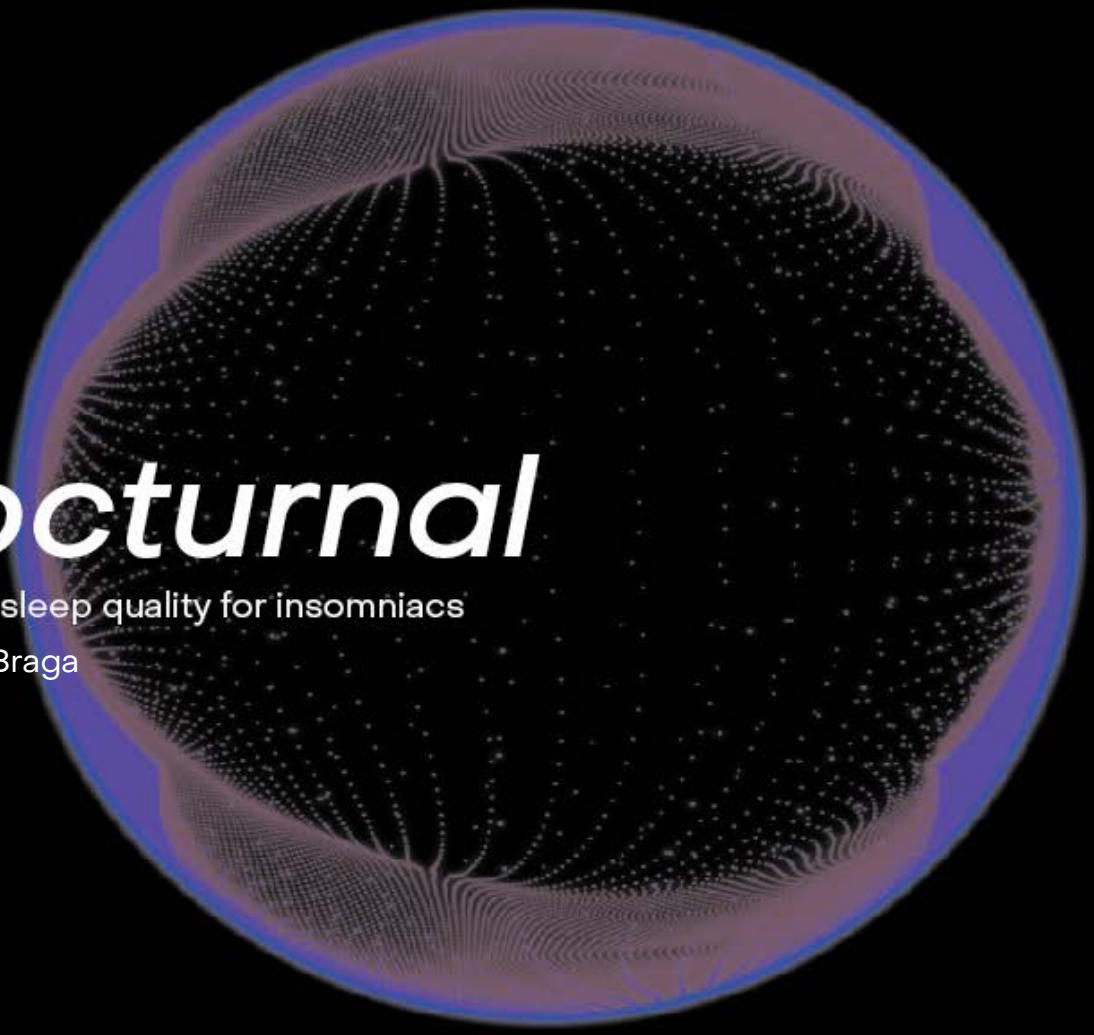

Nocturnal

Improving sleep quality for insomniacs

Alexander Braga

2020

Nocturnal

by

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Supervised by

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Submitted in Partial Fulfillment of the Requirements for the Degree of

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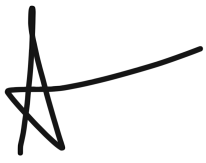
Signature : 

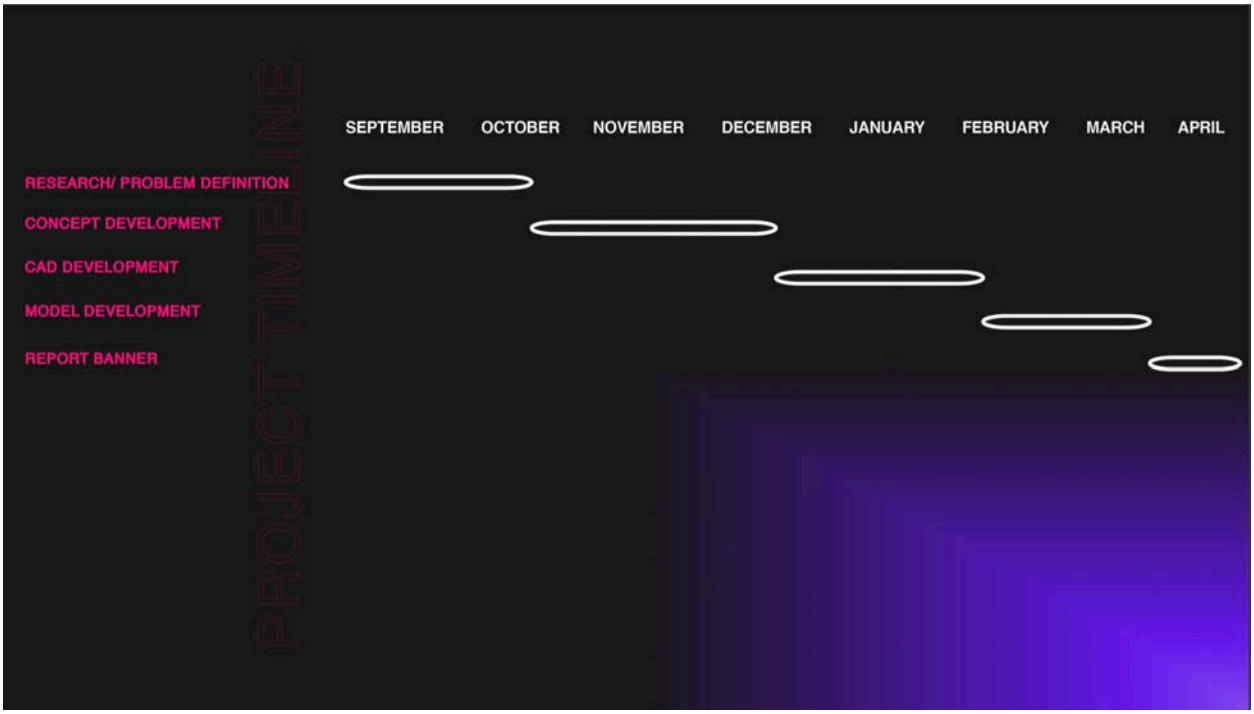
Student Name : Alexander Braga

Abstract

Nocturnal is an interactive design solution which utilizes the combination of digital and physical components to improve sleep quality amongst insomnia sufferers, while understanding and examining user interaction, user constraints and user behaviour. Insomnia is the number one sleeping disorder worldwide. Current challenges and causes include anxiety, depression, stress, physical pain and psychological trauma within a person, additionally, poor sleep quality correlates to substandard cognitive function both during the day and at night. Nocturnal proposes an in depth study of user interactions, behaviours and physical constraints of adults suffering from insomnia through various data collection methods such as, observational studies, interviews, contextual inquiry and surveys. Detailed analysis of user evaluation is aimed to reduce negative experiences and maximize positive experiences relating to improving overall sleep quality. Ergonomic and human factor evaluation relating too spatial, environmental, physical and cognitive functionality was combined to establish a human interaction design solution - Nocturnal. While assisting the user both physically and cognitively to achieve deep relaxation, Nocturnal aims to improve sleep quality amongst adults suffering from insomnia.

Table of Contents

Project Timeline



1 Problem Definition

Figure 1-1 Daw, J. (n.d.). Insomnia

1.1 Problem Definition

Insomnia can be a stand-alone problem or be associated with other complications happening in the human body. Young adults have a high rate of insomnia which can possibly correlate with other complications and issues they may be dealing with or are exposed to in their lives. If not addressed or treated correctly Significant changes and impacts will start to arise. The mental effects of not feeling in control and unpredictability

when falling asleep can create such a burden in someone's life. When the physical effects of panic, lack of comfort and body pain are arising, the user is challenged to deal with both the mental part of the disorder alongside the physical part. A disorder like insomnia which will slowly destroy the human body, has to be identified and cautiously addressed. Current methods at the moment are very limited and can have harsh side effects which solves one problem but then creates another.

1.2 Investigative Approach

For the purpose of this report, understanding the cognitive aspect along with the physical aspect of young adults with insomnia where examined and evaluated. Qualitative and quantitative research methods were conducted to achieve a clear hypothesis revolved around human centered design solutions in combination with potentially providing a new user experience. Comparisons between natural and medical treatments were compared.

Natural ways include:

- Relaxation Techniques
- Stimulus control
- Cognitive behavioral therapy (CBT)

Medical treatments include:

- benzodiazepine hypnotics,
- non-benzodiazepine hypnotics,
- melatonin receptor agonists.

Along with these various research methods explored, this report will cover human centered design, user experience design, appropriate applicable technologies in combination with advisor input to achieve a resolved design solution.

Key Research areas

- Human centered design
- New applicable technologies
- Ergonomics
- User Experience

Key Questions

- What will help aid users to fall asleep, stay asleep, and wake up?
- What's effective/ non effective in terms of current products available?
- How might this design solution reduce and calm anxiety/ improve mood and stress along with improving sleep quality?
- How can this product make a progressive impact, rather than a temporary fix?

Method of solution

Industrial Design Method	Thesis Methodology
Research	**User research** User profile User observation Activity mapping Ergonomic studies **Product research** Literature Review Identifying benefits and features Product Benchmarking
Analysis	**Criteria analysis** Needs analysis Usability & Functionality Aesthetics and materials
Ideation	Ideation/rapid sketching Inspiration Final concept Stylization
Concept development/ Refinement	Ergonomic study Sketch model development CAD development Detail development
Final model	CAD model Hard model

Figure 1-1 –Method of solution

1.3 Background

Sleep disorders are issues becoming more prominent in people's everyday lives. Insomnia is the dissatisfaction with quantity and quality of sleep. It creates complications with one's sleep initiation, maintaining sleep and being able to fall back

asleep. Individuals who suffer from insomnia also suffer from higher levels of anxiety, physical pain, and cognitive failure. Sleep is absolutely vital and without properly obtaining it, the human body will start to deteriorate.

This thesis will aim to improve sleep quality amongst adults ages 18-30 suffering from insomnia developing these 3 stages – falling asleep, staying asleep and waking up. The following chapter outlines research entailing user research, user mapping, ergonomic research, and benchmarking product research.

2 Research

The following chapter will explore the collection of relevant information in relation to this project. Research gathered focuses on user demographics, ergonomic research, user practices and benchmarked products.

2.1 User research

2.1.1 User profile/persona

Primary users:

Primary users of this product will include adults aged 18-30 worldwide non-working and working adults across all professions, hobbies and lifestyles.

Secondary users:

Secondary users will include doctors, social workers and psychiatrists. These users may interact with the product by informing the primary user on how the product works and its effects.

Evidence:

Nighttime insomnia symptoms are more prevalent in adults than in adolescents and children. They are also more prevalent in women and in those with less education and income (Table 1). Nighttime insomnia symptoms have also become more prevalent in recent years. For example, nighttime insomnia symptoms increased by 42% over the eight-year period from 2007 to 2015 among Canadians aged 18 or older (from 16.8% in

the 2007-to-2009 period to 23.8% in the 2014-to-2015 period (Chaput, Yau, Rao, & Morin, 2018, December 19).

Education:

Participants were also examined by household education and household income. Household education was the highest level acquired by any member of the household; three categories were created (secondary graduation or less, secondary graduation but less than a bachelor's degree, and bachelor's degree or more). (Chaput, Yau, Rao, & Morin, 2018, December 19).

Income:

Annual household income was reported by participants and collapsed into three levels: less than $40,000; $40,000 to less than $80,000; and $80,000 or more. (Chaput, Yau, Rao, & Morin, 2018, December 19).

Ethnicity

In Canada alone, chart 1 demonstrates Canada is a quite diverse ethnic region. Insomnia affects all ethnicities, therefore ruling out any bias's. (The following data was pulled from appendix II)

User research located in Appendix II

Table 1
Nighttime insomnia symptoms by age group, sex and socioeconomic status, household population aged 6 to 79, Canada, 2007 to 2015

Sex, age group, household education and household income	2007 to 2009			2009 to 2011			2012 to 2013			2014 to 2015		
	Cycle 1 [†]			Cycle 2			Cycle 3			Cycle 4		
	%	95% confidence interval		%	95% confidence interval		%	95% confidence interval		%	95% confidence interval	
		from	to		from	to		from	to		from	to
Total aged 6 to 79												
6 to 13	7.7	6.0	9.4	8.0[E]	5.0	11.1	6.4[E]	5.1	11.7	8.8	6.0	11.5
14 to 17	12.2	8.2	16.3	12.3[E]	7.7	16.8	18.7	12.6	24.8	15.3	10.1	20.5
18 to 64	17.7	15.6	19.6	19.3	16.2	22.3	26.9[*]	22.5	31.3	25.3[*]	21.8	28.9
65 or older	15.9	10.5	21.2	18.6	14.1	23.1	27.6[*]	21.0	34.2	22.2	18.6	25.8
Male												
6 to 13	7.4[E]	4.3	10.5	7.8[E]	3.1	12.5	8.8[E]	4.5	12.7	9.3	6.5	12.2
14 to 17	9.3	6.3	12.3	9.3[E]	5.7	12.9	F	...	...	11.7[E]	7.2	16.3
18 to 64	13.1	10.7	15.5	16.2	13.0	23.4	23.6[*]	17.3	29.8	20.8	15.1	26.5
65 or older	12.3	8.6	15.8	14.5	9.7	19.3	24.0[E][*]	14.4	33.7	14.4[E]	8.7	20.1
Female												
6 to 13	8.0	6.2	9.7	8.2[E]	4.8	11.6	8.2[E]	3.9	12.5	8.1[E]	4.2	12.1
14 to 17	15.3[E]	8.5	22.2	15.6[E]	8.8	22.4	26.1[*]	19.7	32.4	18.7[E]	10.0	27.3
18 to 64	22.2	20.0	24.5	20.3[*]	17.6	22.9	30.2[*]	26.0	34.5	29.9[*]	24.7	35.0
65 or older	19.2[E]	10.5	27.9	22.4	16.5	28.3	30.9	20.2	41.7	29.1	23.2	34.9
Household education												
Secondary graduation or less	20.7	16.1	25.3	21.1	15.1	27.0	29.3[*]	23.1	35.6	28.4[*]	23.4	33.3
More than secondary graduation, less than a bachelor's degree	17.0	13.7	20.2	18.8[*]	16.0	21.7	27.1[*]	21.7	32.4	28.0[*]	23.8	32.2
Bachelor's degree or more	12.3	10.4	14.1	13.8	10.6	17.0	20.2[*]	16.5	23.8	16.8	13.0	20.7
Household income												
Less than $40,000	22.9	18.9	26.8	21.2	16.1	26.2	27.0	21.3	32.7	27.5	21.5	33.4
$40,000 to less than $80,000	14.5	11.8	17.2	17.6	13.3	21.8	25.7[*]	20.3	31.1	23.8[*]	20.4	27.3
$80,000 or more	13.7	11.7	15.7	15.8	12.4	19.2	22.8[*]	18.2	27.3	20.1	15.9	24.2

... not applicable
[E] use with caution

Figure 2-1: (Chaput, J.-P., Yau, J., Rao, D. P., & Morin, C. M. (2018, December 19).

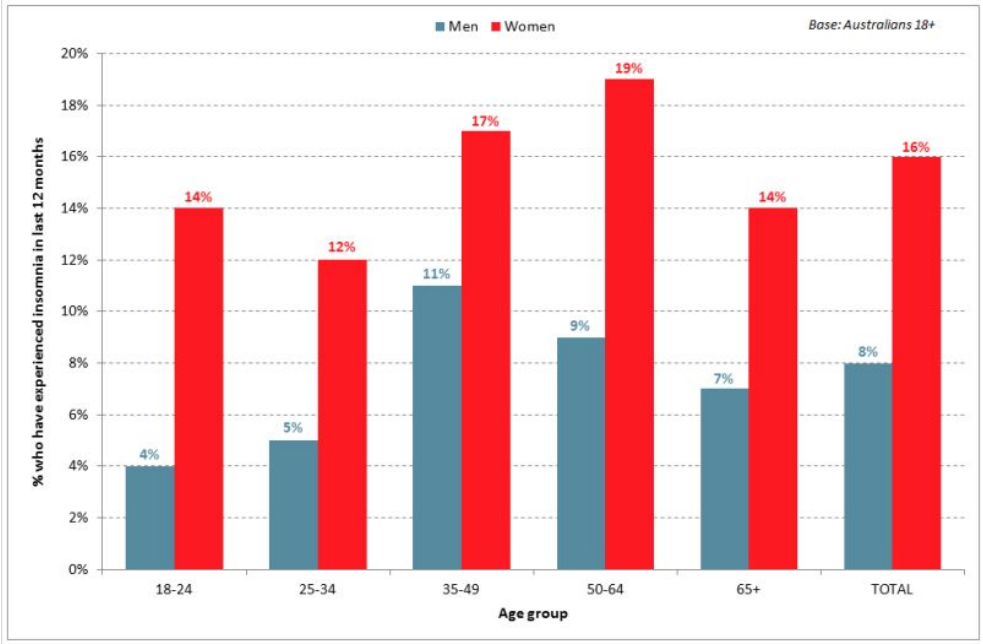


Figure 2-2 http://www.roymorgan.com/findings/6438-sleeping-uneasy-insomnia-more-likely-to- affect-women-201509062246

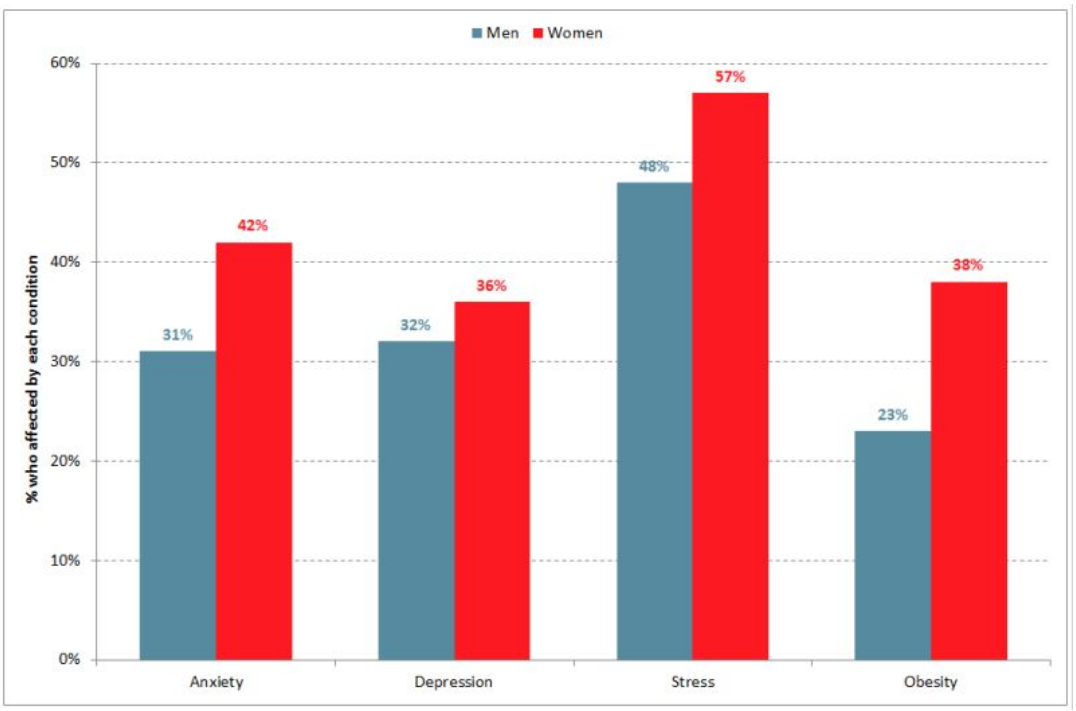


Figure 2-3 http://www.roymorgan.com/findings/6438-sleeping-uneasy-insomnia-more-likely-to- affect-women-201509062246

Demographic Summary (Data pulled from appendix II – User research)

DEMOGRAPHICS		USER BEHAVIOR		PERSONALITY	COGNITIVE ASPECT
AGE	20-50	FREQUENCY OF SLEEP	DAILY/HOURLY WEEKLY DEPENDING ON SEVERITY	ANXIOUS	ADAPTABLE E
GENDER	MIXED	DURATION	30 MIN - 5 HR	AVOIDENCE	SITUATIONAL AWARENESS
CULTURE/ ETHNICITY	MIXED	COMPANION / SOLITARY	COMPANION / SOLITARY	OVER THINKER	COOPERATION
INCOME	Less than $40,000; $40,000 To less than $80,000; And $80,000 Or more	LEVEL OF FOCUS	LOW - HIGH	CALM/QUITE	DIAGNOSTIC CAPABILITY
EDUCATION	MINIMUM POST SECONDARY	LOCATION	USER HOME	ENERGETIC	ABILITY TO PROCESS DATA

Table 1- Demographic summary

Conclusion/findings

Insomnia is a common sleep problem for adults. The National Institutes of Health estimates that roughly 30 percent of the general population complains of sleep disruption, and approximately 10 percent have associated symptoms of daytime functional impairment consistent with the diagnosis of insomnia.

In a 2005 National Sleep Foundation (NSF) Poll, more than half of people reported at least one symptom of insomnia (difficulty falling asleep, waking up a lot during the night, waking up too early and not being able to get back to sleep, or waking up feeling un-refreshed) at least a few nights per week within the past year. Thirty-three percent said they had at least one of these symptoms every night or almost every night in the past year. The two most common symptoms, experienced at least a few nights a week in the past year, included waking up feeling unrefreshed and waking up a lot during the night. A 2002 NSF Poll found that 63 percent of women (versus 54 percent of men) experienced symptoms of insomnia at least a few nights per week. (What are the Facts About Insomnia?)

User Profile

Results showed a significant relationship between nightmare, insomnia symptoms and level of income with increased depression and anxiety in the medical students. On closer examination the symptoms of insomnia, there was a close relationship between depression with sleep onset difficulty, difficulty in awakening and daily sleep attacks, and also between anxiety with sleep-onset difficulty and daily tiredness; hence, it is essential to consider these factors in therapy and prevention

methods to prevent the aggravation of symptoms of depression and anxiety. Given the limitations mentioned, further studies are needed (preferably longitudinally) to investigate the causal relationships between mental health problems with symptoms of insomnia and nightmares. (Javadi & Shafikhani, 2019).

User persona

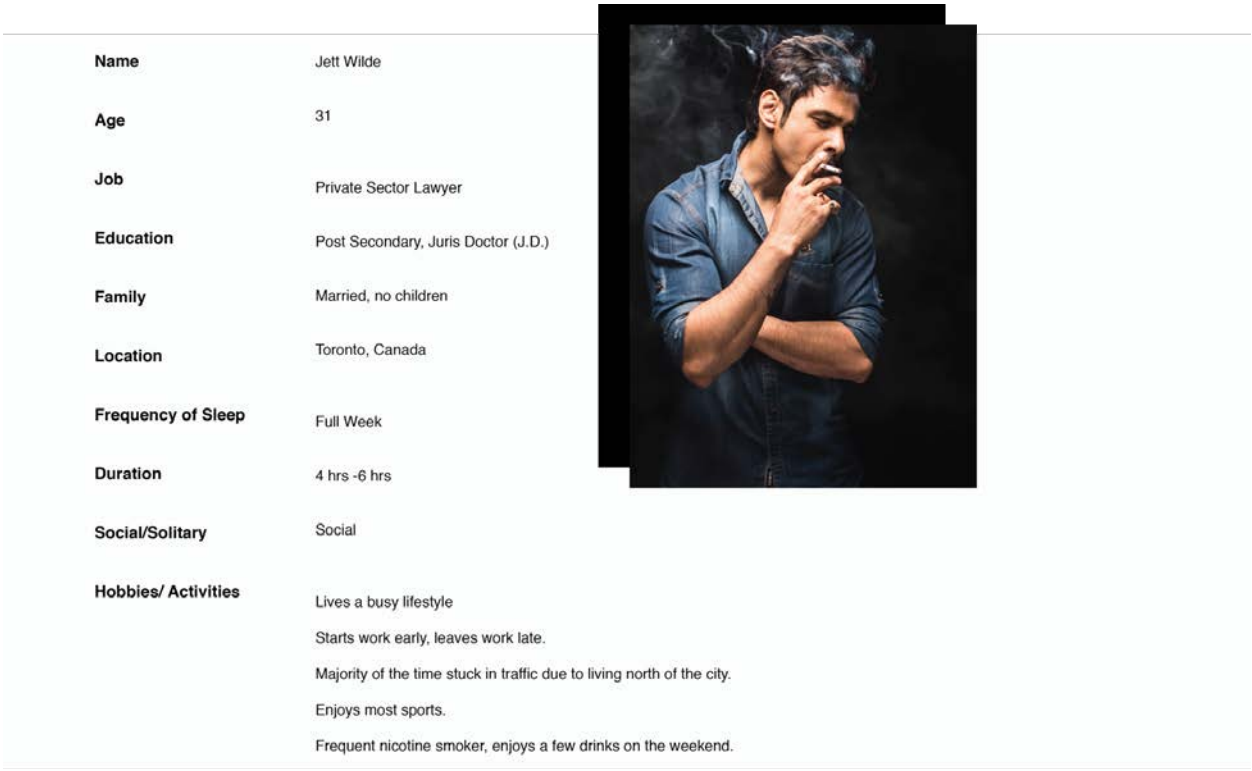


figure 2-4- User persona

Profile

Jett Wilde is a 31 yr. old Caucasian male born in Austin, Texas who moved to Toronto, Canada at the age of 25. He always dreamed to become a lawyer. Jett is extremely educated having completed post-secondary and his J.D. Jett met his wife in

Toronto, where he also became employed in the heart of the city as a private sector lawyer. Jett has no family in Canada, as they all live in the U.S. He does enjoys spending time with his lawyer friends and on the weekends, as his week is filled with work related objectives. Jett lives for thrill and problem solving as he has an over analyzing brain.

User Behavior

Jett wakes up in the morning every day at 5 and has a morning routine. He starts work at 8 am. And is out of the house by 6:30 and gets his morning coffee. Jett and his wife own a home 1hr north of Toronto as his wife enjoys her solitude compared to living in a busy city. During the week he usually spends 2 hrs. stuck in traffic, whereas some days he stays late at the firm. Jett smokes half a pack of cigarettes a day as he has been smoking since he was 20. His passion for sports kept him active during his university days however he cannot find the time in his current busy schedule. Jett struggles to balance both work and leisure as his schedule can be very busy.

Jetts Relationship With Sleep

Jett currently struggles with obtaining more than 7 hrs. of sleep a night due to his weekly schedule. On the occasional weekend, he may get around 7 hrs. Due to the commute to the work every morning, Jett has started to complain about his lower back as well as neck tension which has created odd sleeping positions for him. He has a hard time falling asleep some nights as he tends to eat very late when he is working long nights. Jett hasn’t obtained a sufficient amount of sleep in months and he is worried his

lack of sleep is starting to develop into Insomnia. Jett understands that he needs to find a solution to his poor sleeping habits but doesn't want to start taking sleeping aid medication.

2.1.2 Current User Practice

User Behavior Summary

Research objectives of this study are to understand the cognitive and physical behaviors 3 main areas of insomnia sufferers.

Stages include:

Getting ready for bed.

(Nighttime routine, engagement with any products, objects, mental state)

Trying to stay asleep/falling back asleep.

(what time are they waking up during the night? are they fully in REM sleep? what's the trigger to waking?)

Waking up.

(how are users waking up? what's waking them up? How are they feeling?)

Key Activities

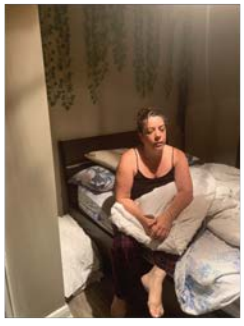
Key activities to be observed include:

- Room environments such a temperature, lighting, sound has an impact on sleep quality
- Anxiety highly contributes to insomnia which relates to how the user feels before going to bed - Understanding (calmness level, anxious, hyper, emotional state) is crucial.
- The effect of electronics uses before bed on the user's brain (The effect blue lighting, phone use, t.v use)
- Quality of bed, pillows, blanket. Taking in consideration weight, material, size

User Observation




room envrioment includes queen size bed, yellow lighting

User checking her phone before bed

feeling tired, and anxious before and after trying to fall asleep
user described the the lighting and lamps do help but do not make much of a difference

Conclusions from observation

Understanding our bodies natural rhythmic system can aid in improving sleep quality and design solutions. Also understanding how the body works in terms of temperature, sleeping positions and sleeping schedules will help in the overall design solution.

2.1.3 Activity Mapping

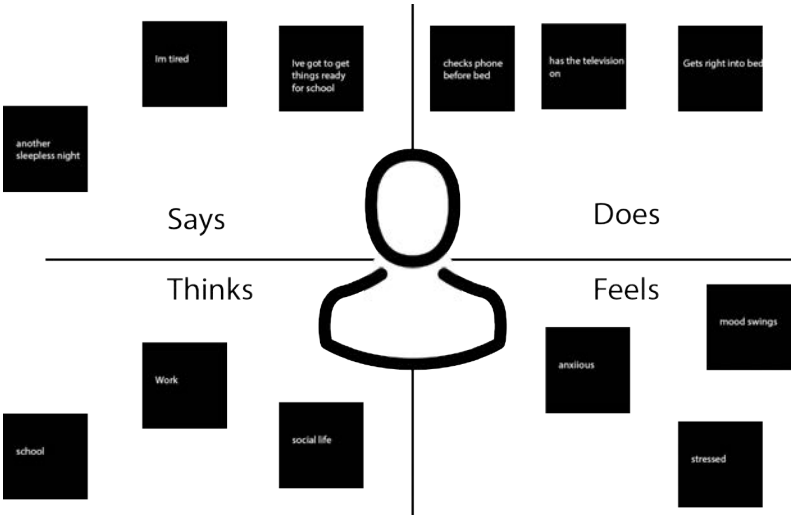


Figure 2-5 - Activity mapping

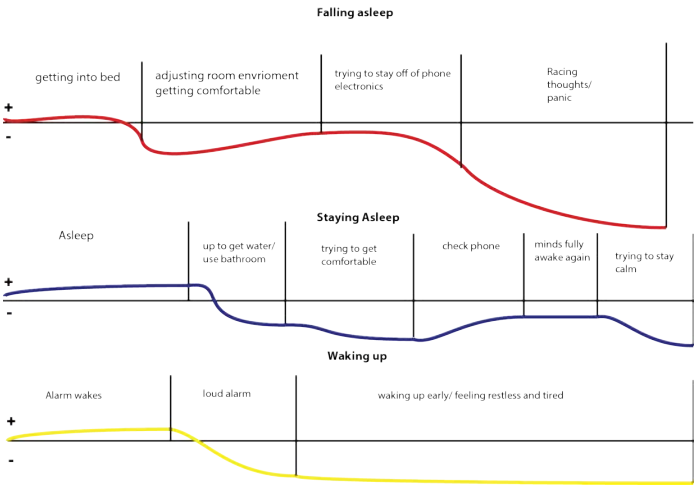


Figure 2-6 – Current user activity mapping

2.1.4 Ergonomic Research – Existing products

Current products for insomnia/ relief treatment vary from sleeping pills on the pharmaceutical side to sleeping aid products which focus on different parts of the body such as the head, torso, legs and arms. The ergonomic standards vary depending on the current benchmarked products.

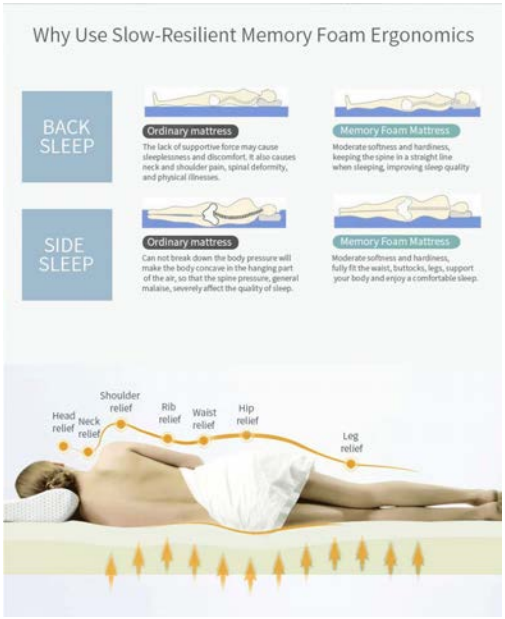


Figure 2-7- http://m.amorhome.com/news/why-use-slow-resilient-memory-foam-ergonomics-15792705.html.

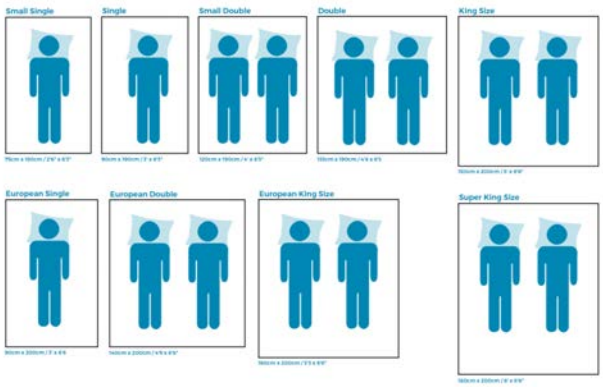


Figure 2-8- https://sleepopolis.co.uk/blog/mattress-bed-size-dimensions

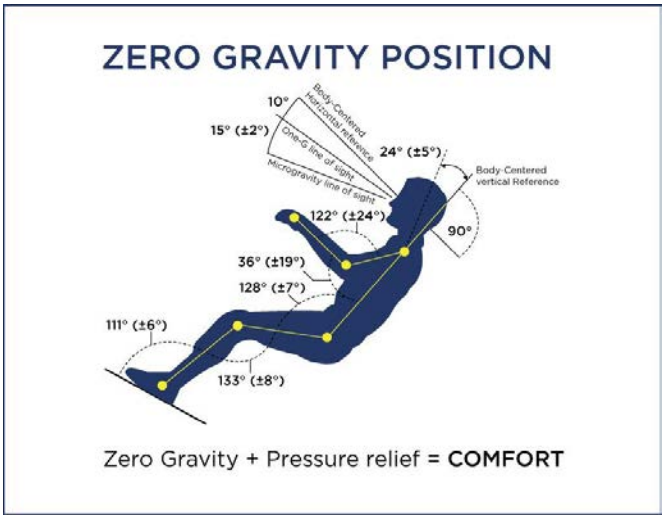


Figure 2-9- https://relaxtheback.com/pages/zero-gravity-explained.

Assessment of Current Benchmarked Products

Common elements of safety include:

Access into bed

Lighting

Fire hazards

Handle grabs

2.1.5 Safety and Health Research

Bed entrapment is a safety concern. Getting caught when making the bed or accessing the bed, the user runs the risk of getting their head, neck, arms and legs stuck in tight spaces. Along with bed entrapment, health concerns revolving around bed bugs maybe an issue if not kept clean.

2.2 Product Research

The following section will explore product benchmarking relating to sleep improvement/ and insomnia. 8 products will be investigated by their benefits, features and relations amongst one another. The purpose is to better understand the affects these products have on users by looking at the overall user experience they provide, their aesthetics and design language, as well as functionalities, their current technologies integrated and price factors.

2.2.1 Current Products Profile

These products currently being used to help relief insomnia are examined through benefits and features to understand their key characteristics as to what makes these products unique and comparable. Data evaluated will be key benefits and features that these products provide to the user as well as to draw comparisons to what they have in common.

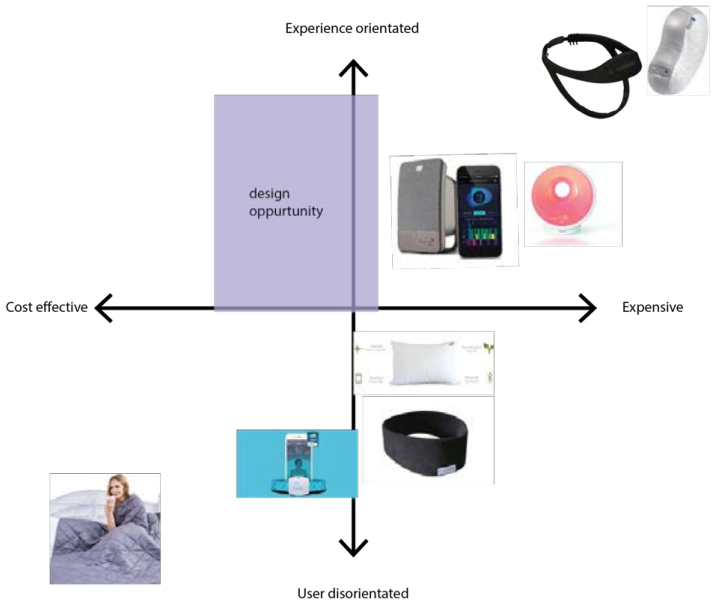
Products Compared: (Appendix II – Bench marked products)

Product name	Benefits	Features	Technology integration
The Somnox Sleep Robot	Comfort, affection, compact	Breathing simulation, Relaxation audio	Breathing detection, motion detection
Sleepscore Max Sleep Improvement Monitor	Lightweight, phone comptable	sleep monitor, provides sleep score	Sleep tracking
Dreampad Relaxation Pillow	Comfort, various sizes	Plays music, gentile vibrations	Dreampad app
Dreem Headband	Compact, lightweight	A.I, measures brain activity , heart rate, movement	Sleep learning algorithms syncs to wifi or Bluetooth
2breathe Sleep Inducer	Phone compatible, light weight	Therapeutic breathing exercises	Resperate technology
OldPapa Upgraded Weighted Blanket	Various sizes, 100 percent cotton Machine washable	Filled with glass beads	
Philips Somneo Sleep and Wake-up Light Therapy Lamp	Coloured sunset or sunrise lighting	Usb charging, play your own music	Guided wind down breathing
AcousticSheep SleepPhones Wireless	Light weight, soft, comfortable, ultra thin	Bluetooth, wireless	

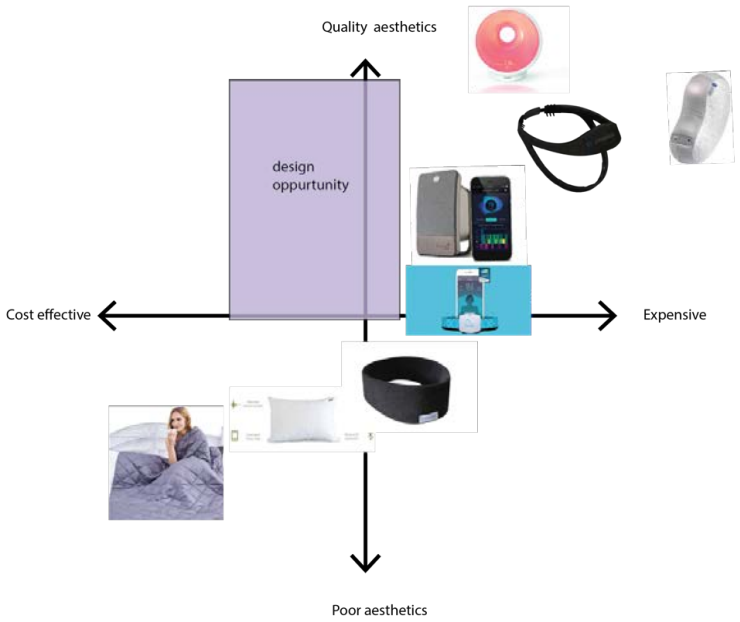
Table 2- compared benchmarked products

X-Y Graphs

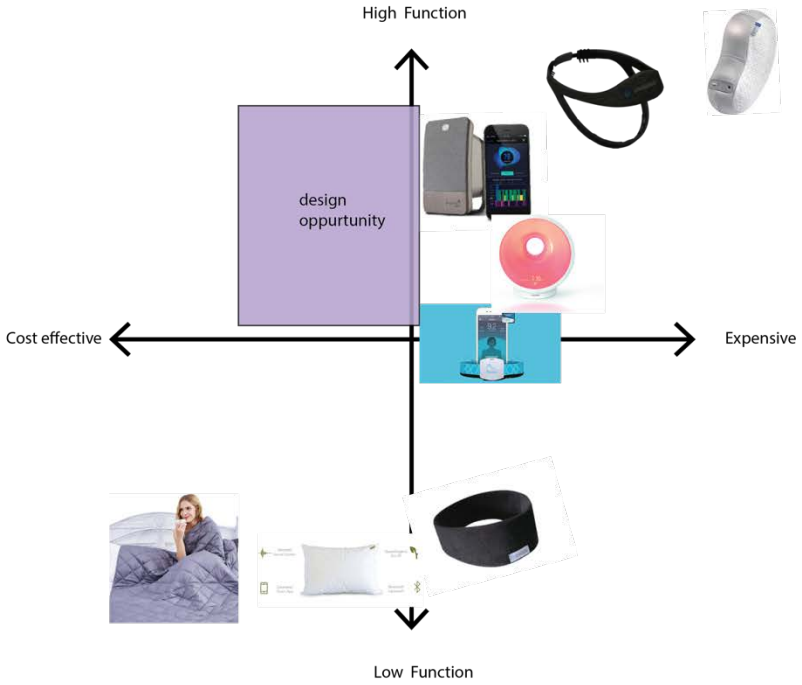
Effective ways to break down the comparison between the products were user experience, aesthetics, functionality along with comparing prices in all 3 x-y graphs. User experience is a crucial element due to the impact the product can have on the user when relating to insomnia. A very positive or negative experience will affect the users cognitive state making the product beneficial or redundant. Functionality and aesthetics contribute to the overall user experience as well.



2.10 - Graph 1; represents the correlation of user experience as well as price comparison.



2.11- Graph 2; represents the correlation of product aesthetics as well as price comparison.



2.12 Graph 3; represents the correlation of functionality as well as price comparison.

2.2.2 Benchmarking - Functionality

As seen in the above graphs 1- 3, user experience, functionality and aesthetics all correlate with price point. The products with the highest price points also include the most technology integration. Correlation between technology integration and a high price point can also be seen. The functionality of each product varies targeting different parts of the user's bodies. Variation can also be seen amongst the products accessibility, environment usage and convenience.

Key Findings

- More than one function example – tracking, sound operation, lighting effects
- App integration
- Compact sizing
- High price points
- Tracking technology
- Diverse Material usage
- Different Body parts – interaction

As seen in the graphs 1-3 price and technology run parallel with these products, technology is constantly advancing which creates an opportunity to innovate in a space where a product can provide the user with the essential benefits and features that will improve their overall sleep quality also providing a new user experience that will match its price tag.

2.2.3 Benchmarking Aesthetics & Semantic profile

Aesthetics and styling within insomnia products vary upon application use, environment, incorporated features/technology and material usage along with cost.

Figure 2.13 Philips Somneo Sleep and Wake-up Light Therapy Lamp

Figure 2.14 The Somnox Sleep Robot

Both figures utilize soft edges and curves representing organic design language. Also the overall design and characteristics are in line with the technology used to achieve a modern aesthetic. Material exploration in both figures differ, figure uses plastic materials which is purpose full for its purpose, optimizing a digital display, sound therapy and multiple light effects. Figure 2.14 is ergonomically shaped to match the contour of a cuddling body, the material used are soft fabrics so sensations can be felt when holding it. The Somnox Sleep Robot releases vibrations and sounds to help the

user breathe comfortably and relax by synchronizing to the rhythm of the users' heartbeat.

Figure 2.15 – Sleep pod -https://hk.asiatatler.com/life/these-luxury-sleep-pods-will-change-your-life

Figure 2.16 – Sleep pod https://www.economist.com/gulliver/2017/09/22/sleep-pods-are-becoming-increasingly-common-at-airports

Both figures above are current forms of sleeping pods designed for sleeping centers, offices, and the bed room environment. Both sleeping pods utilize a mix of different materials for application. High gloss finish on the outside with the use of plastic or metal with the inside containing a comforting appeal with the use of multiple different fabrics such as leather, foam, cotton/polyester and nylon/polyester. Both sleeping pods provide the experience of isolation promoting relaxation to the user. Two main

differences that can be seen between both pods are there ergonomics. The first pod is quite low to the ground providing a grounding effect when getting inside whereas the second pod provides a zero gravity experience, lifting the user higher from the ground with the bed matching the users body contour. Another noticeable difference is the application of lighting the first pod uses lighting to calm the user down whereas the second pod does not use any sort of lighting or power.

Semantic profile

Shape

Both sets of products such as the sleeping lamp and robot as well as the 2 sleeping pods – utilize soft curves, edges to mimic an organic shape. The soft curves are comforting when touching and observing as they provide a positive user experience. Each insomnia product varies in shape in form and material depending on the application it is used for and the body part it its targeting. Although form changes amongst each product, soft curves and edges are always present. There are different propositions for why observers tend to like curved shapes. On one hand, there are studies suggesting that observers prefer curved shapes over angular ones because the spiky transitions in an angular contour conveys a sense of threat. (Palumbo, Ruta, & Bertamini, n.d.) Curvature shapes provide a safe emotional response when viewed thus making it appropriate for insomnia relief related products.

Colour selection

Colour selection varies again on the product and application it is used for. Similarities can be seen throughout, such as soft and light colour pallets with the occasionally contrasting accent parts.

Texture

Texture varies between each product 3 out of the 4 products mentioned above have a matte or high gloss finish on the exterior, the sleeping robot uses the exposes fabric to provide a warm snuggling affect so the user can hold it close to their body's. The texture of the pods and lamp use a high gloss or matte finish to match the modern aesthetic of the user's environment.

Symbolism

The emotional affects these products need to possesses are crucial as they need to provide the user with the a very positive user experience as insomnia sufferers are dealing with stresses', anxieties or physical pains. The overall form of the current products mentioned above all have inviting properties, they all have organic forms which provide the user with more of a human connection mimicking human forms. The emotional connection between user and product is vital for insomnia sufferers. There is a sense of trust and dependency users will start to develop when the product intends to do what its design for. In relation to insomnia, looking at the sleeping robot, that is a product which mimics humanistic forms and builds a strong connection over time as the

user continues to use it due to having trust in the effectiveness of what the product provides.

2.2.4 Benchmarking Materials and Manufacturing

Materials and manufacturing change depending on the products purpose as well as cost and technology incorporated, durability and aesthetics.

Common materials used for insomnia relief products are:

- Polyester/ viscose/ cotton/ foam – Bedding, held products, blankets
- Acrylic sheet, polycarbonate sheet, and polycarbonate film - Led lighting/lighting
- aluminum/engineering plastics – product shapes to be styled accordingly

Also depending on price as well and cost, material can change and still allow the product provide its intended purpose for the user. With higher price points more luxurious materials can be used such as different textiles which could possibly have smart technology integrated in them creating different manufacturing methods and new user experiences.

2.2.5 Benchmarking Sustainability

The following section will cover safety, future environmental footprints and sustainability within insomnia relief products and potential effects it may have on users.

Safety/health

Safety has a significant role with products affecting and having contact with the user's cognitive functionality and physicality. Insomnia sufferers may already be

experiencing anxieties, stresses, physical pain, and phobias. User experience is a crucial element due to the impact the product can have on the user when relating to insomnia. A very positive or negative experience will affect the users cognitive state making the product beneficial or redundant. Functionality and aesthetics contribute to the overall user experience as well.

Environmental Impact

With more sustainable materials and manufacturing process's becoming available the potential for a product to have a long life span bio degradable properties are achievable. Wireless charging, solar power/ energy storage, metalenses and bio plastics/fabrics are some of the technologies which could be incorporated in future insomnia relief products.

2.2.6 Interview results

(Transcripts found in appendix II – User interviews)

Interview #1

Name: Anthony Dalfonso

Age: 26

Sex: Male

Contact: +1 (416) 858 8743

Occupation: Flooring Sales specialist

Date of interview Saturday October 5, 2019

Location: Starbucks

Interview # 2

Name: Laurie Keller

Age: 75

Sex: Male

Contact: (647) 347 1845

Occupation:

Date of interview Monday October 7, 2019

Location: Starbucks

Method of record: Personal interview

Conclusion

Concluding this benchmarking section, there is opportunity to innovate within the area of a combination of these benchmarked products. Functionalities and purposes of each product can be combined to create a new positive user experience with the potential to ease, anxiety's and stress and provide insomnia relief. Insight from this product research creates opportunity to innovate revolutionary insomnia relief concepts.

3 Analysis

The following chapter will gather analysis from the previous chapters. Through the analysis of user needs, user experience, Aesthetics, functionality and sustainability, critical design directions can be achieved.

3.1 Needs Analysis

Insomnia is the number one sleeping disorder worldwide. Current challenges and causes include anxiety, depression, stress, physical pain and psychological trauma within a person, additionally, poor sleep quality correlates to substandard cognitive function both during the day and at night. This thesis proposes an in depth study of user interactions, behaviours and physical constraints of adult insomnia sufferer's through various data collection methods such as, observational studies, interviews, contextual inquiry and surveys. Detailed analysis of user evaluation is aimed to reduce negative experiences and maximize positive experiences relating to improving overall sleep quality. Ergonomic and human factor evaluation relating too spatial, environmental, physical and cognitive functionality is planned to establish a human interaction design solution. Exploration of various solutions, which affects the user both physically and mentally, in combination with each other will aim to improve sleep quality amongst adults suffering from insomnia.

3.1.1 Needs/Benefits

Currently Insomnia products are all on different spectrums, they range from pharmaceutical drugs to weighted blankets to now most current – AI related products helping with controlled breathing. Due to insomnia having effects on different areas of the body both physically and mentally, these products tend to focus on aiding one body part at a time, or trying to aid with the psychological effects through medication. As we gather more information through recent studies about the causes of the insomnia in young adults, there is opportunity to combine new technology these studies to provide a new user experience that will put the user in a comfortable setting to reduce and improve their sleeping quality each night. The following table contains possible benefits based on user needs.

Needs	Benefits
User Experience	Fully interactive user experience, Users can create new experiences with visual, sounds and lighting
Comfort	- Anxiety reducing - Stress reducing - cognitive stimulation to release “feel good hormones” - Adjustable bed settings
Privacy	-Users create their own environment
Customization	- Personalized sleep settings - Personalized lighting,sounds and visual settings - Adaptable for all user groups

Table 1 – Needs benefits

3.1.2 Latent Needs

Needs	Fundamental human needs	Relationship with benefits
User Experience	Safety, confident, excited, relaxation, mood enhancement	Strong
Comfort	Psychological, safety	Strong
Appearance	Confident, Aware, exciting	Moderate
Health/safety	Psychological, safety relaxing	Strong

Table 2 –Benefits relationship

User Experience

The user experience is a crucial and vital component to insomnia relief. Users suffering from insomnia are already in a distress and panic assuming they will have another restless night. There is a big trust component here to provide the user with a positive user experience.

Comfort

Comfort ties in with the user experience. Users will be using this product up to 7.5 hours. Comfort also ties into the trust component as the user needs to be in a state of relaxation now having to think twice about comfortability.

Appearance

Appearance of the product also works with the comfortability component. Also due to the target user and demographic the design solution has to be able be able to fit in a room setting of sleep center aesthetically. In combination with functionality the product has to be attractive for the user to engage with and interact with.

Health/safety

Due to users using this product for up to 6- 8 hrs., safety precautions such as fire hazards will have to be thoroughly looked at.

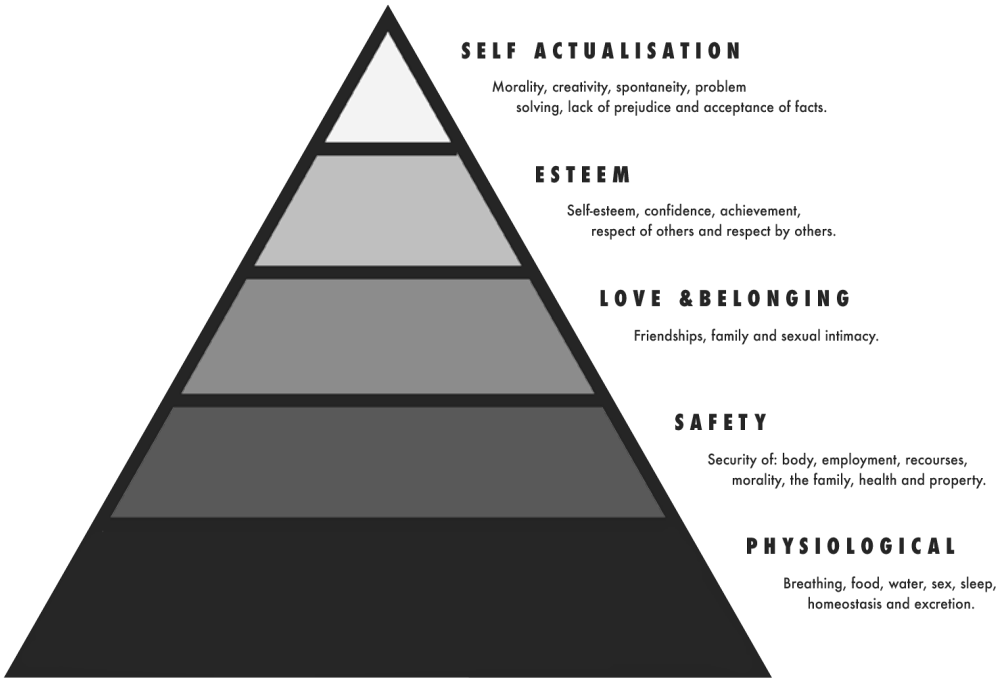


Figure 3-1- Maslow's hierarchy of needs

3.1.3 Categorization of Needs

The design process is focused around bring a new user experience, alongside providing an innovate way users can personalize their experience through customization and comfort that suits their needs. Categorized user needs below contribute to the overall design direction.

Wish's/Wants

- A product which can accommodate all sleeping positions
- Adaptable product for any room or environment
- Product for all user groups

Immediate Needs

- Stress/anxiety relieving
- New user experience
- Customizable personal space
- Comfortable
- Safe environment

Latent Needs

- Refreshing aesthetic
- Easy to access
- Repairable
- Cost effective

3.1.4 Needs Analysis Diagram

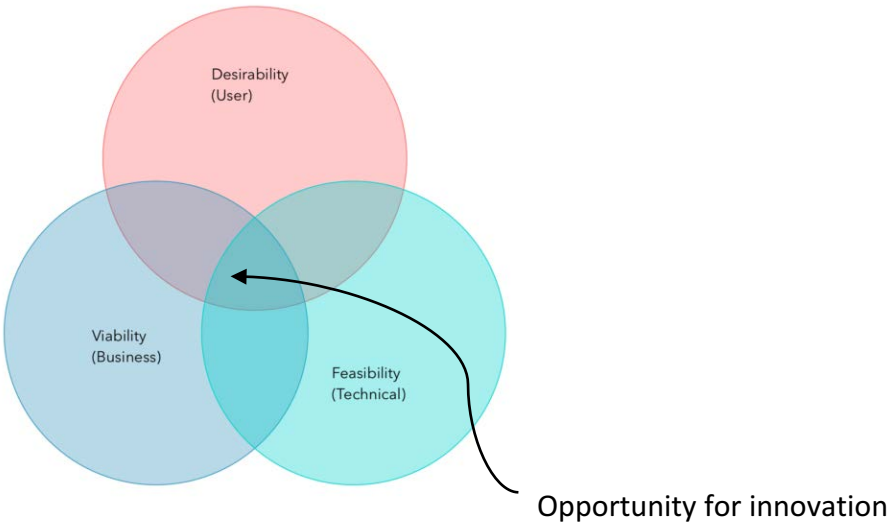


Figure 3-2 Needs analysis diagram

Desirability

Desirability for insomnia relief ties in with the eventually traction may obtain due for its functionality and its effectiveness – does it really work.

Viability

Due to new technology emerging such as interactive OLED screens, VR, augmented reality and AI, there is a whole new category and area to innovate in. Many of these technologies can be used for different purposes as well as possible combinations with both physical and cognitive aspects of the human body.

Feasibility

Feasibility of new technology is constantly growing and changing, technology can change 3-6 months if not even earlier, different applications and manufacturing is always being tested based on popularity

3.2 Functionality

This section will analyze a user in their current room setting before going to sleep.

3.2.1 Activity Workflow Mapping

Observation

After conducting observational research, 2 different design directions where developed.

Observation 1

The user entering his room, ready to whine down for the night. User turns the TV on for background noise and barely watches it as he gets distracted from his phone. Also the user is trying to find a comfortable position too comfortable in but can't due to temperature in the room environment and heat emitting from the electronics on. Through this observation is opportunity to remove the phone and stress that its providing, there is also opportunity to change to the room environment entirely creating a new interactive experience aiding the user to sleep comfortably.

3.2.2 Activity Experience Mapping

The experience mapping journey of the user can be broken down into 3 stages as shown in figure which shows the potential positives the user can endure.

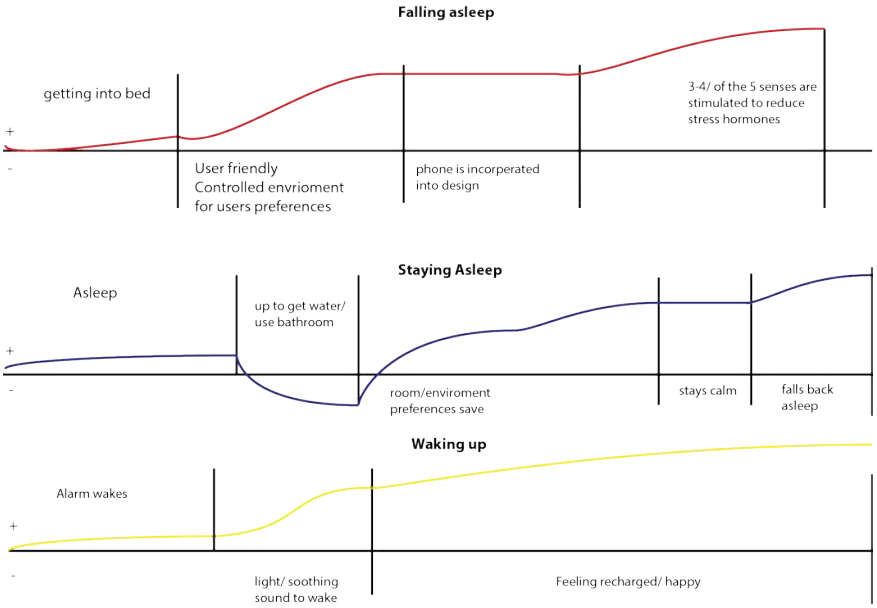


Figure 3-3 – Target user experience potential

Potential

	Falling Asleep	Staying Asleep	Waking Up
Negatives	- Overly stimulated - Not comfortable - Poor environment - Distracted - Increased stress	-Disrupted sleep - Trying to fall back asleep - Finding comfortable Position - Distracted	- Artificial lighting - Poor environment - Loud alarm - Checking phone - Stress
Potential Improvements	- Control user environment preferences - Utilize phone to fall asleep - 3-4 Senses to be incorporated	- environment understands mood/body temperature - Adjustable comfortability - Eases user back to sleep	- Natural lighting - Regulating internal clock - Soothing smell/sound to wake

Table 3- potential

3.3 Usability

Sleeping pods currently have not revolutionized with the access to resources and tech available. The above image is a modern adaptation of the term “sleeping pod” These designs are all mimic and enclosed environment suited for one person. The ergonomics of these designs focus on the sense of comfort and certain functionalities that the pods maybe equipped with. In contrast to what exists currently and the lack of ergonomic considerations an ergonomic buck will be used to test and review to create new user experiences alongside new innovative design solutions. The results obtained from this ergonomic data will be based upon the characteristics of a single user.

Literature Review

Sleeping pods are used into for different environments such as sleeping centers, schools or even the work place. The main focus of this thesis is to improve sleep quality among insomnia sufferers which is linked to sub problems as such as anxiety, stress, over stimulation from phones and electronic devices and overall exertion. “In the present study, it was identified that powered bed movers produced substantially lower muscle activation levels when compared to manual pushing” (Lavender, Conrad, Reichelt, Kohok, & Gacki-Smith, J. 2007).

Again all of the current pod designs have specific ergonomics for a single user, as well as an enclosed design where the user is secluded in their own “world” however some designs may neglect the ergonomics when entering and exiting the pod. Ergonomics may vary due to the function and intent of the design. “First determine the fundamental seating posture(s) needed, and then position the visual targets, reach distances, and appropriate support surfaces to respect that goal.” (Fitzsimmons, J. 2014).

The possibilities to innovate are large due to accessibility to new technology and the incorporation of full body human interaction design. The ergonomic buck will be used to test out new possibilities for a new revolutionized pod. Results obtained from the ergonomic buck will be the pod will be used for 6-9 hrs. daily and its vital the ergonomics accommodate accessing the pod with ease as well as accommodation of multiple sleeping positions along with comfort. "That *baseline* characteristics of the

sleeper and/or their mattress may explain performance and sleeper preferences on future mattress selection." (Vaughn McCall, Boggs & Letton, 2012).

Methodology

The ergonomic evaluation and analysis of a current sleeping pod was conducted with the following considerations:

Objective(s)

The aim of this process is to evaluate the full-bodied human interaction design and full-bodied ergonomic challenges for an insomnia sufferer. For the purpose of this thesis, full body human interaction will include the user's legs, torso, arms back and head as well as posture. This ergonomic evaluation report outlines the methods used to evaluate these major body-part areas for assessment from human factors, ergonomics and convenience of use challenges.

Decision(s) to be made

The following interactions relevant to three specific major body part areas were investigated to maximize the user experience by removing any negative interactions when using the sleeping pod:

- Getting into and out of the pod (Legs, torso)
- Operating OLED screen (rear blind spots) (Head neck and shoulders)
- Interaction with operating controls (hand and arms)

Description of Users Targeted by Product

The ergonomic buck was based around the following descriptive user characteristics:

- The target demographic were individuals who suffer from insomnia.
- Their age ranged from 18 – 30 and both male and females.
- Individuals are located worldwide.
- For this user observation report the inside of bed rooms and sleeping pods where investigated.

Evaluation process

The evaluation process consisted of designing a full scale (1:1) ergonomic buck of the bed, OLED screen and access of enclosure will be replicated. The general scale and size were referenced off a twin size bed which allowed for critical observation of the following:

- Observing how the user enters and exits the pod. (Ingress/Egress)
- Observing how the user interacts with the OLED display and any obstructions that may arise.
- Documenting various sleeping positions
- Identifying touch points with the user interface.

Description of User Observation Environment Used in this Study

For this study, a walkthrough of the space of bedroom environments and ingress and egress from the pod was observed. The observation was carried out in a bed room scenario.

- Simulation of OLED interaction
- Ingress and egress of waking up during the night/morning
- The observation was conducted while in a living room/ bedroom.

Location and Timeframe

Date of Observation(s): 01/01/20 (Observation 1)

Location of Observation(s): House (Observation 1)

Results

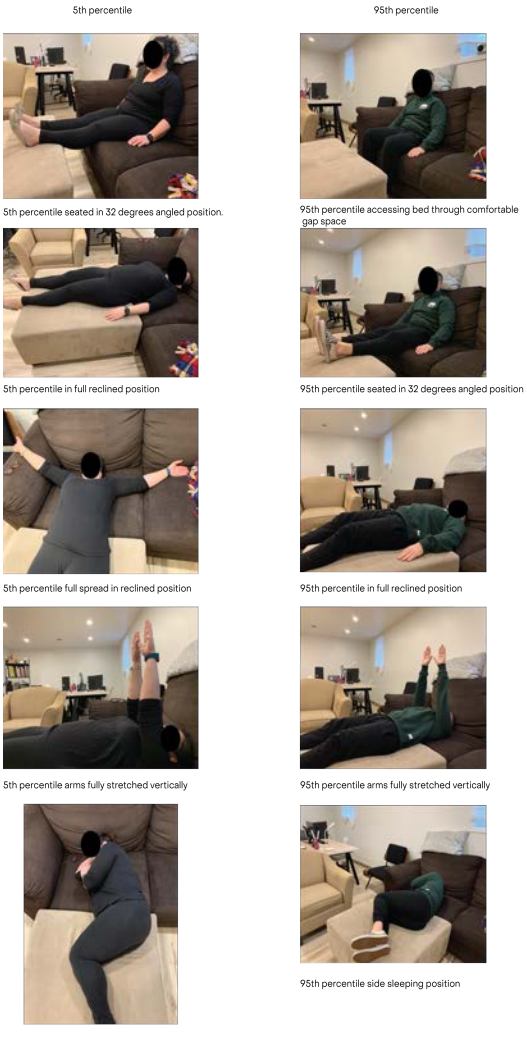


Figure 3-10: 5th percentile female and 95th percentile male – ergonomic positions

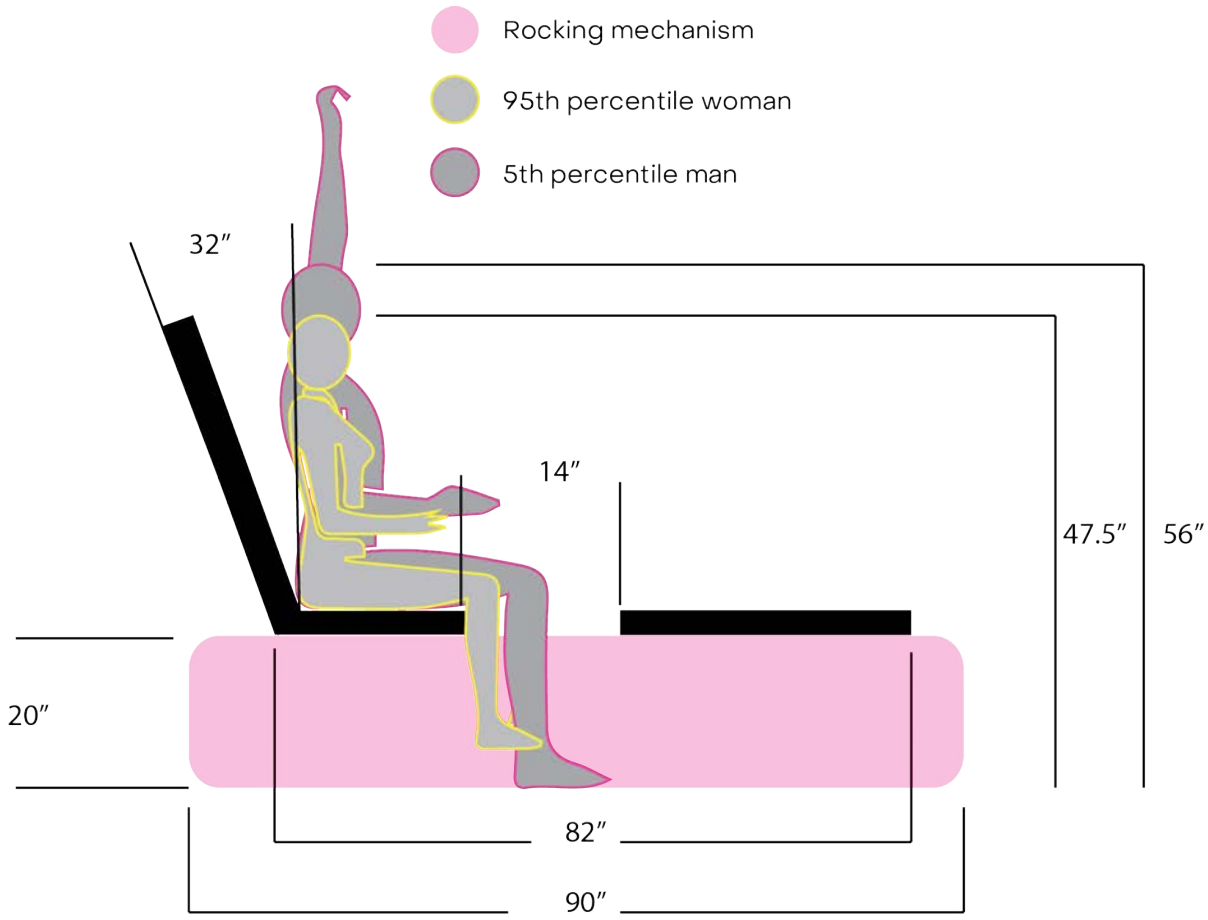


Figure 3-11 Illustrative ergonomic diagrams

Diagram illustrates seating dimensions when entering the pod. Bed height will not exceed over 35” when in flat position.

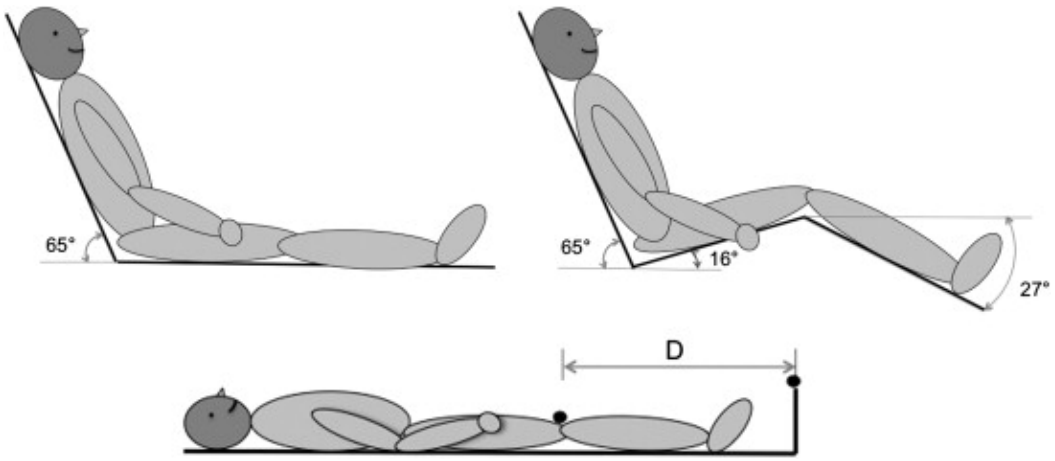


Figure 3-12 Illustrative ergonomic diagrams

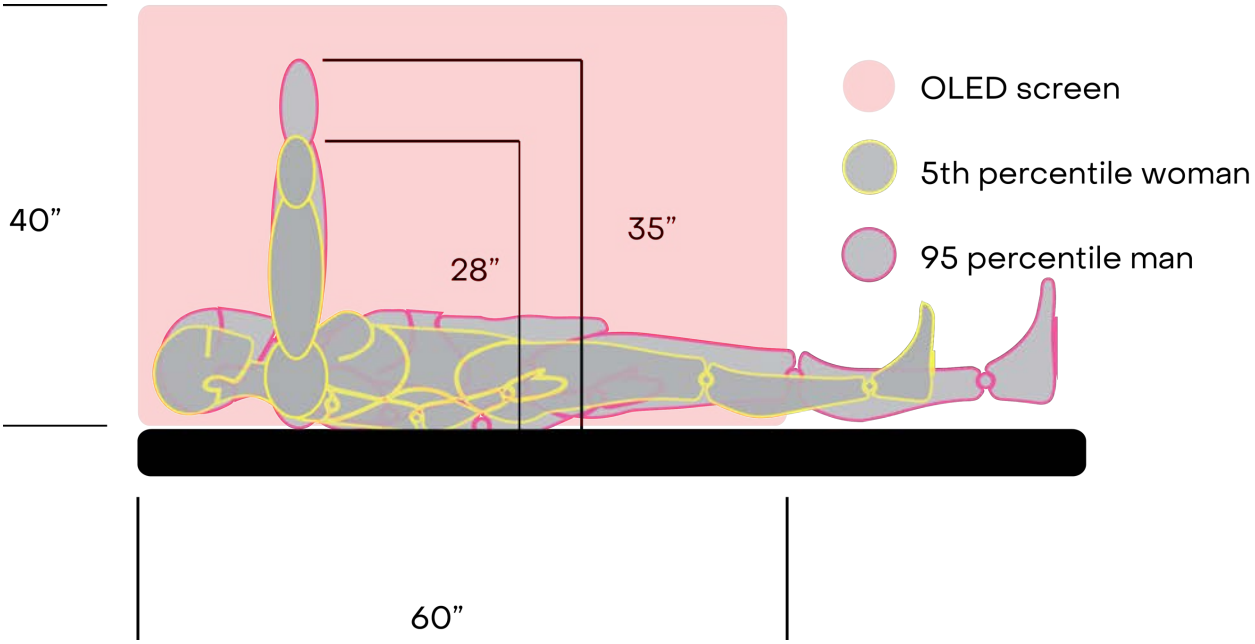


Figure 3-13 Illustrative ergonomic diagrams

Diagram illustrates dimensions when laying the pod. Bed width will not exceed over 90”. Through analysis of the ergonomic study OLED screen can be positioned on the front half of the bed or back depending on the final design. The OLED needs to accommodate getting in and out of the pod.

Analysis

Once completing the study of the ergonomic buck the primary focus was accessing in and out of pod and interaction of the OLED screen. Users interaction time for the pod can be upwards to and 1hr before falling asleep for both percentile users such as the 95th and 5$^{th.}$ To allow access into the pod the bed will split apart allowing the user to be seated rather than having the user jump onto or into. Once seated the end portion will attach, at the same time the seat reclining into a totally flat position allowing the user to lay completely flat. The pod size will mimic the dimensions on a twin XL

bed. This allows for enough space for a single user to have enough room and accommodate any sleeping position. The length dimension will reach a maximum length of 90-95 inches with the rocking base included. The height of the pod will reach a maximum height of 70 -75 inch's allowing for full vertical reach of the 95th percentile man to interact with the OLED overhead screen. The back angle of the seat will stay at 32 degrees which is a comfortable angle for both percentiles, while the seat will stay flat. Users will only be in the eating position when accessing or exiting the pod which can be up to 5-15 min depending on the user's preferences. All controls will be accessed through the overhead OLED screen through motion activated control. Users can change preferences and settings through the wave of their hand. The movable pod base runs on sensors to avoid any injury. The beds overall height without the screen will reach a height of 25-30" giving the user a grounding effect. People sleep in multiple positions with the pod size having similar dimensions as a twin XL, all sleeping positions will be accommodated. Alongside sleeping position accommodations, the pod can fit into any room environment as well.

Figure 3-16- Future of OLED technology - https://sensorytechnologies.com/2018/04/11/oled-technology-future/

The overall process is the user accesses the pod by having a seat through the gap. Once seated and the users are ready, they will lift their legs and place them on the bottom half of the bed. The 13 “gap between allows for enough space for the 5th percentile woman and 95th percentile man have comfortable leg room as well as have their feet reach the bottom half of the bed with ease. As they have they’re feet raised and resting on the bottom half, their backs are supported by the 32-degree angle back support, when ready in one motion the bed connects and the back support lowers creating a perfectly flat surface. Above the user is the OLED screen which will be completely transparent reducing claustrophobia or tightness. All settings are accessed by the screen above the user this decision is used to remove left or right hand problem

and additional panels that the pod would require, which would also be adding more weight and clutter. The 40 “height of the screen allows a good amount of space for both percentile ranges to wave their hands and spread out. The screen will have a max length of 60” if needed, the dimension accommodates the users range of vision by lying flat or seated at and upright position. If the user needs to get up during the night, sensors will have detection, and the user lays flat as the bed returns to a seating position again. A key aspect of this design is reduction of clutter and any complicated controls a user may have to endure like when operating a T.V remote. The focus is to create visual navigation which provides a new user experience and helps calm any anxiety’s or stress the user may have before entering the pod.

Figure 3-17 –futurism inspiration - https://www.youtube.com/watch?v=INJY9akQ3jY

Limitations and Conclusion

Identifying critical human dimensions affecting the pod are as follows:

1. Bed size is extremely crucial to accommodate all sizes.

2.OLED screen size is vital to be able to access and direct the user interface.

3.The bed connectivity feature, needs to be a smooth transition from seat to bed.

This ergonomic study identified specific major body-part areas, a major thesis requirement. In addition, these findings helped to create a design direction for the final design.

3.4 Aesthetics

The Aesthetics and forms vary broadly across all forms of insomnia relieving products. Looking at pods or general beds, they range due to price point, size and the luxurious feel that comes with them. Different materials can be used for bed frames such as wood, plastics or even metals. The mattress itself varies with comfortability being the main factor. The Aesthetics of beds have not changed over the years as they have stayed pretty traditional to fit the modern bedroom. Currently sleep pods are mostly made up of plastics and have an organic shape to them which they also seclude the user. Preferences on beds or pods depend mostly on the user's preference of comfortability, also if they are sleeping alone or with a companion.

3.5 Sustainability

Safety

Some of the dangers for potential insomnia relief design solution are fire hazards, phobias such as claustrophobia or panic disorder triggers. What also has to be taken into consideration is the accessibility of this product. If the product needs to be

accessed through a door panel, stairs and also special awareness – the overall size of the product, the safety of the user when accessing has to be considered such as tripping, falling or slipping.

Health

Users health is the most vital component of this thesis. The aim is to reduce anxiety's and anxiousness and improve sleep quality. This product purely focuses on the user's health.

Environment

The environment in which this product will be operating in is the user's bedroom or sleeping centers. The product will focus on one user, providing the user with full customization of their environment. Key considerations are the sizes of the space in which this product can fit into, the actual size of the product along with the cost of the product.

3.6 Commercial Viability

The following section will explore and investigate feasibility within different manufacturing process and material choices currently being used for similar products.

Figure -19 – Sleep pods - https://www.cnn.com/travel/article/skylodge-adventure-suites-peru-hotel/index.html

3.6.1 Materials & Manufacturing

Commercial viability is based upon its material uses and manufacturing process's as well as overall cost. Due to relatively new progressive technology involved with this product, prices and manufacturing process's will vary.

Engineered Wood

Manufacturability of engineered wood allows for many different finishes and shapes which can then be finished with a real wood veneer. The veneer is onto MDF or birch which provides stability and strength.

Machined Aluminum

Machined aluminum allows for many variations/forms and design of the material to be used for the desired application. Aluminum is light metal containing very robust properties and is corrosion resistant making it great for many different purposes.

Smart Textiles

Smart textiles incorporate conductive polymers which react in in the intended use. There are many variations such as changing in material, memory shaping polymers and electronic sensory.

3.6.2 Cost

Figure -19 – Sleep pods -https://tokyocheapo.com/accommodationcat/capsule-hotel-tokyo-guide/

Cost of manufacturing varies upon material selection and its intended use within its specific designed parameters.

3.7 Design Brief

The objective of this thesis is to develop a sleep improvement product, enhancing the lives of insomnia sufferers through full body interaction design and creating a revolutionary user experience. Key features and objectives are listed below:

- Improve sleep quality
- Comfortable environment and setting for users
- Anxiety, panic, depressive mood reducing features
- New interactive user experience through innovative technologies

- Sustainable material utilization
- Fully accessible to target user group
- Easily adaptable to user’s room or sleeping centers
- Cost effective

4 Design Development

This chapter will go over the overall design development process of Nocturnal. Reviewing ideation, concept development/ refinement/ modelling and final design solution.

4.1 Ideation

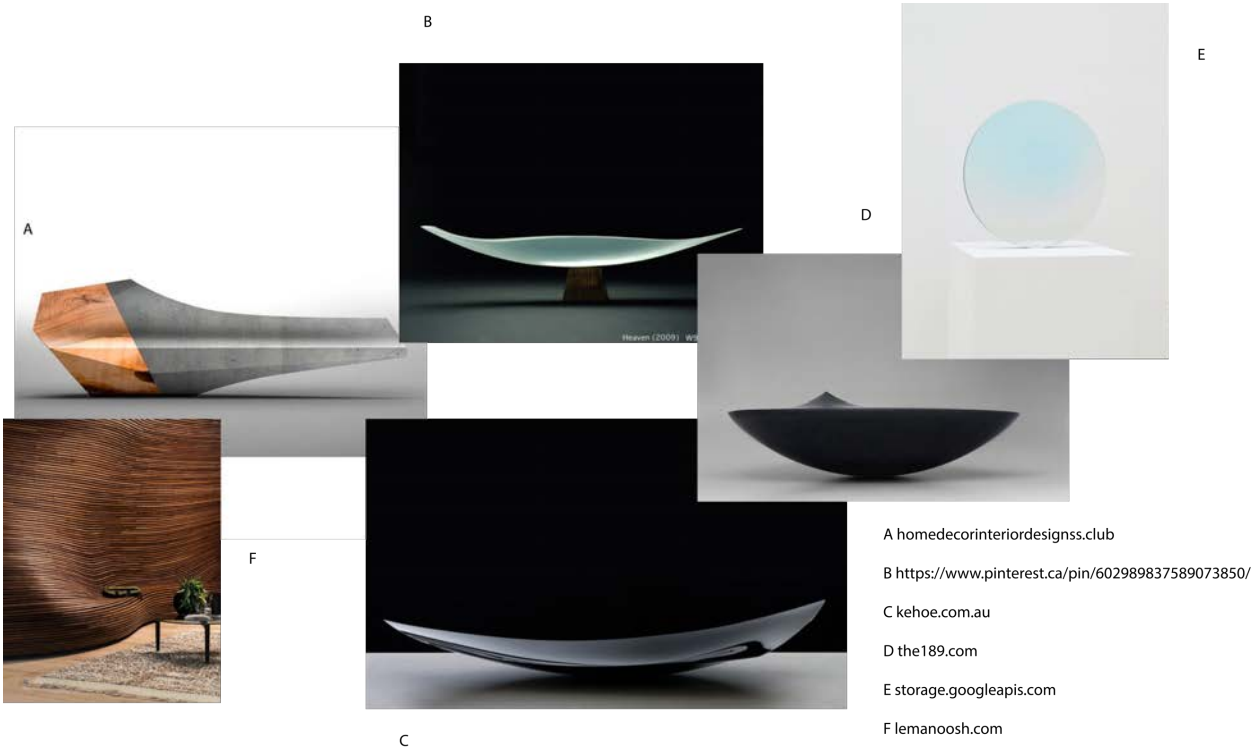
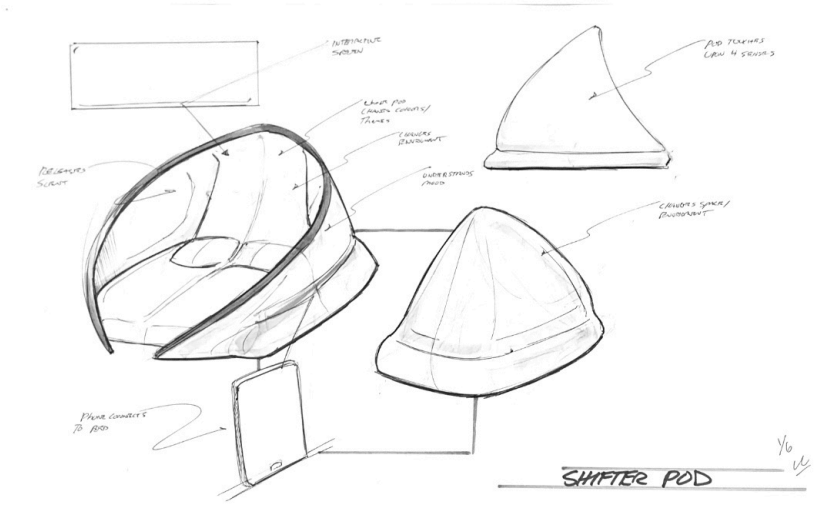


Figure 4-1 –Inspiration board

Early concepts and ideations explored many interaction possibilities that could lead to sleep improvement. Elements are drawn from each concept below to further develop Nocturnal. Concepts explored user experience, ergonomics, interaction touch points and form development.


SHIFTER POD

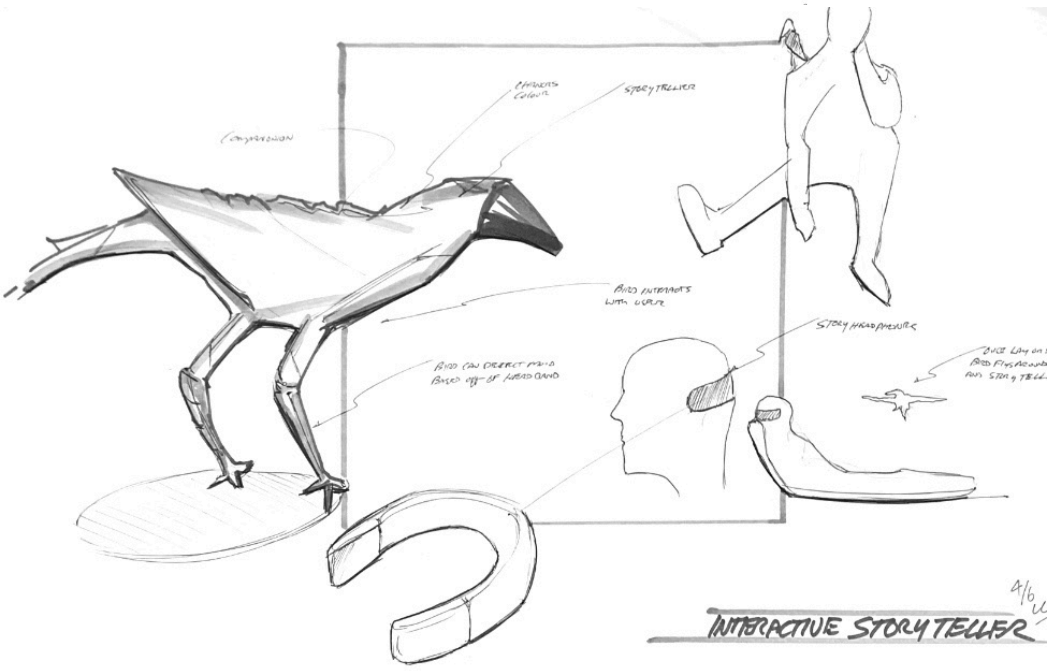

STORY TELLER
INTERACTIVE STORY TELLER

Figure 4-2 – Early stage ideations

Through the process of ideation multiple, elements from each concept were used towards the final design.

4.2 Preliminary Concept Exploration

Through preliminary concept exploration, early development of the concept of what Nocturnal is where starting to form. Concepts were further refined based off of user data collection, semantics and ergonomic research.

Concept 1

This concept mimicked a dome form to which would be fully transparent also mimicking a cave or den. It would rock the user to sleep based on its frame and the transparent glass would be OLEDs to change the user's environment settings.

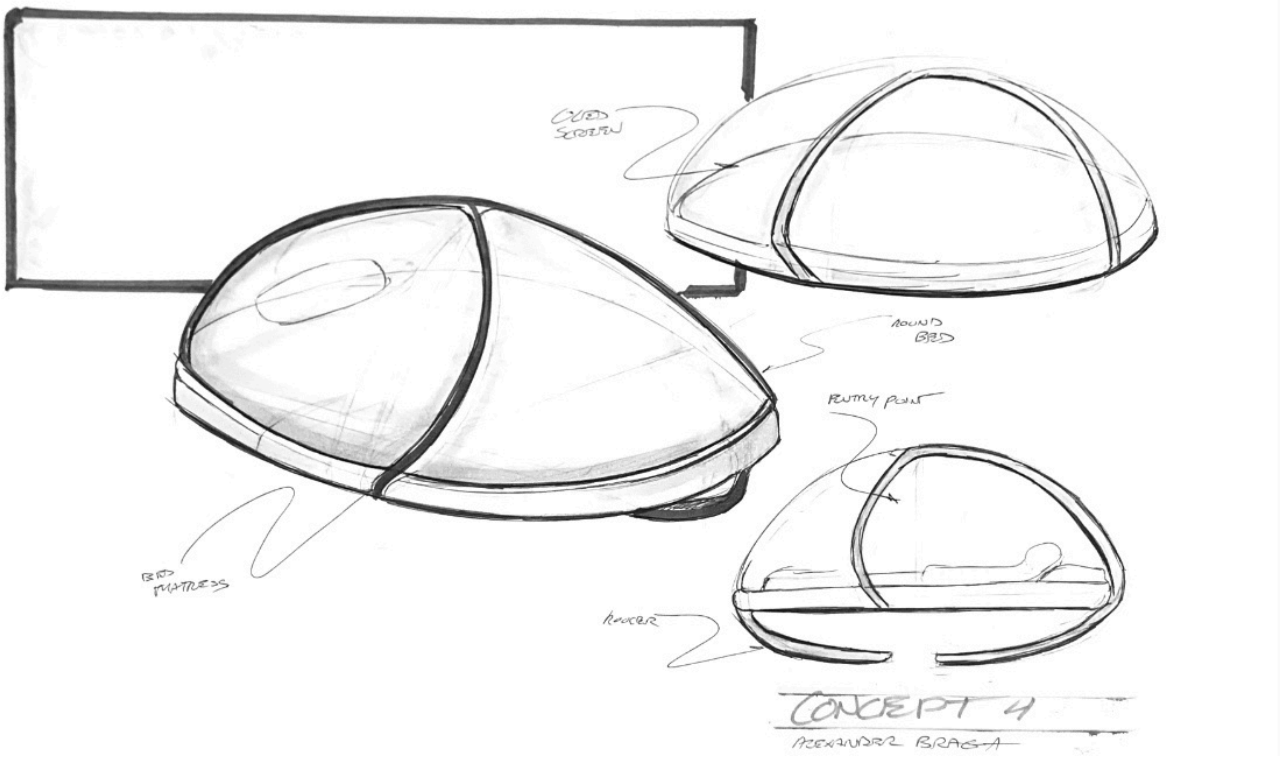


Figure 4-3 – Concept 1

Concept 2

Concept 2 explored more of a traditional bed form, again exploring the use of the OLED interaction screens and the potential for rocking with the frame. This form provides more familiarity to the user.

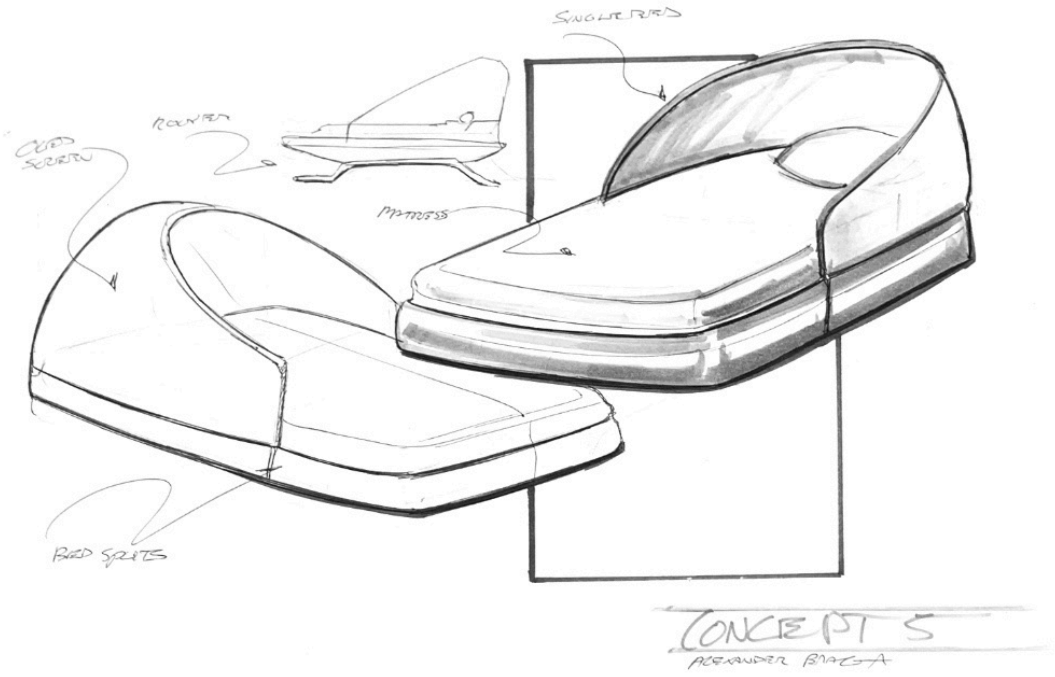
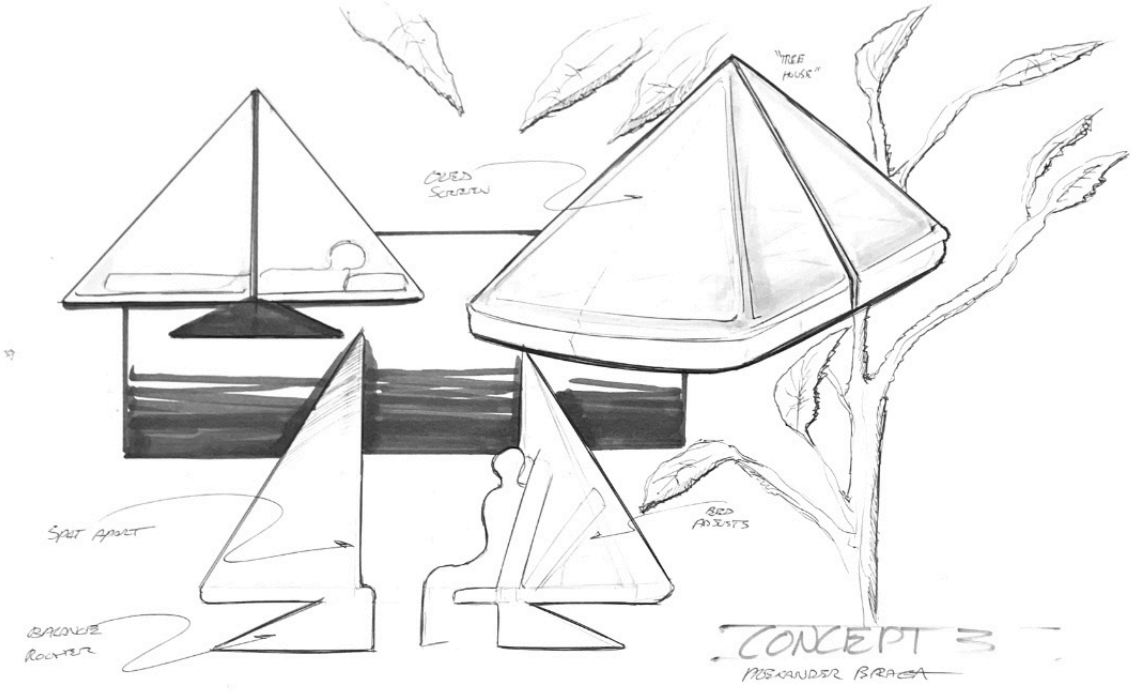


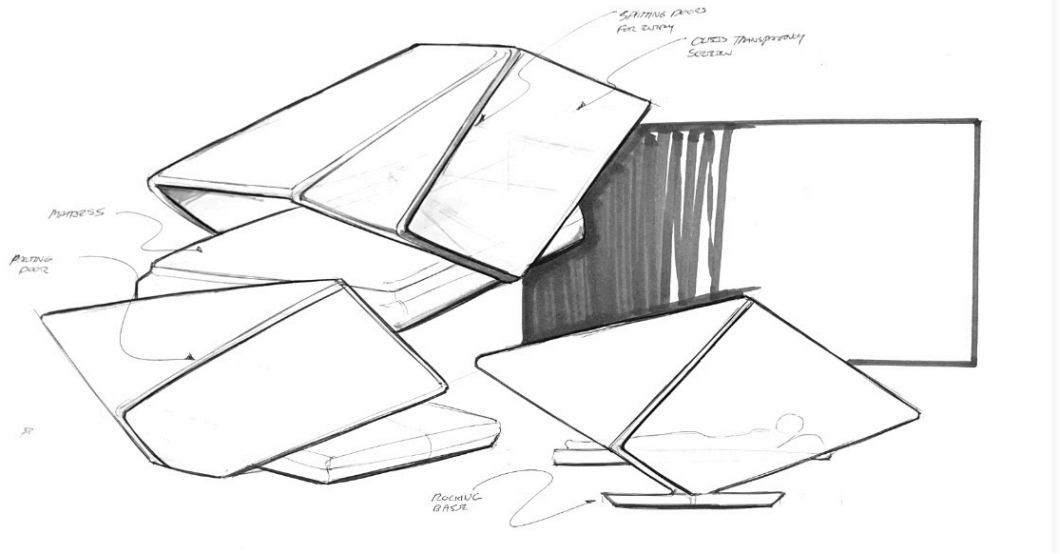
Figure 4-4 – Concept 2

Both concepts explored similar potential design elements and features which are further refined in the following section.

4.3 Concept Refinement

The concept refinement phase explored blue sky form factors and the possibility for tech integration. Major components explored were the OLED screen, entering the bed, the rocking feature as well as the overall form.


"TREE HOUSE"
CURVED SCREEN
SPLIT APART
BIRD ADJUSTS
BALANCE ROCKER
CONCEPT 3
ALEXANDER BRACA


SPLITTING PANELS FOR ENTRY
CURVED TRANSPARENT SCREEN
MATTRESS
FOLDING PANEL
ROCKING BASE

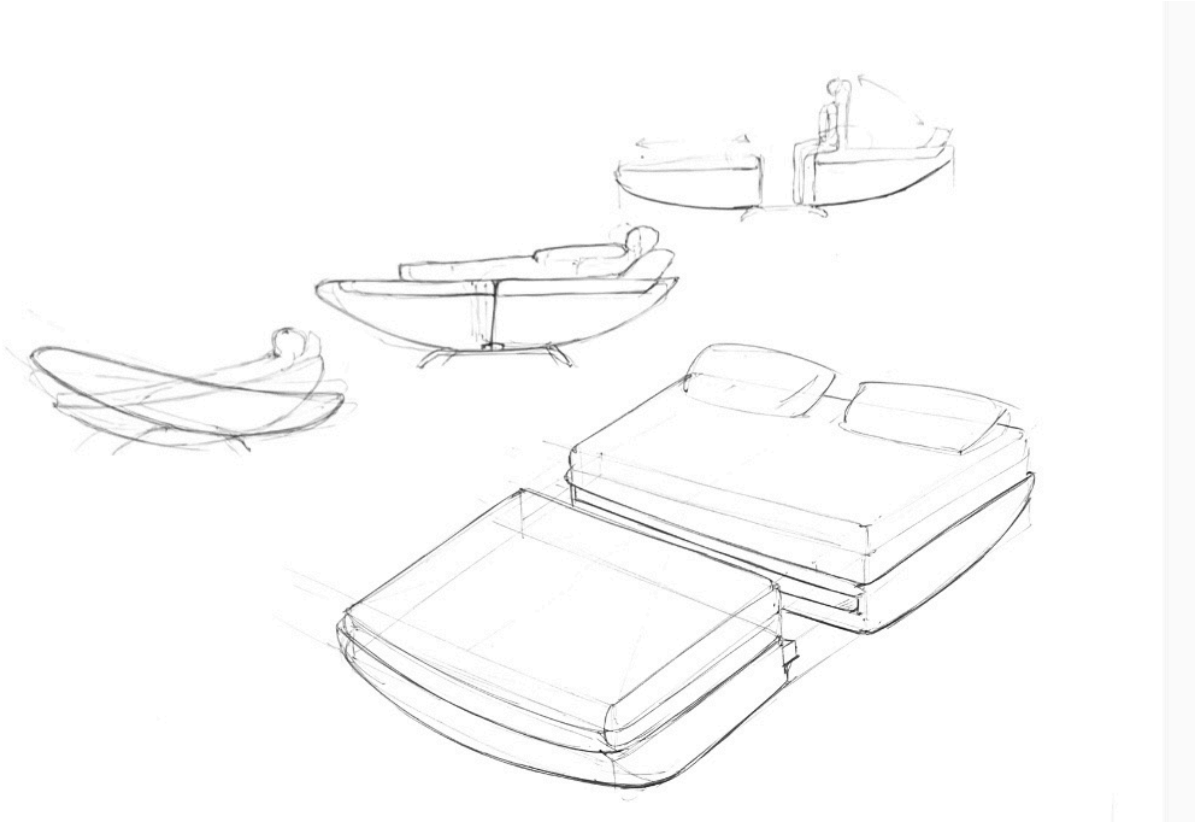


Figure 4-6 – Concept refinement 1-3

In the concepts illustrated above the exploration of form and the use of nature as well as humanistic features can be seen. Manufacturing and feasibility were also considered to reach the next design phase – detail resolution.

4.4 Detail Resolution

Detail resolution focused on refining joinery techniques, manufacturing and material selection as well as finalizing a cohesive design language.

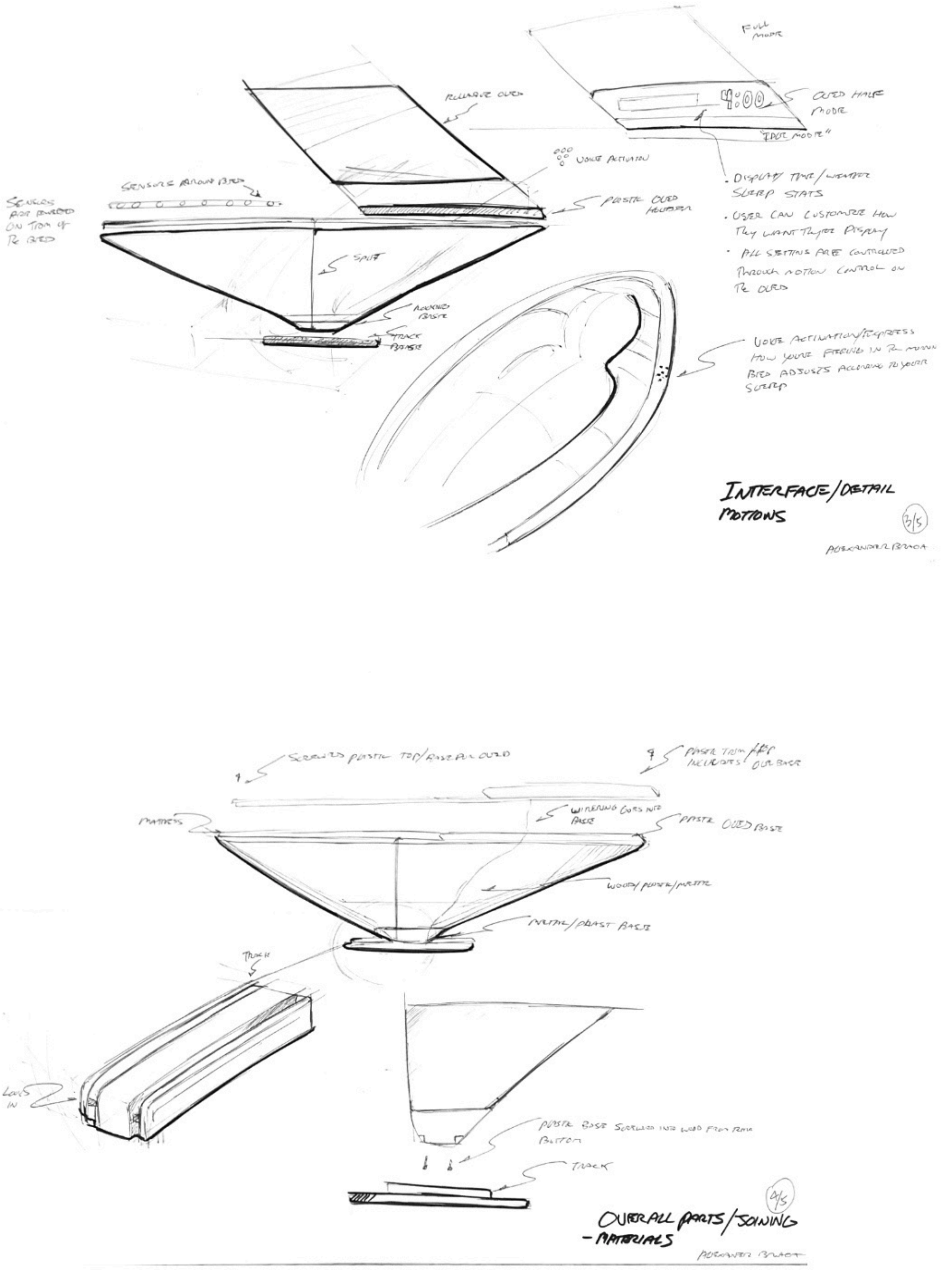


Figure 4-7 – Detail resolution 1-2

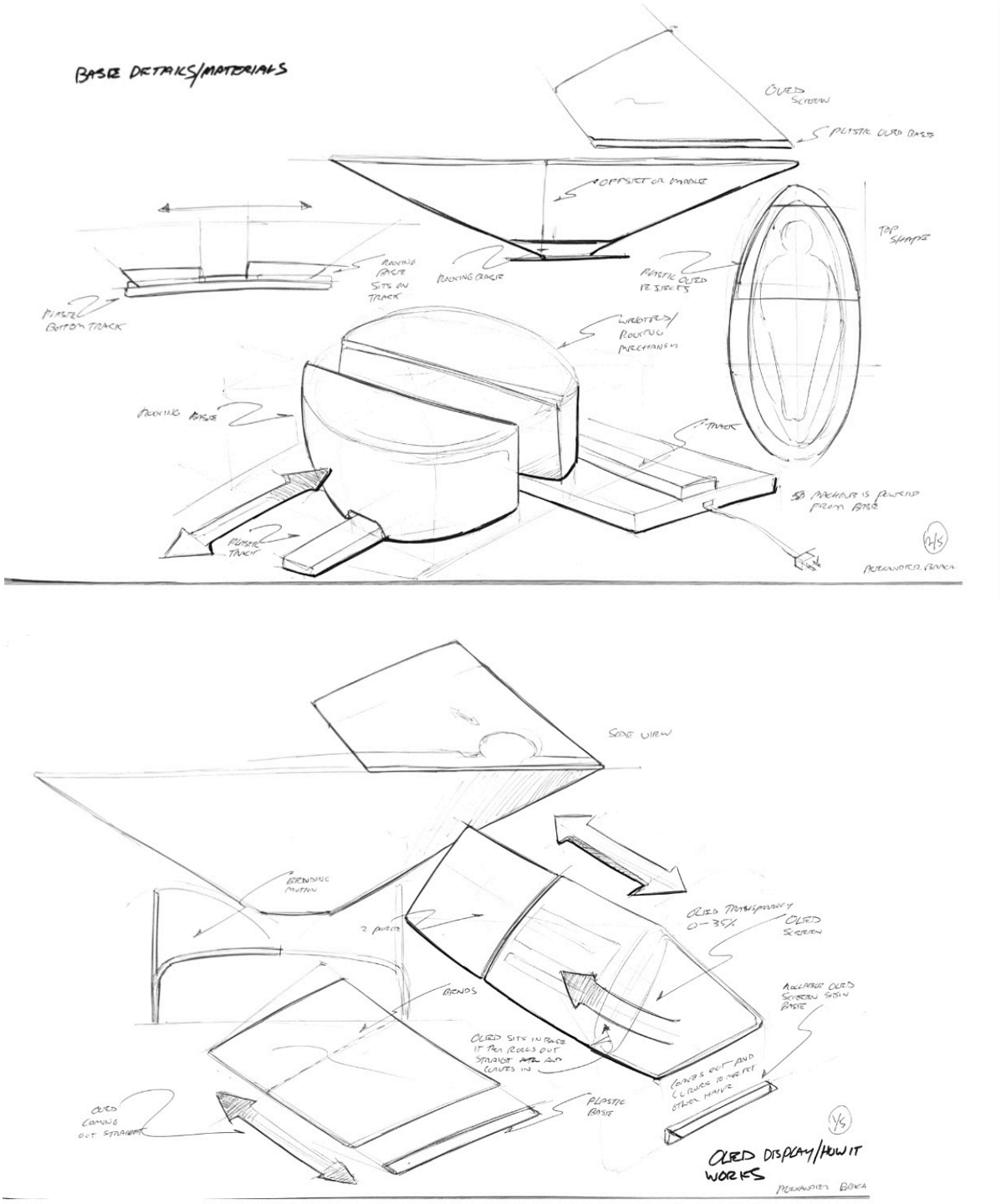


Figure 4-8 – Detail resolution 3- 4

Once finalizing the detailing, it was time to bring the concept into Computer-aided design (CAD) to finalize the design language and refine any further detailing.

4.5 Sketch Models

To obtain a better understating of form and features a 1:10 scale model of nocturnal was created. The sketch model allowed for a better understanding of ergonomic considerations and scale. The model was designed and refereeing elements in early stages of cad to reach this early form.

Figure 4-9 – Sketch Model

4.6 Final Design

The final design takes elements from all previous sections to reach this finalized detailing and form factor. The design takes form elements from 3d design principles, car body designs and futurism to achieve a timeless design and a new user experience.

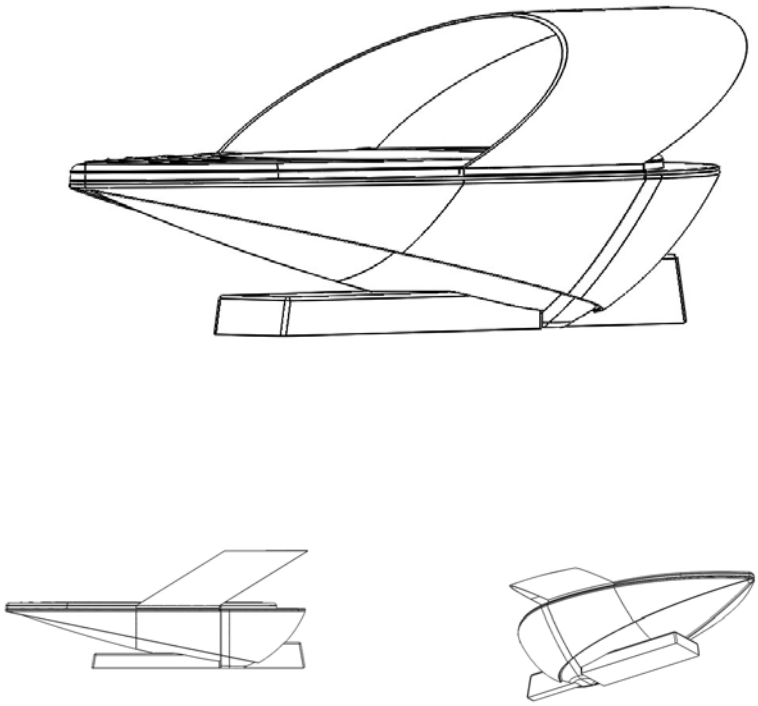


Figure 4-10 – Final design

In cohesiveness with CAD, the overall design was finalized. The following section illustrates Nocturnal's design process in CAD.

4.7 CAD Models

CAD is used to completely finalize the design and manufacturing of each component alongside allowing creation for the fabrication of the hard model and renders. All CAD work was done in Solidworks to achieve accuracy and establish finalization of each design element of Nocturnal. CAD allowed for vital visualization of these design elements in a 3d space to create a beautiful form.

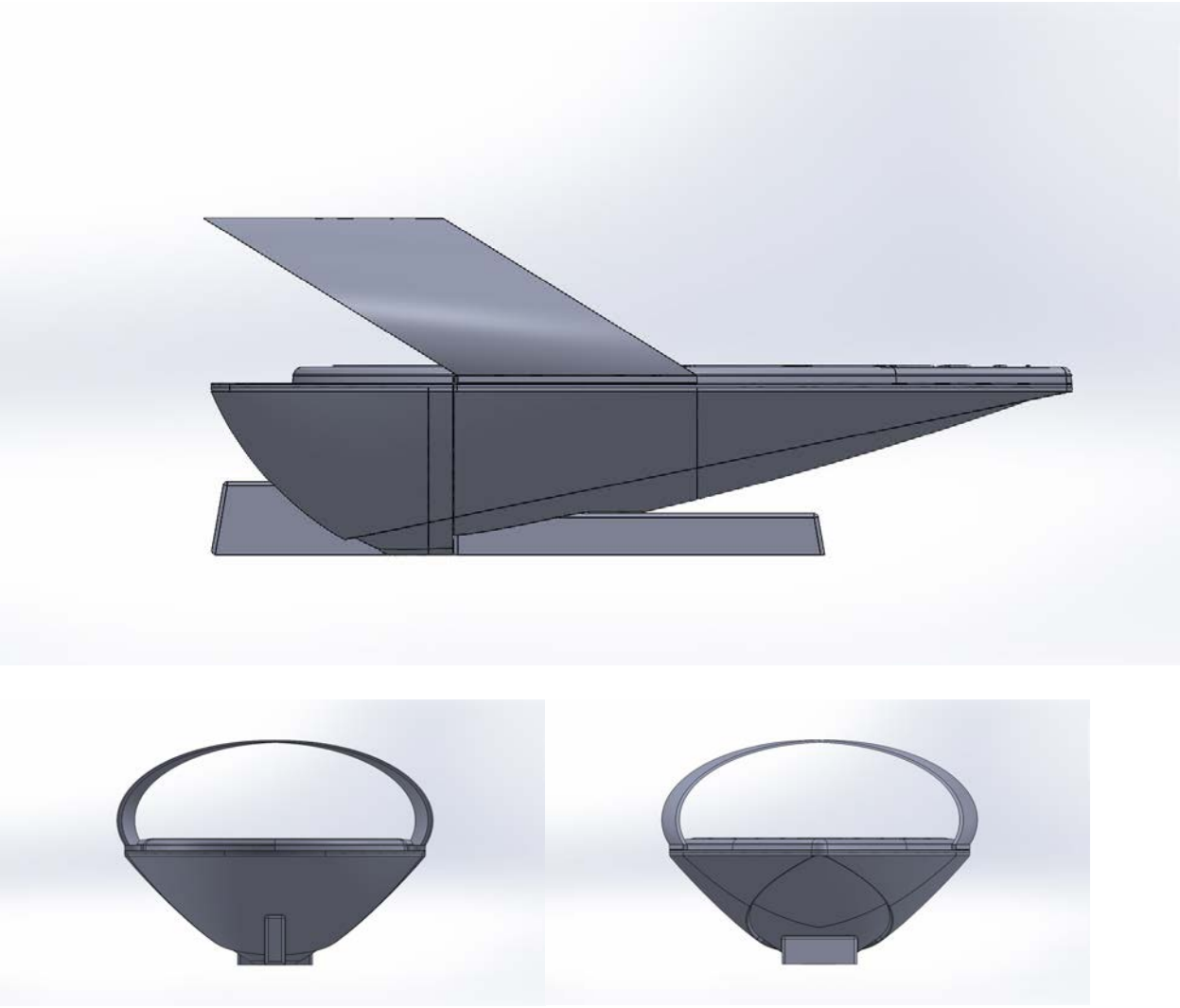


Figure 4-11 – CAD Model

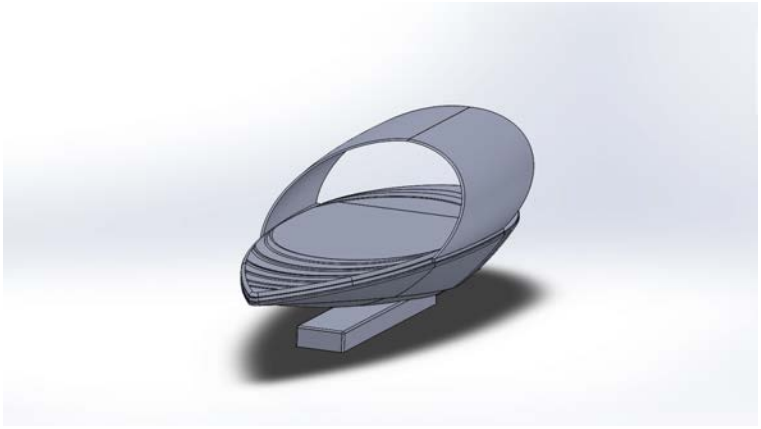


Figure 4-12 – CAD model

All components can be seen coming together to create each element of Nocturnal. Reference back to inspiration were utilized to create the shape of the OLEDs and the cohesiveness the overall design language of the body. all of these components were created using sweeps and lofts.

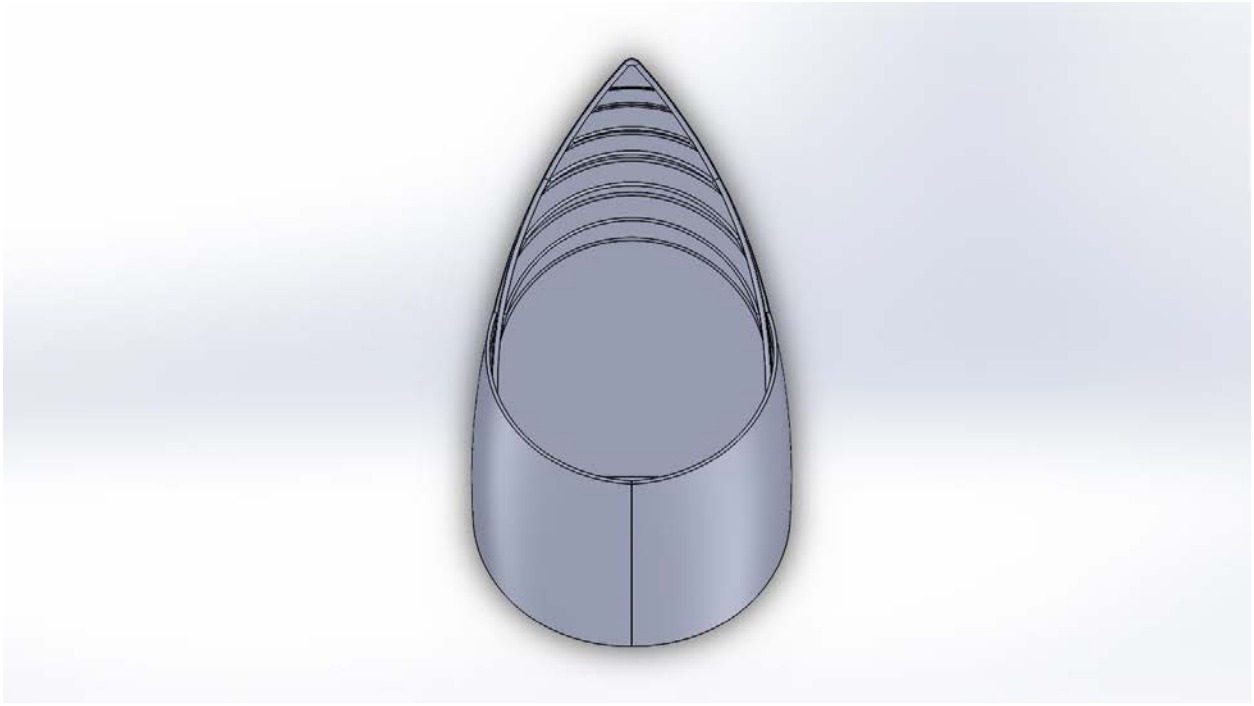


Figure 4-13 – CAD model

Everything came together in the CAD process. Each part and component were finalized to create Nocturnal. The final cad includes the ergonomic opening, OLED features, hydraulic system for opening and haptic sensory. Once complete, the final CAD model was ready to be 3d printed for the hard model fabrication.

4.8 Hard Model Fabrication

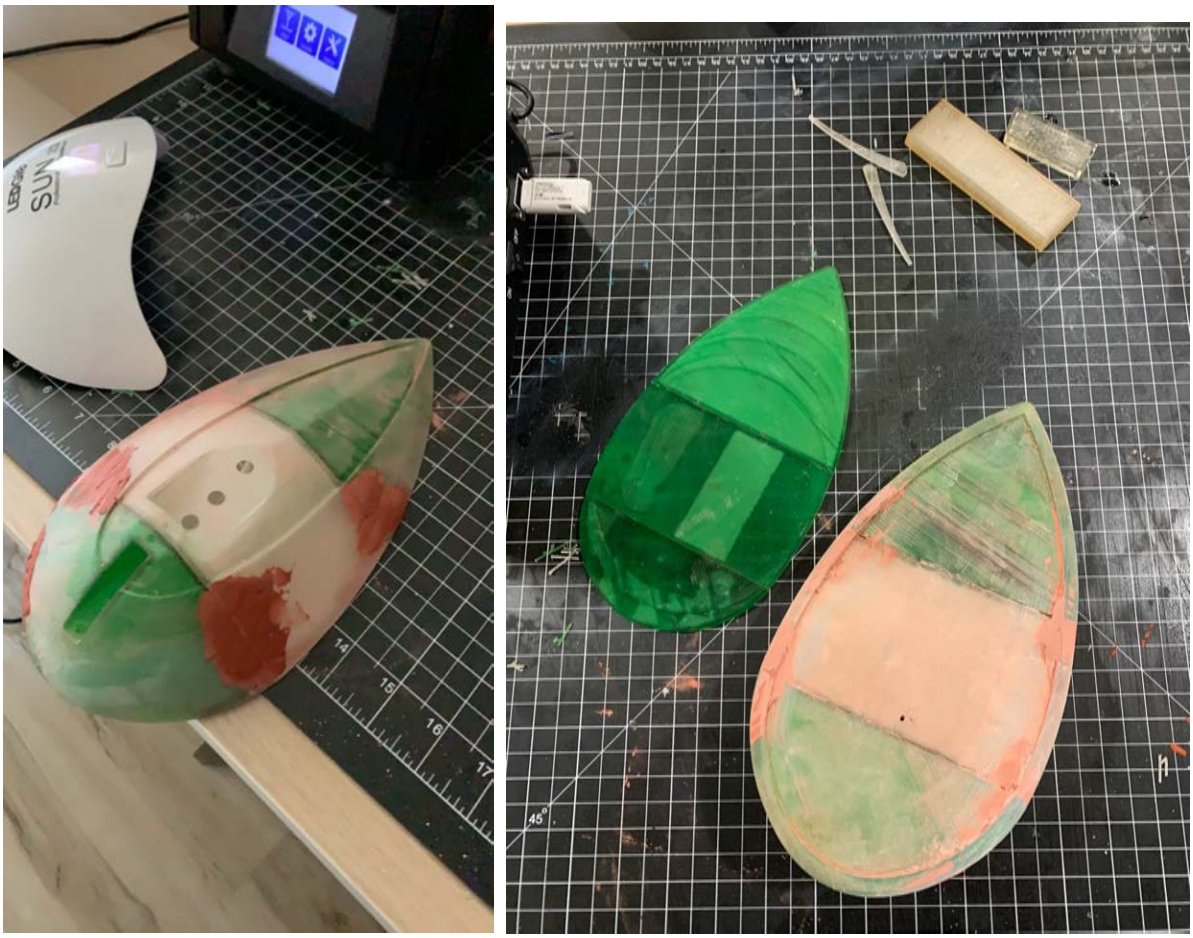


Figure 4-14 – 3D printed components

All components of the hard model except the OLED screen were done in house on a resin printer. The OLED was outsourced to Agile manufacturing. Once all prints where complete, light sanding was required to be prepped for painting and finishing.


Once the printing was finished, the body was fitted together and hand painted to achieve the wood grain effect.


To mimic the haptic and LED underlay, speaker cloth was wrapped around the laser cut piece.

Figure 4-15 – Completed model

Dry fitting was constantly being done to make sure all parts were ready to be painted and then glued in a week's time span. The final hard model fully demonstrates and replicates the form and design features of Nocturnal.

5. Final Design

This chapter review the data collected from the previous chapters and showcase the final design through final renders, sustainability, and hard model photography.

5.1 Summary

Description

Nocturnal utilizes beautiful form features, the use of A.I and feasible technology to create a brand new user experience to improve sleep quality for insomniacs that can be used for not only today, but for the future.

Explanation

Nocturnal's core is based upon its use of A.I technology – sleeping guide. Which explains. *Welcome too nocturnal. I will immerse you into a world of relaxation but first let's review my features. You may enter the bed with gesture control. With the wave of your hand, Nocturnal will open up and you may have a seat onto the morphing mattress. when you are ready just lay back and raise your legs, as Nocturnal will reach a flat position. you are surrounded by haptic technology in both the mattress and underlay to connect you immersively with Nocturnal. an example would be laying down on the warm sand on one of your favorite beaches or laying down and feeling the rain gently refresh your skin. Through Nocturnal's haptic technology you will be connected to your new environment change. I am equipped with machine learning technology, and will design the best possible storytelling experience to aid you to sleep based on how you are feeling.*

while asleep I will monitor your body progressively understanding you're sleeping patterns, emotional state and your vitals. you can speak to me to personalize and customize you're experience at any time, if you are not in the mood to talk all menus are accessible through gesture control. let's get started.

Nocturnal's beautiful form and use of technology integration create a brand new sleeping experience in which physical meets digital.

Benefit statement

Nocturnal is a solution to improve sleep quality for insomniacs by combing both digital and physical design. It utilizes natural materials for sustainability and uses familiar design elements to create a product which is evolutionary.

5.2 Design Criteria Met

The following section reviews the design elements and considerations to create Nocturnal. The design criteria are split into 3 subcategories – ergonomics, materials/process and technologies and manufacturing cost report.

5.2.1 Ergonomics

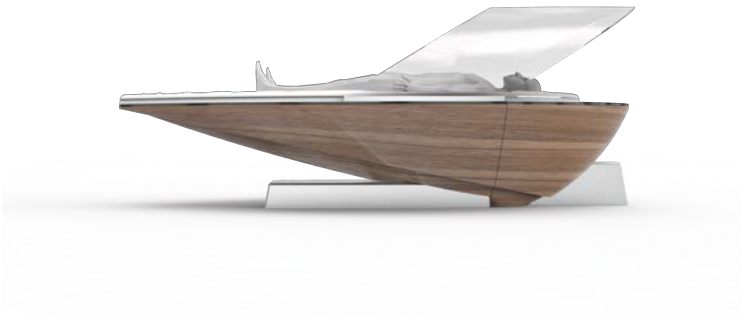


Figure 5-1 – Nocturnal

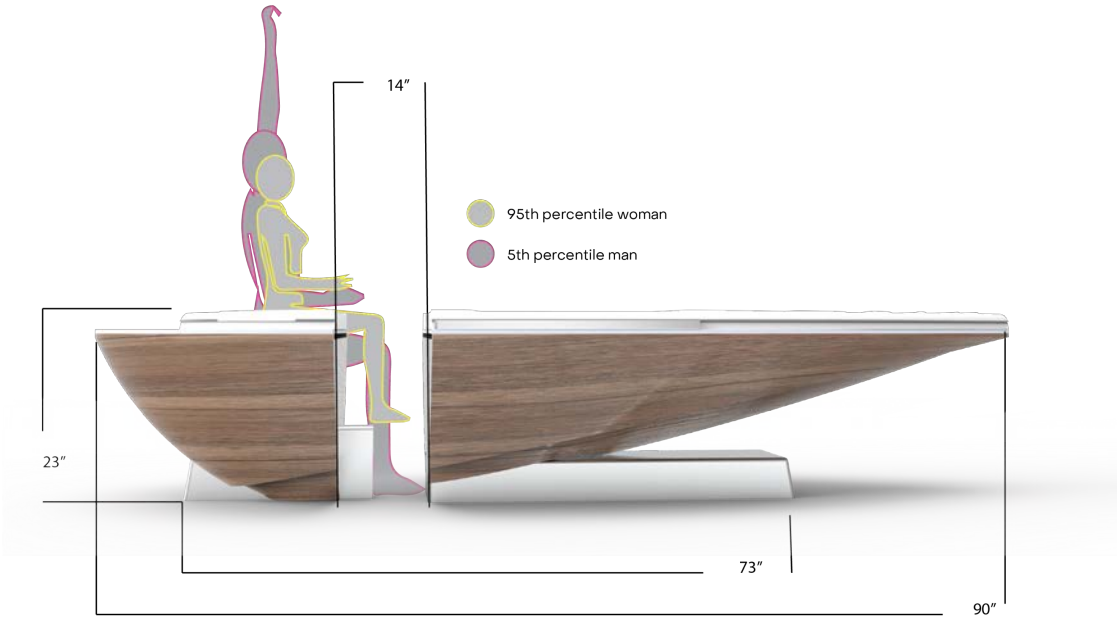


Figure 5-2– Illustrative ergonomic details

5.2.2 Materials, Processes and Technologies

OLED

Figure 5-3– OLED technology - https://www.pcmag.com/news/first-look-lgs-rollable-display-may-be-the-future-of-tvs

Nocturnals OLED display is uses roll able and bendable technology as presented in the above figure. Currently this technology now is approaching the market, however in the next 5-10 years we will see substantial leap forward in bendable, foldable and roll able interactive OLED displays that can be used within many different applications such as Nocturnal. The dynamic display allows for voice/ gesture control to accommodate however the user wants to interact with nocturnal.

Haptic touch

The haptic sensory embedded inside the mattress and underlay provide ultimate comfort to the user and fully immerse them into the nocturnal experience. As the environment changes so does the haptic sensory to ease the user into deep relaxation.

Morphing

Capacitive proximity sensors behind the surface of the mattress recognize the human body. In which then activates the mattress to react and shape through stretchable multilayer surface material to accommodate any contour of the body when entering the bed.

Storytelling

Figure 5-4– Fantasy -https://art.alphacoders.com/arts/view/122478

Improvement of sleep quality by reducing stress and anxiety through Nocturnal's ability to immerse the user into endless possibilities of wonder and deep relaxation. The user's environment is completely changed and they are placed within a new experience through visuals and haptic sensory.

Comfort

A Simple hand motion or voice commands opens the bed which runs along a linear moving track system located on the second half of the frame. This allows for access and accommodates a more relaxed seating position upon entrance.

Gesture and Voice Control

Figure 5-5–Voice interaction -https://www.wired.com/2017/10/review-google-home-mini/

As seen in the above figure, company's such as google and amazon are implementing voice control in future products, with Nocturnal the OLED recognizes and can interpret movements of the human body to react to the users' needs without direct physical contact.

Voice recognition technology allows for voice commands and responses to communicate directly too Nocturnal. As nocturnal communicates with the user, complete interaction within the haptic sensory located in the mattress and underlay can be seen.

5.2.3 Manufacturing Cost Report

The following table estimates the cost of each component of Nocturnal's build.

QTY	PART	ESTIMATED COST
A COSTS		
1	HAPTIC UNDERLAY/MATRESS	$300,000
2	OLED DISPLAY	$70,000
1	WOOD BASE	$90,000
B COSTS		
1	TRACK SYSTEM	$1,000
2	ALLUMINUM BASE	$5,000
2	OLED BASE	$10,000
		SUM - $476,000

Table 4 – Cost analysis breakdown

As seen in the above costing chart, the estimated cost would be $ 476,000 between both A and B costs. Estimates were based upon the hypothesized full scale mass production. Estimated costs will vary and fluctuate as technology becomes further accessible.

5.3 Final CAD Renderings

Figure 5-6– Nocturnal rending 1-2

Figure 5-7– Nocturnal rending 3-4

5.4 Hard Model Photographs

Figure 5-8– Model photos - 1-2

Figure 5-9– Model photos - 3-4

5.5 Technical Drawings

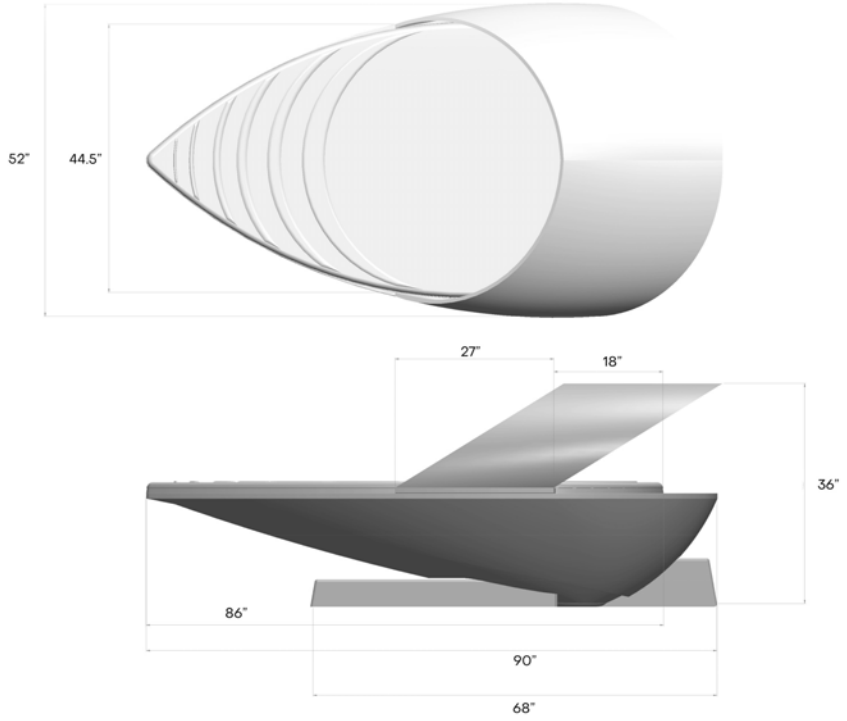


Figure 5-10– Final technical drawings

5.6 Sustainability

Nocturnal combines both digital and physical design to improve sleep quality for insomniacs as a sustainable solution for the future. Technology and the use of A.I are being implemented in the way we live today with progressive advancements being discovered frequently. The implementation of A.I can have substantial benefits when used in the correct context. The potential to move users away from anxiety's and stress can be achieved by using technology for beneficial purposes. In combination with the integration of Nocturnal's A.I sleeping guide, the material choices for the form and design achieve longevity, very minimal wasted material, and a small economical foot

print. With a sustainable and interactive design, Nocturnal provides the user with all the support they need to aid them to enter deep relaxation and fall asleep.

6 Conclusion

Nocturnal is a product which utilizes interaction design to provide a brand new sleeping experience with no negative impacts. The design is completely revolutionary sleeping solution as it combines beautiful design language, the use of intuitive interaction and sustainability. Nocturnal has the potential to be a sleeping solution which can make a breakthrough for the future to come.

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8 Appendix

Appendix I – Discovery

User Interviews

Method

Method of record: Personal Interview

Interview Questions:

How often is the insomnia occurring? Explain any problems staying asleep as well as any problems waking up in the morning?

How often is your insomnia occurring on a weekly basis? explain any patterns you are noticing

How long have you been suffering from your insomnia?

Have you noticed any changes in mood/cognitive function during the day from your insomnia as well as problems trying to stay awake?

How does your current sleep schedule look like?
- How long does it take you to fall asleep?
- What time do you try and go to bed at?
- Do you ever take naps?
- How is your weekend sleeping schedule?

Have you ever tried using sleeping aids to fall asleep? If so what where the affects you experienced both mentally and physically?

What type of work do you do? Occupation wise?
- What time do you start work?
- What time do you finish work?

What are some of the events surrounded by your insomnia? Describe your routine, room setting, any interaction with products before you sleep?

Do you ever notice anything that creates more insomnia for you? Such as behaviors, lifestyle, diet?

What type of sleeping position is most comfortable for you? Explain any transition you may have during the night in terms of your starting position to ending position?

Can you describe anything that has improved sleep quality for you?
- Have you tried any treatments?

Any stressful events in your life that can relate to your insomnia?

Was your insomnia a sudden onset? Or was it a gradual process?

Explain and describe your bedroom environment?

Do you use any substances or stimulates such as cannabis, alcohol caffeine during the week?
- Any medication use?

Do you have any history of mental illness at all?

Any additional information you would like to share about your insomnia?

Findings/Evidence

Interview #1

Name: Anthony Dalfonso

Age: 26

Sex: Male

Contact: +1 (416) 858 8743

Occupation: Flooring Sales specialist

Date of interview: Saturday October 5, 2019

Location: Starbucks

Transcript

1) How often is the insomnia occurring? Explain any problems staying asleep as well as any problems waking up in the morning?

Waking up around 2-4 am,
It takes me forever to fall asleep. Not feeling comfortable, diet causes maybe, wired from work? If I'm betting on sport games... nerves make anxious.

Staying Asleep?

Yes, I definitely have trouble staying asleep I am never in full REM always waking up, I don't know why, I have no particular reason. I try to go on my phone and take my mind off things and to fall asleep.

Waking up in the morning?

Yes all the time because of all the restless nights. Definitely tough to get up in the morning, restless nights because of long day ahead. Knowing that work is going to be busy and forecasting a heavy work load of a day

2) How often is your insomnia occurring on a weekly basis? explain any patterns you are noticing.

I would say 3-4 times a week. It happens more frequent during the week. It's different because on the weekend I know I can relax more but during the week I have the stress of work.

3) How long have you been suffering from your insomnia?

I don't even remember! I don't remember ever having a good sleep anymore. I can't recall a time where I woke up and said I got a very good sleep.

4) Have you noticed any changes in mood/cognitive function during the day from your insomnia as well as problems trying to stay awake?

Not necessarily but I'm tired and I'm yawning and I'm not focused. I'm driving 75 percent of the time and this takes a huge toll on me.
Definitely changes in mood. I would say more agitated getting angrier easier, have no patience for people,
Not focused, all over the map. I'm trying to pinpoint mood patterns.
Some days I get 5 hrs of sleep and some days I don't get any sleep.
Days I don't get sleep I'm more alert during the beginning of the day but then I crash.

5) How does your current sleep schedule look like?

- **How long does it take you to fall asleep?**
- **What time do you try and go to bed at?**
- **Do you ever take naps?**
- **How is your weekend sleeping schedule?**

Between 9:30- 10 depending on if I'm playing video games. Video games cause a lot of stimulation for me.
Pffft hours, 2-4 hrs sometimes I fall asleep instantly but I'm up after an 1hr or so. Yes, I go to sleep later, I wake up later. I'm more relaxed and can ease myself into the day more of a care free attitude.
No never. I don't have the time to nap. No time during the day with my busy work schedule

6) Have you ever tried using sleeping aids to fall asleep? If so what where the affects you experienced both mentally and physically?

No. I have not tried any also.
I would consider trying natural substances only.
I am scared of how my body would react to the medication, and the body sensations as they are unknown. I do not want to feel not in control of my body.

7) What type of work do you do? Occupation wise?

- **What time do you start work?**
- **What time do you finish work?**

Outside sales for a flooring company
I've been in the flooring business for 7 years' now
Starting at 7- 7:30 am and finishing around 4pm

8)What are some of the events surrounded by your insomnia? Describe your routine, room setting, any interaction with products before you sleep?

I do the same routine always. I watch tv at night to try and fall asleep. Maybe it's not the TV itself but I need the background noise to help. On my phone also, I try to put it down around the 9:30 mark.

9) Do you ever notice anything that creates more insomnia for you? Such as behaviors, lifestyle, diet?

Stress and work is a big one it is kind of relative, and my diet is a big one, over stimulation of my phone. I find eating super late at night takes a big toll. I have neck and back issues; I believe it is from my bed.

10) What type of sleeping position is most comfortable for you? Explain any transition you may have during the night in terms of your starting position to ending position?

I move around a lot I move around on my stomach and back. I start off sleeping on my back and end up waking up on my back or stomach

11) Can you describe anything that has improved sleep quality for you?

- **Have you tried any treatments?**

Definitely vacation, cool room environments sleeping with someone at night can make it better depending on sleeping positions and comfort level of mattress and bed
Tried switching up my pillows and opening up windows when it's cool out. So far that's all that's really it.

12) Any stressful events in your life that can relate to your insomnia?

Death of a family member, grandparents.

Anxiety. I noticed my anxiety in high school gr 12.
The stress of university, choosing between hockey and soccer the stress and pressures of succeeding.

13) Was your insomnia a sudden onset? Or was it a gradual process?

It developed it's been so long I can't remember

14) Explain and describe your bedroom environment?

Very warm always hot and I believe that is a big factor, I have a queen size mattress.
Color of the room is blue, some décor of sport memorabilia.
TV is constantly playing I feel like I need the background noise its more of a mental thing. Phone is always around also**.**

15) Do you use any substances or stimulates such as cannabis, alcohol caffeine

during the week?

- **Any medication use?**

Small coffee in the morning always. Majority during the week.
No alcohol during the week however occasionally on weekends. I notice a few drinks when going out… relaxes you I guess
No cannabis.

16) Do you have any history of mental illness at all?

Anxiety and small amounts of depression I guess they go hand in hand.
I definitely believe it plays a toll on my insomnia
My minds never shutting off and I'm always on edge because of my anxiety.
I would say I have general anxiety.

Anxiety use to affect my work and daily life but I've gotten better at it.
I talked to a psychologist when I was younger to help me get through but I realized myself what it was to help combat it.

17) Any additional information you would like to share about your insomnia?

- Unknown why my insomnia happens

- Not one general factor that contributes it
- Can’t pinpoint why I have insomnia
- Suitable sleeping conditions would help
- Comfortability with bed, pillow, blanket, would help

Findings/evidence

Interview #2

Name: Laurie Keller

Age: 75

Sex: Male

Contact: (647) 347 1845

Occupation:

Date of interview: Monday October 7, 2019

Location: Starbucks

Transcript

1) How often is the insomnia occurring? Explain any problems staying asleep as well as any problems waking up in the morning?

When I was on medication, opioids and certain other drugs such as morphine, when I was on these my sleep patterns were erratic. I would get up go outside and walk for an hour. I was so hyper. I stayed up for 45 hours straight once, Because I was trying to eliminate a certain morphine I was taking for pain. I took this sleeping pill which made me sleep for 90 minutes but put me in a deep sleep that I thought I was in for 9 hrs.

Combination of intense pain and the effects of medication. My doctor prescribed at my assistance over a period of time. We tried several sleeping aids from the hypnotic family.
For me there are 3 basic problems:

You rely on them

Secondly you don't wake up refreshed

Thirdly if you don't take them directly they can cause massive depression!

It wasn't so much staying asleep for a long period of time it was more based off of my body beginning to adapt and adopt even though on the drugs –on/ off on/ off on/off and each of those periods are various situations in length. It took after my second operation; it took a good year for my sleep habits to settle. Now it's not unusual for me to sleep through on 6 hrs or occasionally back on - the on/off cycles

2) How often is your insomnia occurring on a weekly basis? explain any patterns you are noticing

6 nights a week depending on the dosage of the medication

3) How long have you been suffering from your insomnia?

I fought it for 3 years, I never panicked. I knew what the causes where. The more educated you are on the topic the more you can understand your body.
My sleep patterns have changed juristically.
I never had anxiety or panic disorder or concerns about my sleeping issues. I realized what was happening, you'd be surprised how many people get into an anxiety trap.

4) Have you noticed any changes in mood/cognitive function during the day from your insomnia as well as problems trying to stay awake?

No notice in cognitive function.
I felt awfully good. More aware, more critical in my thinking and my research and I became more expressive to my doctor to getting to the bottom of this. I have to assume the affliction of the operation and getting back to normal life

One of the major problems with insomnia the doctor they go by the book and try to put you in a sleep clinic. After my 3 half hr surgery I had a brand new back but my sleeping patterns were not stable.

The one thing I learned. if you look at the bright side and your awake use the time its valuable. Don't panic about not falling asleep.

I tried music, I tried medication. I won't go near a sleeping pill!

I tried walking even if its 3 am in the morning, the problem with the doctor if they don't have it they will never understand it other than from a text book. I don't think many insomniacs have similar sleeping issues... there are multiple symptoms

5) How does your current sleep schedule look like?

- **How long does it take you to fall asleep?**
- **What time do you try and go to bed at?**
- **Do you ever take naps?**
- **How is your weekend sleeping schedule?**

It would be most times, a drug induced (medication) waiting for the effect of the drug which would take 40 min -1hr to fall asleep, all medication

6) What are some of the events surrounded by your insomnia? Describe your routine, room setting, any interaction with products before you sleep?

Just taking drugs, I wasn't listening to frequency's, or mediating, I did all my research but it didn't work, my internal clock was rearranged. I've adopted a sleeping schedule.

7) Do you ever notice anything that creates more insomnia for you? Such as behaviors, lifestyle, diet?

I think sometimes the actual drugs make you become drowsy and collapse, but with my internal clock it probably bothered me more than the pain. Try staying up for 45 hrs straight! Reading writing watching tv. A lesser man would of called 911.. You need to understand symptoms and causes.
You have to try and see the light at the end of the tunnel.

8) What type of sleeping position is most comfortable for you? Explain any transition you may have during the night in terms of your starting position to ending position?

2 positions –
Both sides and stomach with one hand high and other hand behind the back I find it extremely helpful but when I go to sleep it's on my left side. Legs 50 percent fetal position.

9) Can you describe anything that has improved sleep quality for you?

- **Have you tried any treatments?**

I have an old pillow that I can shape beautifully, down filled, I have it for years and I wouldn't sell it for a million bucks. Soft putty shaping pillow position around my neck and head is key.

10) Any stressful events in your life that can relate to your insomnia?

It was the s1 nerve that runs down the spine and down to my right leg all the way down to my ankle, the first thing is I walk out of the doctors with a prescription and 100 percosets over a period of 2 years I had 4 MRIs there was another 2 means of dealing with the pain prior to the second operation that where called nerve blockers, the pain was so intense, and I had 2 epidurals which I think was much more exploratory. The

only problem is and again contributing to insomnia is that when the medication wears off you take more; you have to be very very careful with sleeping pills especially those in the hypnotic family. The final solution to fix my insomnia a serious spinal operation which took a year to heal but over that period of time, gradually my sleep was becoming way healthier. It takes time, the only thing I took away from it was the intermittent sleep patterns

11) Was your insomnia a sudden onset? Or was it a gradual process?

It was gradual.

12) Explain and describe your bedroom environment?

Dark as a cave, with reading lights that don't disturb, opening window for fresh air and our bed is king-size, beautiful comforter type blanket. Very comfortable.

13) Do you use any substances or stimulates such as cannabis, alcohol caffeine

during the week?

- **Any medication use?**

Caffeine

Coffee, not regularly no tea, my diet remained the same.

Alcohol

Occasional, at one point I was actually drinking t manage the pain it would help with its numbing affect, the major concern was mixing alcohol with narcotics

On 2 separate occasions I was trying to sleep beautifully I could feel a slight suppression on my breathing and chest and that's when I cut out alcohol.

Cannabis

Very little

14) Do you have any history of mental illness at all?

“I had bad LSD trip once it but hey you learn from it”

15) Any additional information you would like to share about your insomnia?

- I’ve always been a light sleeper
- When I sleep deep its always REM state it’s a dream or something.
- I couldn’t be more opinionated about the value of research which leads to finding and understanding about how your own body works, mentally, physically, externally, internally
- Do your research! There’s pages and pages of insomnia out there, no 2 insomnias are the same.

Key Points

- Physical pain creates irregular sleeping patterns/ schedule
- Sleeping positions vary throughout the night.
- The effects of medication/ substances on the user’s mental state. (feelings, emotion, anxiety, panic)
- Comfortability in bedroom, such as the environment, pillows, lighting, sound, temperature, has great impact
- Understanding the users cognitive state when dealing with pain (scared to relax, panic attacks, feeling of no relief, poor sleeping conditions)

Appendix II – User Research

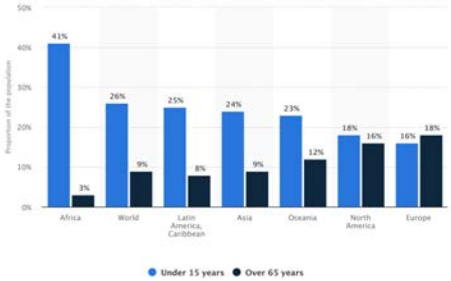
User research

User demographic

Evidence

Nighttime insomnia symptoms are more prevalent in adults than in adolescents and children. They are also more prevalent in women and in those with less education and income (Table 1). Nighttime insomnia symptoms have also become more prevalent in recent years. For example, nighttime insomnia symptoms increased by 42% over the eight-year period from 2007 to 2015 among Canadians aged 18 or older (from 16.8% in the 2007-to-2009 period to 23.8% in the 2014-to-2015 period (Chaput, J.-P., Yau, J., Rao, D. P., & Morin, C. M. (2018, December 19).

http://worldpopulationreview.com/countries/canada-population/world population



World population by age and region 2019

Education:

Participants were also examined by household education and household income. Household education was the highest level acquired by any member of the household; three categories were created (secondary graduation or less, secondary graduation but less than a bachelor's degree, and bachelor's degree or more). (Chaput, J.-P., Yau, J., Rao, D. P., & Morin, C. M. (2018, December 19).

Income:

Annual household income was reported by participants and collapsed into three levels: less than $40,000; $40,000 to less than $80,000; and $80,000 or more. (Chaput, J.-P., Yau, J., Rao, D. P., & Morin, C. M. (2018, December 19).

Table 1
Nighttime insomnia symptoms by age group, sex and socioeconomic status, household population aged 6 to 79, Canada, 2007 to 2015

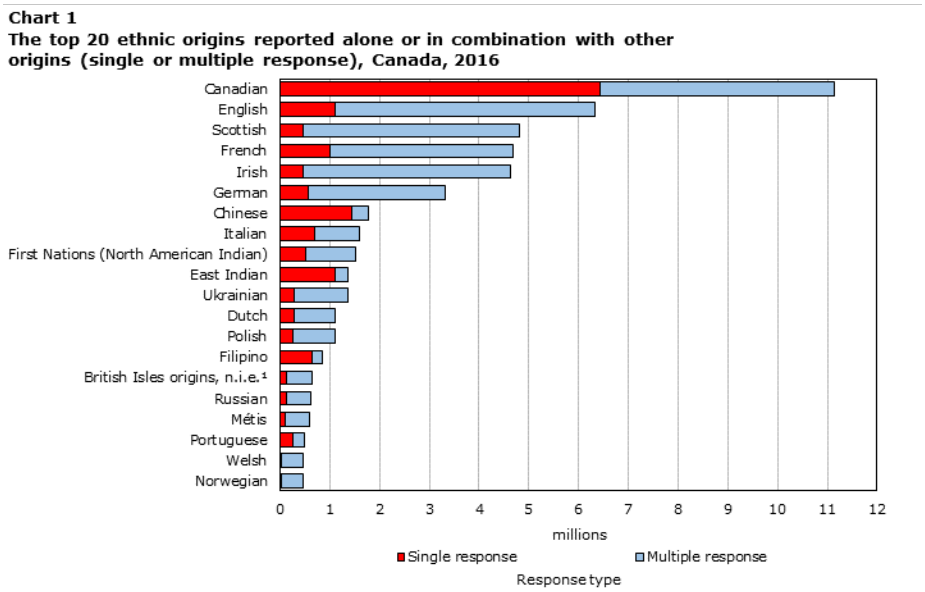
Sex, age group, household education and household income	2007 to 2009			2009 to 2011			2012 to 2013			2014 to 2015		
	Cycle 1[†]			Cycle 2			Cycle 3			Cycle 4		
	%	95% confidence interval		%	95% confidence interval		%	95% confidence interval		%	95% confidence interval	
		from	to		from	to		from	to		from	to
Total aged 6 to 79												
6 to 13	7.7	6.0	9.4	8.0[E]	5.0	11.1	8.4[E]	5.1	11.7	8.8	6.0	11.5
14 to 17	12.2	8.2	16.3	12.2[E]	7.7	16.8	16.7	12.6	24.8	15.3	10.1	20.5
18 to 64	17.7	15.8	19.6	19.3	16.2	22.3	26.9[*]	22.5	31.3	25.3[*]	21.8	28.9
65 or older	15.9	10.5	21.2	18.6	14.1	23.1	27.6[*]	21.0	34.2	22.2	18.6	25.8
Male												
6 to 13	7.4[E]	4.3	10.5	7.8[E]	3.1	12.5	8.6[E]	4.5	12.7	9.3	6.5	12.2
14 to 17	9.3	6.3	12.3	9.3[E]	5.7	12.9	F	..	..	11.7[E]	7.2	16.3
18 to 64	13.1	10.7	15.5	18.2	13.0	23.4	23.6[*]	17.3	29.8	20.8	15.1	26.5
65 or older	12.3	8.8	15.8	14.5	9.7	19.3	24.0[E *]	14.4	33.7	14.4[E]	8.7	20.1
Female												
6 to 13	8.0	6.2	9.7	8.2[E]	4.8	11.6	8.2[E]	3.9	12.5	8.1[E]	4.2	12.1
14 to 17	15.3[E]	8.5	22.2	15.6[E]	8.8	22.4	26.1[*]	19.7	32.4	18.7[E]	10.0	27.3
18 to 64	22.2	20.0	24.5	20.3[*]	17.6	22.9	30.2[*]	26.0	34.5	29.9[*]	24.7	35.0
65 or older	19.2[E]	10.5	27.9	22.4	16.5	28.3	30.9	20.2	41.7	29.1	23.2	34.9
Household education												
Secondary graduation or less	20.7	16.1	25.3	21.1	15.1	27.0	29.3[*]	23.1	35.6	28.4[*]	23.4	33.3
More than secondary graduation, less than a bachelor's degree	17.0	13.7	20.2	18.8[*]	16.0	21.7	27.1[*]	21.7	32.4	28.0[*]	23.8	32.2
Bachelor's degree or more	12.3	10.4	14.1	13.8	10.6	17.0	20.2[*]	16.5	23.8	16.8	13.0	20.7
Household income												
Less than $40,000	22.9	18.9	26.8	21.2	16.1	26.2	27.0	21.3	32.7	27.5	21.5	33.4
$40,000 to less than $80,000	14.5	11.8	17.2	17.6	13.3	21.8	25.7[*]	20.3	31.1	23.8[*]	20.4	27.3
$80,000 or more	13.7	11.7	15.7	15.8	12.4	19.2	22.8[*]	18.2	27.3	20.1	15.9	24.2

.. not applicable
E use with caution

(Chaput, J.-P., Yau, J., Rao, D. P., & Morin, C. M. (2018, December 19).

Ethnicity

In Canada alone, chart 1 demonstrates Canada is a quite diverse ethnic region. Insomnia affects all ethnicities, therefore ruling out any bias's.



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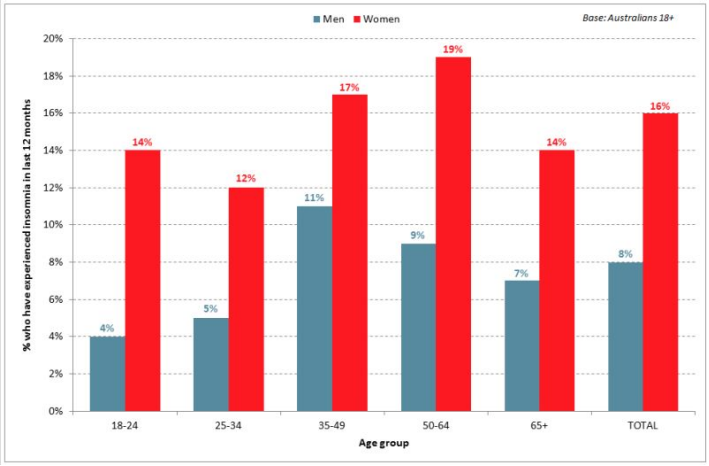
https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016016/98-200-x2016016-eng.cfm

A study conducted in Australia

"According to the latest findings from Roy Morgan Research, 12% of the population report suffering from insomnia over the last 12 months. The condition is far more common among women (16%) than men (8%), and is more likely to affect people aged 35 and older.

Even so, young women aged 18-24 and 25-34 are more than twice as likely than their male peers to experience insomnia. As incidence rises among the 35-49 age bracket, the gap narrows slightly (11% of men vs 17% of women), but then widens once more past the age of 50. (Sleeping uneasy: insomnia more likely to affect women. (0AD)



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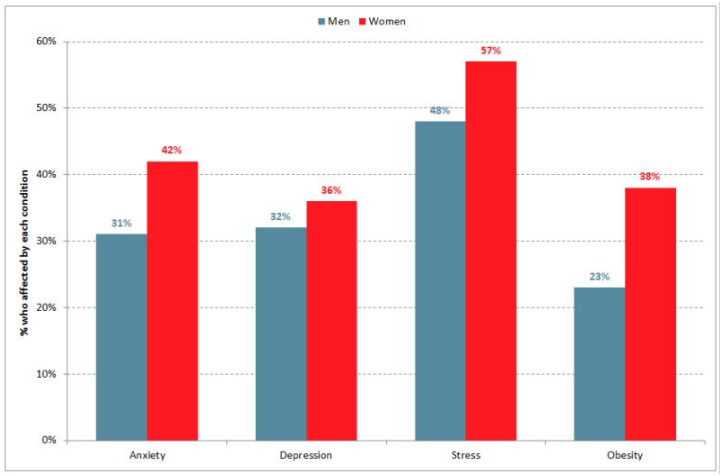

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IMAGE SEARCH

Key words: insomnia, adults with insomnia, sleeping disorders

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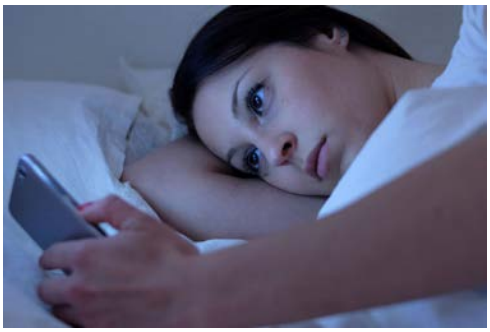

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Demographic summary

DEMOGRAPHICS		USER BEHAVIOR		PERSONALITY	COGNITIVE ASPECT
AGE	20-50	FREQUENCY OF SLEEP	DAILY/HOURLY WEEKLY DEPENDING ON SEVERITY	ANXIOUS	ADAPTABLE E
GENDER	MIXED	DURATION	30 MIN - 5 HR	AVOIDENCE	SITUATIONAL AWARENESS
CULTURE/ ETHNICITY	MIXED	COMPANION / SOLITARY	COMPANION / SOLITARY	OVER THINKER	COOPERATION
INCOME	Less than $40,000; $40,000 To less than $80,000; And $80,000 Or more	LEVEL OF FOCUS	LOW - HIGH	CALM/QUITE	DIAGNOSTIC CAPABILITY
EDUCATION	MINIMUM POST SECONDARY	LOCATION	USER HOME	ENERGETIC	ABILITY TO PROCESS DATA

Conclusion/findings

Insomnia is a common sleep problem for adults. The National Institutes of Health estimates that roughly 30 percent of the general population complains of sleep disruption, and approximately 10 percent have associated symptoms of daytime functional impairment consistent with the diagnosis of insomnia.

In a 2005 National Sleep Foundation (NSF) Poll, more than half of people reported at least one symptom of insomnia (difficulty falling asleep, waking up a lot during the night, waking up too early and not being able to get back to sleep, or waking up feeling un-refreshed) at least a few nights per week within the past year. Thirty-three percent said they had at least one of these symptoms every night or almost every night

in the past year. The two most common symptoms, experienced at least a few nights a week in the past year, included waking up feeling unrefreshed and waking up a lot during the night. A 2002 NSF Poll found that 63 percent of women (versus 54 percent of men) experienced symptoms of insomnia at least a few nights per week. (What are the Facts About Insomnia?)

User Types

Primary users:

Primary users of this product will include adults aged 20-50 worldwide non-working and working adults across all professions, hobbies and lifestyles.

Secondary users:

Secondary users will include doctors, social workers and psychiatrists. These users may interact with the product by informing the primary user on how the product works and its effects.

User Behavior

In 2002, an estimated 3.3 million Canadians (13.4% of the household population aged 15 or older) had insomnia. Factors independently associated with insomnia included painful chronic conditions, activity limitations, mood and anxiety disorders, life stress, frequent use of alcohol or cannabis, obesity, and low education. Compared with those who did not have insomnia, people with insomnia were more likely to report negative situations such as difficulty coping and not having a job.(Tjepkema, M. (2005). Insomnia. Health Reports, 17(1), 9-25)

Physical and psychological problems can interfere with sleep. Painful conditions such as arthritis, migraine and fibromyalgia were associated with insomnia, as were anxiety and mood disorders and stressful life events. As well, alcohol and cannabis use were significant factors. Obesity, too, was related to having problems with sleep.

On the other hand, moderate physical activity and a bit of work stress were protective. The lack of a positive association between work stress and insomnia may reflect the relatively large proportion of insomniacs who do not work.

Some less obvious factors were associated with insomnia. When physical and mental health status, lifestyle, and demographic and socio-economic variables were controlled for, being female, middle aged, widowed, and having a low education were significantly related to insomnia.

Even allowing for a series of physical, mental, lifestyle and socio-economic factors, insomnia was related to some adverse situations. Relatively large percentages of insomniacs had difficulty coping with day-to-day demands and unexpected problems. They were also more likely than other people to have had a recent disability day and to express overall dissatisfaction with life. As well, a significantly large proportion of people in the prime working age range who suffered from insomnia were not employed. .(Tjepkema, M. (2005). Insomnia. Health Reports, 17(1), 9-25)

Table 2. Age-Adjusted[a] Percentage Reporting Health Risk Factors by Sleep Duration—Behavioral Risk Factor Surveillance System, United States, 2014

		Short sleep (<7 hours)		Sufficient sleep (≥7 hours)	
Health risk factor	Definition	%	95% CI	%	95% CI
Obese	Body Mass Index ≥30 kg/m²	33.0	(32.5–33.5)	26.5	(26.2–26.9)
Physically inactive	No leisure time physical activity in past 30 days	27.2	(26.8–27.7)	20.9	(20.6–21.2)
Current smoker	Currently smoke cigarettes every day or some days	22.9	(22.4–23.4)	14.9	(14.6–15.2)
Excessive alcohol	Underage drinker, binge drinker, or heavy drinker[b]	19.4	(18.9–19.8)	19.1	(18.7–19.4)

https://www.cdc.gov/sleep/data_statistics.html

Table 3. Age-Adjusted[a] Percentage Reporting Chronic Health Conditions by Sleep Duration—Behavioral Risk Factor Surveillance System, United States, 2014

	Short sleep (<7 hours)		Sufficient sleep (≥7 hours)	
Chronic condition	%	95% CI	%	95% CI
Heart attack	4.8	(4.6–5.0)	3.4	(3.3–3.5)
Coronary heart disease	4.7	(4.5–4.9)	3.4	(3.3–3.5)
Stroke	3.6	(3.4–3.8)	2.4	(2.3–2.5)
Asthma	16.5	(16.1–16.9)	11.8	(11.5–12.0)
COPD (chronic obstructive pulmonary disease)	8.6	(8.3–8.9)	4.7	(4.6–4.8)
Cancer	10.2	(10.0–10.5)	9.8	(9.7–10.0)
Arthritis	28.8	(28.4–29.2)	20.5	(20.2–20.7)
Depression	22.9	(22.5–23.3)	14.6	(14.3–14.8)
Chronic kidney disease	3.3	(3.1–3.5)	2.2	(2.1–2.3)
Diabetes	11.1	(10.8–11.4)	8.6	(8.4–8.8)

https://www.cdc.gov/sleep/data_statistics.html

Conclusion

User's lifestyles have a substantial amount of an effect on their sleeping habits and schedule. Users experimenting with recreational drugs, stress from work/school, lack of physical activity, frequent alcohol usage, poor diets physical pain and mental illnesses such as anxiety/depression have a high risk of developing insomnia.

Findings

Results showed a significant relationship between nightmare, insomnia symptoms and level of income with increased depression and anxiety in the medical students. On closer examination the symptoms of insomnia, there was a close

relationship between depression with sleep onset difficulty, difficulty in awakening and daily sleep attacks, and also between anxiety with sleep-onset difficulty and daily tiredness; hence, it is essential to consider these factors in therapy and prevention methods to prevent the aggravation of symptoms of depression and anxiety. Given the limitations mentioned, further studies are needed (preferably longitudinally) to investigate the causal relationships between mental health problems with symptoms of insomnia and nightmares. (Javadi, A. H. S., & Shafikhani, A. A. (2019).

Body postures and movements during sleep have been reported to be associated with sleep quality and various health outcomes.[1–3]For example, poor sleepers spend more time on their back,[1] the severity of sleep apnea–hypopnea syndrome is increased in this position,[2] and patients with heart failure tend to favor sleeping on their side.[4,5] These studies thus suggest that distribution of sleep positions may constitute important health-related information. Although the influence of sleep on health and well-being is well documented,[6] information about the distribution of body postures and movements during sleep is scarce. (Eivind, S. S., Mork, P. J., Lund Nilsen, T. I., & Holtermann, A. (2017).

Studies have reported that the preferred body position during sleep is on the side, while the front position is least preferred.[7,8] This is supported by a study showing that children sleep equally much on the side, back, and front, with a progressive preference for the side position when approaching adulthood.[9] The preference for the side position during adulthood was also confirmed by a study on women aged 20–70 years.[8] With regard to body movements, studies have indicated that the number of

positional shifts per night may vary considerably among individuals,[1,7] and that position shifts[7] and body movements tend to decrease with increasing age.[10]Noticeably, previous studies that have investigated sleep positions and movements have been limited to small study samples,[1,7,9]specific age-groups,[1,7] only women,[8] specific medical conditions,[2,4,5] and measurements in laboratory settings.[1,2,4,7,9] As such, there is lack of data that describe the distribution of sleep positions and body movements in the general adult population during free-living conditions.(Eivind, S. S., Mork, P. J., Lund Nilsen, T. I., & Holtermann, A. (2017).

Variables	Total	Sex		Age				Body-mass index		
	All	Men	Women	20–34 years	35–44 years	45–54 years	55–65 years	Normal	Overweight	Obese
n (%)	664	363 (54.7)	301 (45.3)	114 (17.2)	183 (28.6)	264 (39.8)	103 (15.5)	233 (35.1)	256 (38.6)	175 (26.4)
Age, mean (SD), years	44.4 (10.1)	43.3 (10.9)	45.9 (8.7)	28.2 (4.8)	39.7 (2.8)	49.5 (2.86)	58.1 (2.6)	43.1 (10.8)	45.6 (9.5)	44.8 (9.6)
Blue-collar workers, n (%)	491 (74)	265 (73)	226 (75.1)	83 (72.8)	146 (79.8)	186 (70.5)	75 (73.5)	166 (71.2)	195 (76.2)	130 (74.3)
Body-mass index, mean (SD), kg/m²	27.4 (4.9)	27.3 (4.6)	27.4 (5.3)	26.5 (5.6)	27.5 (4.7)	27.6 (4.8)	27.6 (4.9)	22.6 (1.7)	27.2 (1.4)	34 (3.4)
Current smoker, n (%)	153 (23.1)	74 (20.4)	77 (25.6)	27 (23.7)	44 (24)	64 (24.2)	18 (17.6)	67 (28.8)	57 (22.2)	27 (15.4)
Alcohol consumption, ≥7 units, n (%)	150 (22.6)	122 (33.6)	28 (9.3)	34 (29.8)	31 (16.9)	56 (21.2)	23 (22.5)	53 (22.7)	63 (24.6)	28 (16)
Insomnia symptoms, n (%)	72 (10.8)	33 (9.1)	39 (13)	16 (14)	14 (7.7)	30 (11.4)	12 (11.8)	29 (12.4)	21 (8.2)	22 (12.6)
Valid night recordings, mean (SD)	4 (1.4)	3.9 (1.4)	4 (1.4)	3.4 (1.5)	3.7 (1.4)	4.3 (1.3)	4.3 (1.3)	4 (1.4)	4.1 (1.3)	3.8 (1.4)
Total recording time, hours (SD)	29.8 (11.4)	29.5 (11.2)	30.3 (11.6)	26.5 (12.4)	28.5 (11.5)	31.5 (10.8)	31.5 (10.6)	30 (11.3)	30.7 (11)	28.5 (12.1)
Time in bed per night, hours (SD)	7.5 (1)	7.5 (0.9)	7.4 (1)	7.7 (1)	7.6 (1)	7.3 (0.9)	7.2 (0.9)	7.5 (0.9)	7.4 (0.9)	7.4 (1.1)

Table 1 Characteristics of study population stratified by sex, age, and body-mass index Note: Normal weight (BMI 18.5–24.9 kg/m2), overweight (BMI 25–29.9 kg/m2), or obese (BMI ≥30 kg/m2). Abbreviation: BMI, body mass index.
Eivind, S. S., Mork, P. J., Lund Nilsen, T. I., & Holtermann, A. (2017).

Variables	Total	Sex		Age				Body-mass index		
	All	Men	Women	20–34 years	35–44 years	45–54 years	55–65 years	Normal	Overweight	Obese
Sleep position										
Front (% of TIB)	7.3 (12.3)	8.3 (12.5)	6.2 (12)	9.5 (12.8)	7.4 (11.7)	6.2 (12.4)	7.7 (12.5)	7.1 (12.1)	6.9 (11.3)	8.7 (14.1)
Back (% of TIB)	37.5 (18.2)	35.1 (18.2)	40.5 (18.6)	41.2 (17.4)	39.3 (17.8)	36.2 (18.7)	32.8 (19.5)	42 (18)	36.6 (17.5)	32 (19.2)
Side (% of TIB)	54.1 (18.1)	55.6 (17.8)	52.2 (18.4)	47.7 (15.6)	52.3 (16.7)	56.5 (19)	58.3 (18.9)	49.9 (17.7)	55.6 (17.1)	57.9 (19.6)
Duration of nocturnal movements										
Arm (% of TIB)	3.3 (1.8)	3.5 (1.9)	2.9 (1.7)	3.9 (2.1)	3.2 (1.7)	3.1 (1.8)	3.0 (1.7)	3.1 (1.8)	3.3 (1.9)	3.4 (1.8)
Thigh (% of TIB)	2.8 (1.7)	3.0 (1.9)	2.6 (1.5)	3.4 (1.9)	2.7 (1.5)	2.8 (1.8)	2.7 (1.7)	2.6 (1.6)	2.8 (1.8)	3.0 (1.6)
Upper back (% of TIB)	3.2 (2.3)	3.5 (2.3)	2.8 (2.2)	3.7 (2.4)	3.1 (2.5)	3.1 (2.2)	2.9 (1.9)	2.9 (2.0)	3.2 (2.1)	3.5 (2.7)
Shifts in sleep position (n/hour)	1.6 (0.7)	1.8 (0.7)	1.4 (0.6)	1.8 (0.7)	1.6 (0.7)	1.5 (0.7)	1.5 (0.7)	1.6 (0.7)	1.6 (0.7)	1.5 (0.6)

Table 2 Descriptive statistics of sleep positions and nocturnal body movements stratified by sex, age, and body-mass index Note: Values presented as mean (SD). Normal weight (BMI 18.5–24.9 kg/m2), overweight (BMI 25–29.9 kg/m2), or obese (BMI ≥30 kg/m2). Abbreviations: TIB, time in bed; BMI, body mass index..
Eivind, S. S., Mork, P. J., Lund Nilsen, T. I., & Holtermann, A. (2017).

Appendix III – Product Research

Benchmarked products

The Somnox Sleep Robot

 **https://www.amazon.com/Somnox-Sleep-Robot-Reliever-Compatible/dp/B07S2Y18PK**	The Somnox Sleep Robot is a sleep device that claims to enhance quality of sleep. It's a soft-robotic that enhances the quality of sleep and uses breathing regulation and audio to help fall asleep faster, get deeper sleep, and wake up at the optimal time through a smart alarm. https://en.wikipedia.org/wiki/Somnox_Sleep_Robot

Sleepscore Max Sleep Improvement Monitor

 http://www.potterybarn.ca/sleepscore-max-sleep-improvement-monitor	The SleepScore Max is a bedside sleep tracking device that monitors the sleeper's breathing, motion, and room environment. The device uses a smartphone app to give the user a sleep rating. This sleep rating provides the user with recommendations for how to get better quality sleep. https://www.tuck.com/slepscore-max-review/

Dreampad Relaxation Pillow

https://dreampadsleep.com/pages/shop

Our custom-designed pillows and pads connect to your phone and provide a unique sound experience that only you can hear. Choose one of the models below, and download our free app with multiple music selections engineered specifically for the Dreampad to help your body relax and sleep.

https://dreampadsleep.com/pages/shop

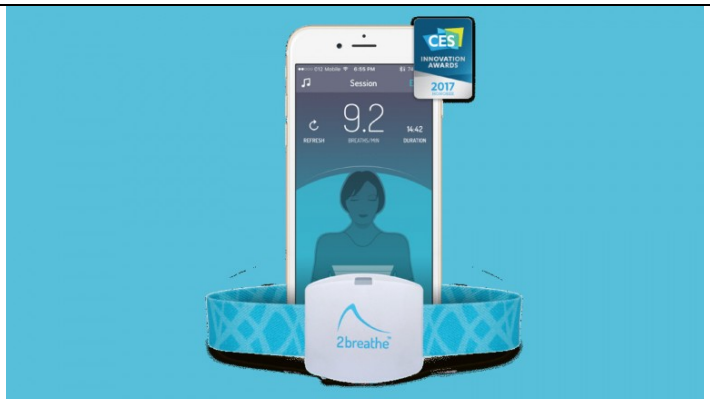
Dreem Headband

https://dreem.com/en/headband

The **headband** in question is called **Dreem**, a device designed to help you sleep better while collecting a wealth of data about your sleep, such as your brain waves and heart rate. It also uses “special bone conduction technology” to disseminate sound through your forehead and into your inner ear.

https://gizmodo.com/this-smart-headband-was-supposed-to-help-me-sleep-bette-1822568894

2breathe Sleep Inducer



https://www.israel21c.org/2breathe-sleep-inducer-wins-2017-ces-innovation-award/

2breathe is a smart device and mobile app that guides your breathing to induce **sleep**. It uses proven technology to lower your neural sympathetic activity and help you fall **asleep**.

https://bio-medical.com/2breathe-fall-asleep-effortlessly.html

OldPapa Upgraded Weighted Blanket

A weighted blanket engineered to be around 10% of your body weight to naturally help you sleep better and faster by simulating the feeling of being held or hugged

OldPAPA own the ability to produce a unique 7-layer weighted blanket. Our 7-layer system is designed to comfortably surround your body and form to your shape while you sleep and the MORE glass beads & LESS fiber fill design offers better temperature control

https://www.amazon.ca/Upgraded-Weighted-Blanket-Softest-60X80-170-230lb/dp/B07MV1S46

Philips Somneo Sleep and Wake-up Light Therapy Lamp

https://www.amazon.ca/Philips-HF3650-60-Wake-Up-RelaxBreathe/dp/B076HZZ2P3/ref=asc_df_B076HZZ2P3/?tag=googleshopc0c-20&linkCode=df0&hvadid=292913989560&hvpos=1o1&hvnetw=g&hvrand=13322327228898

Fall asleep relaxed and wake up naturally with colored sunset and sunrise simulation

The only wake up light with RelaxBreathe: Light-guided wind-down breathing that helps you relax and prepares your body for sleep

https://www.amazon.ca/Philips-HF3650-60-Wake-Up-RelaxBreathe/dp/B076HZZ2P3/ref=asc_df_B076HZZ2P3/?tag=googleshopc0c-20&linkCode=df0&hvadid=292913989560&hvpos=1o1&hvnetw=g&hvrand=13322327228898

AcousticSheep SleepPhones Wireless

https://www.amazon.com/Acousticsheep-SleepPhones-Bluetooth-Headphones-Comfortable/dp/B00EZ4L5GU

SleepPhones are the first and most comfortable headphones for sleeping and relaxing that have helped more than ONE MILLION people. The ultra-thin, flat speakers are comfortable enough to wear while lying down or sleeping on your side while the module's built-in volume and play/pause/skip controls easily let you control your Bluetooth-enabled devices. Listen to soft music, white noise, audio books, and whatever else helps you unwind in complete comfort!

https://www.amazon.com/Acousticsheep-SleepPhones-Bluetooth-Headphones-Comfortable/dp/B00EZ4L5GU

Comparison

Product name	Benefits	Features	Technology integration	Price
The Somnox Sleep Robot	Comfort, affection, compact	Breathing simulation, Relaxation audio	Breathing detection, motion detection	793
Sleepscore Max Sleep Improvement Monitor	Lightweight, phone comptable	sleep monitor, provides sleep score	Sleep tracking	209
Dreampad Relaxation Pillow	Comfort, various sizes	Plays music, gentile vibrations	Dreampad app	187
Dreem Headband	Compact, lightweight	A.I, measures brain activity , heart rate, movement	Sleep learning algorithms syncs to wifi or Bluetooth	299.99
2breathe Sleep Inducer	Phone compatible, light weight	Therapeutic breathing exercises	Resperate technology	149.99
OldPapa Upgraded Weighted Blanket	Various sizes, 100 percent cotton Machine washable	Filled with glass beads		69.99
Philips Somneo Sleep and Wake-up Light Therapy Lamp	Coloured sunset or sunrise lighting	Usb charging, play your own music	Guided wind down breathing	220
AcousticSheep SleepPhones Wireless	Light weight, soft, comfortable, ultra thin	Bluetooth, wireless		106.84

1.3 Conclusion

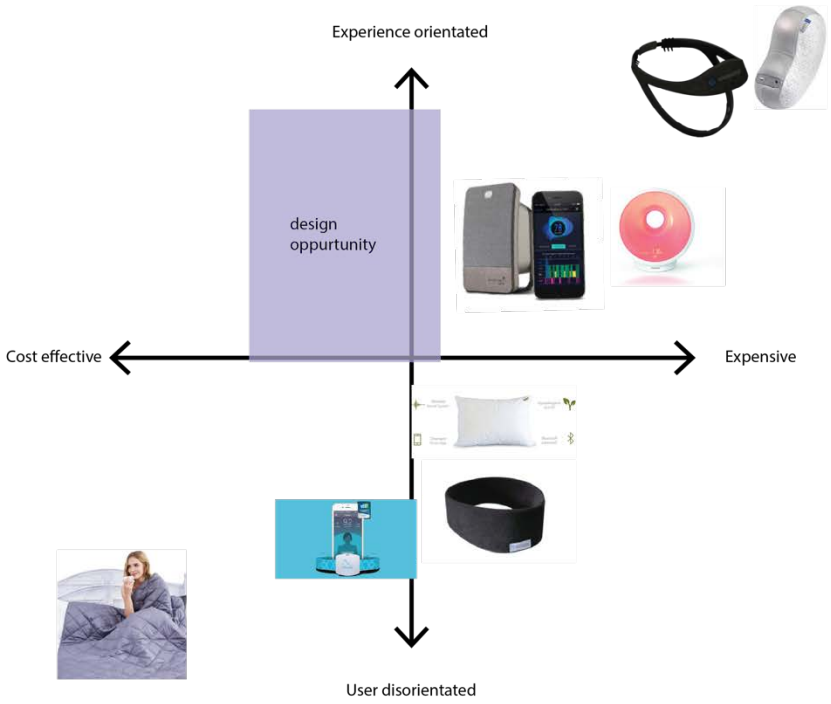
Data collection results:

- More than one function ex – tracking, sound
- App related
- Compact sizing
- High price points
- Tracking technology
- Material usage
- Body parts – interaction

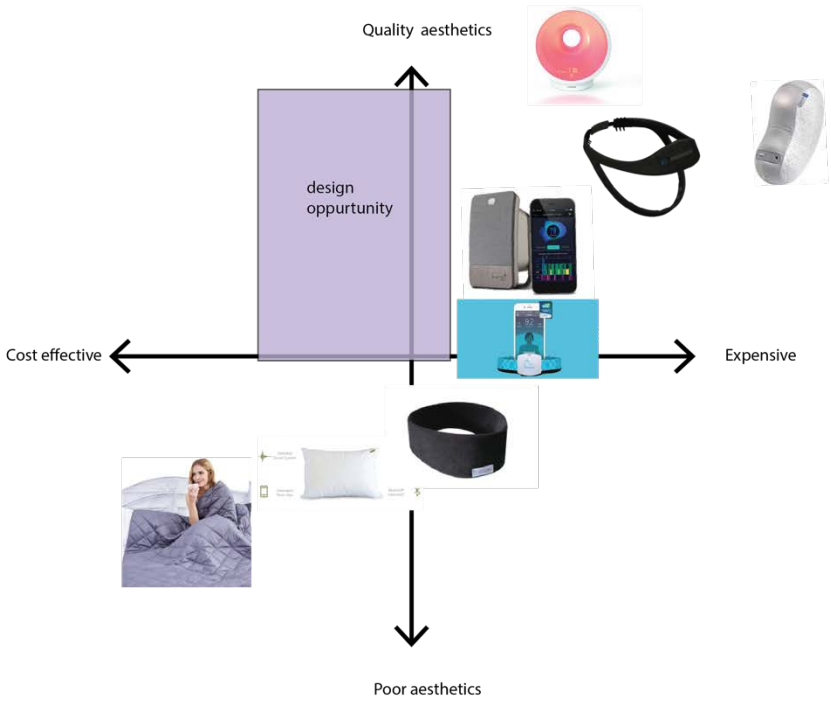
Section 2

2.0 Method

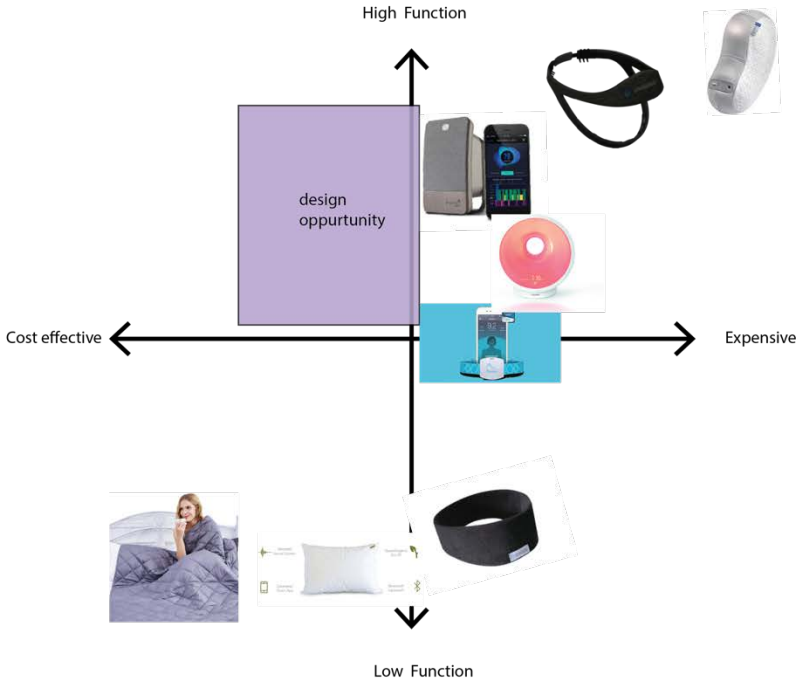
Effective ways to break down the comparison between the products were user experience, aesthetics, functionality along with comparing prices in all 3 x-y graphs. User experience is a crucial element due to the impact the product can have on the user when relating to insomnia. A very positive or negative experience will affect the users cognitive state making the product beneficial or redundant. Functionality and aesthetics contribute to the overall user experience as well.



2.1 Graph 1; represents the correlation of user experience as well as price comparison.



2.2 Graph 1; represents the correlation of product aesthetics as well as price comparison.



2.3 Graph 1; represents the correlation of functionality as well as price comparison.

2.4 Conclusions

As seen in the above graphs 1- 3, user experience, functionality and aesthetics all correlate with price point. The products with the highest price points also include the most technology integration. Correlation between technology integration and a high price point can also be seen. Although price and technology run parallel with these products, technology is constantly advancing which creates an opportunity to innovate in a space where a product can provide the user with the essential benefits and features that will improve their overall sleep quality also providing a new user experience that will match its price tag.

Section 3

3.1 Method

For a better understanding of the 8 benchmarked products, text cues indicating “benefits” and “features” were sorted by frequency.

3.2 Key benefits

BENEFITS	FREQUENCY
SLEEP QUALITY	10
COMFORTABLE	6
TRACKING	5
RELAXING	3
ENHANCE	2

3.3 Key Features

FEATURES	FREQUENCY
CALMING SOUNDS	5
IMPROVE BREATHING	3
APP INTERGRATION	3
LIGHTNG	3
NATURAL	2

Section 4

There are 2 products which are the **“**The Somnox Sleep Robot” and the “Dreem Headband, which are closest to a design direction and opportunity. Both products use a combination of innovative solutions with unique technology integration. Both products to target different parts of the human body, the somnox robot is a companion which is meant to be held close to the human body. The product interacts with the torso, arms and legs. The dreem headband is placed on the users head which affects the cognitive

side of insomnia using calming techniques and tracking technology. When comparing and examining both of these products, there is opportunity to design within both realms of the cognitive and physical side by a potential design solution using a combination of such elements.

Benefits comparison

Features – customer needs	**The Somnox Sleep Robot**	**Dreem Headband**	**Possible niche market**
Calming sounds	Good	Fair	x
Improving breathing/relaxation	Fair	Fair	
App integration	good	good	x
Lighting	poor	poor	
Natural material/natural sleep aiding	good	good	x

Feature comparison

Needs statement

Benefits - customer needs	**The Somnox Sleep Robot**	**Dreem Headband**	**Possible niche market**
Sleep quality	fair	fair	
Comfort	good	fair	x
Enhancing experience	fair	fair	
Relaxing	poor	poor	
Health Tracking	poor	good	x

Insomnia can be a stand-alone problem or be associated with other complications happening in the human body. Young adults have a high rate of insomnia which can possibly correlate with other complications and issues they may be dealing with or are exposed to in their lives. If not addressed or treated correctly Significant changes and impacts will start to arise. The mental effects of not feeling in control and unpredictability when falling asleep can create such a burden in someone's life. When the physical effects of panic, lack of comfort and body pain are arising, the user is challenged to deal with both the mental part of the disorder alongside the physical part. A disorder like insomnia which will slowly destroy the human body, has to be identified and cautiously addressed. Current methods at the moment are very limited and can have harsh side effects which solves one problem but then creates another.

Appendix IV – Needs Analysis

Needs statement

Insomnia can be a stand-alone problem or be associated with other complications happening in the human body. Young adults have a high rate of insomnia which can possibly correlate with other complications and issues they may be dealing with or are exposed to in their lives. If not addressed or treated correctly Significant changes and impacts will start to arise. The mental effects of not feeling in control and unpredictability when falling asleep can create such a burden in someone's life. When the physical effects of panic, lack of comfort and body pain are arising, the user is challenged to deal with both the mental part of the disorder alongside the physical part. A disorder like insomnia which will slowly destroy the human body, has to be identified and cautiously addressed. Current methods at the moment are very limited and can have harsh side effects which solves one problem but then creates another

Description

Insomnia is the number one sleeping disorder worldwide. Current challenges and causes include anxiety, depression, stress, physical pain and psychological trauma within a person, additionally, poor sleep quality correlates to substandard cognitive function both during the day and at night. This thesis proposes an in depth study of user interactions, behaviours and physical constraints of adult insomnia sufferer's through various data collection methods such as, observational studies, interviews, contextual inquiry and surveys. Detailed analysis of user evaluation is aimed to reduce negative experiences and maximize positive experiences relating to improving overall sleep

quality. Ergonomic and human factor evaluation relating too spatial, environmental, physical and cognitive functionality is planned to establish a human interaction design solution. Exploration of various solutions, which affects the user both physically and mentally, in combination with each other will aim to improve sleep quality amongst adults suffering from insomnia.

Research objectives

Research objectives of this study are to understand the cognitive and physical behaviors 3 main areas of insomnia sufferers. Stages include:

Getting ready for bed.

(Nighttime routine, engagement with any products, objects, mental state)

Trying to stay asleep/falling back asleep.

(what time are they waking up during the night? are they fully in REM sleep? what's the trigger to waking?)

Waking up.

(how are users waking up? what's waking them up? How are they feeling?)

Key Activities

Key activities to be observed include:

- Room environments such a temperature, lighting, sound has an impact on sleep quality
- Anxiety highly contributes to insomnia which relates to how the user feels before going to bed - Understanding (calmness level, anxious, hyper, emotional state) is crucial.

- The effect of electronics uses before bed on the user's brain (The effect blue lighting, phone use, t.v use)
- Quality of bed, pillows, blanket. Taking in consideration weight, material, size

Target users

Primary users: Adults ages 17- 30 currently suffering from insomnia.

Secondary users: Doctors, and psychiatrists

Tertiary users: Family members and friends

User environment

The user environment for the observation was conducted in the user's bedroom. By video observing the user's full bedtime routine through the whole night along with their waking up routine.

Preliminary Video Observation

Preliminary Scoping

Video #1

URL: https://www.youtube.com/watch?v=vaAydEAKglw

Title: Attention! This Is Why You Can't Sleep | Bronwyn Milkins | TEDxUWA
Length: 10:06 min

Video #2

URL: https://www.youtube.com/watch?v=X-iQHE5tdUI

Title: Joe Rogan - Sleep Expert on Insomnia
Video #3

URL: https://www.youtube.com/watch?v=_Dgcu5obs4E

Title: A New Approach to Insomnia | Michael Acton Smith OBE | TEDxSFState
Length: 12:16

Video Observation

Title: Attention! This Is Why You Can't Sleep | Bronwyn Milkins | TEDxUWA

Length: 10:06 min

Brief Description:

Understanding the contribution of the cognitive processes the brain goes through before falling of sleep

The video investigates the complexities of our brains and why it focuses on negativity caused by work, stress, and life contributing to people's insomnia.

Relevance to Thesis Topic:

Understanding the brains activity when someone tries to relax to fall asleep is crucial. This video explores the users cognitive process before bedtime with new approach by shifting the user's attention. This approach can potentially lead into multiple environmental design solutions that can be used to interact with the preliminary user by involving 4/5 senses.

Title: Joe Rogan - Sleep Expert on Insomnia

Length: 7:24

Brief Description:

Joe Rogan has sleep expert Mathew walker who discusses the body's temperature and the effect it has on falling asleep. Mathew also discusses our natural body rhythmic and how our environment affects melatonin in the body

Relevance to Thesis Topic:

Understanding our bodies natural rhythmic system can aid in improving sleep quality and design solutions. Also understanding how the body works in terms of temperature, sleeping positions and sleeping schedules will help in the overall design solution. Mathew describes how are bodies are designed and light and temperature are very crucial components in improving sleep quality.

User Observation



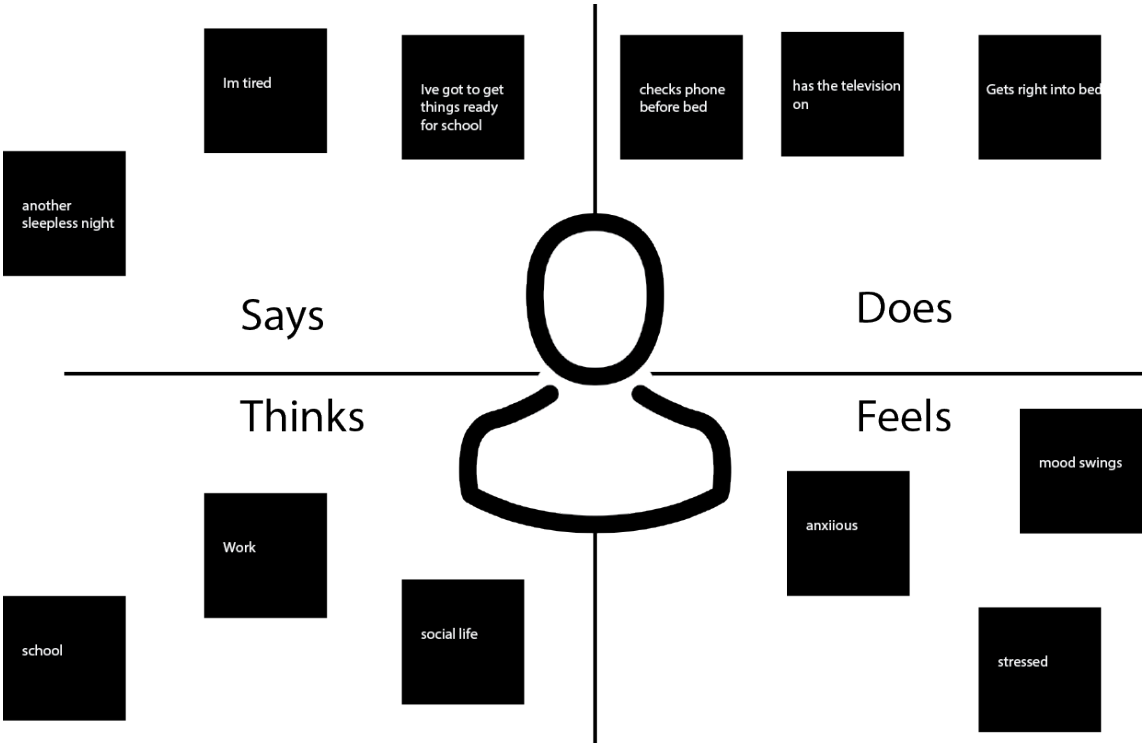

room envrioment includes queen size bed, yellow lighting


User checking her phone before bed

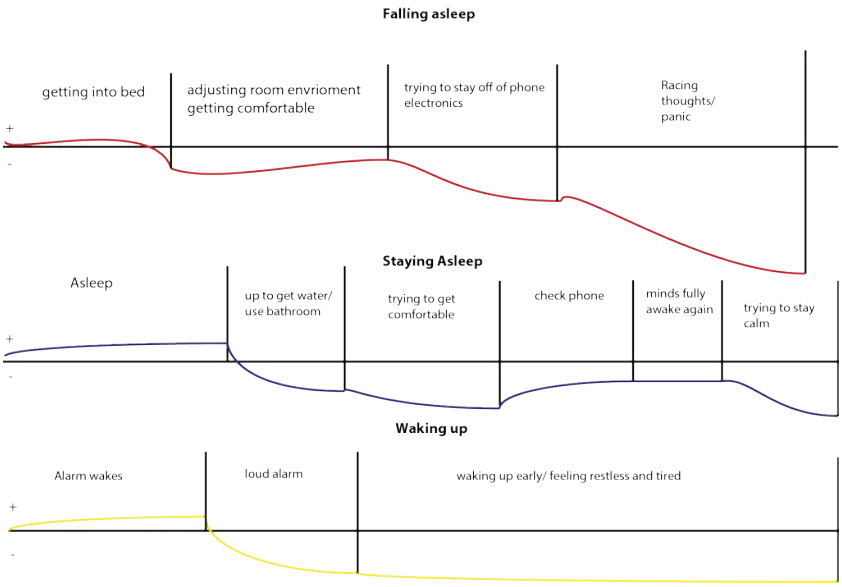
feeling tired, and anxious before and after trying to fall asleep
user described the the lighting and lamps do help but do not make much of a difference

User experience

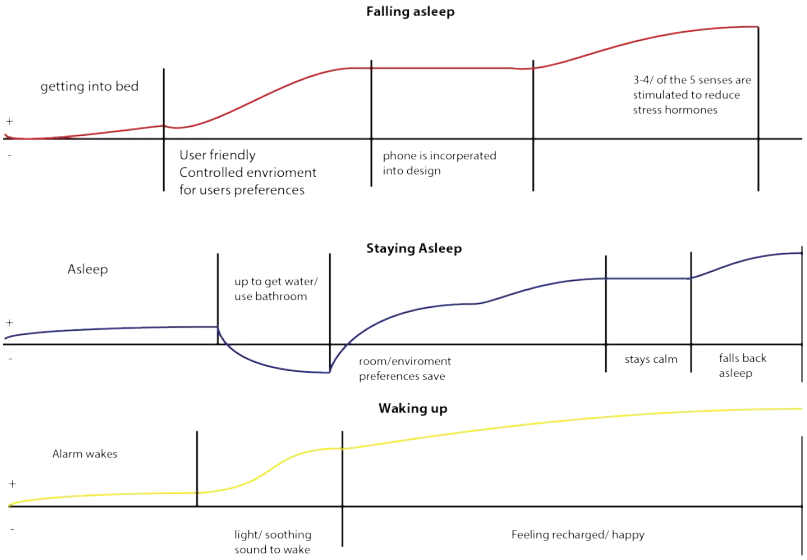
Empathy map



Current UX curve



Target UX curve



Potential

	Falling Asleep	Staying Asleep	Waking Up
Negatives	- Overly stimulated - Not comfortable - Poor environment - Distracted - Increased stress	-Disrupted sleep - Trying to fall back asleep - Finding comfortable Position - Distracted	- Artificial lighting - Poor environment - Loud alarm - Checking phone - Stress
Potential Improvements	- Control user environment preferences - Utilize phone to fall asleep - 3-4 Senses to be incorporated	- environment understands mood/body temperature - Adjustable comfortability - Eases user back to sleep	- Natural lighting - Regulating internal clock - Soothing smell/sound to wake

Overall analysis

Observation that inform design:

Environment: lighting, sound, temperature

Stimulation: phone, t.v,

Comfortability: what the body comes into contact with when trying to fall asleep

Appendix V– Sustainability

Objective

This report investigates the sustainability, material, and manufacturing of current benchmarking sleeping products as well as Nocturnal's. Current sleeping pods and other insomnia related benchmarked products displayed challenges with the enclosure of design - claustrophobia, locations of controls, accessing in and out of the design, and functionality of what the pod does. This evaluation process is aimed to minimize the negative experiences and maximize the positive experiences of nocturnal. Material study, 2d and 3d form, colour theory and manufacturing process's will be evaluated to create Nocturnals final design solution. Re-designing a new form of sleeping for users from these considerations will help improve the human interaction design aspects as well as sustainability and the environmental footprint.

2.2.3 Benchmarking Aesthetics & semantic profile

Aesthetics and styling within insomnia products vary upon application use, environment, incorporated features/technology and material usage along with cost.

Figure 2.13 Philips Somneo Sleep and Wake-up Light Therapy Lamp *Figure 2.14 The Somnox Sleep Robot*

Both figures utilize soft edges and curves representing organic design language. Also the overall design and characteristics are in line with the technology used to achieve a modern aesthetic. Material exploration in both figures differ, figure uses plastic materials which is purpose full for its purpose, optimizing a digital display, sound therapy and multiple light effects. Figure is ergonomically shaped to match the contour of a cuddling body, the material used are soft fabrics so sensations can be felt when holding it. The Somnox Sleep Robot releases vibrations and sounds to help the user breathe comfortably and relax by synchronizing to the rhythm of the users' heartbeat.

https://hk.asiatatler.com/life/these-luxury-sleep-pods-will-change-your-life

https://www.economist.com/gulliver/2017/09/22/sleep-pods-are-becoming-increasingly-common-at-airports

Both figures above are current forms of sleeping pods designed for sleeping centers, offices, and the bed room environment. Both sleeping pods utilize a mix of different materials for application. High gloss finish on the outside with the use of plastic or metal with the inside containing a comforting appeal with the use of multiple different fabrics such as leather, foam, cotton/polyester and nylon/polyester. Both sleeping pods provide the experience of isolation promoting relaxation to the user. Two main differences that can be seen between both pods are there ergonomics. The first pod is quite low to the ground providing a grounding effect when getting inside whereas the second pod provides a zero gravity experience, lifting the user higher from the ground

with the bed matching the users body contour. Another noticeable difference is the application of lighting the first pod uses lighting to calm the user down whereas the second pod does not use any sort of lighting or power.

Sematic profile

Shape

Both sets of products such as the sleeping lamp and robot as well as the 2 sleeping pods – utilize soft curves, edges to mimic an organic shape. The soft curves are comforting when touching and observing as they provide a positive user experience. Each insomnia product varies in shape in form and material depending on the application it is used for and the body part it its targeting. Although form changes amongst each product, soft curves and edges are always present. There are different propositions for why observers tend to like curved shapes. On one hand, there are studies suggesting that observers prefer curved shapes over angular ones because the spiky transitions in an angular contour conveys a sense of threat. (Palumbo, L., Ruta, N., & Bertamini, M. (n.d.) Curvature shapes provide a safe emotional response when viewed thus making it appropriate for insomnia relief related products.

Colour selection

Colour selection varies again on the product and application it is used for. Similarities can be seen throughout, such as soft and light colour pallets with the occasionally contrasting accent parts.

Texture

Texture varies between each product 3 out of the 4 products mentioned above have a matte or high gloss finish on the exterior, the sleeping robot uses the exposes fabric to provide a warm snuggling affect so the user can hold it close to their body's. The texture of the pods and lamp use a high gloss or matte finish to match the modern aesthetic of the user's environment.

Symbolism

The emotional affects these products need to possesses are crucial as they need to provide the user with the a very positive user experience as insomnia sufferers are dealing with stresses', anxieties or physical pains. The overall form of the current products mentioned above all have inviting properties, they all have organic forms which provide the user with more of a human connection mimicking human forms. The emotional connection between user and product is vital for insomnia sufferers. There is a sense of trust and dependency users will start to develop when the product intends to do what its design for. In relation to insomnia, looking at the sleeping robot, that is a product which mimics humanistic forms and builds a strong connection over time as the user continues to use it due to having trust in the effectiveness of what the product provides.

2.2.4 Benchmarking materials and manufacturing

Materials and manufacturing change depending on the products purpose as well as cost and technology incorporated, durability and aesthetics.

Common materials used for insomnia relief products are:

- Polyester/ viscose/ cotton/ foam – Bedding, held products, blankets
- Acrylic sheet, polycarbonate sheet, and polycarbonate film - Led lighting/lighting
- aluminum/engineering plastics – product shapes to be styled accordingly

Also depending on price as well and cost, material can change and still allow the product provide its intended purpose for the user. With higher price points more luxurious materials can be used such as different textiles which could possibly have smart technology integrated in them creating different manufacturing methods and new user experiences.

2.2.5 Benchmarking sustainability

The following section will cover safety, future environmental footprints and sustainability within insomnia relief products and potential effects it may have on users.

Safety/health

Safety has a significant role with products affecting and having contact with the user's cognitive functionality and physicality. Insomnia sufferers may already be experiencing anxieties, stresses, physical pain, and phobias. User experience is a crucial element due to the impact the product can have on the user when relating to insomnia. A very positive or negative experience will affect the users cognitive state making the product beneficial or redundant. Functionality and aesthetics contribute to the overall user experience as well.

Environmental impact:

With more sustainable materials and manufacturing process's becoming available the potential for a product to have a long life span bio degradable properties are achievable. Wireless charging, solar power/ energy storage, metalenses and bio plastics/fabrics are some of the technologies which could be incorporated in future insomnia relief products.

3.5 Sustainability

Safety

Some of the dangers for potential insomnia relief design solution are fire hazards, phobias such as claustrophobia or panic disorder triggers. What also has to be taken into consideration is the accessibility of this product. If the product needs to be accessed through a door panel, stairs and also special awareness – the overall size of the product, the safety of the user when accessing has to be considered such as tripping, falling or slipping.

Health

Users health is the most vital component of this thesis. The aim is to reduce anxiety's and anxiousness and improve sleep quality. This product purely focuses on the user's health.

Environment

The environment in which this product will be operating in is the user's bedroom or sleeping centers. The product will focus on one user, providing the user with full customization of their environment. Key considerations are the sizes of the space in

which this product can fit into, the actual size of the product along with the cost of the product.

5.6 Final Sustainability Summary

Nocturnal is a sustainable solution for the future of improving sleeping quality. Environmental awareness is a crucial component contributing to the final design, with material choices being the primary focus. The combination of material choices provides the user with a luxurious feel, sense of security, and modern aesthetics. Overall all manufacturing process' for each component of nocturnal have low ecological impacts as well as recyclability. Nocturnal combines both industrial and interaction design to provide users with new sleeping experience.

Appendix XI – Topic Approval Forms

Humber Institute of Technology & Advanced Learning
School of Applied Technology
Bachelor of Applied Technology – Industrial Design
Winter 2020
iDSN 4502 Senior Level Thesis Project II
Dennis L. Kappen/Catherine Chong/Sandro Zaccolo

THESIS DESIGN APPROVAL FORM

NAME
Alexander Braga

TOPIC TITLE (Brand)
Nocturnal – ~~How may we~~ improve sleep quality amongst insomnia sufferers.

PS: Ensure that the visualization of the final design, side views and front views in Illustrator or Photoshop are required to be shown to us for securing an approval ✓

Thesis design is approved to proceed for the following:

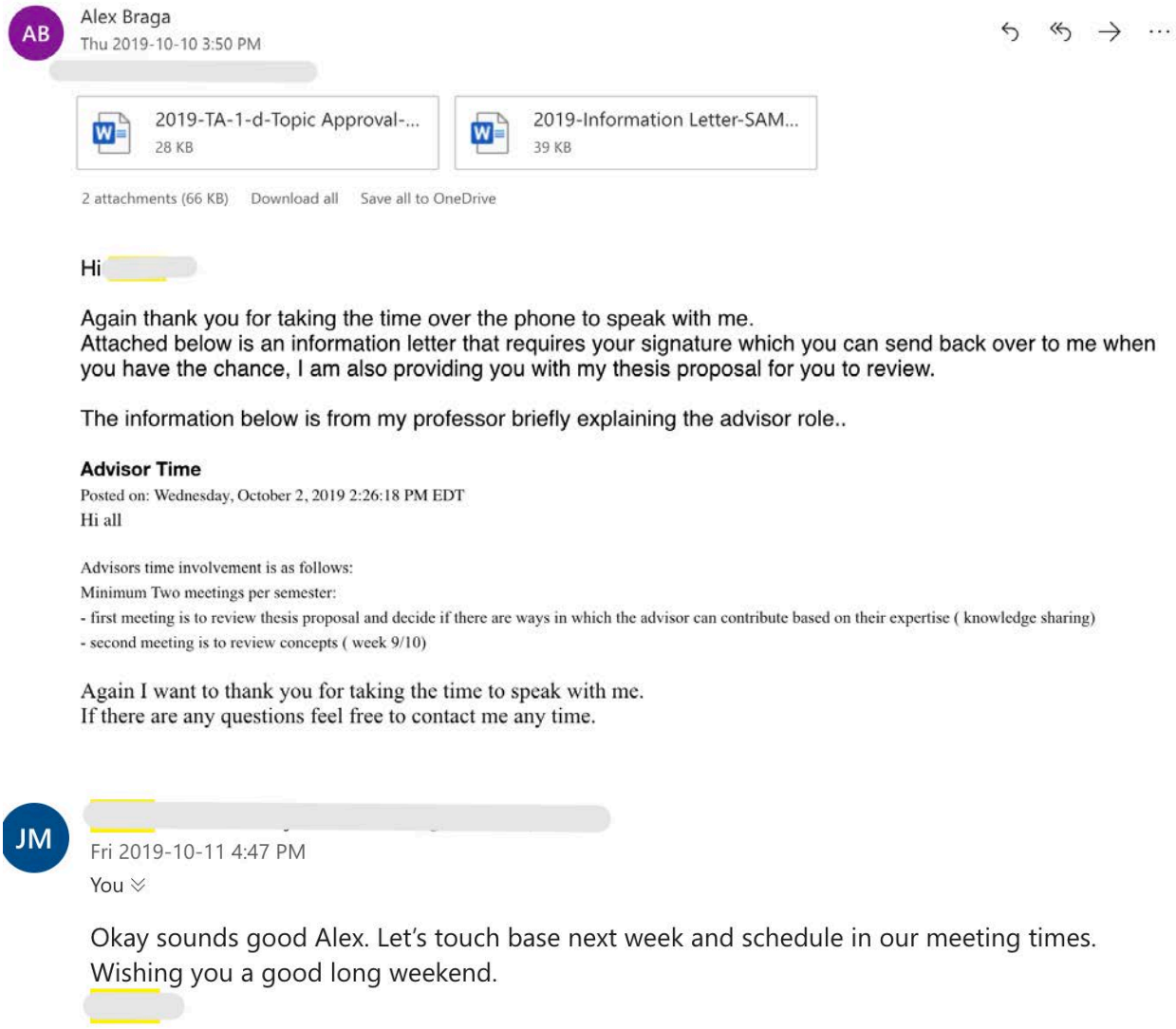
U **CAD Design Phase**

_____ **Rapid Prototyping and model building phase** → review CAD before 3D print.

COMMENTS:
- CAD begin to iron out stylistic aspects & detailing.
- Finalize technology.
- Review for rapid 3D print after design/CAD approval.

Signed U.

Appendix XII – Advisor Meetings & Agreement Forms



AB Alex Braga
Thu 2019-10-10 3:50 PM

2019-TA-1-d-Topic Approval-... 28 KB
2019-Information Letter-SAM... 39 KB

2 attachments (66 KB) Download all Save all to OneDrive

Hi

Again thank you for taking the time over the phone to speak with me.
Attached below is an information letter that requires your signature which you can send back over to me when you have the chance, I am also providing you with my thesis proposal for you to review.

The information below is from my professor briefly explaining the advisor role..

Advisor Time
Posted on: Wednesday, October 2, 2019 2:26:18 PM EDT
Hi all

Advisors time involvement is as follows:
Minimum Two meetings per semester:
- first meeting is to review thesis proposal and decide if there are ways in which the advisor can contribute based on their expertise (knowledge sharing)
- second meeting is to review concepts (week 9/10)

Again I want to thank you for taking the time to speak with me.
If there are any questions feel free to contact me any time.

JM
Fri 2019-10-11 4:47 PM
You

Okay sounds good Alex. Let's touch base next week and schedule in our meeting times.
Wishing you a good long weekend.