

Disrupting Virtual Perception and blending Binaural / 3D audio for unique immersive experiences, promoting mindfulness and meditative states.

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This research project picks up on technologies like 3D audio , Binaural Beats and Virtual Reality and looks at using them in non traditional ways and possible disruption to create unique immersive experiences and to study and reflect on affects of the same. It majorly touches on disrupting the perception in Virtual Reality (HMD's) and using it in unique creative ways to create hybrid vision to headmovement. The project touches on aspects of Binaural Beats, and 3D audio and how these techonologies can be used together to create unique immersive experiences. It also touches on a new way to visualise audio-visual / a way of visualising music / audio in 3D space and optimisation .

Keywords : Virtual Reality , 3D audio , Binaural Beats , Metaphysical , Mindfulness , Meditative , Ω .

CONTENTS

1. Background	3
Metaphysical	
Camera Dynamics	
Aural	
Binaural Beats	
2. Rationale	7
Primary	
Reaching the maximum	
3. Approach	8
Developing Camera Scripts	
Optimisation	
User Feedback	
Supporters	
Aural // Binaural	
Timeline (Gantt)	
Contingency Planning	
4. Needs Analysis	13
5. References	14
works consulted	

This research proposal seeks to combine ,investigate and create creative integration between technologies from different realms of senses such as of audio , visual and more to create unique immersive experiences which promotes immersion, mindfulness and meditative trance states.

Background

Metaphysical

Virtual Reality and Immersive experiences are being researched upon context of mindfulness and meditative experiences as it unables user to get detached from external factors and fully immerse oneself within an environment. Our minds tend to be more focused in a new environment, an experience different from what it's used to, and VR and immersive experiences / installations alike have capabilities to provide so when done right.

“This knowledge can affect the way we behave , our self image and consequently the way we percieve ourselves to interact with our environment” Karen Carr (1995 , p- 4)

The sense of our physical reality is construction derived from symbolic,dynamic information directly presented to our senses and are only present in an incomplete, noisy form so as our eyes provide only a fleeting series of snapshots of only parts of objects present in our visual perception, through a prior knowledge brought to perceptual analysis of our sensory input, we interpret these objects to continue to exist in their entirety, Carr citing Gregory , 1980.

Karen Carr (1995 , p 1-2) dives on the subject of perception and how virtual reality is both a tool and a concept highlighting that how use of Virtual Reality can enhance ones understanding of how knowledge and understanding can come entirely from within oneself. It touches on the aspects of Virtual Reality can synthesis our minds and our perception of reality by plugging us in different environments. Our body senses are fine-tuned to achieve and operate in a certain environment and using external stimulations which do not adhere to our natural functioning of senses can be a both tricky and a serious game.

W. Geoffrey Wright (2014) elaborates on Virtual Environment's(VE) ability to augment brain functions by enhancing perception, eliciting automatic muscle behavior, and inducing sensorimotor adaptation.Wright states if applied properly , VR's ability to augment brain function can be far reaching and can potentially bring brain function back to healthy levels. Scientists, technologist and clinicians are already applying VR technology in rehabilitation.

VR's ability to put a user in a different world is incomparable to any of the current other forms of technology. We have tried to achieve the maximum immersion and similarity in VR world, we have replicated our head movement to vision as it is in reality in Virtual Reality as well.

But what if we can change that?

This technology has ability to change and revolutionise our perception of reality and much more can be done and explored in and with it than treating it just as normal reality. What affect will a hybrid of camera dynamics might just have on our perception and how we feel in this space.

What are the effects of something which we may not define as normal, in sense of how our body and senses coordinates. We are so used to turning our head around towards right and how our scene/reality follows to what's on right, we(our body) subconsciously makes a fair amount of calculations for this outcome. Changing this coordination can have our subconscious to rethink and reallocate and this holds ability to reset perceptions, ideologies and view the reality again from a fresh perspective, from a child's eye.

If you play a VR game in first person, you simulate being a human. In third person, a god. -
Sean Thompson (2018).

Camera Dynamics:

Changing the default understandings of headmovement to vision and perception.

Camera dynamics play an important role in immersion in all from flat cinematics to VR and more. The results of a study conducted by Riva et.al(2007) points towards VR being highly effective in eliciting emotional responses through the virtual environment's design alone. The study also found a circular dynamic between presence and emotion, representing how presence enhanced emotional outcome and vice versa.

Research study conducted by Geoffrey Gorisse(2017), studied affects of first person perspective(1PP) and third person perspective(3PP) further categorized in presence, emotion, space awareness, immersion and more in a detailed experiment.

The results analysis in terms of presence and embodiment demonstrate that both first- and third-person perspectives are able to induce high spatial presence feeling.

Aural

Audio plays an important part in immersiveness, We have discovered and derived 3D graphics from 2D, in sound we went mono to stereo. Now we are exploring Immersive 3D visual, and thus comes along a need and a side to explore, an immersive 3D sound.

“In less than five years, 3D spatial audio is expected to revolutionize our standard for multimedia listening”, Eva Wesemann(2017) founder of one of a BINCI company(Binaural Tools for creative Industries) as she writes on why 3D audio is the next big step for virtual reality. A 360 virtual environment wraps a user visually around it , 3D audio with carefully crafted sound wraps itself around the user in auditory perception. Manipulating this type of audio sensory perception has the potential to completely augment the entire virtual experience.

Just as panoramic stereo audio can make an impact through left and right channeled speakers, 3D audio adds even further to it giving more spacial awareness. Ability to capture one’s attention is one step further focused and dynamic to presence and space and thus higher immersion.

Mindfulness ~

The easiest way to get into a mindful state or meditation is via hearing, take a moment to notice the sounds around you.

Binaural Beats

Binaural beats : In 1839, Heinrich Wilhelm Dove discovered that playing a specific tone in one ear and a slightly different tone in the other generates a binaural beat. Specific Binaural beats can be used to put a mind in different states.

Binaural example:

Left Ear	Result	Right Ear
100 hz	13hz	113 hz

Binaural Beats are highly mentioned for it’s benefits and relaxation mimicing the brain states and frequency of our brain in different moods and stages. Article reviewed by Daniel Bubnis , Originaly by Lori Smith, (2017) mentions on its benefits like deeper meditation , reduced stress, reduced anxiety, and more.

It also reports on a study by Dr. Vincent Giampapa which found that the use of binaural beats therapy in the alpha, theta, and delta patterns had positive effects on the human body and shows specific positive results .

“

Delta patterns: Binaural beats in the delta pattern are set at a frequency of between 0.1 and 4 Hz, which is associated with dreamless sleep.

Theta patterns: Binaural beats in the theta pattern are set at a frequency of between 4 and 8 Hz, which is associated with sleep in the rapid eye movement or REM phase, meditation, and creativity.

Alpha pattern: Binaural beats in the alpha pattern are set at a frequency of between 8 and 13 Hz, which may encourage relaxation.

Beta pattern: Binaural beats in the beta pattern are set at a frequency of between 14 Hz and 100 Hz, which may help promote concentration and alertness..

“

“Some investigators have suggested that binaural beat auditory training may help control attention, arousal, and enhancement of cognitive performance while others have reported negative effects or largely mixed and confusing results. (Physiol Beh 1998;63[2]:249; J Altern Complement Med 2007;13[2]:199; J Pediatr Nurs 2010;25[1]:3).“

Rationale

The primary intent behind is to create a unique immersive VR experience, promoting unique camera dynamic/ perceptions, and mindfulness immersion , probably inducing feelings like of floating, relaxation and alike .

It aims to create an environment to promote meditative and unique experiences, and also explores the realm of altering mind states by combining technologies like Virtual Reality, Binaural Audio, environment interaction and more by using them in a non linear and creative ways.

This project also affords the opportunity to study tools to improve immersion in VR space, to study the affects of third person to first person dynamic and between a hybrid of it, to reflect on affects of changing the camera dynamic such as changing how our visual changes in sense to our headmovement.

The project delivers a prototype for a new way to consume and even make music. To program audio in a 3D visual realm , which can be used in creative ways to deliver unique immersive audio visual experiences.

Reaching the maximum

In current VR development , every headset comes with it's set of api's which (sometimes) means multiple developments to support different headsets. WebVR is an HTML based api for VR supporting multiple VR platforms.

Webpage comes with ease of access where's as an app has higher power, and a pc app even more. A pc application needs most amount of setup before the experience, a mobile app is easier. But both these platforms limit it to either mobile or pc. Where's as something which can exist entirely on web and be interactable directly , is most easy an accesible on every platform with a browser.

Though having something over as a Web experience comes with it's limitations of performance issue . VR being a performance hungry medium , a need of deep profiling and optimisation will be required.

The project tries to answer the query on multiple platform support for VR via using WebVR, exploring it's potentials and workarounds. WebVR being in it's infancy , has a lot more to offer and this project explores a very unique territory within it. Also exploring optimisation techniques.

Approach

~you dont even know what you don't know.

Time on Research and Practice.

Reading through deepest of internet's in recent developments in the field and practicing/developing alongside. Developing small prototypes within each feilds which contribute towards the final vision.

This includes to learn but is not limited to,

- more scripting
- Learning about VR headset backend gyro workings.
- 3D visualisation
- 3D engines
- Performance Optimisation for VR.
- Spatialised Audio
- Binaural audio implementations
- WebVR Apl
- Hosting | prpl or more ? - for smooth experience of heavy files over internet.
 - Push critical resources for the initial URL route.
 - Render initial route.
 - Pre-cache remaining routes.
 - Lazy-load and create remaining routes on demand.

Developing Camera Scripts :

Having different camera dynamics which enables user to experience a different form of perception and sensory input to head movement.

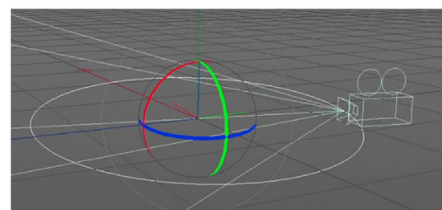
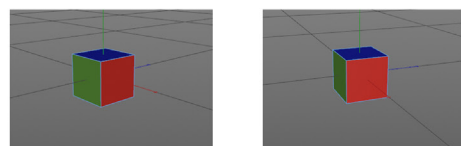
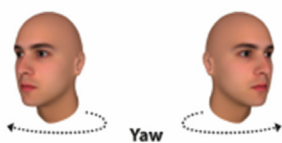
Different ideas for alternate camera scripts: ()

- Script(1) : [Targetted third person] Here camera is targetted towards a central object and revolves around it, which is linked to head rotation of VR headset - on all axis.(like a toroid - inside outside dynamic)
- Script(2) : [Targetted third person inverted y] The camera dynamic is same as 1, only difference being inverting the Y axis. Prototype testing revealed this subtle change can impact perception immensely.
- Script(3) : [Hybrid , semi targetted] In this camera dynamic, camera revolves around targetted object(center) at x-axis , while on y-axis it's normal dynamic ie- camera rotates from pivot (only on Y-axis)

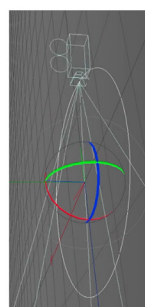
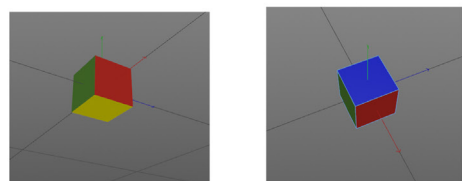
VR Headset Rotation

View/Result inside VR

for better understanding of whats happening , imagine camera move along spline targetted at center.



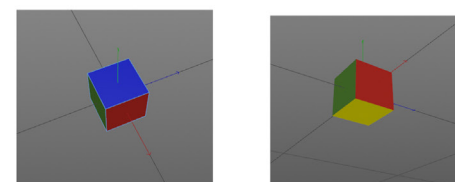
Camera positions rotation on x-axis is linked to vr headset
Camera view is locked towards object



Camera position on y-axis is linked to vr headset . |
Camera view is locked towards object

Script (1)

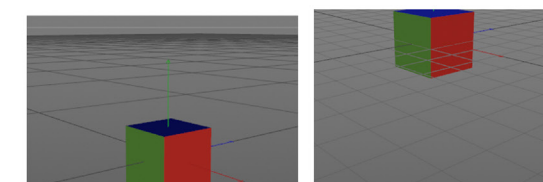
Same as script (1)



Y- axis is inverted.
(when you look up, camera travels to top of object.)
ie- you see top of object when looking up. |
Camera view is locked towards object

Script (2)

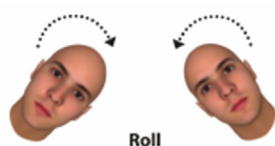
Same as script (1)



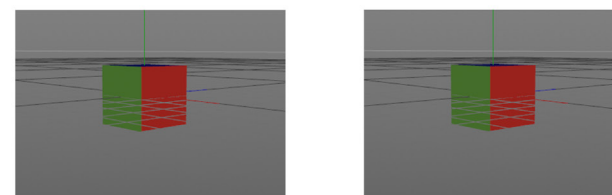
Y- axis is linked in normal dynamic.
ie- scene goes down when you look up and vice versa.
ie- camera rotates from pivot on y-axis just as normal
Camera View not locked towards the object.

Script (3)

This is common to all



When **NOT active** : this is how we will see inside VR,
as it will have no effect on the scene.



When **Active** : ~

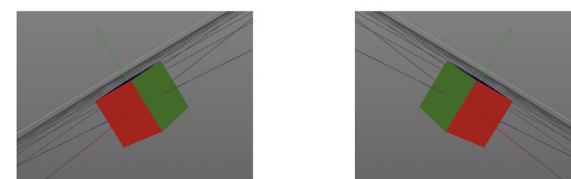


Figure : Visual representation to understand Camera dynamics.

Roll: The element of roll as shown above can be common to all scripts (linked normally) . Though is kept seperately as there can be coding /logical challenges (speacially in hybrid script) which may prevent this to exist.

Different platform also change the script and needs to be written accordingly. A script written in context with WebVR api won't run if experience is converted as an app build. - which can be because of several reason's such as webvr api not able to handle project heaviness etc.

Optimisation

This is a necessity that comes with performance hungry experiences such as VR. For a smooth experience to load up in VR, system must be able to make atleast 90fps. Dealing with WebVR(VR hosting over internet, makes this one step harder. This needs to be kept in mind at all times while making scripts, models, textures and everything.

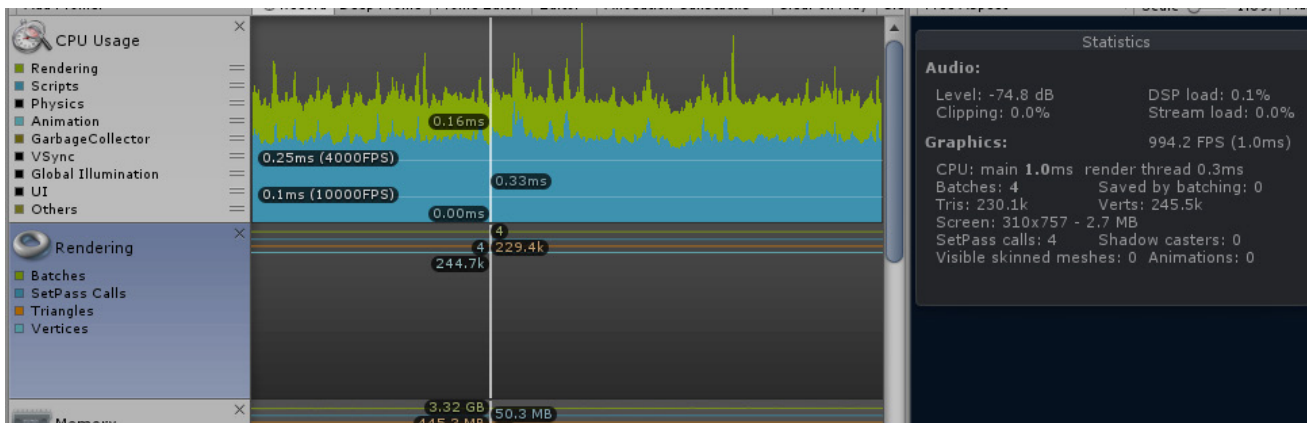


Figure : Profiler : An optimisation tool.

Possible optimisations : Light Weight Render Pipeline (Unity) : Still in preview/ development by unity (30september18)

A scriptable renderpipeline optimised for VR and mobile apps which gives more control over rendering as a developer . It can be used to optimise for fast rendering.

User Feedback

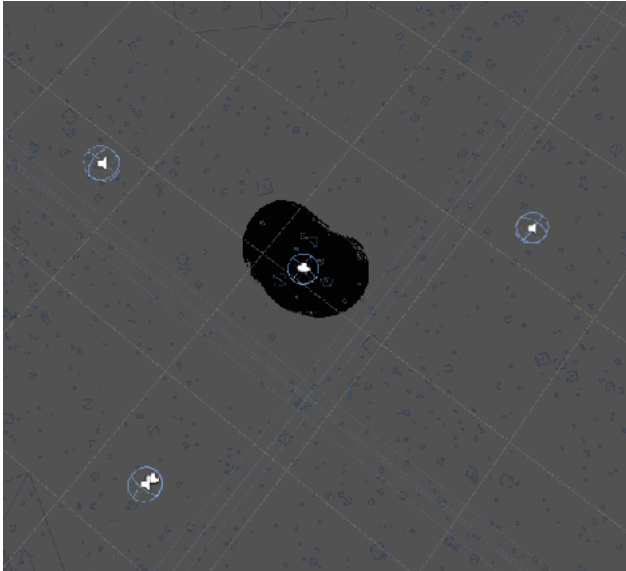
Feedback plays an important while developing alternate camera scripts. Feedback and opinion on level of immersion, how it impacts perception and what works and errors user might be experiencing can be used to determine optimal framerate, errors and movement of scene in accordance to head-movement, also revealing possible places of improvement which might be overlooked otherwise.

Supporters

Developing Visuals , the world, aesthetics , supporting scripts, animation and story-telling. Creating more elements which can be interacted. All these contribute to more immersion and to more attention and thus more mindfulness.

Aural

3D audio , Spatalisation , Binaural.

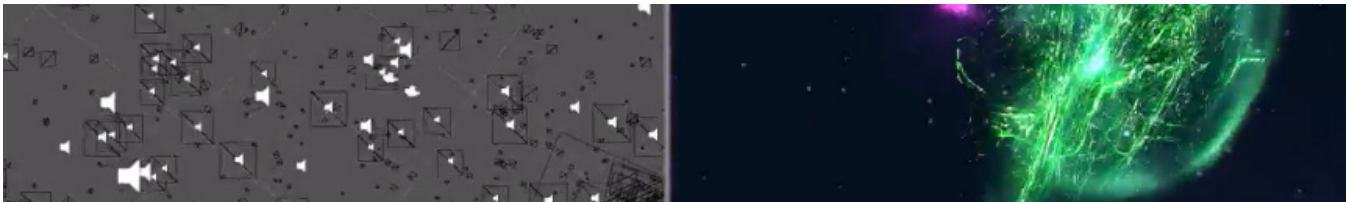


Project aims to combine 3D audio in a unique way where it blends together and forms a peice of abstract music, influenced by a user's headmovement. This offers a unique way in interacting with audio.

A quick prototype was put together to test the ideation. (click image on left to go to video) .

In above four layers of sound were placed in 3D environment, as shown in picture, combining together to create an immersive user location influenced audio mix environment.

A step further - A prototype environment of audio with multiple(many) sources were created to , test the ideation and blend of mix. This can be used to create a fluid audio atmosphere to move through in VR space, and the basis of integration of web of binaural beats to move through. (click image below to go to video)

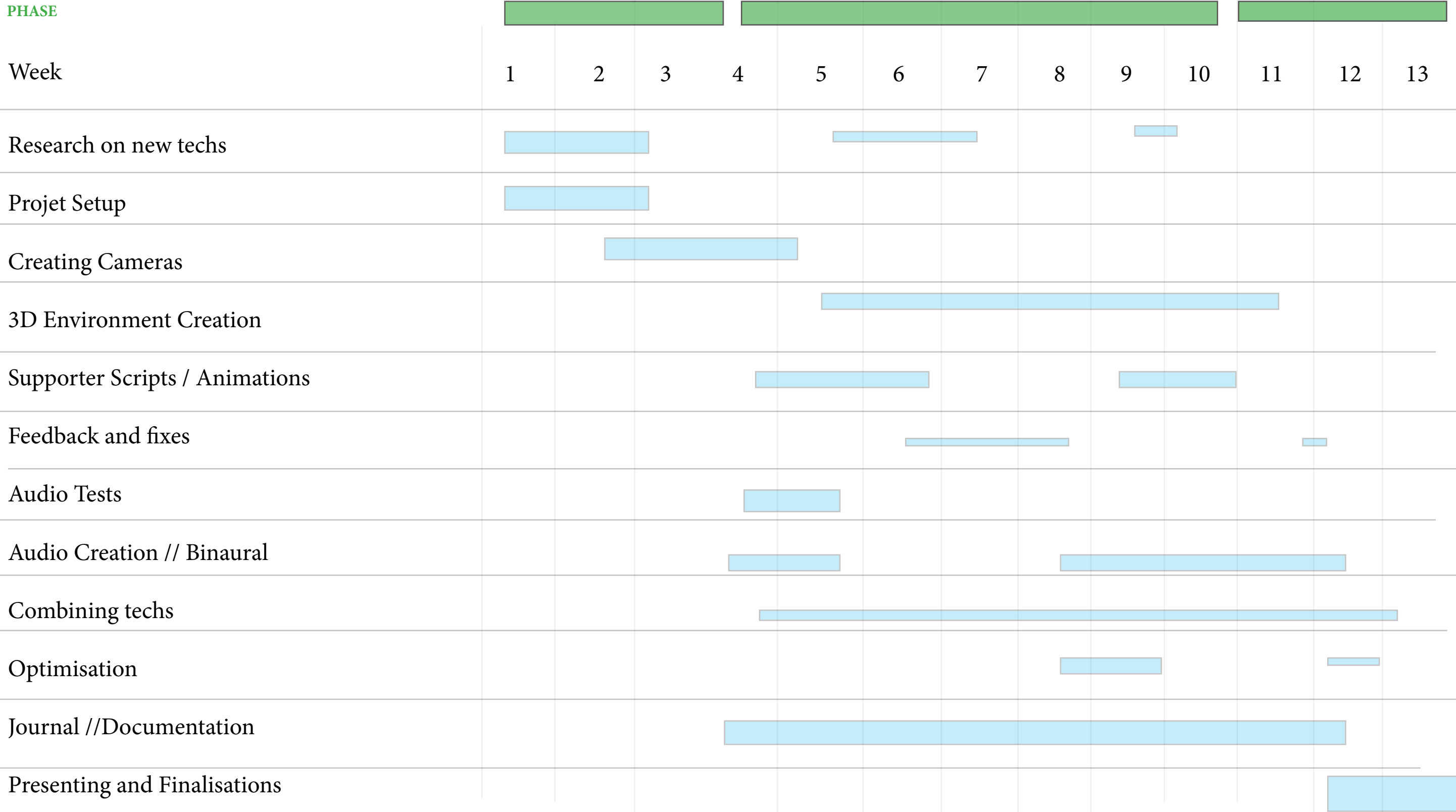


Binaural

For Binaural beat to work perfectly each ear should be provided with different frequencies, with above example of multiple frequencies in a 3D spaces, there is possibilty of leak to the other ear. Some kind of blend between multiple sound layers will need to be formed and re-thought like spatial areas can be set to very minimum and specific audio listeners for left and right channels can be placed with a distance, mimicking a head in real life for lesser leak to the other channel/ear.

Though with a feild of sources of different herdz, it's possible that user will be flowing through range of changing binaural frequencies. Practice-based methods will be employed further here for the purpose of this project that investigates and gains new knowledges from the creative outcomes (Candy, 2006) .

TIMELINE // GANTT CHART



Contingency Planning

Due to complexity and infancy of platforms such as WebVR it's hard to define it as a final platform. Though WebVR is the most optimal platform as discussed earlier, If complexity and heaviness of project even after optimisations is unable to deliver a smooth experience over WebVR platform, the project sees to be shifted towards a platform like of pc application, or an android i.e- platform which can deliver more performance. This will though mean rewriting the scripts and setting up the project from bottom in support. The main fundamentals and concept of the project remains same.

Needs Analysis

Major equipments in project support , ie VR headsets - HTC VIVE / Oculus GO have are available at MAGI studio, where the project is seen to be conducted. Computers of sufficient power are located in the labs with relevant softwares such as Unity3D , Maya, C4D etc. Audio Lab with proper monitor speakers will be used to initiate and test out audio, located at MAGI and HQ monitor headphones (ATHm50) for binaural audio which I own along with Digital Audio Workstations which will be used to create and synthesis audio.

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