

A
D
5
7
6
/
6
7
6
:
E
x
p
e
r
i
e
n
c
e
&
S
y
s
t
e
m
s
.

N
e
a
r
F
u
t
u
r
e
A
l
l
i
a
n
c
e
.

Virtual Reality Basketball Centre



CONTENT

PROPOSITION	3
SITE & RESEARCH	6
- SITE CONTEXTS AND ANALYSIS	
- EXISTING BUILDING ANALYSIS	
PROGRAMME DEVELOPMENT	17
- FITNESS AND EXERCISE EVOLUTION	
- STATISTICS GRAPH OF PARTICIPATION IN FITNESS CATEGORIES	
- CHARACTERISTICS OF THE BASKETBALL GAME	
- EVOLUTION OF VIDEO GAMING PLATFORM	
- STATISTICS GRAPH OF PARTICIPATION IN VIDEO GAMING CATEGORIES	
- THE DIFFERENCE IN VIDEO GAMES	
- VIDEO GAME DEVELOPMENT STAGES	
- VR CHARACTERISTICS	
- POTENTIAL UPGRADE TO VR EXPERIENCE	
- PRECEDENT ANALYSIS	
- PROGRAMME'S CHARACTERISTICS	
DESIGN DEVELOPMENT	43
- EXISTING CONDITIONS	
- PRECEDENT ANALYSIS	
- SCHEDULE OF ACCOMMODATION	
- VISUAL SEQUENCES	
ABSTRACT IDEA	74
- PRECEDENT ANALYSIS	
- ABSTRACT MODEL AND ILLUSTRATIONS	
DESIGN DEVELOPMENT 2	82
- PRECEDENT ANALYSIS	
- SCHEDULE OF ACCOMMODATION	
- MATERIAL ANALYSIS	
- PRECEDENT APPLICATION AND SYSTEMS	

PROPOSITION

From analysing the Royal park and its history, I have found the fitness activities in the park very active. Locals living in the residential houses surrounding the park can be witnessed coming out to walk their dogs as that becomes the mean of their exercise routine. Other activities like table tennis and tennis court have their designated spaces for locals and the public to use. There are benches spread throughout the park for locals and the public to take a break after physical activities.

In terms of monumental structures, my interest peaked at the site of the royal spa as my research led me to focus on the health and fitness aspect of the park. The original Royal German spa was built with healing capabilities by using artificial spring water made through the use of chemicals which was an innovation at the time. Spa, in general, is a facility to heal fatigue and other health-related issues. Due to that, I have focused on it to create a programme that is innovative and non-existent to this day.

As the spa has been demolished, there are no traces from the original spa element of the monument. However, the structure is located right in the entrance of the park. Building these activities in this location will allow the users to have a good view of the park and the structure of the activities can be used to preserve and display the proud legacy of the spa for the future generations. These activities will also make active use of the existing building and allow the public to access it as currently, it is off-limit used by the nursery school next to it.



Summer Activity in the Queen's park, Brighton



Tennis Court located in the Queen's park, Brighton

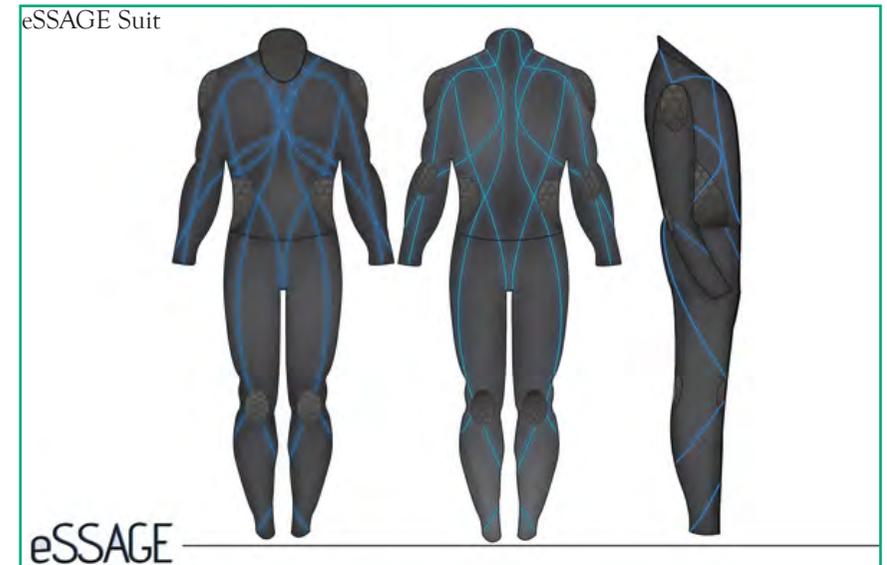
Potential Activities:

Building a virtual reality basketball (Futuristic way of fitness and exercise)

As basketball falls in popularity in the UK, this will be a new way of encouraging the nation to be involved in this sport. People these days are very involved with gaming in their consoles and other forms of gadgets more than the physical activities. Using a VR technology to introduce them to a sport such as a basketball will influence them to try the actual sport and get physically involved. The virtual game is a very recent development that involves people to physically move their body to play a virtual game. If this concept is applied to sports or a bigger scale activity, this idea can be developed into an innovation. Also, the space required for a VR activity is far smaller than the physical aspect of the basketball facility for example. Therefore, using a VR technology to promote basketball can be established in almost anywhere and within the area where the royal german spa is situated, it is enabled to design a proper facility that follows the principle of a sports hall.

Virtual Massage (Futuristic way of healing)

As the gears for VR technologies have developed to the point where it allows users to get sensory experiences. There is an existing conceptual design of eSSAGE massage suit by Andre Cofield and existing Teslasuit by TE-SLASUIT team, a team dedicated to creating innovative products for VR and the gaming industry. eSSAGE bodysuit is a wireless massage suite which allows the wearer to pick a person of their choice who can deliver a series of sensory experiences such as strokes and touches through a dedicated app. Teslasuit has received CES innovation awards, 2019 Honoree. It is similar to eSSAGE suit but designed for VR usage. It allows the wearer to get sensory experience in the virtual world such as touches temperature. It also allows the wearer to record data such as stress level, emotional state and key health indicators. Mixing the features of these two suits can allow the users of VR sports to have a real sense of experience in the VR session and also provide massage therapy afterwards to heal their sore muscles.



SITE & RESEARCH

SITE CONTEXTS AND ANALYSIS



PEPPER POT



Pepper Pot of Today

Observation Tower (Original Structure)

Toilets (Built in 1960s)

History of Pepper Pot:

- Built in 1830
- Housing pump and water tank for the Villa Attree Villa
- Garden Observation tower for the grounds of Attree Villa
 - an observation tower in the second world war
 - A scout headquarter
 - An artist's studio
 - Public Lavatory

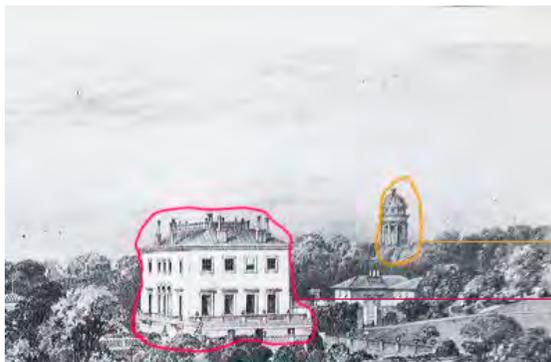


Pepper Pot bird's eye view

Tree Obstructions

Building Obstructions

As my proposition states interests in the physical activity sides of the programmes within the park, the history of Pepper Pot had many different uses. The use for army purposes during the world war links to the physical activity aspect of my programme planning, however, the location itself is not ideal for showcasing an innovative programme that I plan to build. Out of all the sites with best views, it is the furthest seating on a high ground level with lots of viewing obstructions. As of today, the building is listed at grade 2 restriction to preserve it and not in use.



Pepper Pot in 18th century

Pepper pot (Existing)

Villa Attree (Removed)

Original North Gate (Removed)



Pepper Pot in 19th century

EGREMONT GATE



Toilet (Not in use since 2009)

Egremont Gate



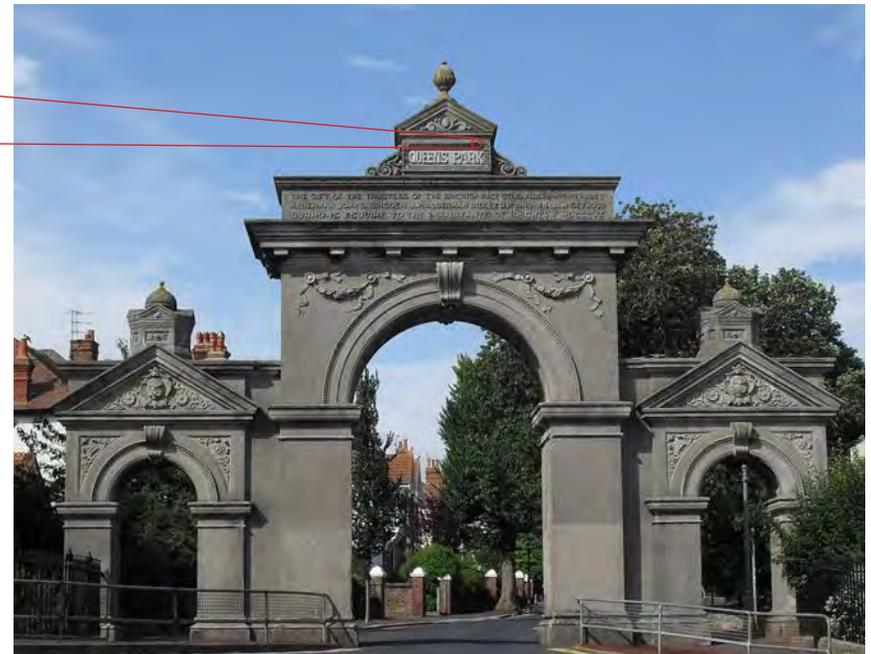
Egremont Gate (North View)



Stone Rat (Neil England's signature)

Residential Homes

Tree Obstructions

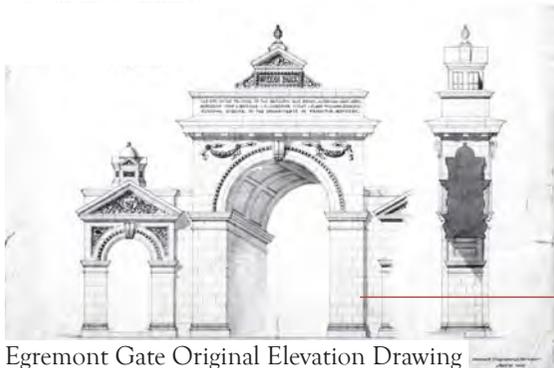


Egremont Gate (Current)

History of the Archway:

- Built at the same time as Attree's Villa around 1830
- Rebuilt in 1890 along with the second one at the Park Street when the Park was opened to the public
- Used as one of the main entrances to the Park
- The Egremont Gate archway was restored in 1997 by a plasterer Neil England

Through my research, the Egremont Gate doesn't have any link to the physical activities side of my proposition. While the disused toilet that is soon to be a cafe and bakery can be used as a refreshment station to compliment my programme, the location itself has some issues. It stands at a very high topography level and it has lots of tree obstruction to oversee the park. Situated in a west drive, it is at the corner edge of the park, therefore the centre view of the park cannot be seen.



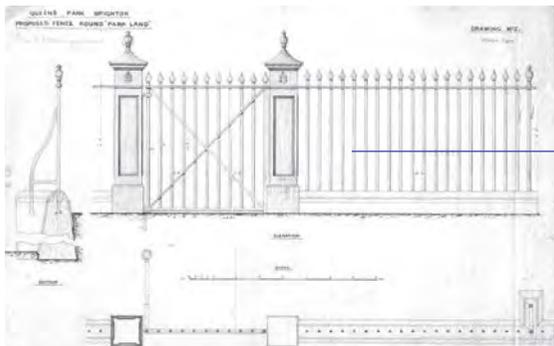
Egremont Gate Original Elevation Drawing

Existing Wall Connected to

The Original Brick textures are covered with stucco finish



Existing Wall Connected to the Egremont Gate



Original Fencing Surrounding the Queen's Park

The Original Fencing used to define the boundaries of the park had metal balustrades units removed and only the concrete base remains



Remains of the Original Fencing



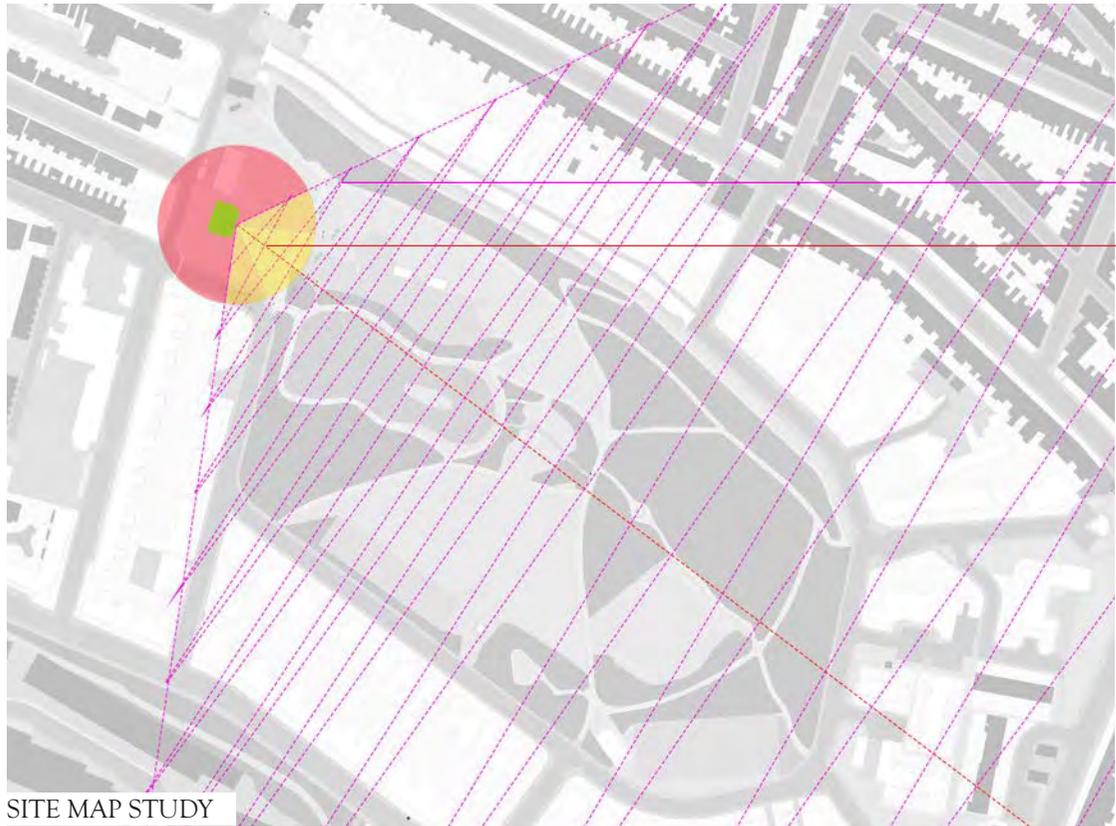
Concept Drawing of the disused toilet

The toilet is planned to be converted into a bakery and cafe under the name 'Real Patisserie, Kemp Town'



Disused Toilet Structure

ROYAL GERMAN SPA (CHOSEN SITE)



Binocular Vision Coverage

Centre Line

Vegetation Obstruction



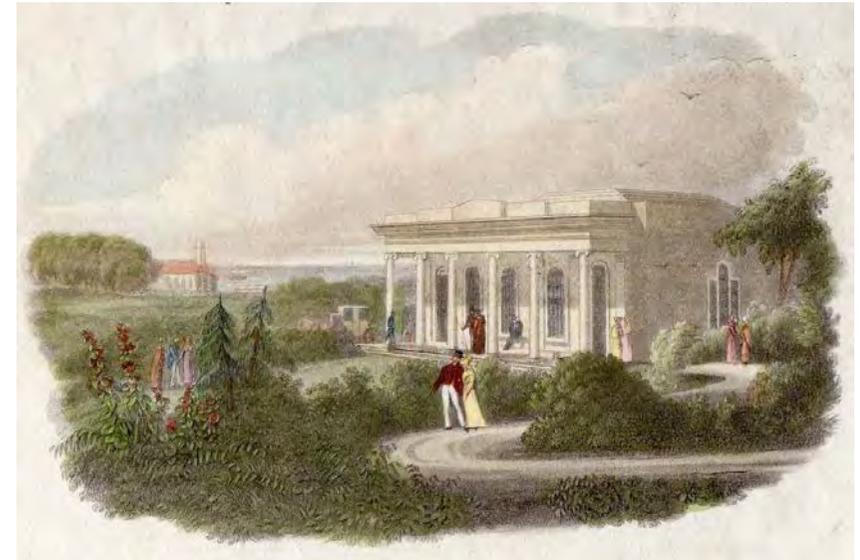
VIEW TO POND

The Royal German Spa has a very interesting history. It was the first spa to use chemically made spring water for bathing purposes which links to an innovative side of my programme. As the spa's purpose, in general, is to provide relaxation to the body, it complements the physical activity side of my focus. The location itself is in the very centre line of the Queen's park. The terrain it seats at is at a very ideal level where there are least obstructions to oversee the whole of the park. The space within the structure has enough space to house reception as it was originally with space for a lounge area. Furthermore, the space available until the existing fencing boundaries can be used for further extensions for entrance pavements pathways, placement of VR and massage booths. The Royal German Spa is used by a nursery next to it as of today and the building is listed at grade 2 restriction similar to the Pepper Pot.

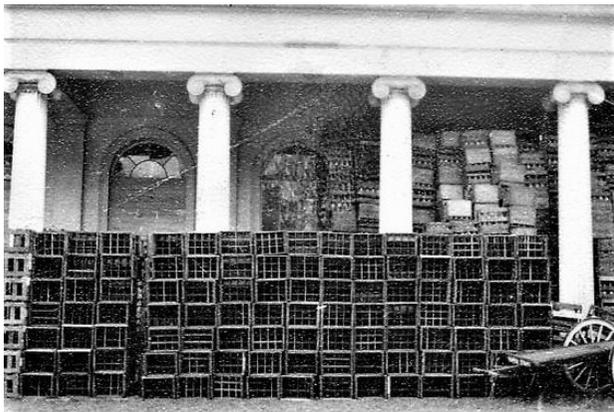
BRIEF HISTORY

History of the Royal German Spa:

- Built by the architect Lorraine for Dr Struve and opened in 1825.
- “Dr F.A. Struve had opened similar spas at Berlin, Dresden and Leipzig.”
- From a visit by King William IV- formerly known German spa became ‘Royal’ German spa after obtaining the royal warrant in 1835.
- Dr FA Struve was a chemist and inventor who strived to open health spas around Europe after his journey to cure his Cyanide poisoning. He studied the Europeans spa waters and their unique healing properties. He then carbonated these properties in his factory and set on a journey around Europe curing the sick and ailing folk while making fortune.
- The Royal German Spa provided mineral water identical to many natural healing spas around Europe through the mixture of chemical he invented himself.
- The 1830s- the height of popularity and 1850s- the decline of popularity which led to the closing of the pump room.
- The production of bottled mineral water continued until 1965.
- Pump room demolished the mid-70s but the spa’s neo-classical facade remains credited to the long public campaign to save it.
- Neoclassical facade remained due to public campaigning
- Nursery opened 1977
- 1985- destroyed by a fire “in an arson attack” and soon rebuilt the same year.



German Spa and Pump Room, Brighton (1827)
<http://sbpc.regencysociety.org/category/building-type/spa/>



Ceased bottling the waters (1965)



Mineral water bottle dating back to 1800s



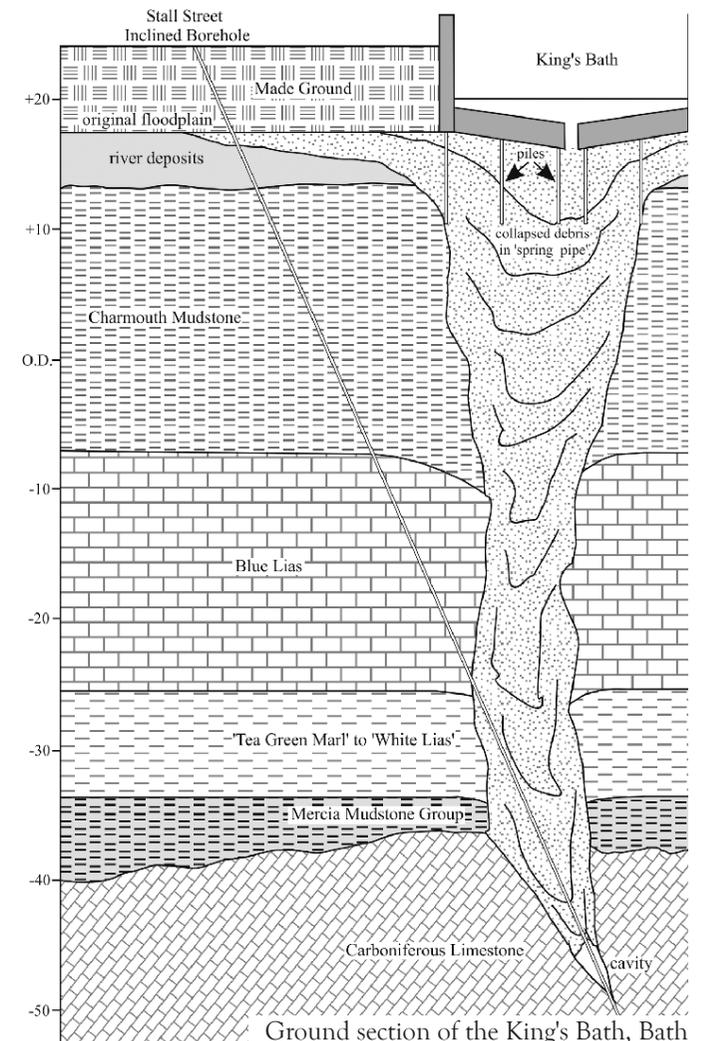
Pump room demolished but neo-classical facade remains (1974)

Natural Mineral Spa bathing is the oldest form of health care found in various places around the world. In the UK, there is one destination of such example known as Thermae Bath Spa located in Bath. It was first discovered by Prince Bladud who discovered the natural thermal springs in 863BC located in Bath, which now is a popular spa resort currently known as Thermae Bath Spa. The waters in the springs are said to cure skin disease of Prince Bladud when he took a bath in them. The source of the waters is believed to be “Mendip hills 30 miles to the south of Bath but recent findings suggest that the rainwater enters through the carboniferous limestone closer to the City and the Avon Valley”. The thermal waters contain over 42 different minerals, the most concentrated being sulphate, calcium & chloride.

Minerals found in Hetling Spring:

- Sulphate Mg/l 1015
- Calcium Mg/l 358
- Chloride Mg/l 340
- Sodium Mg/l 195
- Bicarbonate Mg/l 193
- Magnesium Mg/l 57
- Silica Mg/l 21
- Iron Mg/l 0.5

The natural process of Mineral Spas in the UK is formed through the rain which fell 10,000 or more years ago, which sank to a depth of 2 km. The water is then heated by underground rocks at “high temperature before rising back up through one of the three springs in the centre of the city, the Cross Spings, Hetling or King’s Spring, which supplies the Roman Baths”.



EXISTING BUILDING ANALYSIS



Arson Attack (1985)

Carved Stone Decoration

Inscription

Six fluted Ionic Columns

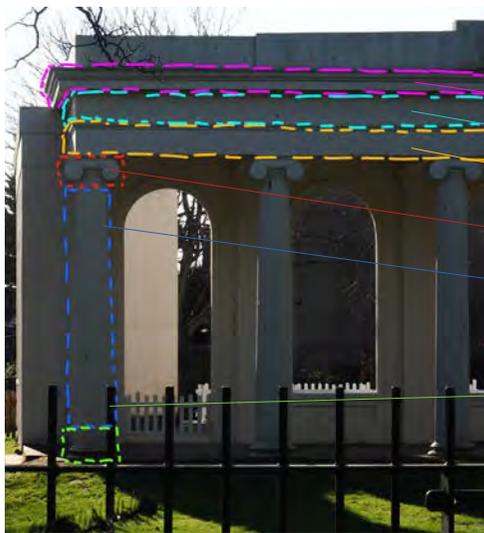
Arced Openings

Non-Existent

Existent



German Spa (In active times)



GERMAN SPA CLOSE UP

Cornice

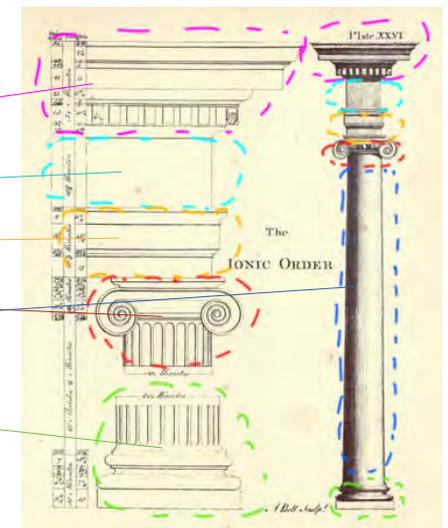
Frieze

Architrave

Capital

Greek Style Fluted Shaft

Base



Ionic Order



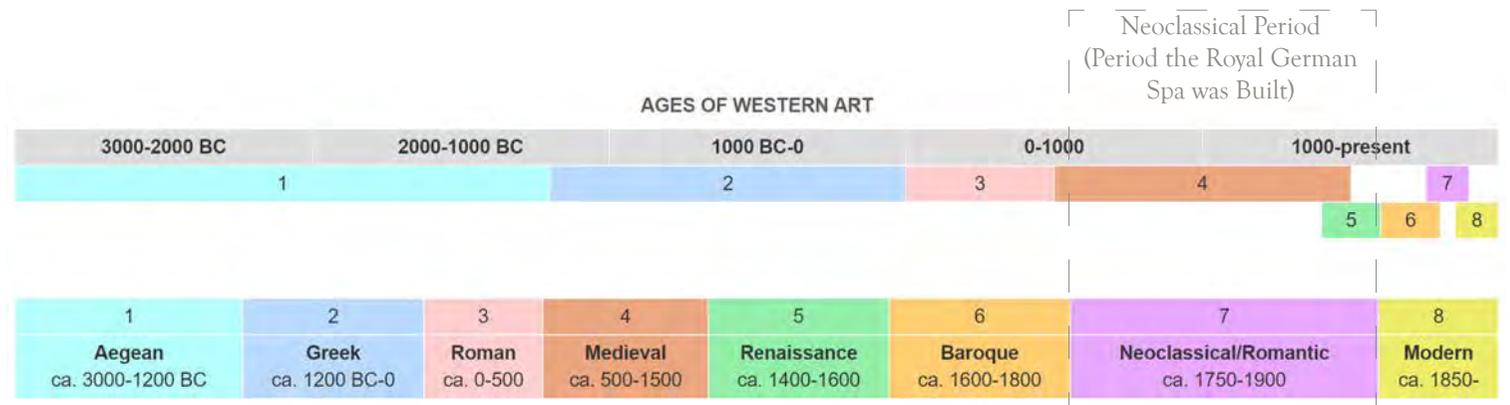
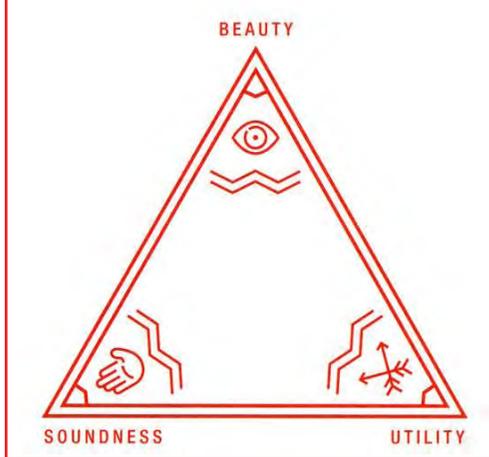
GERMAN SPA (CURRENT)

Balustrade

Neoclassical Facade

The spa is a Palladian Style Neoclassical architecture. The key feature of such style is the balustrade along the edge of the roof. In the classical period, such a feature was a common method of crowning a low-lying roof which is a railing with vertical supports.

Neoclassical facade follow's the Roman architect Vitruvius's three major principles.





Stonemasonry Blocks

Venetian Style Windows

Reception

German Spa (1820s)

The early art illustration of the German Spa shows that the walls are made of **Stonemasonry blocks**. It also shows the windows to have a very similar style of a **Venetian style** of windows on the sides. One such window opening still exists to this day. Furthermore, this drawing gives us a context of the spa such as how people accessed the inside and the positioning of **reception** that manages the patrons.

The stone used for the columns and the walls has a similar texture in the illustration. Considering 1800s, the stones used can be narrowed down to Limestone and Sandstone relying on the light texture. However, since the spa is a bathhouse, Sandstone had better properties to withstand water and chemicals to Limestone. Sandstone is essentially formed of sand granules with a feldspar content and high quartz. Sandstone may carry remnants of other rock. *“The high quartz content gives sandstone”* an advantage of structural strength and definite sparkle in the sunlight. While limestones are effective under heavy pressure due to its density, *“sandstone is harder and provides better resistance against heat and impact”*. *“Silica-based sandstone is also more resistant to the effects of dilute acid”*. Some varieties contain *“high levels of calcite, sandstone is generally better suited”* to water-based structures. **Today the wall materials aren't visible and seem to be covered by stucco finishing which is then confirmed by a source: <https://historicengland.org.uk/listing/the-list/list-entry/1380699>. It is said that it happened during 1978 when the restoration following Greek Revival style and building a nursery next to it.**



Sandstone



Limestone

PROGRAMME DEVELOPMENT

"At a time when we are paradoxically isolated from one another but united in a common cause, public spaces that we all share and that benefit health have become more important than ever," by Jason Long, OMA partner

The focus of my programme is to revolutionise the public fitness facility. Following the innovational history of the spa, the introduction of new methods and programme will be introduced to the public in Queen's park. This programme will make use of artificial intelligence to benefit the existing sport of basketball and programmed to reproduce the realistic sensory experience while playing.

FITNESS AND EXERCISE EVOLUTION



Neolithic Times: Crop Culture (8,000 BC to 10,000 BC)



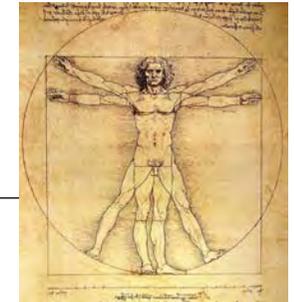
Primal Times: Hunting (10,000 BC)



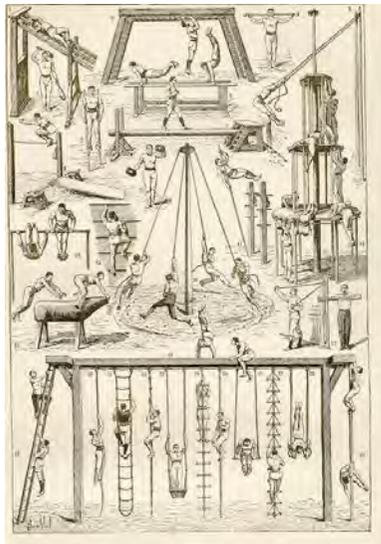
Ancient Times: War between Greeks and Romans (Between 4,000 BC to 476 AD)



The Dark Ages: Barbarian invasions, and devastating plagues (5th to the 15th Century)



The Renaissance: Interest in the body, anatomy, biology, health, and physical education (1400 to 1600)



The Old Times: Introduction of physical exercises and games (1774 to 1900s)



The Rise of the modern Fitness Industry (20th century)



The idea of VR fitness gaming began with the introduction of VR technology in the gaming industry. The very first VR fitness was introduced to the public through a game Box VR. The game also tracks the health data of the users such as minutes of playing and calories. (2017)

Demo:
<https://www.youtube.com/watch?v=VLalyGdONTg>



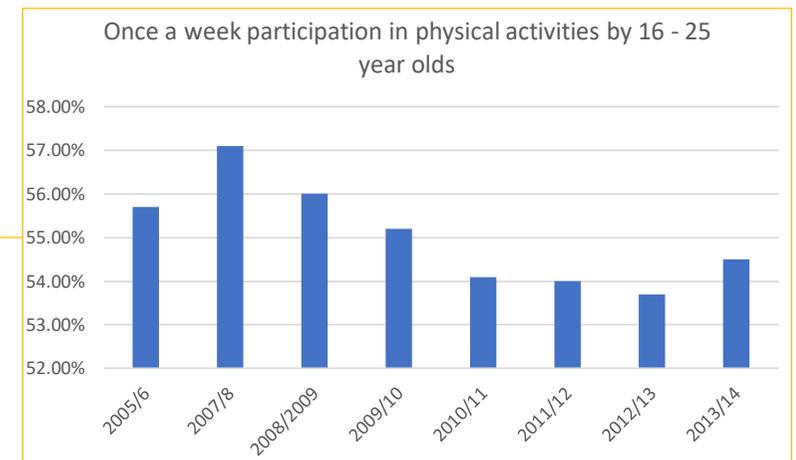
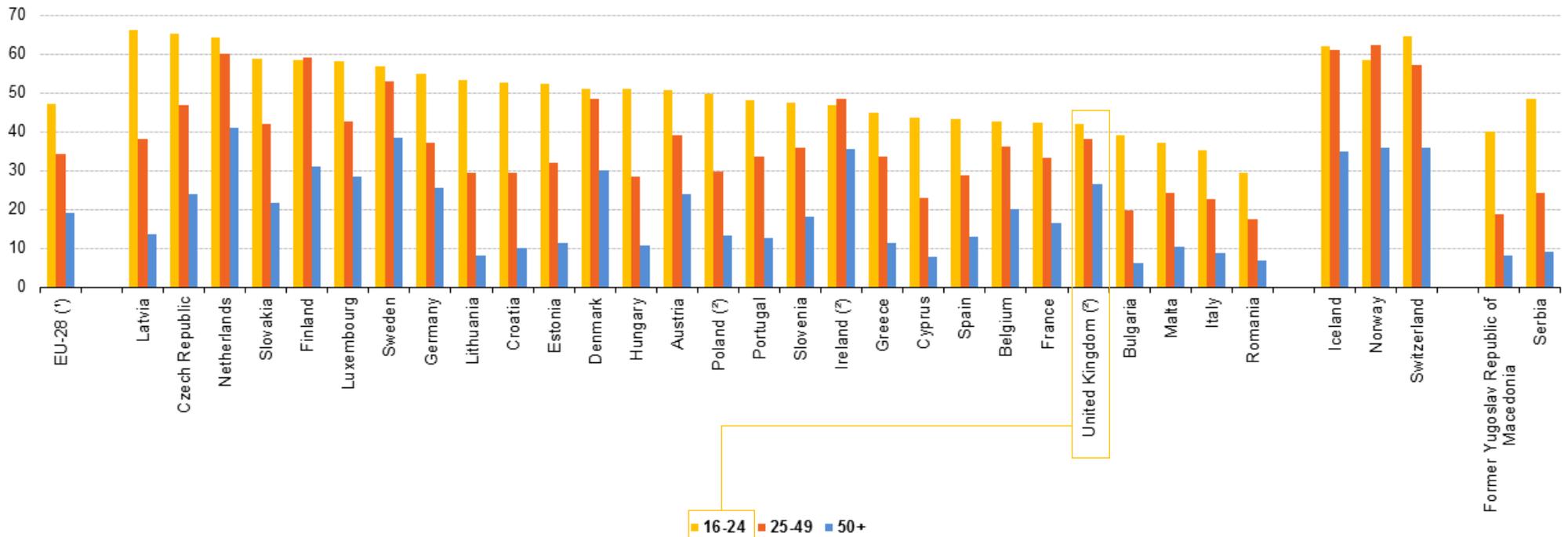
Introduction of fitness gaming. It began with Nintendo Wii introducing the first-ever game designed for physical interaction and fitness. (2007)

Demo:
<https://www.youtube.com/watch?v=XerF3tpkCmE>

STATISTICS GRAPH OF PARTICIPATION IN FITNESS CATEGORIES

Physical activity participation in Europe by age groups:

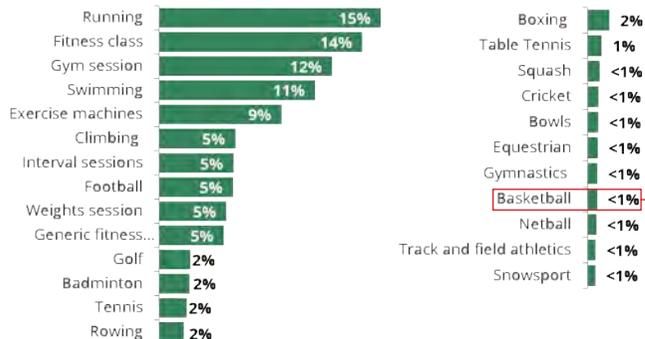
(% of population aged 16 and over)



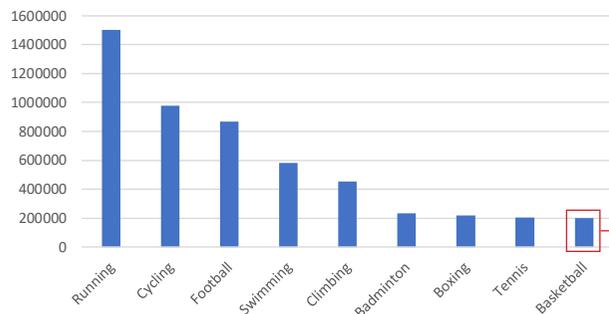
Analysing the graphs, the age group of 16 to 24/25 are mostly active to take part in physical activities. Further researching on the involvement of this age group, their once a week involvement has been very consistent around 53% - 57% from 2005 - 2014. This analysis makes the age group of 16 - 25 the ideal targets for my programme focusing on the physical activity side of the park. However, the age group of 25 - 49 is short by a few percentages, therefore they will be considered my secondary targets.

PARTICIPATION IN TOP 25 SPORT ACTIVITIES (ENGLAND MAY 2017)

Adults (aged 16+) participating at least twice in the last 28 days

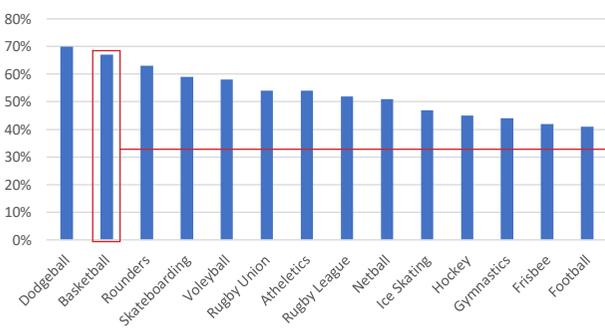


16 - 24 Sports Participation in The UK (2019)



Within two years, basketball has growing participants

16 - 24 Sports Participation Share in The UK (2019)



The share graph shows that basketball is the most efficient sport with tendency for 16 - 24 to participate

From the list of popular physical activities for 16 to 24, the figures for basketball has a noticeable growth. Within two years of surveying, the analysis shows that the involvement by the 16 to 24 has reached 200,000 participants in 2019. The tendency graph shows that it falls a few percentages below dodgeball. This sport has the potential to grow and inspire youths of the UK to play in a professional basketball league like Fiba and Nba. Currently, the biggest basketball league Nba has only one player from the UK, Ogugua Anunoby.

CHARACTERISTICS OF THE BASKETBALL GAME

“Discover your gift, develop your gift, and then give it away every day.” by Don Meyer, Former Headcoach of Hamline University and Lipsomb University

As participation in the game of basketball is constantly rising to popularise the sport in the UK. The aim of my programme is to provide a facility for the public in the UK to practice the game and develop it further. By doing this, the nation of Great Britain will develop further to provide world-class players to play in the professional league and inspire the younger generation to follow such lead.

Basketball is very popular in the U.S. and around the world. "There are more than 200" nations that play and partake in Olympics to win a team title. Achieving a win in Olympic is one of the highest honours that a country can hope for. The popularity of Olympic basketball stage has helped make it the second-most popular team sport in the world, falling behind football.

Basketball has a very flexible rule that allows anywhere from two up to ten players to participate in a game at a time. The game consists of 1 on 1, 2 on 2 up to 5 on 5 full-court games with the exact balance of the number of players on each team. The game consists of three kinds of scoring and many forms of defence. The first and simple form of scoring is known as lay-up, the second is shooting which varies depending on your placement of shooting. When shot behind the arc line, you can score three points for your team, however, any shots inside the big arc on the court will count as two. The final form of scoring is dunking, which is hardest depending on the height of a player. The basketball rim is 10 feet tall and due to that, not many players of average height can perform dunks unless they train their vertical jump. The defence in basketball varies from one on one to team zone defences. The most notable form of defence would be a block, which makes the crowd rally with applause.

Despite being a simple sport, on a professional level, there are many tactical plays carried to break down a team defence or their offence. Depending on the team, they scout for players to match their team's plays and all the plays are planned by a team's head coach and performed by the players. Although plays are important, some teams allow players to play isolation play, which involves the most effective player to break down the player guarding him score a point on a one on one battle. This sort of one on one play, known as isolation in basketball term is very entertaining as an individual player showcase their talent to score the opposing team. Some famous players to carry out this play at a high level are Kobe Bryant, Michael Jordan and Carmelo Anthony.



Dunk



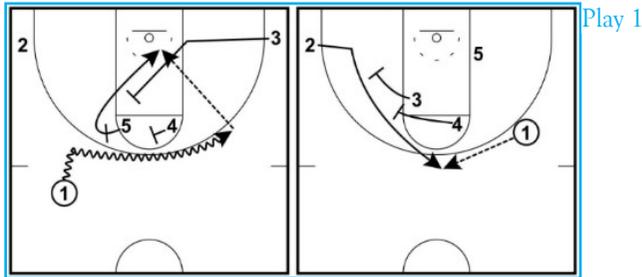
Lay-up



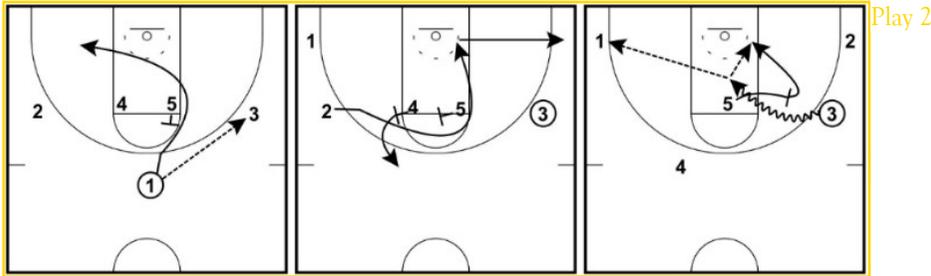
Block



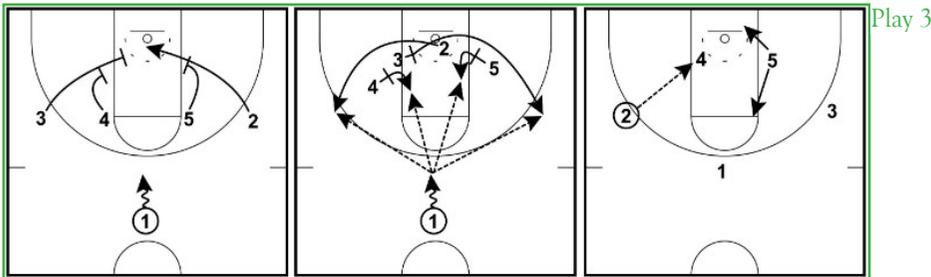
Shoot



Play 1



Play 2



Play 3



Play 4

Position: PG (Point Guard)

- ① Their main role is to run the offence through handling the ball and passing. They are also required to guard their match up, most likely the point guard from the opposition team. This role is assigned to the best ball handler and passer of the team, usually the shortest member of the team.

Position: SG (Shooting Guard)

- ② Their role is to shoot the ball consistently. Their secondary role includes defending their matchup and facilitating the ball. This role is assigned to the best shooter of the team who can shoot and score the ball consistently from variable distances from the basket.

Position: SF (Small Forward)

- ③ Their role is to play a switch between small and large players when the offence is run. They are expected to roam all over on the court helping the team score from long-distance shooting to close layups and dunks.

Position: PF (Power Forward)

- ④ Their role is to defend and score against tall players under the basket. Their role also involves rebounding the basketball and take longer shots than a centre position.

Position: C (Centre)

- ⑤ Their role is to defend the basket through blocking the opponent's close shots, rebounding and in the offensive end, they play close to the basket and score. This role is assigned to the tallest player of the team.

Watching these patterns of play runs, It creates a very intriguing form of movement in the space. Configuring and applying these form of movements can build interesting pathways in my design. These pathways can be applied to the pavements to the entrance, positioning of facilities like toilets and changing room that creates such forms of pathways.

Setup: "Play starts in a 3-out 2-in formation with the posts on the elbows and the wing players in the corners."

1. "1 starts the drill by dribbling their defender down one side of the floor to create good screening angle."
2. "3 walks their defender down to the low block."
3. "4 and 5 set a staggered screen for 1 as they dribble around the top of the key."
4. "As 1 is dribbling off the screens, 3 sprints up and sets a strong back screen on 5's defender".
5. "5 immediately rolls to the basket looking for the pass for the quick layup. If that's not open, they establish deep post position."
6. "If 1 can't get the basketball into the post, 3 and 4 set a staggered screen for 2 who cuts to the top of the key ready for the open shot."

Setup: "The play starts in a 1-4 high formation."

1. "1 passes to 3 on the wing."
2. "1 then performs a UCLA cut off 5's screen looking to receive the pass for the open layup. If it's not open, 1 clears out to the weak side corner."
3. "4 and 5 then set a staggered screen for 2 who curls towards the ring looking to receive the pass for the open layup also. If they don't receive the pass they clear out to ball side corner."
4. "4 pops out to the top after screening to create space."
5. "5 then sets a pick and roll for 3 who attacks the rim hard looking to score or create a play for a teammate."

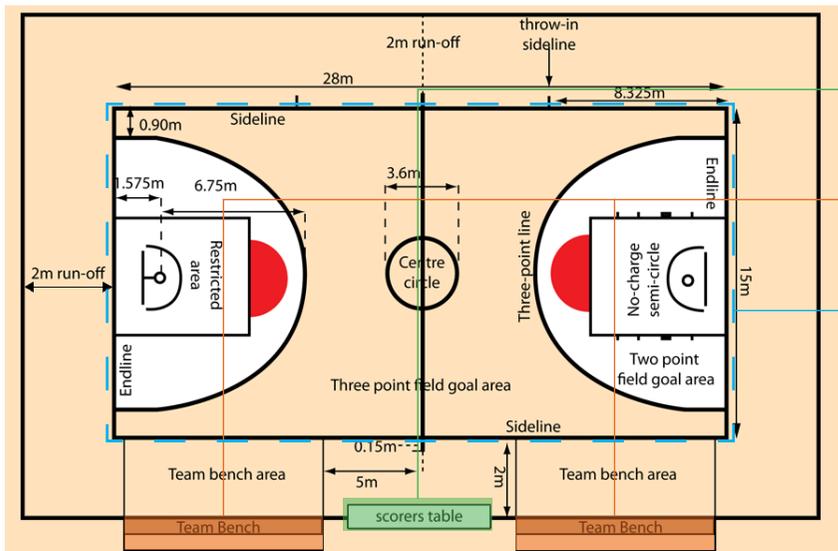
Sourced from- <https://www.basketballforcoaches.com/basketball-plays/>

Setup: "The play starts in a 1-4 high set."

1. "1 dribbles down the floor and calls out the name of the play."
2. "2 and 3 cut along the baseline with 2 stopping close to under the rim."
3. "4 and 5 turn and trail once 2 and 3 have cut past them."
4. "3 sets a screen just inside the paint as 4 and 5 set screens a foot outside the low blocks on their respective sides."
5. "2 now has the option of using the staggered screen or the single screen. For this example, 2 uses the staggered screen and cuts to the perimeter."
6. "Once 2's defender has passed through the screen, 3 will cut off the screen the opposite side to 2. For this example, 3 cuts off the single screen by 5."
(*"If 2 were to use 5's single screen, 3 would turn and cut to the perimeter off 4's screen."*)
7. "After screening, 4 and 5 immediately duck in and look to receive the quick pass for the layup. Often 4 or 5's defender will be forced to help on the player cutting to the perimeter which leaves 4 and 5 on smaller defenders."
8. "The point guard has now had 4 great passing options which lead to quick open shots."
9. "If 2 or 3 catch on the perimeter, the closest post player immediately attempts to get a low seal while the other post player clears to the high post to give them space."

Setup: "The play begins in a horns set with your wing players level with the lower blocks."

1. "The play starts with 1 passing to either of the two post players on the elbow. Preferably the side with the best shooter on the wing."
2. "1 then cuts down the center of the lane and sets a flex screen for 2."
3. "2 can cut either high or low off the flex screen and looks for the pass from 4 and the easy layup."
4. "5 sets a down screen for 1 for a screen the screener action. 1 cuts to the top of the elbow or slot looking for the catch and shoot."
5. "After screening for 1, 5 immediately sets another screen for 2 who cuts out to the wing."
6. "If 1 wasn't open for the shot, they must swing the basketball to 2 who should be open on the wing for the shot."
7. "After screening 2's player, 5 attempts to get a deep seal in the paint. If 2 wasn't open, they can pass in for the score."



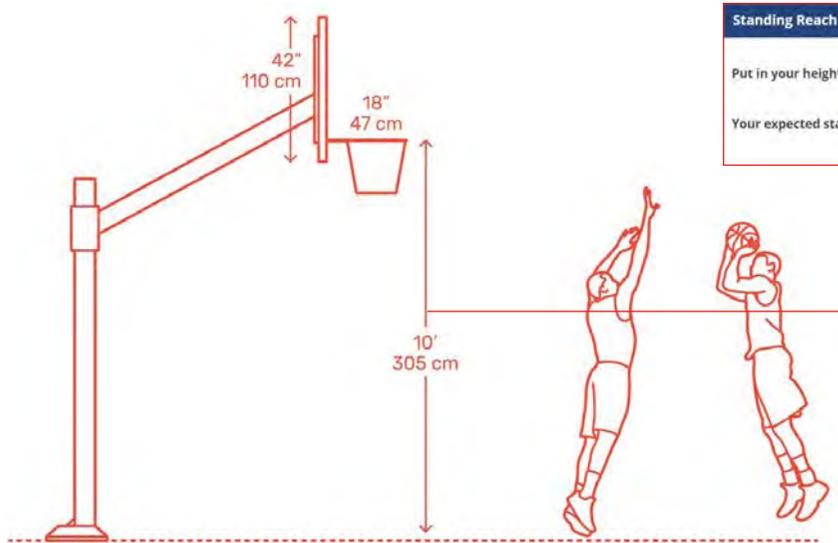
Basketball Court Layout

This element won't be needed as it will be displayed virtually

This element won't be needed as the users will be playing session individually or in a team of five

The full-size court is possible to fit within the area available around the boundaries of the Spa

Gender	Excellent	Above average	Average	Below average	Poor
Male	>65cm	50 - 65cm	40 - 49cm	30 - 39cm	<30cm
Female	>58cm	47 - 58cm	36 - 46cm	26 - 35cm	<26cm



Basketball Post Dimensions

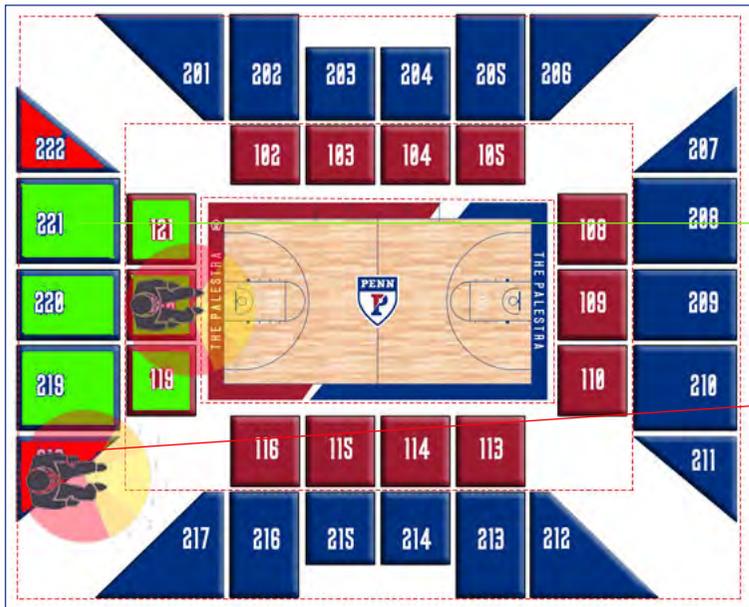
Standing Reach Calculator:

Put in your height: 5 ft 9 in

Your expected standing reach is: 7 feet 8.1 inches

238 cm

The average height of the UK is 175 cm. Therefore the basket height is too high and needs to bring down to the reachable height of 274 - 284 cm.



The simple geometry of linear seatings have very clean aesthetic and space are divided equally. Middle seats have a good perpendicular view.

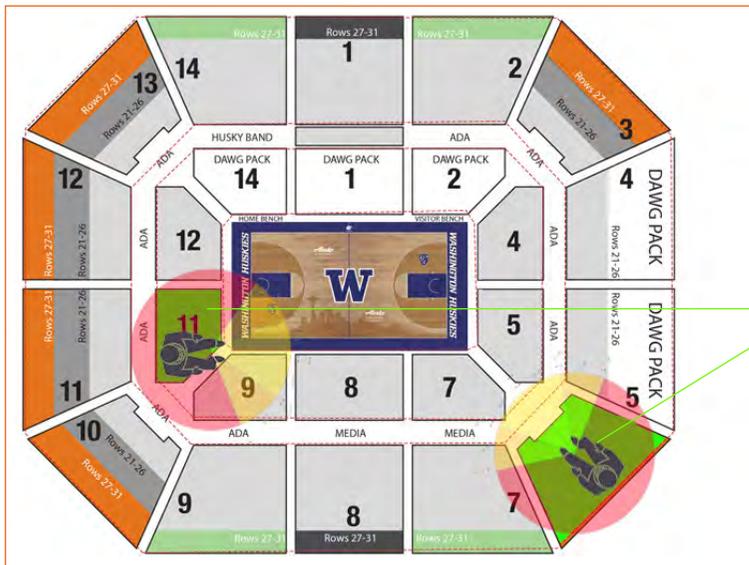
Sharp edges at each side's corner have a further distance of view and straight viewing positioning will create strain to the neck while viewing.

Box Layout



Oval Layout

Seatings are positioned at a gently inclined angle that faces the court simultaneously throughout the space. The mild angling of seating creates almost an arc shape that follows the path of court.



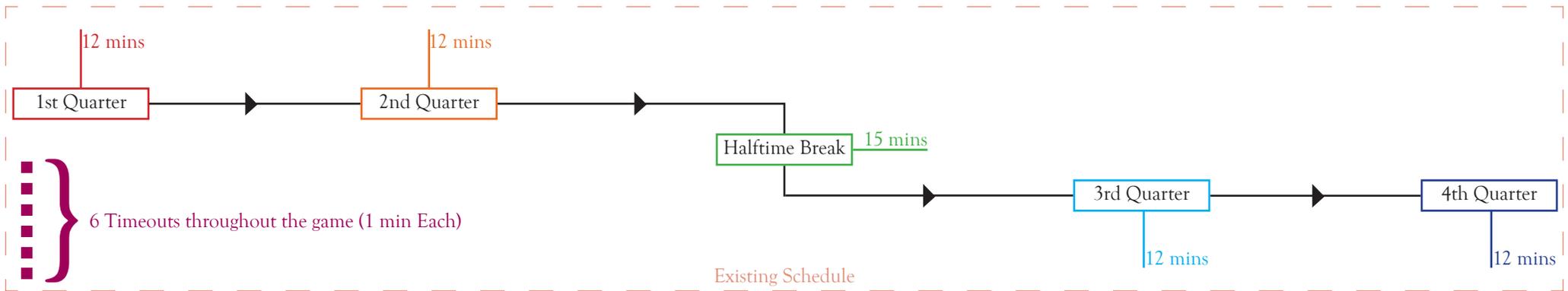
Front seats are linear and second-row seatings inclined for good viewing angles. The use of two formations of square and diamond gives the space a unique adaptation to the court.

Diamond Layout

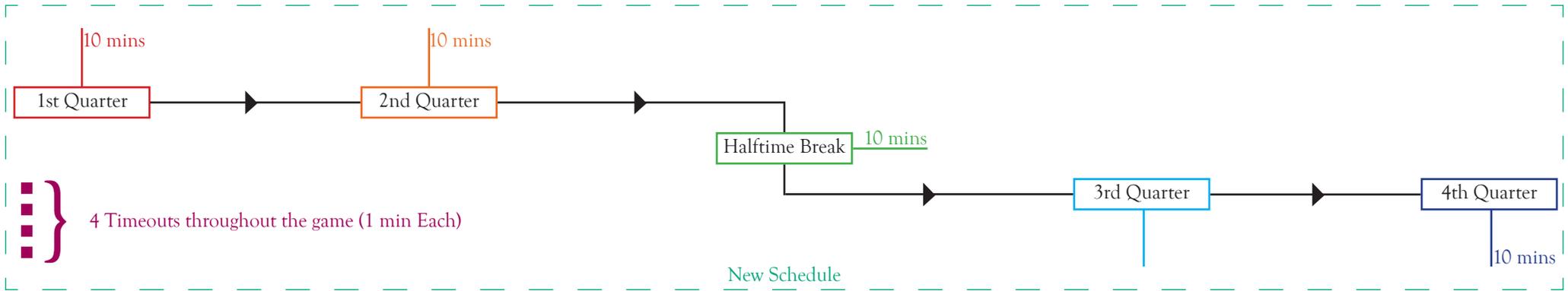
These three seating layouts are the most common in the Basketball Court.

The box layout is very common in college-level basketball facilities and outdoor courts. The diamond layout is also common in a college-level basketball court but there is some bigger scale of basketball courts on a professional level that follows such layout. The oval shape layout is mostly used in a grander scale of basketball facility. In the NBA, almost all the teams have their home court designed with such seating layout.

Analysing the patterns of the seatings, the oval has a resemblance to the fencing boundary of the Royal German Spa. Using this layout will have a few advantages such as consistent distance between the audience and the court, and a better viewing angle overall.



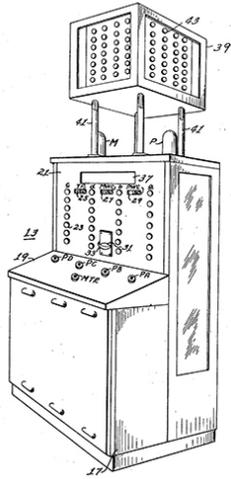
Existing Schedule
 1 hour and 9 minutes of game time including all the timeouts called for teams to discuss their game plans and substituting players to rest the fatigued ones



New Schedule
 54 minutes of game time including the 4 timeouts of 1 minute each. There will be no substitution for players as users are required to play through the whole game.

Analysing the physical basketball game time, it is very long and exhausting to apply it to the VR basketball. Therefore a new schedule is required for players to avoid overexerting themselves. Considering the time it takes for users to change into the VR gears and getting into the booth, each session can last from anywhere from 1 hour to 1 hour 15 minutes.

EVOLUTION OF VIDEO GAMING PLATFORM



A computer designed for playing a game of NIM where a player tries and avoids picking the last matchstick. (1940)



Odyssey, the very first video game console produced through a prototype of 'Brown Box', that enabled users to play games like tennis, ping pong and more. It was the introduction of home gaming. (1968)



Atari Video Computer System is the first console that allowed users to switch games with various available game cartridges. It is also the first system that introduced the joystick controller and colours in games. (1977)



Microvision is the second handheld console, but the first-ever to introduce attached screen. The concept of cartridges was different as it came in the form of different faceplates. This gave the console a variety of outer appearance. (1979)



A computer programmed for playing multiple games such as chess, blackjack and checkers. (1950 - 57)



The very first arcade machine designed for playing a table tennis game. (1972)



Intellivision is the console that first introduced a handheld gaming console. It had advanced controls and better graphics than Atari 2600. (1979)



In (1981), the realism in the computer gaming was introduced in the computer. The very first game to introduce such feature 3d Monster Maze. It used a graphical projection and basic 3d gaming environment to imitate 3d.



The notion of real 3d gaming began with Playstation 1. It was the turning point in the gaming industry which led to games of today. (1995)



Wii is the very first console that used the physical motion sensing control system. The system had an infrared sensors to be tracked by the signal wave bar. (2006)



The Game Gear by Sega introduced colour in the handheld console for the first time. (1991)



The first handheld console to utilise 3d gaming experience was Playstation Portable (PSP). (Late 2004)



Playstation VR was the first gaming movement of immersing virtual world through the use of VR headset. This is believed to be the new notion in gaming and currently, lots of companies are working to develop games for it. (2016)

STATISTICS GRAPH OF PARTICIPATION IN VIDEO GAMING CATEGORIES

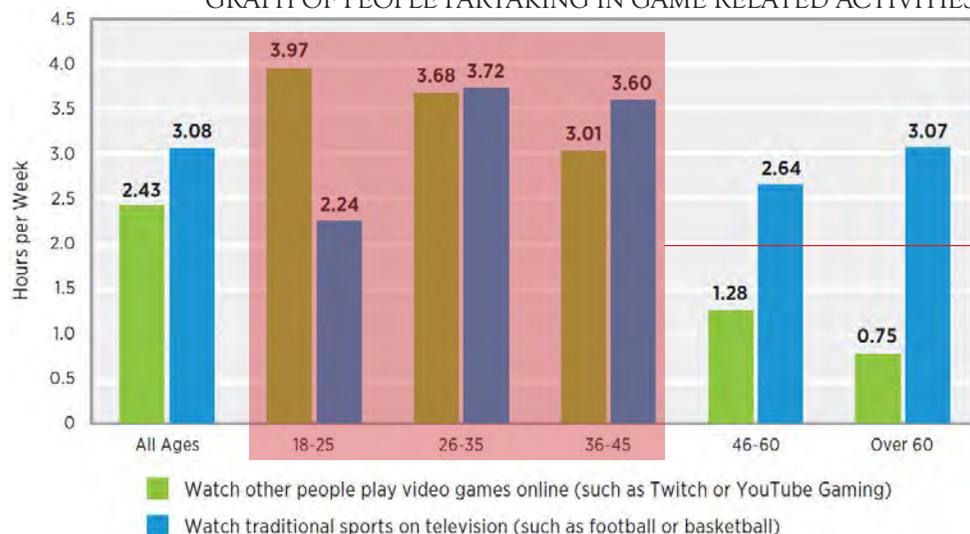
Total time spent on playing video games (Scale of 0-4)					
	Gaming Console	Computer	Tablet	Mobile phone	Average
18-25	1.58	1.88	0.93	2.35	1.685
26-35	1.86	1.68	1.16	2.16	1.715
36-45	1.54	1.71	1.11	2.13	1.6225
46-60	1.03	1.84	1	1.59	1.365

A video game is a form of entertainment that is very popular in modern days. Modern technology of today offers the experience of gaming in many forms. The traditional beginning of such entertainment started from computer gaming which was a success and gained big popularity around the world. As such form of entertainment evolved, it started coming in different forms such as console gaming, mobile gaming and tablet gaming.

From analysing such form of gaming, mobile gaming has far exceeded the other forms of gaming as of today. This might be because it is very easily accessible as everyone in today's society have a mobile phone. Due to that, mobile gaming is very convenient and accessible to people of all ages.

Hours spent each week playing video games								
Age	Less than 1 hour	1-2 hours	2-4 hours	4-7 hours	7-12 hours	12-20 hours	More than 20 hours	Average
18-25	15.70%	14.70%	21.20%	15.50%	14.20%	8.10%	10.60%	14.29%
26-35	16.90%	15.60%	19.70%	18.40%	12.90%	8.70%	7.90%	14.30%
36-45	18.80%	18.80%	16.60%	17.20%	12.90%	8.70%	6.90%	14.27%
46-60	24.90%	20.60%	16.00%	16.90%	10.10%	6.60%	5.00%	14.30%

GRAPH OF PEOPLE PARTAKING IN GAME RELATED ACTIVITIES



From analysis, gaming has a big range of following from 18 - 45. The scale graph shows that the group division of these age ranges has very few percentages of differences. Furthermore, the media graph shows that people of these age ranges have very close interests in both the gaming and the sport. This concludes my targetted audiences for my programme which are young adults from 16 - 45.

Genres of games

Sports as a genre has 33% of global gaming fans. It is at 6th highest fan rates, tying with Strategy and Simulation. This is a good circumstance as my programme, the game of basketball requires strategy in a team play and the simulation is achieved through the VR interface. The highest compatibility of the sport genre players is a shooting genre as shown by the percentage of 'likelihood of playing the second genre'. This is another circumstance that emphasis the similarity to my programme idea. The shooting is one of the main aspects of the basketball game. Using the VR technology to highlight the shooting interplay to have a similar feature of aiming and shooting of shooting games can be applied as a feature in my programme. The fact that my programme is a game of multi-player basketball game, sport and shooting are the only two genres popularised through multiplayer functions.

Likelihood of playing the second genre

THE POPULARITY OF GAME GENRES GRAPH

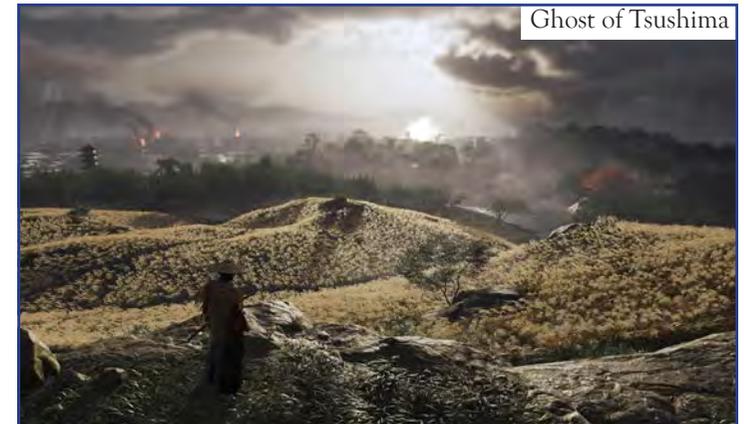


THE DIFFERENCE IN VIDEO GAMES

In today's industry, games are divided into two main developers, Indie and AAA. The main difference in these developers is the number of members in their team. Indie developing teams usually consist of less than 30 people while the AAA developers workforce exceeds 100s in some cases. The other difference is the budget for developing. Indie developers usually work with crowdfunding or their savings while the AAA developers are funded by big companies.



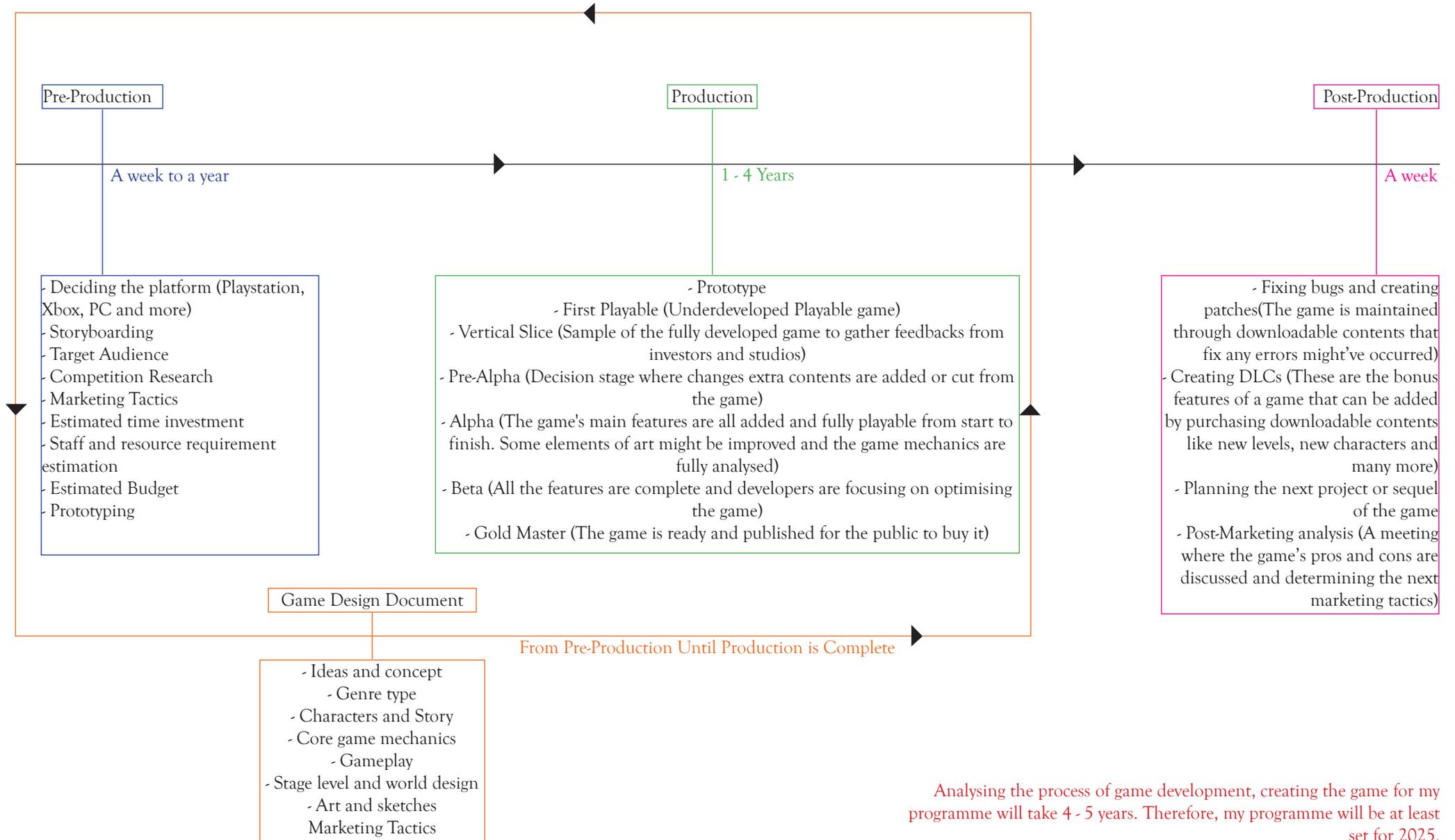
The games designed by Indie developers have unrealistic textures visually and in some cases, they are very simple and follow the traditional methods of flat plane animations (2D) with better illustrations.



The games designed by AAA teams have very realistic textures and animations of characters. The details in games are very precise including the environment, materials and lightings.

For my programme, I will be using AAA gaming for VR experience. The reason behind is to create a realistic form of VR interaction on the subject of the basketball game. This will immerse the users into a convincing realism of the basketball game, therefore the experience will be as real as the actual basketball game.

VIDEO GAME DEVELOPMENT STAGES



Analysing the process of game development, creating the game for my programme will take 4 - 5 years. Therefore, my programme will be at least set for 2025.

VR CHARACTERISTICS

“VR is a way to escape the real world into something more fantastic. It has the potential to be the most social technology of all time” by Palmer Luckey, Founder of Oculus Rift

By introducing the VR technology in the game of basketball, the programme will have a wider target of audiences. This will benefit the programme to have entertainment value, as well as sportsmanship through physical interaction to space through VR technology.

Virtual Reality is the term describing a three-dimensional, computer-generated environment which allows a person to explore and interact with. It enables the person to become part of this virtual world, who is then absorbed within this environment and “manipulate objects or perform a series of actions”. “There is a range of systems used for this purpose, such as headsets”, special gloves and one-directional treadmills.

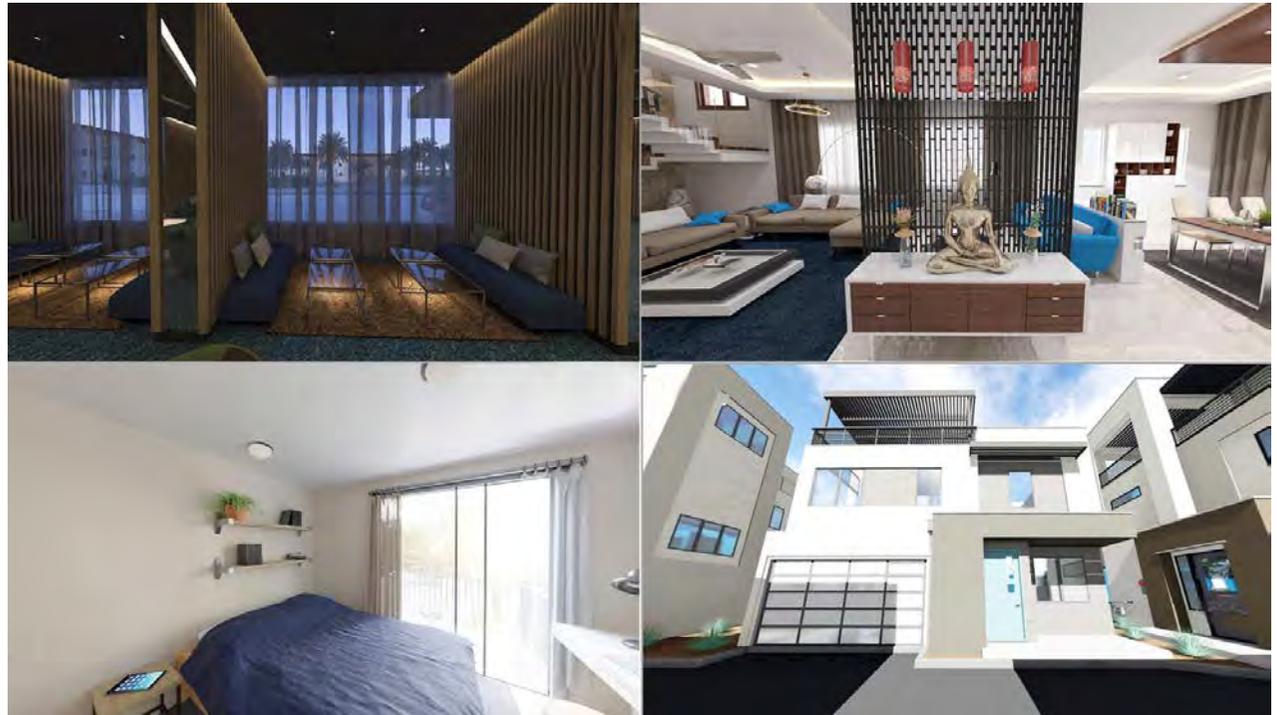
There are numerous “virtual reality systems but they all share the characteristics” of “the ability to allow the person to view three-dimensional” life-sized images. The images changes as the person move around their environment corresponding with the scope of vision. The image created is a seamless join between the eye movements and the person’s head and the suitable response such as a change in perception ensuring the virtual environment both enjoyable and realistic.

The benefit of virtual reality creates a possibility to carry out tasks that are expensive, impractical or dangerous. Such tasks include training trainee medical surgeons, trainee fighter pilots to a cost-effective method to view building development virtually, etc. Virtual reality and its enlarged reality could considerably change the way we interact with our digital technologies.

Organisations using virtual reality practice:

- Architecture
- Medicine
- Film
- Video Game
- Sport
- The Art

Architectural Render Views with VR Headset



VR POTENTIALS



VR Basketball



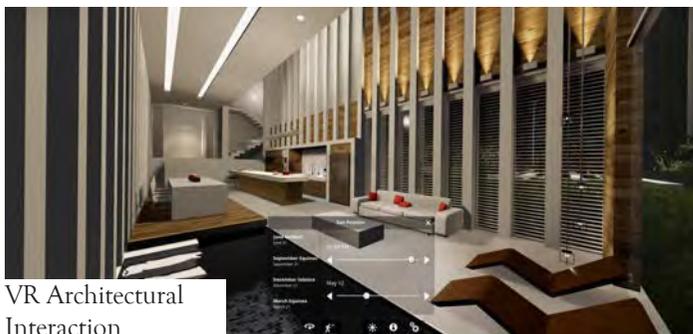
VR Hockey



VR Surgery



VR Shooting Game



VR Architectural Interaction



VR Model Interaction



VR ICAROS Fitness

- Playing Virtual games through physical means.
- Interacting with the existing atmosphere such as homes and offices to carry general tasks such as starting the washing machine, turning on lights etc...
- Carrying out 3d projects with a real sense of sizes and visual.
- Training simulation in professional fields
- Joining other users to play your favourite games with realistic experience
- Playing your favourite sports with less effort.
- Studying the interactive physical objects with VR headset and exploring the potentials.
- Work out at home without necessities of travelling distances to nearby sports hall or gyms.

VR GEARS



Machine Washable



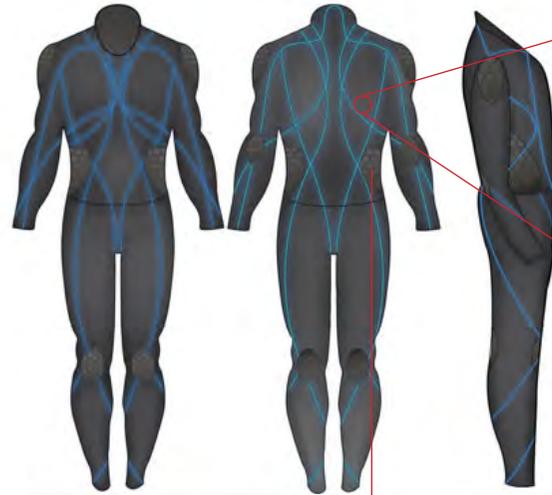
The **Treadmill** is costly, but better physically interactive in terms of actual movements. It has a low-friction surface which allows the special shoe designed for it to effortlessly slip within. Tracking pods are attached in the shoe for the treadmill to sense to the motion of the user and the harness is attached to the waist grip of the treadmill to keep the user standstill within the surface. (Currently available in the market)

The **Cybershoes** is a cheaper alternative to the treadmill. The shoe part has all of the functions from sensing the direction of movement to the speed. To use the cyber shoes, a chair that rotates 360° and a soft carpet are necessary, as it allows the user to turn easily and the shoe to have a smoother surface to slip. (Currently available in the market)

The **Tesla Bodysuit** is another VR technology that allows the users to have haptic feedback from the VR world. This involves a sense of temperature, physical touches and presence of elements from the VR world. The glove is a part of the suit which allows the same kind of sensory effects. The suit and the glove also monitor the heart rate, excitement level and physical stress of the users. Other than the sensory effects and physical monitoring, these technologies have capabilities to track accurate motions which allow far greater interaction accuracy to the VR world compared to other VR motion technologies so far. (To be available from second half of 2020)

POTENTIAL UPGRADE TO VR EXPERIENCE

eSSAGE CONCEPT



Skin grafts to maintain flexibility



Inbetween inner and outer layer, massage studs that perform the massage. It is programmed by a device such as a tablet through an app.



The concept of eSSAGE suit is to allow the wearer to get massage through the use of an app designed specifically for it as stated in the proposition. It is said to be “able to deliver a precise and accurate massage as if the hands were right there on your skin”. The inner layer of the suit is made of Antimicrobial Polypropylene for resisting odours and the need of washing it.

From the research, VR technology will benefit my programme by providing both the entertainment aspect of gaming and the physical aspect of exercise. Furthermore, the development of VR gears like Tesla Bodysuit, VR gloves and VR shoes has enabled the sensual experience of physical activity. Adding the eSSAGE suit with the Tesla suit for VR Basketball purpose, it will create a suit that allows sensual experience, as well as a massage therapy after the activity. The use of eSSAGE suit will help my programme link with the relaxation and healing aspect of The Royal German spa's history.

PRECEDENT ANALYSIS

MARRIOT TELEPORTER



Spray and smell diffuser for simulating sea spray and smell

Infrared Heater

VR Goggle for visuals

Headphones for surrounding sound experience

Polygon shaped walls directing the wind to the user

Augmented reality floor simulator for walking experience

Marriott teleporter is a project conducted by Marriot hotels to create a 4D Virtual holiday experience with the means of VR technology. Their aim of this project is to provide an instant trip to some popular holiday destination through modern technology in the form of a telephone booth. The first lunch of this project was in September 2014. It offered two destinations at the time where guests could “*explore the black sand beaches of Hawaii or the top of London’s Tower 42*”.

The idea of an instant link between reality and virtual is what I plan to imply to my project. The instant link from existing structures of my programme to a virtual basketball court is what I intend to implement to my design.

ZERO LATENCY



Headset and Earphone for visual and audio

A gun with controller attachments

Backpack with VR docking that connects the VR system to the computer wirelessly.

The room used for movements which translates to movements in the game

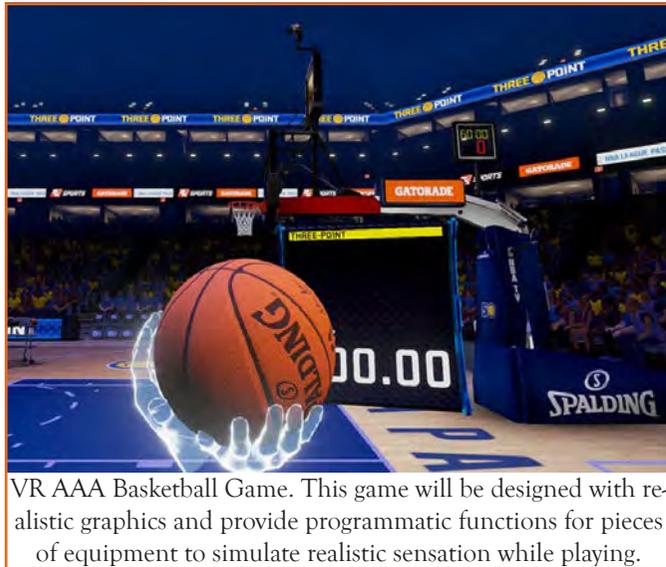
Computer generates the game file for the players



Zero Latency is a VR space located in Wembly, UK. This space has a very simple VR configuration which uses a spacious room for movement. This programme is based on a video game about killing zombies. The game allows up to a group of 8 to participate at a time. This form of gaming allows a physical movement in the existing space which simulates the movements in the game through VR technology.

The idea of group gameplay allows players to interact with each other and work together as a team creating emotional bonds. Such a simple configuration of the VR setup can also be utilised to the space available in the Royal German Spa. Analysing Zero Latency, such concept of VR gaming can be used in an actual basketball court where players wearing gears can have bigger movements in the court while playing the game through their VR gadgets. This will lead to further straining users physically, similar to the physical basketball sport.

PROGRAMME'S CHARACTERISTICS



VR AAA Basketball Game. This game will be designed with realistic graphics and provide programmatic functions for pieces of equipment to simulate realistic sensation while playing.

Programme:

- 5 years of development from analysing the time schedule of game development on page 32.
- A year for testing it with the pieces of equipment and fixing the issues. As most of the AAA games have some minor issues in their game after releasing it to the public, it can take anywhere from a few months to years. Therefore, having a year extended for testing the developed game will produce refined visuals, systems and functions to the game.



Stand

Jump

Seat

Crouch

VR treadmill with the property of versatility in movements and postures. The base is the frictionless surface where VR shoe will slide effortlessly.



VR Bodysuit for simulating touch sensations to the body. It will offer users to feel the collision and contacts of the game. This suit will also allow users to get massage therapy following the concept of eSSage bodysuit.



VR gloves for simulating hand movements, touch sensations and using to perform dribbling, shooting, lay-up, dunking and many more.



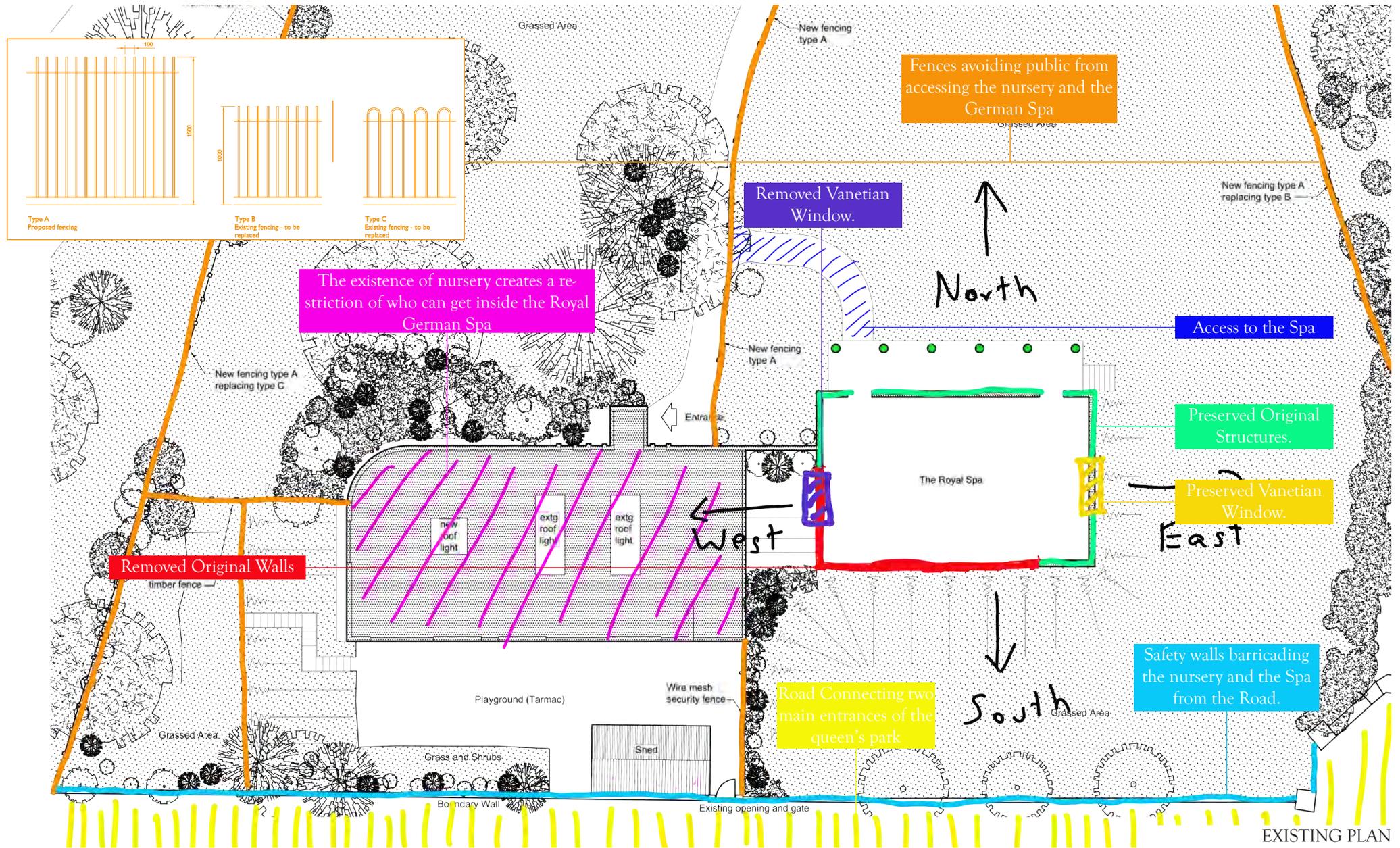
VR shoes for simulating touch sensations to feet. The shoe is frictionless to slide in the VR treadmill and offers the friction sensation of wearing a Basketball shoe on the court.

Equipment:

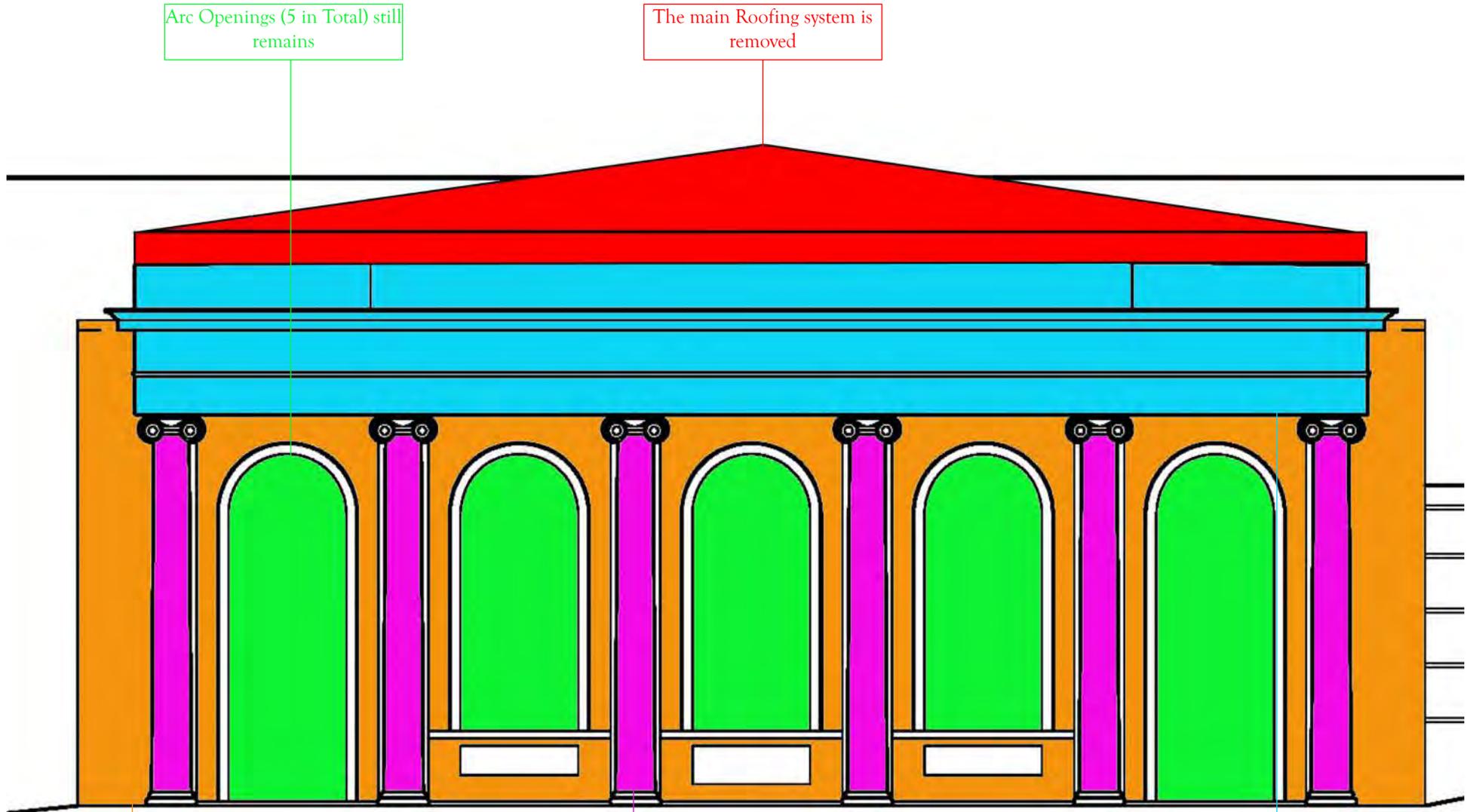
Most of the types of equipment are already out in the market, however, to programme the massage aspect to the bodysuit, it will take a year as it is not available so far. The 1-year prediction is due to the fact that the Tesla Bodysuit has features of generating physical touch simulation, however, the programming aspect hasn't focused on the massage aspect. Therefore going over the source for developing new software from the beginning, it takes anywhere from 8 months to a year when working in a bigger team.

DESIGN DEVELOPMENT

EXISTING CONDITIONS



EXISTING PLAN



Arc Openings (5 in Total) still remains

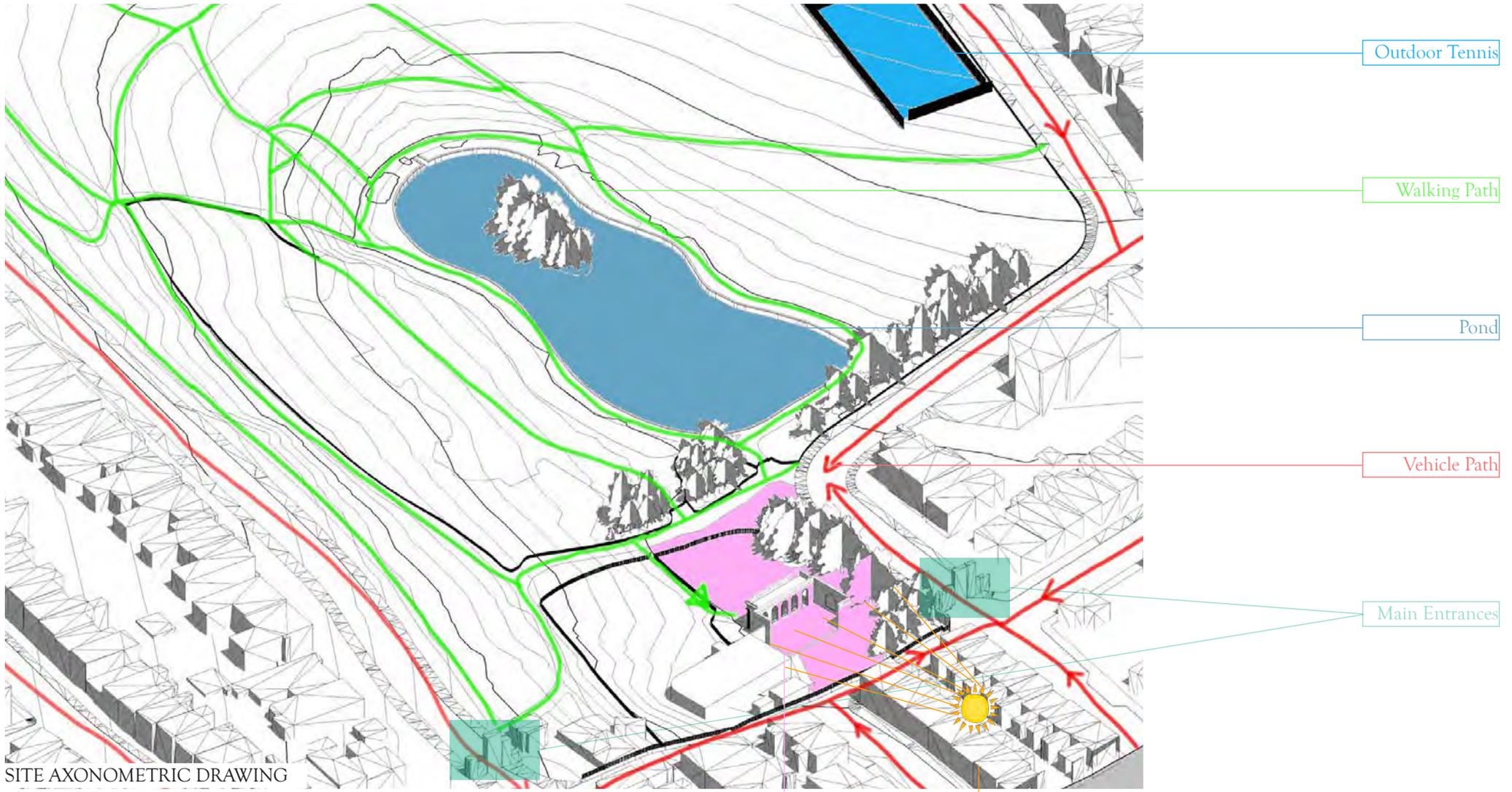
The main Roofing system is removed

Original Wall structure still remains but with Stucco finish

6 Ionic Columns with Greek style Fluted shaft still remains

Ionic Order style Facade Still remains without the Inscriptions

NORTH ELEVATION



Outdoor Tennis

Walking Path

Pond

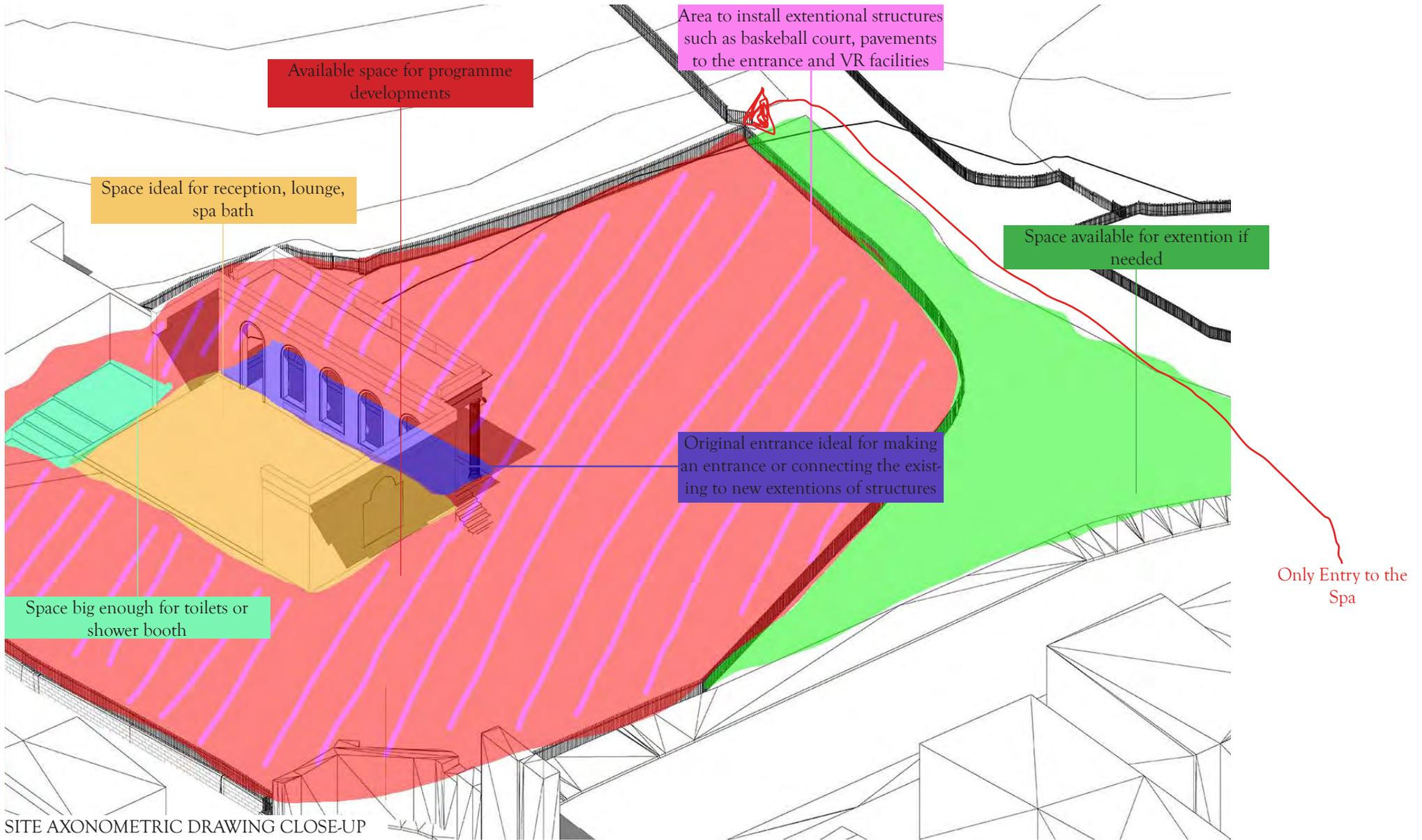
Vehicle Path

Main Entrances

SITE AXONOMETRIC DRAWING

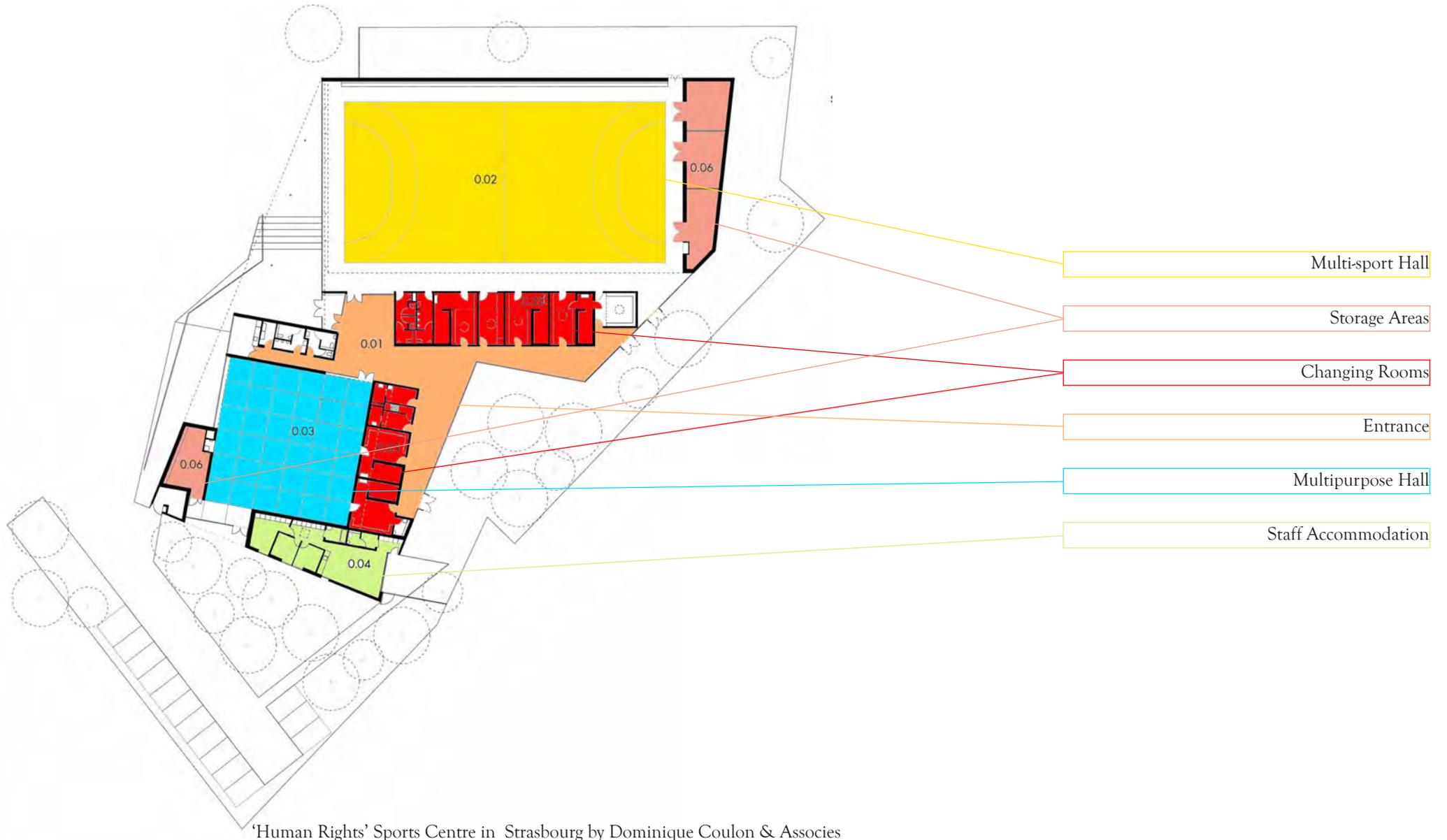
Light in Space

Summer solstice



SITE AXONOMETRIC DRAWING CLOSE-UP

PRECEDENT ANALYSIS



'Human Rights' Sports Centre in Strasbourg by Dominique Coulon & Associates

*“Light is of decisive importance in experiencing architecture.
The same room can be made to give very different spacial
impressions by the simple expedient of changing the size and lo-
cation of its openings.”* by Steen Eiler Rasmussen, Architect

The aspect of natural light defines the spatial qualities and purposes. My focus on this subject is to describe the programme through natural means and create a unity of the existing natural environment and the new added modern concept of design. Using light as a natural source, I plan to create an atmosphere suitable for each function space and their use. While some spaces require exposure to the public to show the activity, others require privacy and dark spaces for their purposes.



Glass to allow natural day light to enter the space

Glass also allows the passing by spectators to see the inside of the building

Varnished oak parquet floor laid in a checkerboard pattern.

Varnishing the floors protects the surface of the floor by preventing scratches, dents and residue to buildup. These benefits allow the floor to be less slippery and avoid stumbling hazards.

Perforated MDF panels

Perforated MDF panels are coloured to match the aesthetic of the space. The technique of perforating the MDF panels also gives the space good acoustics and creates a cushioned surface to finish compared to common wall materials like a brick or hardwood finish.



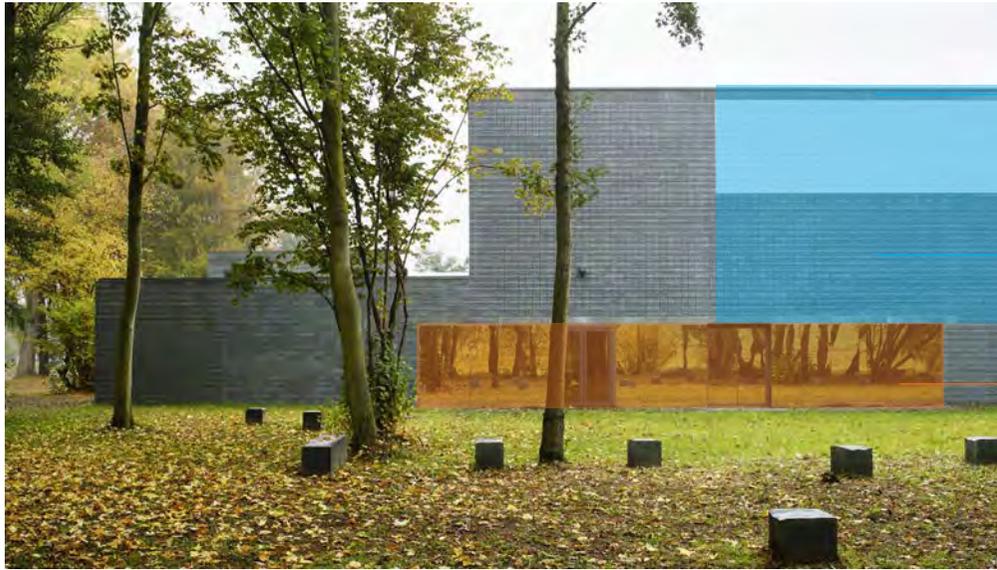
Galvanised Steel

Galvanizing the steel beams avoids corrosions in the steel, resistance to mechanical damage during the handling, construction and storage. It is a very sustainable coating of molten zinc that gives it incredible longevity, therefore less cost spend on the maintenance.

Linoleum Flooring

Linoleum flooring adds add a faint glow on the surface. This allows the natural light to bounce off its surface and reflect the light to the surroundings. It also adds a contrast to the concrete walls and metal beams on the roof which has a very pleasant aesthetic in the space.

The sports centre has a very close link to my proposition. As my agenda is about providing a program for basketball through the use of a VR technology, the consideration for spaces needs characteristics of a sports centre. Following the example of 'Human Rights' sports centre, I started prioritising the natural light through the use of transparent materials like glass. The flooring is guaranteed to be a wood material as such found in a basketball court. Using the depth of the site, I can analyse the positioning of each space, mainly focusing on exposing the players inside of the space.



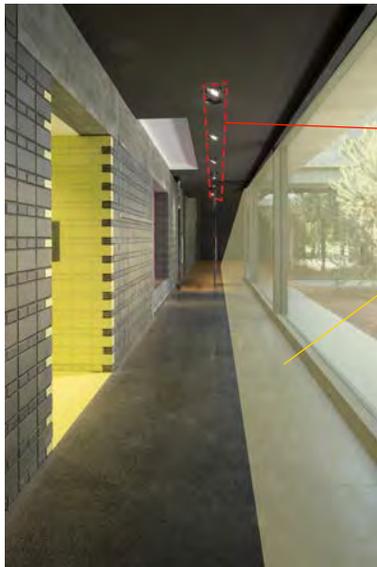
Sports Centre, Rotterdam by Koen van Velsen Architects

Green-Grey Bricks

The grey bricks are very subtle in colour and create a contrast to the vibrant colour of the surroundings. The green bricks are very light in colour and blends with the natural environment as it resembles a moss growing in the facade.

Mirrored Claddings

The mirror claddings reflect the surroundings of the site and make the inside of the building visible.



The Interior space makes use of artificial and natural lights through an array of light installations and glass panel walls.

The roof system is hidden through the installation of wood panels for creating an aesthetic that blends with the tone of the bricks.





Alberto Campo Baeza's Madrid Sports Centre

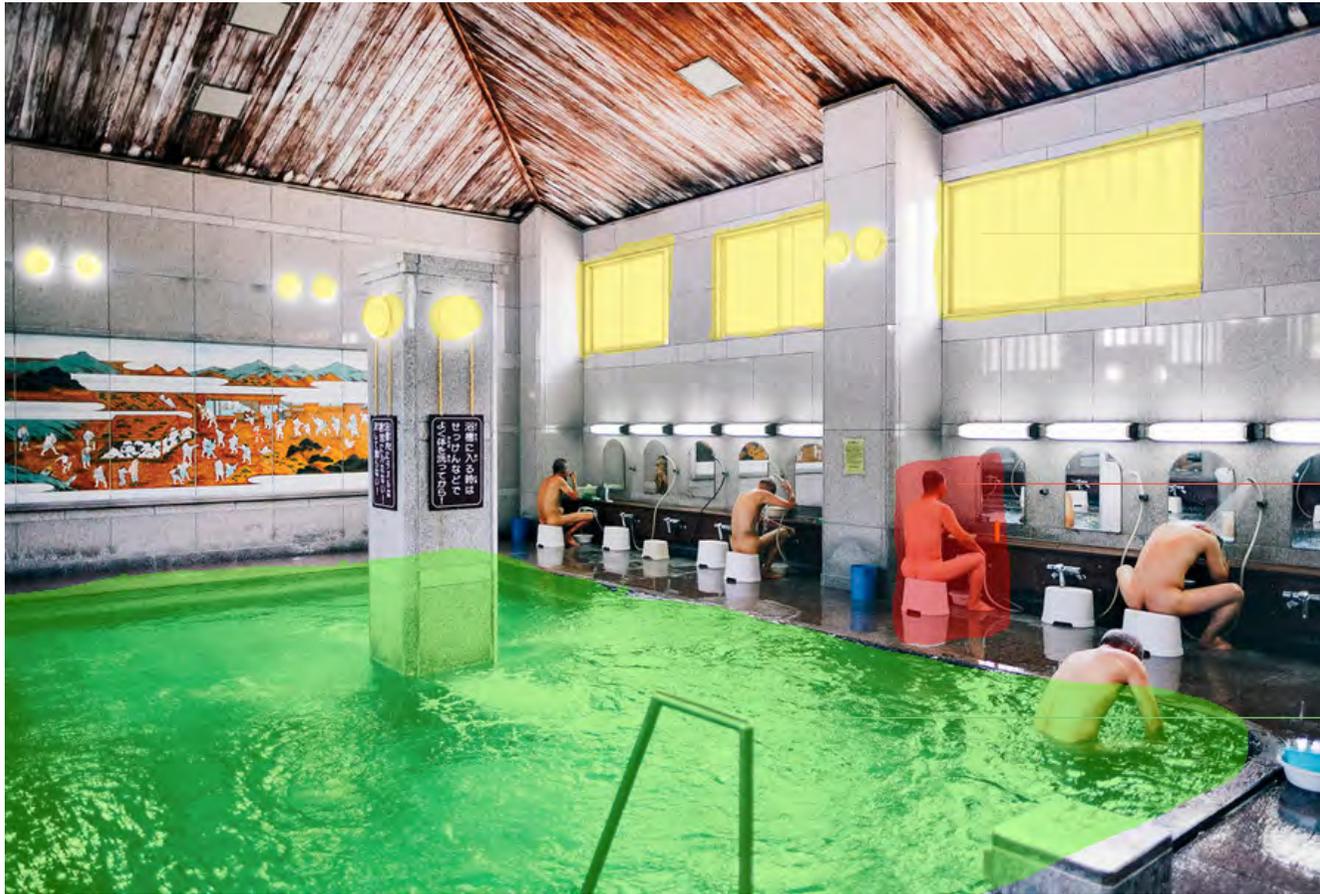
Light metal trusses extend from the metal beams which is used to support the immense structure of the roof.

The use of a large volume of glass as walls allows plenty of natural light to lit space. The structure is very minimalistic with a pleasant tone of white colour theme that blends with the light cast inside of the space.

The seatings are elevated high off the ground which allows visitors to have a wider coverage of view.



The roof is elevated very high off the ground. This allows for an activity like basketball to exhale as it leaves enough roof for shooters to shoot high without the ball contacting the roof. The other advantage is the amount of light cast in the space will be greater.



Onsen, Japan

The space is very bright with natural and artificial lighting. Good lighting in the space makes it very relaxing and therapeutic. This also allows users to see clearly in the space, therefore limiting the slips and falls.

Shower units are installed throughout the space for multiple visitors to have access.

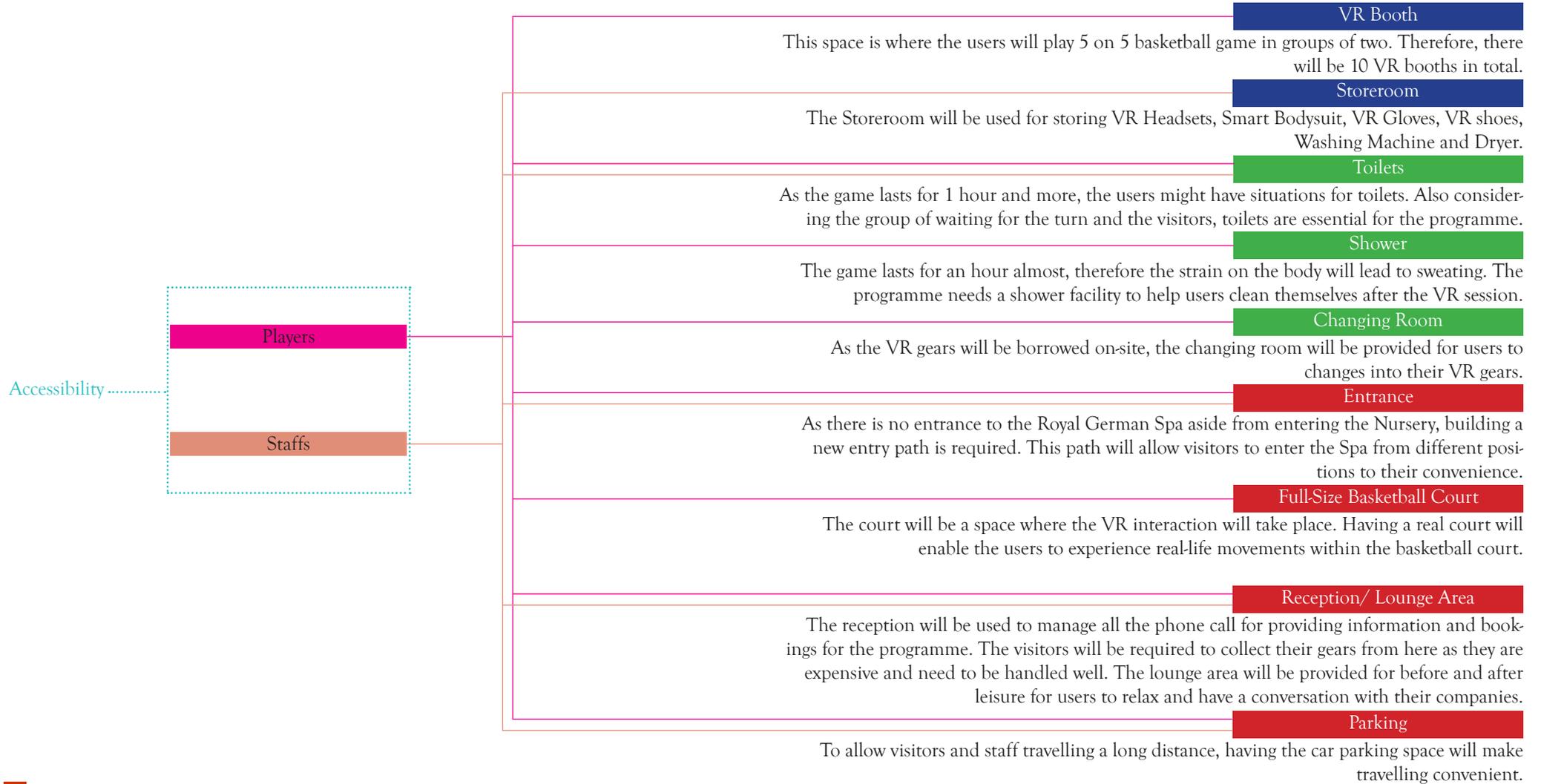
The Hot Bath (Onsen) is situated at the centre of the space. Its positioning is approximately equal distance to every shower units surrounding it.

Onsen is very common in Japan and almost found in any city throughout the country. The hot bath is fused with natural minerals or artificial which varies with each onsen. Before getting into the bath, users are required to shower first. This is to maintain good hygiene among the users and also to keep the bath as clean as possible for longer usage.

Examining the onsen, it has a very similar concept to the bathhouse in the Spa. However, the design of space is simpler and less extravagant with a smaller structure. The concept of Onsen can be used in my programme to address the history of the Royal German Spa.

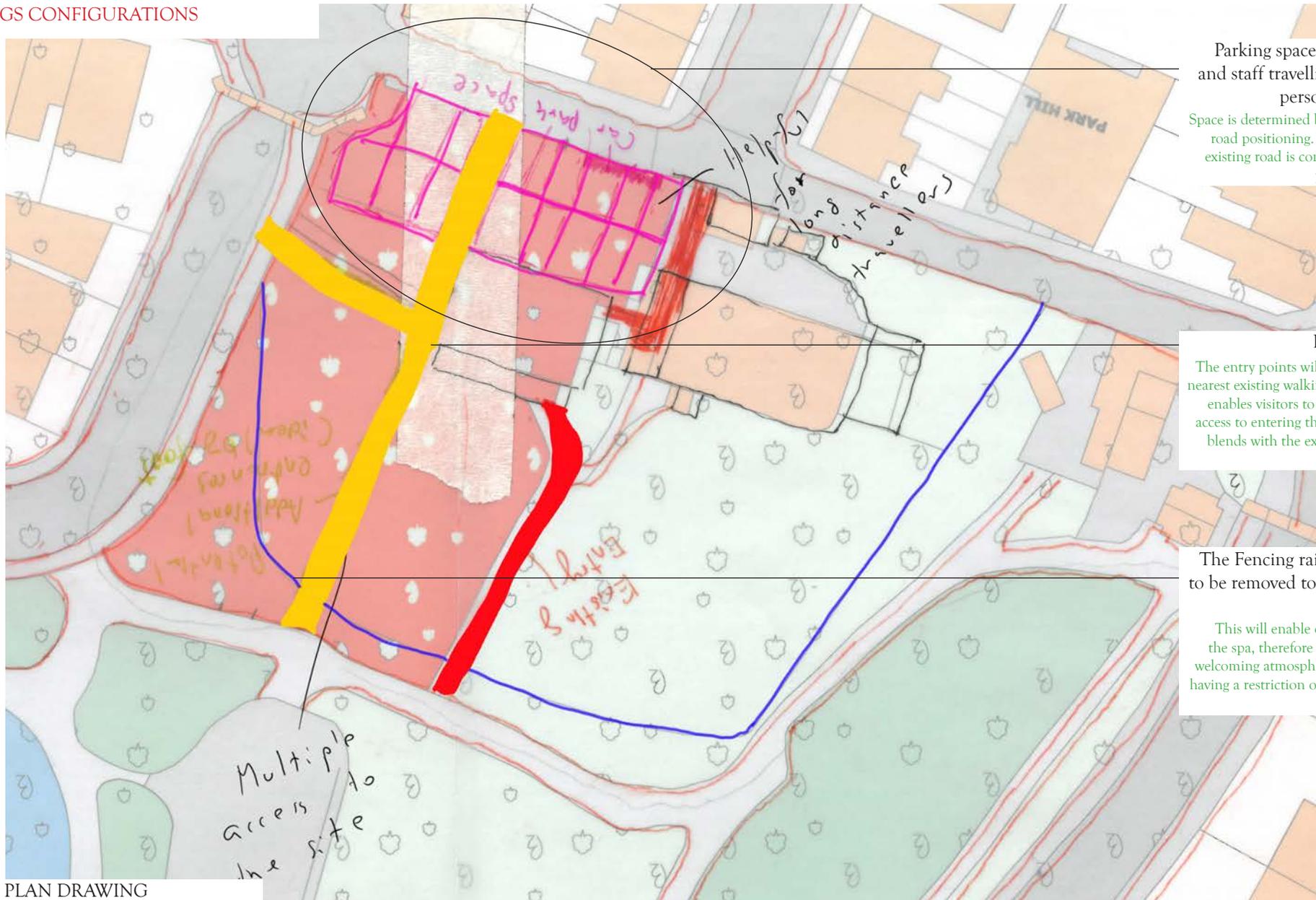
SCHEDULE OF ACCOMMODATION

KEY SPACES AND PURPOSES



- Requires Large Space
- Requires Less Space
- Situated Within the Space

DRAWINGS CONFIGURATIONS



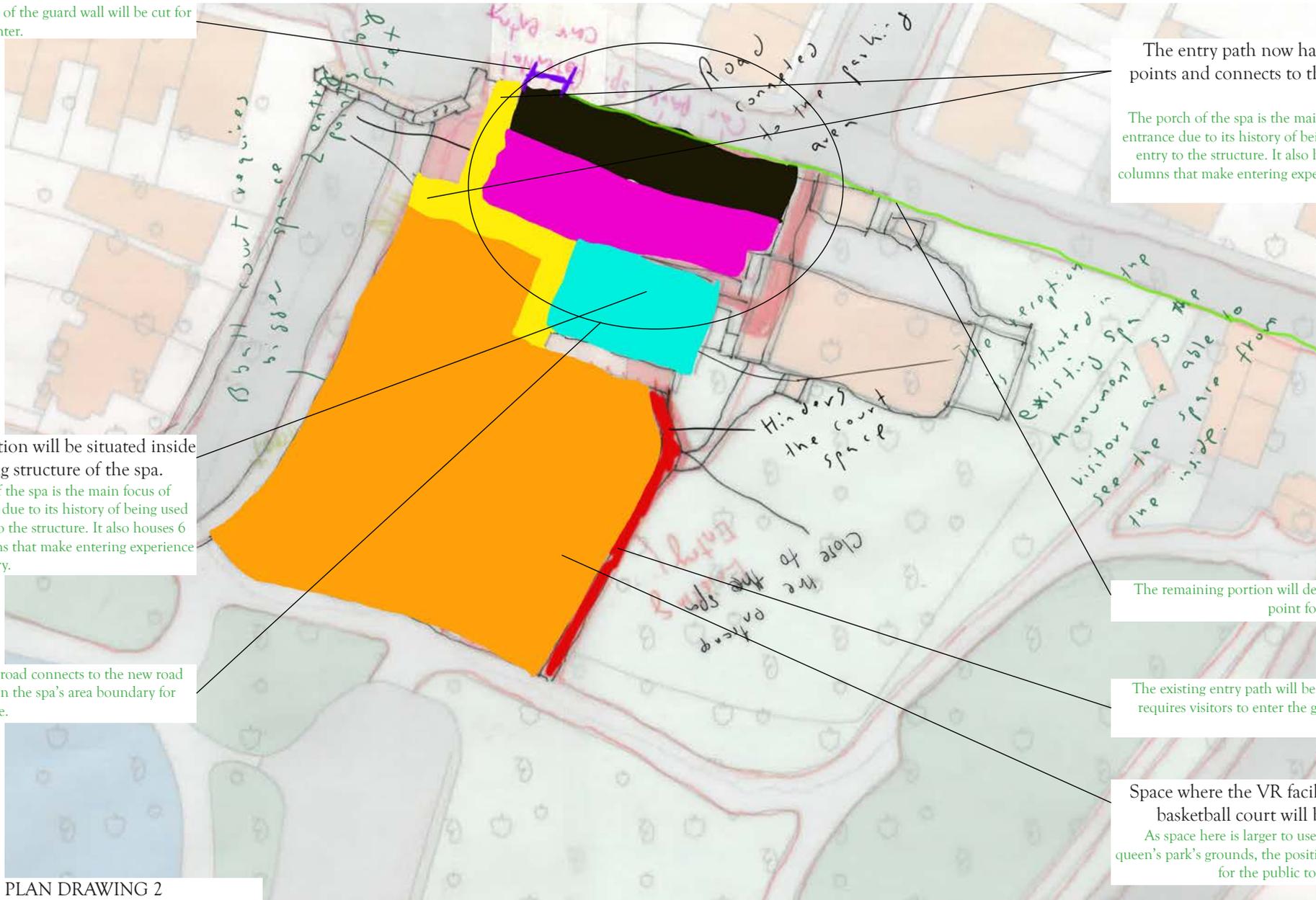
Parking space for visitors and staff travelling by their personal vehicle
Space is determined by the existing road positioning. Therefore the existing road is connected to the parking space.

Entry Paths
The entry points will focus on the nearest existing walking paths. This enables visitors to have multiple access to entering the space which blends with the existing walking paths.

The Fencing rails will have to be removed to create new entry way
This will enable open access to the spa, therefore it will create a welcoming atmosphere, instead of having a restriction of fences defining the entry

PLAN DRAWING

This portion of the guard wall will be cut for vehicles to enter.



The entry path now has two entry points and connects to the porch of the spa.

The porch of the spa is the main focus of the entrance due to its history of being used as an entry to the structure. It also houses 6 ionic columns that make entering experience link to history.

The reception will be situated inside the existing structure of the spa.

The porch of the spa is the main focus of the entrance due to its history of being used as an entry to the structure. It also houses 6 ionic columns that make entering experience link to history.

The remaining portion will define the entry point for the vehicles.

The existing road connects to the new road created within the spa's area boundary for parking usage.

The existing entry path will be removed as it requires visitors to enter the grounds of the nursery.

Space where the VR facility and the basketball court will be situated.

As space here is larger to use and faces the queen's park's grounds, the positioning is ideal for the public to see the users.

PLAN DRAWING 2

Basketball Court facility for visitors interested in experiencing the real-life basketball

The idea of having an actual basketball court is to connect the VR experience with real-life basketball experience. As the users come out of the VR booths, they have an option of either making their way to the reception through the basketball court, or just take the short route to it.

This pathway will be removed to extend the space for the VR space and the spectator's seatings.

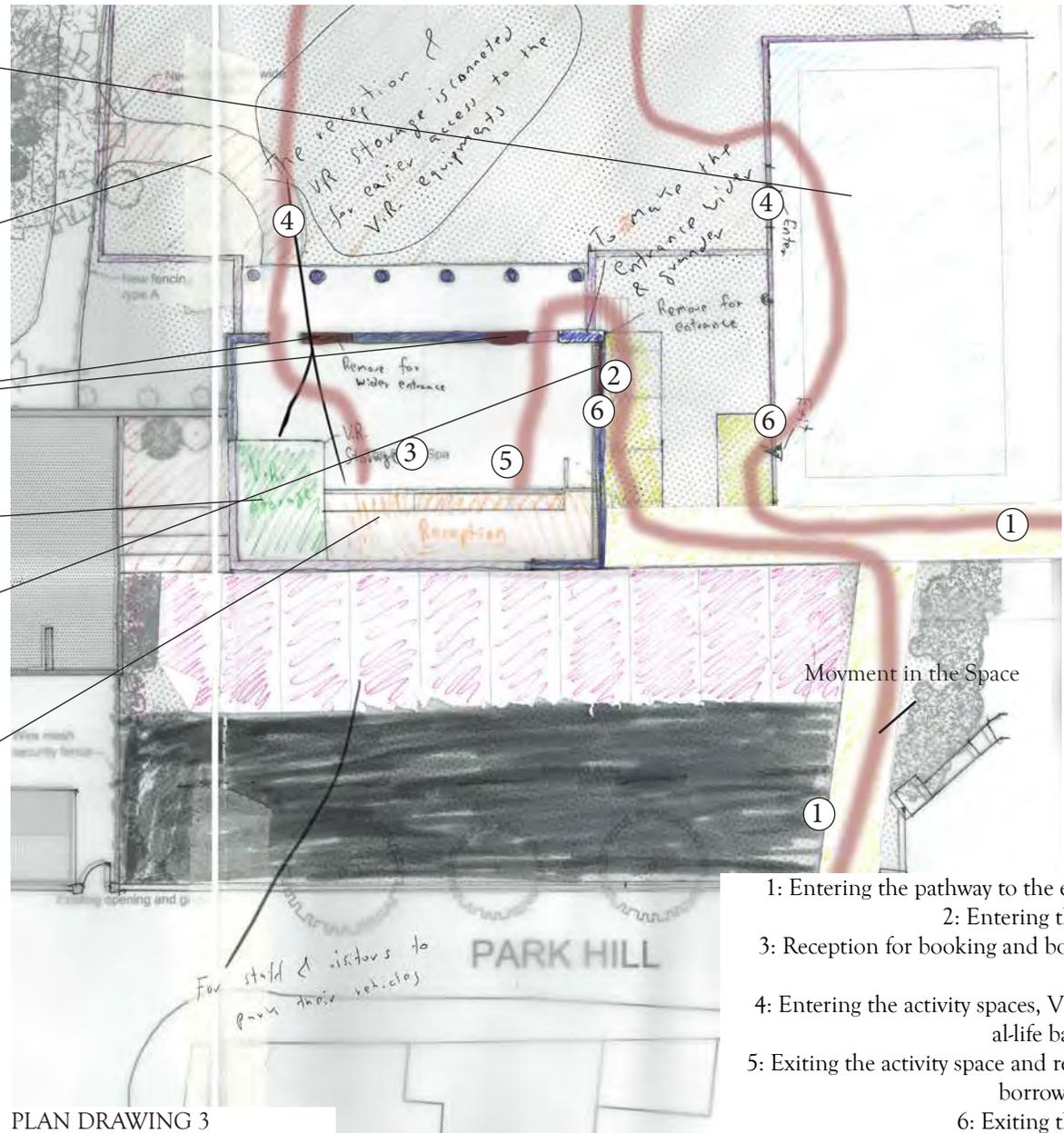
These arcs will be widened for visitors to access VR space and basketball court.

The storage unit will be situated next to the reception for quick access to the staff when handing out the gears.

The portion of the existing wall will be cut for entrance purposes. This new entrance will enable the existing arcs to be used as the connection between the existing and new addition of the programme.

The reception is positioned at the bottom centre of the existing structure. This position allows the reception to face directly at the entrances arc where the visitors enter the space. This helps create a sudden connection between to working staff and the visitors.

This drawing is working through paper cutouts of scaled space needed for parking space, a basketball court and walking pavements that lead to the entrance of the programme.



- 1: Entering the pathway to the entrance
- 2: Entering the space
- 3: Reception for booking and borrowing gears
- 4: Entering the activity spaces, VR or Real-life basketball
- 5: Exiting the activity space and returning borrowed gears
- 6: Exiting the space

*“There are no straight lines or sharp corners in nature. Therefore, buildings must have no straight lines or sharp corners” by
Antoni Gaudi*

The site that hosts my programme has a nature defined flexible landscape. The boundaries of land hosting the Spa structure has a curvature. Therefore, using it as a pattern will define the structure of my programme and create a connection to the natural aspect of the park.

The second toilet will be situated within the gap in-between the nursery and the spa, which is further and hidden from the entrance.

The VR booth will have glass walls in order for the public to see the activity inside of the space.

The seating steps are positioned to face outside towards the vast green land of the Queen's park. This allows users to both see the users' activity and the activity outside in the park.

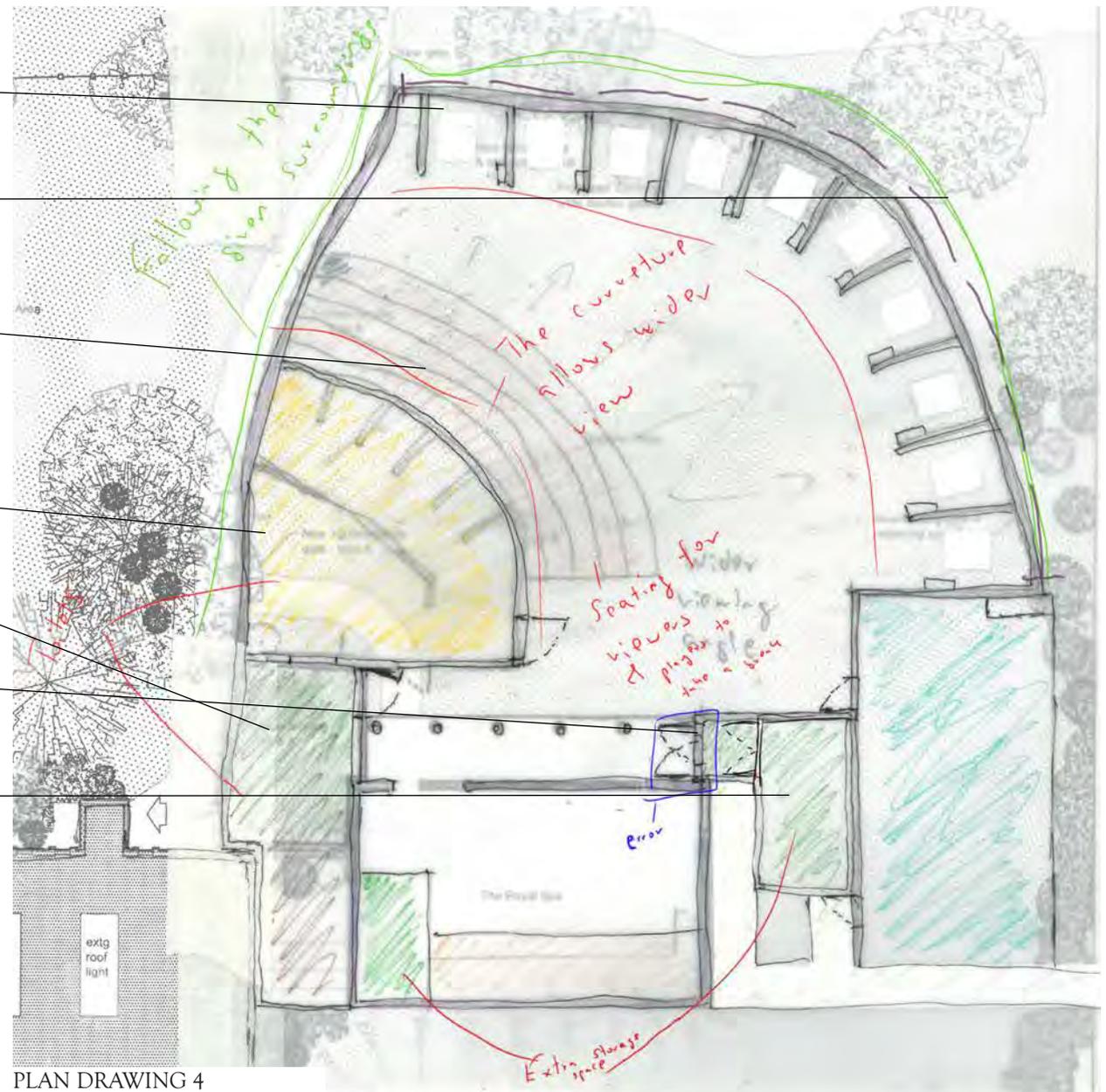
The positioning of toilets is positioned in a way to make it less noticeable.

The first toilet is situated within the spectator's seating, therefore it is concealed and less noticeable.
The second toilet will be situated within the gap in-between the nursery and the spa, which is further and hidden from the entrance.

The entrance is connected to the porch of the existing Spa building. Having one arc for entering and the other arc for exiting the reception creates a smooth passage for movement in the space.

Storage Unit extension for real-life basketball facility. It will be used to store extra basketball posts and basketball balls for lending to the users.

This drawing's layouts are defined by the surrounding existing contexts. The shaping of the VR space and the layout of VR booths follows the existing space boundaries defined by the fence units in the space.



PLAN DRAWING 4

- Toilet Booths
- Urinals
- Sink
- Shower Booths
- Bath
- Parking Space
- VR Booths

There are two exits from the basketball court. One of them leads back to the reception for returning the borrowed gears and the other to exit the programme space.

The VR booths are now positioned to face the north-west. It is positioned in such a manner to create a smoother transition from VR booths to the basketball court.

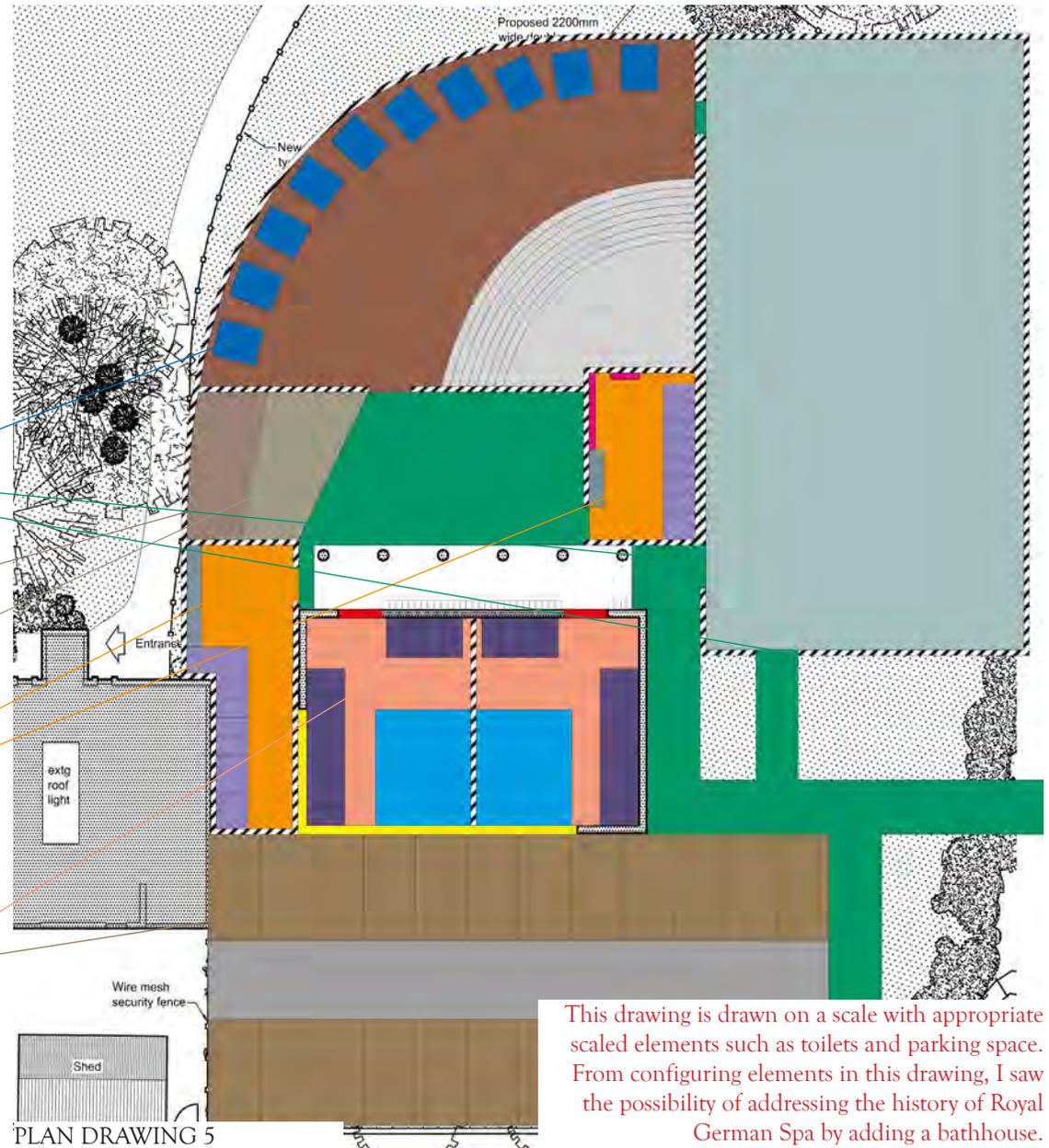
The storage space is now situated behind the reception. it will only be used to store VR gears and smaller pieces of equipment such as basketball.

The reception is positioning allows users to see the bath space first, which addresses the history of the spa. It allows users who aren't familiar with the history to have some understanding of the site, therefore creating a deeper connection.

Toilets follow the same concept of limiting the attention as the main focus of the programme is to highlight the VR space, basketball court and the bathhouse.

Shower and bath facilities are located inside the existing structure to address the history of the spa. This arrangement creates a deeper context of the space and brings back the original purpose of the Royal German Spa. This space will be used for changing additionally.

Parking space has more parking bays, hence more vehicles can be parked.



This drawing is drawn on a scale with appropriate scaled elements such as toilets and parking space. From configuring elements in this drawing, I saw the possibility of addressing the history of Royal German Spa by adding a bathhouse.

- Parking
- Reception
- Corridor to VR Space and Bath
- Bath
- Toilets
- VR Basketball

The VR space now has the elements of VR and the physical basketball court. The movements will resemble the physical movements of the basketball game with VR interaction. The court's dimension is now cut to the size of half of the basketball court. The court is big enough for users to play from 1 on 1 to 5 on 5 basketball game.

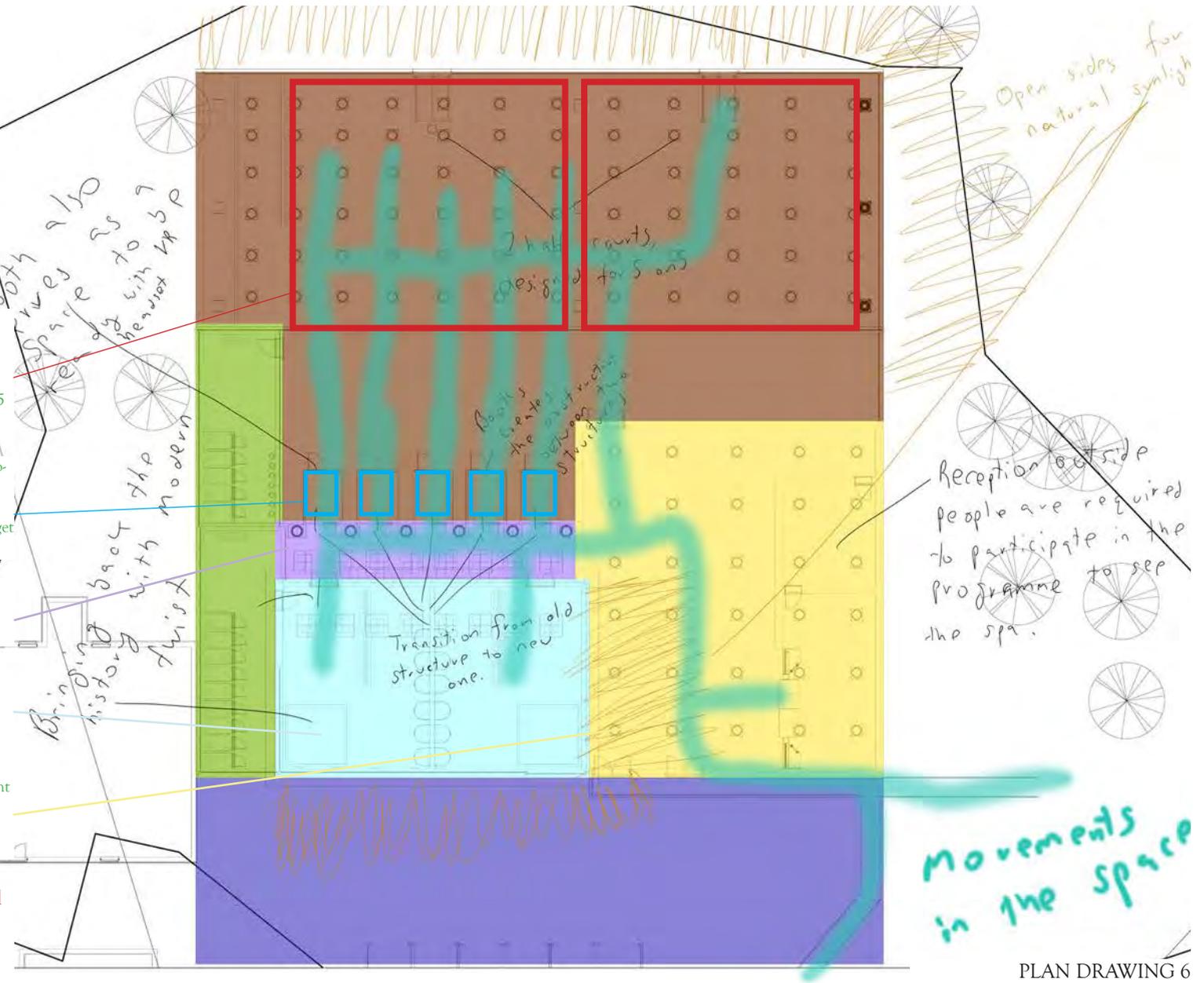
The gaps in columns now houses 5 booths for changing. It is positioned there for highlighting the transition of existing and the addition of structures. Additionally, changing booths are there for users to instantly enter the activity space without having to get into the bath space for changing into VR Gears.

The existing porch now serves as a corridor that connects the function space and the bath space. This space will also hold storage shelves for users to keep their belongings secure.

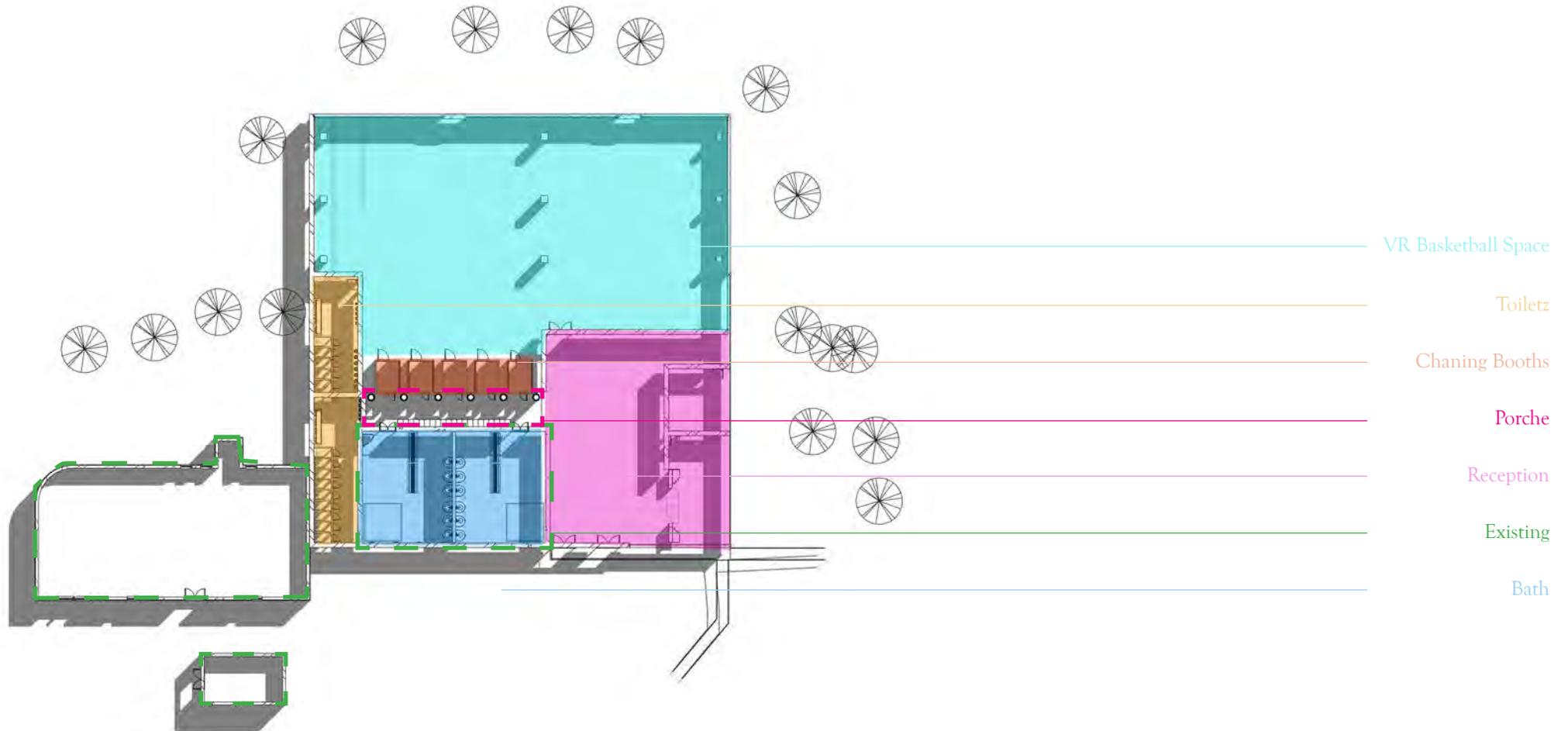
The positioning of the bath is now at the bottom corners of the existing space. This is determined by the positioning of the shower booths in the middle wall dividing two spaces.

The reception is now positioned before the existing structure. The concept for this positioning is to accelerate the dull moment of bookings and hasten the pace to the interesting features of the programme. The reception now has direct access to the VR function space for staff to use.

This drawing is a plan view of a 3d model designed for analysing the spatial qualities of the space. The drawing is a simplified version of my previous processes with linear structures.

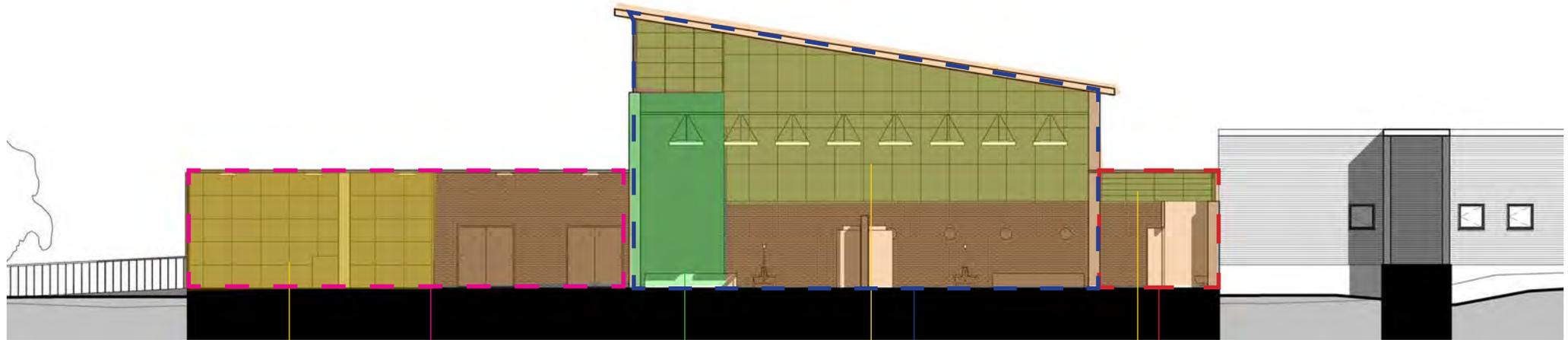


PLAN DRAWING (1:500)



To see the spatial quality of my developments, I designed a 3D programme space with ideas gathered from sketches. The structure focuses on making the most use of natural light through high ceilings and glass facades. The system and materials are a reflection to my analysis to create this draft 3D drawings to see the potential of the programme for developing further.

NORTH SECTION (1:200)



Glass to allow natural lightings

Reception

Existing Structure used for support addition of structures

Bath

Toilets

As the visitor' first impression will come from the reception, it will be well lit and show the surrounding contexts. Therefore, the use of glass allows visitors to see through the confined space and also blend the space to the surrounding due to the transparency of the curtain glass walls.

WEST SECTION (1:200)



VR Basketball

Changing Booth

Porch used as a corridor
that connects existing to
the new

The rim for the basketball is in reachable height for average people height in the UK. Traditionally, basketball rim is very high for people with average height to reach. Hence, lowering the rim height enables users to feel the excitement of dunking which is difficult to achieve with the traditional arrangement.

The Basketball Space and the bath space has high elevated roofs to allow more lights in the space. This allows the space to have good visibility naturally and creates a pleasant experience.

VISUAL SEQUENCES

ENTRANCE

- The exterior of the space has a very neat aesthetic.
- Applying clear glass walls on the reception area gives information about the inside liveliness as it allows the natural light to enter the space. However, the low roof casts a large area of shadows.
- The grey brick walls have a very light tone which matches the aesthetic of the Royal German Spa, but it also highlights the new addition from the existing.
- The parking space has enough space for a fair amount of visitors to park their vehicles.



Existing

RECEPTION AND LOUNGE

- The sizing of the space is wide and spacious with enough areas for lounging. Although, it is far too big with lots of unused spaces and needs to be sized down a little.

- The varnished flooring reflects the light and creates a nice glow in the space. However, the ceiling level is ineffective to cast natural light in overall space and needs to be raised.

- The Glass walls extend from the east and meet the structural brick walls on the south. This concept is successful in terms of following the natural source of light.



PORCHE

- The Corridor is successful to define the contrast of the existing and the new. However, the enclosed design of the programme is restricting the light from entering the space.

- The positioning of the changing booths within the gaps of the columns creates a very pleasant transitioning step. These existing columns have a historical connection in terms of design both structurally and visually. Allowing the visitors to get close to these columns creates add compliment inexperience.



SHOWER AND SPA BATH



Existing

The Bath space has a very calming spatial quality. The high roof allows a good amount of lights to enter, yet space isn't very brightly lit. The middle wall dividing two genders' baths is installed with marble tiles. Marbles have good property against water and the white tone is to blend with the existing walls and the floor.

Having this space seems to divide the programme into two programmes, hence divert the attention from the primary programme. Using the enormous space of the existing structure, it unbalances the focus of the programme. Therefore, removing the Bath element, or positioning it in a different area would be sensible.

CHANGING BOOTH

The use of designated changing booths seems sensible as it allows users to get to the programme quickly. However, it feels very enclosed and trapped due to the enclosure of the additional structures.



VR BASKETBALL COURT

The idea of positioning the VR Court facing the north creates a nice introduction to the programme. This is because of the positioned north of the Royal German Spa. As the main footpath and entrance are facing in the north, public walking in the park can view the game without even entering the space.

The use of high glass walls brings an advantage that makes the activity visible as it allows natural light to enter the space. However, during the summer the light cast in the afternoon time has small coverage.

The size of the space is immense with enough space to install benches and house a large number of groups to watch the game.

Displays the VR Game in Real Time



VR GAME



From analysing visual sequences, I began to focus on the open space. The VR game allows users to experience the outdoor environment of the existing site while they are playing the game in an existing confined space.

The element of boosting one's morale through spectator's cheering is very common in any sports game. In the gameplay, users will see virtual spectators cheering for them.

Despite the game being an actual sport, the VR world is fictional gameplay. The users are transferred from the court to the inside of existing Spa structure to create a connection to the reality. As there are many living organisms in the site such as birds and insect, they will be included to add depth in the context

NORTH VIEW



To analyse the visuals of my programme development I made a 3d model on 'Revit' with few systems and materials I analysed from previous precedents. I then used the software 'Twinmotion' to render the perspectives I developed after a few experimentations and used real-life light configurations to study the space of my development.

The idea of confining space similar to most of the traditional sports halls requires large volumes of space. Furthermore, natural light qualities are lacking and the structure is very plain and symmetrical.

ABSTRACT IDEA

PRECEDENT ANALYSIS

ORIGAMI is a form of art allowing freedom in design. Studying the origami, an integrative approach investigates the mathematical, architectural, and structural aspects of folded structures. This helps to understand how folding paper can be used as a mechanism to solve aesthetic and structural problems. Origami presents an interface to obtain cognition on form finding and spatial configurations and serves as a potent tool for further morphological explorations in the architectural design process. Due to the efficiency of origami modelling, this practice has gained popularity into a wide range of design applications and even led to the discovery of new forms and methods of construction.

- The origami-inspired glass exterior of the building makes it stand out from the repetitive surrounding buildings.
- A Double facade not only provides lots of natural light to enter but solves zoning rules requirements, energetic, fire-resistant and acoustic insulation too.
- The folded detail introduces mutability and the dynamic of the city. This element offers multiple views of the surrounding and changing its appearance dependant on the point of view, the hour and the season.

Floor Levels



Basque Health Department Headquarters
by Coll-Barreau Arquitectos
(Bilbao, Spain)



Light Metal Frames for
installing glasses and
supports the structure



2 layers of exterior walls
(Allows Ventilation)



The positioning of the building creates a gap in
traditional building contexts.



Facade and roof made with panels for easy transportation and installation.



Light Material Walls, possibly pliable and supported through angled slope geometry of exterior walls and interior wall structures.



Cavities to make the walls lighter and smart installation of ceiling lights.

Thin columns installed to support the long and high roof structure.

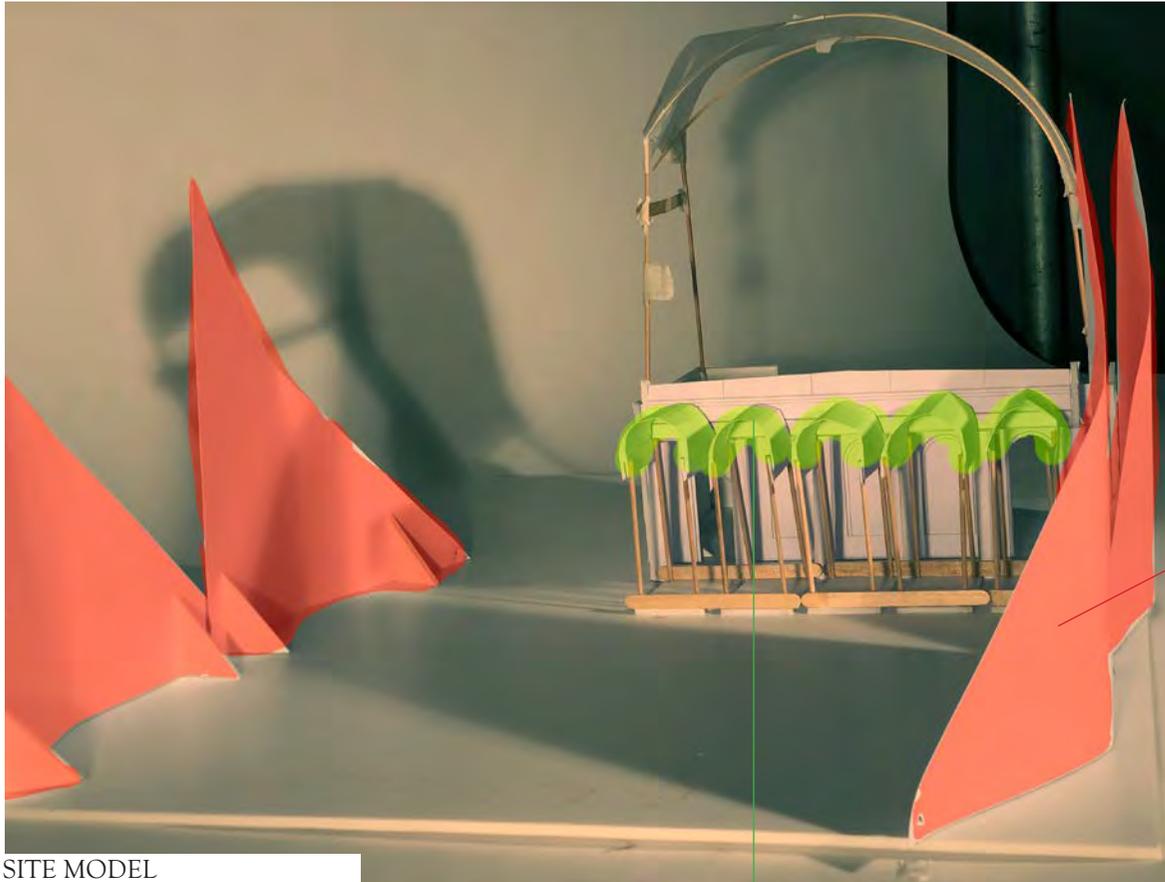
The cut-outs of glass installations define the characteristics of the casted natural light. The protruding roof structure creates a faint glow from the artificial lights situated on the floor around the structure.



Karuizawa Museum Complex
by Yasui Hideo Atelier
(Annaka, Japan)

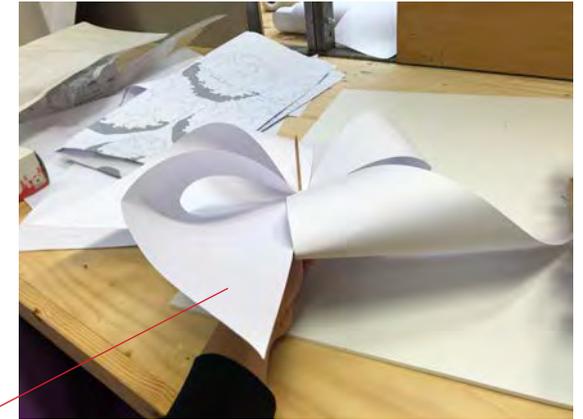
- The design of the structure was inspired by art pieces held in the museum which are appraised internationally. The form factor of Japanese craft such as Origami, Sensu fan and Byoby screen made of a single piece of paper, which gives an infinite possibility to be shaped in numerous forms are reflected in the structure.
- The elevated sharp lines of the structure were considered through the mountain scenery in the area such as Yatasugatake and Asamayama mountains which creates a contrast of the nearby museum with curved lines.
- The complex itself appears to be an artwork with such thoughtful consideration instead of just a facility next to the museum.
- The glass openings in the complex are positioned in a way that the light enters without any restriction of proportions and sharp edges

ABSTRACT MODEL AND ILLUSTRATIONS



SITE MODEL

Changing Booth
The arc ceiling defines the arc
of the opening of the existing
building.



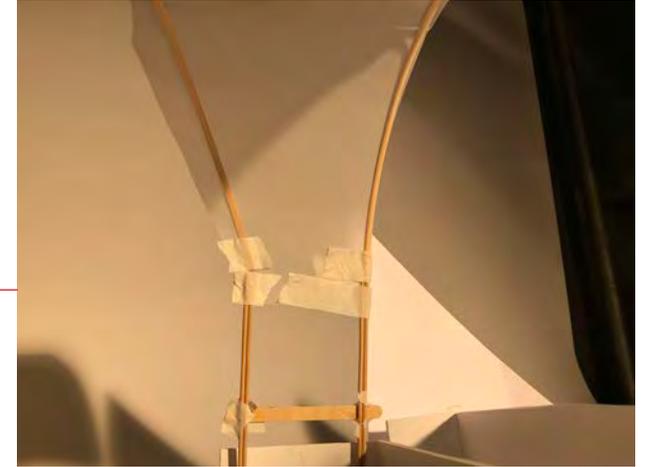
ORIGAMI FAN

The blades are cut and applied as
exterior walls in front of the Spa
building.

Analysing the origami forms, I developed a model with thin sheets of modelling papers for versatility of forms and pliability that of an origami. I used curve shapes to define the qualities of the existing structure such as arc openings and the bends in walkways. For structural usage, I started used columns to refer to the existing one and used as the main structural system for the roofs. This model is a development stage to a visual sequencing stage. The idea was to redevelop a confined space but upon further inspection, the quality of the model as its physical open space drove me to inspect open space programme.

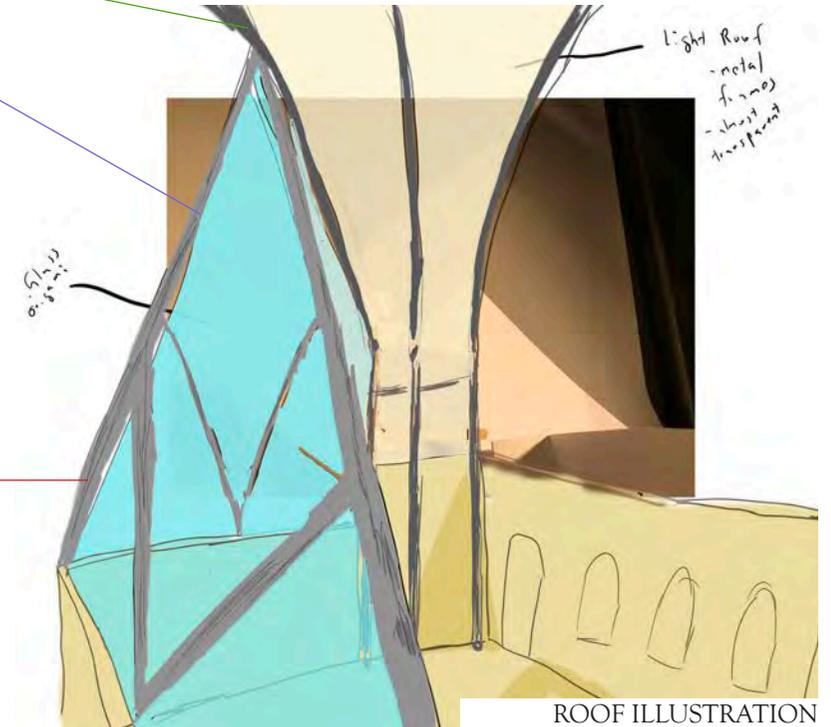


Basketball Rim



ROOF

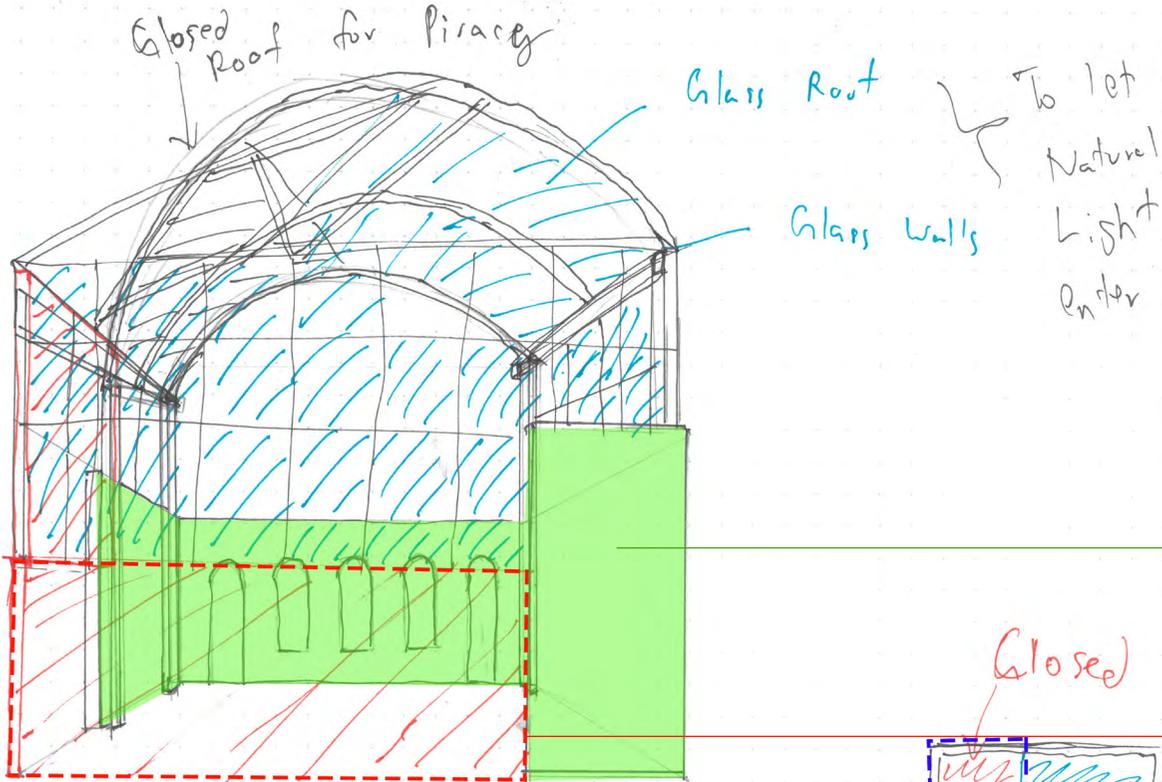
The ceiling is designed to match the round characteristic of a basketball. From visualising the basketball side of elements, I further illustrated a glass angled roof wall to match the diamond framing to resemble the basketball net. The material is glass to bring in natural light in the afternoon period of the day due to its positioning to face south.



ROOF ILLUSTRATION

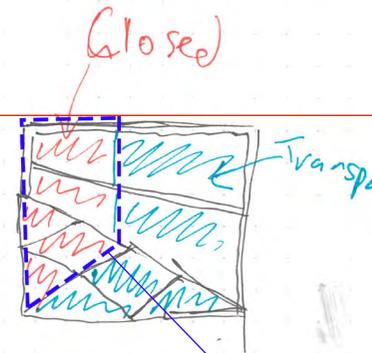
PERSPECTIVE SKETCH

- ◆ Added extra walls
- ≠ Glass



This side will be closed as it faces elevated landscape.

For Privacy in changing Room



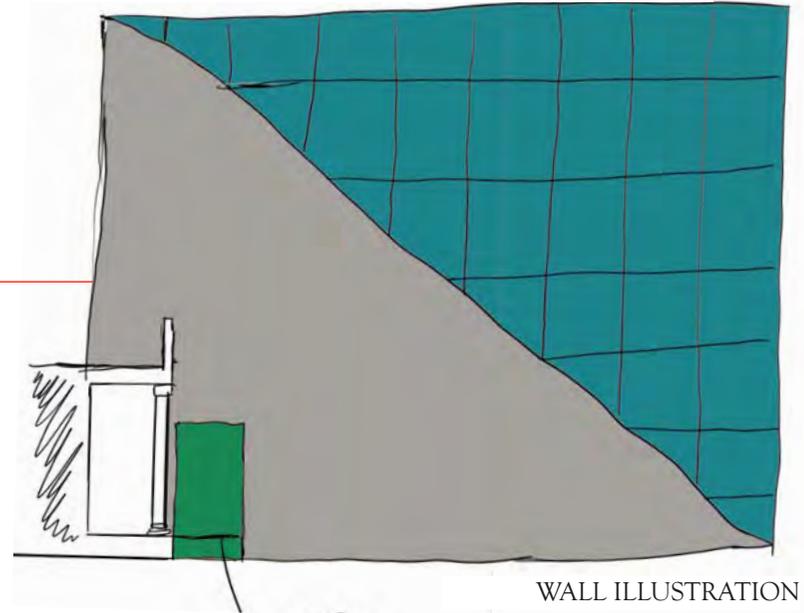
This space is closed to block the view from the high landscape of Egremont Gate Entrance

Chang.ing Room will focus on relaxation

- Good Natural Lighting
- Hot tub bath to share



VIEW OF THE PORCHE



WALL ILLUSTRATION

Analysing my model, the changing booth has a good quality of being used as a tunnel to transition from an old to new. The concept of the tunnel adds a focus on the existing arcs as it stretches from the existing to the new development of the programme.

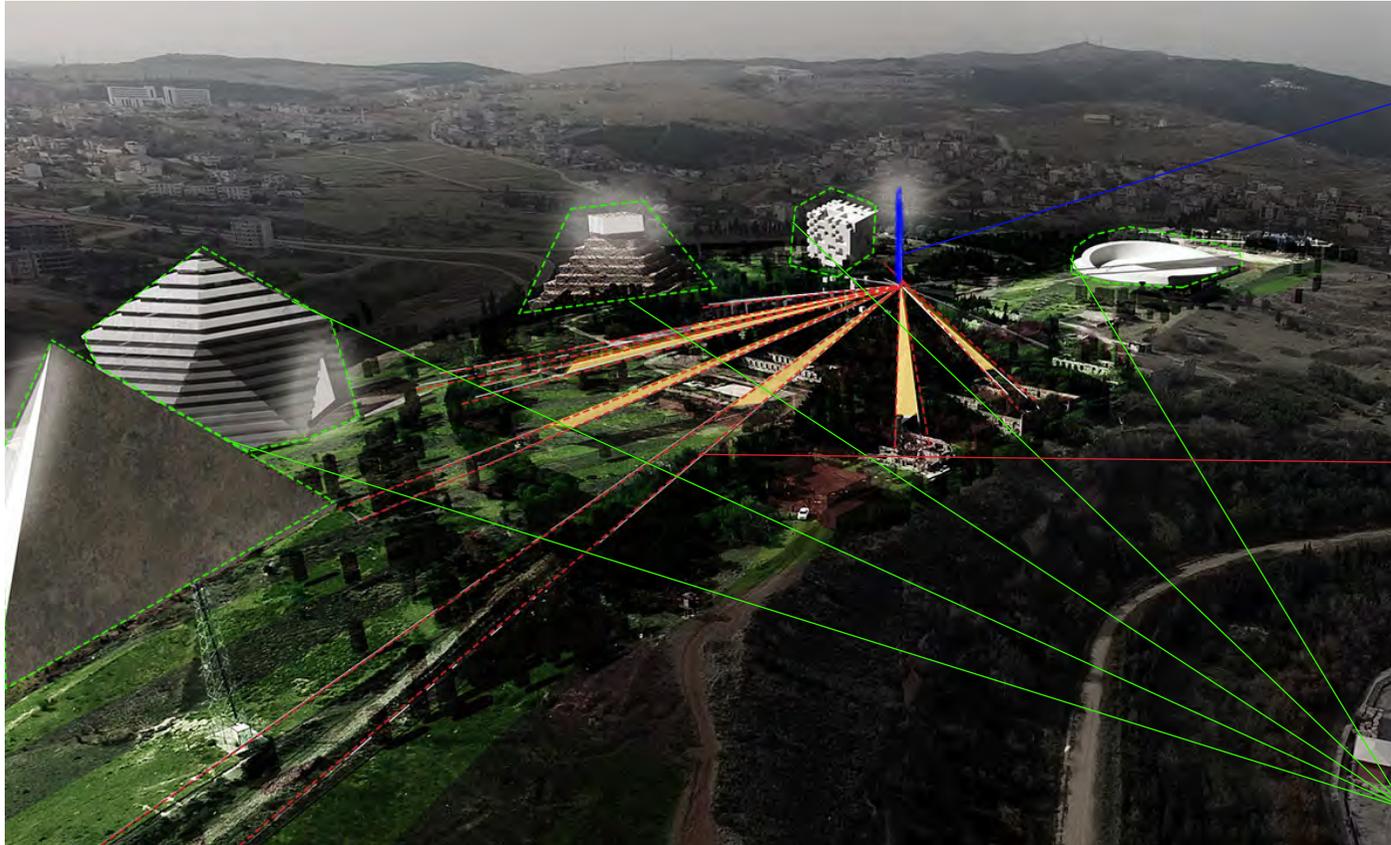


BOOTH ILLUSTRATION

My progression with the concept of origami wasn't successful in terms of structure, however, the ideas I developed of implementing elements of basketball helped me determine the key focuses. Moving forward, the design will focus on highlighting the elements of a basketball court and bring a modern twist to the existing structure's details.

DESIGN DEVELOPMENT 2

PRECEDENT ANALYSIS



Vision of Bandirma Park Competition by Building Office

The main column extrudes at a height that covers the tree level of the surroundings. This creates a connection to nature as well as structural support for the roof beams. From the source, the column is positioned at the centre of the market space, therefore it's height and beams extending from its direction acts as a guide to lead visitors to the market space.

Metal beams extend to a long path from a single column to create an open roof that covers a wide area. The idea of open roof uses fewer materials to highlight a bigger area while the openings allow for nature to impact the space, such as rain and winds. It makes the experience of visitors less enclosed and environmentally aware.

The scattered buildings are located at the end of the beams' paths and visitors are informed of its location through following the directions of the beams. As each building has different functions, the visitors are informed of the purpose through its individual characteristics.

The scattered building system to house a city landscape is different from traditional methods of roads and blocks of the building covering the grounds of the area in large volume. The scatter system preserves most of the natural grounds and could be considered environmentally friendly. As the surrounding context of the project is very similar to the Queen's Park's expanded with nature, this system can be beneficial to my programme. By scattering the structures, it allows creating different forms and shapes to give unique characteristics to each function spaces.

Doing so will also enable defining the hierarchy which is the VR Function.



Lazika Municipality by Architects of Invention



The columns are the main structure that supports two of the elevated structures. It enables the building to have the floating appearance and directs the volume of the structure to extend horizontally. This technique allows the structure to have void levels and the vision of surrounding contexts aren't obstructed in the process.

The lift pillar allows the users to access the upper floor quickly. This structure also forms a sub-category of support for the middle and the top floors.

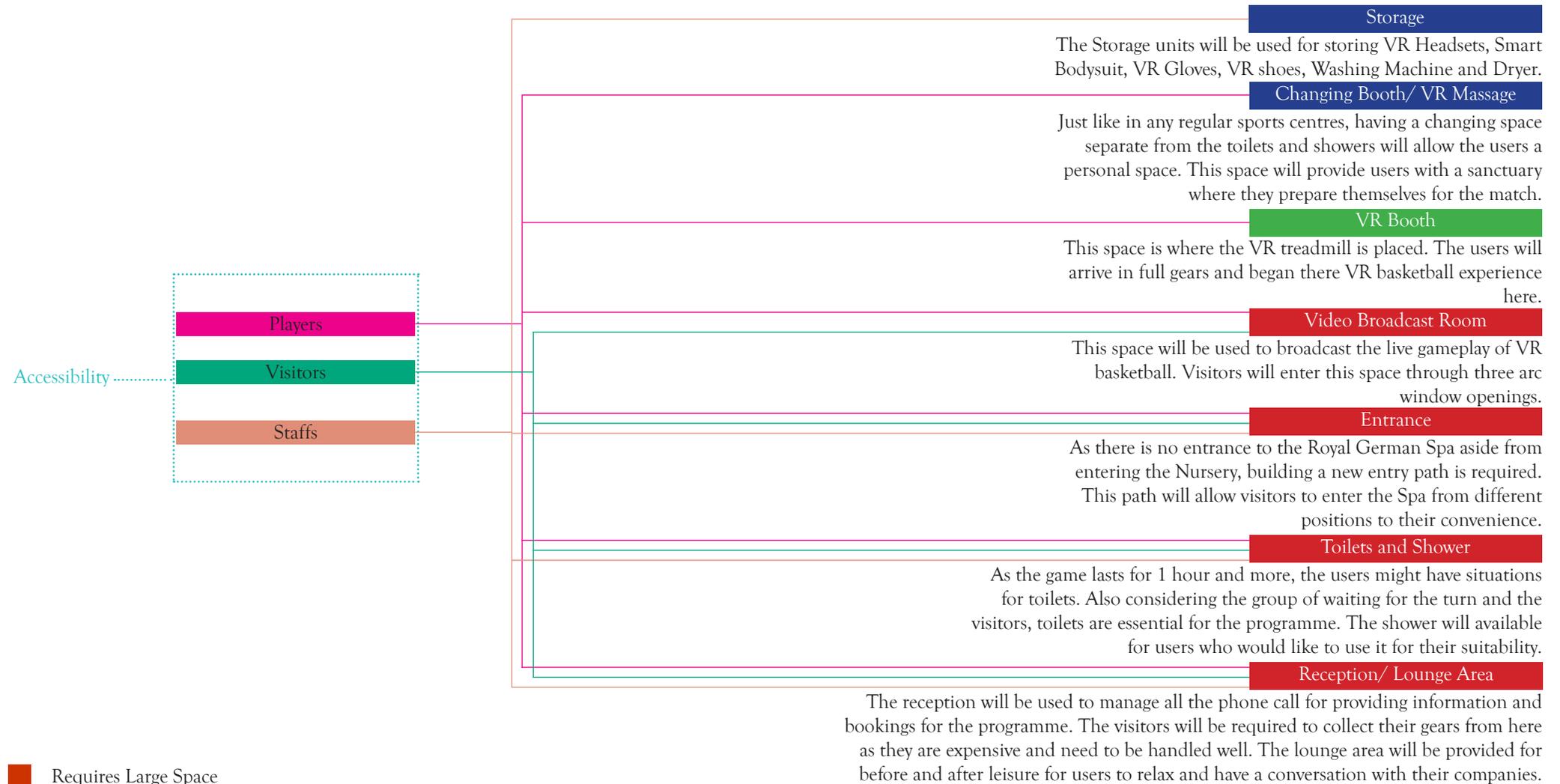
As the base of the top floor is where the top ends of the columns are positioned. The cavity in the centre of this structure reduces the overall weight of it. It also allows the natural light to enter from the centre curtain glass walls, which helps this large volume of space to be illuminated.

The Middle floor has an interesting geometry where the wall is curved at one end, possibly to reflect the light glow inside of the space. The columns penetrate it with each end connecting to the top and the bottom floors. This arrangement of columns; pillar penetrating the space for usage is very interesting. While it supports the structure to elevate it off the ground, some of these penetrating columns create an intriguing aesthetic inside of the space.

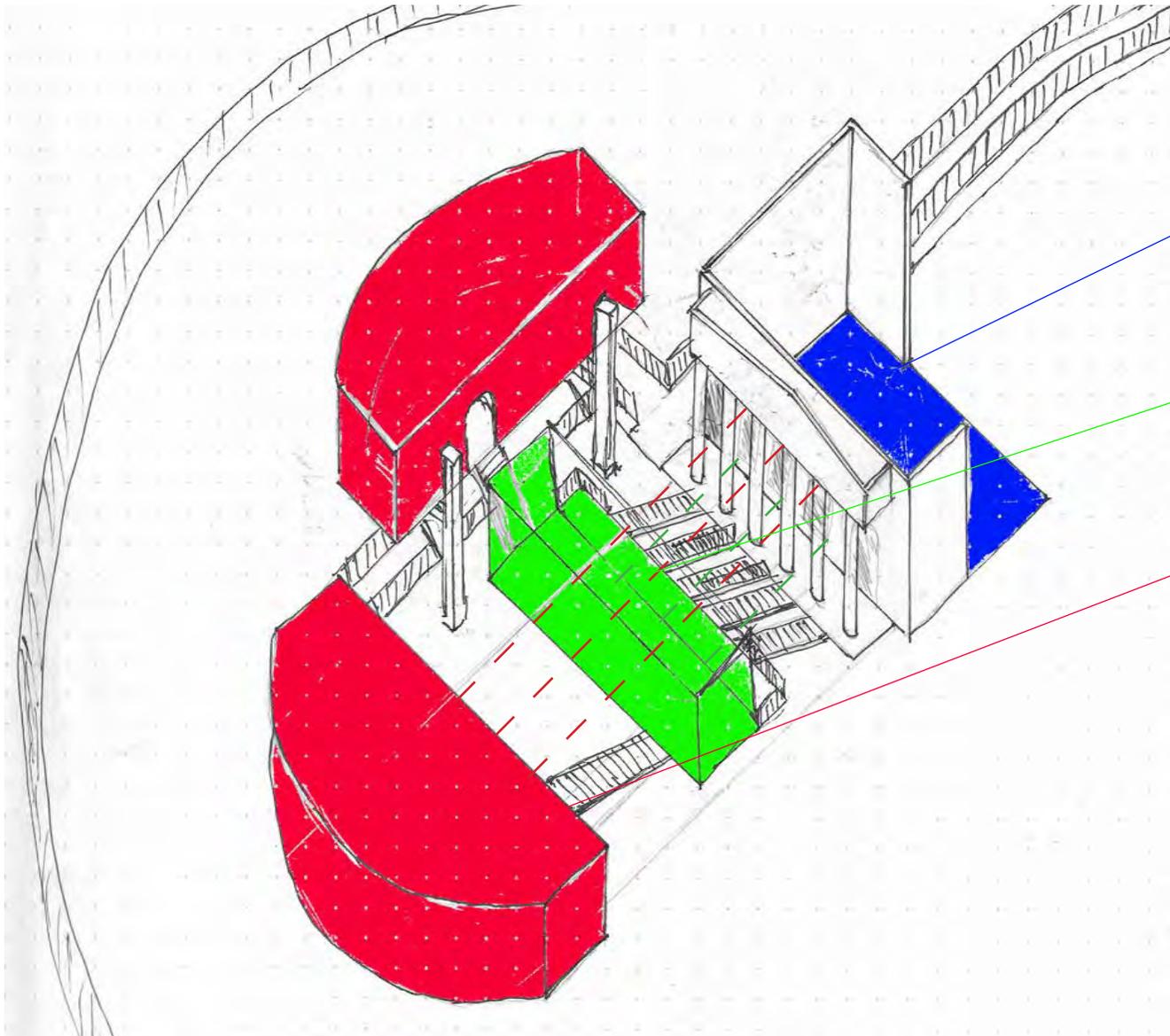
Analysing Lazika Municipality, the idea of using levels horizontally befits my programme in-terms of providing a context to design. As the Royal German spa has preserved columns and arcs from windows and doors, adjusting the levels of my function structures according to it will create a stronger connection between the existent and the added elements.

SCHEDULE OF ACCOMMODATION

KEY SPACES AND PURPOSES



SKETCH CONFIGURATIONS



The Reception will be placed inside the existing building. This is to put the main focus on the existing structure as it has a historical connection to the site. In order to do so, the additional structures will extend from the existing.

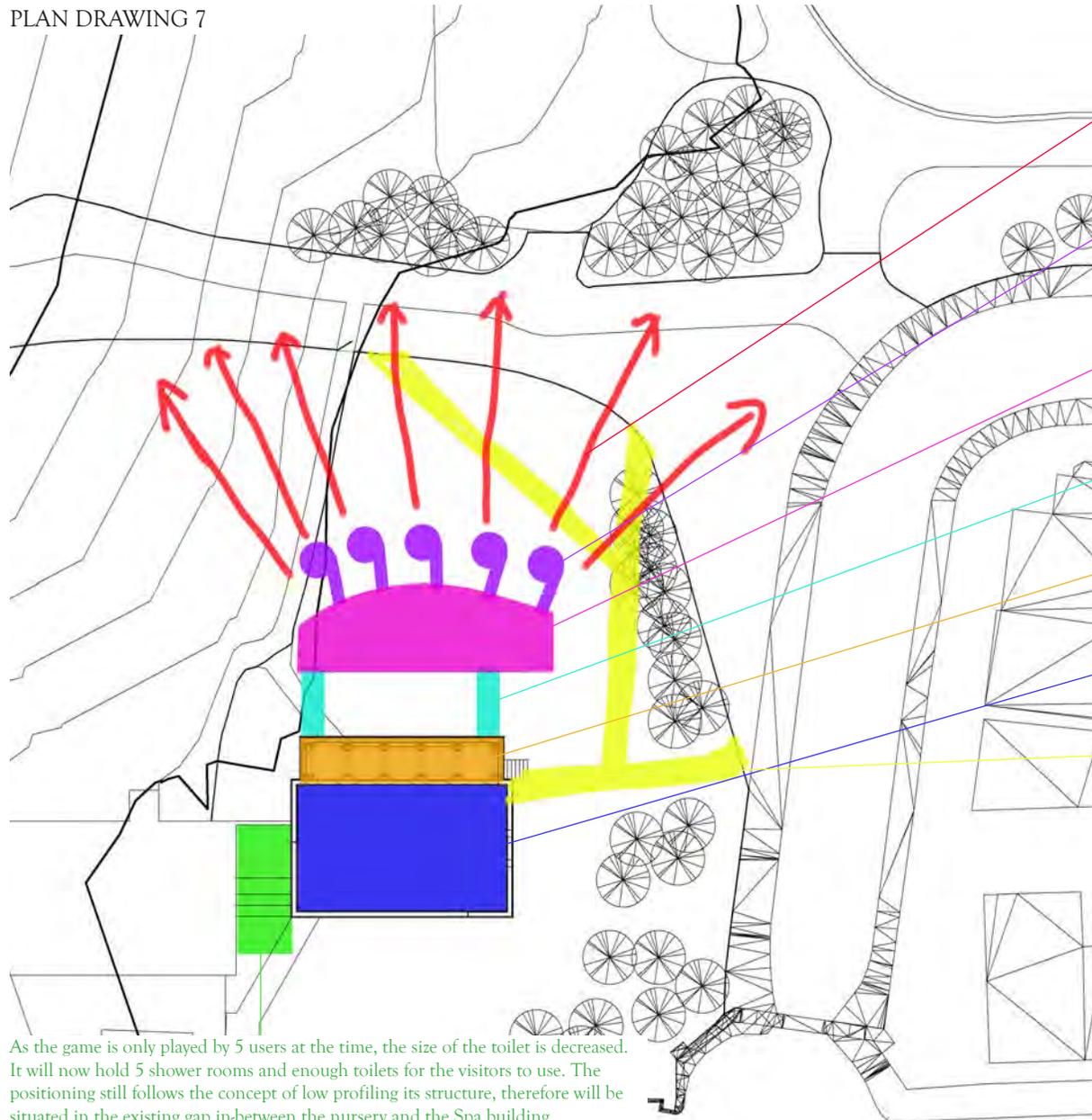
This platform will house the changing booths where the VR users will get changed before entering the booths. It will be elevated from the ground to reach the base of the window arcs to address its context.

The VR booths will now be divided into two structures. One will be positioned to face the north, while the other will face to the east. This is done so that the VR faces a wider context of the site, therefore it will be more noticeable by the public.

This drawing is a process of dividing the levels of function spaces. As through my research, I found the cluttered layout and multiple levels will benefit my programme more. This helps to make each function space unique and occupies less space of the site. The other benefit is to place other functions underneath the elevated structures which makes the most use of the space occupied by the programme.

AXONOMETRIC SKETCH

PLAN DRAWING 7



As the game is only played by 5 users at the time, the size of the toilet is decreased. It will now hold 5 shower rooms and enough toilets for the visitors to use. The positioning still follows the concept of low profiling its structure, therefore will be situated in the existing gap in-between the nursery and the Spa building.

The positioning of the booths now faces a wider context of the park. As it is levelled high off the ground, greater numbers of the public will be able to see the activity inside of the VR booths.

The VR booths are now limited to 5 users at a time. This is to address the progress of technology, therefore they will be playing against AI (Artificial Intelligent) opponents. The base of these booths will be the same height as the existing column's top and it will be accessed by individual bridges extending from the platform housing the changing booths.

This platform will hold personal changing booths for users to change into. These booths will be the point where the users have their personal space for preparing themselves for the game. It will be elevated to match the column's height to form a connection with the existing. As the platform level is high off the ground, users will have some time to admire the view of the park before transitioning to a VR world.

These stairs will lead to the elevated platform where the changing booths will be located. This creates a level which transitions the space from old to new modern added structures.

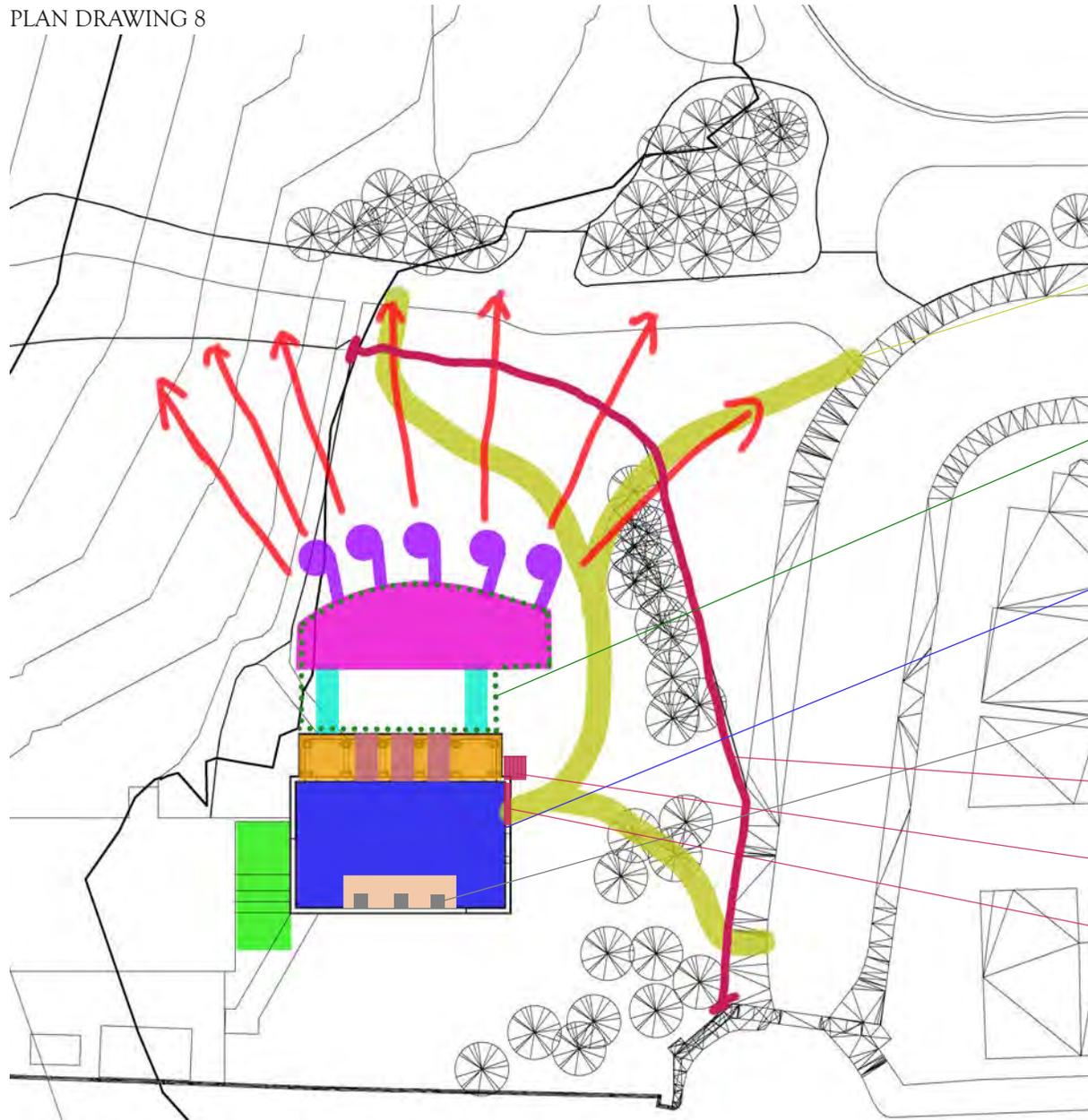
The existing porch will be used to connect the existing to new. This configuration uses the gaps in columns as a gateway to the path that leads to the VR function space.

The reception is positioned inside of the existing structure as it is the first phase of the programme. When the users enter the reception, they are greeted with the historical monument, therefore it will make a strong first impression to the visitors.

The pathways now have three entry points. Each entry points are facing the main paths public enters the space from. Two of them faces the walkway that connects from the Egremont Gate and the Pond while the other face gate of the Park Street arch.

From analysing my schedules further, I decided to remove some elements of the programme that I developed previously. As the park is an ideal location for physical activities, the parking space has been removed to encourage visitors to travel to the site through physical means. The bathing space is removed to use the existing space for the reception to make a stronger impression when entering. Due to the bathing space requiring a big space, it is also unideal for a change made in a group of users. Hence, 5 shower rooms will be efficient to use and also efficient in terms of space occupied by the programme.

PLAN DRAWING 8



Looking back to page 22, basketball plays have very interesting movements. Applying this to the pavement that leads to the entrance of the programme, it creates a depth of basketball's context. The curved pavements also help the visitors to see the programme structure in different angles as they approach near with angular movements.

This space underneath the elevated platform for changing booths will be a leisure room for the visitors. It will broadcast the VR gameplay of the users to the people situated within this space. Having this room will introduce VR basketball to the visitors who are hesitant to attempt it.

The reception will be elevated to the base of the window openings. This is to allow users to walk through the window arc openings and enter the video broadcasting room of VR basketball. Additionally, the wide size reception will also function as a lounge room. This space is for visitors waiting for their turn or the users who are done playing the game to relax and get refreshments.

The Storage systems will be positioned within the reception as a furniture unit. As VR pieces of equipment are very compact in size, it is not necessary to designate a big space to store it.

The existing fence units will be removed on the mark areas for the new walking pavements.

The existing stairway to the porch will be removed as it holds no purpose.

This portion of the wall will be removed for a new entrance for the programme.

MATERIAL ANALYSIS

Smoked acrylic

Other Variation:

- Polypropylene
- Timber
- Steel
- Aluminium

Absorbent Foam Paddings

Powder Coated Solid Steel

Other Variation:

- Galvanised Steel
- Aluminium

Polyester with polypropylene Net

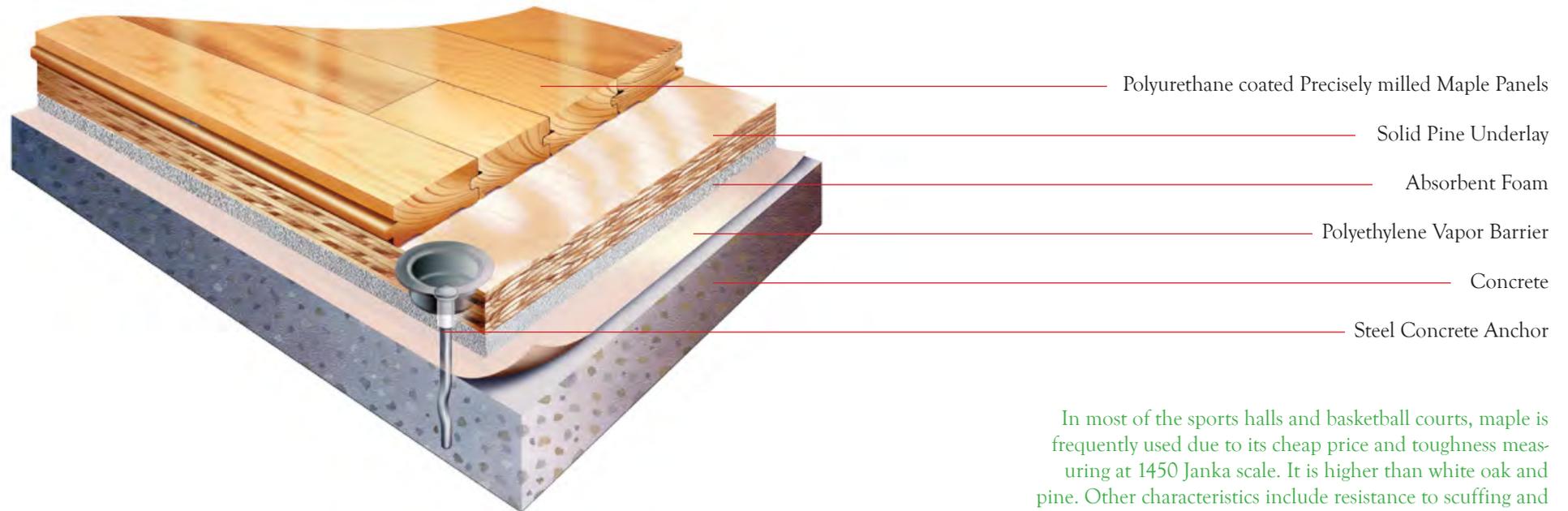
Other Variation:

- Nylon
- Polyester
- Galvanised Steel
- Steel



To decide my material palette, I researched the materials found in basketball space. Using the basketball court materials, the intention of the programme can be introduced with visual. Additionally, the court system of basketball has a very strong infrastructure as the average basketball players are very big and stronger compared to the average human's physique.

Basketball Post of professional league



Polyurethane coated Precisely milled Maple Panels

Solid Pine Underlay

Absorbent Foam

Polyethylene Vapor Barrier

Concrete

Steel Concrete Anchor

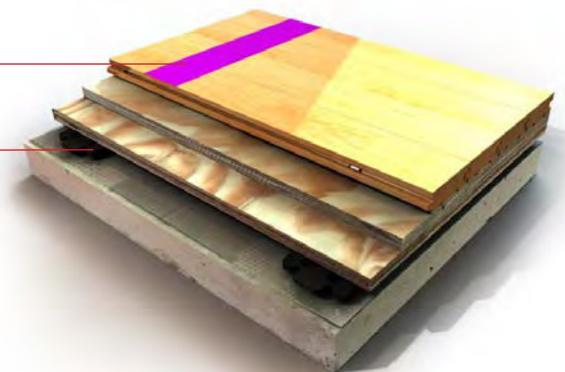
In most of the sports halls and basketball courts, maple is frequently used due to its cheap price and toughness measuring at 1450 Janka scale. It is higher than white oak and pine. Other characteristics include resistance to scuffing and scratching and has good shock resistance.

Anchored Basketball Floor System

The system of basketball floor is very robust but cushioned at the same time. From personal experience of playing basketball, the feel of the basket court is completely different from the regular wood panel floors. To bring such experience to my space will give the space a unique characteristic of such flooring. It then becomes a method of introducing the purpose of the programme sensually.

Acrylic Paint finished with thick coating of varnish

EPDM Pad



The floating floor system has exactly the same construction principle but without the anchor. The difference is that it is elevated slightly using a pad made of EPDM and provides better cushioning.

Floating Basketball Floor System

MATERIAL PALETTE



Galvanised Steel

- It has incredible longevity with “85-micron” coating delivering a life expectancy of “30 years or more”
- Sustainable due to longterm protection, therefore less maintenance needed
- Cost-effective as the paint system of steel is “35%” more expensive than hot-dip galvanising according to a source
- It has faint glow in texture, therefore less flare and reflectiveness

This material will be my primary material for supporting structures.

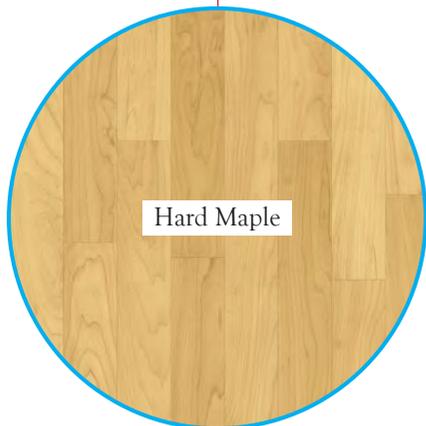
- It offers optical clarity
- Has good resistance of sunlight and excellent weatherproofing
- Good rigidity with impact and excellent strength
- It offers excellent “dimensional stability and low mould shrinkage”

All the roof units will be built using sheets of 20 mm thick acrylic glass.



Smoked Acrylic

Recyclable and Reusable



Hard Maple

- It is widely used in basketball courts due to its hard, light, elastic and tough properties
- Easier to clean due to its exceptional pore structure
- Mostly stable and only shrinks lightly
- Offers good rigidity from its density at “0.62g/ cm³”

This material will be used for flooring surface.

- It offers versatility in shapes and properties as the making process is carried off-site
- It is cost-effective as it reduces site disruption, safety concerns and project schedules
 - Resistant to mould, natural disaster and fires
- Offers sound absorption, thermal mass and low maintenance

This will form the extensions of the floors and walls at ground level.



Precast Concrete

PRECEDENT APPLICATION AND SYSTEMS



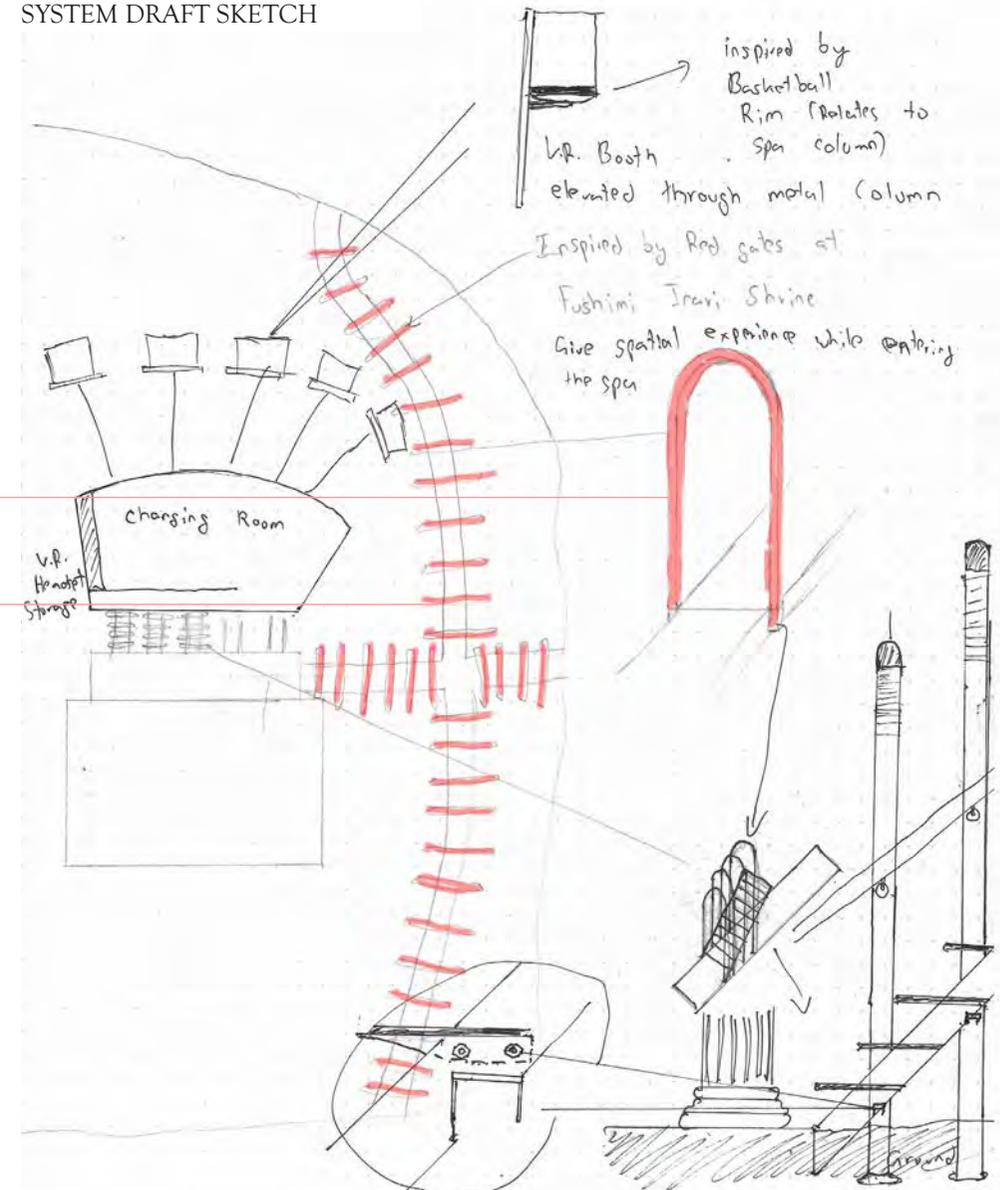
Fushimi Inari Shrine, Southern Kyoto

The arcs highlight the opening of the existing arcs. The idea of arc following pavements through the site extends the range of visitors' view. It creates the atmospheric element of informing visitors of their location and guides them to the entrance.

- The Idea of Arrays of Gates that serves as navigation through space.
- It marks the historical Tori gates that are the main attraction for the tourists.

These arrays of gates relate to the Spa as the spa has tall arches as doorways and windows. They are very fascinating to look at and its grand stature makes the purpose of walking enjoyable. Building arrays of these arches will affect the space spatially and systematically as they can navigate users in the clustered design of space.

SYSTEM DRAFT SKETCH



To highlight the existing structure further, the positioning of arc arrays of tubes will be symmetrically positioned to follow the existing arcs. Focusing on the existing structure and removing the arc element from the walkways reduces the volume of materials used.

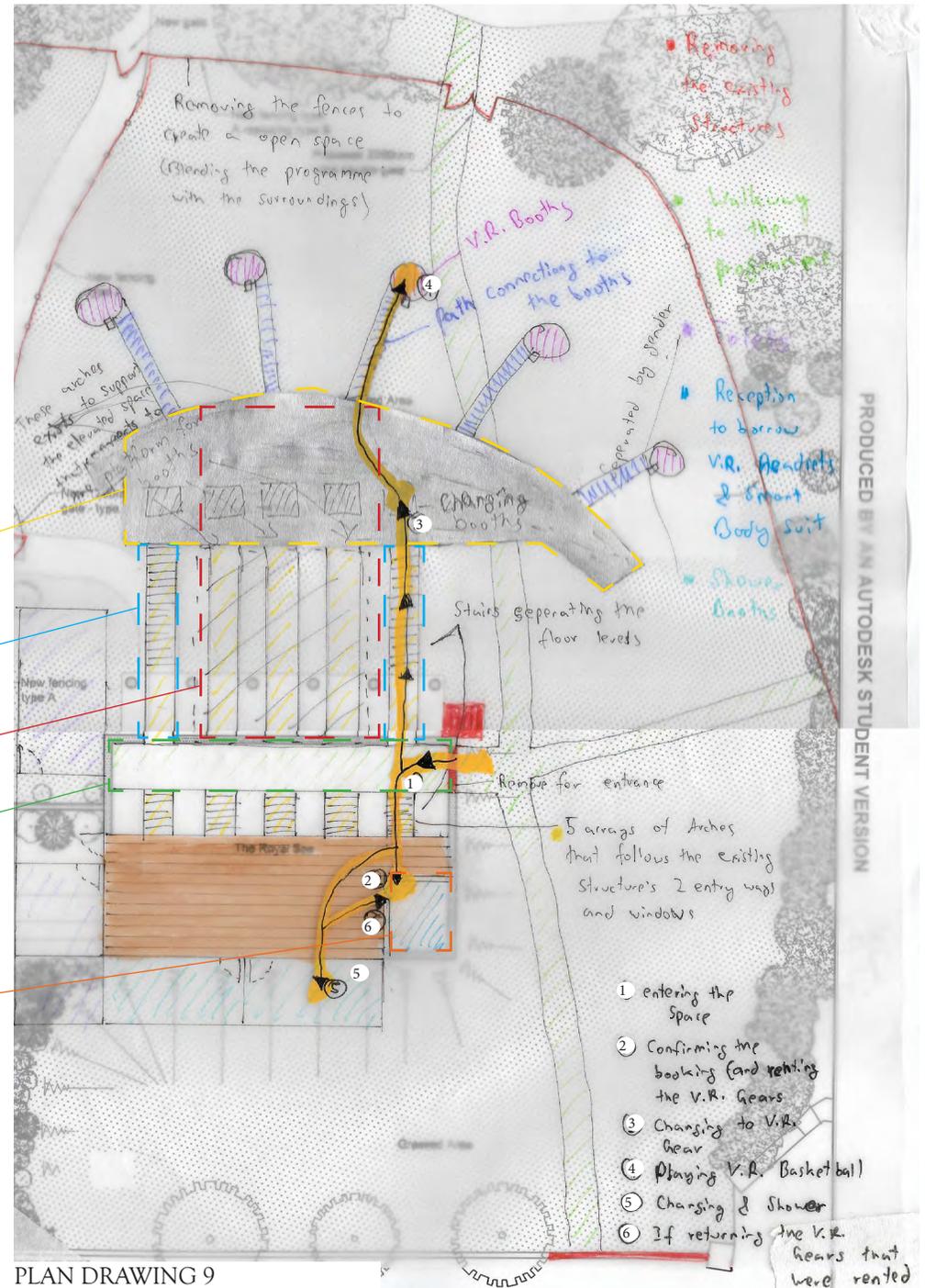
- The elevated floor is curved to allow better angles of surrounding views.

- Two arcs from the door positioned will stretch to follow up to the elevated platform.

- Three arcs following the window openings will extend to support the elevated platform.

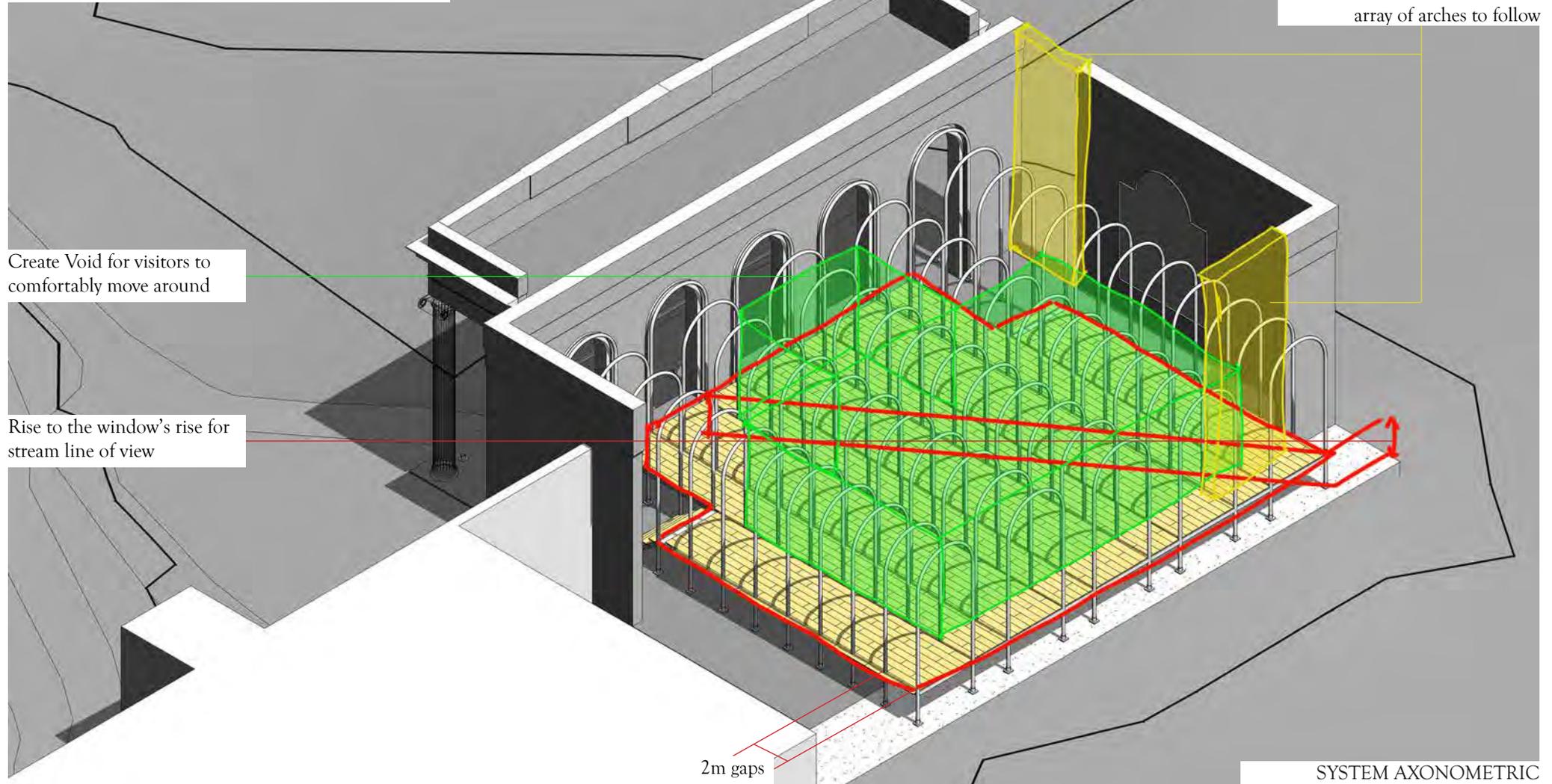
- The reception floor will be pushed back 2 meters for the entry path.

- The reception will be positioned closer to the entrance opening for accelerating this stage of the programme and hastening to the primary programme of VR basketball.



PLAN DRAWING 9

Proceeding with the array system, I removed some portion of the wall on the south and east sides to continue the array system and for entrance purposes. I further extended the flooring with concrete floor to create a contrast in texture and creating a bigger reception/ lounge space.

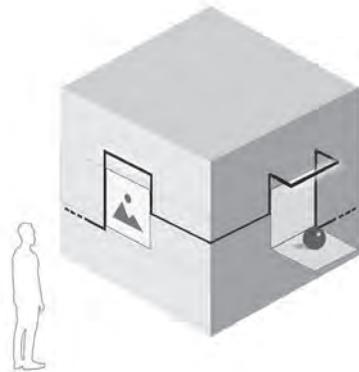




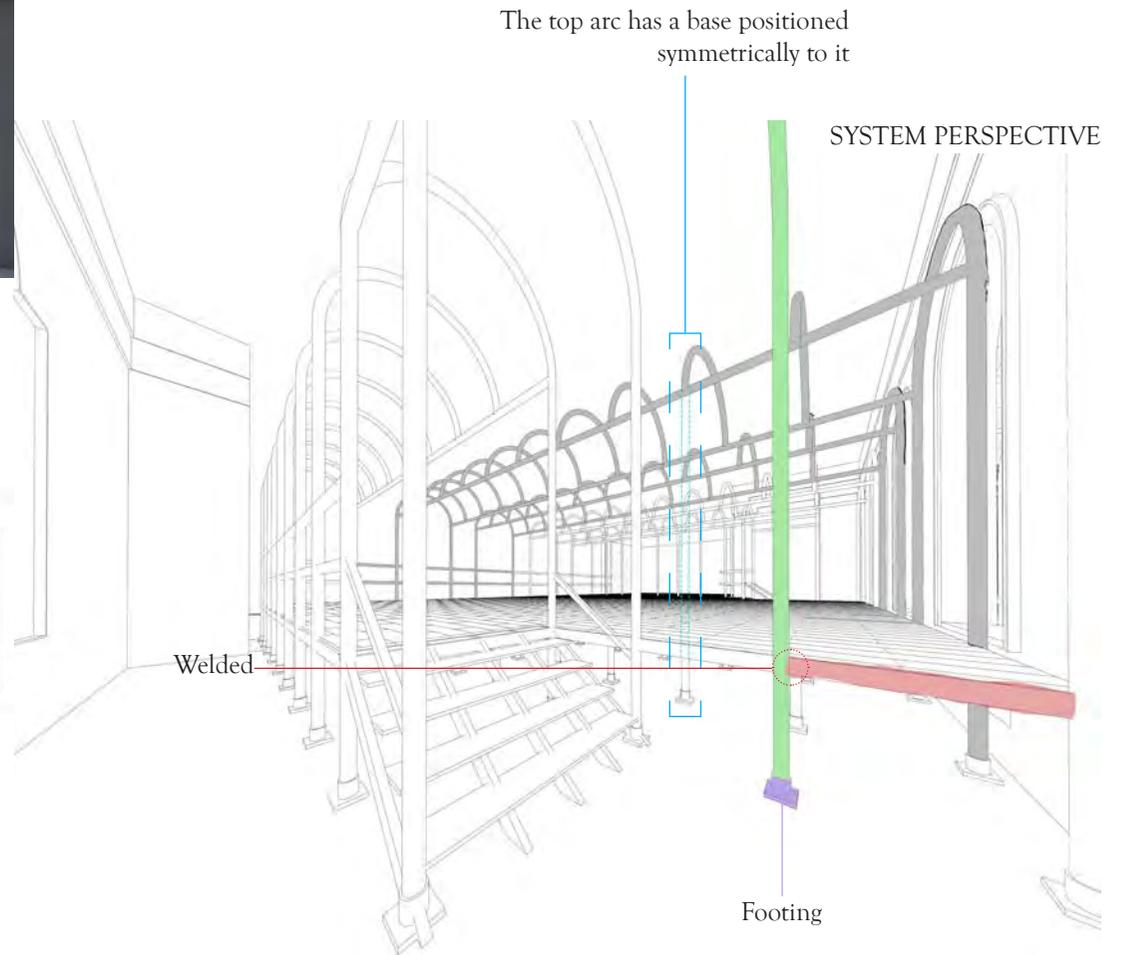
Museum of Hamam by Studio Vertebra Work

- The interior space has very simple yet attentive use of metal frames that highlights the works at the display. The shape is very linear yet follows the principle of the interior space.

- Metal frames entering the archways and curving at the arc of the ceiling as shown at the top images also enables the simple frame to highlight the building structure.



The system of metal arc tubes are light in weight and two beams extending from the front of the arc tube unit to the last one will be able to hold the top arc of remainders. The base of the elevated floor of the reception will be held through metal framings which are welded to the footings of the tube arc units.



Implementing the design idea of framing from Museum of Hamam, it helped me to create space within arrays of arc tube units which were influenced by Fushimi Shrine. With the application of these two precedents, a simple existing arc will be viewed in a different way where the opening view follows from inside of the structure to the outside nature-filled park.

- This Surreal interior is built entirely from wire mesh with the intention of imitating sacred spaces. It comprises arches, domes, colonnades, columns mainly based on Italian basilicas designs. Space also highlight living organisms like birds and arches that house trees and plants.

- The idea of bringing big monumental structures and also focusing on the animals and nature influenced me to implement ideas of nature to my design. As the Queens park is filled with trees and assorted plants, the gaps in-between each array of arches will be filled with metal frames of tree branches influenced. These also have the system of mesh, as many of these branches acts as a strong structure that creates hollow walls between each array.

- These branch-like frames also create an obstruction of view within the gaps and users are, therefore, led to focus on the arches to see linear view within the site.

The concept of this architecture can be applied to my programme for bringing outside contexts within the programme structures. As the site is located in the park filled with vegetation, using this approach to bring the element of trees can represent the park visually. Furthermore, the gaps between the arcs can be used for installing columns for the roof. Hence applying this idea can benefit the programme to have a system and a structural context of the site.

Planted Vegetation

Wire Mesh Bird Sculpture



Wire Mesh Installation in Private Royal Event by Edoardo Tresoldi, Abu Dhabi

Column for the roof structure

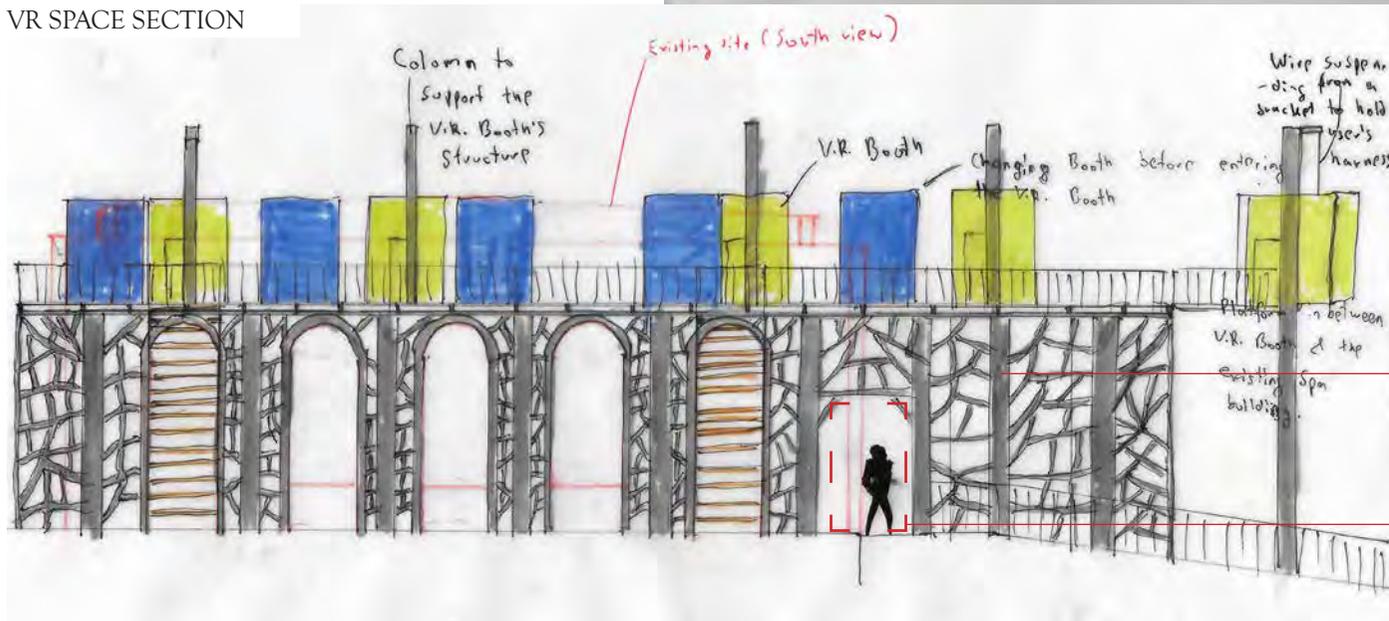
Transparent Roof

SPA SECTION



Branch mimicking the tree which is then welded to the arc tube units at the bottom and the next roof column

VR SPACE SECTION



The Elevated platform requires a stronger column to support the weight, therefore these column's thickness will have similarity to the Spa's Greek-style column. The tube units stretching from the three window opening will also add structural support to the elevated platform.

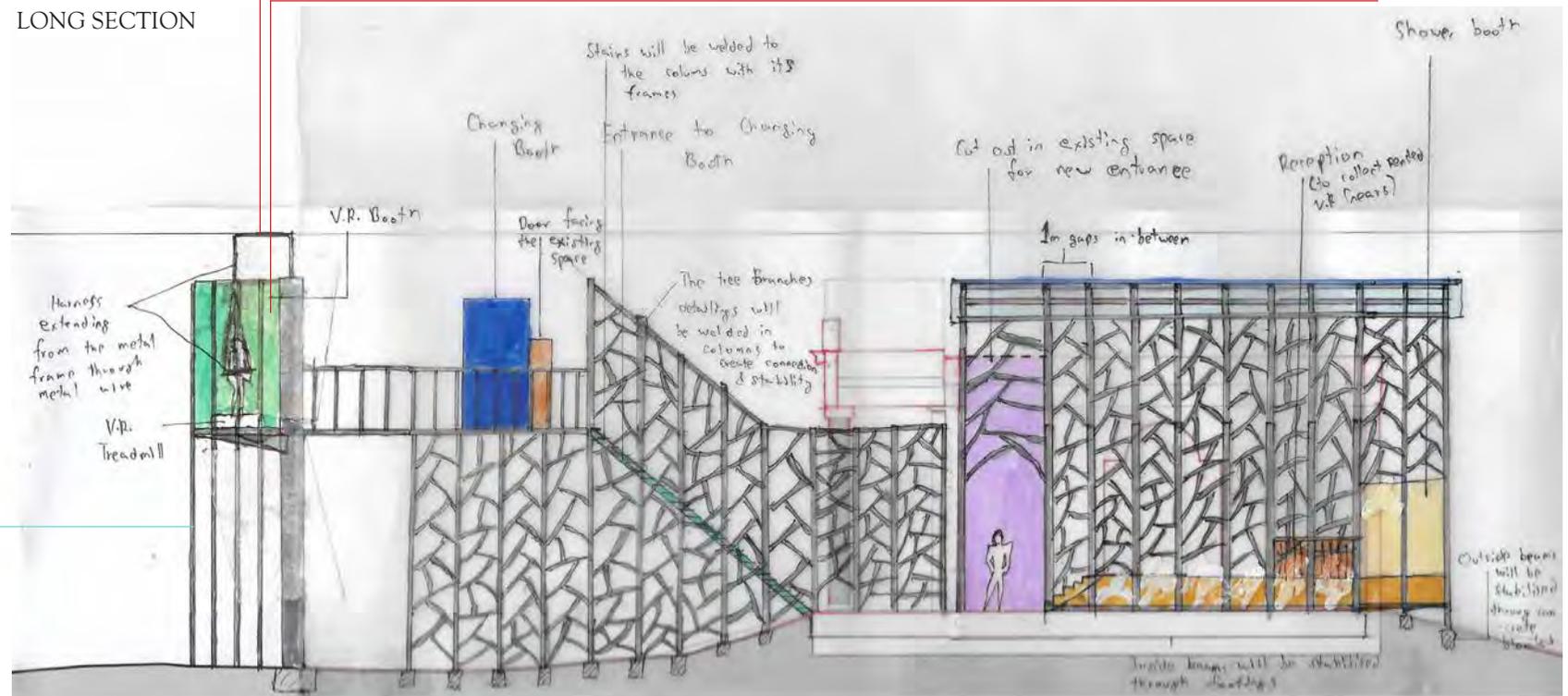
Opening for pavement walkway

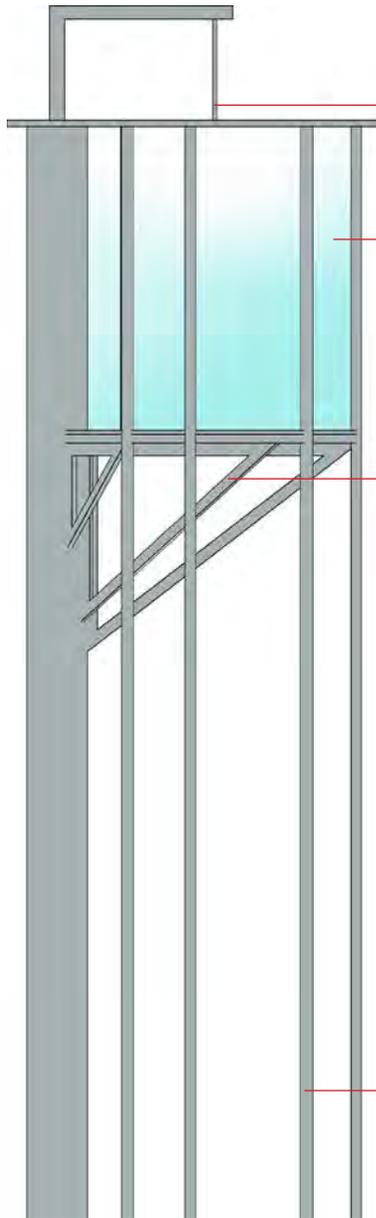
The idea of columns for VR booth is to create a connection of the new space to the existing. Analysing the fluted greek columns, to address the cavities I designed long horizontal beams that support the roof and the floor frame of the booth structure. Furthermore, these beams will also be used as a framing for the glass installation.

The metal frame extending to hold the roof will be a structure that will be used to install rope for the VR treadmill. This rope installation allows the users to be braced within the treadmill boundary.

The glass material will expose the users to the surrounding and vice-versa

LONG SECTION



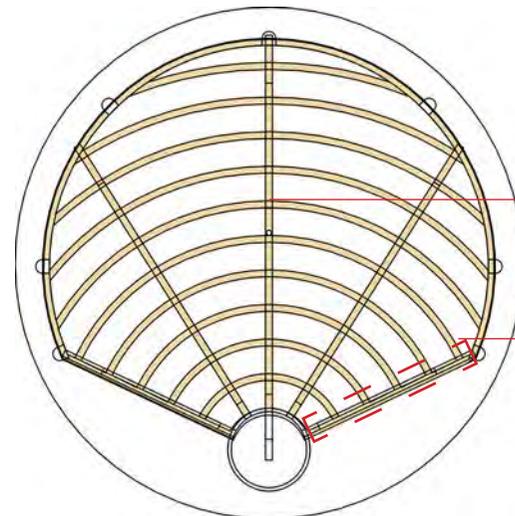


VR BOOTH

Rod to attach suspending rope for VR treadmill

Acrylic glass for clarity and keeping the consistent material palette

Frame for installing floor frame



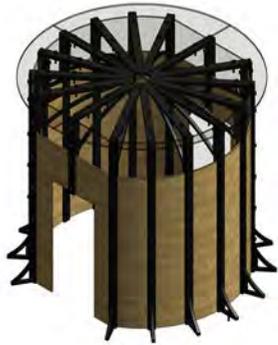
VR BOOTH'S FLOOR FRAME

Frame for the floor

Entry

Beams for installing the glass and providing additional support with the overall structure

CHANGING BOOTH 1



The size of this booth is fairly large to allow comfortable space for users to relax after the VR game. However, due to its heavily metallic framing and size, it cramped the space and looked better aesthetically than the VR booth.

CHANGING BOOTH 2



To minimise the aesthetic, this booth has a simpler aesthetic with a tall roof to allow natural light cast. The concept of curtain entry doesn't work against wind and the metal visible metal framing made it the primary focus.

CHANGING BOOTH 3



Steam Bending System

The idea for changing booth is to match the aesthetic of the VR booth, therefore it has a round shape. The structural material for the changing booth consists of steel and maple wood. Maple wood is used for its reliable properties and the steel is used for the supporting framings. Having a contrast of natural wood material wall in the changing booth and the translucent acrylic wall on the VR booth, the second phase of transition is highlighted. And, continuing on the third phase of the VR world.

In order to hide the metal framings, this design provides a clean aesthetic. The frames are hidden inside of the maple wall and the door system is sliding which is unaffected by the wind. The roof is an acrylic sheet which consists of four sheets of industry-standard to form the clear roofing for light.



Agri Chapel by Yu Momoeda

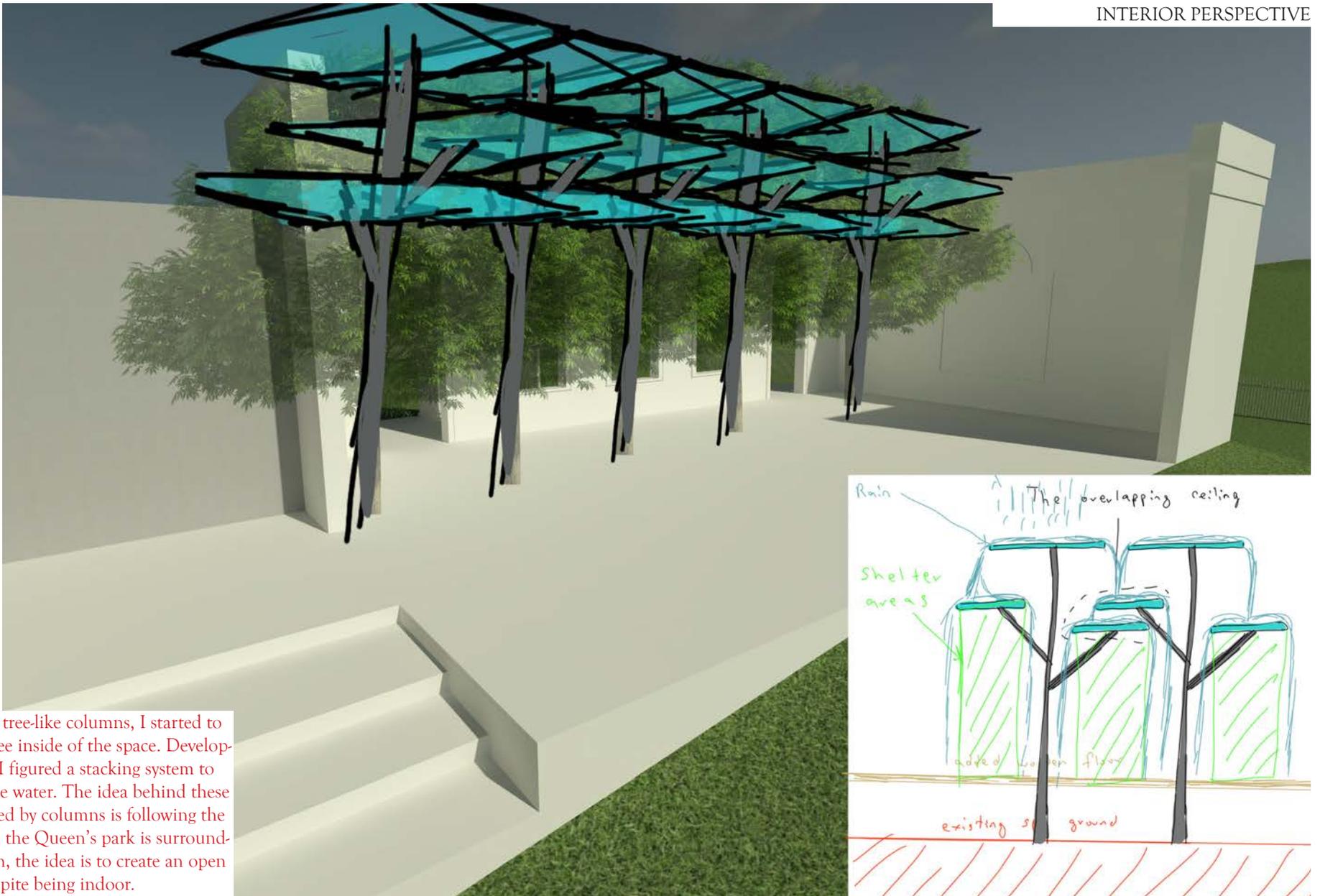
The timber columns vary in thickness and hold the roof structure. These tree-like columns have 8 branches each which stretch further up into smaller scale columns through supports of the bottom thick columns.

Thin strings of metal plates are coated white to match the robust walls. These plates are stretched vertically and horizontally to brace the wood columns in place and provide extra structural integrity.



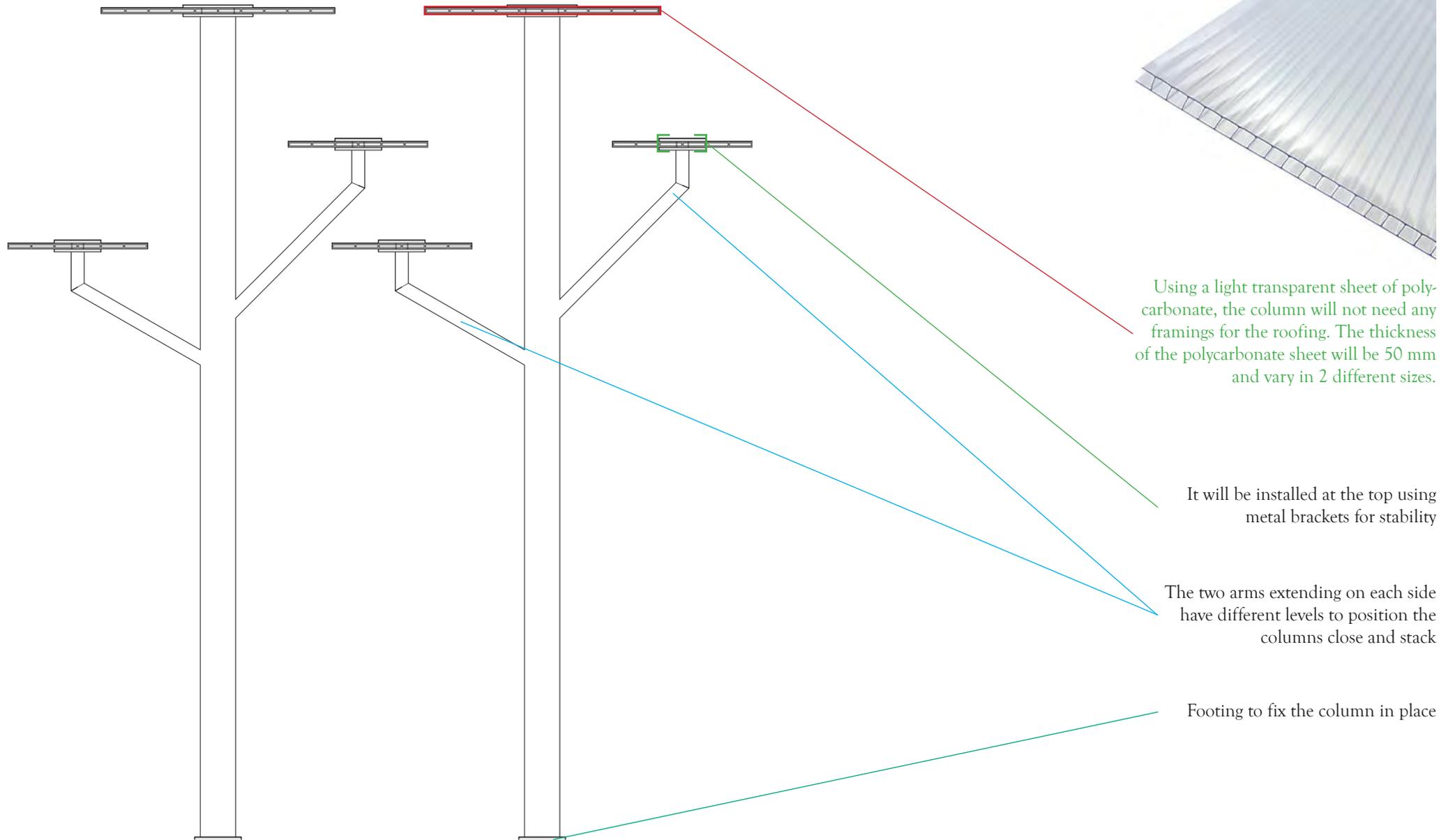
The spatial natural lighting is very calming with lots of natural light entering through glass openings in the walls. The tone of white walls brings a nice glow to space and keeps it well lit.

The concept of Agri Chapel serves my programme to bring the surrounding nature's context. As my focus shifted on creating an open structure for my design, the element of tree-like columns can be used as a column to support the roof of the structure. The existing building of the spa has a void roof, therefore the application of the smoked acrylic can be done for roofing which enables the space to have good access to natural light.



Exploring the idea of tree-like columns, I started to envision the actual tree inside of the space. Developing this idea further, I figured a stacking system to disrupt the flow of the water. The idea behind these tree-like roof supported by columns is following the principle of a tree. As the Queen's park is surrounded by green vegetation, the idea is to create an open space atmosphere despite being indoor.

TREE COLUMNS



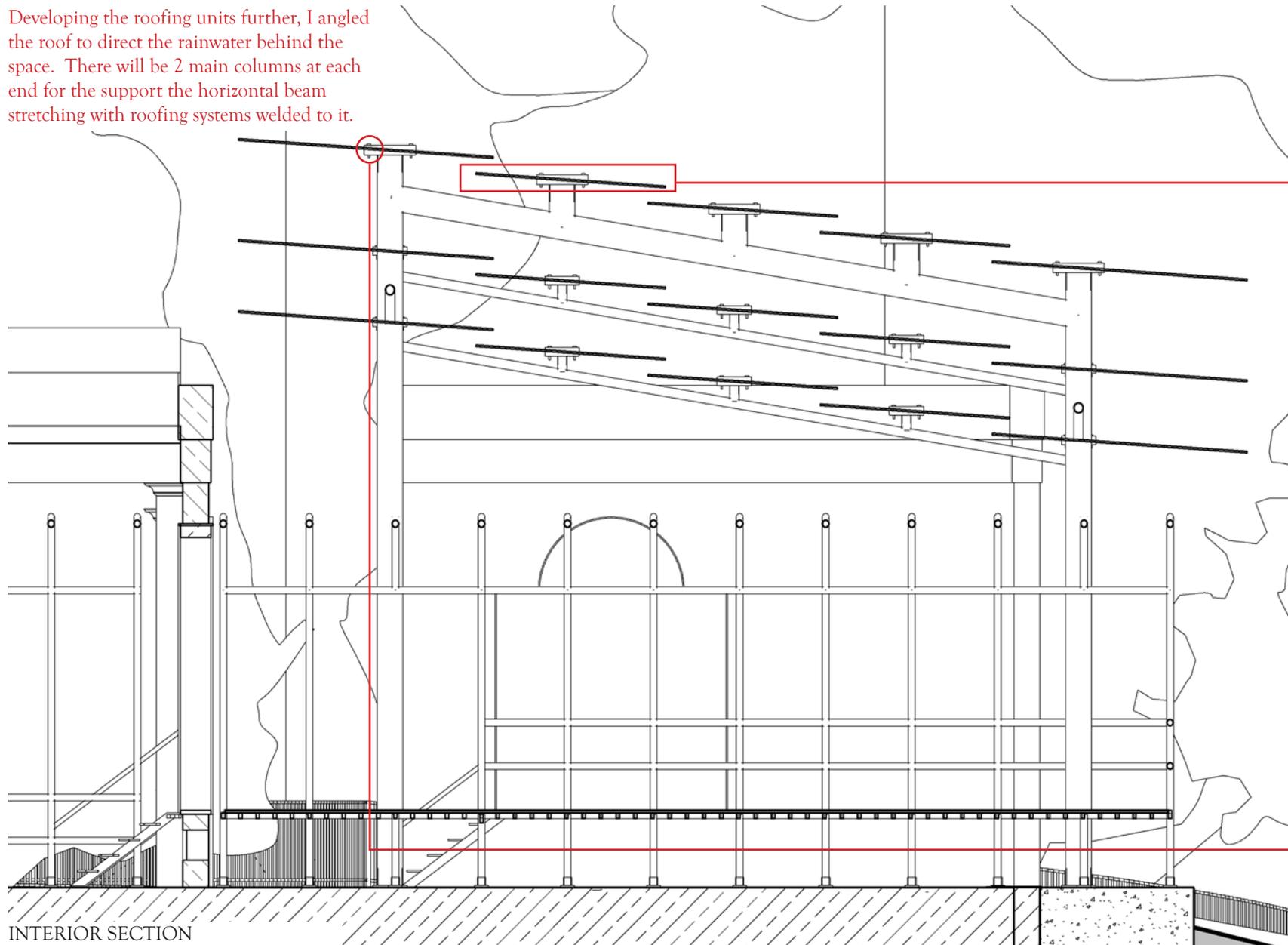
Using a light transparent sheet of polycarbonate, the column will not need any framings for the roofing. The thickness of the polycarbonate sheet will be 50 mm and vary in 2 different sizes.

It will be installed at the top using metal brackets for stability

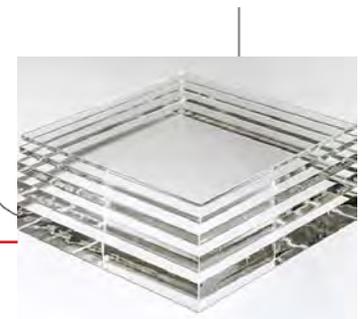
The two arms extending on each side have different levels to position the columns close and stack

Footing to fix the column in place

Developing the roofing units further, I angled the roof to direct the rainwater behind the space. There will be 2 main columns at each end for the support the horizontal beam stretching with roofing systems welded to it.



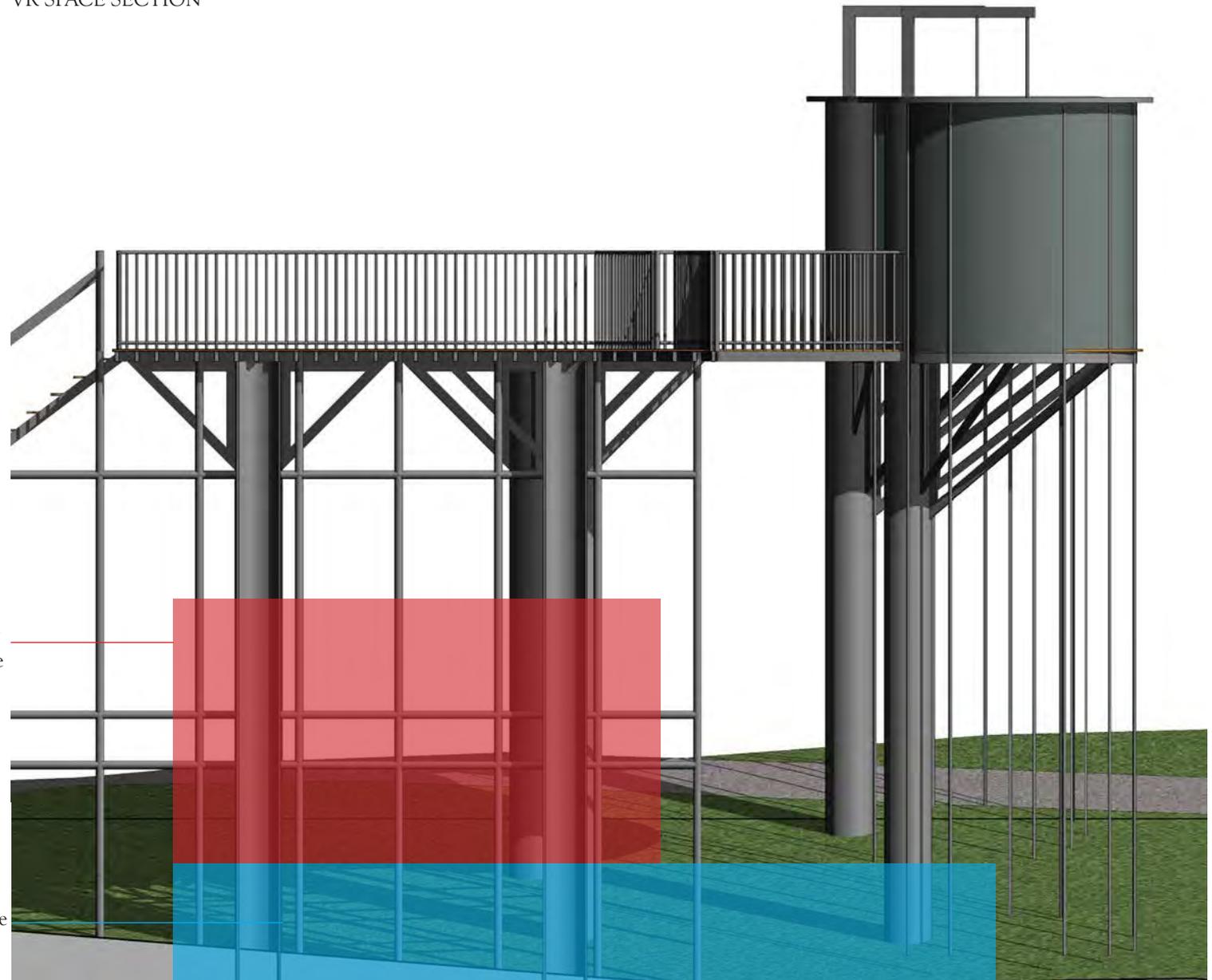
INTERIOR SECTION



The roofing sheets will be an smoked acrylic sheet for various reasons. It is 10 times stronger and allows an additional 2% of lights to pass through than a glass. The reason I chose acrylic over polycarbonate is due to the clarity in the texture of the acrylic. In terms of weight, acrylic weighs more therefore, it is better windproof than a polycarbonate.

The brackets will clamp the smoked acrylic sheet in place and a bolt will pierce through the holes designed in the brackets. The bolt will be then welded through a Nelson Bolt welding technique to keep the brackets tight and secure.

VR SPACE SECTION



The space underneath the elevated floor has the potential for extra function. While my previous developments have an element of the audience seeing the real-time broadcast of the VR activity, this space can be refined to hold such function.

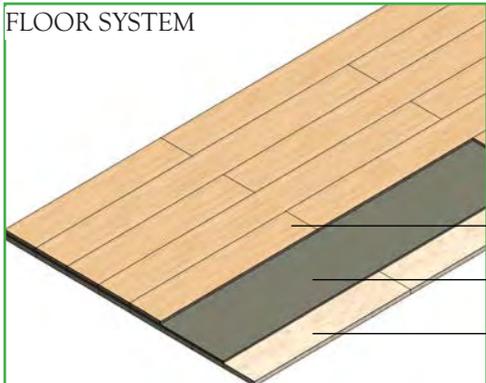
From researching the environmental effect of the metals, the contact between the soil ground and the metal columns tend to be harmful. The direct contact between these two elements leads to soil contamination and affects vegetation growth. While in the phase of direct contact, galvanised steel can be affected too by the Ph level of the soil.

LONG FINAL SECTION

As the elevated space will be used by 5 users at a time, the needs for multiple arc tubes will not be necessary. Therefore, a light frame connecting two columns of VR both's sizes are capable of delivering the support for the floor framings.



FLOOR SYSTEM



- Hard Maple Wood with Anti-Slip Coating for surface finish (10mm)
- Shock Absorbing Foam for cushion (7mm)
- Maple Plywood for support(15mm)

Concrete floor is added to prevent direct contact with the soil. The use of concrete will also be used for installing the maple flooring for the video broadcast space.

BIBLIOGRAPHY

IMAGES:

- “[MOD] Spectrum 3D Monster Maze.” Spectrum Computing. Available from: <https://spectrumcomputing.co.uk/index.php?cat=96&id=30402> (15 March 2020).
- “100.000 anos da historia de Galicia nunha visita | Historia de Galicia.” Historia de Galicia. Available from: <http://historiadegalicia.gal/2019/03/100-000-anos-da-historia-de-galicia-nunha-visita/> (15 March 2020).
- “28 Basketball Plays to Dominate Any Defense.” Basketball for Coaches. Available from: <https://www.basketballforcoaches.com/basketball-plays/> (5 February 2020).
- “750mm x 1000mm CLEAR Perspex Acrylic Plastic Sheet – 2mm, 3mm,4mm,5mm,6mm Thickness (750x1000x2mm). Amazon.co.uk. Available from: <https://www.amazon.co.uk/750mm-1000mm-Perspex-Acrylic-Plastic/dp/B071DMVZHH> (5 February 2020).
- “Agri Chapel / Yu Momoeda Architecture Office.” Archdaily. Available from: <https://www.archdaily.com/884875/agri-chapel-yu-momoeda-architecture-office> (5 February 2020).
- “Anchor Flex LP Flooring System | Anchored Resilient Floor System.” Sports Venue – Technology.comTM . Available from: <https://www.sportsvenue-technology.com/products/action-floor-systems-llc/action-anchorflex-lp-flooring-system> (2 March 2020).
- “Atari 2600 VCS Video Computer System Information Specs – Gametrog.” Gametrog. Available from: <https://gametrog.com/atari-2600-vcs-video-computer-system-information-specs/> (2 March 2020).
- “Axiome Twinwall Polycarbonate Sheet Clear 690 x 6 x 3000mm.” Screw Fix. Available from <https://www.screwfix.com/p/axiome-twinwall-polycarbonate-sheet-clear-690-x-6-x-3000mm/205fh> (3 February 2020).
- “Basketball Hoop & Backboard.” Dimensions.Guide. Available from: <https://www.dimensions.guide/element/basketball-hoop> (2 March 2020).
- “Basketball Rims & Nets.” Dimensions.Guide. Available from: <https://www.dimensions.guide/element/basketball-rims-nets> (12 February 2020).
- “Basque Health Department Headquarters in Bilbao / Coll – Barreu Arquitectos.” Archdaily. Available from: <https://www.archdaily.com/7093/basque-health-department-headquarters-in-bilbao-coll-barreu-arquitectos> (12 February 2020).
- “Building Office Unveils Proposal With Scattered Buildings For Bandirma Park Competition.” Worldarchitecture.org. Available from: <https://worldarchitecture.org/architecture-news/cvpzz/building-office-unveils-proposal-with-scattered-buildings-for-bandirma-park-competition.html> (14 February 2020).
- “Clear Acrylic Sheets.” Cutmyplastic.co.uk. Available from: <https://www.cutmyplastic.co.uk/acrylic-sheet/clear/> (12 March 2020).
- “Cybershoes + Cybercarpet.” Cybershoes. Available from: <https://www.cybershoes.io/product/cybershoes-cybercarpet/> (18 February 2020).
- “Dead Cells.” store.steampowered.com. Available from: https://store.steampowered.com/app/588650/Dead_Cells/ (25 March 2020).
- “Disused Building For Rent in QP.” Friends of Queens Park, Brighton. Available from: <http://www.fqpbrighon.net/4873/disused-building-for-rent-in-qp/> (25 March 2020).
- “File: F6 participation in live sport events (in the last 12 months), by age group, 2015 (% of population aged 16 and over).png.” Eurostat Statistics Explained. Available from: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:F6_Participation_in_live_sport_events_\(in_the_last_12_months\)_by_age_group_2015_\(%25_of_population_aged_16_and_over\).png&oldid=394074](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:F6_Participation_in_live_sport_events_(in_the_last_12_months)_by_age_group_2015_(%25_of_population_aged_16_and_over).png&oldid=394074) (31 February 2020).
- “File:Mattel-Intellivision-Console-FR.jpg.” Commons.wikimedia.org. Available from: <https://commons.wikimedia.org/wiki/File:Mattel-Intellivision-Console-FR.jpg> (31 February 2020).
- “Fushimi Inari Shrine.” Japan-guide.com. Available from: <https://www.japan-guide.com/e/e3915.html> (17February2020).
- “Galvanised Steel Sheet | 500mm x 250mm x 0.55mm.” Hardware Warehouse. Available from: <https://hardware-warehouse.co.uk/Galvanized-Steel-Sheet-500mm-250mm-0.55mm> (17February2020).
- “Game Gear.” En.wikipedia.org. Available from: https://en.wikipedia.org/wiki/Game_Gear (24 February 2020).
- “German Spa and Pump Room, Brighton – Historic images of Brighton and Hove.” Sbbc.regencysociety.org. Available from: <https://sbbc.regencysociety.org/german-spa-and-pump-room-brighton-2/> (24 February 2020).
- “German Spa and Pump Room, Brighton – Historic images of Brighton and Hove.” Sbbc.regencysociety.org. Available from: <https://sbbc.regencysociety.org/german-spa-and-pump-room-brighton/> (7 March 2020).
- “History of the spa.” My Brighton and Hove. Available from: <https://www.mybrightonandhove.org.uk/places/placepark/queens-park-2/queens-park-22> (7 March 2020).
- “How does the practice of meditation help to achieve the state of 360-degree consciousness with eyes open? – Quora.” Quora.com. Available from: <https://www.quora.com/How-does-the-practice-of-meditation-help-to-achieve-the-state-of-360-degree-consciousness-with-eyes-open> (9 March 2020).

"Icaros Workout Machine with VR." GearNova. Available from: <https://gearnova.com/icaros-workout-machine-with-vr/> (9 March 2020).

"Indoor Sports Complex Floor Plans." Pinterest. Available from: <https://www.pinterest.co.uk/pin/397794579564961884/> (9 March 2020).

"Karuzawa Museum Complex / YASUI HIDEO ATELIER." Archdaily. Available from: <https://www.archdaily.com/348270/karuzawa-museum-complex-yasui-hideo-atelier> (15 February 2020).

"KAT Walk Premium." KATVR. Available from: <https://www.kat-vr.com/products/kat-walk-premium-vr-treadmill#kat-contact> (11 February 2020).

"Los Angeles Lakers on Instagram: LeBron throws down a nasty reverse off the bounce." Pinterest. Available from: <https://www.pinterest.co.uk/pin/479844535297288713/> (10 March 2020).

"Magnavox Odyssey2 ." En.wikipedia.org. Available from: https://en.wikipedia.org/wiki/Magnavox_Odyssey%C2%B2 (10 March 2020).

"Market Research: The State of Online Gaming - 2019." Limelight Networks. Available from: <https://www.limelight.com/resources/white-paper/state-of-online-gaming-2019/> (10 March 2020).

"Marriott - Framestore VR Studio." Framestore VR Studio. Available from: <http://framestorevr.com/marriott> (9 March 2020).

"Meetspace VR (ft Zero Latency) - Wembley." Tripadvisor. Available from: https://www.tripadvisor.co.uk/Attraction_Review-g528820-d18717320-Reviews-MeetspaceVR_ft_Zero_Latency_Wembley-Wembley_Greater_London_England.html (9 March 2020).

"Miami Heat v Chicago Bulls." Zimbio. Available from: <https://www.zimbio.com/photos/Dwyane+Wade/Derrick+Rose/Miami+Heat+v+Chicago+Bulls/jGq7Fsjbaio> (5 March 2020).

"Museum of Hamam - follow the black line." Berk Tellioglu. Available from: <http://www.berktell.com/museum-of-hamam> (5 March 2020).

"NBA 2KVR Experience." Playstation. Available from: <https://www.playstation.com/en-us/games/nba-2kvr-experience-ps4/> (6 March 2020).

"Neoclassical and Romantic Architecture." Essential Humanities. Available from: <http://www.essential-humanities.net/western-art/architecture/neoclassical-romantic/> (26 March 2020).

"Neolithic Revolution." U.S. and World History. Available from: <http://sharpsocialstudies.weebly.com/neolithic-revolution.html> (26 March 2020).

"Nostalgia: The German Spa that was once in Brighton." The Argus. Available from: <https://www.theargus.co.uk/news/14608899.nostalgia-the-german-spa-that-was-once-in-brighton/> (2 March 2020).

"Omni Shoes." Omni By Virtuix. Available from: <https://www.virtuix.com/product/virtuix-omni-shoes/> (3 March 2020).

"Outdoor Gym." Pinterest. Available from: <https://www.pinterest.co.uk/pin/557531628844001906/> (2 March 2020).

"PlayStation Portable." En.wikipedia.org. Available from: https://en.wikipedia.org/wiki/PlayStation_Portable (16 March 2020).

"PlayStationRVR - Over 500 Games and Experiences. Feel them all." PlayStation. Available from: <https://www.playstation.com/en-us/explore/playstation-vr/> (11 March 2020).

"Queen's Park Conservation Area Character Statement (Draft)." Brighton-hove.gov.uk. Available from: <https://www.brighton-hove.gov.uk/sites/brighton-hove.gov.uk/files/Queens%20Park%20Draft%20Character%20Appraisal.pdf> (17 February 2020).

"Queens Park Conservation Management Plan." New.brighton-hove.gov.uk. Available from: <https://new.brighton-hove.gov.uk/sites/default/files/migrated/article/inline/Draft%20Queens%20Park%20Conservation%20Management%20Plan.pdf> (18 February 2020).

"Revit Live Projects Show Off New Potential for BIM and VR." Architizer. Available from: <https://architizer.com/blog/inspiration/industry/revit-live/> (18 February 2020).

"Suppliers, Manufacturers, Exporters & Importers." Pinterest. Available from: <https://www.pinterest.co.uk/pin/445926800587453233/> (27 February 2020).

"Swingsets and Playsets Nashville, TN | Ryval Coach 72" C872." Swingsetnashville.com. Available from: <https://www.swingsetnashville.com/product/ryval-coach-72-c872/> (20 February 2020).

"Taclim." Taclim-Cerevo. Available from <https://taclim.cerevo.com/en/> (20 February 2020).

"Teslasuit - Full-Body Haptic Suit." DudeIWantThat.com. Available from: <http://www.dudeiwantthat.com/entertainment/video-games/teslasuit-full-body-haptic-suit.asp> (22 February 2020).

"Teslasuit." Alzashop. Available from: <https://www.alzashop.com/teslasuit-d5250186.htm?layoutAutoChange=1> (20 February 2020).

"The 'Pepperpot'." My Brighton and Hove. Available from: <https://www.mybrightonandhove.org.uk/places/placepark/queens-park-2/queens-park-10> (20 February 2020).

“The 5 Most Important Battles of The Ancient Greek Wars.” All That’s Interesting. Available from: <https://allthatsinteresting.com/greek-wars> (20 February 2020).

“The Archways, built c 1830.” My Brighton and Hove. Available from: <https://www.mybrightonandhove.org.uk/places/placepark/queens-park-2/queens-park-2> (20 February 2020).

“The History of Physical Fitness.” The Art of Manliness. Available from: <https://www.artofmanliness.com/articles/the-history-of-physical-fitness/> (23 February 2020).

“Top Indie Game Releases of September 2017.” All Gamers. Available from: <https://ag.hyperxgaming.com/article/3081/top-indie-game-releases-of-september-2017> (23 February 2020).

“Ultimate Free Roam Virtual Reality Experience for Four at Zero Latency.” Virgin Experience Days. Available from: <https://www.virginexperiencedays.co.uk/ultimate-free-roam-virtual-reality-experience-for-four-at-zero-latency-> (23 February 2020).

“Untreated, Rough, and Unfinished Sandstone Blocks.” Regatta Universal Exports: An Indian natural stone company. Available from: <https://www.regattaexports.com/untreated-rough-unfinished-sandstone-blocks/> (10 March 2020).

“Video Game History Timeline.” Museumofplay.org. Available from: <https://www.museumofplay.org/about/icheg/video-game-history/timeline> (10 March 2020).

“Virtuix Omni.” Omni By Virtuix. Available from: <https://www.virtuix.com/product/virtuix-omni/> (10 March 2020).

“VR for Architecture: From Virtual Design to Real PR.” Stambol. Available from: <https://www.stambol.com/2018/02/26/vr-for-architecture-from-virtual-design-to-real-pr/> (11 March 2020).

“Washington Huskies.” Washington Huskies. Available from: <https://gohuskies.com/sports/2018/5/17/mens-basketball-general-season-tickets.aspx> (29 March 2020).

“Women’s Basketball Tickets.” Penn Athletics. Available from: <https://pennathletics.com/sports/2018/7/30/womens-basketball-tickets.aspx> (11 March 2020).

“WSU Men’s Basketball vs Santa Clara.” Ticketwest. Available from: <https://www.ticketwest.com/events/detail/wsu-men-s-basketball-earn-1229> (14 March 2020).

“Xtreme Maple Plank 600S.” Beauflor. Available from: <https://www.beauflor.com/en/products/heavy-duty/xtreme/xtreme-maple-plank-600s> (29 March 2020).

Albornoz, M. “5 Architecture Offices Using VR to Present Their Designs.” ArchDaily. Available from: <https://www.archdaily.com/899599/5-architecture-offices-using-vr-to-present-their-designs> (31 February 2020).

Augustyn, A et al, “Order | architecture.” Encyclopaedia Britannica. Available from: <https://www.britannica.com/technology/order-architecture> (31 February 2020).

Ballard, C. “Golden Touch: How to Shoot like Steph.” Sports Illustrated. Available from: <https://www.si.com/nba/2016/03/14/stephen-curry-golden-state-warriors-bruce-fraser-steve-kerr-shot> (8 February 2020).

Bell, M. “Infotopia—The Middle Ages or Medieval Period.” Infotopia.info. Available from: http://www.infotopia.info/articles/article_medieval.html (8 February 2020).

Bonasio, A. “Training Your Brain Muscles with VR.” Tech Trends. Available from: <https://techtrends.tech/tech-trends/training-your-brain-muscles-with-vr/> (28 February 2020).

Coby, A. “AT THE SHARP END Ghost of Tsushima PS4 release date update – when is the samurai epic coming out, when is it set and is there gameplay?.” The Sun. Available from: <https://www.thesun.co.uk/tech/8255242/ghost-of-tsushima-ps4-release-date-update-ps4/> (28 February 2020).

Egremont Gate. Francis May. 1890. Egremont Place, Queen’s Park, Brighton, City of Brighton and Hove, East Sussex. Available from: [https://commons.wikimedia.org/wiki/File:Egremont_Gate_\(to_Queen%27s_Park\),_Brighton_\(IoE_Code_480728\).jpg](https://commons.wikimedia.org/wiki/File:Egremont_Gate_(to_Queen%27s_Park),_Brighton_(IoE_Code_480728).jpg). Photograph by The Voice of Hassocks. (16 March 2020).

Eldredge, B. “Stunning Japanese chapel showcases tree-like fractal columns.” CURBED. Available from: <https://www.curbed.com/2018/1/4/16848894/japan-chapel-architecture-fractal-yu-momoeda> (6 March 2020).

Eternal Beige Moleanos Limestone block from Portugal. Alibaba.com. Available from: https://www.alibaba.com/product-detail/Eternal-Beige-Moleanos-Limestone-block-from_50034655302.html (29 March 2020).

Fairchild, C. “Video: This 360-Degree Treadmill Will Make your Virtual Reality Experience More Immersive.” Nextgov. Available from: <https://www.nextgov.com/emerging-tech/2016/02/video-360-degree-treadmill-will-make-your-virtual-reality-experience-more-immersive/125963/> (8 March 2020).

Falco, A. “From unwanted to defensive nightmare, the journey of Ben Wallace.” Basketball Society. Available from: <https://basketballsocietyonline.com/ben-wallace-detroit-pistons-number-retirement-3> (13 February 2020).

Frearson, A. “Lazika Municipality by Architects of Invention.” Dezeen. Available from: <https://www.dezeen.com/2012/12/20/lazika-municipality-georgia-architects-of-invention/> (18 March 2020).

Gallois, R. “The geology of the hot springs at Bath Spa, Somerset.” Semantic Scholar. Available from: <https://www.semanticscholar.org/paper/The-geology-of-the-hot-springs-at-Bath-Spa%2C-Gallois/4ace9d48628b671d83ff33d78ca4fd-454319ca0c> (18 March 2020).

Gibson, E. “Koen van Velsen Architects uses green-grey brickwork for sports centre near Rotterdam.” Dezeen. Available from: <https://www.dezeen.com/2016/12/05/grey-brickwork-sports-centre-koen-van-velsen-architects-rotterdam-netherlands/> (17 March 2020).

Griffiths, A. "Glass walls create visual connection between Strasbourg sports hall and its surroundings." Dezeen. Available from: <https://www.dezeen.com/2018/03/18/sports-hall-dominique-coulon-associates-strasbourg-france/> (18 March 2020).

"Teslasuit Bringing VR Gloves with Pulse-Tracking." VRGear. Available from: <https://vrgear.com/news/teslasuit-bringing-vr-gloves-with-pulse-tracking/> (8 March 2020).

Seal, M. "In Hot Water: Japan's Onsen Culture." Departures. Available from: <https://www.departures.com/travel/inside-japans-onsen-bath-houses> (3 March 2020).

Martinez, P. "'Ring fit adventure' releases on Nintendo switch in October, helps players exercise." Newsweek. Available from: <https://www.newsweek.com/ring-fit-adventure-nintendo-switch-release-date-price-trailer-1458949> (13 March 2020).

McCarriston, S. "Hartford women's basketball team gets first win of season vs. America East champs Stony Brook in final game." CBS SPORTS. Available from: <https://www.cbssports.com/college-basketball/news/hartford-womens-basketball-team-gets-first-win-of-season-vs-america-east-champs-stony-brook-in-final-game/> (13 March 2020).

McKeand, K. "NBA 2KVR Experience brings b-ball to your eyeballs in VR." Pcgamesn. Available from: <https://www.pcgamesn.com/nba-2kvr-experience/nba-2kvr-experience-release-date> (23 February 2020).

Nazihah, N. "AN ISLAMIC ANIMATED INFOGRAPHIC MODEL FOR DA'WAH DISSEMINATION: A CASE STUDY OF PRPHET'S SUNNAH IN EATING AND DRINKING." University of Malaysia, 2017.

O'Brien, G. "Best outdoor places to workout in Brighton and Hove." 3Fs Personal Training. Available from: <https://3fspt.co.uk/best-outdoor-places-to-workout-in-brighton-and-hove/> (19 February 2020).

Pepper Pot, Brighton. John Fielding. 2020. Brighton. Available from: <https://www.google.com/maps/place/Pepper+Pot,+Brighton/@50.82726,-0.124865,3a,75y,90t/data=!3m8!1e2!3m6!1sAF1QipPL1bSnF1r7GJb5kRZdriAIXPqypQk-JRZksN-JA!2e10!3e12!6shttps:%2F%2Fh5.googleusercontent.com%2Fp%2FAF1QipPL1bSnF1r7GJb5kRZdriAIXPqypQk-JRZksN-JA%3Dw179-h120-keno!7i4000!8i2669!4m5!3m4!1s0x487585979e4670c1:0x2306dd024a52716f!8m2!3d50.82-726!4d0.124865!hl=en> (31 February 2020).

Pita, P. "List of Full Body Virtual Reality Haptic Suits." Virtual Reality Times. Available from: <https://virtualrealitytimes.com/2017/02/28/list-of-full-body-virtual-reality-haptic-suits/> (30 February 2020).

Queens Park. Waterlows. 1863. Brighton. Available from: http://regencysociety-jamesgray.com/volume24/source/jg_24_159.html (date accessed). Photograph by Edward Fox. (4 February 2020)

Robertson, A. "Teslasuit's new VR gloves let you feel virtual objects and track your pulse." The Verge. Available from: <https://www.theverge.com/2019/12/26/21037855/teslasuit-glove-vr-haptic-feedback-glove-announce-pricing-release-date-cs-2020> (4 February 2020).

Rotharmel, M. "The eSSage Suit Allows You to be Massaged by Anyone, Anywhere." Digital Massage Ensembles. Available from: <https://www.trendhunter.com/trends/essage-suit> (15 February 2020).

Smisek, P. "LET'S GET PHYSICAL: NEW SPORTS CENTRES." Architonic. Available from: <https://www.architonic.com/en/story/peter-smisek-lets-get-physical-new-sports-centres/7001762> (25 March 2020).

Takahashi, D. "Fundamental VR raises \$5.6 million for virtual reality medical training." Venturebeat. Available from: <https://venturebeat.com/2019/10/30/fundamentalvr-raises-4-8-million-for-virtual-reality-medical-training/> (20 March 2020).

The Pump Room, Queen's Park, Brighton. Dr Frederic Struve (later Hooper-Struve Company). 1825. Queen's Park, Brighton. Available from: <https://www.pinterest.co.uk/pin/501869952227215421/>. Photograph by Iliffe-Moon, P. 1960. (15 February 2020)

The Royal Spa at Queens Park. ©Argus Photo Archive. 1974. Brighton. Available from: <https://www.brightonandhovestuff.co.uk/p/89932kfg/19565924204/brighton-1974-royal-spa-queens-park> (17 February 2020)

Treese, T. "Top 25 Best VR Fitness Games 2019." Fitness Insider. Available from: <https://www.vrfitnessinsider.com/top-25-best-vr-fitness-games-2019/> (19 March 2020).

Walker, E. "Plans turn Queen's Park public toilets into cafe and bakery." The Argus. Available from: <https://www.theargus.co.uk/news/18297596.plans-turn-queens-park-public-toilets-cafe-bakery/> (19 March 2020).

Woodhouse, J et al., "The future of basketball in the UK." House of Commons Library. Available from: <https://commonslibrary.parliament.uk/research-briefings/cdp-2018-0034/> (19 March 2020).

INFORMATIONS:

“Accessories.” Omni By Virtuix. Available from: <https://www.virtuix.com/accessories/> (10 March 2020).

Bereznik, M. “Teslasuit - A Wearable Smart Suit With Applications Beyond Imagination.” ExploreBiotech. Available from: <https://explorebiotech.com/teslasuit-a-wearable-smart-suit-with-applications-beyond-imagination/> (9 March 2020).

Craven, J. “Architecture Timeline - Western Influences on Building Design.” ThoughtCo. Available from: <https://www.thoughtco.com/architecture-timeline-historic-periods-styles-175996> (15 March 2020).

“Cybershoes Gaming Station.” Cybershoes. Available from: <https://www.cybershoes.io/product/cybershoes-gaming-station/> (8 March 2020).

“28 Basketball Plays Dominate Any Defense.” Basketball For Coaches. Available from: <https://www.basketballforcoaches.com/basketball-plays/> (1 March 2020).

“EGREMONT GATE AND ATTACHED WALL AND RAILINGS.” Historic England. Available from: <https://historicengland.org.uk/listing/the-list/list-entry/1380496> (5 February 2020).

Baker, J. “City of Mississauga Facility Accessibility Design Standards.” Mississauga. Available from: http://www7.mississauga.ca/Departments/Marketing/Websites/Accessibility/Mississauga_FADS.html (5 February 2020).

“Basque Health Department Headquarters in Bilbao / Coll-Barreu Arquitectos”. archdaily. Available from: <https://www.archdaily.com/7093/basque-health-department-headquarters-in-bilbao-coll-barreu-arquitectos> (25 February 2020).

Dawson, “J. BeBop Sensors VR haptic glove will be on show at CES.” KITGURU. Available from: <https://www.kitguru.net/gaming/james-dawson/bebop-sensors-vr-haptic-glove-will-be-on-show-at-ces/> (2 March 2020).

“Fushimi Inari Shrine.” japan-guide.com. Available from: <https://www.japan-guide.com/e/e3915.html> (11 March 2020).

“Finding Glass Alternatives for Windows.” A&C Plastics, INC. Available from: <https://www.acplasticsinc.com/informationcenter/r/plastic-materials-that-are-replacing-glass> (10 March 2020).

Emmins, C. “Soft Drinks.” British Soft Drinks. Available from: https://www.britishsoftdrinks.com/write/MediaUploads/Soft_Drinks_Their_Origins_and_History.pdf (3 February 2020).

Gallois, R. “The geology of the hot springs at Bath Spa, Somerset.” Research Gate. Available from: https://www.researchgate.net/publication/268043834_The_geology_of_the_hot_springs_at_Bath_Spa_Somerset/figures?lo=1 (3 February 2020).

Gromicko, N. and K. Shepard. “The History of Concrete.” Nachi. Available from: <https://www.nachi.org/history-of-concrete.htm> (5 February 2020).

Horton, R. “The Lancet.” Google Books. Available from: https://books.google.co.uk/books?id=Trc1AQAAMAAJ&pg=PA234-IA2&lpg=PA234-IA2&dq=dr+struve+chemically+made+mineral+water&source=bl&ots=OVotrLuogA&sig=AC-fU3U1mC5_lwdzD1UoyG15HdkEUmMJeA&hl=en&sa=X&ved=2ahUKewiZrNa9u6vnAhXzTxUIHUFAB0cQ6AEwDHoECACQAQ#v=onepage&q=dr%20struve%20chemically%20made%20mineral%20water&f=false (4 February 2020).

“Evolution of Building Elements.” University of the West of England. Available from: https://fet.uwe.ac.uk/conweb/house_ages/elements/print.htm (12 February 2020).

Fairchild, C. “Video: This 360-Degree Treadmill Will Make Your Virtual Reality Experience More Immersive.” Nextgov. Available from: <https://www.nextgov.com/emerging-tech/2016/02/video-360-degree-treadmill-will-make-your-virtual-reality-experience-more-immersive/125963/> (31 February 2020).

Kubba, S. “Curtain Wall.” ScienceDirect. Available from: <https://www.sciencedirect.com/topics/engineering/curtain-wall> (6 March 2020).

“Teslasuit Bringing VR Gloves with Pulse-Tracking.” VRGear. Available from: <https://vrgear.com/news/teslasuit-bringing-vr-gloves-with-pulse-tracking/> (8 March 2020).

“Wire Mesh Installation Features Architectural Fragments Constructed At 1:1.” archdaily. Available from: <https://www.archdaily.com/871641/edoardo-tresoldi-wire-mesh-installation-features-architectural-fragments-constructed-at-1-1> (12 March 2020).

“Geometric Design of Highway Engineering.” Engineering Society. Available from: <https://www.engineering-society.com/2018/05/geometric-design-of-highway-engineering.html> (14 February 2020).

“History of the spa.” My Brighton and Hove. Available from: <https://www.mybrightonandhove.org.uk/places/placepark/queens-park-2/queens-park-22> (27 February 2020).

“How To Design A Sports Changing Room.” Sports Changing Rooms in the UK. Available from: <https://www.sportschangingrooms.co.uk/how-to-design-a-sports-changing-room/> (9 February 2020).

“Karuzawa Museum Complex / YASUI HIDEO ATELIER.” archdaily. Available from: <https://www.archdaily.com/348270/karuzawa-museum-complex-yasui-hideo-atelier> (24 February 2020).

Klein, K. “OMA reveals updated design for Washington DC garden bridge.” dezeen. Available from: <https://www.dezeen.com/2020/04/23/11th-street-bridge-park-oma-olin-washington-dc/> (8 May 2020).

“Column.” ENCYCLOPAEDIA BRITANNICA. Available from: <https://www.britannica.com/technology/column-architecture> (7 March 2020).

Megahed, N. “Origami Folding and its Potential for Architecture Students.” Taylor & Francis Online. Available from: <https://www.tandfonline.com/doi/abs/10.1080/14606925.2017.1270511?src=recsys&journalCode=rfdj20&> (2 March 2020).

“Popularity of Basketball Around the World.” topendsports. Available from: <https://www.topendsports.com/world/lists/popular-sport/sports/basketball.htm> (1 March 2020).

Sawh, M. “VR fitness looks amazing but there’s still one big problem.” Wearable. Available from: <https://www.wearable.com/vr/vr-fitness-holodia-one-big-problem> (30 February 2020).

“VR for Architecture: From Virtual Design to Real PR.” Stambol. Available from: <https://www.stambol.com/2018/02/26/vr-for-architecture-from-virtual-design-to-real-pr/> (30 February 2020).

Yasuka. “Sentō: Japanese Communal Bath House.” KCP International. Available from: <https://www.kcpinternational.com/2015/02/sento-japanese-communal-bath-house/> (11 February 2020).

LaChuisa, C. “Ionic.” Buffaloah. Available from: <https://buffaloah.com/a/DCTNRY/i/ionicord.html> (7 February 2020).

“Natural Thermal Waters.” Thermae Bath Spa. Available from: <https://www.thermaebathspa.com/the-spa/natural-thermal-waters/> (2 February 2020).

“Nostalgia: The German Spa that was once in Brighton.” The Argus. Available from: <https://www.theargus.co.uk/news/14608899.nostalgia-the-german-spa-that-was-once-in-brighton/> (5 February 2020).

“Parking Layouts Dimensions & Drawings.” Dimensions Guide. Available from: <https://www.dimensions.guide/collection/parking-layouts> (4 February 2020).

“PlayStation VR Tracking Guide.” Owlchemy Labs. Available from: <https://jobsimulatoregame.com/psvrfaq/> (7 February 2020).

“QUEEN’S PARK, BRIGHTON.” Historic England. Available from: <https://historicengland.org.uk/listing/the-list/list-entry/1001319> (5 February 2020).

“THE ROYAL SPA.” Historic England. Available from: <https://historicengland.org.uk/listing/the-list/list-entry/1380699> (5 February 2020).

“Royal Spa 1824.” Friends of Queens Park Brighton. Available from: <http://www.fqpbrighton.net/park-history/royal-spa-1824/> (5 February 2020).

“The Royal Spa: opened in 1825.” My Brighton and Hove. Available from: <https://www.mybrightonandhove.org.uk/places/placepark/queens-park2/queens-park-28> (2 February 2020).

“What is Virtual Reality? - Virtual Reality Society.” Virtual Reality Society. Available from: <https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html> (3 February 2020).

“Museum of Hamam – follow the black line.” Berk Tellioglu. Available from: <http://www.berktell.com/museum-of-hamam> (14 March 2020).

Caddy, B. “WTF: Suit allows you to have a remote “massage” [YEAH RIGHT].” shinyshiny. Available from: https://www.shinyshiny.tv/2012/07/suit_allows_you_to_have_a_massage_wherever_you_happen_to_be.html (21 March 2020).

Frearson, A. “Lazika Municipality by Architects of Invention.” dezeen. Available from: <https://www.dezeen.com/2012/12/20/lazika-municipality-georgia-architects-of-invention/> (17 March 2020).

“Haptic Feedback.” TESLASUIT. Available from: <https://teslasuit.io/the-suit/> (10 March 2020).

Savvides, L. “The SuitX exoskeleton made me super strong | Beta Test #1.” YouTube. Available from: <https://www.youtube.com/watch?v=OiAVTz5BbZQ> (28 March 2020).

“Wooden Basketball Flooring - The Best Choice For Indoors.” SlideShare. Available from: <https://www.slideshare.net/acesurfaces/wooden-basketball-flooring-the-best-choice-for-indoors> (1 April 2020).

“Neoclassical Style: Guide to 18th Century Art and Architecture.” MAYFAIR GALLERY. Available from: https://www.designingbuildings.co.uk/wiki/Neoclassical_architecture (6 April 2020).

“THE TOWER OR PEPPER POT.” Historic England. Available from: <https://historicengland.org.uk/listing/the-list/list-entry/1381031> (7 February 2020).

“German Spa and Pump Room, Brighton.” Historic images of Brighton and Hove. Available from: <https://sbpc.regencysociety.org/german-spa-and-pump-room-brighton/> (11 February 2020).

“Order.” ENCYCLOPAEDIA BRITANNICA. Available from: <https://www.britannica.com/technology/order-architecture> (21 March 2020).

Carlos, C. “Neoclassical Architecture || HISTARC2.” YouTube. Available from: <https://www.youtube.com/watch?v=pty5AvldfSw> (21 March 2020).

“The History of Physical Fitness.” GET ACTION AOM. Available from: <https://www.artofmanliness.com/articles/the-history-of-physical-fitness/> (21 February 2020).

“Masonry Favorites: Limestone vs Sandstone.” D.L. Hickman & Son Inc. Available from: <http://www.dlhickman.com/blog/2016/12/31/orange-county-ca-masonry-favorites-limestone-vs-sandstone> (4 April 2020).

“Know your Venetian windows.” The Guardian. Available from: <https://www.theguardian.com/money/2005/apr/17/observercashsection.theobserver8> (19 March 2020).

“The Archways, built c1830.” My Brighton And Hove. Available from: <https://www.mybrightonandhove.org.uk/places/placepark/queens-park-2/queens-park-2> (5 March 2020).

Walker, E. “Ambitious plans to turn public toilets into cafe and bakery.” The Argus. Available from: <https://www.theargus.co.uk/news/18297596.plans-turn-queens-park-public-toilets-cafe-bakery/> (12 March 2020).

Burmester, A. “Just what are the most popular sports for 16-24 year olds?.” caytoo. Available from: <https://caytoo.co.uk/article/just-what-are-the-most-popular-sports-for-16-24-year-olds/> (9 April 2020).

“THE STATE OF ONLINE GAMING – 2018.” Limelight NETWORKS. Available from: <https://www.limelight.com/resources/white-paper/state-of-online-gaming-2018/> (9 April 2020).

“THE STATE OF ONLINE GAMING – 2019.” Limelight NETWORKS. Available from: <https://www.limelight.com/resources/white-paper/state-of-online-gaming-2019/> (11 April 2020).

Woodhouse, J., L. Audickas and S. Pepin. “The future of basketball in the UK.” House of Commons Library. Available from: <https://commonslibrary.parliament.uk/research-briefings/cdp-2018-0034/> (9 April 2020).

“Basketball Positions.” jr.nba. Available from: <https://jr.nba.com/basketball-positions/> (10 April 2020).

Aseroge. “File:F6 Participation in live sport events (in the last 12 months), by age group, 2015 (% of population aged 16 and over).png.” eurostat Statistics Explained. Available from: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:F6_Participation_in_live_sport_events_\(in_the_last_12_months\)_by_age_group,_2015_\(%25_of_population_aged_16_and_over\).png&oldid=394074](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:F6_Participation_in_live_sport_events_(in_the_last_12_months)_by_age_group,_2015_(%25_of_population_aged_16_and_over).png&oldid=394074) (10 April 2020).

“Marriott Hotels' Virtual Travel Experience (Behind the Scenes).” YouTube. Available from: https://www.youtube.com/watch?time_continue=138&v=a9725H0ls7c&feature=emb_title (12 March 2020).

Sturgis, I. “‘Teleporter’ allows users to see, feel and smell holiday locations.” Mail Online. Available from: https://www.dailymail.co.uk/travel/travel_news/article-2762092/Marriott-virtual-reality-teleporter-booth-lets-travellers-feel-smell-holiday-locations-without-booking-flight.html (9 March 2020).

“Ultimate Free Roam Virtual Reality Experience for Four at Zero Latency.” Virgin EXPERIENCE DAYS. Available from: <https://www.virginexperiencedays.co.uk/ultimate-free-roam-virtual-reality-experience-for-four-at-zero-latency-> (12 April 2020).

“Basketball Hoop & Backboard.” dimensions.guide. Available from: <https://www.dimensions.guide/element/basketball-hoop> (7 March 2020).

“What is Standing Reach - And How do You Measure it Correctly?.” THE HOOPS GEEK. Available from: <https://www.thehoopsgeek.com/standing-reach/> (30 April 2020).

Castro, F. “‘Human Rights’ Sports Center in Strasbourg / Dominique Coulon & associés.” archdaily. Available from: <https://www.archdaily.com/889849/human-rights-sports-centre-in-strasbourg-dominique-coulon-and-associes> (4 April 2020).

“11 Reasons Why You Must Galvanise Steel.” GALVANIZERS ASSOCIATION. Available from: <https://www.galvanizing.org.uk/galvanise-steel/> (3 April 2020).

Willis, Z. “What Kind of Wood Are NBA Courts Made From?.” Sportscasting. Available from: <https://www.sportscasting.com/what-kind-of-wood-are-nba-courts-made-from/> (4 April 2020).

Eldredge, B. “Stunning Japanese chapel showcases tree-like fractal columns.” CURBED. Available from: <https://www.curbed.com/2018/1/4/16848894/japan-chapel-architecture-fractal-yu-momoeda> (15 April 2020).

“Discover the Sustainable Characteristics of Metal.” ZAHNER. Available from: <https://www.azahner.com/blog/metal-sustainability> (15 April 2020).

Lowry, B. “The major differences between ‘indie’ and ‘AAA’ video games.” Windows Central. Available from: <https://www.windowscentral.com/indie-vs-aaa-which-type-game-you> (3 April 2020).

Mahesa, R. “The Difference Between Working in Indie and AAA Game Development.” Packt Hub. Available from: <https://hub.packtpub.com/difference-between-working-indie-and-aaa-game-development/> (7 April 2020).

Legault, M. and J. Weststar. “Working time among video game developers: Trends over 2004-14.” GAMASTURA. Available from: https://www.gamasutra.com/view/news/257143/Working_time_among_video_game_developers_Trends_over_200414.php (7 April 2020).

“Video Game History Timeline.” the strong NATIONAL MUSEUM OF PLAY. Available from: <https://www.museumofplay.org/about/icheg/video-game-history/timeline> (5 April 2020).

Strife, R. “Microvision Review.” The Video Game Critic. Available from: <https://videogamecritic.com/extras/reviews/microvision.htm?ex=1> (7 April 2020).

Laud, J. “History of the First 3D Video Games.” itstillworks. Available from: <https://itstillworks.com/12314899/history-of-the-first-3d-video-games> (17 April 2020).

“History Of Virtual Reality.” Virtual Reality Society. Available from: <https://www.vrs.org.uk/virtual-reality/history.html> (31 March 2020).

Martin, L. “Ring Fit Adventure Switch review: A worthy successor to Nintendo Wii Fit.” Menthol-ban. Available from: <https://www.express.co.uk/entertainment/gaming/1193052/Ring-Fit-Adventure-Nintendo-Switch-review-Wii> (30 March 2020).

“The world of gaming.” globalwebindex. Available from: https://www.globalwebindex.com/hubfs/Downloads/The%20World%20of%20Gaming%20Report.pdf?utm_campaign=Generic%20nurture%202019&utm_source=hs_automation&utm_medium=email&utm_content=83249182&_hsenc=p2ANqtz-8vVG47E713BW1p6E5Xo_ZKSSHwdy6M9dWWDNDEL7aOzC8blGXEt3hEnBDxPkR5fLBw85lS1TLc3ilR89dMPANjQtUFyA&_hsmi=83249182 (29 March 2020).

Stefyn, N. “How Video Games Are Made: The Game Development Process.” CG Spectrum. Available from: <https://www.cgspectrum.com/blog/game-development-process> (4 April 2020)

DeLuca, R. “REPORT: The State of VR Fitness in 2019.” VR FITNESS INSIDER. Available from: <https://www.vrfitnessinsider.com/report-the-state-of-vr-fitness-in-2019/> (6 April 2020).

“How to cut a space in a concrete wall for a door.” Concrete Cutting. Available from: <https://www.concrete-cutting-perth.com.au/how-to-cut-a-space-in-a-concrete-wall-for-a-door/> (4 March 2020).

“Building Office Unveils Proposal With Scattered Buildings For Bandırma Park Competition.” World Architecture Community. Available from: https://worldarchitecture.org/architecture-news/cvpzz/building_office_unveils_proposal_with_scattered_buildings_for_bandirma_park_competition.html (26 April 2020).

“Q&A: Our Steam Bending Technique.” Tom Raffield. Available from: <https://www.tomraffield.com/blogs/blog/steam-bending-q-a-with-our-workshop-team> (16 April 2020).

“OUTDOOR GARDEN BASKETBALL SYSTEMS. FREESTANDING GOALS.” CRA Basketball. Available from: <https://www.cra-basketball.co.uk/PORTABLE-basketball-goals.html> (15 April 2020).

“Basketball Court Paint | Backyard Court | Court Surfaces.” SportMaster Sport Surfaces. Available from: <https://www.sportmaster.net/basketball/> (15 April 2020).

Seal, M. “In Hot Water: Japan’s Onsen Culture.” Departures. Available from: <https://www.departures.com/travel/inside-japans-onsen-bath-houses> (3 March 2020).

“SPORTS FLOORING Health & Fitness.” Gerflor the flooring group. Available from: <https://www.gerflor.co.uk/product-ranges/leisure.html> (15 April 2020).

“Flooring for Indoor and Outdoor Basketball Courts.” Sports By APT. Available from: <https://sportsbyapt.com/flooring-indoor-outdoor-basketball-courts/> (20 April 2020).

“What makes sports flooring different?.” how stuff works. Available from: <https://home.howstuffworks.com/home-improvement/home-diy/flooring/what-makes-sports-flooring-different.htm> (18 April 2020).

Tate, T. “How Long Does It Take To Build Custom Software?.” SOLITECH. Available from: <https://soltech.net/how-long-does-it-take-to-build-custom-software/> (4 April 2020).

Perez, J. “Fixing the most common glitches in AAA games.” GAMASUTRA. Available from: https://www.gamasutra.com/blogs/JuanBelonPerez/20150403/240407/Fixing_the_most_common_glitches_in_AAA_games.php (1 April 2020).

Gibson, E. “Koen van Velsen Architects uses green-grey brickwork for sports centre near Rotterdam.” dezeen. Available from: <https://www.dezeen.com/2016/12/05/grey-brickwork-sports-centre-koen-van-velsen-architects-rotterdam-netherlands/> (26 March 2020).

Morris, A. “Alberto Campo Baeza’s sports centre building in Madrid is a “box of light”.” dezeen. Available from: <https://www.dezeen.com/2017/08/05/alberto-campo-baeza-francisco-de-vitoria-university-sports-centre-pozuelo-madrid-spain/> (26 March 2020).

D, J. “Acrylic - Details and Uses.” The Plastic People. Available from: <https://www.theplasticpeople.co.uk/blog/acrylic-details-and-uses/> (29 April 2020).

“Best Basketball Nets (2020 Buyers Guide).” Play N Basketball. Available from: <https://playnbasketball.com/best-basketball-nets/> (1 May 2020).

“What are Best Basketball Nets Available? Let’s Review Replacement Options!.” Game Basketballs. Available from: <http://www.gamebasketballs.com/best-basketball-nets/> (1 May 2020).

“Anchored PowerSleeper™.” Sport Surfaces. Available from: <https://sport-surfaces.com/anchored-powersleeper-se/> (2 May 2020).

“Anchored PowerSleeper™.” Sport Surfaces. Available from: <https://sport-surfaces.com/anchored-powersleeper/> (2 May 2020).

“Anchored or Floating Floor: What’s the Difference?.” Anderson Ladd. Available from: <https://andersonladd.com/news/anchored-or-floating/> (2 May 2020).

“TriPower™ Pad.” Aacer Flooring. Available from: <http://www.aacerflooring.com/wp-content/uploads/2012/11/TriPower-Pad.pdf> (2 May 2020).

“RPM Sports Floors | React™ Synthetic Wood Flooring.” Rpm Sports Floors. Available from: http://rpmsportsfloors.com/products_react.php (2 May 2020).

“The Differences Between Galvanized and Aluminum Metal Pallets.” Container Exchanger. Available from: <https://blog.containerexchanger.com/difference-galvanized-aluminum-metal-pallets/> (3 May 2020).

“Types of concrete: Which type of concrete would be most suitable for your building or construction activity?.” Economic Times. Available from: <https://economictimes.indiatimes.com/small-biz/productline/building-materials/types-of-concrete-which-type-of-concrete-would-be-most-suitable-for-your-building-or-construction-activity/articleshow/69923173.cms> (3 May 2020).

“Pre-Cast Concrete Walls | How It’s Made.” YouTube. Available from: <https://www.youtube.com/watch?v=HO7ECuUtswc> (3 May 2020).

"Maple Wood." Vermont Woods Studios. Available from: <https://vermontwoodsstudios.com/content/maple-wood> (4 May 2020).

"Acrylic." United Plastic Components. Available from: <https://www.upcinc.com/resources/materials/acrylic.html> (4 May 2020).

"Benefits of Precast." Wells Precast. Available from: <https://www.wellsconcrete.com/benefits-of-precast/> (4 May 2020).

"Maple." musterkiste.de. Available from: http://www.musterkiste.com/en/holz/pro/1008_Maple.html (6 May 2020).

Singh, J. and A. Kalamdhad. "Effects of Heavy Metals on Soil, Plants, Human Health and Aquatic Life." Research Gate. Available from: https://www.researchgate.net/publication/265849316_Effects_of_Heavy_Metals_on_Soil_Plants_Human_Health_and_Aquatic_Life (6 May 2020).

"Famous architecture quotes." archisoup. Available from: <https://www.archisoup.com/architecture-quotes> (8 May 2020).

"20 Basketball Quotes on Self-Motivation and Team Work." Goalcast. Available from: <https://www.goalcast.com/2018/05/18/20-basketball-quotes/> (8 May 2020).

"Top Virtual Reality Quotes." Medium. Available from: <https://medium.com/viarium/top-virtual-reality-quotes-d4e57f33347c> (8 May 2020).

Borson, B. "Natural Light – Clean Aesthetics." Life of an Architect. Available from: <https://www.lifeofanarchitect.com/natural-light-clean-aesthetics/> (8 May 2020).

"TECHNICAL STRUCTURE OF THE PLANK." cadoringroup. Available from: <https://www.cadoringroup.com/Technical-structure-plank> (18 April 2020).