Design, Technology and Innovation
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Lecture-2
User Centred Helmet Design Part 1

So students, good afternoon. This is one of my most favorite topics: User Centered Design, and we hear a lot about User Centered Design when it comes to, you know, online platforms, websites, buying, online buying platforms, when you have these online shopping portals because they are, you know, it immediately translates into business like when you sort of, you know, somebody comes to your site and if it is very easy to use and he bought something on your site.

If it is too tedious they would not buy so coming from that angle when I go and see my products which are around me a lot of products are extremely tedious to use. Because of various reasons some reasons could be that they are because of legislation. Some reasons could be because of material properties and the people are not looking at how to make these products very comfortable to the user. So, I am talking about a physical product where helmets, which are used, on two wheelers.

So, let me tell you a small story. I had the student *Mandar Kale* in 2007 I think, and he came late for a product design course. That is we have a P2 project where he was late for a week. Then I asked him, you know, 'Mandar why are you so late?' and 'What has happened?' He said that his friend died in a motorcycle accident.

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And the motorcycle helmet was strapped to the back of the motorcycle. This was in Pune, and he was very disturbed because he was saying that if only, you know, my friend would have put on that helmet he would not be dead because he had a head injury. Head-on collision with the truck in the front because the truck did a sudden break and he is going at it, you know; so then, you know, it struck me that *Mandar* if you are so concerned cannot we design a product where you encourage users? That is, you go like the way you take your key, you put on your helmet and then you go, cannot we do such a thing?

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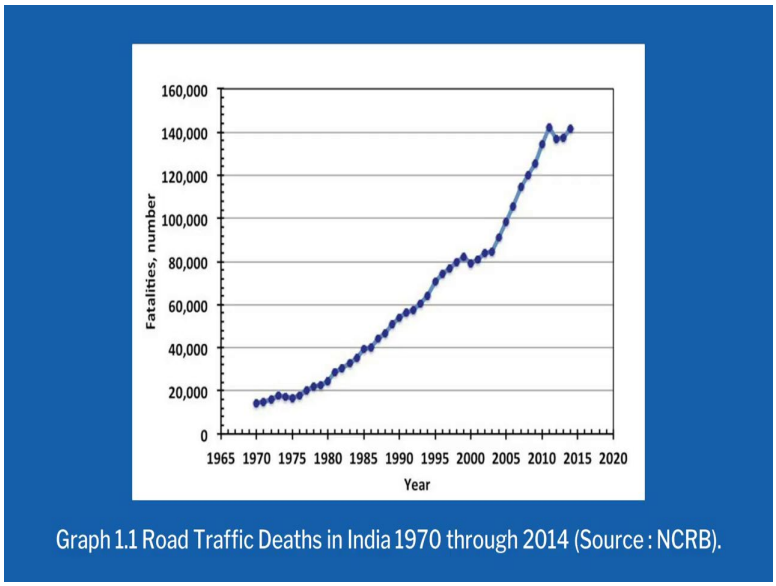

Why are helmets so uncomfortable? And then we studied. We found out so many new problems with helmets aren't so many deaths. 140,000 deaths, you know, in the year 2015 but if you go now

the increasing, you know, day by day now that we, you know, fines are much more severe people will wear helmets but I am just saying, why should the policeman ask for fines when you are saving your life? So, this is the whole challenge we started with in this, you know, journey of designing a helmet which will be extremely comfortable. But if you have an extremely comfortable helmet will it be unsafe? need not be, very good.

Will it not pass Indian standards? No, it has to pass Indian standards. Whose talking about, today we are talking about technologies, materials and processes.

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And they are, we have to make technology, we have to make materials and we have to make our engineering process suit the user right? Not, you know, give a manufacturer in specification that you to make these helmets, you know, like in this particular way and, you know, there should be no ventilation and, you know, this ventilation the helmet will crack which are not even, you know, which are not even justified from them to make.

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So, we start with that premise and we said we have to look at the situation around us. Then this is one of my, you know, project associates in our design studio Mr. *Chari.* He worked with us, he was also an M. Des designer and he said it is also complex: our culture, our ecosystem, the way we use helmet, the way we use the two wheelers, the way we use our two wheelers and he made this wonderful, you know, sketch, you know, saying that our head gears you have, you know, if you are having in head gear what will you do.

If you are having, you know, milk, if you are a guy who is taking milk around how will you handle it? So, we found it very, very challenging.

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So, from there on we started and we said let us understand our culture, let us understand the local situations and habits and let us also look at the socio-economic condition. If the helmets are too expensive nobody will buy right. The helmets have to be, you know, also looking at who is using the helmet for what purpose. So here we come down to a very important, you know, topic in design which is product planning. You need to have that variety of products which are suitable for different, different types of people.

And it is a myth when we say that I have designed one product and it will be good for everybody. I take a good example of your spectacles, everybody uses a different spectacle. Let it be style, let it be convenient, let it be, let it be a type of choice you have. Similarly, you need to have helmets which are, which are that type of variety, so that you can choose the right helmet for your requirement.

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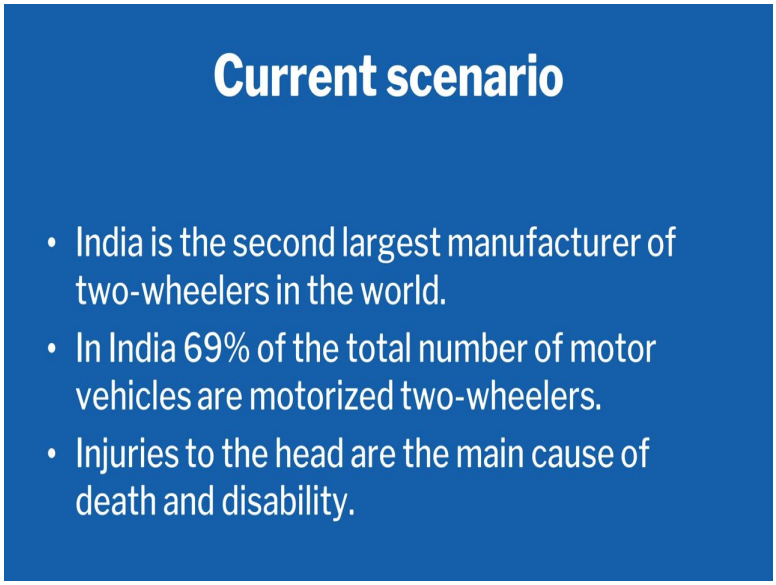

And we looked at, you know, conditions in India. Becomes the largest two wheeler manufacturer, is still growing. 69% of the total number of motor vehicles are motorized. Injuries to the head are the main cause of death. And here, for example, you will be surprised that when it is called a blunt injury.

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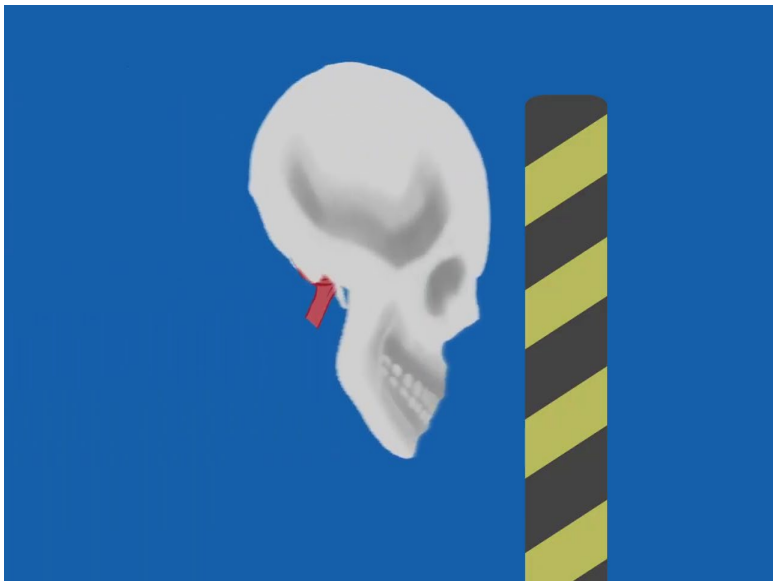

When the injury to the head happens, the brain goes and hits the skull inside because the brain is in a fluid and when it hits the skull the person is brain dead. You would not see any injury outside but the person is dead.

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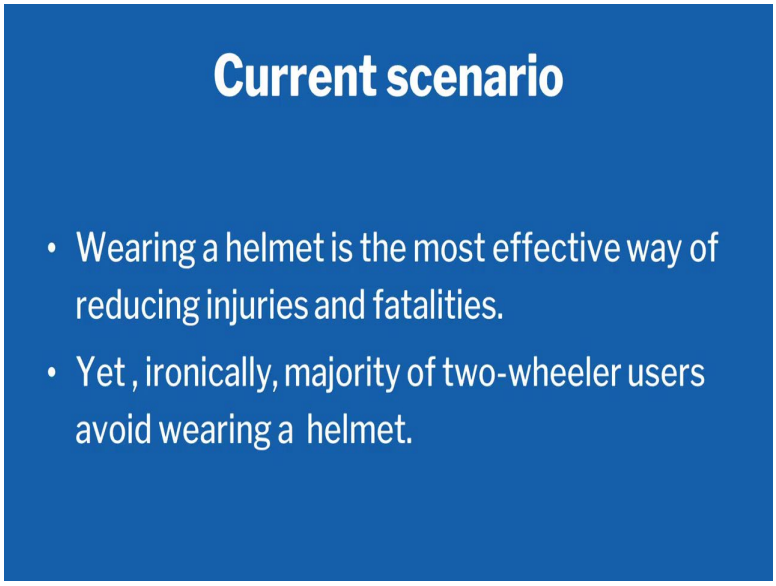

So, these are the, you know, challenging things we were facing and we are saying that anyway a helmet is the most effective way of reducing these injuries. And the majority of two-wheelers, anybody we interviewed, we found out that they just do not want to wear a helmet. Then we went and started studying our market, and our situations and people. People is a very, very important study for us. And then we were watching the type of risks on the road. Risks are too many. What is happening when you are stuck at a traffic junction the, you know, helmet gets very hot.

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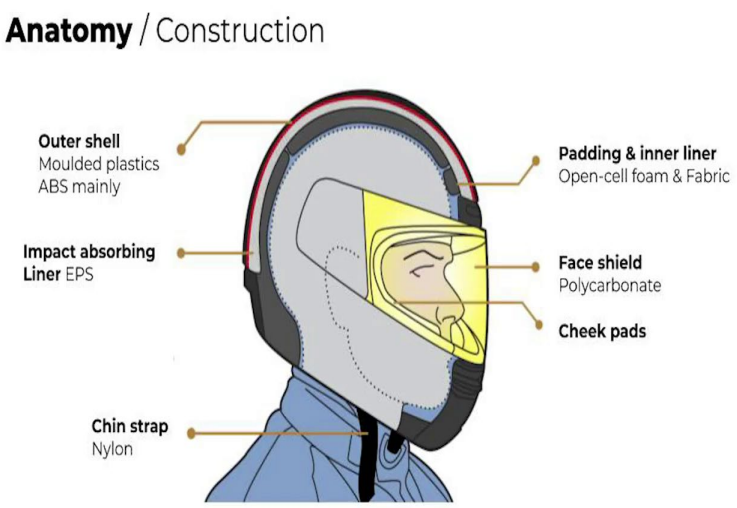

Let us look at the construction of the helmet. What do you think saves the person's life in all these three parts of the helmet: the shell, the thermocol which is the expanded polystyrene foam and the PU padding inside, out of these three, which is the one which saves the life? Thermocol. And that does not cost anything right? Thermocol is the packaging.

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This thermocol has a special property of actually reducing the acceleration of the head, the brain inside when it is going to hit the head and that type of, you know, that type of compression loading and we are not able to get in any other material till now. We tried a lot of options. We are not able

to get that type of compression where you get that type of cushioning so that the brain does not go on hit. I must tell you a nice story over here.

In Delhi we were given a big task by the transport department and they told us, you know, please check out whether these roadside helmets are good or not they selling at 400 bucks 600 bucks 200 bucks and they may be very dangerous for the people who are buying them. Then we took all the roadside helmets into our, we have a very good bio medical facility at IIT, Delhi when I was teaching there, and Professor *Dinesh Mohan* was the in-charge.

We got these Studds helmets which are the best in the grade. Then we got the other brands. Four other brands, and we bought four local roadside helmets. And we put them on the testing machine with sensors and everything and to our shock the roadside helmets were performing much, much better. 20% to 40% better than the Studds helmet. What could be the reason? More thermocol.

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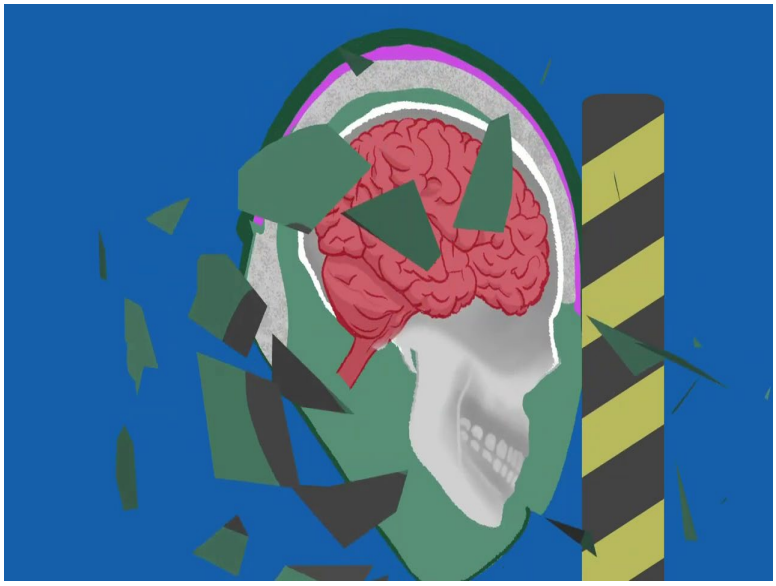

And another interesting issue was that the shell which we thought was the most important would crack in the other helmets and break but save the life of a person. The roadside helmets did not use that much resin as Studds was using. So, if you use a lot of resin the shell is very hard, it takes all, when it goes and hits the floor, what happens? It absorbs less energy whereas the roadside helmet shell would go crack. What happens when something cracks? It releases all, it loses all the energy and it was much, much better. That was a shock for Studds.

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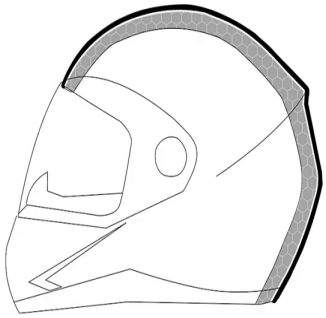

Branded helmet

Their thermocol, the Studds, you know, when the thermocol in the Studds helmet, was actually 18 to 19 millimeters and sometimes it was curvilinear because of the style and all, they had to make it with some grooves inside. Whereas, the outside helmet, no fancy design. It was straightforward round shell of 22 to 23 millimeter thick. That was the minimum, you need a minimum 20 millimeter thick for saving the life of a person, it was 20 to 24 because, it was just because of lack of, you know, things and you want to make a simple element there EPS form which is the expanded polystyrene was thicker and a uniform cross-section, so it did very well in them in the field.

So that gives us the impetus that we need to, you know, do something very drastic in, you know, making people aware of this as well as see to that, you know, people wear helmets.

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So then we said let us study all the materials available. Where will we use Kevlar? Bulletproof. Very, very high-end and then we also checked out other materials like lexan, lexan is a polycarbonate material. Polycarbonate is very strong again. Why should I study these high-end materials when I am designing a helmet for a two-wheeler rider? I am not going to use them but by studying the materials we study the properties. We are studying the properties I can come up with ideas for better use of material in my context also.

So we always do that whenever we have some study we will study parallel products whatever materials they are using, so we can come back and do multiple work.

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So, here then, we also looked at an ABSPC. This is a styrene material which is used in all plastic scooter parts and abs is a very good, you know, ABS is acrylonitrile butadiene styrene which is very easy to paint. It is injection molded.

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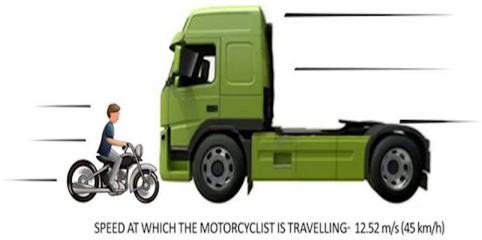

So, just to, you know, give you a little illustration of what happens if you are traveling at, say, 45 kilometres an hour and you have a head-on collision.

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It is like falling from the second-floor balcony head down. that is the type of impact and it is pretty severe we do not realize it, and for 45 kilometres an hour is nothing. Most of us go ahead at 60 to 80 kilometers an hour and if that is the speed you should be like falling from the terrace of this

five-story building there is no chance of survival, but after the collision it drops. Here it is adding on but if I come with this, you know, standstill truck then my 45 kilometers will become around 25 to 40, by the time I go and hit the, because some amount of deceleration happens when I hit.

Because some amount of shock gets absorbed by the vehicle and then the movement of the body, all that, so it reduces a little bit. So, but then you just if can imagine that if the speeds are much higher it could be very, very fatal. And that is what we see outside, so many deaths because of that reason and that perception is not there. That is a challenge for us.

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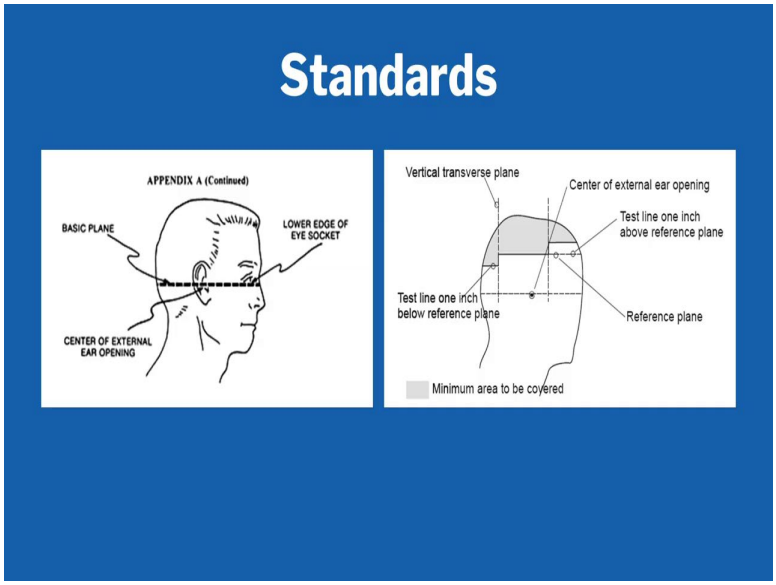

And then we went and studied the standards, and a very interesting cartel happens in the standards. In the standards we have people. We have professor's, we have visual experts and we have also industry representatives and unfortunately they are completely biased towards manufacturing. We are biased towards technology, and they are not having any context of user convenience. And then all the helmet standards are coming from cold countries.

They take in the British standards and they brought it down, and all in Europe, where do they use motorcycles? Racing, mountains, going, so for them and what type of weather? Very cold. So what happens if you borrow the standards from them? Your head will get cooked in India. Literally. And that is what happens in Delhi. When the temperature outside is of 47 degrees and you are wearing a helmet on your head you just cannot survive.

It is so hot inside. So we went and told, we then met the Indian Standards and we told them this is not right. You have to have a person who is responsible for the comfort of a person in your committee so that they look at the comfort and then introduce all the new norms. Then we did lot of observations of people's problems of, you know, how they store their helmet. How difficult it is to buckle and why people do not buckle their helmet.

You know, that they do not buckle the helmet. Then what happens? Tell me. The helmet flies somewhere else and you hit the head, head hits. So it, and we found out that this 20% accidents are happening, people are wearing helmets and not buckling, it is happening because of that. That is also very, very, you know, serious concern of buckling up.

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So, here we are looking at, you know, gets very hot and muggy there was, you know, people use a cloth inside carves and, you know, lot of people, you know, drive with the visor up though it hurts their eyes, so the air is blown inside the, inside the face.

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Or interaction between two people, extremely difficult when you wear a helmet. So that is a serious issue or will you improve that?

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There is no, it restricts vision is a very, very clear thing. Your helmet sizes are so big sometimes it restricts the vision from the side.

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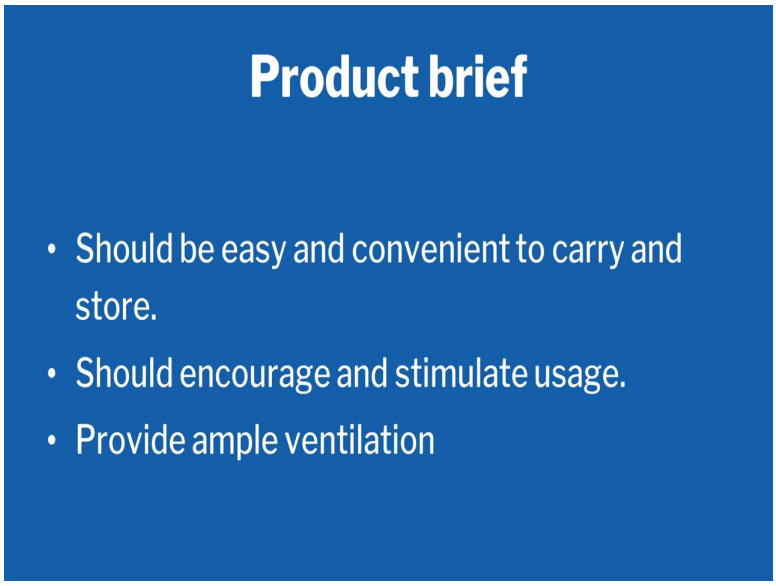

So, this is the most important thing of our design process. The product brief. Here we are saying that the helmet should be easy and convenient to carry and store. Should encourage and stimulate use. Provide ample ventilation. Should be lightweight, helmets are very heavy, that was a very important component which people did talk about. Should fit, you know, aptly on the head without wobbling. Lot of helmets will be loose.

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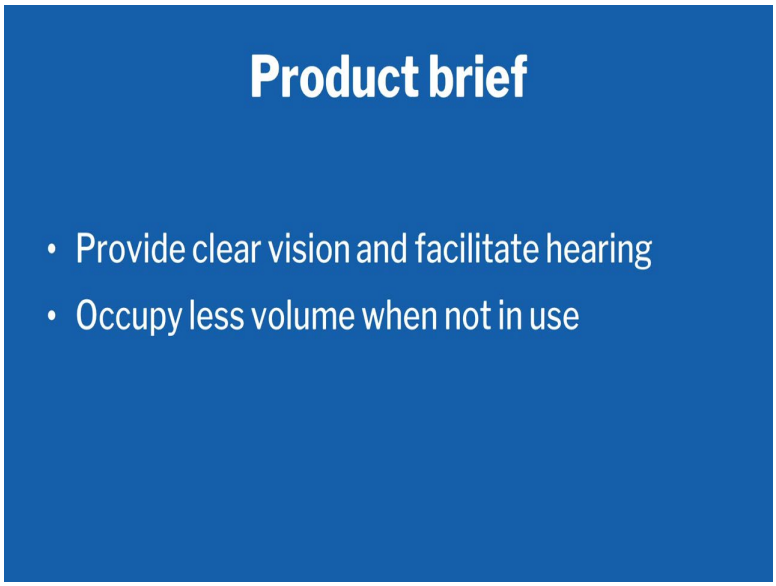

And then provide clear vision and facilitate hearing and occupy less volume when not in use. So, these are the briefs. So, when you have a brief points you want to, you know, sort of, work on this brief and make multiple ideas. Each problem should have an idea right? Multiple ideas together

will make a concept right? Multiple concepts will compete with each other to get selected as a best concept and the criteria of a selection will be the product brief, got it?

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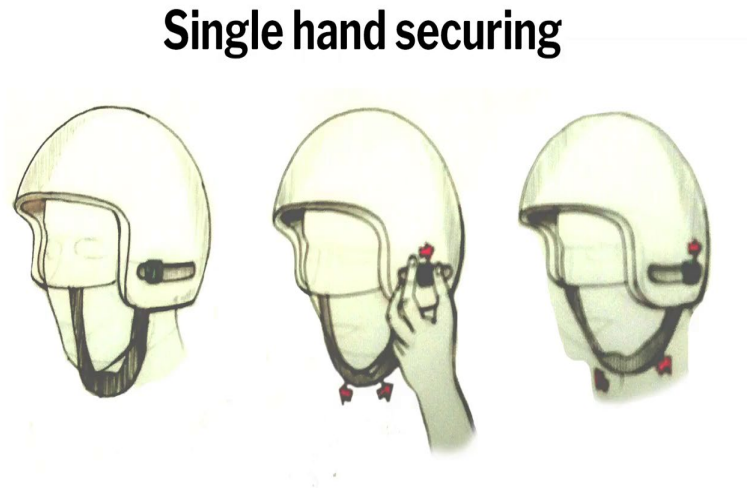

So, let us see how this whole journey went. What is this doing? Buckling, because buckling by the side. You just move these levers and the helmet is not coming out anymore. And when you are doing ideas remember, no questions asked. Right? You did that creative brainstorming. So the idea is there, respect the idea, 'Yeah good solution'.

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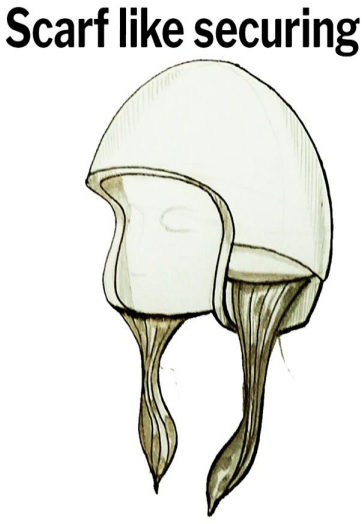

Wow! I love this idea. This is the scarf idea and a lot of pillion riders, women riders would say that they are much more comfortable scarfing rather than buckling. With a buckling a lot of people

have fear that the buckling will not come out. Sometimes it rusts and the buckles are very difficult to pull out. So, scarfing is a very common way of tying. And then tell me if I put a scarf what will Indian standards say? It is not secure enough. Very good and what will they do? They will test the knot in the testing machine.

They will pull and check. Right? All that can be done by getting the type of fabric but if you want to have an idea to go to the next level you can always do whatever you want.

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This is interesting, Sweat ring on the top, because too much of sweat is coming, so there is a, you know, ring on the top for sweat.

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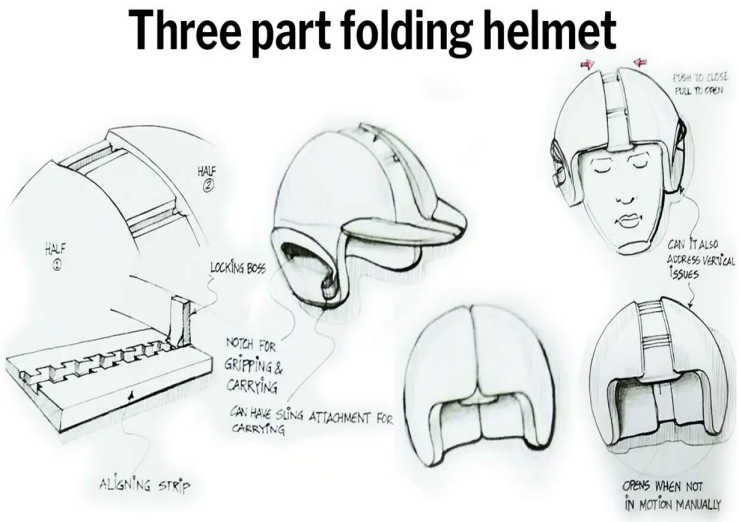

Another idea again *Mandar* only made all these ideas, where you are receding sideways to make the helmet very slim and small.

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Again, you know, two part receding helmet. You pull them out and put them inside so it becomes like, very narrow like a small file.

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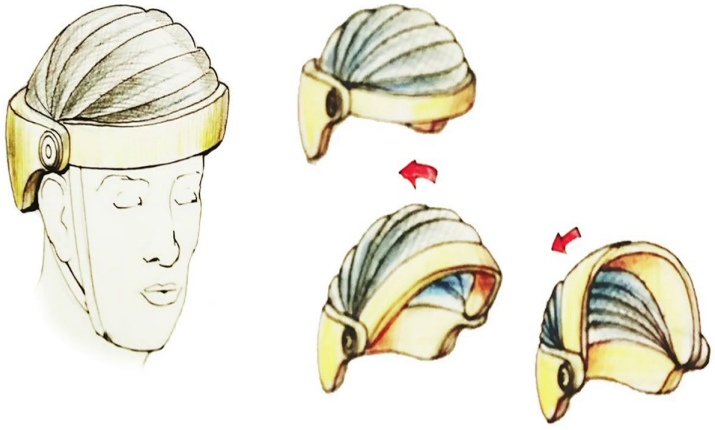
A self collapsing helmet



This is again a collapsing, you know, self collapsing helmet. It is like all around, on the top it has got a net. Most of the protection happens on the side.

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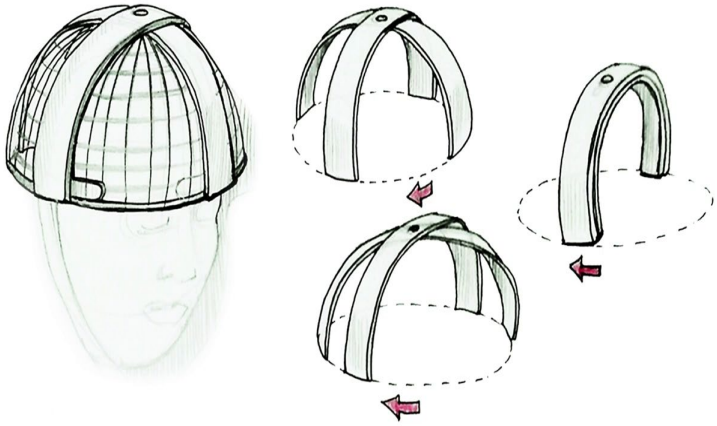
Swiveling helmet



This is again an interesting idea of swivel. You have two shells you swivel and you lock, becomes very slim. All storage ideas. Right?

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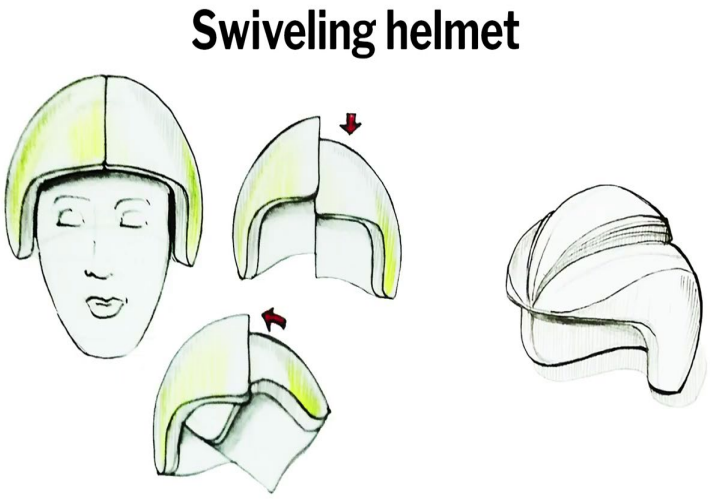

Side folding. Right?

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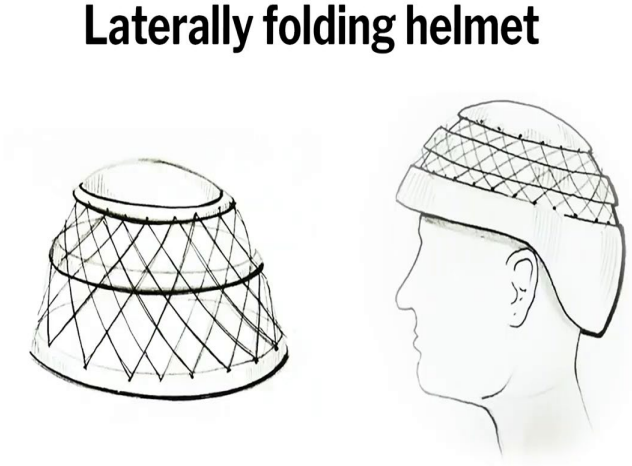

This has been inspired by the sheikhs who wear this, you know, round ring cap with the cloth, so it is inspired by that and it is like, you know, ease of wear idea of it. Just it should be as easy as wearing a cap or just, you know, with a ring on the top.

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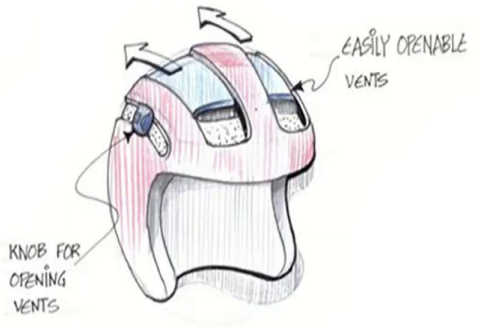
Opening up when stationary



So, this is windows on the helmet for letting air inside. So when you are the signal you can actually open the ventilation ports or they can bring out the helmet so that you get the breeze needed.

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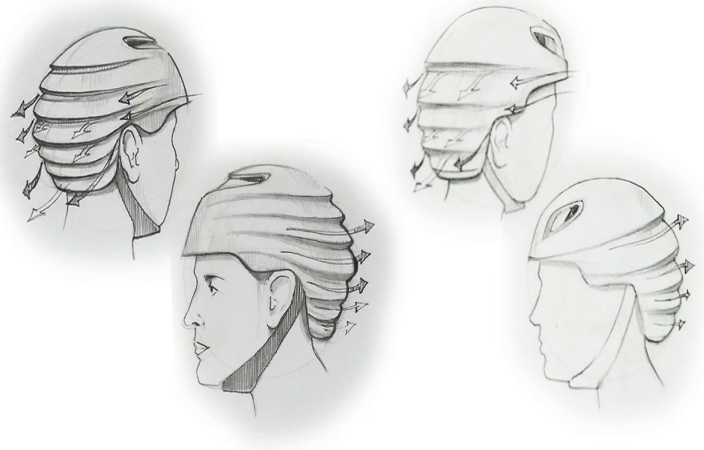
Positioning and number of vents



Then, you know, inspired by various insects. Different, different ways of sort of air ventilation. So, that your air, you know, is the; you are very, very ventilated inside.

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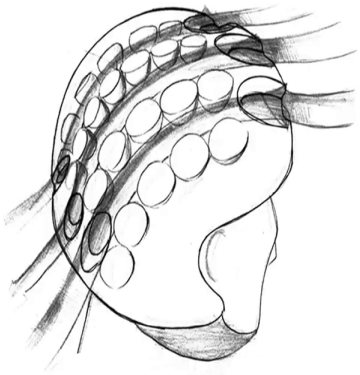
Dimple shaped foam - air channels



Again different types of dimples so that your air channels are formed so your head is cool because of the venturi effect.

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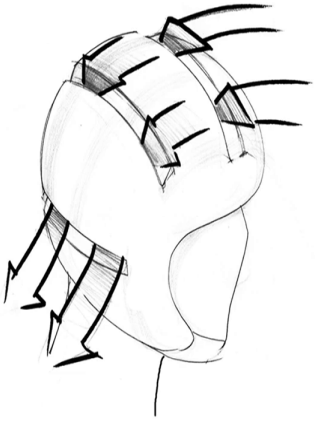
Slits from front to back



Slits from the sides if possible;

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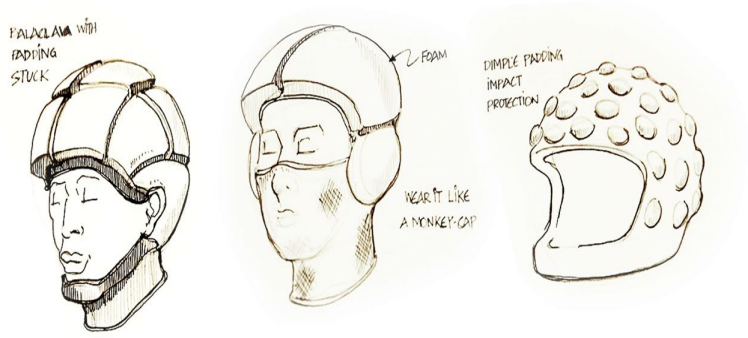
Helmet with padding on the outside



This is a helmet with padding on the outside. Remember those people sitting next to each other and want to talk. The helmet actually hurts quite a bit. A lot of people complain that they would dash against the helmet when there is a pillion rider who wants to talk to the front because of the, very easy, so the padding on the helmet. So, each problem you will come with an idea.

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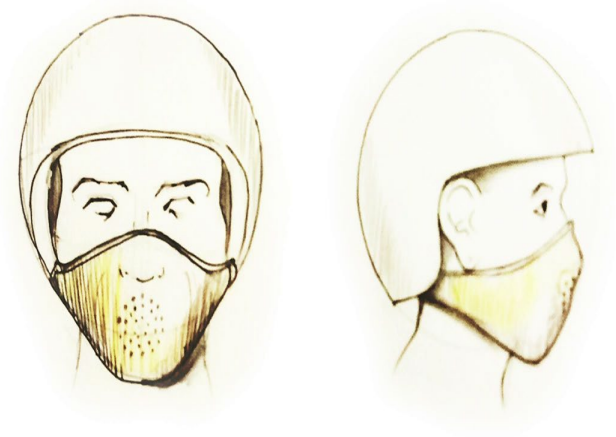
Integrated pollution mask



Biggest challenge is pollution, so much pollution that if it is an integrated helmet with a pollution mask it can be fabulous.

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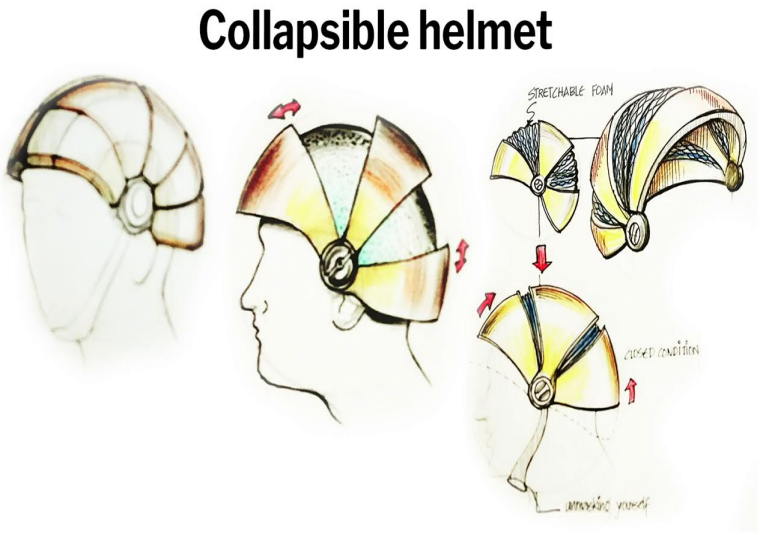

Again if it is easy to store very good, so we can think of a collapsible helmet. And then these are only very few ideas we showed. We had some 150 ideas. I will show you some of the clusters. So what happens when you have a lot of ideas like this, you know, you very clearly we are coming down to the first three points which is talking about comfort of use, encouragement of use and regulation, right? So, automatically when you cluster ideas these types of situations will come forward to you.

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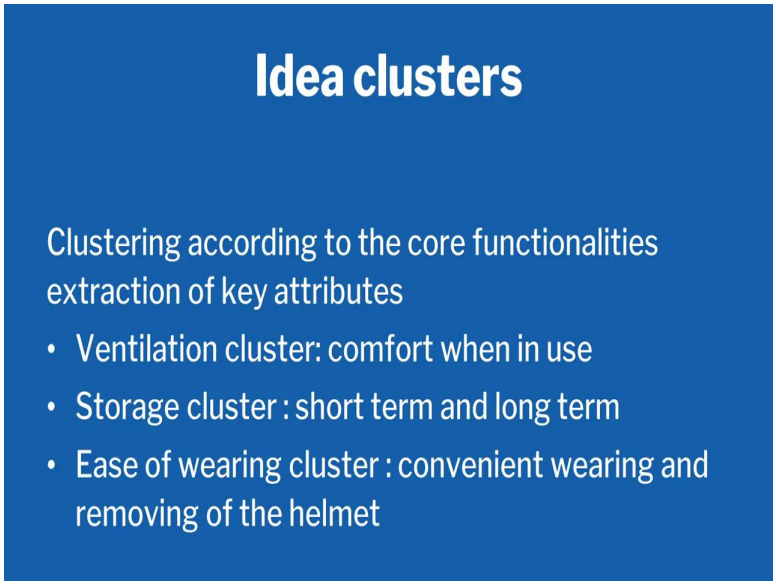

So, we had a ventilation cluster that is I put all the ideas which talked about ventilation as a ventilation cluster. I put all the ideas on the board, we actually do allotting, which was the storage cluster, easy to store cluster. And all the ones where it is easy to wear. We talk about motivation

and, you know, less resistance to use a helmet that we put in the ease of wearing cluster. Look at this ventilation cluster. This is put in this cluster because it has a chance of ventilation also. This was going to the folding cluster.

So you can actually bring a couple of ideas together. Look at the window idea, look at the gaps, look at the ventilation. Lot of ideas are put together and then what you do is, you actually use all those ideas. For example these split ideas were also used; the lure ideas also were used inside for the thermocol. The ideas where you are opening, remember that side openings were also used. So when you build an idea you use the other ideas as your inspiration. Because you cluster them together. Then we chose that as the champion idea.

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So, how will that happen that is called amalgamation and building up of an idea into the concept.

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So, you are building this idea into a concept now. So, this idea then you start working on this it is too open so I need to close it in.

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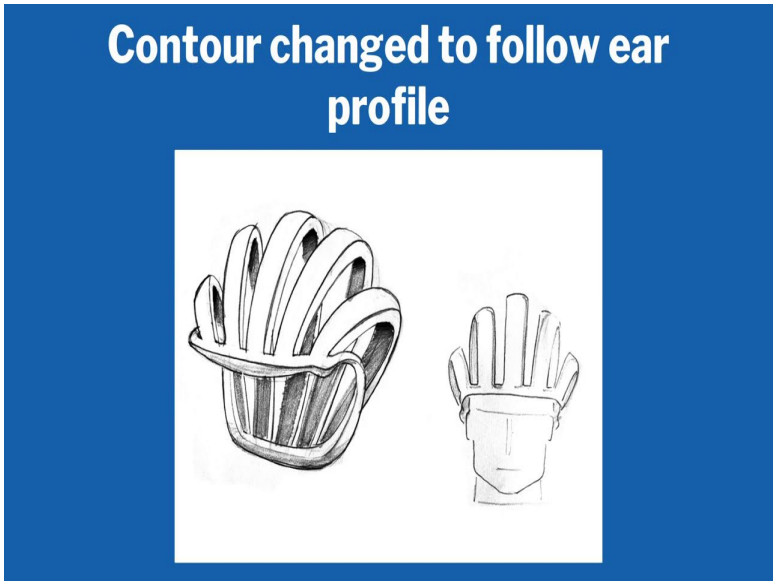

In and to close it further in.

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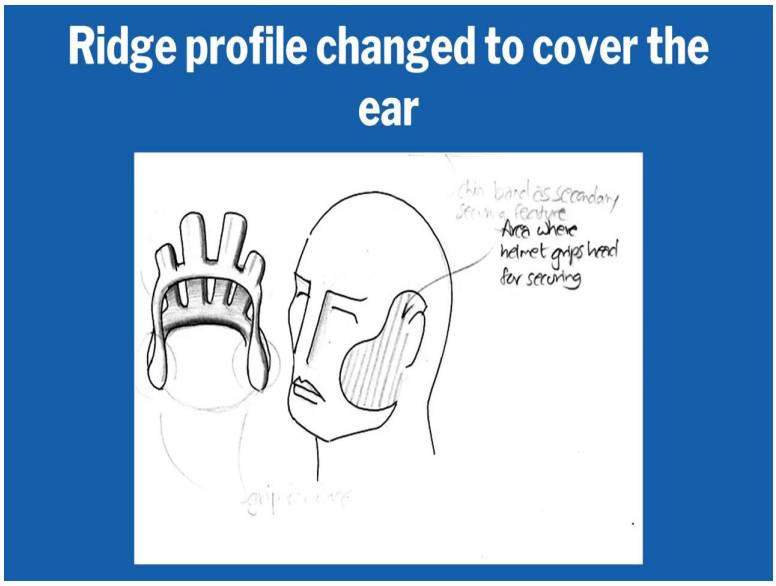

And, you know, please check out the areas which is not covering. Bring those areas in and then you make a helmet which is all the features.

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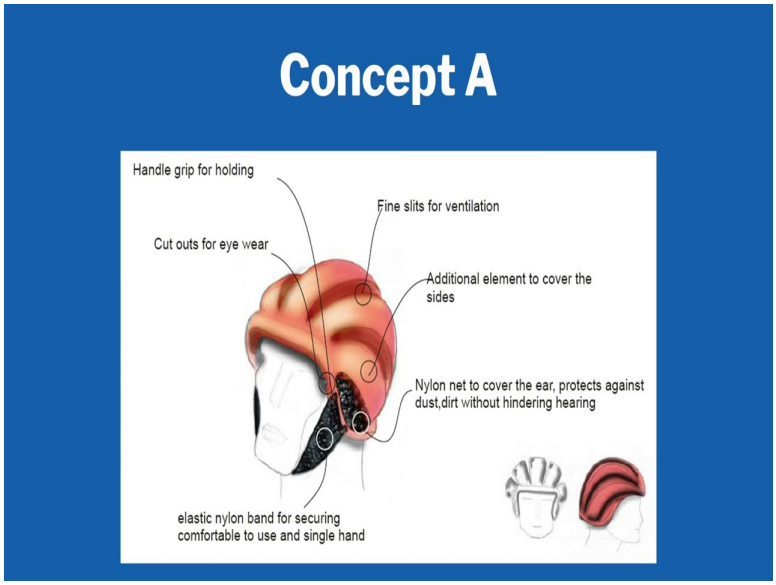

And look at this strap, there is no buckle there. That is the most innovative point: the strap is done using an elastic. Okay? So here we have concept A and the concept A is personifying ventilation. Right? But it is a full concept. It is got all the features which are built in.