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Drift

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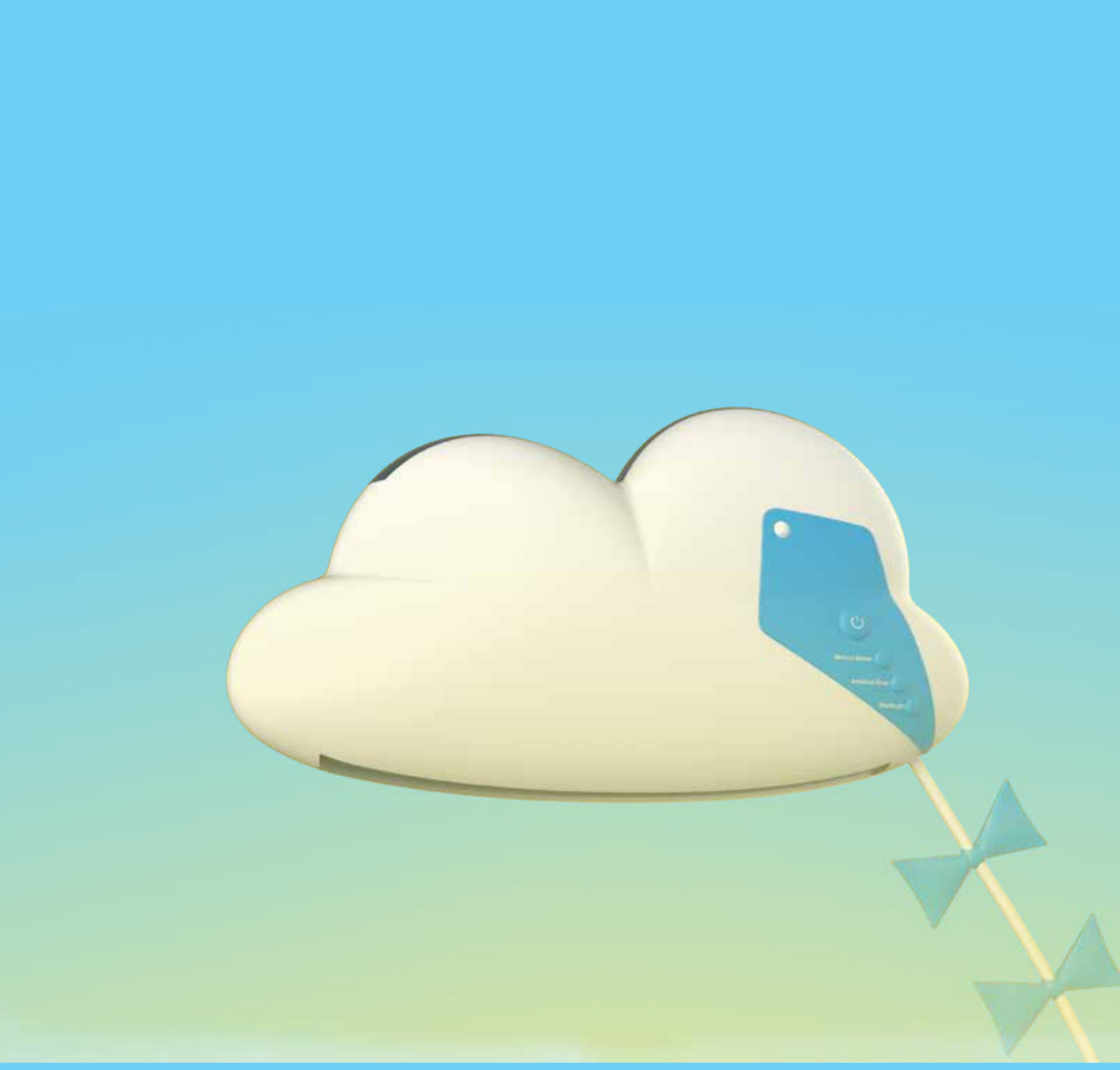


Project Overview

"I was having a tough time adjusting to having a newborn. The sleep deprivation had to be the worst... I wish there was an easier way to help my child to sleep through the night."

-Mother of a 9 month old

Every parent knows the stress of the frequent wake ups and sleepless nights when raising a newborn, because when baby isn't sleeping neither can the parents! This stress drives parents to pay infant sleep psychologists to help establish a sleep training routine to help their child fall asleep and sleep through the night..

Shouldn't there be a product that helps parents easily establish a sleep schedule and routine with their child without lifting a finger? A routine established without the need to pay sleep psychologists hundreds of dollars or to struggle through sleep training techniques that can result in parent dependency or a screaming child that still refuses to go to sleep?

enter

DRIFT

***DRIFT* uses active circadian lighting to help establish a sleep routine with children from their first night in the crib until they are sleeping through the night, every night.** Active circadian lighting helps children establish a physiological sleep routine by mimicking the patterns of the sun and a natural, 24 hour circadian light/dark cycle. This lighting environment also helps children more quickly develop their circadian rhythm giving them the ability to sleep through the night at a younger age.

DRIFT* and its connected smart phone app allows parents to easily monitor and adjust their child's sleep training schedule.** The app allows parents to track their child's sleep so they can stay on track with their sleep training regimen. Additionally, parents can sync the location of their ***DRIFT so it rises and sets perfectly in sync with the sun anywhere in the world.

***DRIFT*, because when baby is sleeping, parents can too!**

Research

Pages 6-21

Infants & Sleep

Infants Need Sleep, and a Lot of It

One of the most crucial aspects of infantile development is sleep. Parents know how cranky a baby is when tired and how happy they can be when well rested. But there are more fundamental benefits to infantile sleep than just mood.

A good nights sleep for an infant also means:

- development of healthy sleep patterns
- proper brain function
- cognitive development
- healthy growth
- a stronger, healthier immune system
- better overall behavior

Parents Losing Sleep

Sleep is Precious for Parent & Child

Every parent understands that sleep deprivation is part of raising a newborn. Infants often wake up and rarely sleep through the night. This causing parents to get out of bed multiple times a night.

of parents agree that the ***loss of sleep*** is one of the most stressful parts of raising a newborn.

of parents with children aged less than 24 months will get no more than ***3 1/4*** hours of sleep a night.

of sleep debt is accrued by parents over the first ***6 months*** of a newborns life.

Parents & Sleep Training

Its a Struggle

When their child has trouble falling asleep and staying asleep through the night parents turn to infant sleep specialists and sleep psychologists to establish a sleep training routine. These sleep experts all recommend the same thing: **a sleep schedule with repetition.**

While daytime naps are important, especially for newborns, night time sleep is the most crucial for healthy development. Experts say that around the age of six months children should start to sleep less during the day and for longer periods overnight.

This transition can be tough on both the child and the parent. The sixth month mark and the transition from daytime naps to overnight sleeping is when most parents turn to infant sleep experts and sleep training techniques to ease the transition from one sleep schedule to another. However, infantile sleep specialists can be expensive and cost anywhere between 45$ and 80 dollars an hour so some parents resort to sleep training methods and try to work through it on their own.

Common Sleep Training Methods

They're Difficult

Co-Sleeping

Sleeping in the same room as your child, often times in the same bed.

-Can lead to dependency on parental presence to sleep.

The Chair

Sitting in a chair near the crib until the child falls asleep. The chair is slowly moved farther from the crib night after night from the crib until out of the room.

-Can be uncomfortable and tiring for parents.

Pick Up Put Down

Picking up a child and rocking them back to sleep before putting them back into the crib.

-Leads to the parent getting up and out of bed multiple times.

Cry it Out

Letting the child 'cry it out' and fall back asleep on their own.

-Can be stressful for the child and parent and be inefficient.

Establishing a Network

I knew early on that I needed to reach out to an infantile sleep specialist first hand to find out why parents resort to this option in the first place and what exactly parents are seeking from this interaction. I got in touch with Alexis Dubief of Precious Little Sleep to do just that.

Alexis is the author of the book Precious Little Sleep that is filled with tips and trick on sleep training as well as first hand stories from Alexis when she was raising her own two children. Since the release of this book, Alexis has become very popular among sleep training parents. Precious Little Sleep is now also an online parenting blog and a Facebook page with over 45,000 active members and counting.

When making contact with Alexis, I was also granted permission to contact parents on the Precious Little Sleep Facebook group in regards to my project to get feedback on surveys, and design decisions to move my project forward.

PRECIOUS LITTLE SLEEP

Alexis Dubief

Infant Sleep Specialist,
Author/Owner of Precious Little Sleep

“When sleep training, establishing a schedule and a consistent rhythm or routine is always the most important first step.”

Key Realization: *Utilizing Circadian Lighting*

Circadian Rhythm

Keeping in Cycle

Circadian rhythm, or your "internal body clock", is a cycle that tells our bodies when to sleep, and when to rise. Your circadian rhythm works best when you have regular sleep habits, like going to bed at night and waking up in the morning around the same times from day to day.

Biological clocks are also affected by signals from the environment – primarily light and darkness. When there is less light, such as after sunset, the light sensors behind your eyes direct the brain to produce more melatonin, a hormone that makes you sleepy. In this way, the master clock directs our sleep-wake cycles.

in the nursery to drive schedule and routine!

Circadian Lighting

12AM-3AM
0 K (No Light)

9PM-12AM
3000~2000 K

3AM-6AM
0 K (No Light)

6PM-9PM
4000~3000 K

6AM-9AM
2500~4000 K

3PM-6PM
5500~4000 K

9AM-12PM
4000~6000 K

12PM-3PM
6000~5500 K

Applying Rhythm to Artificial Lighting

Circadian lighting is a dynamic light source that mimics the rhythm of the sun's light and dark cycles in both intensity and color temperature.

As the day progresses, light will slowly shift from a warm, dim 3000 Kelvin at dawn to a cool, bright 6000 Kelvin when the sun peaks in the sky. Then it will drift slowly down to 2000 kelvin at dusk until it gently fades to darkness.

Infants Developing Rhythm

It Takes Time

Around 6 months of age, infants circadian rhythm is developed enough that they will be able to sleep through the night on a regular basis. Daytime naps, irregular feeding schedules, and light can all effect a child's rhythm and their ability to sleep through the night.

The time your child sleeps is just as important as how long your child sleeps. Healthy sleep means the right amount of sleep, at the right time of day. When a child sleeps in synch with their circadian rhythm they are able to get the most restorative, best quality and more healthy sleep.

Parent Testimonials

"When my daughter hit the 10-month mark, I was so sleep deprived I could barely remember my own name. I was spending an average of 8 hours a day rocking her to sleep..."

-Parent of a 10 month old

"My son never slept more than two hour at a time. Every day I got up completely exhausted from the night before and could barely function during the day..."

-Parent of a 6 month old

"I hit my wall when my husband and I were fighting in the middle of the night because we were both so mentally and physically exhausted."

-Parent of a 15 month old

Parents Understand the Struggle

"I tried sleep training when my son was 8 months old and it was horrible. I researched all the sleep training methods before, had bought books on the subject and even attended a sleep training consultation – whose method sounded so terrible to me that I just decided to not even try it.

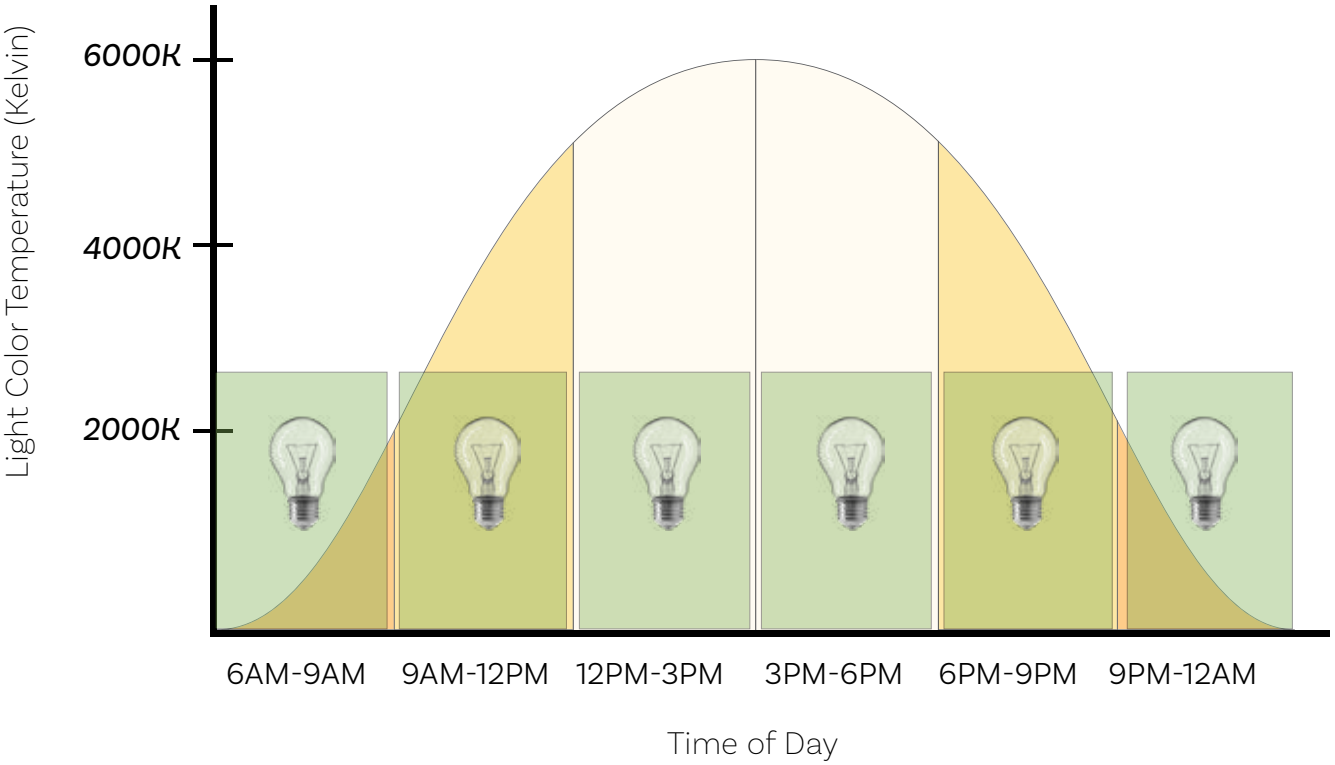
-Parent of am 11 month old

"My husband usually carries our daughter around on his shoulder until she falls asleep. If he's not around, we're all doomed."

-Parent of a 16 month old

Incandescent Night Lights

Circadian Lighting vs. Incandescent Lighting



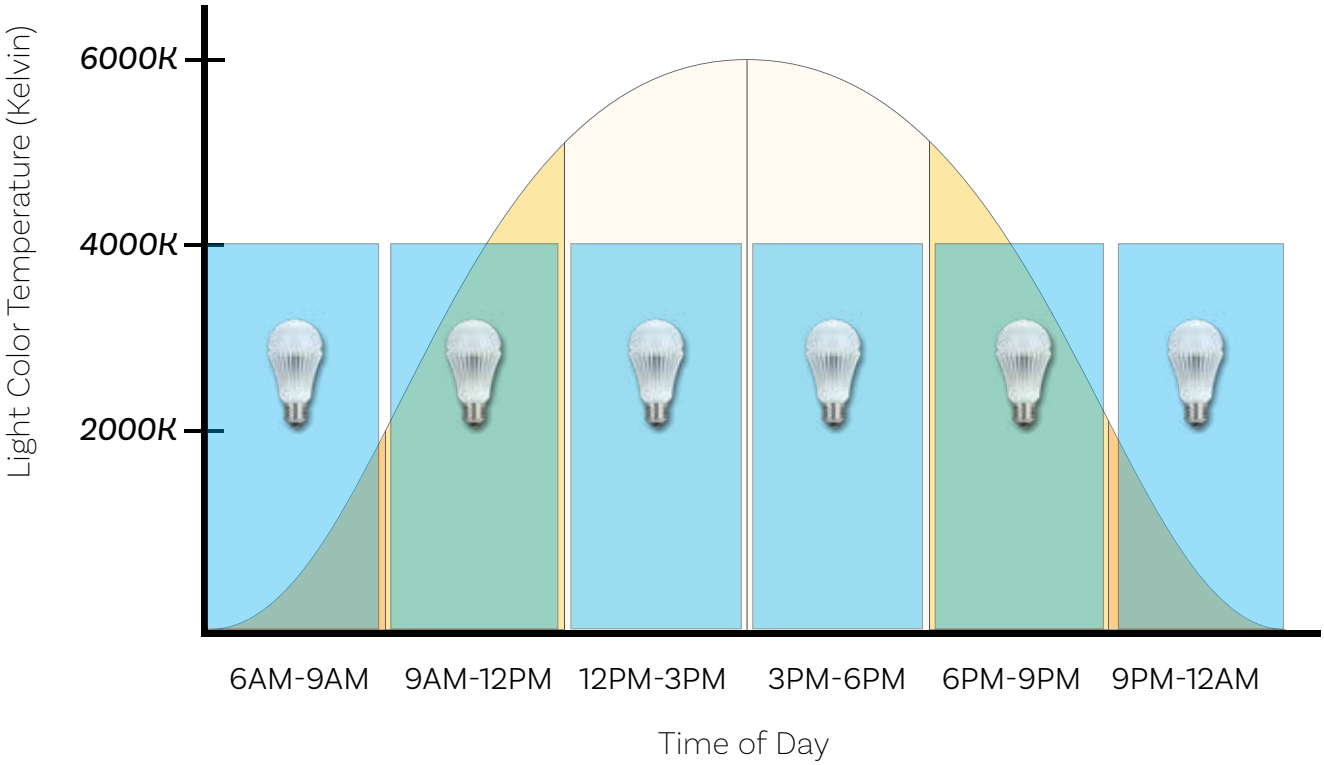
Static vs. Dynamic

Incandescent bulbs typically fall between 2400-2700 Kelvin however, the 2400 Kelvin bulb is the most common.

The artificial incandescent light is producing 2400K light that is causing your body to produce melatonin which can make baby sleepy during the mid afternoon and lead to more daytime naps that can interrupt a normal sleep schedule.

Traditional LED Night Lights

Circadian Lighting vs. LED Lighting

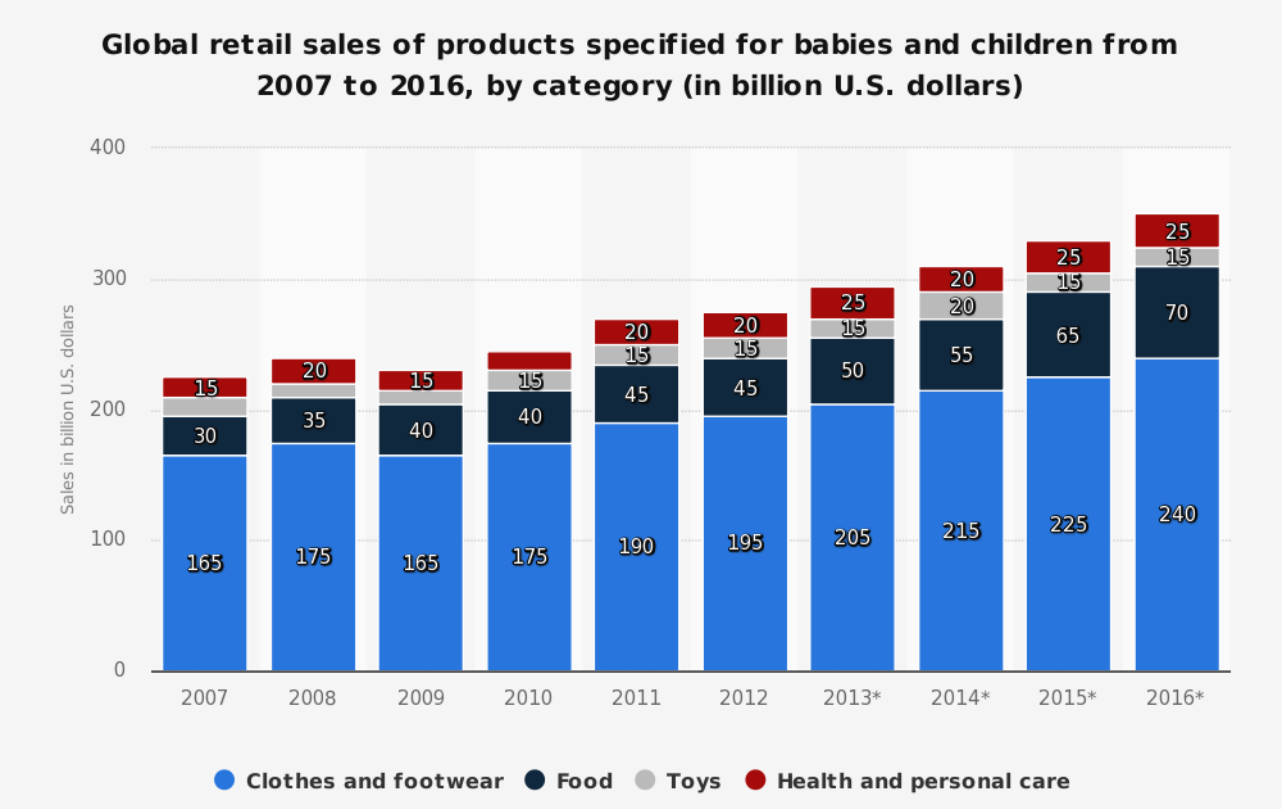


Static vs. Dynamic

LED's can range in color temperature from 3500-5500 Kelvin, but most LED's used in children's night lights are about 4000 Kelvin.

The artificial LED light is producing light at 4000K which is telling babies body to inhibit the production of melatonin. This can cause problems falling asleep and staying asleep as well as potentially causing more frequent night time wake ups.

State of the Market



Babies Are Expensive $ $ $

Baby care is a ***$10.3 Billion global market.***

The average middle-income family will spend roughly ***$12,000*** on child-related expenses in their baby's first year of life.

The trend in the market shows that ***parents are spending more money*** on products for their child than ever before.

Products that are intended for the child's well being accounts for more than ***$2.5 billion being spent in the United States*** in 2016 alone.

A Flooded Market

Traditional Night Lights

Projectors/Toys

Dimmable/Adjustable Night Lights

Market Opportunity

Active Circadian Lighting Product

Design Criteria

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1. *Encourage baby to sleep through the night at a younger age.*

2. *Get parents their sleep back!*

3. *Help parents know when and how long their child should be sleeping.*

4. *Provide way finding light for parents in the nursery.*

5. *Illuminate the nursery to standardized light levels without supplemental lighting.*

Design Development

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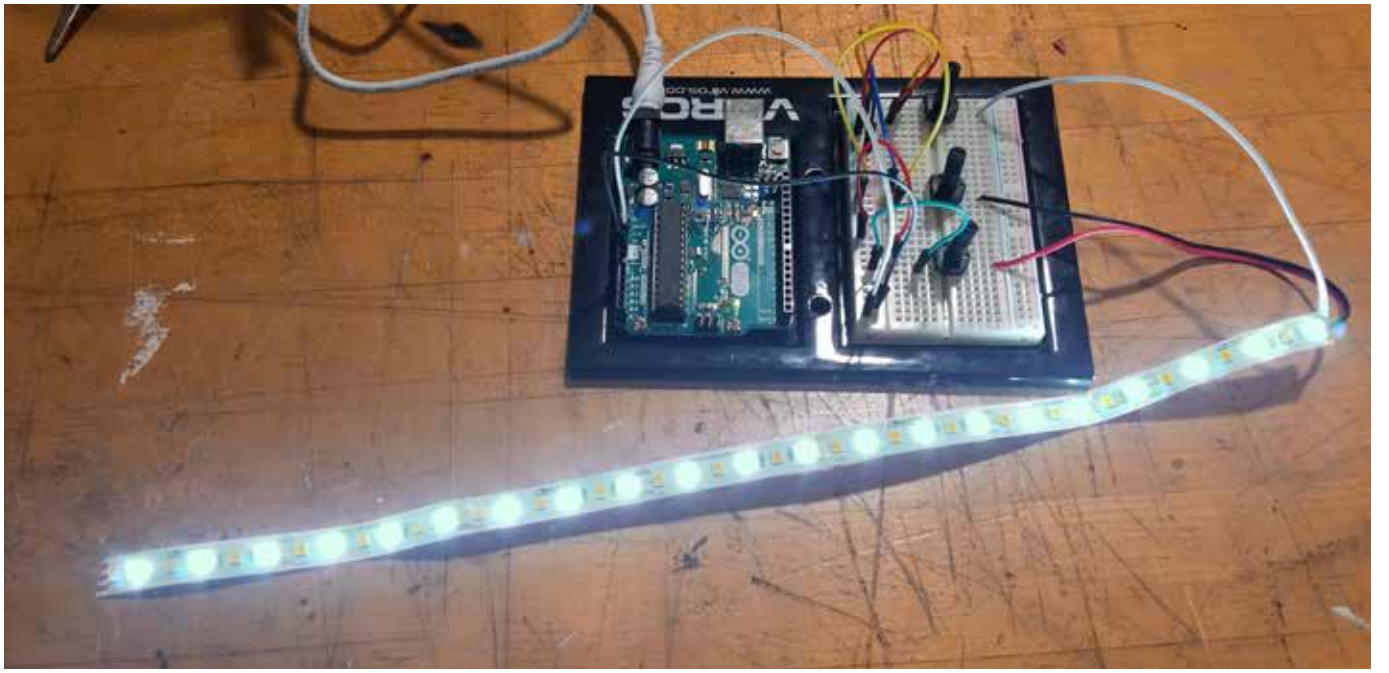
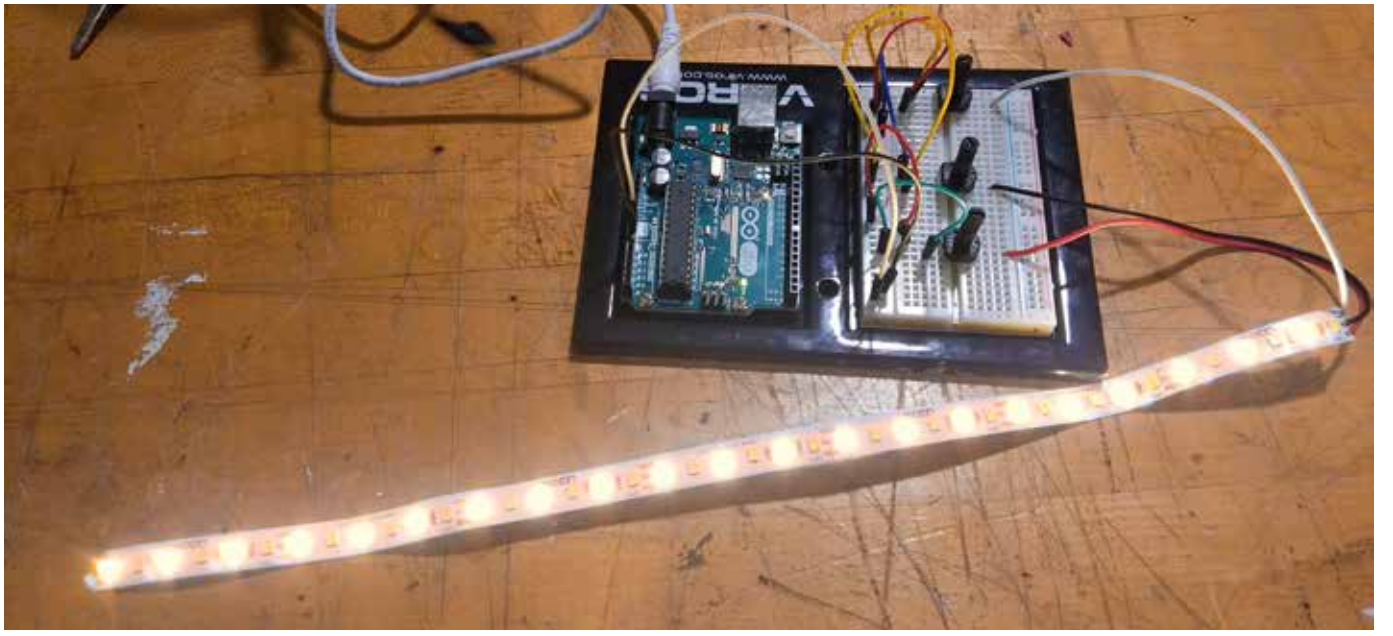
LED Programming & Prototyping

The first step towards validating my concept was to prototype LED's to achieve a natural circadian rhythm through artificial lighting.

I began by controlling the intensity of cool and warm white LED's using potentiometers and an arduino board to achieve different Kelvin values.

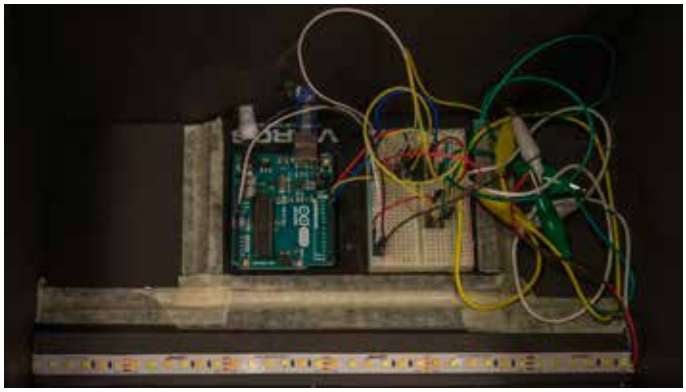


Cool white LED's at full intensity and warm white LEDs off.

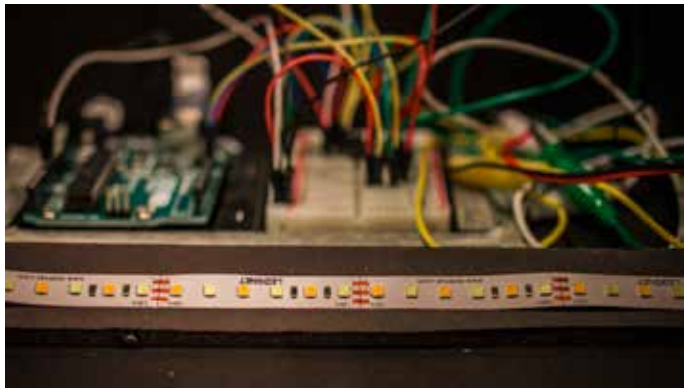


Warm white LED's at full intensity and cool white LEDs off.

Moving forward I began to use digital potentiometers to control LED's. I built a light box to house the tech in order to test the light output in terms of Kelvin value. With this method I could effectively control Kelvin output values.



Light Box Internal Componentry.



LED Strip with alternating cool & warm white diodes.

Cool white transitioning to warm white.

Warm white at full intensity.

6000 Kelvin

2500 Kelvin

Professional Input

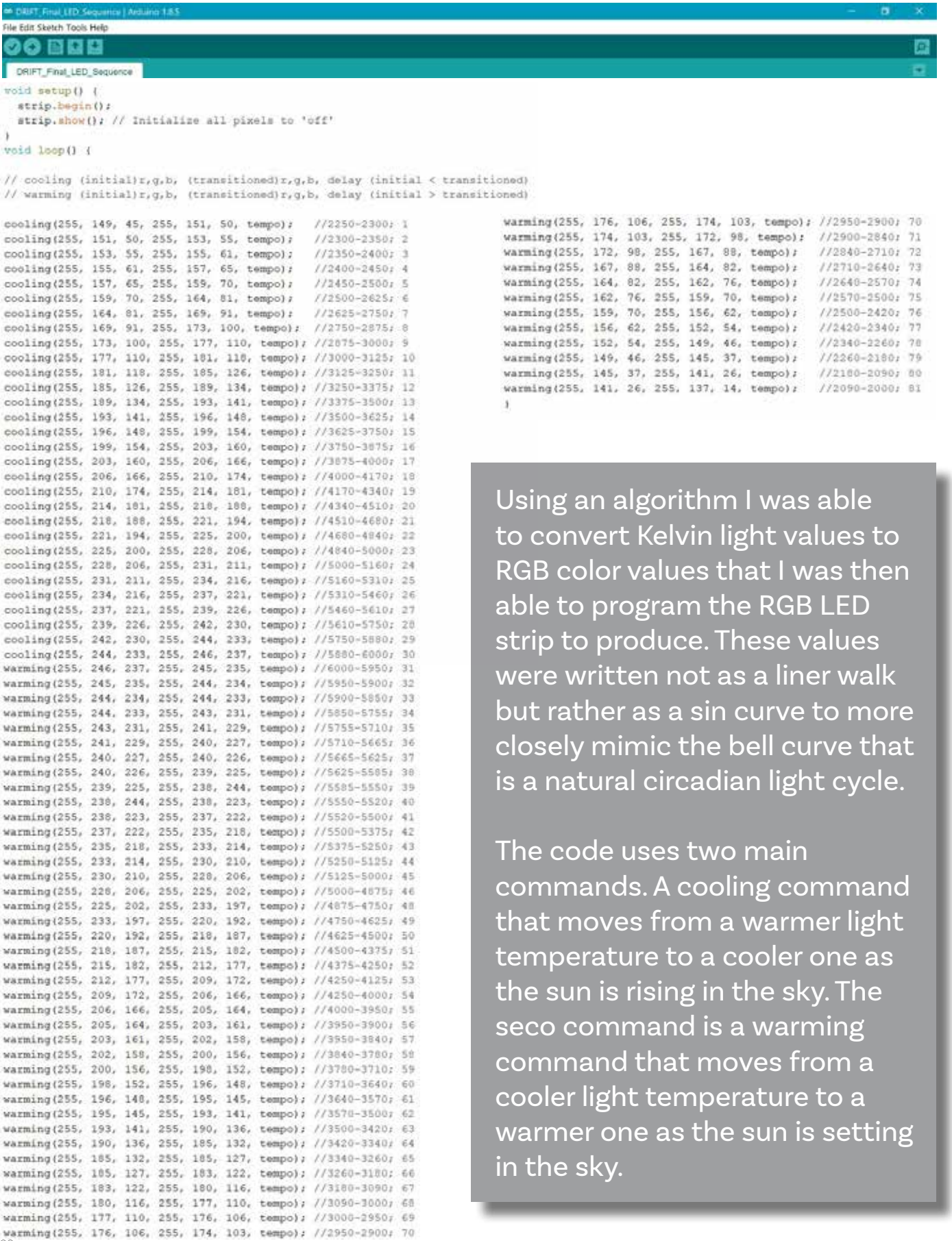
At this point I took my research and prototyping to Dr. George "Bud" Brainard for his professional input. Bud is the head of the Jefferson Lighting Lab who specializes in studies on neuro-endocrine physiology and circadian regulations. Bud was hesitant to confirm that this device would provide any health benefits but did confirm the potential of establishing a physiological routine.

Bud also offered advice on how to achieve the best circadian lighting environment that I could provide through the use of programmable LED's.

Dr. George “Bud” Brainard

Head of the Jefferson Lighting Lab

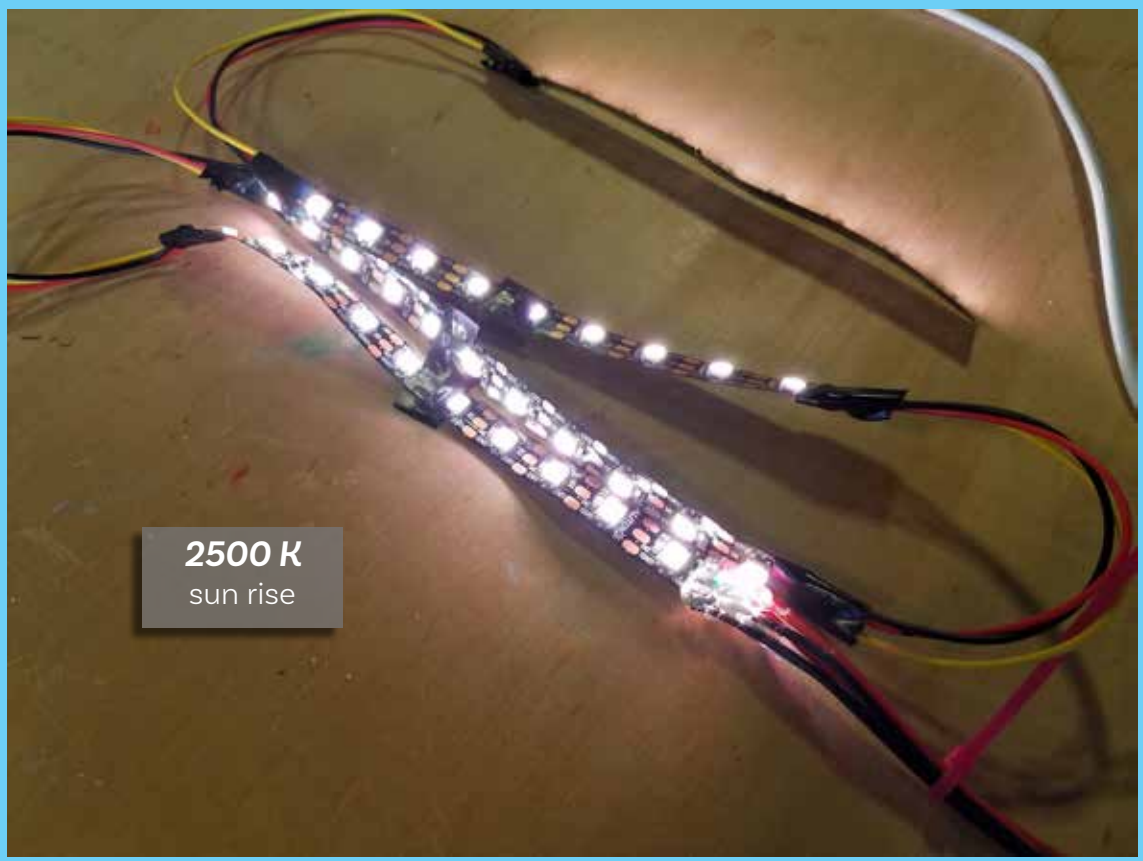
“You also need to consider the wavelength [of the light], the frequency of white LED’s are usually in the very stimulating blue light spectrum .”



Using an algorithm I was able to convert Kelvin light values to RGB color values that I was then able to program the RGB LED strip to produce. These values were written not as a liner walk but rather as a sin curve to more closely mimic the bell curve that is a natural circadian light cycle.

The code uses two main commands. A cooling command that moves from a warmer light temperature to a cooler one as the sun is rising in the sky. The seco command is a warming command that moves from a cooler light temperature to a warmer one as the sun is setting in the sky.


6000 K
mid day sun


2500 K
sun rise

Concept Inspiration

I took inspiration from nature and that which effects our lighting environment on a day to day basis. I developed three basic forms to gather feedback from parents on the Precious Little Sleep Facebook page to find out what luminaire parents would most like to see in the nursery.

Initial Concepts

Cloud

Sun

Moon

Parental Feedback

Through a Facebook survey asking only “What would you as a parent want to se as a sconce (a wall mounted light) in your nursery. Like your favorite form below. The cloud inspired form was the favorite by almost a 2: 1 ratio.

Cloud

139 likes

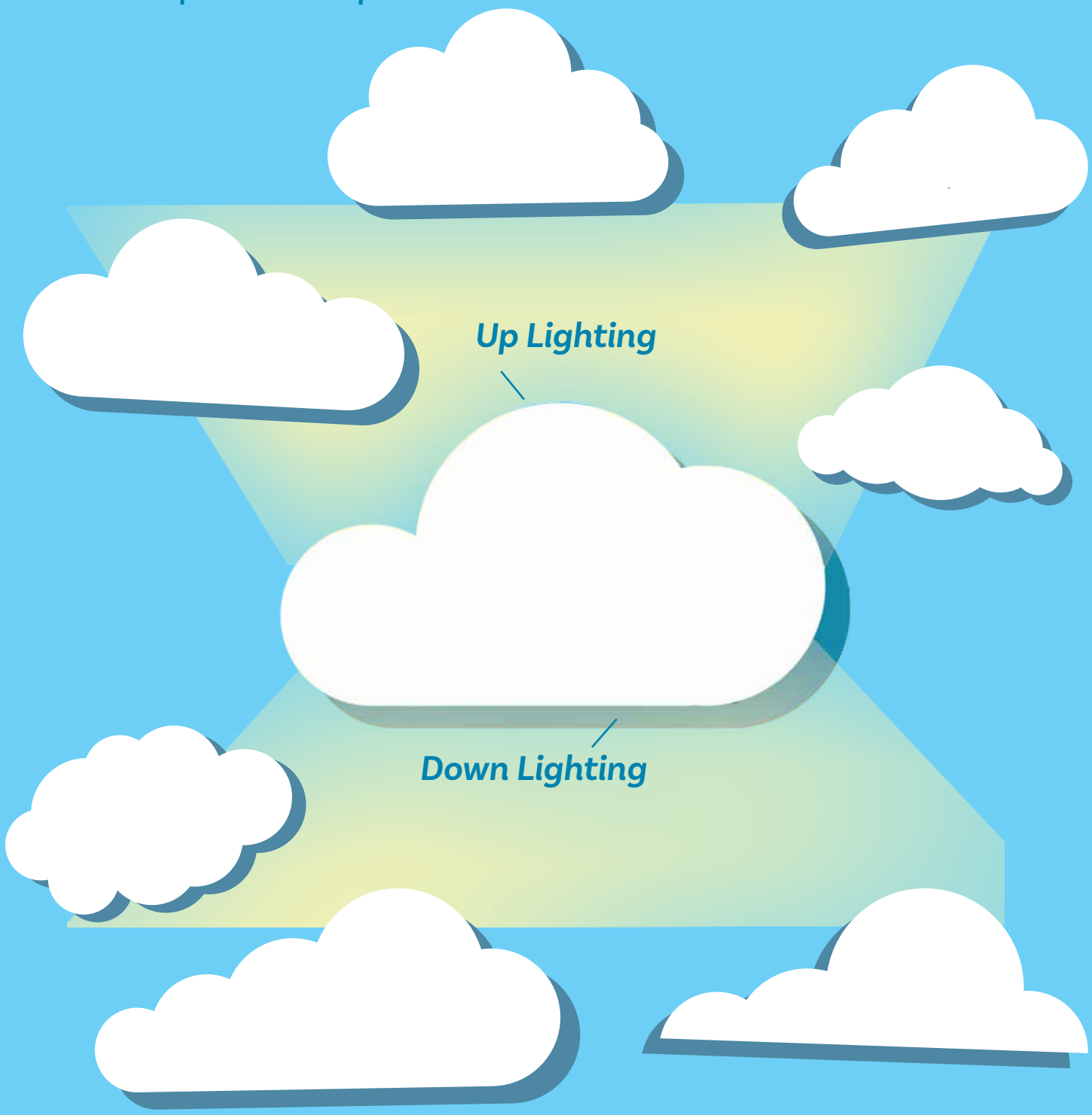
Sun

76 likes

Moon

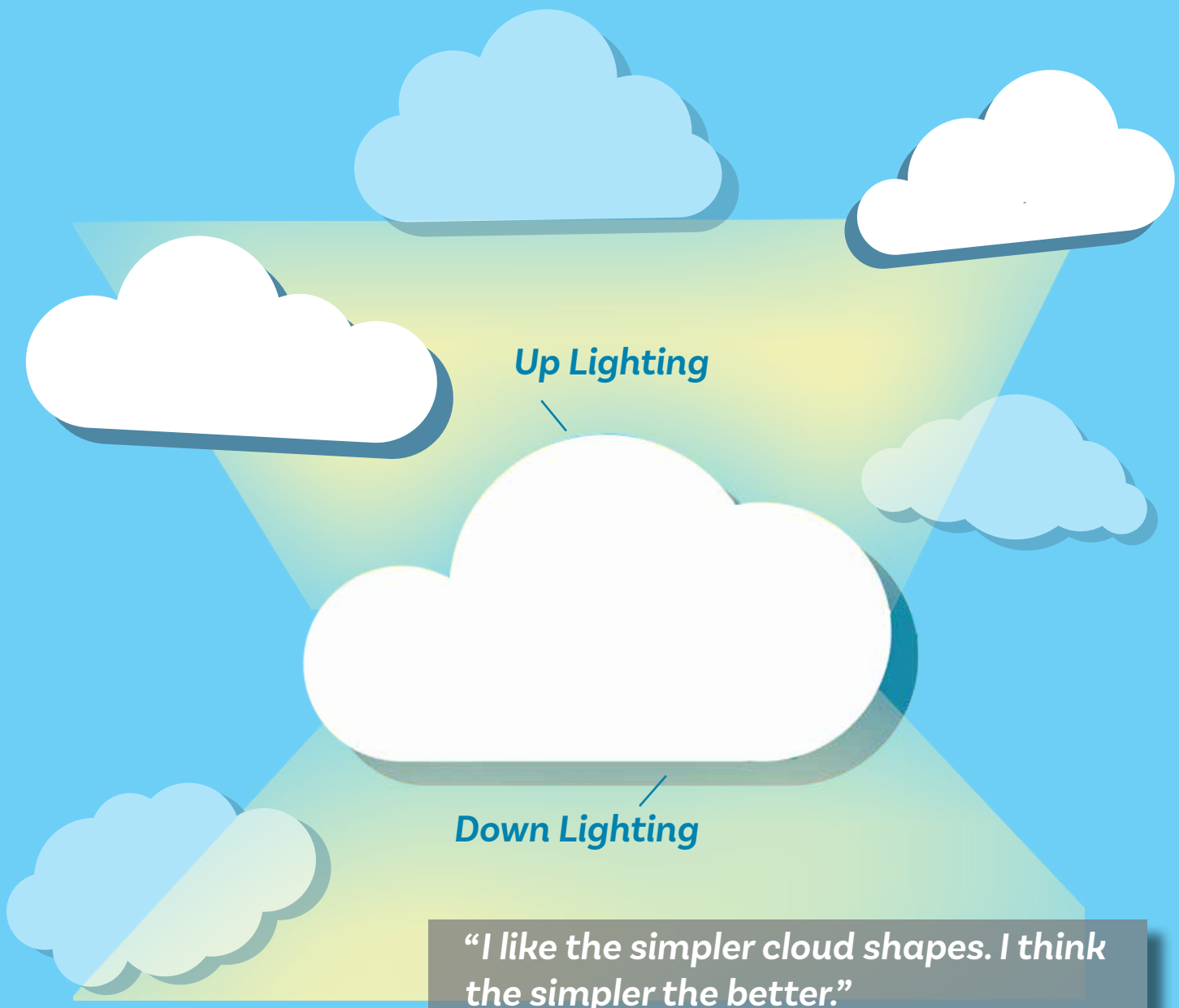
62 likes

Concept Development



I dove further into form development to explore how the from should relate to the intended features as well as what parents wanted to see in the nursery. I began exploring simple and complex forms as well as taking scale and proportion into consideration.

Parental Feedback



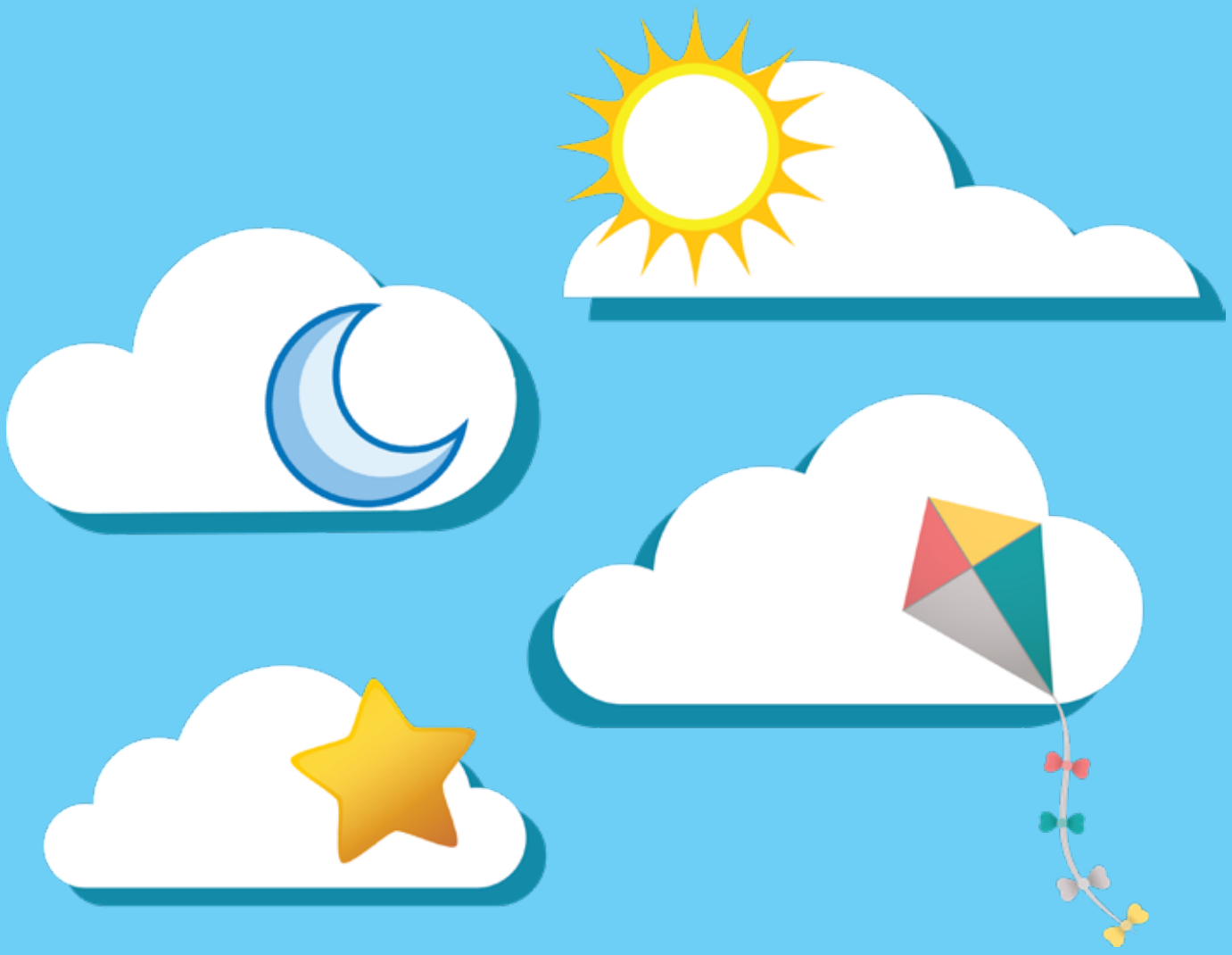
"I like the simpler cloud shapes. I think the simpler the better."

- Parent of a 7 month old

"I wish the front would light up too! It would be so cute on the wall."

- Parent of a 6 month old

Revised Concepts



Understanding that if the cloud itself were to illuminate (per parent request) I would need to hide the embedded technology within to prevent shadows form showing on the surface, I began to apply different forms and explore different combinations of forms. This applied form was also intended to facilitate a user interface on the device itself.

Parental Feedback

"The kite is adorable. I could see this on the wall in my daughters bedroom!"

- Parent of a 10 month old

Final Concept

Taking parents feedback into consideration, as well as the need to house necessary technology and components for the included features, the ability to manufacture and current nursery style and decor, the final design was completed.

Final Design

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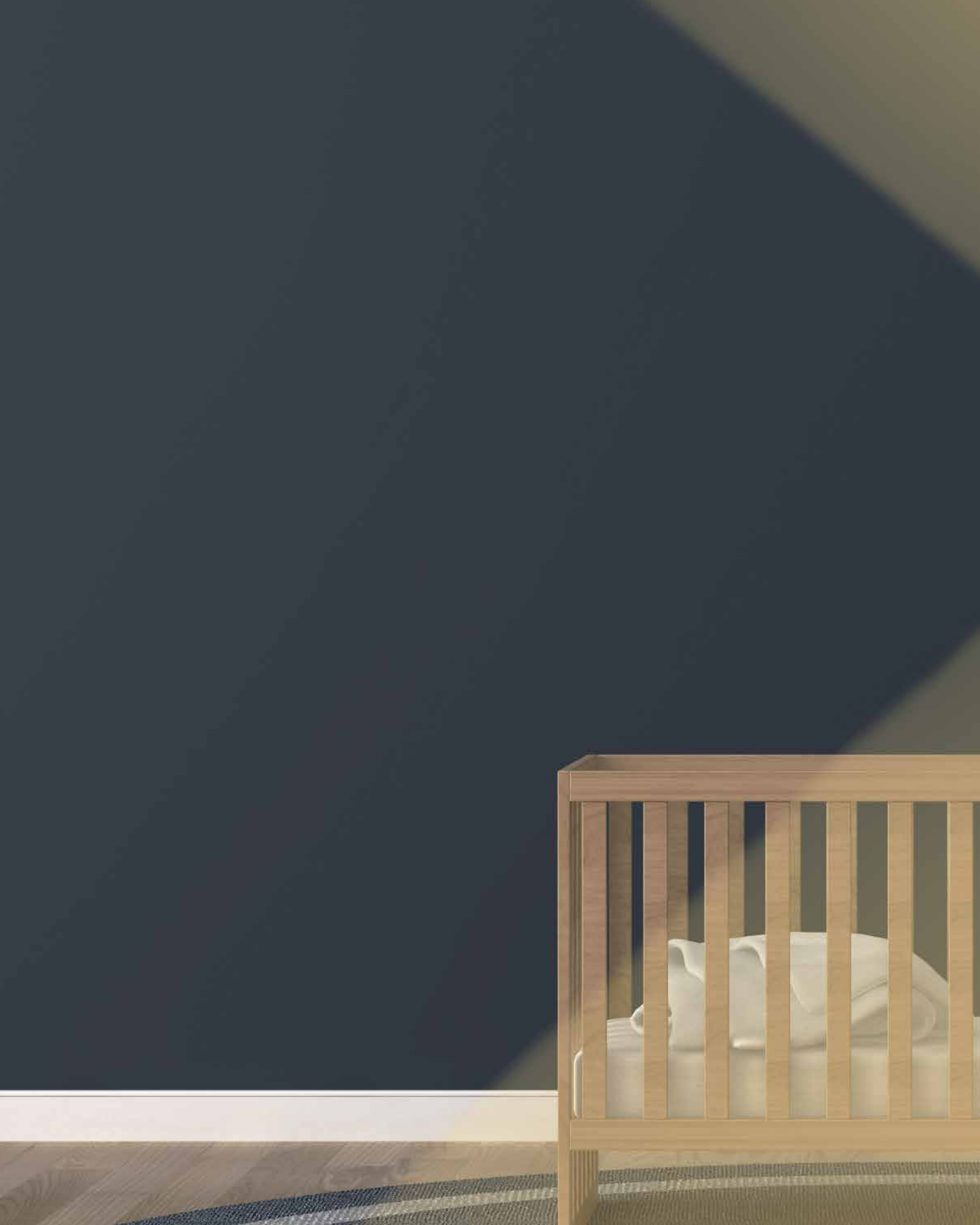


Active Circadian Lighting

- A dynamic light that changes intensity and kelvin value to mimics the patterns of the sun.
- LED's follows circadian lighting principles.
- Helps baby establish physiological sleep routine.
- Helps baby develop their circadian rhythm.
- Ultimately helps baby sleep through the night at a younger age.
- Produces roughly 120 lumen.

Features: *Active Circadian Lighting*

Active Circadian Lighting

- Light values measured in Kelvin relative to time of day as suggested by USAI Lighting.
- Follows the bell curve of circadian lighting and is not a linear walk of adjustments.
- Arduino code is written to step through 90 individual steps to mimic natural lighting.
- Can be adjusted through the app based on location and time zone so it is always perfectly in rhythm.

12AM-3AM

No Light

9PM-12AM

3000~2000 K

3AM-6AM

No Light

6PM-9PM

4000~3000 K

6AM-9AM

2500~4000 K

3PM-6PM

5500~4000 K

9AM-12PM

4000~6000 K

12PM-3PM

6000~5500 K

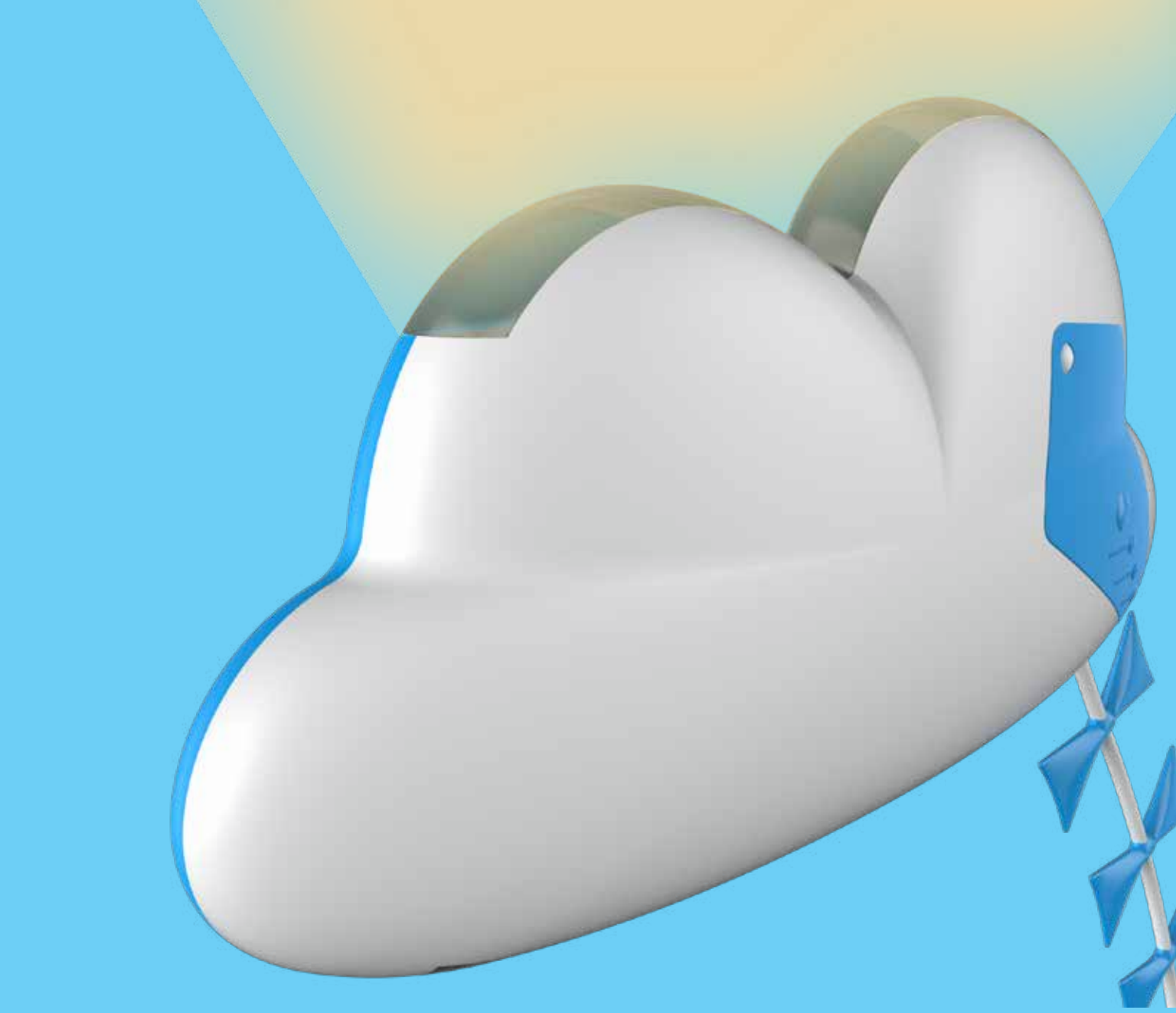
Final Prototype at **6000 K** *

Final Prototype at 2000 K *

* All lighting features illuminated for demonstrational purposes.

Motion Sense Lighting

- Illuminates with motion such as the parent entering the nursery.
- When illuminating it matches the light settings of the active circadian lighting to stay in rhythm.
- Can be turned on/off through the physical user interface.
- Adjustable through the app to change how long the motion light stays on once activated.
- Produces about 120 lumen.
- Perfect for anything from diaper changes, to feeding, to story time.



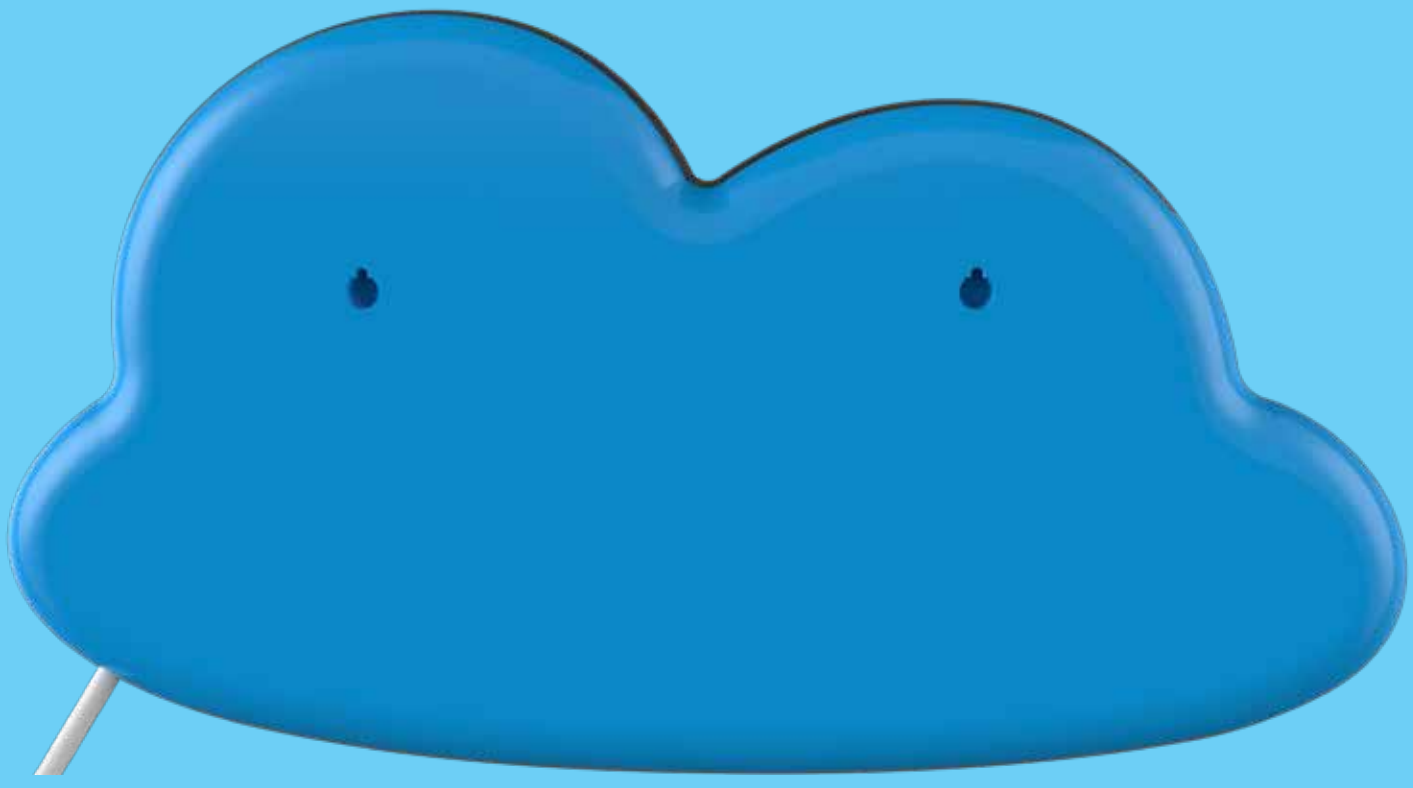
Ambient Glow Lighting

- Puts off a soft, ambient glow similar to a traditional night light.
- When illuminating it matches the light settings of the active circadian lighting to stay in rhythm.
- Can be turned on/off through the physical user interface.
- Adjustable through the app to turn on/off the ambient glow feature or sync it with the motion sense light so when it turns on, so does the ambient glow lighting.


Motion Sense
Ambient Glow
Bluetooth

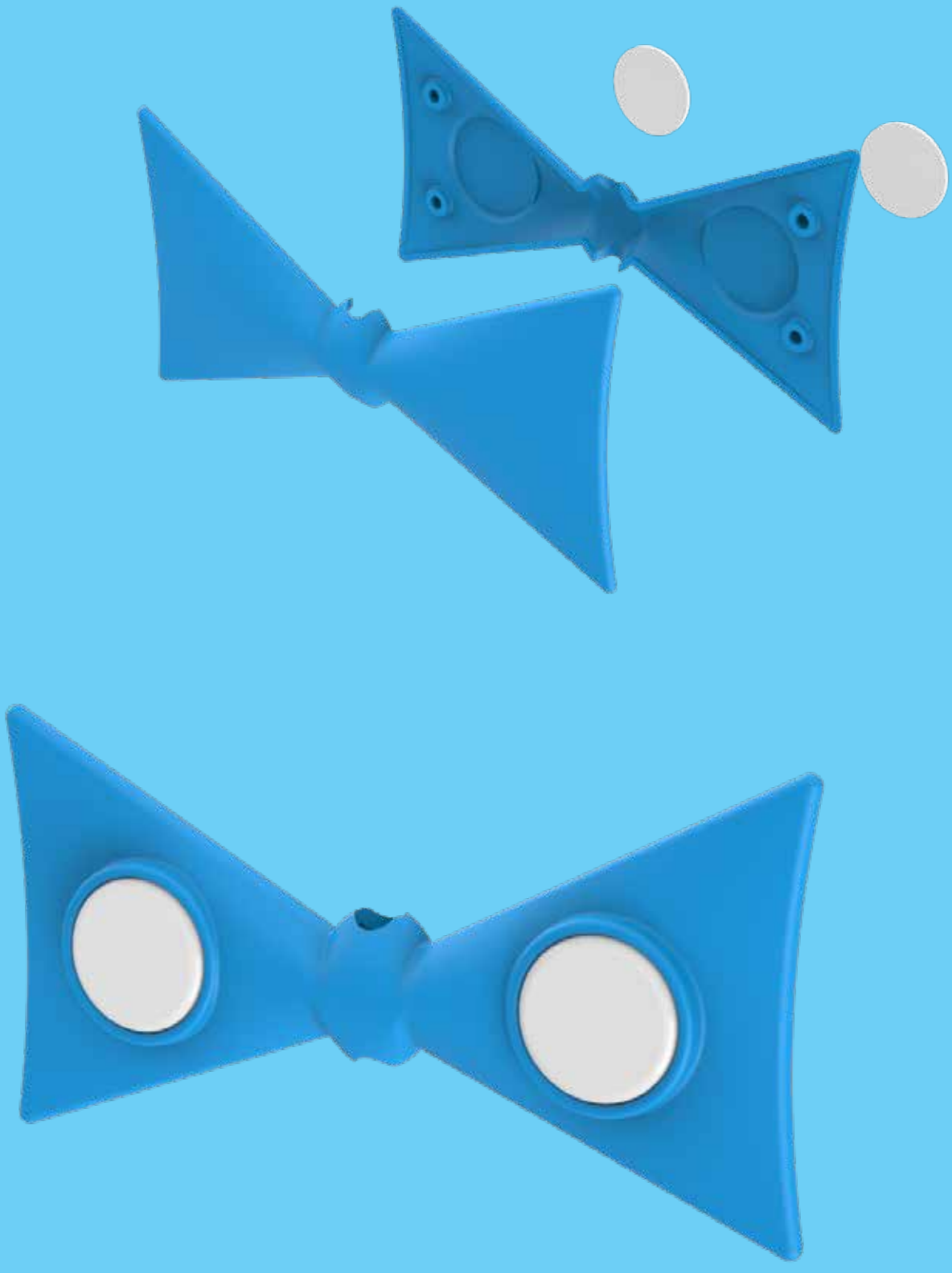
Easy Hang Wall Mounting

- ***DRIFT*** ships with two (2) self-drilling wall anchor screws.
- Simply screw into the wall, hang drift on the exposed screw heads and apply a small amount of down force until ***DRIFT*** locks into place.
- Plug ***DRIFT*** in and it is ready to go.



Cord Management

- The bows on ***DRIFT***'s power cord serve more than just an aesthetic purpose.
- The rear of the kite bows has two (2) 3M adhesive mounting pads
- Parents can slide the bows up and down the power cord and reposition and reroute the power cord away from the crib and out of reach of baby.



User Interface

- Tactile buttons allow users to operate ***D R I F T***'s main features independently of the connected smart phone app.

- Parents can turn ***D R I F T*** on and off as well as control the motion sense lighting and the ambient glow features.

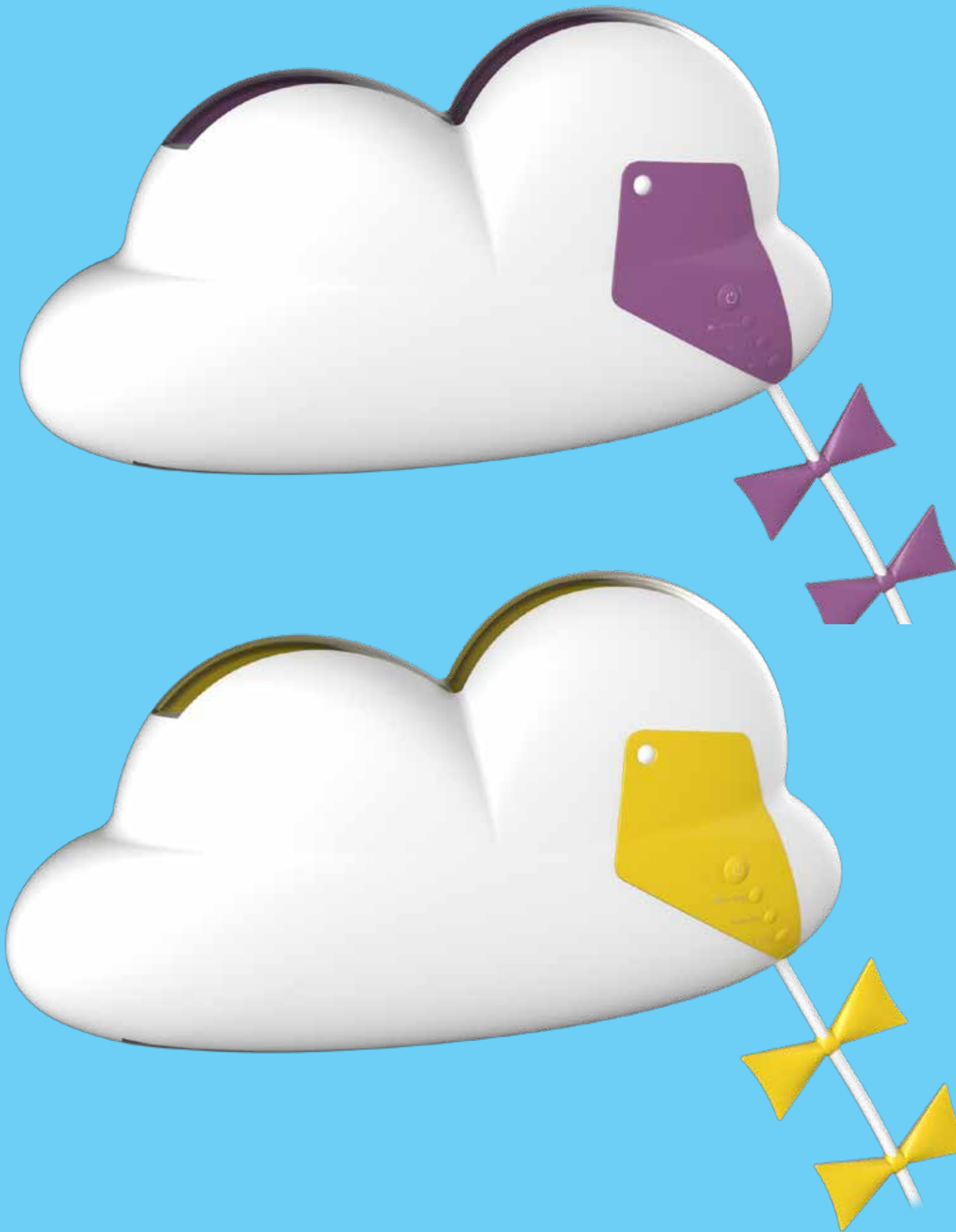
- Parents can also connect to Bluetooth to enable interaction through the connected smart phone app.


Motion Sense
Ambient Glow
Bluetooth

Features: *Colorways*

Colorways

- ***DRIFT*** comes in multiple colors to match most nursery decor and be appropriate for both boy and girl.



Materials & Manufacturing: *Overview*

Molded Acrylic Prismatic Diffusers

- Rim Snap Connection and Assembly

Injection Molded ABS

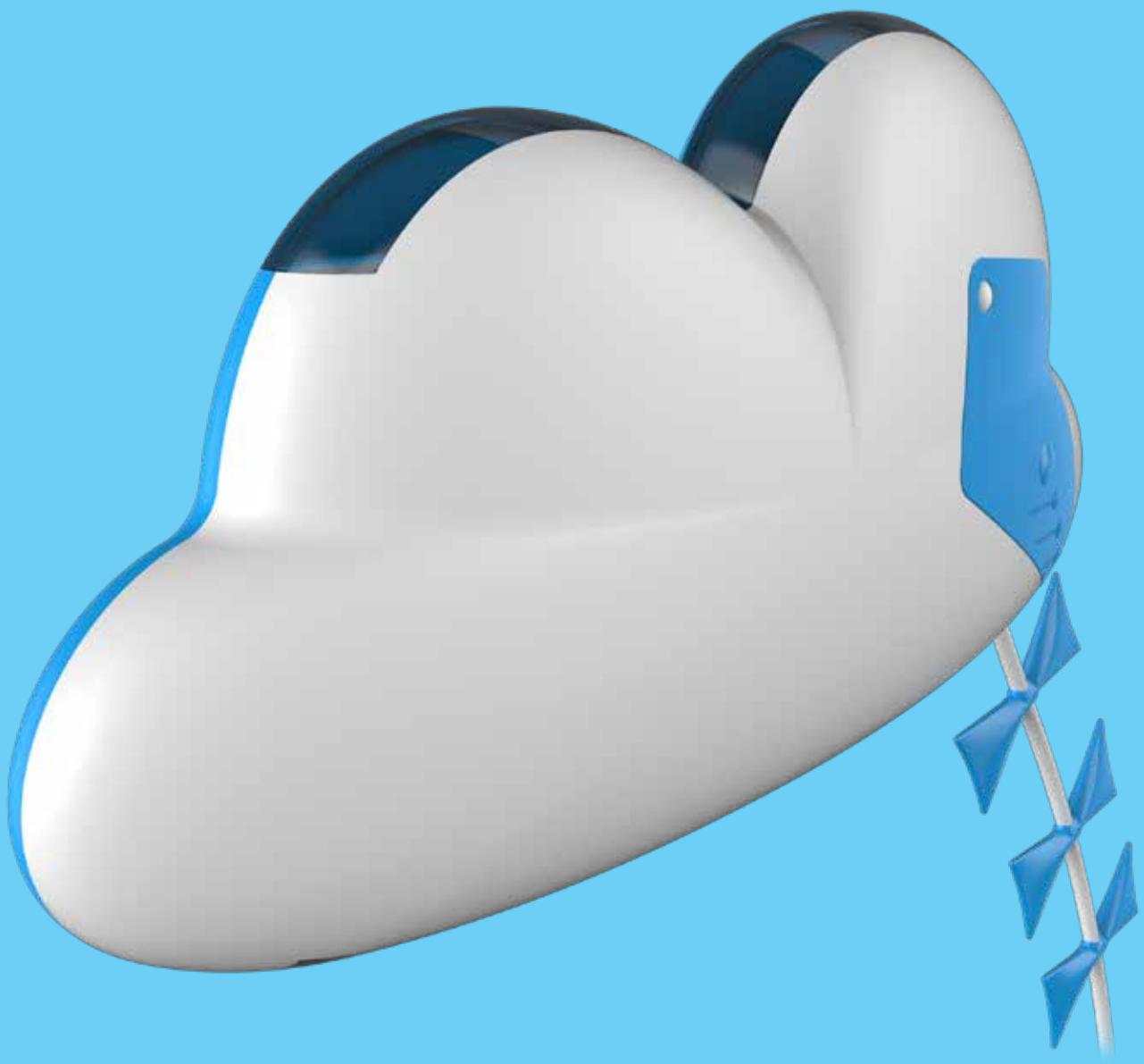
- Rim Snap Connection and Assembly

Injection Molded Glass Filled Polypropylene

- Rim Snap Connection and Assembly

Molded Silicone

- Glued to front face and hides technology



Materials & Manufacturing: *Overview*

NeoPixel RGB LED Strips

- Four 8 inch sections

Printed Circuit Board

- Embedded technology and LED driver

Motion Sensor

- Infrared beam

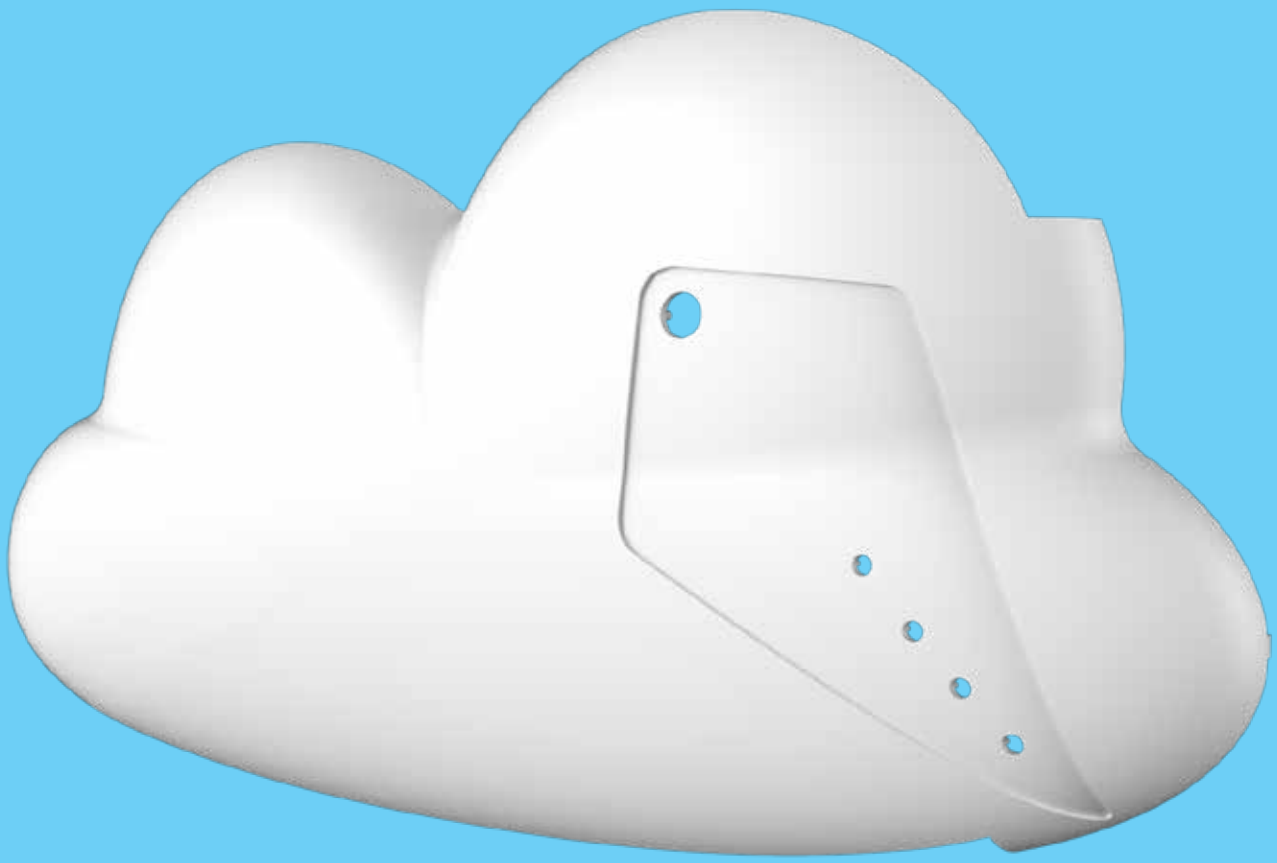
Tactile Buttons

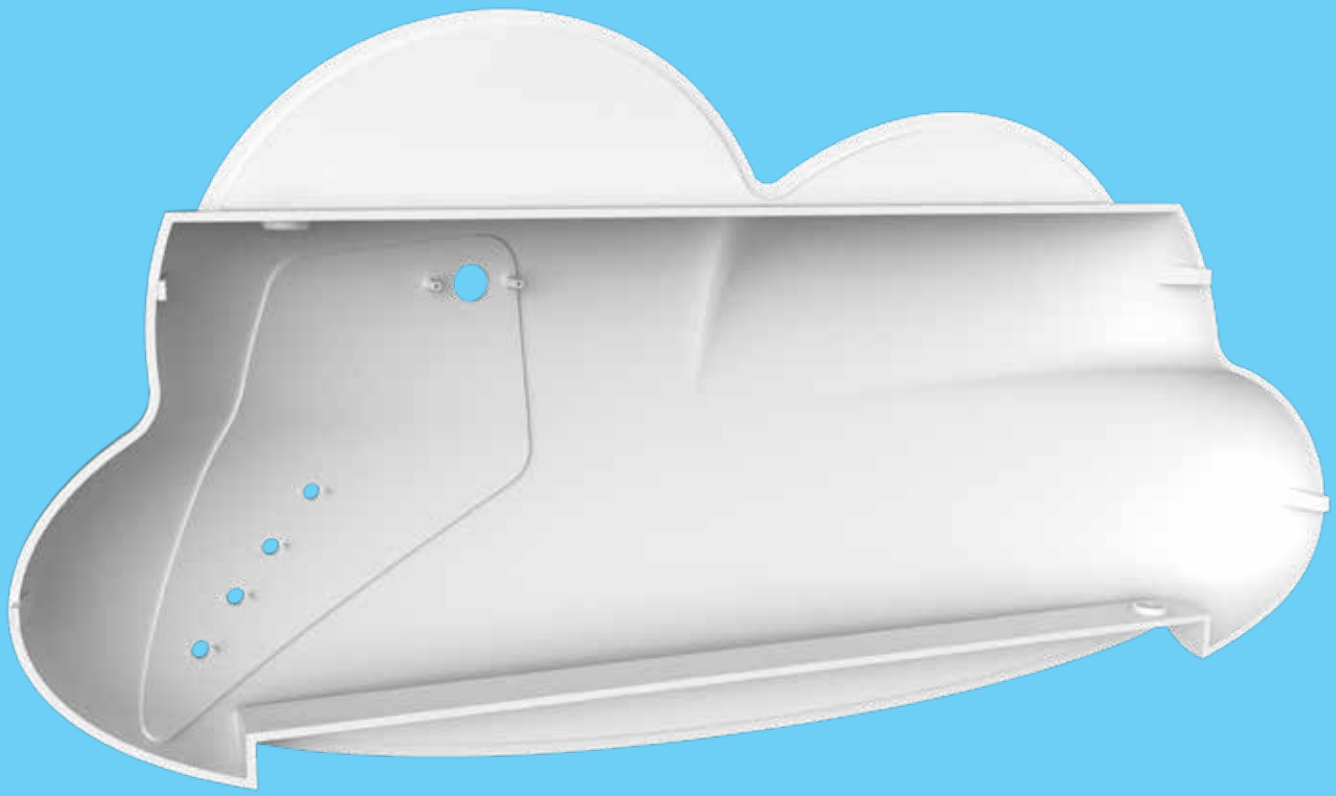
- Facilitates user interface

Materials & Manufacturing: *Front*

Injection Molded Glass Filled Polypropylene

- Glass filled to eliminate the need for ribbing that would cast shadows when the ambient glow lighting feature is turned on.
- Screw bosses to attach the tactile buttons and the infrared motion sensor.
-
- Reinforced holes to route internal wiring of LED's
- Rim snap hooks to facilitate the connection to the rear.
- 3 degree draft angles to allow for injection molding.

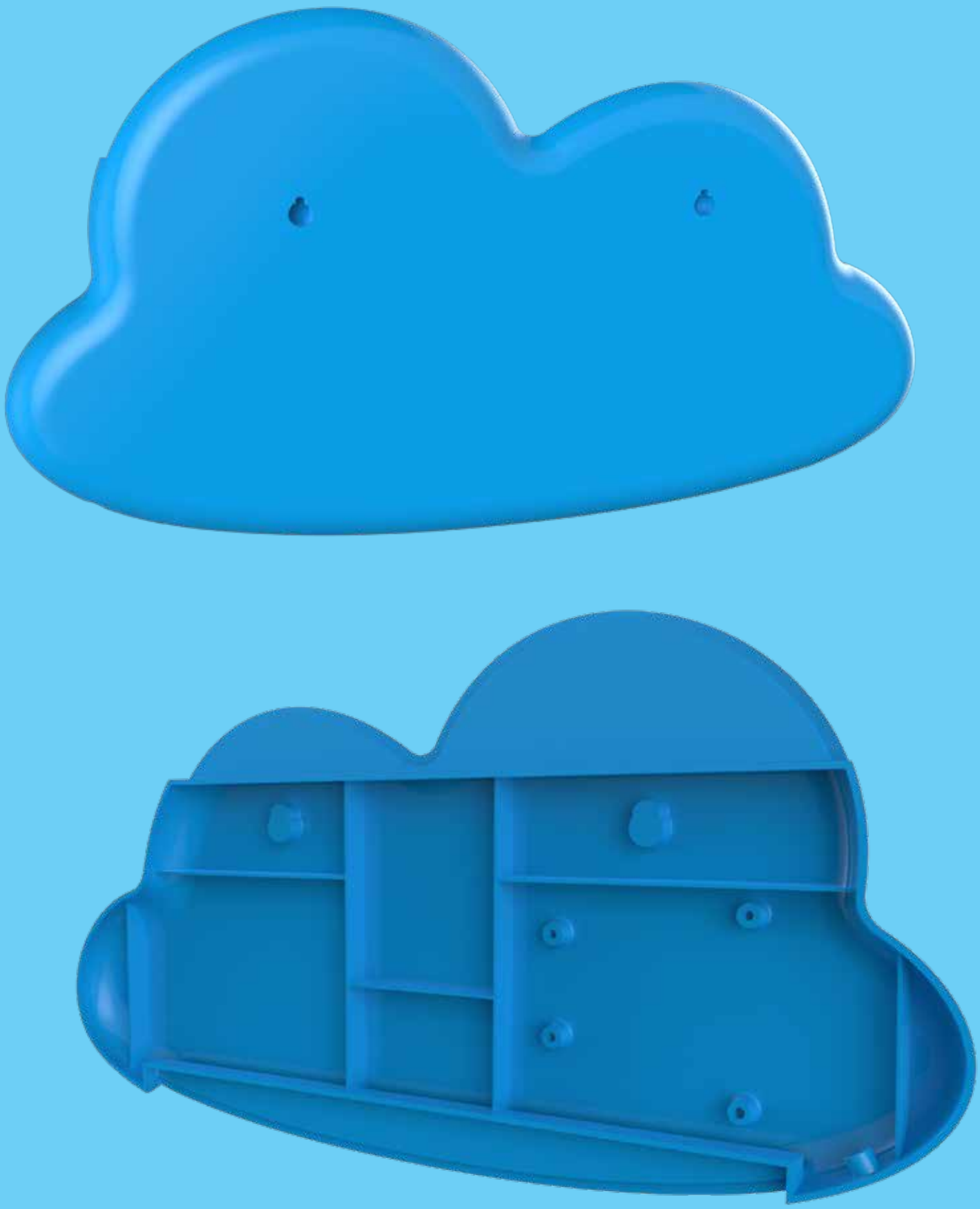




Materials & Manufacturing: *Rear*

Injection Molded ABS

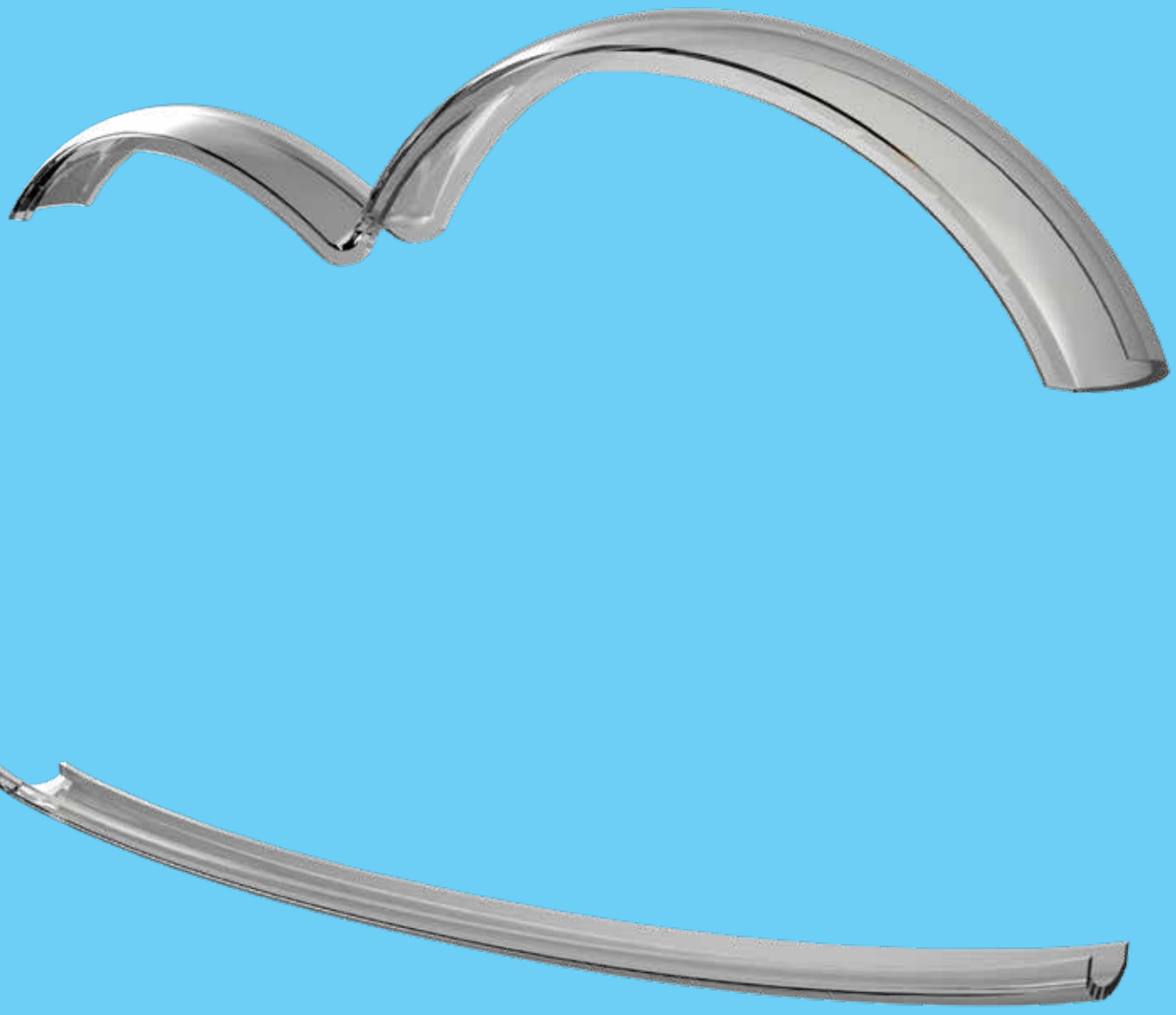
- Internal ribbing to reinforce the abs injection molded part.
- Screw bosses to attach the printed circuit board.
- Rim snap groove to facilitate the connection to the front.
- Reinforced power cord port to prevent pull out or breakage.
- 3 degree draft angles to allow for injection molding.



Materials & Manufacturing: *Diffusers*

Thermoformed Prismatic Acrylic

- Aligned with male/female joints.
- Thermoforming process does not damage the etched prismatic finish that helps to diffuse and scatter light.
- Glued to the front and rear pieces for a tight fit to eliminate light bleed out.



Materials & Manufacturing: *Kite*

Molded Silicon

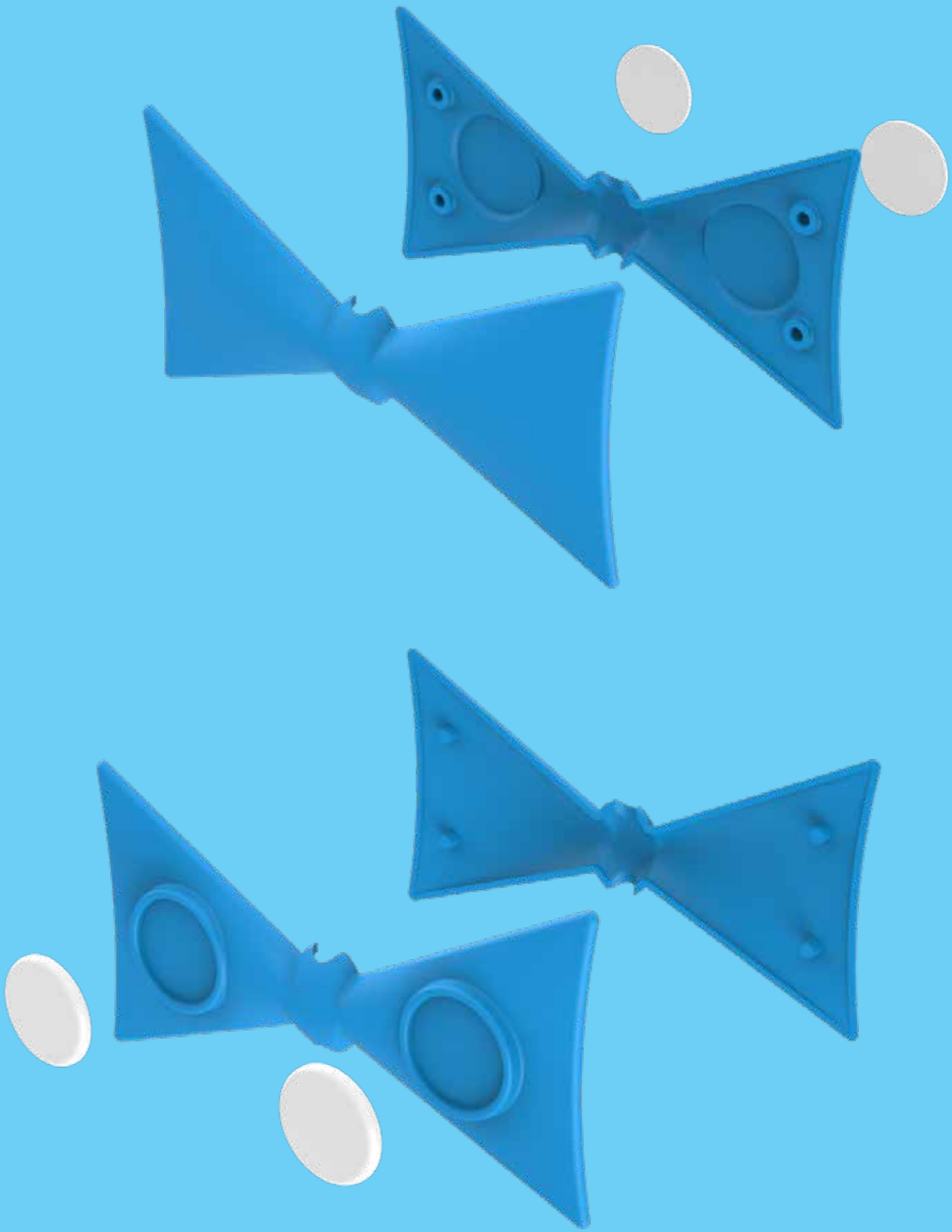
- Molded hollow buttons to interface with tactile push buttons.
- Overmolded button details and lettering.
- Cutout for the motion sensor.
- Glued to the front face.


Motion Sense
Ambient Glow
Bluetooth

Materials & Manufacturing: *Kite Bows*

Injection Molded ABS

- Rim snap connection.
- Male/female bosses to help with alignment.
- Recessed area for 3M mounting adhesive pads.
- 3M pads added post production.



Connected Smart Phone App Overview

App Overview

- Enjoy seamless control of your ***D R I F T*** device from the palm of your hands and from the comfort of your own bed.

- Parents can control ***D R I F T***'s most important feature to personalize them for what suits their child and their schedule.

- Remember not every child sleeps the same so let ***D R I F T*** help baby sleep through the night while you monitor and adjust their sleep training schedule for the best results.


welcome to
DRIFT
Sign Up
Login
Because when baby is sleeping, parents can too!

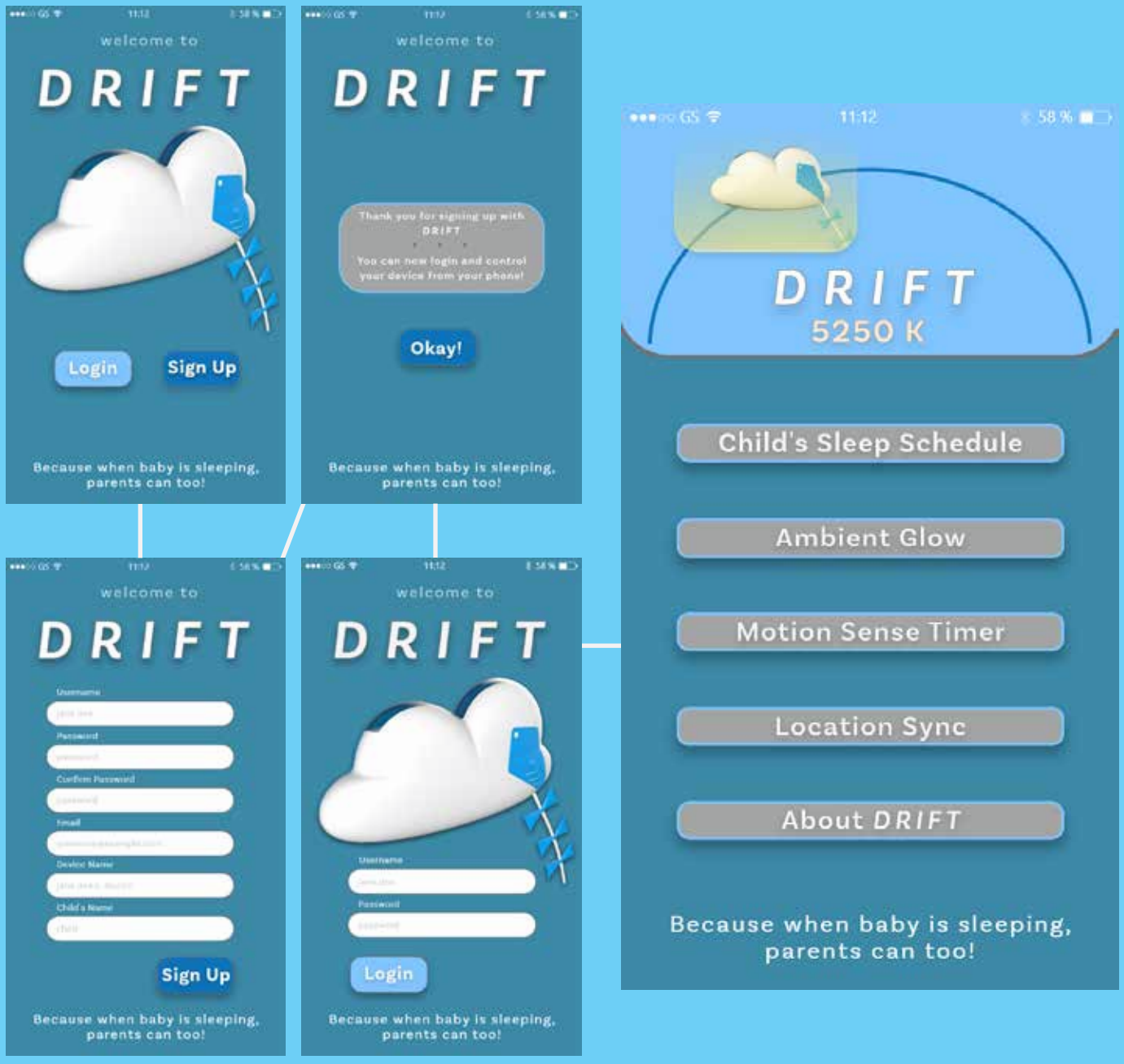
App Design: *Sign Up & Login*

Sign Up & Login!

- Parents can sign up and login to their own personalized ***DRIFT*** account

- Once signing in, parents can monitor their child's personalized sleep schedule as well as control various features right from their smart phone!

- DRIFT does not share personal information, it only utilizes this information to make your experience as personalized and tailored to you, the parent, as possible! Enjoy seamless control, personalized messages and reminders right in the palm of your hand!


welcome to
DRIFT
Login
Sign Up
Because when baby is sleeping, parents can too!
welcome to
DRIFT
Thank you for signing up with DRIFT
You can now login and control your device from your phone!
Okay!
Because when baby is sleeping, parents can too!
welcome to
DRIFT
Username
Password
Confirm Password
Email
Device Name
Child's Name
Sign Up
Because when baby is sleeping, parents can too!
welcome to
DRIFT
Username
Password
Login
Because when baby is sleeping, parents can too!
11:12
58 %
DRIFT
5250 K
Child's Sleep Schedule
Ambient Glow
Motion Sense Timer
Location Sync
About DRIFT
Because when baby is sleeping, parents can too!

App Design: *Sleep Schedule Monitor*

Find What Works Best for You!

- Parents can monitor their child's personalized sleep schedule to find what works best for them or choose from a pre-loaded schedule based on their child's age.

- Even if starting from a pre-loaded schedule, parents can add or remove events as well as change what times these events are scheduled.

- What works for one child doesn't necessarily mean that is what will work for all. Experiment with different feeding times or nap schedules to see what your child responds to best. Remember, there is no one right answer!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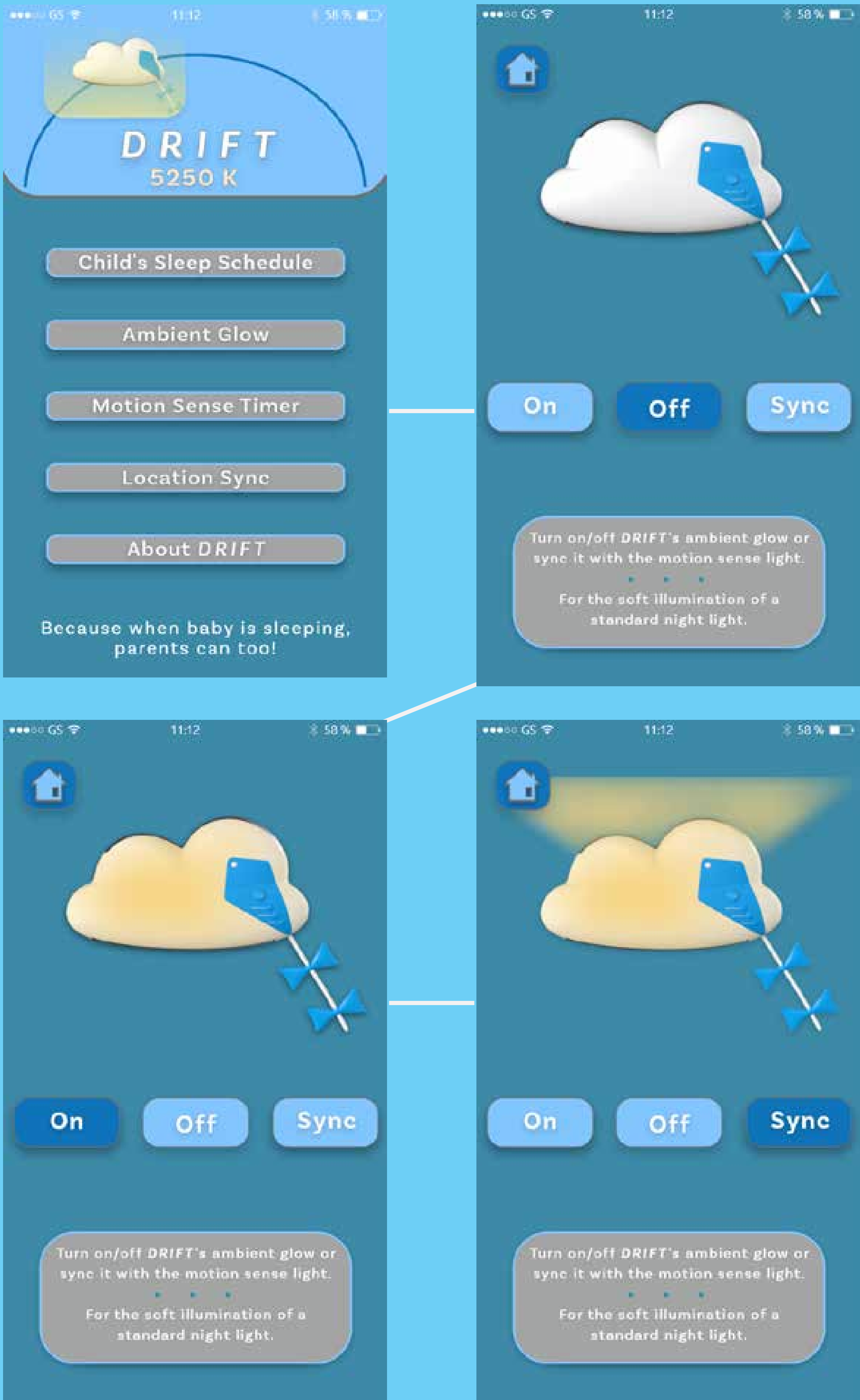
10 Month Sleep Schedule
Good Morning!
7:30 AM
First Feeding
8:00 AM
Nap Time!
10:30 AM
Second Feeding
12:15 PM
Nap Time!
1:45 PM
Third Feeding
5:00 PM
Goodnight!
7:30 PM
Edit Schedule
Remove Event
Add Event
Change Times

App Design: *Ambient Glow Feature*

For the Soft Illumination of a Standard Night Light

- Parents can turn on/off the ambient glow feature or choose to sync it with the motion sense light.
- Parents can turn on/off this light as an alternative to the cry it out method, turning it on from the comfort of their own bed when baby starts to cry.
- This feature can also be controlled independently of the app with ***D R I F T***'s tactile user interface.



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On
Off
Sync
Turn on/off DRIFT's ambient glow or sync it with the motion sense light.
For the soft illumination of a standard night light.
On
Off
Sync
Turn on/off DRIFT's ambient glow or sync it with the motion sense light.
For the soft illumination of a standard night light.
On
Off
Sync
Turn on/off DRIFT's ambient glow or sync it with the motion sense light.
For the soft illumination of a standard night light.

App Design: *Motion Sense Timer*

Change How Long the Motion Sense Light Stays Active

- Parents can adjust how long the motion light stays on once activated.
- Parents can choose anywhere from 5-30 minutes in increments of 5 or enter a custom duration.
- Parents can choose to adjust this feature based on their intended activity in the nursery. For example, a diaper change may only require 5 minutes, whereas story time might require 20-30 minutes.


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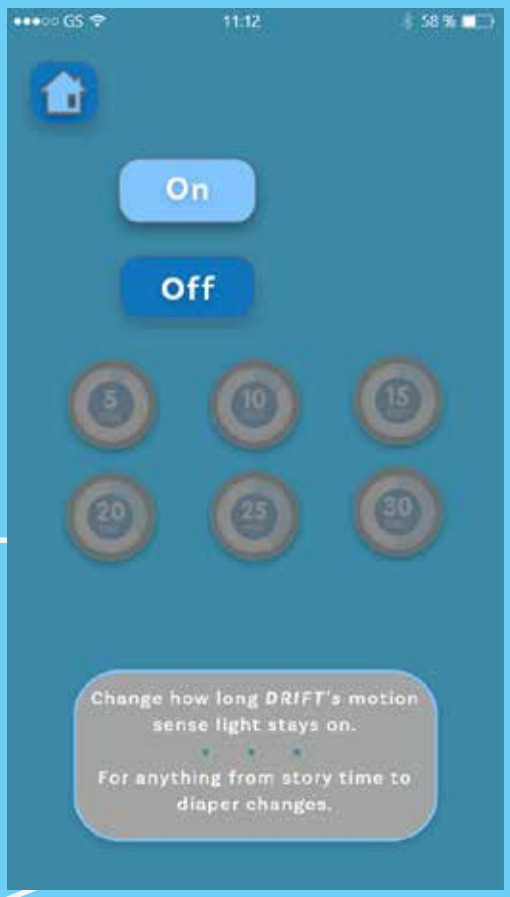
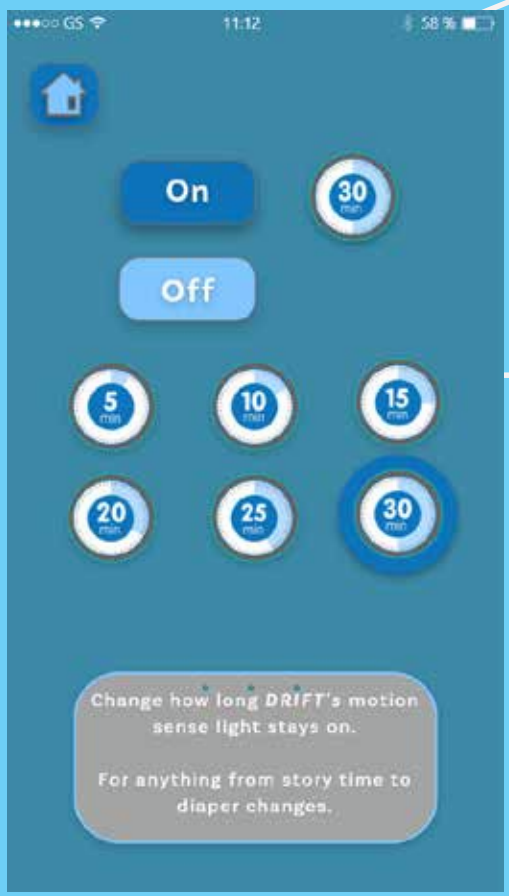
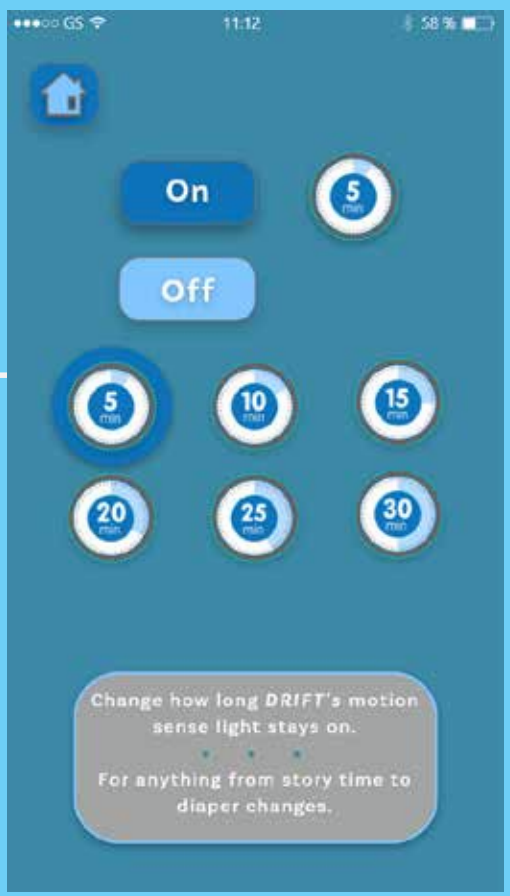

On
Off
5
10
15
20
25
30
Change how long DRIFT's motion sense light stays on.
For anything from story time to diaper changes.


On
Off
30
5
10
15
20
25
30
Change how long DRIFT's motion sense light stays on.
For anything from story time to diaper changes.


On
Off
5
5
10
15
20
25
30
Change how long DRIFT's motion sense light stays on.
For anything from story time to diaper changes.

App Design: *Location Sync*

*Sync Your Device with your location so **D R I F T** is Always Perfectly in Rhythm*

- Parents can sync ***D R I F T*** with their location to pull times for sunrise and sunset.

- ***D R I F T*** will adjust its pre-programmed lighting environments to match that of your location

- ***D R I F T*** can also respond to time of year with access to your phones internal clock so it can adjust to time of year as well as location.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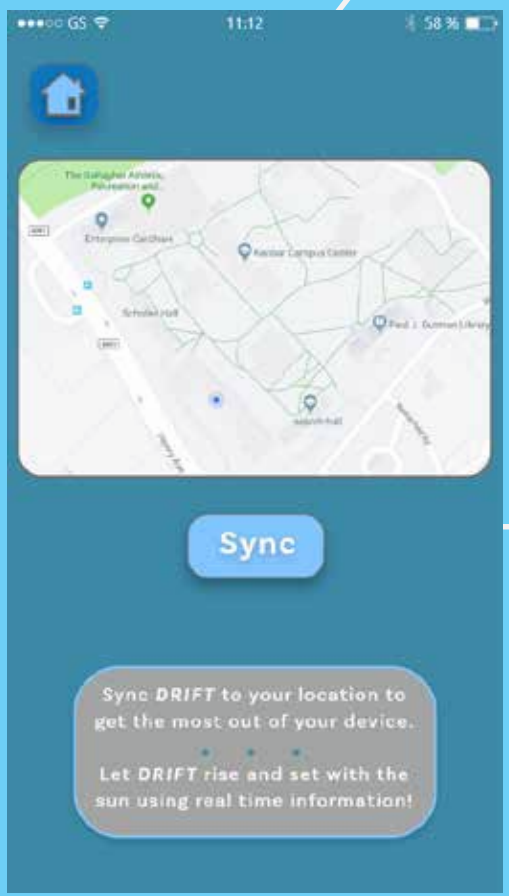
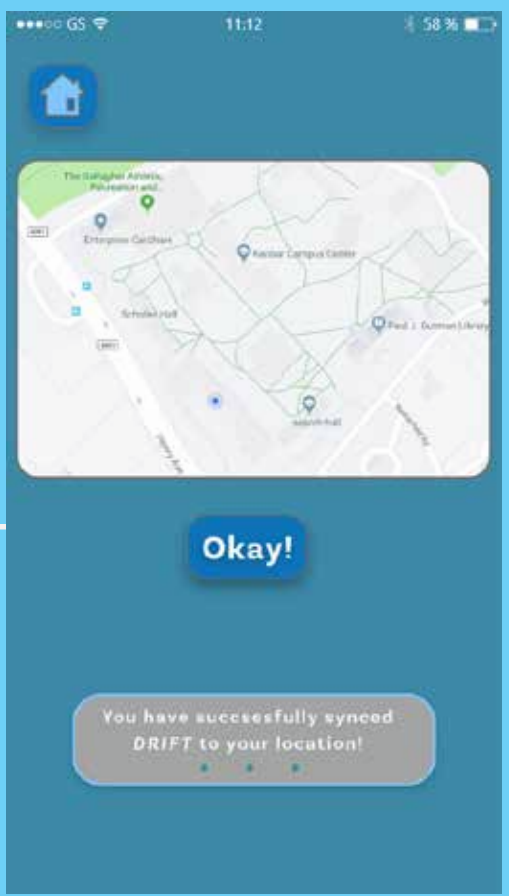
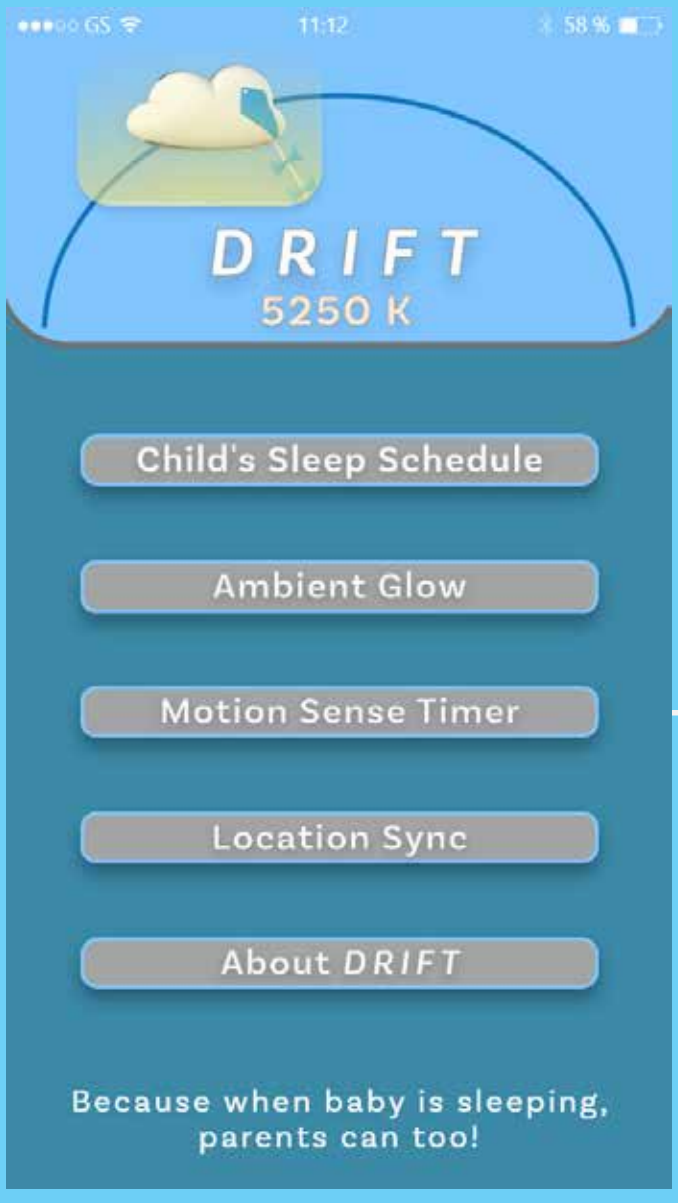

Sync
Sync DRIFT to your location to get the most out of your device.
Let DRIFT rise and set with the sun using real time information!


Okay!
You have successfully synced DRIFT to your location!

*About **D R I F T***

- Parents can learn about or remind themselves of everything ***D R I F T*** does and then some!

- Enjoy your experience with ***D R I F T***!


GS 11:12 58 %
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GS 11:12 58 %
DRIFT is a circadian nursery light for infants and young children that helps them establish a healthy and natural sleep schedule.
DRIFT works to help baby develop their natural circadian rhythm, or internal clock, to give them the ability to sleep through the night at a younger age.
Circadian lighting allows children to establish a natural light/dark cycle. This cycle helps children produce and supress melatonin, the hormone responsible for natural and healthy sleep, at the time of day nature intended. This leads to more resorative sleep for a happy and healthy baby.
Because when baby is sleeping, parents can too!

Thank You