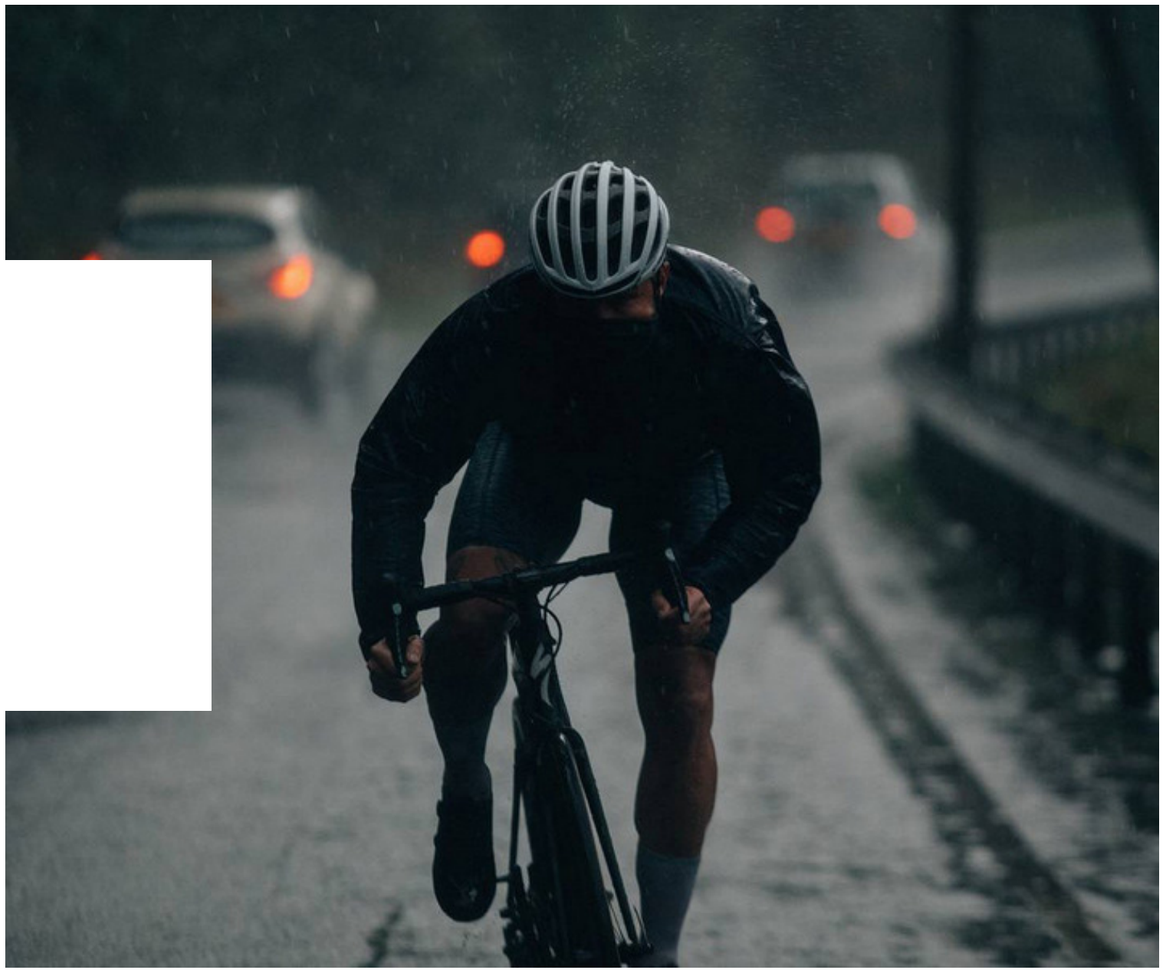
THESIS PROJECT: BFA DEFENSE

Ryan Provenza 2023

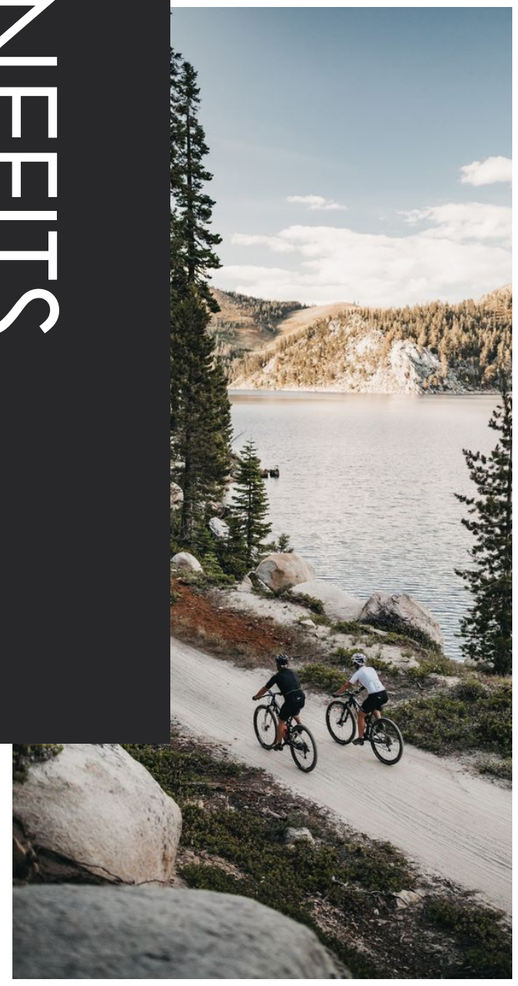


CYCLIST SAFETY

BACKGROUND

I started biking in 2016 as a form of exercise and to decrease my carbon footprint but soon found the experience to be very beneficial. I enjoyed riding so much that I would usually choose my bike over my car to commute to school or work, often riding at night. I still ride today enjoying all the physical and mental benefits, however, my new route is from coventry to downtown which has **high traffic and almost no bike lanes forcing me on the sidewalk with pedestrians for safety reasons.**

BENEFITS



PHYSICAL

- increased cardiovascular fitness
- increased muscle strength and flexibility
- improved joint mobility
- improved posture and coordination
- strengthened bones
- decreased body fat levels
- prevention or management of disease
(betterhealth)

FINANCIAL

- save on gas
- free parking
- less car maintenance

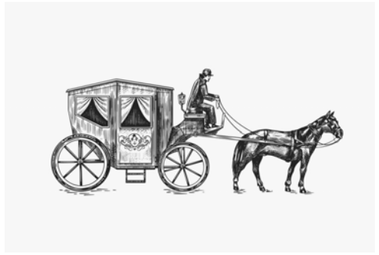
MENTAL

- improve your brain health
- reduce your risk of depression and anxiety
- improve sleep
(CDC)

ENVIRONMENTAL

- no emissions
- reduce carbon footprint

HISTORY



Past
Horses

1870's
Bike Boom

1908
Model T

1960-70s
Road bike and
Mountain bike

1817
"swiftwalker"

1880's
Cyclists lobby
for flat roads

1919
Transportation is
taken over by cars

1971
Bike Lanes.

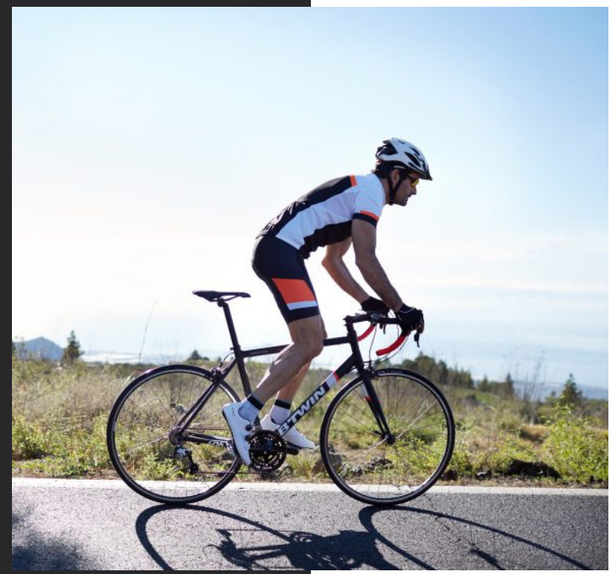
2020
COVID creates
new bike boom

CYCLISTS

CYCLING TODAY

41 million people in the US use bikes recreationally and occasionally for quick transportation.
A **10% increase** since 2020.

872,000 people commute to work in the US.



TYPES OF CYCLISTS

- Commuters
- Errand Runners
- Recreational (Fun)
- Exercise (Road)

My main focus is cyclists in **Urban areas** where **3/4 of all cycling deaths occur**.

PROBLEM

ACCIDENTS

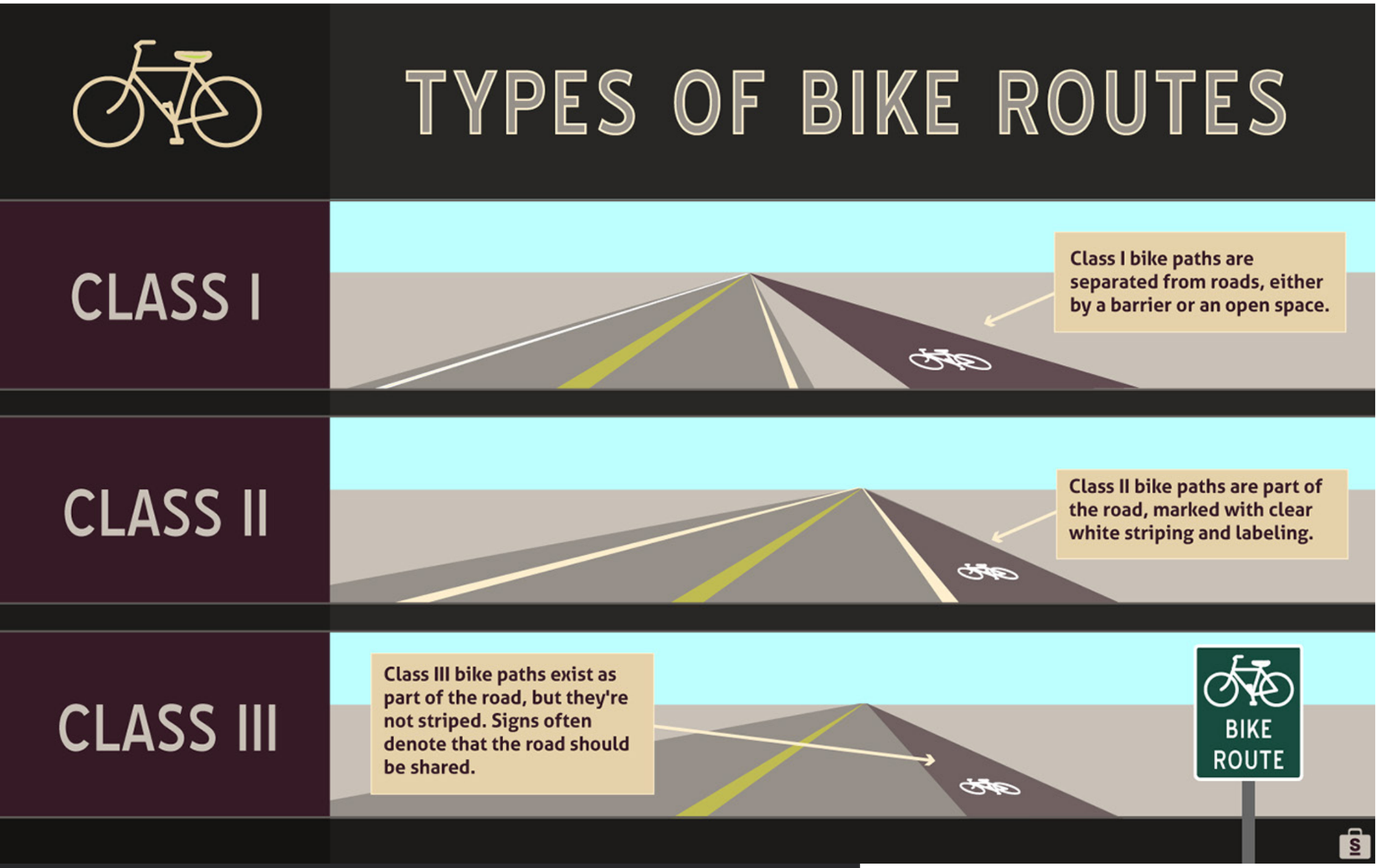
- The increase of cyclists has created an **increase of accidents by 9%**

- **Nearly 1,000 bicyclists die and over 130,000 are injured** in crashes that occur on roads in the United States every year.

- **Most accidents occur when light conditions are lowest** from 6pm to 9pm during week days and 9pm to 12am during weekends.

Most accidents on the roads are caused by drivers:

- unsafe lane changes
- turning without looking for cyclists
- driving too close to bike lane
- using cell phones behind the wheel
- failing to yield the right of way
- blind spots



ROADS TODAY

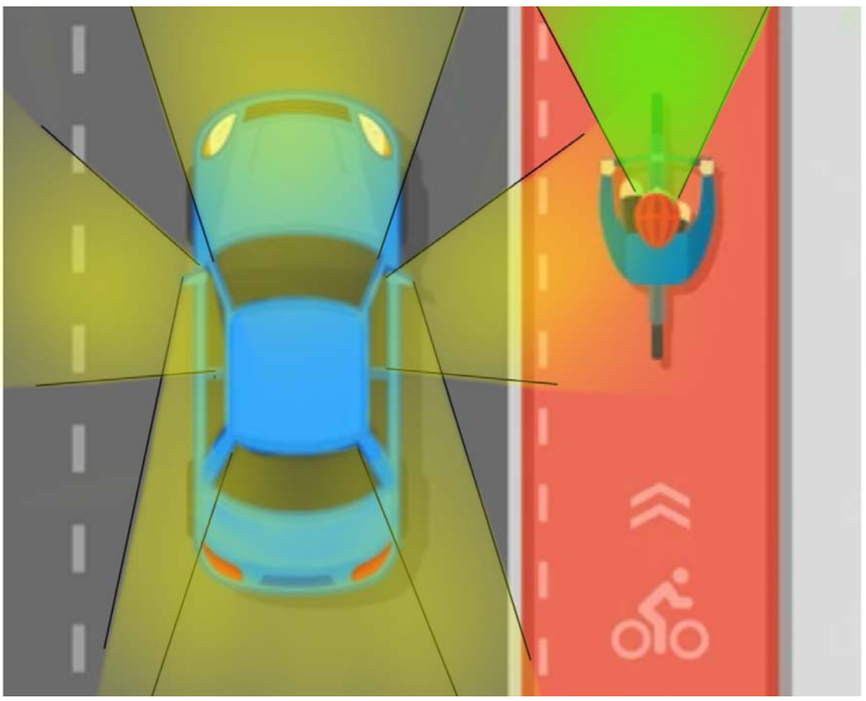
Even if you are cycling right your chances of an accident increase based on where you are cycling.

Separated bike lanes exist but in rare numbers. They require cities to change their entire infrastructure. In the US Portland, San Francisco, and Denver have Class 1 bike lanes. But a majority of cities have Class 2 and 3.

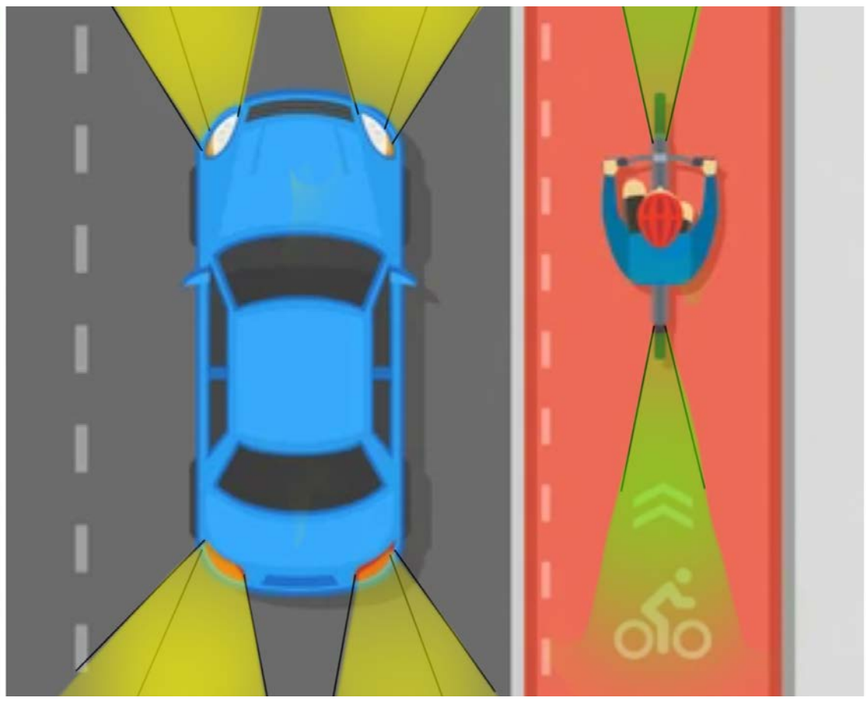
Class 2-3 bike lane cyclists have a **50% higher chance of getting into an accident**.

COMMUNICATION/ AWARENESS ON THE ROAD (BIGGEST PROBLEM)

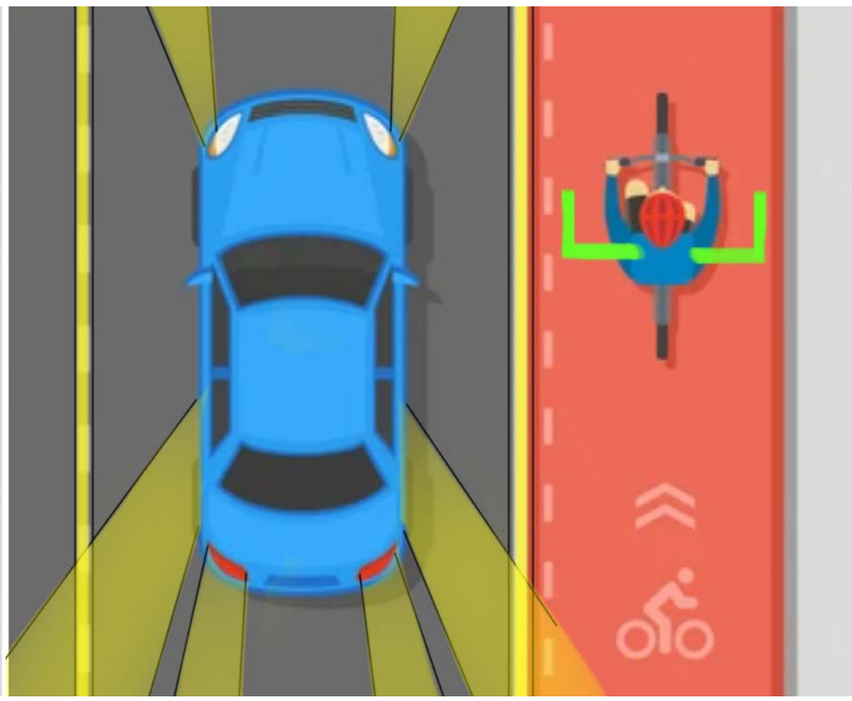
Vision



Visual Lights



Signaling/ Warnings



There is a clear disconnect of communication between drivers and cyclists. Cyclists are at a disadvantage having to resort to analog signaling while drivers have brake lights and turn signals to inform other drivers of their movements.

Visually it is easy for vehicles to not see cyclists in bike lanes. Along with this cyclists can't see approaching vehicles at all.

DRIVERS VS CYCLISTS

There is a fued between drivers and cyclists

Cyclists are considered road vehicles and want to be respected as such. But drivers see most cyclists as obstacles that shouldn't be taking up lanes.

This feud can cause reckless driving and unaware cycling, leading to crashes and accidents.

REDDIT

"Basically, drivers are just so damn angry."

"Transit users of all kinds have the misimpression that there should be no delays or complications in their journey."

"Sometimes they don't signal you to pass them they just act completely oblivious to you driving behind them."

"The ones I've encountered in Georgia seem to have a superiority complex and just ride wherever they want, and look annoyed when you exist."

SURVEYS- 67 CYCLISTS

Biggest Concerns- Safety

#1 Driver Inattention

#2 Lack of Safe Bike Lanes

Crashes

25% have been in a crash with a car

100% due to driver inattention.

SURVEYS- 43 DRIVERS

83.3%

Drivers feel Cyclists are liable for their own safety

76.9%

Drivers have been unaware of cyclists near them

Extended Responses

When asked what are the biggest headaches they've faced while driving with cyclists around. A majority of the answers were a **lack of awareness** from the cyclists and also how **unpredictable** they are.

MARKET

What are Current Market Trends for people that want to be safer while cycling?

GENERAL- MOST POPULAR

Head/ Tail Lights

- Small Profile

Mirrors

- Outdated

Bright Gear

- Ugly

OUTLIER CATEGORIES

- WARNING LIGHTS
- COMMUNICATION
- AWARENESS

WARNING LIGHTS POSITIONING

POC Omne Eternal bike safety helmet features a self-powered light.

SMART braking REVO lights that act as headlights and a brake warning for cars.

Vest with reflectors, bright colors, and lights for securing driver attention.

COMMUNICATION VISIBLE

Projector light signals what the cyclists is doing on their back.

Give cyclists vehicle signaling with turn signals and brake lights.

Lane laser lights give cyclists a bright lane along with cyclists awareness to vehicles.

AWARENESS

WARNING

GARMIN brake light and radar warns the cyclists of approaching vehicles using vibrating handles.

FEEDBACK LOOP

GARMIN brake light and radar warns the cyclists of approaching vehicles. Brake light flashes for drivers and display shows distance away.

TAKEAWAYS

- Products have singular focus

- Nothing holistic- niche

- Product posistioning is important

- Direct communication is only done with lights due to efficiency

- Limited awarness for cyclist

- Focused on the drivers awareness

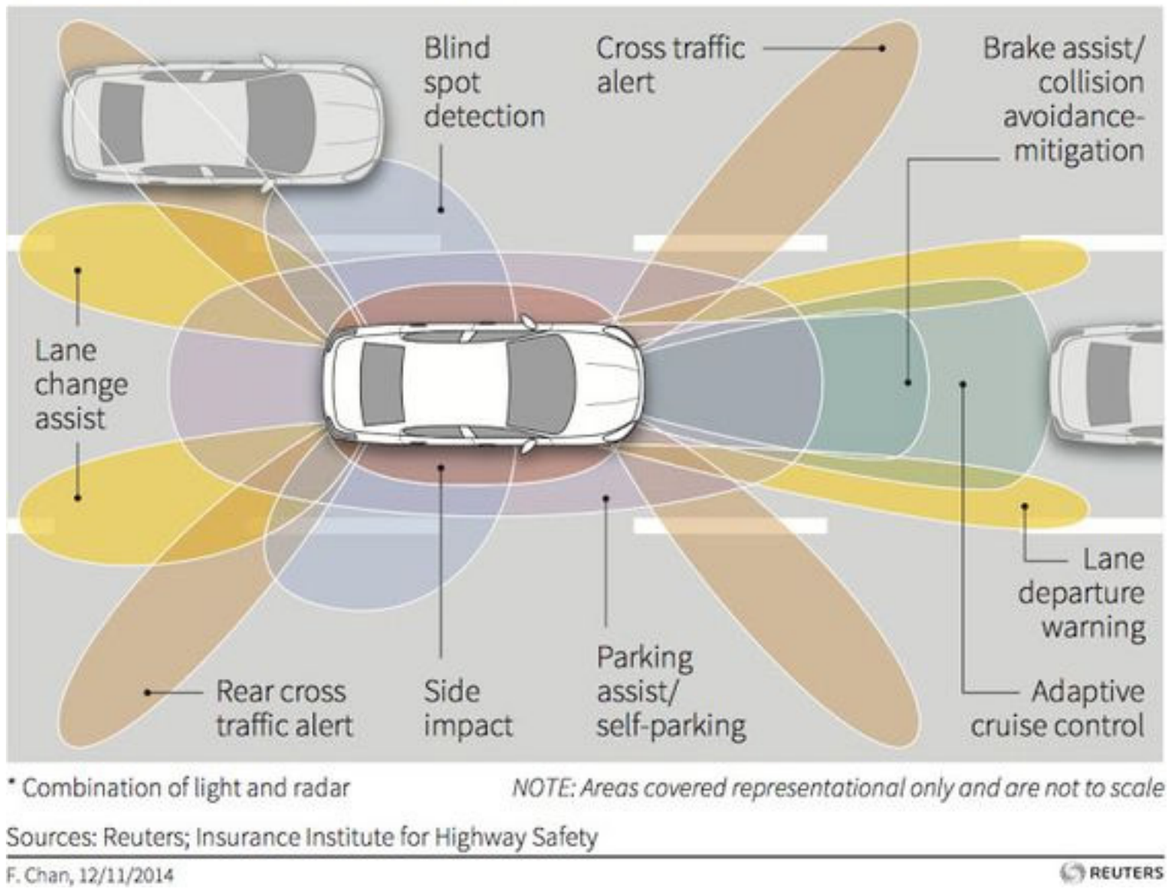
OPPORTUNITY

Automotive safety tech such as sensors, radar, LIDAR, cameras, etc give drivers improved awareness on roads.

- **Decrease the chance of an accident by 50%**

- This technology is not widely available for cyclists

- Would increase cyclists awareness and reduce crashes



TRACKING SYSTEMS- “NEW EYES AND EARS”

“The first step to improved awareness and communication on the road today.”

1. Global Positioning System (GPS)

Uses satellites to track a devices exact position. This data can be relayed and shared to any GPS device.

2. BLE (Bluetooth Low Energy) Beacons

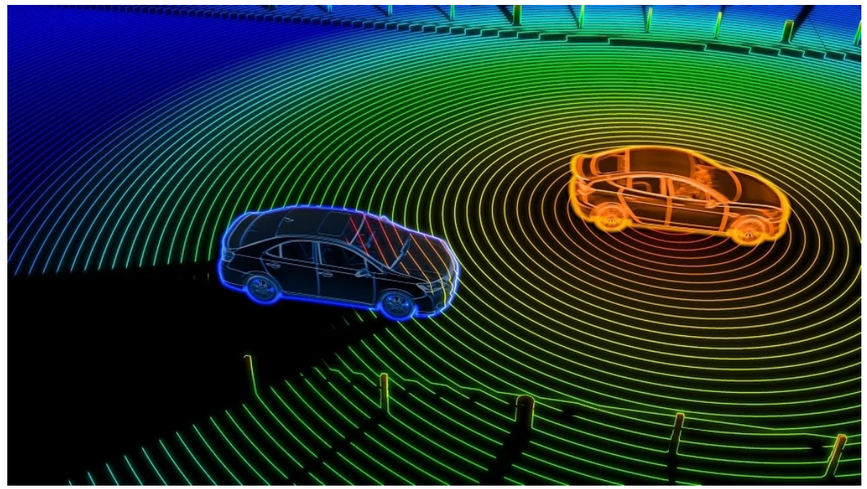
BLE beacon is a small hardware device that enables data transmission to mobile devices within a specific range. Active Bluetooth allows tracking and instant communication.

3. Automotive Radar Transceivers

Radar is also a core technology in existing Advanced Driver Assistance Systems (ADAS), which utilizes radar for adaptive cruise control, forward collision warnings, lane change, etc.

4. Lidar (3D Laser Scanning)

A method used to measure distances (ranging) by illuminating the target with laser light and measuring the time it takes for the light to reflect back to the sensor. One way tracking in many vehicles today.



RESEARCH SUMMARY

INCREASE OF ACCIDENTS

The reimergance of cycling in Urban areas increased accidents/ crashes by **9%.**

UNSAFE URBAN BIKE LANES

Cyclists using bike lanes connected to the road have a **50% higher chance of an accident**.

POOR DRIVER AWARENESS

Accidents occur when drivers are unaware of a cyclist around them. Even with lights on bikes **73% of drivers are unaware of cyclists** around them.

POOR CYCLIST AWARENSS

Cyclists have more blind spots than vehicles and have less time to react to incoming cars resulting in the **highest rate of cyclist deaths**.

LACK OF COMMUNICATION

Drivers focused on the road mixed with unpredictable movements of cyclists has created a clear lack of any direct communication.

CLEAR SOLUTIONS

These problems can be solved by **introducing vehicle safety tech** and more **purposeful lighting** to bikes along with creating new forms of communication and awareness between the two using **tracking systems**.

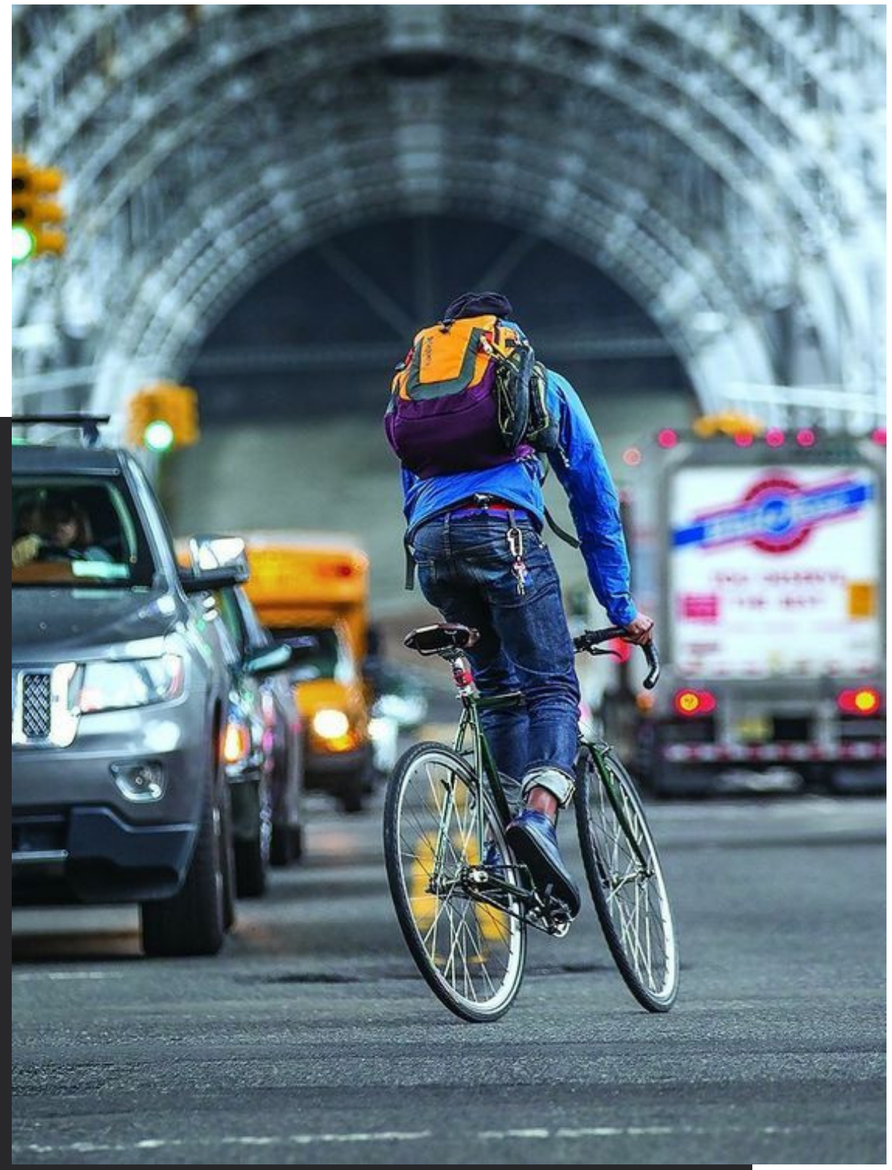
PROBLEM

STATEMENT

It is intimidating for people to bike in urbanized areas. This is due to safety concerns relating to awareness, driver inattention, and a lack of communication.

HYPOTHESIS

By addressing barriers relating to user safety, awareness, and communication between drivers and cyclists people can be safer biking in areas that lack biking infrastructure. Therefore experiencing the benefits without worrying about a crash.



DESIGN BRIEF

- Utilize visual signals to help communicate with drivers and increase driver awareness

- Provide a visual buffer around cyclists

- Use current vehicle safety tech on the bike to provide a warning system for cyclists

- Aid in driver/ cyclist awareness with direct links to the bike and vehicle with tracking tech

- Product should not inhibit cyclists movements

- Should be easy to install and use on the bike while being easy to charge, waterproof, and durable

CONCEPTS

Ryan Provenza

CYCLIST SAFETY

INITIAL CONCEPTS: HIGHLIGHTS

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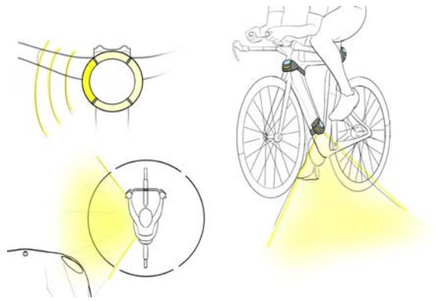

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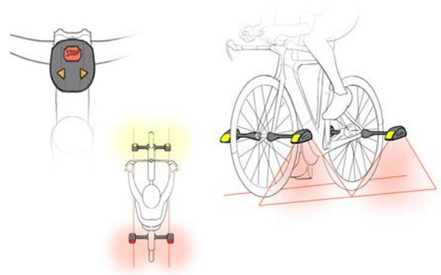

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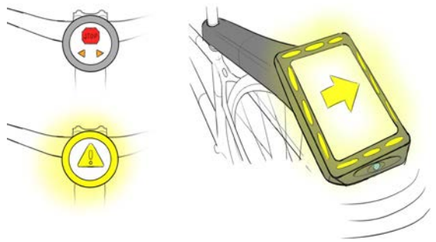

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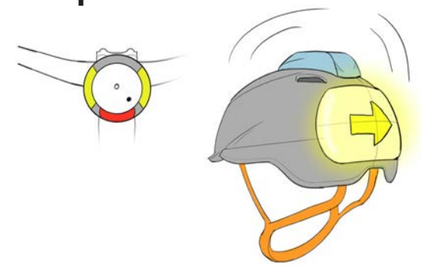

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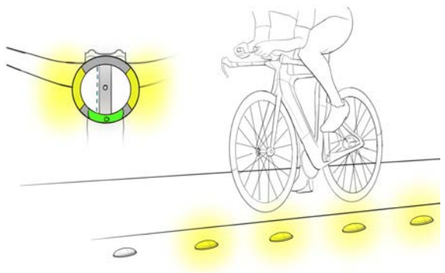

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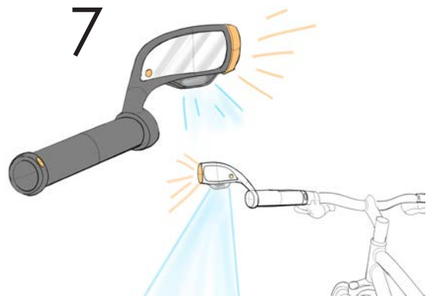

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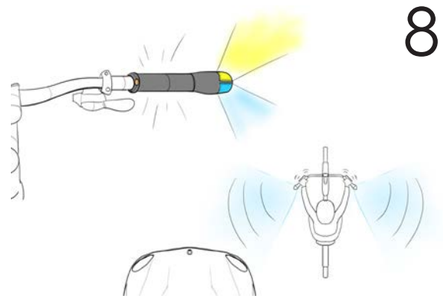

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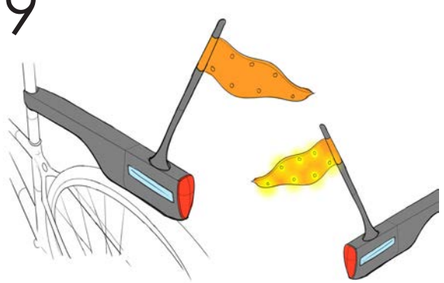

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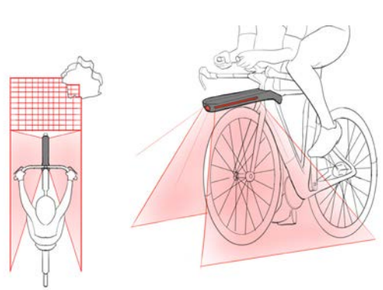

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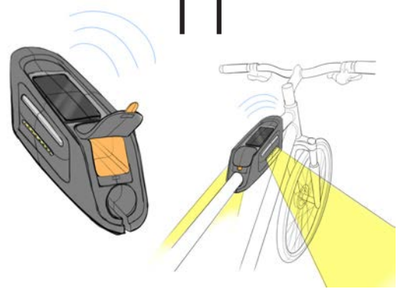

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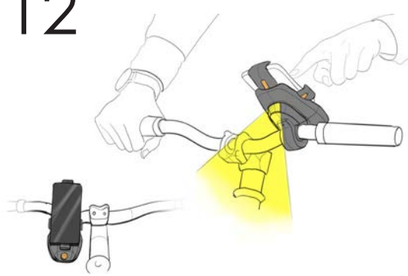
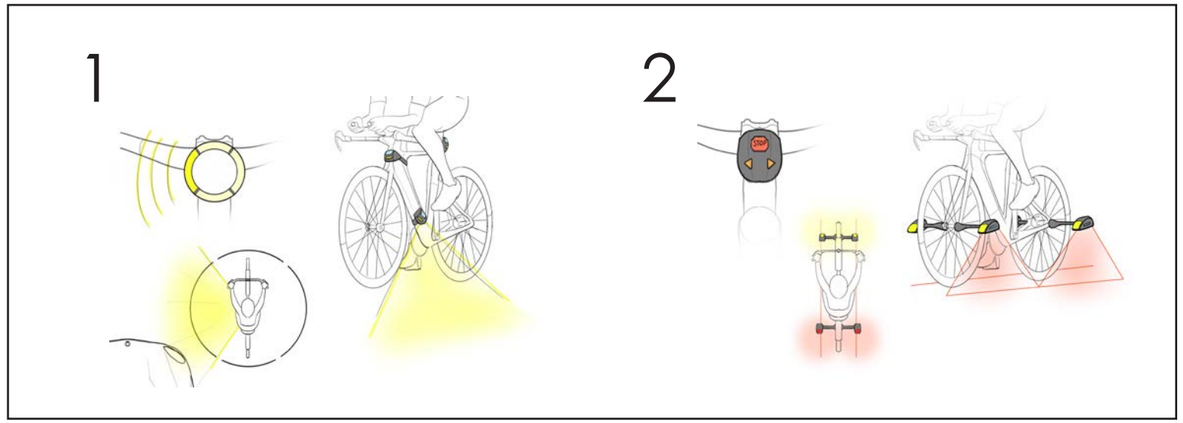
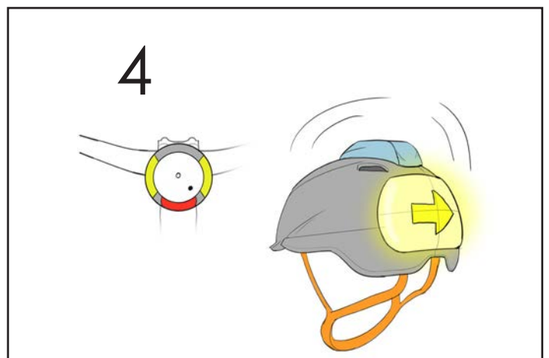




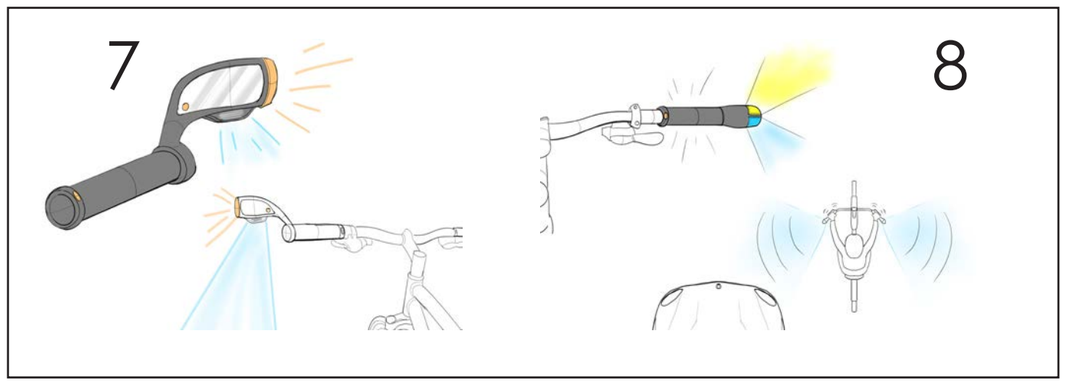
VISUAL BUBBLE/ FEEDBACK LOOP

Increases the cyclists presence and awareness
through all around sensors and visual warnings.



TECH ON HELMET/ COMMUNICATION

Increases cyclists awareness through LIDAR and
helps communicate to nearby drivers.



TECH IN HANDLE/ AWARENESS

Signals to the cyclists vehicles in their blind spots
and allows for directional communication
to drivers.

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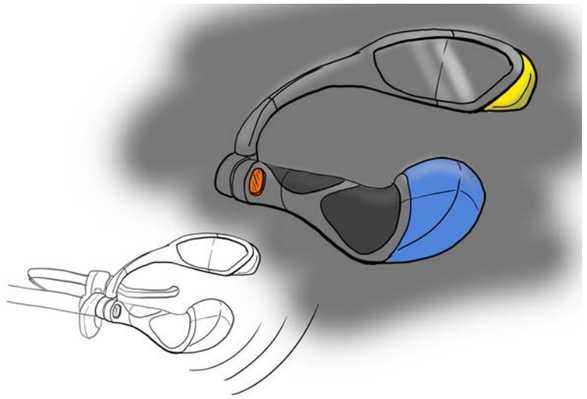

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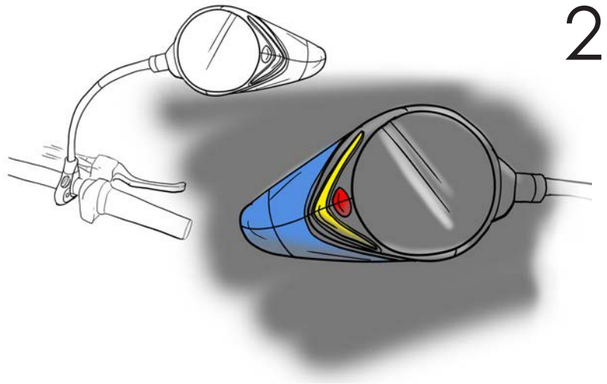

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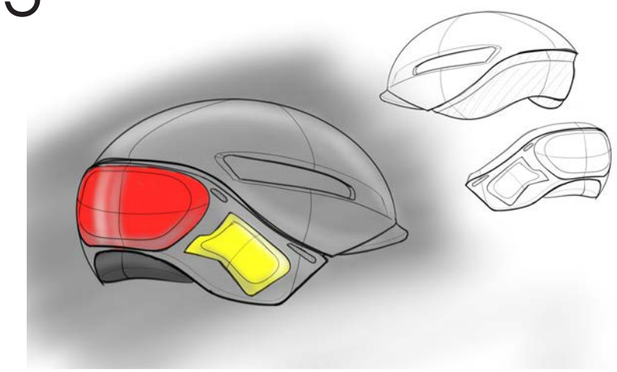

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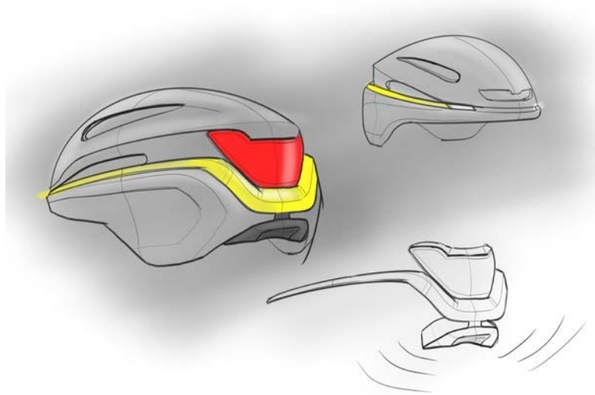

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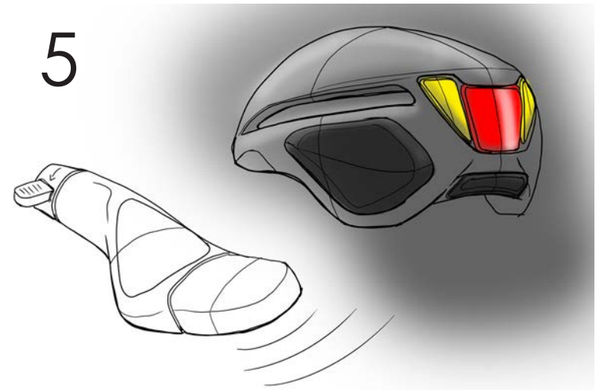

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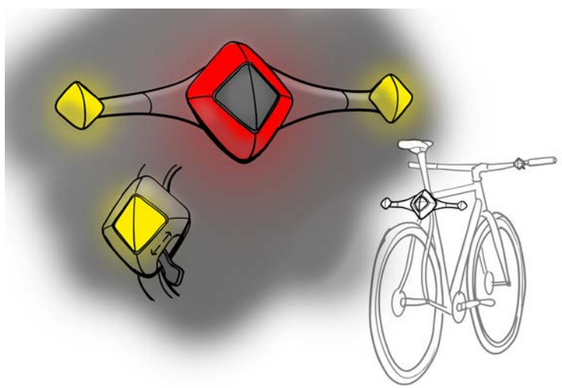

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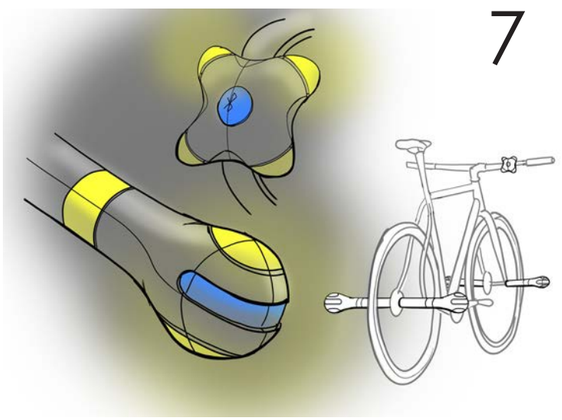
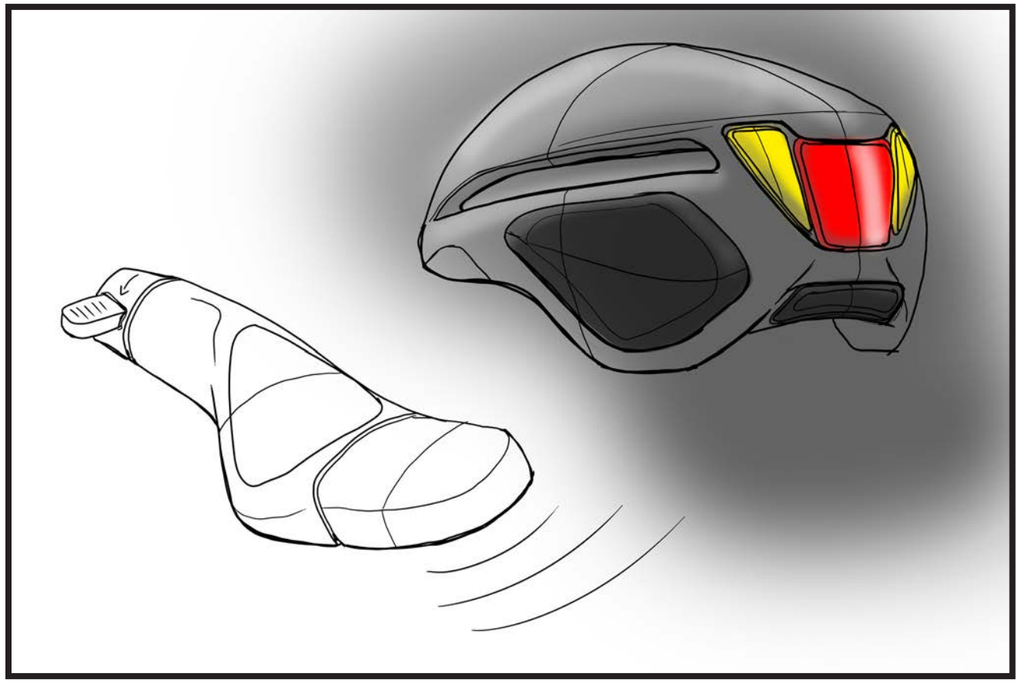




- Sensors on the helmet and handles provide better awareness to the cyclist using LIDAR and Radar. Lights warn the cyclists while simultaneously informing drivers of their presence.

- This creates a visual bubble around the cyclists and feedback loop for both cyclist and driver.

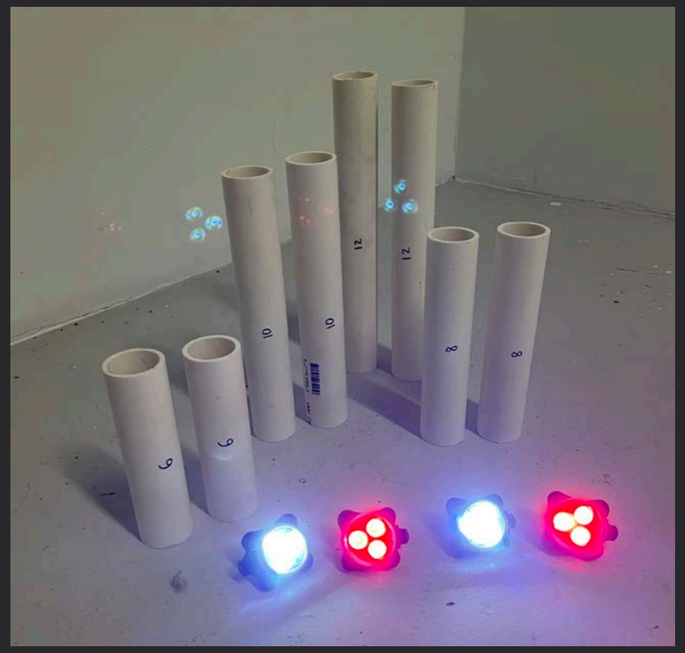
VISUAL BUBBLE/ FEEDBACK LOOP
TECH ON HELMET/ COMMUNICATION
TECH IN HANDLE/ AWARENESS

Why the helmet and handle?

- The helmet and handles provide optimal positioning for the sensors along with easy use and accessibility for the cyclist.

- These products can also have added functions such as directional signaling and physical protection.

PROOF OF CONCEPT/ LIGHT TESTS



Takeaways

- The best positioning for the lights was front and back

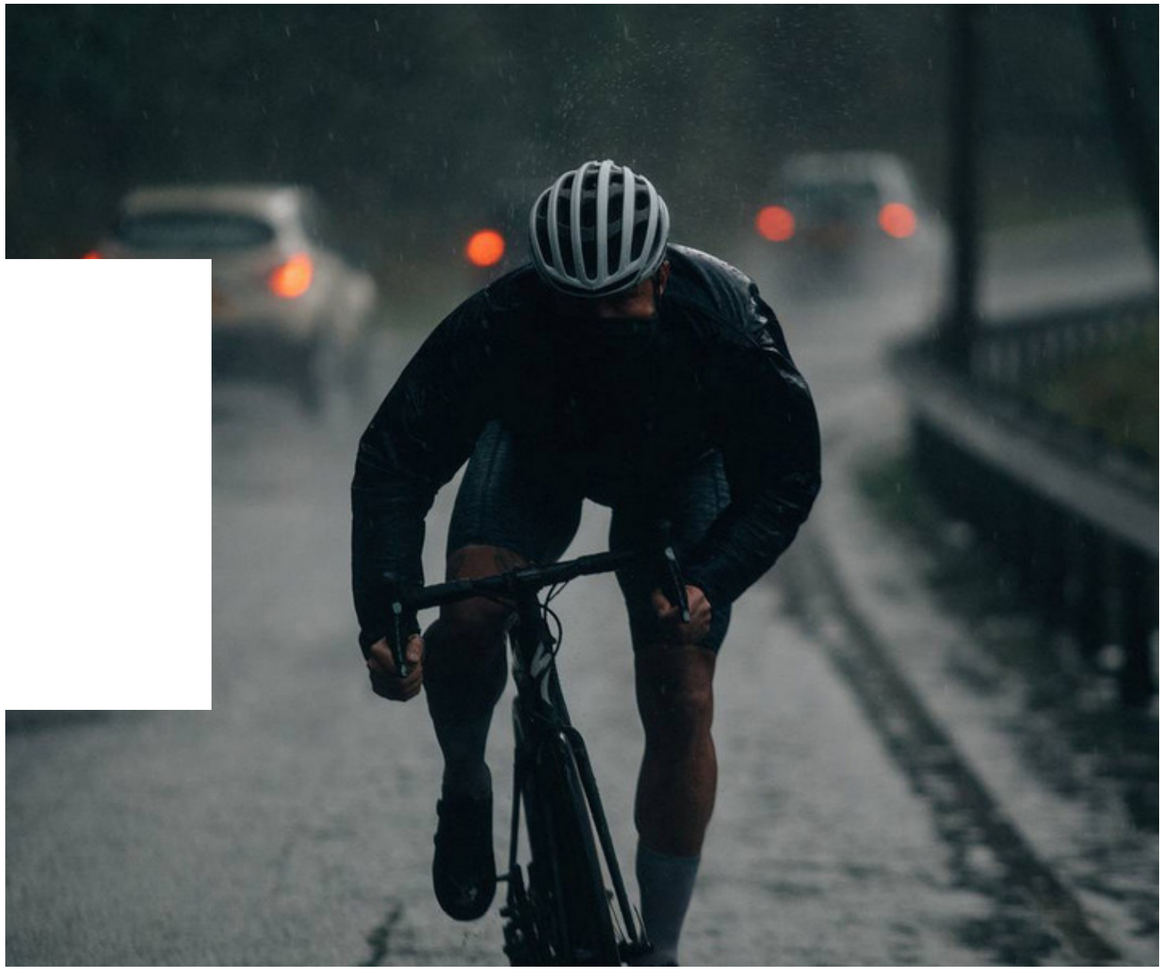
- The optimal length for the handles was between 8 and 10in

- The 130 lumen lights were hard to see during the day but are very visible at night

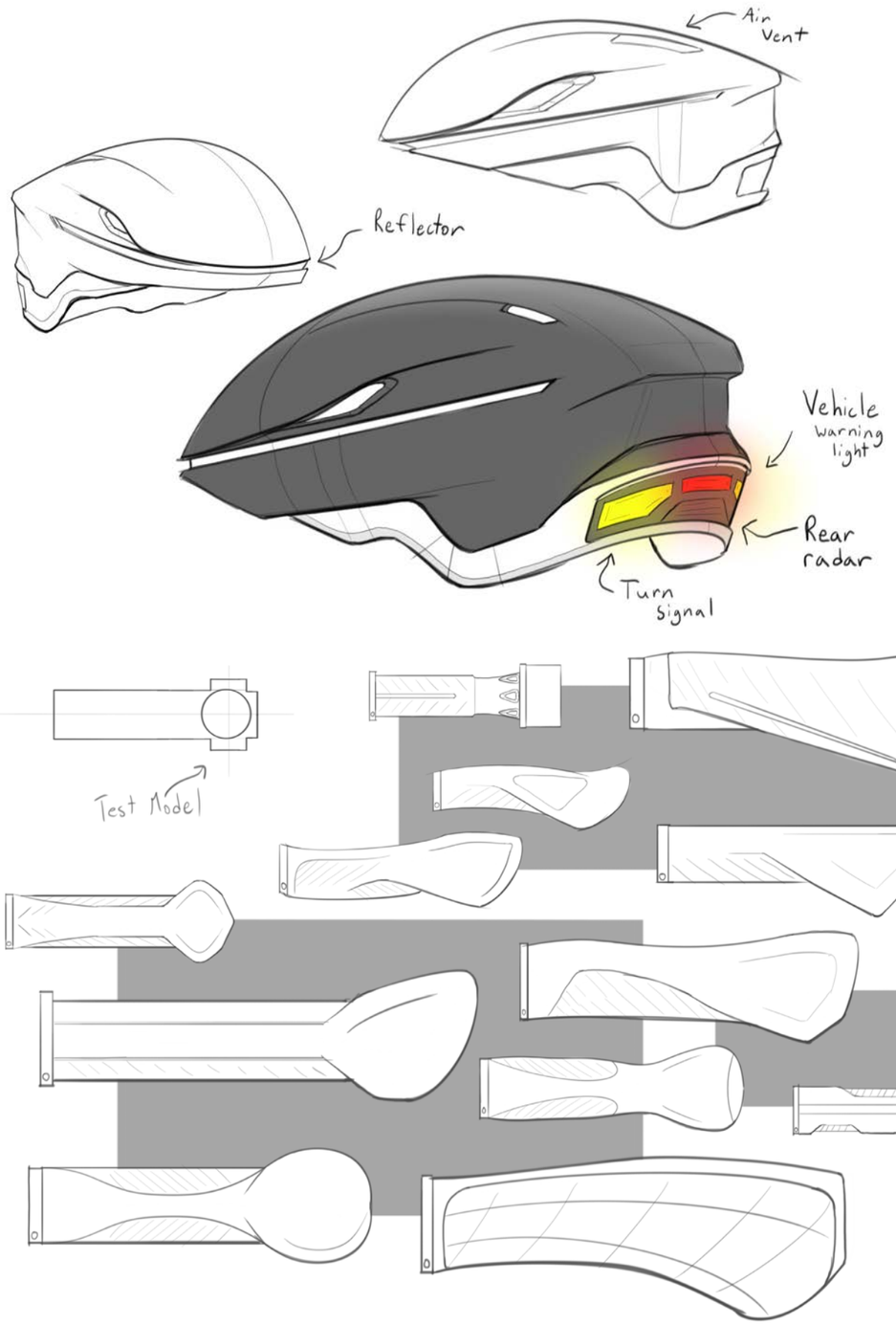
- Package for the internals was found

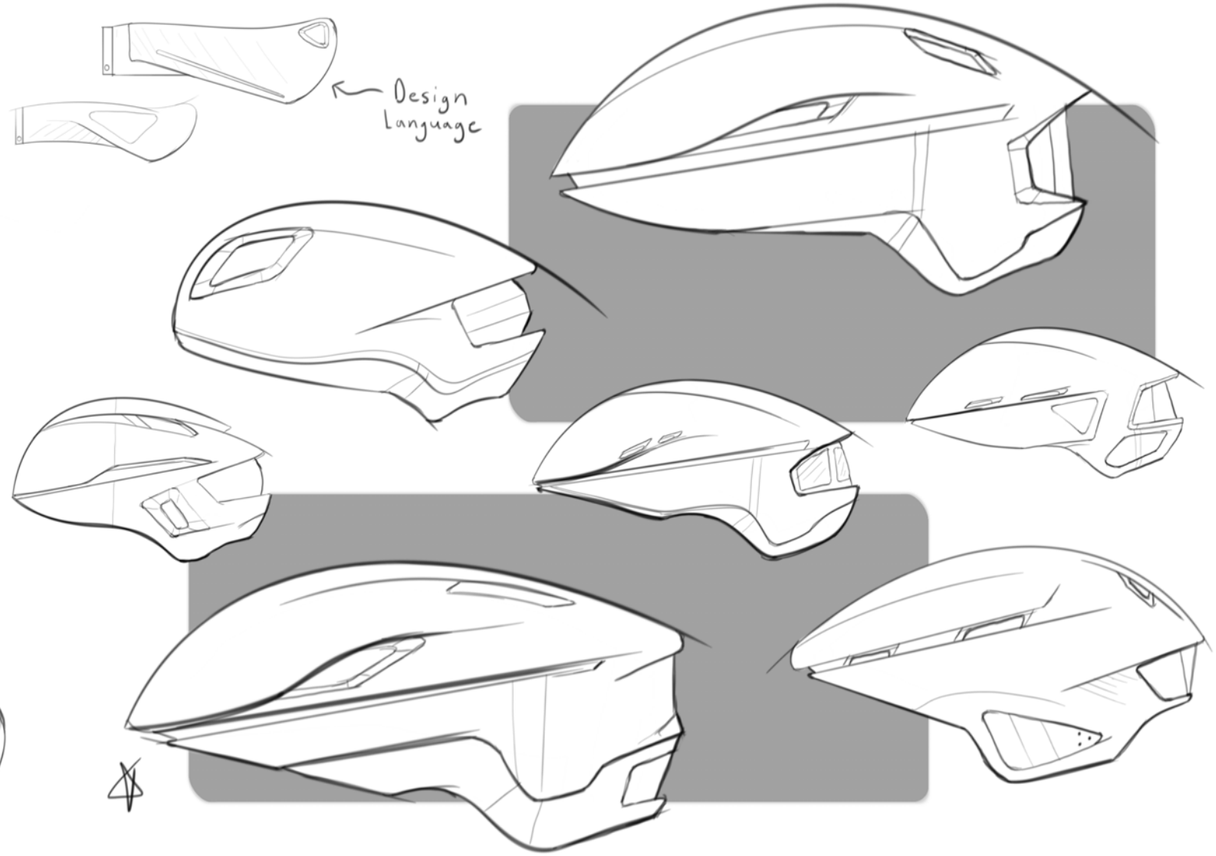
STYLIZE

Ryan Provenza

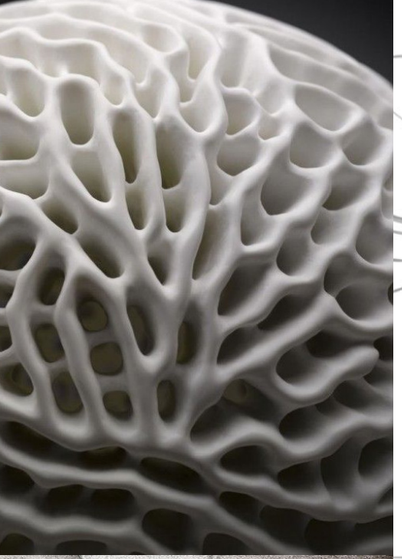


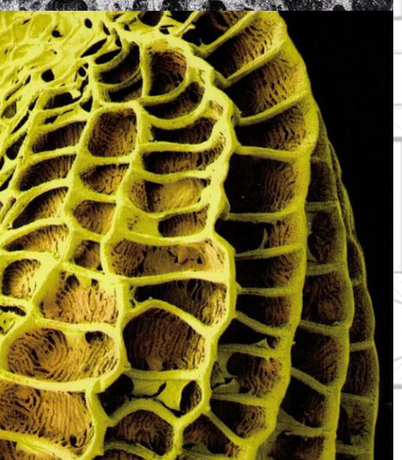
CYCLIST SAFETY

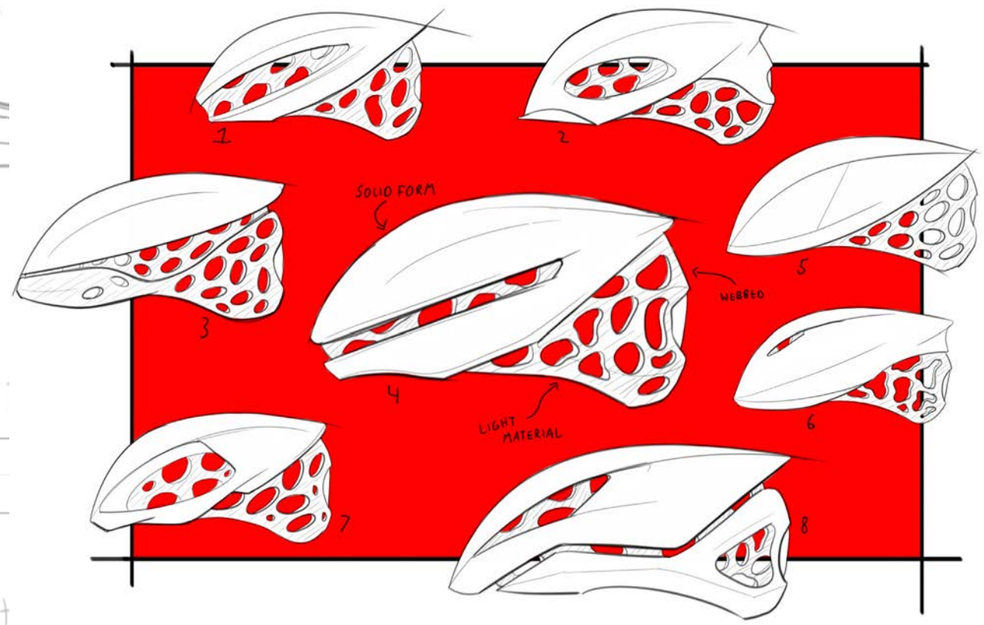

Air Vent
Reflector
Vehicle warning light
Rear radar
Turn signal
Test Model


Design Language


Ergonomic handle
Quick lock grip
Turn Signal
Front light
Rear light
Lidar



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SOLID FORM
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WEBBED
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LIGHT MATERIAL
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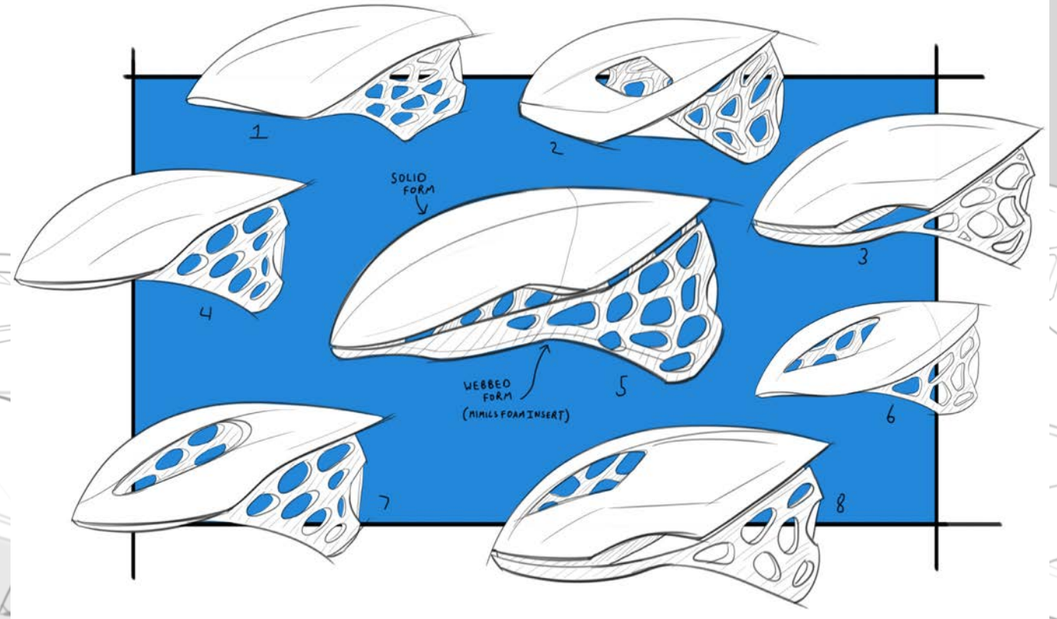
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SOLID FORM
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WEBBED FORM (MIMICS FOAM INSERT)
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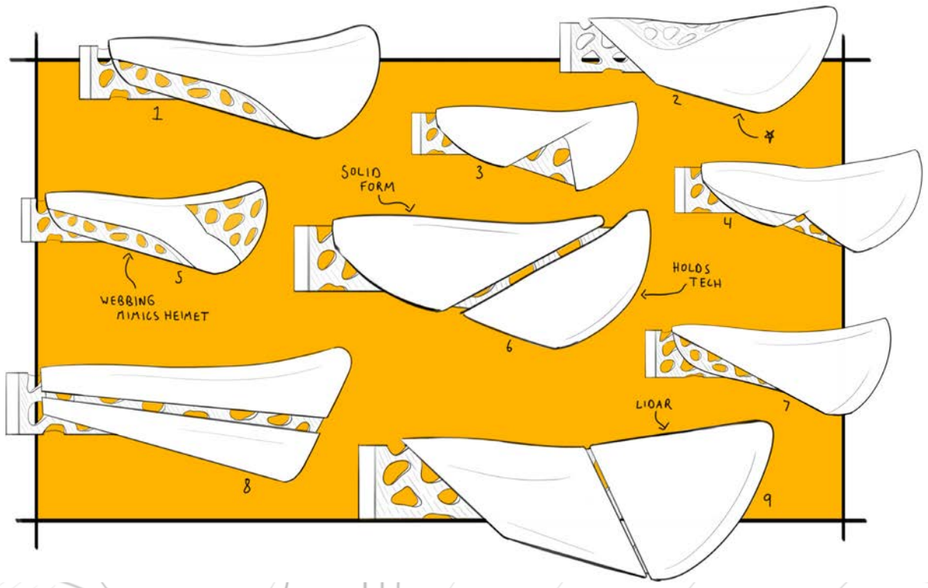
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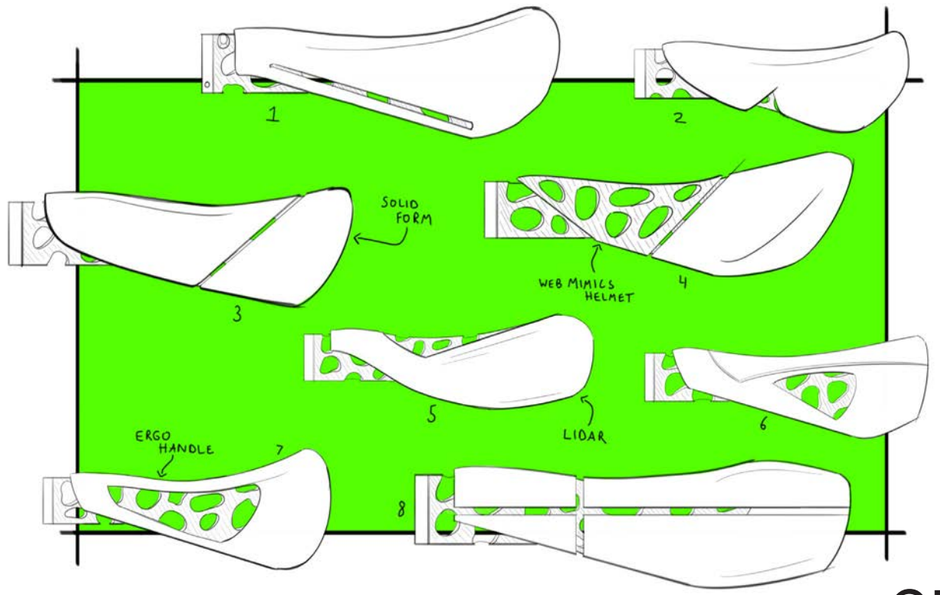
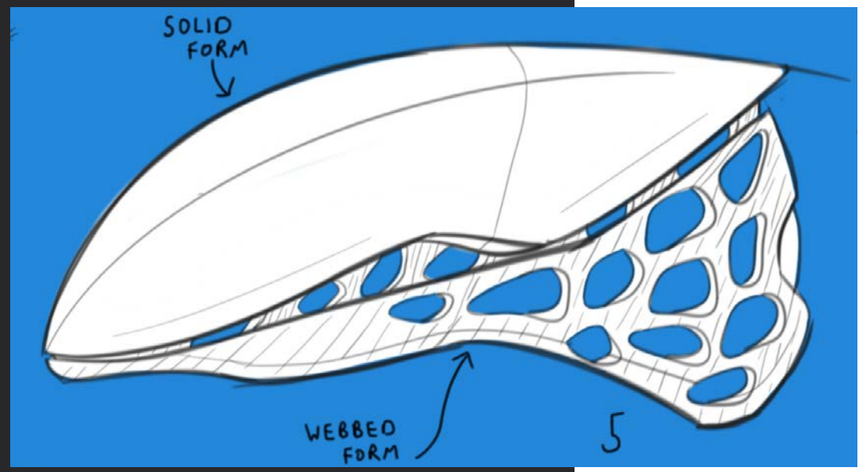
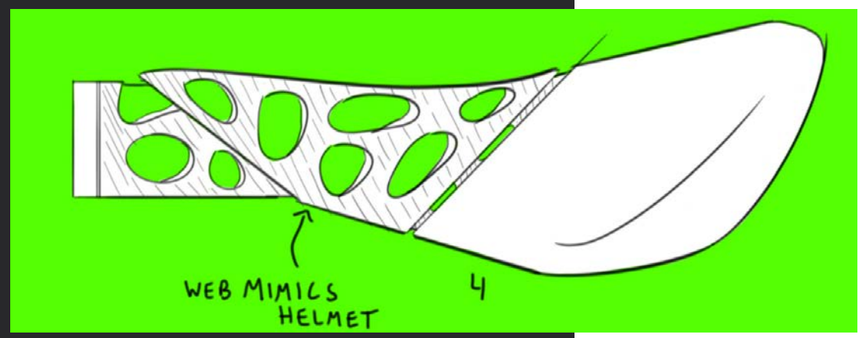
2
3
4
SOLID FORM
5
WEBBING MIMICS HELMET
6
HOLDS TECH
7
8
LIDAR
9


1
2
SOLID FORM
3
WEB MIMICS HELMET
4
5
LIDAR
6
ERGO HANDLE
7
8

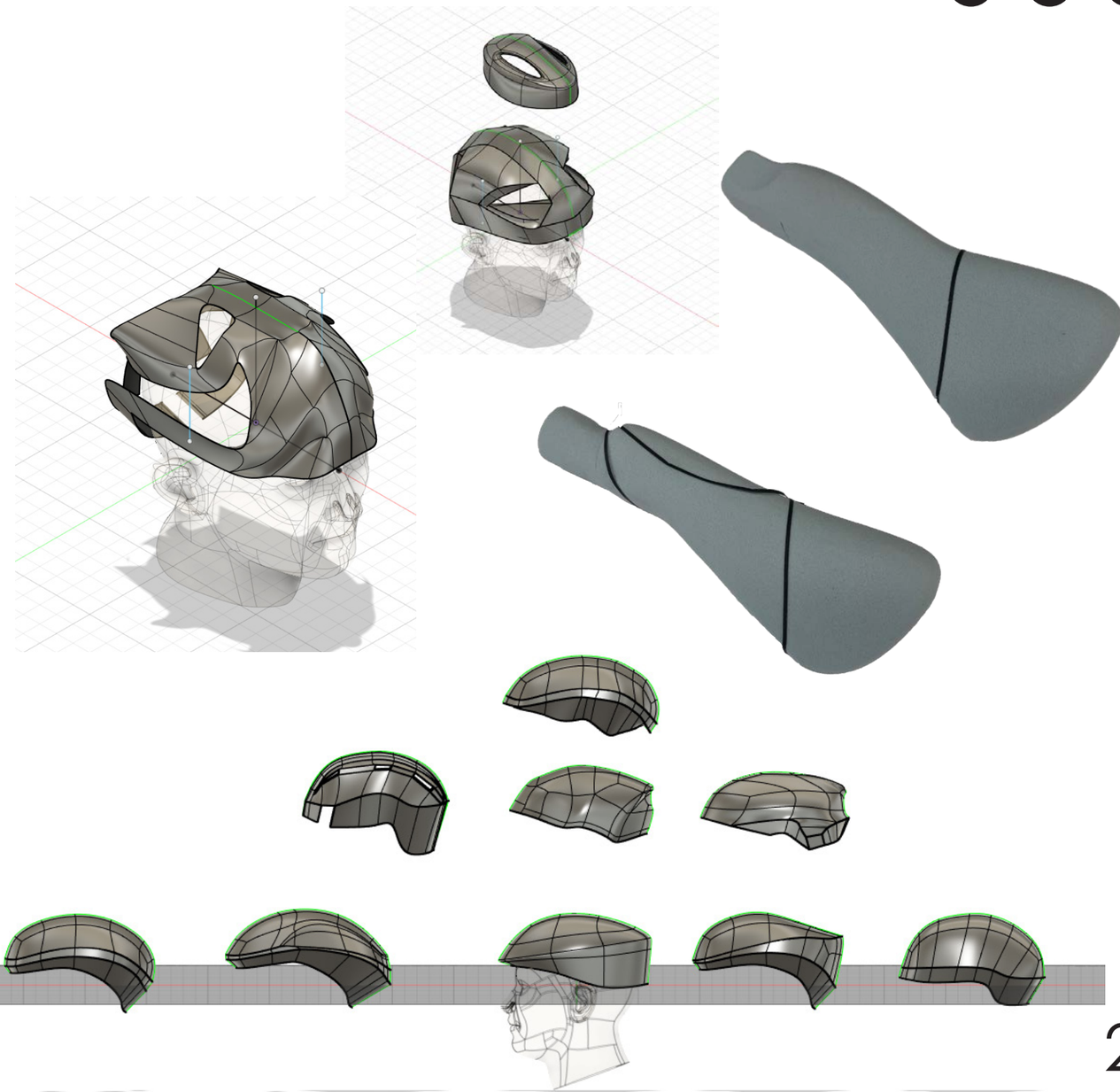
CHOSEN STYLE/ MODEL EXPLORATION





CHOSEN SIDEVIEWS

- These designs communicated well and had an interesting form language I knew would be a challenge modelling.



Introducing

RAGNO

The helmet/ handle combination, built to make cyclists safer.

Introducing

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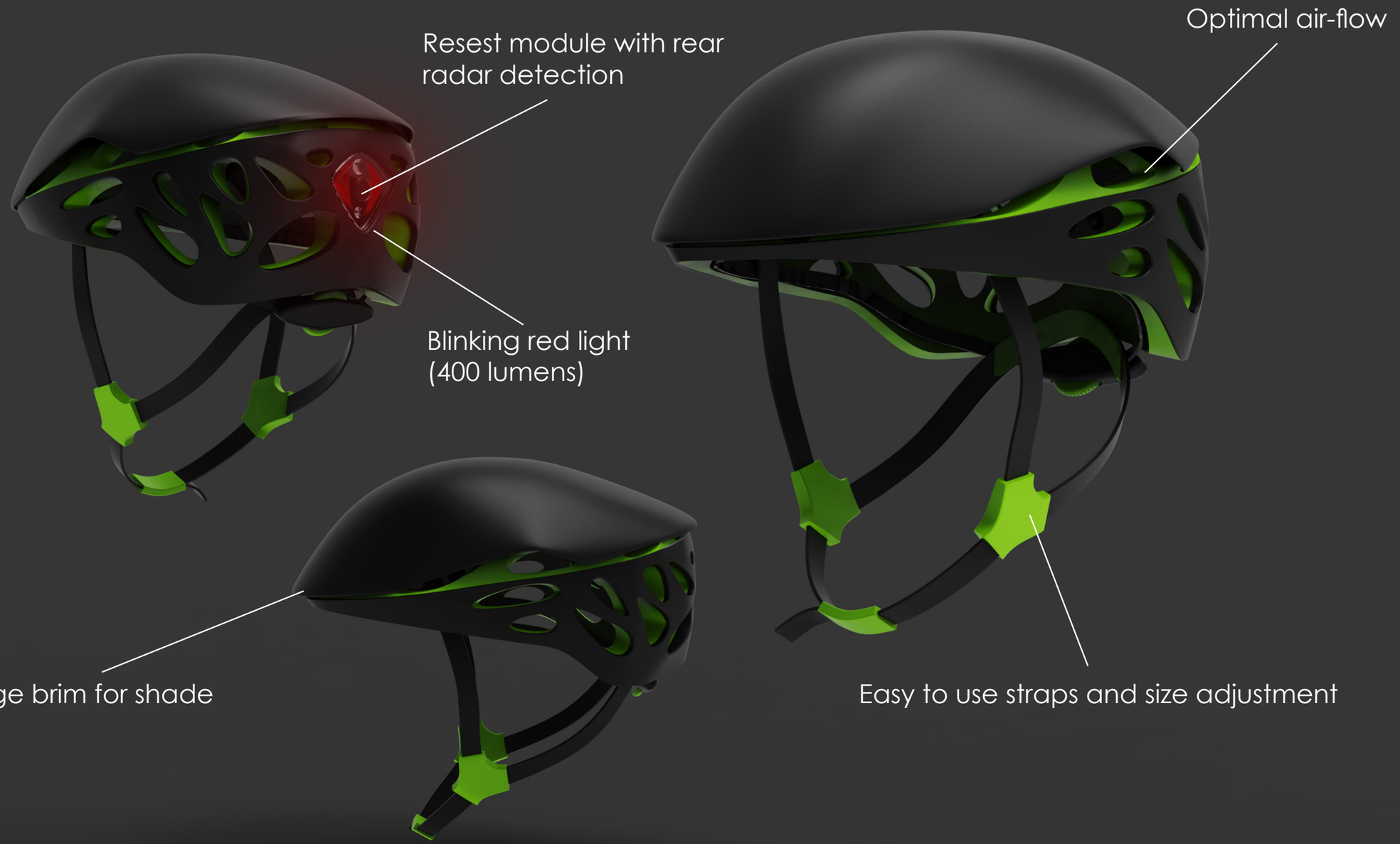
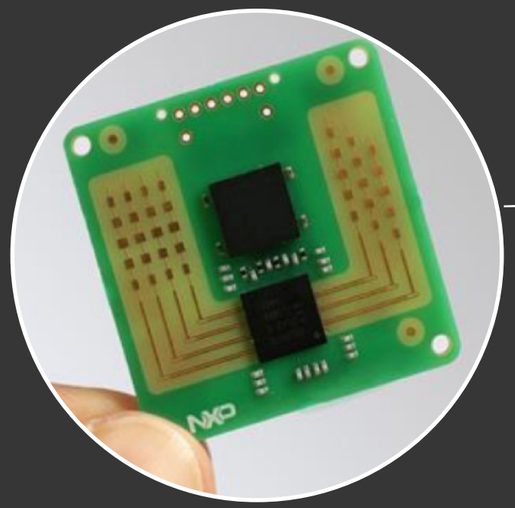
The helmet/ handle combination, built to make cyclists safer.

HELMET

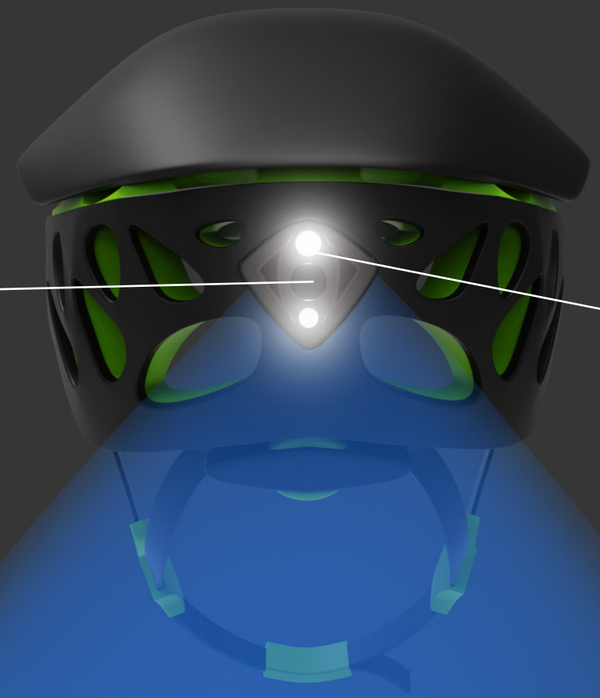

Resest module with rear radar detection
Blinking red light (400 lumens)
Optimal air-flow
Large brim for shade
Easy to use straps and size adjustment

FUNCTION

Bone conductive speakers
warn cyclist of approaching vehicles
no matter how loud it is on the road.



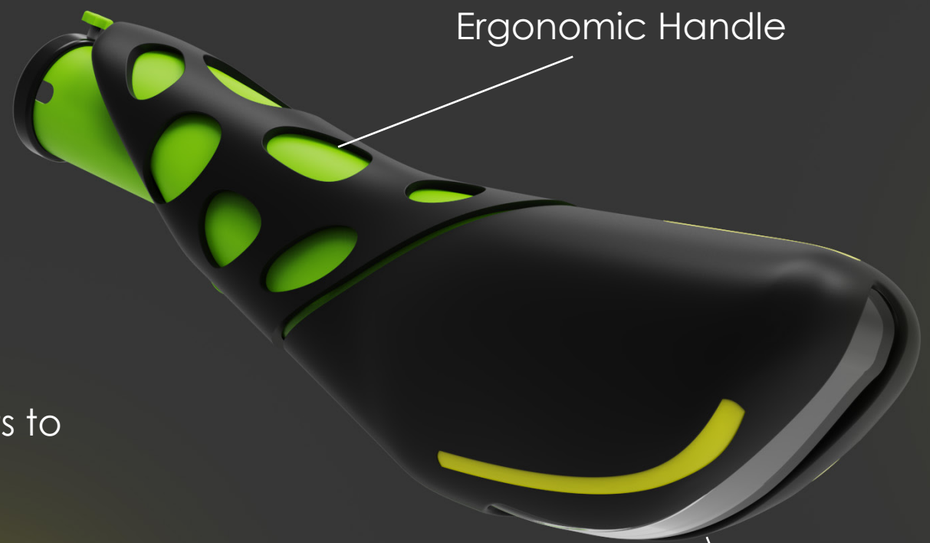
- New radar transceiver for automotive industry is easilly embedded in the light module.

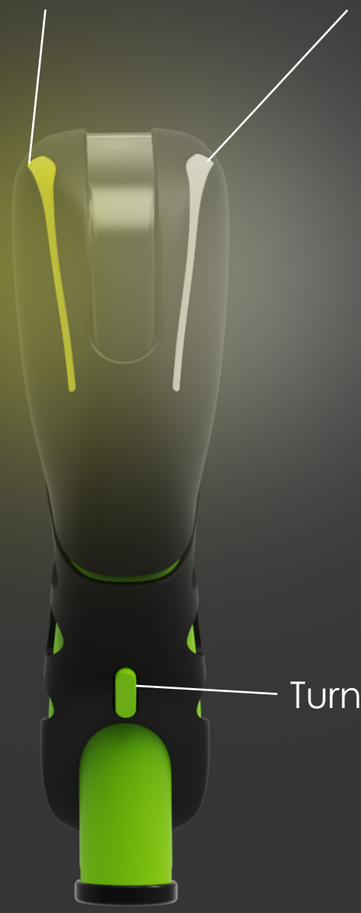


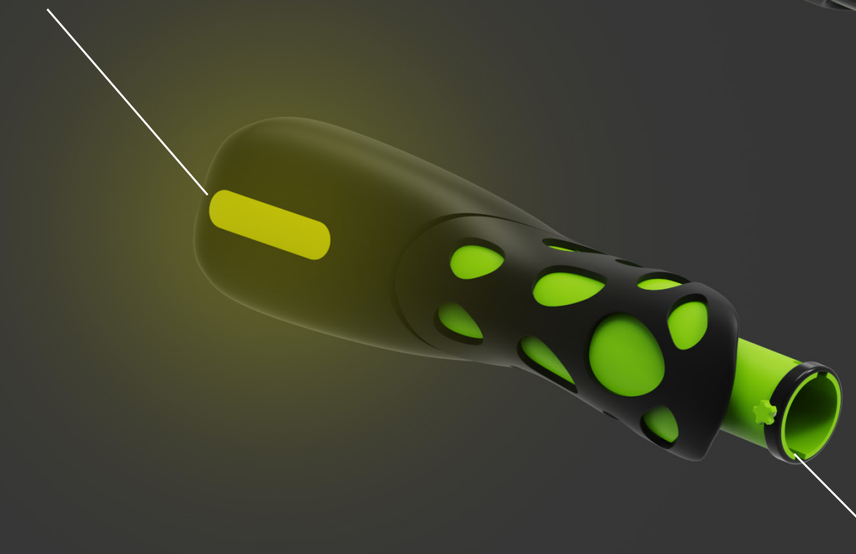
Warning lights for drivers
(400 lumens)

- Radar transeiver can read up to 50m behind cyclist. The closer the vehicles gets, the faster the lights fash.

HANDLES

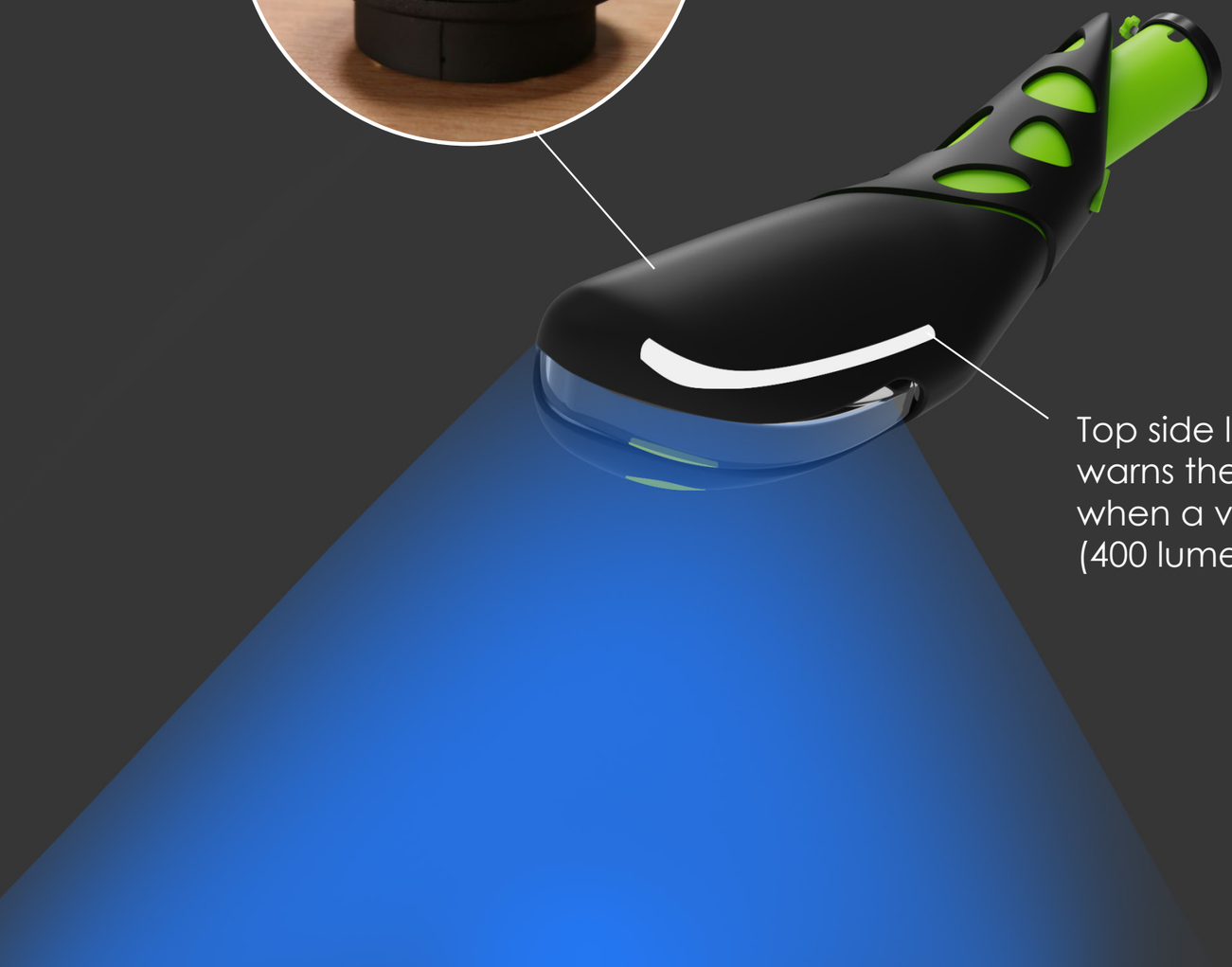

Ergonomic Handle
LIDAR detection keeps eyes on the sides of the cyclist


Turn signal and warning lights
Turn signal button


Forward lights act as headlights to luminate drivers blind spots
Quick release handle for easy removale

FUNCTION

- Small LIDAR module recently developed for drones easilly fits into the handles.

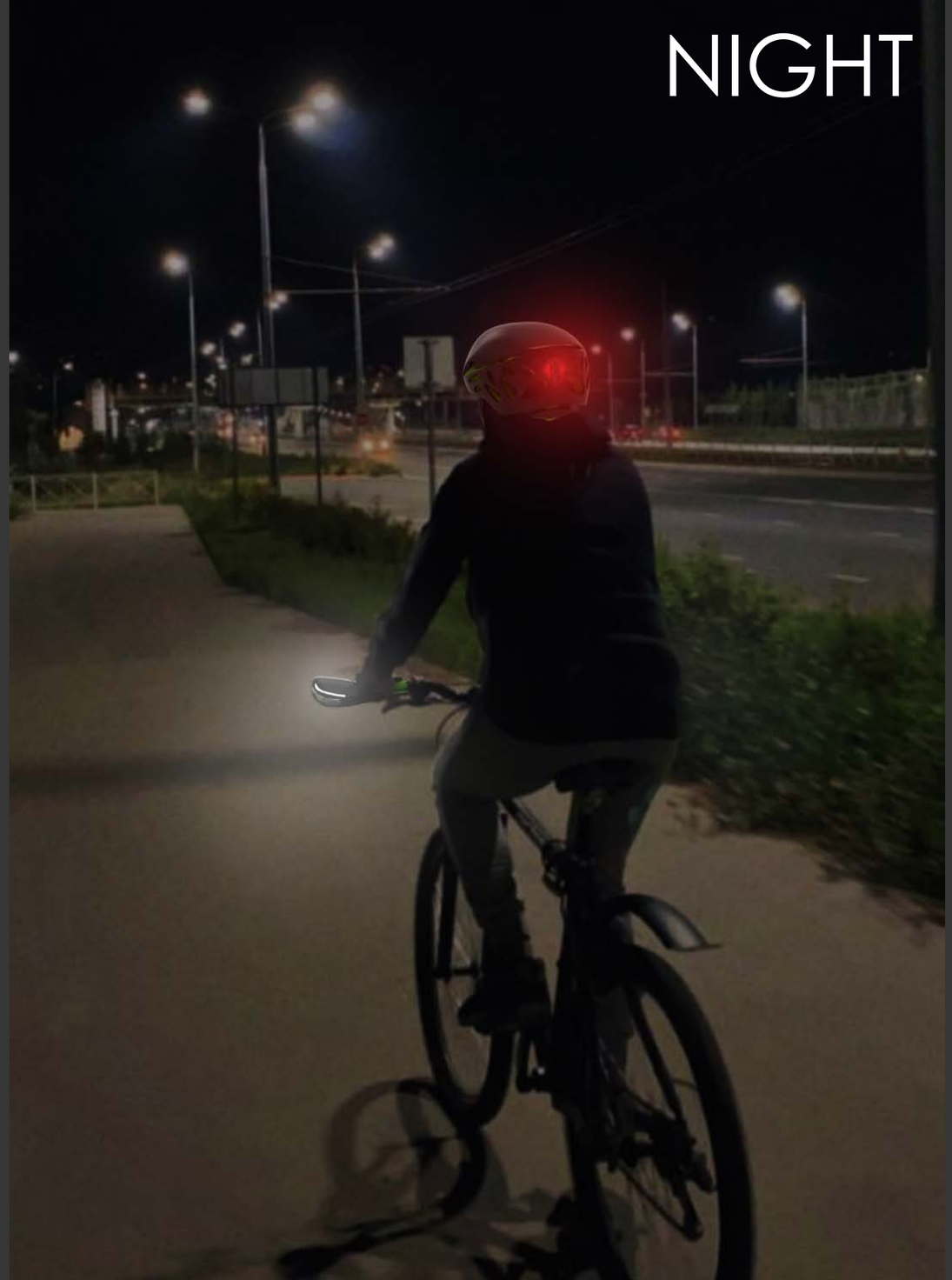


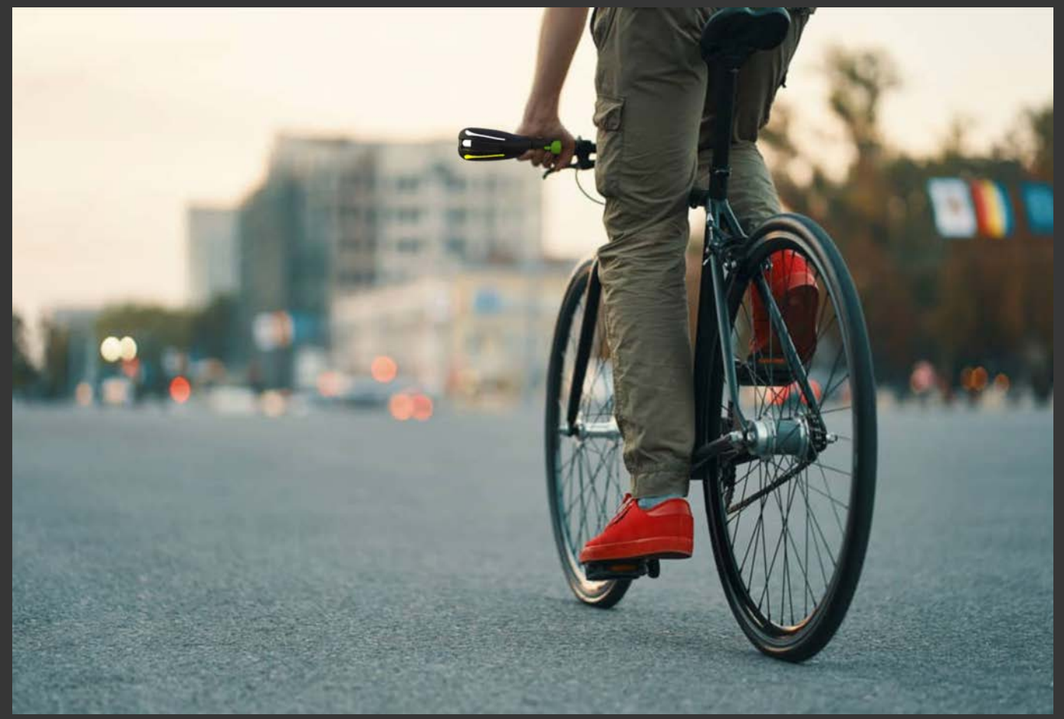
Top side light simultaniously warns the driver and cyclist when a vehicle is detected (400 lumens)

- LIDAR constantly scans blind spots for vehicles with a range of 40m.

DAY

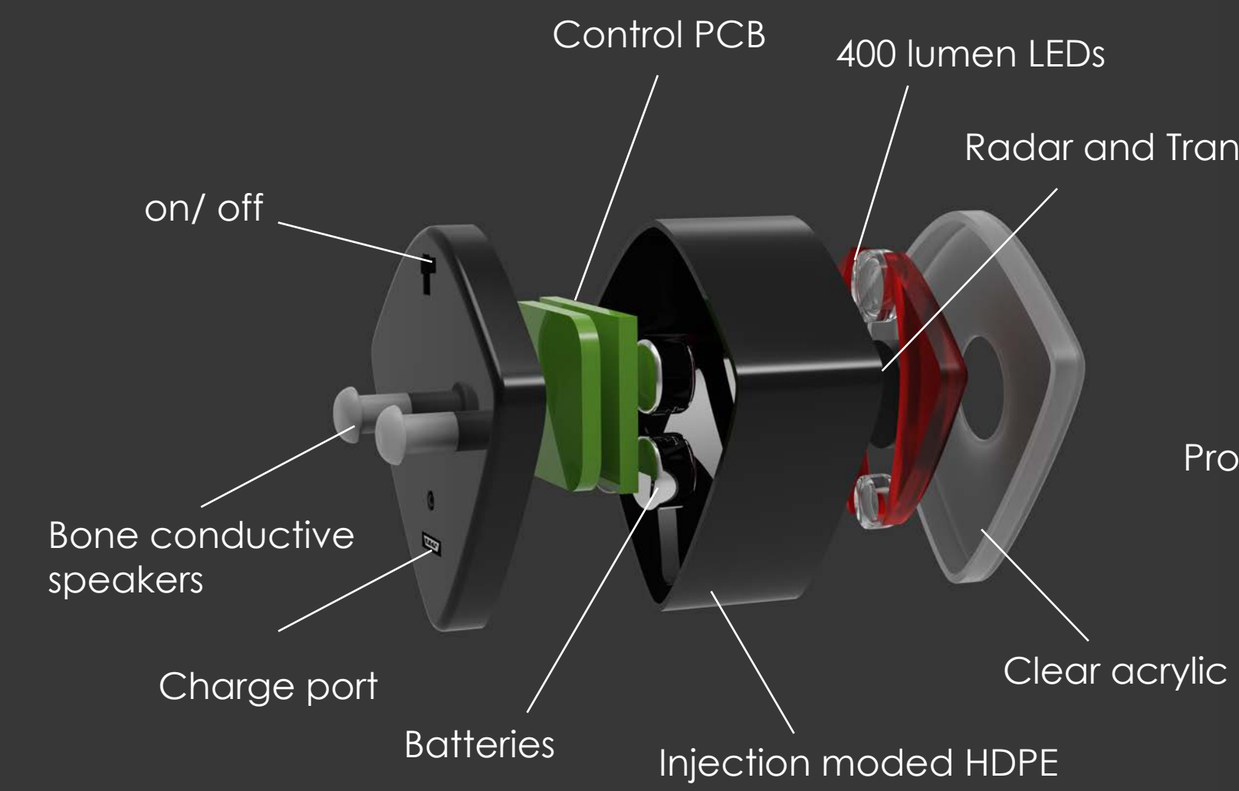
NIGHT

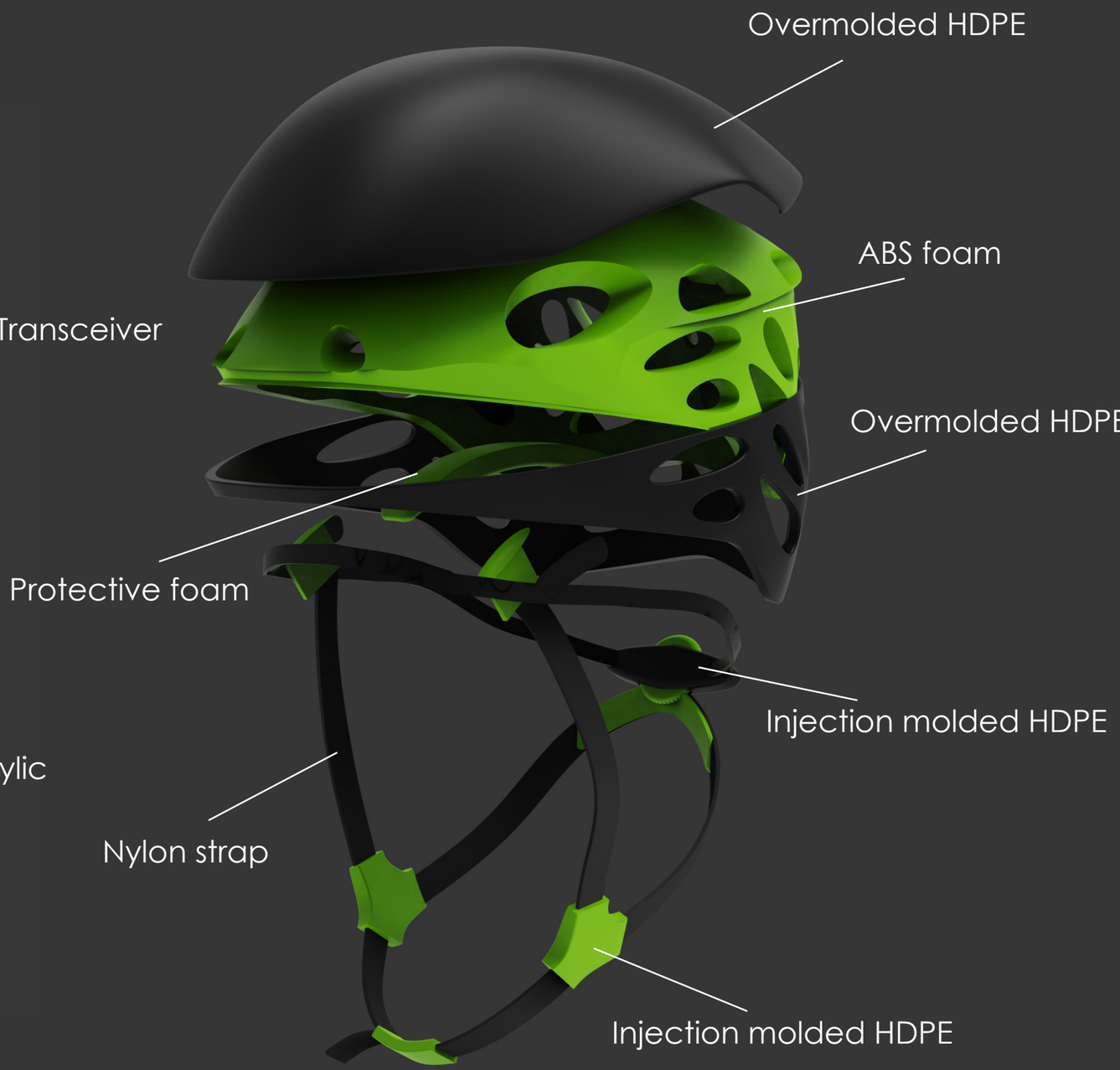


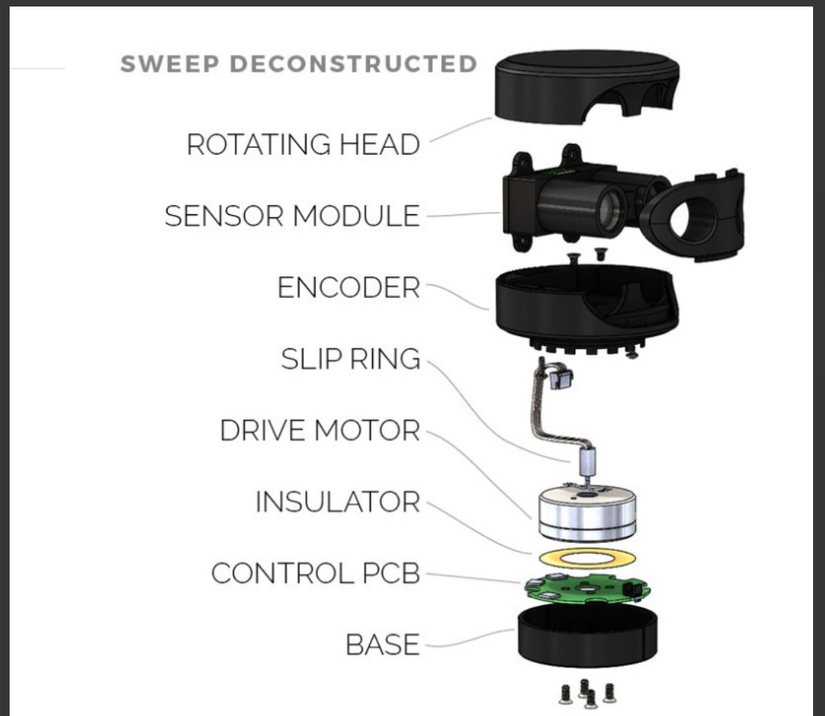


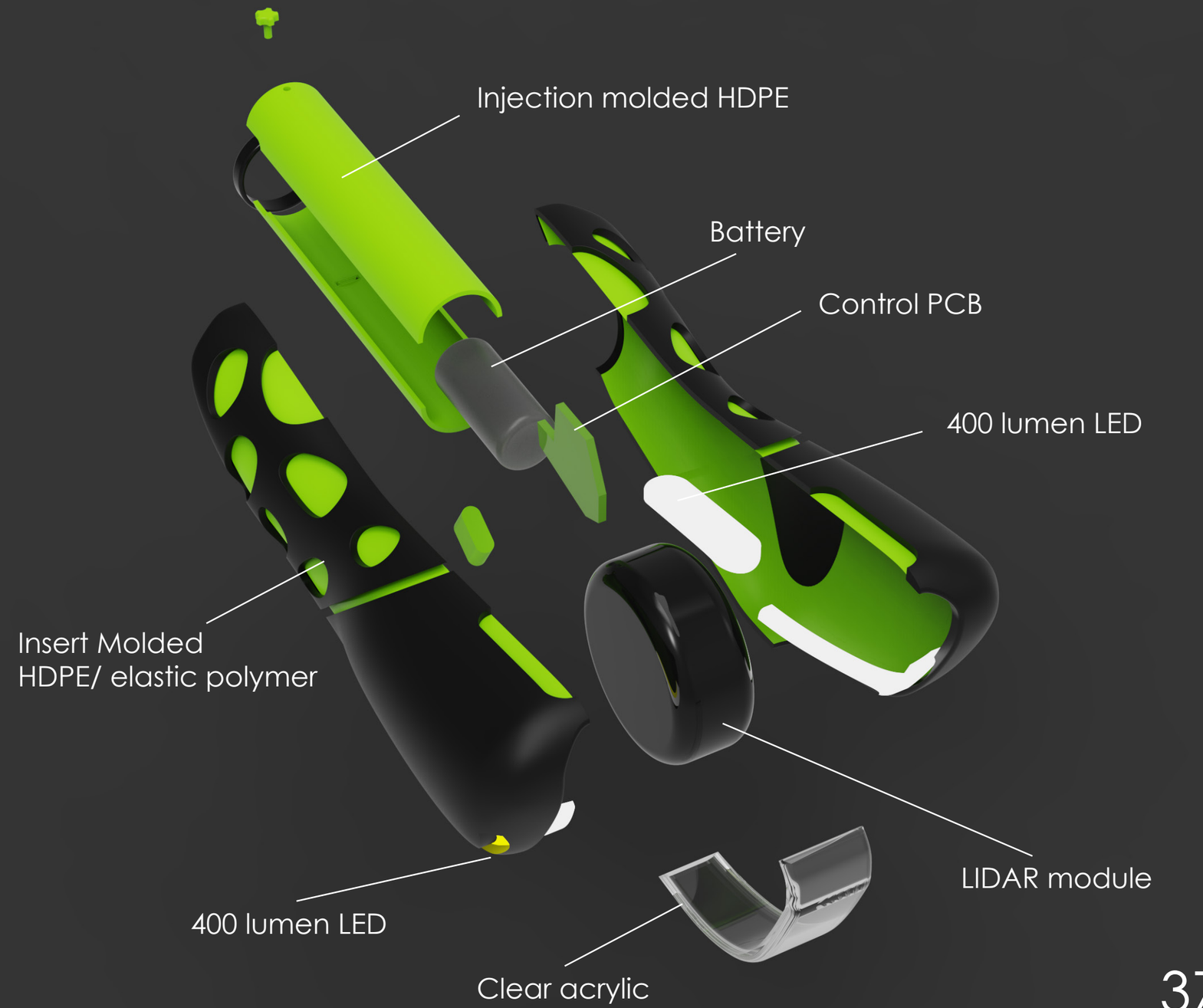
CONTEXTUAL VIEWS

EXPLODED VIEW





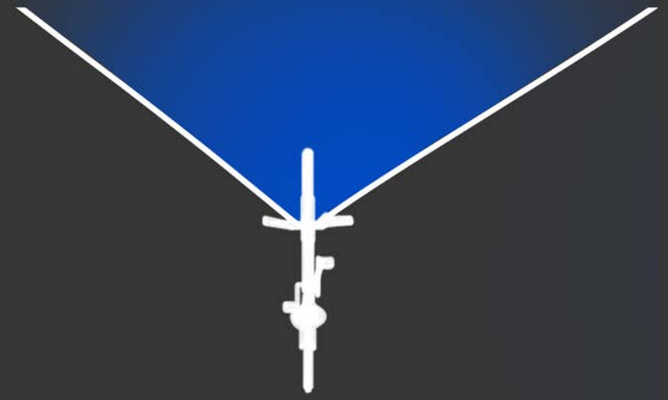


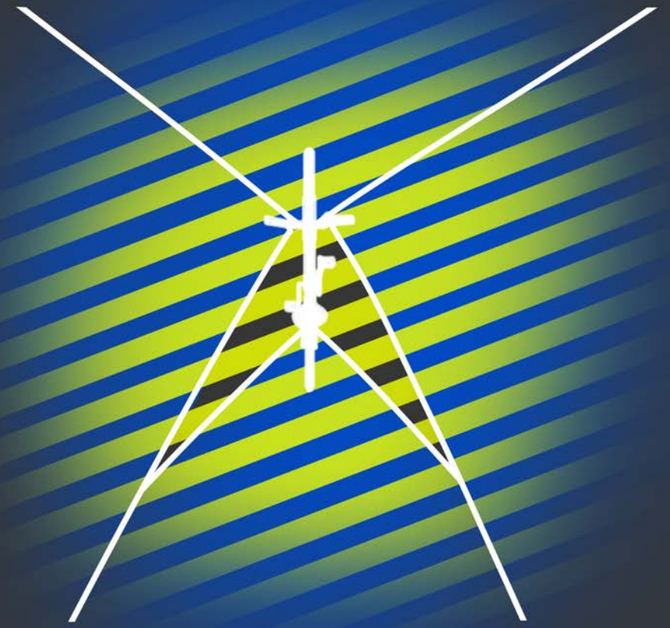


EXPLODED VIEW

COLOR VARIATIONS

COLOR VARIATIONS





Awareness (Vision)

Warning Lights

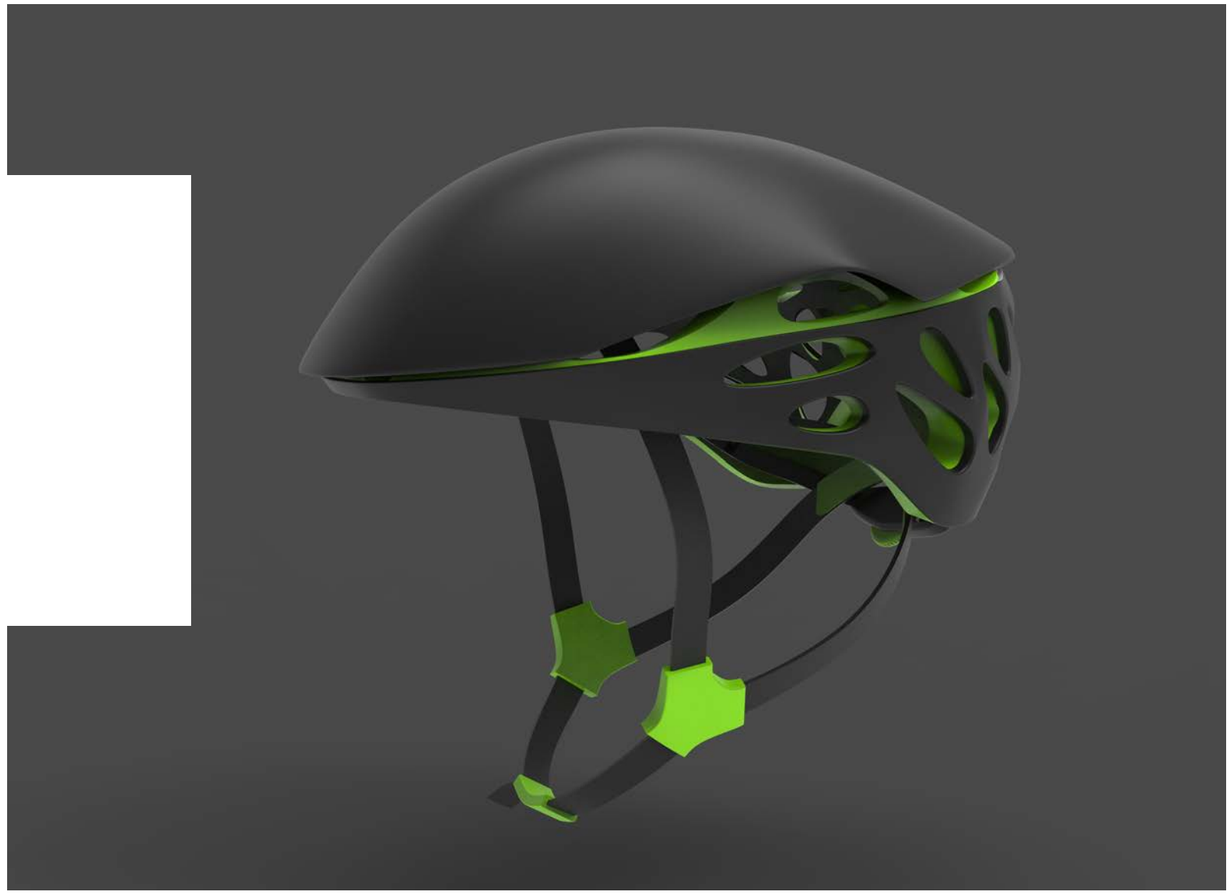
WITHOUT RAGNO

- Without RAGNO the cyclist is relying solely on their vision to stay aware. Their rear and sideviews are blind spots with no lights to signal to drivers.
- They are unaware of their surroundings and unpredictable.

WITH RAGNO

- With RAGNO the cyclist has almost perfect 360 degree awareness. They now have no blind spots and can rely on the tech and lights to signal to themselves and incoming vehicles.
- They are aware and can clearly communicate to drivers.

THANK YOU



Ryan Provenza 2023

CYCLIST SAFETY