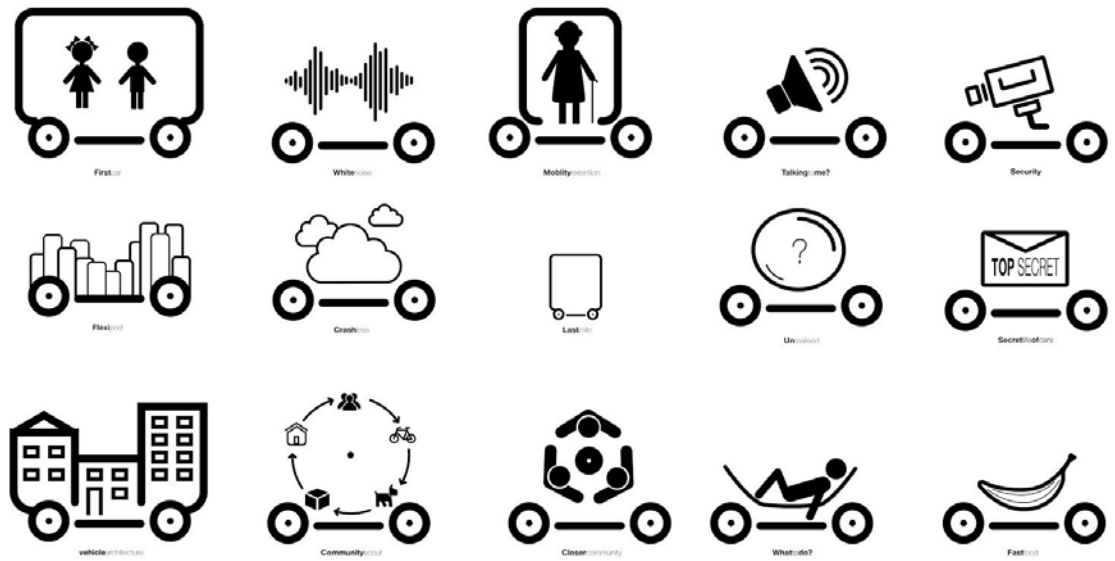
D3.3 RCA Student and Internship Report

GATEway Project



RCA Research Team
Professor Dale Harrow - Principal Investigator
Rama Gheerawo - Co Investigator
Sam Johnson - Project Researcher
Daniel Quinlan - Project Researcher
Dan Phillips - Project Manager

GATEway

RCA/180 Royal College of Art
180 Years of Innovation, Art & Design

1. **Introduction**
    a. Project 1 - Interns
    b. Project 2 - Students

2. **Project 1 - Interns**
    a. Objectives
    b. Methods
    c. Briefs
    d. Workshops
    e. Outcomes

3. **Project 2 - Students**
    a. Objectives
    b. Methods
    c. Briefs
    d. Workshops
    e. Outcomes

4. **Conclusion**

1. Introduction

Between June and December 2016 the GATEway team ran two projects aimed at generating ideas and content on the subject of driverless vehicles. Project 1 worked with interns on a number of predetermined briefs while Project 2 worked with students in a more open and exploratory fashion.

A. Project 1 (interns)

In the summer of 2016 the GATEway project team took on four interns. They were tasked with developing concepts based around the idea of driverless vehicles. The interns were made up of three graduating RCA vehicle design students, a first year vehicle design student, and a graduating architecture student.

Based at the Helen Hamlyn Centre for Design (HHCD), the students worked with the GATEway RCA research team to propose concepts based around themes that had been identified. This was linked to the GATEway workshops that were running alongside the internships, feeding ideas to the interns who gained firsthand insights from the process.

B. Project 2 (students)

Project 2 engaged with first year vehicle design and second year textile design students, seeking to understand their thoughts and ideas on driverless vehicles.

The project ran throughout the first term of the 2016/17 academic year with students being given broad briefs to encourage a wide range of ideas. They also had the opportunity to pitch their ideas to members of the public who they met through the GATEway project.

The two projects were designed to work together, with the intern projects focusing on a specific area and gaining a deeper understanding while the students projects were designed to cover a broader area of concepts but with a lighter level of insight.

The outcomes of both projects helped to make up the content for the first GATEway exhibition held at the London Transport Museum from March to April.

2. Project 1 (interns)

A. Objectives

The purpose of the studio projects was to generate content for public engagement delivered in the form of an exhibition held at the London Transport Museum from March to April 2017.

In addition to this the interns also acted as facilitators during public workshops on driverless vehicles. This gave them a better idea about public needs and developed their communication and listening skills.

The studio project output was to produce a set of concepts and ideas based around driverless vehicles. These concepts were defined in two ways:

1. Through briefs set by the GATEway team
2. Through public influence from the GATEway workshops.

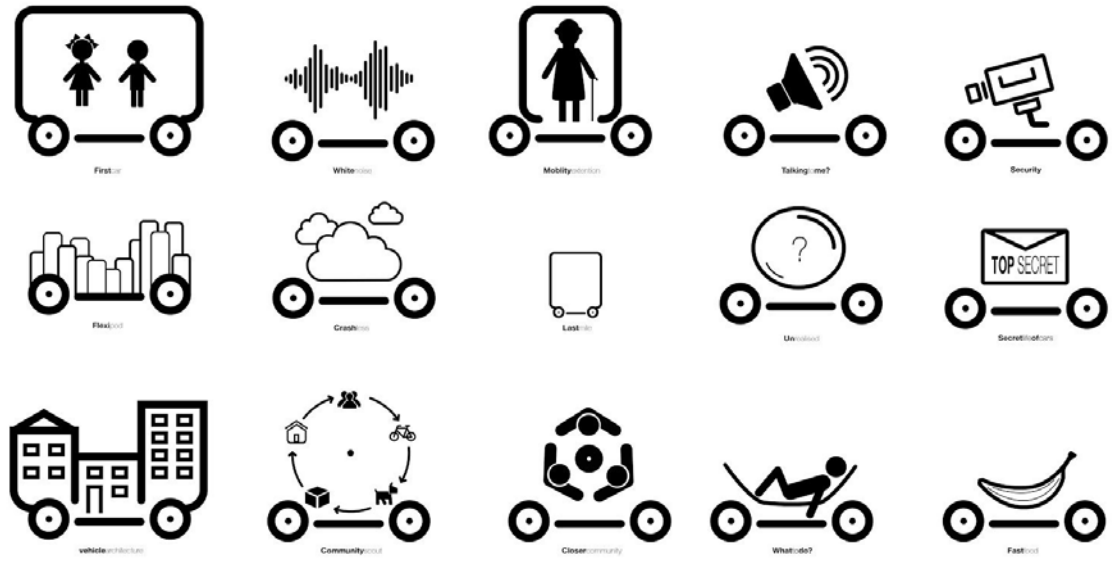
B. Method

We sent out an introduction email to 1st and 2nd year vehicle design students explaining the project and inviting them to send us a portfolio to review.

We had 11 responses of which we interviewed 6 and selected 4. We were looking for designers who not only had strong visual skills but also had diverse backgrounds and processes. We hoped this would allow the interns to focus on the subject in a less traditional way.

C. Briefs

Prior to the interns starting work, the GATEway team put together 15 briefs highlighting areas of driverless vehicles that could be explored. These categories were developed from ideas developed by the GATEway team combined with early feedback from the public workshops and assigned to students prior to them arriving at HHCD.



Initially fifteen areas were highlighted as points of focus. The category titles were as follows:

> ‘First car’, ‘white noise’, ‘mobility extension’, ‘talking to me?’, ‘security’, ‘flexi pod’, ‘crash-less cars’, ‘last mile movement’, ‘unrealised’, ‘secret life of cars’, ‘vehicle architecture’, ‘community scout’, ‘closer community’, ‘what to do?’ and ‘fast food’.

This briefs were condensed and focused so that they met the interests and skills of the interns. The final briefs provided to the interns are shown below.

Brief 1 - The second car

Congestion in London rises by 67% in rush-hour. Part of this congestion is caused by children being delivered to and collected from school and makes up 8% of rush-hour traffic between the times of 7.30 to 9.30am and 4.30 to 6.30pm. This brings more vehicles onto the road at peak time, increasing the volume of traffic. This issue is exacerbated further because schools are often located in residential areas with limited parking, forcing parents to stop in places that increase congestion further, and which can cause accidents.

The school-run car is often also the shopping car and it can also be the station-commute car.
This second family car could be seen as anti-social, unsafe, 'street-clogging' and surplus to requirements.

Find a design solution to the problem. Look at ways of reducing the number of vehicles being used; focus on how the system can be made more efficient by designing a vehicle fit-for-purpose. If there is no driver, then the car could be just for kids. What are their needs and could it do the station run as well? Look at how vehicles can be used when not ferrying children to and from school. What secondary purpose could a vehicle of this nature have during its unused hours? Could it collect the shopping? Does it need to be parked on the street? Where could it be stored? Who will have ownership and who is responsible for the children or things inside?

<u>Examples</u>

- A car that never parks
- Vehicle purely designed for carrying children, or multi-peak purpose?

2 Mobility extension

Large sections of the community have limited mobility beyond their homes. With life expectancy extending, there is an increasing market of older people who are on a decreasing scale of mobility. Key to this decreasing mobility is movement. People's joints become worn and covering long distances becomes harder to achieve. Whether it is travelling to see family and friends or assistance with the moving of larger objects, autonomous vehicles have the potential to massively improve and extend mobility for this group of people. Providing flexible mobility can help elderly generations to keep connected with society.

As people age, they lose their cars, often forcing people to use other local mobility devices. However, scooters are stigmatized, heavy, short range, low speed, not always safe and not always weatherproof. If people are disabled, they may be unable to drive. If they can driver, it is in a vehicle that are converted and are often cumbersome.

Design a multipurpose vehicle that can assist older generations or the otherwise less able. Consider the varied way that people might use the vehicle and plan a platform that is able to adapt to a variety of needs. Also consider access in and out of the vehicle as well as how someone who might not be fully computer-literate could interact with such an autonomous vehicle.

<u>Examples</u>

- Better quality of life.
- Live longer – blue zones
- What type of vehicle would be suitable? A luxury vehicle or a utilitarian vehicle. Bentley Mulsanne or Honda Element.
- Think of this entirely new consumable opening up a major new market.

3 Community Flexi-pod

With the increased popularity of ‘shared public spaces’, cities have the potential to be a lot more compact – see Masdar City. However this will put new strains on the transportation infrastructure. Even buses and other road-based public vehicles could be too rigid a system for future cities. Greenwich is an evolving shared space that can be used as a test-bed of how a middle ground transportation system could be implemented – neither bus nor car. With more flexible routes and timetables and variable volumes, a range of high-to-low frequency services, with vehicle sizes matching differing traffic-flows, with on and off peak options, suggests an intermediate PSV service less rigid than a bus and less expensive than a taxi.

What could a vehicle tackling this transportation issue look like? What will be the hybrid that lies between the bus and the cab? How will it integrate with the bus, train and cab, and with the overall journey-infrastructure?

Explore how our interaction with autonomous vehicles will evolve. How will we integrate the full breadth of society with an autonomous future? What are the challenges we face by providing a less privately owned system? How will this affect how manufacturers operate and what implication will it have for us as the users?

How could it navigate small shared spaces and provide the flexibility the local community needs? What is beyond the bus and how could the interior space evolve to fit the needs of the occupants? Such vehicles need to provide mobility for all and should be capable of carrying as few as 10 or as many as 20 people. Differing volumes could accommodate differing interiors for a range of customers in tomorrow’s cities.

Examples

- Shared space vehicle. Could a vehicle be a roaming park bench?
- Would people treat the vehicles like a roaming herd of cattle?
- Could services vary in times, volume, destination and in their interior facilities?

4 The crash-less future

The autonomous vehicle is now mainstream. Early in the 21st century autonomous vehicles are introduced alongside cars driven by people. They immediately prove more reliable and safer than drivers, reducing congestion and accidents. The result is that 'drivers' are increasingly seen as a risk to themselves and others. Thanks to spiralling insurance premiums, driving becomes a privilege, motoring returning to its roots, limited to the wealthy. Eventually people are considered too dangerous to drive and are only allowed on tracks or private roads.

As drivers are banned, autonomous vehicles continue to improve and are crashless. This leads to a relaxation in safety regulations. If vehicles don't crash, do we need airbags, crash structures or seatbelts? The efficiency gains from reducing vehicle mass means it uses less energy and goes further, with less need for complex connectivity with other vehicles, less equipment, less materials, less components.

Without a driver, autonomous vehicle architecture can change - for the first time since the car's creation. Exterior shape and interior orientation of passengers can be completely different. Manufacturing process can change. Low volume production is possible. Materials hitherto impractical will become valid. New materials will evolve.

As the user imports connectivity, does the vehicle become impersonal, detached, simply a space-tool, or even more connected, and an AI personality - a home from home, workplace, friend in need, or perhaps, just a taken-for-granted convenience?
Perhaps there will be a wider range of mobilities, with a new concept of luxury space.

Design a vehicle for this future. If safety no longer matters, how does that affect structure, design and aesthetic, and how does passenger layout change and evolve?

Examples

- Paper bag car, or a car made out of a bubble….pop!
- Rucksack vehicle: collapses and expands to fit various needs
- The quiet car? Use your own device, and leave the car to its own devices.
- Does an autonomous vehicle need windows, four wheels or corners?
- What will it be, what will it do, will we love it or leave it, or luxuriate within it?

5 You talking to me?

Imagine a semi-autonomous future where driverless vehicles have to interact with drivers, pedestrians, cyclists, etc. as well as with the occupants.

How will we interact with autonomous cars? A lot of our current interaction with pedestrians and road users consists of gestures, body language, driving style and eye contact to convey a person's actions and intent. What happens when that human element is lost? How can a car that is autonomous replace the gestures that other road users rely on? How will the occupant communicate with the car?

Design a vehicle exterior based on gestures. How can we evolve current vehicle signage (lights, indicators) and adapt it to autonomous vehicles, that will have to interact with other human road users and pedestrians? Design a vehicle that will make the passengers feel safe inside and will convey strong indications of intent to other road users and pedestrians.

What does an autonomous vehicle sound like? Electric cars have distinct sounds but there is currently no differentiation between a normal and an autonomous vehicle. Research what autonomous sounds there could be. What could the makeup and structure be and can we use these sounds to inform a design language for autonomous devices?

Examples

- How can a vehicle be polite?
- Light, voice, sounds, gestures…
- Vehicle noise can be a means of communication

6 Community scout – sharing economy

With ownership of vehicles reducing and more urban users moving to ‘pay as you go’ models, will there be an increased demand from the companies or other groups who own the vehicles? ‘Time is money’ and a business is going to want to see maximum return on its investment. Will communities see common benefit in the village vehicle, the suburban service, the countryside car? Will commuters pool less money in common mobility? Will families combine two current cars into one future multi-mobility?

Corporates may see benefits in a smaller, more flexible fleet. Small communities may spend rate product on communal service rather than subsidise infrequent rural buses. People may prefer the cheaper shared car to

the expensive nearest-town taxi. Parking reduced, connections improved, costs lowered, there could be a case for a product and service between PSV and car.

Explore how a corporate could benefit with a more flexible fleet, how a community could connect and interact with a vehicle in a variety of ways, how groups of people could invest less in a more flexible mobility. It needs to be able to adjust and to adapt depending on the needs of the company, group or community it serves. From transporting goods and parcels to people and pets, from paperwork or sales samples to old, slow and younger, hurried users, it needs to provide a space that can be changed easily by the users wherever the vehicle happens to be. A secondary aspect of the vehicle is its downtime. As a semi-public vehicle how can it be used when it is not hired?

<u>Examples</u>

- Public transport by day and street cleaner by night.
- How can a vehicle serve the public space and juggle its responsibilities?
- Designed to multitask.

These 6 briefs provided a grounding in one subject area for each of the interns. This meant that the interns were looking at different subjects and operating in different spaces.

D. Workshops

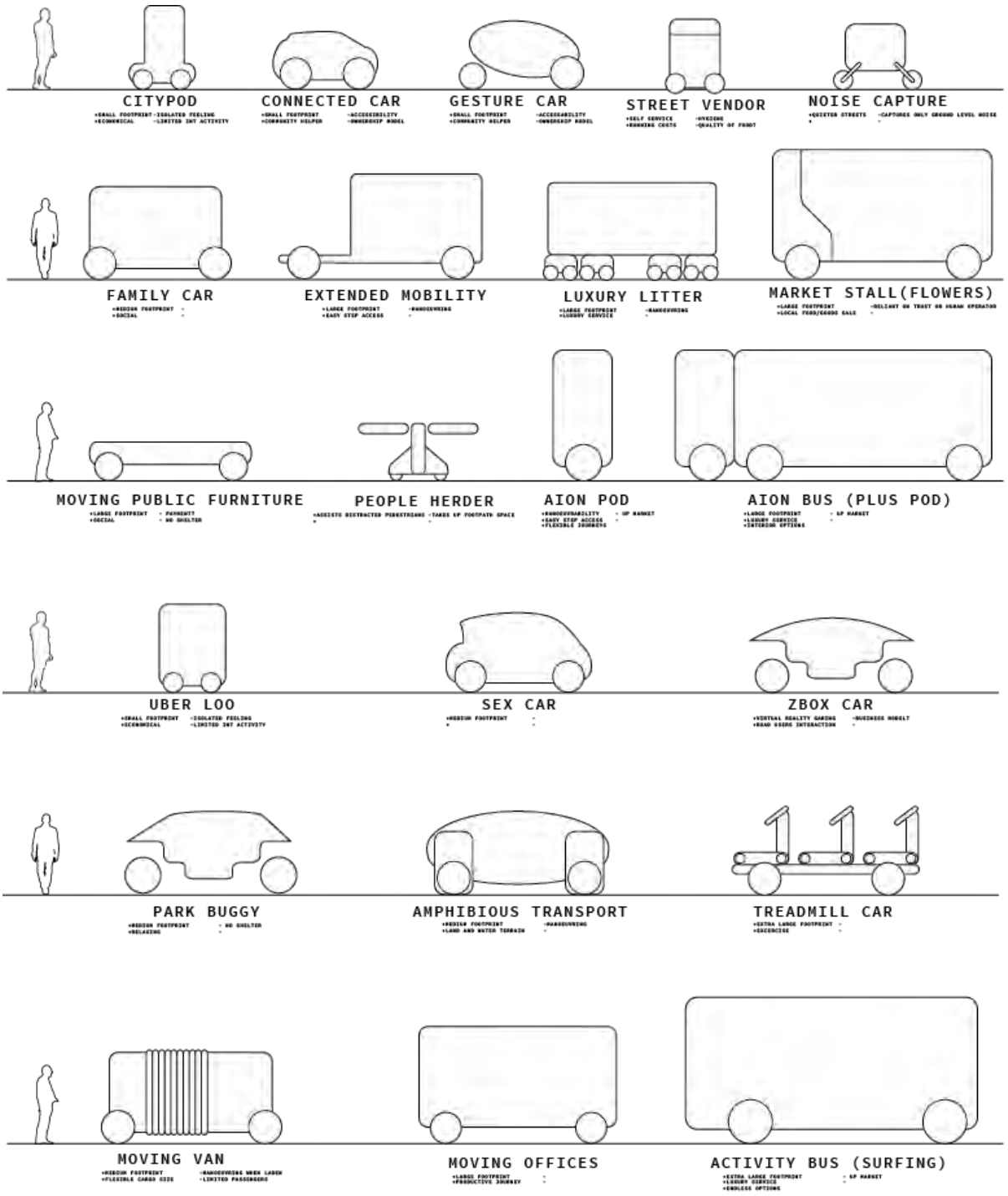
Using public opinion to help form and generate ideas was an important factor in the design process and all interns also worked as facilitators during the workshops.

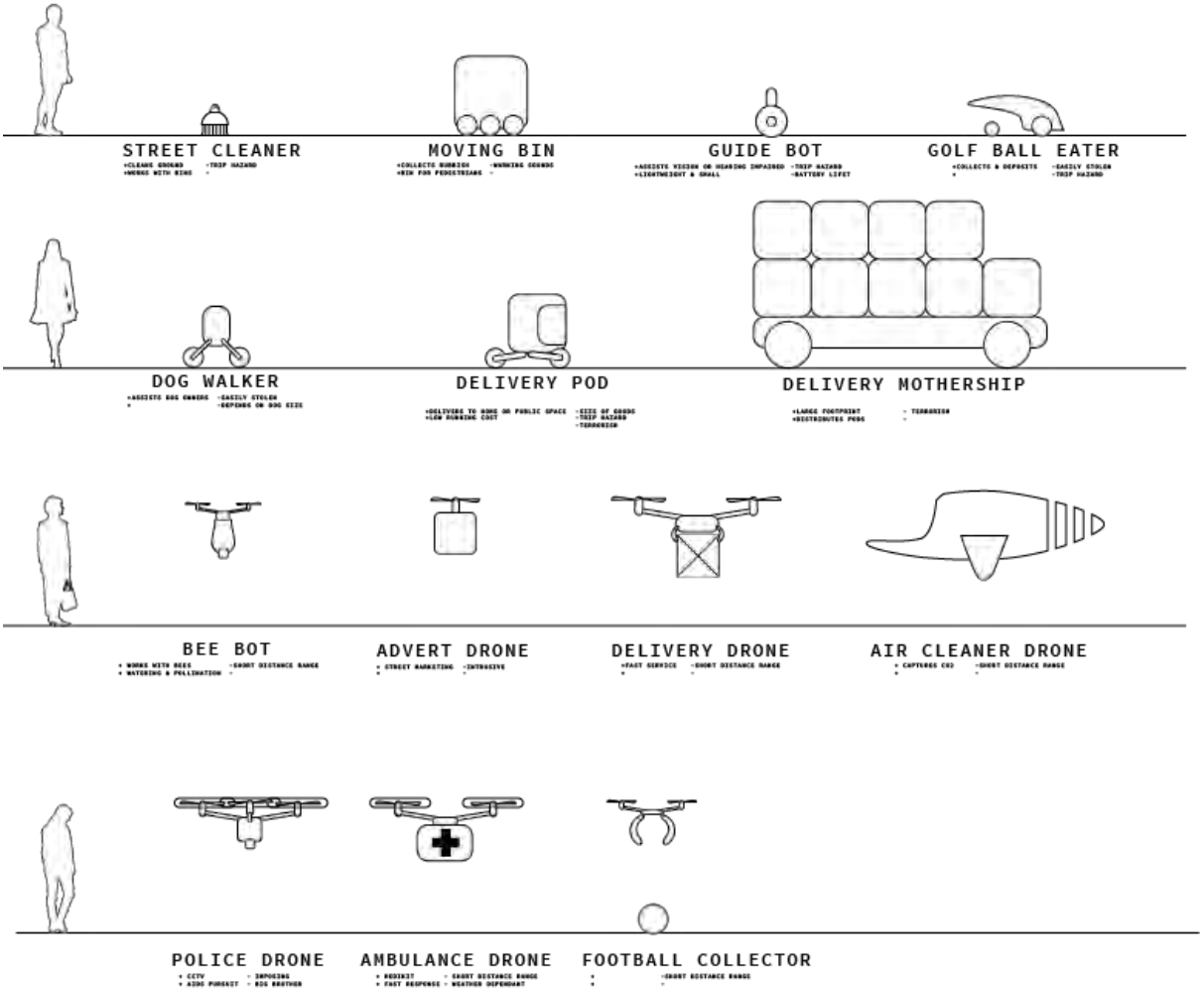
To help us integrate the ideas from the workshops, the GATEway team held regular design reviews of the projects that helped summarise the insights learnt from the workshops.

As the workshops were happening alongside the internships, the method of combining the design work and workshops was through direct interaction and insights gained from the workshop. This allowed a fluid transfer of ideas to move between workshop and design studio challenging the ideas of the interns and offering a broader perspective on the subject of driverless vehicles.

E. Outcomes

The outcomes of the project offered a wide range of concepts focusing on a variety of subject areas. The range of concepts developed are shown in diagrammatic form below:





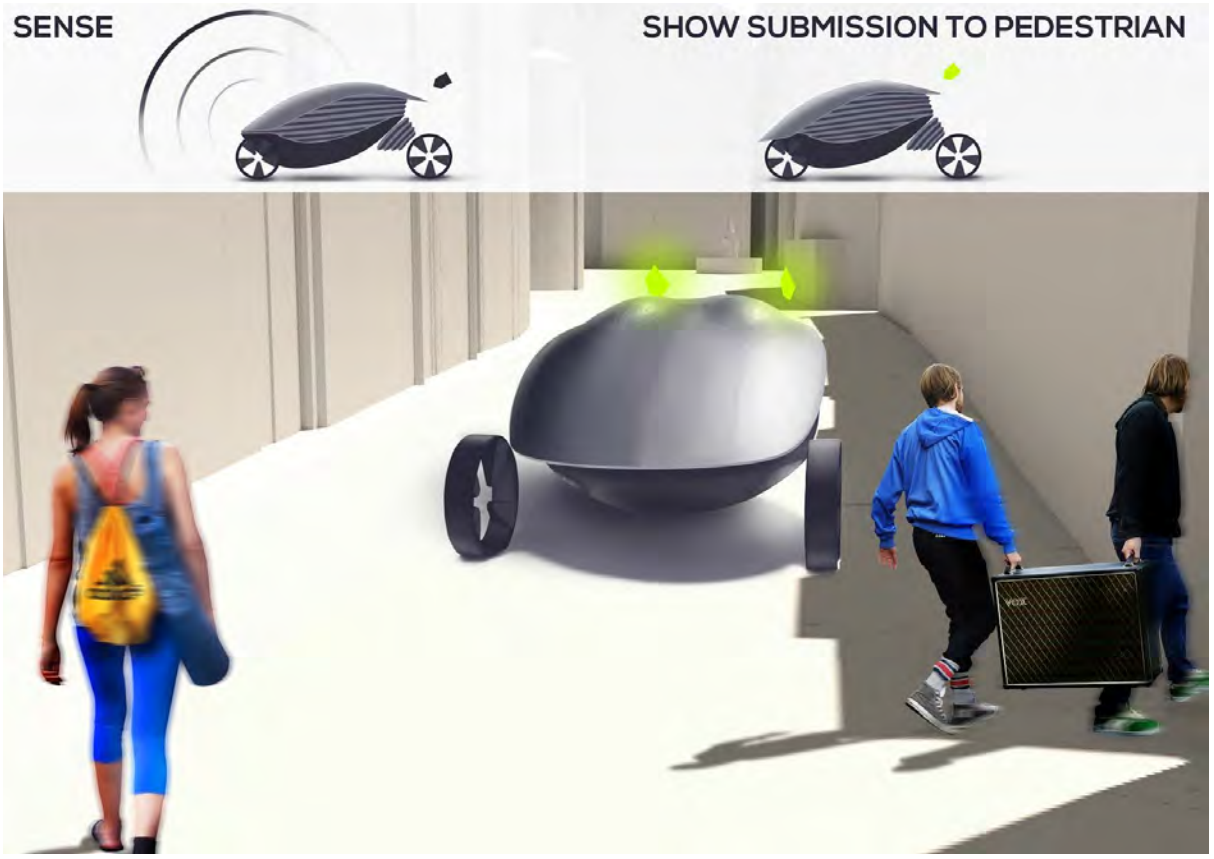
We highlight below a summary of some of the projects.

1. How can machines communicate with people?

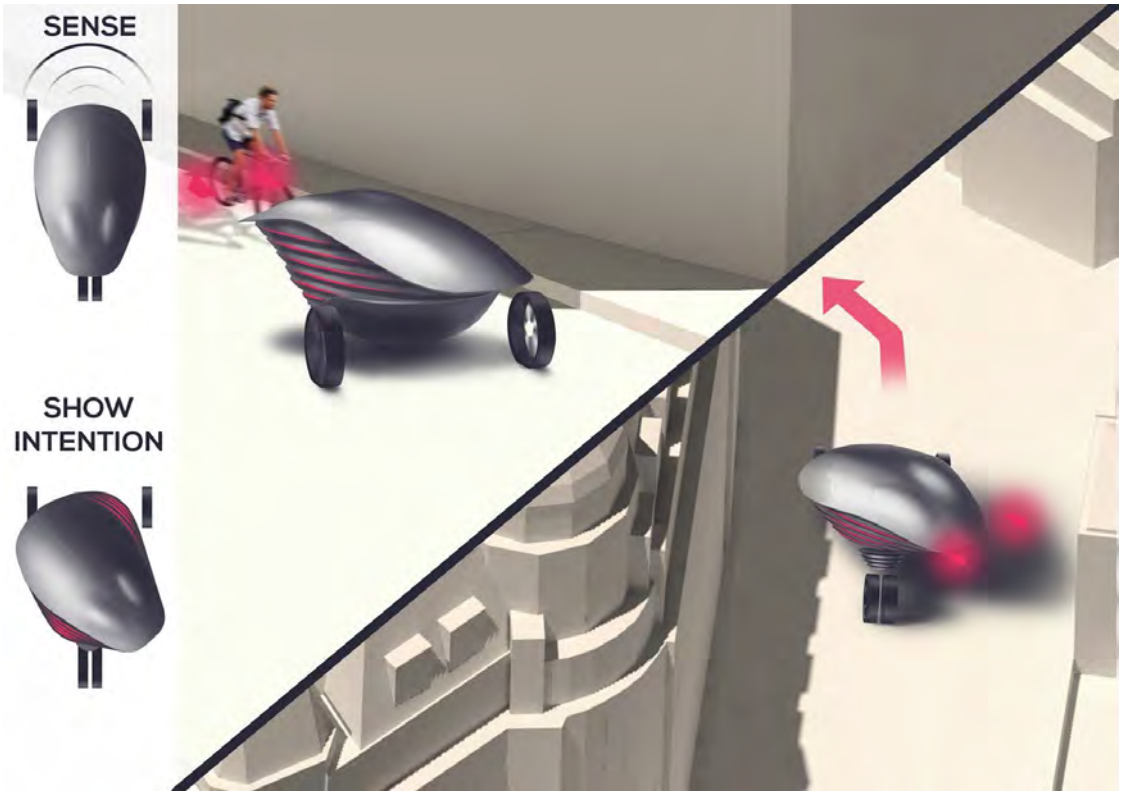
This project, developed by intern Roman Boretskyy, looked at how vehicles on our streets could communicate effectively with the people they share the space with.

Roman's idea was inspired by the gestures that humans and animals make to communicate with each other. He studied expressions and movement and created a series of gestures that could allow the vehicle to express a wider range of actions.

Using this methodology allowed the vehicle's character to be informed by the ‘emotion’ of what it was seeing and reacting to around it. The machine can be passive, happy or angry. Or submissive and courteous.



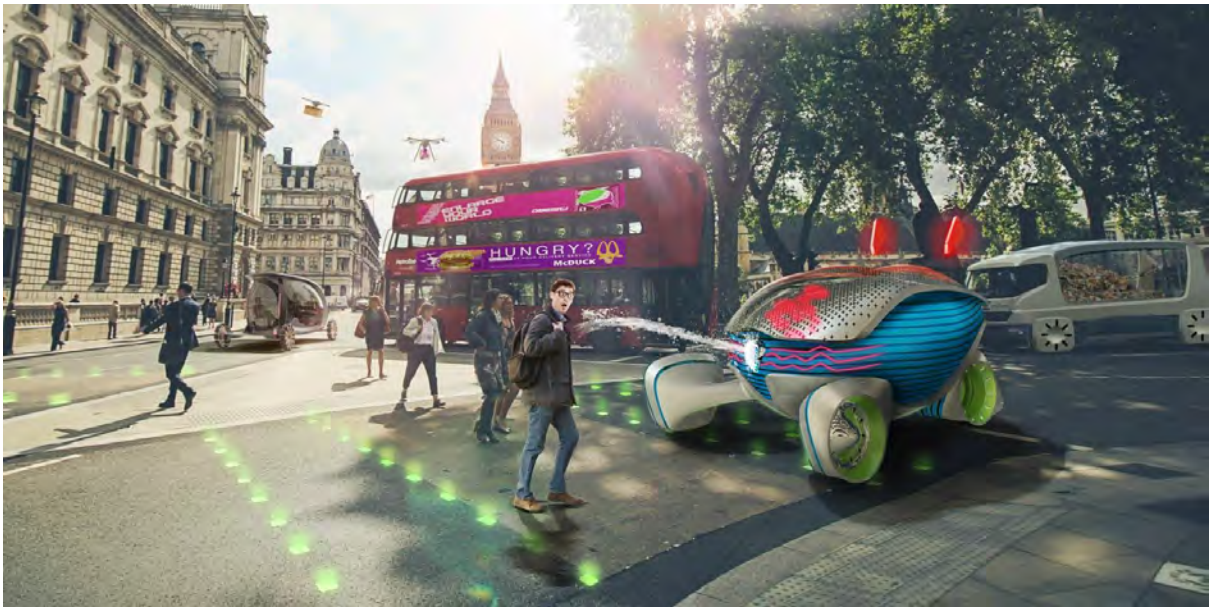
This project focused on the vehicle's movements indicating its intentions, unlike past projects that have used lighting or sounds as the main form of communication.



Vehicle indicating it is turning left.

One of the areas that was explored was the ‘character’ of future vehicles. This concept suggested that it could understand human behaviour well enough to react when it ‘feels’ it is being misused or obstructed on purpose.

This could be enhanced by the passenger expressing how he or she is feeling on the inside of the vehicle being expressed on the outside.



Vehicle upset by pedestrian crossing the street when the car is trying to pass.

Vehicle ‘bowing’ to the pedestrian and displaying silhouette of the person on the vehicle to indicate that is has seen them. This concept comes from IDE students working with HHCD who were developing a prototype system Humanising Autonomy.

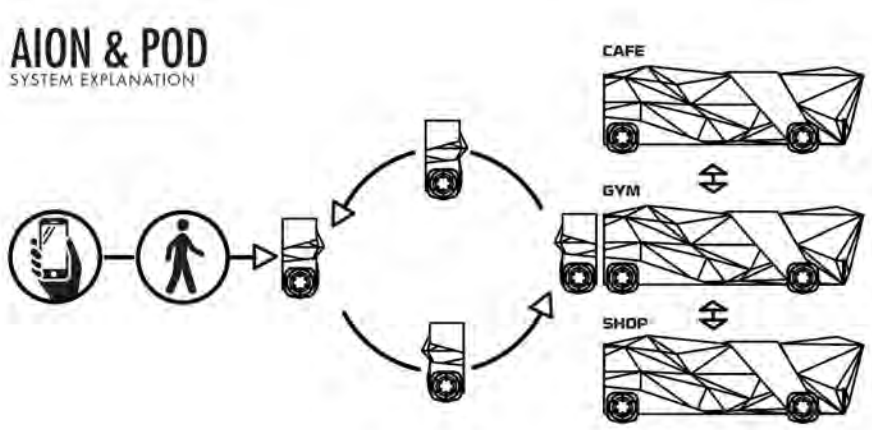
2) Urban Bus System (AION bus & Pod)

The AION system was designed by inten Paul Piliste. The project looks at how the interior of driverless vehicles could affect our future journeys. Today, millions of commuters spend an average of around two hours commuting per day.

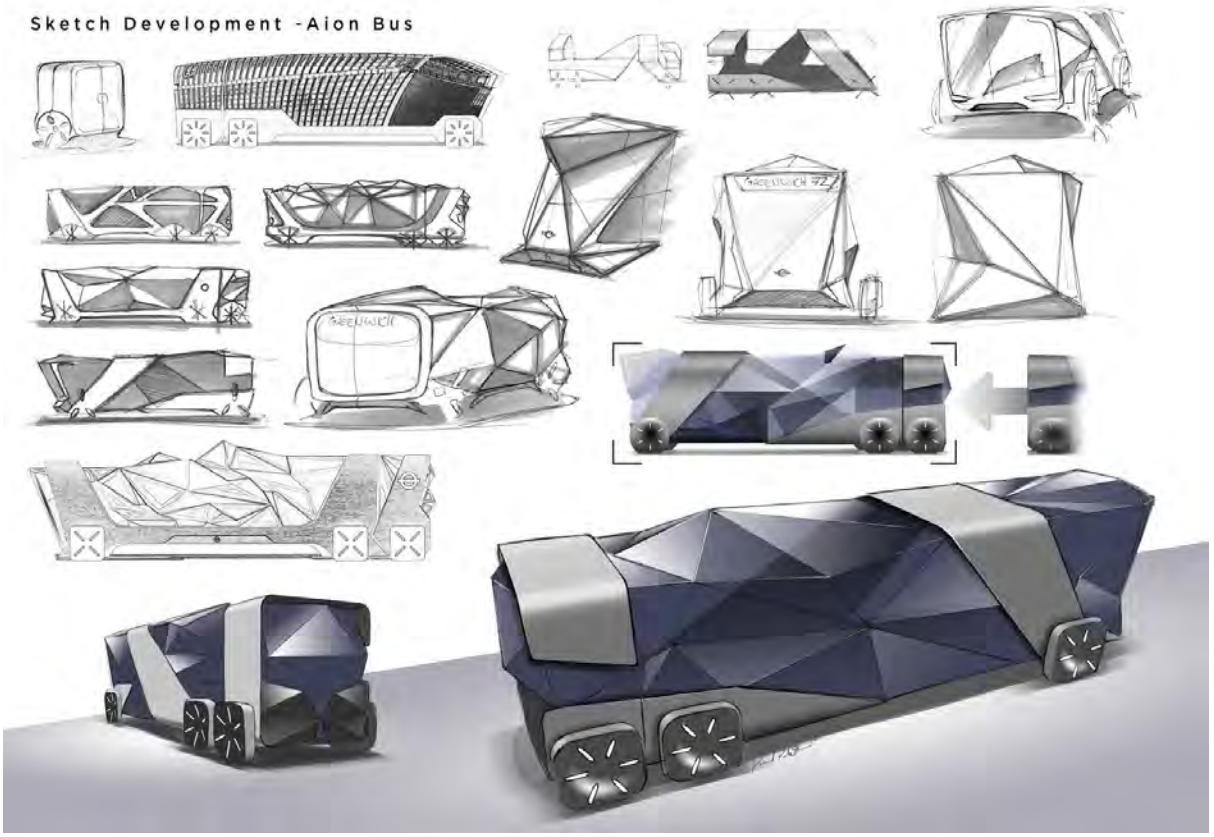
The Aion Bus service is designed to offer ways in which our time can be spent during these journeys. This could be time for sleeping, relaxing, and spending time with our friends and families.

The introduction of driverless technology has the potential to produce new services, offering people choices and flexibility in their everyday commute.

The system works without bus stops. Instead you are picked up by a ‘pod’ that takes you to the Aion bus that is constantly moving for efficiency of journey. The pods role is to deliver people to and from these constantly moving platforms.

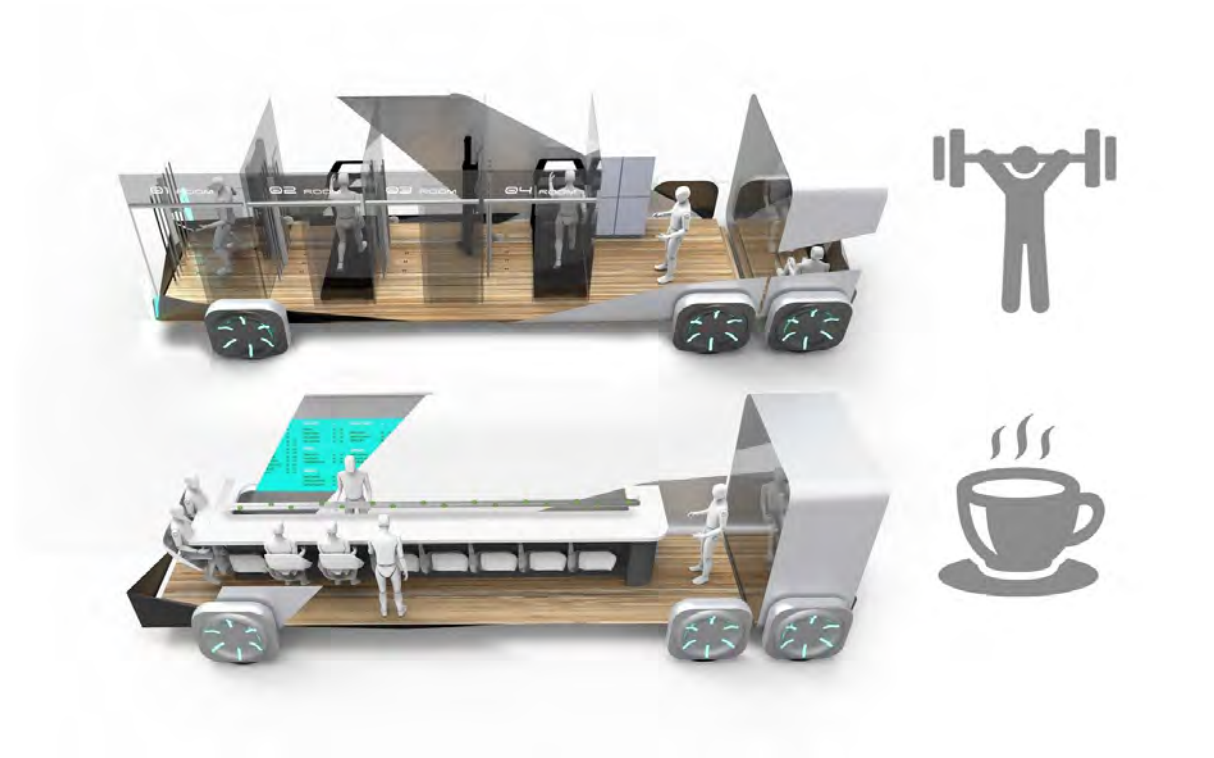


This systematic feature aims to reduce the journey time and offer the comfort of having a door-to-door service. Using an app, the services you can order include: a cafe´, gym, lounge and even your favourite clothing shop.



Inspired by modern architecture, the concept was to reflect its surroundings and present the city in different, yet captivating angles.

The interior spaces would be designed depending on what was being placed inside the Aion bus. Below is an example of a moving cafe, but it could be a gym, lounge, shop or bar. It would be down to the operator to decide how they think the space would best serve the commuters.

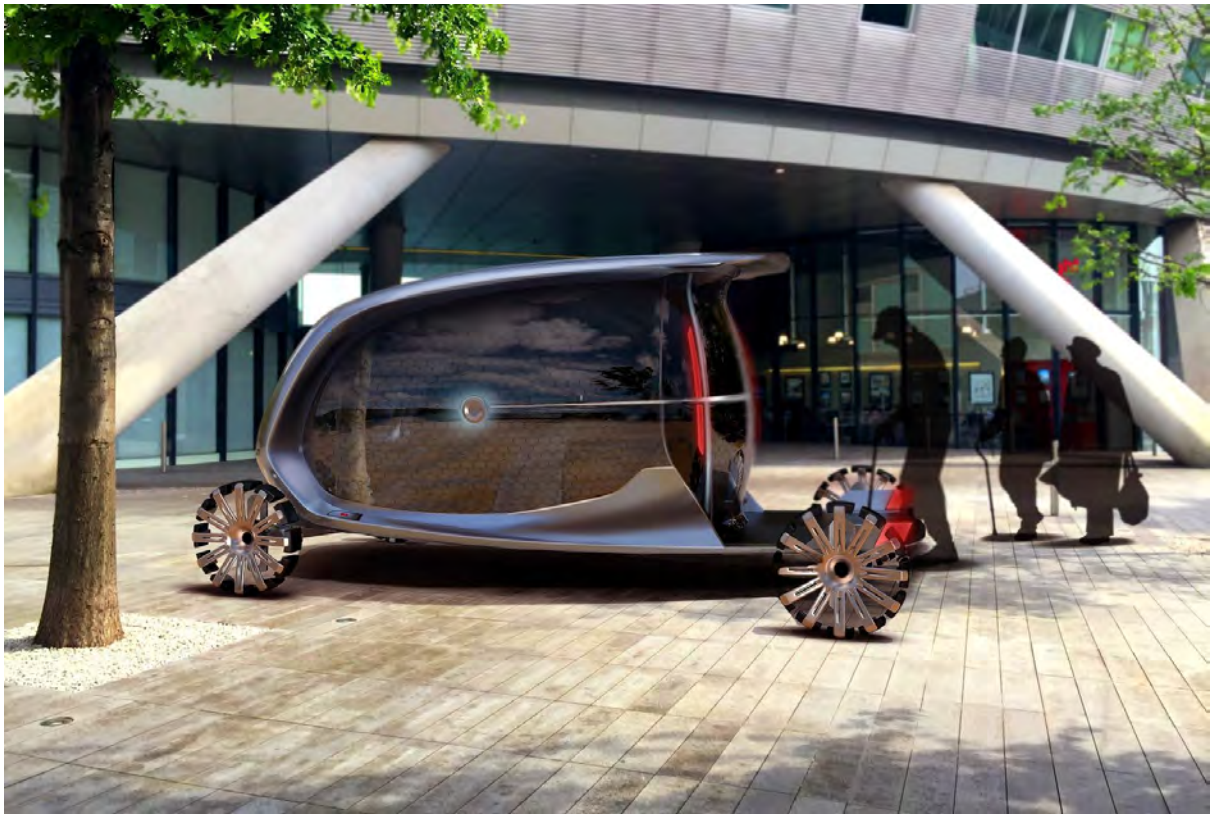


The Aion bus also has the potential to fit into a dystopian world. If the cost of rent continues to rise in high street retail spaces, the risk is that these retailers may become mobile platform businesses, and eventually abandon the high street all together.

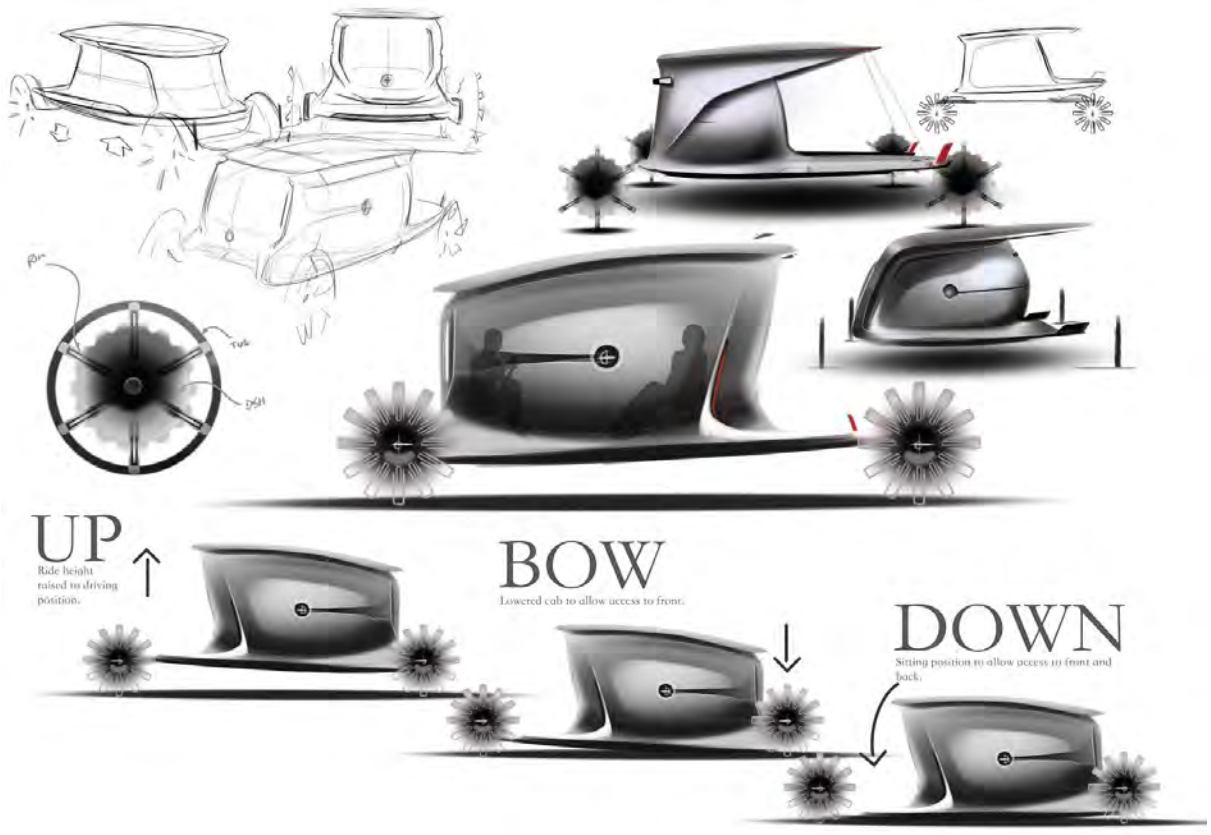
It is clear that autonomy can put driver jobs at risk, however, the Aion can offer alternative work as a service person on board any of the offered services.

3) Extending mobility

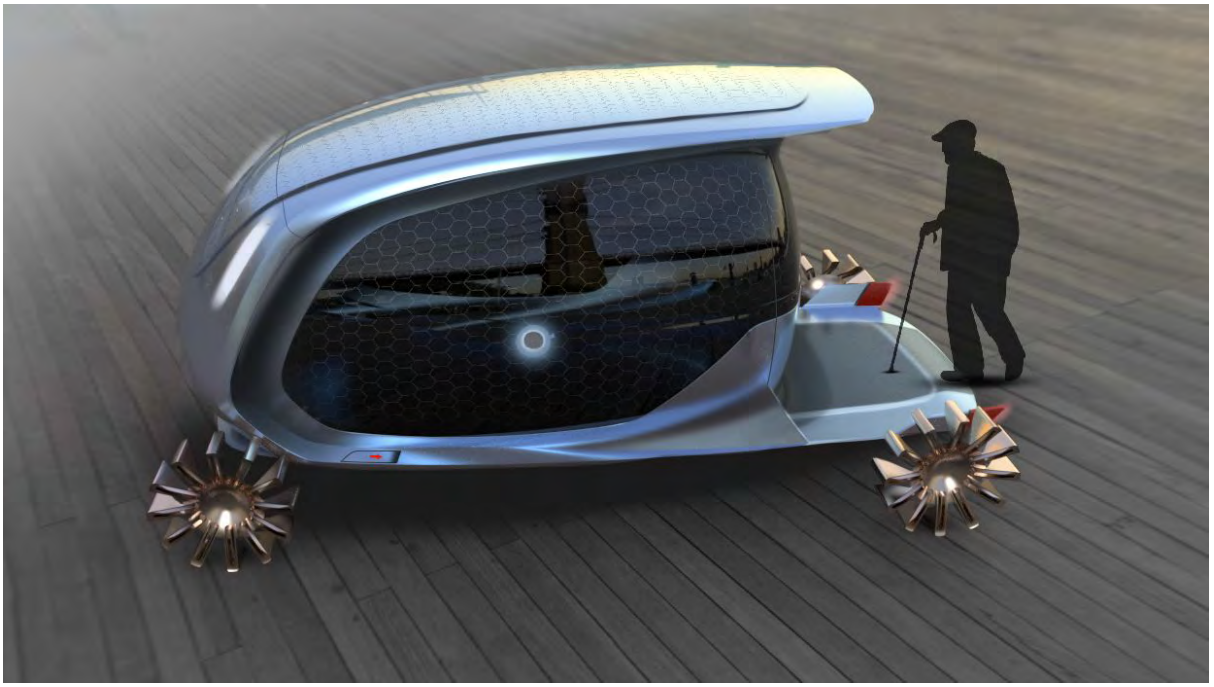
The extending mobility project, designed by Sam Johnson, looks at how mobility in older generations can be designed for, using simple solutions. This focuses around ease of access and integration of accessibility devices like ramps, to remove the stigma of using ‘mobility devices’.



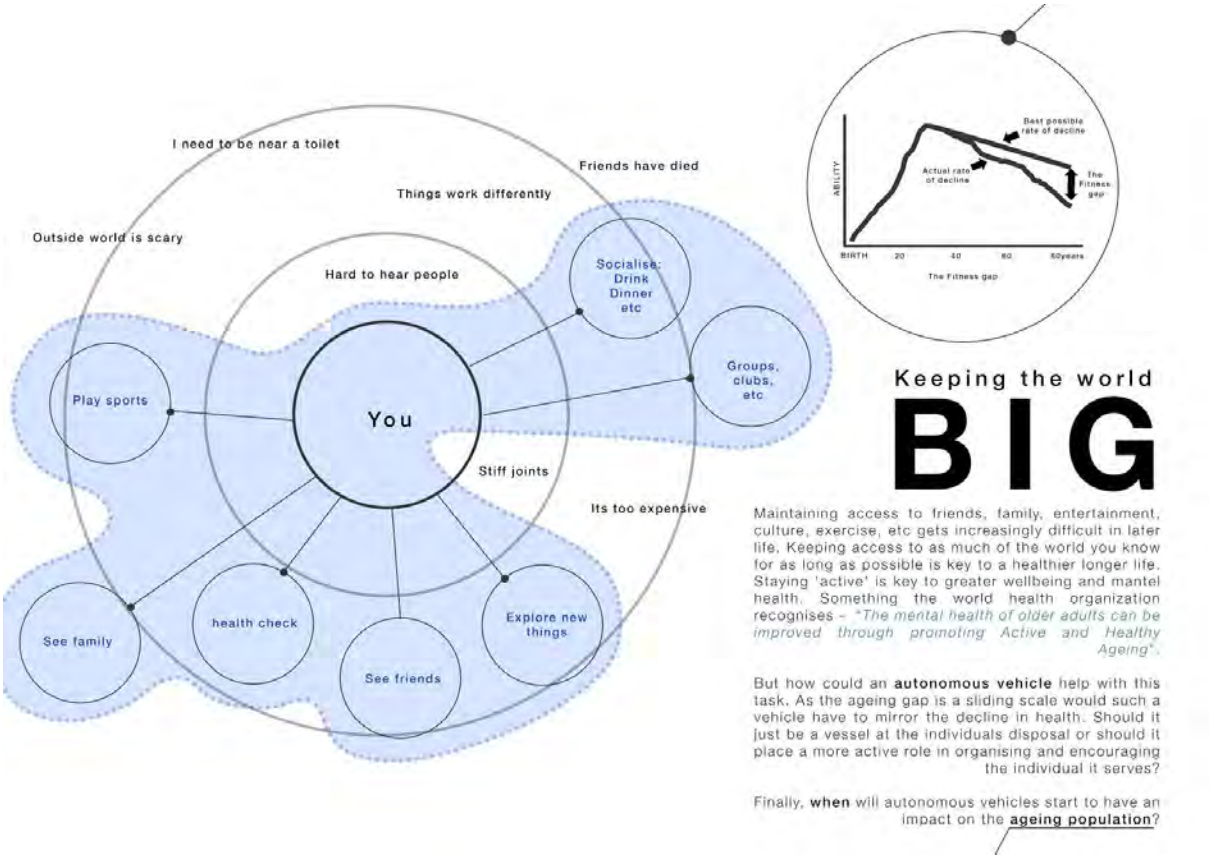
The vehicle's design makes it accessible in three key ways. It incorporates a body that can sit on the floor or adjust to any height that is convenient for accessing the vehicle, allowing occupants to enter the vehicle with greater ease. It also incorporates a ‘ramp’ into the design to allowed users in wheelchairs easy access. Finally, the vehicle height allows occupants to stand in rather than having to ‘shuffle’ themselves in.



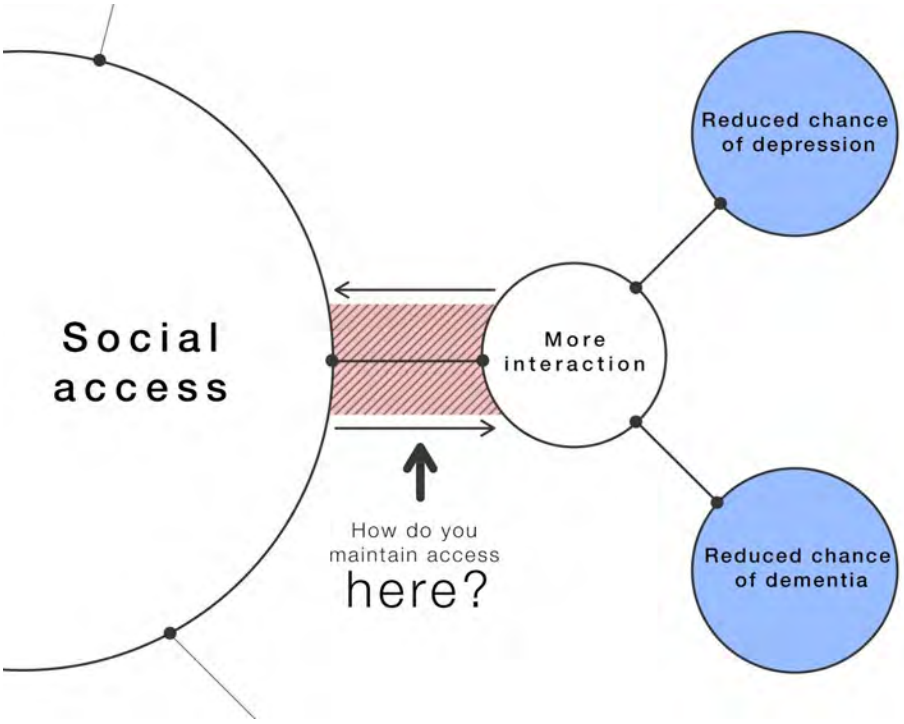
The purpose of this is not only to allow easy access but also to encourage adoption and use of the vehicle by older people who are not necessarily digital native and who can suffer from lack of mental stimulation.



The aim of the vehicle is to encourage older people within a community to remain socially active and to keep their world as big as possible for as long as they want.

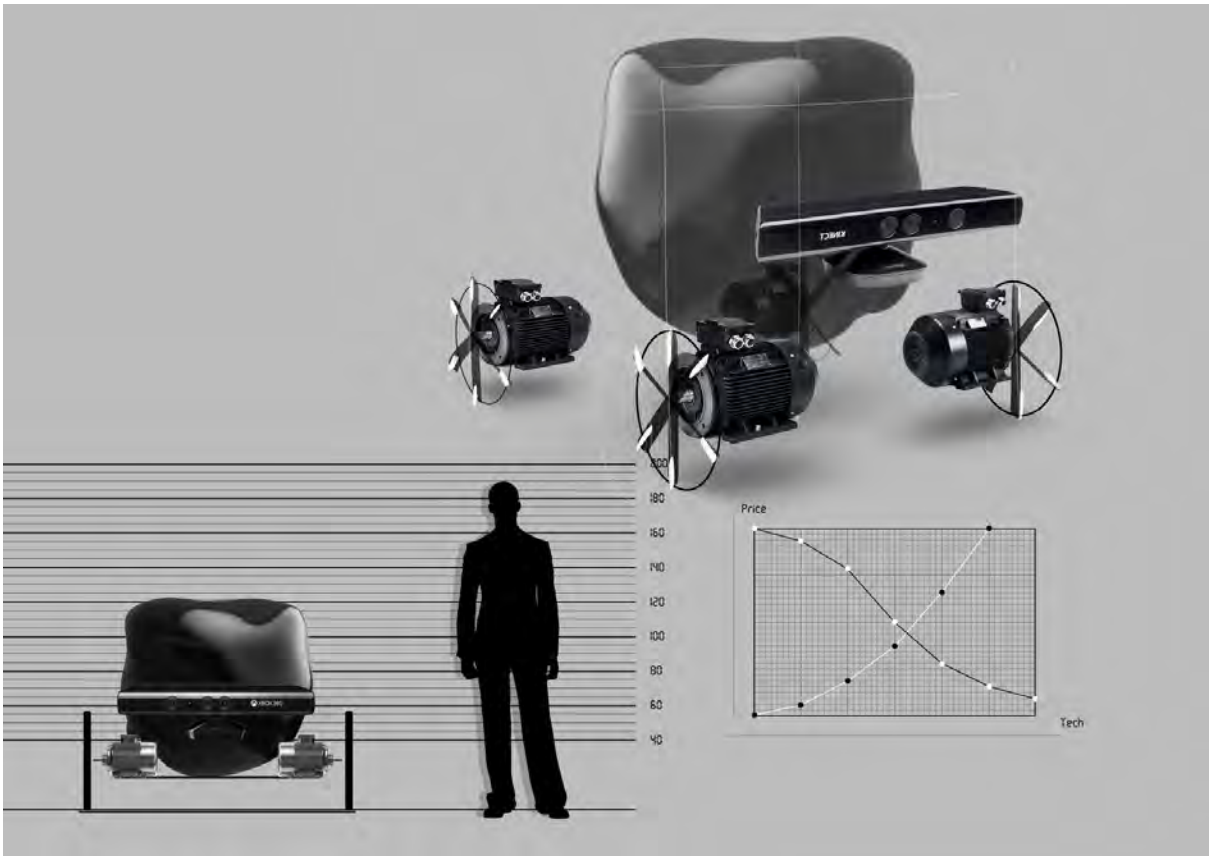


This vehicle aims to act as an enabler for social access and improving mental health whilst not drawing attention to disabilities and providing a multipurpose space that can be repurposed for multiple users types.

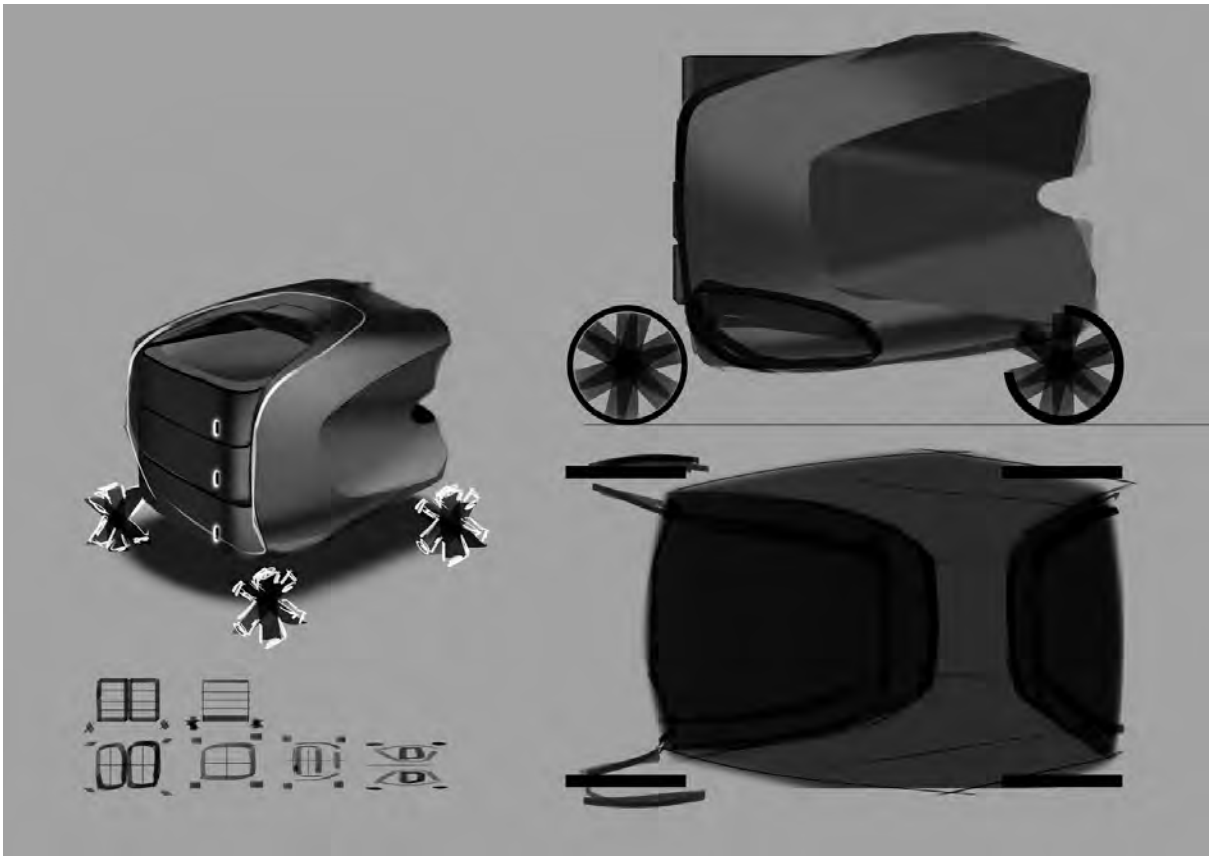


4) Last mile delivery

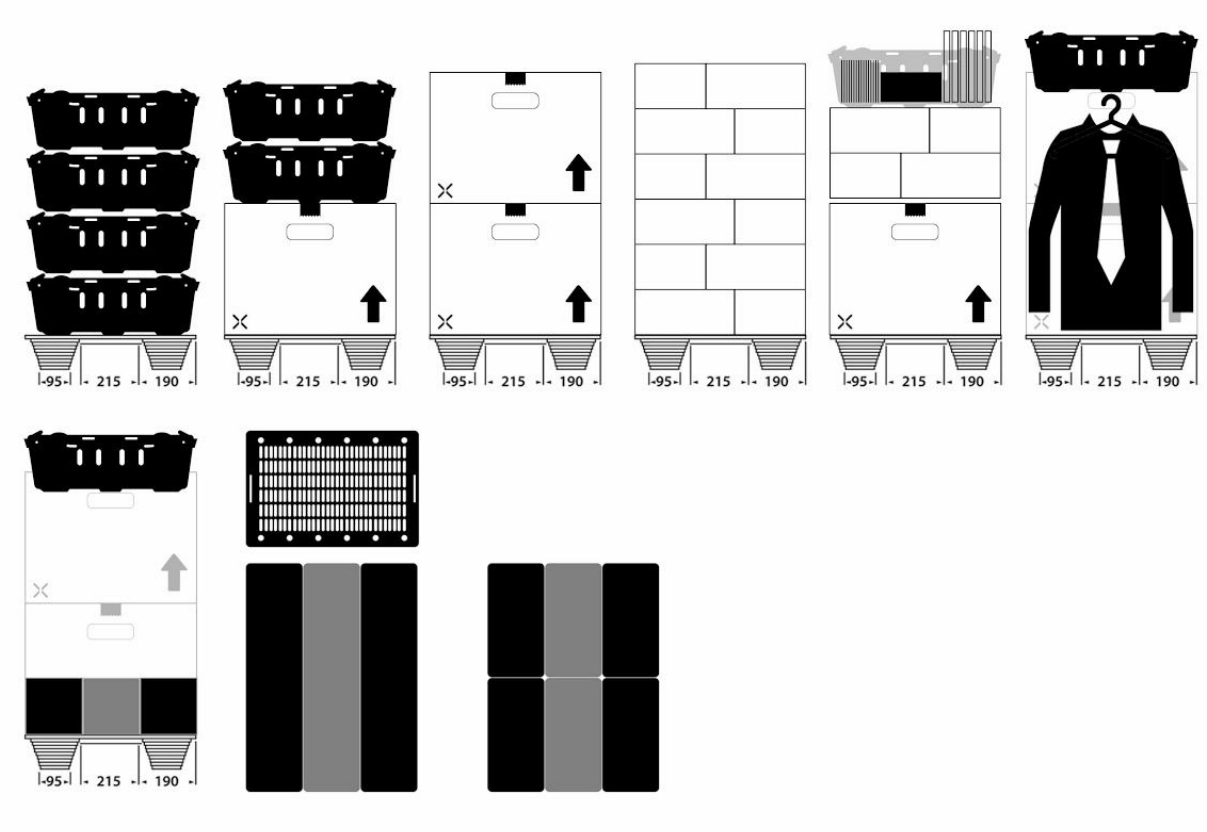
This project designed by Daniel Quinlan looks at how driverless vehicles could affect how our goods are delivered. The world's delivery network is extremely efficient as well operated systems that can transport an object from one side of the world to the other in hours. However, 'last mile' delivery remains an often slow inconvenient process that that can sees the end customer frustrated.



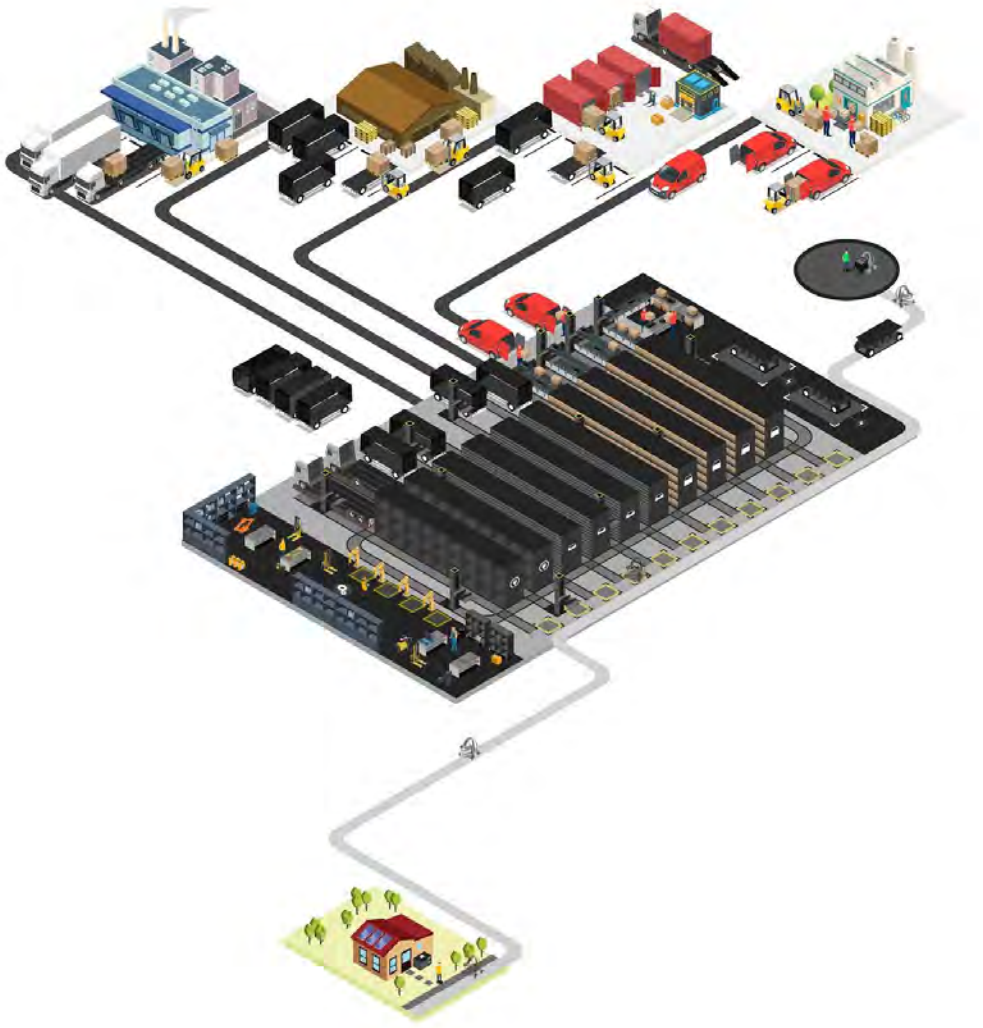
To tackle this problem the Road Drone is a small vehicle that eliminates these inefficiencies. Instead of one large truck or van there are a swarm or team of vehicles that deliver multiple goods or services to multiple people at the same time rather than one large vehicle delivering slowly in sequence. Resulting in a more efficient system.



This road drone when added into the current system not only enhances the efficiency but simplifies it. It allows for a more fluid and dynamic network. So that it is possible to order a product and have it delivered in minutes rather than days, like we see with certain manned delivery systems today, such as fast food delivery (eg Deliveroo) or a private courier on a bike.



The system, vehicle and processing hub was redesigned in this project to show the possibilities of a fully automated system. Instead of packaging products this proposed system suggests a new type of ‘Smart Tray’ that with the aid of an RFID tag removes the waste of packaging in the system and speeds up the process.



The implications of this product might enhance our daily lives by providing services to assist us in day to day tasks and bringing ‘just in time’ services to our doorsteps. This system generated also influences other autonomous systems in our homes that could be designed to work in conjunction with the delivery system. Need some milk? Order it from your phone and 10 minutes later it appears in your fridge. The benefits of this could have a broad implication but could also encourage bad habits that are enabled by the system.

Daniel also looked at the broader implications to the driverless delivery system. It has the potential to take away jobs and increase unemployment within the delivery sector. So should part of the responsibility of designing these machines and systems incorporate human assistance or could this type of technology open other job opportunities? These machines working in the background 24 hours a day have the potential to make our lives and companies work much faster and more efficiently.

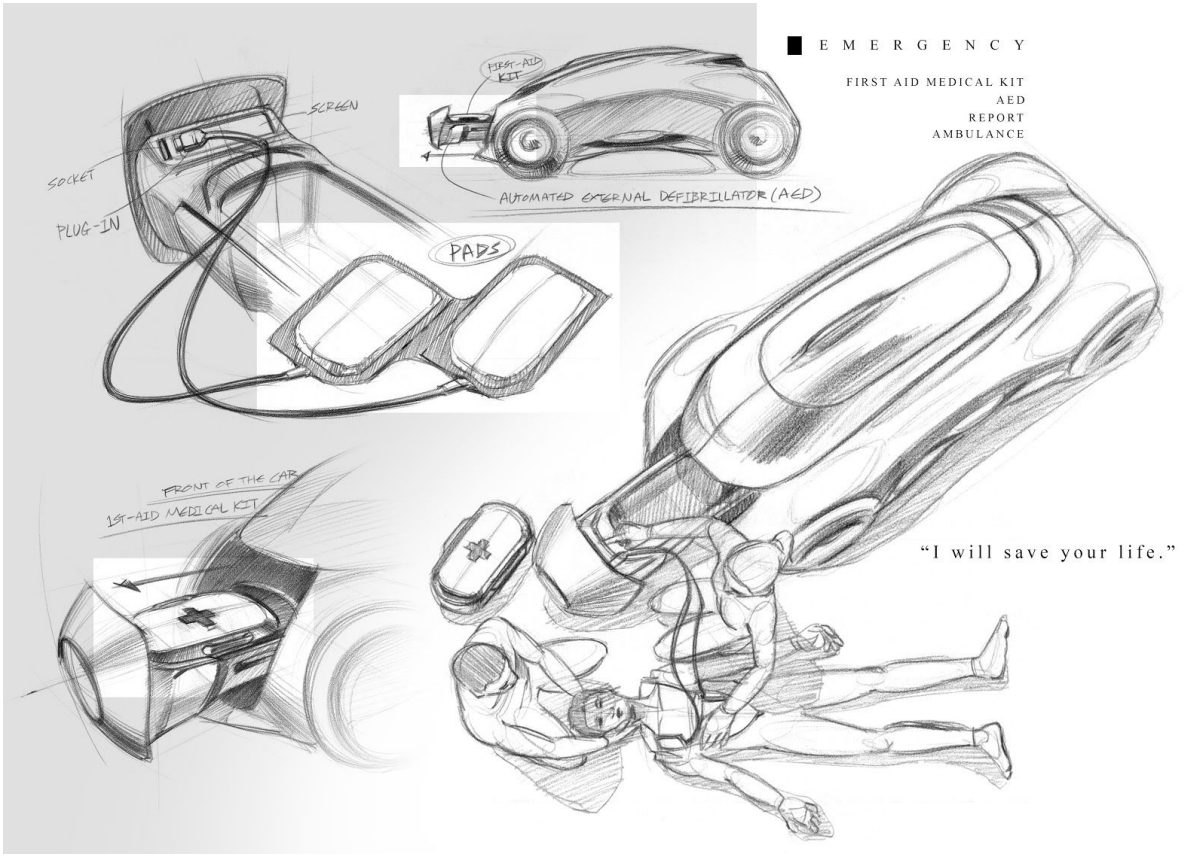
5) Secret life of cars

The secret life of cars project bas born from the statistic that current cars on average spend 95% of their time stationary. This mass of static vehicles fills up the streets and wastes a huge amount of space.

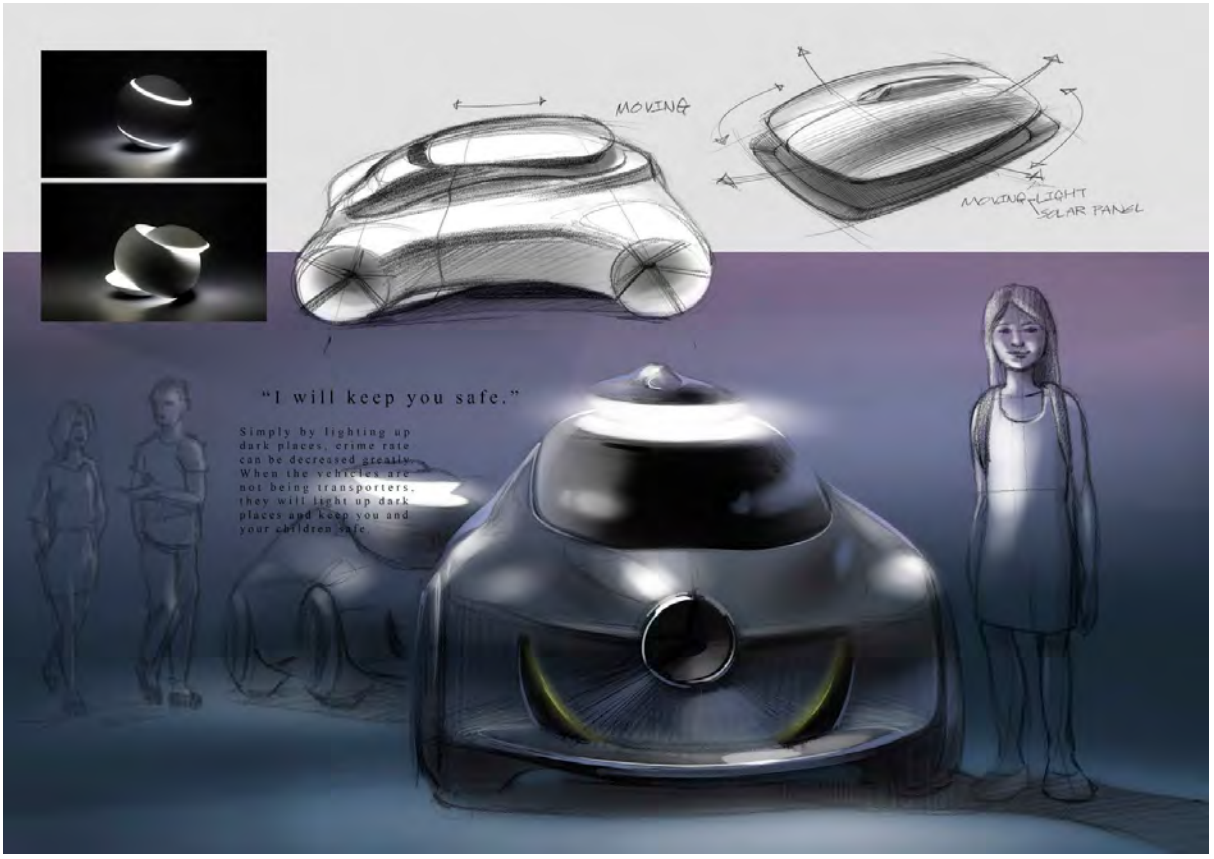
But with the introduction of driverless cars, that could all change. Your car could have its own life finding the best sport to collect solar energy to charge itself or earn its keep by being a taxi whilst you're at work.

Intern Dongwon Lee developed this concept and looked at the vehicle as a superhero of the local community with the idea that is could assist when it was needed.

Although the one person vehicle's primary role is to operate as a small city commuter vehicle it has a range of additional abilities.



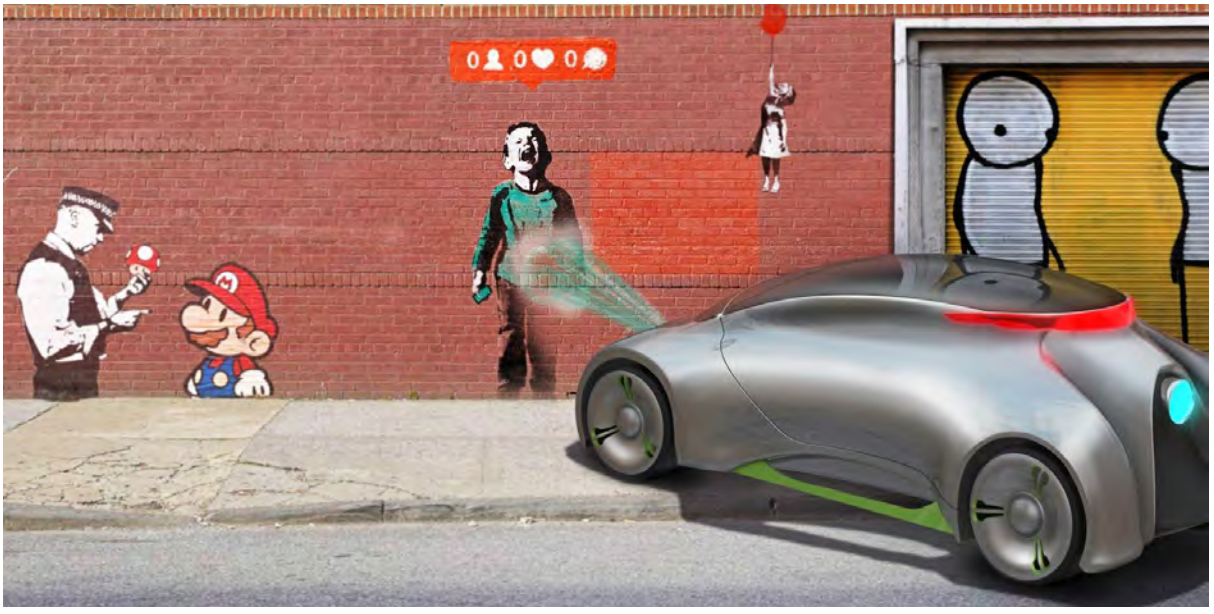
It could provide basic medical assistance to first responders providing vital first aid in an emergency. It could be used by the police as a roadblock or to cordon off an area.



It could provide support to the local community, providing light to the surrounding area or guiding people home.

Finally it could also be hired by owners who were comfortable with the idea of sharing their vehicle. The car could provide a peer to peer taxi service like airbnb.

Don also explored the possibility of hacking. With superheroes comes super villains. With the onset of driverless vehicles also comes the possibility of a hackable vehicles.



Here the vehicle is spray painting a wall. But it could be used to carry out all kinds of crimes. Driverless vehicles being used to rob people on the streets, intimidate individuals selected by the hackers or carry out remote assassinations, with all the memory wiped before it's delivered back to the owner.

Virus protection currently runs at around 30% efficiency which suggests that the vast majority of harmful programs are not even known by the protectors of our electronic devices. When you consider that the ‘device’ is a 2000kg car, it becomes a larger problem.

When you get back in your car at the end of your days work you many have no idea what it's been up to..

6) Sound of the city

Intern Cameron Smith explored the idea of sound and noise in urban environments. With the introduction of autonomous vehicles comes a variety of ways we can view pollution. He suggested that with the reductions in traffic and congestion from cleaner, quieter autonomous vehicles, Noisy old cars could be perceived as dirty.

He went about this by defining the difference between sound and noise, comparing them to flavour.


SOUR
BITTER
SWEET
SALTY
HARMONY
RHYTHM
BASS
TEMPO

The perception of noise in the city is something that we currently take as something that goes hand-in-hand with the urban environment. However with the reduction of traffic noise, it could amplify the remaining noise on the streets.

This solution offers a service that ‘cleans’ noise using the Aura bot. The bot travels around the city finding sounds that have been defined as’ bad’. This system could be supported by the public highlighting ‘noise sports’ or could be the responsibility of the person or people generating the noise to hire an Aura bot.

For example if roadworks or drilling is happening, Aura bots could be used to reduce the sounds.

A more controversial use of the bots is for loud sports cars. Some people find the sound of sports cars unpleasant, whereas other like the noise. This raises the question of how sounds and noise are defined and could the introduction of Aura bots effectively become a tax on sound?

7) Bee bot

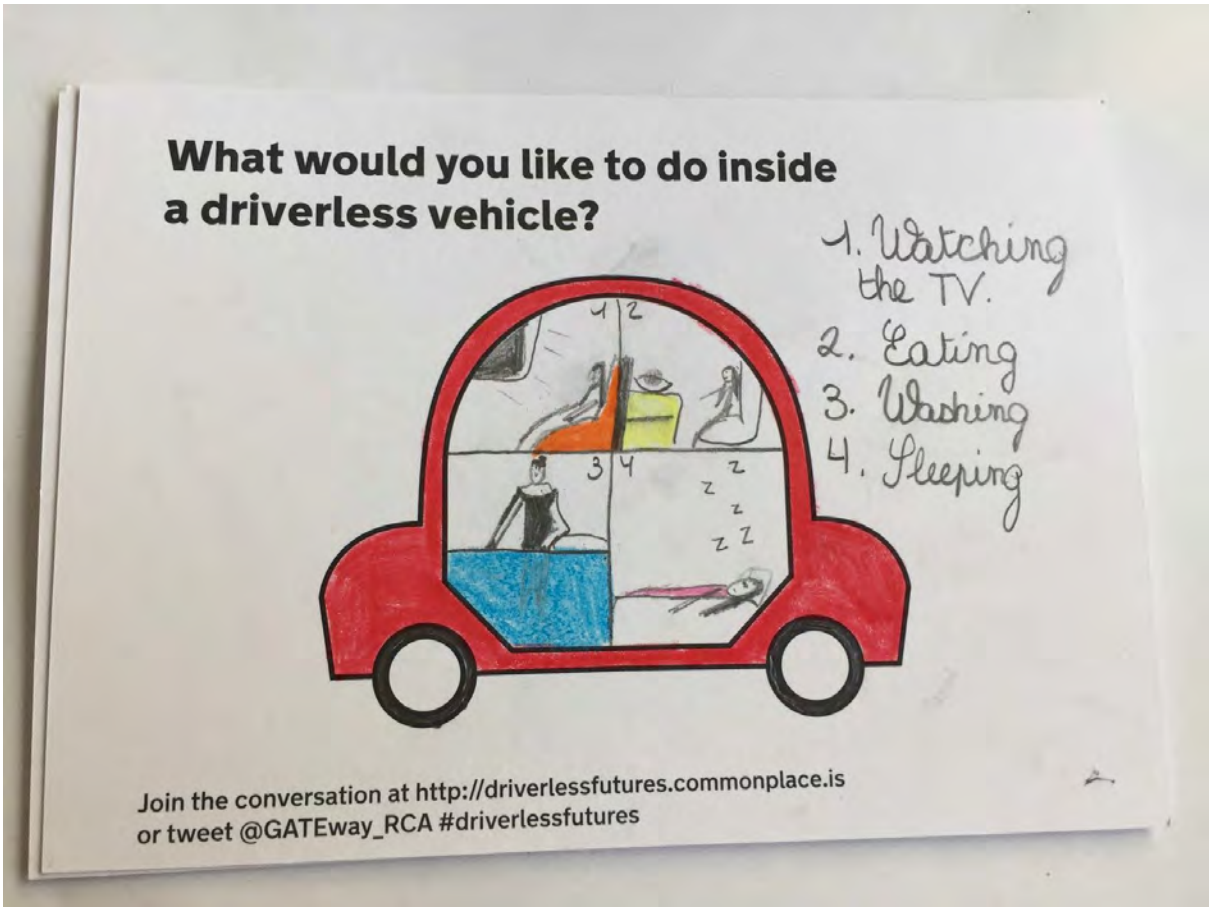
Bee bot looks at how our urban landscapes have affected nature and the ecosystem that animals, birds, insects and plants support. With the declining number of bees in the British isles will we need to find a replacement method of pollination.

The Beebot concept looks at how we may be able to use autonomous drones to replace the declining number of bees. This opens up the possibility of a wide range of autonomous urban ‘gardeners’ that could work within our cities to keep air clean, grow local produce and support the urban ecosystem.

8) Shower car

The shower car concept developed by Cameron Smith was a playful idea that identifies tasks currently reserved for the home or static buildings, that could now be brought into a moving spaces.

This concept does not necessarily suggest we will be showing on the move whilst going to work. But what it does do is open the door to a whole range of opportunities of how we could use the automotive space. It changes the area of automotive design into mobility

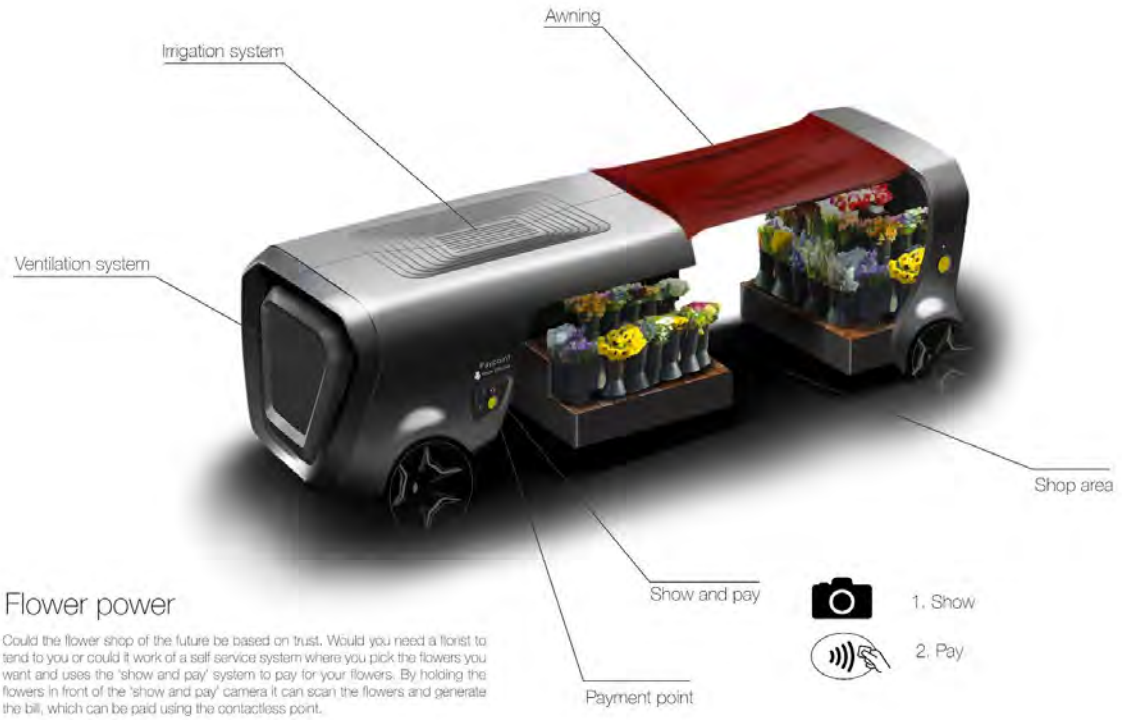


This idea of bringing parts the home with you has been repeatedly suggested and raised by participants during workshops with a range of activities and facilities suggested (see Uber loo). This suggests that ideas like the shower car should not be dismissed so quickly.

9) Future of markets?

This concept explores how a trust based system could operate with mobile markets that come to you. The designer, Sam Johnson, asks the question: ‘If we are moving towards services being provided by machines, could a flower shop (for example) be based on trust’?

The concept works by self service which has become commonplace in supermarkets. By holding the flowers in front of the ‘show and pay’ camera it can scan the flowers and generate the bill, which can be paid using the contactless point.



The benefits of this type of system could be fresher produce delivered to where you are, when you need it - partially inspired by Disney's 1958 film ‘The Magic Highway’. However, basing the system on trust is a difficult to implicate what happens if someone walks off without paying. Would the vehicle need its own inbuilt surveillance system and if it does, is it really working on a trust basis?

Either way it could offer an interesting social experiment to see if the benefits of reviving a delivery of fresh produce that you can select, wherever you are at, potentially a cheaper price, is respected or abused?

10)People herders

This dystopian concept developed by Cameron Smith looks at the reliance we have on mobile technology and our using it in public spaces. This satirical concept suggests that in the future, pedestrians will need assistance whilst navigating their way around the capital.

The solution to this is ‘people herders’ that will be on constant standby to guide and protect pedestrians who are more interested in what is happening on their mobile devices then where they are going.

This satirical concept raises the idea of the people being the problem. Most of the mistrust in machines are blamed on programming errors or malfunctions. But with so many variables that a cityscape with people in it bring. Will AI be able to react to a person walking out in the street without looking? And who is to blame if the individual is hit?

11)Dog walker bot

The dog walker bot was a project created by interns Cameron Smith and Paul Piliste. It shows how driverless vehicles could rapidly expand the range of services that could be offered by autonomous technology. Today people offer services such as ‘walking your dog’, but employing humans can be quite expensive.

In the future you could order a Dog Walker Bot and let it walk you dog for you, keep it company during the day and feed it when you're not at home. Using an app you can plan a route, see where your dog is on a map and see a live view from your dog.

This project is a good example of how autonomous technology could be used. but it also points to just how different areas autonomous technology could spread to.

12)Future cityscapes

Future cityscapes depict possible London scenes that play on how autonomous vehicles may change London. Designer Ralf Awani defined the scenes with utopian and dystopian themes.

The utopian scene looks at how greater efficiency of driverless vehicles could reduce the need to excessive roadway in urban environments. Allowing them to be repurposed for other uses. These spaces could allow London's many buried rivers to be reinstated and more green space developed, providing better air quality and more pedestrian spaces.

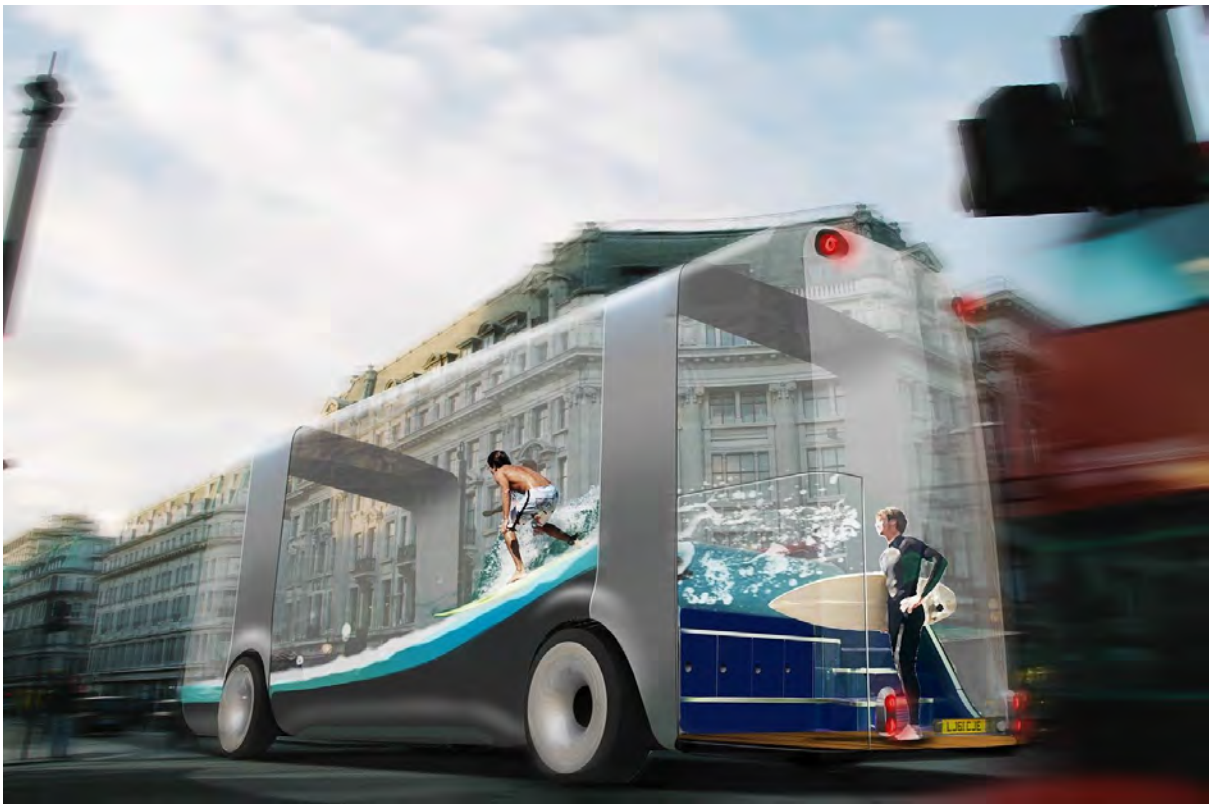
The dystopian scene plays upon the potential negative impact driverless vehicles could have on urban environments. With the mass automation of many service jobs, London's streets have become part hyper wealthy and part shanty town. This subject is also explored in the ‘excessive luxury’ project by Paul Piliste.

13)‘Uber’ loo

This project designed by Paul Piliste, looking at the diversity of future services using driverless vehicles and aims to tackle a common and often sensitive problem: How many times have you been in central London and needed to use a toilet? Many of us have experienced trouble finding a toilet, something that the Great British Public Toilet Map (greatbritishpublictoiletmap.rca.ac.uk) has working towards solving. This project explores how moveable facilities could become a service in the future.

The vehicle works using an app, using the current ridesharing service ‘Uber’ as a basis. Once ordered, the Uber Loo arrives and parks itself on the side of a road. When inside, the glass turns mirrored to create privacy for the occupant. The future could see a variety of services that aim to serve us.

14)Surfing bus

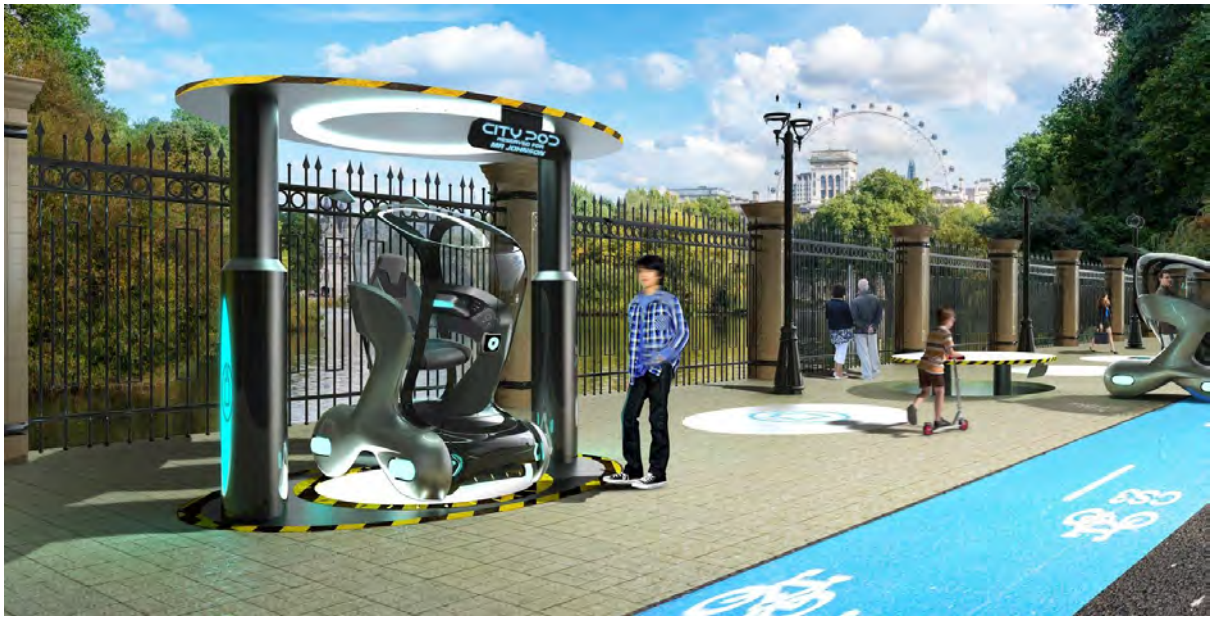


This project, designed by Paul Piliste, explores some of the most extreme uses of space inside driverless vehicles. Based on the idea of CAV (Connected Autonomous Vehicles), traffic does not have to stop at traffic lights and congestion is a thing of the past. This paves the way for larger vehicles more versatile without adding to congestion.

Inspired by this famous image of pilots playing tennis on the wings of the first autopilot airplane, the surf bus is intended as a provocation to today's drivers: who wants to be stuck in traffic when you could be surfing on an artificial wave?

15)City Pod - Isolation in the city

According to the US census 2013, today 70% of commuters travel to work in four passenger vehicles, on their own. This is wastes energy and causes traffic congestion. Designer Paul Piliste looks at how autonomous vehicles could be made more fit for purpose? Could the vehicle footprint be minimised to allow for optimised traffic flow?

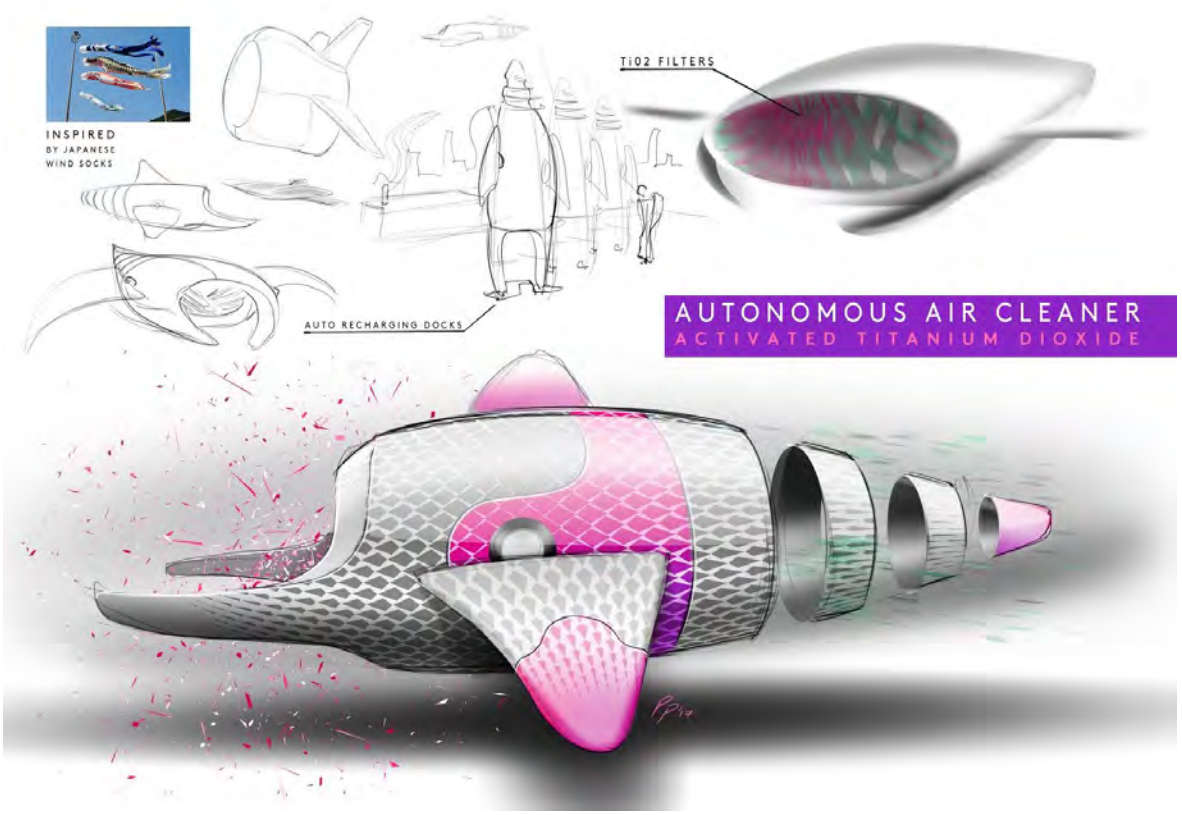


The City Pod is designed as a single passenger vehicle that can travel in flocks. City Pod can be ordered or collected in a similar way to the 'Boris Bike' stations seen around London. Once inside the pod the vehicle takes you to a predetermined destination and allows you to work, watch TV or socialise online, on the way.

Although single person pods looks at solutions of reducing congestion and allow individuals to move around the city with greater ease, it also raises questions regarding the negative impact it could have on the people who use them.

It is possible that people could become lazier if they are driven door-to-door everyday? It's also possible that people can end up feeling isolated, as human contact and interaction diminishes. One thing is clear that future design has a huge role to play: socially, culturally and psychologically.

16)Cleaning our air



London’s air quality has not been lower since the smog of the 1950s. According to the Evening Standard in 2017, scientists estimate that toxic air is to blame for a death toll of up to 9,400 people a year in London, with emissions from diesel vehicles significantly blamed for air pollution levels.

This project developed by Paul Piliste, looks at how autonomous vehicles could improve the quality of life within the Capital. The ACD (Air Cleaner Drone) is a flying drone that captures pollutants in the atmosphere, improving the air quality in the capital. Inspired by a manta ray, the drone floats with helium and uses its 'mouth' to capture particles and airborne pollutants.

The use of driverless technology in aerial vehicles is a subject that has not really been touched upon but has the potential to be a massive market.

17)Mobile food stand

Today, London’s streets are packed with people at food stands selling snacks, but what happens when it is more profitable to have a machine take over this task?

Designer Paul Piliste explores the possibility of mobile autonomous food stands and how they could affect the way we consume perishable goods and highlights what happens to the people who used to run the shops.

The hotdog stand contains a miniature assembly line that makes fresh hotdogs, and it uses contactless payment to avoid theft or robbery.

One theory is that in the future, the cheapest food will be prepared by machines, much like instant coffee machines today. To have a quality meal, it will be a luxury to have a person prepare your food, similar to a Barista in a coffee shop. This project raises many questions on the uses of autonomy and proves how delicate London's job ecosystem can be.

Also explored during this process was how driverless vehicles could affect other urban services. Below are a number of proposals exploring the idea of urban service mobility.

18) Guide bot

Designed as an easy to use alternative to guide dogs for the visually impaired, it is a wheeled robot that can speak to you and assist with wayfinding in urban environments. This project by Paul Piliste also looks at how autonomy can extend further than passenger vehicles.

People form friendships with their guide animals, but could technology replace the need for guide animals all together? Could we form a relationship with these vehicles and at what level of artificial intelligence would be required for people to feel comfortable talking to a machine?

19) Bins and street cleaners

Another project that looks at how communities can be assisted by autonomous technology. Street cleaning has already started the step towards automation.

It is clear that employing humans to perform simple tasks carries a cost, so if it were given to more cost-effective machines, how could it look? Autonomous street cleaners could be more compact than the current generation of machines and could work alone or alongside machines and people collecting rubbish, in a team.

The Street Cleaners could be supported by small scrubbers that clean the pavements and roads, working alongside the moving bins that collect rubbish and allow people to discard their waste. These machines could work 24 hours a day keeping the streets clean with minimal human intervention.

20) Excessive luxury

This project looks at how driverless vehicles may affect the automotive marketplace. With most new technology, when it is first introduced it can often only be afforded by the wealthy. We see examples of this today with most active cruise controls and other electronic aids being introduced into ‘executive vehicles first.

This concept combines this cost theory with the reduction in services jobs (see previous projects), reducing the possible market share and leaving driverless vehicles exclusively to the super wealthy. Designer Paul Piliste, was inspired by historical Roman excess designed a modern day vehicle of opulence. This two passenger vehicle is carried by servant bots that take the passengers to and from their destinations.

When the vehicle is not in use the eight slave bots serve the users by collecting groceries, dry cleaning or delivering documents. The interior features a voice recognition interface, privacy curtains, lounging seats and a robot arm that can feed you.

3. Project 2 (students)

a. Objectives

The objective of the student project was to gain a broader understanding of the future possibilities for driverless vehicles.

b. Methods

The project was organised by Helen Hamlyn Centre for Design (HHCD) and the Intelligent Mobility Design Centre (IMDC), postgraduate research centres within the RCA. With help from the RCA Vehicle Design and RCA Textile Design Programmes, it ran from the 27th October 2016 until 8th December 2016. During this time students from the two courses were asked to design concepts that looked at driverless vehicle within an urban environment.

Students were encouraged to gain a wider understanding of the subject by engaging with members of the public on the subject of driverless vehicles. Some students carried out surveys, others spoke to people on the streets and all participating students took part in a workshop organised by HHCD/ IMDC.

The project was broken into three main sections.

1. Students were asked to research an area of interest defined by three briefs. They were asked to define who the vehicle would be for and how autonomy would affect the typology of the vehicle. They were then asked to present their findings to HHCD/IMDC staff

2. The second step was to apply this design thinking to a concept and feed it back to members of the wider public to gain an understanding of how designing with people outside of the design field can help their design process.

This encouraged them to test the ideas early and be influenced by multiple sources of input.

3. The final stage was to digest the feedback they had received, learn to capture and digest the useful information, and apply it to their design. This process not only made them think about the positive input of co-design but also to critically analyse feedback and understand what information is useful and what is not.

Students were also encouraged to collaborate with different design disciplines during the project. However this did not end up happening as most students choose to work alone. The exception to this was a group of three textile students who worked together to outline their future vision of an autonomous future.

c. Briefs

Within Vehicle Design there are three pathways (Inside out, Urban flow & Automark) which provided a natural boundary when assigning subject areas to look into.

We asked the three groups to look into:

1. Natural vehicles: what the vehicles could do.
2. The secret life of cars: how vehicles can be used.
3. Smart city: how the vehicle will affect our surroundings.

We then selected a variety of projects that we felt provided an interesting design provocation to place within the exhibition at the London Transport Museum as part of our wider engagement strategy.

The brief itself was left as open as possible to encourage a wide range of responses. The full brief given to the students can be found below.

METRO PROJECT
Driverless Futures

The Metro project involves individual research, isolating a specific issue, presenting findings, and an intention towards design solutions, using all relevant skills to provide outcomes, in model, visual and verbal modes.

BACKGROUND

GATEway is a national project, comprising of leading organisations, including the RCA

It is about understanding and enhancing public perception and acceptance of automated vehicles, their wider implications, social and human consequences.

***Driverless Futures** follows Research Associate and intern design developments.*

It includes workshops with public participants, and interface with Textile designers, working as a team of three with each pathway.

BRIEF
Create a design response to engage with public perception of the driverless future.

Following GATEway team findings, develop a total user/journey proposal.

Consider future travel opportunities and potential users, public or private, individual or collective, young or old, service or product.

Design a future journey that explores and exploits autonomous mobility.

Be innovative, imaginative and creative.

DELIVERABLES
Deliver a clearly developed user-based argument, detailed sketch work, and use any media to describe journeys, define issues, and present total mobility solutions.

SCHEDULE

INTRODUCTION
Thursday 27 October - Senior Common Room facility
1100 Introduction and briefing
1115 GATEway team: Sam Johnson & Dan Quinlan
1200 Visiting Tutor Sam Livingstone
1415 Pathway direction workshops: opportunities and consequences (including Textile student team)

FINDINGS
Thursday 10 November - Vehicle Design Seminar Room
Five minute presentations with feedback
1100 Automark
1400 Inside Out
1530 Textiles
1600 Urban Flow

INTERIM GROUP WORKSHOPS
Wednesday 16 November - VD Seminar Room
Individual design development, with public participation, in two workshop groups
1400 Introduction
1415 Group A workshop
1515 coffee break
1530 Group B workshop
1630 Conclusions

CONCEPTS Thursday 24 November - VD Seminar Room

Five minutes individual presentations with feedback
1000 Inside Out
1200 Textiles
1400 Urban Flow
1500 Automark

INTERIM GROUP WORKSHOPS Wednesday 30 November - VD Seminar Room
Individual design development, with public participation, in two workshop groups
1400 Introduction
1415 Group A workshop
1515 Coffee break
1530 Group B workshop
1630 Conclusions

PROPOSALS – Thursday 08 December - Meeting space to be confirmed
Five minutes individual presentations with feedback
1100 Automark
1400 Inside Out
1530 Textiles
1600 Urban Flow
1700 Overview

d. workshops

The GATEway team ran two workshops with the students during the project. The first helped the students to think about driverless vehicles in a broader way.

We did this by taking them through parts of the workshop carried out by the GATEway team in the summer of 2016. This also helped prepare the students for the second workshop as all of the public participants had gone through the same workshop earlier in the year.

Students were asked what their hopes and fears were on the subject of driverless vehicles. Five categories were covered: Environment, safety, ownership, cost and other benefits.

These core areas lead to a series of group discussions designed to trigger ideas and form opinions.

The second workshop gave the students the opportunity to pitch ideas to members of the public to gather feedback from a wider range of people with little or no design background.

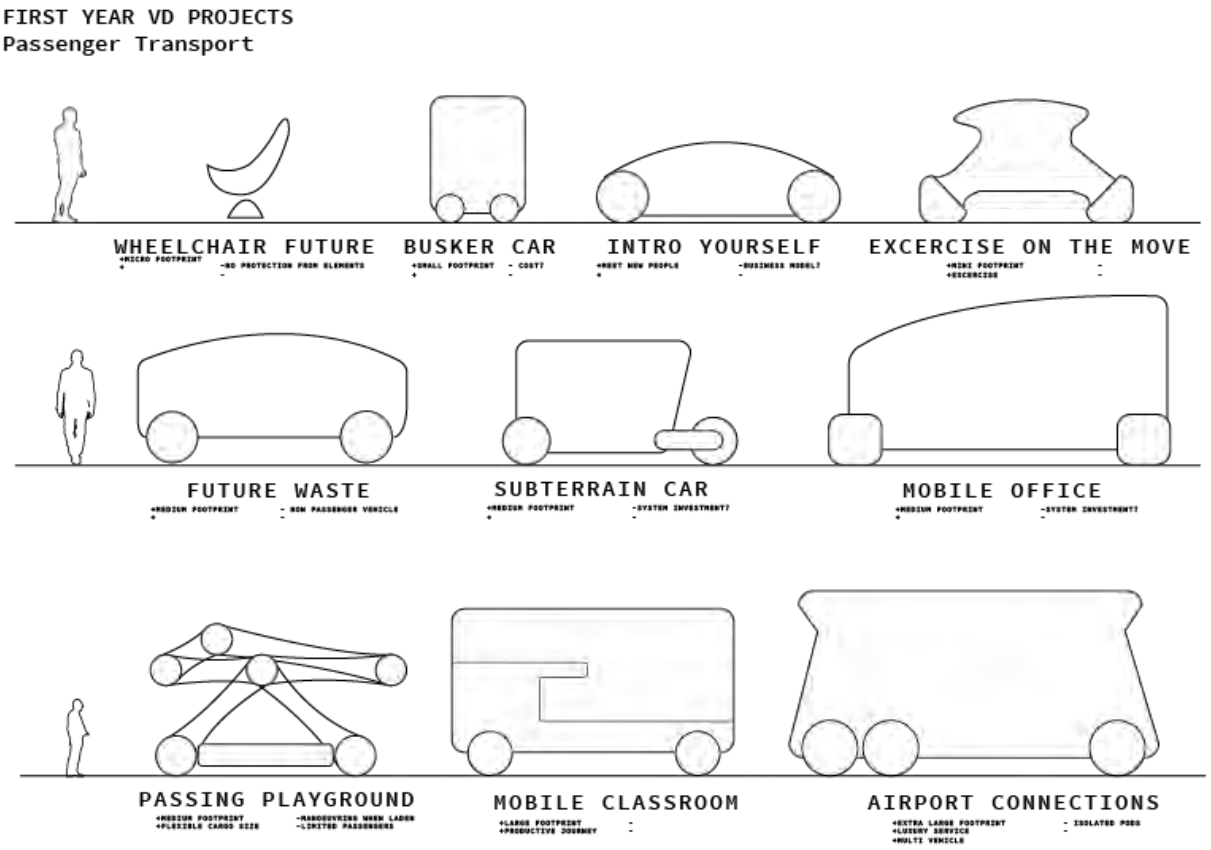
There are a number of benefits to this. Students were made to adapt the way they were delivering ideas from person to person depending on the individual's knowledge and understanding. A range of users participated meaning a variety of opinions could be gathered over an afternoon. This was enhanced by the makeup of the participants, who ranged from professional stakeholders, drivers and technology enthusiasts to people with a range of disabilities.

From this feedback, students were then challenged to understand the value of the data that they had collected, what was relevant to their project and how to critically analyse public engagement.

e. Outcomes

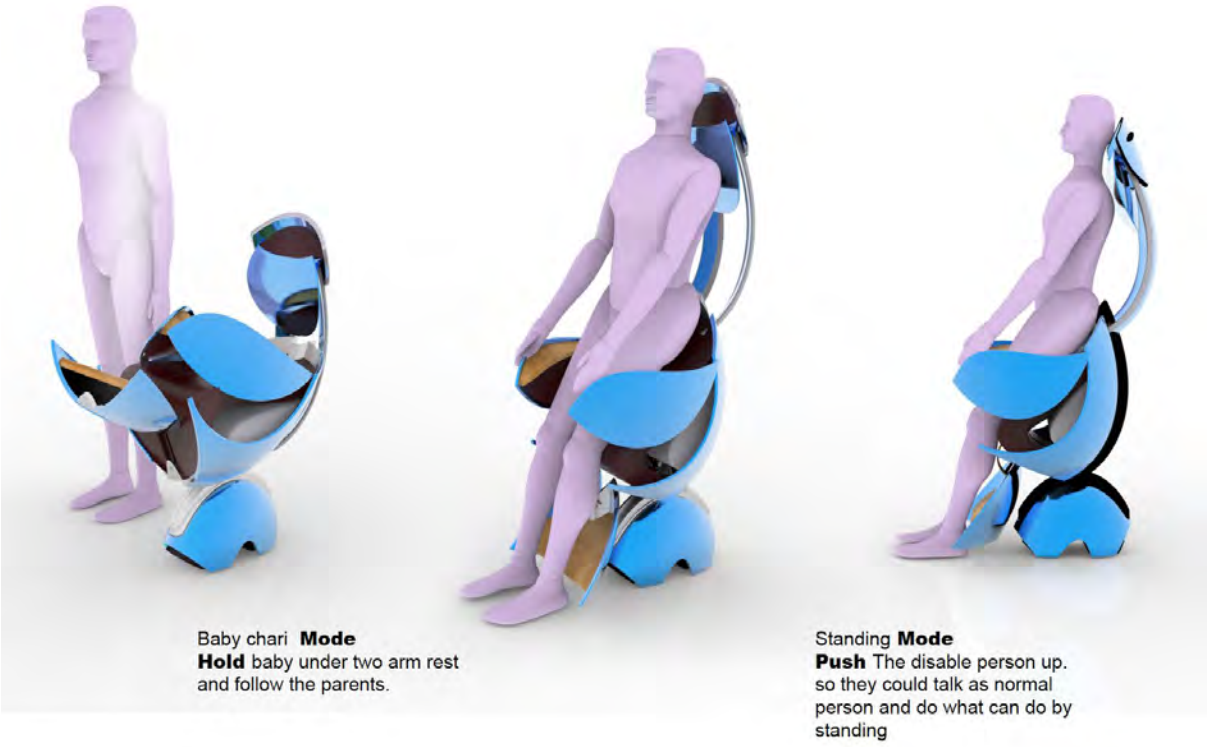
The outcomes of the project offered a range of concepts focusing on a variety subject areas.

The concepts developed are shown below in diagrammatic form:



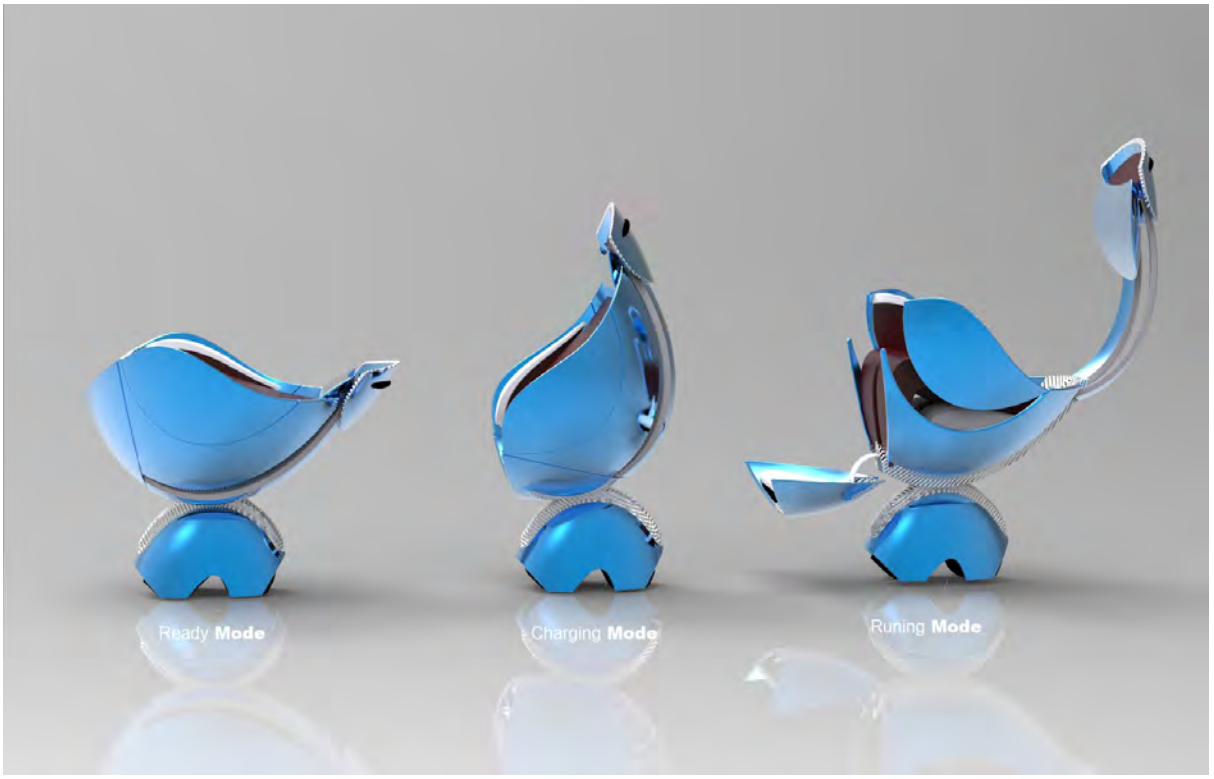
Future Wheelchair

The future wheelchair was one of the few projects that focused on inside and outside mobility. Wheelchairs, for many, mean that travelling short to medium distances is possible.



However, the mobility offered by standard wheelchairs is still not perfect. This project, by student Yang Liu, looks at ways driverless devices could address these issues.

The proposal provides local support to a range of users with accessibility needs. The autonomous chair can reduce the need for people to need assistance and to assist with access inside the home. It helps people ascend and descend stairs without equipment and provides local mobility, connecting to wider networks of transportation.



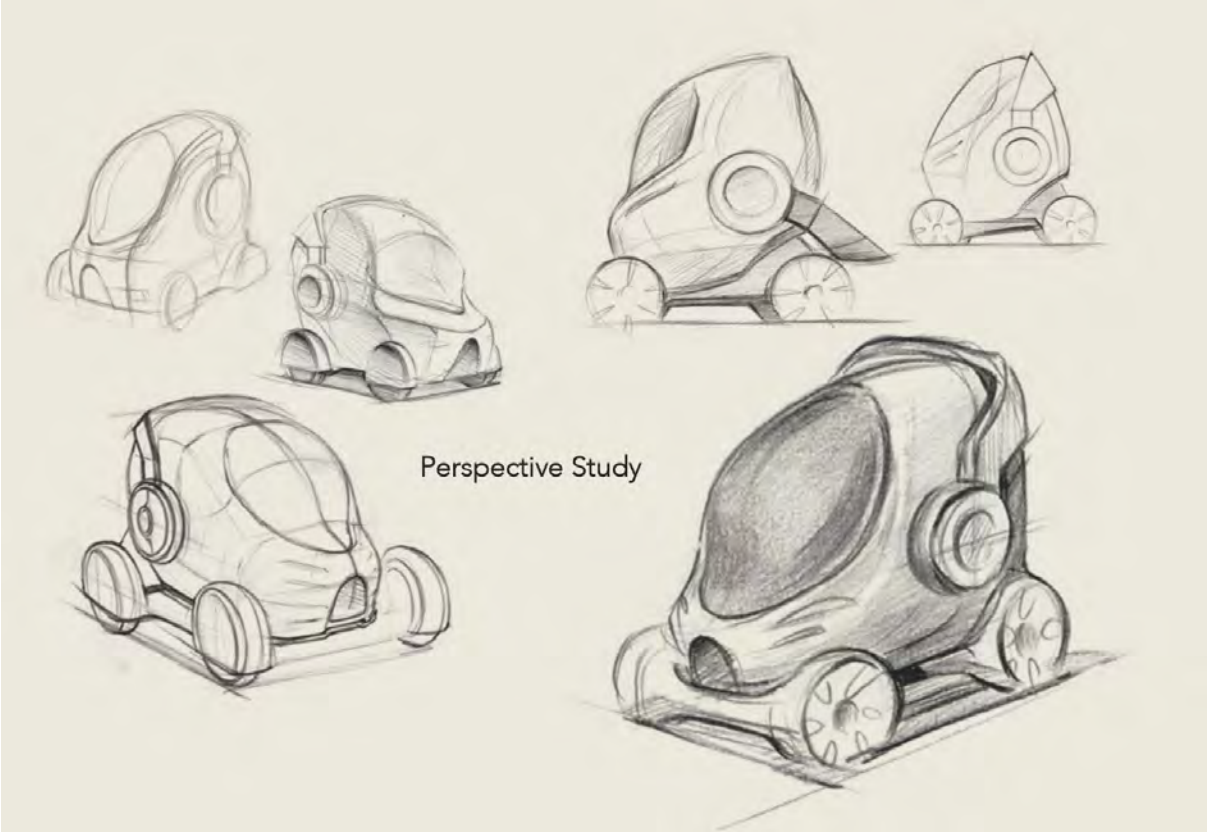
All of these things assist individuals to remain or gain independence.

The project also raises the idea of mobility not only being for outside your home and identifies the possibility of driverless vehicles being involved in multiple ways inside the home.

This is an area that is already being explored, for example the Scewo chair addresses accessibility issues caused by stairs for disabled people, showing the need for more capable mobility devices. There is potentially a whole area of driverless vehicles that could be developed for this market place that currently do not exist.

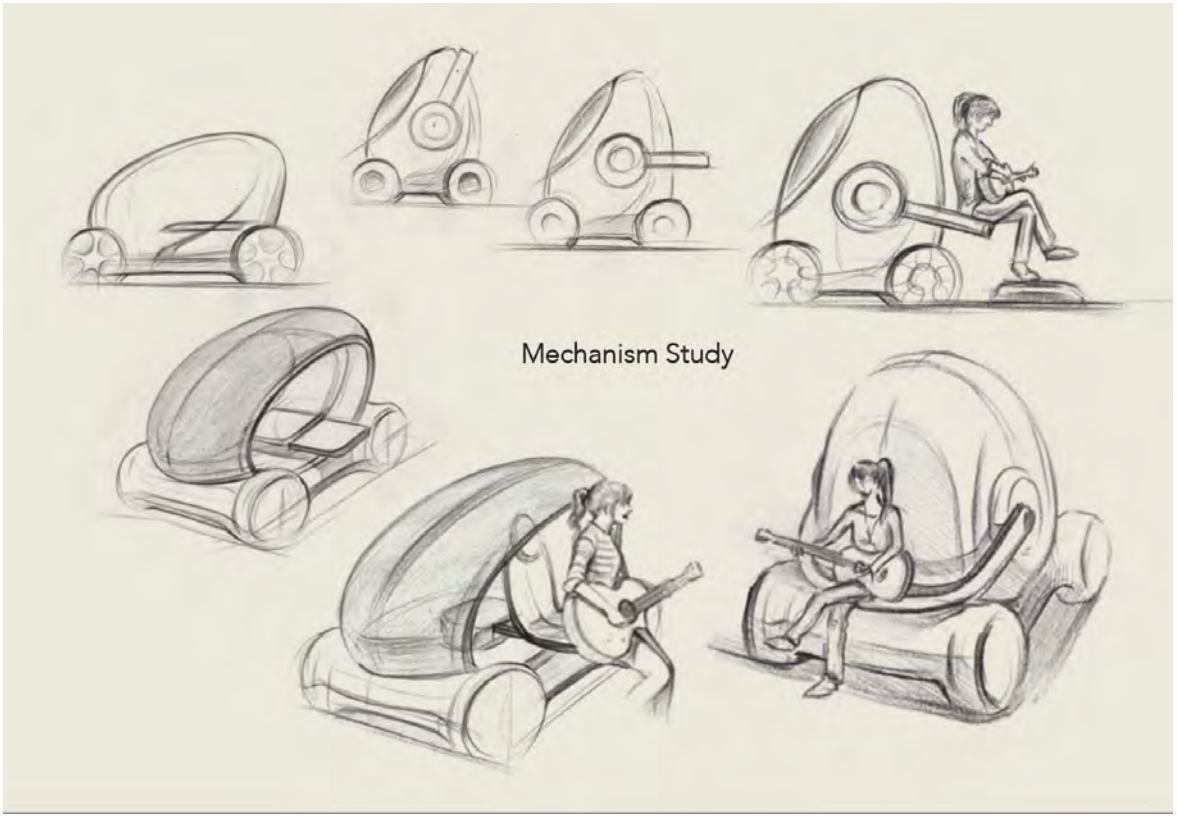
Busking autonomously

Student Hye Sun NamGoong looked at how existing experiences and activities could be influenced by the introduction of driverless vehicles. Busking is part of London's culture and is something many people experience on a daily basis.



Hye Sun looked at how buskers could access new audiences and musicians could come together to interact and perform.

Through the use of social media local communities can meet and perform together with greater ease.

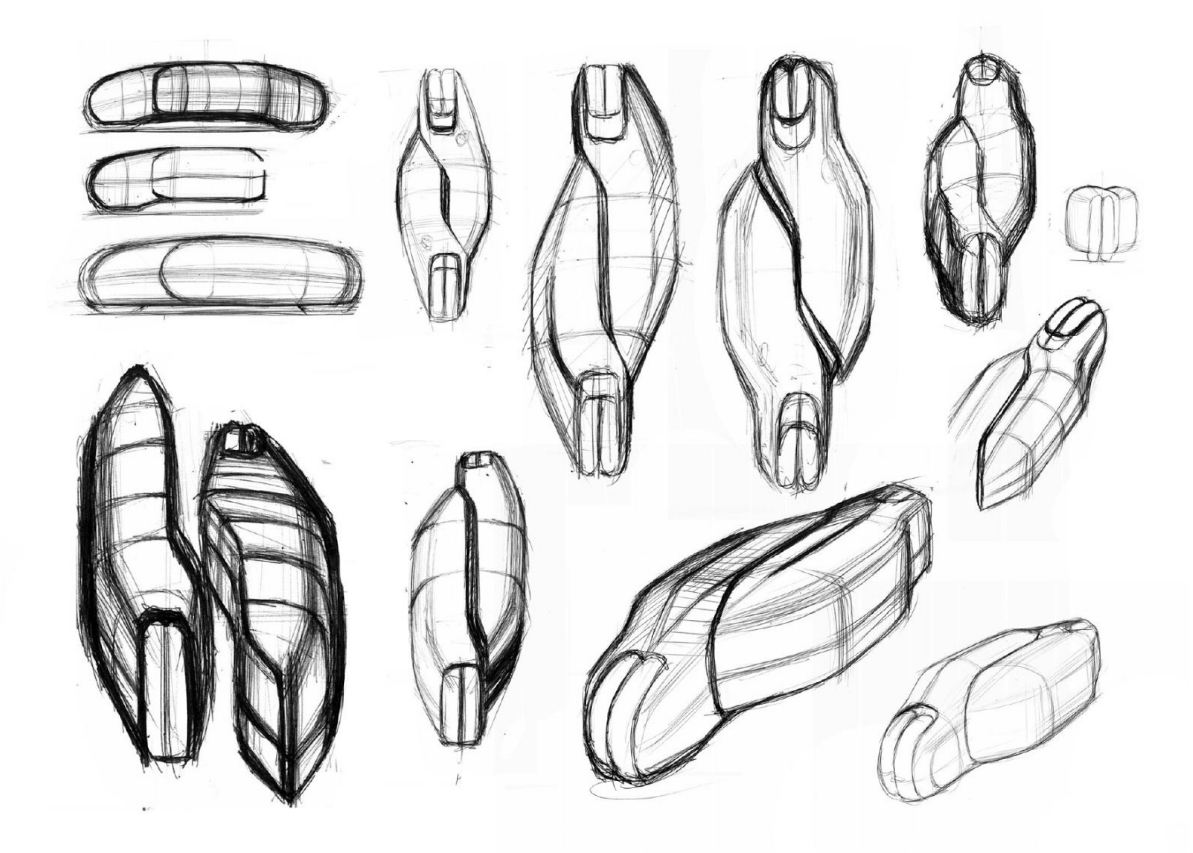


This project explores the potential that social media could drive the design of vehicles. Performers can now communicate directly with fans through a variety of media devices. However, this outlet for their performances would require months or years of planning and high costs.

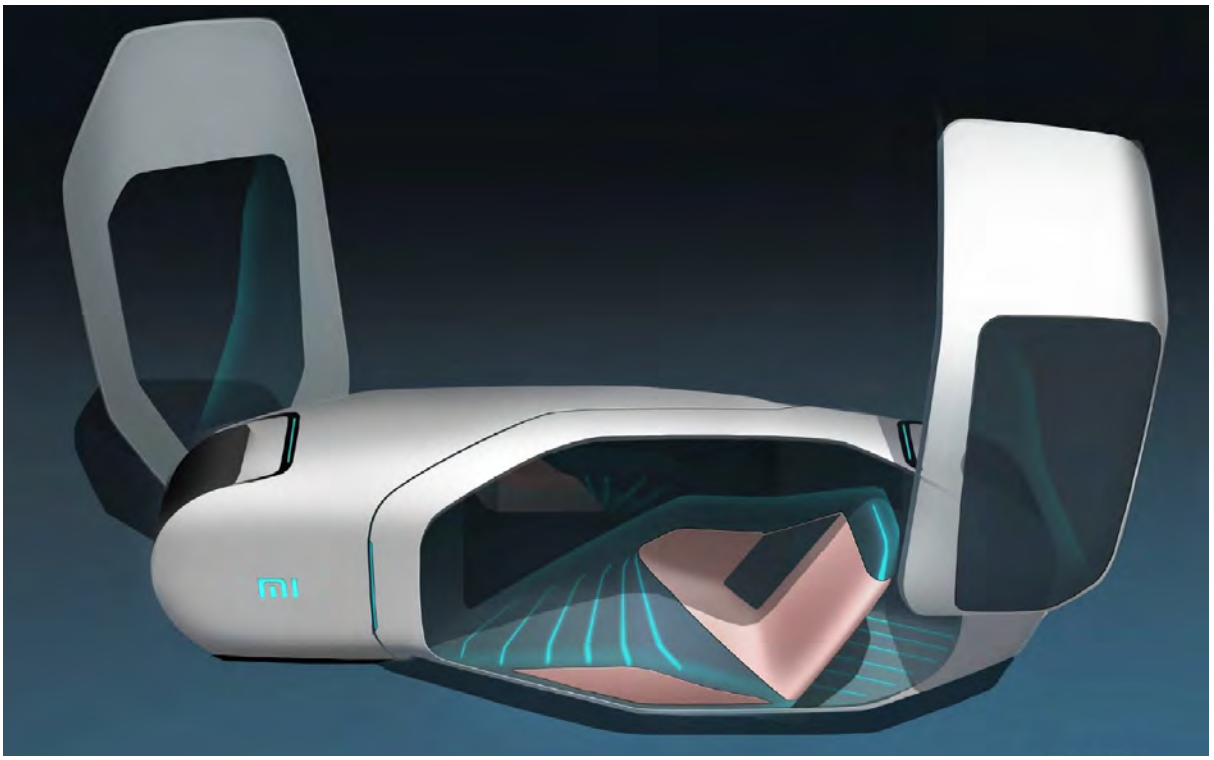
The methodology developed during this project suggests that a flexible system could be used to give local performers a greater presence within the local community whilst providing established performers the ability to put on smaller, more intimate gigs that engage with the fans who support them.

Introduce yourself

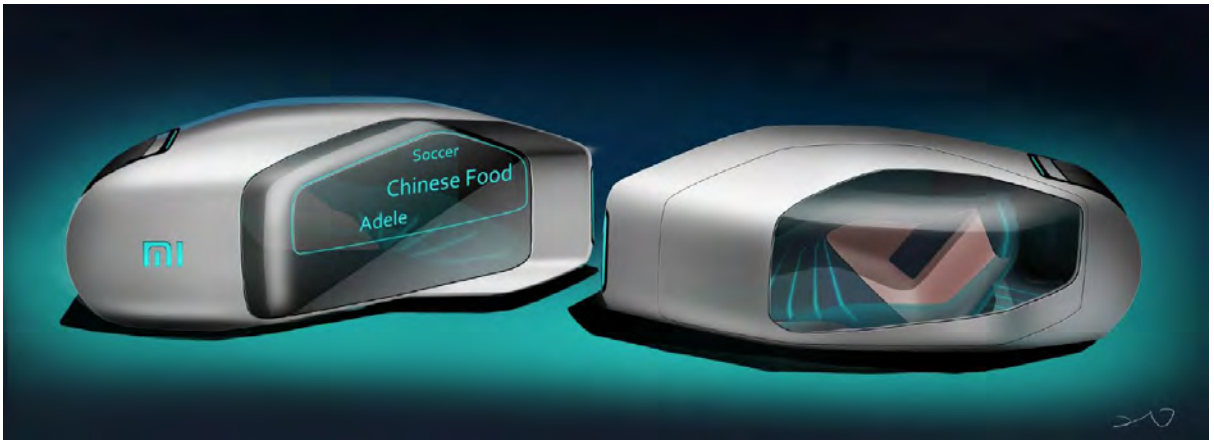
Designer Bin Sun developed the ‘introduce yourself’ project as a reaction to the isolation that can often be experienced in large metropolitan areas.



His concept used social media data to pair commuters together that may have interests or things in common and pair them together for a reward. When two pods are together additional functionality is unlocked with the suggestions of higher speeds or access to ‘sharing lanes’.

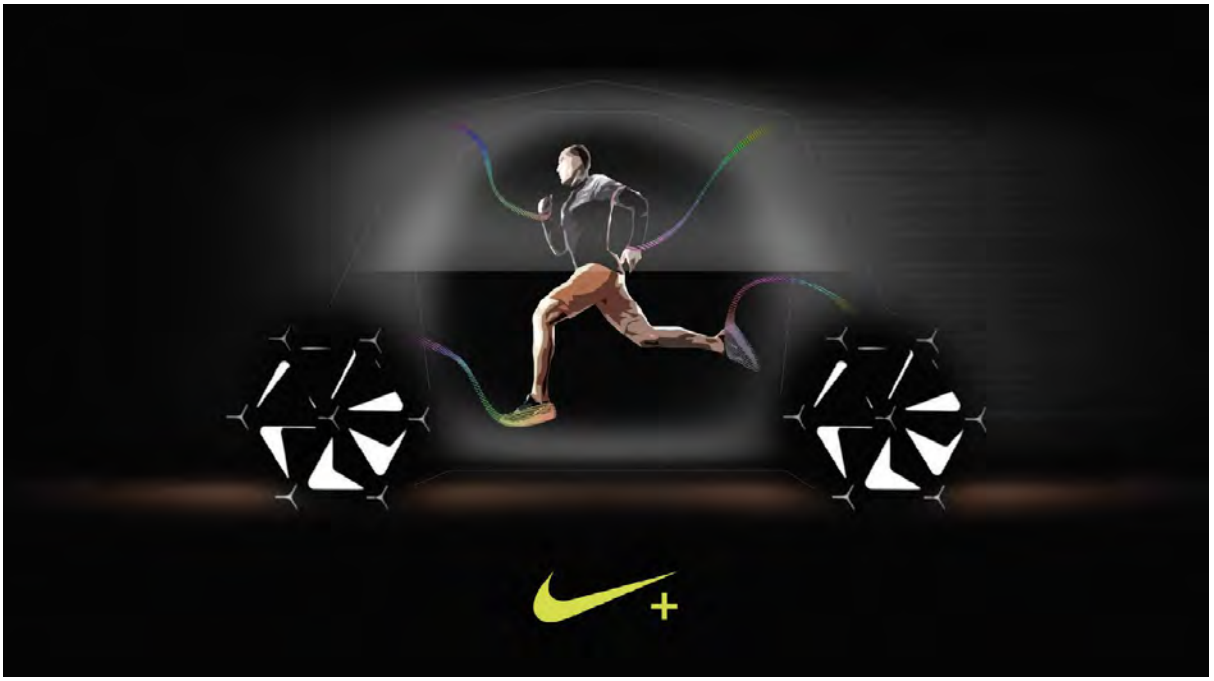


The design highlights the potential of how ‘big data’ can be used to enhance and assist people's lives, bringing individuals together. Finding new social ways in which people travelling across London can do this is an area companies are already exploring with the increasing popularity of the ride sharing program Uber Pool.

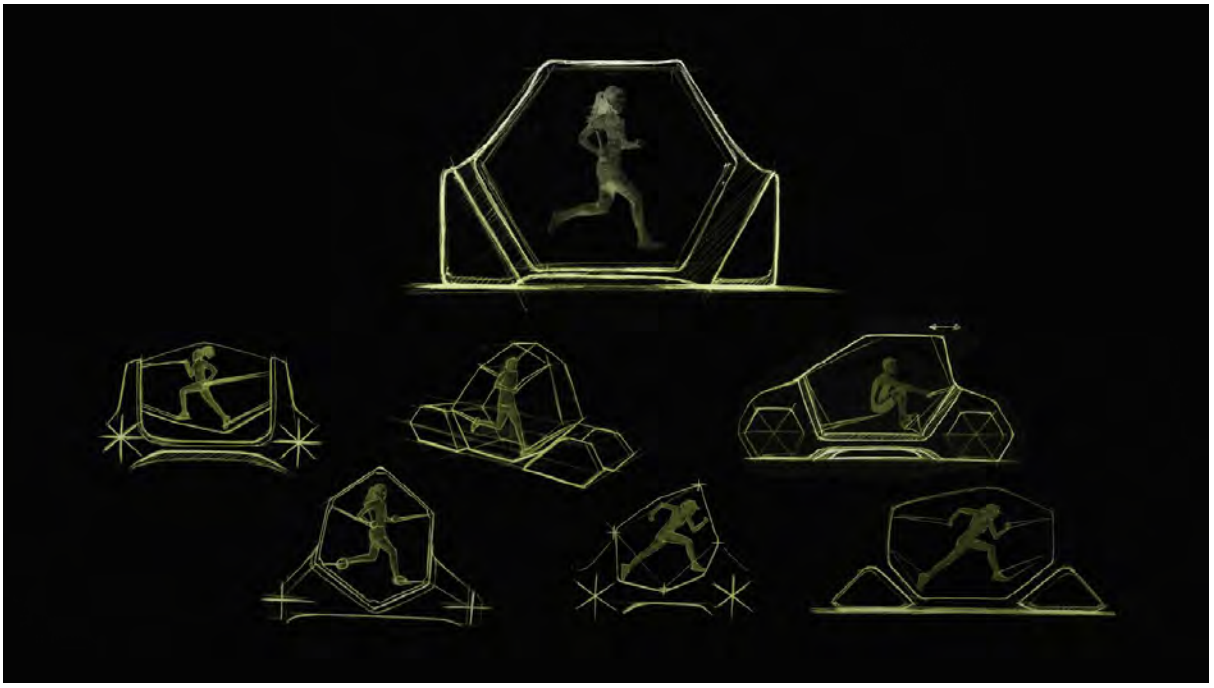


Exercise on the move

Student Jonathan Stokers' concept looks at how we can spend our time better on the move. His solution is to combine exercise with travel. Like many of the student projects it focused on the daily commute and how time can be spent 'better'.

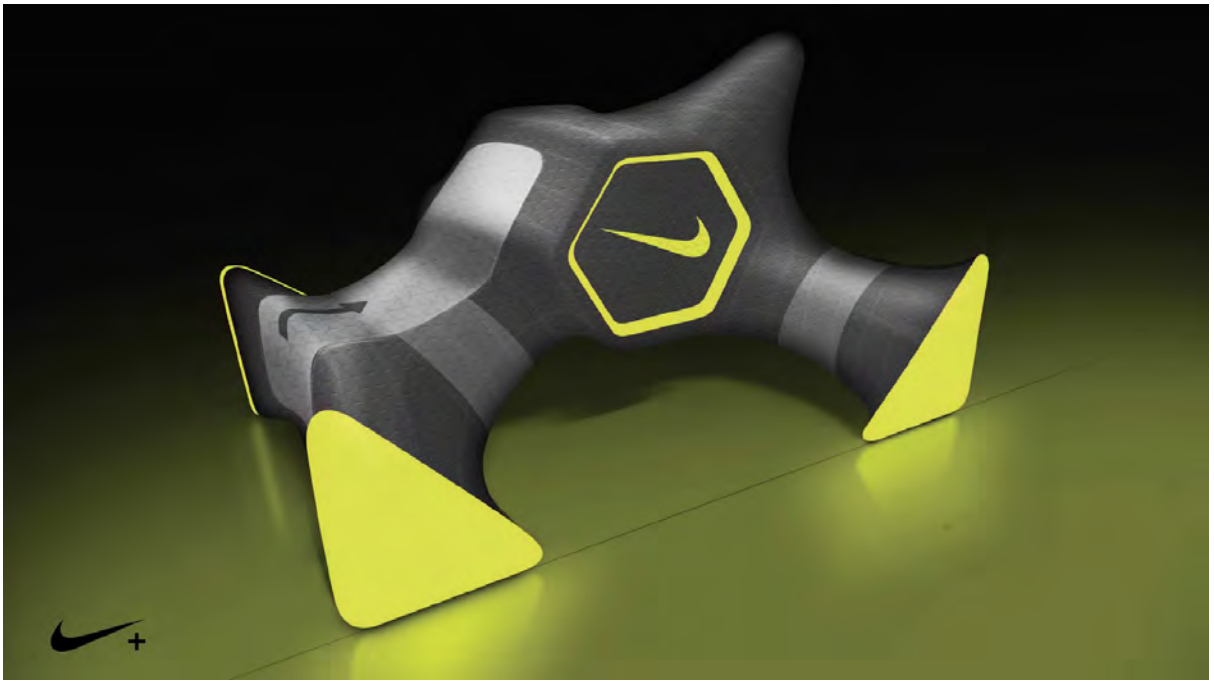


The solution combines a gym with a vehicle allowing occupants to run, jump and row without leaving the vehicle.



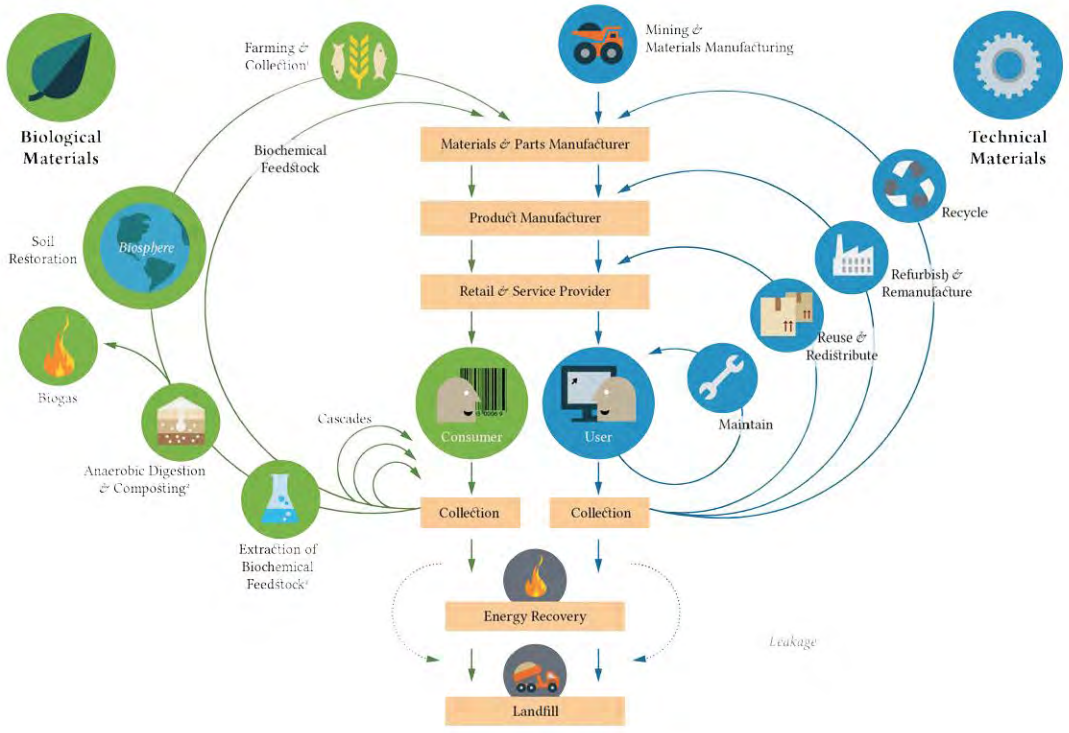
What is interesting about this vehicle's proposal is how these types of movement can inform the exterior design of the vehicle.

The vehicle fabric exterior moves in relationship to the occupants activities bringing a relationship between the inside and outside.



Future waste disposal

This project looked at how the future of our civic services may be affected by driverless vehicles in the future. Student Robert Dooley identified waste disposal as an area that could be highly automated and researched heavily into the subject.



He spent time with rubbish collectors on their rounds on the streets of Greenwich to better understand the processes used and how this may change with the use of driverless machines.

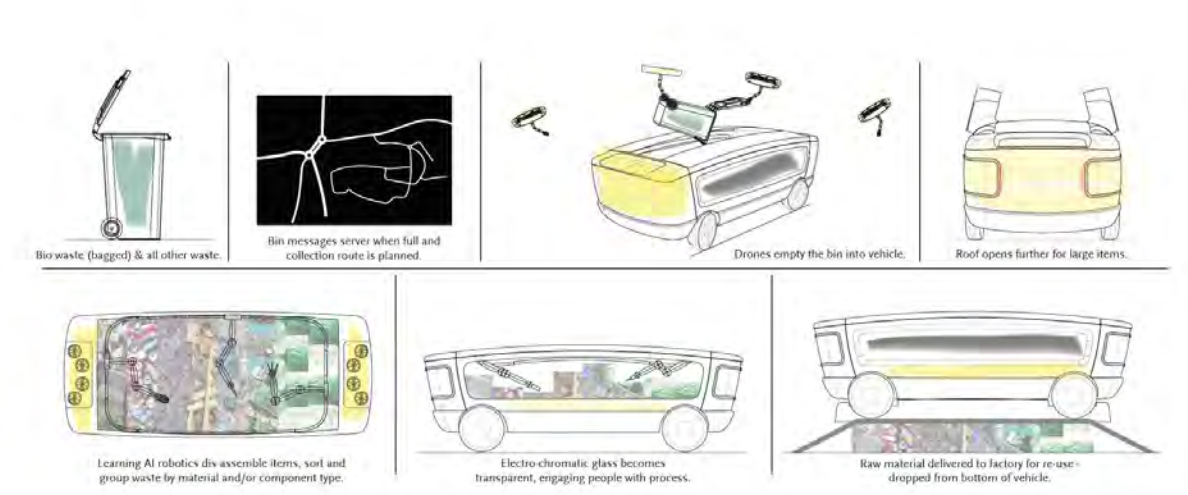
RBoG Ride Along

I joined one of the Royal Borough of Greenwich's (RBoG) dry recycling collection teams to gain a better understanding of practical challenges faced when collecting waste.

When collecting waste, loaders take bins from outside of residents properties and load them into the back of the vehicle. Loaders and drivers often have to educate residents as to what can (and cannot) be recycled. Vehicle drivers work out fastest route possible, based on geography and household numbers. Developing the round schedule is an iterative process, however one fixed variable is the collection day, as changing this causes significant inconvenience to residents.

The vehicles used by RBoG's collection teams are developed internally by their Maintenance Department. The current vehicle combines a Mercedes cab with a Dennis Olympus body and Terberg hoist. This configuration has been developed over a number of year, working with drivers, loaders and technical workshop teams. It has been found to be the most reliable, easy to drive and cost effective to maintain. This combination also offers a low entry cab, which sits the driver at a lower angle and gives better visibility of cyclists. The vehicles are coloured yellow to increase visibility for other road users. Most vehicles provide a minimum 5 years usage. Currently, all vehicles are all diesel powered, but with increasing emissions regulations, hybrid/alternative energy vehicles are on the horizon.

To support this design process Robert used the ‘circular economy’ to influence his design thinking when laying out the systems that would support his proposal. The design itself is fully autonomous, collecting, sorting and recycling rubbish on the move.

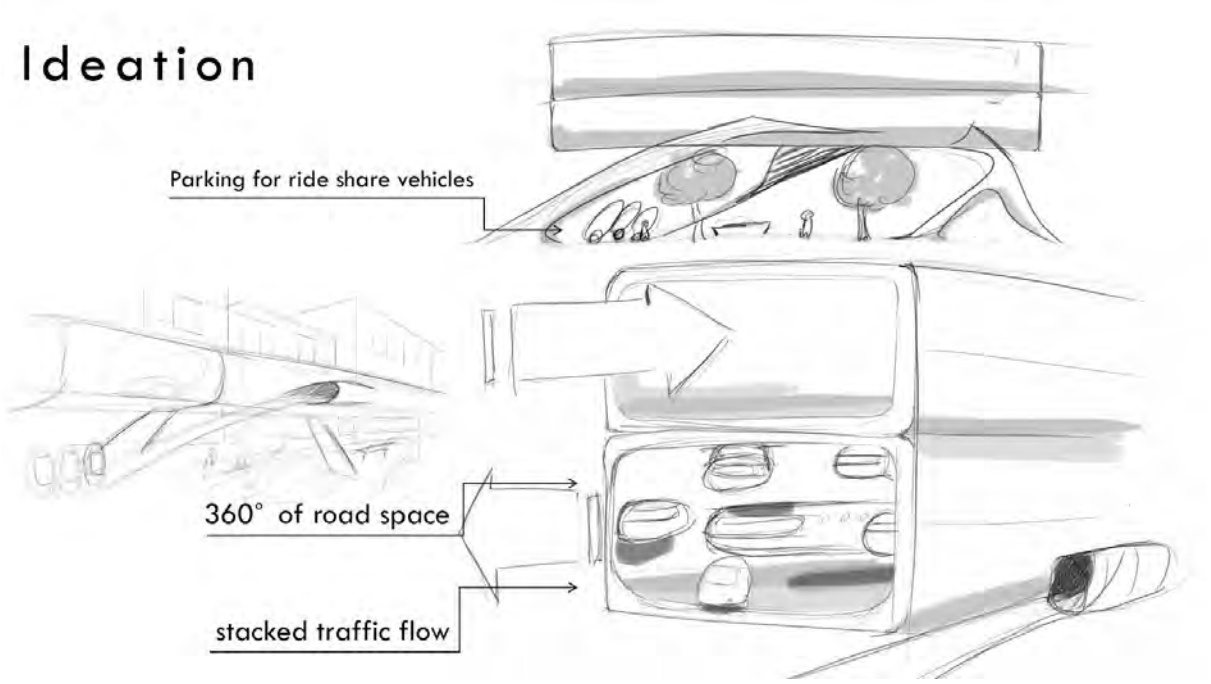


The vehicle uses small drones that have the maneuverability and dexterity of people. These detach from the main platform to collect rubbish bins from the side of the road. It also means that the current bin system does not necessarily have to be replaced.

It shows how driverless vehicles could change the way we develop existing services. It also highlights how people may be designed out of a service and raises questions of who's responsible for the people whose jobs are lost. Should they be included in a new system on some level and what may these jobs be replaced with?

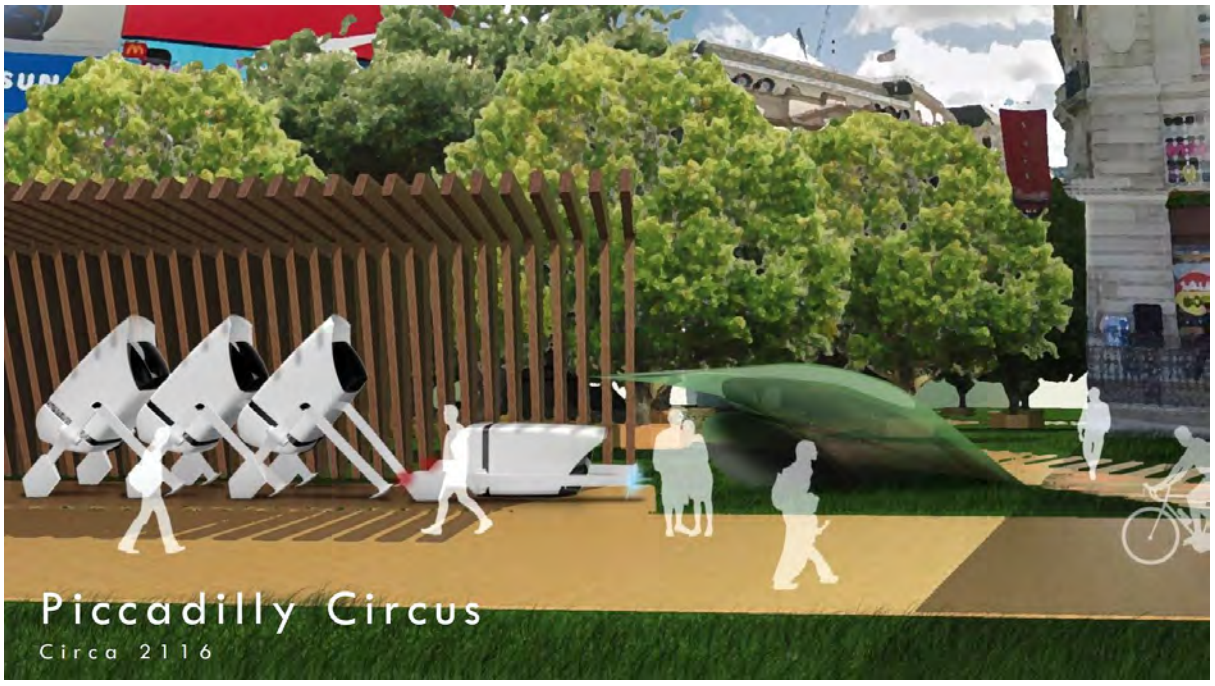
Subterranean London

Throughout London's history the supporting infrastructure has always grown organically to meet the demands of London's population. As a result of this many of London's streets are narrow and spend much of their time congested and polluted. Austin Dewees subterranean concept looks at how we can use underground roads to reduce surface congestion and reclaim public spaces for pedestrians.

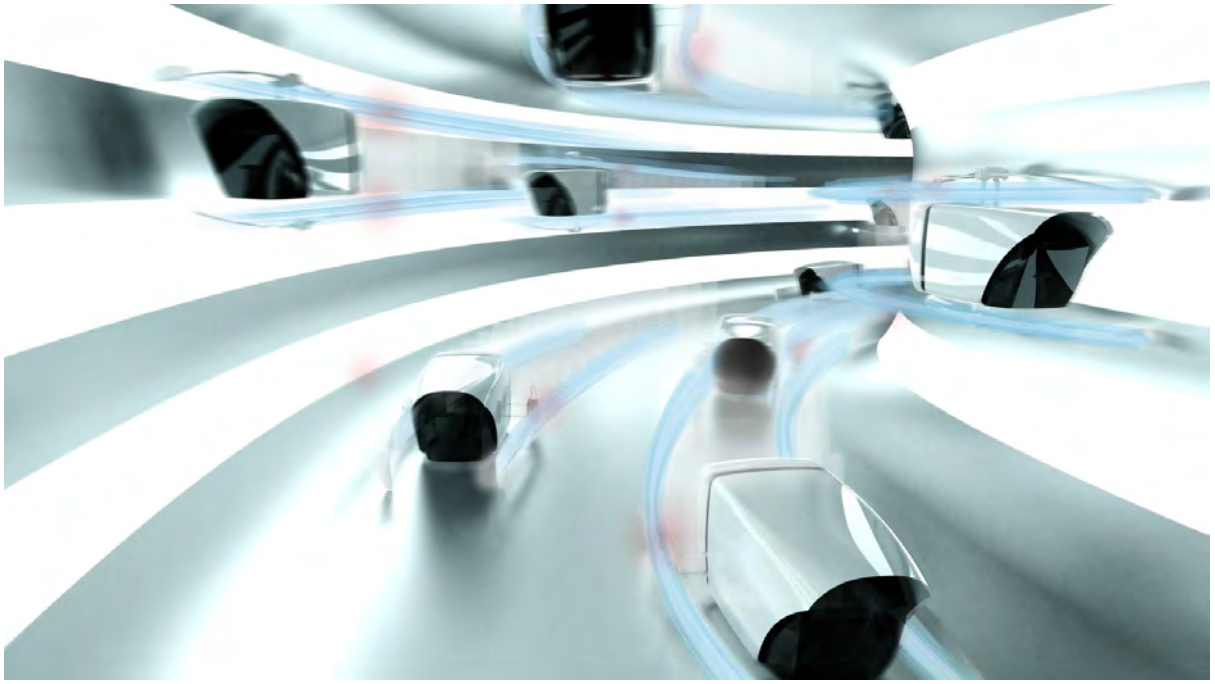


The project looks at the use of multidimensional roadways, utilizing maglev technology to suspend pods on four sides of the tunnels the pods travel in.

This is a concept that has been suggested before in the 1959 ‘The Magic Highway’ film by Disney.



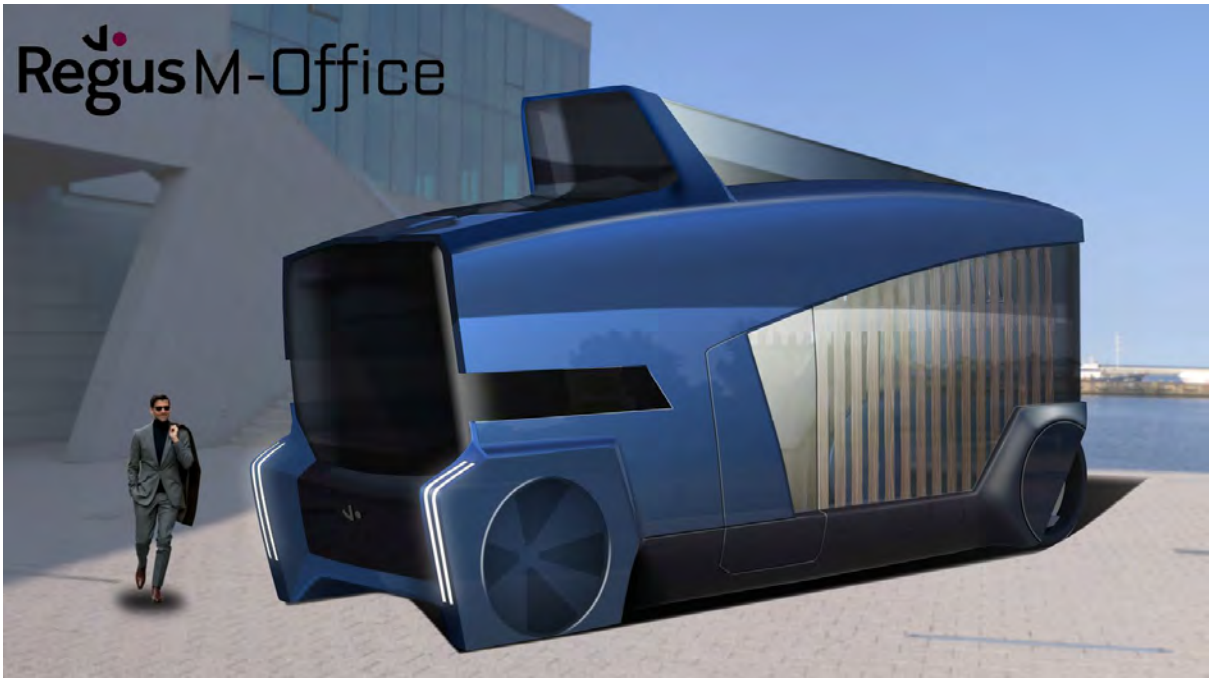
The project suggests an interesting way in which we could shift congestion and have a less intrusive transport network.



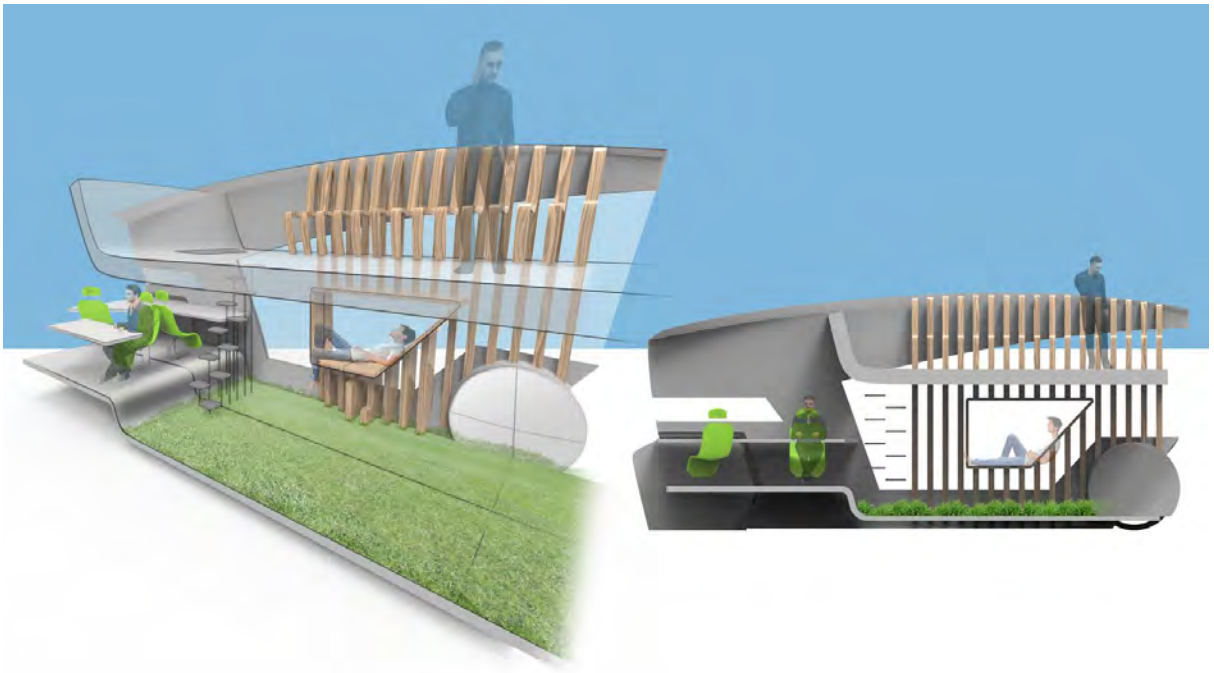
Mobile office

Student Mehmet Berberoglu's project looks at how transportation systems may become specialised in the future. His design looks at how work spaces could be designed into vehicles, allowing users to work on the go.

The project also looks at the future of scale on our road network. Suggesting that there may be more space on our roads that is gained through more efficient driverless systems. Could it be possible that vehicles will take advantage of this additional space and become larger?



The interior space of this work based concept provides multiple, adaptable spaces that allows passengers a flexible work environment depending on their needs. With two tiers of work space it could offer a relaxing work environment on the move for between 6 - 12 people.

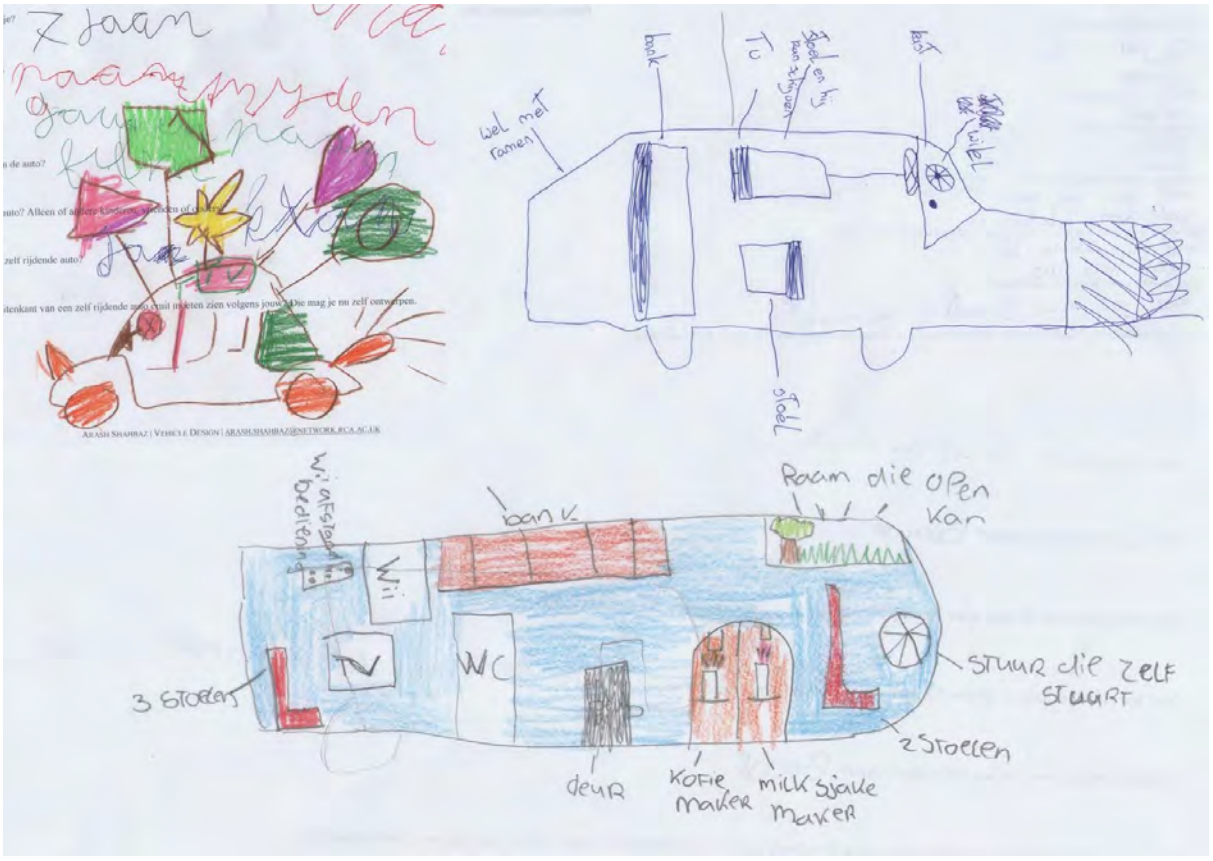


This offers an interesting insight into how automotive space may become more architectural in the future, looking more like a building then a vehicle. This has implication for the vehicle's exterior which become defined by the interior space.

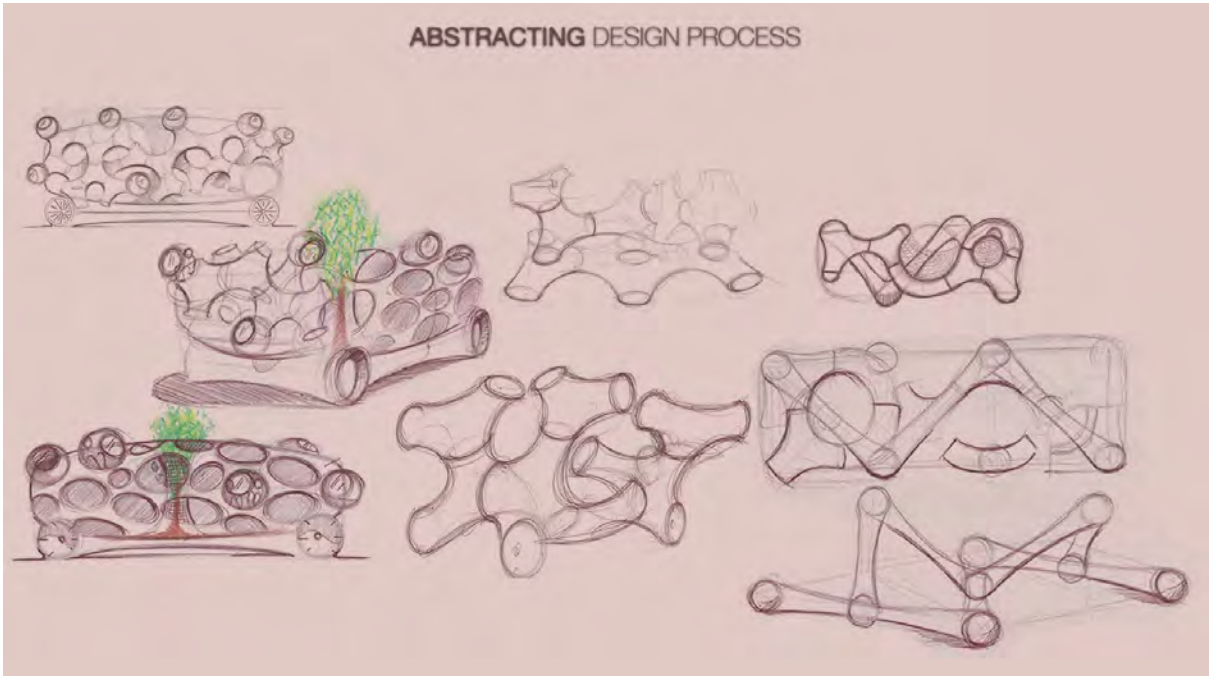
The scale of the vehicle shows a spacious environment for a relatively small number of people compared to the size of the object. With ridesharing set to increase it may be a plausible possibility. Will the vehicles we use in the future become bigger and how will we manage the increased volume on our streets?

Passing playground

The Passing Playground project by student Arash Shahbaz shows just how diverse driverless vehicles could be. The concept does not offer transportation but a mobile service, providing a playground for children that comes to where they are.



During the design process Arash engaged with children, asking them what they would like from cars of the future and used what they were drawing as inspiration.



Using this process he redefined the typology several times before reaching a final form.

We have seen in recent years the desire to bring a playfulness to structures and installations learning more from interaction and activity than from sculptural form. An example of this is AZC architects Bouncing Bridge created in 2012.

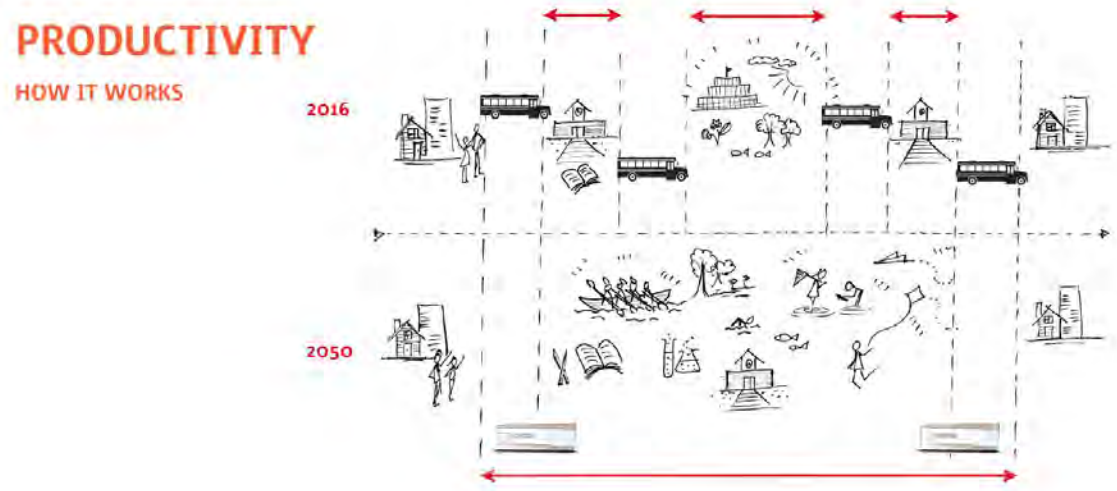
The final outcome focused on simple outdoor activities as a basis for the design, offering children a movable climbing frame. The project shows just how wide the range of services offered by driverless vehicles could be and indicates how whole businesses that currently don't exist could come into being.

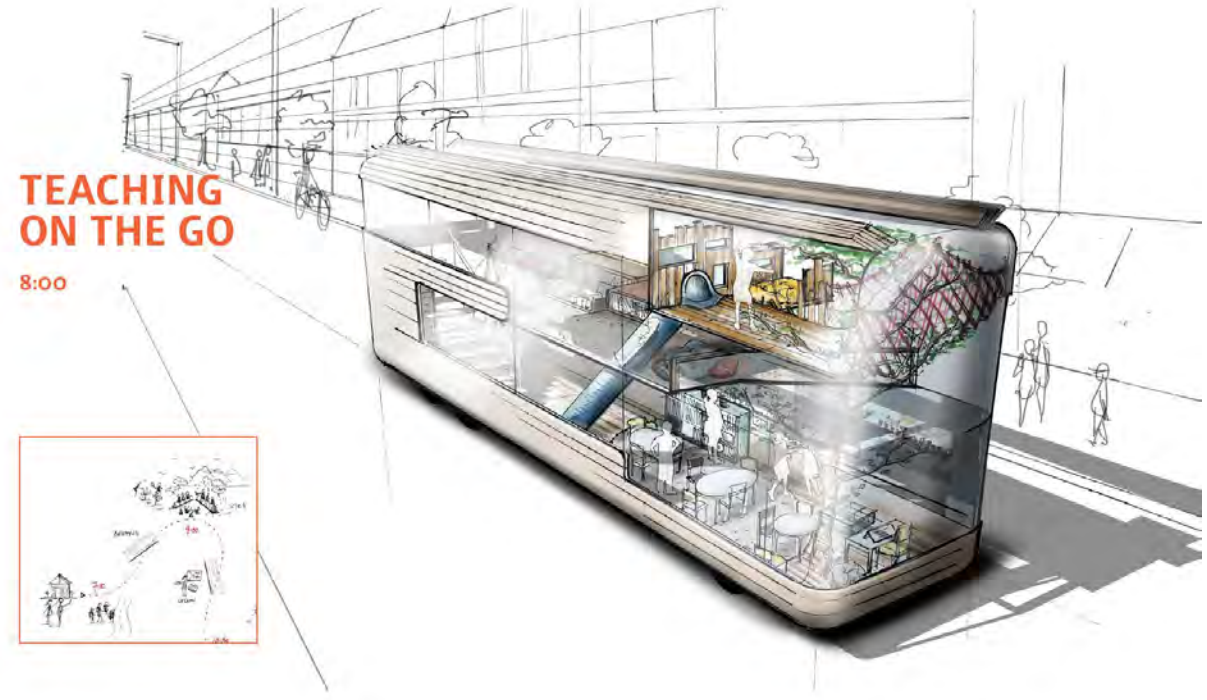
Mobile Classroom

Driverless vehicles and education is usually considered in the context of delivering students to the learning space. However Irene Chiu considered the benefits of combining the two.

Schools are increasingly using open spaces to educate their classes, embracing the benefits of out of classroom activities. Irene carried out a survey asking teachers what the main benefits of this type of structure were and the shortcoming of the current system.

Identifying the above shortcomings, the concept developed a mobile school that could integrate travel with education and experience.





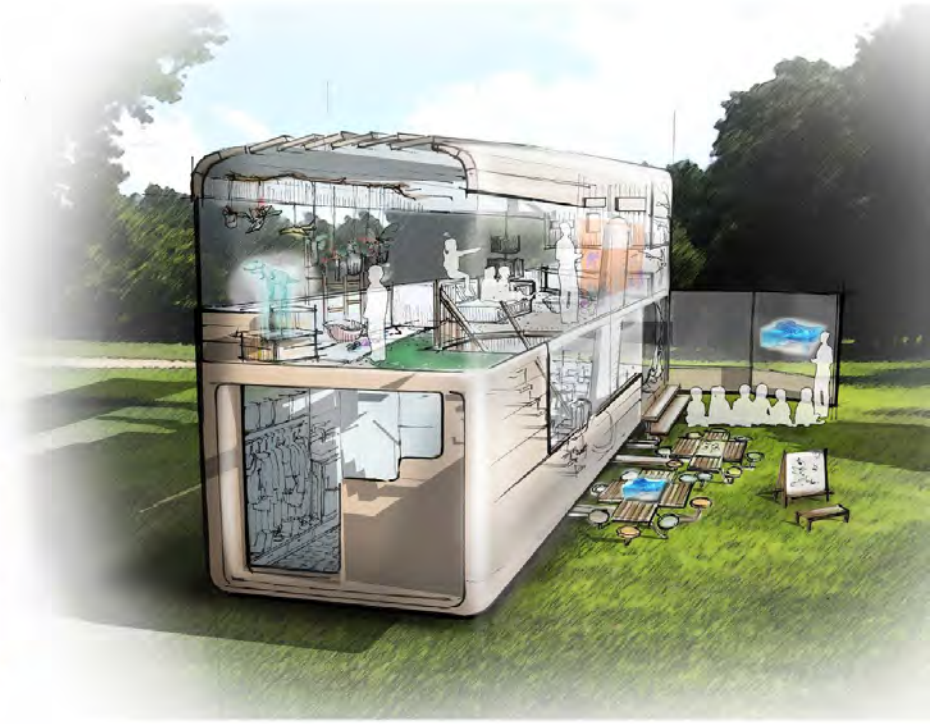
The bus that she designed is a moving classroom with all the necessary facilities on board. The vehicle would be capable of operating on its own, however research indicated that younger students benefit from having a permanent base to feel secure, so the bus is also designed to ‘dock’ with a static infrastructure, so the classes can come together in a static building that would offer a bedrock for the school community.

ON SITE

12:00

Outdoor furniture can expand from from mobile classroom.

Walls with smart screens can open to allow teaching outdoors.

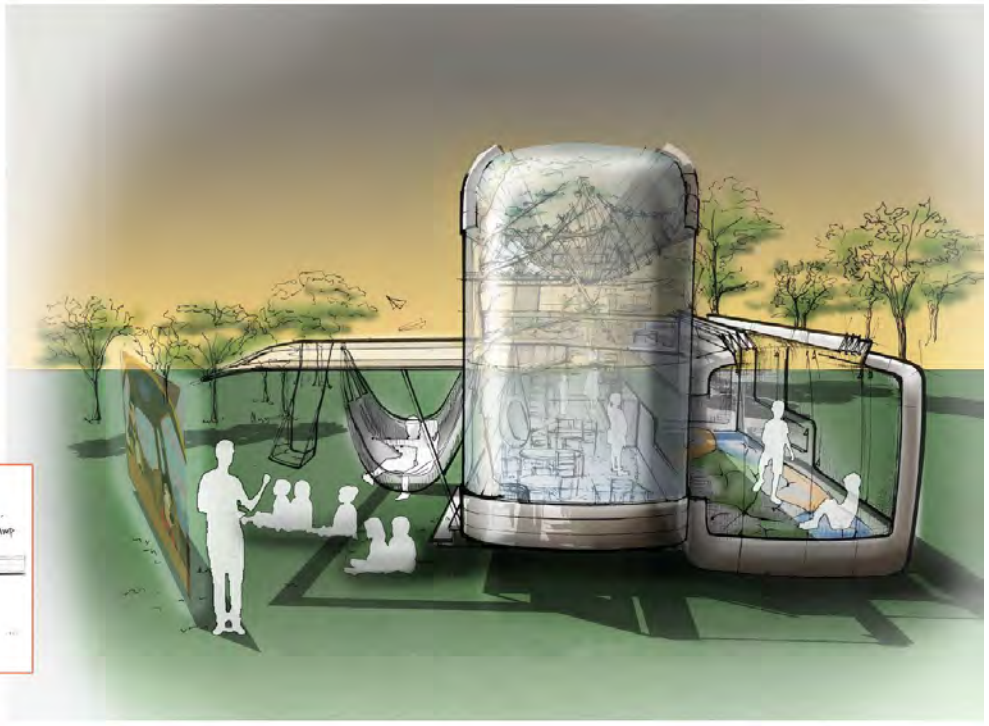


The concept shows how driverless technology could change the way we view even the most rooted institutions within our society and points to the future of automotive design being as much about services and systems as it is about products and experiences.

CAMPING

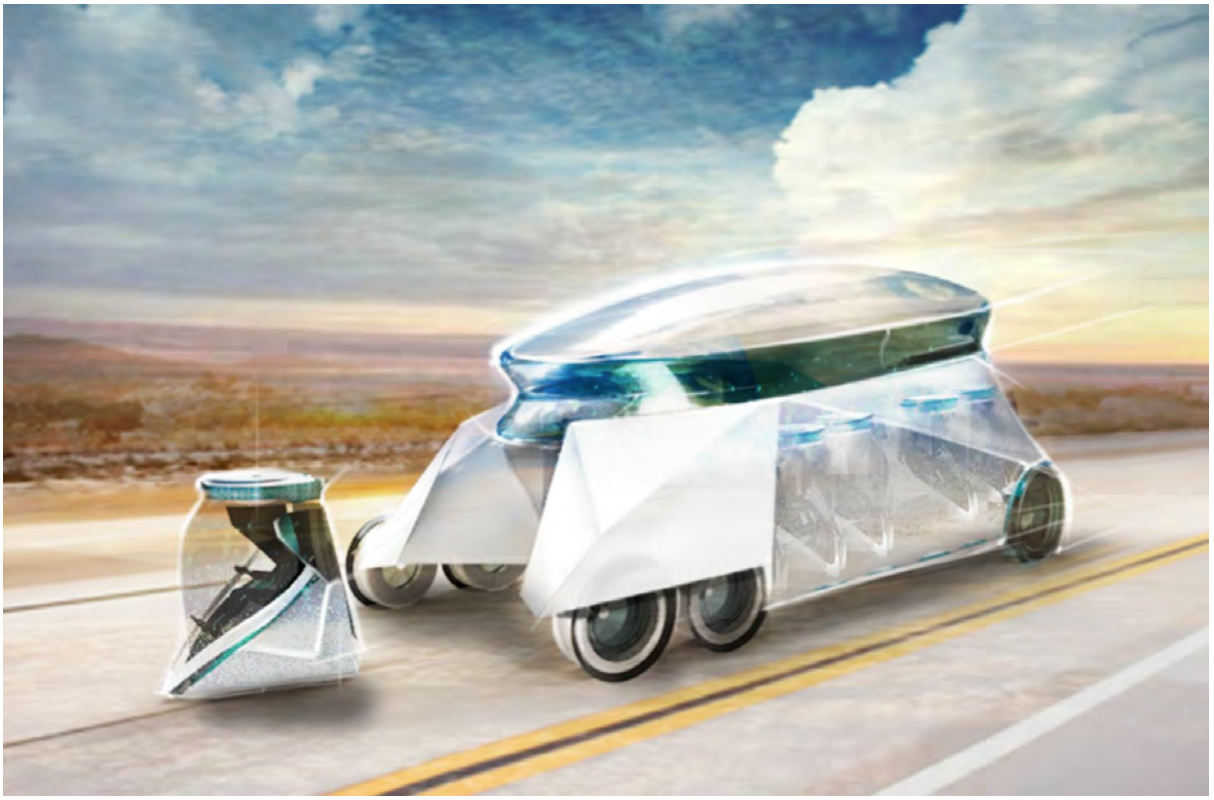
17:30

The vehicle is equipped with inflatable tents, awnings and outdoor furniture, allowing extended adventures.



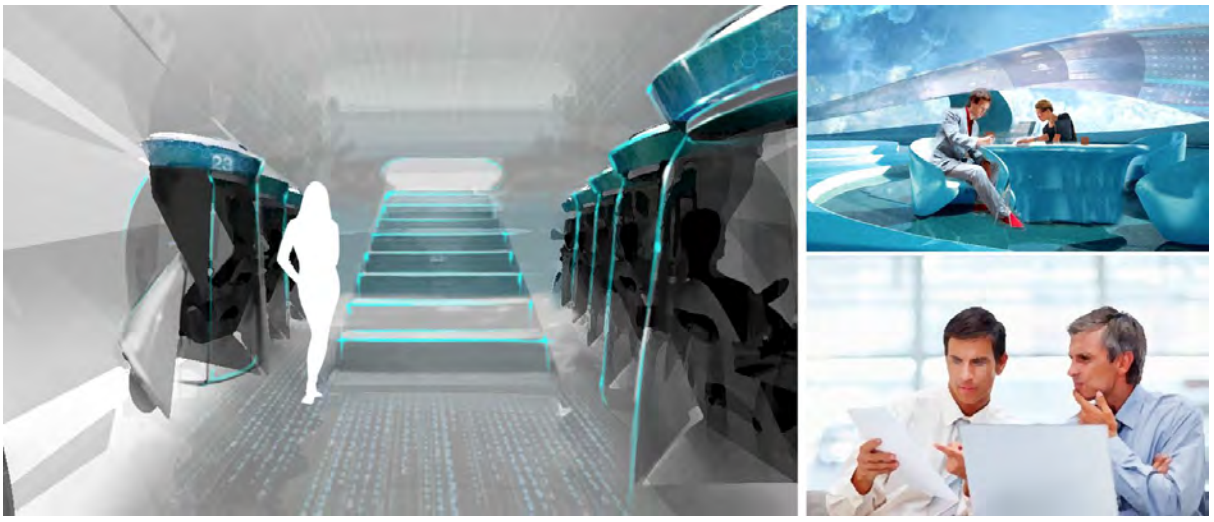
Airport connections

Commuting in foreign countries can be a challenging experience and simple things like travelling from the airport can be much harder than they need to be. Eunji Choi used her experiences to develop a transportation system designed for professional visitors from other countries.



The vehicle is divided into two sections. Pods that can be found at airports and other transportation hubs that visitors can hire using an app displayed in their own language. The pods then join a mothership that transports them from the airport to the city - Stansted airport to central London for example.

During the journey passengers can catch up with calls, get some sleep or make use of the facilities onboard the larger motherbus.



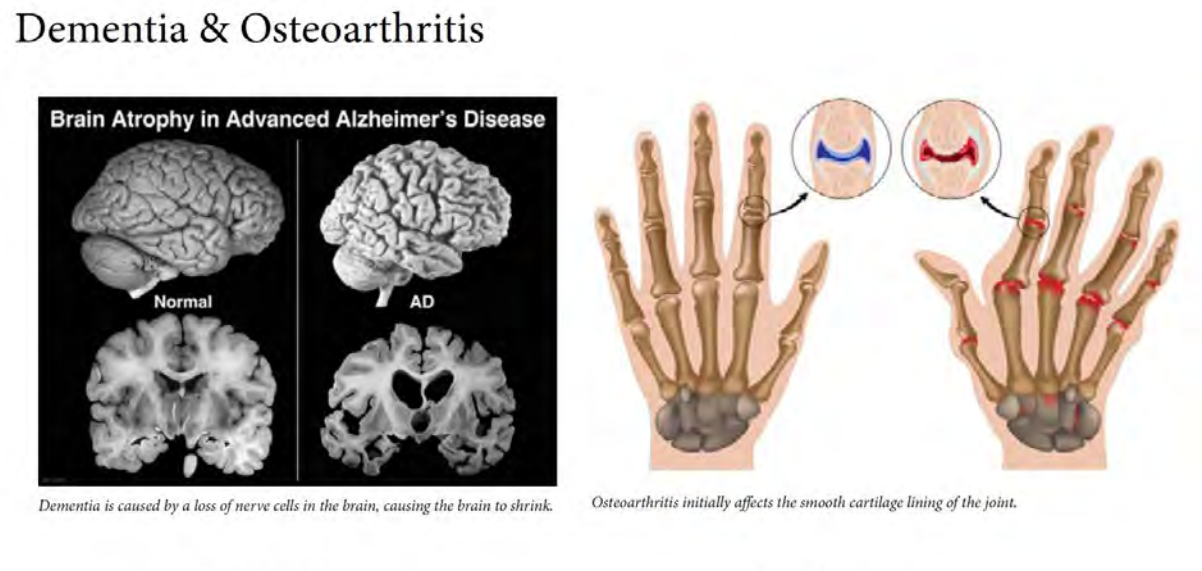
Once the rich the city, passengers rejoin their pods where they detach and travel to their chosen destination.

This project focuses on the alienation that is often experienced by foreign travellers when arriving in a new country and offers a professional autonomous infrastructure that makes life easier. Although this could benefit the ‘business’ user in the short term it avoids local contact and potentially isolates the individual from the local culture and language slowing or preventing their understanding of the country they are in.

Although this may raise more issues than it solves it does show how driverless vehicles need to be considered in a wider context and designed in a way that assists the user while considering the longer term implications.

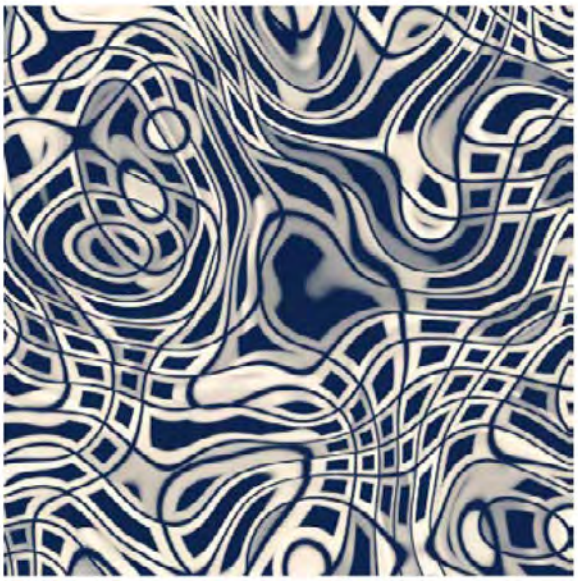
Textile design

The scope of the driverless vehicle project was extended to the textile department. Three students responded, working in a team to explore how textiles may influence driverless vehicle design in the future. Amy Collins, Samantha Yang and Kate Webster looked at two subject areas within the ageing population; arthritis and dementia.

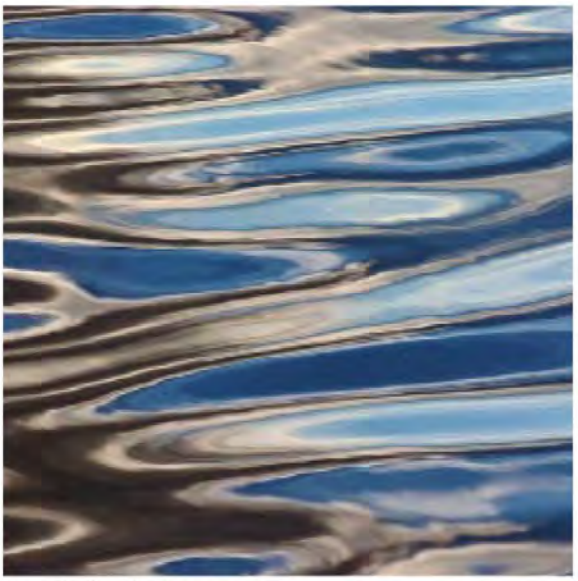


Exploring these two subjects they mapped the issues around each of the subjects and produced a set of requirements that could assist them in designing a future mobility device.

They also identified issues with current transportation textiles. For example, individuals with dementia can have problems with ambiguous patterns and often find it difficult to gauge the depth and material of the surface.

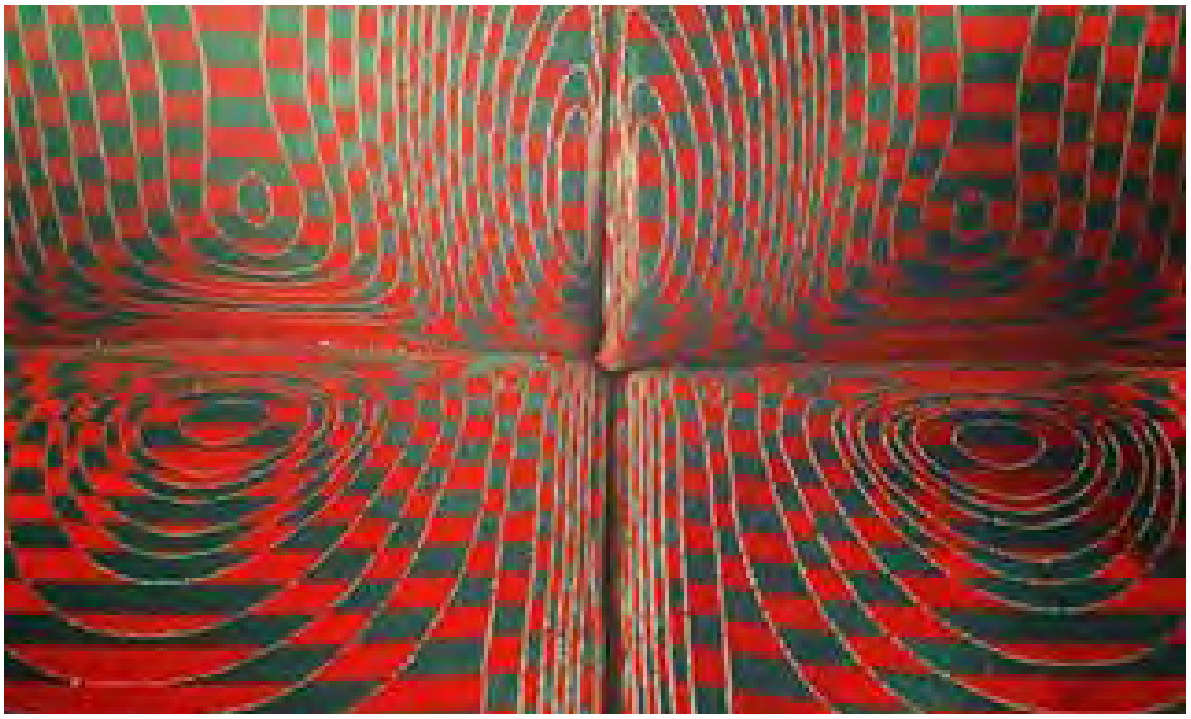


Ambigulous, wavy pattern

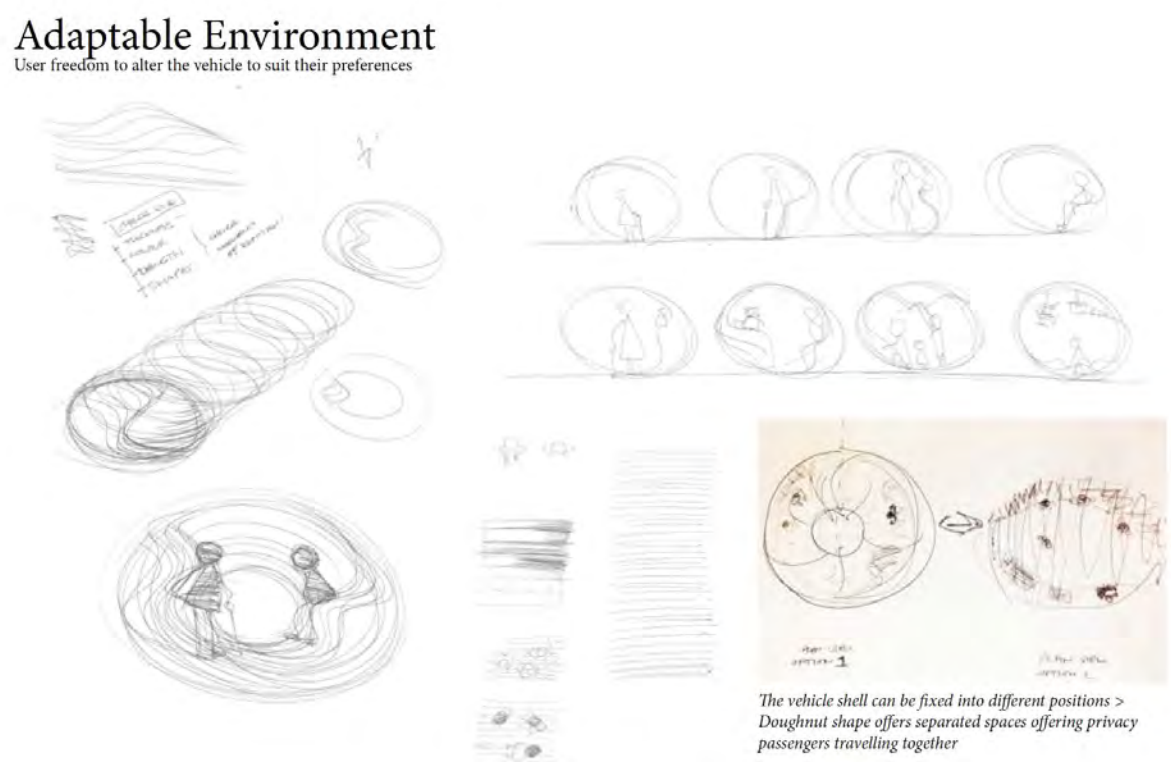


Perceptived reality of pattern

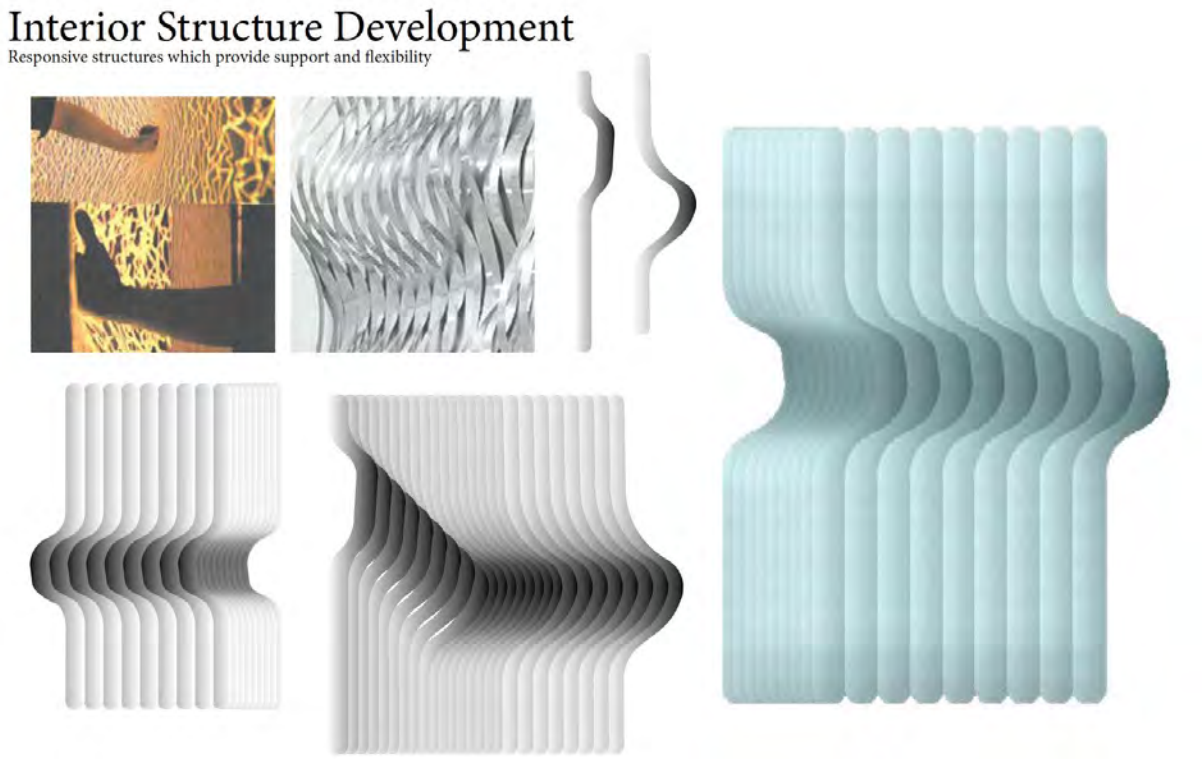
However ambiguous patterns are common place in TFL buses and trains as it hides marks and stains.



Heatherwick seating textile.



Combining this knowledge they designed a seating methodology, categorising what type of materials could be used and the requirements of each of these materials.



This shows the level of input that different disciplines can have on the automotive process and suggests that design methodologies and skills can come from a very different direction with an alternative hierarchy of importance.

4. Conclusion

The primary purpose of the projects was to generate content for the Driverless Futures exhibition at the London Transport Museum in March 2017. Designers, interns and students were exposed to the workshop research being carried out in tandem and were encouraged to draw inspiration from members of the public's ideas.

The two projects together paint a compelling picture of what a driverless future might hold with many projects provoking response and debate when displayed at the LTM exhibition. From 15 original themes 30 designers, interns and students produced 46 designs ranging from miniature street cleaners to moving offices and floating air purifiers.

A breakdown of the major themes that emerged are explored below.

- Urban and trans city typology divergence
- Size of driverless vehicles
- Non human vehicle market
- Autonomous effect on infrastructure
- Public service (not public transport)
- Human to car communication

Urban and trans city typology divergence

What became apparent during the design process is the breadth of possible opportunities that could open up as a result of driverless vehicles being introduced. Multiple vehicle typologies and platforms were explored opening up new business opportunities and benefits for urban residents.

Most current vehicles travel in and between urban environments. However, due to the specialised nature of many of the DVs developed during the project, one theme that emerged is that vehicles may well be split into separate urban and trans city vehicle typologies.

The could allow more specialised vehicles to better meet the needs of their users and encourage the adoption of driverless technology.

Size of driverless vehicles

The project work also predicts a wide range of sizes for driverless vehicles. The GATEway team explored a range of vehicles that focus on urban transportation needs like last mile delivery, medical care, drone technology and mobility assistance devices for disabled and blind people.

This points to an area of the automotive industry that is currently in its infancy, an exception being the last mile delivery company Starship. The micronisation of autonomous technology has the potential to significantly change our urban landscape and the way many of our services and goods are transported across the city and has potential to offer a much more flexible urban mobility model.

Non human vehicle market

The micronisation of driverless vehicles will in part be possible through the removal of people onboard some vehicles. This will open up the service and goods transportation markets to allow for better packaging of the vehicle, a smaller footprint and allow vehicles to access more places within the city.

The implications of this are wide reaching with a possible impact on certain jobs as well as the development of new services that meet the on-demand culture where almost anything can be scheduled around people's needs and desires.

Autonomous effect on infrastructure

The shift in vehicle typology may also have an effect on the infrastructure of the city. Increases in traffic and mobility efficiency could lead to road networks being repurposed for other activities.

In addition to this we may also see urban environments being designed to accommodate these new types of driverless vehicles leading to the increased popularity of 'shared space'.

Public service not public transport

Public transport was identified as a potential 'big player' within the driverless marketplace, as they operate large fleets. If public transport are early adopters of the technology there is potential for an increase in mobility for many who currently do not have it. Another benefit will be that urban inhabitants are more likely to come into contact with the technology which will help in the education of the public and increase adoption and acceptance.

With the flexibility that driverless vehicles could offer, the GATEway team suggest that public transportation in its current form may be too static and rigid a system and

new more flexible systems may need to be developed to make the most of the technology.

The jobs of drivers and conductors will also need to be considered. A public body like TFL may want to balance the service they provide for the people of London whilst also maintaining employment. There are many possible ways to achieve this, for example the removal of the driver could allow buses to have hosts, Or the purpose of the bus could change from not just being a method of transportation but also providing additional services like a coffee shop, bars or retail spaces. This is something we already see on riverboat services.

Human to car communication

The final theme that the projects touch upon is how can people on the street and in other non-driverless vehicles understand the intentions of a fully autonomous vehicles. This is potentially one of the most complex areas that needs to be developed, especially in urban environments.

Person to person interactions happen through a whole range of body movements, eye contact and gestures, all of which promote trust between road users. The team suggest that it is possible to combine physical movement, lights and active surfaces, as well as audio and other sensory outputs to create a more complex language - moving from information and warnings to communication and understanding.

What can we use and take forward - what subjects were most compelling

All of the areas above could lead to further exploration to better understand the subject area and their possible implications. Going through a design process to visualize each of the projects in this document has allowed the designers to try and get to grips with the needs of the people who may use the vehicle, the design challenges that may arise during the process, the possible requirements and specification of the vehicles of the future and the opportunities and challenges that may arise in the future.

Acceptance and adoption

Although the primary aim of the projects was to generate provocations for the exhibition at the London Transport Museum many projects pointed to possible ways new services, typologies, functionality and accessibility can encourage the adoption and acceptance of driverless technology. As the technology matures many of the project features could become commonplace in a city like London.

One of the key areas that came to the forefront of the project was the relationship between private, shared and public vehicle platforms. At present the private and shared sectors are leading the way and therefore leading the conversation. However we see driverless vehicles having the biggest potential when applied to public transportation. If adopted by public bodies this is something that could benefit many more people and increase acceptance and adoption in a more holistic way.