INCLUSION AND EMPATHY MEETING SPECIAL MOBILITY NEEDS IN THE AGE OF AUTONOMY
JUNE 2018

Royal College of Art
IMDC'

FORWARD

Every year, the Royal Automobile Club, the second oldest Motoring Club in the world, sets an automotive-themed challenge for new students on the Royal College of Art Masters programme.

In Autumn 2017 the Club's challenge, set in partnership with motoring think-tank the RAC Foundation, was to explore the design implications involved in seizing the opportunity offered by the development of driverless vehicle technology to create a more inclusive society, granting the independence, freedom and personal mobility that motorists have long enjoyed to those, who for various reasons such as disability, have thus far been excluded from the motoring world.

This challenge deliberately reflects the radical changes we are currently seeing across vehicles, transport, and patterns and modes of mobility. Technologically we are on the cusp of a sea change in personal mobility - driven by the advance of electric power and autonomous vehicles and a rapid rise in urban development within the context of evolving smart cities. The connection of mobility to an extended network of services - promise a completely new model for how we think about transport. For designers this means the understanding that future mobility solutions are far more subtle and complex - requiring an increasing sensitivity to more participatory and human-centred approaches.

RCA is delighted to present the IMMA student's divergent ideas, visions and scenarios to the collective challenge set by the RAC Foundation and RCA Intelligent Mobility MA in response to the question:

'How could vehicles, services or infrastructure (digital or physical) help those who are currently excluded or poorly served by transport options in London?

We hope the results and discussion in this document also achieve the aim of expressing the opportunity for truly empathetic design vision and thereby opening the narrative and debate for future innovation projects which advance and build on the emergent insights herein.

Professor Dale Harrow, June 2018

INTRODUCTION TO THE PROJECT

Background

Almost one in five people in the UK are disabled and by 2035 over a third of us will be of a pensionable age. For many, lack of access and mobility has a serious impact on our quality of life and opportunities for education, employment and wellbeing.

Meanwhile, great claims are being made by advocates of driverless technology, not least the prospects of independence and convenience being enjoyed more widely, and safely, in a world of autonomous vehicles.

So, when the RAC Foundation discussed future projects with the Intelligent Mobility Programme at the Royal College of Art, it was natural for us to develop a project that sought to understand the relationship between future driverless transport and the needs of those who are less well served.

What will these vehicles look like? What will drive the design of their interiors? How will they engage with their passengers and the world around them? And, who better to ask than the designers of the future who will be living in and shaping that world?

The Brief

"You never really understand a person until you consider things from his point of view – until you climb into his skin and walk around in it"

What would it be like to be blind, wheelchair bound or have the responsibility to care for and travel with others as you try and navigate the city? And critically, how could vehicles, services or infrastructure (digital or physical) help those who are currently excluded or poorly served by transport options in London?

This project is an opportunity for you to empathise with people with different mobility needs from yours and create new solutions to make travel more enjoyable, healthy, safe or less expensive. We want your solutions to imagine London mobility in 2030 making use of advances in technology and materials including autonomy and artificial intelligence.

You will work in groups directly with people who have specific unmet mobility needs - creating

and recording your design process as well as the outcome - to understand their challenges and create urban interventions and alternatives which enhance and enable mobility for them.

The RCA teams

The RCA signed up 40 intelligent mobility design students and a range of people who suffer mobility challenges including some with disabilities and some who were restricted by finance or young families.

Students were divided into small groups and asked to carry out background research looking at issues of empathy, inclusion and the future of mobility and technology.

They were also provided with briefings from Steve Gooding, director of the RAC Foundation, and Keith Richards, chair of the Disabled Person's Transport Advisory Committee. We ran a creative workshop where our teams met with members of the public to hear their hopes and fears for future transport, to share the problems that they faced on current journeys and to work together to co-create future journeys and vehicles that not only overcame problems but also created more delightful experiences.
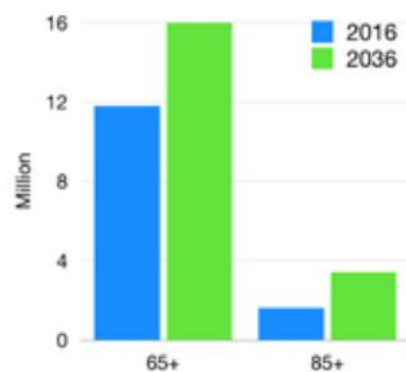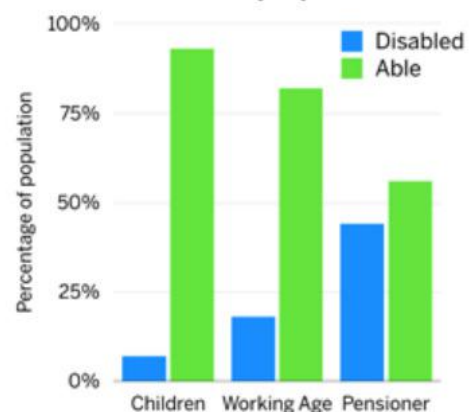
APPROACH

Introduction

This project evolved through a series of stages which mirror the divergent-convergent double diamond process embodied in the model detailed in the Design Council's overview of design as below. This approach is a useful backdrop to this work not least because the project necessarily required a sensitivity to problem/domain insight and research; phase 1 and envisioned futures; phase 2.

Explore   Focus   Develop   Deliver
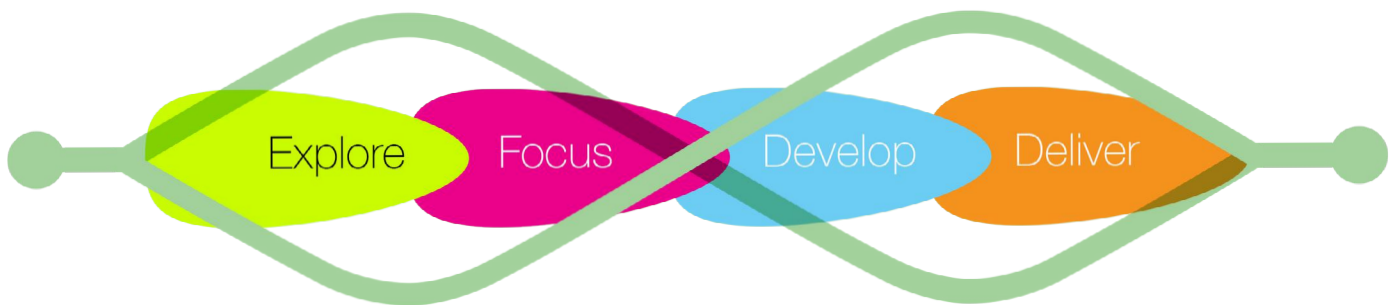
Discover

During this phase designers' planed out project activities and responsibilities, carried out desk and field research, meet with the people they were serving and other stakeholders. To support this, the RAC Foundation organised a briefing with Keith Richards, the chair of the Disabled Persons Transport Advisory Committee, and the RCA ran a co-design workshop with public participants.

The co-creation workshop included sharing people's hopes and fears when they thought about a driverless future; mapping out the steps and the problems that people experience on everyday journeys; imagining how driverless technology and other innovations might not just overcome these problems but also create more delightful journeys and experiences; and building a physical model of a future dream vehicle that included emotional, functional and technical layers.

Designers also met with experts to understand the wider needs of particular disabled groups, undertook service safaris to experience what it means to travel through London with specific physical or mental health conditions and continued to identify insights that might be valuable for future products and services. The second phase provides an opportunity for

Define

designers to make sense of all the insights and knowledge gathered during this phase. What matters most and what should be discarded. The goal is to develop a clear creative brief that frames the fundamental design challenge.

During this phase designers examined journeys in more detail to identify the key challenges that they needed to overcome and the key opportunities that they want to include in their design definition.

Methods that designers use included creating 'personas' that describe in more detail the people that they are designing for; carrying out brainstorming activities to agree which insights and directions to follow; and the creation of a design brief that specifies the direction that the team wish to develop solutions for.

Develop

Once a direction is agreed designers develop a variety of solutions that can be prototyped, improved and tested. Idea development is a highly creative process where designers sketch out different solutions to the problem; create future journey storyboards, interior environments, exteriors, interfaces and other touch points; and make full size mock-ups.

Key activities include idea development, physical prototyping together with product and experience testing.

Deliver

While students were not tasked with delivering a finalised product or service, they were tasked with presenting their proposals in order to gain feedback and to develop mini business-cases that they could reflect on it later projects.
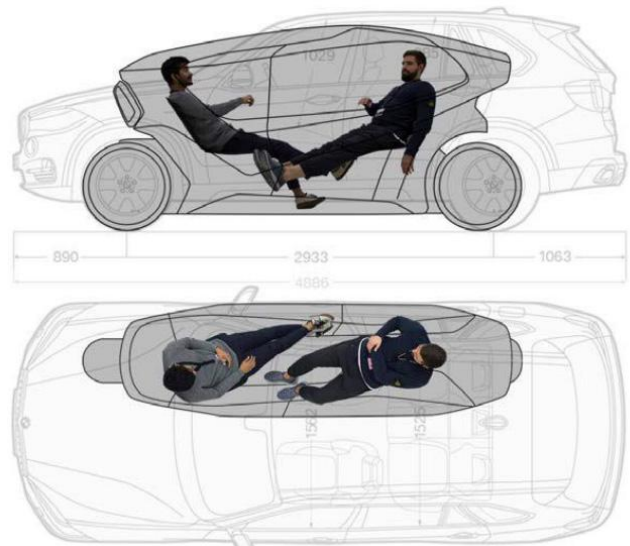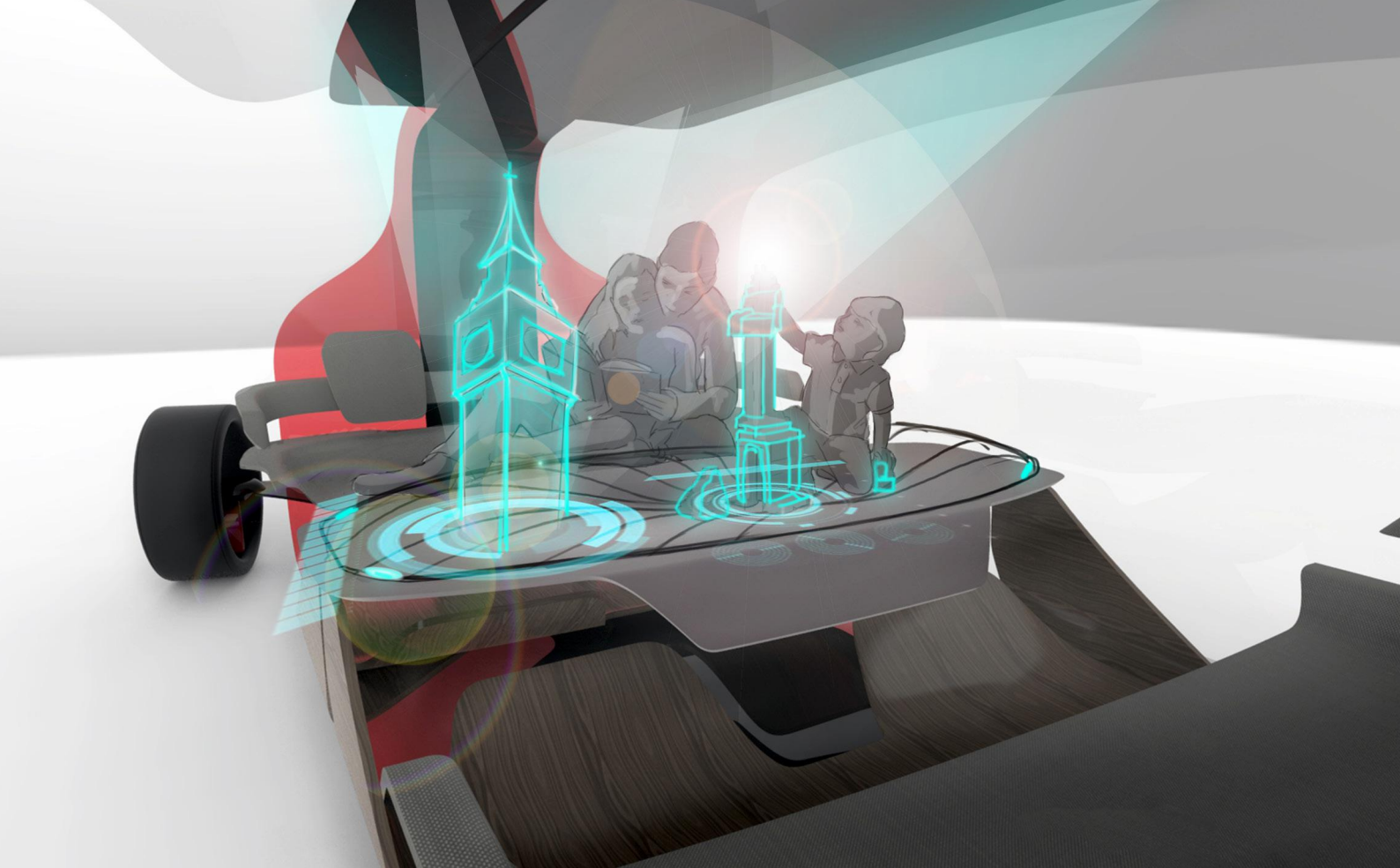
INTELLIGENT MOBILITY
MA STUDENT WORK

Royal College of Art
Intelligent Mobility

Autono Me & You

Autono Me & You presents a concept to bring the public of 2030 closer to an autonomous future. The family vehicle, as part of a shared school-run transport service, provides a growing experience for families of all sizes. Futuristic materials and VR experience create an interactive and educational space, enabling families to share time and develop values.

This shared transportation service enhances every-day lives by utilising autonomous and high-tech developments to prioritise human interaction and cultivate family values. When it is not required for that it will work as a private hire vehicle for anyone in the city.

Key quote:

"moving from private to shared ownership increases quality and inclusivity for all"

Designers
Hamish Chandler, Ji Soo Hwang, Zeyuan Lin, Vartan Padaryan, Anat Patel

Theme
Autonomy for learning on the move

Team 30

Up-Cycle is an autonomous bicycle that uses London's existing cycling network to shuttle passengers around the city. Our goal was to provide a cost-effective mode of transport, focusing on benefits to the general public as well as the local environment.

A new-grade material, Mycelium, would make up the main structure of the vehicle, allowing a one-week life cycle, before being returned to the earth for future remanufacture.

The pedals give the user the opportunity to return charge to the vehicle's batteries, benefiting the user by encouraging physical activity and rewarding them with further discounts after milestones have been achieved.

Key quote:

"cost and convenience are key"

Designers
Rhys Lewellyn, Carwyn Hong-Eveleigh, Cho Wai Lee, Jyiyoon Ahn

Theme
Holistic and healthy personal mobility for financially limited

Master of Puppets

This proposal helps those with impaired or complete loss of eyesight locate and reach the nearest form of public transport as independently and safely as possible. The system finally proposed contains a drone, which collects instant information about traffic and the environment around the individual, and a headphone, which conveys information through voice. The proposal also features two optional devices – a glove, which detects and conveys information by echo-location and vibration, and a cane with a wheel, which has a similar function to the glove.

Users can choose between these two devices, depending on their adaptability to new technologies and whether their emotional needs are fulfilled. Using the system, people with impaired vision can move more freely and independently to public transport and other locations, helping them become confident and enabling them to integrate with others.
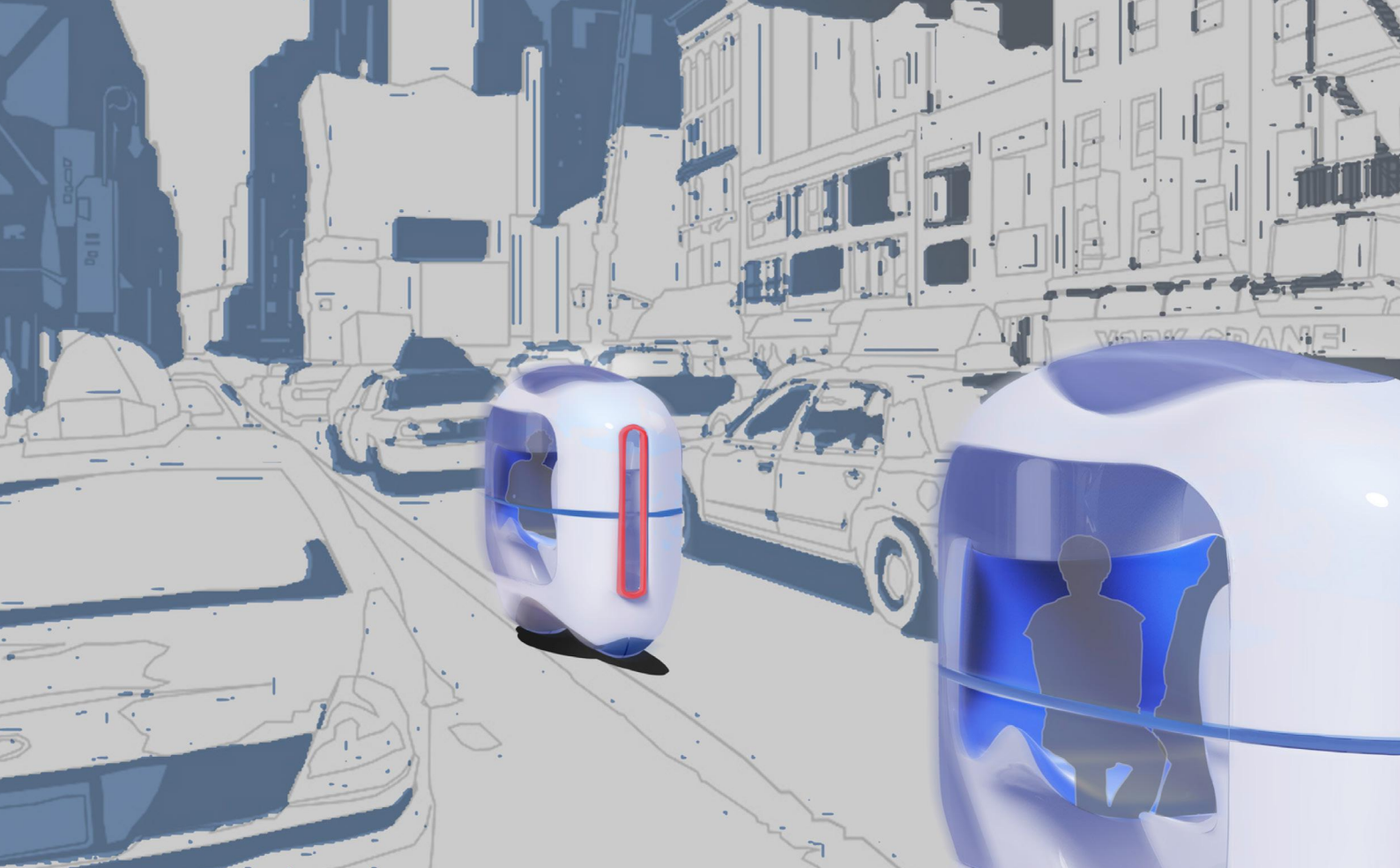
Key quote:

"Everyone has a different way of sensing the world"

Designers
Dain Kim, Wojciech Morzstyn, Jiayue Wu, Zhiyang Yu

Theme
Future sensing systems for those with e.g. impaired vision

Faith

Team FAITH (Future Automotive Intelligence Technology Hope) design is a mobility solution focused primarily on young families carrying out the school run in 2030 central London.

The current problem the team considered was congestion, lack of parking, cost and long walks to connect to public transport. During our research, we noticed users, particularly millennials, were more concerned about access than ownership – there was an increase in the use of public transport and Uber taxis.

Our solution is a gyroscopic four-seater motorcycle. The reduced width of the vehicle allows it to slip easily through traffic and its top speed of 30 mph gives it access to the bicycle highways of 2030 London.

Key quote:

"Everyone has a different way of sensing the world"

Designers
Pei Chan, Goeun Lee, Aaj Patel, Fenton Robothan, Jasmine Wallace

Theme
Systems for those with impaired vision

Dralf

Team DRALF looks at the issues for those people confined to a wheelchair and to identify daily challenges encountered by physically impaired people. These were primarily issues of height, alienation, loss of identity and stigma.

For the research, they hired out a wheelchair in a shopping centre to experience at first hand the difficulties faced by users such as using escalators, browsing in shops and dealing with customer service staff.

The team devised a mobility solution based on shared vehicles, which could be used easily by both able-bodied and physically impaired people.

The vehicles were linked via a network of meeting points to enable and encourage interaction and engagement and foster a sense of community between all of the systems users.

Key quote:

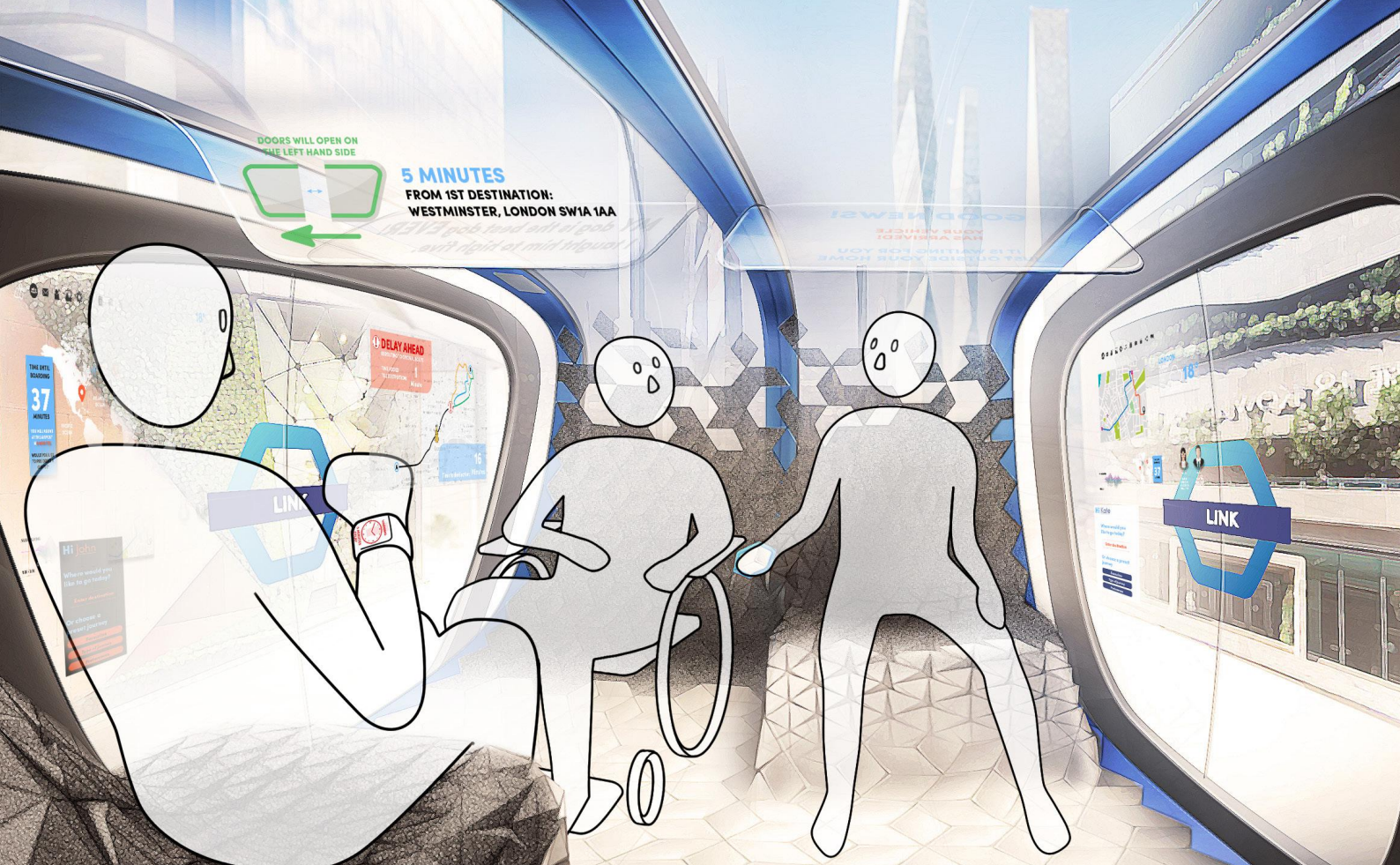*"Same level and equal experience and a sense of belonging"*

Designers
Dan Flackett, Kai-Tse Lin, Anurag Nandi, Li Pengduowen, Riccardo Petruzzi

Theme
Systems for those physically impaired or wheelchair bound

Furbee

Link is a service vehicle built primarily for the deaf, or otherwise hard of hearing, but is ultimately beneficial to everyone.

We started our research by interviewing a volunteer, John, who was born deaf, before conducting first-hand research and working with the British Deaf Association.

Our proposal is a fleet of two- and four-seater vehicles, owned and run by Transport for London.

Replacing black cabs with fully driverless vehicles (at the international Level 5 definition of full autonomy), would drastically improve visual communication before, during and after the use of the vehicle, creating a seamless interface between the user, vehicle and user-to-user.

Key quote:

"People don't want to feel isolated or treated differently"

Designers
Hilja-Maaria Kaitila, Ashley Kennard, Shunsuke Mogi, Or Shachar,

Theme
Systems for those with impaired hearing

INFRARED
PRESSURE POINTS

SPINAL SUPPORT

HyperG⊙n ©

ALLEVIATING SUPERSUIT

PRE-ACTIVITY GRADUATED COMPRESSION SUSTENANCE AND RECOVERY SUIT *

TEAM 24 / Kun-Yang Chen, Chenchang Li, Rotenda Nevhutalu, Louis Saout, Olli Seppälä

DAY'S OVER. BUT THE NEXT ONE ISN'T. THIS IS ALLEVIATING TIME. CRITICAL TIME. HYPERGON'S GRADUATED POWER GRID COMPRESSION AND ITS INTEGRATED CONNECTED ADAPTIVE LIVING SKIN REDUCE MUSCLE PAIN, NUMBNESS AND TINGLING BY PUTTING PRESSURE WHERE AND WHEN YOU NEED IT. IN THE TRANSPORT, AT WORK, ON HOLIDAY, IMPROVING DIAGNOSTICS AND MONITORING, MAXIMIZING THE INDEPENDENCE AND PARTICIPATION OF INDIVIDUALS.

PERSONALIZED, EMBEDDED, UNOBTRUSIVE, AND USABLE ANY TIME AND ANYWHERE.
LET THE PRESSURE HELP MANAGE YOUR OWN GENERAL HEALTH.

* AUTOMATIC CALIBRATION, WEATHERPROOF AND WATERPROOF SYSTEMS, INTEGRATED WIRELESS TRANSMITTERS THAT CAN COLLECT DATA EVEN OUTSIDE 4G (BLUETOOTH) AREAS, DATA CAN ALSO BE SENT TO DOCTOR - VIA SMART PHONE OR TABLET APPLICATION (OPTION FOR REAL TIME) - TRANSMITTED TO A REMOTE SITE SUCH AS A HOSPITAL SERVER FOR CLINICAL ANALYSIS.

GRADUATED COMPRESSION

TIGHT

BACK 30%

ABDOMINAL WALL 30-50%

THIGH 50-60%

CALF 60-80%

ANKLE 100% 15-25 MMHG

TIGHTEST

POWER GRID
HYPERGON'S GRADUATED POWER GRID DESIGN CREATES A SMOOTHER TRANSITION FROM TIGHTEST TO TIGHT

ADAPTIVE LIVING SKIN
HYPERGON'S ADAPTIVE LIVING SKIN REDUCES MUSCLE WEAKNESS, SPASMS AND STIFFNESS

DRI-BLEND
MADE WITH A BLEND OF 52% COTTON, 43% BAMBOO, 5% LYCRA KEEPING YOU COMFORTABLE

Royal College of Art
RAC Foundation

Team 24

Multiple Sclerosis (MS) is a chronic auto-immune disease attacking the central nervous system. Approximately 2.3 million people world-wide are affected, yet the cause is unknown and there is no cure. Our alleviating supersuit is a pre-activity, graduated compression, sustenance and recovery suit.

Our concept, Hypergon, comprises a graduated power grid and an integrated and connected, hexagon-shaped, adaptive living skin, helping to reduce some important multiple sclerosis symptoms – muscle pain, numbness and tingling – by applying pressure where and when you need it.

On the move, at work, or on holiday, the supersuit improves diagnostics and monitoring, maximising the independence and participation of affected individuals.

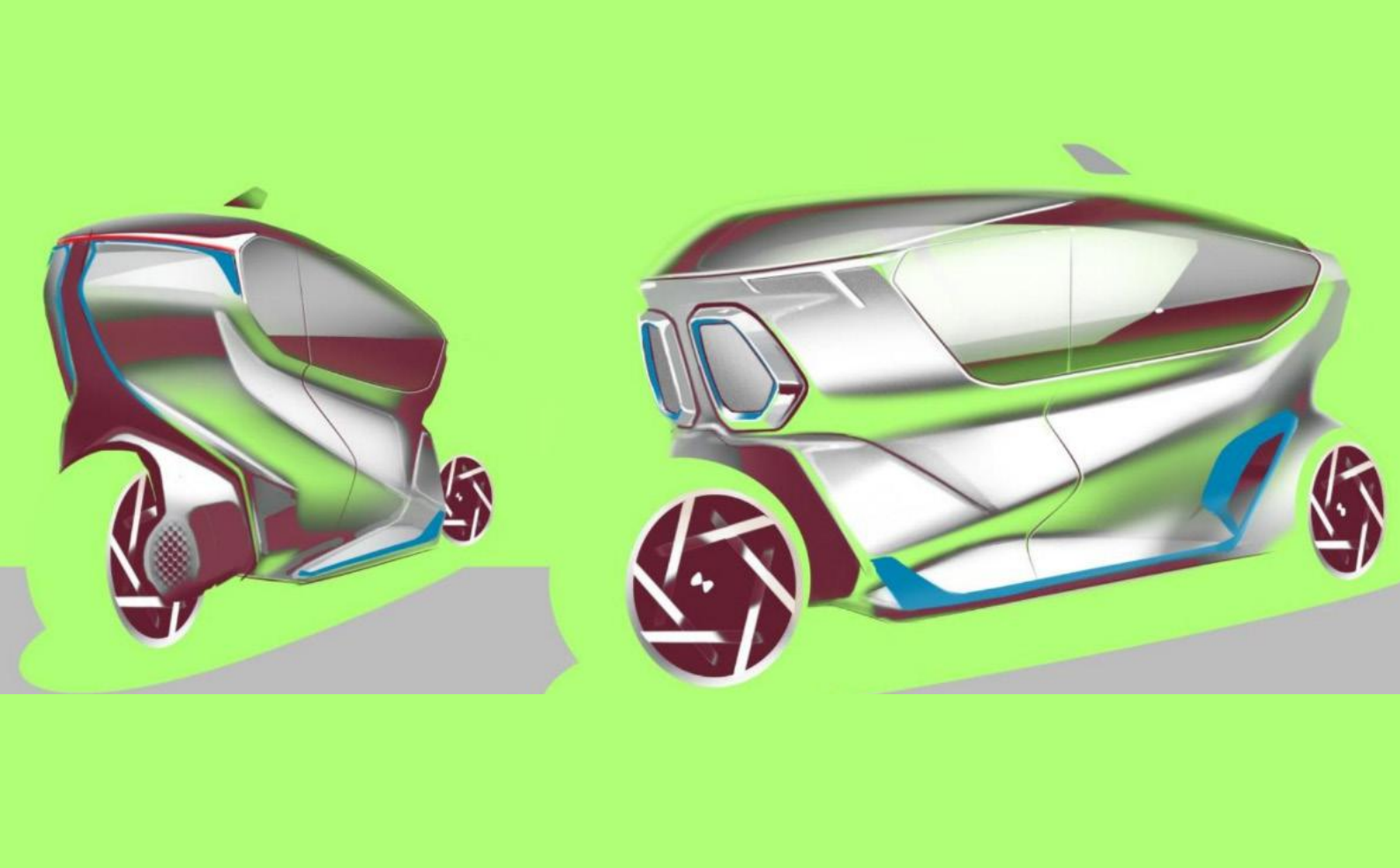**Key quote:**

"Not all disabilities are visible"

Designers
Astra Li, Kun Yang Chen, Olli Seppala, Rotenda Nevhutalu, Louis Saout

Theme
Advanced concealed support and intelligent clothing for MS sufferers

Adapt

Transportation is a considerable issue for people with impaired ability. In our efforts to design a better system for everyone, we realised that every step of our design process must consider key user needs.

The process began with Norin, a Londoner and registered blind citizen. During our time with Norin, we learned of his hopes and fears about current and future transport systems. We had first-hand experience through a 'blind' experiment and focused on creating mobility, not only for visually impaired but for the general community.

A vehicle almost half the length of an SUV would solve the issue of congestion on the narrow streets of London and we developed our solution around the interior, making ingress-egress easier, while also creating a social environment inside the vehicle. Our design would not only help the visually impaired to travel, but also give a fresh look to the streets of London in 2030.

Key quote:

"Getting in and out of vehicles is key"

Designers
David Hardie, Aditya Jangid, Alexander Matthews, Paul Windermut

Theme
New mobility for the blind

KEY INSIGHTS

A need for empathy

If we are going to realise the promise of more inclusive and independent mobility from autonomous technology, the above concepts begin to illuminate the range of subtle and often inter related issues which surround mobility design. In this last section however we wish to point to what we feel has emerged as a series of main insights.

These are not intended to be exhaustive but more salient and focal insights which can serve as catalysts for further research by different stakeholders in this sector.

The first insight we wish to identify is the need for greater empathy and understanding in the design of transport services. In short this needs a more strategic and thoughtful approach to recognise the needs of disabled and otherwise mobility constrained people. The challenges and issues faced by the spectrum of users in our study highlighted the need for a more nuanced understanding.

Physical needs are an immediate area for consideration which came out of much of the work and investigation in this study and are arguably one of the first areas under consideration when thinking of additional needs as highlighted in the following g quotes.

"My elderly mother cannot cope with sudden movement or big steps."
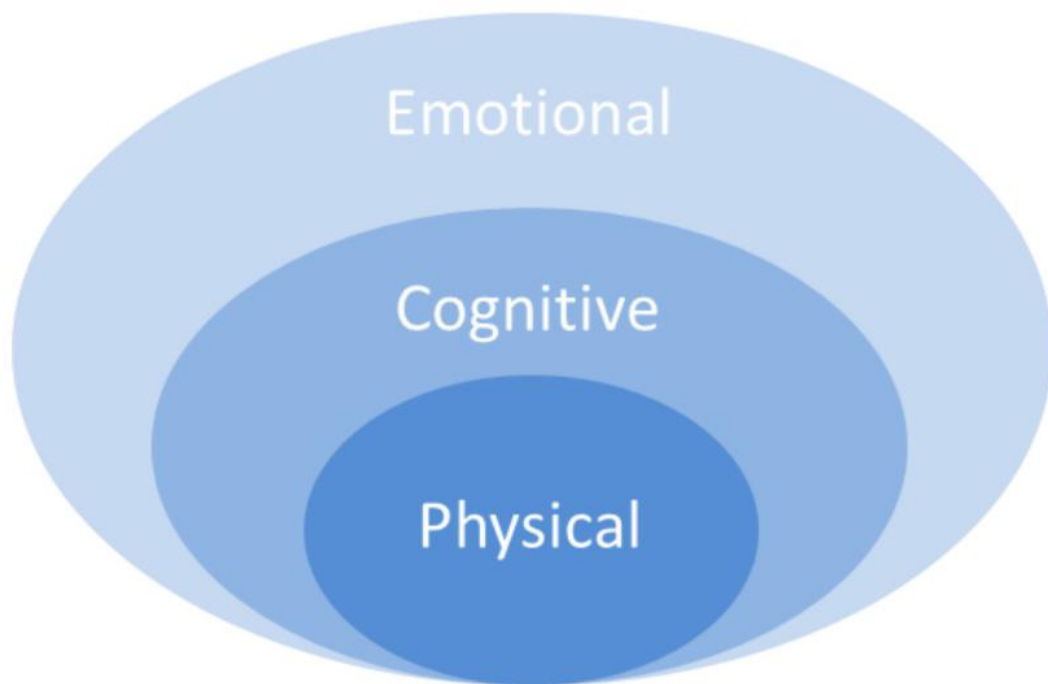
"Sometimes getting to the nearest bus stop can just be too far for me to walk to, so I don't go."

Emotional issues and concerns although perhaps being the least directly referenced, involve some of the most complex and subtle challenges designers need to consider, with issues including dependence, trust, dignity influencing the level of success of different approaches.

"Although I travel independently, I depend on assistance."

Cognitive/Sensory issues were also repeatedly highlighted through different discussions within the project – with information provision repeatedly being raised as a problem area in current transport provision.

"I'm deaf so all information given using sound is useless!"

28% of Londoners do less than 30 minutes of activity a week

34% of Londoners walk or cycle a day

£1.7 Billion
Saving for the NHS over 25 years if people walked 20 minutes a day.

DECREASE
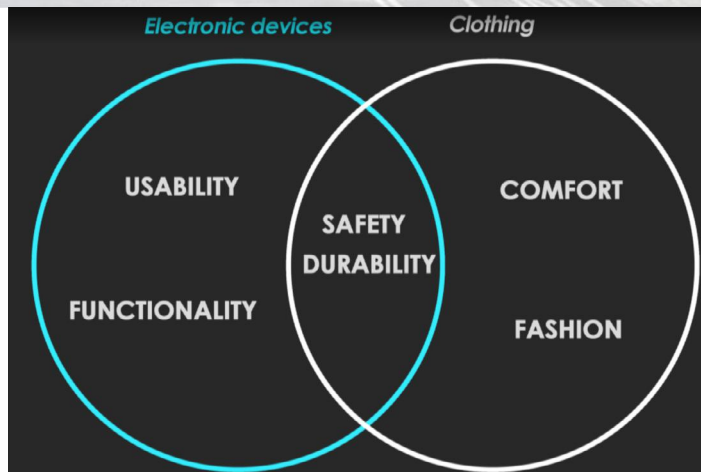In diabetes, dementia, depression, heart disease and cancer.

TFL HEALTHY STREETS

TFL's plan for a better London. Using these 10 principles to improve Londons streets. The main core is to encourage cycling and walking

System and stakeholder connectivity

We clearly need to think beyond the vehicle to consider the factors that currently trap people in their homes and limit their independent mobility. The vehicle is just part of the picture – passenger smartphone and data infrastructure will increasingly open the opportunity for effective adaptation of environments to passenger needs.
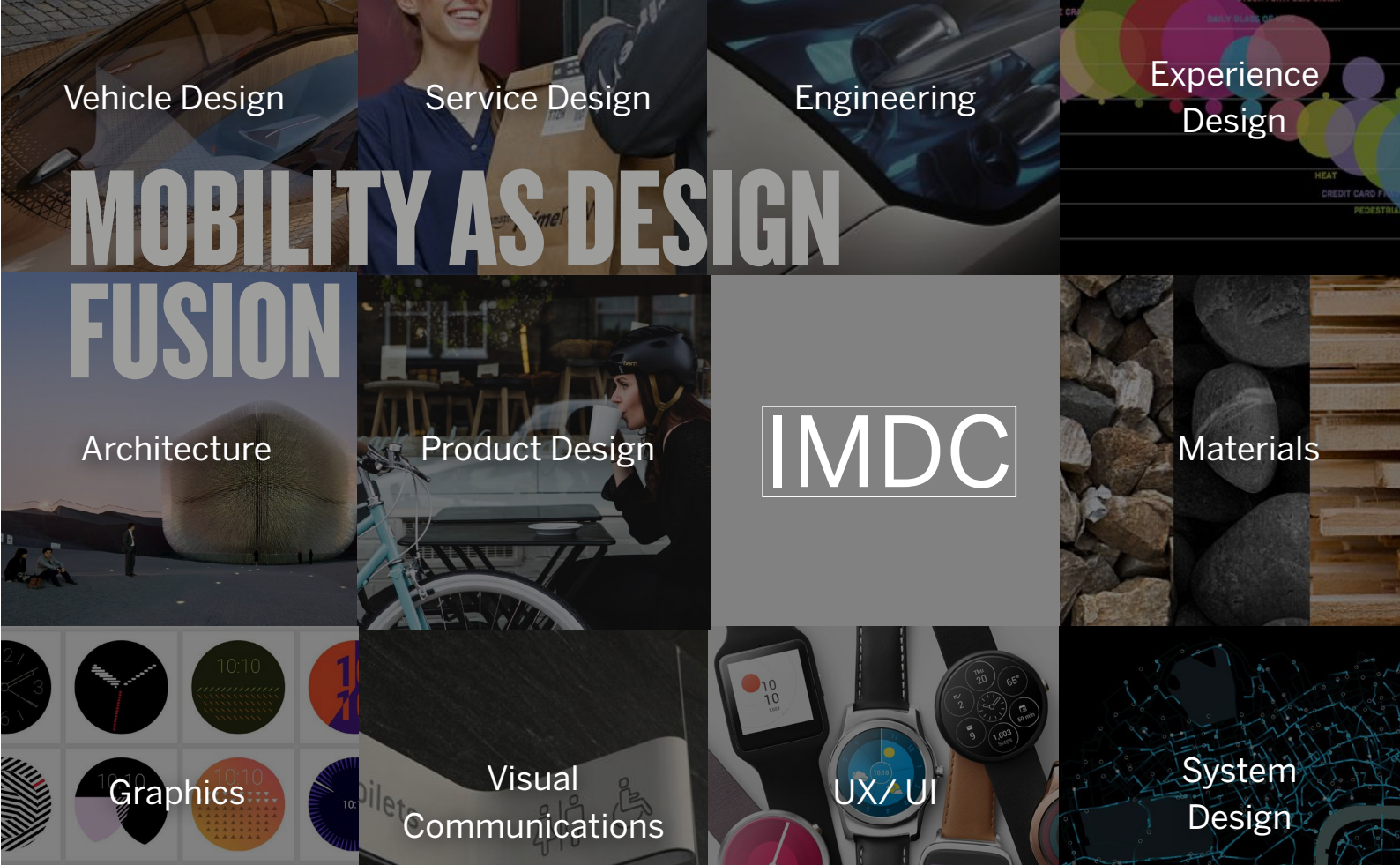
In practice this may mean adapting information and displays to aid the visual or cognitively impaired - for example if a smart phone is able to communicate key information about an occupant which can be used to adapt the environment. However it is also likely to spread to include physically adaptive systems enhancing comfort and safety or facilitating more efficient mobile working through enhanced temporary privacy.

The more visionary big win though may come not just via enhanced passenger mobility but via the understanding and continued care for passengers. The Hypergon project highlighted the way such extended functionality can work for example in the area of smart clothing.

HUMAN ASPECTS IN SMART CLOTHING

MOBILITY AS DESIGN FUSION

Vehicle Design

Service Design

Engineering

Experience Design

Architecture

Product Design

IMDC

Materials

Graphics

Visual Communications

UX/UI

System Design

An opportunity for OEM's

To inform that thinking, designers and professionals must engage with people to fully understand the world they experience, the challenges they face and their desires and aspirations for mobility. When this occurs there opens a distinct opportunity for new approaches, tools and technologies to be used by OEM's to deliver more relevant and visionary transport options. Remember good design practice thrives on continual evolution against the contextual challenges of specific areas – allied to the testing and development of tools and approaches.

Designing effective mobility for blind, physically or cognitively impaired users is therefore a vitally important space for design process itself to be advanced and tested.

This includes taking a more cross disciplinary approach – for example by integrating service design with user experience (UX) and physical hardware (especially vehicle and transport exterior/interior) – to deliver a more relevant, visionary and ambitious set of journey scenarios.

PROJECT TEAM

RCA Team

The Inclusion and Empathy project was led by the RCA's Intelligent Mobility programme team – headed up by Prof Dale Harrow

RAC Foundation
Steve Gooding
RAC Club Motoring Committee Guy Nicholls

Special thanks to:
Keith Richards,
Chair of the Government's Disabled Persons' Transport Advisory Committee

Layout & Design
Dan Quinlan

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Autono Me & You:
Hamish Chandler, Ji Soo Hwang, Zeyuan Lin, Vartan Padaryan, Anat Patel

Team Faith: Pei Chan, Goeun Lee, Aaj Patel, Fenton Robothan, Jasmine Wallace

Furbee: Hilja-Maaria Kaitila, Ashley Kennard, Shunsuke Mogi, Or Shachar

Team Dralf: Daniel Flackett, Kai-Tse Lin, Anurag Nandi, Li Pengduowen, Riccardo Petruzzi

Team 24: Chen Chang Li, Kun Yang Chen, Olli Seppala, Rotenda Nevhutalu, Louis Saout

Team Adapt: David Hardie, Aditya Jangid, Alexander Matthews, Paul Windermut

IMDC/IMMA Project lead
Professor Dale Harrow

Professor Dale Harrow is Chair of the Intelligent Mobility Design Centre (IMDC) and Head of the Intelligent Mobility Design Programme recognised as a global centre of excellence in automotive and design education. As a former Dean of the School of Design at the RCA he introduced new Programmes in Service Design and International Programmes in innovation design and championed multi-disciplinary design methods through new curriculum development.

IMMA Senior Tutor
Dr Chris Thorpe

Dr Chris Thorpe is a Senior Tutor in Intelligent Mobility at the RCA. He is Director of Intelligent Design Associates Limited, established in 2011, a strategic interdisciplinary 3D design studio focused on the commercial ethical-technical design research. Chris has 25 years' experience in commercial design and academia. He led the design innovation group at QinetiQ from 2000 to 2011 – working on a wide range of innovation and research projects for global brands including Unilever, Nokia, Virgin Atlantic and the UK Government's department of health.

IMMA Tutor
Guy Colborne

A graduate of the RCA Vehicle Design course (the forerunner of the Intelligent Mobility programme), Guy Colborne has over 24 years of experience in the global automotive design industry having worked for Opel, BMW, Daewoo, TWR and Ford. He is also Design Manager at Elemental Motor Company Ltd, based in Hampshire, as well as working as a freelance design consultant.

His expertise in 3D CAD systems and processes, vehicle exterior concept and production design assist in the education of students on the Intelligent Mobility course

IMMA Tutor
Cynthia Charwick-Bland

Cynthia Charwick-Bland is an automotive designer with 30 years of experience in the motor industry, having worked at IAD, Daewoo, SAAB, Volvo and Ford. Her extensive knowledge of materials and production processes, concept build and a specialism in interior vehicle design are vital factors that contribute to the education and guidance of students on the Intelligent Mobility course.

IMMA Visiting Professor
J Mays

J Mays is a world-renowned vehicle designer and Visiting Professor in the RCA's Vehicle Design programme. He has worked at an international level throughout his 30 year career, and his influence in the automobile design industry is evidenced through his work for major global car manufacturers including Volkswagen, Audi, BMW and Ford. He has been instrumental in the design of some of the world's best-known and best-loved cars, including the new VW Beetle, and the Audi TT.

Research Assosiate
Dan Phillips

Dan Phillips is a designer and engineer with 30 years' experience in the development of innovative environments, products and services. He studied at Imperial College and the University of Cambridge and tutors on the Service Design programme at the Royal College of Art and Imperial College. He is a Fellow of the Royal Society of Arts and has been a member of a number of institutional advisory groups on cities, sustainability and the built environment.