

Design Project 2

IMMERSIVE LIGHT EXPERIENCE

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APPROVAL SHEET

The project titled 'Immersive Light Experience' by Deepanwita Ghosh is approved in partial fulfillment of the requirements for the degree of Master of Design in Product Design.

Guide:

Chairperson:

Internal examiner:

External examiner:

Date:

DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas and words have been included , I have adequately cited and referenced the original sources. I also declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and can evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Signature:

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Date:

ACKNOWLEDGEMENT

I wish to express my sincere gratitude towards my guide , Prof. P. Kumaresan who has always been there to support my ideas and inspire me during the complete journey of my project.

I would also like to thank all the professors who have given their valuable feedback during the stage presentations.

During the course of my project I have received some very important inputs and insights from my friends which have been of great value to me. I would like to thank them for their support and encouragement which helped me complete this project.

CONTENTS

1.0 Abstract	6	9.0 Idea Generation.....	27 - 34
2.0 Introduction.....	7	10.0 Concepts and Simulation.....	35
3.0 Study- Natural light.....	8	10.1 Concept A.....	35-37
3.1 Natural Light in its different hues.....	9	10.2 Concept B.....	39
3.2 Other forms of light.....	10	10.3 Mood Board.....	40
3.3 Elements of Natural Light.....	11	10.4 Experience Trial & Ergonomics.....	41-42
4.0 Relaxation.....	12	10.5 Results of Ergonomic study.....	43-45
4.1 Conventional Relaxation Methods.....	13	10.6 Evaluation of concepts.....	46
4.2 Other Relaxation Methods.....	15	10.7 Final Concept.....	47-49
4.3 Light and Relaxation.....	16-17	10.8 Form Explorations.....	50-52
4.4 Colour and Relaxation.....	18-19	10.9 CAD model of basic structure.....	53
5.0 Immersiveness.....	20-22	10.10 Elements of Structure and Assembly.....	54
5.1 Elements of Immersive Experience.....	23	11.0 Study of Weave Patterns.....	55
6.0 Combining the 3 aspects.....	24	12.0 Photographs of the Process.....	56
7.0 Project Brief.....	25	13.0 Final Model Images.....	57-58
8.0 User & Usage.....	26	14.0 References.....	59

1.0 ABSTRACT

The idea of this project was to bring in the visual attributes of natural light (colour, illuminance and perception of motion) to create an immersive experience that helps a person to relax. So how can these visual attributes translate into relaxing a person?

Relevant data was collected on light, relaxation, colour - for example - studies have revealed that colours have an effect on our cognitive responses and certain wavelengths help in calming the mind, a theory on which *Chromatherapy* is also based. Relaxing can be even more enjoyable if the light is soft. Information on immersiveness and its significance in any experience was also obtained during user studies and interviews.

Finally all the research study was combined to get a comprehensive knowledge to bring out the Immersive Light Experience. The project brief and user details was then defined. Ideas were generated from which concepts were detailed and tested to simulate the desired effects to reach the final concept level.

2.0 INTRODUCTION

Nature has played an important part in our lives since time immemorial. It presents to us the most purest form of beauty that demands our attention while it is humbly offered. Rousseau, a philosopher from 18th century believed that *‘much of what was considered human progress was actually separating humanity from nature, and thus creating distractions and pressure to conform.’*

As cities develop, become more urbanized and engulf all the open spaces, our connection with nature gets weaker and weaker. The immersive experiences that nature provides us with are totally lost to this generation. Now, our lives are full of stressful activities and a lot of work related pressures. There are deadlines to be met, reports to submit, meetings to attend and agendas to be discussed. This is what our lives have reduced to! To add on to this, there are other health issues to tackle as well. All these stressful activities take a toll on our health immensely and unconsciously. We forget to pause and take a break . Relaxing and spending time in the midst of nature has become very precious.

To try and get back these experiences of nature and bring it in our lives is what this project aims to achieve by studying light, relaxation and immersiveness.

3.0 STUDY - NATURAL LIGHT

Light is about much more than mere illumination. It has a spiritual character to it. The fresh feeling that one gets with the first rays of the sun falling on your face is unparalleled. Its as if light paints the world anew ,every single day ,bringing in colourful immersive experiences.

Studies have shown that these immersive experiences like the early morning light makes us alert, attentive and focused. The lights at the different times of the day have varied effects on our mind and body.

Sadly, all these effects fall short in influencing us in our regular lives. The entire day passes by and we, being so much absorbed in work , fail to acknowledge its existence. Most of the times the modern apartments in high raised buildings are not exposed to sunlight at all -leave alone experiencing its hues and colours!

So what makes us enjoy this natural light - whenever we can? A little observation makes us realize that it is :

- fresh and different
- has unique effect on our senses
- is living/dynamic
- has multitude of colours
- is thought provoking/ allows reflection in our minds
- gives us an immersive experience



Fig 1: A woman enjoying the Natural Light
Ref : <https://www.google.co.in/?BwZFU=natural+light>

3.1 NATURAL LIGHT IN ITS DIFFERENT HUES...



Fig 2



Fig 3



Fig 4



Fig 5

Figs(2-7): The different colours and light intensity experienced during the day is represented in 6 images ie. dawn, early morning, midday, afternoon, evening, dusk
 Ref: <https://www.google.co.in/search?q=natural+light&tbm=isch&t>

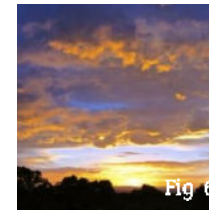


Fig 6



Fig 7

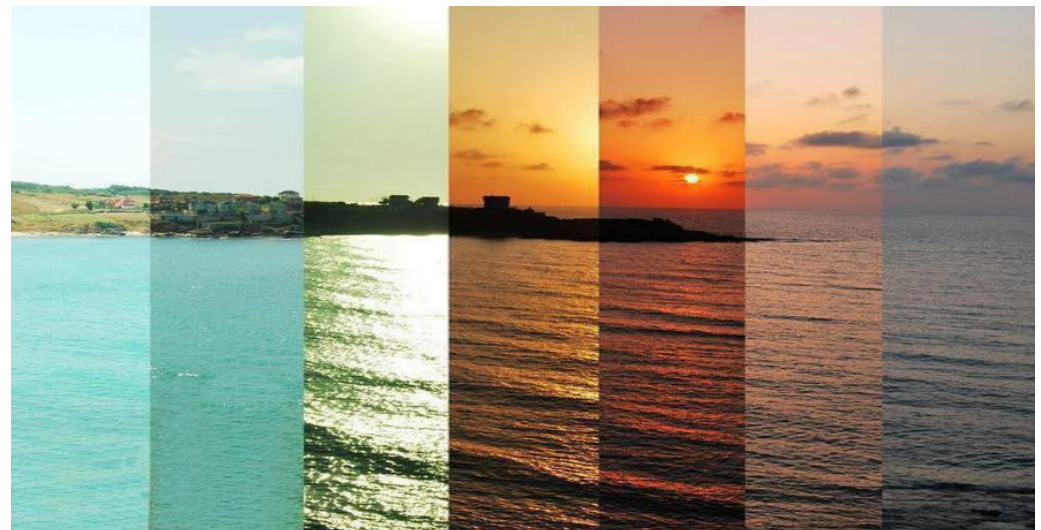


Fig 8 : The hues of natural light at different times of the day
 Ref : <http://webecoist.momtastic.com>

3.2 OTHER FORMS OF LIGHT THAT EXIST IN NATURE (GENERATED/PHENOMENA)



Fig 9

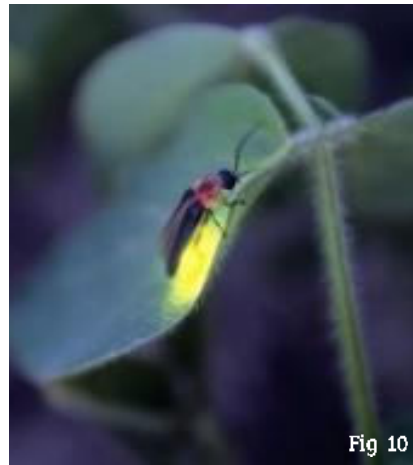


Fig 10



Fig 11



Fig 12



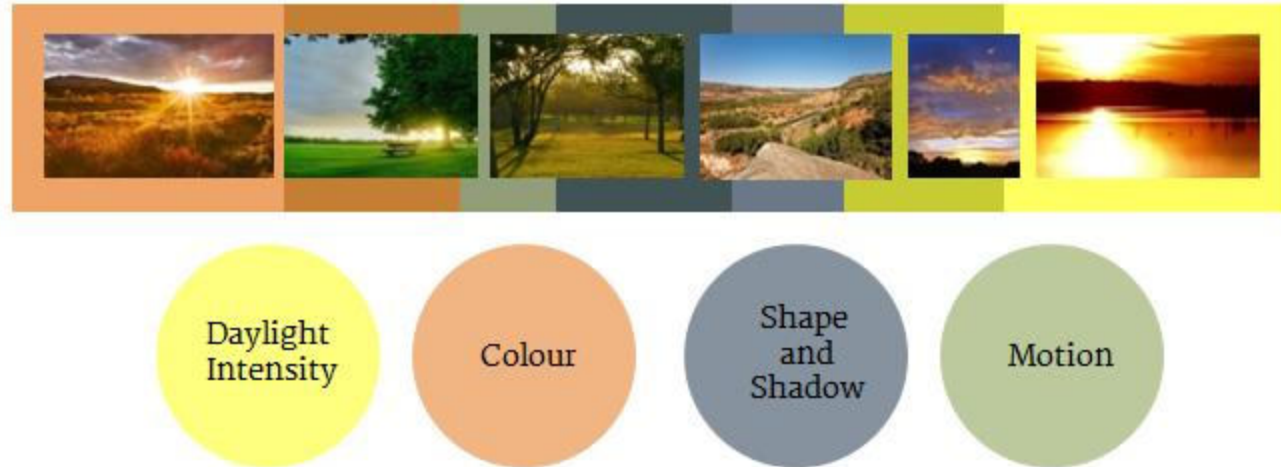
Fig 14



Fig 13

Figs(9-14):
Lightning, Fireflies, Stars, Northern Lights
Rainbow and Jellyfish
Ref:
<https://www.google.co.in/forms+of+light>

3.3 ELEMENTS OF NATURAL LIGHT



From the above data collected, it can be observed that there are certain visual attributes by which we can define the presence of light. The above four elements have been derived from natural light.

Daylight Intensity gives the illuminance (lux) at sunrise, mid-day, noon etc...ie. at different times of the day. Different colours of the sky and features of landscapes are visible because of light. It forms shadows and helps perceive motion.

4.0 RELAXATION

'The importance of restoration is rooted in our physiology. Human beings aren't designed to expend energy continuously. Rather, we're meant to pulse between spending and recovering energy.'

Relaxation is the most essential key to well-being. It helps to alleviate stress which eventually contributes to various diseases. The benefits of relaxation have been well researched and some of these are summarized below.

Relaxation gives the heart a rest by slowing the heart rate, reduces blood pressure , slows the rate of breathing - which reduces the need for oxygen , increases blood flow to the muscles & decreases muscle tension.

As a result of relaxation, many people experience more energy , better sleep , enhanced immunity, increased concentration , better problem-solving abilities , greater efficiency , smoother emotions — less anger, anxiety, frustration , less headache and pain. (Source - <http://heartofhealing.net>)



fig 15: Picture of a man relaxing
Ref: <http://www.breathslim.com/proper-breathing-blog>

4.1 CONVENTIONAL RELAXATION METHODS

There are different ways in which people relax and some of the common techniques are as follows:

Imagery - Visualization is an enjoyable manner of relaxing our minds and bodies. It involves using imagery to completely immerse ourselves in a pleasing scene, recreating the sights, sounds, smells, and tactile sensations.

Meditation - Relaxing with constant concentration, where the end goal is to achieve a calm state of mind by contemplation and reflection.

Self-Hypnosis- Unlike meditation, in self hypnosis, optimistic statements are used to manage stress, build self-confidence and bring in positive thoughts.

Using Music – Listening to soothing music is quite helpful for relaxation.

Physical Relaxation Techniques – It is a method to consciously tense and relax the muscles to feel the maximum effects of relaxation.

Yoga- Yoga places great emphasis on deep, rhythmic and effective breathing allowing the brain to be richly oxygenated and the body to relax.



Fig 16: Meditation Pose

Ref : <http://www.mindtools.com/stress/RelaxationTechniques>

4.2 OTHER RELAXATION METHODS

Mood Lighting - New products and environmental designs are using the *calming properties of light* to attempt to instill people with feelings of peace and tranquility. These innovations are experimenting with how light's color, intensity and design can be intentionally deployed to help improve health and well-being. (Source: www.psfk.com/publishing/future-of-light)

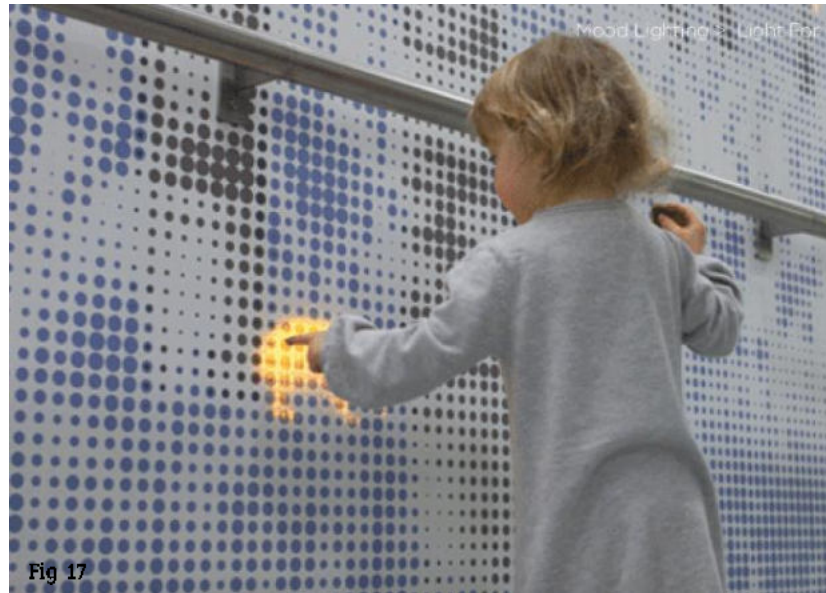


Fig 17

Figs(17-18): The Nature Trail is an illuminated wall designed to soothe and engage kids on their way to the operating room.
Ref: www.psfk.com/publishing/future-of-light



Fig 18

OTHER RELAXATION METHODS CONT'D...



Figs(18-21):An expansion to the Phoenix Children's Hospital in Arizona uses LED lighting fixtures to create an immersive escape for patients and families and distraction from the medical ailments surrounding them. (Ref: www.psfk.com/publishing/future-of-light)

Sensory Deprivation Chamber



Figs(22-23) :A sensory deprivation chamber- is a light-less, soundproof enclosure, filled with salt water that is kept at skin temperature. In this chamber a person will float weightless on the water with their senses deprived (Hence the name Sensory Deprivation Chamber). They are unable to see or hear anything, all while because of the water being the same heat as your body, subjects have been noted to have said "it all just fades away" and all that's left is the mind. (Ref: <http://www.wefloat.net/index.php/articles-on-floatation-therapy>)

4.3 LIGHT AND RELAXATION

A research group [1] believes that lighting has high effect on health, performance, mood and social behaviours. They used 32 different lighting items to create a questionnaire for analysis of a few important elements and show the effects of light in human behaviours. These elements include brightness, day lighting, social setting, etc. *The result shows that the combination of different decoration with dim colour is more pleasurable and induces a relaxing feeling for clients.*[2]

Another research carried out by Chan-Su Lee, Yeungnam University, Korea, ‘investigated whether the illumination stimuli of LED lighting can enhance attention and relaxation level by controlling color temperature and illuminance according to activities’[3]. The following were the details of the experimental set-up:

‘EEG(Electroencephalography)signals are used to estimate attention and relaxation levels of human subjects under different lighting conditions. Nine participants with normal eye sight and color vision participated in the experiments with four different activities under different illumination conditions. LED lighting with color temperature 3600 K in 240 lux is used for relaxation activities, and LED lighting with 6600 K in 794 lux is used for the task which requires attention. These lighting conditions are compared with conventional lighting condition with 4600 K in 530 lux. *Preliminary experiment results show that low color temperature with low illumination intensity of LED lighting enhances relaxation level and high color temperature with high illuminance improves attention level compared with conventional lighting environment without illuminance and color temperature changes.*’

LIGHT AND RELAXATION CONT'D...

‘Scientists have demonstrated via quantitative and qualitative research that light truly does help banish the blues. In fact, research studies carried out by a group of scientists in Canada recently compared depressed patients who were randomly assigned either a chemical antidepressant or to light therapy in the form of a light box. Alleviation of symptoms was essentially the same, with the light therapy patients having a slightly faster response in the first week of therapy than the medicated patients.

Another interesting aspect is this: light’s effects seem to only occur if the light source is above or at face level, not below.’ - Source :(<http://www.destress.com/relax/physical/light-and-depression.htm>)

4.4 COLOUR AND RELAXATION

The interface between colour and human response : Current Research

‘A number of recent studies have indicated that certain wavelengths of light may have specific impacts. For example, blue light may improve cognitive performance [4]. The term colour psychology, often used interchangeably with “the psychological effects of color” as suggested by Van Wagner [5], tends to refer to a range of affective, cognitive, and behavioral responses and associations linked to specific colours.

Symbolic colour associations and colour meanings are often mentioned in conjunction with a range of psychological responses to colour including affect, preference, and cognitive judgments ; and these in turn are often mingled with biological and behavioral responses to colour. An example of the intermingling of a range of different types of response is provided by Van Wagner as follows :

“Red is a bright, warm colour that evokes strong emotions; Red is also considered an intense, or even angry, colour that creates feelings of excitement or intensity. Red stimulates the physical and adrenalin. It raises blood pressure, the heart rate and respiration.”

“Blue calls to mind feelings of calmness or serenity. It is often described as peaceful, tranquil, secure, and orderly. Blue is often used to decorate offices because research has shown that people are more productive in blue rooms.....”

COLOUR AND RELAXATION CONT'D...

and ‘the sight of the colour blue causes the body to release tranquilizing hormones when it is surveyed, particularly a strong blue sky’’ and ‘‘many believe (blue) can lower blood pressure, slow the pulse rate and decrease body temperature.’

Green is restful, soothing, cheerful and health-giving. Green is thought to relieve stress and help heal.

With regard to colour healing, it is suggested that colour can be used as a treatment tool in conjunction with the seven chakras of the body . The chakras are considered to be energy centers within the human body. Under the colour-chakra theory, a colour is linked to each of the seven chakra and these colours are associated with body functions and dysfunctions within each chakra area.’[6]

5.0 IMMERSIVENESS

Immersion is a metaphorical term derived from the physical and emotional experience of being submerged in water. *Being immersed* gives a feeling of submergence and engrossment.

USER STUDY AND THEIR CONCEPT OF IMMERSIVENESS

Instance 1• Immersiveness in Nature

Goes on treks to forts and likes discovering old ruins on weekends and feels like a '*hero of that story*'. The smells of the earth ,the breeze, the sway of grass envelops him and he feels mesmerized by the play of light and shadow. A feeling of '*renunciation*' comes while experiencing the dusk in its purple-orange haze...



Fig 24: Immersiveness in nature.



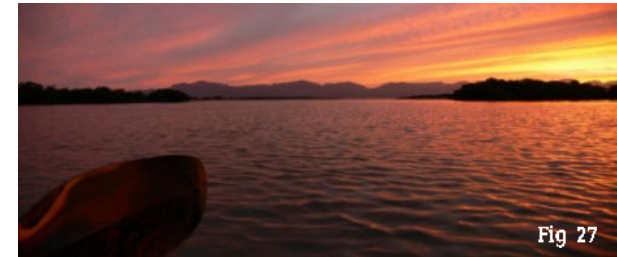
Fig 25: Purple orange haze

Instance 2• Immersivness in Pattern

Interviewee talked about how involved she got watching the pattern in the waves on a ferry ride to the Elephanta caves. ‘The crest and the trough formation was beautiful especially with the streaks of sunlight shimmering on the tips.’



Figs(26-27): The immersive patterns in ripples
Ref : <http://wallshd.net/image-18480.html>



Instance 3• Immersiveness in Random

Interviewee was attending the ‘Evening Aarti’ in Banaras and found himself captivated by the flickering of the flames of the diyas that float on the water. He talked about the way the floating diyas moved in the water...sometimes clustering and then separating...the randomness was immersive...



Figs(28-29; Floating diyas in water
Ref: <http://hariharji.blogspot.in>



Instance 4• Immersiveness in games

Interviewee stated 'I have been playing this game for a year (temple run and paper plane) and I've never seen what's the end of this game like...I want to know what's so special about getting to the end...playing this game involves me completely.'



Fig 30



Fig 31



Fig 32

Figs(30-32) :Immersive game apps
Ref: <http://mashable.com>

Instance 5• Immersiveness in technology

Interviewee was amazed with 'Microsoft Surface'. He mentioned that 'it was the first time a table top application was so interesting and engaging in different ways. It responded to your weight if you bent on it, recognized any object you kept on the surface, and multiple touch options'...



Fig 33



Fig 34



Fig 35

Figs(34-35) :Microsoft Surface
Ref: <http://www.dvice.com>

5.1 ELEMENTS OF IMMERSIVE EXPERIENCE

KEYWORDS SELECTED

Discovery, Feel, Smell, Breeze, Play of light and shadow, Colourful purple-orange haze, Mesmerized, Experiencing, Watching, Pattern, Streaks of sunlight, Shimmering, Flickering flames, Movement, Randomness, Involves, Aware, Amazed, Engaging, Interesting, Other-worldly, Different, All-encompassing, Indescribable, Familiar- yet new, magnificent, Personal, Fun-but scary, Makes me aware of what I don't know, Liberating...

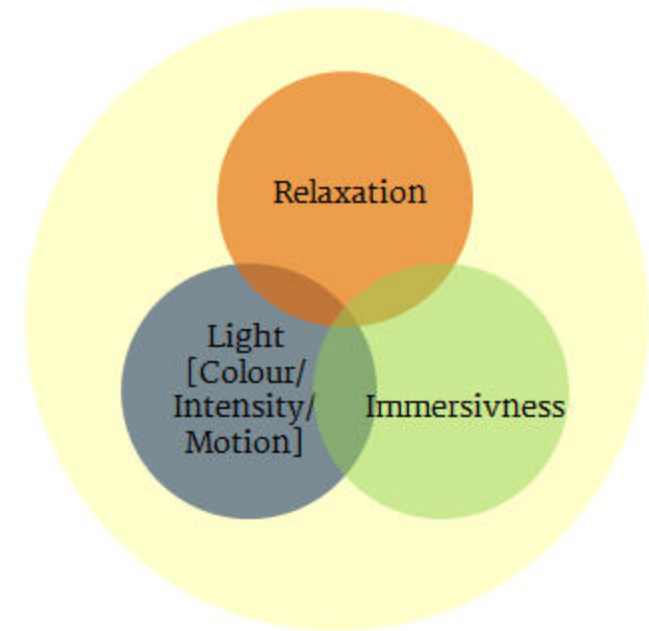
Above mentioned are the keywords that were selected from the experiences that were shared by different users. From these words the elements of Immersive Experience were derived :

- The sensory cues
 - feel (breeze, temperature)
 - smell (earth, grass, rain)
 - touch (surfaces),
 - sight,
 - sound
- The effect of colours
- A sense of motion
- The perception of scale
- Interaction and engagement for a certain period of time

6.0 COMBINING THE 3 ASPECTS TOGETHER AND OPTIMIZING THE DATA FOUND

The diagram on the right shows how the 3 aspects when put together can create an experience.

The table below elaborates this diagram by representing that if the relaxation level is low, Blue/Violet coloured light with high intensity and slow pulsations/fluctuations will help a the user relax. Also if this light is accompanied with music that is slow with deep bass, it has a better calming effect.



Relaxation	Low Level	Medium Level	High Level
Colour	Blue/Violet	Yellow/Green	Red/Orange
Intensity	High	Medium	Low
Motion/Movement	Slow	Medium	Medium
Music/Sound	Calm/slow/string instruments/deep bass		Fast/ has beats(percussion instrument)/high pitch

7.0 PROJECT BRIEF

“To design an immersive light experience that is derived from the elements of natural light which helps urban professionals to relax in a personal space.”

From the data gathered and optimized, the colour, illuminance and motion factor of the light will be utilized to help achieve relaxation through music.

8.0 USER AND USAGE

User - The target user would be urban working professionals from age group of 22 years and above who experience a lot of work and travel related stresses during the day. They need relaxation and tranquility to de-stress themselves for better performance and productive work.

Usage - This product will allow the user to have a personal space to relax. Hence it can be used in homes and in public spaces(like recreational rooms in offices or as a relaxation space in airport)



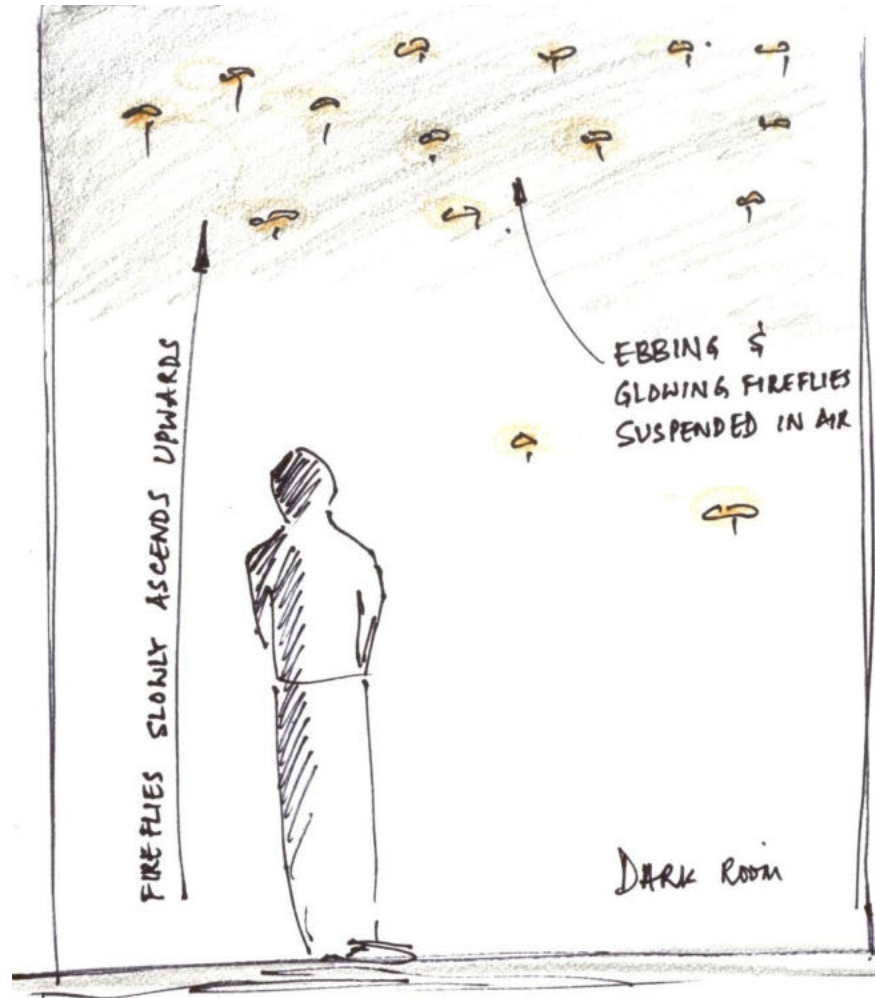
Fig(36-37): Work stress
Ref: <http://healthmeup.com/photogallery>

9.0 IDEA GENERATION

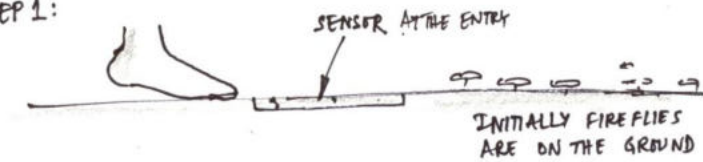
The following Ideas were generated to bring in the elements of light , relaxation and immersiveness together.

- 1: Experience of a Summer night in forest with simulation of fireflies
- 2: Experience of flotation with lights with interactivity using sound and touch
- 3: Kaleidoscope effect of lights in an immersive cocoon- formless light
- 4: Streak of lights- lights that change colour and glow with hand gestures(sound could be involved)
- 5: Experience of a waterfall that enhances the bathing experience-ripples effect highlighted with lights as water drops
- 6: Imitate the motion of fishes in a bath tub with lights
- 7: Motion sensing balloon that lights up when it senses activity and then fades off

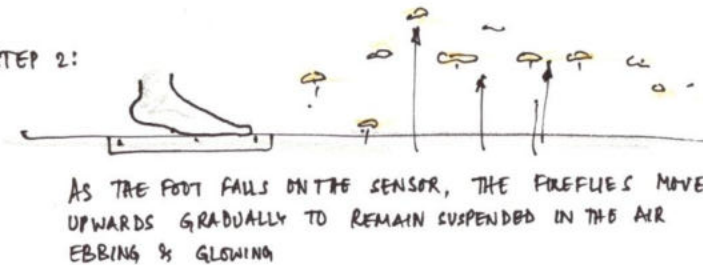
IDEA - Experience of a Summer night with fireflies



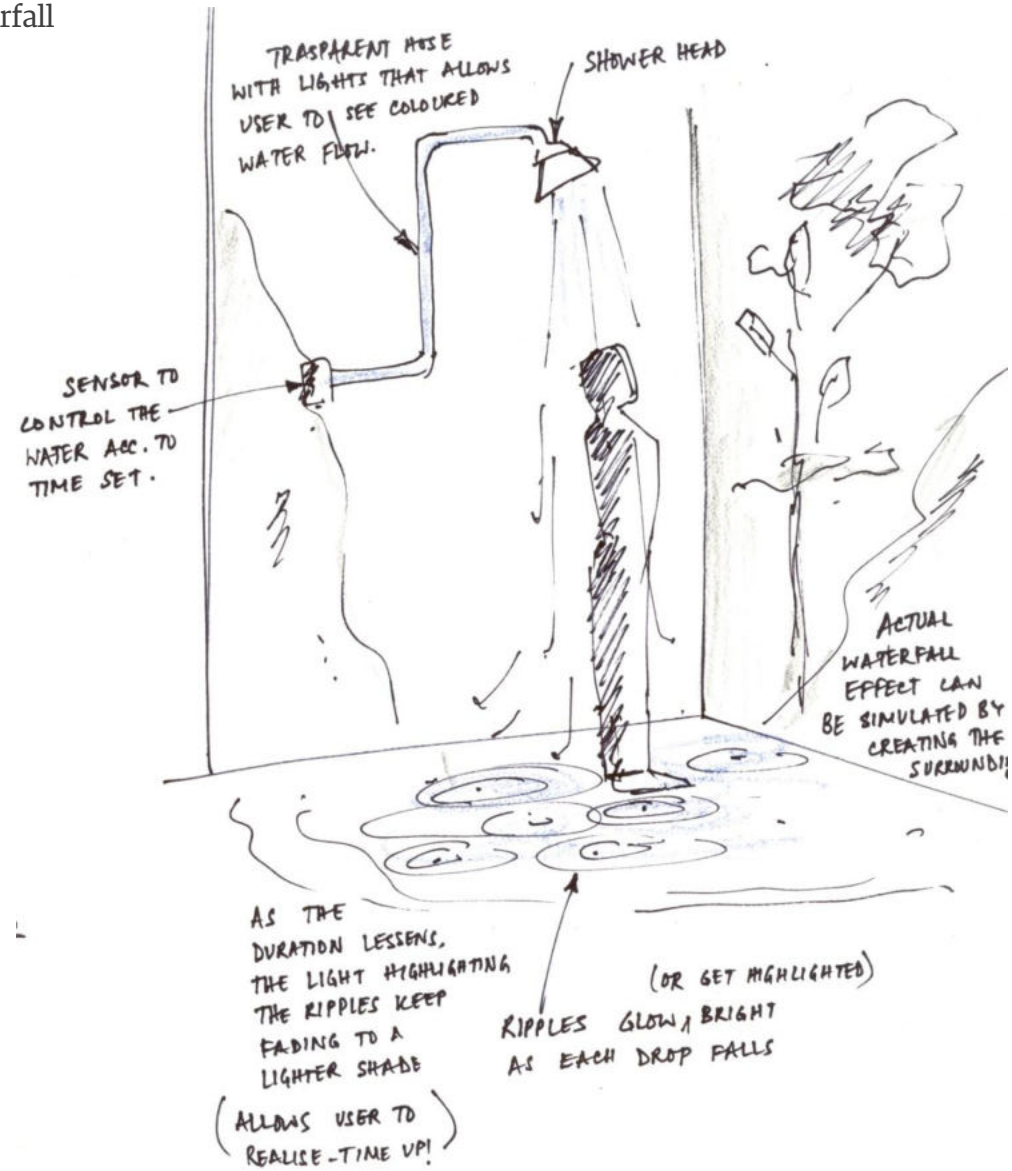
STEP 1:



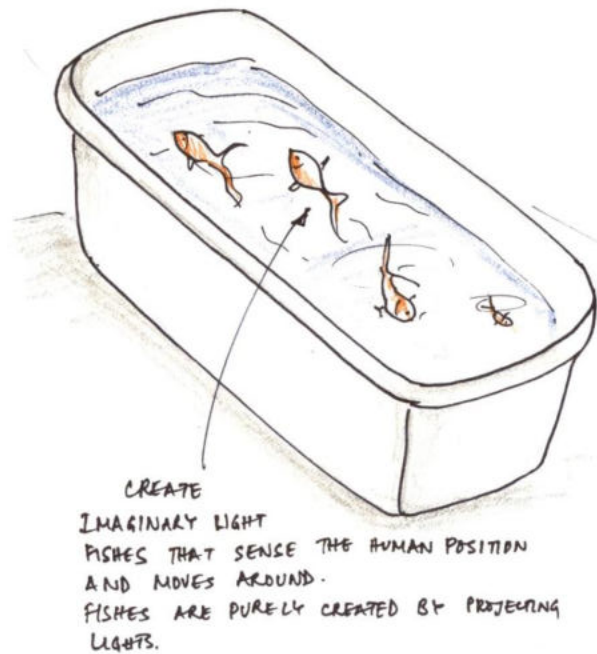
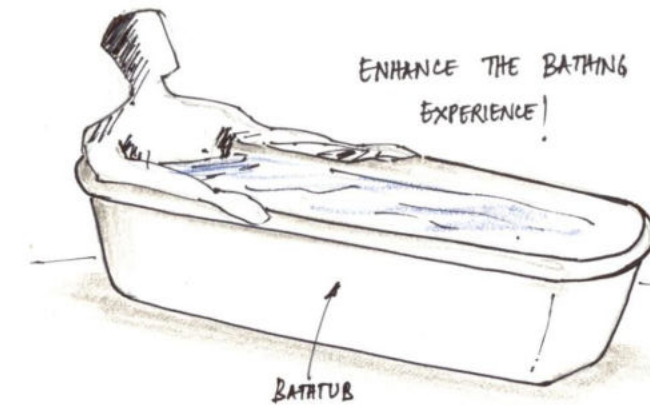
STEP 2:



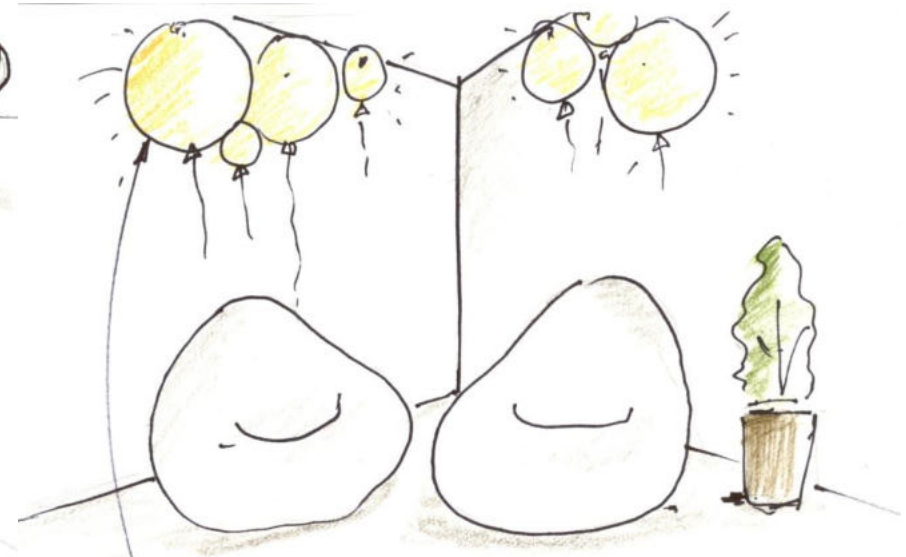
IDEA - Experience of waterfall



IDEA - Fishes in Bathtub

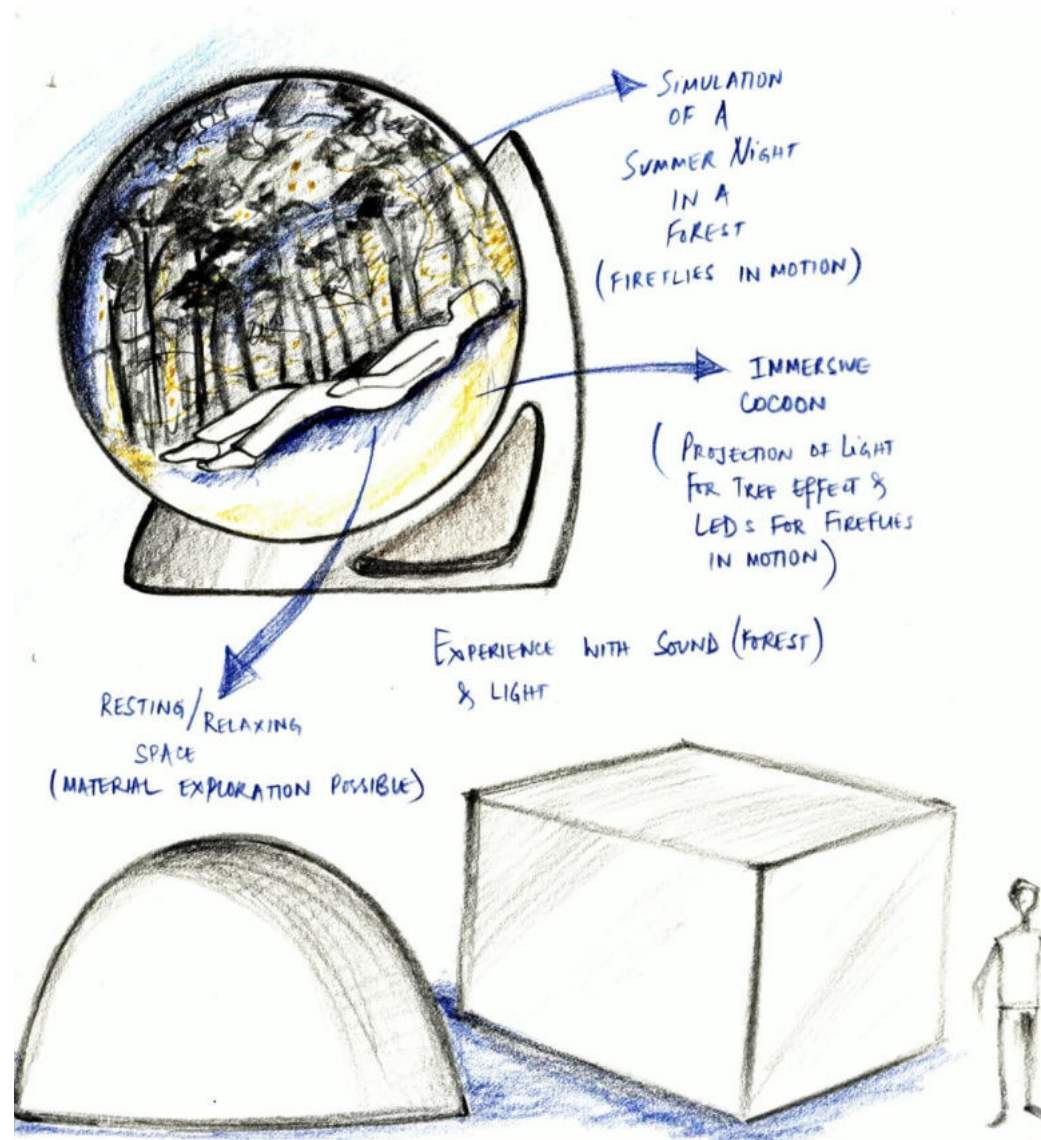


IDEA - Floating Lights



THEY GLOW WHEN MOTION IS DETECTED
THE FLOTATION OF LIGHTS ALLOW IT TO BE MOVED AROUND
FROM ROOM TO ROOM (LIKE FLOATING CANDLE)

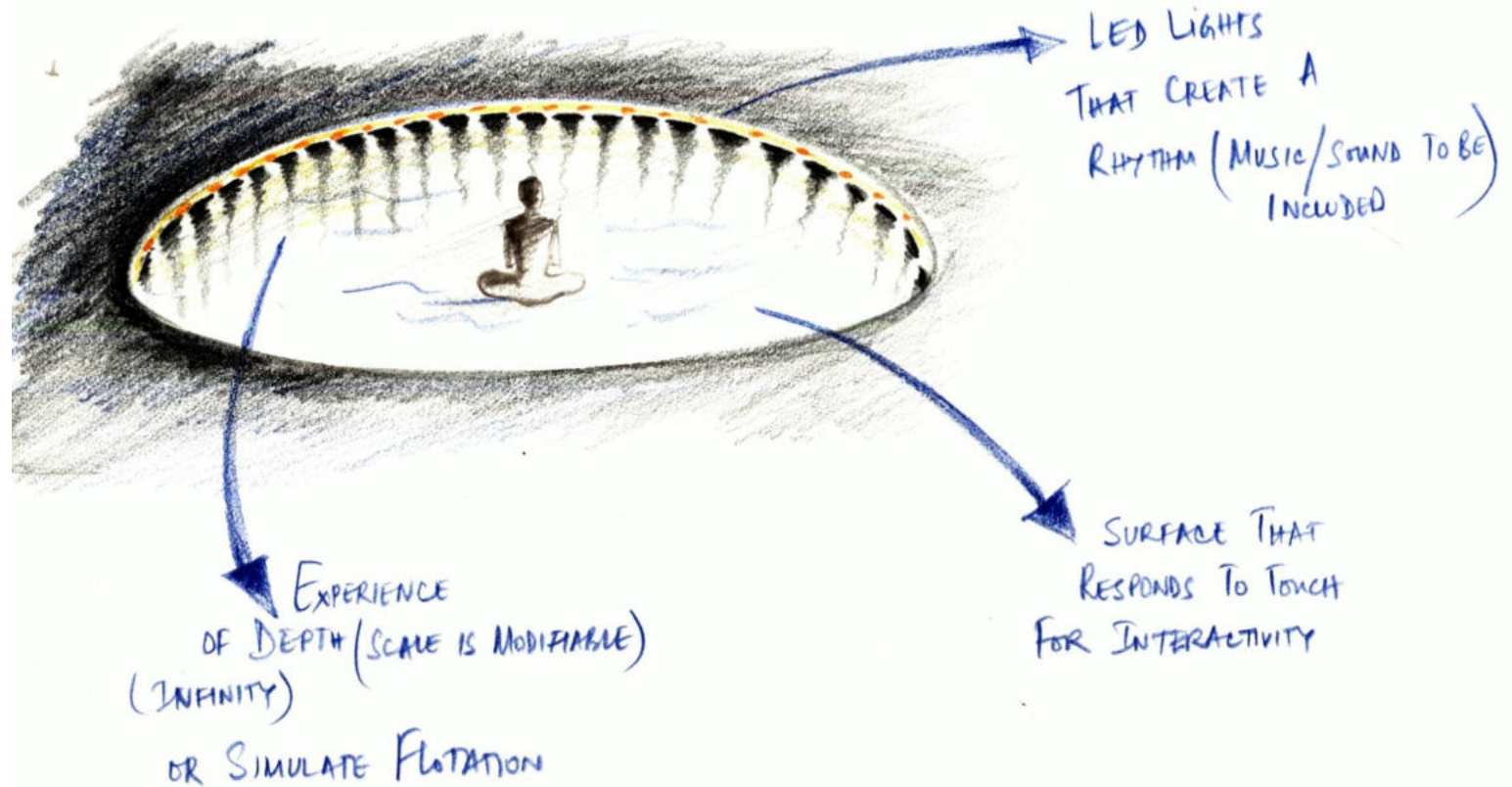
IDEA- Immersive Cocoon



Technology Exploration-

Light projection,
Interactive lights - ebb and
glow of fireflies
Relaxation chair material
for sensorial experience

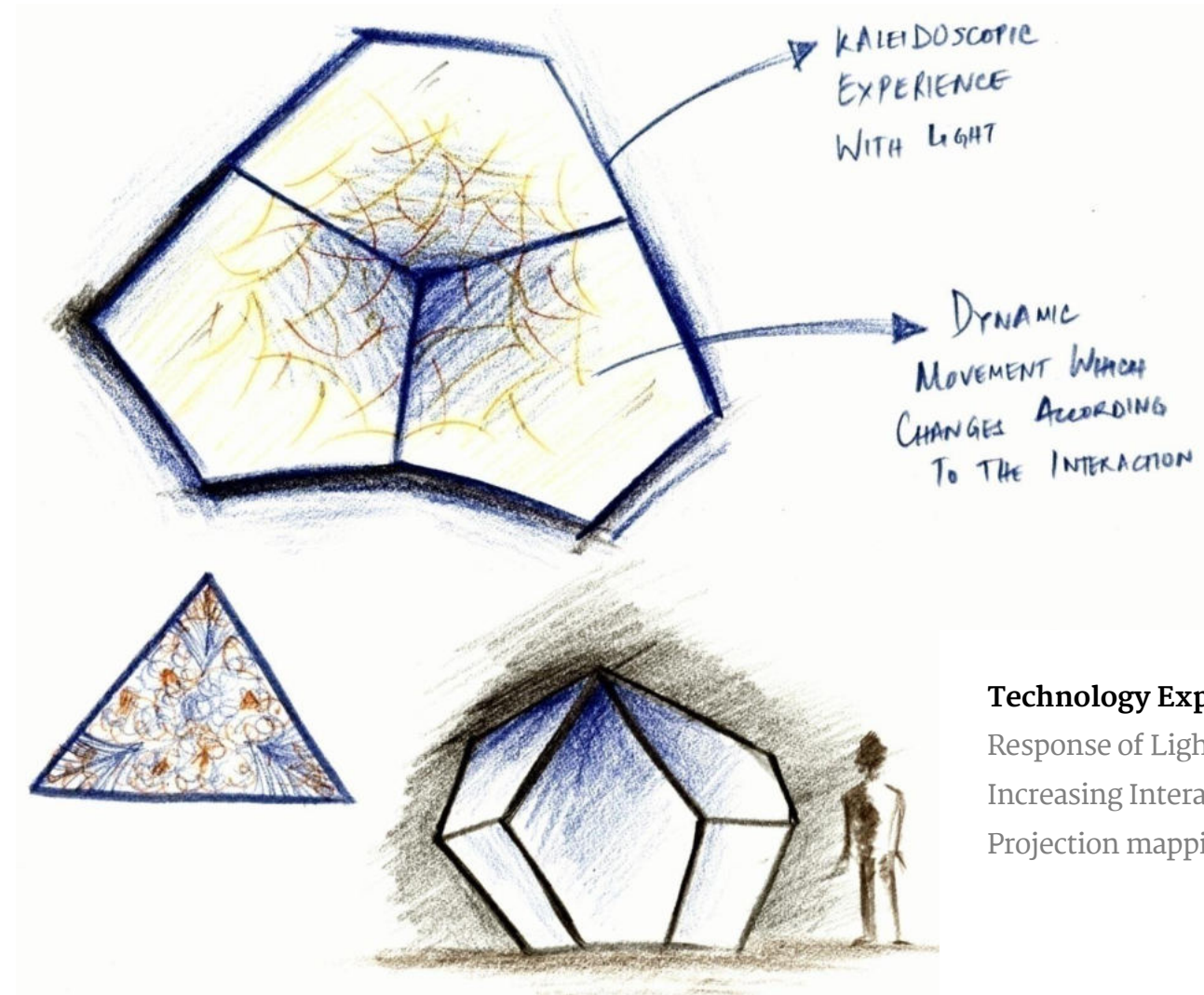
IDEA-Experience of flotation with lights and interactivity using sound and touch



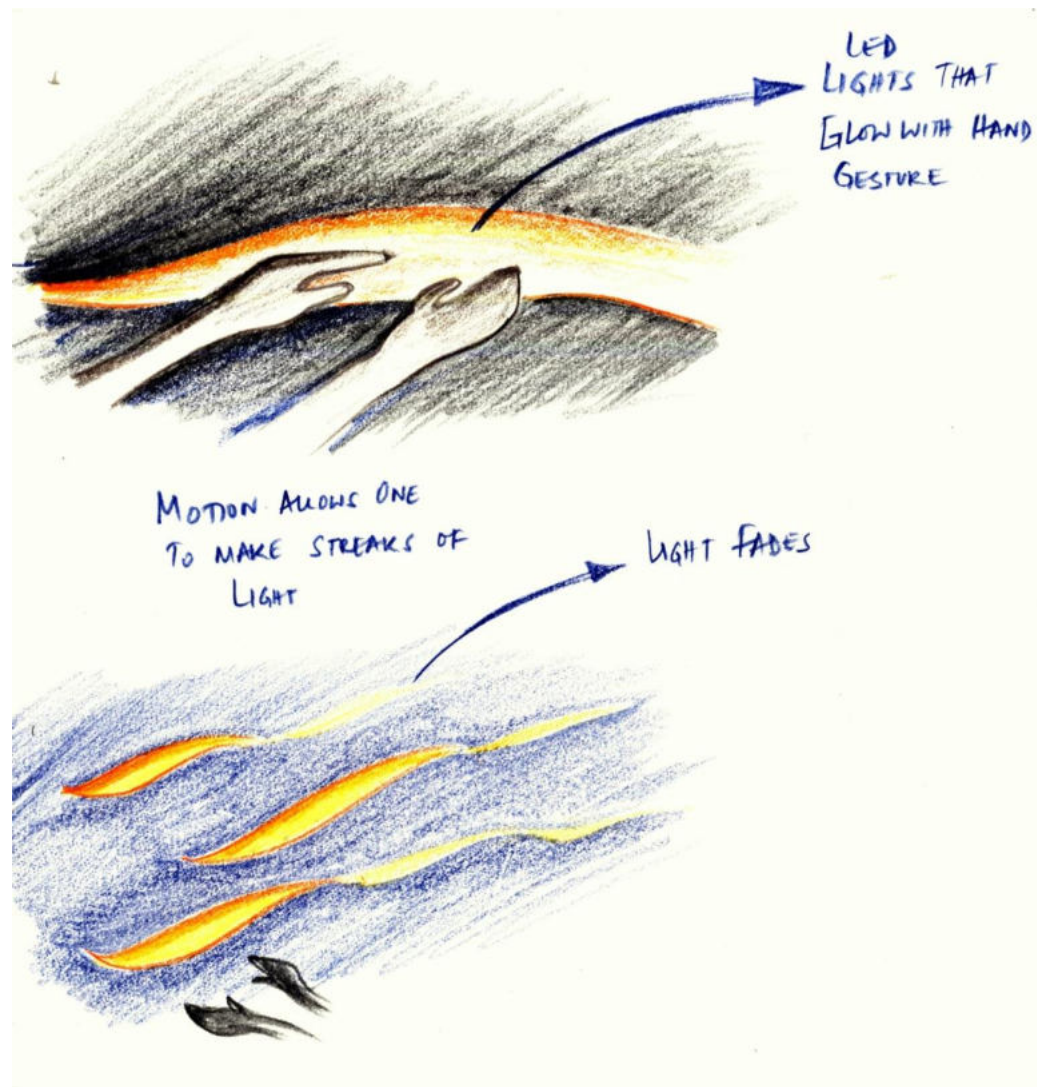
Technology Exploration•

Response of Light with Sound
Increasing Interactivity

IDEA- Kaleidoscope effect of lights in an immersive cocoon- formless light



IDEA- Streak of lights- lights that change colour and glow with hand gestures



Technology Exploration -

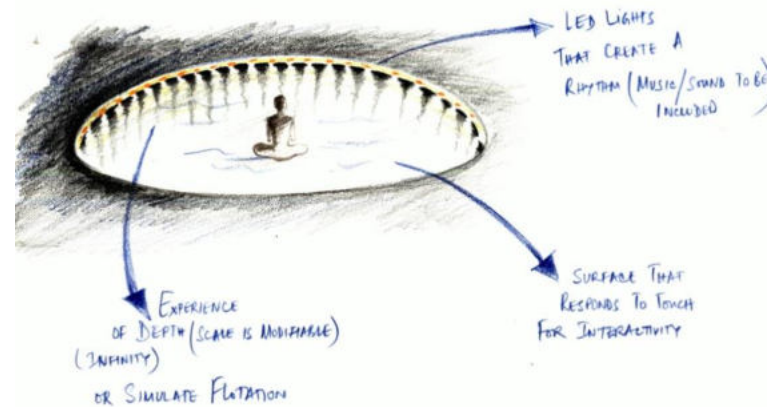
Motion sensing

Proximity Sensors

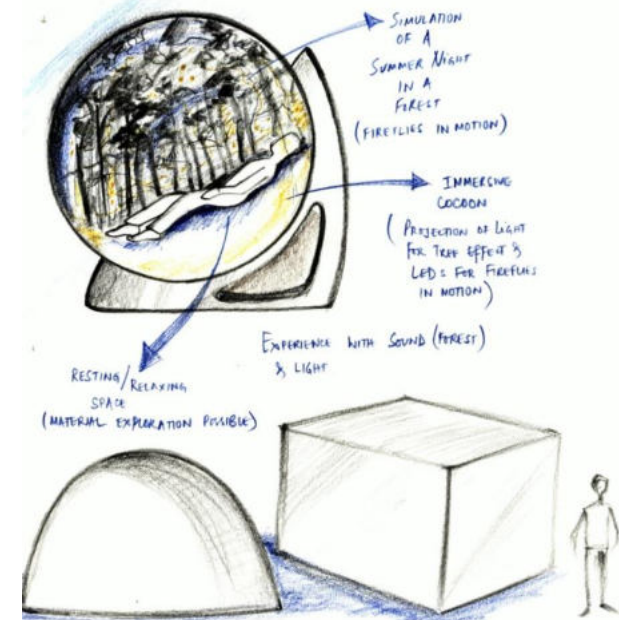
10.0 CONCEPTS AND SIMULATION

Of the Ideas that were generated, they were evaluated in terms of feasibility, highest Immersive experience and whether they conformed to the project brief. The first and the second idea were then selected for further explorations for concepts.

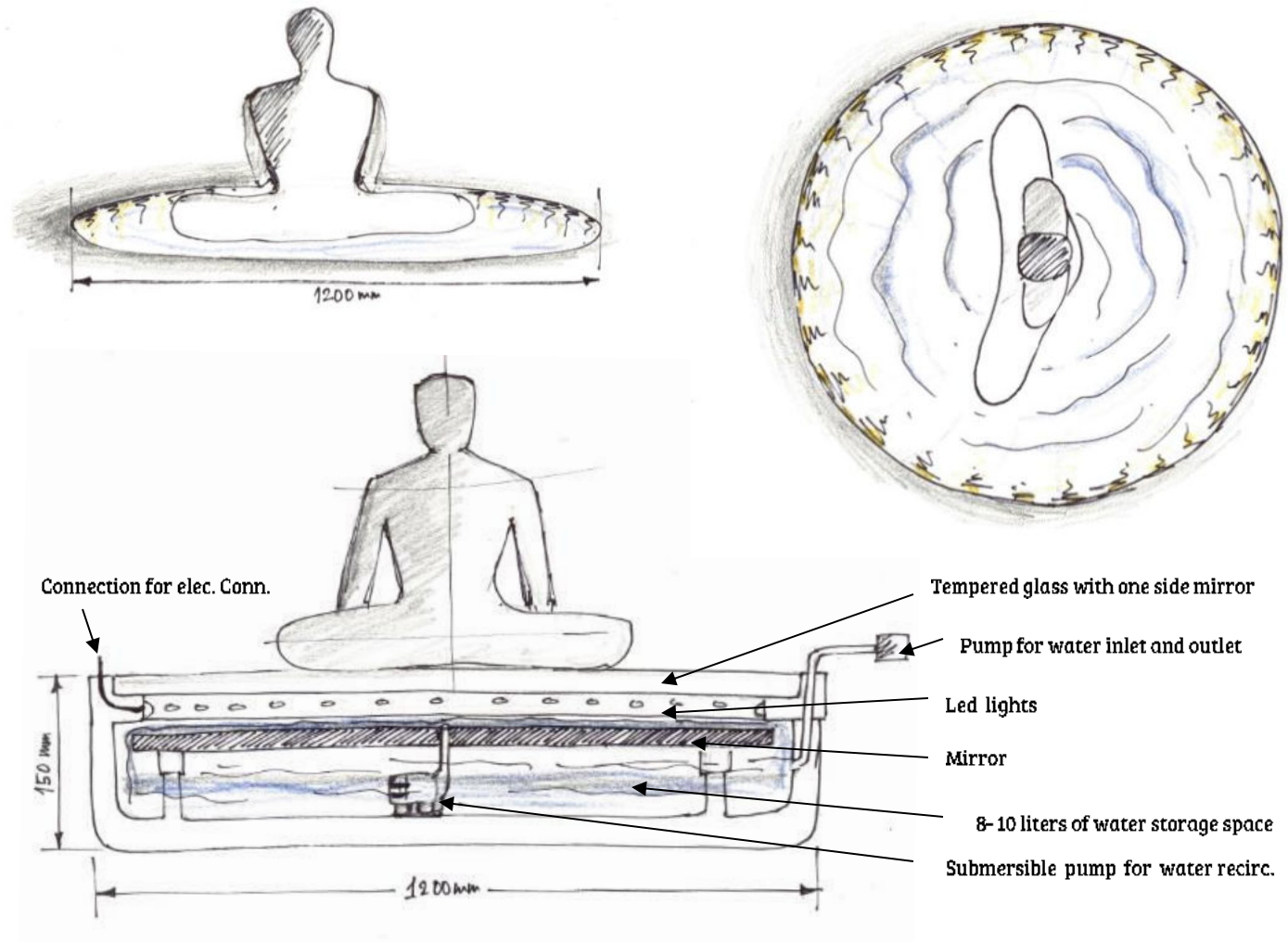
CONCEPT A : Experience of depth with lights with interactivity using sound and touch



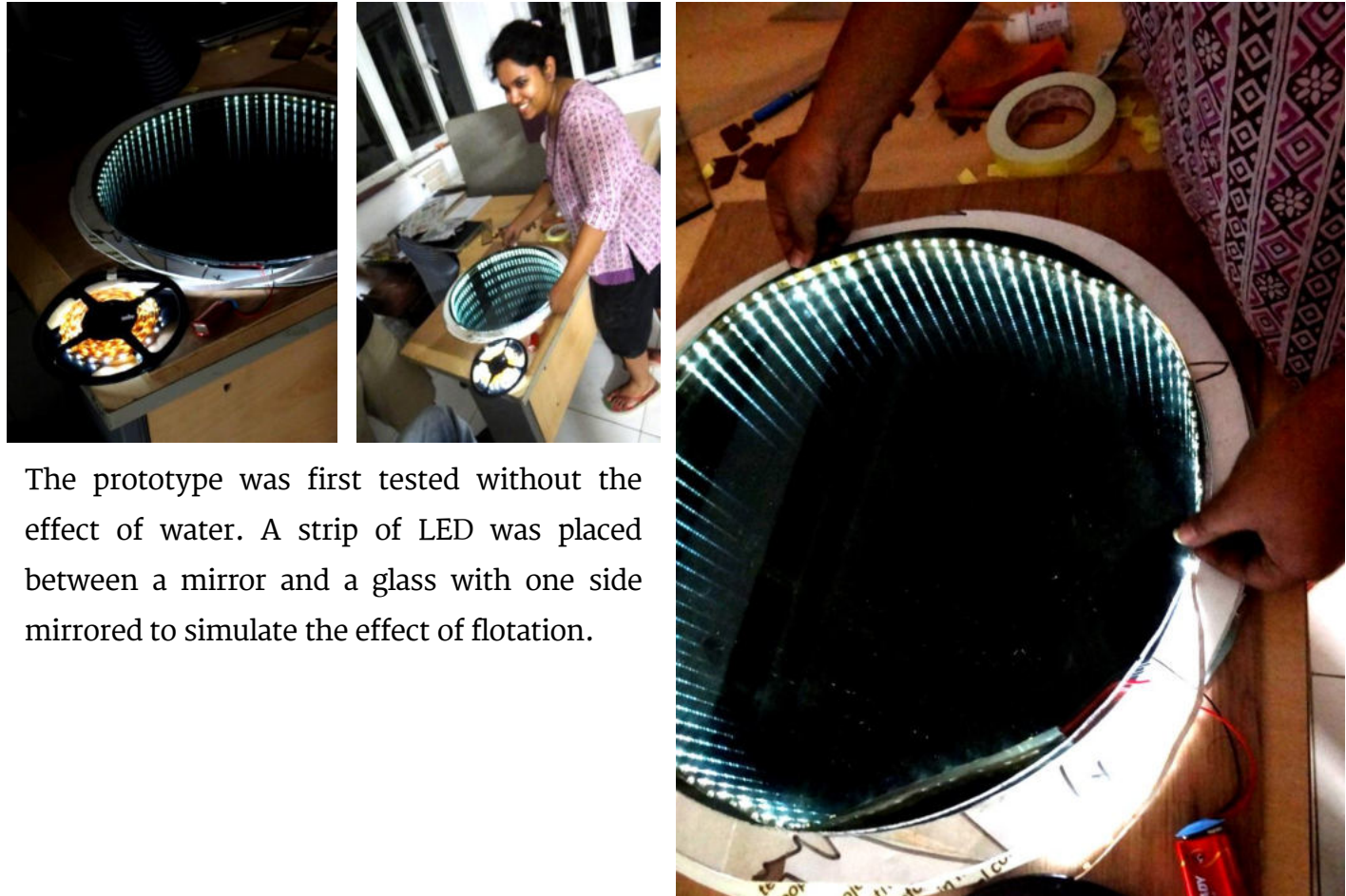
CONCEPT B : Immersive Experience of a cocoon. Here the coloured lights will be synchronized with music for helping the users to relax. The top of the structure will have modulating glow of optical fibers to simulate the effect of 'stars'.



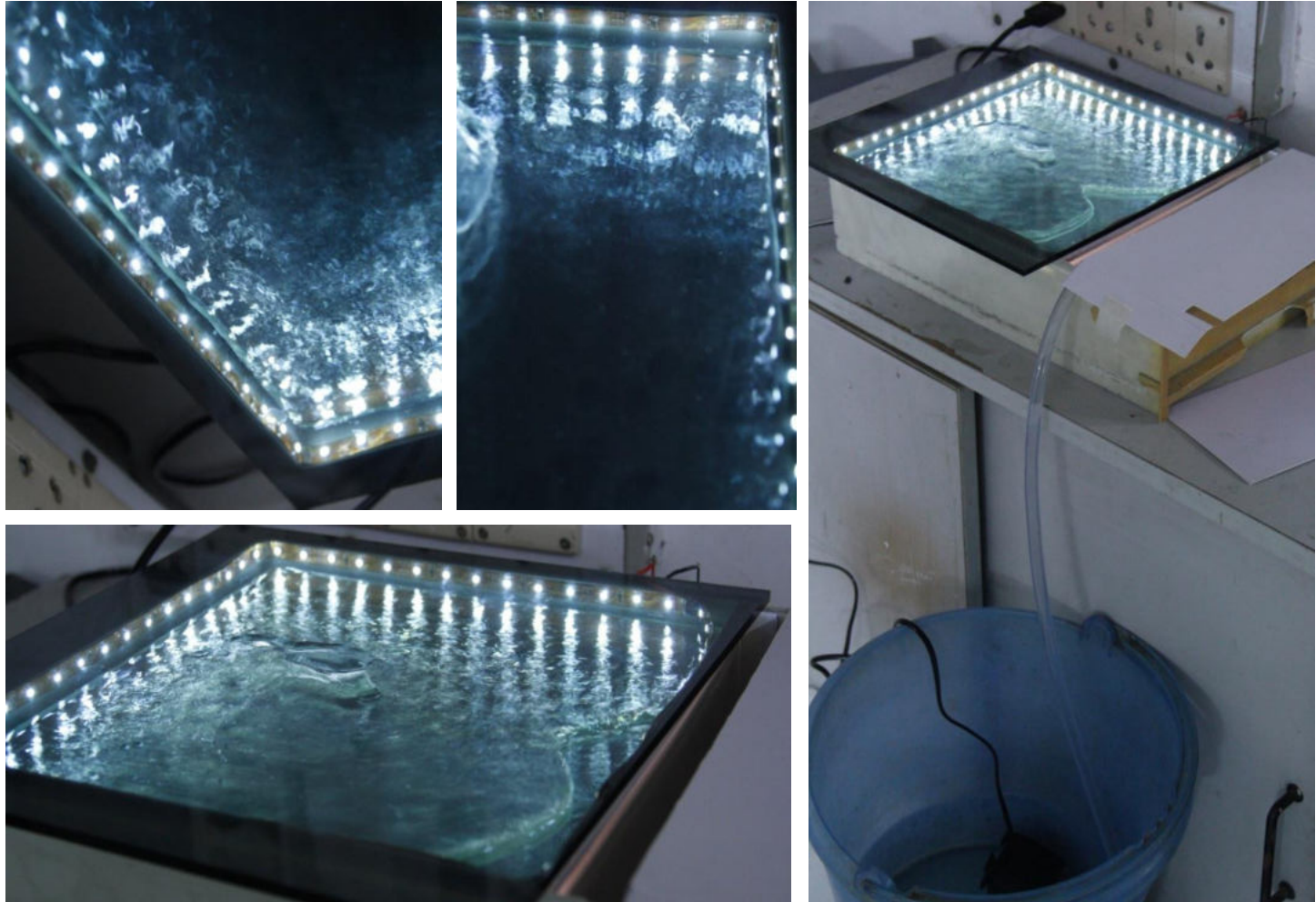
10.1 CONCEPT A : DETAILS



CONCEPT A : PICTURES OF ROUGH MOCK UP MODELS.



The prototype was first tested without the effect of water. A strip of LED was placed between a mirror and a glass with one side mirrored to simulate the effect of flotation.



Set up is a testing prototype for the dynamic effect of flotation. This is where water flows between the mirrors and is constantly re-circulated using the submerged pump.

10.2 CONCEPT B : IMMERSIVE EXPERIENCE OF A COCOON

- The Immersive Cocoon is located in the user's house.
- The Stressed User, after returning from work wishes to relax and hence approaches the cocoon
- The User sits and enters the cocoon as shown in the following slides.
- The interior of the cocoon is made of soft white matte micro polyester jersey fabric which allows air to circulate . There is a plush cushiony surface on which he can sit and relax.
- There is a USB port which is to the right of the user (input port) to which he connects his cell phone.
- Immediately a soft warm yellow glow fills the entire cocoon.
- In the cell phone an application asks the user about his stress level (3-min/5/8-max) on a scale of 10.
- After the user selects his level, the lights moderate into colours and a soothing music accompanies the lights. Further into the music the lights moderate on the basis of the users stress levels. The more stressed he is, more of blue, violet hues are generated as per previous research reference to calm him down.
- The ceiling of the cocoon has tiny lights ebbing and glowing to simulate the effect of stars.
- After the music stops, the cocoon goes back to the original glow.
- An option of reading light is included if the user wants to relax by reading a book.

10.3 MOOD BOARD FOR FORM EXPLORATIONS



Fig 38



Fig 39



Fig 40



Fig 41



Fig 42

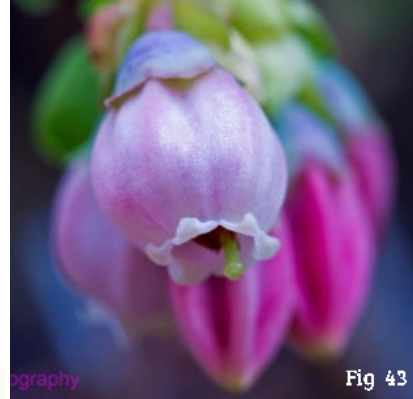


Fig 43



Fig 44



Fig 45



Fig 46

Fig(38-46): Cliff Swallow's nest, erica marifolia, woollen strands, butterfly cocoon, maize, pink waxbells, weaver bird's nest, nubuck leather bag, yellow flower

Ref:
<http://ledgeandgardens.typepad.com>
<http://www.the-beautiful-things.com>

10.4 CONCEPT B : EXPERIENCE TRIAL AND ERGONOMICS

A rough mock up model was made to simulate the immersive effect with blue light

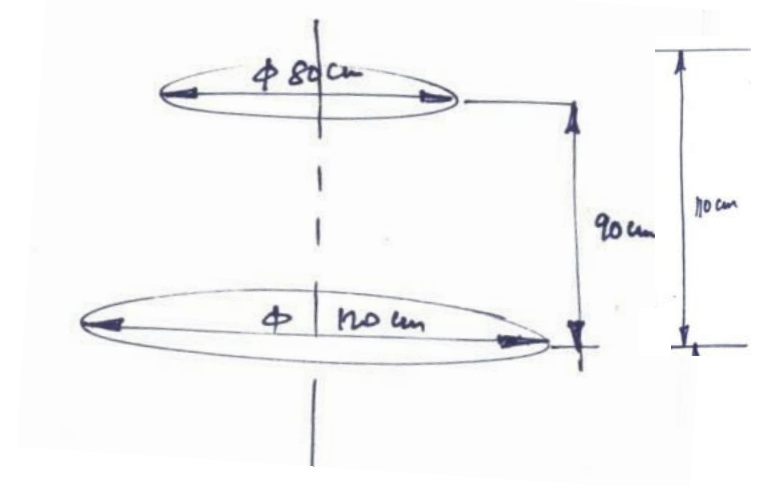
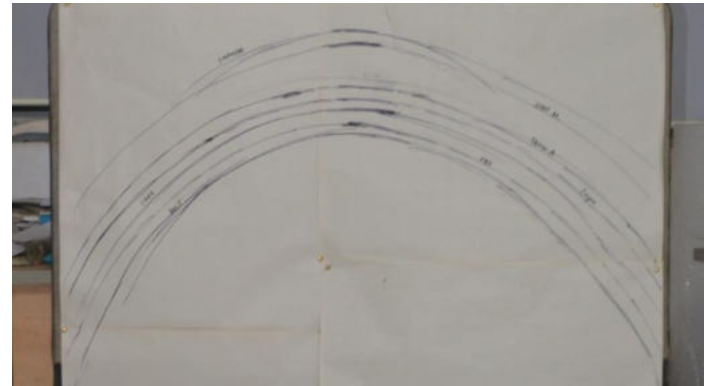
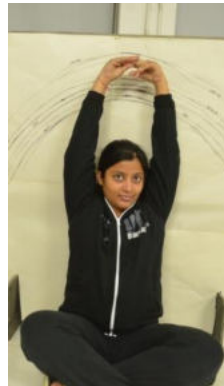




A user survey was conducted with 10 different users for ergonomic study.

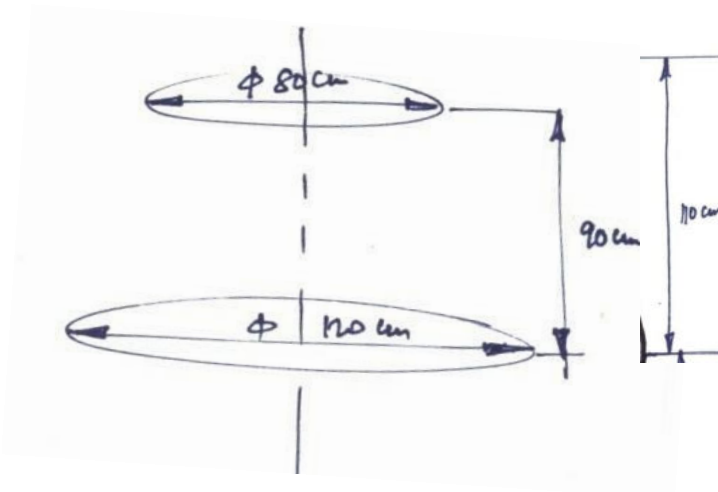
10.5 RESULTS FROM ERGONOMIC STUDY

Users were asked to indicate their level of comfort in an enclosed space by which the average height for the structure was determined.

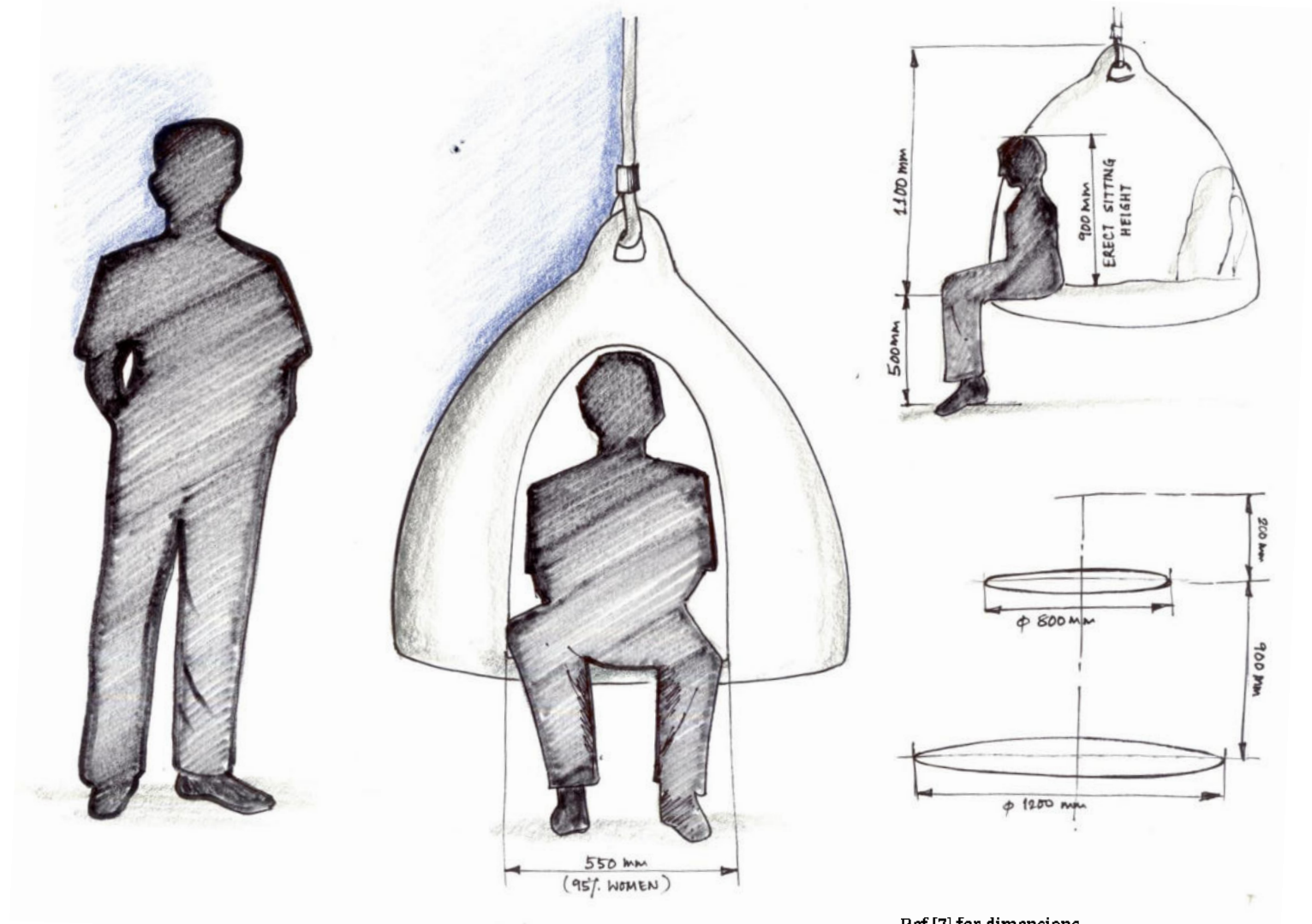


RESULTS FROM ERGONOMIC STUDY CONT'D...

- From the study, the entire height of the structure was selected as 1100 mm (average between 1200 mm and 1000 mm) since majority indicated that level.
- The diameter covered by the umbrella was 900 mm, and the finalized dimension was 800 mm to include the form factor as well.
- The maximum dimension for a person sitting erect was found to be 880 mm and according to the referred anthropometric data book, the maximum height for 95% male is 900 mm.
- The height from the ground referring to the data book was considered as 500 mm (75% combined)
- The opening area width is considered to be 550 mm (95% women)

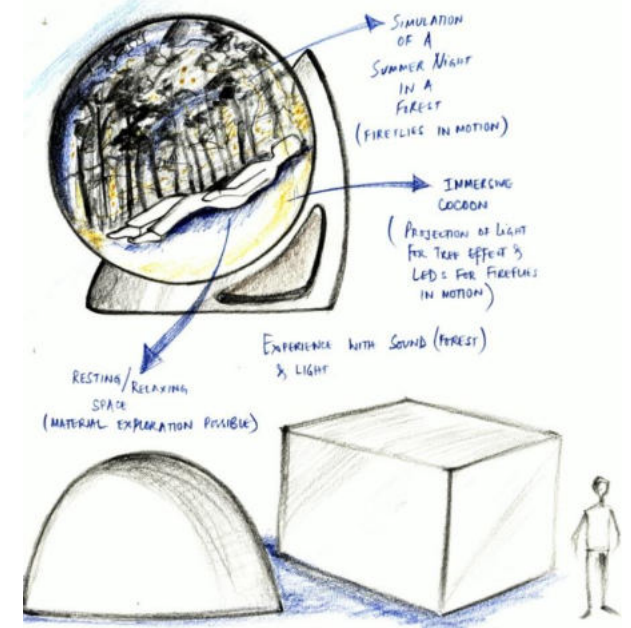
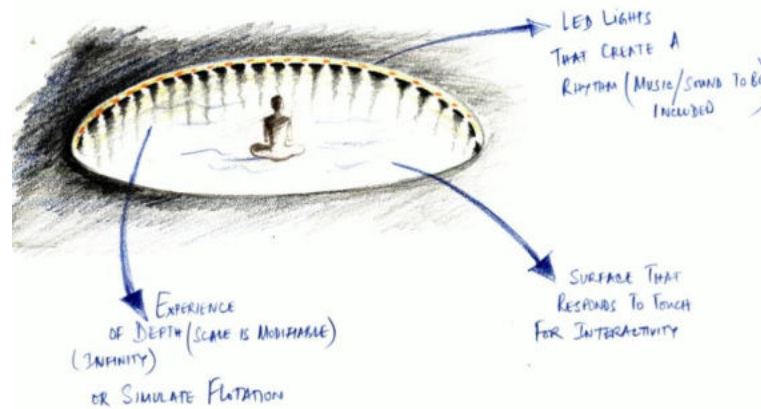


DIMENSIONS FROM STUDY AND BASIC STRUCTURE OBTAINED



Ref [7] for dimensions

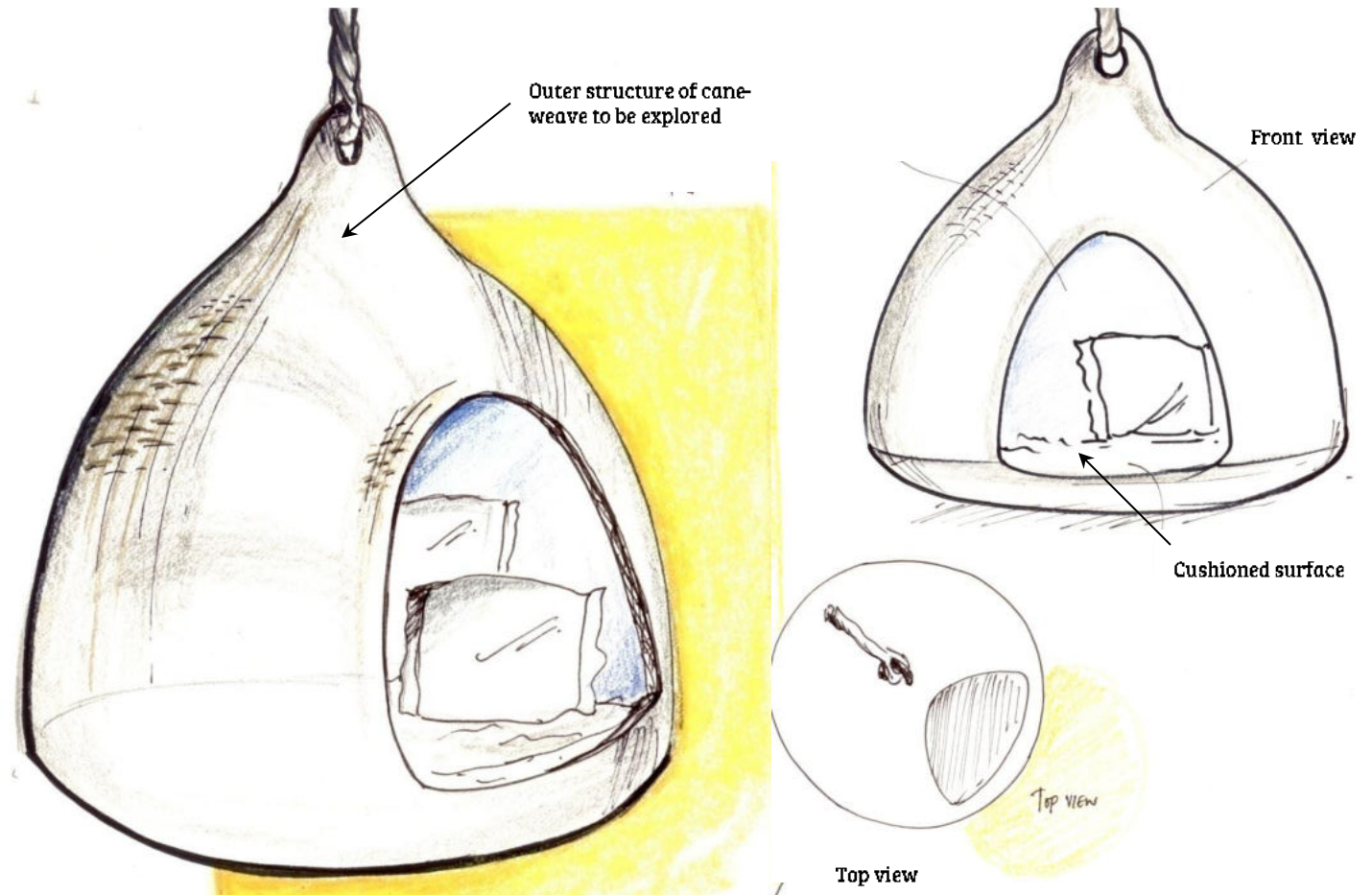
10.6 EVALUATION OF CONCEPTS



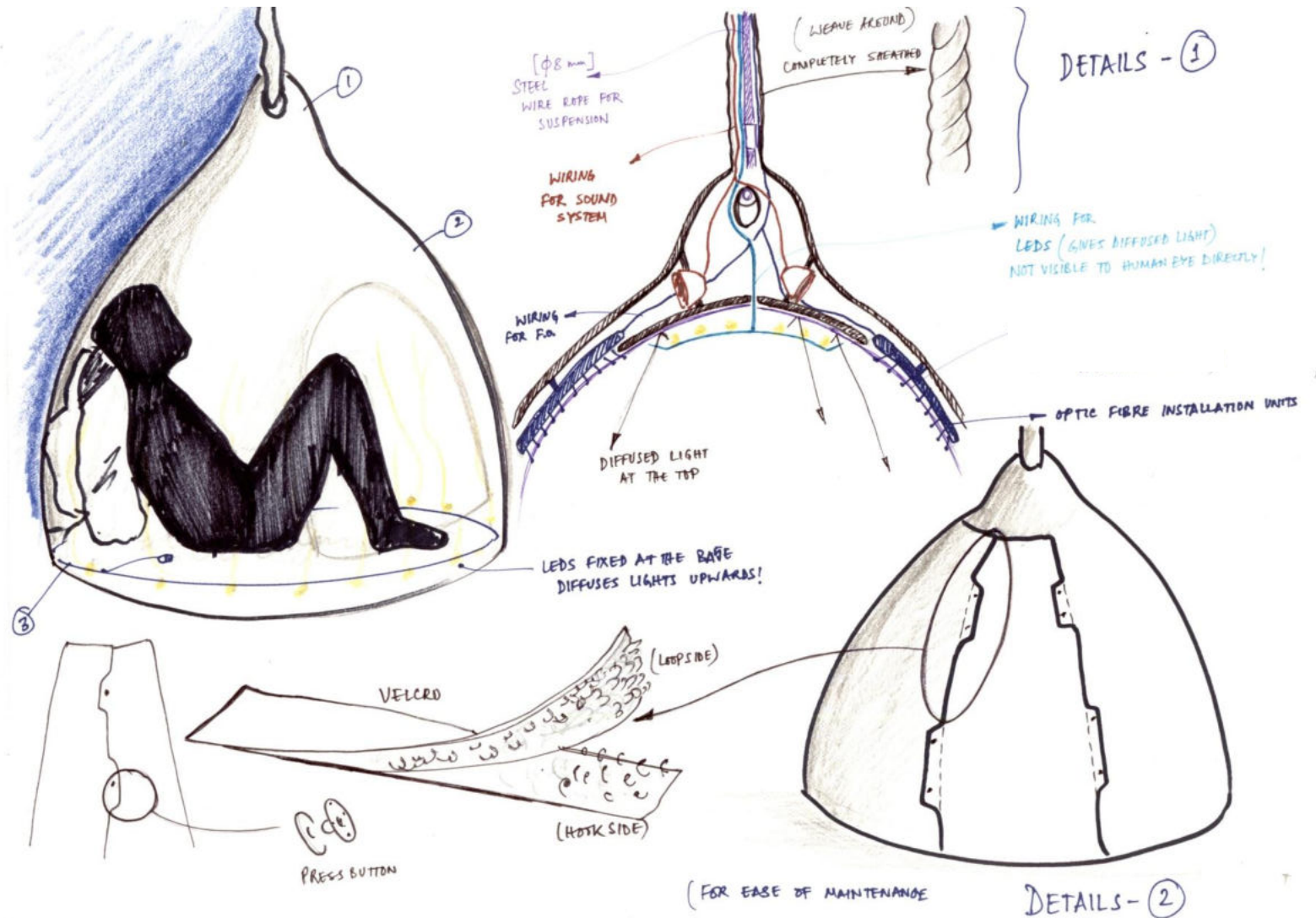
Criteria	Concept A	Concept B
Personal Space	Not defined	Defined
Ergonomics	Visuals are below eye level	Visuals are above and at eye level
Maintenance	Difficult due to water/leakage issues	Easier
Posture	Sitting/Standing	Sitting, Inclined Sitting
Immersive Experience	Good	Better

10.7 FINAL CONCEPT

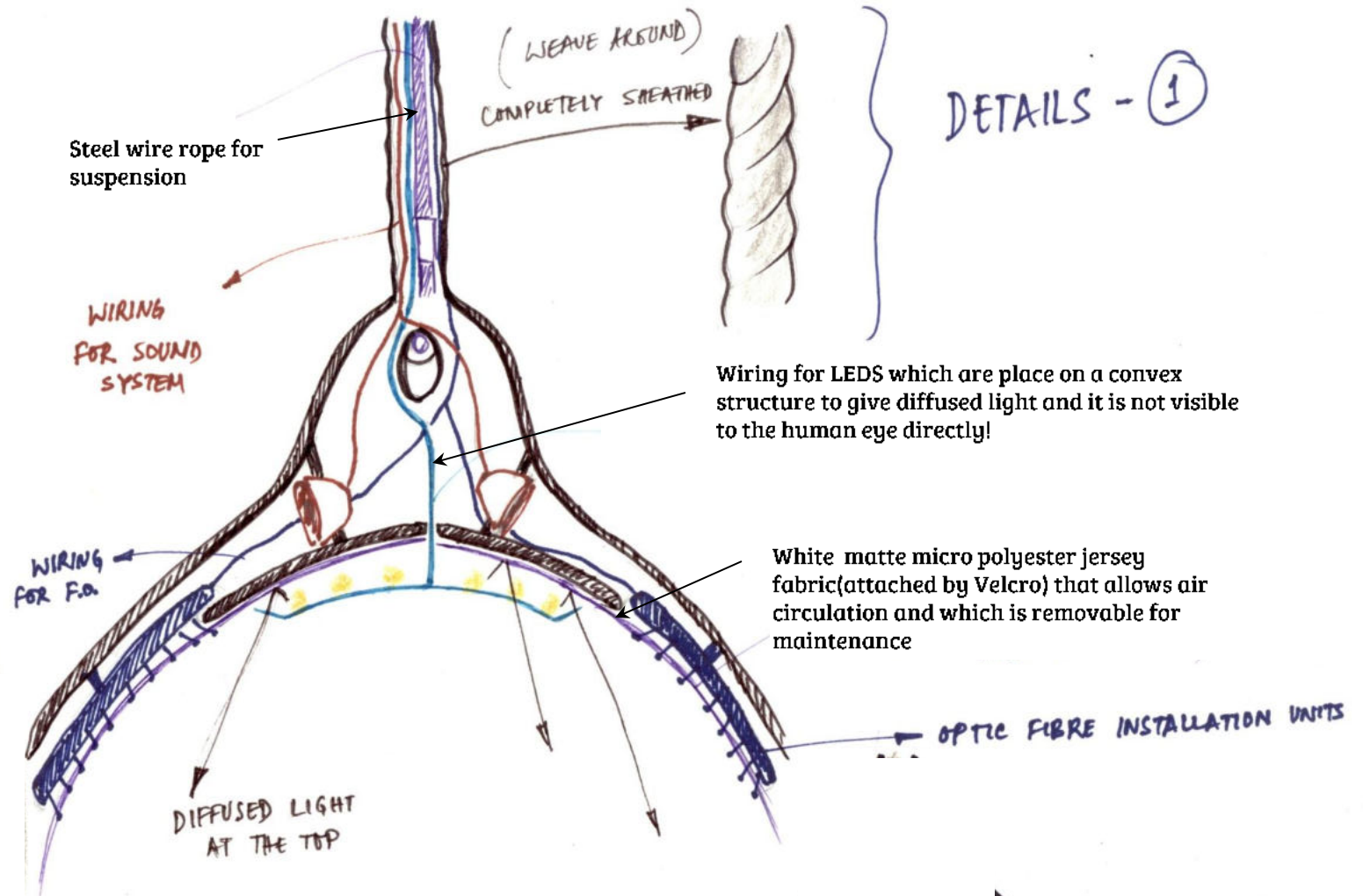
From the prototypes and the user experiences of the two concepts were evaluated in terms of scale, immersive feel and usability and Concept B was selected to be the FINAL CONCEPT.



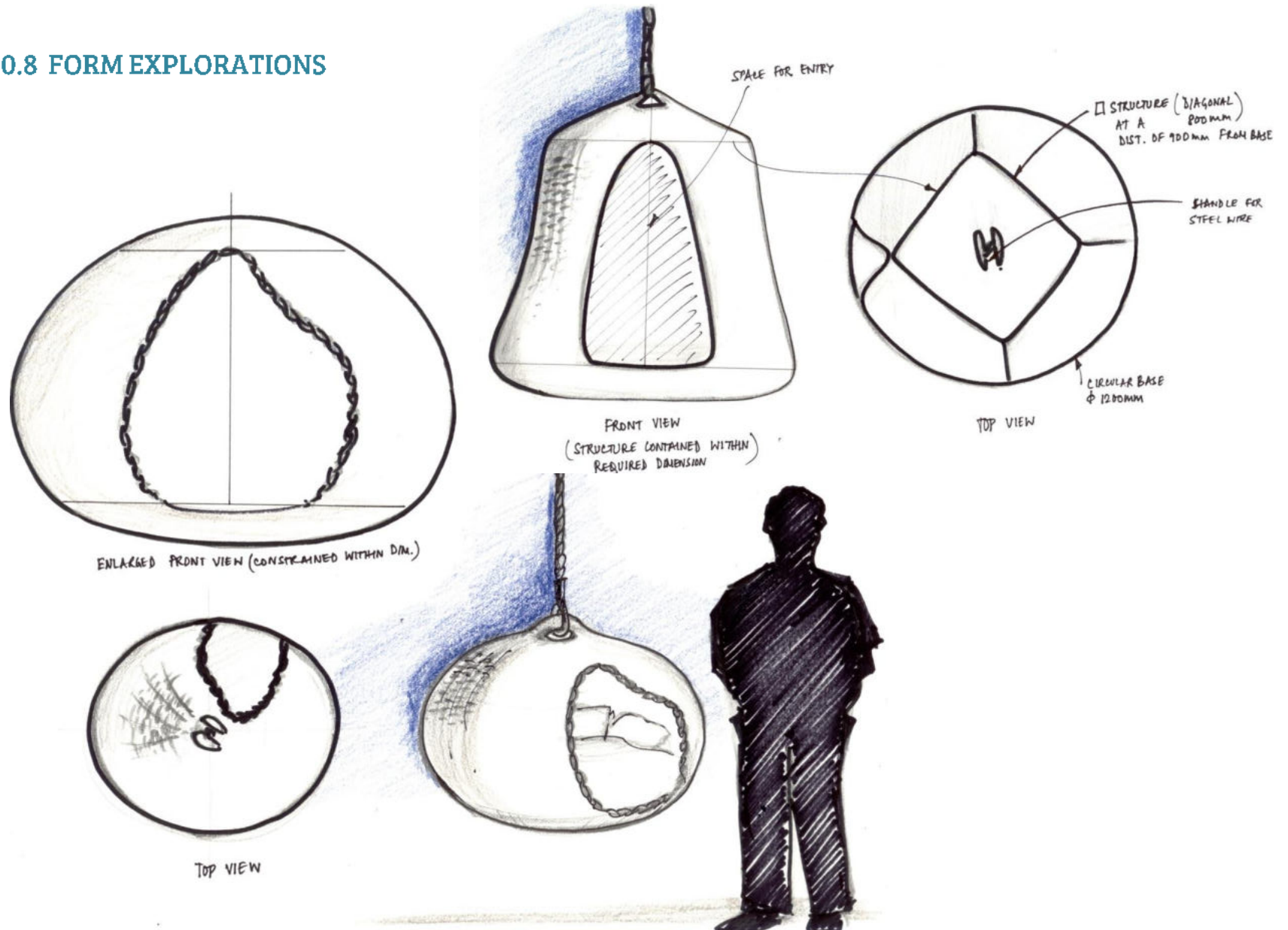
DETAILS OF THE WIRING AND INSIDE STRUCTURE



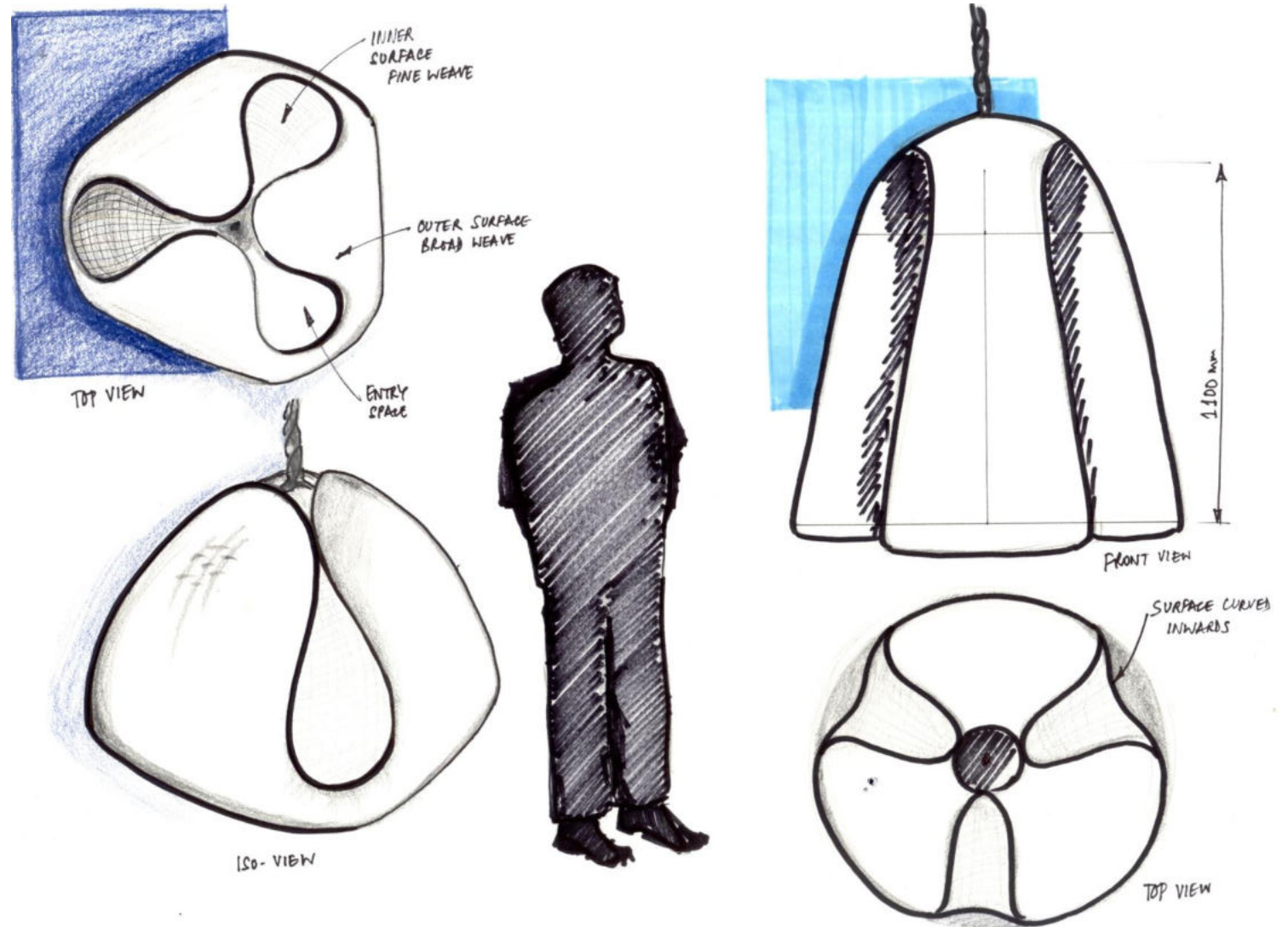
DETAILS OF THE WIRING AT THE TOP OF THE STRUCTURE



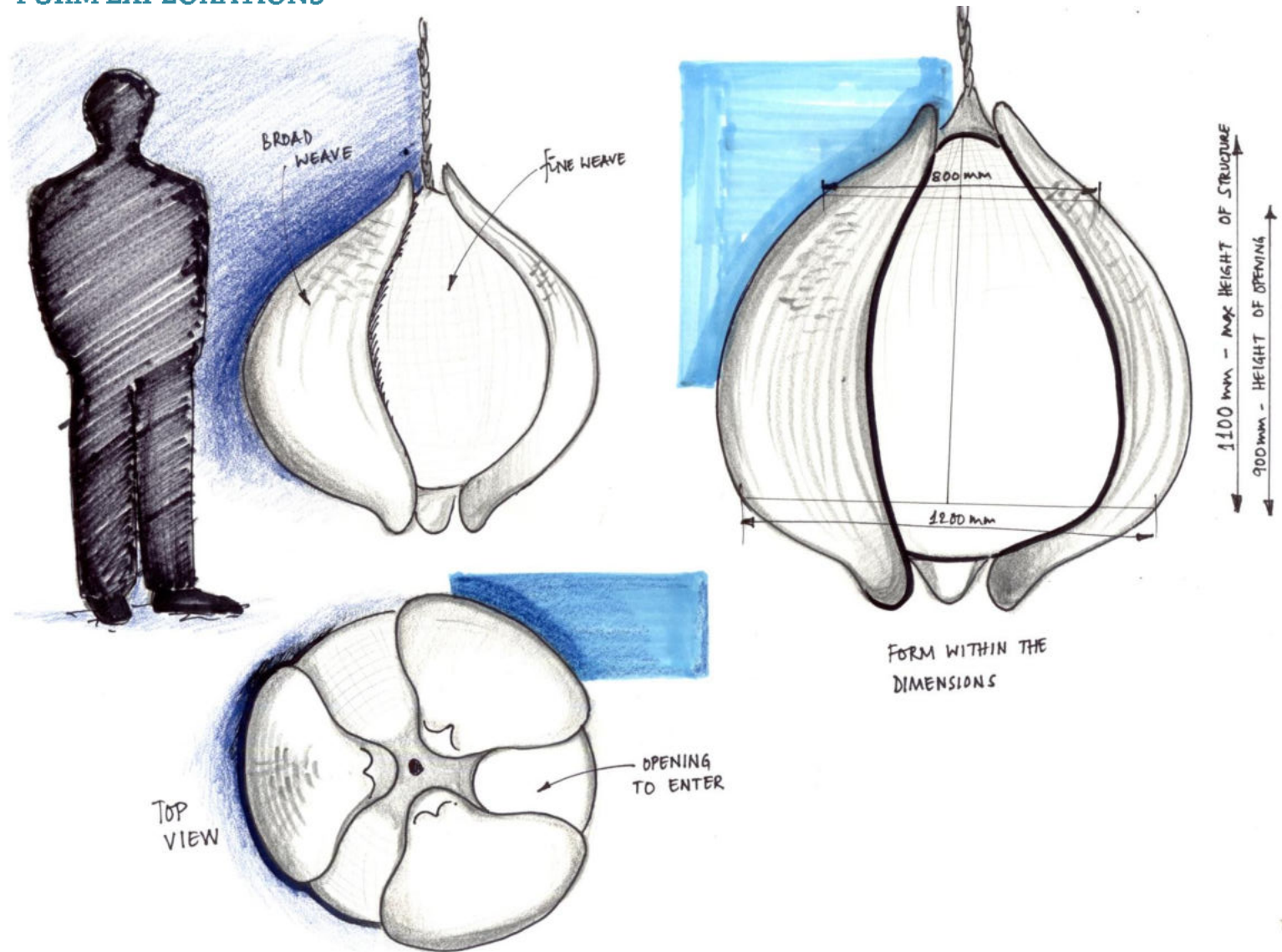
10.8 FORM EXPLORATIONS



FORM EXPLORATIONS



FORM EXPLORATIONS

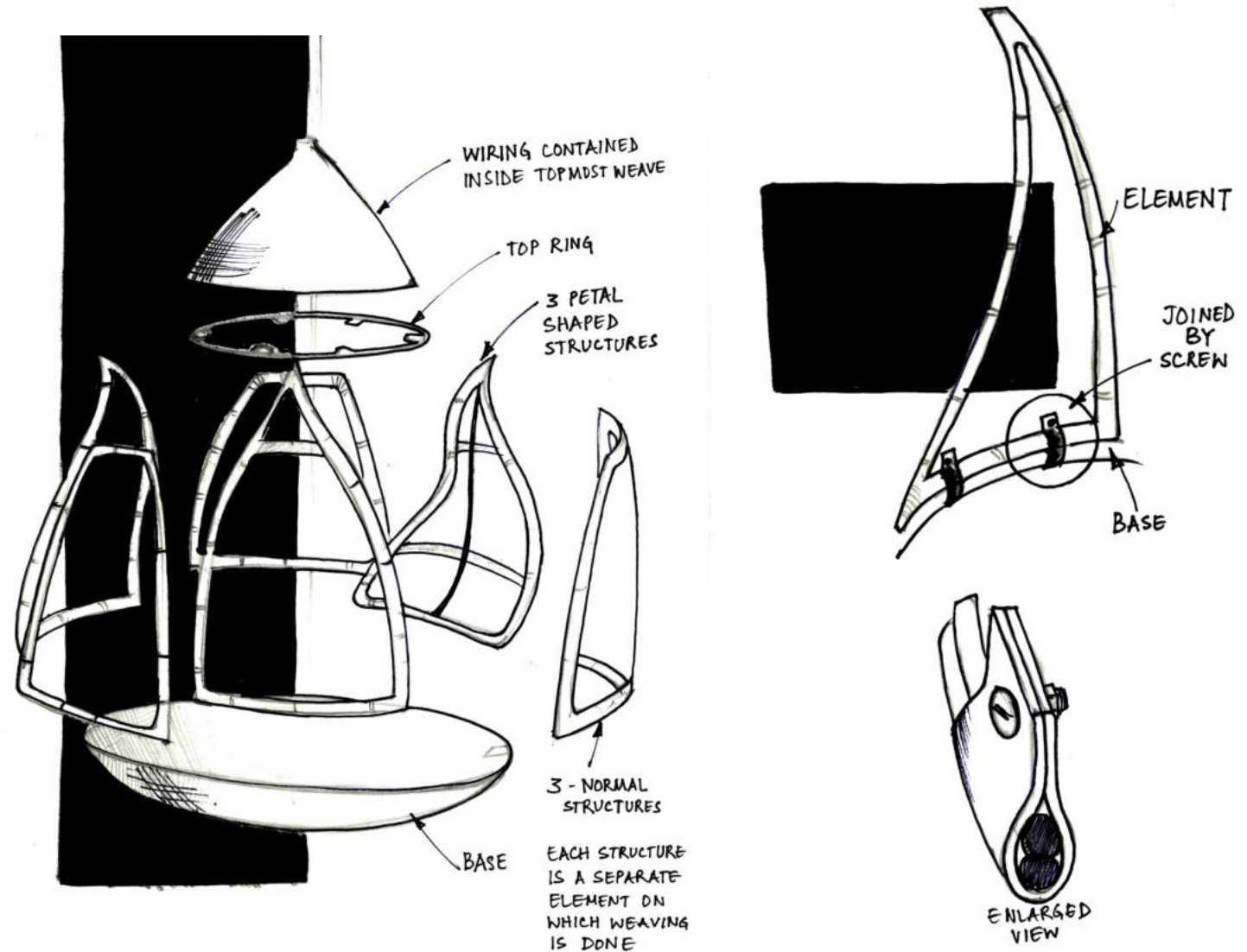


10.9 CAD MODEL EXPLORATION OF BASIC STRUCTURE

The basic structure has been explored in CAD to visualize the form which is constrained by the dimensions obtained in the ergonomic study. Further exploration in CAD for the final form is in progress.



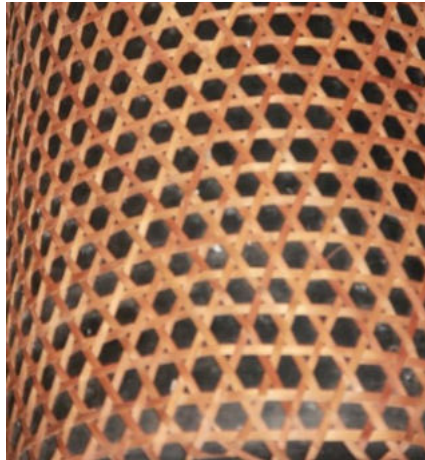
10.10 ELEMENTS OF THE STRUCTURE AND ASSEMBLY



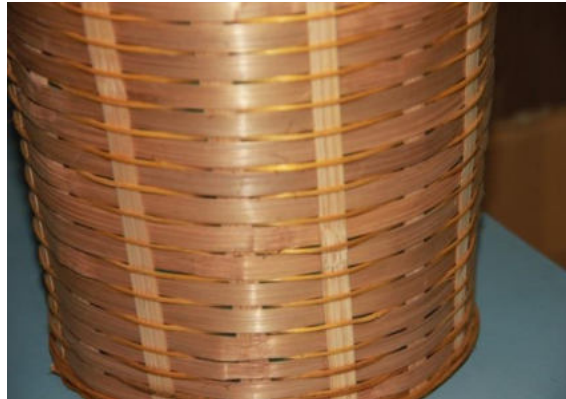
11.0 STUDY OF WEAVE PATTERNS

The different patterns in bamboo weave were studied to select the final patterns for the model. The weaving is done manually. From split bamboo, epidermal layer is removed and slivers of thickness ranging from 0.6mm to 1.0 mm are made and dried in air. The dried slivers are manually woven into mats and baskets of different sizes and patterns.

Hexagonal Weave



Cane and Bamboo Weave



One by Two Cross- Pattern Weave



Basket Weave

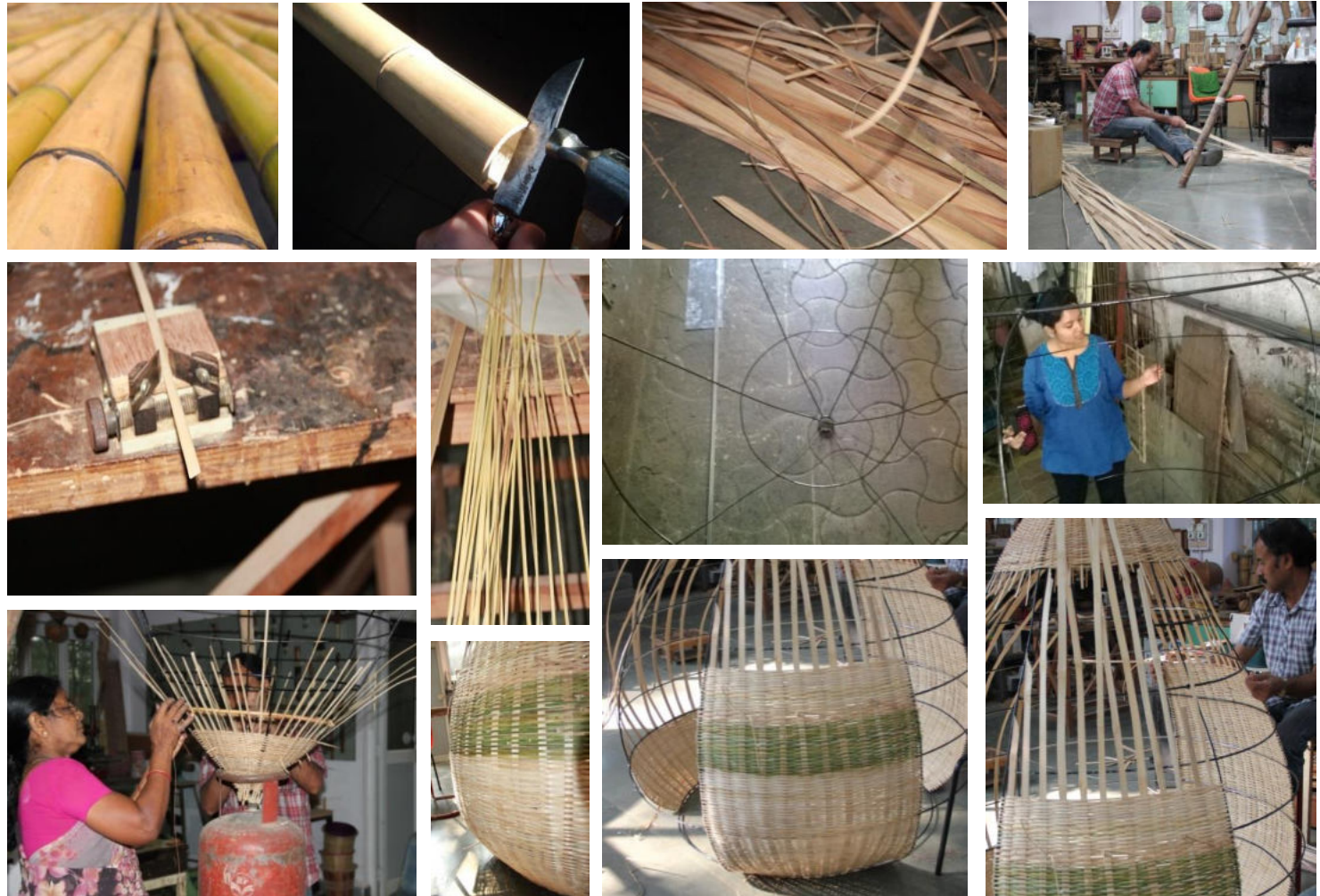


One by One Mat Pattern Weave



Diagonal Mat Pattern Weave

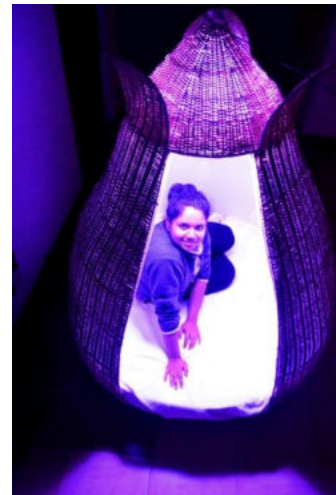
12.0 PHOTOGRAPHS OF THE PROCESS



13.0 FINAL MODEL IMAGES



FINAL MODEL IMAGES



14.0 REFERENCES :

- [1] Jennifer A.Veitch, Robert Gifford, 1996, 'Lighting effects on health, performance, mood, and social behavior', SAGE social science collections, vol.28, No. 4, P446-470.
- [2] Arefan Atlier, 2011, 'Interior light effects on human mood and social behaviour- LITERATURE REVIEW'
- [3] Chan-Su Lee, Ji Yea Shin, Jongwoo Nam, SinWon Park, Sung Yong Chun, Ja-Soon Jang, ' The effect of visual stimuli of LED lighting by color temperature and illuminance control on attention and meditation level of mind', Yeungnam University, Korea ,P1-16
- [4] Lehl S, Gerstmeyer K, Jacob JH, Frieling H, Henkel AW, Meyrer R, Wiltfang J, Kornhuber J, Bleich S. Blue light improves cognitive performance. J Neural Transm 2007; P457-460.
- [5] Van Wagner K. Color psychology: How colors impact moods, feelings and behaviours. Psychology. Volume 2009: Available at: About.com; Accessed on 2009.
- [6] Zena O'Connor, 11 September 2009 ,Colour Psychology and Colour Therapy: Caveat Emptor
- [7] Indian anthropometric dimensions for Ergonomic Design Practice ,Debkumar Chakraborty