AUTONOMOUS EXTERIOR

Degree Project
Master of Transportation Design

Øyvind Hansen Norheim
MFA Transportatin Design
Úmeå Institute of Design
Úmeå University
2015
AKNOWLEDGEMENT

Demian Horst for helping me pursue the dream of transportation design. Tony Catignani and the staff at UID for all your support.

Semcon for financial support and Linus Öberg and his two interns for CAD modeling.

Classmates of 2015 for feedback and joy. Especially Ernst Hellby for encouragement in the toughest times.

Erik Evers for guiding me in the process of communication.

Friends and family!
Automation will challenge our notions about communication between the vehicle and its surroundings. This thesis explores how an autonomous Peugeot vehicle could look like if the exterior design would be smart and aware about the world around it.

Using as reference the needs of a small family and inspired by ripple effects as a reaction to an impulse, the design process also included research, ideation and form development using analog and digital tools. Animation and video were also used for testing and visualising the ‘autonomous language’.

The result is a concept vehicle with an active skin and a unique sculpture reflecting its new architecture, enabled by an electric powertrain and autonomous driving technology. New light modes that let the lights be projected towards the vehicle instead of the road will enhance the volume description of the vehicle to be visible, especially at night.

The design process included context research, needs of people inside and outside of the vehicle, interviews, ideation, package study, digital form development and physical model. It is important to me that my concept fits into a believable context of the future and creates a vision upon issues that we strive to develop today.
Project focus: Exterior

The project focuses on exterior design and how my vision of the future affects and translates into the form and functionality of the vehicle.

For my thesis I wanted to choose a topic that could prove my ability to design. Much of the development today regarding autonomous cars are related to the interior and systems designs around it. When taking the challenge to enhance the communication between autonomous vehicle and the surroundings, I can explore the potential for exterior design and showcase what I can achieve. I can prove my skills to add meaningful input to an area of design that I am the most passionate about. Diving into the unknown, experimentation is needed to evaluate ideas, creating new scenarios, mock ups and testing with people is necessary to receive feedback and provide evaluation to add credibility.

Peugeot Designlab

During my time as an intern I was fortunate to have my placement at Peugeot Designlab. There I got introduced to a cutting edge design studio where I was pushed to develop my skills and creativity rapidly. I gained a greater understanding of the brand and also their design philosophy. From a personal point of view the design philosophy is what attracts me. Over the years Peugeot have produced several concepts that truly distinguish themselves as a brand and broaden our perception of premium in a sustainable way. Being open minded to bring in new elements to transportation design is challenging, but as a designer, that is what I want to do.
Learning not to drive

Autonomous technology is already implemented in cars today. People are experiencing technologies like cruise control or automated breaking to avoid collision or lane keeping assistance. When adapting to the safety benefits of this technology, the acceptance of this new way of transportation will grow in the public eye. Car manufacturers are currently pushing on implementing this technology and it is expected to be a revolutionary step into this area leading to fully self-driving automated cars within a few years. The Tesla model S is currently offering an autopilot system enabling the car to handle traffic without the driver behind the wheel. This means that people can experience driving while not touching the steering wheel, although only allowed in four states in America (Nevada, Florida, Michigan, California). Furthermore, every S model is being built with the necessary hardware for autonomous-driving features to be activated on a later date. (1)

An autonomous car—also known as a driverless car, self-driving car, or robotic car—has the unique capability to fulfill the transportation capabilities of a traditional car. As an autonomous vehicle, it is capable of sensing its environment and navigating without human input. (2)

1919
Cadillac’s self-starter system means drivers no longer have to hand-crank their vehicles. (3)

1939
Promoted as an advance “that makes driving so simple”, Oldsmobile unveils its Hydra-Matic, the first automatic transmission. (3)

2008
Mercedes introduces Attention Assist, which warns drivers when they show signs of drowsiness. (3)

2014
Google prototypes a fully self-driving car with no steering wheel or break pedal. (4)

2015
Tesla model S features autopilot, which can drive 80 percent by itself according to Elon Musk. (1)
02

METHOD
The process

To create a strong research, there are many factors from different fields that need to be understood. I wish to define and expand my knowledge on the areas that are important. To combine the knowledge I have a good base to create a scenario of which is yet to explore. This will furthermore lead to more research, as questions will arise when designing for the scenario and generate new knowledge to the area of study. I believe that creating scenarios is key to fulfill desirable design solutions. The scenario works as a checklist for needs and problems to solve, in relation to story of the people living there. It also communicates very well when communicating your design ideas. Although taking into consideration as many factors as possible I believe that as an individual and a designer you have big opportunity to influence what the future will be. Relying on statistics that gives credit to an evolutional trend is not a certain answer. The future is there for you to decide for yourself what you think it should be. However, understanding the situation we live in is key to understand the potential for evolution. Creating a positive future scenario for the world we live in and the means to support that is what I believe a designer should do. It is important to me that my concept fits into a believable context of the future and creates a vision upon issues that we strive to develop today.
Why autonomous is great

There are numerous ways that autonomous driving will improve the way we transport today. The driver is a machine not a human and it can react incredible fast. That means that it can absorb and react on information faster then we can as human beings. Each year, an estimated number of 1.3 Million people die in traffic accidents, which is the 10th leading cause of all deaths overall, and 50 million more suffer injuries, according to a Wall Street Journal Report based on World Health Organization data. They will be able to react instantly to the moving traffic ahead with closer distances to each other, and this will create a much more efficient and continuous flow of traffic, which will increase highway capacities, even in packed situations. When safety is increased, the speed limits can increase as well. Driving high speed on designated lanes is a possible scenario and commuting long distance will be faster. In city areas where parking spot and the actually place you want to go is somewhere else, the autonomous car can park and pick you up at the place you want to be. The most obvious is probably the time you save from driving, whether you like driving or not, the time you spend commuting in the car can be used for something else.

Andy Palmer, the Executive Vice President of California-based Nissan Motors Ltd., has announced that Nissan will make fully autonomous vehicles available to the consumer by 2020. These cars will be able to drive in urban traffic. (8)

Sergey Brin plans to have Google driverless car in the market by 2018. (8)

Andy Palmer, the Executive Vice President of California-based Nissan Motors Ltd., has announced that Nissan will make fully autonomous vehicles available to the consumer by 2020. These cars will be able to drive in urban traffic. (8)

Expert members of the Institute of Electrical and Electronics Engineers (IEEE) have determined that driverless vehicles will be the most viable form of intelligent transportation. They estimate that up to 75% of all vehicles will be autonomous by 2040. (8)

Sergey Brin plans to have Google driverless car in the market by 2018. (8)
The Brand

The lion have been the symbol of Peugeot’s logo from the very beginning. Not only does Peugeot mean lion in French, but it can be found in design elements on their cars. To enhance the focal point on the badge, on newer production cars the badge is in the center of the grill. (9)
Motion Emotion

Peugeot relaunched their market campaign with the slogan “motion emotion”. From being more engineering-focused, they now aim towards softer values as well. The motion side represent the performance of their vehicles. The emotion side have been developed through offering more care of the customer, without just the driving pleasure. (10)

Autonomous Identity

Some competing companies have made a strategy for their autonomous identity. Values such as passion for driving somehow disappear in an autonomous vehicle. This can be discussed because a vehicle without a steering wheel does not have to mean that you are not in control of the vehicle. Nevertheless, this is what most car enthusiasts dislike of the autonomous vehicle. As there will be more autonomous vehicles, companies need different identity values. Peugeot’s “Motion Emotion” slogan is great to build upon, as the emotion side is easy related to autonomous vehicles. What kind of emotions should the autonomous vehicle trigger?

An autonomous vehicle could be an extension of their slogan as it represents the next step for important values in how we travel.
Google Driverless Car

Google’s founder Sergey Brin has made it clear that the company plans to have its driverless cars on the market no later than 2018. At the signing ceremony for California’s autonomous vehicles law, he outlined Google’s path towards commercialization of its driverless cars. Within 2013 Google plans to expand the number and usage of their driverless cars to Google employees. Thereafter it will not take longer than 5 years to get the cars into the market.

Google is arriving with a different approach to car making. The impersonal look compared to what is usually coming from the automotive industry is a statement of something different. The car does have a face, but the overall shape is more box-like and characterless. The vehicle does not seem intended for personal ownership. Google recently bought the Uber taxi app. There is a huge potential to having autonomous vehicles shared between users just wanting to go from A to B. You don’t have to deal with all the hassle of owning a car and it is probably cheaper as well, removing the taxi driver. The car is fully yours even though it is only for a short period of time. What is interesting about Google making a car is how this could inspire companies. Will companies with specific expertise in other fields start making cars as well? Will the future hold more segments and more purpose built vehicles for designated tasks?

Mercedes-Benz F 015

Mercedes launched a concept showcasing their take on autonomous driving. “The car is growing beyond its role as a mere means of transport and will ultimately become a mobile living space”, Dr Dieter Zetsche, head of Mercedes-Benz cars. Time and space as luxury is the main concept of the vehicle. The time is time for yourself and the vehicle handles the job of commuting. The exterior suggests an interior environment shut off from the outside since there are only windows- suggestions and the windows are bodycolored. The space is shown on the exterior with the stretched cabin. The exterior have some interesting parts that the front face is without a grill. Instead it is a display for graphics and laser light projections.

Mercedes have established themself with a clear vision for their autonomous driving. What will be the vision for other companies?
Hybrid Age

For the future technology will blend even more with our everyday products. Clothing for example will become a wearable where the technology is cleverly implemented. More analog objects are becoming embedded with sensors and gaining the ability to communicate. Our house is connected with our car, our phone and the technology knows us and look for patterns that can help to improve our lives. Different kinds of technologies such as big data, computing power and regenerative medicine will converge and integrate. (13)(14). Technology is expanding the opportunities for human beings, but also leaving people behind. As technology have been something that people have to learn how to use I believe in the future technology will work seamlessly without our attention.

The Microsoft Hololence, not on the market yet although a functional prototype is made. Using hologram you can compute in the physical world, using voice and gesture to summon data and layer it on top of physical objects. Computer programs will be able to digest so much data that they’ll be able to handle far more complex and nuanced situations. Cyberspace is all around you. The interesting thing is that the hologram is basically light projection perceived by the eye similar to how we perceive the world around us, without light we cant really see anything.

As the holograms get so realistic that having decoration in your apartment like paintings or flowers could be perceived as the real thing. Would this blur the borders of what we consider real or virtual? (How would you consider real danger to virtual danger?)

Biomechatronics is applied interdisciplinary science that aims to integrate mechanical elements, electronics and parts of biological organisms. Similar approaches is found in liquids. An example is the swallowable. ways of expressing yourself is being found in for example a swallowable perfume. The swallowable perfume will be activated when sweating.

NikeFuel is a wristband to measure and track all kind of activities, from morning workout to a big night out. It tracks full body movement and is connected with an app to promote an active lifestyle. As people start tracking their lifestyle, wearables is a natural object to carry.
Looking towards the future there will be a transition period where cars both have the autonomous mode and the conventional driving mode. But taking a step further, what happens when both autonomous cars and conventional driving vehicles are operating in the same environment? As where a fully autonomous network system might offer great safety the transition time where both autonomous and conventional vehicles share the same road will lead to both predictable and unpredictable situations. Conventional car drivers could easily take advantage of the systematic behavior of autonomous cars by driving ahead. Cutting off an autonomous vehicle in order to commute faster knowing that the autonomous vehicle will automatically break or stop, creating an unpleasant ride for the passengers inside autonomous vehicles. How can the autonomous car be respected?

Is the autonomous vehicle bound to follow the rules? What if you are sick and need immediate transportation, could the vehicle function as an ambulance? If so, it would have to break out of its regulated behavior and how could it communicate to the surroundings that it needs to pass through.

Cognitive

Commuting in a city is a big mix of different means of travel, cars, bikes, scooters, bicycle and pedestrians, all trying to make their way. As a pedestrian cross the road the natural reaction to an approaching car is to look towards the drivers eyes. In that way you get feedback that the car is aware of you and you feel safe to step out in the road even if the car still is approaching with speed. With the autonomous car there is no driver paying attention to the surroundings or in control of the vehicle. There is a feedback needed from the vehicle that it is aware of the crossing pedestrian. Digital recognition systems remain invisible. To enhance the comfort level between human and machine the communication needs to be visible in order to build trust in the technology.

Cars are an emotional object and often reflect the personality of the owner. The fact that the car is an object of which you are in control I interpret as an underlying factor that the car is such a strong symbol of the driver. Driving on the grid (autonomous) instead of driving on the road means a system designed for the general public. Could the way an autonomous car communicates represent a stronger element of individualism and personality?
How is the exterior affected?

The current car exterior has several indicators to communicate traffic movement like changing lanes and visibility both for the driver to see and to be seen. This is mainly in form of light but also sound on trucks for reversing. Different color and repetition of on/off, have different communication meanings. For autonomous vehicles it could be different because they would already know this information by communicating with other vehicles.

For visibility the lightning of the car is important. It allows the driver to see the surroundings in a dark environment. For a pedestrian it is easier to spot the car, although this is different from right to day where the lights are less visible. The lights sit in the front and rear sides giving an indication of the length and width of the car. In an autonomous environment the lights are not necessary for the driver inside the vehicle. You do not need visibility to drive because you are not driving. It is still important with light for the people outside the vehicle as it need to be visible for them to navigate around, but light does not have to be directed in the same way they are today. This means that light could have a different functionality like giving a better volume description of the vehicle. Or, there will be no light on for example highways designated for autonomous cars.

Indicators are there to communicate right or left in advanced before the vehicle moves. For autonomous vehicles this is not necessary as they would know already it is a clear signal, but for a pedestrian you read speed and placement, as factors too to confirm how the vehicle will take action after blinking. This system is not bullet-proof and there are many examples of accidents related to misunderstanding in traffic.

The cabin offers needed visibility for driving today, but the same layout of visibility is not needed in an autonomous car or could be changed.

Autonomous driving is potentially 100% safe. There is no need for safety features, as vehicles will never crash. That means a new vehicle architecture.

Much of the car brand’s identity is shaped in the light graphic. The grill represent the logo and the badge. The way most people recognize a car brand at first glance is by looking at the grille and lamps. For an electric car, the grill is not necessary anymore. This is a challenge when designing what could be an honest autonomous car, as the key elements of a brand’s design language have to be removed or translated.

If the vehicle’s software system is responsible for traffic navigation, today’s legislations on signals and communications parts on the vehicle is not necessary between vehicles. However pedestrians and other means of transport still need traffic communication as well as between autonomous and conventional cars.
Problem identification and interviews

As part of imagine and understanding possible problems in the future, scenarios were made. Interviews with professionals working with traffic laws and teaching to broaden my knowledge and get a different point of view to the topic. Group sessions with Semcon where designers from different fields (interaction design, product design) were present to discuss the possibility for my topic. For my thesis I had already decided that my intention is not to design the system around the vehicle. I was therefore looking for a key problem are related to the exterior.

The main problem area is to know if the vehicle is aware of you.

Main problem to cause stress and irregular behaviour is that there is no information from the vehicle that if you have been seen, noticed or taken into consideration.
Carved Surfaces

The SR1 concept gives the impression of being carved from a solid block. It is even more visible on the Onyx Sofa where most of the Volvic volcanic lava stone is left untouched, just a single carve that continues with the carbon fibre.

Three plan shape

The three plane shape is visible on overall silhouette and in details although with different linewidth and lead in.
Coupe Franche
The cut is a abrupt change in material and makes the different material use even more visible and strong. It could read as a symbol of motion and emotion, splitting the performance carbonfiber with the luxury copper material on the onyx.

Griffe
The rear lights resemble the “griffe”, a lions claw.

Bubbleroof
Features on the RCZ model as well as several concepts. Emphasize driver oriented “cockpit”
we are running after technologies and yet they are obsolete the day you buy them. Society will need to rest a bit.

Gilles Vidal
Peugeot Design Director

Latest Peugeot concept cars are a good example on how they succeeded bringing in a crafted feel and clever use of recyclable materials as an element for premium. In a digital dense world I believe that the tactile and crafted feeling is something that is highly appreciated. Peugeot is a brand that represents innovation in material use and to further build on this I think have enormous potential. Mixing motion and emotion, looking into interactive materials could be key to create a greater impact on human beings.

Newspaperwood
Made from recyclable newspapers.
Highly sustainable.

Copper
It is in the process that the material surface offers a nonlasting visual expression as the copper transform from golden to green. The patterns and texture that arises will deform and change over time making a specific impact in time unique.

Brushed aluminum
A natural feel and also really robust and strong.

Sharkskin
Surface treatment inspired by sharkskin for drag coefficient.
Ephemerality

Is shortlived physicality that can have a long lasting influence. Redefining the value of memory and enriching our experience and sentiment. Being physical provides a refreshing pause in our digitally dense world.

Physical objects or material change can be combined with technology allowing the communication to be physical and real. Creating patterns and texture that arises and deform will make a specific impact in time unique.

The Onyx concept gives small hint on ephemerality with the copper material. It is in the process that the material surface offers a nonlasting visual expression as the copper transform from golden to green.

Another example is Cymatics, transforming sound to physical objects, water will react to to sound vibration giving a visual experience to something we cant see.

Visualizing in this manner is rather abstract, but for a vehicle this could be a subtle way of communication.

The key image represent the feeling that i am after. It is a reflection of a person, and even if he is not touching, the image gives the feeling of the ripple effect by his behaviour. The mirror reflects the persons image and movement.
Looking into material I explored smart materials to support the ripple effect on the exterior.

Shape memory materials are materials that can deform and return to the original state after an impulse as temperature or electricity is added. (17).

The BMW Gina concept has a skin covering the exterior on the vehicle. Under the skin there is a mechanic structure to support the vehicle and to create transformation to the skin. (18).

Looking into the fashion industry I found a lot of interesting materials related to 3D printed fabrics. Reactive wearable technology was one of them. While giving small input of force from a specific area, a transformation throughout the structure of the printed material transform. (19).

Printing complex structures have become developed as coding and controlling the structure is possible through dedicated 3D generating software (such as Grasshopper). (20).
The family is looking to buy their first autonomous car. Their previous car was a 308 small family vehicle driven by the father. Their main reason for buying an autonomous car is to save time as the car can handle pick-ups of the kids without a parent present in the vehicle. The family help out in the local community working to create a nice environment for the people as the city has grown even more crowded and busy.
Summary

I am looking to design what could be Peugeot’s vision of autonomous cars. I will design for year 2020 when both autonomous and conventional cars will be on the road. However there will be designated roads for autonomous vehicles, as a result of enhancing traffic efficiency.

My thesis will explore the relation between the exterior and its surroundings. Using new technologies and materials suited for the purpose. It will focus on exterior design, not a system around the vehicle.

The vehicle will have a different seating position as sitting faceforward is not necessary in an autonomous vehicle. New vehicle architecture means a design challenge when it comes to keeping the identity for the brand.

Thesis question

What could be Peugeot’s vision for autonomous cars?

How to create a considering relationship between autonomous cars and the surroundings?
GOALS & WISHES

Project goal
Besides a well-reflected research, I want to have a good sketch process that shows a clear and readable development, visualizing different ideas and themes on a high quality level.

For the end result, I want to have a model for sure, this is to prove similar aspects as the clay model although to a more finished state with material properties.

Vehicle attributes
House four people with additional storage
Support a different seating architecture
Operate in an autonomous environment as well as with conventional vehicles
Enhance comfort level for people interacting with the exterior

An additional communication is added to communicate that the car is aware of people outside the car.
**IDEATION**

In the ideation face I was looking to find a form language that would communicate that this is an autonomous vehicle and coherent with Peugeot's form identity.

The key sketch represents a dynamic form language. I see the potential for a carved feeling to the treatment of the surfaces. The greenhouse is untraditional in the way that it has a clear peak in the middle, right in the center of all the passengers (they are facing towards the middle). This gives the highest point in the middle of the entir- or, supporting a seating position facing towards the center.
Coupe Franche

Explorations on where to split the material for the windows when visibility for the driver is not needed for driving safety. Also represented by the "Coupe france" signature split.
Final theme sketches

Sketches with slight detail and form iterations to finalize the theme.
All four wheels are housing an electric engine. The shape of the wheel and the spokes is quite flat to support aerodynamics. Where flat rims seen on electric cars tend to look less exciting, I tried to bring in a new element, making the wheel rubber part of the rim, blending where you read the edge of the rim.
Form evolution

I tried to make an evolution of the “carved surface” to give an example of what could be the next Peugeot form evolution. By focusing on sculpting what is inside the original carved surface to add more elegance and refinement.
CONCEPT

The exterior reflects Peugeot’s brand slogan “motion emotion” by dividing the exterior into two parts represented by different materials with each their purpose.

Transparent Glass

This part is entirely transparent, giving visibility and light for the traveling passenger. It is also a clear statement to only have visibility in the rear. This is to communicate that this vehicle is unconventional and autonomous. Another reason not to have visibility towards the front is to leave wall space for entertainment systems and screens because I believe that this is just as preferred amusement during traveling as looking out the window.

Dynamic Fabric

The front part is focused on the surrounding environment showing through smart material that people are consider by the vehicle technology. The vehicle will be perceived as more alive. It will be prominent but gentle.
The ripple effect

The vehicle is reflecting the person, but also creates a movement by the ripple effect on the exterior that is triggered by the person approaching. The person influences the exterior surfaces. It gives a personal and living impression as the ripples is something that will never look the same, creating a moment in time that is unique.

This attribute is there to communicate that the vehicle have noticed you. That it is aware of your presence.
In a more practical example, the vehicle takes notice of the pedestrians crossing the streets, each individual pedestrian creates a ripple on the exterior of the vehicle.
Autonomous Light mode

The vehicle will operate in a scenario where both autonomous and conventional vehicles are on the road, therefore conventional lighting is still used on the vehicle to stay within the traffic rules. However, the vehicle has an autonomous lighting mode, where the light is projected onto the vehicle instead. This is a sign to communicate autonomous driving and the light gives volume description of the vehicle for pedestrians.
The lights do not need to provide visibility for the passengers inside. However, they need to be visible for the people outside of the vehicle with indicators to communicate turning right and left. The light signature is represented by light bars. The autonomous lightning is a glowing light, but still taking the same character and shape as the signature light.
A scenario image showing the vehicle navigating in narrow streets.
**Interior layout**

Half of the vehicle’s walls are transparent. This gives the passengers a view of the outside as well as the interior mood is affected by the outside light. The non-transparent half is dedicated to the interior entertainment and storage space. All the passengers are sitting so that facing towards the outside is just as easy as facing inside.

The doors open slightly, then lift from the reinforced shoulder, making an entrance quite spectacular.
Package

The vehicle is targeted for city use and weekend long travels, hosting a small family. The layout of the interior is changed to give a more social seating position, but not directly facing each other so it may feel awkward and forced to stare at another person for longer trips. Seats for four people makes it a spacious interior.

The layout gives an interesting vehicle architecture as the “greenhouse” will have a more diamond shaped form creating a wide point on the middle of the shoulder.
**Skin technology**

The front half of the vehicle contains a special skin technology. There is a 3D printed structure underneath a soft skin. The 3D printed material is structured in a way that allows for mechanical input in one area to create a kinetic effect throughout its structure. This is a conceptual way of applying the reactive 3D printed material, but it is the same as explained under analyses and conclusions (see page 42-43).
Alias development

During the alias development I had help from Semcon building the model. The process was quite challenging and learningful on how to communicate your design in the best way. The 3d data was later used to build the physical model.
The 3D model from Alias was split into pieces in order for the three-axis milling machine to drill form the correct angles. All the surfaces needed to be sanded as the milling machine does not create an absolute smooth surface. A structural frame was built to turn the object for the milling machine to be able to mill from the correct angles. High precision was needed to make sure the whole object didn’t change the “zero point” which is the starting point for the milling pattern.
Details

Details such as split lines was taped as reference onto the model. 3d printed parts was added as separate pieces. The tape decided the width of the split line. It also was the reference border of which I cutted a line with the paper knife to create a wall. This was to create an even wall on each side of the split line when sanding out the material from the middle of each tape side.
For painting the model I got help from Ruben Eriksson who did an awesome job in getting the paint finish correctly.
Finished model

The next pages are dedicated to images of the model.
The Master thesis represent a summary of my skills and what I can achieve. Therefore my ambition was high going into this project. It have been a meaningful experience that have given me confidence in what is my strength and also where I need to improve.

Looking back I believe the project is an answer to many of my personal goals. Building a physical model have been something that I have wanted to do for a long time.

The project touches upon issues that I believe is highly valuable for the industry to consider. Especially how we can enhance human communication with vehicles. Making the autonomous vehicle’s consideration about the environment visible, we can achieve greater safety and sense of security for human beings. It also creates more character and identity to the vehicle. In the making of this concept it was important to me that the solution would not be a system of rules that you have to adapt. The solution is therefore an aesthetic expression. An example to follow that allows for different interpretations and creations to evolve in the future of transportation design. There is a lot of potential in material technology for exterior design.

The project scenario happens in an in-between stage of both autonomous and conventional vehicles driving in the same environment. This means that there are considerations that have to be made to make the concept believable for that context. I believe I managed that the most by re-locating the package of a conventional vehicle to optimize for an autonomous layout while keeping safety features like bumpers and pillars on the exterior design. Autonomous vehicles will not be 100% accident free as long as human beings are driving next to them. Therefore the overall semantics of the vehicle remains quite similar to a conventional vehicle, but I made a strong statement of showing autonomous by having no visibility towards the front.

In this project I reached out to people from different fields of expertise, most importantly interaction designers. Learning about the technology that exist in this profession is amazing. This proves to me how important it is to collaborate across disciplines.
REFERENCES

14. Ayesha Khanna. Machines will be embedded within us in hybrid age: Ayesha Khanna, Hybrid Reality Institute 06.03.2012
TIME SCHEDULE

Research

Sketch Development

Alias

Modelmaking

JAN.

19-20 Jan - Official kickoff, Cambro & school presentation
09 Jan - Related Topics

FEB.

16 Feb - Research review & Concept freeze
10 Feb - Tutoring

MAR.

16-17 March - Tutoring
30 March - Tutoring
6 March - Midreview & design freeze

APR.

10 April - Process gateway
27 April - Tutoring
16 April - Midreview & design freeze

MAY.

19 May - Tutoring
10 May - Presentation & examination
11 May - Submit degree report

JUN.

3-4 June - Design talks & exhibition