SENSUM
An Ambient Environment For Mindfulness Practices

by Mahsa Karimi

A thesis exhibition presented to OCAD University in partial fulfilment of the
requirements for the degree of MASTER of DESIGN (MDes) in
DIGITAL FUTURES.

Open Space Gallery, 49 McCaul Street,
Toronto, Ontario, Canada, April, 2018

COPYRIGHT NOTICE

AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I authorize OCAD University to lend this thesis to other institutions or individuals for the purpose of scholarly research. I understand that my thesis may be made electronically available to the public.

I further authorize OCAD University to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

ABSTRACT

OCAD University Digital Futures
Master of Design, 2018
SENSUM:
An Ambient Environment For Mindfulness Practices
by Mahsa Karimi

The reality of today's fast paced environment has created emotional challenges for everyone. In order for us to overcome these emotions, we might require to look within ourselves. This thesis project uses methodologies such as "Research through Design" (RtD) to investigate and reflect on the application of Ambiguity in Design, Color Therapy and "Calm Technology" to address the impacts of daily life challenges. This thesis project introduces an ambient environment to its users, encouraging them to disconnect from their busy daily activities and focus on themselves for a short period of time at the end of a busy day. The prototype of this thesis project, Sensum Light, incorporates a set of tangible products including a stationary object that is to stay at the user's home as well as a mobile piece that is carried by the user throughout the day. Sensum Light aims to inspire users with their emotional well-being. In this document, I describe and reflect on the process of making and testing Sensum Light.

Key Words:
Mindfulness, Calm Technology, Mood Elevation, Self-Help, Mental Health, Digital Technology, Inclusive Design, Human Centered Design, Meditation, Self Awareness, Light Therapy, Ambient Environment.

ACKNOWLEDGMENT

To my wonderful parents.

Thank you for your endless love and support.

TABLE OF CONTENTS

LIST OF FIGURES

Chapter 1
INTRODUCTION

The ubiquity of self-monitoring technologies has made it easier for everyone to monitor and track their personal well-being. Smart technologies in the health industry have enabled users to engage in activities and obtain quantitative feedback about their physical and mental state for better assessment of their health. However, according to Madhavan Mani of the Institute of Health & Biomedical Innovation at the School of Psychology and Counselling, Queensland University of Technology in Australia, *"The global prevalence and burden of mental health disorder is substantial, and delivering mental health services effectively to millions in need remains a challenge"*(Mani et al., 2015). In terms of mental health, mindfulness has proven effective in prevention and management of anxiety and depression. Mindfulness practices can help people become more aware of the surrounding world and their feelings in response to the happenings around them. The goal of this thesis project is to provide an ambient environment through design of a supportive tool for managing emotional well-being through mindfulness practices.

While mobile mindfulness applications provide an easy to access and cost effective platform for users to practice mental wellness, research has shown that one of the main barriers of using mobile applications, is the location where mindfulness was practiced by the users(Laurie and Blandford, 2016).

Above research suggests that in spite of users having access to the application on their mobile phone throughout the day; they have stated that they were more comfortable engaging with the application "while at home, in a place that they would not be distracted, somewhere safe, quiet and comfortable; usually in their bedroom" (Laurie and Blandford, 2016). A study by Neimeyer and Feixas sheds light on the role of homework and skill acquisition in the outcome of cognitive

therapies for mental well-being. Their research suggest that use of home practices elevates the results of mental health management and improvement (Neimeyer, Feixaz, 1990).

Today, mobile phones act as small computer interfaces with many features. People turn to their mobile phones to make phone calls, check their emails, capture photos, use social media, etc. It is almost impossible to disassociate a mobile phone from all the other features while using one of the applications. Though mobile applications can provide users with a platform to introduce mindfulness practices, the cell phone might as well become a distraction by itself. Consequently challenges to choose an optimal location and the right medium have turned out to be some of the main gaps and barriers in mindfulness practices.

Understanding the above challenges as gaps within the current system of self-help in mobile applications, this thesis project is focused on creating an environment that prompts mindfulness without the distraction associated with the screen based solutions. The focus of the project is to introduce an ambient environment for people practicing self-help and emotional wellness through mindfulness. This environment also aims to encourage adults who enjoy the practice of mindfulness and who seek emotional well-being through mindfulness practices to disconnect from their daily activities and focus on themselves for a short period of time at the end of a busy day. This thesis project focuses on designing a platform that provides users with a tool for mood elevation, mindfulness practices, and use of self-help techniques to manage emotional well-being outside of medication and therapist intervention.

I have applied principles of "Calm Technology" in development of the prototype of this thesis project. In the book "Calm Technology," Amber Case talks about how technology can be functional and operative without becoming a distraction for the user (Case, 2015). "Calm Technology" is a method that does not encourage constant contact with the user. The intention is to design an interaction that remains on the periphery of the user at all times and only introduces those

interactions when needed. "Calm Technology" aims not to make its users dependent on the interaction but *"to enhance their humanness and retain human choice"* (Case, 2015).

> *"A person's primary task should not be computing, but being human."* *Amber Case*
> *(Case, 2015)*

Following the principles of "Calm Technology" design, my goal is to design a functional and operative system that prompts users to do their daily mindfulness practices while mitigating the technology from turning into a distraction for the user. Mobile based mindfulness practices constantly interrupt users by the pre-set notifications. My thesis project instead aims to introduce a technology that invites users for participation but leaves the interaction up to them.

The research questions that I address throughout this study are as follows:

1. How might a digital tool facilitate self-support to improve one's emotional wellness (mood)?

2. Using "Research through Design"; how might a hybrid (digital + tangible) technology work cohesively to reinforce and enhance the effects of a digital application?

This thesis project is divided into six chapters. Chapter 1 includes a general introduction as well as the background and motivation for the thesis project. Chapter 2 defines mindfulness, color therapy and ambiguity in design.The significant aspects of these theories are reviewed in relevance to the design of an ambient environment that prompts emotional well-being practices. Chapter 3 focuses on other researchers who have developed design solutions to address mental wellness and self-help behaviours. Chapter 4 introduces the three main research methodologies that were used to obtain the foundation of the thesis project and design of my prototype. These principles and methodologies include the following: "Research through Design" (Zimmerman, Stolterman &

Forlizzi, 2010), Qualitative Research (Yardley, Bishop 2008), and User Testing and Interviewing involving selected participants. Chapter 5 describes the principles and conceptualizations behind the design of the prototype for this thesis project. It also goes over the changes made based on the evaluations and feedback from the participants through user-testing and interviewing stages of the research. Chapter 6 explores the possible future studies and opportunities that could drive from this thesis project.

1.2 Background and Motivation

My interest in this thesis project is to provide awareness on the importance of mindfulness and the significance of self-help in emotional well-being. We are all busy and face challenges everyday. These are not necessarily physical obstacles that might test one's physical abilities. Most of the time we are also faced with emotional challenges. In order for us to overcome these emotions, we might need to look within ourselves. Living in a fast paced environment where multi-tasking has become a substantial part of life, we forget at times to take few moments to disconnect from all distractions around us and concentrate on the present moment. "*...the distractions to daily practice in today's world can be challenging"* (Sarath, 2006). With this thesis project, I explore the possibility of providing an environment that encourages the users to pause with their busy lives and be mindful of themselves within that moment.

Chapter 2
LITERATURE REVIEW

In this section, I define some of the main terms that are used throughout my thesis project. These topical terms include the following: Mindfulness, Color Therapy, and Ambiguity in Design. First, I talk about the aspects of mindfulness that are relevant to this project. Then I define the relevance of light and color therapy in relation to mindfulness practices. In this regard, I look into the effects from nature in mood elevation. Last I introduce the concept of ambiguity in design which provides users with an opportunity for a personalized experience in the interpretation of an artifact and my approach in using this concept in the creation of the prototype of this thesis project.

2.1 Mindfulness

Daily life often includes challenges that might make people experience and suffer unpleasant emotions. People turn to mindfulness to make themselves feel better. What mindfulness intends to accomplish is to help a person to explore their daily emotions and discover freedom within those emotions. Mindfulness is intended to help a person create a relationship with themselves to help them understand what is going on in their inner self (Germer, 2004). It is our emotions in response to these moments along with all the enjoyable ones, which shape us as people. Mindfulness is a practice that allows us to understand that in order to feel better, we do not need to avoid bad and unpleasant experiences, but rather we must accept the pleasurable and painful moments as they happen in life. To be mindful is to experience and understand the present moment and accept what it encompasses (Germer, 2004).

> *"...to live life as if each moment is important, as if each moment counted and could be worked with, even if it is a moment of pain, sadness, despair, or fear."*
> *(Kabat-zinn in Germer and Siegel, 2005)*

Mindfulness is being conscious of our body and mind in the moment we live in and the ability to reduce proneness to distraction. In the book "Integral Psychology," Ken Wilber focuses on human consciousness and the importance of embracing it to increase the quality of a person's health and emotional well-being (Wilber, 2000). As consciousness has been associated with human health and state of mind, Thich Nhat Hanh also explains that mindfulness, as a form of consciousness, is the state of a person both physically and mentally being present in the current moment (Nhất Hạnh, 2013). He introduces the importance of breathing in maintaining and enhancing emotional well-being. With the breathing exercises he introduces in his book, he helps the reader achieve presence with both their body and mind (Nhất Hạnh, 2013).

Breathing is one of the main mindfulness-based exercises. It helps one's mind to connect with their body. If done right, breathing can help people disconnect with daily distractions and guide them to focus on the present moment. There are many wearables and assistive technologies that have been designed to guide the user to the correct way of breathing as part of their mindfulness exercise. Chapter 3 covers some example of assistive technologies that help with mindfulness exercises.

Daniel Goleman, psychologist and science journalist, suggests that like psychological medication which puts the human mind in an 'altered state', mindfulness leads the human brain to similar conditions with the only difference being that it is much more lasting and positive. Goleman calls this 'altered traits' (Goleman and Davidson, 2017). Professor Zindel Segal of the University of Toronto, Department of Psychology, also focuses his study on the outcome of mindfulness on the human brain. He suggests that for many years it was believed that the only way to improve one's mental state in cases such as depression was to prescribe chemical medications. He is now focusing on research that aims at proving the positive outcome of mindfulness on human mental wellness even in cases diagnosed with clinical depression (Boundless.utoronto.ca, 2018). Professor Segal states that due to human brain plasticity, the functioning of the central nervous system can be

changed through our *"emotions and cognitive habits."* Hence, mindfulness could also help change

the human brain (Boundless.utoronto.ca, 2018). Mindfulness can enhance emotional well-being by

making people conscious of the moment they live in. The amount of attention given to a task could

vary the pleasure and enjoyment of doing that task; where the higher the attention and focus or the

state of consciousness, the higher the enjoyment of that living moment (Brown and Ryan, 2003).

> *"Don't do any task in order to get it over with. Resolve to do each job in a relaxed*
> *way, with all your attention. Enjoy and be one with your work. In mindfulness one*
> *is not only restful and happy, but alert and awake."* *Thich Nhat Hanh*
> *(Nhất Hạnh, 1999)*

Mindfulness, which is the focus of my thesis project, is a form of consciousness that helps people

concentrate on the present moment, and be in charge of their mind and their body.

2.2 Color Therapy and Effects of Nature

Another theory that I have explored in my thesis project is the use of color and its effect on users

while practicing mindfulness. Many researchers have focused on the human responses to different

colors and light settings and the effects of such variables on human emotions. A scientific approach

on researching light and its effects on the human brain suggests that: *"Light influences the human*

circadian rhythm". The circadian rhythm helps us manage our sleeping cycle which correlates to

our physiological and metabolic processes (O'Connor, 2011). Thus, disruptions in light exposure

may result in changes in mood and our emotions (O'Connor, 2011)

Studies show that different wavelengths of light, producing different colors may have distinct

impacts on our emotions (Kasper et. al, cited in O'Connor, 2011). The human emotional response

to different colors is also affected by other factors such as age, culture, and personal preferences

(O'Connor, 2011).
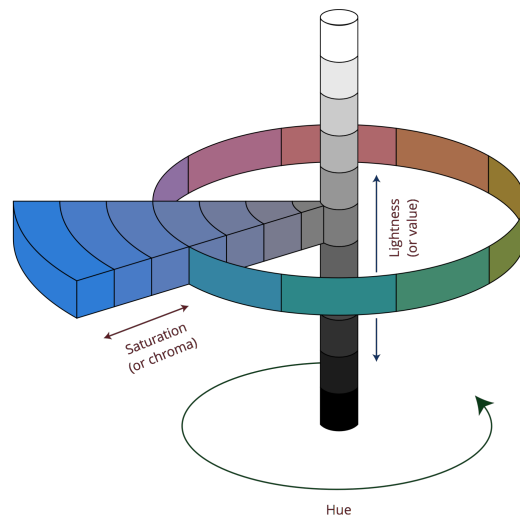
Figure 1. Munsell color system (Neal O'Grady)

A research study called 'Relationships between Color and Emotion: A Study of College Students' by Naz Kaya and Helen H. Epps, focuses on the relationship between color and human emotions.

> *"Color is an inseparable part of our everyday lives and its presence is evident in everything that we perceive. It is widely recognized that colors have also a strong impact on our emotions and feelings (Hemphill, 1996; Lang, 1993; Mahnke, 1996)."*

In the qualitative research study by Naz Kaya and Helen H. Epps, a total number of ninety-eight college students were asked to provide their emotional feelings in responses to different colors and their personal reasons behind their choices. This research was obtained based on the Munsell Color System, shown in Figure 1. Munsell differentiates every color based on hue, value (lightness), and chroma (color purity) (Kaya, Epps, 2004).

Hue helps the eye distinguish different colors from each other. The value characteristic of every color corresponds to the lightness and darkness of the color in relation to the colors white, black

and the shades of grey. Chroma is associated with the vividness (saturation of hue) of every color (Kaya, Epps, 2004). The results of this study indicated that the colors associated with the highest number of positive responses were green, yellow and blue with average positive responses of 95.9%, 93.9%, and 79.6%, respectively (Kaya, Epps, 2004).

Colors are associated with symbolism. Hence every color can be correlated with an object or an environment. The three colors mentioned earlier, i.e., green, yellow, and blue, are associated with nature, trees, sun and blooming flowers. These attributes and symbolic connections resulted in triggering emotions such as happiness, comfort, peace, and hope in the participants of the study (Kaya, Epps, 2004). The colors grey and black were both highly associated with negativity and depression; and the color white was highly associated with peace, innocence, and hope (Kaya, Epps, 2004).

The book "Teaching Mindfulness Skills to Kids and Teens" presents research focused on the effects of nature on the human mind. Spending time in nature, or taking inspiration from nature may result in elevating one's mood (Grinde, cited in Willard and Saltzman, 2015). Natural settings have healing effects on both the body and mind, thus improving focus and concentrations (Grinde, cited in Willard and Saltzman, 2015). Richard Ryan, Professor of Psychology at the University of Rochester, said, *"Nature is fuel for the soul"* (Skye cited in Willard and Saltzman, 2015).

Color therapy and effects from nature as described above have both been used in my thesis project in the development of the prototype to help with mindfulness practices aimed towards emotional well-being. Although different colors may relay different meanings in every culture, but through usage of colors based on the outcome of research from Naz Kaya and Helen H. Epps, I have borrowed nature aspirations to facilitate a connection between the user and the designed prototype.

Figure 2. Photo of nature (1) (Gaetan Meyer)
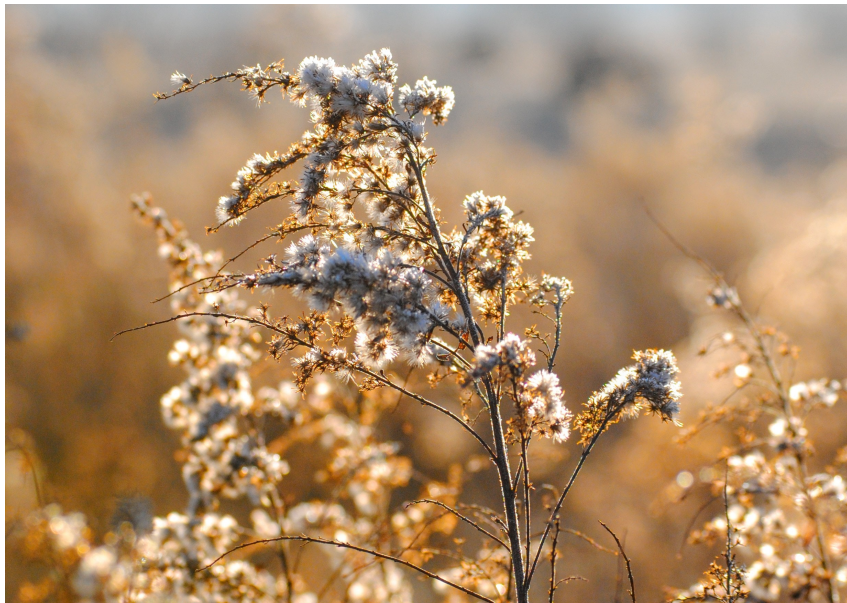
Figure 3. Photo of nature (2) (Dabir Bernard)

2.3 Ambiguity in Design

Lastly, I have used the theory of ambiguity in design in my thesis project. Ambiguity is an approach in design that invites users' interpretation to complete the purpose of an artifact, a product or system. Although it is frustrating to interact with an object that conveys unclear information and purpose; Gaver et. al argues that ambiguity in design could be perceived as an opportunity rather than a problem. Ambiguity invites people to create a more intimate connection with the design or the system at hand by creating a deeper and more personal relation with it. It suggests the users to come up with their own meaning and direction based on their sociocultural background, approach and interpretation (Gaver et al., 2003).

This was an important approach for my thesis project as well since I also aimed at providing users with an opportunity for a personal experience and interpretation of the prototype object while attending to mindfulness practices. I used this approach to explore creating a stronger and longer lasting connection between the designed prototype and the user.

The research study "Ambiguity as a Resource for Design", by Gaver et. al suggests three different approaches to ambiguity in design, namely, Ambiguity of Information, Ambiguity of Context, and Ambiguity of Relationship. Each sub-category of ambiguity in design is explained below.

1. Ambiguity of Information

"Ambiguity of information impels people to question themselves the truth of a situation" (Gaver et al., 2003). For example: artists such as Leonardo Da Vinci and Picasso have purposefully created masterpieces that have attracted people's attention due to their ambiguity caused by lack of information. Da Vinci's Mona Lisa is one example of an ambiguous art piece, in which the artist has blurred the subject's facial expression to create the mysterious and famous Mona Lisa smile. By

11

providing minimal information, the viewer has to use her imagination to create and complete the smile of the subject. Thereby, this art piece might be perceived differently by different viewers.

2. Ambiguity of Context

"Contextual ambiguity can question the discourses surrounding technological genres, allowing people to expand, bridge, or reject them as they see fit" (Gaver et al., 2003). This type of ambiguity results in different perceptions of a system or an art piece, each suggesting different meaning of it. Gaver talks about Marcel Duchamp's 'Fountain', as an example of an artifact with contextual ambiguity. Duchamp tried to challenge the art world by introducing new directions in creating an art piece that pushes the audience to use their own perception to create new meanings for his artwork. In an unsigned editorial in Dada journal, Duchamp states: *"He [the artist] took an ordinary article of life, placed it so that its useful significance disappears under the new title and point of view — created a new thought for that object"* (Stokstad and Cothren, 2011).

Another great example of a contextual ambiguity in design is the 'Juicy Salif' lemon juicer by Philippe Starck. The Metropolitan Museum website notes: *"Starck's designs are frequently mysterious in their ambiguity, their purpose is not always at once identifiable"* (The Metropolitan Museum of Art, i.e. The Met Museum, 2018). What is amazing about this design is that although at first glance it seems to be a juicer, it is by no means functional. 'Juicy Salif' has become one highly recognizable decorative piece of art.

Figure 4. Salif Juicer (Philippe Starck, 1990)

3. Ambiguity of Relationship

"Relational ambiguity, finally, can lead people to consider new beliefs and values, and ultimately their own attitudes"(Gaver et al., 2003). Ambiguity of relationship employs the user's personal belief to create a connection between the user and the object. Thus, every user's connection to the artifact, system or the design at hand might be different from that of another person as it is directly impacted by the user's role in determining the implications and use of the artifact.

Another example of ambiguity in art and design practices can be seen in the interactive art piece created by artist Jazmine Yerbury, a Master of Fine Arts graduate from OCAD University in Toronto, Canada. Jazmine created a set of sensory objects that enabled the artist, the participants, and the material to engage together in the act of creating an art piece (Yerbury, 2017). The ambiguity in the results due to this collaboration facilitated with the sensory objects designed by Jazmin, creates stronger connection between the participant, artist and the created work.

Figure 5. Sculpture-bot (Jazmine Yerbury, 2017)

2.3 Summary

My thesis project aims to create an environment that allows users to disconnect from all surrounding distractions and focus on themselves for a moment within their busy daily lives. In order to create these personal intimate moments; this project pursues the concept of ambiguity in design to invite it's users to create a connection to the designed piece that is unique to each person and their own experience.

> *"Embrace ambiguity actually frees us to pursue an answer that we can't initially imagine, which puts us squarely on the path to routine innovation and lasting impact - We may not know what that answer is, but we know that we have to give ourselves permission to explore." (Patrice Martin)*

Chapter 3
CONTEXTUAL REVIEW

In this Chapter, I introduce current products that focus on mindfulness and self-help. I conclude each review with my personal assessment, and the pros and cons of those products.

3.1 Headspace Mobile Application

Headspace is a mindfulness mobile application that was launched in 2010. The goal was to provide access to and teach the essentials of meditation and mindfulness to as many people as possible. The design and research behind Headspace revolves around *"the understanding of how the benefits of in-person meditation training translates to app-based meditation training"* (Headspace, 2018)
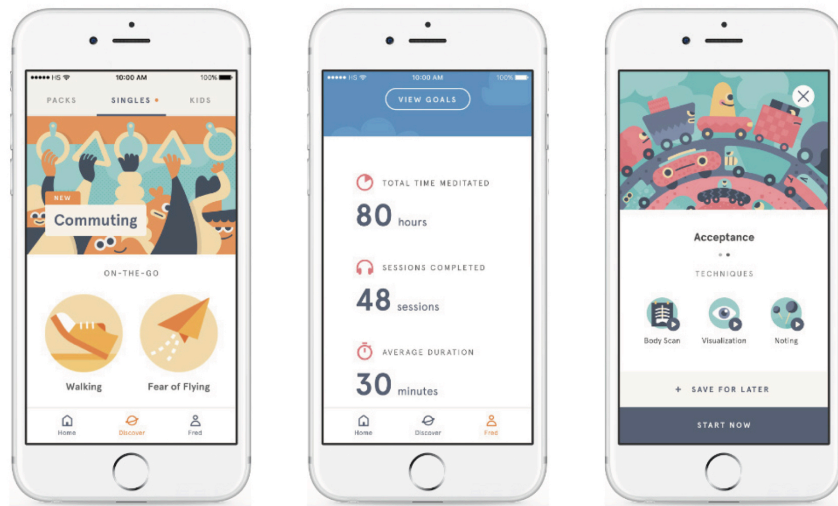
Figure 6. Headspace mobile application (Headspace, 2018)

Headspace argues that mobile mindfulness based trainings have similar effects as in-person trainings. Headspace further continues that the mobile based mindfulness practices are effective for both healthy and vulnerable population (Headspace, 2018).

The potential benefit of Headspace is that it has made meditation and mindfulness more accessible to its users. Headspace claims that their mindfulness based exercises help their users reduce their stress, improve their sleep quality, have happier and healthier relationships, manage their anxiety, and sharpen their concentration (Headspace, 2018).

The study by Howells, Ivtzan and Eiroa-Orosa, titled, *"Putting the 'app' in Happiness: A Randomized Controlled Trial of a Smart-phone Based Mindfulness Intervention to Enhance Well-being"*, focuses on the effectiveness of mindfulness mobile applications. The research trial was conducted with "*a diverse self-selecting pool, randomly assigned to engage with an empirically supported mindfulness intervention (n = 57) or a control intervention (n = 64) for 10 days*" (Howells, Ivtzan and Eiroa-Orosa, 2014).

The outcome of this research trial validated the positive results of mobile based mindfulness applications, and 'Headspace' in particular.

A separate research study, *"Making Time For Mindfulness"* by Laurie and Blandford, also uses Headspace to study the factors and barriers to effective use of mindfulness-based mobile applications and analyzes its participants' experience using this application.

For any type of technology to be effective, it has to work cohesively with the users' life styles, values and expectations (Laurie and Blandford, 2016).

This research reveals the importance of clear explanation of mindfulness benefits through direct communication with the participants at the beginning of their experience with the application. Some participants turn to mindfulness practices for a 'quick fix' or distraction from certain mental states. As a result, these participants normally stop using the application and ultimately lose the benefits of the mindfulness exercises due to the lack of short-term outcomes (Laurie and Blandford, 2016).

One of the main barriers found in this research was the location that the mindfulness practice was performed by users with the Headspace application. Although participants had access to this application on their cellular phone throughout the day; they stated that they were more comfortable engaging with the application "while at home, in a place that they would not be distracted, somewhere safe, quiet and comfortable; usually their bedroom" (Laurie and Blandford, 2016).

Another outcome of this study is the time barrier, and the challenges users face trying to include the mindfulness exercises within their busy daily lives (Laurie and Blandford, 2016). Although it is important to also provide guidance on the topic of time management, I believe that based on the results from Laurie and Blandford research, the participants get more efficient results from mindfulness when they can practice these exercises in their own relaxed environment.

Mobile based applications have provided users with a platform to access their exercises instantly in any place throughout the day. But as mentioned earlier in Chapter 1, due to many features associated with a cellphone such as texting, phone calls, connection to social media, etc., it is impossible not to see the cellphone itself as a form of distraction. As a result, I decided to stay away from developing another screen-based application, which might distract users from the goal of this thesis project.

3.2 Spire - activity tracker

Spire is an assistive wearable technology that helps users achieve mindfulness through breathing exercises. It can determine a wearer's emotional state based on their breathing patterns. Spire is worn either on the belt or the bra strap and can monitor the wearer's breathing pattern by collecting data through the expansion and contraction of the torso (Spire, 2018).

Figure 7. Spire activity tracker (Spire, 2018)

This wearable device works in parallel with a mobile application that receives data gathered by the sensors in the Spire activity tracker. The mobile application analyzes the received data and based on predesigned algorithms, it divides up its gatherings into three different groups suggesting the following different emotions: Calm, Tense and Focused (Spire, 2018).

STATE-OF-MIND FACT SHEET

Calm	Tense	Focus
6-12 breaths per minute*	18-24 breaths per minute*	16-20 breaths per minute*
slow, regular breathing	fast, erratic breathing	very consistent breathing

Figure 8. State-of-mind fact sheet (Spire, 2018)

Developers of Spire believe that people might go through tense moments within their daily lives without realizing it. By using the data gathered through sensors, Spire can sense whether the user is having an uneasy moment. In such cases, it notifies the wearer to take a moment and focus back on calming down by resetting their breathing pattern (Spire, 2018). Spire thus promotes mindfulness by drawing attention to the importance of breathing. Spire is meant t be worn by the user throughout the day and it informs the wearer if there is any changes to the pattern of their breathing (Spire, 2018).

What makes Spire different from Headspace is that it requires no conscious input from the user. The embedded sensors in the Spire wearable device collect the needed information as the user is proceeding with their daily life activities. The user is only notified at crucial moments and is left to continue with their day-to-day activities the rest of the time.

This is a major difference between Spire and Headspace, although both devices promot mindfulness. Spire only notifies its users when its algorithm spots changes in the user's breathing pattern suggesting change in their state of mind. Otherwise it does not interact with the user. In contrast, Headspace sends out push notifications to the user's phone asking users to interact with their mindfulness activities based on previously programmed times. Since these times are pre-programmed, they do not consider the user's state of mind or what they are doing at the given moment. This might stop the user from participating in these activities.

at the given moment. This might stop the user from participating in these activities.

In my opinion, although Spire does not require a designated spot or environment for its users to participate in the breathing exercises, users may find the results more effective if they are focusing on the breathing exercises in a more comfortable environment, where they are not interrupted by possible surrounding distractions.

3.3 Mindful Lights

Figure 9. Mindful Lights art installation (Logan, 2018)

Mindful Lights is an interactive art installation aiming to provide a mindful moment within the busy lives of passerby students at the Columbia University. This was a research study by a group of three Master of Design students from Parson School of Design exploring the idea of creating an environment that invites people for a moment of mindfulness. Mindful Lights was installed at Offit Gallery (Logan, 2018). The designers used lighting installation with mixed materials to create a visual conveying an experience of waterfall through subtle changes in the light installation, combined with a waterfall audio track. This art piece was built with sensors that correspond to the user's movements in front of the installation. If the sensors detect an object passing by, they respond to the movement by turning on the lights within the installation. These lights stay off if the sensor do not detect any movement. This draws the attention of the passerby viewers and hopes to

invite them to take a closer look at the installation. As the viewer approaches the art piece, a waterfall audio track turns on to create an ambient environment that aims to provide the students with a mindful moment within their busy day (Logan, 2018).

> *Waterfall was the primary inspiration for the formal design of Mindful Lights. We wanted to create an experience where the viewer felt like a gentle flow of water was washing over him/her."(Logan, 2018)*
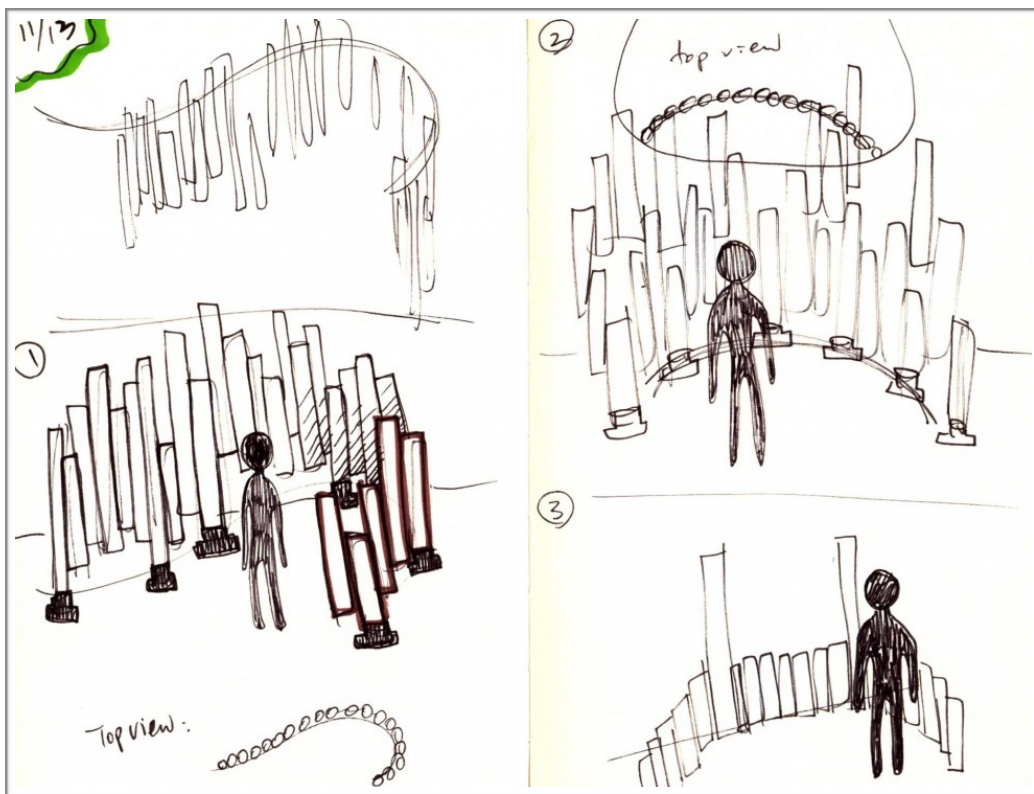
Figure 10. Mindful Lights art installation, initial sketches (Logan, 2018)

It is my opinion that the art installation has utilized the concepts of ambiguity in design as well as ideas from "Calm Technology" to enhance the effect of lighting and audio effects in creating the space for a mindful moment. Ambiguity in design is embedded in the art installation by way of

providing no information or context to viewers letting them experience and discover the object as they perceive. The designers also took advantage of principles of "Calm Technology" as the installation does not impose any forced interaction on the viewers, but let the viewer to initiate the interaction in corresponding to the subtle changes in lighting and experience a mindful moment at their own pace.

As it was mentioned earlier in Chapter 1, lack of an optimal location and use of intrusive medium have been identified as some of the main gaps in practicing mindfulness which is the reason I have chosen to mitigate them in my thesis project. As such, Mindful Lights has provided the most inspiration to my thesis project, as it has successfully addressed those gaps by creating a non-screen based ambient environment within a public space. With my thesis project, I aim to address the same gaps by introducing an ambient environment for mindfulness practices within the user's home.

Chapter 4
METHODS & METHODOLOGIES

With this research I am exploring how a hybrid object consisting of both tangible and digital parts could create an ambient environment that prompts users with the practices of mindfulness for self-help in emotional well-being. This thesis explores design of a stationary object that is located within the users' home and delves into creating stronger connections with the user by introducing a mobile piece that is carried with the users and stays with them throughout the day.

Below provides the methodologies that I have used in development of my thesis project.

4.1 Research through Design Methodology

In this research, I have applied Christopher Frayling's concept of "Research through Design" (RtD) to conduct data resulting from replicate experiments and prototypes. "Research through Design" (RtD) is an approach that provides valuable knowledge gain through the process of prototyping (Frayling, 1994). In an interview with Frayling in the RTD conference in 2015, he mentions that in the traditional form of research, design would be added to the process of research at the very end. He explains "Research through Design" is an approach that allows design to lead in order to generate the research. Design theorist, Horst Rittel, and urban designer and theorist, Melvin Webber, introduced the concept of "Wicked Problem". "Wicked Problem" focuses mainly on social problems, such as anxiety and stress, that due to their complexity and conflicting objectives involved, they cannot be looked at through the traditional lens of scientific research (Rittel and Webber in Zimmerman, Stolterman and Forlizzi, 2010). This creates an opportunity for the design research to present findings through methods that are unique to design and the design process (Zimmerman, Stolterman and Forlizzi, 2010). At the beginning of the process of "Research through Design", designers engage in creating objects that are based on initial assumptions. In this

process, designers first make assumptions that later will be tested and modified through data gathering such as user-testings. These data gatherings will be reflected in the final outcome of a "Research through Design" (Gaver, 2012).

> *"First we guess it. Then we compute the consequences of the guess to see what would be implied if this law that we guessed is right. Then we compare the result of the computation to nature, with experiment or experience, compare it directly with observation, to see if it works. If it disagrees with experiment it is wrong."*
> *(Feynman in Gaver, 2012)*

The process of "Research through Design" for this thesis project consisted of three prototyping stages. First was the Sensum Mobile Application. The second was Sensum Light which focused on a non-screen based solution to practice mindfulness, and the third was Sensum Light II which concentrated on how the form of an object could also enhance the experience of the users while practicing mindfulness. "Research through Design" initiated research through literature and contextual reviews which followed with brainstorming ideas, sketching and prototyping techniques. This process later included gathering reflections and feedback through interviews and user-testing sessions. The gathered data from each prototype led to the production of the next prototype.

We live in a fast-paced environment where multi-tasking has become an expected way of life. With all distractions surrounding us, it is easy for one to lose their sense of self. This opens an opportunity for this thesis project to explore the wicket problem of how a tangible object could help users to disconnect from the distractions surrounding them and encourage them to practice mindfulness. I explore the possibility of this solution through testing of multiple prototypes throughout my research.

4.2 Qualitative Research Methodology

This thesis project focuses on the topic of mindfulness and the effects of a hybrid technology (digital and tangible) to enhance one's mood and emotional state. As the collected data from this research and the experiments throughout the whole process varies from person to person, it was impossible or extremely difficult to use quantitative analysis to support the outcome of the research. User interviews, participant observation, and context analysis were some of the methods I have used to complete the qualitative research methodology analysis of the data.

4.3 Expert Interviews

As part of the research for this project, I held two separate interviews with a social worker and an industrial designer who had previously worked on projects that involved creating everyday objects focusing on mindfulness and human consciousness. All the interviews were done in person. Interviewing these practitioners helped me gain knowledge on their specific areas of interest and experiences. I had prepared 5 questions for each of the interviews and further asked questions relevant to the topic being discussed throughout the interview.

I held the first semi-structured interview with Robyn Shaw, M.S.W, RSW. She is a registered social worker, manager of the health and wellness centre at OCAD University. She holds a Master of Social Worker from the University of Toronto. The complete interview has been documented in Appendix A.

A non-directive interview was held with Filipe Ligabue. Filipe is a Master of Design candidate in Design for Health at OCAD University in Toronto, Ontario. He holds a Bachelor of Design degree in Industrial Design from the University of Brasilia and has previously focused on designing

everyday objects that promote consciousness focusing on hypnosis and meditation. The complete interview has been documented in Appendix B.

4.4 User-Testing Sessions

All research conducted in this section was covered under the REB application that was submitted for the Thesis 3 course in Digital Futures program by Dr. Martha Ladly.

In "Research through Design", the resultant prototype evolves and changes based on the data gathered through the process of research. To test and monitor user behaviours while interacting with the designed prototype of this thesis project, I later tested the prototype with 5 participants between the ages of 25-32 years. All five participants in this research were from the Digital Futures graduate students at OCAD University. This research was conducted towards the end of the graduating year. The main purpose of user-testing for this project was to validate the assumptions made initially about the relationship of ambiguity in design and mindfulness, and the effects of simulating nature qualities such as sound and colour to introduce an ambient environment in order to promote mindfulness exercises and how a tangible prototype can enhance the effects of a digital platform in elevating users mood. Semi-structured interviews were conducted following the participants engagement with the designed artifact in order to obtain insight from their experience while using the object and to validate the qualitative analysis of the results. Appendix C covers the full outline of the interview questionnaire, while the results of the conducted data are presented in Chapter 5.

The expert interviews gave me an opportunity to review the effective design approaches that could be used in mindfulness practices and implementing them in connection with the feedback that I collected from the user-testing sessions in order to improve the design of this thesis project's prototype.

Chapter 5
SENSUM

5.1 Introduction

I have chosen to name this project Sensum Light. Sensum is a Latin word meaning 'something sensed'. Sensum is an object consisting of two separate components. The main component is a stationary object that stays within the user's home. The second component is a mobile piece that is carried around by the user throughout the day.

The idea behind Sensum is to create an ambient environment that helps users disconnect from all distractions around them at the end of a busy day and take the opportunity to reconnect their body and mind and focus on the present moment.

Sensum Light does not impose any forced exercise or action on its users. The interaction is designed such that it invites its users to engage with any mindfulness activity of their choice in the ambient environment facilitated by Sensum Light for creating a mindful moment for the users.

In this chapter, I describe the process of prototyping and research that ultimately led to the design of Sensum Light. By focusing on "Research through Design" (RtD), I created three separate prototypes. With every prototype, I conducted research through literature reviews, interviews, and user-testings with participants. Each earlier prototype helped with the development of the next prototype.

5.2 Prototype One - Sensum Mobile App

The first prototype of this thesis project was a mobile application that asked users to keep track of all emotions they go through within a day. This prototype was created prior to my findings on the constraints that mobile phones have on the practices of mindfulness. In fact this prototype was part of the research that helped me redirect my approach in designing a non-screen based interaction as the final prototype of this thesis project. The idea behind the app was to send push notifications to the user at different times of the day asking them to track their emotional state. The user also had an option to go to the app and track their emotions in between the push notifications.
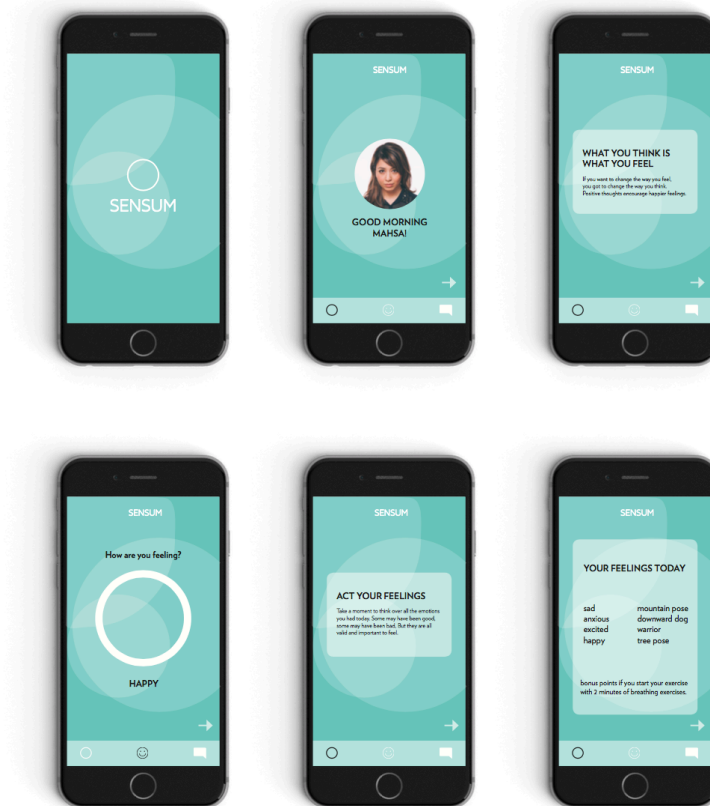

Figure 11. Sensum mobile application (Mahsa Karimi)

This prototype would ask the users to evaluate their emotional state during different times of the day. Based on the given data, the app would generate a 30-min yoga exercise that associated different emotions to certain yoga poses. Sensum Mobile App aimed to help the participants disassociate with the challenges that arose from negative emotions. It invited the user to take a moment to think about all the emotions they had within the day as they were all valid and important to feel, though some were good and some were bad.

I conducted research through a literature review of a research study, "Making time for mindfulness," International Journal of Medical Informatics by Laurie and Blandford. This paper focuses on participants' experience while using the 'Headspace' mobile application. Chapter 2 covers in details the outcome of this research paper. The journey map below was put together based on data gathered through this literature review:

USER JOURNEY	DOWNLOAD	ENGAGE	EXIT	RETURN
DOING	Finding the most popular mindfulness application based on research and ratings.	Going through the exercises, creating reminders for future interactions with the app.	Exiting the application and waiting for the reminder to continue with the exercises.	Once the next reminder is goes off the user is goes back to engage with the activities.
THINKING	Looking for a platform to help them mindful of their feelings	How can I do this correctly? Where is the best place to engage with this app?	Cool! How should I implement these exercises in my daily life?	Right now? I need to find a more private place.
FEELING	I want something new. The ratings on this app is high Curious to start.	Feeling vulnerable. I don't feel comfortable using this app just anywhere.	Happy I've found an app helping me with Mindfulness, stressful to use it everywhere.	Depending on the location either annoyed or ready to continue.
EXPERIENCING	Courage Helpfulness	Stepping out of comfort zone Vulnerability Helpfulness	Accomplished Helpfulness	Stressed Helpfulness Vulnerability
OPPORTUNITIES	Clear goal setting, Creating a better experience while using the app Helping users find time to do the exercises.			

Figure 12. Headspace journey map (Mahsa Karimi)

This journey map visualized the experience of the user through the different stages of interaction with the 'Headspace' mobile application. By making this journey map, I was able to locate and define the gaps within the users' experiences. Based on my gatherings some of the gaps are as

follows

1. Clear goal setting

2. Helping users find more time for mindfulness exercises

3. More suitable time and location to participate with the mindfulness exercises

I also participated in a 4-day long user-testing experiment on myself, collecting my emotional state at different times of the day. These entries were both prompt by the push notifications and self-initiated. I set the timer on my phone at different times of the day to remind me to track my emotional states. On the first day of the experiment, I set timers to notify me at 9 am, 12 pm, 3 pm, 6 pm and 9 pm. This experience was very overwhelming. On that day, I had a meeting from 9:00 am to 11:00 am and a class that went from 11:50 am to 6:30 pm. The pre-set notifications interrupted me once during the beginning of the meeting in the morning and 3 times during my class to have me record my emotional states. As a result, I decided to limit the number of notifications to 2 or 3 times per day for the remaining 3 days of the experiment. Although this change resulted in less interruptions during class hours and meetings, I found myself receiving notifications while I was in public spaces such as coffee shops and public transit. During the experiment, I felt very vulnerable opening up my feelings in public places.
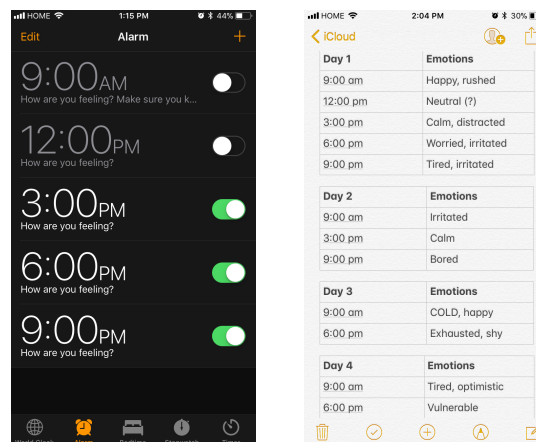
Figure 13. Results from the 4-day experiment on myself (Mahsa Karimi)

The results from user-testing on myself was aligned with some of the findings from the above literature review. The push notifications became more of an interruption than reminder to be mindful and to exercise mindfulness. Through my own personal experience, I was able to verify that having a suitable environment and choosing the right time to participate in mindfulness exercises is a key to users' engagement. Since users have already developed many associations to their mobile phone, using this medium as the means to provide the mindfulness exercises also verified that it might not be the best choice.

5.3 Prototype Two - Sensum Light

The second prototype focused on designing a device that could assist with the previously identified gaps in the system from the outcomes of Prototype One in Section 5.2 of Chapter 5. Based on these gatherings, most of the users were only comfortable in engaging with mindfulness exercises at home or places where they could maintain their privacy. With the second prototype, I explored the idea of having a stationary object that stays in the users' home. I also explored designing an interaction that was not facilitated by the user's mobile phone to avoid unwanted distractions during a mindful moment.

5.3.1 Inspiration (Jellyfish and Rhythm)

The inspiration behind designing the new prototype was taken from observing mindful moments within some social actions. I had an opportunity last year to visit the Ripley's Aquarium of Canada in Toronto. It was interesting to observe what invited people to stand in front of the fish tanks for a long period of time watching the jellyfish as light shined through their body and their very subtle movements. The subtle movements of jellyfish created a continuous rhythm that invited the viewer to focus on the present moment and almost disconnect with all distractions surrounding them. Designers and researchers have taken inspiration from similar interactions to create lights that are

currently being used for purposes of meditation. Taking inspirations from such events and designs, I also wanted to explore the same experience with Sensum Light by introducing subtle choreographed light pulses and examining the effect of such rhythm by user-testing of the prototype on my participants.
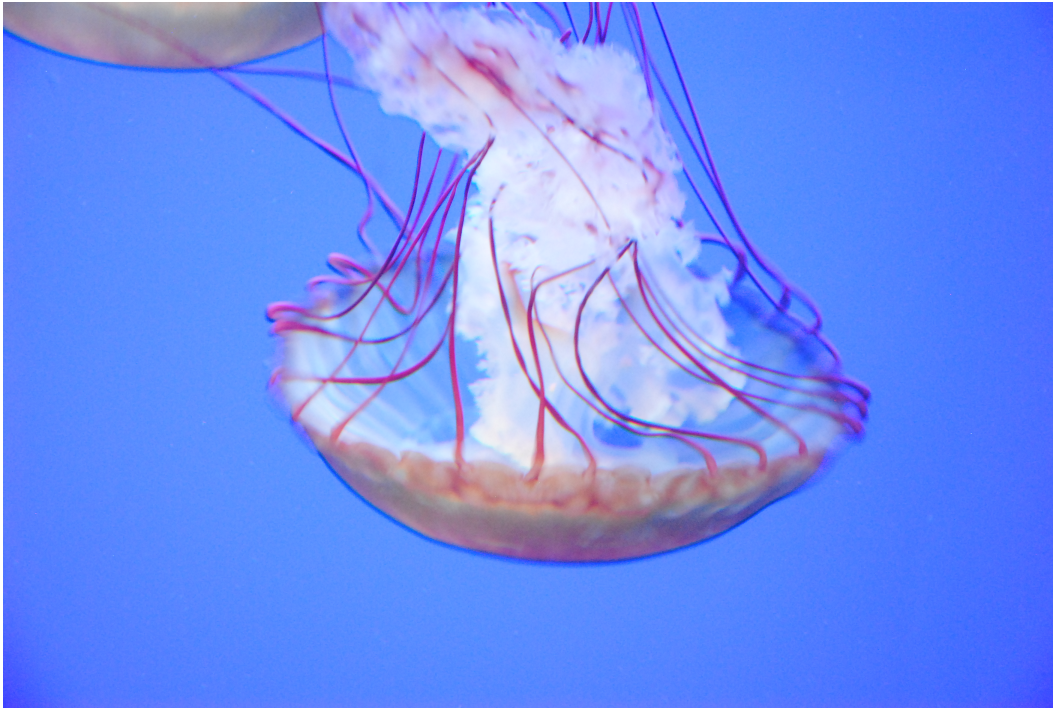

Figure 14. Jellyfish from Ripley's Aquarium of Canada (Hammadullah Syed)

The book "Teaching mindfulness skills to kids and teens" focus on the importance of human connection to nature and nature simulations on both mental and physical health (Willard and Saltzman, 2015). With the design of Sensum Light, I utilized nature qualities when introducing interaction with this object.

5.3.2 Design Choices

In designing the second prototype, my focus was to introduce a shape that adapts to most living settings. I also made sure that it did not resemble objects that might prevent users trusting and using it comfortably. More importantly, I avoided shapes that might resemble Google Homes and Alexa smart home gadgets due to their association with surveillance and control. The purpose behind Sensum Light is to create an ambient environment that by gaining users' trust enables them to practice mindfulness within that environment. This prototype was a cube shaped box with a translucent top that allows light to shine through it.

As an industrial designer, I looked into creating a shape and a neutral color palette that adapted to any environment it was introduced to. In my interview with Filipe Ligabue, he talked about a technique that people use to inspire concentration. This is when they imagine themselves in an empty room where everything is white. This creates an empty canvas for the brain, clearing out all the distractions and thoughts. An object that prompts mindfulness could take inspiration from such metaphors. Thus with this prototype, I looked into visually creating an object that resembles the empty space Filipe was talking about to be able to invite the users to a moment of mindfulness.

To enable the user to only focus on their experience of mindfulness, I aimed to create a clean form where the simple touch points were designed to create an effortless and smooth interaction with the object. The choice behind the size of the prototype was to make it not so small to be shadowed by other objects surrounding it, yet not so big to turn it into an overwhelming object to interact with.

As mentioned earlier, Sensum Light consists of two separate components, the stationary light that stays in user's home and a keychain module that stays with the user during the day.
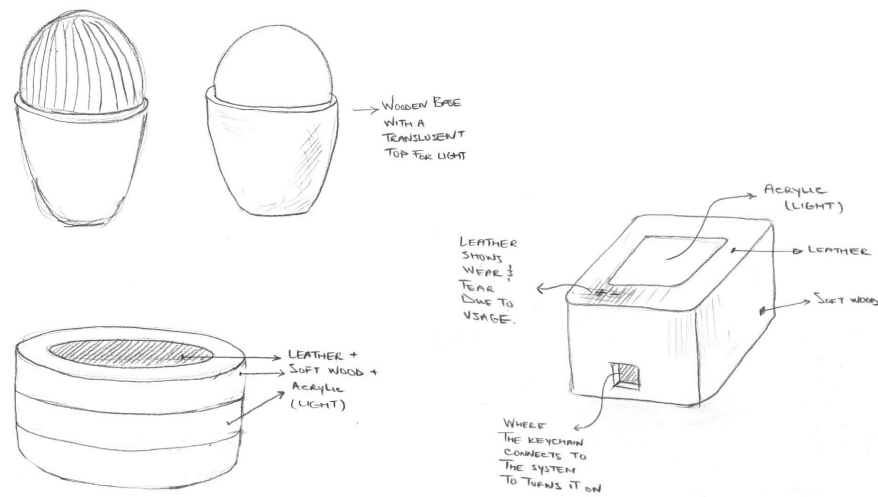
Figure 15. Ideation sketches for Prototype Two - Sensum Light (Mahsa Karimi)

Formal mindfulness is practiced in yoga, sitting meditation, breathing exercises, body scan meditations, etc. (Dimidjian and Linehan, 2008). These formal mindfulness exercises could be practiced with Sensum Light at home.

Informal mindfulness practice is referred to bringing the mindfulness mindset into ordinary daily life activities, such as eating, walking, talking on the phone, etc. (Dimidjian and Linehan, 2008). These activities are not constrained to the environment of the users home. Hence the keychain module that is carried around by the users is a reminder that mindfulness could be practiced anytime throughout the day.
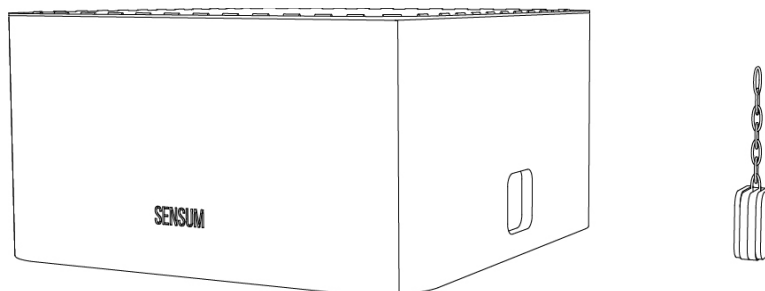
Figure 16. Illustration of the final design of Prototype Two (Mahsa Karimi)

5.3.2.1 Sensum Light

The stationary component of Sensum Light consists of a NeoPixel strip light and a speaker module. Once it is turned on, the lights are designed to pulse on and off in a breathing-like pattern inviting the user to follow that rhythm; taking a breath in when the lights are turning on, having a short pause, and breathing out as the lights are turning off. The lights start shining green, yellow and blue based on an earlier research study on the effects of color on human emotions in Chapter 2, where a research study by Naz Kaya and Helen H. Epps emphasizes on the positive effects of the selected colors on human emotions. The user also has an option to choose from two audio tracks consisting of fire burning, ocean wave, and wind sounds. The audio of Sensum Light has been designed such that it does not allow the user to adjust its volume. The volume is set on a fixed pitch that invites the user to disconnect from all the other distractions around them such as their cellphones, radio, and television to be able to hear and interact with the object.

Pine soft wood and leather were the chosen materials for Sensum Light. Both wood and leather have the characteristics that make them change overtime due to wear and tear, and usage. I wanted to take advantage of such characteristics to emphasize that the ultimate design goal of the object is only revealed through usage. The changes appearing on the material are unique to each user, and will be different from one person to another.

By emphasizing on the changing characteristics of the chosen materials of Sensum Light, I aim to illustrate that all the emotions that one experiences throughout their daily lives, make them the individuals that they are. In his book, "Peace of Mind, Becoming Fully Present," Thich Nhat Hanh explains that in order to have happier lives, no one has to ignore the hard feelings and events that expose bad emotions on them. We have to understand how to live with all the happy and perhaps negative emotions that we face throughout the day, as they will define the persons we are (Hanh, 2013).

Figure 17. Sensum Light with the keychain attached (Mahsa Karimi)

5.3.2.2 The Keychain

To assist users throughout the day, when they are not around the stationary object which is meant to remain at users' home, they are given a keychain that could be carried throughout the day to remind them of the mindfulness exercises, and help them draw their attention to the present moment.

The keychain also acts as a switch that turns on Sensum Light. As it is shown in Figure 18, by placing the keychain in the designated area on Sensum Light, the embedded strip of metal on the surface of the keychain completes the broken electronic circuit that ultimately turns on the device.

Same as the stationary object, the keychain is also made out of pine softwood and leather. The idea behind the keychain of Sensum Light is to create an object that taps into all the emotions that users encounter throughout their day to day lives. The designed object will resonate and age with the user. The characteristics of the material of the keychain changes as it is used. The material is chosen such that it shows wear and tear through usage over time. The change in the exterior of object becomes part of the design and the process.

The keychain is given to the user in an envelope that says: "Embrace the first dent and celebrate the first scratch." The dent and scratches on the keychain as the result of everyday use, symbolizes all the feelings and emotions one goes through in a day and how all those feelings despite being positive or negative shape the persons we are.

Figure 18. Sensum Light keychain (Mahsa Karimi)

5.3.2.3 The Electronics

The electronic components of Sensum Light include a microprocessor (Feather Huzzah), a soundboard, a speaker, set of buttons, and a Neopixel strip light. The light/speaker module only turns on if the keychain component is placed in the designated spot on the stationary module to complete the circuit. From there the user has an option of either interacting just with the lights or choosing from three distinct therapeutic tracks of fire burning, ocean waves, and wind sound. The buttons to choose the tracks are embedded within the wooden structure and the laser cut graphics on the leather signifies the location of these buttons.

Below picture shows the break in the circuit. Due to this break, even if Sensum Light is connected to the power, it remain off. The system only turns on when the keychain is placed into the cutout on the body. The strip of medal embedded on surface of the keychain completes the electronic circuit which turns on the system.

Figure 19. Power switch mechanism of Sensum Light (Mahsa Karimi)

5.3.3 Observations

Sensum Light was intended to provide a mindful moment at the end of a busy day in the user's home. The keychain is a smaller piece from that experience that is carried with the user throughout the day to reconnect them with their mindful moments at home. I invited five participants, each to engage individually with Sensum Light for about 20 minutes towards the end of their day. The participants were given a keychain to carry around a few days prior to the user-testing session. The participants then used their keychain to turn on Sensum Light. The participants were left alone to engage with the object with whom I later conducted a semi-structured interview to understand whether the design and the intended use of Sensum Light was intuitively understood by them. I also invited the users to reflect on experiences that they went through while using Sensum Light which might have not been the initial intent of the design. Referring back to Gaver et. al approach in ambiguity in design, I also wanted to understand the impacts that ambiguity in context and information had in creating new interactions and experiences for the users and effects of ambiguity on the connection the users made with Sensum Light.

Figure 20. Sensum Light in the living space (Mahsa Karimi)

5.3.4 Reflections

All five participants in this research were from the Digital Futures graduate studies at OCAD University. This research was conducted towards the end of the graduating year.

All participants had positive relaxing experience with Sensum Light. The changing lights and the sound tracks helped them become calmer and relaxed. Only one participant had engaged in practicing calm breathing. He had been doing this exercise regularly, hence he mentioned the movement of the lights naturally made him follow that rhythm to stabilize his breathing.

All participants were asked if the shape of Sensum Light reminded them of any other objects. Two of the participants associated Sensum Light to a similar meditation light they had interacted with in the past. One participant mentioned that this object reminded her of the night light she had as a child in her room. The night light symbolized safety to her in that age and this connection made her feel more comfortable and safer around Sensum Light.

All participants enjoyed the audio aspect of the prototype. All connected the sounds to a nostalgic event or place in their memories that helped them calm their minds. They believed that the audio aspect of the design worked well due to the connection it made to an already developed positive emotion of a specific sound in nature.

Three of the participants would use this object to help them fall asleep at night. One mentioned that he would only disconnect the keychain to turn off the device in the morning when he is leaving his apartment for work. Two of the participants agreed that they enjoyed how the lights animated the space they were in, though they could only see the reflections of the light while laying down, and not necessarily the actual screen on top of the object.

Although all enjoyed the simplistic shape of the box, and the fact that the interaction was limited to only two buttons, four of the participants recognized a lack of connection between the shape of the object to the characteristics of nature that the lights and the audio tracks reflected. In a setting where the participants were sitting on a cushion at the same level as the object, one participant explained how she would have appreciated if the shape of the object was more inviting so that she could also interact with the physical object while sitting in front of it.

Two out of five participants appreciated the connection between Sensum Light at home and the keychain with them throughout the day. One participant described her relationship with he keychain as followed: *"I like to keep my belongings looking as new as possible. I usually keep the protective plastic on my new devices (like my phone) till they fall off by themselves. By acknowledging the meaning behind the slogan "Embrace the first dent and celebrate the first scratch" in relation to the keychain, I was reminded that imperfections still have beauty within them. In this case, they describe how hard I have been working to embrace my mindfulness."*

One participant mentioned that she looked forward to the end of the day to interact with Sensum Light, but the keychain did not add to her experience although she carried it with her outside home.

As a form of mindfulness exercises practiced in the past, one participant had engaged in breathing exercises while three others had attended yoga classes. One of the participants had experienced using mindfulness mobile applications and mindfulness podcasts. She appreciated how her experience with Sensum Light was not through her mobile phone. She reflected how the mobile phone itself had become a source of anxiety and stress in her case that had stopped her previously to continue her engagement with the mobile mindfulness applications. She found it difficult to do meditation and mindfulness exercises in silence and appreciated that Sensum Light provided an ambient sound that took away the silence during her meditation exercises.

Although all participants had similar experiences with Sensum Light, they each interpreted the device differently. Ambiguity in context on the design of Sensum Light allowed the participants to create personal connections to the object and introduce interactions that were not described to them prior to their use. These interactions were reflections of each participant's daily habits that perhaps distinguish them from each other. One participant approached the object as a means to help him practice mindfulness. His instant interaction with the device was to perform breathing exercises. Another participant would solely use the device to help her fall asleep. Other participants enjoyed reading a book while both the audio and the lights of Sensum Light were on. Although all participants shared the calm and relaxing experience, they each had their own distinct way of interacting with the object which allowed them to experience the same emotional outcome.

Figure 21. Sensum Light - Light projection limitation of Prototype Two (Mahsa Karimi)

Based on the gatherings and observations from the interaction of the users with Sensum Light, it was evident that the shape of the object itself did not add to the quality of their experience. The shape was limiting the participants at times to fully engage with the object. Sensum Light limited the interaction of the users with the lights to only when they were standing or sitting in front of the object. As seen in Figure 21, although they still engaged with the projection of the lights onto surrounding surfaces, the shape had limited them to engage with the lighting screen on top of the object when lying down.

Based on the feedback and the gatherings from the user-testing sessions on Sensum Light, I decided to redesign the shape of Sensum Light to make it easier for the users to interact with. The simplicity of the object was appreciated by the users and the ease of interaction with it was appreciated by all participants. Accordingly, I have decided to design a form that follows the clean and clear concept of Prototype Two but in a shape that is more inviting and approachable by the users, a shape that allows the users to visually interact with the reflected lights from all angles.

5.3.5 Final Iteration

Earlier in the paper, I discussed how Sensum Light's hues of light, audio tracks, and form were chosen to reflect fluid characteristics from the natural world. For example, the audio tracks include sounds from ocean waves and wind blowing in the trees. To further this concept, I also wanted to visually represent the idea of movement through the abstract form that is Sensum Light. Sensum Light's final prototype form exists as a sphere that has been divided into many-layered sections. The form begins at the bottom and ends at the top like the rhythmic twirling of a ribbon. The misalignment of these levels reveals gaps that expose the inner contents of the object; resembling the action of peeling fruit to reveal what is hidden inside.

The form of the object visually represents an unfolding experience; however, it also embodies fluctuation and flexibility. I wanted to compliment these qualities when considering the choice of materials for Sensum Light as well. The choice of materials was also determined by how the object would then resonate with users and how that might vary depending on age, gender, and past experience with other similar mindfulness experiences.

Materials such as leather, paper, or wood can reveal wear and tear through usage over time. These changes are meant to be embraced by the user as they create the ultimate design of the object. The wear and tear in the material emphasizes the range of emotions one goes through throughout the day.

In this way, the characteristics of the object change alongside the user over time. Sensum Light, in its final form, becomes part of another process and eventually its own unique object. In traditional Japanese design, the concept of wabi-sabi describes how there is beauty in the imperfections of a designed object. I also aim to create a sense of wabi-sabi through Sensum Light where the challenging moments in life can be recognized and embraced.

Sensum's audio output has been designed so that it does not allow the user to adjust the volume. The volume is set on a fixed pitch that invites the user to disconnect from all the other distractions around them, such as their cellphones, radio, and television, to be able to hear and focus with the object. Similarly, in order for one to better interact with the light projections, they are invited to turn off all the other lights.

These choices are not forced to the user but they are suggested for a better experience with the object. In this way, Sensum Light not only becomes a component in the practice of mindfulness but in the creation of an environment that facilitates mindfulness practices, through thoughtful design considerations.
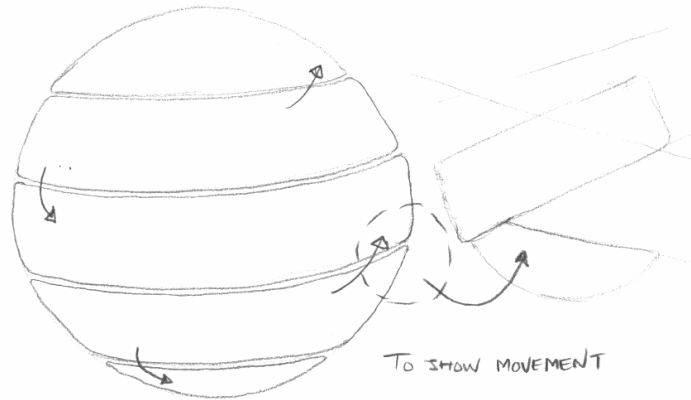
Figure 22. Sensum Light, final iteration ideation sketches (Mahsa Karimi)

This shape was 3D printed using an FDM 3D printer. FDM 3D printers create support structures enabling to print any design with steep overhangs or bridges. Since this design has a domed like top layer that arches over the object, the 3D printer is required to build support structure to print this form. In order to minimize the material used in building the support structure, I divided the design into 5 different layers that each was printed separately and glued together later. The 3D printing of this design took over 2 days.

Figure 23. The final design of Sensum Light (Mahsa Karimi)

5.3.6 Summary

As conclusion, I sum up all the gatherings and insights through the semi-structured interviews and the user-testings on the prototype and their significance on shaping the future designs.

Through the process of designing and building Sensum Light, I assumed that based on the literature review and studies on ambiguity in design, a person can create a connection to an object based on their personal preferences. The findings from the user-testing sessions indeed verified my earlier assumption. Ambiguity in context and information that was amongst main concepts in the design of Sensum Light led each individual to approach this object differently and build interactions with it that was more suitable and unique to their personal way of life.

Lastly, my initial intention in designing Sensum Light was to design a shape that fits into any lifestyle and setting, calmly inviting the user to interact with the built-in designed technological system. The feedback from the users throughout the user-testing sessions confirmed that not only did they make connections and relations with the system but also with the form of the object. This feedback from the users led me to further investigate shapes and forms that could enhance the experience of the users interacting with the object.

By "Researching through Design" I created multiple different prototypes where each prototype was user-tested on myself or selected participants from the Digital Futures cohort. The design of every prototype was influenced by the data and feedback gathered through the user-testings of the prior prototypes.

Chapter 6
CONCLUSION

In this chapter, I go over the main focus of this thesis project, and some of the limitations I faced. I also note some of the possible directions that could be taken to further investigate this research in future.

6.1 Scope and Limitation

This thesis project focuses on designing tangible objects that create an ambient environment to practice mindfulness. It explores the effectiveness of non-screen based technologies in promoting mindfulness exercises. Modern busy lifestyles could be in contradiction to one's needs to practice mindfulness and appreciate the present moment. Sensum Light aims to promote the importance of self-help in the development of emotional well-being by introducing mindful moments within the user's busy daily lifestyle. More importantly, this is a qualitative research that does not focus on any medical and psychological intervention and outcomes.

Time was one of the main limitations of this thesis project. With more time at hand, I would have liked to also gather data by user-testing of the final revised form of Sensum Light.

Another limitation to this project was the material resources available to build the final design of Sensum Light. The organic form of the final prototype was built using an FDM 3D printer. New technology has enabled 3D printing with a wide range of materials. In an ideal case with no financial constraint, and no time and material resource limitations, I would have liked to explore printing this design with paper. The aging characteristics of paper align with the choice of other materials such as leather and wood which change and grow through usage over time.

6.2 Contributions and Implications for Future Work

Due to schedule constraint, this thesis project leaves some opportunities for further iterations and future work.

Long-term experiences of mindfulness practices with Sensum Light

As the first future step, I would like to leave Sensum Light with the participants to interact with over a longer period of time. Future research needs to explore the effectiveness of Sensum Light when it is interacted with, on a more regular basis in order to explore in detail how the system would be experienced by the users beyond just examining the assumptions for the approach of the designed system.

Exploring wider range of materials

This thesis project explored two different materials, leather and wood, with the idea in mind that they reform and reshape as they are used. The focus of these material choices were more evident in the keychain piece that was carried around by the user throughout the day. In future, research could investigate the applicability of other materials in enhancing users' experience for interacting with the stationary object as well.

Extended personalized features

The future research can investigate the effects of personalized settings for sound tracks and light projections based on experience of the users. As such it can investigate to add an option for the users to extend their choices of sound tracks and light settings based on their personal preferences. This could be facilitated by a mobile application that can be integrated with Sensum Light. It is important to ensure that the integration of the mobile application does not turn into a distraction to overshadow and change the main focus of Sensum Light which is to stay away from another screen based interaction.

6.3 Conclusion

This thesis project developed a set of objects that together build an environment in which individuals can disengage from disturbances surrounding them to be enabled to focus on their emotional well-being by practicing mindfulness at the end of a busy day. The motivation behind this research was to focus on the importance of self-help in emotional well-being, and how a tangible object could help users achieve a mindful moment at home in a more optimal place and time to practice mindfulness exercises.

To understand the effects of a hybrid (tangible and digital) technology on the experience of the users practicing mindfulness, I examined research studies by therapists, as well as designers and also undertook user testing reflections through "Research through Design" methodology. I have come to the conclusion that a hybrid "Calm Technology", can enhance user's experience by providing an environment where the users could practice mindfulness exercises.

The qualitative analysis of the data conducted through the semi-structured interviews and user-testing session throughout this thesis project addressed how a hybrid (tangible and digital) object could encourage mindfulness without introducing another screen based interaction. Reflecting on Gaver et. al's approach on ambiguous design where ambiguity could be approached as an opportunity rather than problem, this thesis project was also able to show that ambiguity in context and information can lead users to create a more intimate connection and unique interaction with the designed object. Adapting "Calm technology" frame work, This thesis project explored the possibility of designing an object that "enhances humanness and retains human choice". Although Sensum Light intends to create an environment to practice mindfulness, it does not impose any specific interactions on its users. An insight from the data gathered from the participants was that stillness in the created space led them to have a calmer, mentally present and focused moment while the ambiguity of design provided them with personal choice in the usage of Sensum Light

which allowed the users to engage with the object in different ways based on their own personal preferences.

I would like to reiterate that this project does not dismiss the outcomes of medical and psychological interventions and neither replaces the needs of medical assistance. This thesis project aims to create an ambient space that prompts mindfulness practices for those people who enjoy them

The practice of mindfulness could be different in individuals, some might enjoy practicing mindfulness in a yoga studio where they challenge their physical strength and mental self while exercising, some might enjoy a stroll in the park after a long day at work, etc. Sensum aims to provide users with another platform for the practice of mindfulness at their own home.

Chapter 7
BIBLIOGRAPHY

Boundless.utoronto.ca. (2018). *How does mindfulness combat depression?*. [online] Available at: http://boundless.utoronto.ca/impact/how-does-mindfulness-combat-depression-relapse-segal/ [Accessed 27 Feb. 2018].

Brown, K. and Ryan, R. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), pp.822-848.

Dimidjian, S., & Linehan, M. M. (2008). Mindfulness practice. In W. T. O'Donohue & J. E. Fisher (Eds.), Cognitive behavior therapy: Applying empirically supported techniques in your practice (pp. 327-336). Hoboken, NJ, US: John Wiley & Sons Inc.

Frayling, C. (1994) Monograph, Research in Art and Design (Royal College of Art Research Papers, Vol 1, No 1, 1993/4) Other. Royal College of Art, London.

Gaver, W. (2012) 'What should we expect from research through design?', Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems - CHI '12, p. 937. doi: 10.1145/2207676.2208538.

Gaver, W. W., Beaver, J., & Benford, S. (2003, April). Ambiguity as a resource for design. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 233-240).

Germer, C. (2004) 'What is mindfulness?', Insight Journal, (1), pp. 24–29. doi: 10.1037/11885-001.

Germer, C. and Siegel, R. (2005). Wisdom and compassion in psychotherapy. p.130.

Goleman, D. and Davidson, R. (2017). *Altered traits*. 1st ed. New York, New York: Penguin LCC US, 2017.

Headspace. (2018). *Meditation and Mindfulness Made Simple - Headspace*. [online] Available at: https://www.headspace.com [Accessed 30 Jan. 2018].

Howells, A., Ivtzan, I. and Eiroa-Orosa, F. J. (2016) 'Putting the "app" in Happiness: A Randomised Controlled Trial of a Smartphone-Based Mindfulness Intervention to Enhance Wellbeing', Journal of Happiness Studies, 17(1), pp. 163–185. doi: 10.1007/s10902-014-9589-1.

Kaya, N. and Epps, H. H. (2004) 'Relationship between Color and Emotion: A Study of College Students', College Student J, 38(3), pp. 396–405. Available at: https://nzdis.org/projects/attachments/299/colorassociation-students.pdf.

Laurie, J. and Blandford, A. (2016) 'Making time for mindfulness', International Journal of Medical Informatics, 96, pp. 38–50. doi: 10.1016/j.ijmedinf.2016.02.010.

Logan, Z. (2018). *The Minds behind Mindful Lights*. [online] Gottesman.pressible.org. Available at: http://gottesman.pressible.org/zkl/the-minds-behind-mindful-lights [Accessed 7 Feb. 2018].

Mani, M. et al. (2015) 'Review and Evaluation of Mindfulness-Based iPhone Apps', JMIR mHealth and uHealth, 3(3), p. e82. doi: 10.2196/mhealth.4328.

Nhất Hạnh (2013). *Peace of mind*. 1st ed. Berkley, California: Parrallax Press.

Neimeyer, R. A. and Feixas, G. (1990) 'The Role of Homework and Skill Acquisiton in the Outcome of Group Cognitive Therapy for Depression', Behavior Therapy, 21, pp. 281–292. Available at: http://www.sciencedirect.com/science/article/pii/S0005789405803314.

Newman, M. G. et al. (2011) 'A review of technology-assisted self-help and minimal contact therapies for drug and alcohol abuse and smoking addiction: Is human contact necessary for therapeutic efficacy?', Clinical Psychology Review, 31(1), pp. 178–186. doi: 10.1016/j.cpr.2010.10.002.

O'Connor, Z. (2011). Colour psychology and colour therapy: Caveat emptor. Color Research & Application, 36(3), pp.229-234.

SARATH, E. (2006). Meditation, Creativity, and Consciousness: Charting Future Terrain Within Higher Education. Teachers College Record, 108(9), pp.1832.

Spire. (2018). *Spire - Live Better*. [online] Available at: https://spire.io [Accessed 30 Jan. 2018].

Stokstad, M. and Cothren, M. (2011). *Art history*. 4th ed. Upper Saddle River, NJ: Pearson/Prentice Hall, pp.1037-1038.

The Metropolitan Museum of Art, i.e. The Met Museum. (2018). *Philippe Starck | "Juicy Salif" Lemon Squeezer | The Met*. [online] Available at: https://metmuseum.org/art/collection/search/491871 [Accessed 6 Feb. 2018].

Wilber, K. (2000). *Integral psychology*. 1st ed. Boston: Shambhala.

Willard, C. and Saltzman, A. (2015). Teaching mindfulness skills to kids and teens. 1st ed. Guilford Publications, p.438 pages.

Vandewalle, G. et al. (2010) 'Spectral quality of light modulates emotional brain responses in humans', Proceedings of the National Academy of Sciences, 107(45), pp. 19549–19554. doi: 10.1073/pnas.1010180107.

Yardley, L., & Bishop, F. (2008). Mixing qualitative and quantitative methods: A pragmatic approach. *The Sage handbook of qualitative research in psychology*, 352-370

Yerbery, J. (2017) 'Please Touch: The Power of Interactive Art'.

Zimmerman, J., Forlizzi, J. and Evenson, S. (2007) 'Research Through Design as a Method for Interaction Design Research in HCI design research in HCI', pp. 493–502.

Zimmerman, J., Stolterman, E. and Forlizzi, J. (2010) 'An analysis and critique of Research through Design: towards a formalization of a research approach.', Proceedings of the 8th ACM Conference on Designing Interactive Systems (DIS '10), pp. 310–319. doi: 10.1145/1858171.1858228.

Chapter 8
Appendices

Appendix A - Semi-Structured Interview With Robyn Shaw

Full documentation of the semi-structured interview with Robyn Shaw at the OCADU Wellness Centre:

Q. How do you encourage patients to continue with their CBT exercises?

A. We introduce these exercises in a one on one session and by checking on the homework's we build the accountability for the patients to keep up with their assignments.
The idea of supportive communities are always encouraged. There are some 'mom group types' on Facebook or any social media platform that help participants keep in touch with their peers to follow through with their goals.

Q. How do you help patients over come the challenges that oppose them from doing their CBT exercises?

A. There are times that the patients need to find a way to bring their mind to a state that they can actually start doing the exercises. At times when they are going through stressful period, they cannot concentrate enough to do the exercises. In such situations these exercises could not be as effective.
Together with the patient we try to create or build a connection with an object or a something with sentimental values that can help the patient to draw their focus on a memory that could help them calm down and concentrate on themselves.

Q. How can mindfulness help a patient in their management of mental health?

A. We always encourage mindfulness exercises, they can go hand in hand with the CBT. Any activity that could help the patients concentrate in that moment, the present. Depending on the patient, these exercises could vary. Some, like Yoga, some like sketching, some like to simply clean. But these exercises encourage the participants to stop over thinking and only focus on the task they are completing.

Appendix B - Non-Directive Interview With Filipe Ligabue

Full documentation of the non-directive interview with Filipe Ligabue, Master of Design Candidate in Design for Health at OCAD University.

Q. As an industrial designer, what are some of the aesthetically design choices you consider in designing an object that aims to provide mindfulness?

A. For my undergraduate thesis at the University of Brasillia, I focused on designing an everyday object by taking inspirations from mindfulness and hypnotic practices. This project familiarized me with some concepts in hypnosis.

A hypnotherapist can suggests things that would induce the person to this mental state that is very relaxed and calm where they are very receptive to other suggestions. Although an object cannot bring a person's mindset to that receptive state, it could act as a reminder that suggests calmness and mindfulness to the user.

A technique that people use to inspire concentration is to imagine themselves in an empty room where everything is white, this creates an empty canvas for the brain, clearing out all the distractions and thoughts. An object that prompts mindfulness could take inspiration from such metaphors.

Another way of looking at this design challenge is to think about the Japanese design concept "Wabi-sabi". Wabi-sabi is a concept in design where all the imperfections in the material is very well appreciated. This approach is also interesting in designing an object with relations to human emotional state and mindfulness. Creating an object in which the imperfections are celebrated could create a platform for the user to also appreciate all imperfections within her life as well.

## Appendix C - User-testing Questionnaire

SCENARIO:

You get home from another busy day at work. You are tired. You turn on your TV and go to the kitchen to make yourself a cup of tea. Grab the cup of tea to the living room where your TV is and while watching the TV you continue siping from your tea. At times you turn on your phone to check your emails, messages, and go on social media.

In front of you on the living room table you have Sensum Light. It is almost 9 pm and soon you start getting ready to go to bed. You turn off the TV, and put your phone away. Dim the lights of the living room grab your keychain connect it to Sensum Light to turn it on.

QUESTIONS:

1. Describe your experience using this object:

2. Does Sensum Light remind you of any other object, if yes name and describe the object.

3. How do you describe the relationship with the keychain from at the beginning of the use compared to the end of the trial?

4. In the past what were the mindfulness based activities you have done and where did you do these exercises? Did Sensum make any changes in the experience of your mindfulness exercises, if yes how was it different?

5. What were your thoughts while interacting with Sensum Light and with the Keychain throughout the day?
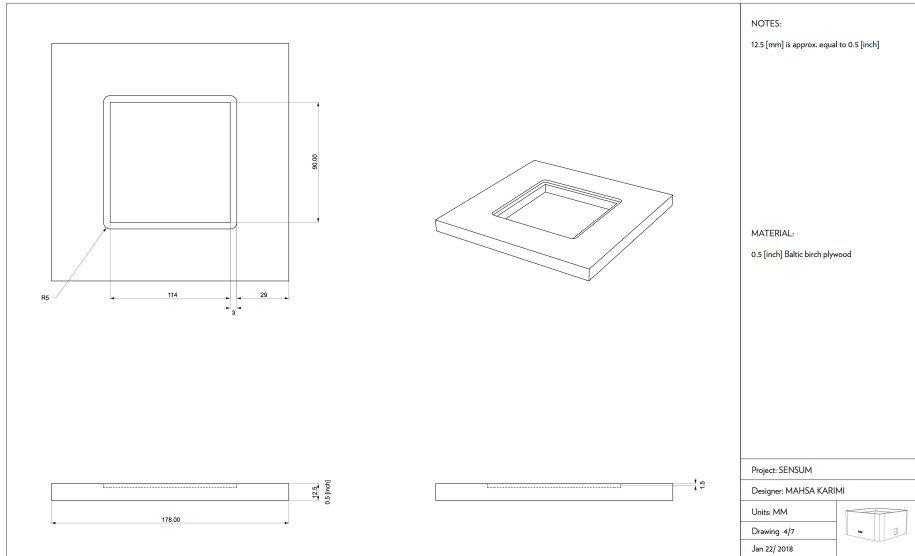
Appendix D - Technical Drawings
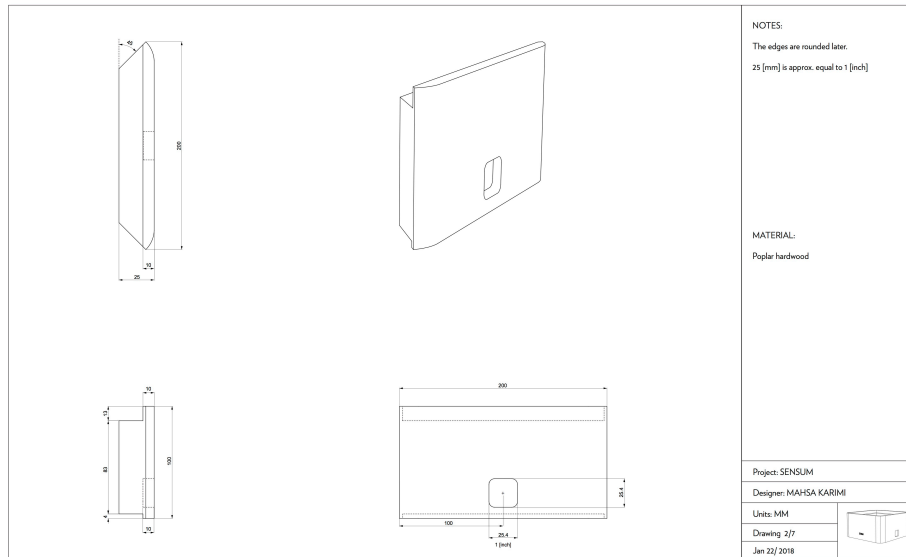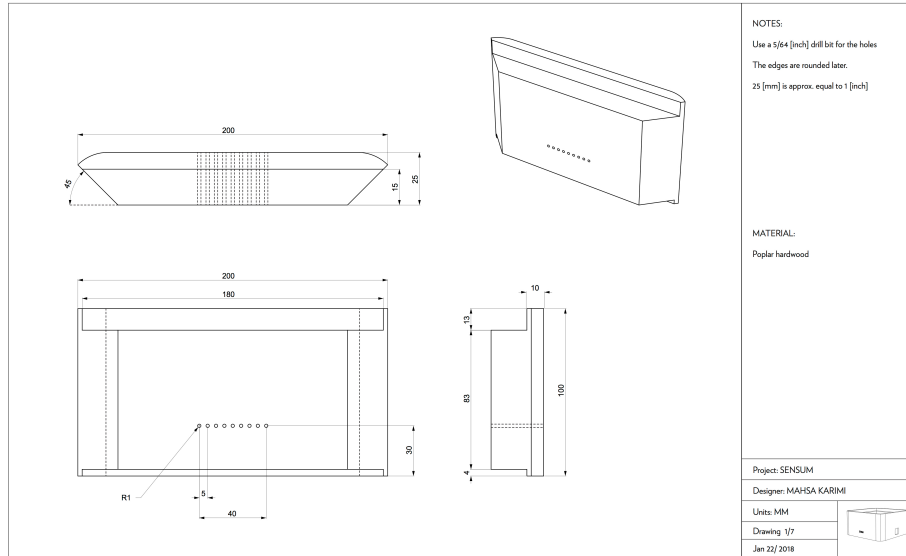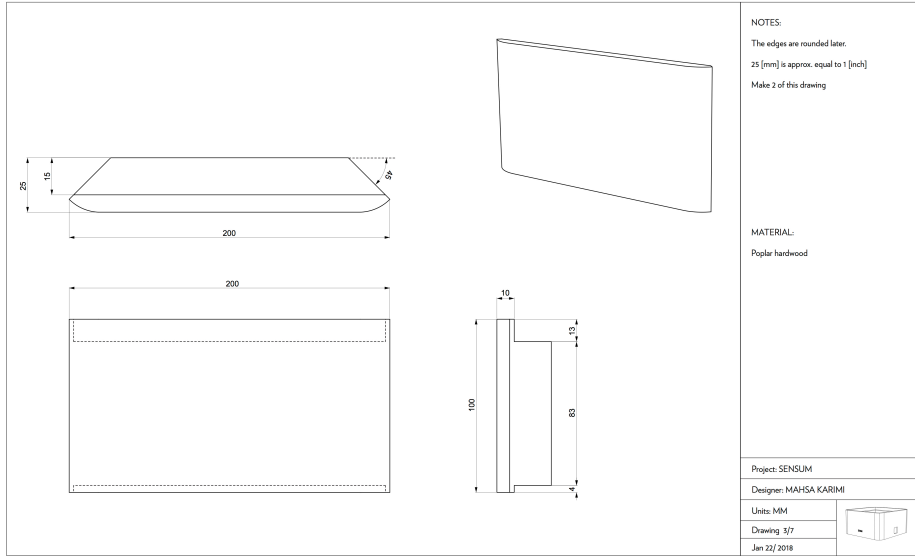
NOTES:

The edges are rounded later.

25 [mm] is approx. equal to 1 [inch]

Make 2 of this drawing

MATERIAL:

Poplar hardwood

Project: SENSUM

Designer: MAHSA KARIMI

Units: MM

Drawing 3/7

Jan 22/ 2018

NOTES:

12.5 [mm] is approx. equal to 0.5 [inch]

MATERIAL:

0.5 [inch] Baltic birch plywood

Project: SENSUM

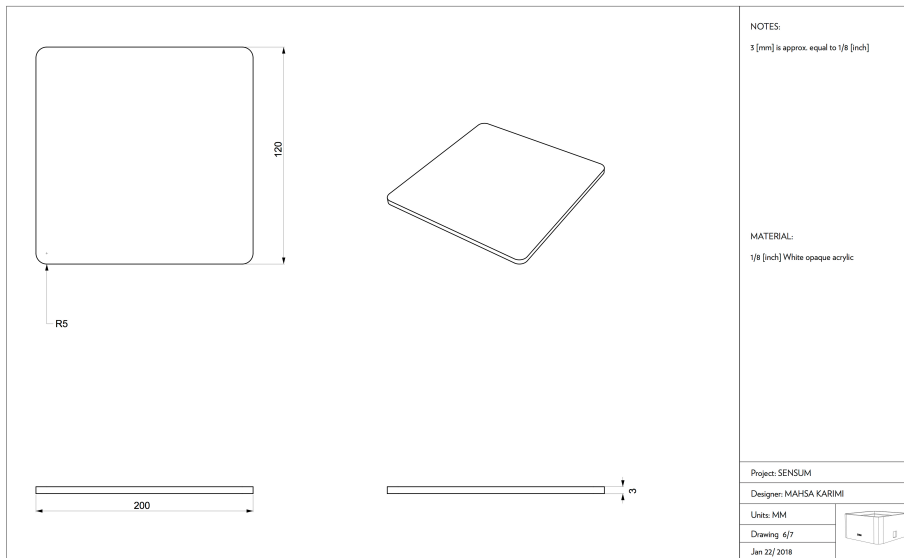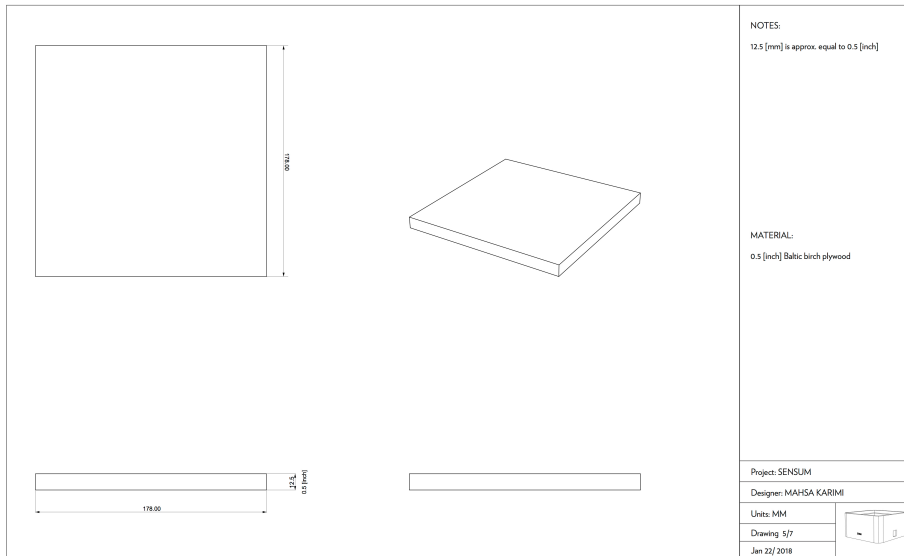Designer: MAHSA KARIMI

Units: MM

Drawing 4/7

Jan 22/ 2018

58

Figure 24. Technical drawings of Prototype Two (Mahsa Karimi)