

HAPPINESS IN YOUR HAND:  
THE POWER OF COMPACT BRIGHT LIGHT THERAPY

by

Erin Riley Cooper

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## **Author's Declaration**

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# THE POWER OF COMPACT BRIGHT LIGHT THERAPY

Master of Digital Media, 2020

E. Riley Cooper

Digital Media

Ryerson University

## **Abstract:**

Now, more than ever, it is vital that we take care of our mental wellness and harness the power of Bright Light Therapy to do so. While traditional Bright Light Therapy devices have achieved considerable success, there is a continuing need for improvement; specifically, in the accessibility of their size and portability. Through research, market analysis, and experimentation, my work investigates three questions: 1. What is Bright Light Therapy and why is it so important? 2. How do existing devices function? 3. Is it possible to create a product that addresses the current inadequacies in the market? As little as fifteen minutes of exposure to Bright Light Therapy a day has been proven to successfully treat several mental illnesses and disorders, but is not readily available. To combat this issue, I propose the creation of a mobile phone case that is a compact, portable, and rechargeable Bright Light Therapy device. I call it: The PomCom.

**Keywords:** Bright Light Therapy, non-seasonal depression, mental wellness, compact/portable bright light, bright white light, accessible solutions.

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## **Introduction:**

The benefits of Bright Light Therapy are undeniable (Kripke et al. 1983). It has been proven to decrease a person's symptoms of depression (Kripke et al. 1983), improve a person's focus (verilux.ca n.d), even help with the symptoms of what is called, "Night Eating Syndrome" (McCune et al. 2015). Whether one uses Bright Light Therapy to treat a certain affliction, or to simply elevate his/hers/their mood, *will* make a difference. When choosing to focus on the future of Bright Light Therapy, it was unknown what 2020 would hold. According to Dr. Roger McIntyre of the University of Toronto, there is "no greater assault to mental health than the circumstances we are under right now" (E. McIntyre, personal communication, April 15 2020). Studies from 2019 expected the Bright Light Therapy industry to flourish *before* Covid-19. Now, one can only imagine what the future has in store for the prospering Bright Light Therapy marketplace. Thus, alongside my research into the therapy itself, I chose to examine the prospects of what is to come in this industry, and how I can be a part of addressing the gaps in the market.

## **Background:**

In November of 2019, Professor Richard Lachman proposed to myself and my peers a project; the goal was to envision a product that could exist in ten years' time. As I appreciate indulging in Bright Light Therapy, but struggle with the size of such devices, I approached this topic from a personal, research and business perspective. While typical Bright Light Therapy devices have indeed achieved considerable success, there is a continuing need for improvement; particularly in size and portability.

There were two things I wanted to keep in mind to combat the said issues:

1. As of 2018, data showed that over 70% of Canadians owned a Smart Phone (Media in Canada 2018) meaning that it is arguably the most accessible technology.
2. The average size of an apartment is 800 sqft (rentals.ca 2020); or, about one tenth of a basketball court.

Some further questions included: What would be the best size/shape/method for Bright Light Therapy exposure? Would it be possible to attain the same benefits from Bright Light Therapy in a smaller container?

Products of Bright Light Therapy tend to be larger in size; the average height being 10.5 inches (Verilux n.d). Because of today's ever-changing lifestyle, this was particularly concerning. Take Toronto for example: A study published in 2019 by Statistics Canada, revealed that the median size of an apartment within the city was 647 sq ft (D. Wong 2019). Furthermore, it is said that the average cost of a one-bedroom apartment in Toronto's City Centre is approximately \$2,100 CAD a month. As a student, it is not uncommon to hear of people who live with a roommate in a one-bedroom apartment but divide their space with a curtain or live in a dark, windowless den. Therefore, with such a lack of space, I ask: Where are we intended to put large, standard Bright Light Therapy devices? Upon discussing this issue with my classmates, many of whom are international students and are used to year-long sun, it was unmistakable that a better solution was essential.

As of 2018, data established that over 70% of Canadians owned a Smart Phone; meaning they are easily accessible to over 25.5 million people within the country (Media in Canada 2018). I propose that the effects of depression can be alleviated by the implementation of Bright Light Therapy on one's phone. Knowing that as little as fifteen minutes can make a difference (Kripke et al. 1983), I further deliberated how I might be able to morph the smartphone and Bright Light Therapy industries.

The more I considered, the more questions came to light: What makes this type of light different from others? What type of lights are needed to create such a device? Would it be created to emit different colours? For this reason, I knew there was research to be done.

### **Literature Review:**

In 2018, a study conducted by the Blue Cross Blue Shield (BCBS) Association of America discovered that more than nine million commercially insured Americans had been diagnosed with depression (BCBS 2018; p.3). This number has indicated that depression is one of the most impactful conditions on a person's overall health (CAMH nd.); second only to accidents involving a vehicle (Statistics Canada 2019). Unfortunately, the amount of people personally affected by this disease does not appear to be decreasing. The BCBS has furthermore found that the diagnosing of individuals with depression has risen dramatically within only five years; 47% of whom were Millennials and adolescents (Generation Z) (BCBS 2018; p.6).

While mental illness does not solely affect individuals who associate with these age groups, it is especially important to consider the impact on youth as they account for much of the smartphone owner 'demographic' (Statistics Canada 2020). It is estimated that by the year 2041, approximately 535,000 Americans aged 15-24 will be suffering from this disease; a horrifying 44% increase from the already too high 300,000 youth who battle the disease today (P. Smetanin et al. 2011; p.91). If suicide accounts for 24% of all deaths among this age range within Canada (Statistics Canada 2019), there is an urgency for Bright Light Therapy to become easily accessible. For these reasons, I intend to explore the impacts Bright Light Therapy has on those living with depression alongside other mental illnesses.

In 1980, Dr. A. J. Lewy and his team at the National Institute for Mental Health documented for the first time that high frequency lights significantly increase the rate at which melatonin is released by the pineal gland in one's brain (A.J. Lewy et al. 1980). In 1981, the study was noticed by an engineer (whose name is not documented) suffering from depression, who later became the first successful patient of what is now known as Bright Light Therapy (BLT) (A.J. Lewy et al. 1982). Today, companies such as Sunnex Biotech have established a physical form of Bright Light Therapy in the shape of large blocks or alarm clocks. The aim of these lights is to simulate the effects of sunlight and therefore stimulate the activity of one's neurotransmitters and serotonin which results in the 'lifting' of one's mood (Verilux 2019). Hence, Bright Light Therapy has adopted a more colloquial name: Happy Lights.

According to one study completed in 1983 by Daniel F. Kripke, S. Craig Risch, and David Janowsky, by exposing twelve patients with depression to bright light for as little as 15 minutes, the patients' symptoms of depression decreased at overwhelming rates (Kripke et al. 1983). A further study conducted in 2008 by Klaus Martiny confirmed that the use of Bright Light Therapy in patients of non-seasonal depression significantly reduced the symptoms of depression in the majority of the 102 test subjects (K. Martiny 2008). Each study, using a test of set questions before and after the treatment, gave reason to believe that bright, white light does indeed make a difference with regards to a person's symptoms of depression.

Why *white* light, and how could I ensure that consumers of my product could fully benefit from the effects of Bright Light Therapy? As may well be known, colour and light has a history. For example, according to Edwin D. Babbitt (1878), orange light has the ability to animate one's nerves, whereas blue light is "cool and soothing to the nerves and blood" (Edwin D. Babbitt 1878; p. 67). While the human circadian system tends to be more sensitive to blue-light (Gooley et al. 2010; p.1), with recent over-exposure to this light from devices such as smart phones and tablets and the corresponding impacts (Harvard Publishing 2012), there is concern that the negatives outweigh the positives. Meanwhile, white light in such therapy is widely used, and the benefits (which include enhanced mood, improved focus, and better sleep (verilux.ca n.d)) are undeniable (Kripke et al. 1983). Yet, there is more to Bright Light Therapy than it simply being white. For example, early studies suggested the use of full-spectrum bulbs (Columbia.edu n.d.). However, research is constantly evolving, and this is no-longer the case.

What is critical, is that these devices emit a total of 10,000 Lux (or 850 lumens) (Mayo Clinic n.d.). Those who practice this therapy can also choose to use dimmer devices but may either require longer sessions (Mayo Clinic n.d.), or may find that there is more of a placebo affect than truly reaping the benefits (Volz et al. 1990; p.15). As Lux is defined by one lumen per square meter (Rapid Tables n.d), the challenge was now to create a gadget that could equal in power what already existed, but in a portable and compact manner.

### **The Product:**

In order to combat the current absence of accessible and portable Bright Light Therapy devices, I created a product which houses bright, white lights in the form of a mobile device case. The housing itself consists of three parts: A flexible case that holds the phone, a translucent covering over the lights, and a final back to the case that makes it so the lights are not always visible. The electrical components consist of 51 SK6812 WWA LED Lights (cool white (6,000-7,000K) warm white (2700-32000k) and amber light (1800k-2000k), a microcontroller (programmed solely to use the cool and warm white lights with no amber light), and wires to connect said lights. The final component is a power bank which, when plugged into the microcontroller, gives the device its power. Through the use of state-of-the-art 3D technology, the product is no bigger than a typical, tough phone case.

The following is a detailed description of what the PomCom consists of from a technical perspective:

1. A bright light therapy mobile device case in three pieces, comprising the first piece/cavity wherein a 10,000 Lux arrangement of lights is attached to the back and connected to a micro-controller, all with a translucent shield overtop, the shield being glued to the first piece/cavity at the bottom and top allowing its sides to be snapped onto by a back cover.
2. The arrangement of 10,000 Lux of lights recited in claim 1 wherein said arrangement is connected to a micro-controller.
3. The arrangement of 10,000 Lux of lights recited in claim 1 whereby they are configured so as to connect and fit within the surface area of the first piece/cavity.
4. The first piece/cavity recited in claim 1 modeled and manufactured in a fashion that allows the arrangement of construction in claim 1.
5. The back cover recited in claim 1 modeled and manufactured to which the shield attaches by snapping on.
6. The translucent shield recited in claim 1 modeled and manufactured in a fashion such the claimed arrangement of lights stays attached to the back, allowing its sides to be snapped onto by a back cover.
7. The translucent shield recited in claim 1 modeled and manufactured in a fashion that is translucent, so as to enable the entire arrangement of 10,000 Lux of lights to radiate unabated.

8. The back cover recited in claim 1 modeled and manufactured in a fashion that attaches to the shield;
9. The back cover recited in claim 1 modeled and manufactured in a fashion that, when attached, it appears and acts as an extension to the first piece/cavity when attached.
10. The first piece/cavity and the back cover recited in claim 1 each modeled and manufactured in a fashion that it allows replacement by different coloured pieces, providing a different visual effect, without abating the radiance.
11. The micro-controller recited in claim 1 programmed to ensure the entire arrangement of 10,000 Lux of lights radiates unabated.
12. The micro-controller recited in claim 1 programmed so that the entire arrangement of 10,000 Lux of lights emits pure white light.
13. The micro-controller recited in claim 1 programmed whereby the entire arrangement of 10,000 Lux of lights radiates consistently.

The PomCom is the first of its kind in the Bright Light Therapy industry. As previously mentioned, the average height of current Bright Light Therapy devices is 10.5 inches. In addition, by powering the PomCom with either a circuit within, or an external powerbank, it is furthermore, to my knowledge, the first rechargeable method of attaining Bright Light Therapy within Canada. By ensuring the device functioned with 10,000 Lux of lights, unabated, programming it to emit pure white light, and taking the square footage into account, the research attests that this will indeed ensure users benefit from the PomCom the same way they

would from traditional Bright Light Therapy devices. To recap, some benefits include: Enhanced mood, improved focus, and better sleep (verilux.ca n.d). Hence the name, PomCom.

While not immediately obvious when reading the name in an academic format, PomCom is a play on the words “palm” and “calm”. From a business standpoint, when written as I have chosen to, it has a certain ring to it and maintains an obvious pronunciation. There are two phrases that capture the essence of the PomCom: “Well In Hand” and “Happiness In Your Hand”. It was therefore important to me that the name capture the feeling of the product, and reflect the fact that the PomCom is the first Bright Light therapy device that you can hold in the palm of your hand.

### **Methodology:**

The goal of the project, presented by Professor Richard Lachman, that inspired this product was to imagine what could exist in ten years’ time and would make a difference on society. In the past, I have relied heavily on my Bright Light Therapy alarm clock when I needed a boost. However, I have found the devices that currently exist such as the large blocks, or even my trusty alarm clock were often too big for a modern apartment; many of which have no outdoor spaces or windows. So, I began to consider how that issue could be solved. Perhaps a picture frame with the lights within... Or, maybe Bright Light Therapy that is attached to one’s phone.

The first iteration of my project proposed the lights be within the screen. However, this would be sure to present several challenges: 1. For the lights to be placed within/underneath

the screen, one would either have to create the phone from scratch or rely heavily on the partnership of a pre-existing smartphone manufacturer.

2. The cost of this process and therefore the marketplace price would make it difficult to sell. 3.

There would be a chance that the Bright Light Therapy would clash with the lights of the phone screen and reverse or impede upon the benefits. So, came the idea of making a phone case; compact, portable, and potentially rechargeable Bright Light Therapy.

With the idea of creating a phone case in mind, the main focus was the process. Would it be possible to attain the 10,000 Lux with such small surface area? How was the case going to be made? How would it be powered?

The most important aspect to creating the prototype for my Bright Light Therapy phone case was ensuring that attaining the lights at the required Lux was possible. For the first iteration of my device (when the lights were within the screen), I had used LED lights not knowing about the required Lux. However, using such lights was where the journey began and helped me figure out how I could attain 10,000 Lux. 60 5050 SMD LEDs in one meter are said to output up to 1,000 lumens per one metre (InStyle LED n.d.). As  $\text{lux} = \text{lumens}/\text{m}^2$ , and I a) had to acquire 10,000 Lux and b) needed to cover  $0.085\text{m}^2$ , I learned that I needed 850 lumens or 51 LEDs.

When buying pre-made LED strips, one will find that there are two popular options for lights per metre: 30 or 60. Seeing as a phone case covers such small surface area, these

selections added thickness that I did not want. Thus, I discovered the Jercio WWA SK6812 144pixels/LEDs; made up of 5050 LED chips. With less space between the lights *and* the make of the lights being based upon white light rather than popular RGB lighting, these lights would both be able to attain 10,000 lux, and fit into the space requirement. After soldering the 51 lights together in the phone case fitting pattern, power was now the main issue.

There are two options to power such lights: Through an embedded circuit, or through an external 5,000 milliamp/hour power bank. Given current circumstances and the lack of accessible resources, the power bank was the clear winner; and it would still ensure that the lights could be deemed rechargeable. However, in order to link the lights to the power source, I needed to program a microcontroller to emit the lights to their fullest potential.

The chosen lights for this product were created with three types of white light: Cool white, warm white, and amber light. With the SK6812 LED lights, there is the option to program these lights as separate entities to different levels. As previously mentioned, in order to reap the full benefits of Bright Light Therapy, it is vital that the light is as pure white as possible. Therefore, I chose to program the cool white and the warm white to their highest potentials and turn the amber light off entirely. With the 5,000 milliamps from the power bank connected to the lights and the pure white light programmed to be emitted, the electrical portions were complete.

The final component to creating this device was the physical mobile phone case through 3D modeling and printing. By disassembling several phone cases with special features, I learned that I wanted there to be a thin, translucent layer over the lights, and that I did not want the lights to be seen at all times. The modeling and printing process would then consist of three layers: A case to hold the phone within, a translucent layer that could protect the lights without limiting their exposure, and a back case that would either click or slide on. Creating these objects was a process because I had never 3D modeled before, and quickly learned that there are different types of filament; some more flexible than others. Ultimately, I chose to use TPU filament for all but the translucent shield. Once put together, the aforementioned PomCom was created and it was as easy to hold in one's hand as a typical phone case.

## **Business Analysis**

### **Problem & Solution**

A recent study indicated that within just one decade, symptoms of depression in young millennials have increased from 9% to 15% and the probability of symptoms increasing appear unyielding (BCBS n.d.). These statistics will only be amplified by current events. As stated by the Mental Health Commission of Canada, "in times of high anxiety and stress, it's more important than ever to safeguard your mental wellness" (Mental Health Commission of Canada 2020).

To reiterate, in order to combat the aforementioned issues of size and portability in traditional Bright Light Therapy devices, I propose the creation of a mobile phone case that is a compact, portable, and rechargeable Bright Light Therapy device (Patent Pending) called the PomCom.

## **Market**

Our two-sided market includes people living with a mental illness that can benefit from Bright Light Therapy or those who simply want to ‘boost’ their moods as well as Smart Phone users. According to the Canadian Mental Health Association, it is expected that by the age of 40, almost 19,000,000 Canadians will be living with a mental illness (CMHA 2020). Furthermore, in 2018, the “global mobile phone protective case market” had a value of \$28.6 Billion CAD. While initial launches intend to be within Canada, there is potential to also make use of the global market.

## **Key Stakeholders**

Those with mental illnesses that can benefit from the use of Bright Light Therapy – Customers.

Smart phone users – Customers.

Others within the Bright Light Therapy Industry – Channel Partners

Mental Wellness Professionals – Channel Partners

Social Media Influencers – Channel Partners

## **Business Model**

Adopting a manufacturing model for customers on both sides of the market who either use a smartphone or Bright Light Therapy, PomCom will sell the product to customers and distribute to any participating channel partners.

## **Competitive Analysis**

The PomCom will be the first Bright Light Therapy mobile device case to address the issues of accessibility and portability. Currently there are manufacturers in both the mobile phone case and Bright Light Therapy industries who make their respective products, but no company has created a product that brings the two industries together. Traditional methods of Bright Light Therapy are indeed used by similar customers but are limited by their size and their need to be plugged into a wall.

## **Technology, IP, Risks**

The PomCom has been created as a three-piece phone case to accommodate the needs of the 10,000 Lux arrangement of lights. Some of the components were made and modeled from scratch, while others existed and were programmed and organized to meet the needs of the product. The details of the product have been submitted to the Government of Canada and therefore the status of the PomCom is “Patent Pending”.

A key risk when creating this product is that it is a new method of being exposed to Bright Light Therapy and therefore people do not trust it. To mitigate this risk, we have taken the research of many trusted professionals in the industry (medical and otherwise) and have ensured that the requirements for one to benefit from this therapy have been sufficiently attained. If these risks occur, we intend to re-evaluate our communication a marketing development strategy and, if necessary, proceed with further validation.

**Findings/Results:**

Upon deciding to focus my research on the future of the Bright Light Therapy industry and how to fill the gap in the market, I truly did not know if creating a device that was compact, and accessible would be possible. Research has proven that there are three vital aspects to consider when creating a Bright Light Therapy device: That the light attains 10,000 Lux unabated (Mayo Clinic n.d.). that the light emitted is a pure white light, and that when trying to attain the 10,000 Lux, the square footage of the surface area was considered. Through many thorough calculations, and much experimentation, I was indeed able to meet the requirements of Bright Light Therapy.

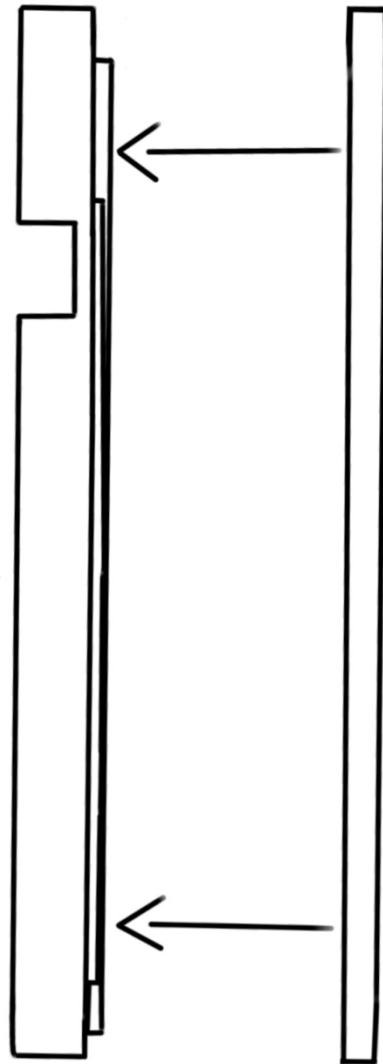
**Conclusion:**

It is expected that by the year of 2025, the Bright Light Therapy industry will hit a market value of \$1 billion USD (Globa lNewswire 2019). Traditional Bright Light Therapy devices have proven successful, but their size and lack of portability continue to be an issue. With current events, it is vital that such a beneficial therapy, or method of simply boosting your mood, can be accessed by anyone anywhere. Bright Light Therapy can indeed decrease a person's symptoms of depression (Kripke et al. 1983) particularly when emitted through pure white light (Edwin D. Babbitt 1878; p. 67). Through modern 3D modelling technology, as well as by arranging and programming existing technology, I have found a way that ensures one can reap the full benefits of Bright Light Therapy while also addressing the gaps in the market. I have created a Bright Light Therapy device in the form of a mobile phone case; I give you, the PomCom.

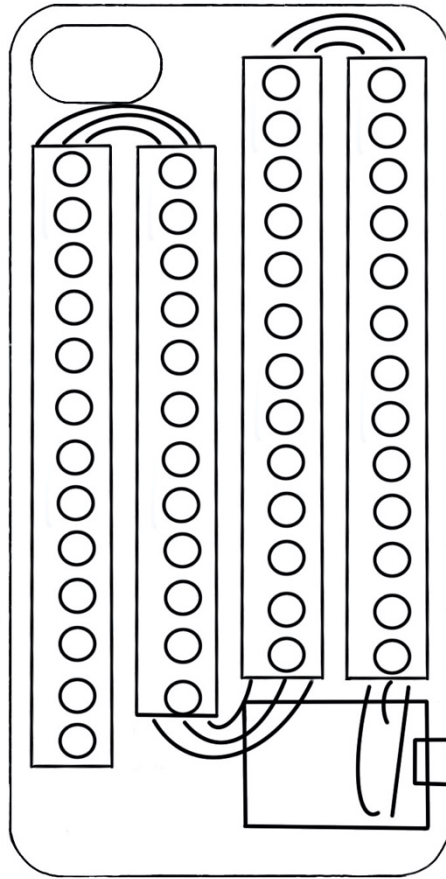
**Summary:**

The aims of this project were to examine the industry of Bright Light Therapy, analyze how it can be further put to use, and to fill the existing gaps in the market; particularly in size and portability. While traditional Bright Light Therapy devices have shown significant success, and are expected to become a \$1 billion industry as of 2025 (Global Newswire 2019), there is still ample room for improvement. The initial assignment that inspired the examination of these areas asked that we consider what could exist in ten years' time that would simultaneously have an impact on society. Now, I have brought this 'artifact of the future' to present times and have created a mobile phone case that also acts as a Bright Light Therapy device. I call it, the PomCom. By using state of the art 3D technology, WWA LED lights in an arrangement of 10,000 Lux, and a programmed microcontroller to maintain the white light, the PomCom fills the gaps in the market and has the added benefit of being rechargeable. Now, more than ever, it is vital that everyone has the option of accessing Bright Light Therapy from anywhere. My product ensures that this is possible.

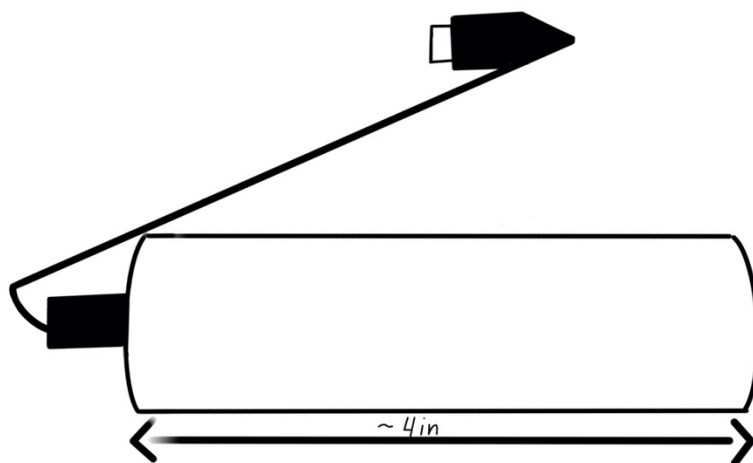
## Appendix A – Illustrated Components of Product



*Figure A-1.* Illustrated Components of Product. This illustration depicts the three parts of the mobile device case: The front piece/cavity, the translucent shield, and the back cover which snaps on.

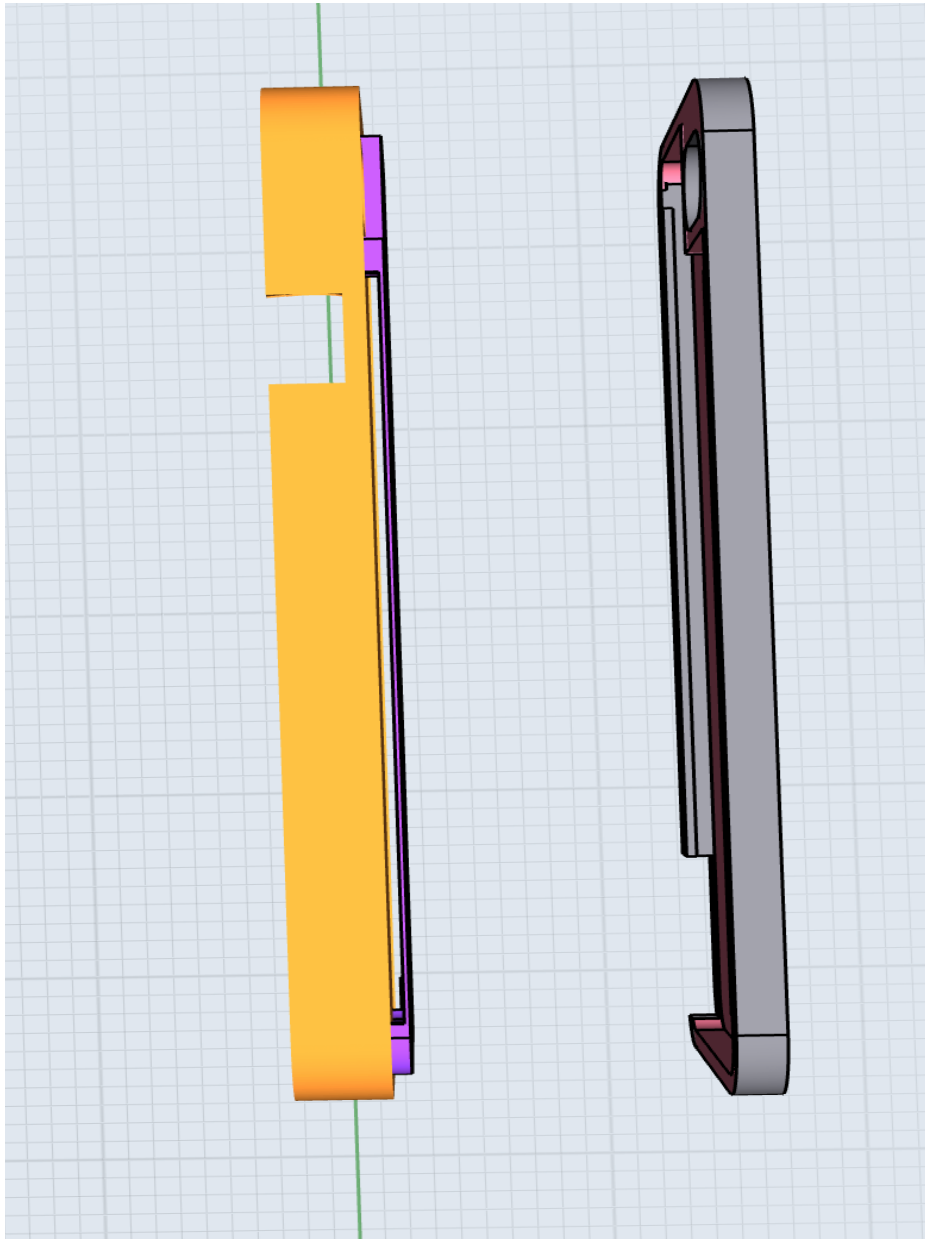


*Figure A-2.* Illustrated Components of Product. This illustration depicts how the 51 lights look on the front piece/cavity alongside the microcontroller.



*Figure A-3.* Illustrated Components of Product. This illustration depicts how an external power bank may look.

## Appendix B – 3D Models of Three-Piece Case



*Figure B-1.* 3D Models of Three-Piece Case. This image is a screenshot from the 3D modelling software used to create the product, it depicts the three pieces of the phone case, much like Figure A-1.

## Appendix C – Images Throughout the Soldering Process



*Figure C-1.* Images Throughout the Soldering Process. This image shows the beginnings of the lighting component. There were only two strands soldered together and connected to the microcontroller and power bank.



*Figure C-2. Images Throughout the Soldering Process. This image portrays the 51 lights soldered together and placed on the back of my phone case to ensure the arrangement fits the surface area.*

# Appendix D – Calculations to Ensure Lux

Square inches:  $5.44(l) \cdot 2.64(w)$   
 $1 \text{ inch} = 0.0833 \text{ ft}$   
 $l = 5.44 \cdot 0.0833 = 0.45 \text{ ft} = 0.137$   
 $w = 2.64 \cdot 0.0833 = 0.22 \text{ ft} = 0.067$   
 $\text{ft}^2 = 0.099 \quad \text{m}^2 = 0.03$   
 - camera portion:  $(1.38" \times 0.79")$  feet  
 $1.38" \times 0.0833 = 0.115'$     $0.79" \times 0.0833 = 0.066'$   
 $C = 0.115 \cdot 0.066 \quad C = 0.0076$   
 $0.099 - 0.0076$   
 $\text{ft}^2 - \text{camera} = 0.091$   
 $\text{m}^2 = 0.091 \div 10.764$   
 $\text{m}^2 = 0.0085$   
 $\text{lusc} = \text{lumens} / \text{m}^2$   
 $10,000 = \text{lumens} / 0.085$   
 $\text{lumens} = 10,000 \cdot 0.085$   
 $\text{lumens} = 850$   
 # of lights needed  
 $\frac{\text{lumens}}{\text{m}} \quad \frac{850}{500} = m$   
 $m = 1.7$   
 # of lights needed  
 $30 \text{ in } 1 \text{ m} = 500 \text{ lumens}$   
 $x \text{ in } 1.7 \text{ m} = 850 \text{ lumens}$   
 $30 \times 1.7 = 51 \text{ lights}$

Figure D-1. Calculations to Ensure Lux. These calculations were completed to ensure that the essential Lux could be attained on the surface area of a smartphone; iPhone 7 in this case.

## Appendix E – Photos of Final MVP



*Figure E-1.* Photos of Final MVP. This image shows the final MVP with the back cover, and brand associated vinyl on top alongside the final MVP without the back cover and with lights displayed.

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