their daily lives."

EOLIA continues a symphony of storyliving on Oculus/Meta Quest 2 this summer for $14.99 with support for English voice and text, with text localization for additional languages coming post-launch. For more information about ROTU Entertainment, please visit the official website, follow the studio on Twitter, Instagram, and Facebook, and join the official community on Discord.

About ROTU Entertainment

Based in Boston, Massachusetts, ROTU Entertainment is an immersive entertainment studio striving to define the future of storytelling. A fully remote, ever-evolving network of artists, entrepreneurs, and industry leaders provides ROTU Entertainment with unparalleled access to talent, creativity, and innovation. The team comprises developers with experience working at Valve and Capcom, as well as on renowned games such as *Hot Dogs, Horseshoes & Hand Grenades,* and *République*. ROTU Entertainment currently works on IP development as well as pre-visualization and virtual production using Epic Games' Unreal Engine.

Learn more about ROTU Entertainment, *Rhythm of the Universe: IONIA*, and *EOLIA* by visiting the company website or reading their interview on UnrealEngine.com.

Media Contacts

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EOLIA - BETA

TARGET AUDIENCES

EOLIA - BETA

VRC QUEST ACCESSIBILITY

The following are the accessibility VRC's Eolia is targeting:

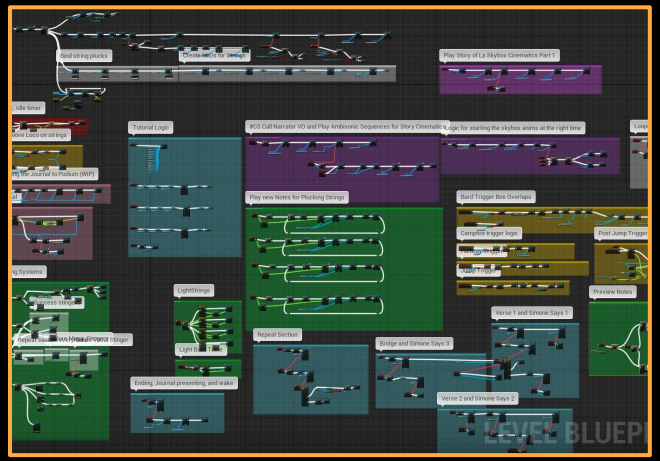
VRC.Quest.Accessibility.3
VRC.Quest.Accessibility.7
VRC.Quest.Accessibility.8
VRC.Quest.Accessibility.9

For more information visit: HERE

EOLIA - BETA

OVERVIEW

EOLIA - BETA
OVERVIEW



TECHNICAL LIST OF INTERACTIVE ELEMENTS

1. Player Locomotion
    - OK pinch brings up two HUD elements
    -pull up jumps
2. Mounted Locomotion
    - Idle, walk, trot, gallop
3. Remote Grab of Inventory (Modus)
    - Palm out open / grasp is most natural
4. Satchel
    - can drop held items over bag to add to inventory
    - place in front of you with UMG display
    - UMG columns for Consumables, Collectables and Quest Items with flick and pinch
5. Journal
    - palm facing opens it, tabs to select pages
    - Will contain main menu, quest information, puzzle hints and tips, etc
    - UMG pages with widget interaction
6. Remote Grab of Puzzle Elements (Modus)
    - Palm out open / grasp is natural
    - HMD trace, hand only needs to be marginally in view
7. Climbing System
    - Grab grips, ledges (chin up), ropes
8. puzzles
    - Slider and knob controls
    - Plucked strings and drum pads as instruments
    - Dynamic music systems
    - Keyboard (organ)
    - Free play wind instruments

EOLIA - BETA - OVERVIEW

HANDS FIRST GAMEPLAY

WALK

Left Pinch, forward motion.
Alternative Controller: Left Thumbstick north/south

TURN

Right Pinch, left/right motion
Controller Alternative: Right Thumbstick east/west

JUMP

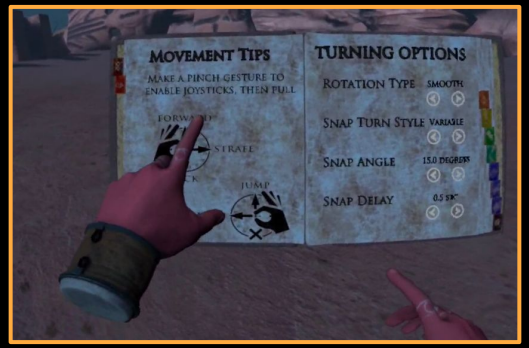
Right Pinch, Upward motion
Alternative Controller: A Button

EOLIA - BETA - OVERVIEW

HANDS FIRST GAMEPLAY

INVENTORY SYSTEM

User will find the “satchel” or inventory system in the palm up menu.
Find useful potions that temporarily provide modus powers and items that dive into the story.



JOURNAL

Find game options, puzzle hints, progress milestones, and more.

Open by grabbing Palm Up Journal Icon for 2 seconds.

PALM UP MENU

Both hands facing palms up will trigger three options: Satchel, Flute, Journal

Same gesture on Controllers

EOLIA - BETA - OVERVIEW

HANDS FIRST GAMEPLAY

Y SHAPED FLUTE

Flute that can play harmonies (multiple notes simultaneously)

Pick up the flute and discover melodies that unlock powers!

STRINGED INSTRUMENTS

Play music with bards, ships, and more that recite the epics of Eolia.

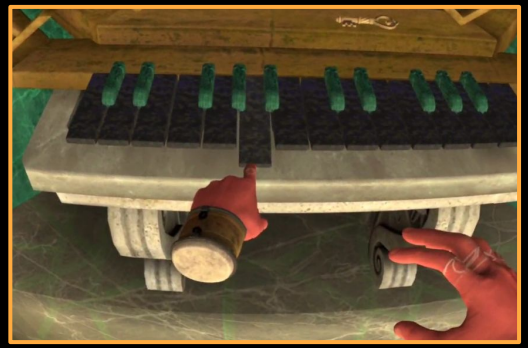
Combining Gameplay and Storytelling!

DRUMS

Use many different Drums throughout Eolia to unlock puzzles and speak with the past!

EOLIA - BETA - OVERVIEW

HANDS FIRST GAMEPLAY



GIANT CHURCH ORGAN

Play the Tuvarian Organ and here the sound resonate through an amphitheatre sized church.

KUDUM PUZZLE

Find the correct angles to redistribute energy and trigger harmony.

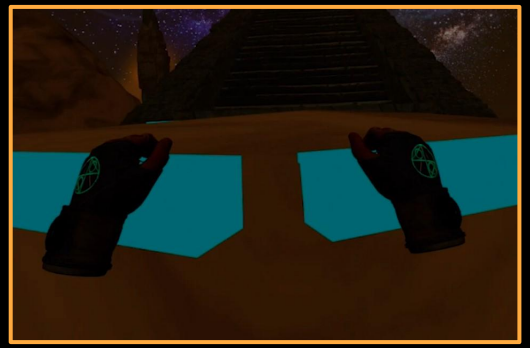
Hardest and longest puzzle in the game!

MIXING MACHINE

Use the Journal for hints!

EOLIA - BETA - OVERVIEW

HANDS FIRST GAMEPLAY



CLIMBING

Grab and Pull down.
Controller Alternative: Trigger

LHARGO RIDING

A rideable mount.

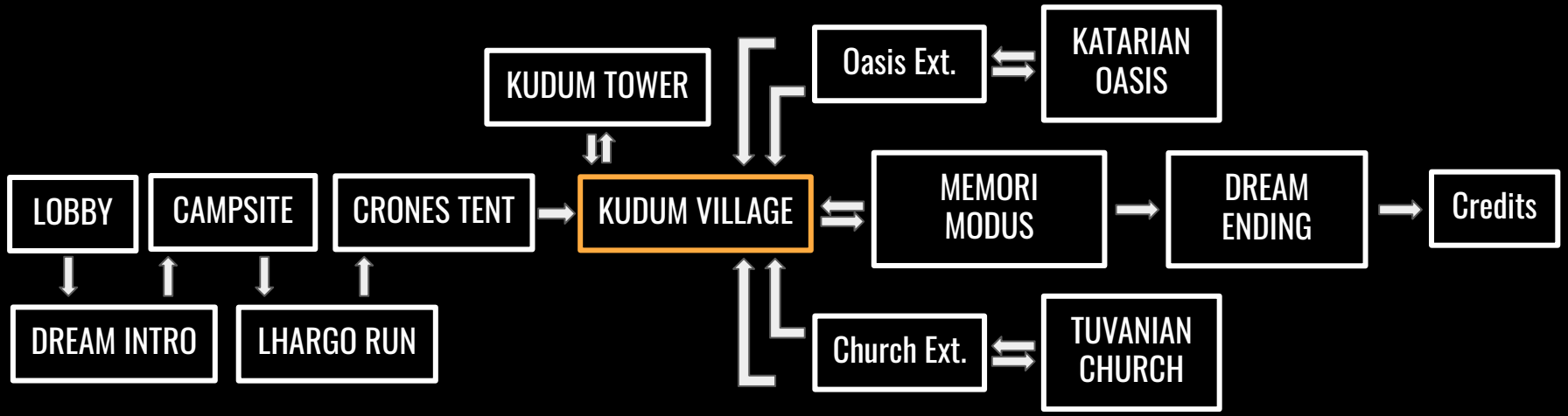
The only creature in Eolia that will run toward a sandstorm.

NPC DIALOG SYSTEM

Choose with near or far field selection options.

EOLIA - BETA

OUTLINE PROGRESSION



EOLIA - BETA
WALKTHROUGH

EOLIA - BETA - WALKTHROUGH

MAIN MENU

PLAYTIME

1+ MIN

LOOK & GRAB

Far field icon indicates what user is looking at. A simple hand closing gesture selects

MENU

Choose save slots, levels, and options

OPTIONS

Change settings both ingame and in the main menu for audio, locomotion, and accessibility including vignette comfort.

EOLIA - BETA - WALKTHROUGH

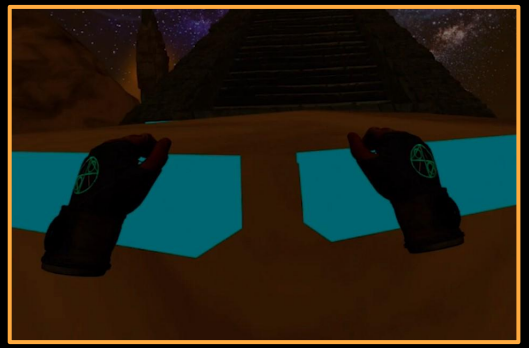
DREAM INTRO

PLAYTIME

10+ MIN

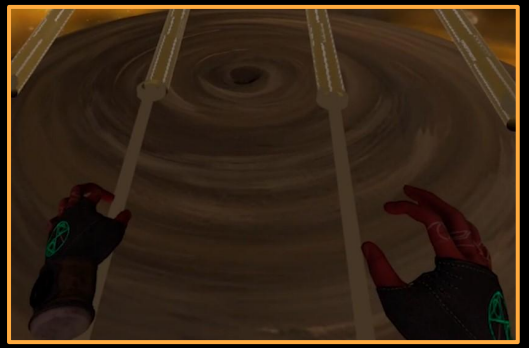
STORYTIME

The starting cave and next area triggers a larger than life intro to the Eolia story.



LEARN THE ROPES

The Introduction level shows the player how to use locomotion, climb, and interact with objects.



PLAY THE STRINGS

Play the music instrument basics with a bard that recites the epics of Eolia. Combining Gameplay and Storytelling!

EOLIA - BETA - WALKTHROUGH

DHOLAK CAMPSITE

PLAYTIME

5+ MIN

TALK WITH DHOLAK

Use a menu system to learn more about Eolia and start your first quest!

PUT OUT THE FIRE

Take the potion from Dholak and drop it on the campfire.

**Potion will be a bucket of water for Beta.*

LEARN TO RIDE LHARGO

Follow Dholak's instructions and follow him on the Lhargo.
Get up by grabbing the foot hold and move by whipping the reins!

EOLIA - BETA - WALKTHROUGH

LHARGO RUN

PLAYTIME

5+ MIN

AVOID OBSTACLES

You better ride fast because a storm is chasing you. Move out of the way if you see rocks! A successful run requires full speed on the lhargo. Head toward the storm breakers.

DODGE TORNADOES

Dust Devils sent by Salius Locrius are following you! Make sure you get out of the way.

TRAVEL THE DESERT

Make it all the way to Kudum Outpost.

EOLIA - BETA - WALKTHROUGH

CRONES TENT

PLAYTIME

5+ MIN

CRONE'S DIALOG

Learn what is next in your adventure via dialog system.

VISIT CIMBASSO

You will be given a task to find Cimbasso

SEARCH FOR ITEMS

Several Items can be found. You will not be able to return so stock up!

EOLIA - BETA - WALKTHROUGH

KUDUM OUTPOST PT. 1

PLAYTIME

5+ MIN

TALK TO CIMBASSO

Kudum is an outpost made up of tents. Crones tent is distinct. This is where you start. You will be given a task to find Cimbasso

KUDUM TOWER ENTRY

A Tower a tall as the eye can see sits above the Kudum Outpost. You heard from the villagers that the energy source will help bring harmony to the land. Cimbasso will help you up.

MORE CHESTS

Find Items that will help you run faster, jump higher, and fix kudum tower.

EOLIA - BETA - WALKTHROUGH

KUDUM TOWER

PLAYTIME

15+ MIN

EXPLORE

The tower has a lot to find. Many mini puzzles and side quest are available.

**For beta The tower will be bustling with NPC's*

FIND THE ENERGY

You can find many ways to reach the top. Any way will be treacherous.

You will use advanced jumping and grabbing techniques.

KUDUM PUZZLE

Use the circuit breakers in the correct order to finish the puzzle.

**For beta the puzzle will look like a musical staff and puzzle pieces will be scattered.*

**Solution on following slide*

EOLIA - BETA

KUDUM PUZZLE PART 1

PLAYTIME

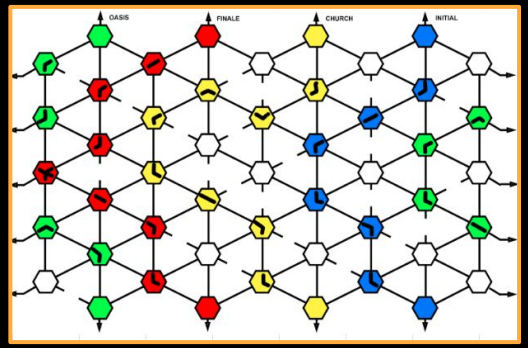
5+ MIN

HOW TO START

Part 1

Locate blue “energy” joints and where they are placed on the machine.

Remember you can use your environment if you need to reach something.



MIX & MATCH

Part 2

Align the correct joints to the energy grid to unlock enough Blue energy for the Memori Modus Door.

You will only need to solve 1 (blue) of four lines of energy to progress game.

FINAL PIECE

Part 3

After completing (single joint), energy will fill feed to the floor, powering Memori Modus Location in Kudum Tower.

You will need to return later in the game to finish the entire energy grid.

EOLIA - BETA - WALKTHROUGH

KUDUM VILLAGE PT.2

PLAYTIME

5+ MIN

MEMORI MODUS ENTRY

Unlocked with Blue Energy in Kudum Tower and is where you will explore next.

KATARIAN OASIS ENTRY

Use Kudum Outpost to enter the Katarian Oasis Exterior

**After Memori Modus and green energy in kudum tower is solved*

TUVANIAN CHURCH ENTRY

Use Kudum Outpost to enter the Tuvanian Church Exterior

**After Tuvanian and red energy in kudum tower is solved*

EOLIA - BETA - WALKTHROUGH

MEMORI MODUS PT.1

PLAYTIME

5+ MIN

MEET TENORA

Tenora will great you with a story that will help the user understand what is going on.

RECEIVE GLOVES

Stick your hands in the gloves machine. You now can grab objects from afar by looking and making a grabbing gesture.

LEARN WHERE TO GO

Through Tenoras story it is clear your Journey will need to take you to the last Oasis and an abandoned Church, for powerful musical objects

EOLIA - BETA

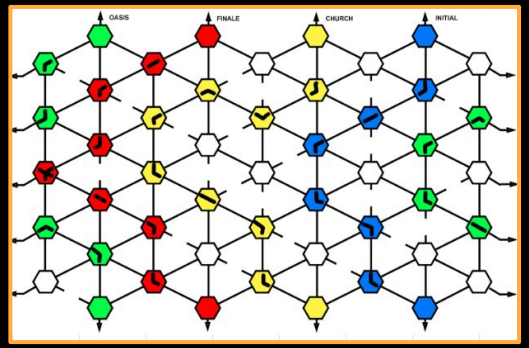
KUDUM PUZZLE PART 2

PLAYTIME

5+ MIN

RETURN TO KUDUM TOWER

Travel through Kudum village and up to Kudum Tower, use the elevator to solve the GREEN Energy line



MIX & MATCH

Align the correct joints to the energy grid to unlock enough energy for the town.

You will need to solve 2nd (green) line of energy

FINAL PIECE

After completing, energy will fill feed to the floor, powering the Oasis Door. You will need to return later in the game to finish the entire energy grid.

EOLIA - BETA - WALKTHROUGH

KATARIAN OASIS EXTERIOR

PLAYTIME

5+ MIN

SADDLE UP

Ride the Lhargo and follow the path until you find Area two.

Enjoy the scenery!

LIFE FINDS A WAY

Toward the end of the path flora and fauna indicates the player is near the Oasis. Hidden paths lead the options items to collect!

OASIS ENTRANCE

Dismount the Lhargo and proceed on foot.

EOLIA - BETA - WALKTHROUGH

KATARIAN OASIS

PLAYTIME

10+ MIN

LOCKED DOOR

After the bars of the door are removed use remote grab on the door to finish lifting it to a open and locked position. Now you are ready to enter the Oasis.

MUSIC MACHINE

Solve Puzzle One or alternatively find hidden paths full of collectables. After solving, proceed across the bridge.

**Solution on following Slide*

LA's INSTRUMENT

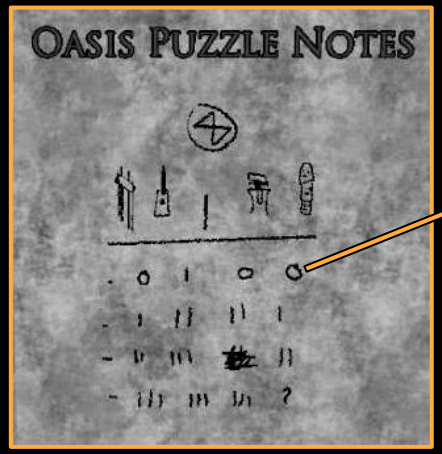
Listen to Salius Locrus's message and grab the 1st piece of a powerful Harp artifact

EOLIA - BETA

MUSIC MACHINE PUZZLE

PLAYTIME

5+ MIN



HOW TO START

Part 1

Place sliders in the correct order as seen above. Do one at a time and complete Simon Says for each.

SIMON SAYS

Part 2

Each pattern of sliders (four altogether) triggers interactive strings attached to the music machine. Play the pattern correctly and move onto the following pattern via the sliders in step one. Remember to turn the center knob to advance.

BRIDGE

Part 3

After completing all four patterns, a bridge will light up in front of you. Make your way across the bridge to find the Heartstrings artifact.

EOLIA - BETA

MUSIC MACHINE PUZZLE

PLAYTIME

5+ MIN

EOLIA - BETA

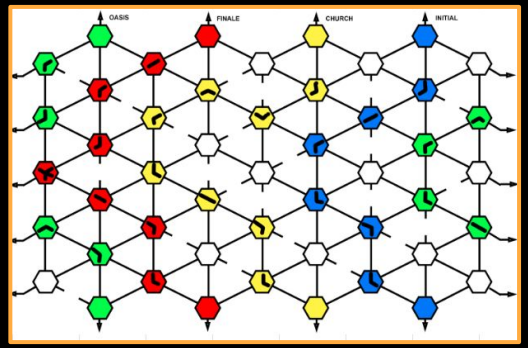
KUDUM PUZZLE PART 3

PLAYTIME

5+ MIN

RETURN TO KUDUM TOWER

Travel through Kudum village and up to Kudum Tower. Pro Tip, use the elevator to fast travel to the puzzle.



MIX & MATCH

Align the correct joints to the energy grid to unlock enough YELLOW energy for the Tuvanian door.

You will only need to solve 1 (YELLOW) of four lines of energy to progress game.

FINAL PIECE

After completing, energy will fill feed to the floor, powering the Oasis Door. You will need to return later in the game to finish the entire energy grid.

EOLIA - BETA - WALKTHROUGH

TUVANIAN CHURCH EXTERIOR

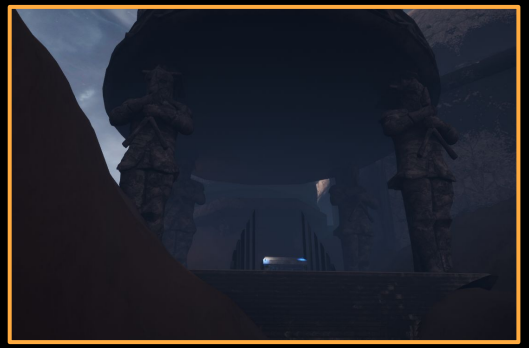
PLAYTIME

5+ MIN

SADDLE UP

Ride the Lhargo and follow the path until you find Area two.

Enjoy the scenery!



HIDDEN PASSAGE

Find the scroll of Levitation after breaking through some feeble walls with your Lhargo.

EPIC CHURCH

Look for an entrance into the tuvanian Church After Dodging a tornado. It looks sorta like an organ, doesn't it.

EOLIA - BETA - WALKTHROUGH

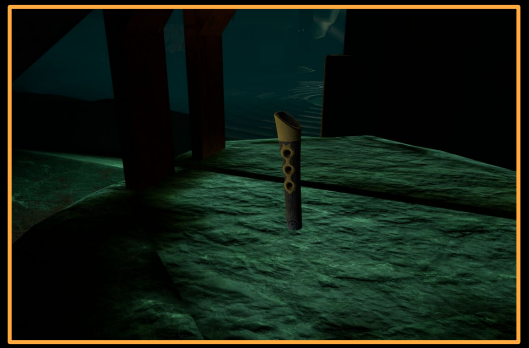
TUVANIAN CHURCH

PLAYTIME

30+ MIN

FIX THE ORGAN

Restore the Organ Pipes and play to uncover the second piece of LA's Instrument



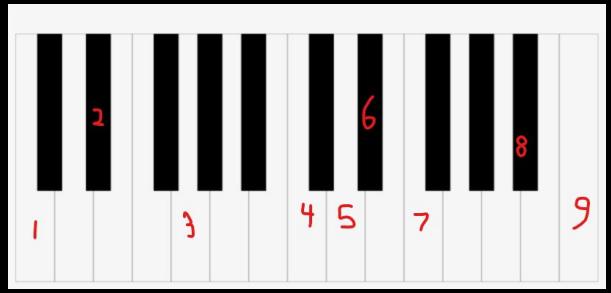
FIND THE FLUTE PIECES

The Church is Large and holds rare and much needed flute pieces, where could they be?

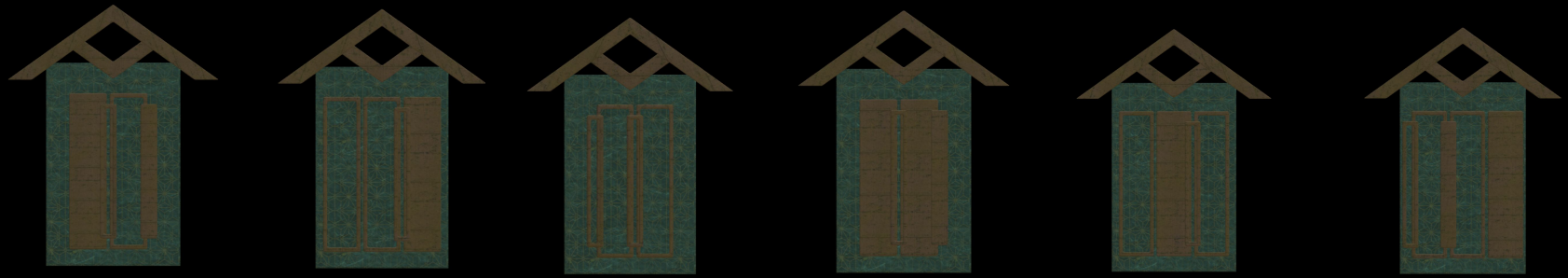
THE CATACOMBS

Find a wealth of useful treasure chests

EOLIA - BETA
FIX THE ORGAN



PLAYTIME
5+ MIN



FIND THE NOTES

Search around church and find the organ puzzle pieces shown above.

Keep them in your satchel for safe keeping

FIX & MATCH

Step 1 Find and play melody Call to Healing near giant red vines to remove from organ pipes.

Step 2 -Align the organ puzzle pieces (as shown above) to the organ and perform the notes on the organ. They match the exact layout of the keyboard.

REACH LA'S INSTRUMENT

After solving the organ puzzle use the hand Button on the right side of the organ to start the elevator, reach the room with La's Instrument.

EOLIA - BETA

FIX THE ORGAN

PLAYTIME

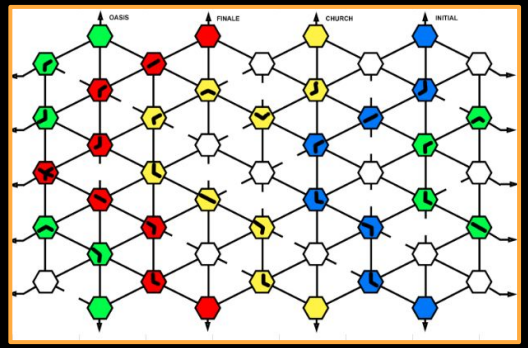
5+ MIN

EOLIA - BETA
KUDUM PUZZLE PT. 4

PLAYTIME
5+ MIN

RETURN TO KUDUM TOWER

Travel through Kudum village and up to Kudum Tower. Pro Tip, use the elevator to fast travel to the puzzle.



MIX & MATCH

Align the correct joints to the energy grid to unlock enough RED energy for the Tuvanian door.

You will only need to solve final (RED) of four lines of energy to progress game.

FINAL PIECE

After completing, energy will fill feed to the floor, powering the Door in the center of the room the user is in.

EOLIA - BETA

KUDUM PUZZLE PT. 4

PLAYTIME

5+ MIN

EOLIA - BETA - WALKTHROUGH

KUDUM TOWER CENTER

PLAYTIME

10+ MIN

ELEVATOR

Find a door in the center of the kudum tower puzzle.

BE CAREFUL

The room with LA's final piece is not easy to find.

LA's FINAL PIECE

Go through the modus door and use grab powers to obtains LA's Instrument

EOLIA - BETA - WALKTHROUGH

KUDUM TOWER CENTER

PLAYTIME

10+ MIN

EOLIA - BETA - WALKTHROUGH

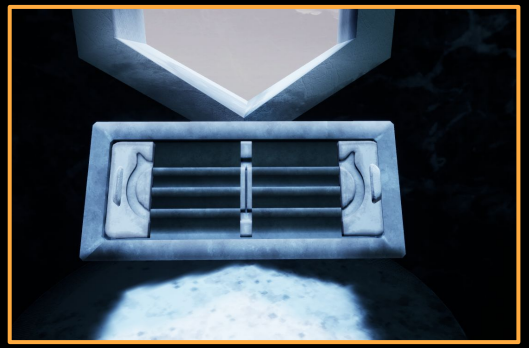
MEMORI MODUS PT.2

PLAYTIME

10+ MIN

MEMORI MODUS

Travel back to Memori Modus. Pro Tip: Use the flute to fast travel.



PLAY LA's HARP

Add The Harp pieces togetherfound in Oasis, Tuvanian Church, and Kudum Tower. Play a single note...

TRANSPORT TO REPRISE

Energy will cover around you transporting the user to The Final Dream Sequence called LA's Reprise

EOLIA - BETA - WALKTHROUGH

MEMORI MODUS PT.2

PLAYTIME

10+ MIN

EOLIA - BETA - WALKTHROUGH

FINALE DREAM

PLAYTIME

5+ MIN

GET ON THE BOAT

The Dream Sequence starts when you land on the boat

SIMON SAYS

Repeat the melody and Rhythm to progress the dream

CLIFFHANGER

Player realizes the story is just the beginning!

EOLIA - BETA - WALKTHROUGH

CREDITS

PLAYTIME

5+ MIN

EXPLORE

Learn about the team in a creative way!

EOLIA - BETA
TECHNICAL NOTES (Blog)

Challenges with Locomotion

The first technical system we sought to tackle was the player movement / locomotion system. After all, if you cannot move in-game, you can't test too many other mechanics.

With hand tracking enabled, we were missing many of the traditional hardware inputs we had been using in previous VR experiences ... Joysticks, D-pads, thumb pads, ABXY buttons, grip, trigger axes, and more. However, teaching the player how to push forward on a stick to move forward was reasonably straightforward, and there was virtually no difference in how various players interacted with the controllers.

What we instead had available to us through the Oculus API were individual finger joint rotations, pinch strength values and a system for recording and detecting individual hand poses, or chains of poses, to trigger game logic. The dramatic increase in immersion provided by the new system was quite stunning indeed. And it's now certainly possible to create more input commands than the count of hardware inputs allowed previously. However, there are prices to pay for these increases in agency:

It is essential to make hand gestures highly intuitive with hand tracking as it is more challenging to train a player how to use these systems. But you can't know if all players will perform a gesture in the same way. If you widen the range of error to account for player-to-player differences, you can start experiencing false-positive responses to other similar gestures. For example, if you require a player to snap their fingers, most will start with the thumb against the middle finger and end with the thumb up and the middle finger down. However, there are significant differences in what players do with their index and pinky fingers in particular. Given the current hand pose system in Unreal it is an all-or-nothing approach to every finger joint angle - ultimately this meant we had to abandon using the default Oculus gesture system.

Self-occlusion is a second major hurdle when setting up hand poses. Fingers can be quite easily blocked by the thumb or the back of the hand. We first set out to replace our point-and-click style of teleportation and snap turning with certain hand gestures. For teleporting, you need one gesture to activate and point an arc and another to execute the move to a desired location, although neither should be common enough to cause the player to teleport when they do not desire to do so. We first tried using a finger gun gesture using the index finger to aim with the thumb up, and pressing the thumb down to execute the move. Unfortunately, there were two problems with this. First, as most movements are away from the body, the index finger becomes foreshortened in the camera frustum, causing significant drift in the intended direction as errors stacked through multiple index knuckle joints. Second, with the thumb up, it would also frequently block the index finger from the cameras entirely. Moving the aim to wrist bone instead was more reliable but lacked the fine control we would get from a finger. Moving the aim to the thumbnail (like a pistol scope) worked a little better but blocked the line of sight to the destination. Tracing arcs from the HMD through the hands also failed, so a decision was made to scrap teleportation entirely and move to a capsule-based Character setup where the player informs the game of their intended direction instead of a destination.

Here's where we learned that a third major hurdle to overcome is ergonomics and stress positions. Lacking joysticks, we thought, hey, why not turn the player's thumbs into joysticks instead? Two thumbs up became the gesture to enable our new movement system. On the left hand, pressing the thumb forward moved the player forward. Twisting the left wrist to either side created a strafe, and tipping the wrist back moved backwards. On the right hand, putting the thumb up while twisting the wrist to either side was used for rotation, and we soon established a jump with the right thumb. The system worked well enough, and we were quickly able to run around a greybox level. Most people testing for the first time got the idea pretty quickly. However, that's also when we learned that things would get pretty uncomfortable after a few minutes of locomotion, especially along with the forearm muscles. Two key points to remember, the 3D space where the hands can be tracked with the highest confidence is not exactly where the hands can be comfortably held for long durations.The second point, hand positions where the fingers are most easily tracked (palm facing or away vs. on edge), can also be the most uncomfortable orientations on the forearms.

Our Current Solution to Locomotion

Considering the three major hurdles to overcome - reliable, intuitive gestures that do not self-occlude or cause stress positions - we came around to using a simple edge-facing "OK" pinch to initiate locomotion. Using a combination of just the basic index to thumb pinch strength with an alignment of a palm vector aiming in a similar direction to the player's HMD (to avoid pinching movements when manipulating other objects) we enable two HUD components per hand the moment these two conditions become true.

The first component is a relatively simple movement HUD plane that stays locked to the player's local space at the coordinate where the pinch began. This movement HUD plane gives the player a frame of reference to work with. The second component is a small sphere affixed just off the index finger that is locked to the movement of the hand. Although the player is touching their thumb, it feels like a bit of tactile feedback for a pinched "joystick" of sorts. We then convert the offset of each joystick sphere against its HUD's plane of reference into input values for movement. Letting go of the OK pinch stops the movement and hides all movement components.

A pinch and push forward with the left hand moves the player forward. A pinch and lateral movement strafes the player. A pinch and lateral movement with the right hand rotates the player capsule—a pinch and pulling up triggers a jump.

We chose to increase the speed the further from the center you pull. While changing a player's acceleration often causes motion sickness, we found when a player has full control over this they are far less likely to feel ill. The problem is more prevalent on a roller coaster or moving platform where acceleration
changes are unexpected for example.

This system is highly intuitive, comfortable, and less prone to errors and false-positive effects than anything else we have attempted to date. It works well for fine adjustments as well as large movements. Finally, it is less immersion-breaking than instantly teleporting 10 ft away or snapping around in 30-degree increments.

VR Climbing Systems

Being able to run around and jump on flat surfaces is certainly a lot of fun but given the VR medium is three dimensional, adding the ability to climb to great heights can create highly emotional experiences.

Creating a climbing grip is fairly straightforward. You just need to make a grabbable VR object like any other thing that can be picked up, except upon movement, you use the offset from its original position to counter offset the player before returning it (and your hand) to that original position. In this way, if you pull a grip down 1cm during a single tick frame, you push the player up 1cm and put the grip back where it was.

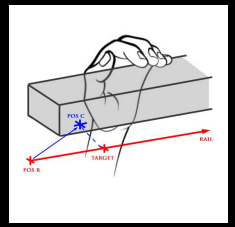
We have developed several categories of climbing systems that work like this with some specific customization:

- Standard grips: Horizontal grabbing surfaces that can be freely placed anywhere
- Ledges: When grabbed with both hands and pulled below the player's head a set distance, the system moves the player to a standing position above the ledge
- Ladders: A customizable vertical array of standard grips with a ledge at the top
- Ropes / Swings: A vertically aligned grip the player can climb up along
- Free climbing walls: Large custom collision surfaces that can be grabbed anywhere, such as a tall wall of ivy, often used with ledges near the top

Our Solution to Climbing Hand Animations

Lacking any tactile feedback, it is very common (especially with hand tracking) for VR hands to ‘ham fist’ an object instead of conforming the hand to the surface of that object. This clunky way of grabbing looks highly unusual and, unfortunately, cannot be adjusted with the standard hand-tracking VR hand. A solution was to add an additional pair of animated skeletal mesh hands to the character for these use cases. These are hidden until needed and swapped in place when a climbing grip is detected. Grabbing poses were authored to fit the grips perfectly.

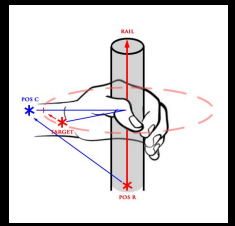
A key technical challenge in doing this is knowing how to position the false hand, so the pose lines up correctly with the grip, given that the player’s wrist position and orientation are likely not in the correct spot. To do this, we use a hidden offset rail running parallel to the grip that a scene component rides along, holding the proper position and orientation where the false hand can snap to place. The trick then is to find the distance along that rail closest to the player’s wrist (motion controller root) for best alignment.



This trick isn’t too difficult to determine. Taking the location of the hand controller (Pos C) and subtracting the location of the rail’s origin (Pos R), we get the solid blue offset vector shown here.

Multiplying that by the forward vector of the rail yields the distance along the rail perpendicular to the wrist.

Add that back onto the rail’s origin, and you will have a target point to snap the false wrist (Target). This is the closest perpendicular location to the grip from the current wrist location.



Climbing ropes use this same technique to determine where in Z the wrist should snap vertically. However, the rail is located down the centerline of the rope because the player could approach it from any angle.

We need to offset the target a fixed distance away from the rail to match the grabbing pose. But that means one extra bit of math - finding the "Look At" rotation of the player's hand controller to set the best matching yaw of the false hand.

Given that the API tells us the exact rotation of all the finger joints of the tracked hand, we can set an initial matching pose on the animated hand right before swapping visibility to avoid any pops or jerks. Then in the Animation Blueprint, we can ease into the desired pose and final location and orientation.

One particular issue with climbing ropes is that the thumb and back of the hand tend to obscure the rest of the fingers when making a fist in a vertical orientation. Therefore, we found it best to consider the index and thumb pinch strength here as they are the most visible fingers.

Another common issue with climbing grips is that the player frequently pulls their hand down out of view, looks up to see their destination, or perhaps even pauses climbing to look around. To avoid falling or movement error in low confidence mode, we continuously store the current player position and freeze them in place when the primary climbing hand's position becomes unknown.

Our Solution to Menu Systems

Another subsystem that was impacted by the lack of controller based input controls was having a button to pull up 3D menus to return home, adjust controls, interact with stored inventory, check maps or quest progress, etc.

We felt that one way to avoid needing a gesture or input to pull up a menu system was to create a tangible 3D asset that the player always had on their person. We decided to make a Journal in the form of a book that was strapped to the player's belt that could simply be grasped when needed. The more than the journal's normal vector aimed towards the player's HMD, the more the book opens. It can also be 'dropped' in a fully open position where it floats in air allowing the player to interact with its pages.

Page turning is handled by way of colored tabs which the player can touch with a collision sphere located on their index finger. We use a 2D blendspace where one axis is used for flipping through various pages from cover to cover, while the other axis is used to open and close the book fully.

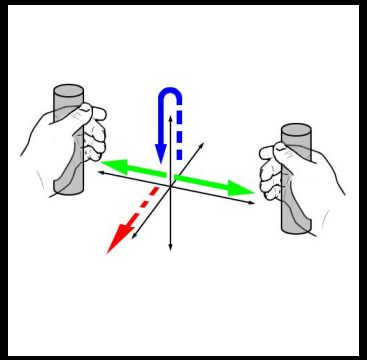
Using sockets on each page bone in the skeletal mesh, we were able to attach UMG widgets that carry all the logic for what appears on each page of the journal. For performance reasons, we only display the menus on the currently opened section, as well as spawning ones on pages we know the player is about to flip to, and destroying ones that have become hidden as the pages close.

One technical challenge with hand tracking is how to handle widget interaction components. They work just fine for hovering over widget controls and knowing what the player is pointing at, but again there is now no button press available to use as a mouse cursor click.

To solve this last small step, we use collision boxes on each cover (height adjusted depending on page number) as a contact surface. We then use the combination of Begin Overlap with the index sphere and the widget interaction component's target to send a Click event over to that page's menu system.

Our Solution to Riding Mounted Animals

The land of Eolia is set in a sprawling open world desert, a terrain devastated by climate disaster. We determined that in addition to walking around and climbing, we wanted to give the player the ability to cross long distances quickly. So we set about attempting to allow the player to mount a beast - in our case, a mythical creature we call the Lhargo. Mounting and dismounting our Lhargo happens by way of grabbing onto a stirrup to get up, and two hand grabbing the saddle horn to get down. The last technical challenge then was to figure out how to give steering and speed controls to the player to actually ride it.
Going back to a strategy of providing intuitive, comfortable and non-blocking hand positioning, we felt that most players would be at least familiar with how to ride a horse. We present two reins for the player to grab, offering ergonomically comfortable hand positions. Here we are monitoring the average location between the left and right hands against a local coordinate reference plane located above the horn of the saddle. As this averaged location moves left and right along the green (Y) axis we assume the player is pulling the reins in a way that would steer our mount left and right. This uses roughly the same logic as our strafe and turn functions when walking on the ground. As the player pulls back on the red axis (-X), we slow the beast to a stop exactly how you would whoa a horse. Because pushing forward was not intuitive, we instead detect the reins going up and down in the blue (Z) axis a minimum distance over a short timer. This whipping motion works as a giddyup mechanic to jolt the Lhargo to move faster forward.



Here again we found that dead zones were helpful in reducing noisy input results. And we also range-clamped the strength of the inputs in a non-linear way so that more extreme movements yielded stronger input values.

An important note on motion sickness here is that the player is more susceptible to illness when they are being rotated around an axis than rotated on an axis. For this reason, we made sure the root and capsule centerlines of our mounts ran vertically up through the HMD as close as possible.

Given that the player is still able to move around in meat space, this central head alignment cannot always be guaranteed over time and locking the HMD to that axis, removing fine movements of the head, actually causes more motion sickness than from the rotation itself. Therefore other methods to reduce sickness should be considered. One approach is to limit the player's peripheral vision, which can be done with vignette tricks or by putting them in riding goggles.

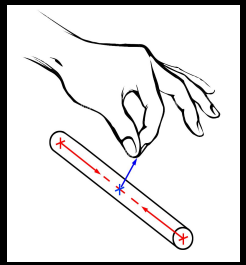
Our Solution to Stringed Instruments

Our first VR experience, Rhythm of the Universe: Ionia, is a VR controller-based game. Given that our games tend to include multiple interactions with musical instruments, we were limited to percussive, impact style instruments such as beating on bongos, hanging pan drums, or striking xylophones with mallets due to lacking fine finger control. So we were very excited to attempt playing stringed instruments as we set out to make a hand tracking experience.

The first technical challenge was determining which types of instruments would be better than others to try and emulate. So again, we set out to categorize things in terms of intuitiveness, comfort, and maintain high confidence in the hand tracking system. Preventing hand overlap quickly became the most significant measure.

For example, most brass and woodwind instruments are difficult to do. The hand positions on a clarinet or flute are overlapping and not in the HMD's cameras' immediate frustum. A trumpet puts the hands in a better position relative to the cameras and sets many fingers up to be primarily blocked by index fingers. Thus something like a trombone falls into a much better category - but alas, who among us enjoys trombone music? With all this in mind, one might come to something like a Y-shaped pan flute as a potential candidate. This Y-shape could be held at an acceptable distance from the HMD, where the hands are separated from each other, and the resolution of individual finger positions can be reasonably determined.

Stringed instruments can also be classified by how well they respond to hand tracking limitations as well. Holding a guitar in a natural pose is very difficult to track because the strumming hand is out of view below the HMD, and the chord hand is out of sight to either side of the HMD. Having all the strings in front of you is ideal, such as being seated behind a harp. Here again, we run into issues with hand overlap and finger resolution, just like a trumpet. Instruments like a violin are better when the chord hand is out in front of you and not blocked by the bowing hand. The most comfortable choice where finger resolution is ideal would be on a piano or a zither (a family of instruments where the strings run left to right across your body on a base).



We use a fairly thick string composed of three bones not parented to each other. We use a bone in the center of the string for animation, such as playing a rapid sine wave after the string is plucked. And then two bones at either end of the string set up with LookAt constraints for skinning purposes.

When a pinching gesture occurs within a minimum distance from the string's centerline, we snap the central bone to the pinched location. However, when the pinch is let go or exceeds some maximum distance from the centerline, we fire off the note and animation with some extra dynamics for volume and timbre.

One central puzzle area in Eolia involves a console with several strings, toms, and other controls to manipulate. It's a mixture of solving locked codes in between call and response events, while behind the scenes, we present the player with only select notes that are always in harmony with the music generated. In this way, players of any age or skill level can jam and make magic without ever playing a discordant melody.

Future Developments

We have explored these and many other use cases for hand tracking in our development of Eolia. And for the most part, we have successfully overcome certain limitations or at least recognized how to develop in an intelligent way optimal for the technology. But it feels like there is so much left to explore.

One key area of development we are working on now is handling interactions with NPC characters found throughout the game, using the new opportunities presented to us with hand tracking. For example, might it be possible to shake hands with an NPC to initiate a dialog sequence? How does a player without input buttons navigate through dialog options? The free sample project provided by Oculus demonstrating sign language recognition offers many interesting ideas.

The desired expansion of the current gesture pose recognition system would be to include gesture tracking through 3D space. Currently, we can recognize a finger being pointed, but there's no easy way to track that same finger drawing a box or star shape in the air. For us, tracking the player conducting to a beat would open up a whole new area of teaching musical skills and creating interesting music-based puzzles. This type of spatial tracking would be a very welcome addition to the hand tracking API.

Conclusion

Throughout this blog, we have explored three major themes that any developer of any genre of VR experience should keep in mind when working with hand tracking.

Are your gestures intuitive? Input mapping is no longer as simple as informing the player, "Press B to jump." When the player first sits on top of a mount and sees two reins, or stands in front of a stringed instrument, will they know what to do? Can you detect inputs reliably given differences between players?

Are your gestures optimized to maintain high confidence tracking? Not only do the hands need to stay where the cameras can see them, but considerations should also be taken to ensure that the fingers do not become occluded by the thumbs or backs of the hands. What alternative design ideas can you come up with to avoid situations that are not working well?

Are your gestures comfortable? Dedicated testing by a large number of people is essential for discovering these issues early. It can be pretty easy to find that a certain pose works just fine, only to find out later that making that motion repeatedly or holding it for a duration starts to wear out the hand and forearm muscles.

We hope you have enjoyed this article and possibly found some inspiration from the ideas presented. Feel free to join the conversation over at https://discord.gg/TurTFqsA or check us out at https://www.rotu.com/ to learn more!