

# Re-Designing a helmet for the young age group

P2 Report

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# Approval Form

This is to certify that the Industrial Design Project entitled "Re-design of a helmet for daily commute" by Pranay Gurumukhi is approved for partial fulfillment for the Master of Design degree in Industrial Design.

Prof. B.K. Chakravarthy [Project Guide]:

For 

Signature of the Chairperson:

Signature of the Internal Examiner:

Signature of the External Examiner:



# Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited of whom proper permission has not been taken when needed.

Pranay Gurumukhi

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M.Des Industrial Design

Date: 13/12/2022

A handwritten signature in black ink, appearing to read 'Pranay Gurumukhi', written over a horizontal line.

# Acknowledgement

The success of this project is a cumulative outcome of a lot of guidance and assistance from many people.

I would like to thank our guide Prof. B. K. Chakravarthy for his constant guidance, feedback, and suggestions on generating new ideas for tackling the problems at hand. In addition, I also thank assistants in IDC for their support, and guidance and for helping me to drive my work in the proper direction to achieve the goals.

Also, sincere appreciation for the valuable resources and assistance provided by the other assistants and staff.

I would like to extend my acknowledgment to our ID co-ordinator, Mr. Avinash Shende for their encouragement and support for the accomplishment of this project.



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# Introduction

## Your life is precious, don't compromise on safety

According to the Ministry of Road Transports & Highway statistics, 4 lives are lost every single hour because of fatal head injuries suffered by motorcyclists in India. A shocking 78% of the riders do not wear helmets which leads to grave injuries. A majority of these accidents take the lives of children and pillion riders who are at a much higher risk of a head injury in the event of an accident. Therefore, motorcycle helmets for women and helmets for kids are also equally important when it comes to staying safe on the roads.

Wearing good quality helmets that meet safety benchmarks can prevent fatal head injuries and save your life. Also, insurance payouts are hassle-free when you have a helmet on during a mishap. In most cases, insurance adjudicators often conduct an investigation before paying out insurance coverage. If you failed to abide by any traffic laws, there could be a potential problem in receiving the insurance money. So, word of advice, never forget to put on your helmet even if it is a short ride to the grocery store.



# Design Methodology

01

## Research

Introduction

Primary Research

Secondary Research

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Market Study

02

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Define brief

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## Ideations

Initial Ideas

Form evolution

Final Concepts

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## Design

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Final Design

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05

## Testing

Prototype testing

Rating the product

Comparision

Production

Final Product



## Being responsible is cool

Despite legal stipulations, many still consider the use of helmets 'optional', which has led to steeper fines! Being responsible and pushing the benchmark for better road safety is the new trend. Be a part of it by never missing out on wearing your helmet.

Opting out of wearing a helmet is not cool, especially when your life could be at risk. It is common to see people just wearing a pair of sunglasses and nothing else while riding. Another common sight on Indian roads is people hanging their helmets by their arms instead of putting them on their heads. Helmets are designed to be great lifestyle accessories, but the primary purpose is to be used for head protection, which fails when it is hanging by the arm!



## Change with changing times

With the pandemic, concerns of contamination in shared commutes has risen. Play safe, maintain social distancing even on your commutes by opting for a two-wheeler ride. For that, you will need the right riding gears and a helmet is the most basic necessity.

Using a helmet also protects you from people sneezing and coughing on the road. With new findings indicating that viruses can mutate and become airborne, wearing a helmet becomes even more important not just to save your life from physical injuries, but also from pathogenic risks.

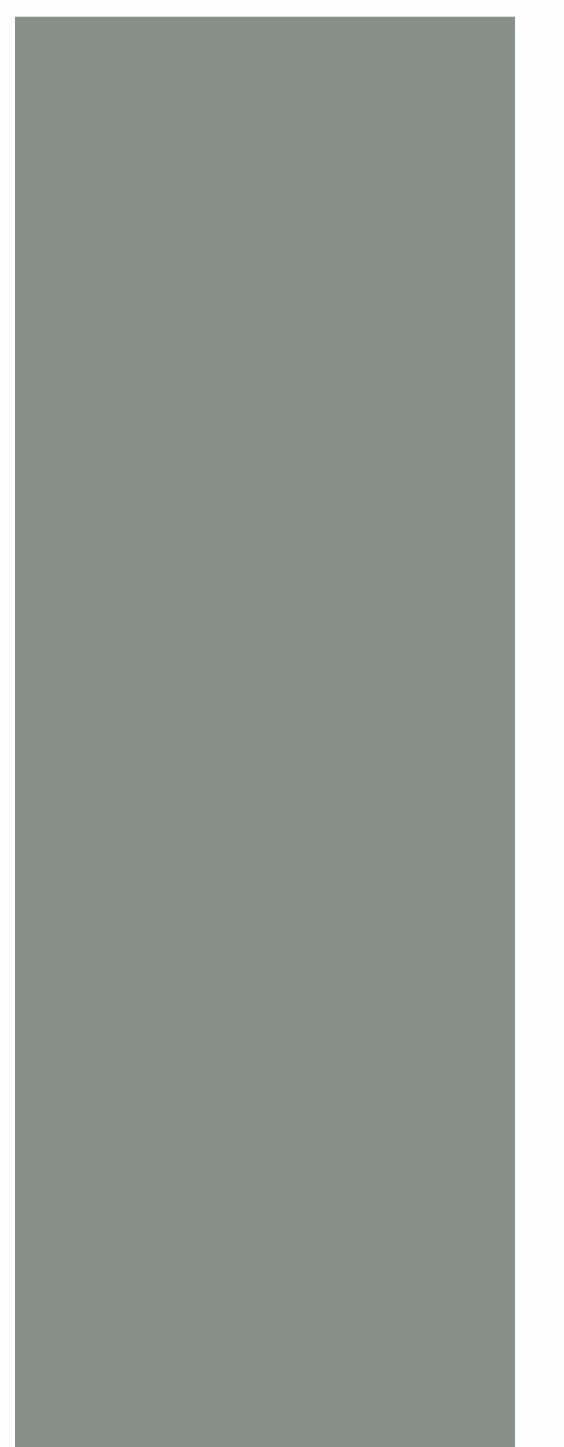
# Primary research

It is time to disregard the urban legends and myths and look at the facts. The Government Accountability Office (GAO) released a report in 2012 that showed states that did not have an all-rider helmet law saw 59% of the motorcyclists killed not wearing helmets while only 8% of motorcycle fatalities in states with all-rider helmets.

## Motorcycle helmet statistics

Helmets reduce the risk of death by 42% and the chance of head injury by 69%. Considered a hazardous vehicle transportation, 4,668 motorcyclists were killed in 2013 and another 88,000 injured that same year. The National Highway Traffic Safety Administration estimates 1,630 motorcyclist lives were saved by helmets that year and another 715 lives could have been saved across all states if helmets had been worn.

The Insurance Institute for Highway Safety has indicated that around 2% of people who have lost their lives in accidents involving other vehicles are bicyclists. Many of the fatalities are due to head injuries which according to research could be reduced by up to 85% if helmets are worn.



# Importance of Helmet while riding

1

Reduces head injuries

- absorb the impact of a head injury.
- reduce the chances of you suffering from external and internal head trauma
- thus, protecting the head and saving your life.

2

Eye protection

- It also helps protect your eyes from the dust, debris, and intense light when you are driving your two-wheeler
- to ensure that you have full sight range so you can drive safely

3

Vehicular control

- it boosts your attention while you are on the road
- You tend to be more careful and control your speed when you wear a helmet, which reduces the risk of you getting into an accident

4

Buffer from natural elements

- protect your eyes, ears, and head
- prevent ears from clogging ears
- prevents water from seeping into your eyes during the monsoon, and your head from scorching heat in the summer

5

Comply with laws

- along with motor insurance and bike insurance, wearing a helmet is also mandatory
- you can attract heavy fines and punishment

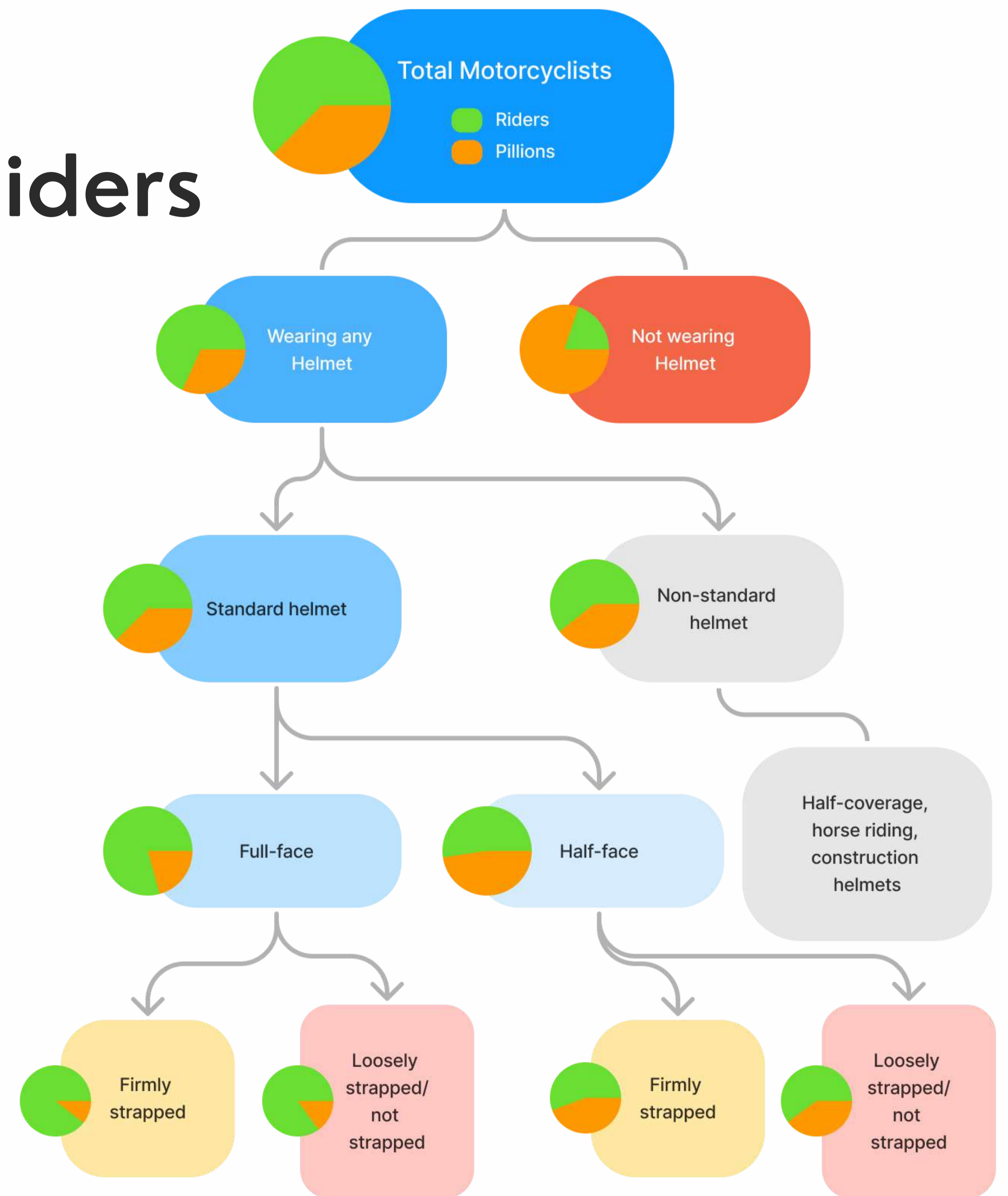
# Indian Scenario

India has a high burden of fatal road traffic injuries (RTIs). A large proportion of fatal RTIs in India is among motorcyclists. These are increasingly being recognized as a global public health problem accounting for about 1.24 million annual deaths. RTIs are projected to be among the leading cause of global deaths by the year 2030. Globally, RTIs are unequally distributed with residents of low- and middle-income countries (LMICs) accounting for about 90% of fatal RTIs.



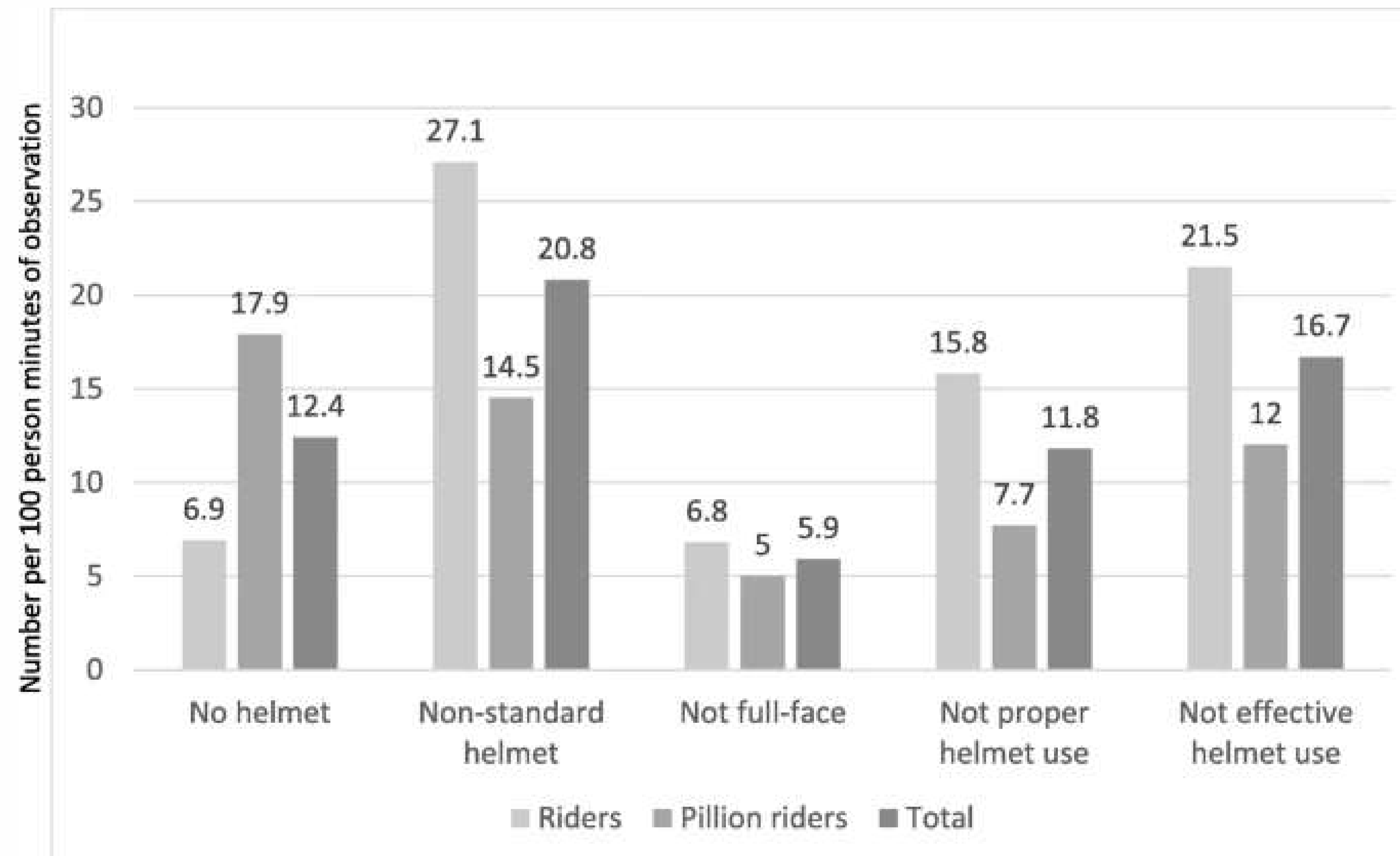
# Statistics of Riders and Pillion Riders

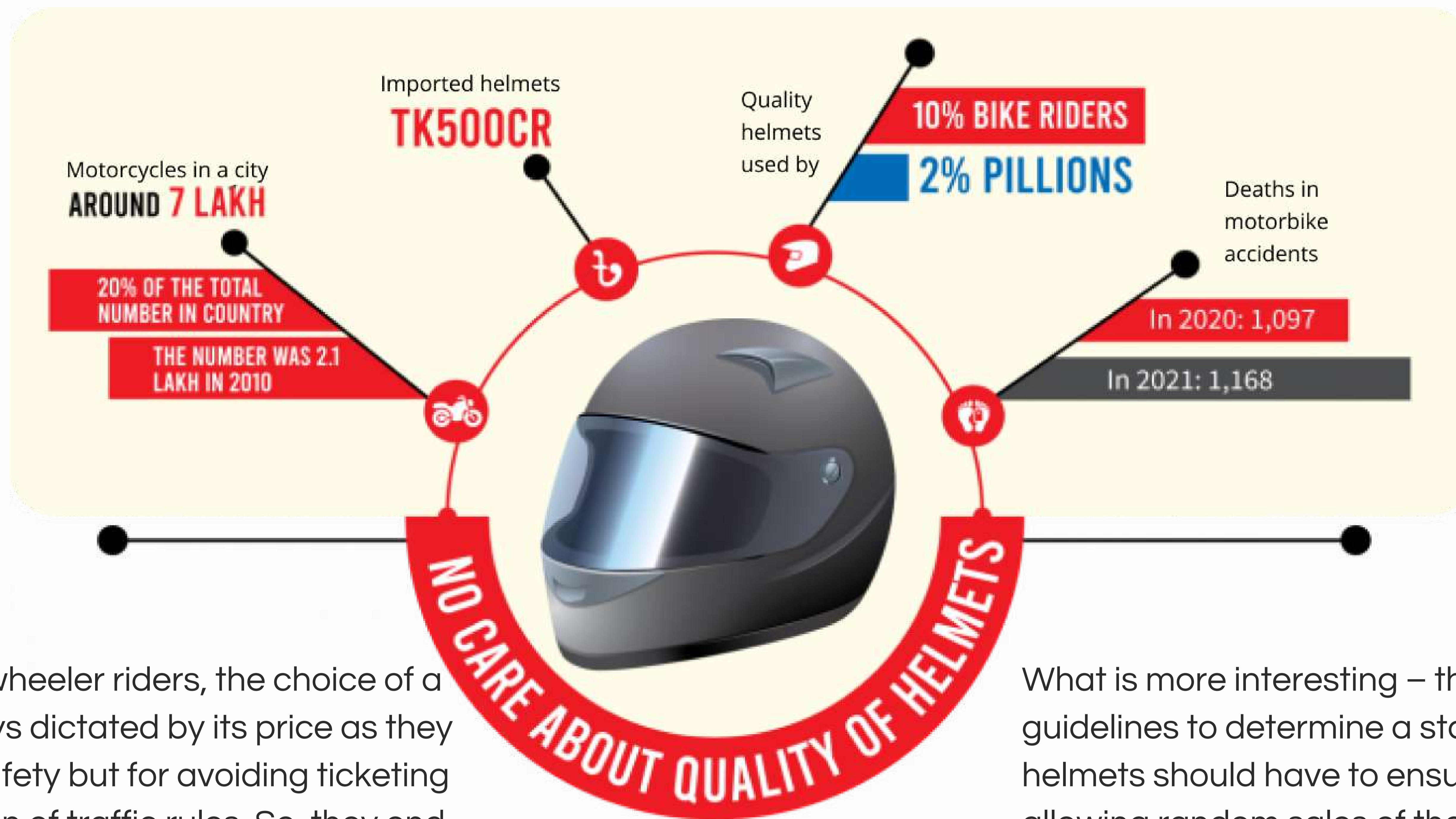
Cross-sectional road side observational study of motorcyclists (motorcycle riders and pillion riders) at traffic intersections was done followed by interview of random sample of the above riders. Effective helmet use proportion and effective helmet use per 100 person-minute of observation was calculated. Multivariate logistic regression analysis was done to identify factors associated with effective helmet use.



# Statistics of Riders and Pillion Riders

Prevalence of effective helmet use was 28 per 100 riders and 19.5 per 100 person-minute of observation in traffic intersections. Prevalence rates of effective helmet use was higher among riders (34.5% vs pillion riders 18.1%), female riders (51.3% vs male riders 26.8%), and male pillion riders (30.5% vs female pillion riders 13.7%). Riders commuting for work and school and those ever stopped by the police in the past 3 months had significantly higher odds of effective helmet use.






For most two-wheeler riders, the choice of a helmet is always dictated by its price as they use it not for safety but for avoiding ticketing against violation of traffic rules. So, they end up buying sub-standard helmets.

Bikers are not in the know about what types of helmets are "appropriate" for wearing.

What is more interesting – there are no local guidelines to determine a standard that helmets should have to ensure safety, allowing random sales of those with shoddy quality that exposes riders to fatal accidents.

# MOTORCYCLE SAFETY AND THE EVOLUTION OF THE HELMET





**1925 COOL FACTOR**

The preferred headgear for riders was a Marlon Brando style traditional "Flat-Cap". Providing little to no head safety, it was mainly used to keep your hair from getting messed up in the wind!

**1935 FAMOUS INSPIRATION**

After T. E. Lawrence (a.k.a. Lawrence of Arabia) was killed in a motorcycle accident, his attending neurosurgeon Dr. Hugh Cairns developed crash helmets for riders. His early helmets were made of vulcanized rubber, pulp and cork!

**1940 WORLD AT WAR**

During World War 2, the British Army issued rubber-lined helmets to their dispatch motorcycle riders to cut down on injuries.

**1953 PATENT PENDING**

Professor C.F. "Red" Lombard created a helmet that was designed to absorb and spread the shock of a motorcycle accident impact. He applied for a patent for his design. Many helmet manufacturers followed Lombard's lead, and this was the start of the development of modern-day motorcycle helmets.




**1958 PONCH & JON?**

The California Highway Patrol set a new safety precedent by requiring that all of their motorcycle police officers wear helmets.

**1961 DOWN UNDER**

Australia became the world's first government to implement a mandatory motorcycle helmet law on January 1, 1961. The United States would not enact their own mandatory helmet laws until 6 years later.





**1966 A NEW STANDARD**

The American National Safety Standard for Motorcycle Helmets was introduced, requiring performance standards for helmets that helmet manufacturers were obliged to meet.

**1967 FULL FRONTAL**

The first full facial helmet was introduced in 1967. This new design provided vastly improved head protection and vision. Stronger and lighter helmets were continually developed, giving riders more comfort and increased protection.

**1972 ENERGY CRISIS**

Advances in technology created an increased use of energy-absorbing materials and better eye protection, making helmets safer than ever.

**1980/90's USE IT OR LOSE IT**

National Highway Traffic Safety Administration (NHTSA) estimated that over \$13.3 billion was saved in insurance & medical costs and property damage between 1984 and 1999 from increased helmet use.




**2012 HIGH TECH**

Helmets with "Heads Up" displays, incorporating GPS technology, are made available to the public.

**2015 IT'S THE LAW**

47 states, the District of Columbia, the Northern Mariana Islands, Guam, Puerto Rico and the U.S. Virgin Islands have a helmet law for motorcyclists. Only 3 states don't- Illinois, Iowa and New Hampshire.




**SHOULD YOU WEAR A HELMET?**

The statistics lean heavily towards saying "Yes".

**Wearing a helmet reduces your risk of death by 29%.**

- Helmet use has increased throughout North America.
- Don't end up as a statistic. Wear a Helmet.



If you're seriously injured in a Motorcycle Accident, call Del Rio & Carichoff. We're here to help.

# Helmet misconceptions

Wearing a branded motorcycle helmet is not just mandatory by law, it also protects you against the dangers on the road! Unfortunately, many people belittle the need to wear a branded motorcycle helmet because they are confused by baseless myths associated with these life-saving accessories.

- Helmets are only for professional riders - that there are specifically designed helmets made to be used by professional results on a race track, but even those helmets can be used on the road by anybody
- Helmets are optional for short rides - people ride without helmets because they think that making a grocery run is not dangerous! In reality, nobody can predict with any degree of certainty when and how accidents may happen
- Women and pillion riders don't need helmets - The risk of injuring oneself in an accident is equally present for both the rider as well as a pillion seated behind a rider
- Helmets aren't available in kids' sizes - The anatomy of a child is more delicate compared to that of an adult, which makes it even more important for them to be protected
- Wearing the strap is not always necessary - in the event of an accident, the physical impact can dislodge and throw the helmet out of your head leaving it exposed to the hard surface of the road. The helmet cannot protect you unless it is properly strapped down
- Only full-face helmets are safe - all of these helmets that are certified by the relevant authority in your country are all equally safe irrespective of the configuration they come in

# Helmet misconceptions

- Helmets make it difficult to breathe - take special care to design their products with specific ventilation systems and hot air exhaust which allows the cooler to come inside the helmet and remove the heat which keeps the user comfortable, without creating any issue of breathing problems
- It's ok to use someone else's helmet - One of the most common misconceptions that are endemic to the Indian subcontinent and some parts of the South Asian region is that people think it is okay to wear someone else's helmet. Not only is it unhygienic, but it also completely defeats the purpose of wearing a helmet in the first place that does not fit your head size properly
- Helmet visors fog when it rains - This is a problem that has been resolved with the use of Pinlock® technology, which makes use of microstructures on the surface of the visor that prevents fogging. Even if your helmet does not have a Pinlock® visor, you can easily remedy the problem by applying a little bit of toothpaste on both surfaces of the visor and wiping it clean with a soft cotton cloth. Another technique to prevent fogging is to apply anti-fogging spray solutions which are easily available at any motorcycle accessories shop near you
- Loose-fitting helmets are more comfortable - Riding in hot and humid conditions can be really challenging which is why many people opt for a loose-fitting helmet which they believe keeps them cool, unfortunately, that is not true
- Safety Certifications Don't Matter - Any helmet that has not been rigorously tested for safety and protection it is nothing but a plastic shell meant to fool the police!

# Cleaning of helmet

With high temperatures in summer, helmets become stinky because you have to sweat consistently and that gets absorbed by the inner lining and padding of top branded premium motorcycle helmet that you may have been using for all these years to stop the longer you use the helmet without changing it, the worst the stink becomes!

- Take the helmet apart
- Soak the helmet in soap solution
- Gently exfoliate the dirt and grime
- Allow the helmet to dry naturally
- Assemble the helmet
- Deodorise the helmet



# Health problems of a motorcycle rider



- Allergies and runny nose
- Fevers
- Gastrointestinal distress
- Eye itching and allergies
- Back pains

# Guidelines for buying an all-purpose, all-season helmet

- Focusing on the weather sealing
- Full-face vs open face
- Visors for all lighting conditions
- Choose modular helmets for ease of maintenance
- Features vs the cost - the balancing act

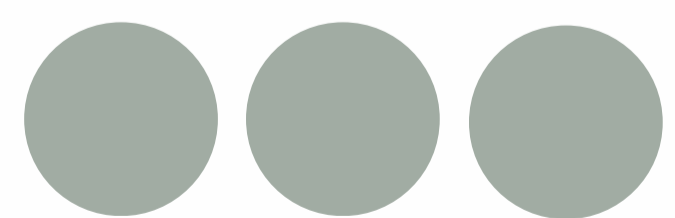
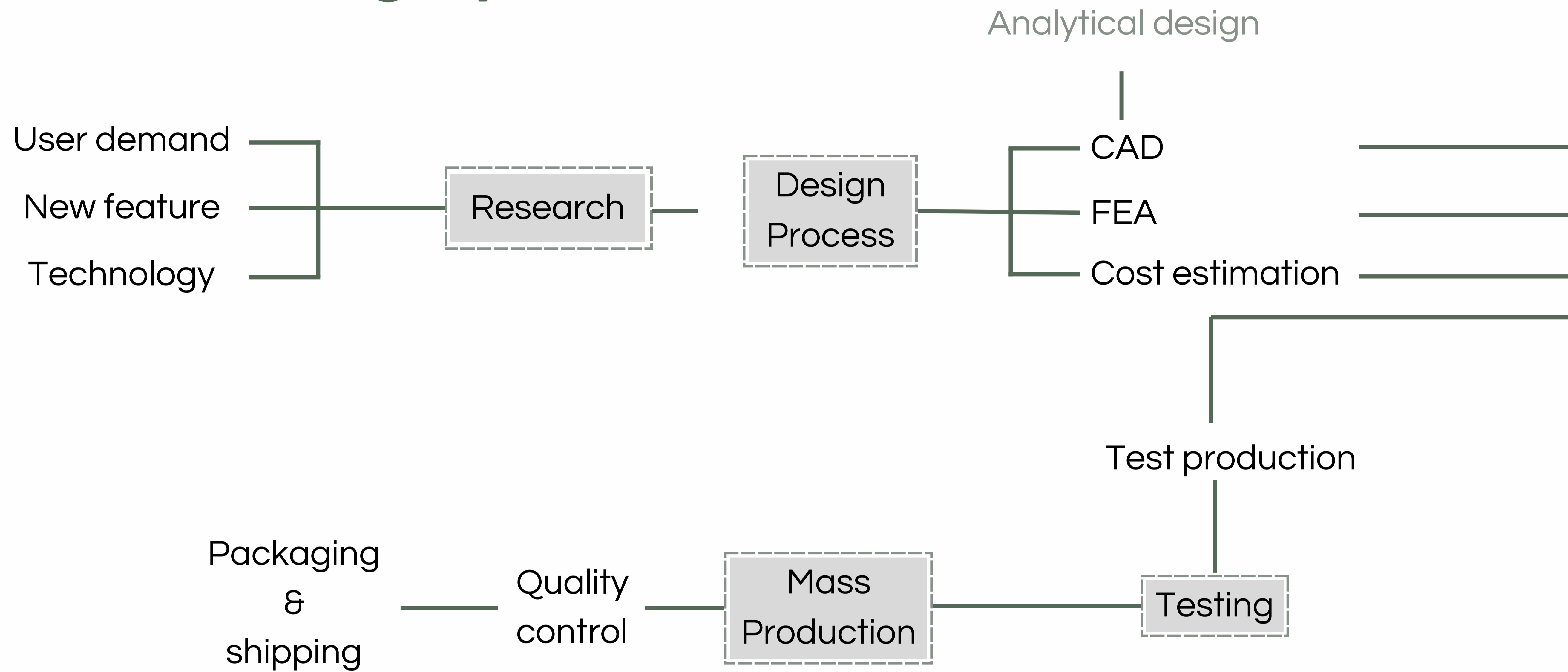


# Advantages of tinted visor

Light is necessary to see things, but too much of it can make things difficult for you especially when you're riding under bright sunny conditions. In that case, you are going to need a helmet with a tinted visor on it. Tinted visors are important aspects of good motorcycle helmets that are designed for maximum comfort and ease of use.

- Material - The dark shade that you see in tinted visors usually comes from coloured polycarbonate and chemical hues which are added to the molten material during the manufacturing process. In addition to that, visors are also equipped with other protective features such as UV resistance, anti-fog and anti-reflective coatings.
- Reduces eye glare - Bright sunlight reflecting off surfaces or from headlights shining from oncoming traffic can cause disorientation. The glare can become really dangerous especially when you are at high speeds on highways where every second matters and even a small delay in making the right decision can become fatal for you.
- Protection against UV light - Research has shown that extended exposure to ultraviolet rays can lead to macular degeneration, a disease of the eye that reduces vision. In addition to that, ultraviolet rays can also become the cause of cataracts.
- Manages eye fatigue and makes it easy for you to ride longer - keeping your eyes open for an extended period of time it is evidently going to create eye fatigue which is a very common problem in case of long-distance riders. Eye fatigue can become a cause for other eye diseases in the long run.

# Helmet design process



# Helmet standards

Motorcycle safety standards can be confusing because there are quite a few different boards that certify Motorcycle helmets worldwide. While they have many things in common with each other, but there are also important differences. A helmet that passes according to one standard may fail according to another.

The first helmets were made of leather and kind of resembled upside down cowhide diapers. Sounds safe, right? These helmets were so effective that many board track racers lived through several races!

Real change in helmet technology finally came in 1935, with the over-the-handlebars death of writer, army officer and historical badass T.E. Lawrence (known as “Lawrence of Arabia” to his groupies). Lawrence was treated by a neurosurgeon named Sir Hugh Cairns, who was compelled to study the effects of head trauma during a motorcycle crash. From his testing, the first “crash helmets” were born.

The Cairns crash helmet was a great start, but it really only protected a rider from penetration injuries (i.e., things getting stuck into your head). It was not until a Californian named Herman Roth patented a protective helmet with an internal, energy-absorbing liner, that the modern helmet was born. This futuristic lid had it all: an inner layer made of a “substantially non resilient material,” floating inner suspension system, hard outer shell with a visor, and even a chin strap to hold it on! This became the standard for motorcycle helmet design in the 1950s.

When race car driver Pete Snell was killed in a 1956 crash, he was wearing a helmet similar to the Roth design. Instead of getting a tattoo with his name, Pete’s friends and family decided to cherish his memory by creating the SNELL Memorial Foundation in 1957. This group of scientists, engineers and generally smart cookies established methods of testing helmets for effectiveness. Helmet safety testing was born!

## Department of Transportation (DOT)

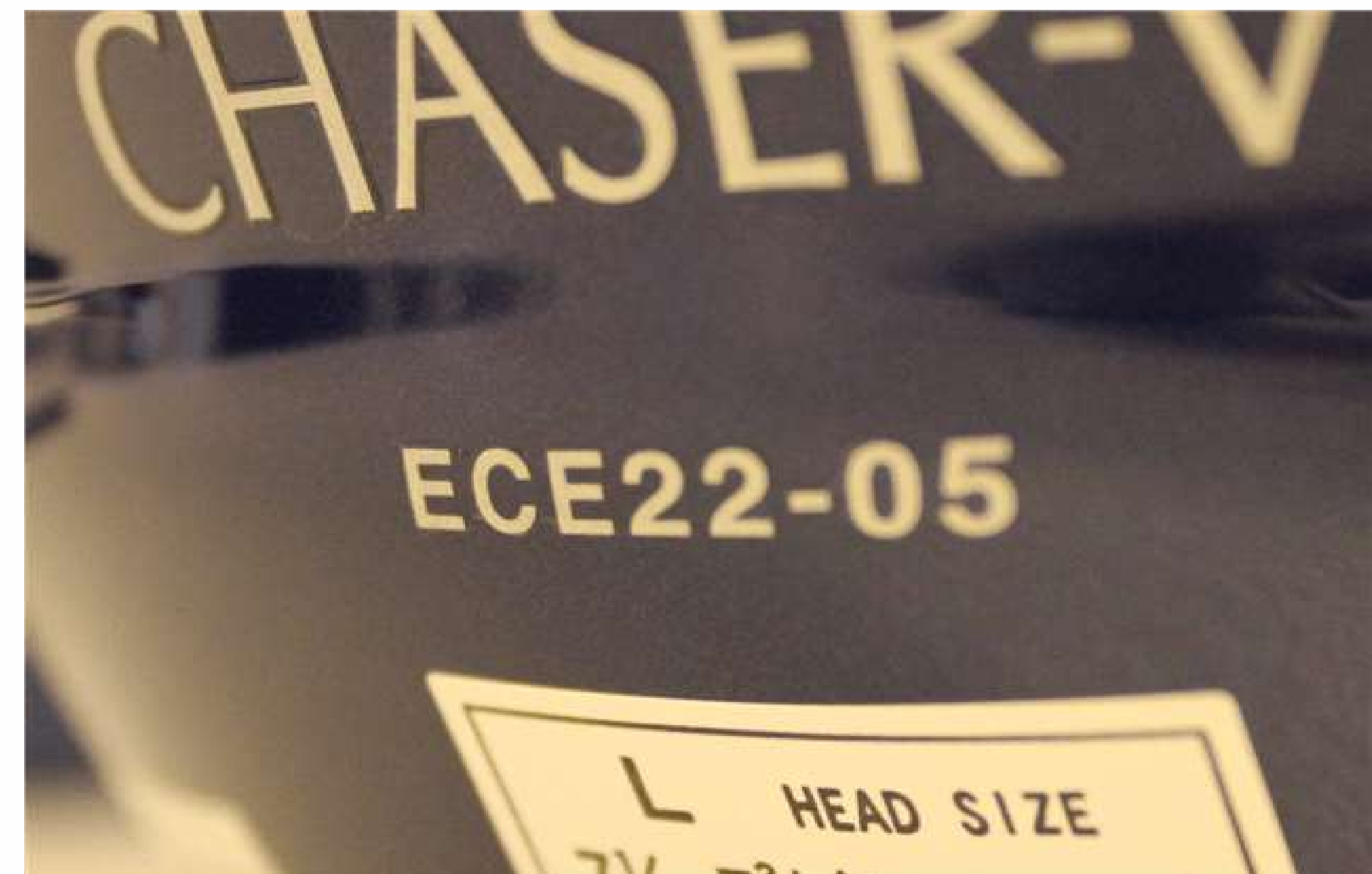
The DOT standard is the most important standard for helmets to meet in the United States as it is a mandatory requirement. Most real motorcycle helmets used in the USA meet DOT standards. The Department of Transportation tests are less strict than some other tests but still weed out inferior helmets.

1. Impact test - test involves striking the helmet against an anvil to see how hard of a crash it could take. Both a flat anvil and a rounded anvil are used. It is not enough for the helmet to be able to resist impacts and absorb shock in ideal conditions. The helmet must work in humidity, in hot or cold weather, and if the helmet is wet. Safety tests simulate these adverse conditions to make sure the helmet will work regardless of the situation.
2. Penetration test - A typical test requires a helmet must be able to withstand a six-pound pointed object dropping from a height of 10 feet 10 inches onto the helmet. The helmet must also pass the penetration test even if it is wet, hot, or cold.
3. Retention strap test - Weights are also used to test the strap. If the strap does not break but does stretch by more than is allowed, the helmet fails the retention strap test. There is only a limited amount of tolerance for the strap lengthening when pulled on.
4. Peripheral vision test - any helmet that interferes with the wearer's vision will not pass. Generally, a helmet must allow for at least 105 degrees of peripheral vision from the center to as far as you can see right or left.



# Helmet standards

ECE: This is the Standard set by the Economic Commission for Europe. This multinational standard is used by most European nations. The current ECE standard is ECE 22.05.



# Helmet standards

SNELL: This standard is set by the Snell Memorial Foundation located near Sacramento California. The Snell Memorial Foundation is a private non-profit organization that was founded after the death of race car driver Pete Snell to promote and advance helmet safety.



# Helmet standards

FIM: This is the newest standard for motorcycle helmets for use in professional motorcycle racing. The FIM test standards are set by FÉDÉRATION INTERNATIONALE DE MOTOCYCLISME (FIM) which is the world body that sanctions global professional motorcycle racing.

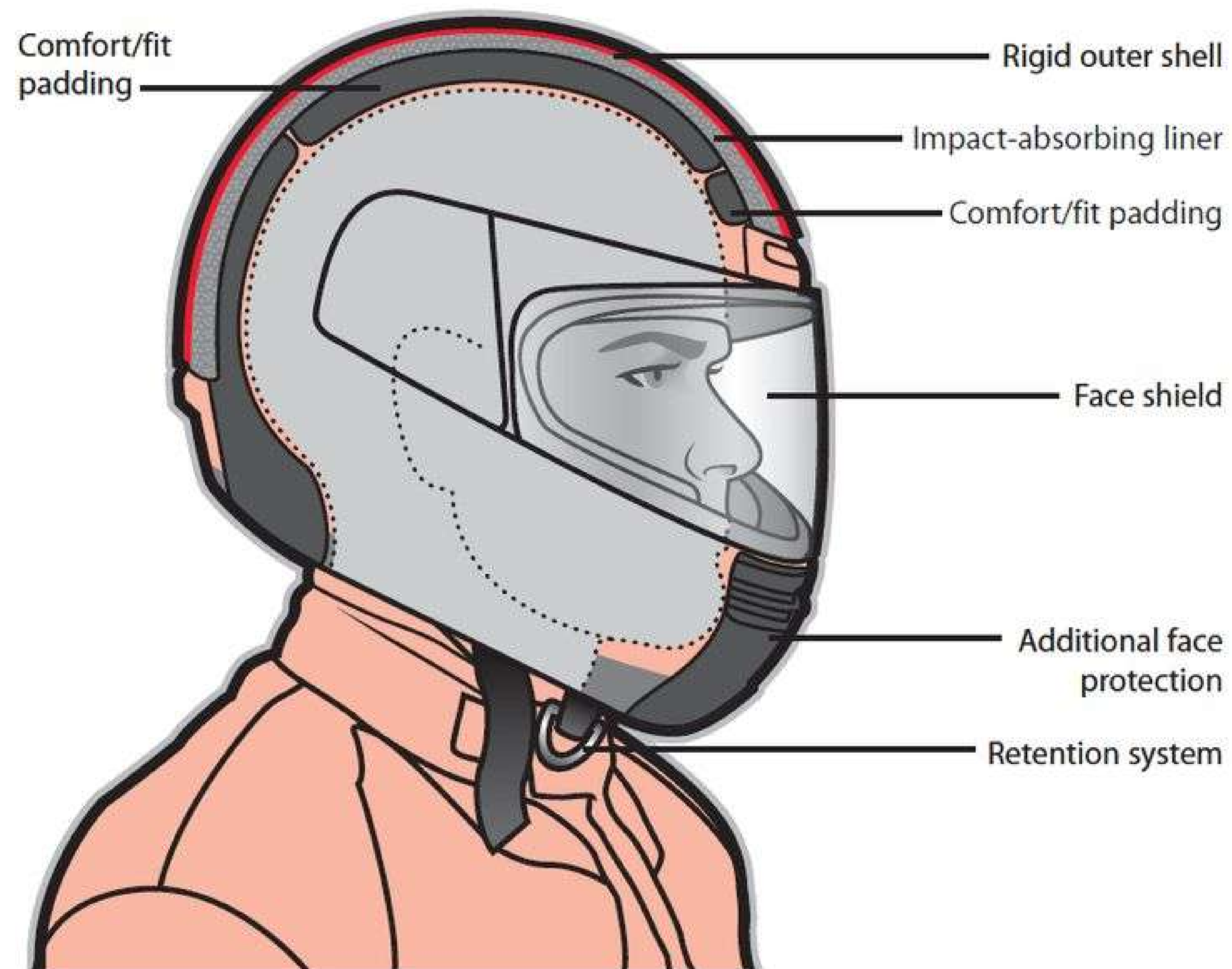


# Helmet standards

SHARP: is a motorcycle helmet rating system established by the Government of the United Kingdom in 2007. The British Government wanted to create a performance rating system for motorcycle helmets with the goal of improving motorcycle safety on public roads in Britain.



# Getting to know more about helmets



# Types of helmet



FULL FACE



MODULAR



OFF-ROAD



HALF



OPEN FACE



DUAL-SPORT

# Materials used for Production on helmet

## Shell - The first line of defence

The shell is the largest and one of the most important components of your helmet. It is the outer structure of the helmet that covers your head. The chin bar is part of the shell on a full-face helmet and separates on a modular design. Companies manufacture helmets shell out of different materials, and they each have their own strengths and weaknesses.

- Polycarbonate - Polycarbonate is a form of high-tech thermo- plastic that has high impact and concentration performance. While polycarbonate works well for protecting against penetration it does not absorb shock as well as shells that are made of laminated layers such as your head, it does not last as long as fiberglass shells. Water will weaken polycarbonate over time.
- Kevlar - Kevlar is better used as an addition to a fiberglass helmet than as the sole material. It is an expensive material and very lightweight. Its disadvantage is not only that it is more expensive than other materials, but it does not absorb energy as well as conventional fiberglass.
- Fiberglass - Fiberglass is a material that is not as strong as Kevlar but exceeds Kevlar's shock absorption capability which is the most important feature of a helmet shell. Fiberglass is a little heavier than Kevlar and offers excellent shock absorption.

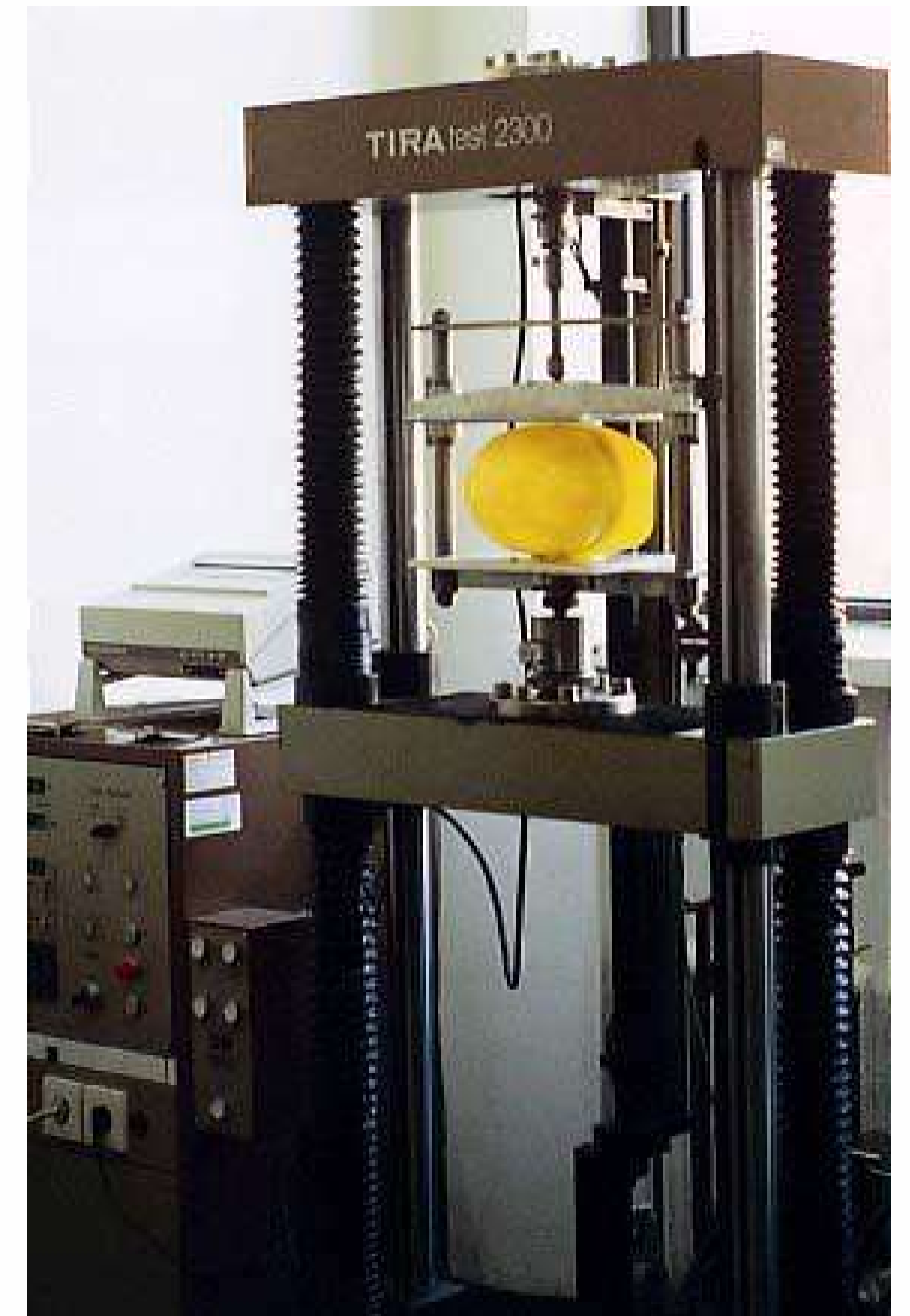
# Laminate and rigid thermoplastic material

Arguably, a more rigid material is not the right way to go for bike helmets. A rigid material is extraordinarily strong and has high penetration resistance. However, laminate materials absorb more of the impact and protect your head from shock after impact. Which is better depends on what type of accident and impact you have.

## Foam liner - the second line of defence

A strong helmet shell with no padding underneath would not be enough to save you from serious injury. Motorcycle helmets use Expanded Polystyrene Foam (EPS) to shield your head from impact. A hard impact will crush the foam – most of the impact's energy will go throughout the foam liner and as little as possible to your head.

Sometimes the EPS in a motorcycle helmet is denser or less dense than average. Denser foam is not always better. Some helmets have multi-density EPS foam liner



**SHELL**

**EPS LINER**

**FACE SHIELD**

**COMFORT LINER**

**RETENTION SYSTEM**



The less-dense foam will collapse more easily and dissipate energy quickly when it collapses. However, the foam might collapse too quickly, leaving no remaining foam to shield your head from impact. If the impact is low enough the foam does not collapse too quickly, less dense foam is advantageous as it absorbs more energy in these circumstances.

Denser foam can be better in high-impact situations because it does not collapse too quickly. The disadvantage is that it might not collapse much at all, so your head will take a hard impact in low-speed crashes. Somewhere in-between is best, and no one knows exactly how dense the foam is supposed to be for the best protection because you can't choose your accident!

Higher-end motorcycle helmets may combine denser foam with more collapsible foam. This way, the less dense foam will collapse if the impact is moderate, and the denser foam will not collapse too much if the impact is hard.



If your chin strap is weak or does not fit properly, a crash might pull your helmet off your head. A good, properly fitting chin strap can save your life. A helmet is useless if it does not remain on your head in the event of an accident.

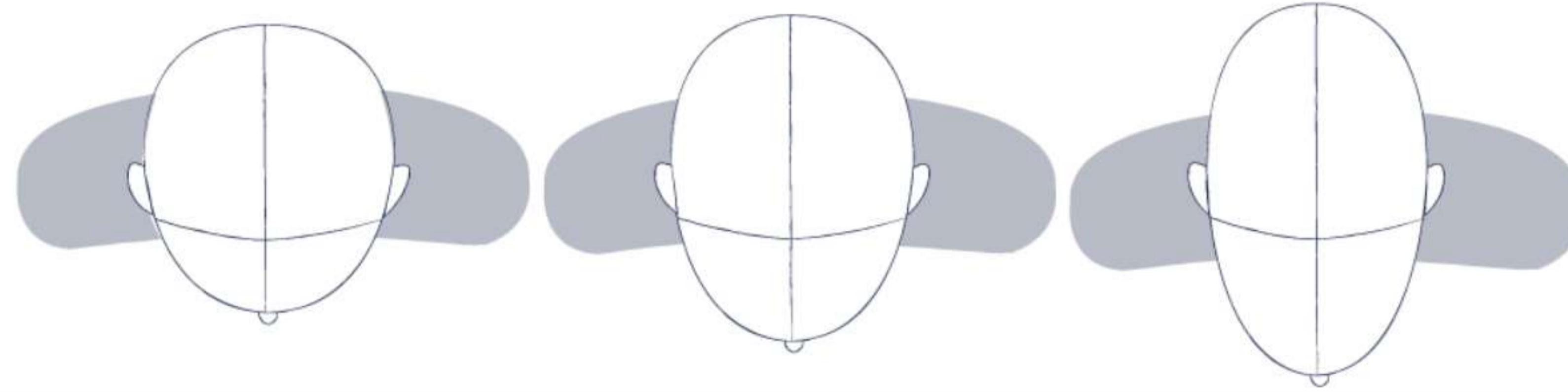
A loose-fitting helmet will not protect your head properly. If you crash with a loose-fitting helmet on, your head will slam against the side of your helmet.

A properly fitting helmet prevents your head from moving around, is more comfortable, and can save you from serious injury. Make sure that the interior liner is the right thickness and prevents your head from moving around inside your helmet. A helmet can also come off during a crash if it does not fit snugly.

Polycarbonate is a better material for face shields than acrylic. Acrylic distorts your vision to some extent and is easier to scratch than polycarbonate. Both acrylic and poly-carbonate visors are strong enough to protect your face. Some of them also offer UV protection.



# Sizes of Helmet



Round oval

Intermediate  
oval

Long oval

<b>ADULT HELMET SIZING</b>					
<b>Impact Racing Size:</b>	<b>EXTRA SMALL</b>	<b>SMALL</b>	<b>MEDIUM</b>	<b>LARGE</b>	<b>EXTRA LARGE</b>
<b>Hat Size:</b>	6 2/4 to 6 7/8	6 7/8 to 7	7 1/8 to 7 1/4	7 3/8 to 7 1/2	7 5/8 to 7 3/4
<b>Inch Size:</b>	20 5/8" to 21"	21 5/8" to 22"	22 1/2" to 22 3/4"	23 1/4" to 23 5/8"	24" to 24 1/2"
<b>Centimeter Size:</b>	53 to 54	55 to 56	57 to 58	59 to 60	61 to 62

<b>YOUTH HELMET SIZING</b>			
<b>Impact Racing Size:</b>	<b>SMALL - Two Inserts</b>	<b>MEDIUM - One Insert</b>	<b>LARGE - No Inserts</b>
<b>Hat Size:</b>	6 1/8 to 6 1/4	6 3/8 to 6 1/2	6 5/8 to 6 3/4
<b>Inch Size:</b>	19" to 19 1/4"	19 1/2" to 20"	20 1/2" to 21"
<b>Centimeter Size:</b>	49 to 50	51 to 52	53 to 54

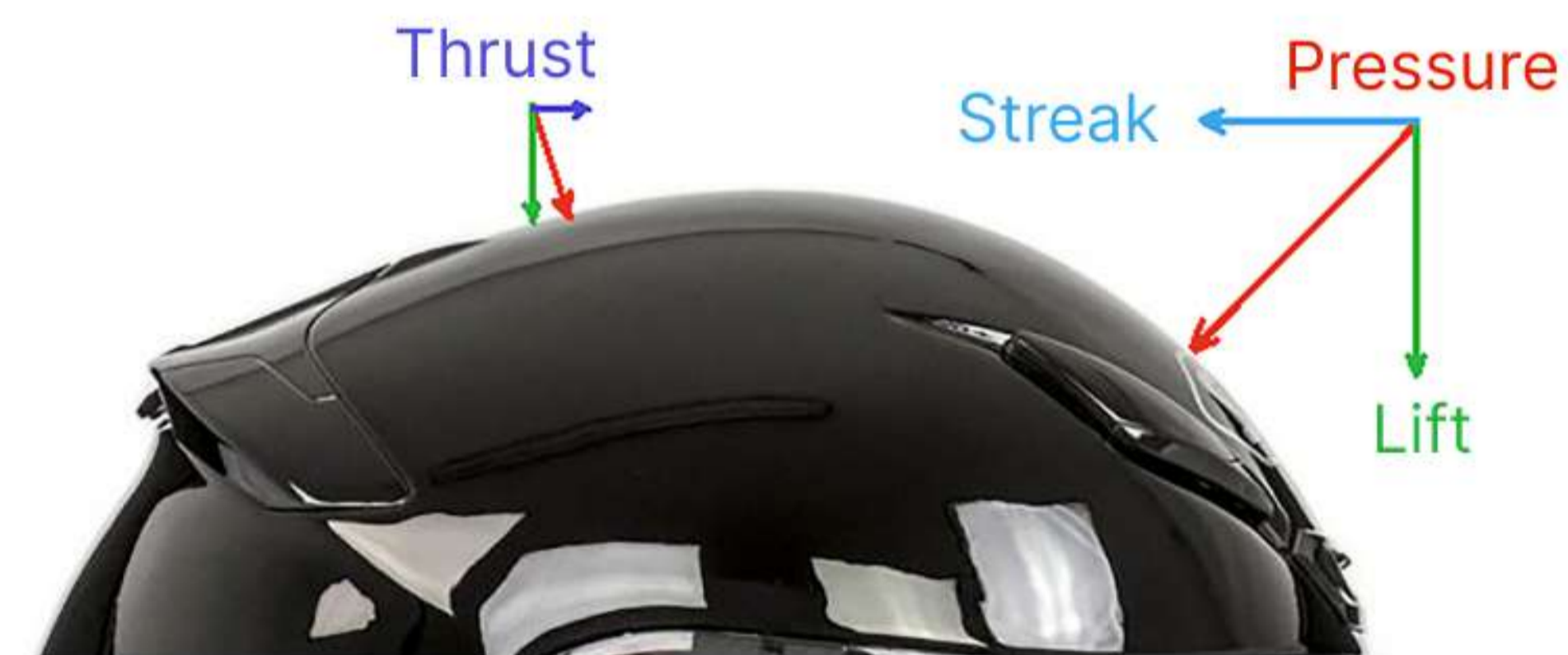
# Aerodynamics of Helmet

You don't have to be an experienced biker to realize that not all helmets are created equal in terms of comfort. The air noises as well as the parasitic movements at high speed do not have the same intensities with a top-of-the-range helmet and with a lower quality helmet. Noises and parasitic movements can be consequences of the aerodynamics of the helmet used. In the context of use on the track, the aerodynamics of the helmet also affects the performance of the pilot.

## Drag

When a motorcycle is moving, air travels along the helmet at very high speeds. The flow is turbulent. Two major constraints apply between the moving object and the fluid:

- Friction stress
- Pressure constraint



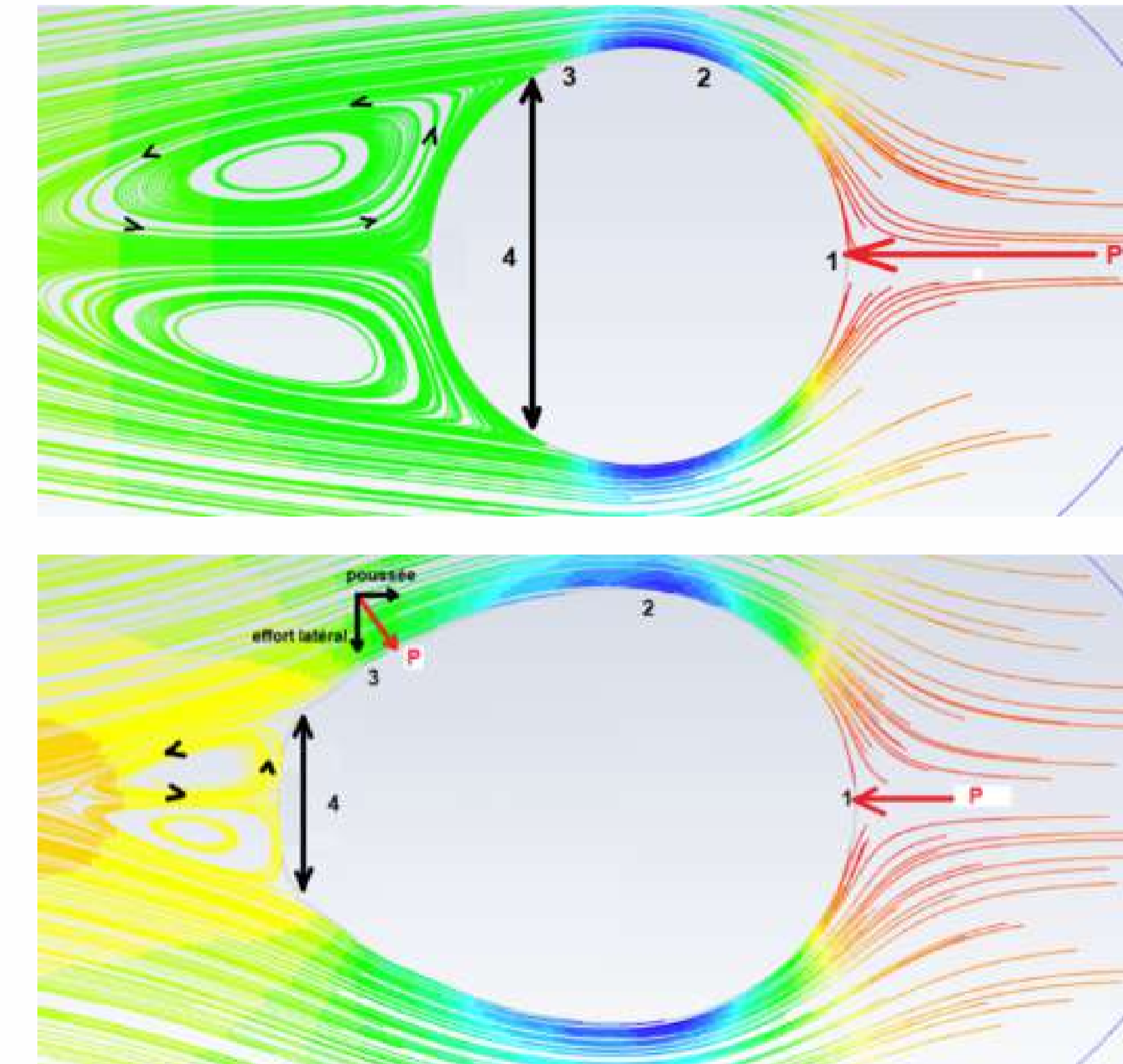
## Helmet Profiles

- Almost all current sports helmets feature large side deflectors. Most of the time, these deflectors are an integral part of the spoiler, either in the form of an offset shell, or fins integrated directly into the shell of the helmet.



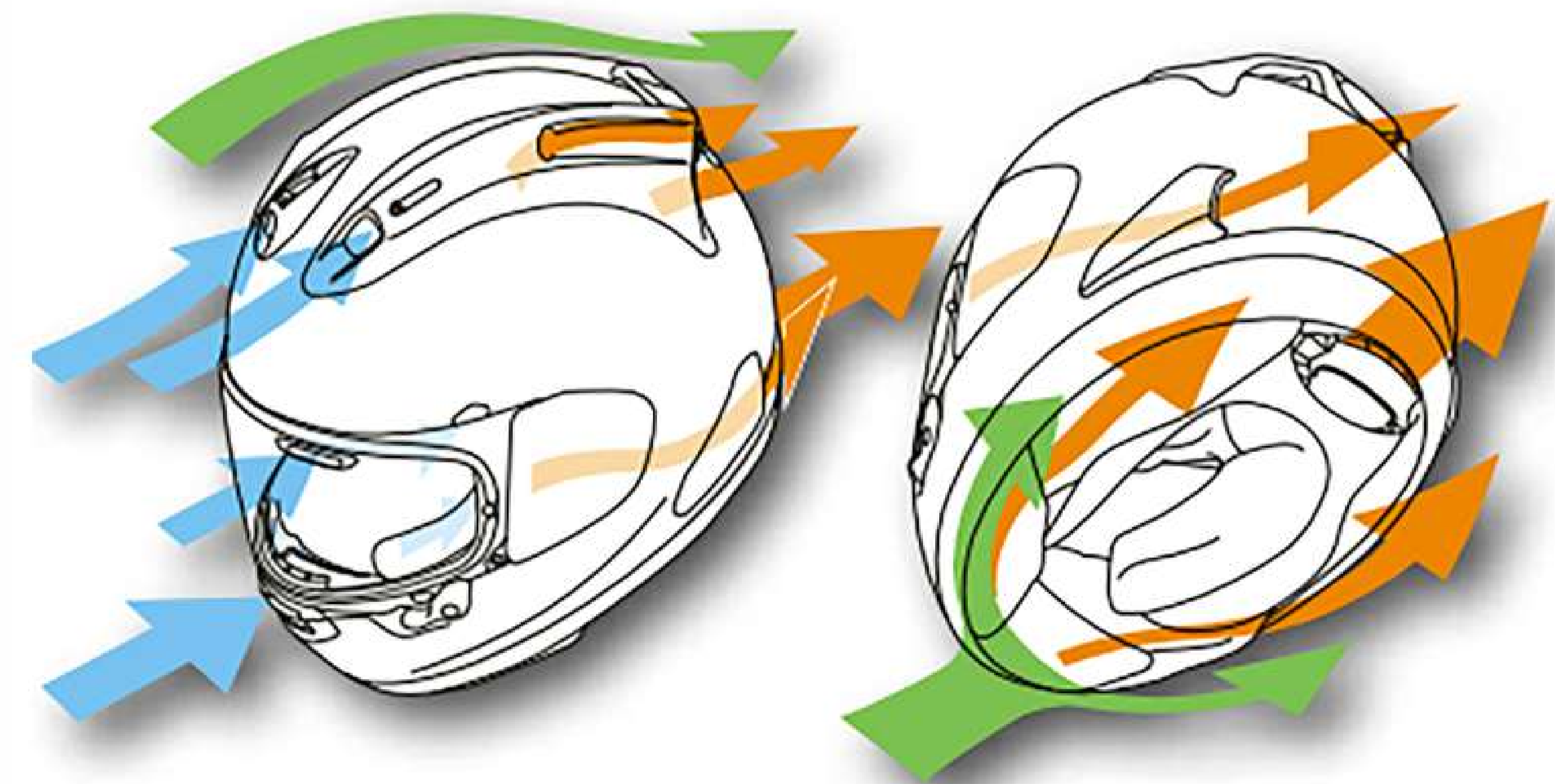
The deflectors improve the aerodynamic profile of the helmets. To understand their usefulness, we compare the behavior of the same air flow on two different helmets: one with refined aerodynamics, such as those fitted with deflectors, and the other with unremarkable aerodynamics (similar to a sphere).

- Leading edge
- Low pressure
- Detachment point
- Recirculation zone



## Ventilation work

comfort is an important aspect of the design. For maximum comfort, helmets are designed to limit temperature rises during use. For this, airflow passes through the helmet through several vents. Inevitably, these airflows create drag. The vents are distributed all around the helmet to maintain adequate ventilation while limiting drag.





# Market Study

Visiting showrooms are helmet shops to know more about the helmets available for the current market.

Got a lot of understanding of what features Vega, Studds, MT, SMK, Axor, Royal Enfield, etc are offering in their range of budget helmets.

# User Study



I visited Transportation sectors such as Public Health and Safety Organization and RTO offices to gain more insights into the rules and regulations regarding the use of helmets among people. Later I interviewed some people to discuss more their demands, the problems, and the challenges faced by the riders as well as billions.

Also, we discussed:

- user's ambiguous demands
- comfort and fit
- the later actual condition of the use of helmets
- the factors affecting the rider's concentration while riding because of helmets and other things
- noises to hear in the interest of road safety, look, and appearance of the helmet - style, appearance, graphics, etc.

# Method to wear Helmet

## Male User

Whether you are a casual rider or a competitive equestrian, a well-fitted riding helmet is a must. You want a helmet that is made specifically for horseback riding, that fits snugly around your entire head, and that protects your forehead without blocking your vision. Knowing what to look for when you try on various styles will ensure your helmet is comfortable, as well as safe.



# Observation

Wearing and taking off a helmet

Male User





# Method to wear Helmet

## Female User

An average Indian female head size is about 540 millimetres and there are a ton of helmet options that you can choose from in that size. In order to get the perfect fit for your head size, measure your head using a tape or with a cotton thread wrapped around your forehead and then measure it out against a marked ruler.

# Observation

Wearing and taking off a helmet

Female User





# User Reviews



**Name: Shivanee**  
**Profession: Designer**  
**Age: 24**

Loves to go for weekly rides, adventures, off-roading and camping

## Product



## Vehicle



## Pain points

Fog gets accumulated on the visor

Feels heavy during a long ride

Weight on head loses her concentration on the road

## User needs

- Her helmet should be comfortable for long rides
- Don't want to get distracted during rides due to helmet problems

# User Reviews



**Name: Dilip**  
**Profession: Govt. Service**  
**Age: 52**

General Info: He is a government servant and has to go daily to office and is very careful about his health

## Product



## Vehicle



## Pain points

Scratches and finger impression in visor makes it difficult to see as it disperses light

Lots of vibration causes fatigue

## User needs

- He wants a good helmet which is good for his age and can be comfortable for him while driving
- As he uses a full face helmet, he needs more visibility of the road so that he can drive safely

# User Reviews



**Name: Ajay**  
**Profession: IT Engineer**  
**Age: 25**

He have to travel daily with his bike in heavy traffic to office & enjoys weekends traveling outside the city

## Product



## Vehicle



## Pain points

Have a huge problem of hairs as wearing a helmet damages his hair as well as his hair-style

Hair-loss

## User needs

- He wants a comfortable head space for his daily ride so that it doesn't affect his hairs
- As he daily rides to the office, he need proper fitment for his earphones or earbuds in helmet

# User Reviews



**Name: Riya**

**Profession: Student**

**Age: 18**

Just bought a moped to go to college and sometimes bunk classes to go for trips

## Product



## Vehicle



## Pain points

Even the smaller size of the helmet doesn't fit her head properly

Helmet wobbles while driving

Worried about her hairs as wearing a helmet damages them as makes them entangled

Faces problem in ponytail hairs

The Chin strap doesn't fit properly and irritates her in neck area

## User needs

- She wants a modular helmet so that she can adjust according to her needs
- A perfect fit for her so that she can enjoy her driving time without any hassle
- A well designed helmet where she can adjust according to her hair style

# User Reviews



**Name: Tushar**

**Profession: Delivery agent**

**Age: 28**

He has to travel in heavy traffic as well as small roads where its difficult to ride the bike with navigation ON. He also has to take care of delivery parcels

## Product



## Vehicle



## Pain points

Communication problems with the customers while putting the helmet on the head

Constant sweating irritates him

Leaving a helmet on the bike for deliveries without a lock

## User needs

- He wants to complete his primary tasks while putting on helmet without any hassle like looking at the directions, talking with the customers as well as delivering parcels.

# User Reviews



**Name: Priyesh**  
**Profession: Rider**  
**Age: 29**

He is a professional rider of a group and runs a YouTube channel and creates professional vlogs about travelling and riding

## Product



## Vehicle



## Pain points

Has a aerodynamic load when he switches positions to

leaning forward and backward

## User needs

- Want a balanced distribution of load of helmet on the head

# User Reviews



**Name: Vandana**

**Profession: Housewife**

**Age: 46**

She is a housewife and travels in the city for buying stuff for the house and the essentials. She likes to go for shopping once in a week.

## Product



## Vehicle



## Pain points

Loose strap that she needs to adjust every time while driving which distracts her

Excessive noise from the surrounding irritates her

Worried about her hairs as her curly hairs get stuck in the liners and sometimes gets plucked while pulling the helmet off

## User needs

- She needs a good helmet which she can wear and remove the helmet easily without harming her hairs
- A provision where she can lock the helmet with the vehicle when she has no space left in the boot

# User Reviews



**Name: Shivam**  
**Profession: Farmer**  
**Age: 21**

He uses his bike to bring the essentials for farming to help his brother and father and to avoid fine he uses a helmet

## Product



## Vehicle



## Pain points

Dust gets accumulated inside the inner linings of the helmet

Water comes from the visor which makes him unable to see

Putting helmet to the bike unlocked

## User needs

- He needs a helmet which can be cleaned easily by removing the cushioning as he travels from a rural area
- Needs a good budget-friendly helmet for him

# User Reviews



**Name: Pravin**

**Profession: Businessman**

**Age: 35**

He travels from city to city for his business deals and sometimes he have to travel for 2-3 days continuously in a week

## Product



## Vehicle



## Pain points

Strain in neck during a long ride after more than 2 hours

Cramps in cheeks because of uncomfortable paddings

## User needs

- Wants a good material inside a helmet which can be comfortable for his daily travel

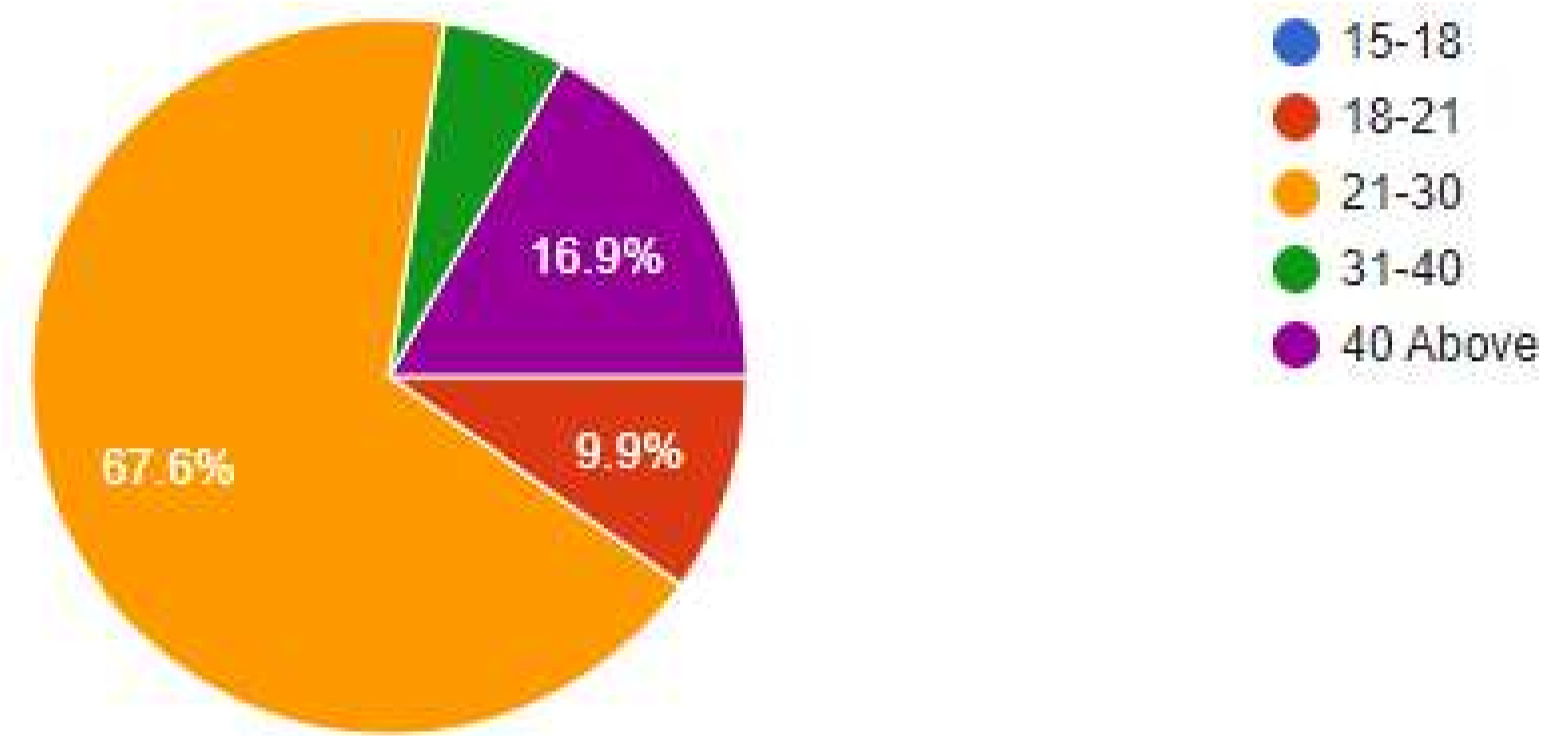
# User pain points

- lots of vibrations causes fatigue
- uncomfortable paddings
- pressure on head and neck after long use
- need balanced distribution
- aerodynamic load to driver
- inertia movement - neck strain (muscle fatigue)
- improper ventilation - fog on visor
- heating inside loss of concentration
- visor should be scratch proof, water proof and should provide UV rays protection
- excessive noise
- sometimes its hard to clean the helmet from inside
- cramps on cheek
- hairs get stuck in upper padding
- whistling problem starts at higher speeds
- unstable helmet straps
- water droplets on inside of visor makes the visibility difficult
- dust gets saturated easily
- sweating problems
- delivery -

# Insights from Online survey

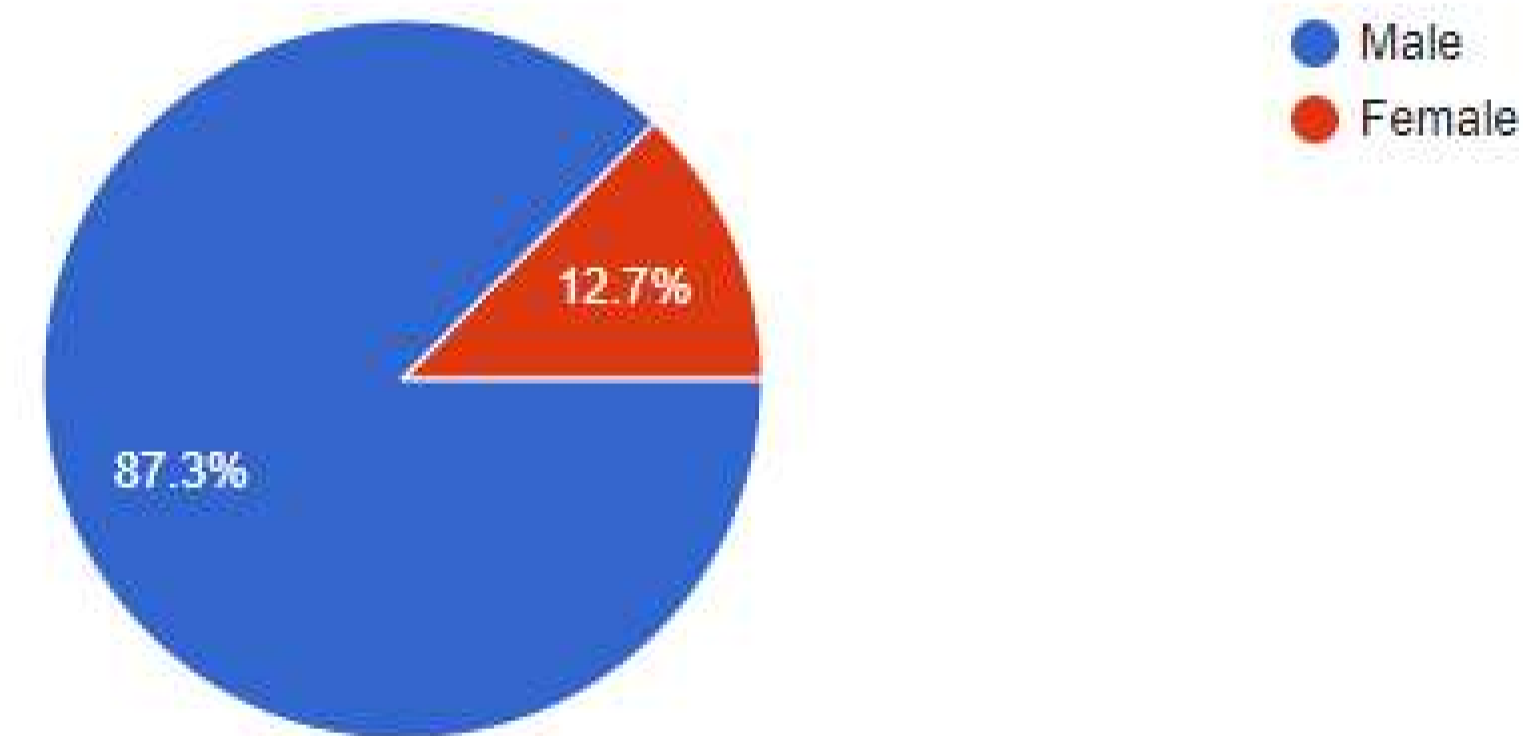
## Age Group

71 responses



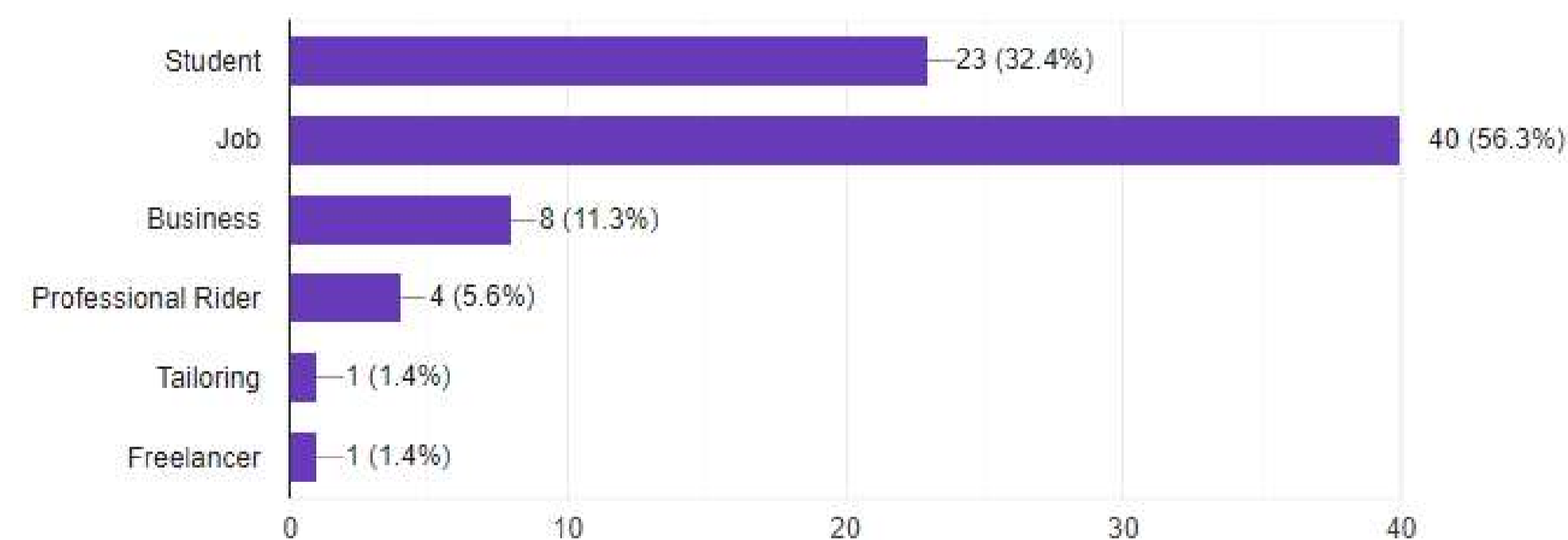
## Sex

71 responses



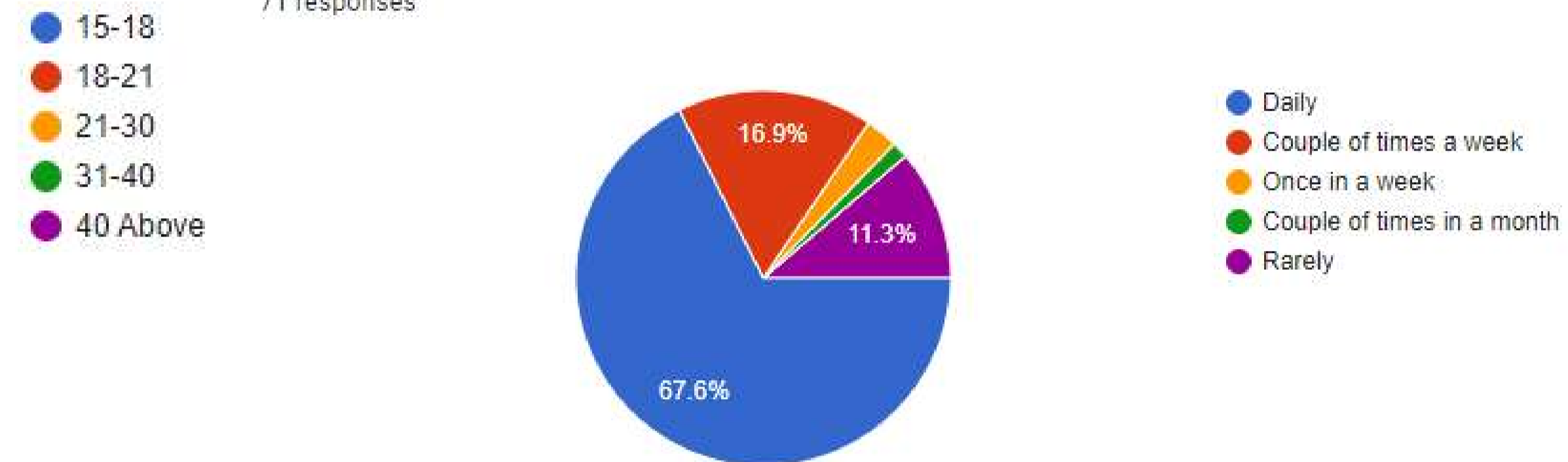
## Occupation/Field of work

71 responses



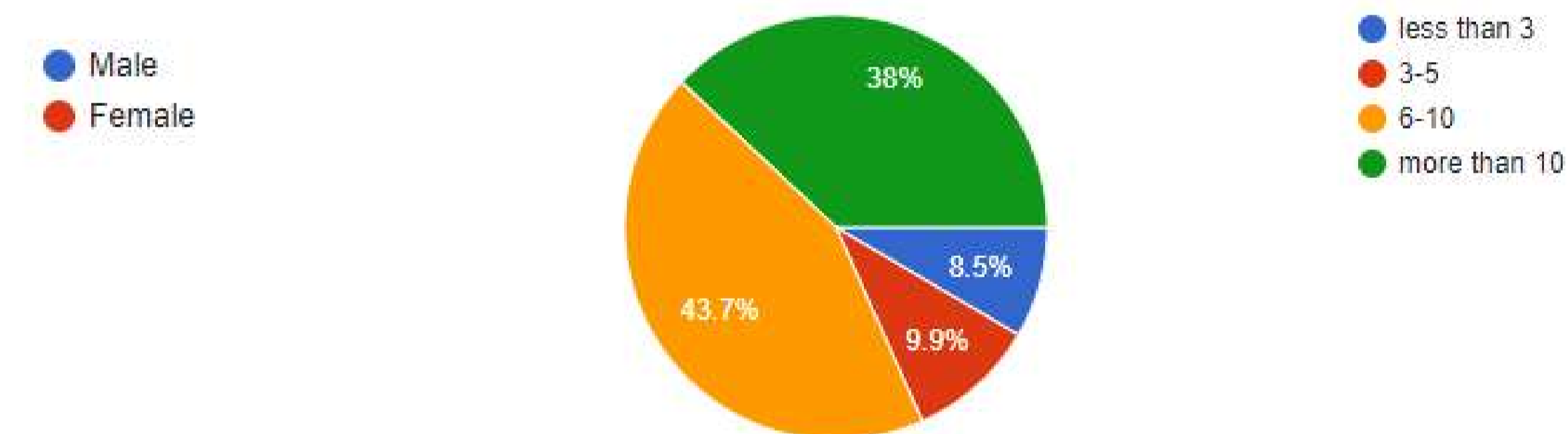
## How often do you use Helmet while driving?

71 responses



## Years of experience driving a motor vehicle?

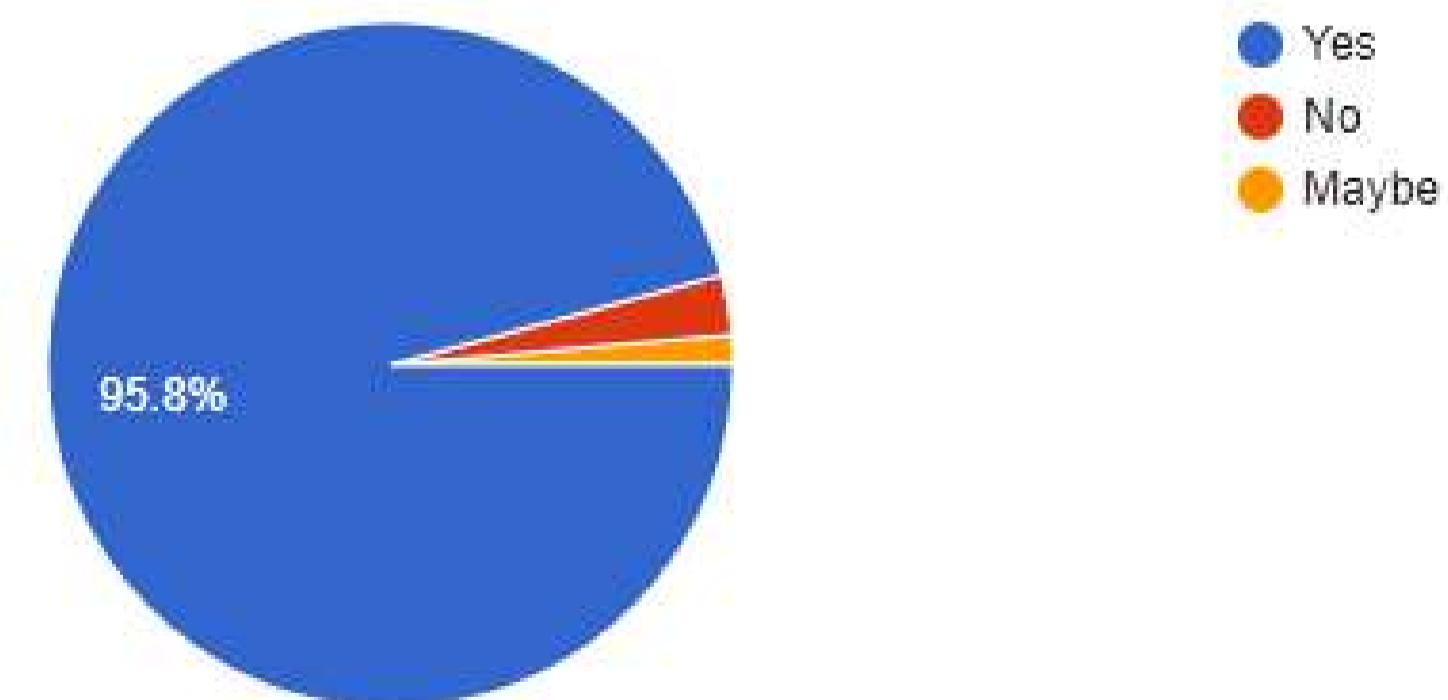
71 responses



## Are you concerned about safety while driving?

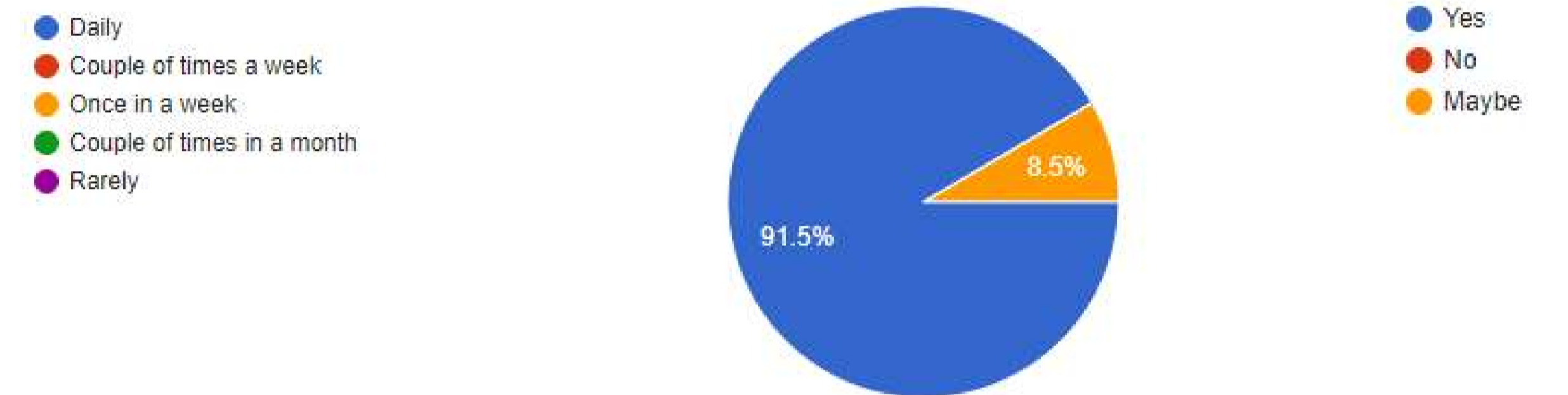
71 responses

Copy



## Do you think the pillion rider (passenger at back seat) should also wear the helmet?

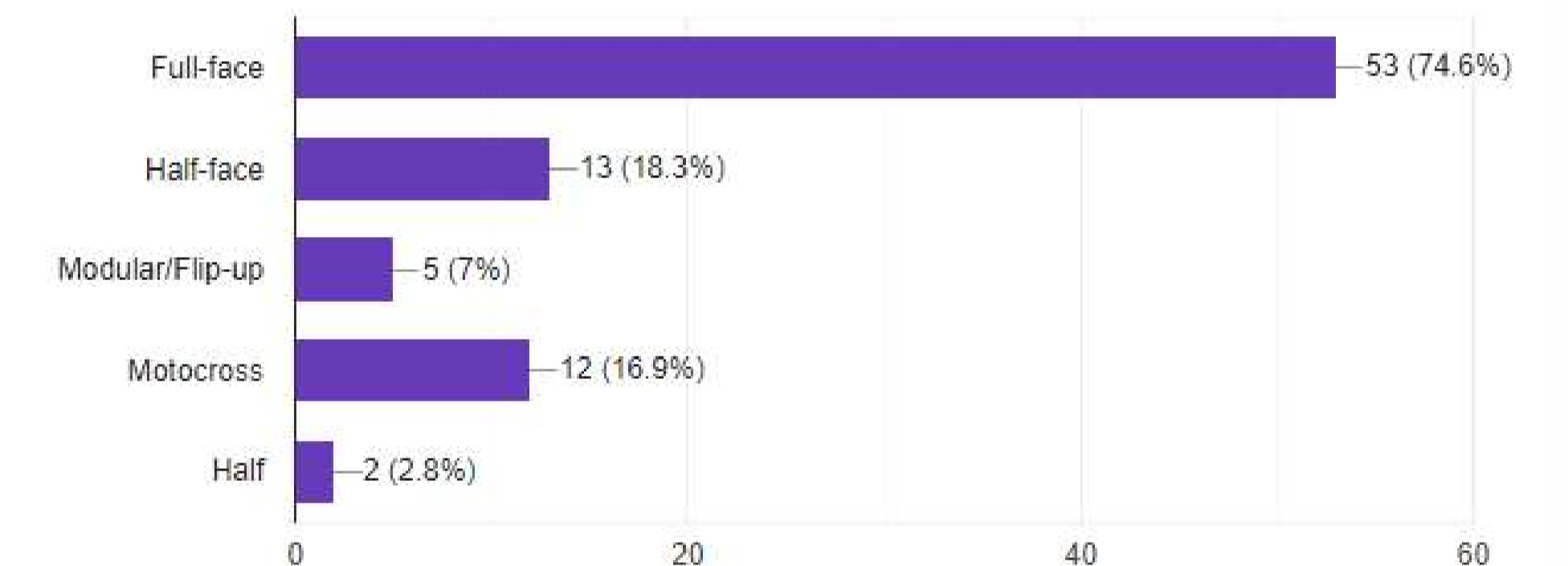
71 responses



## Which type of helmet do you use?

71 responses

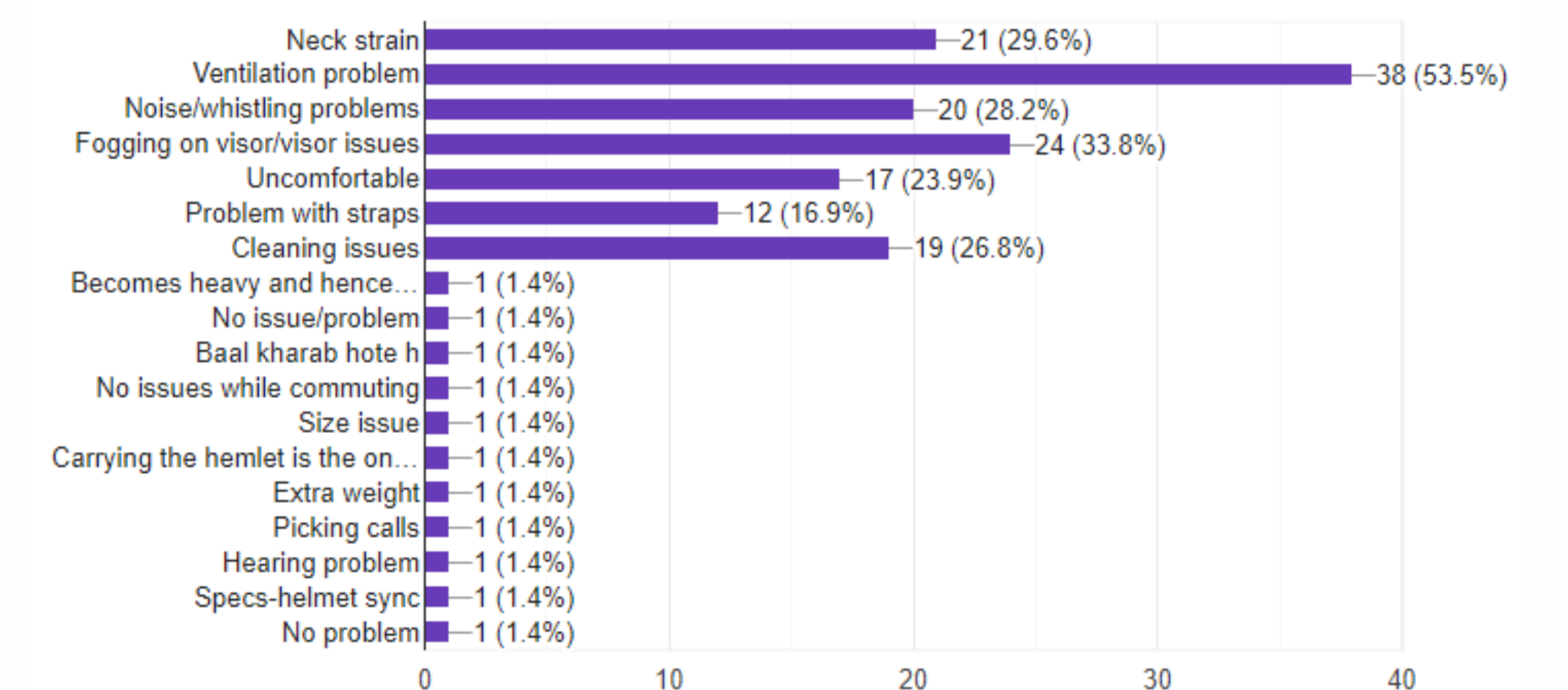
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## What problems do you face while using helmet while commuting?

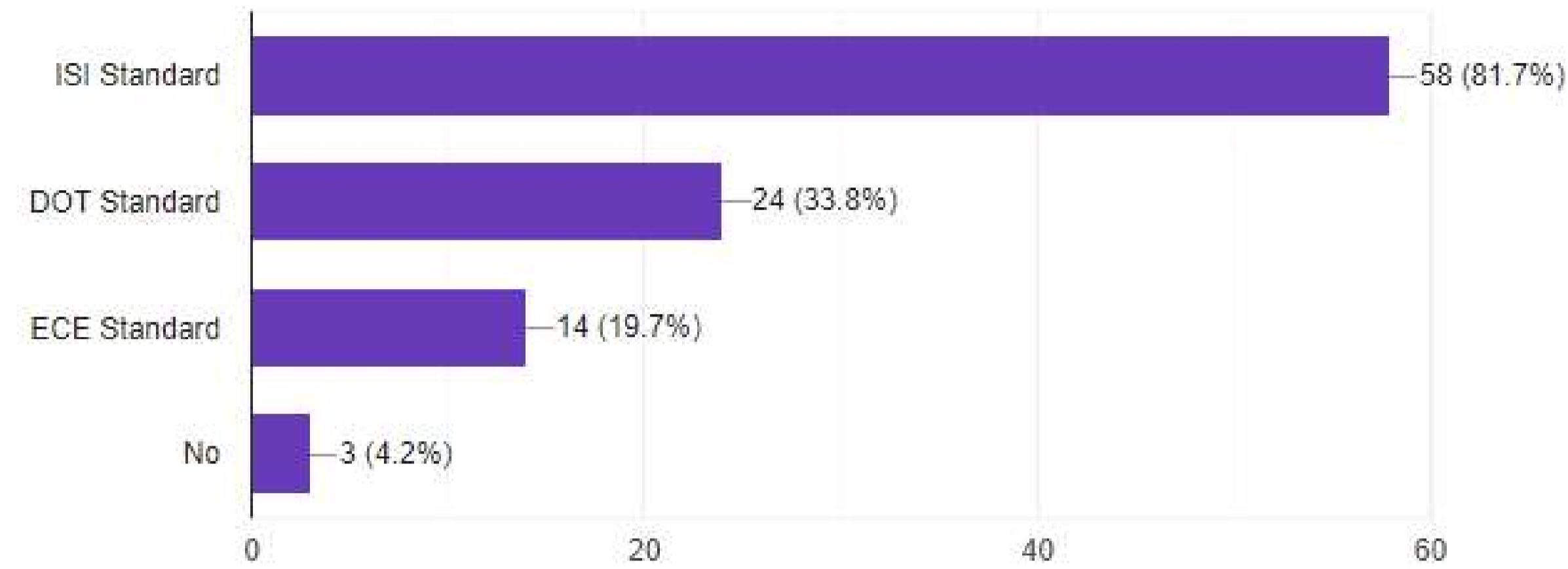
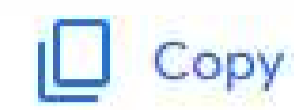
71 responses

Copy



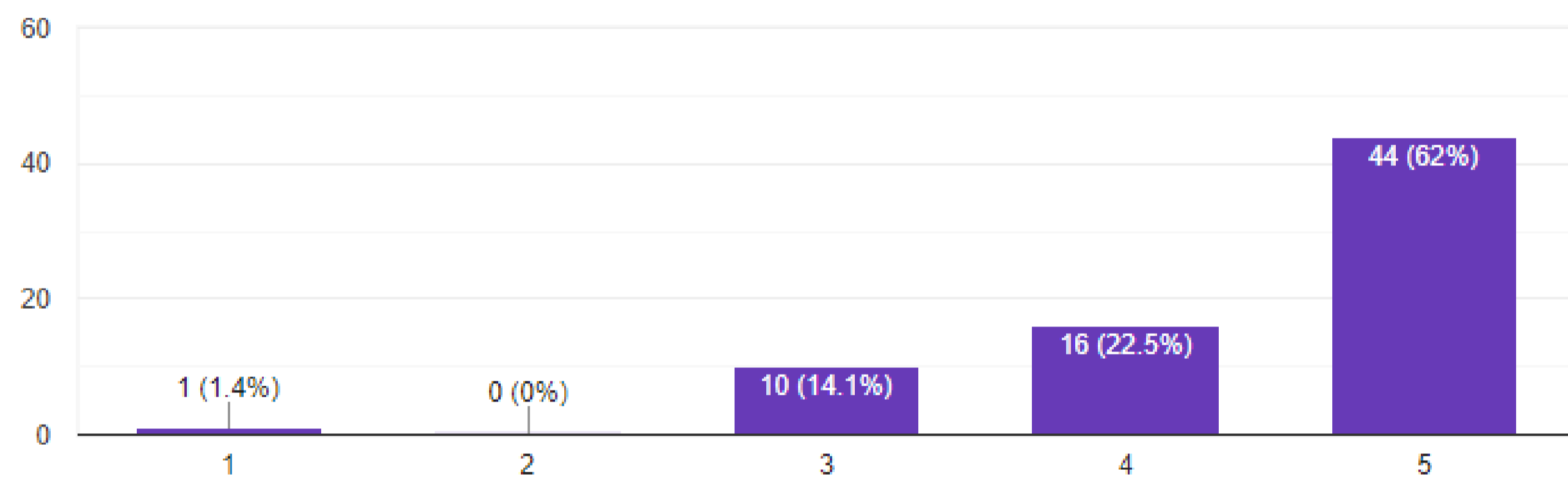
### Do you consider buying a standard helmet?

71 responses



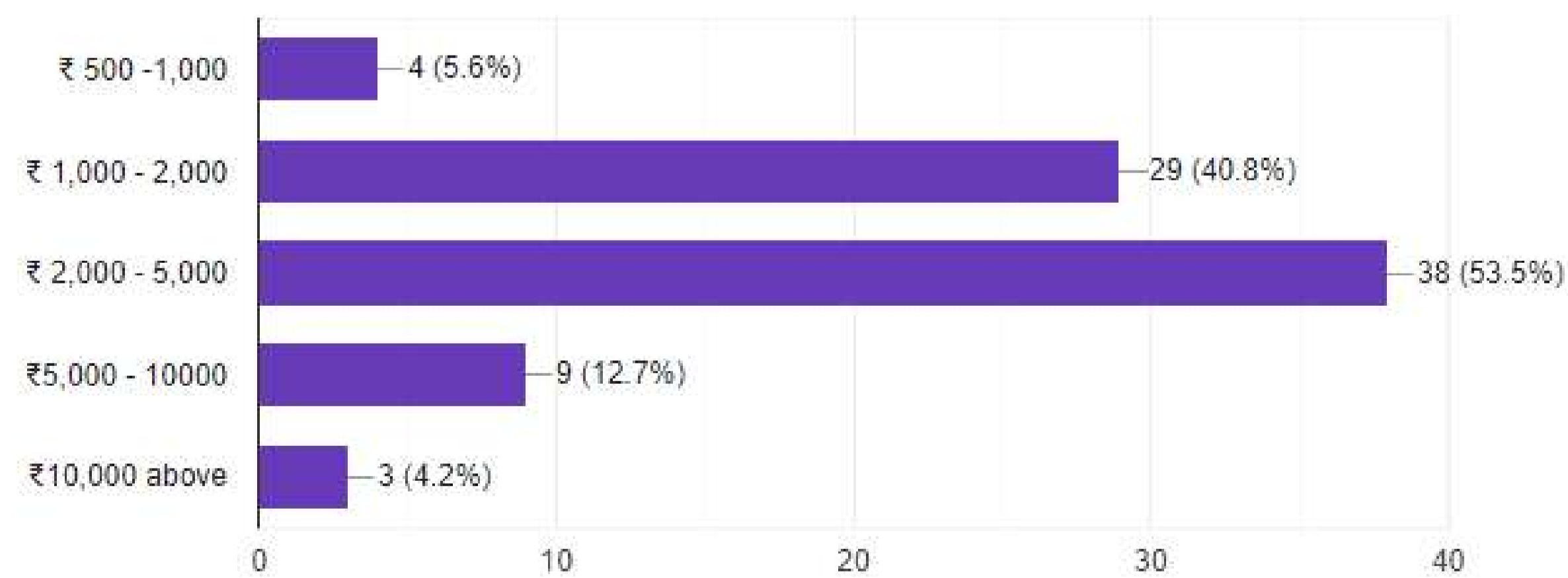
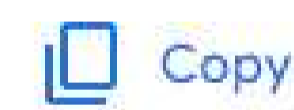
### Rate how you consider quality of helmet and the material while purchasing one?

71 responses



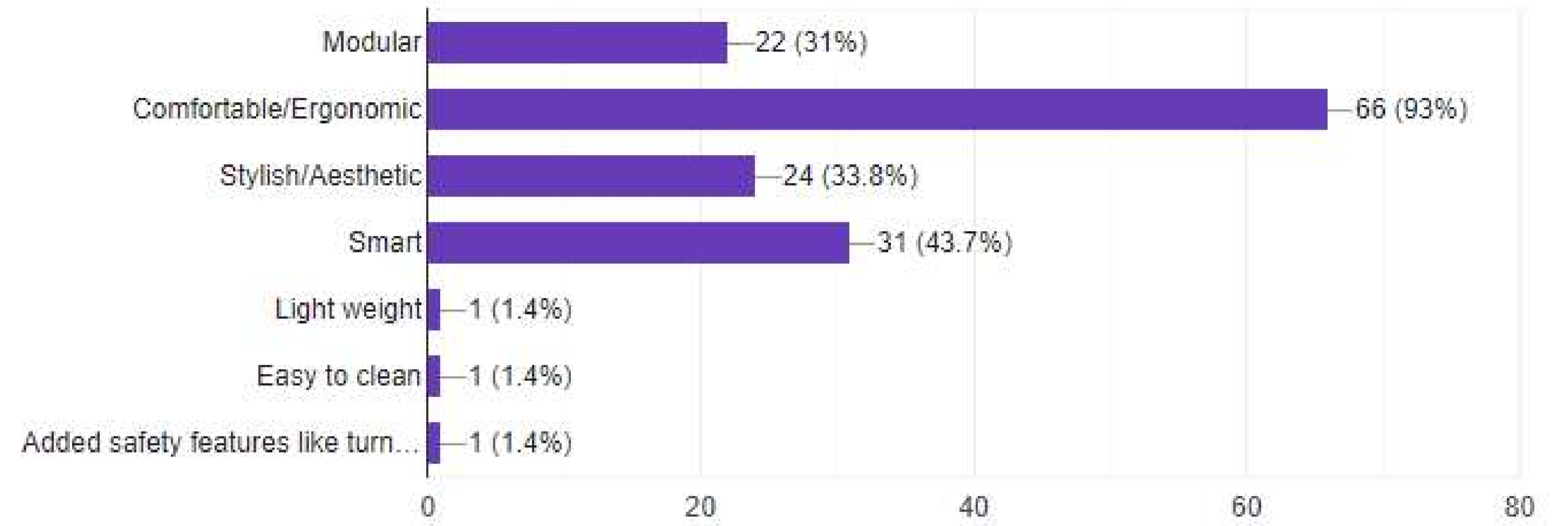
### Price range you consider price of helmet while purchasing?

71 responses



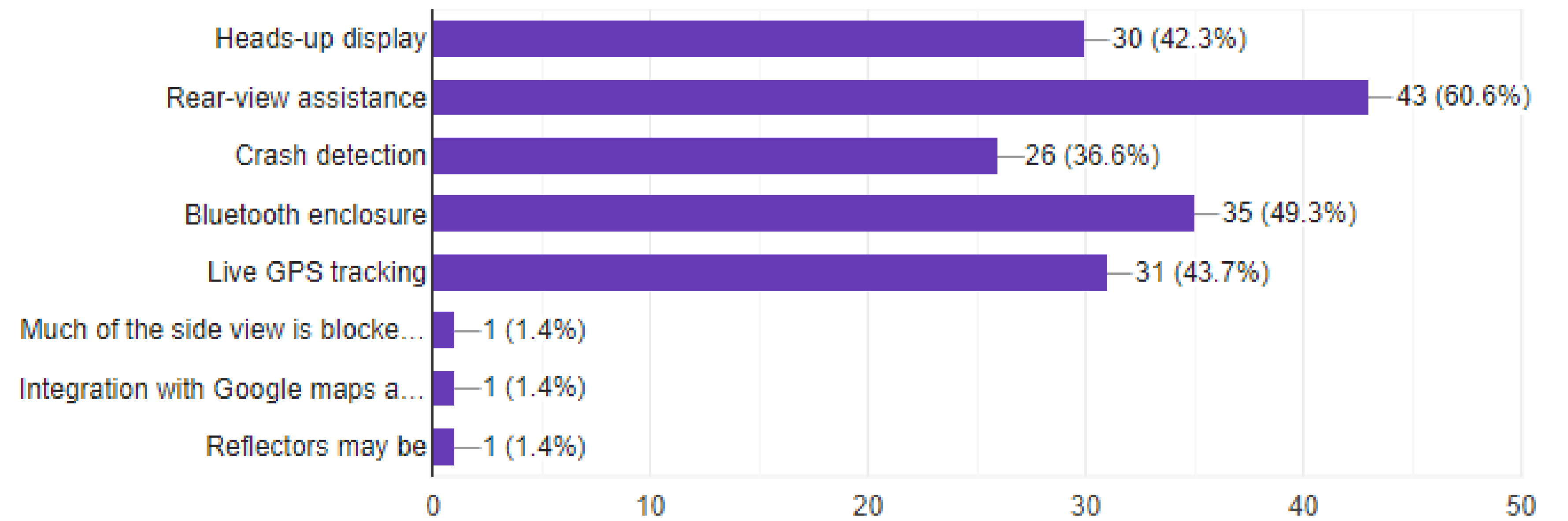
### What features you think which can be improved in helmets according to your needs?

71 responses



### What features you will like to have in your smart helmet?

71 responses



Wearing or taking off the helmet

Cleaning the helmet

Difficult to wear earphones, receive call

Sometimes

Strap gets struck

Strap becomes difficult to open

it takes time and finding straps might be cumbersome

the paddings are quite stuck for cleanin

Inner lining becomes sweaty and difficult to clean

I face this problem in rainy season as well.

Inside is very difficult to clean Along with the vents

A helmet of head size should be obtained

Little bit

Uncomfortable while removing ot wearing with specs on

especially whenever i do ponytail hairstyle, i have to adjust it or untie it for wearing helmet comfortably

except for my hair

cushions and interiors of the helmet are not accessible

I tend to sweat a lot normally and when wearing a helmet the sweating increases, And this makes the helmet smelly, but it is difficult to wash the helmet as the foam absorb the water and doesn't dry quickly

The visor mounts are difficult to reach . Also on not so high end Helemets, the padding can't be cleaned

Feeling uncomfortable

Often too fit to wear

locking mechanism is not easy and often requires extra efforts

locking mechanism is not that great, sometimes it takes a lot of effort to unlock/lock it

Rubbing of scalp

mainly the front glass part

specially in rainy seasons, It smells. And also for cleaning thermocol type of helmet there is lot of trouble

Non removable cushion

Intricate cleaning

The ear tends to fold in while wearing the helmet

the only problem is to find out the ejecting button

Releasing the clip can be little frustrating

It becomes difficult to keep wearing a mask while taking off a snug fit helmet . Also , difficult with longer hair

Yes, due to Airpods

The padding is often non-removable and gets dirty due to sweat dust and hair oils

first i don't even know how to clean it, i think the foam padding comes off, but i don't prefer taking it off and then i won't be able to fix it properly

If atmosphere is humid the inner surface tends to develop fungus

Smells from inside after some time, hand cleaning of cushion

While driving

Weather conditions

Hair loss issue  
 air entering from front, going into eye  
 Foggy visor on breathing or due course of time  
 Hearing problem  
 Scratch on visor  
 Uncomfortable, squishes my ears

Fog on the front glass  
 Inner lining gets wet and unwearable in rains  
 Gets really uncomfortable in summer  
 Fogging in winter and rain, sweat problems in summer, weight of helmet  
 Rain hampers visibility

Its a bit difficult to see side ways when someone suddenly overtakes you  
 I prefer half helmet just because it doesn't cover my entire face and the airflow is somewhat maintained.  
 Specifically for those applying hairoil daily: If wore without helmet cap ,leads to foul smell from helmet because of hairoil reacting with inner cushion turning it rancid  
 Fogging issue  
 Headache because of helmet weight

Helmets getting to hot  
 Too hot inside on a sunny day  
 Yes during rainy season the shield of helmet gets wet and I am not able to see properly through it also in winter season the shield gets totally foggy and I can't see anything in front  
 1) Hard to use in rain.  
 2)Front plastic gets yellow after sometime.  
 3)fogging in winters

No locking mechanism to leave it on the bike  
 side Sight gets cut  
 Bluetooth connectivity  
 Problem to the hairs  
 Weight is bit heavie  
 Uncomfortable fit if added aftermarket accessories like intercom

In rainy seson the fogging issue  
 Viper could be a vaulable addition as the vision gets blurry during rain and mist  
 Due to less Ventilation Fogg is the issue and in rainy season Mud as well as heavy rain fall sometimes become problem  
 Fogging on glass. Because of rain sometimes inner side of helmet gets wet. Visor protects eyes n face in rainy season but it should have something that improves visibility also

After long use of helmet I get cramps on cheek  
 Pinching on the ears is very uncomfortable  
 Placing specs, fog due to breath, heavy, clamping of straps, sweaty, scarf gets displaced, hair gets messy  
 No proper mechanism in present bikes for locking helmet in rain/ water that makes them wet. Which lead to foul smell from it  
 Blurred vision, missing sunshield  
 Hair becomes messed up  
 Weight of helmet

In rainy season the helmet get wet and there's no way for me to dry it quickly  
 Heavy fogging during the rains and winters  
 Extreme hot and sweaty during summers  
 Glare at night  
 Can't see in rain, hot in summer

Not complete coverage of face because of half helmet  
 Sweating  
 Straps open up. Heavy.  
 Not able to hear horn noise  
 Suffocation  
 Contacted eyesight  
 Storing/securing helmet to any place is not possible  
 Major issue carrying a helmet everywhere  
 Outside sound

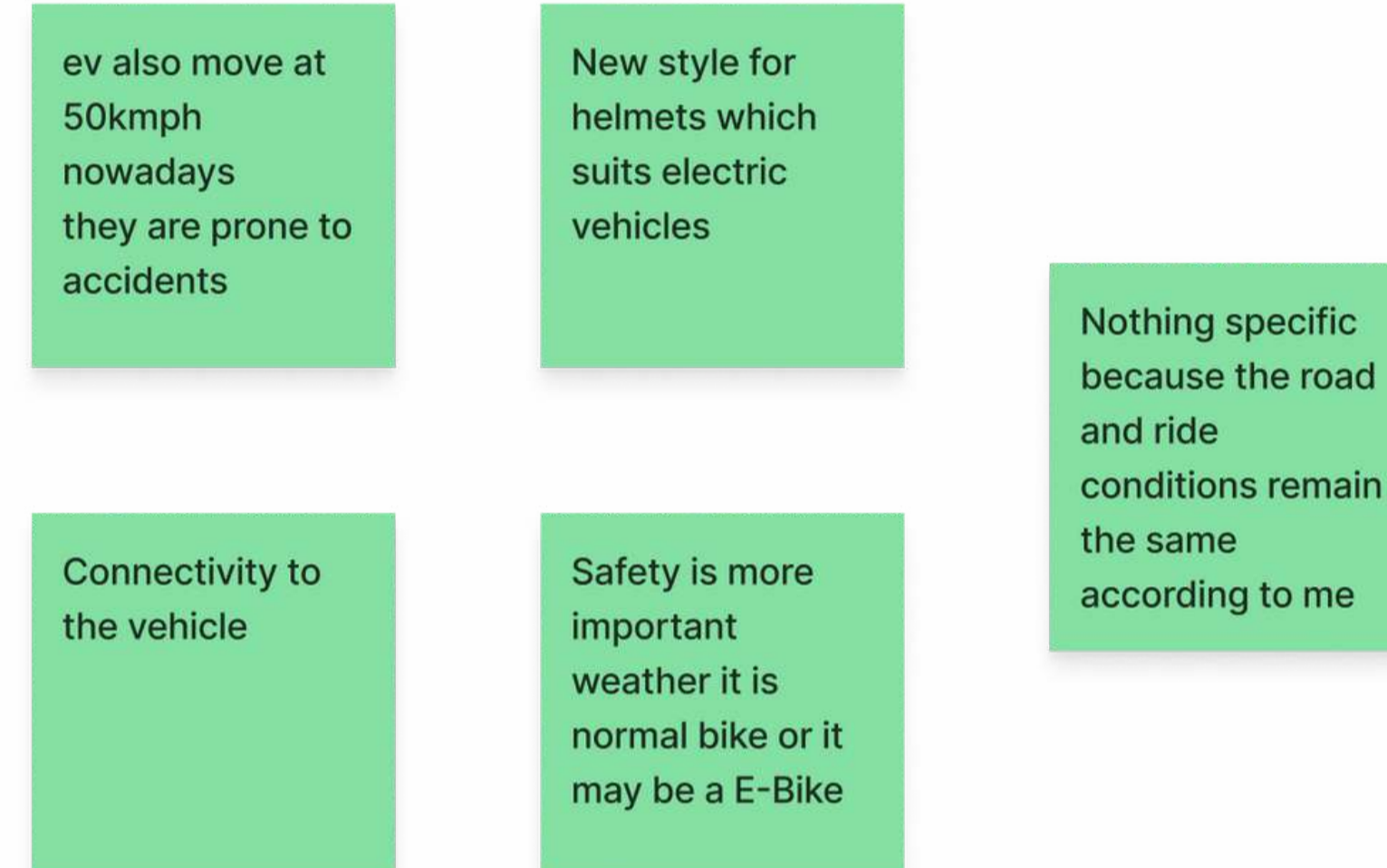
These are temperature, atmospheric pressure, cloud formation, wind, humidity and rain. A small change to any of these conditions can create a different weather pattern. Every weather pattern has a knock-on effect, creating a ripple effect around area  
 water droplet strains in rainy days  
 rainy season, there is visor issues and hearing issues  
 Riding in the rain is the biggest issue  
 Light reflects  
 Also in winter, the chil wind

Ventilation, hearing the pillion rider or the environment around  
 Visor issue  
 Helmets are not properly ventilated and it cancel maximum voice of the other honking vehicles  
 Scratchy head  
 Scratched visors cause bad glare at night  
 Neck strain and problem with strap

Experience



Electric



Smart helmet



# Major Pain Points



# Problem Identification

- undistributed load and weight of the helmet
- improper ventilation
- uncomfortable padding and provision for removing the padding
- improper straps and find it difficult to open or release
- the problem for people with spectacles while wearing or taking off the helmet
- finding a perfect fit is a hassle
- wider and rear visibility
- unable to lock the helmet to the bike
- accumulation of fog and water on the visor as well as scratches
- hard to navigate while driving, also to pick up calls
- there's no particular helmet design language for electric vehicles
- people cant change the accessories of helmet according to their needs

# Re-defining Brief

To design a helmet for the age group 18-30 which are basically students and young working people, which have to travel on a daily purpose

- The product should be easy to wear and take off
- The helmet should be modular and fulfil the user's purpose
- The helmet should give a good user experience to the rider keeping safety as a first priority
- The helmet should also fulfil the purpose of technology-integrated aspects such as navigation, device connectivity, etc.

# Re-defining Target User

The user will be a younger group which includes:

- college going students
- working professionals



# Ergonomics

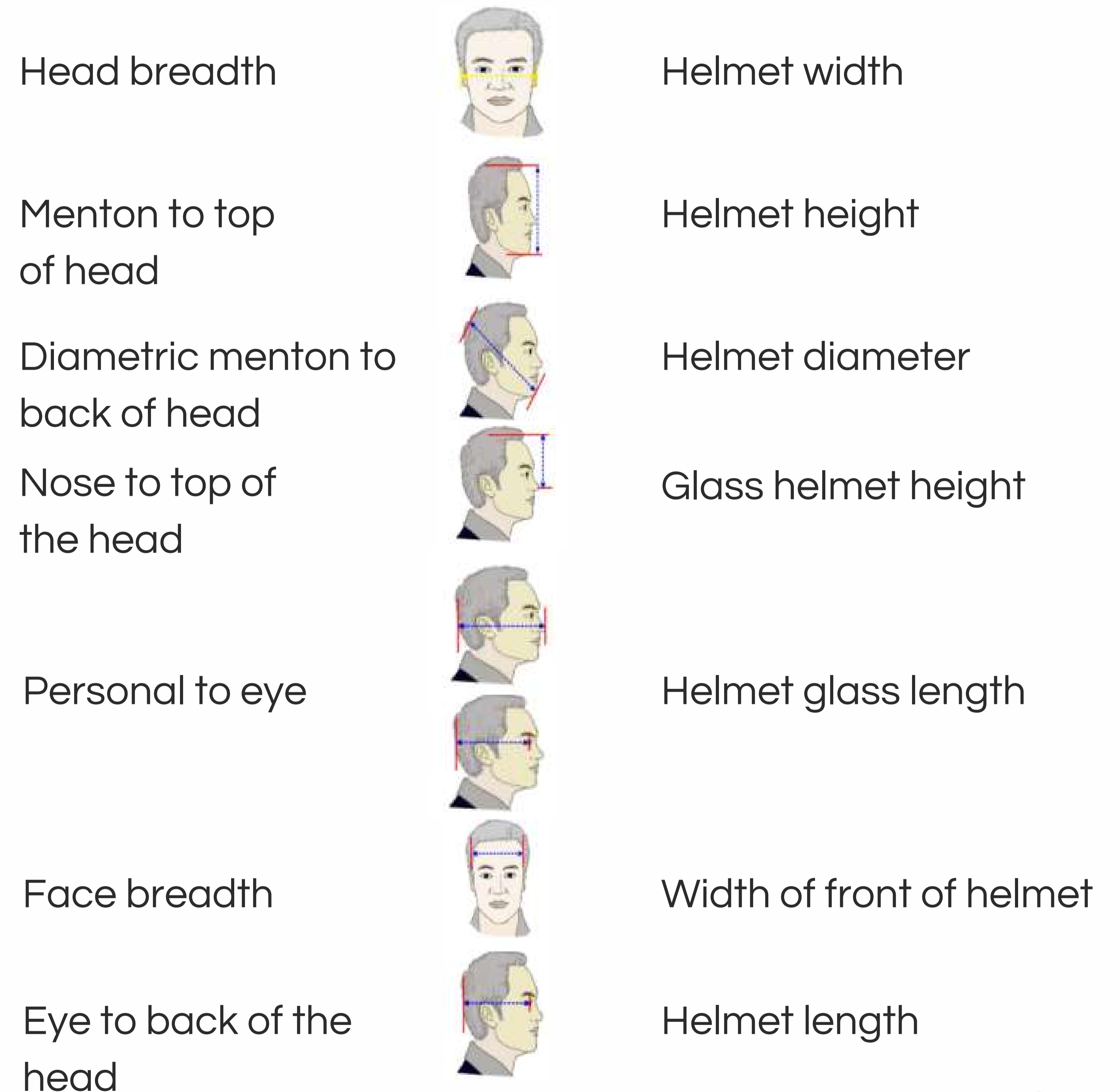
One of the fundamental applications of ergonomics is the use of an anthropometric approach for product design and evaluation. Based on the preliminary study, the following head dimensions from anthropometric data is considered important for helmet design. For helmet design, the anthropometric head is used as a basis for determining size.

Head anthropometry measurement is conducted by using Martin anthropometer, due to its flexibility.

Parameters	Data
Sample size	60
Stature (X) in cm	169.8 ± 6.36
HL in cm	19.2 ± 0.89
HB (Y) in cm	14.2 ± 0.45
CI	0.74 ± 0.04
$\Gamma_{xy}$	0.30*

Values in AM ± SD, \*P<0.05

## Anthropometry for Helmet design



# MOODBOARD



Adaptable



Futuristic

Aero-dynamic



Robust



Sci-Fi



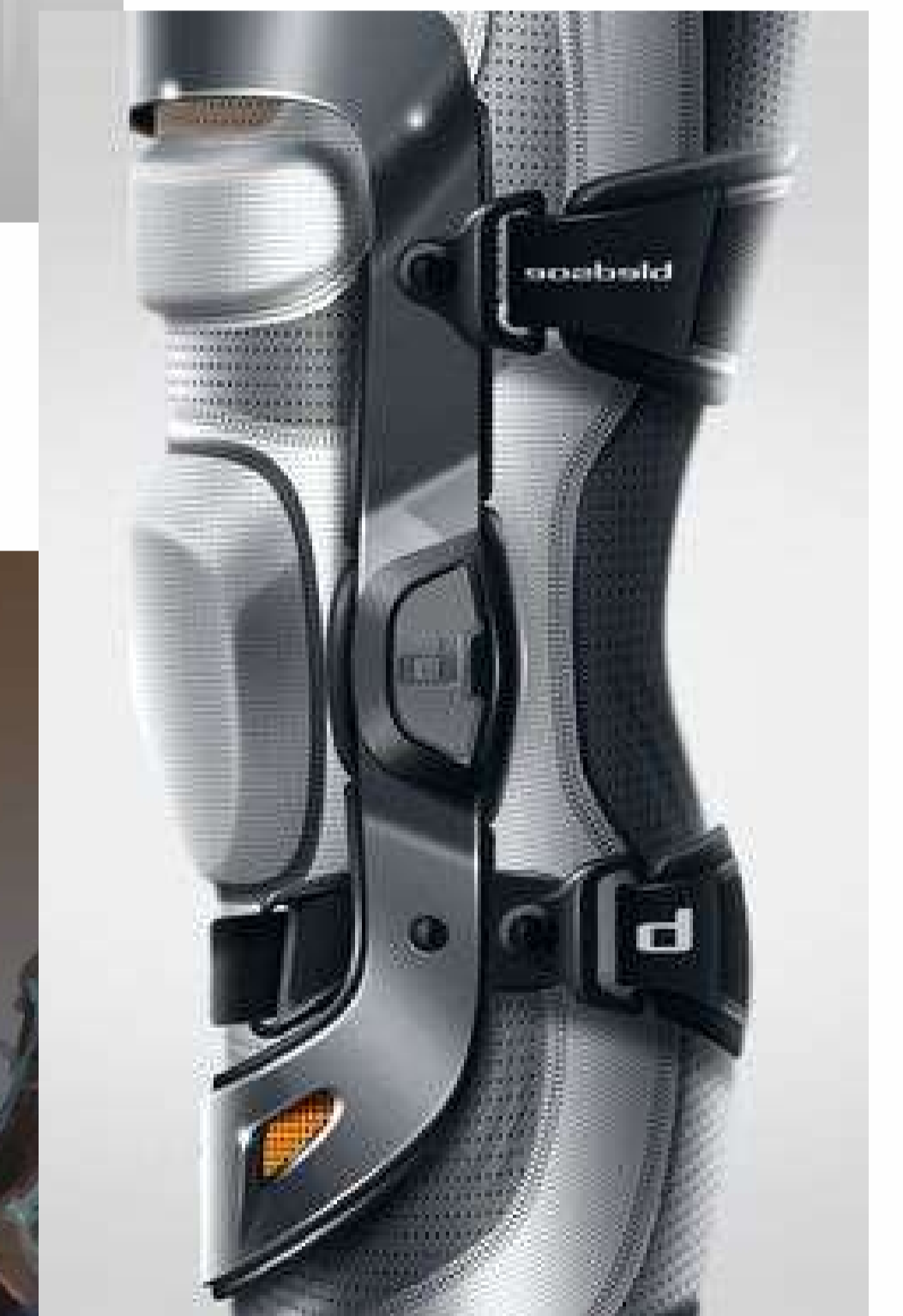
Sleek



Gaming



Modular



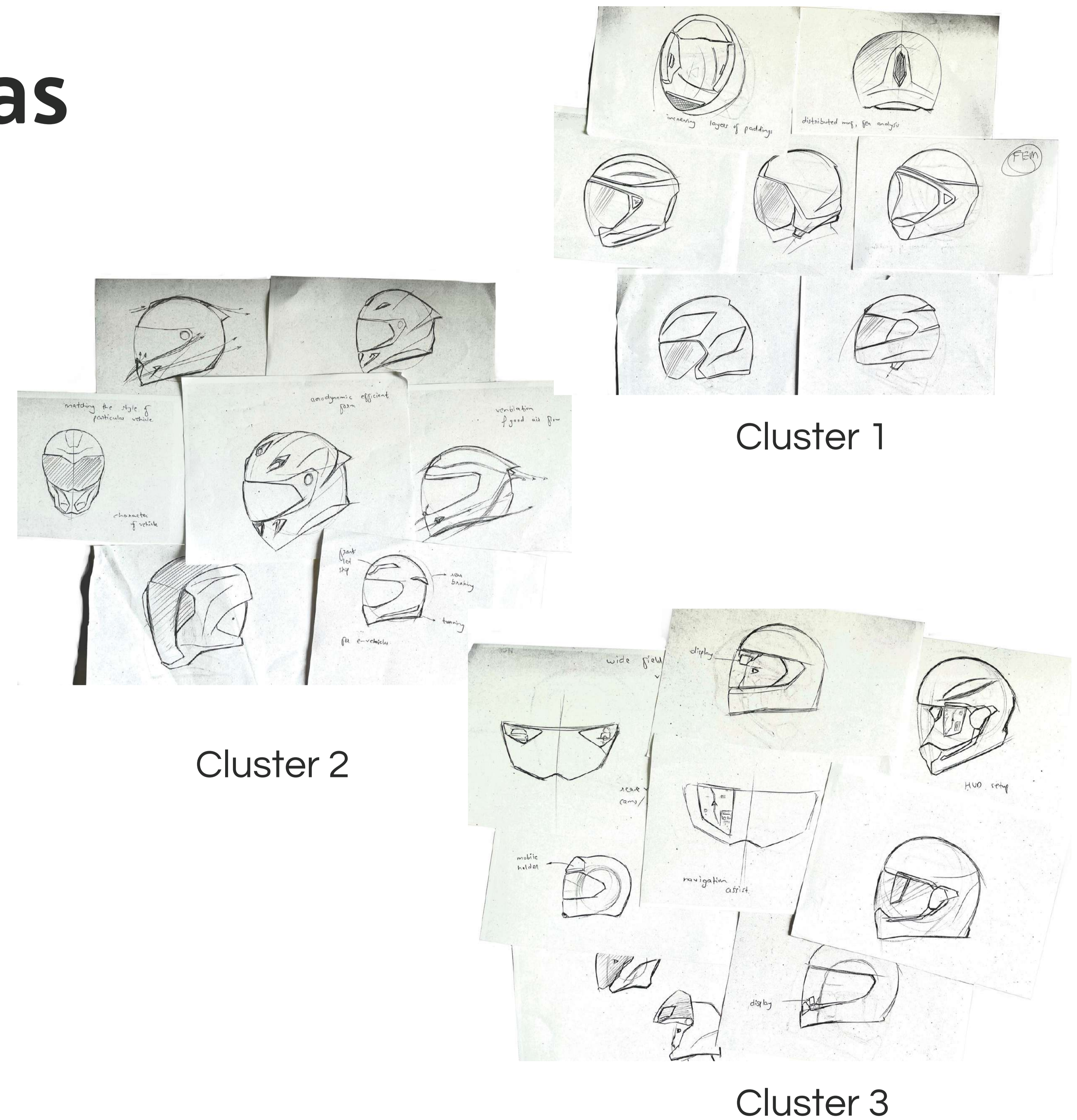
# IMAGE-BOARD



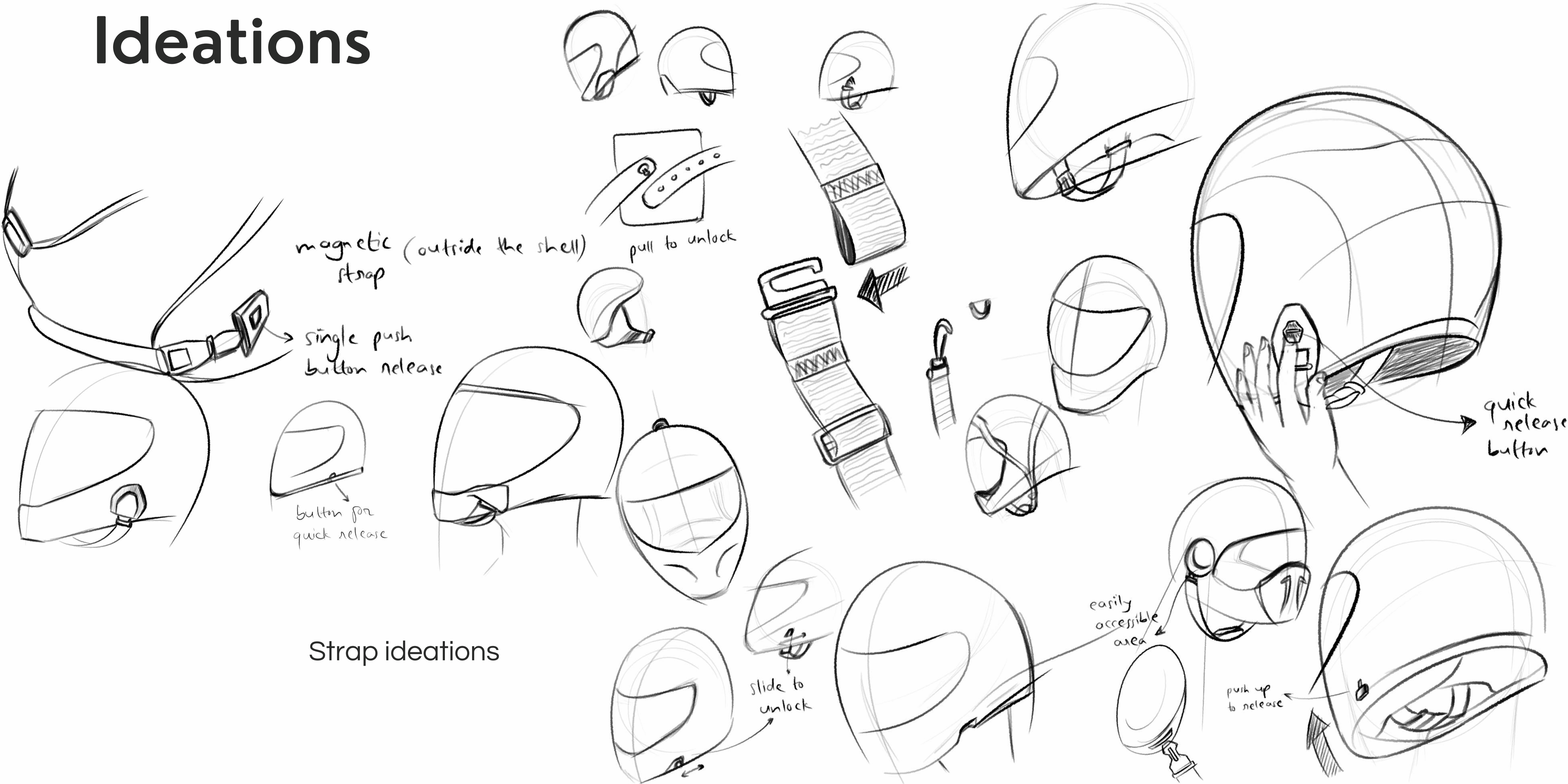
# Initial clustering of ideas

We started with initial brainstorming of ideas and solutions.

Prof. Chakravarthy organized a session for in-house discussion and clustering of the design ideations so that we look further for the design directions for the project



# Ideations



magnetic (outside the shell) strap

pull to unlock

single push button release

button for quick release

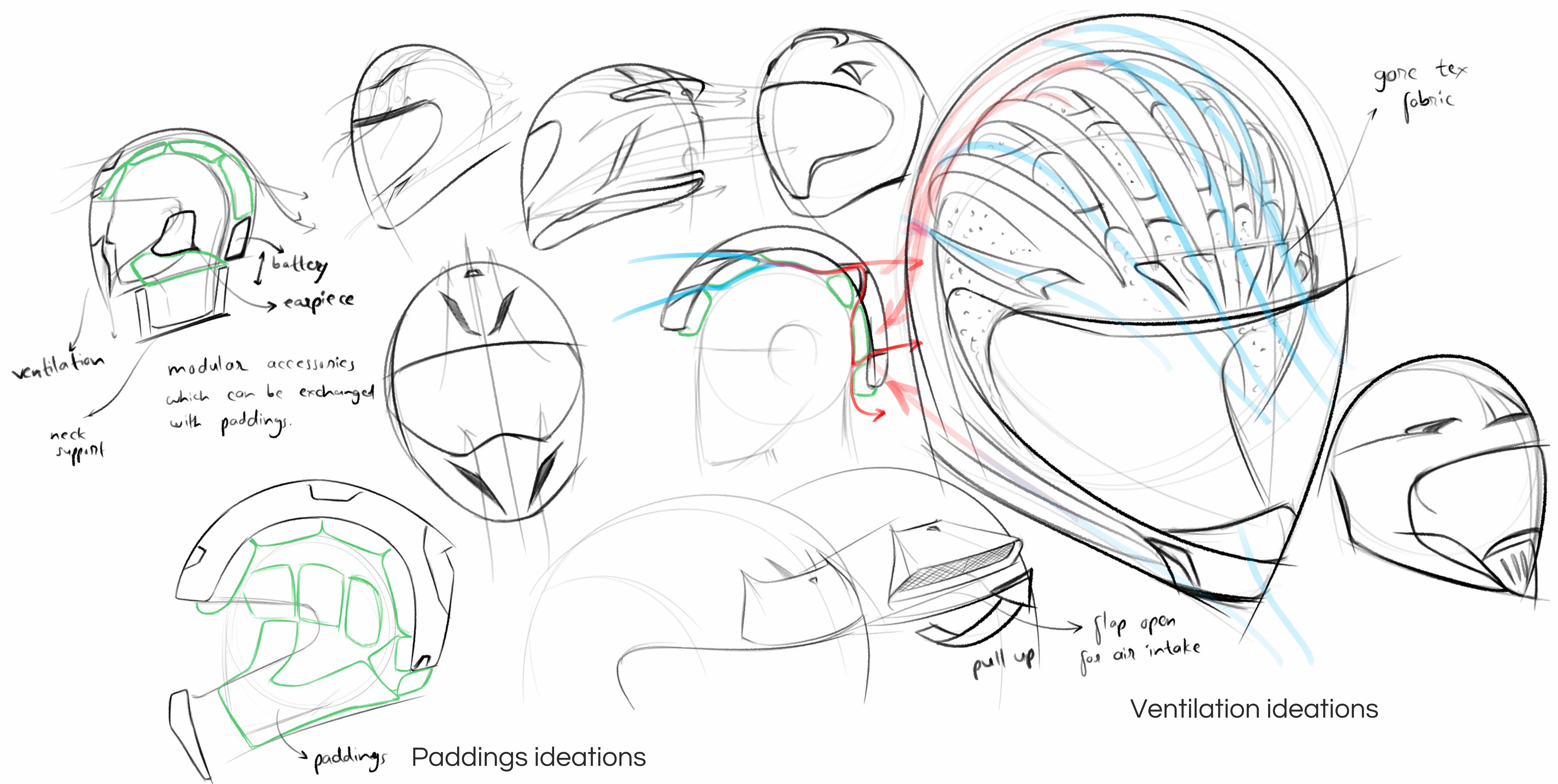
quick release button

Strap ideations

slide to unlock

easily accessible area

push up to release



ventilation  
neck support

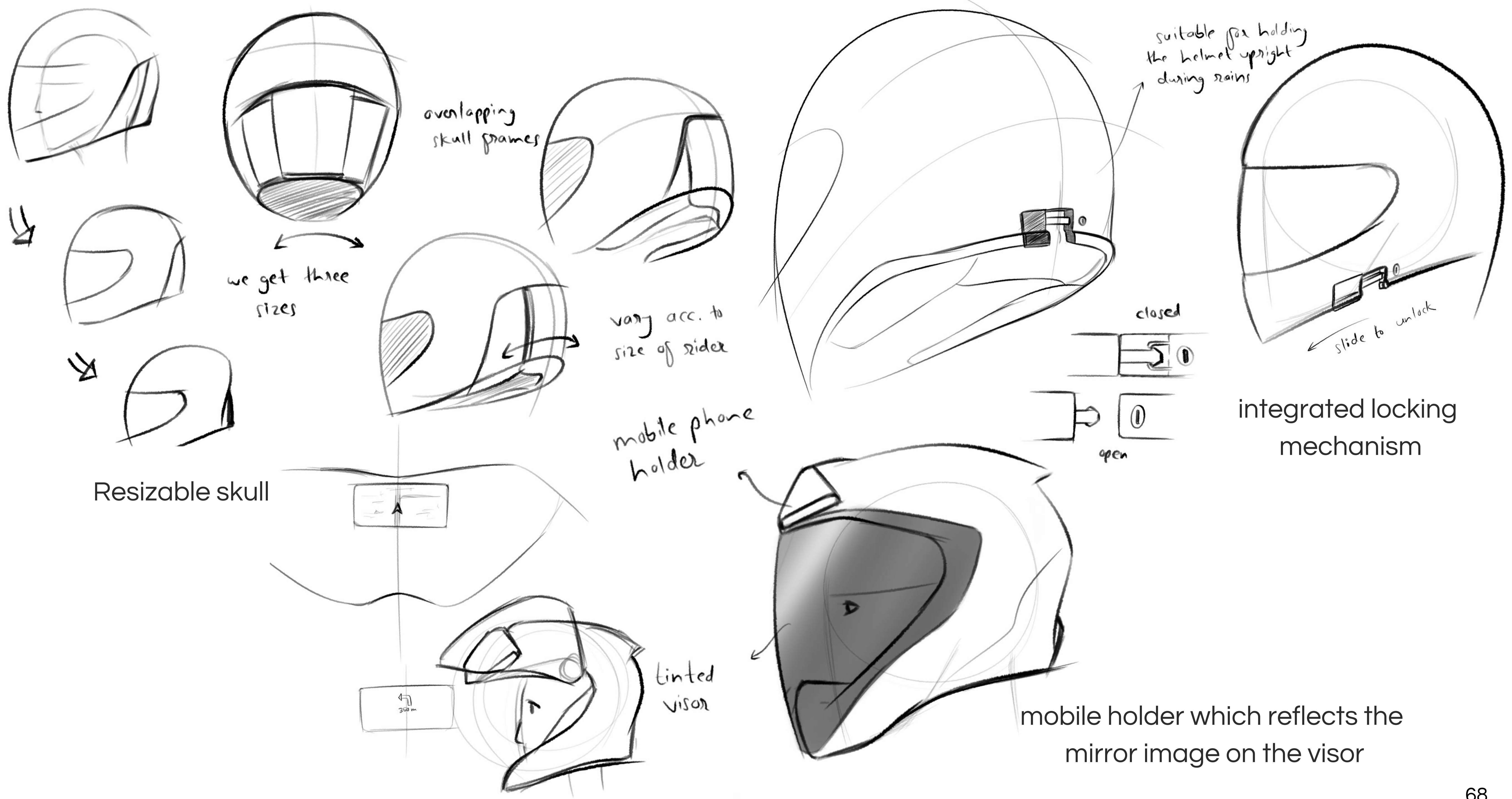
modular accessories  
which can be exchanged  
with paddings.

paddings Paddings ideations

gore tex  
fabric

pull up  
flap open  
for air intake

Ventilation ideations



overlapping skull frames

we get three sizes

vary acc. to size of rider

mobile phone holder

suitable for holding the helmet upright during rains

closed

open

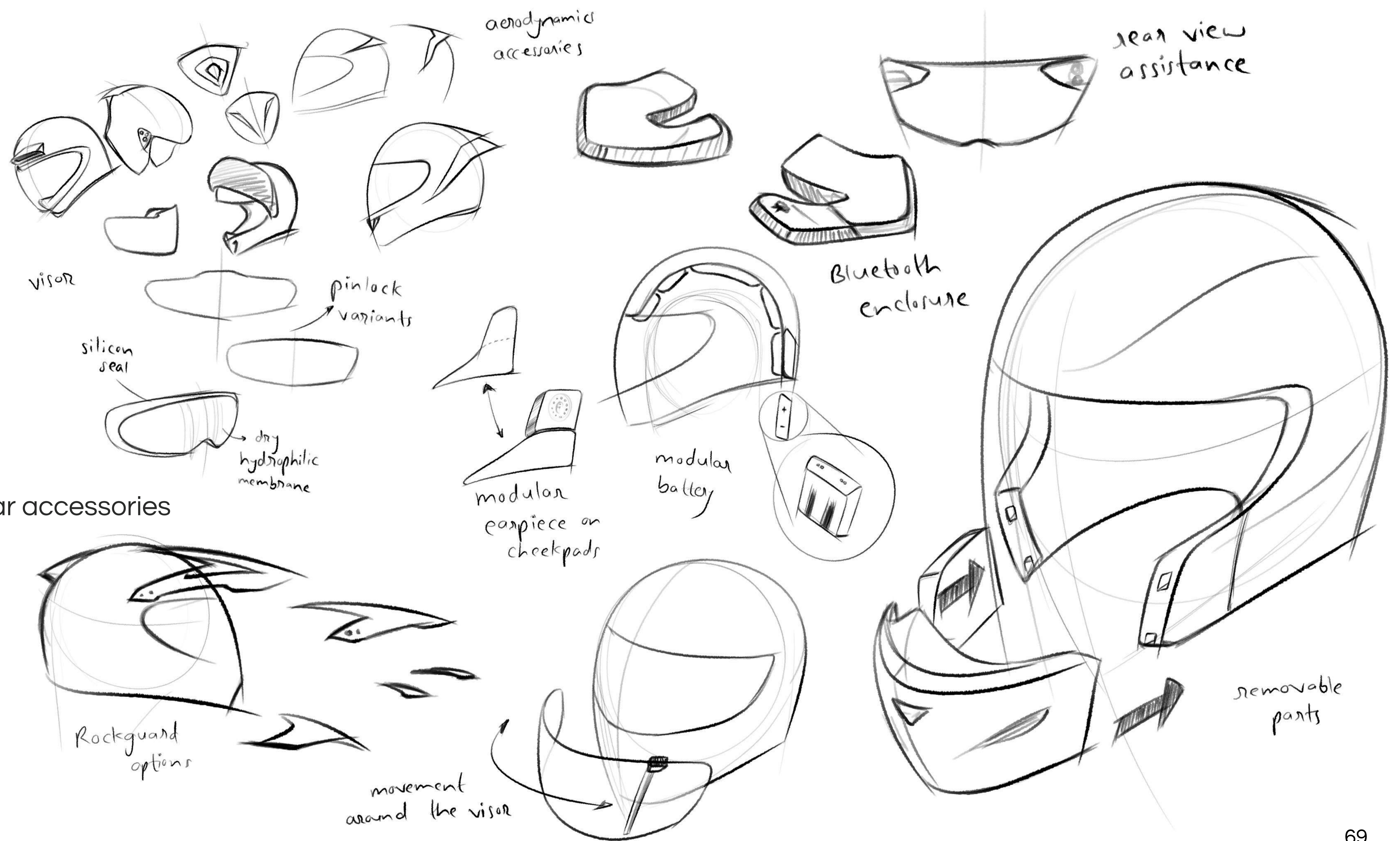
slide to unlock

integrated locking mechanism

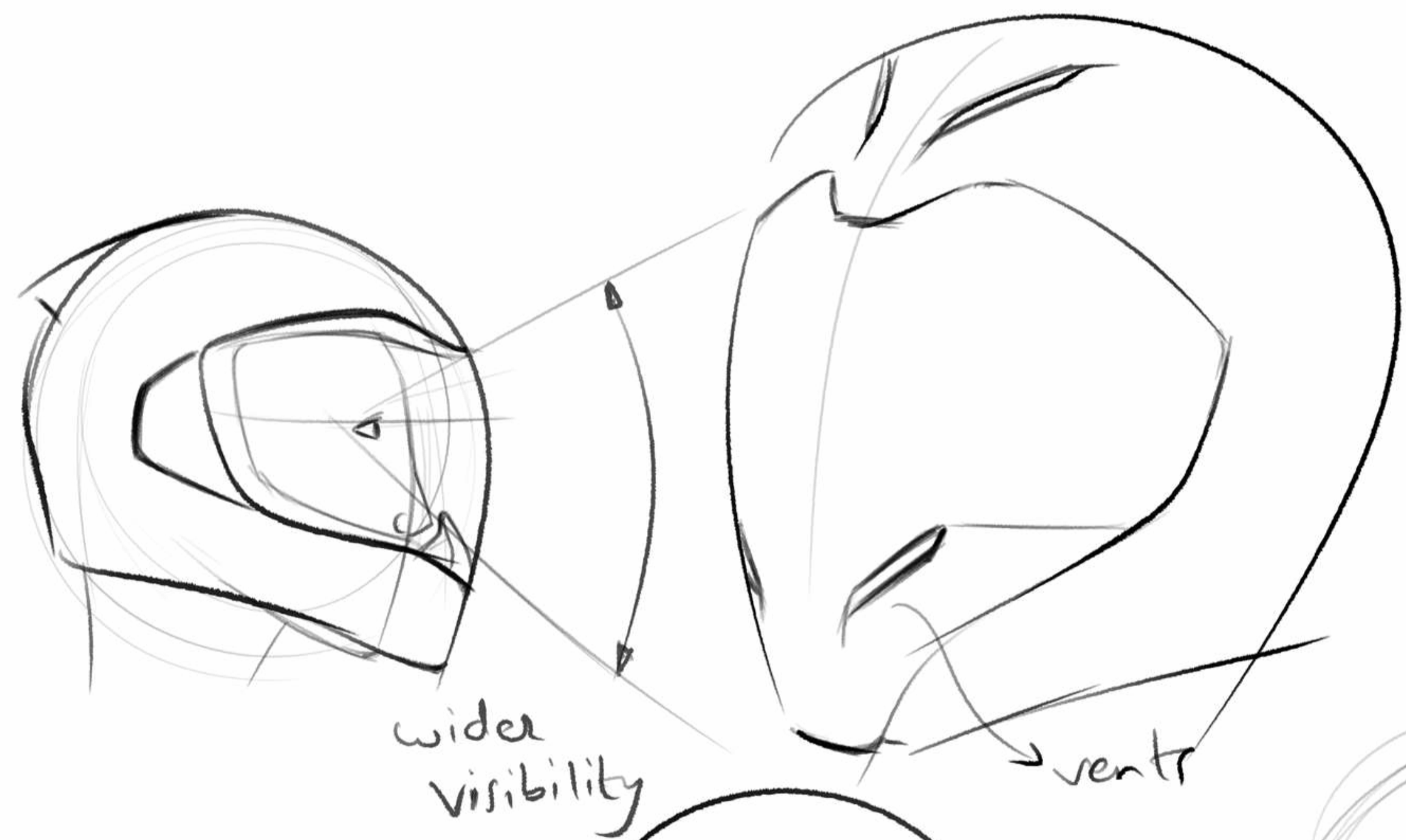
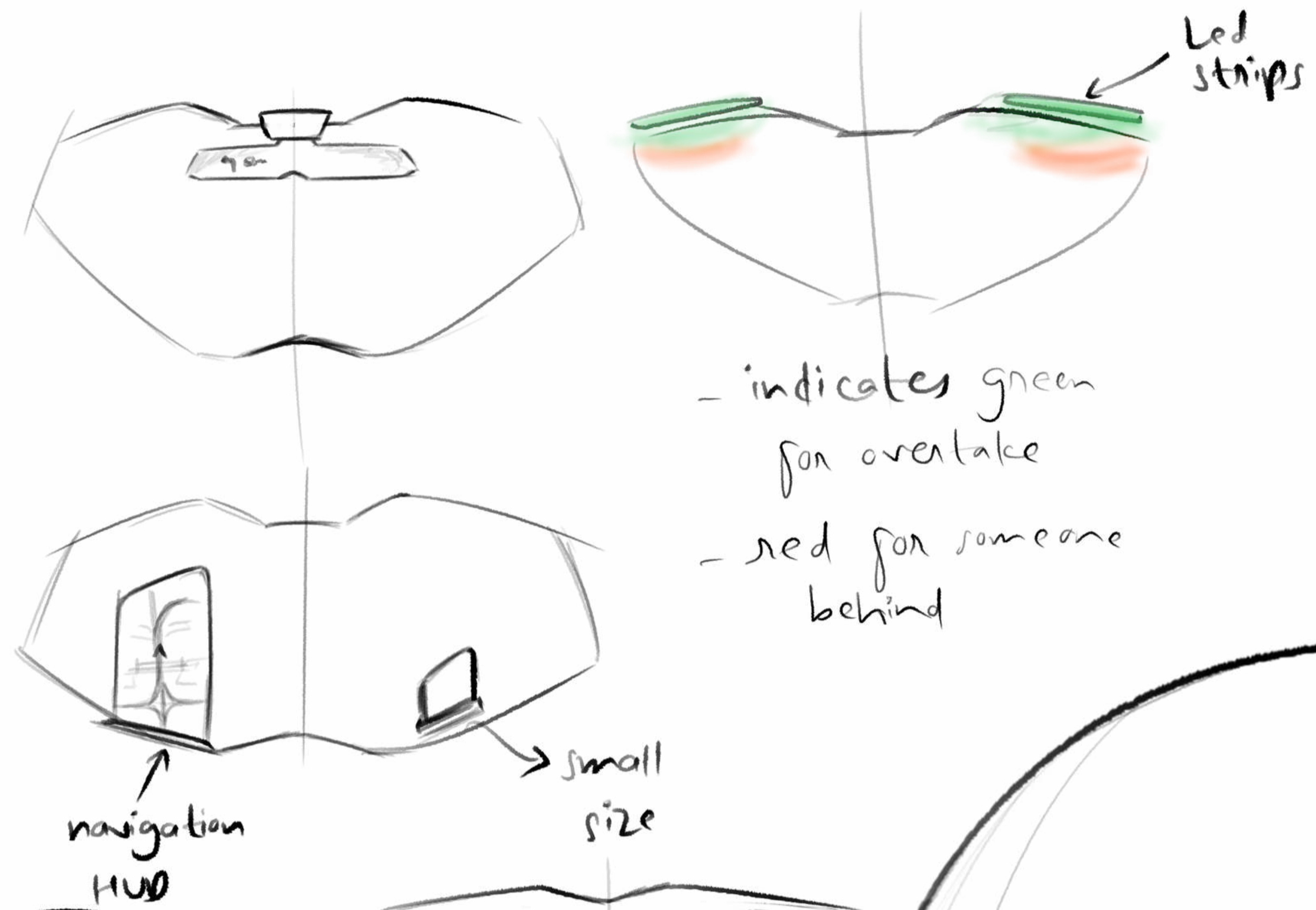
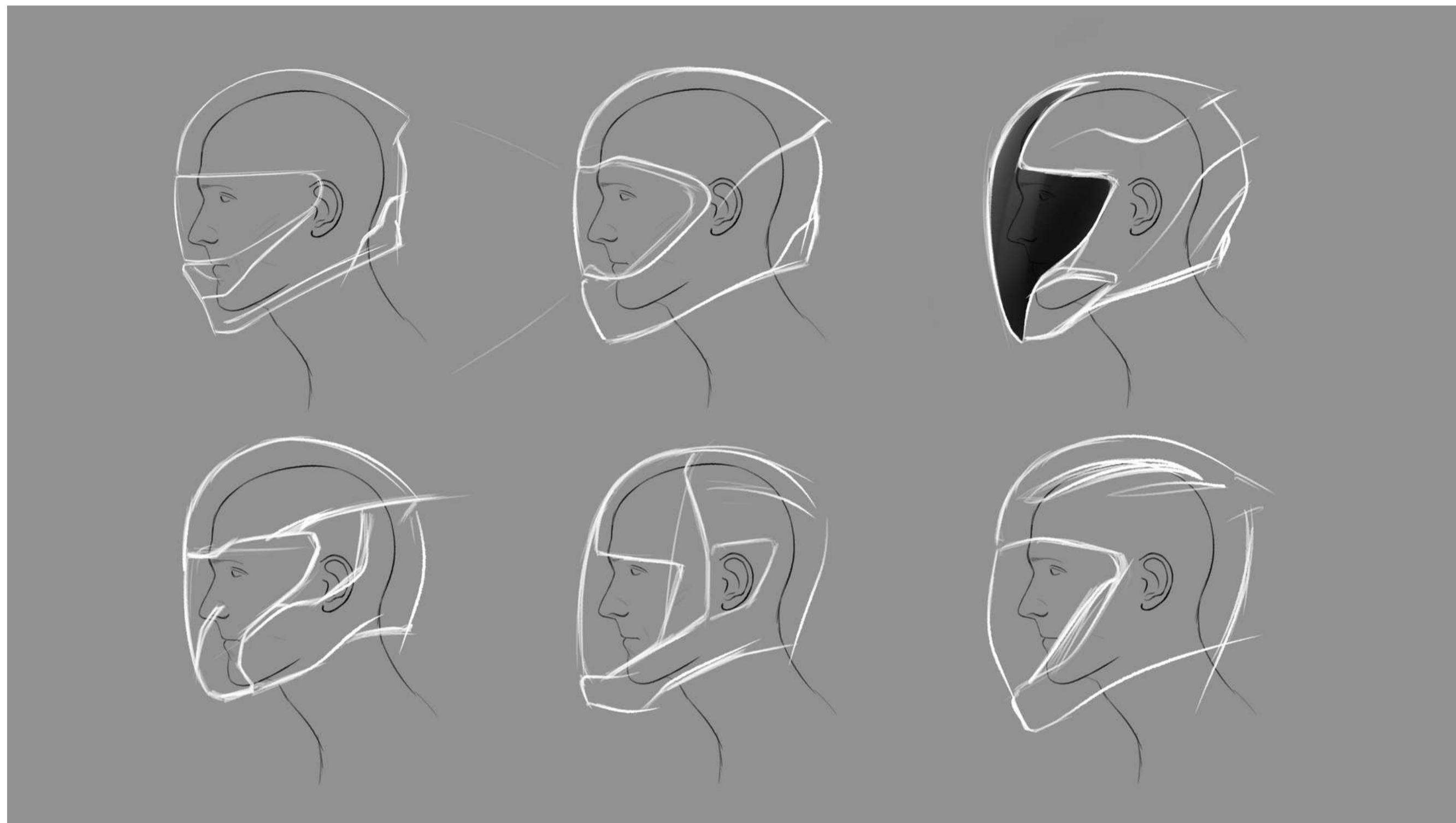
Resizable skull

tinted visor

mobile holder which reflects the mirror image on the visor



Modular accessories

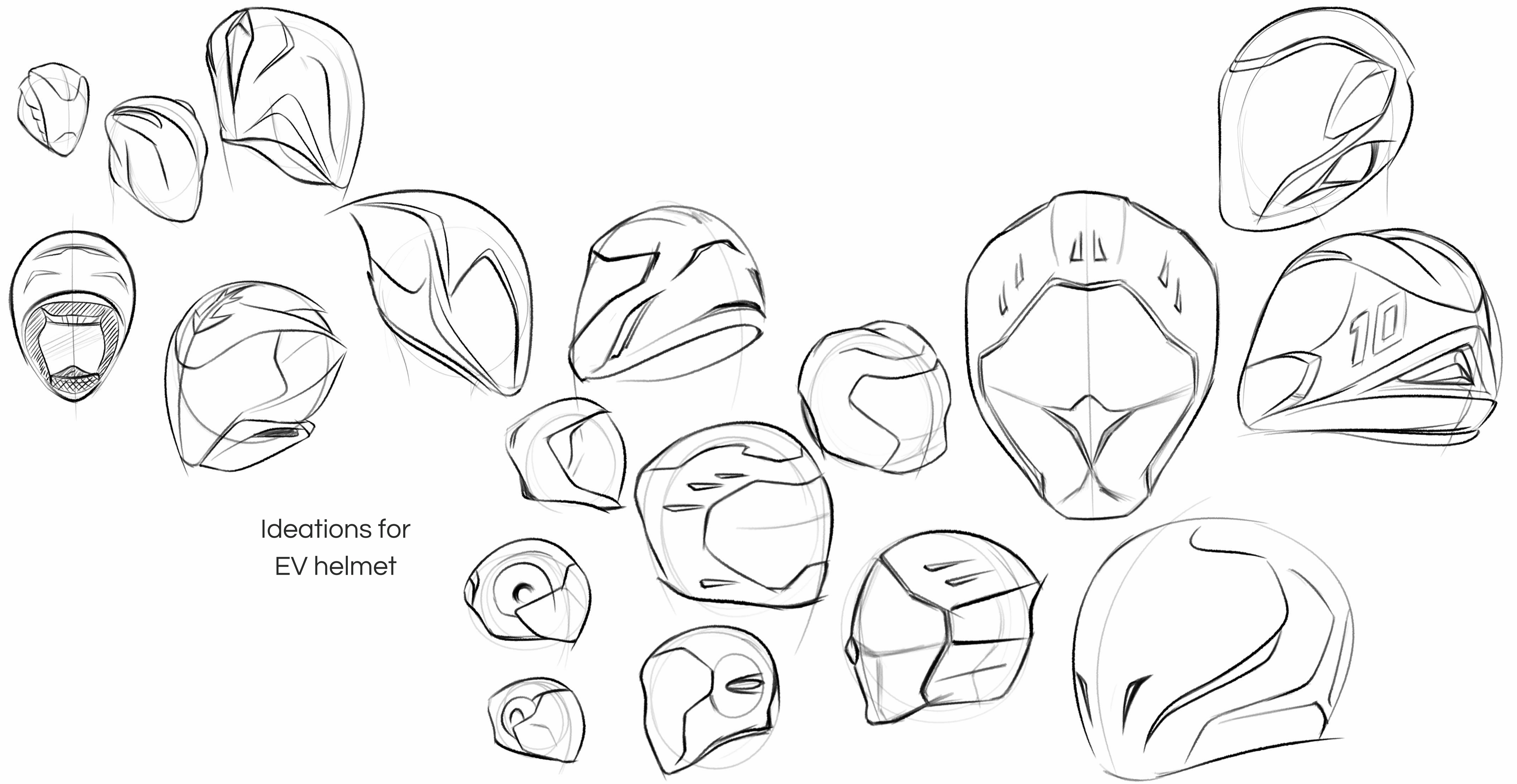


Wide viewing angle



HUD





Ideations for  
EV helmet



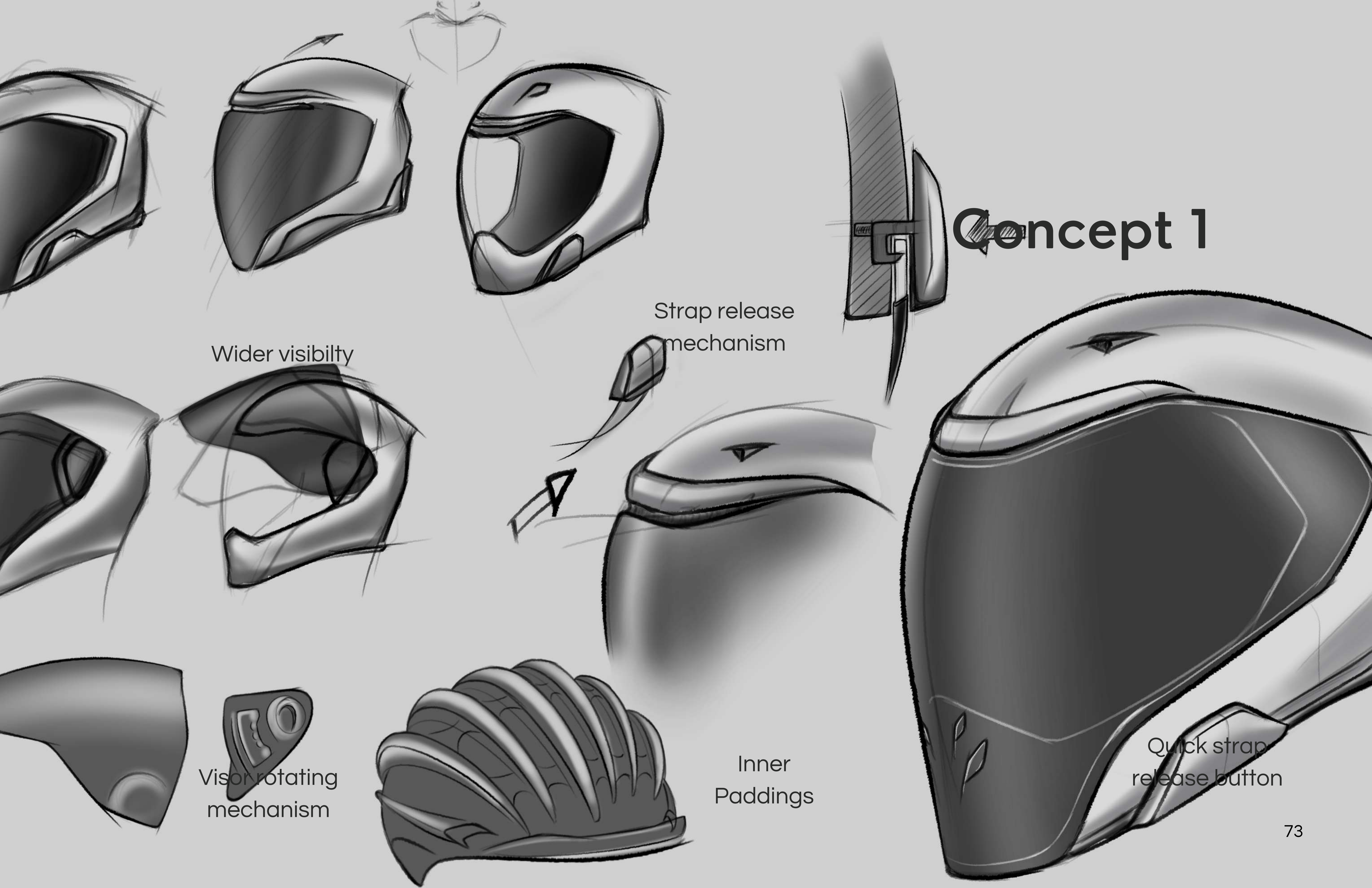
Integrated lock mechanism



Wider visibility



Modular



# Concept 1

Wider visibility

Strap release mechanism

Visor rotating mechanism

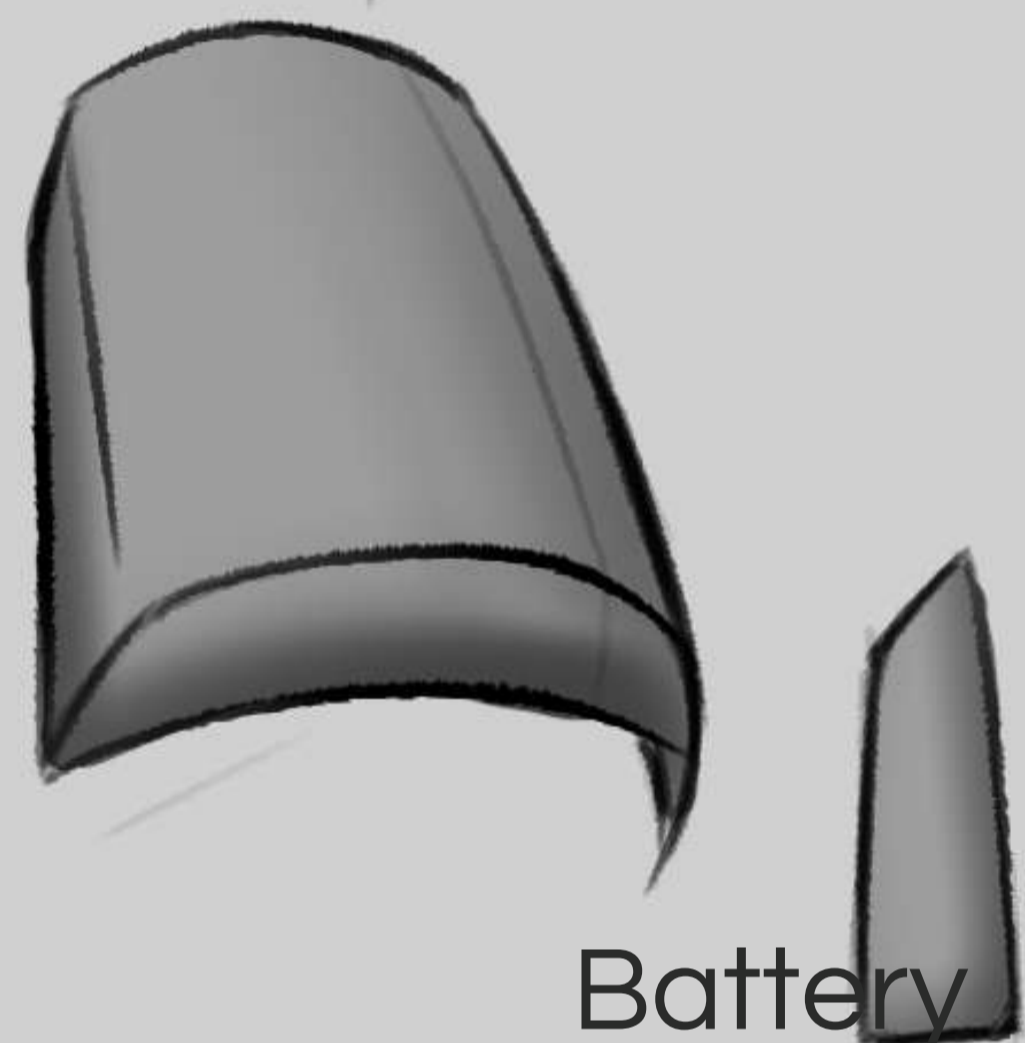
Inner Paddings

Quick strap release button

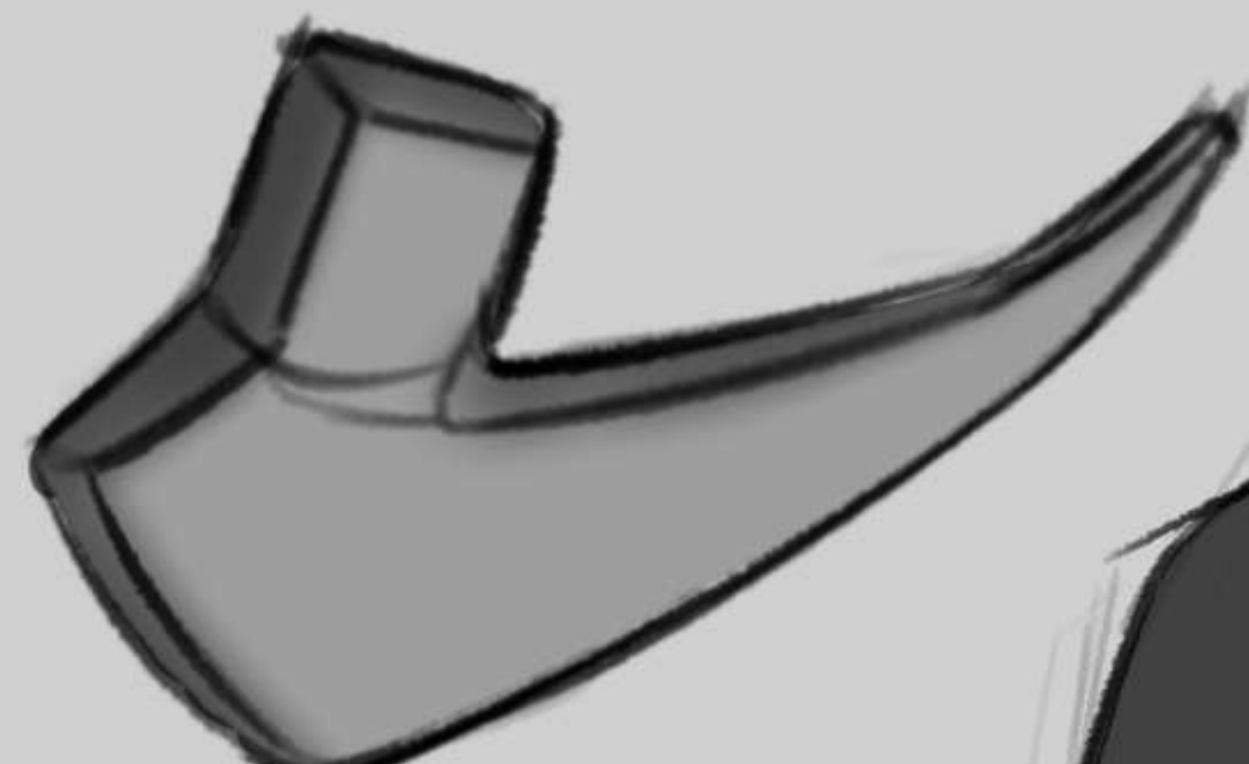
# Concept 2



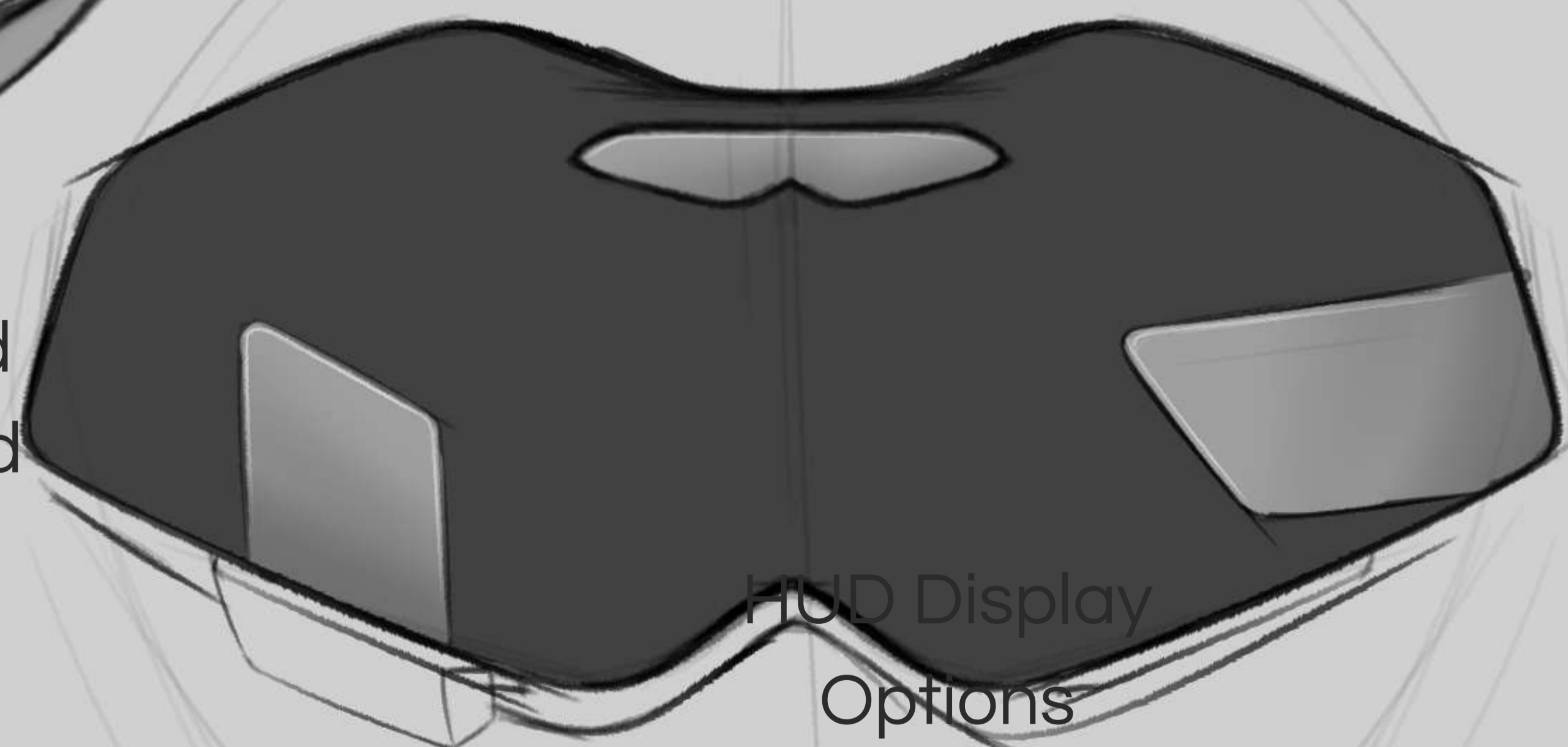
LED  
Lights



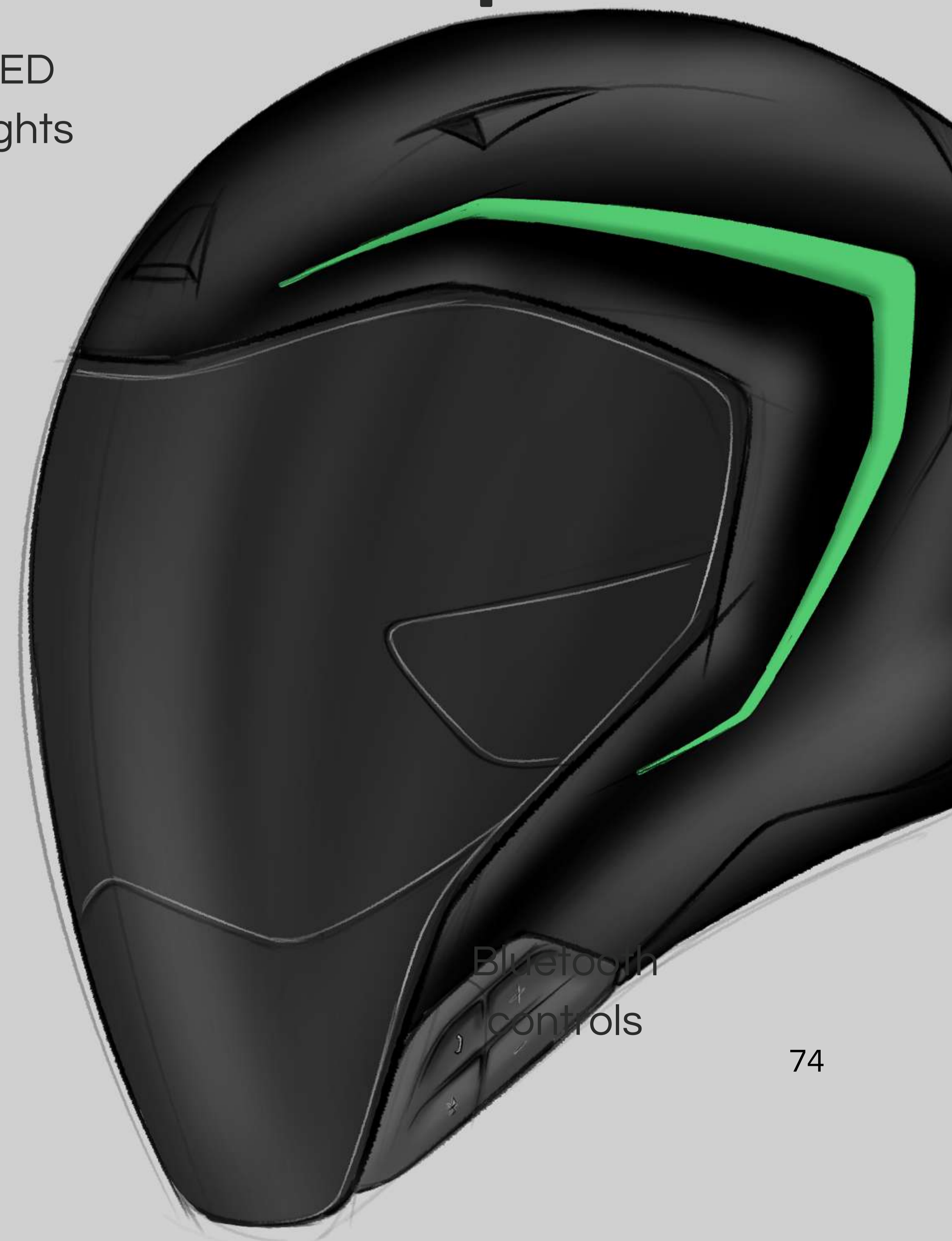
Battery



Speakers and  
mic integrated  
in paddings

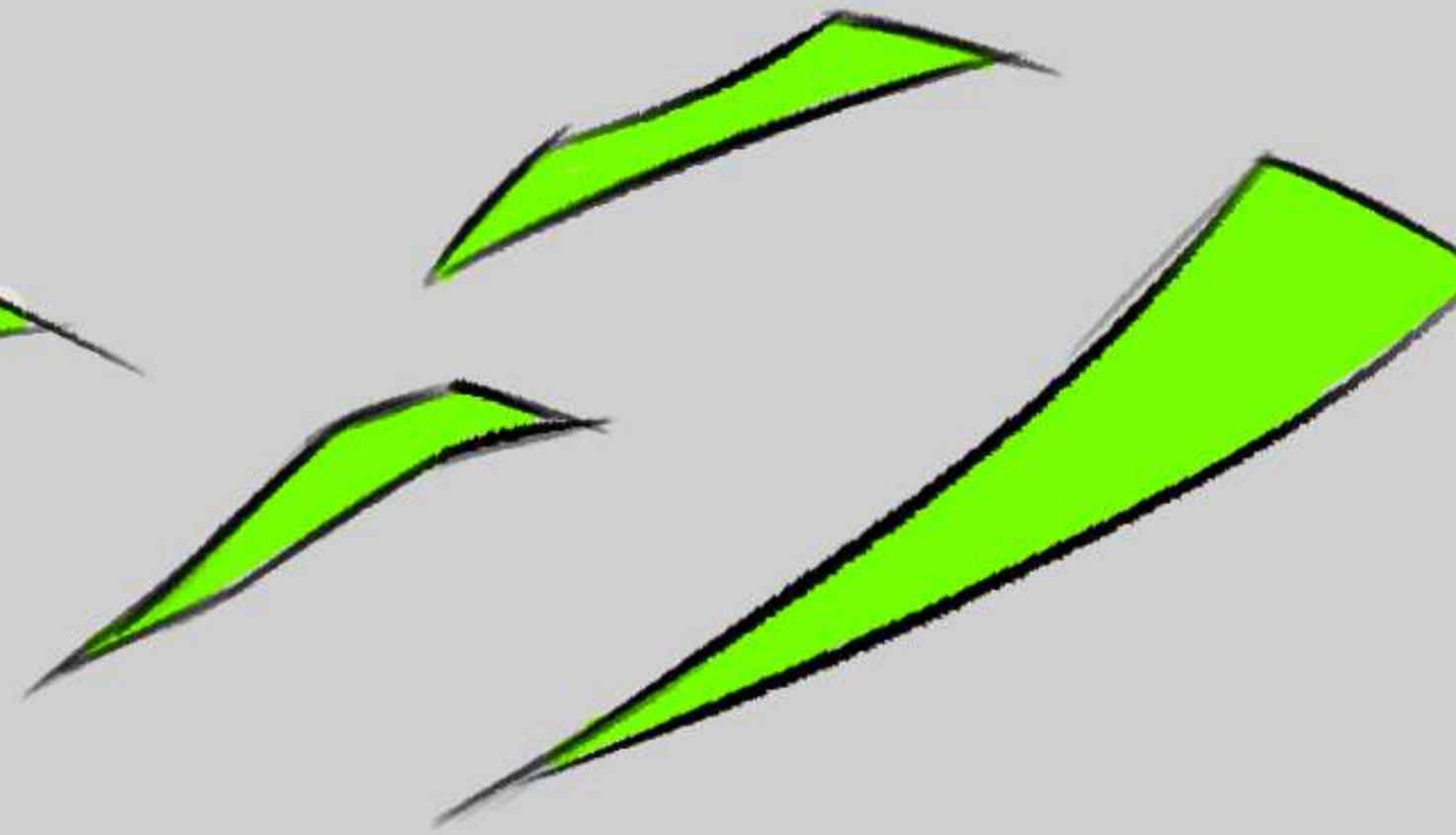
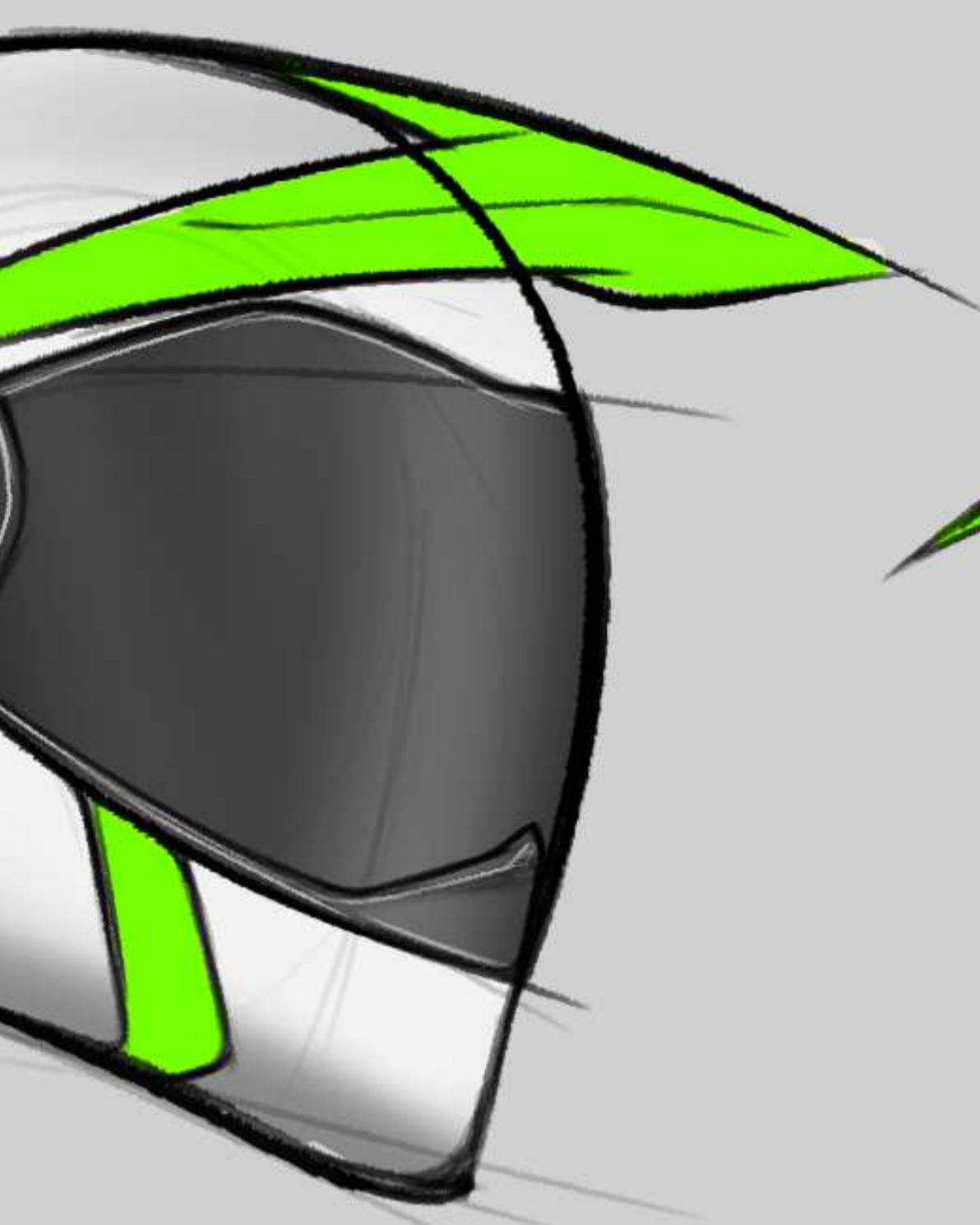


HUD Display  
Options

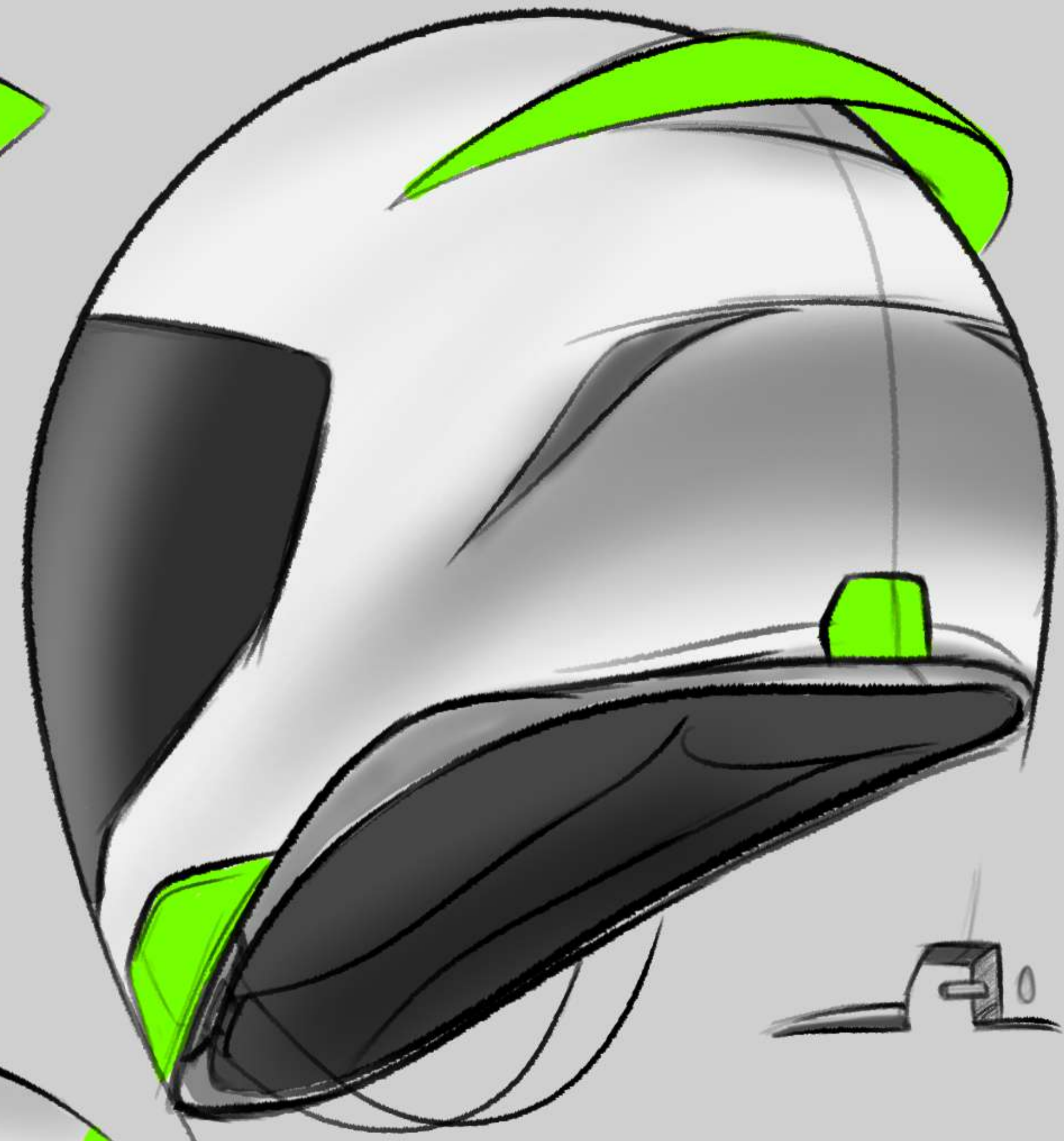


Bluetooth  
controls

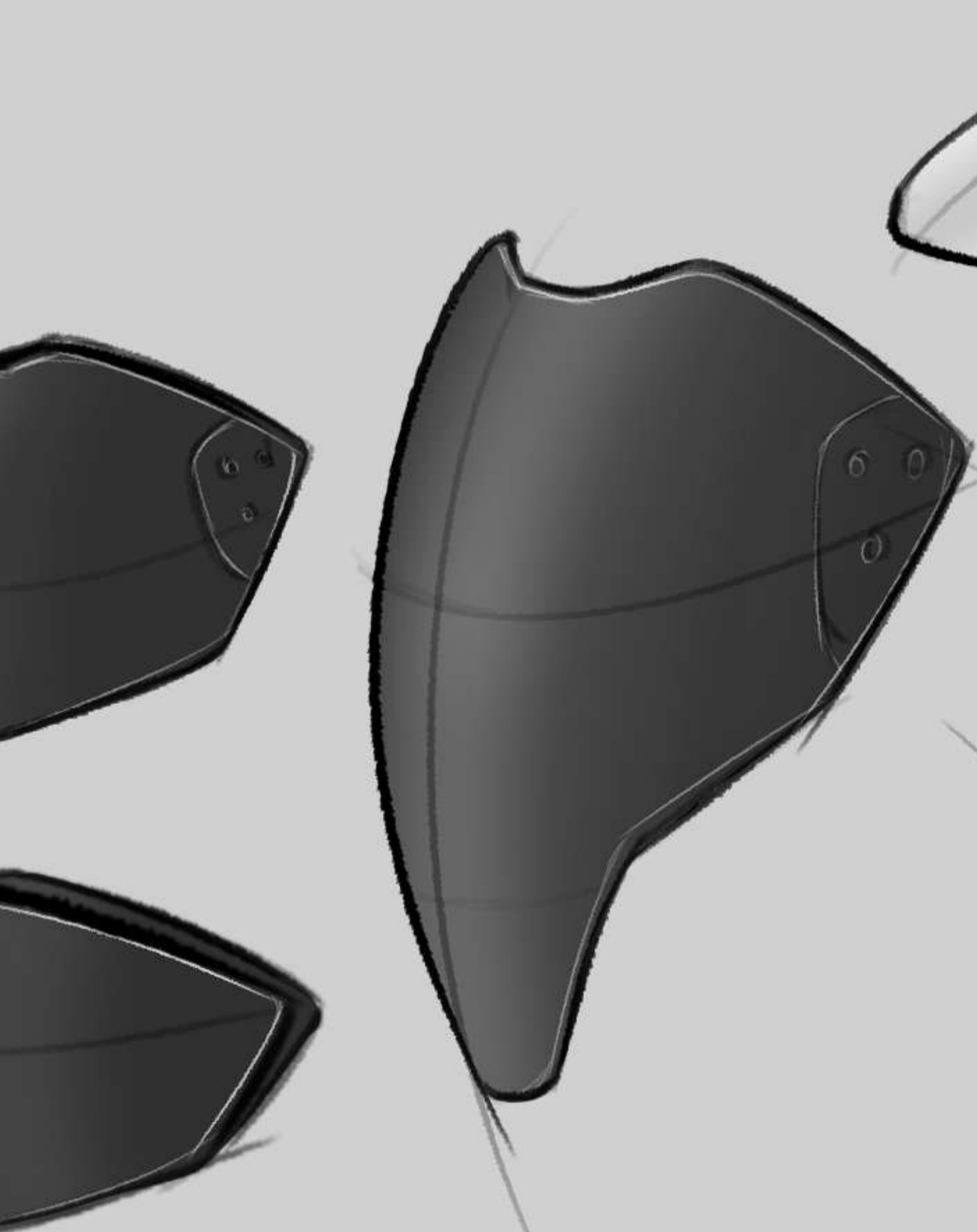
# Concept 3



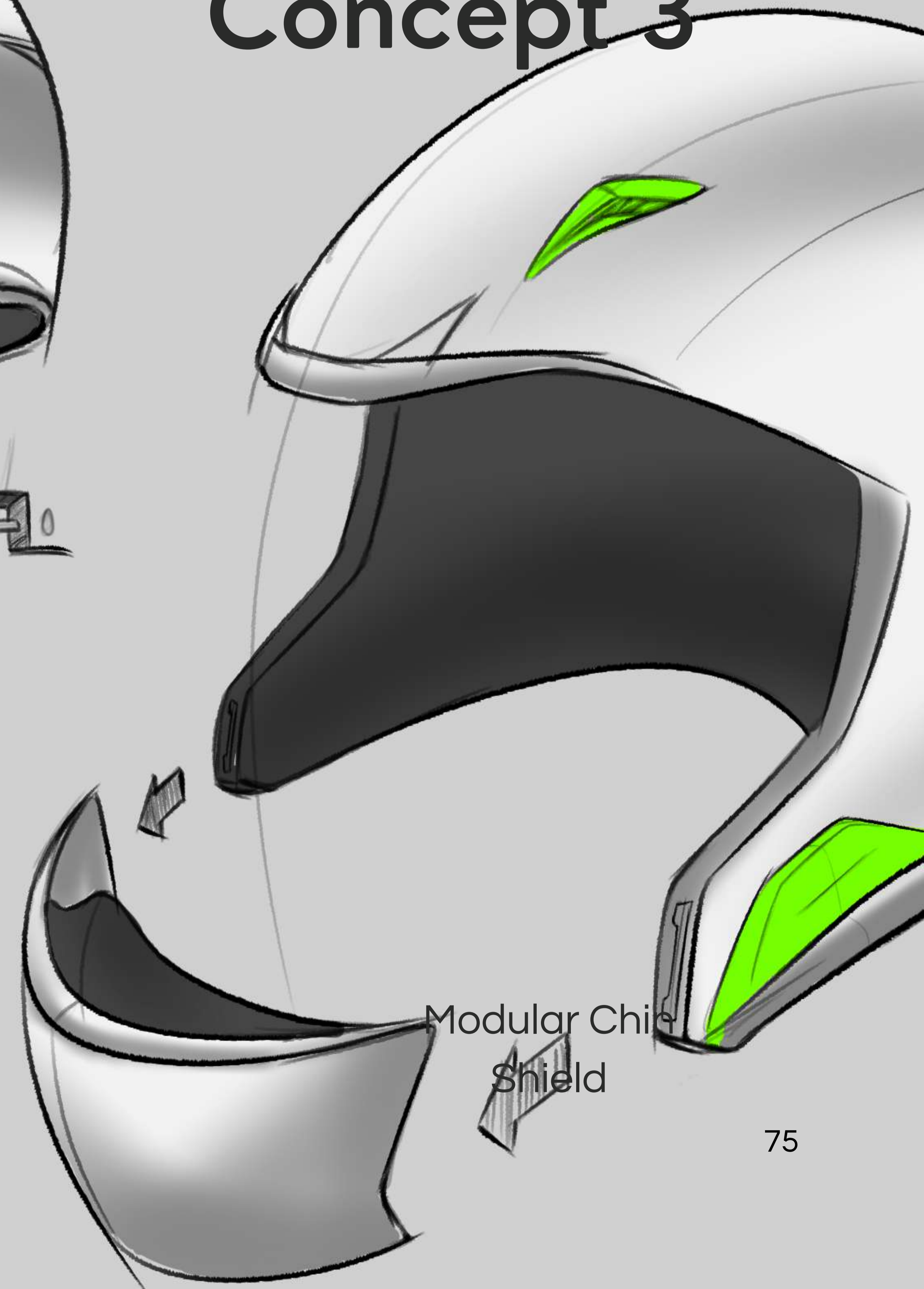
Modular  
aero kit



Integrated lock  
mechanism



Modular  
Visor kit



Modular Chin  
Shield

# Evaluation of ideas from concepts

Concept 1

Wide visibility

Quick strap release

Spaced liners

Aero form

Large vent for  
intake

Concept 2

Smart accessories

LED Lights

HUD Display

Integrated battery

Modular paddings

Concept 3

Modular kits

Integrated lock

Quick release buttons

Simple form

Removable chin  
shield

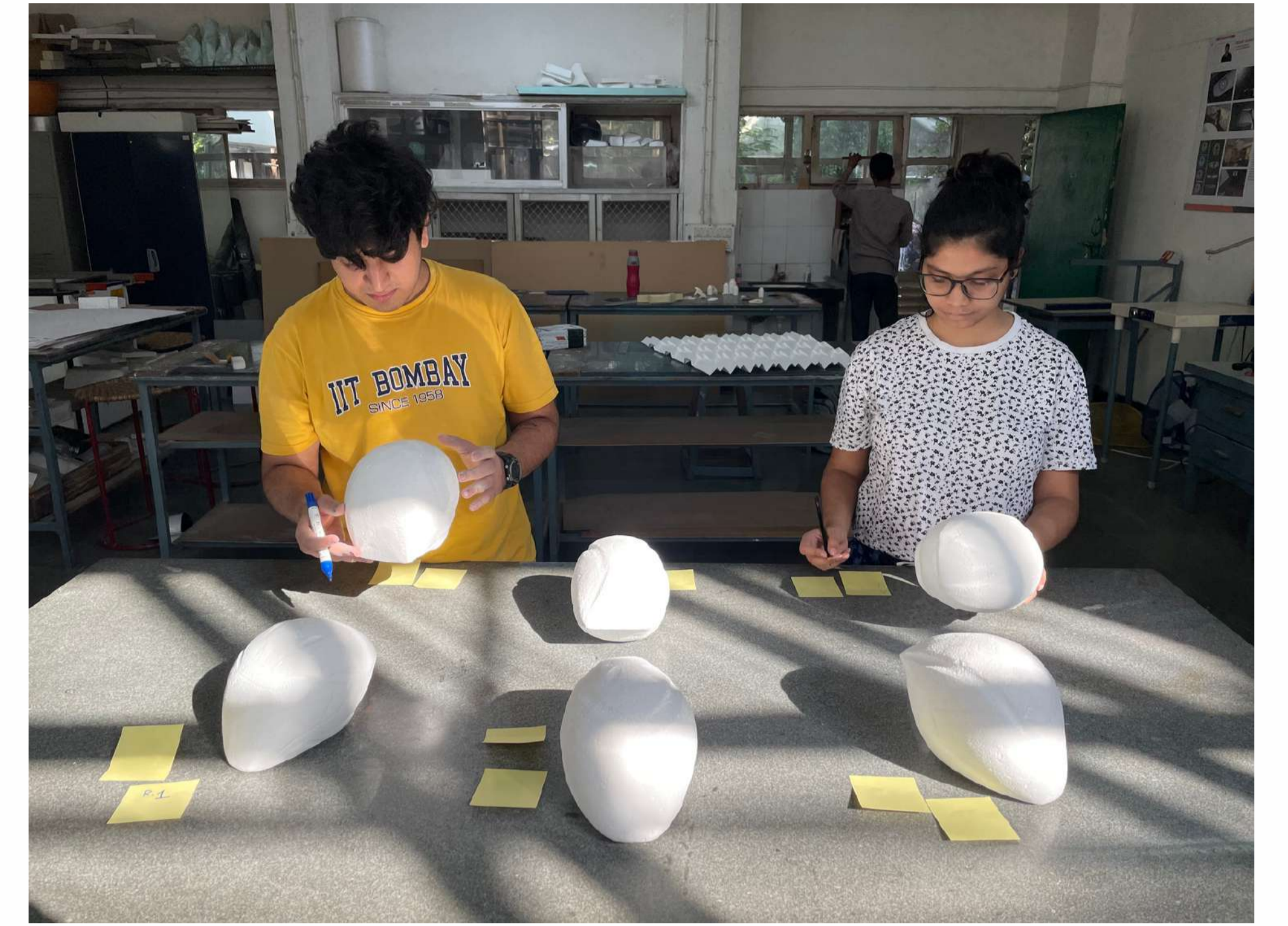
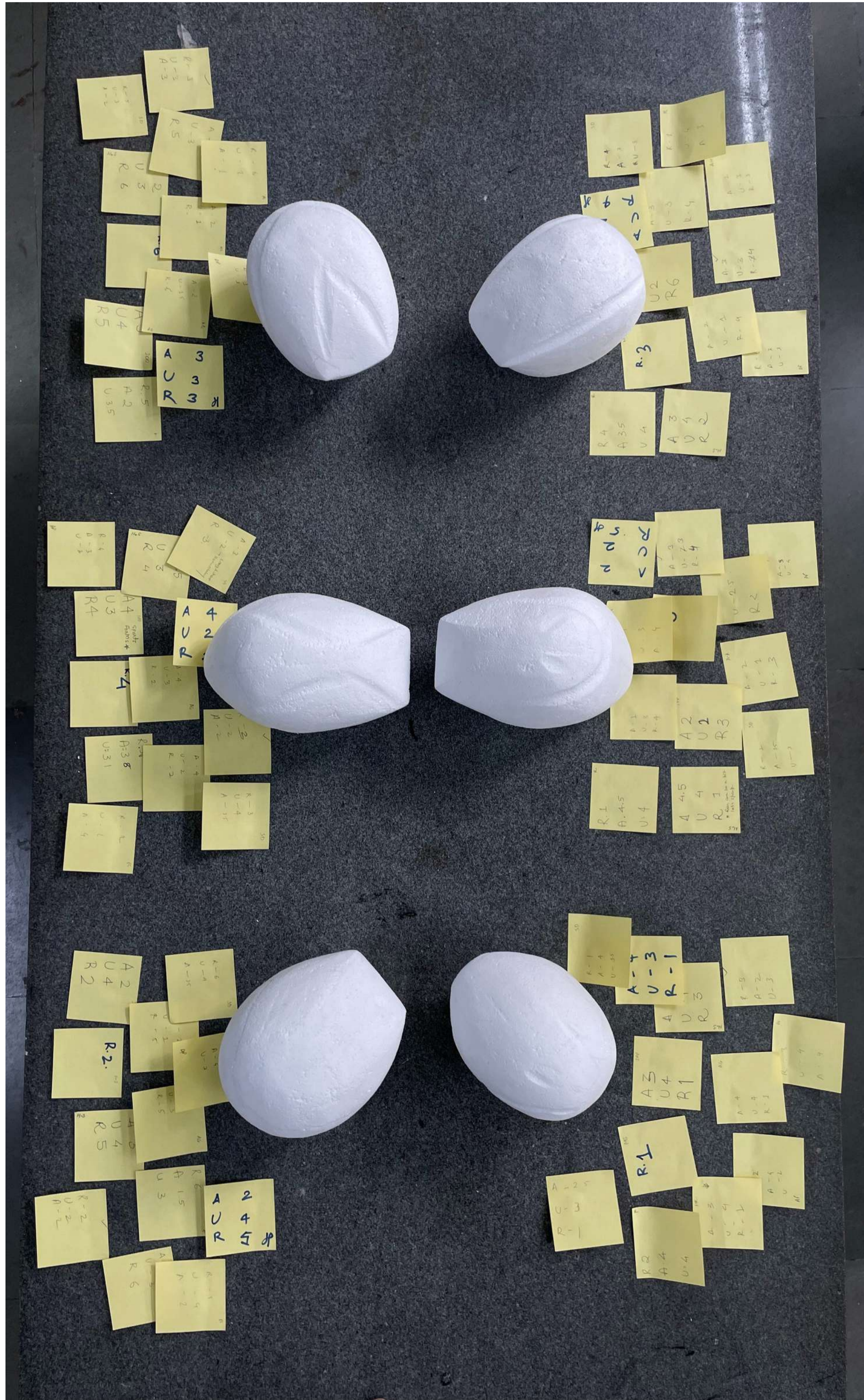
# Form Explorations



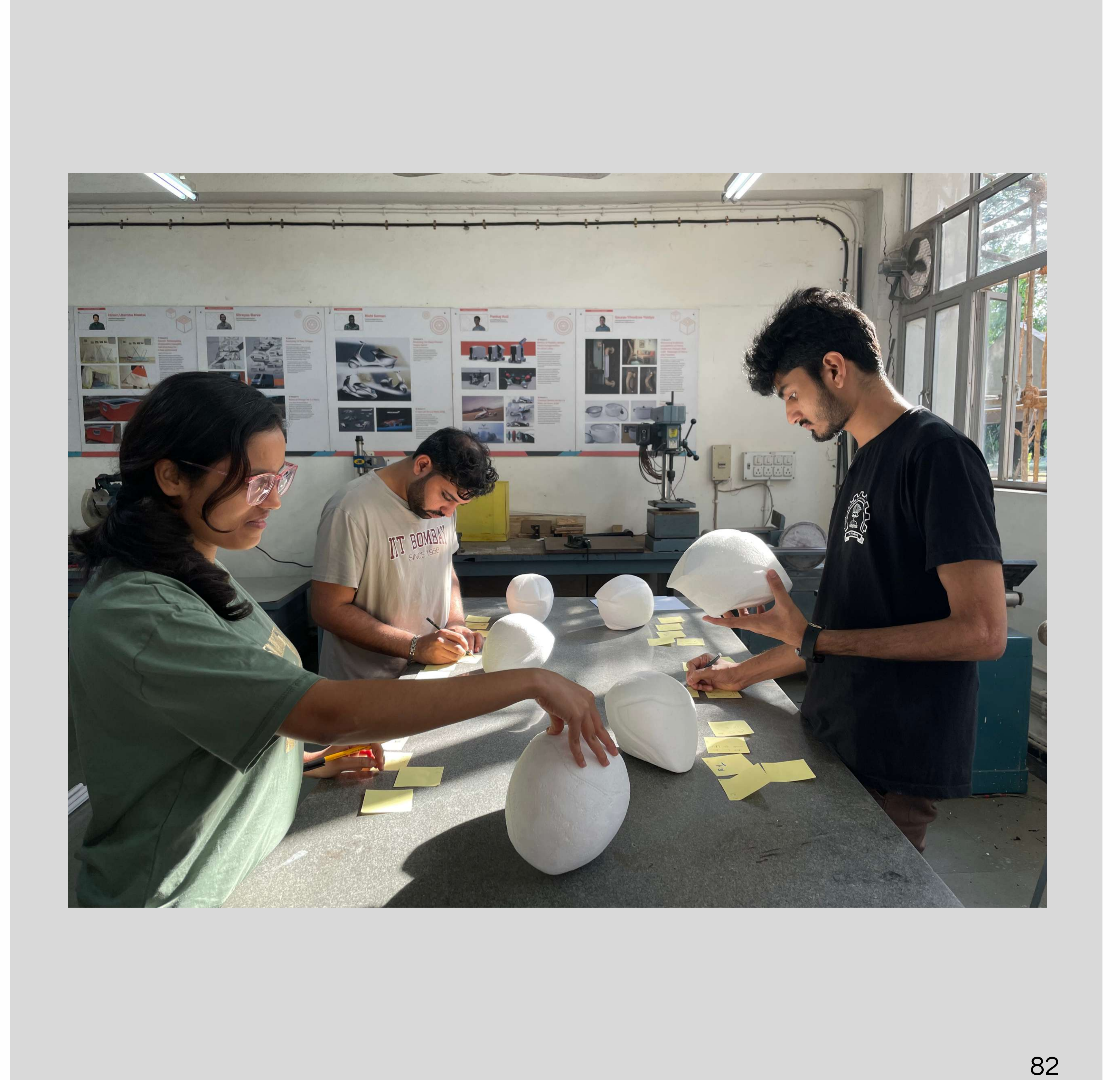
# Form Explorations



# Feedback from users







# Insights gained

- The aero form looks fantastic for them
- Form 6 looks sleeker and more aerodynamic
- Circular forms are now old fashioned
- Aero vents may cause problems for pillion rider
- Strap on the outside is better than having it inside and will be easier to find
- The form is developed aesthetically but should take care of dimensions as well
- Small details will make it more beautiful
- Also, the edges and grooves will help to grip the helmet while wearing and taking off
- Users preferred a form that has a balance of aesthetics as well as usability

I started developing the final design of helmet from the insights I gained from the users taking care of aesthetics along with functionality

# Final Design



Side View

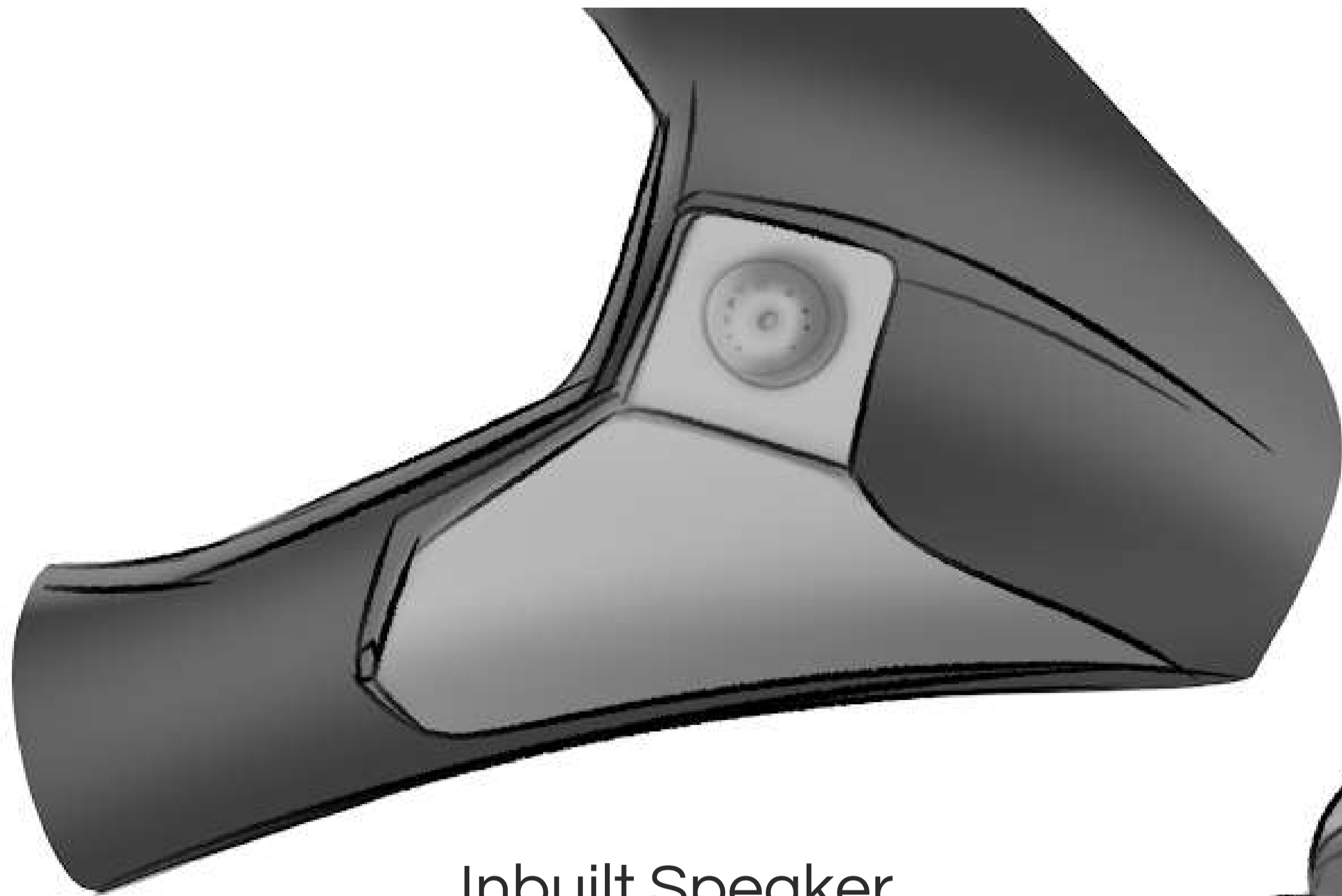


3/4 Rear View

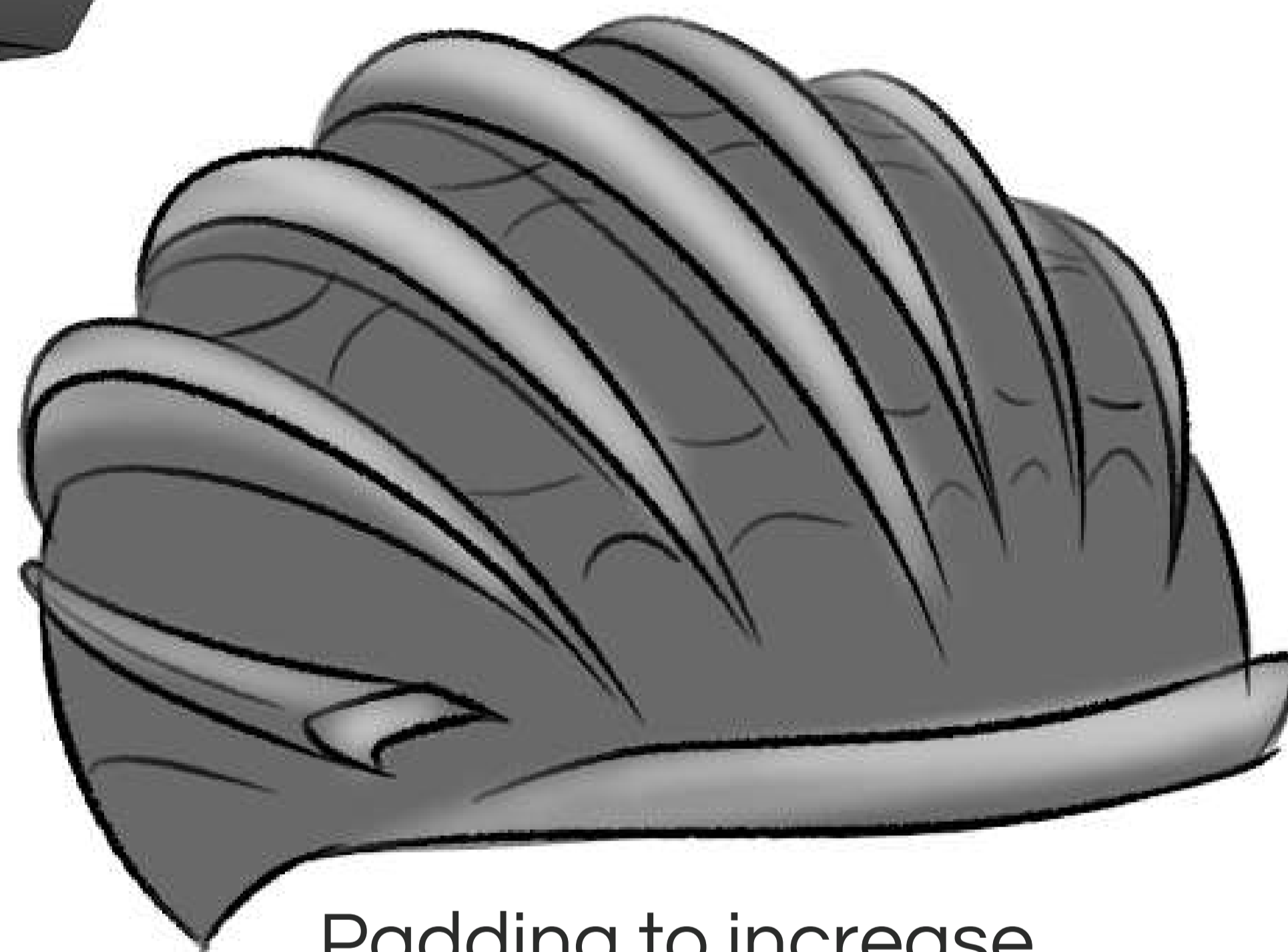


3/4 Front View

# Features



Inbuilt Speaker  
in padding



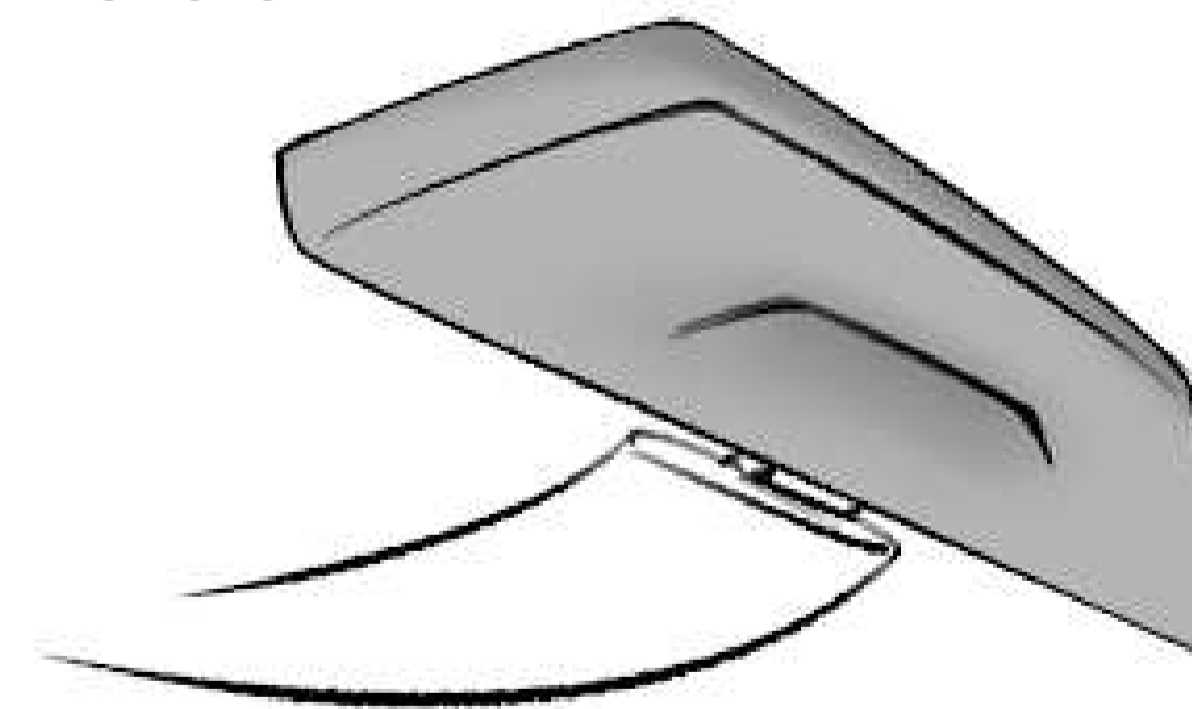
Padding to increase  
more air flow inside



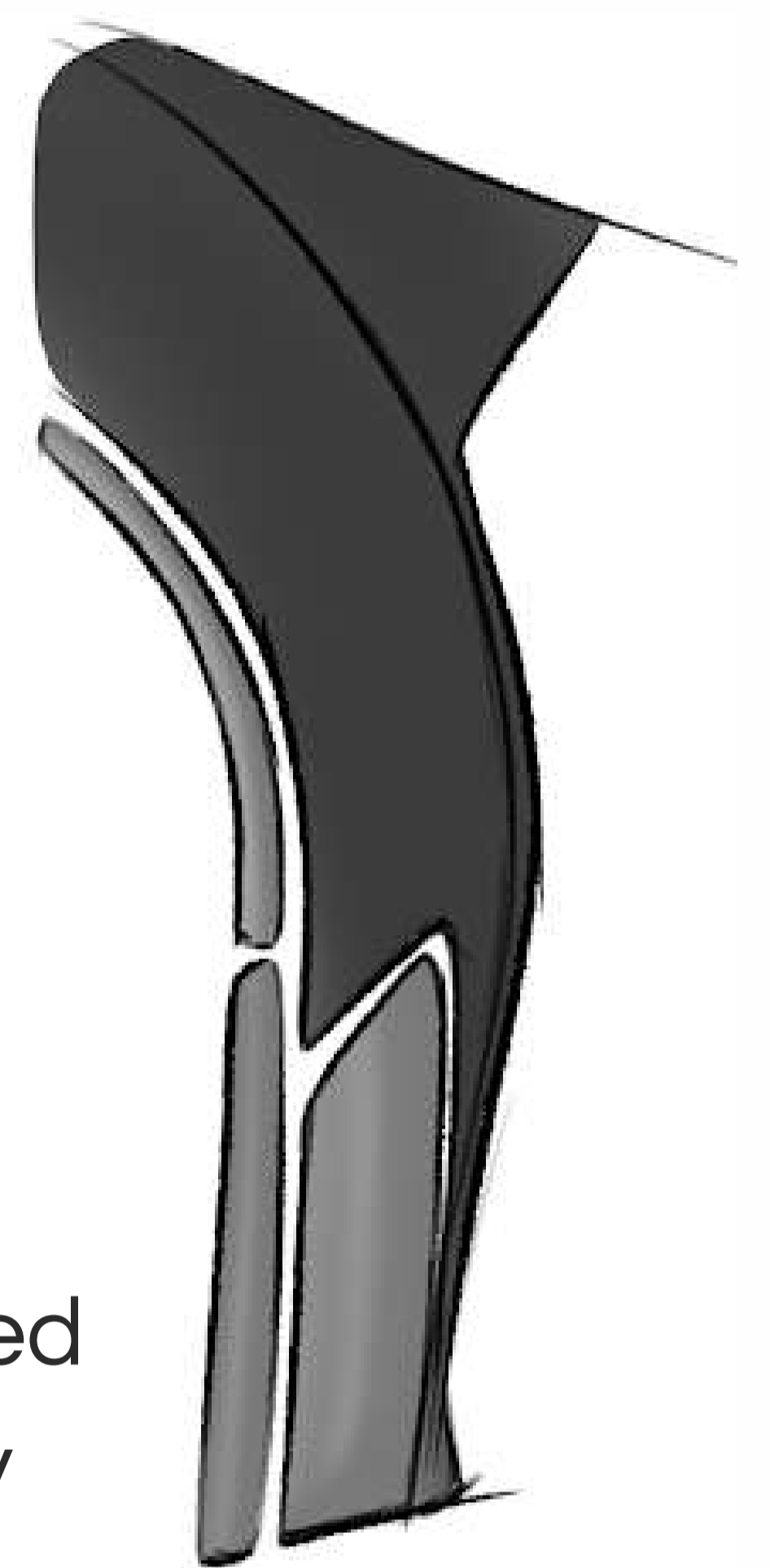
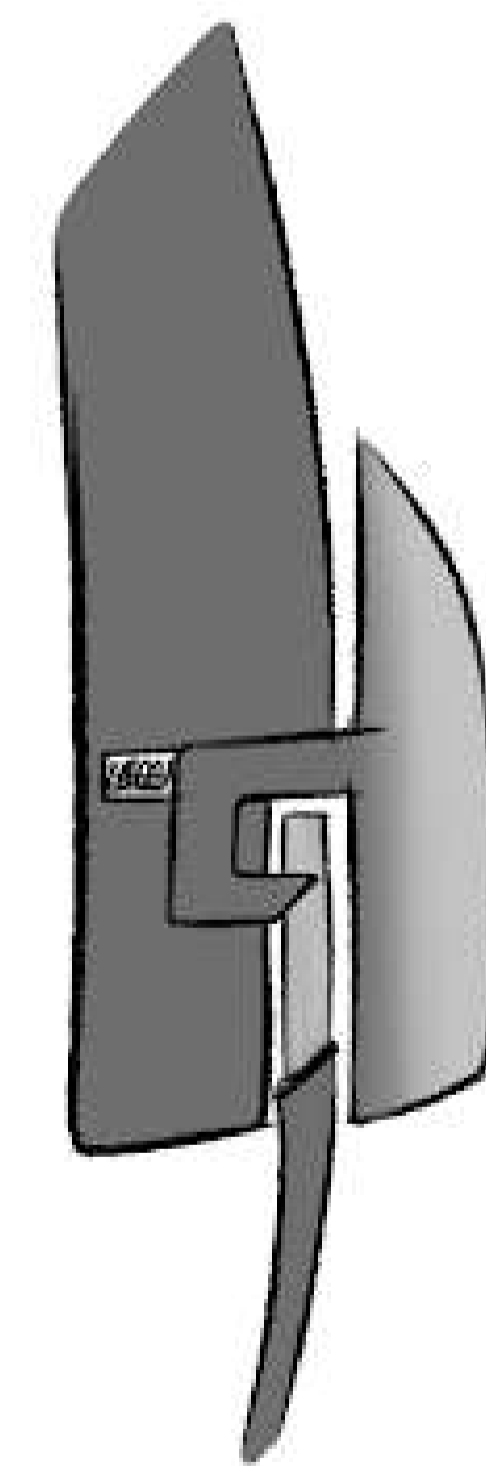
Integrated  
battery



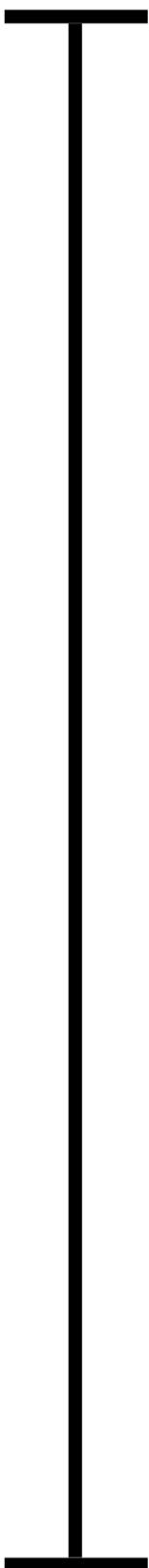
Smart Bluetooth  
Intercom



Quick strap  
release  
button



# Design Dimensions



33.86 cm



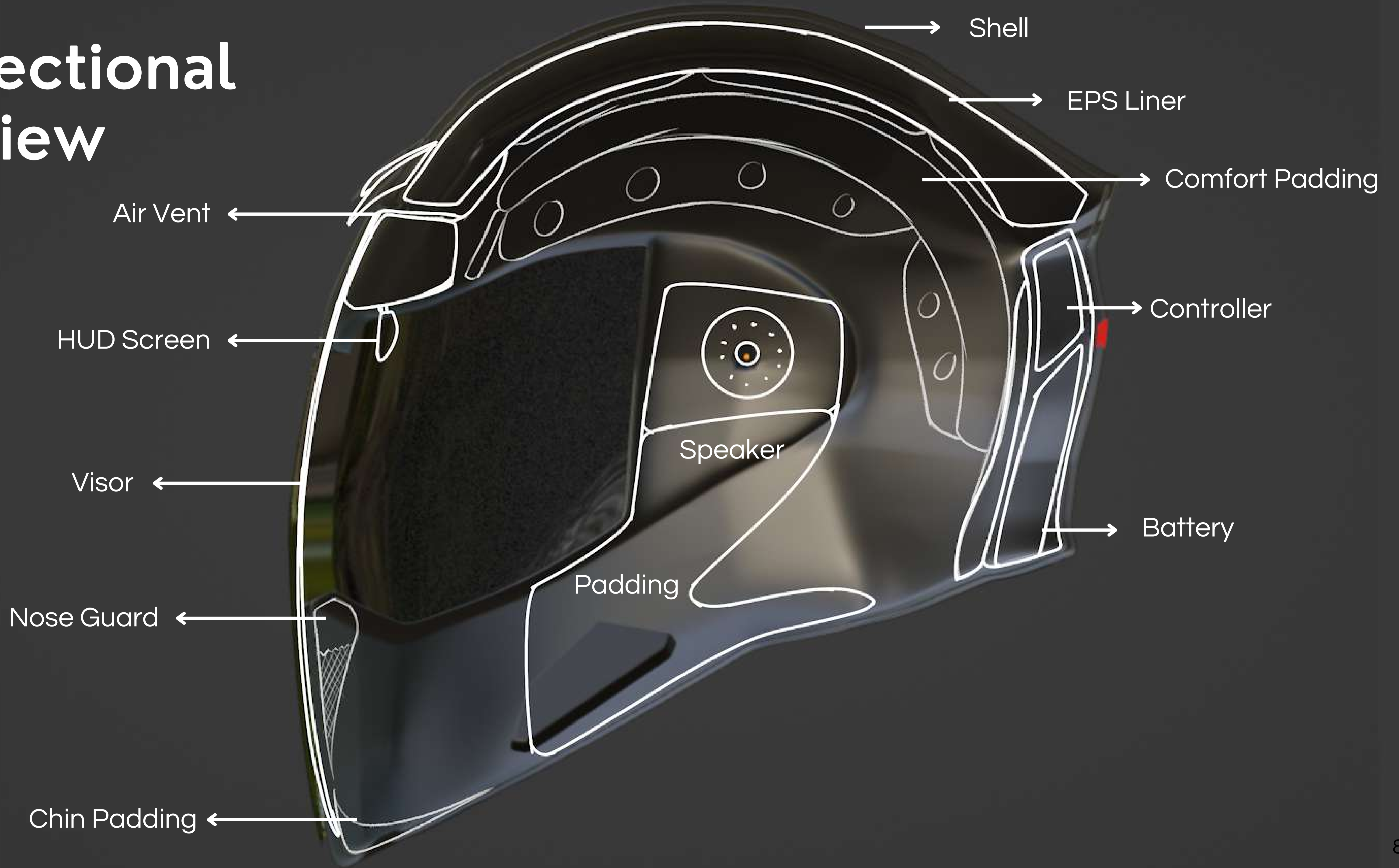
26.62 cm



33.67 cm



# Sectional View



# Material and Processes

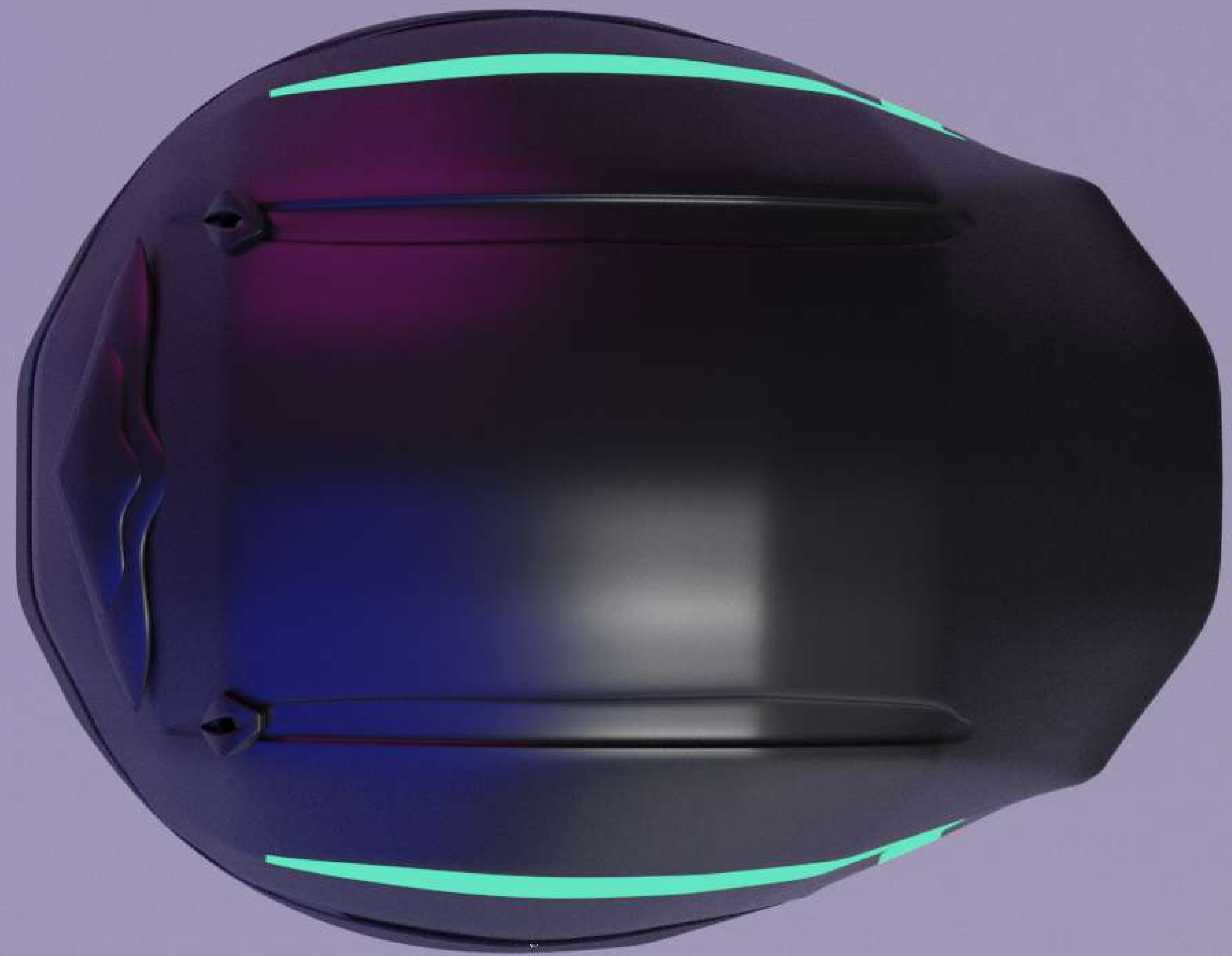
- |                       |   |
|-----------------------|---|
| 1. Shell              | Material - Fiberglass<br>Process - Reinforced molding     |
| 2. Foam<br>Liner      | Material - EPS<br>Process - Pre-expansion and<br>molding  |
| 3. Visor              | Material - Polycarbonate<br>Process - Polymerization      |
| 4. Comfort<br>Padding | Material - LDPE<br>Process - Extrusion,<br>Polymerization |
| 5. Strap              | Material - Nylon<br>Process - Fabric Weaving              |



# Renders



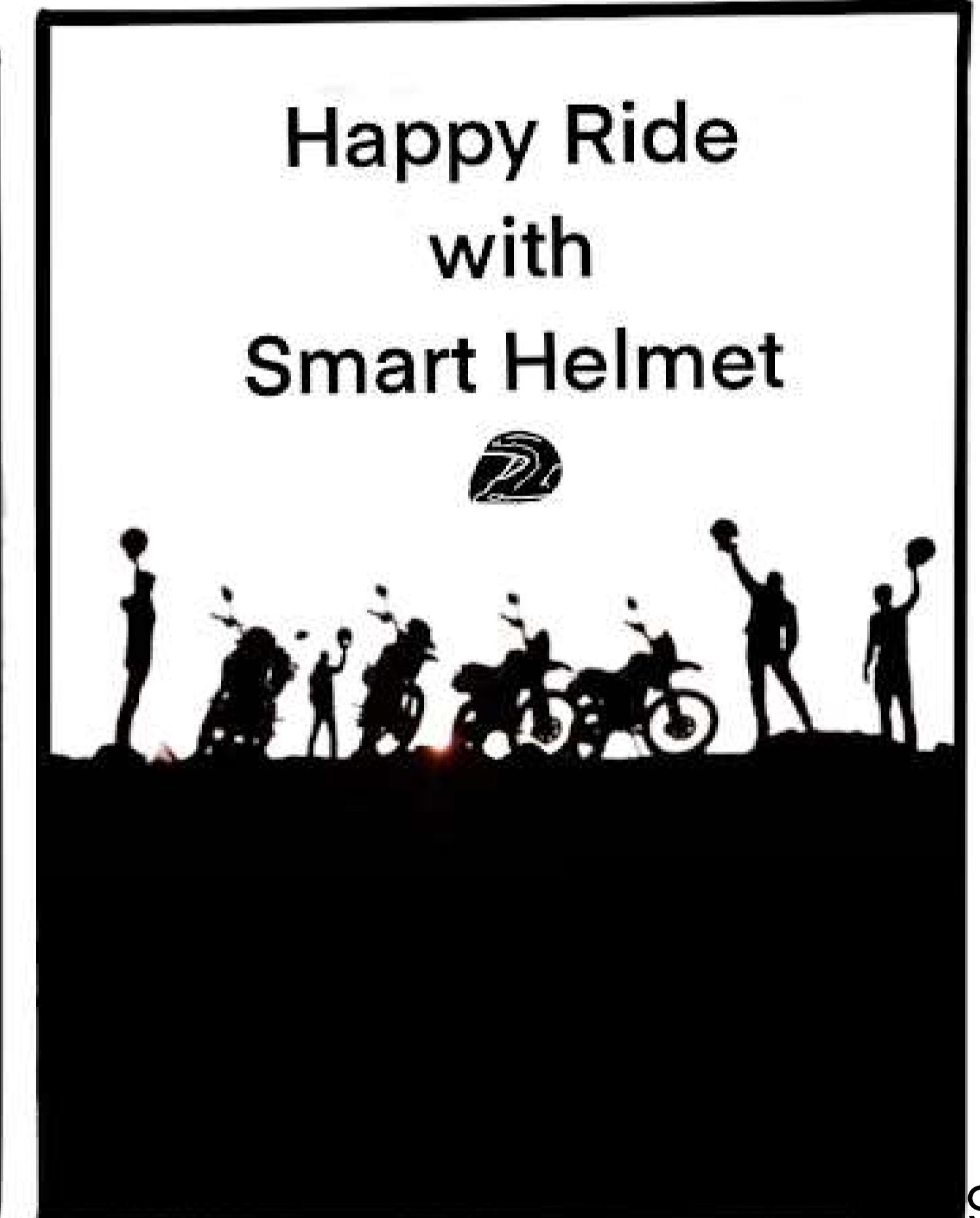
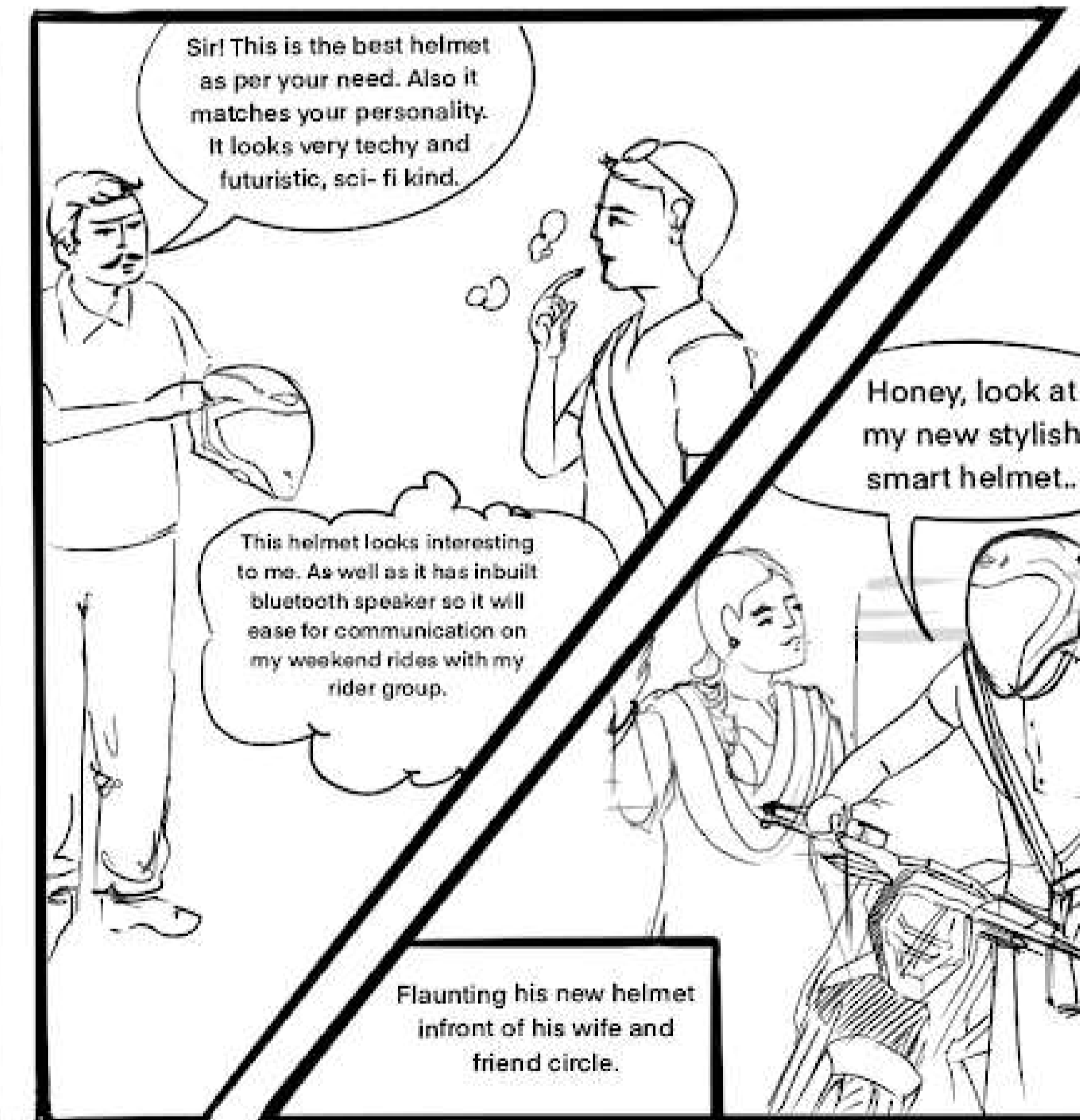
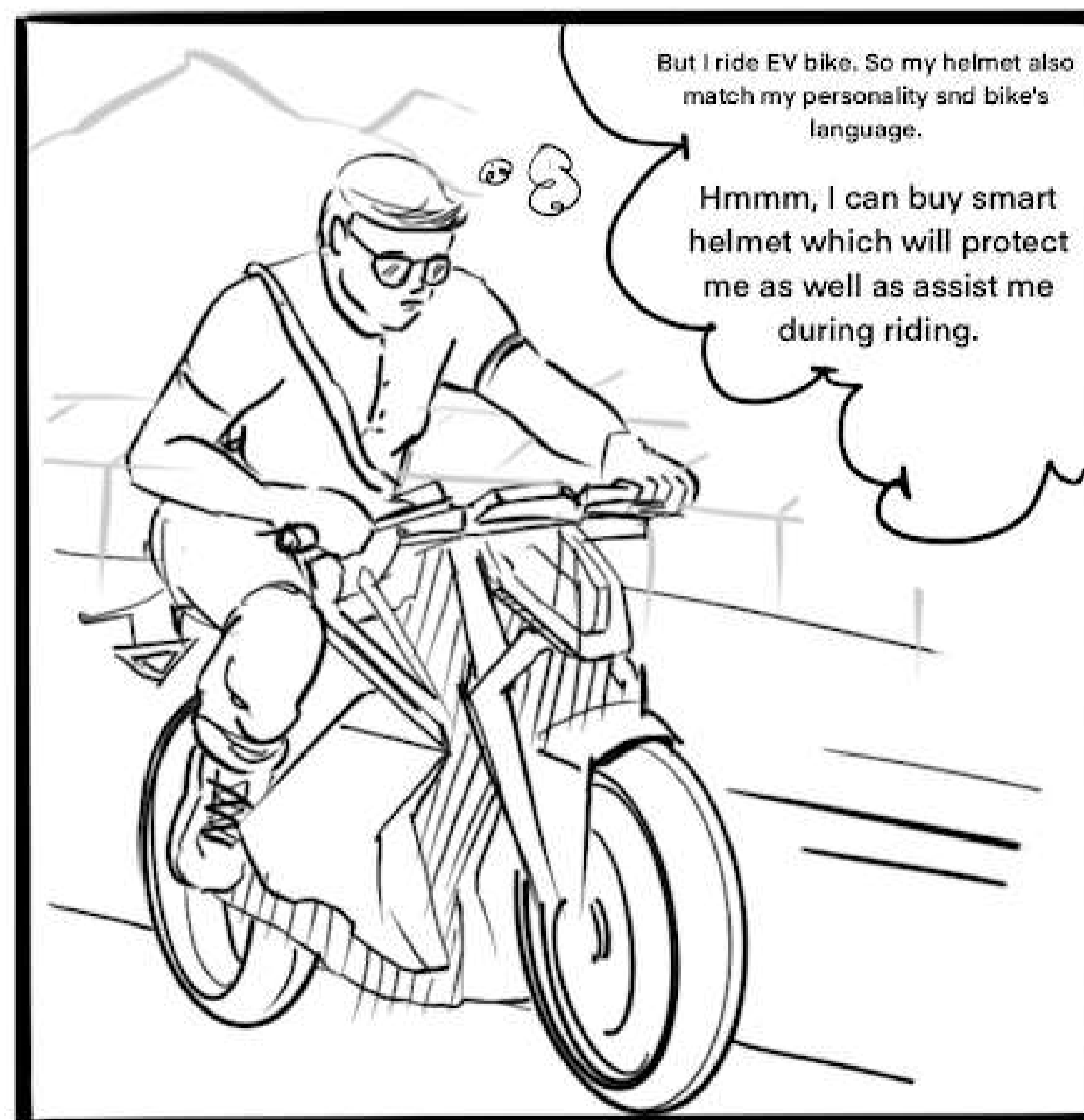
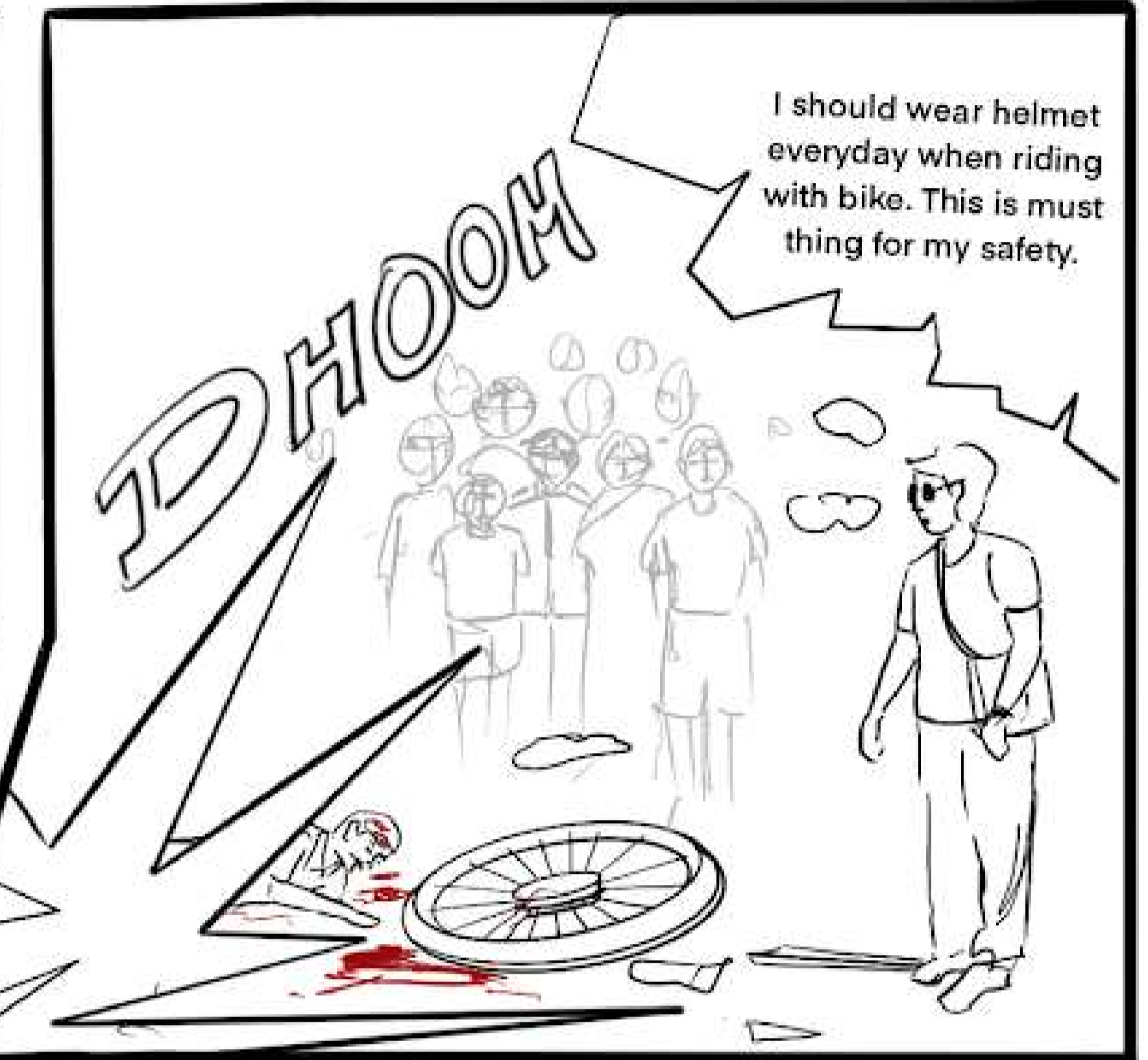






# Visibility Driver POV





# Story-boarding

# User Testing



# User Testing



# User Testing



# Model Development











# User Testing



# User Testing



# User Feedback

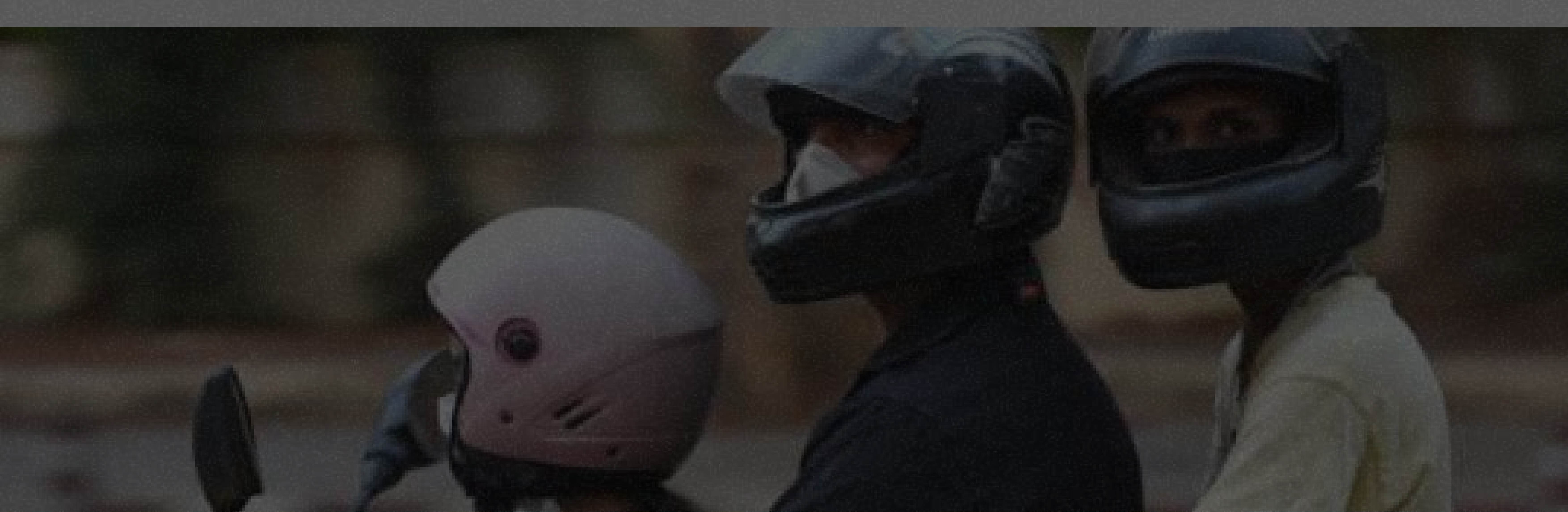
- Good in terms of broader visibility
- The form is really cool and looks techy
- The form also gives a feeling of a different personality
- The Chin guard is quite elongated they feel
- Good in terms of accessibility
- Features are really helpful for a big ride or riding with the community of rider group
- Graphics gives a feeling of sci-fi kind of stuff
- The placement of the battery should be better and safe
- As well as it will be difficult to clean the helmet properly

# Future scope

- Using this integrated tech in the product, People can easily relate the particular segment of the event
- This should be a resemblance of the form for which they are making, which can easily understand the bike's language
- Many EVs are switching and applying newer technologies, this could be a helmet for the client's flagship model, where they organize monthly rides and want to make their users communicate well-using intercoms or other devices.

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# Thank You

If you got a head, you need a helmet !