ABSTRAKT

Pocket Laboratory for the Future

TRANSFORMING TRANSPORT

ON THE VISION OF INTELLIGENT MOBILITY

AND STORIES ABOUT FLYING ELECTRICITY, ETERNAL MISTAKES AND ROBOTS WITH MOUSTACHES

W.I.R.E.
THINK TANK FOR BUSINESS, SCIENCE & SOCIETY

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TRANSFORMING TRANSPORT

ON THE VISION OF INTELLIGENT MOBILITY

A guide to the future of mobility

With contributions by
Stephan Rammler, Gerald Huff, Bjarke Ingels, Sebastian Moffett,
Kim Stanley Robinson, Karl Gernandt, David Young and Richard Branson

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TRANSFORMING TRANSPORT

A guide to the future of mobility

CRITICAL LONGTERM THINKING

TRANSFORMING TRANSPORT

A guide to the future of mobility

BACK TO AN INTELLIGENT FUTURE

BY SIMONE ACHERMANN

In the Hollywood classic "Back to the Future II", protagonist Marty McFly's flying DeLorean time machine takes him from the year 1985 to 2015. The future looks different today from the way they imagined it in the 1980s: we don't have flying cars, hovering hoverboards or fusion drives that use garbage as fuel. Nevertheless, the visions of today are more relevant now than they ever were.

We live in the age of mobility. Being on the go is part of the way we perceive ourselves in modern society. Day on day we spend hours on the way to work, school, shops, friends or well-earned holidays. Mobility is a symbol of freedom, self-empowerment and flexibility. Those who don't roam the world are deemed narrow-minded. The right to freedom of movement is deeply embedded in our culture. Technological progress additionally favours the growing importance of being on the go. Travel from A to B gets faster and faster, so we do it more and more often. And in a highly complex world which is less and less influenced by individuals, the steering wheel in your hand provides a sense of identity.

On the one hand, it's a good thing. Because mobility is indispensable to the good of society. It is a core prerequisite for all kinds of development - in nature, society and business. Encounters with someone or something

different are absolutely essential to enable new things to be created. There is no trade without an exchange with other economic systems, no biological evolution without a change of living environment, no cultural diversity without geographic diversity. Mobility and progress belong together.

On the other hand, we have now reached the point where mobility is no longer furthering the development of civilisation, and where it has less to do with its own immanent idea of freedom. Awareness of the boundaries and negative consequences of increasing mobility is growing: CO_2 emissions are polluting the environment, fuels are running short, transport systems are permanently congested and the pressure on hypermobile humans is growing.

Because mobility is increasingly reaching limits and incurring risks to people and the environment, the call for more efficient and sustainable forms of travel has increased steadily over the past few years. Granted, it will be difficult to extend the congested road system by a third dimension as in "Back to the Future II" with its flying cars, and garbage-evaporating drives are not in mass-market use despite first prototypes by US start-ups. However, the promise of a paradigm shift towards "smart" mobility is in prospect instead: based on self-driving cars, alternative electric drive systems and new business models in the context of the "sharing economy". It will not be long – that's the general assumption– before the mobility sector will be turned upside down by new players from the software market, such as Google and Apple, and start-up companies like Uber.

Accordingly, the transformation of mobility comprises much more than a new generation of vehicles. Nothing less is expected than a disruption of the mobility industry in which cars will become part of a large intelligent infrastructure created by integrating different means of transport. The focus of mobility would then shift from the product to the service. People will buy the trip and not the vehicle; it won't matter what form of transport they use to reach their destination; the car will lose its value as a status symbol.

It sounds good. The general mood of a fresh departure seems justified. The mobility sector will enter a better, more intelligent future, headed by the cars that science fiction stories have always used as a projection of radical transformation and that seem ideally suited to leading the charge. Yet in the light of the forthcoming revolution, a critical consideration of the promises from Silicon Valley are of increasing importance: will mobility, from private vehicles to the global transport system, be fundamentally redefined? In reality, 90% of world trade is still covered by marine transport. Will the majority of drivers on our roads be robots in a few short years, as prophesied by Elon Musk? And if so, what will that mean for even more efficiency? Is this the foundation for new economic growth and even more freedom, or ultimately just a continuation of the old dream of opening up new aspects of life to mobility technologies? What constitutes innovation in the context of the integration of different means of transport? And anyway, how much mobility do we actually need in the age of digitalisation? In concrete terms: what is truly intelligent mobility?

ABSTRAKT N° 15 addresses these issues. Based on an analysis of the present, opinions and ideas from experts and current innovations are critically assessed. They form the basis of W.I.R.E.'s conclusions, ideas and hypotheses.

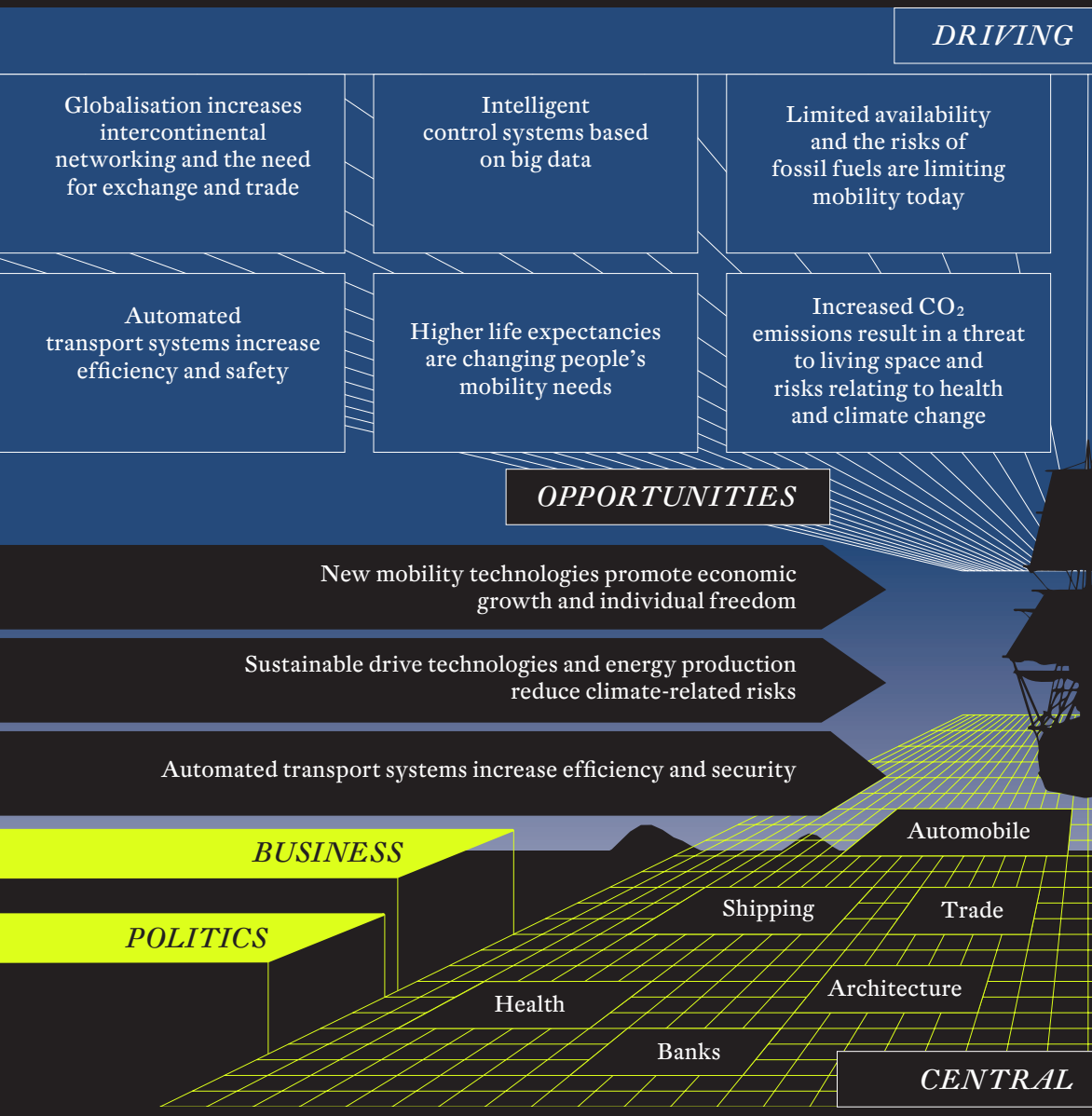
Stephan Rammler, Professor of Transport and Design, Bjarke Ingels, architect of the new Google Campus in Silicon Valley, mobility journalist Sebastian Moffett, science fiction author Kim Stanley Robinson, Gerald Huff, a leading software engineer in Silicon Valley, Karl Gernandt, Executive Chairman of logistics group Kühne + Nagel Holding AG, entrepreneur and adventurer Richard Branson and others have their say.

One thing is certain even today: the importance of mobility will continue to grow in the future. The possibilities for travel will increase further with technical progress. However, the complexity of the system will also increase with the availability of new products and services. The question at the core of the mobility debate is therefore not "what is feasible?", but "what is desirable?". Technology as an end in itself will get us nowhere. The journey to the future of mobility starts with people.

Ride on!

POINT OF

Mobility is undergoing a transformation. The market is characterised by various forces of change that lead to specific opportunities or new challenges. At the heart of this change are traditional providers such as car manufacturers or operators of public transport systems. In



How will we shape transport in the digital age?

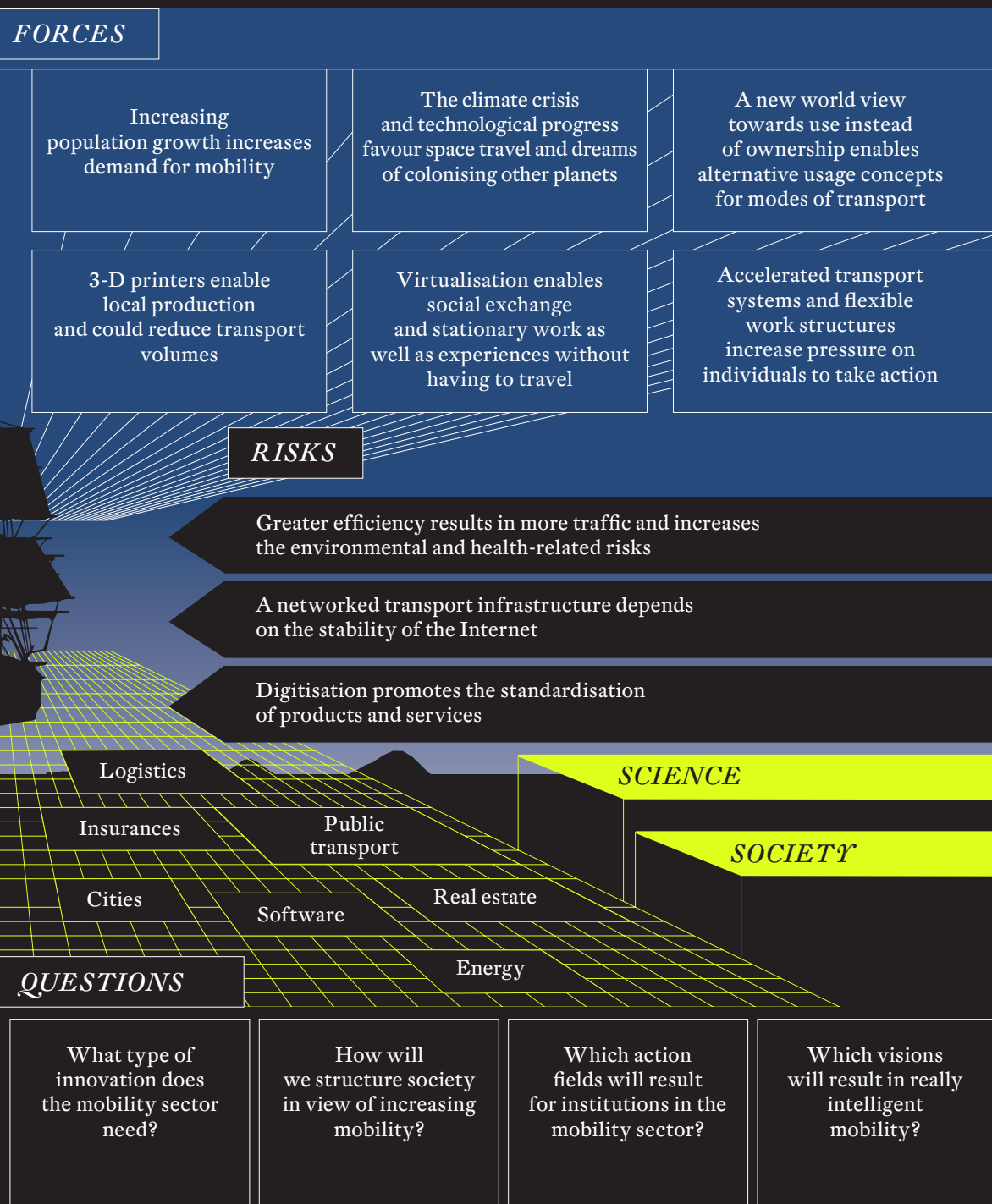
What is the significance of autonomous vehicles?

What influence does virtual communication have?

How do we shape cities and living space?

DEPARTURE

addition, mobility comprises many more sectors and public-sector tasks from healthcare to provision of foodstuffs, and from city planning through to the energy supply, which – against the backdrop of the new developments – raise fundamental questions.



PROGRESS THROUGH MOBILITY

ESSAY BY STEPHAN RAMMLER

Mobilisation and civilisation go hand in hand, and will continue to do so in the future. That's because movement is essential to humanity's evolution and is the foundation of cultural diversity. However, the present transport system needs to be redefined, shifting from an efficiency mindset to a focus on accessibility and social participation.

HOW MOBILISATION AND CIVILISATION INTERACT

The original meaning of "mobility" was the potential for motion, not the motion itself as it is generally understood today. The concept ranked high first of all in biological evolutionary theory and anthropology as a core condition for evolution: spatial mobility opens up to species new habitats with different selection conditions. Together with genetic mutations, variations in habitat therefore play an important role in the development of life. This argument can also be applied to the development of civilisation: spatial diversity encourages cultural diversity. Mobility is both a reaction to changing spatial living conditions and an opportunity to develop new habitats. Systems thinkers also emphasise the importance of mobility for living systems such as plants, animals and entire ecosystems. They can only build and grow their structures by using constant processes to exchange information, building materials, energy and ultimately waste products. Human society can also be described as an open system requiring constant input and an internal exchange of resources. From the point of view of anthropology, conditions – threatening nature, obdurate habitat or shortage of time – therefore led the human race to invent the wheel and – metaphorically speaking – constantly re-

invent it, and as a consequence to transcend humanity's natural limitations ever further through civilisation. To paraphrase anthropologist Arnold Gehlen, man with his biological constitution would be utterly unable to survive in raw nature. His intelligent actions are therefore aimed at changing the external environment out of pure organic necessity. According to Gehlen's view, inventions of techniques to overcome distance can be explained as principles of organ substitution, organ relief and organ strengthening. Cars and riding animals relieve us from walking and perform far better than humans. Pack animals provide a tangible illustration of the relief principle. Aeroplanes substitute for the wings that nature failed to give us, in a way far superior to any natural flight.

IS MOBILITY A HUMAN RIGHT?

If, then, there is a thread running through the history of humanity, an important part of that thread is the constant interaction between mobility and the development of civilisation which has raised both to ever higher levels and is still in operation today. From that point of view, mobility is a premise of human society that enables social participation and economic and cultural exchange. In that case, is it not ultimately a human right as well? In so far as the free development of personality and freedom of movement are embedded in the constitution, it can certainly be described as a means to realise a fundamental right, even if it cannot be termed a human right in itself. Government programmes such as Germany's "social tickets" for public transport to guarantee all citizens a minimum standard of mobility, however, point to universal entitlement to such a right. This right to give free rein to our mobility reaches

its limits where others are deprived of opportunities for development and physical integrity now and in the future. In particular, the consumption of fossil fuels by still-increasing modern transport, the associated excessive emissions and the rapid increase in urban density are bringing this conflict more and more to a head. It is therefore time to revisit a forgotten definition of mobility and start a new discussion under the heading of "access" – particularly in view of the opportunities of digitalisation. Mobility in this sense, a concept created in the field of traffic sociology, is a basic condition for access to amenities, information and services, which has to be guaranteed politically, socially and economically. According to traffic researcher Eckhard Kutter, mobility can thus only be meaningfully defined as the accessibility of establishments where people pursue activities that are essential to their lives. In any case, neither of these approaches confers a human right to fossil-based mobility, to high speeds and long journeys by car or jet.

DIGITAL FUEL

In view of the above-mentioned crises of fossil-based mobility, a hope may be expressed that digitalisation has the potential to become the new "fuel" of the global mobility industry. Data flows may possibly have the power to replace current fossil-based/industrial forms of mobility or at least to supplement them to a material extent. In the digital age, mechanical thrust would be increasingly replaced by the omnipresent intelligence of digital technologies. Over the last 150 years, fossil fuels have led to a demand for energy for which there can be no substitute within the foreseeable future. However, more density of

information in highly networked and logistically optimised processes may reduce the demand for the traditional form of overcoming distance. Digital media can make transport more efficient through cross-system information, planning, booking, access and billing systems. A vision then dawns of seamless mobility, with all forms of movement optimally networked. An intermodal traffic system of this nature could represent a sustainable alternative to the efficiency of the present fossil traffic system, or even open up still more development potential. In addition to digitalisation, regenerative energies need to be used to operate electric drive systems and increasingly dense residential and industrial structures.

Moreover, data traffic could actually replace vehicular traffic in the future if digital technologies aimed at supporting various kinds of teleactivities (teleworking, teleconferences, teleeducation, telemedicine) are developed further. A "high-speed standstill" (Paul Virilio) using highly accelerated data packages to make every physical trip superfluous is still in the realms of fantasy at present. Flows of energy and materials are a fundamental necessity for living systems. The link between mobility and the development of civilisation continues to apply. Even if mobility is reformatted as "accessibility" by politicians and planners, and even if digital teleactivities are deployed to a much greater extent, the demand for physical travel will continue and may even increase in the light of a growing world population.

// *STEPHAN RAMMLER* is Professor of Transportation Design & Social Sciences at the Braunschweig University of Art (HBK). His research interests are the future of mobility and transport, energy and innovation policy. Cultural transformation processes through technological progress and sustainable environmental and social policy are the central focus of his work. His book "Schubumkehr – Die Zukunft der Mobilität" ["Thrust Reversal – the Future of Mobility"] was published in 2014.

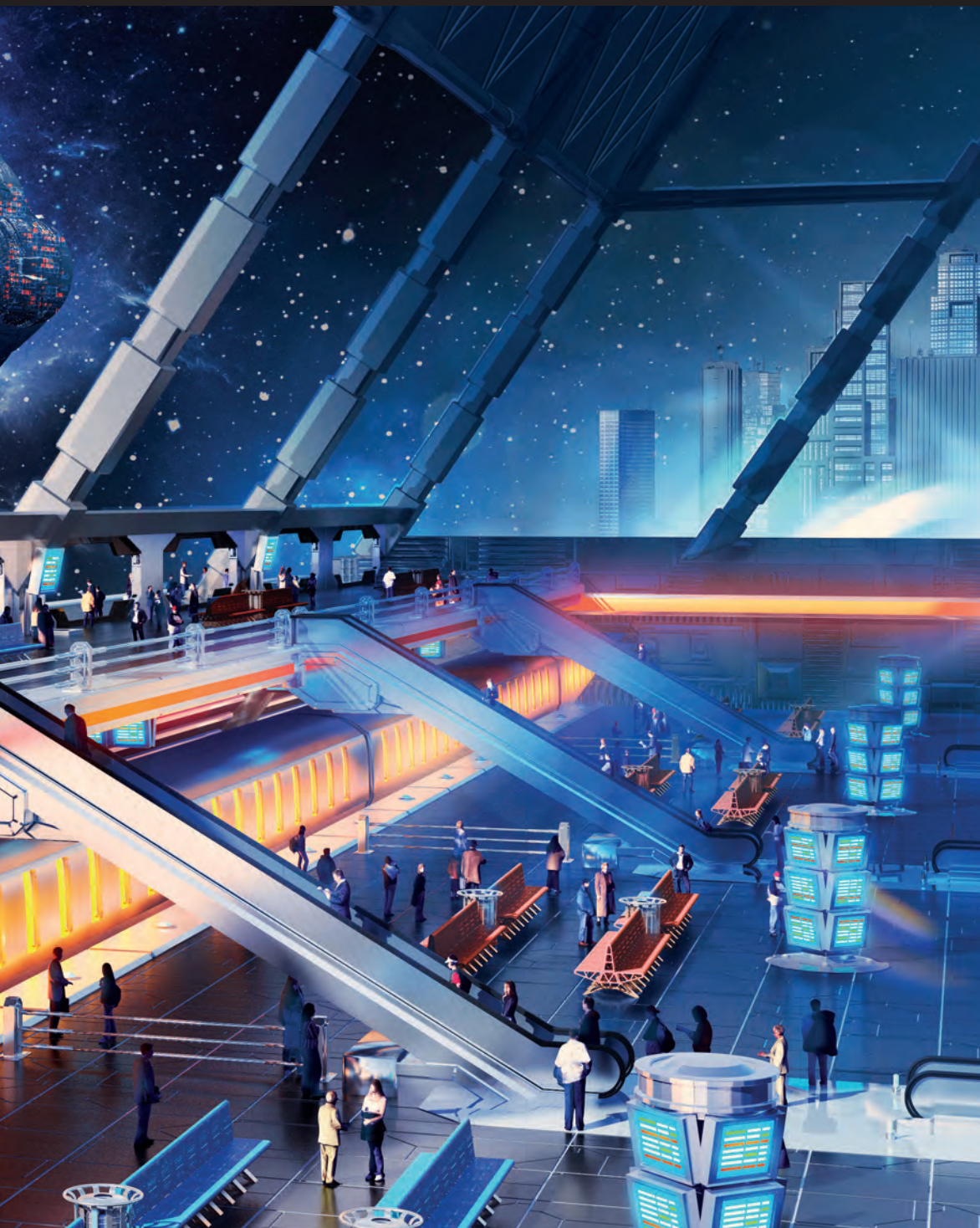
The future will be shaped not just by the further development of technologies, but by ideas and visions that go beyond what is currently feasible.

Scenario #1

NIGHT TRAIN TO TOKYO
High speed trips make the world a village

The acceleration of the physical transportation of people and goods is continuing unabated. Passenger planes can fly at six times the speed of sound, spacecraft commute between planets, and magnetic levitation trains replace conventional rail trains both on the surface and underground.

In addition to analysing current developments, W.I.R.E. has drawn up further-reaching scenarios that take their cue from the future needs of humankind. These serve as points of convergence for further discussion on how a desirable future of mobility might look – and where we ought to set limits.



THE END OF A STATUS SYMBOL

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INTERVIEW WITH GERALD HUFF
By Stefan Pabst

We won't own a self-driving car, we'll hire one as and when needed. Appearances will therefore become less important. That won't just affect the people who currently use their cars as symbols of their personality. Manufacturers will also have to get used to totally new customers, says Gerald Huff, a leading software engineer in Silicon Valley.

What do you think traffic in New York City will look like in 25 years' time?

By that time the era of self-driving cars will have well and truly arrived. All road users will use mobility as a service. We'll provide details of where we are, where we want to go and for what purpose using a mobile device. A suitable vehicle will then pick us up. However, services like car pooling and car sharing will also be widespread. They'll help to reduce traffic density, currently the biggest problem in urban transport. That said, it still isn't clear how these new facilities will interact with public transport.

How will these developments impact on rural areas? Will self-driving vehicles revive their attractiveness by enabling commuting time to be put to better use?

I think that actually is a possible scenario. One major challenge in commuting is handling the peak times. If that bottleneck can be cleared in an efficient way, regions outside the cities will become more attractive again. The future of commuting illustrates an uncomfortable consequence of the rise of autonomous cars: if commuting time becomes productive and, above all, cheaper, we may paradoxically commute even more. Accordingly, traffic density can only decrease if we develop new automobiles that

can carry several people without their having to sacrifice their private sphere. The benefits of car pooling and self-driving cars need to be combined. Because if people still want to travel alone, congestion will not be eliminated even when self-driving cars come along.

Isn't digitalisation making our working models more and more flexible and constantly reducing the number of traditional 9 to 5 jobs, which automatically distributes the traffic volume better?

These effects are actually becoming gradually more evident, and market forces will boost them further. Uber, the transport network company, already uses so-called "surge pricing" today, with demand setting the price of a trip. That makes trips outside the rush hour more attractive, which, in turn, could speed up the changes in the world of employment.

Virtualisation will soon be so advanced that remote working won't feel remote any more. With augmented reality glasses, your co-workers will literally be with you. That being the case, what reason do we have to travel? Movement will evolve from a necessity to an option.

When will we travel, then? When we want to visit foreign places, perhaps?

Digitalisation will transform the travel industry as well. There will be travellers who would gladly have virtual travel as a substitute for the genuine experience. For many people, long-haul trips will be quite simply unaffordable in future. It's not only visits to major cities that are getting more expensive, and for this reason virtual trips will become a real option for millions of people. A number of

new business sectors will grow up as a result. You only have to think of the possibilities of visiting cities like Paris as a virtual tourist. The concept will start to get really exciting when these virtual tourists control a real robot locally that will move around Paris in their place and transmit all sensory impressions to them live.

What will become of the automotive industry when people no longer have to drive cars?

Private ownership of cars will plummet. The market will develop towards fleets of self-driving cars. This will change the automotive manufacturers' customers. The customers will no longer be individuals, but companies that will manage these fleets.

The perception of what's important in a car will also change. The future will still contain brands that promise a certain status. However, it's not clear how these niches will develop for self-driving cars: customers' loyalty to automotive manufacturers will fade significantly because in theory you can book a different vehicle every day. The choice will depend on what we want to use the car for: we'll choose a luxury vehicle to get to a business appointment, a sporty number when we want to go out of an evening. Going out shopping we may rent the smallest and most efficient vehicle of the lot and, on the return journey, one with room for our purchases – the brand will take a back seat. Competition will then be about the entire product spectrum and the reliability of a fleet.

What role will vehicle design play?

I think this, too, will quite simply be less important. If I just get into the car and it takes me from point A to point B, its appearance plays far less of a role than if I've toiled for years to possess it at long last and express something very personal. A self-driving car will not make a statement about me. It's like a taxi. It has to work and it has to be clean.

Let's go back to the example of an important business appointment that you're attending by car. If I want to leave an impression behind I may order a luxury brand to pick me up. That said, the others will know that the car isn't mine. What status do I express by doing that? It's evident that I've paid more for the trip, but is that enough? If I own a luxury car today, I've really achieved it, bought it myself, driven to the appointment myself, and then I meet with the others. That creates a social context and communicates something about me as a person. If I arrive with the equivalent car in 20 years' time, I'll have selected it on my mobile phone. Maybe we'll send the same signals as today by doing that, but I doubt it very much.

What's your opinion on the debate about ethical decisions by self-driving cars when accidents occur?

Today's developers aim to prevent accidents of all kinds and therefore also to avoid ethical dilemmas. Research is very good at that even now, and it's getting better all the time. Thought experiments like the trolley problem do not appear to be playing a big part in this development. Personally, I don't believe that we are talking about realis-

tic problems here. Cars can't see how many children there are on a school bus or how old the driver of the other vehicle is. If, however, all vehicles were digitally linked, they might be able to exchange this information. But then the risk situations that require such ethical decisions won't occur in that case, because the communication between the vehicles will prevent a collision. I don't believe that self-driving cars will ever really make ethical decisions. All their decisions will be based on physical principles.

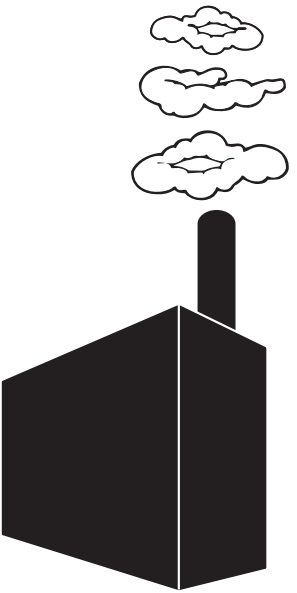
// *GERALD HUFF* is principal software engineer at a leading car manufacturer in Silicon Valley. Prior to that, Huff was director of the Technology Innovation Group at Intuit, exploring the application of emerging technologies to solve problems in the consumer and small-business space. In his keynotes he discusses particularly the impact of and potential solutions to the problem of technological unemployment.


1 HOUR
AUTHENTIC DRIVING WITH
COMBUSTION ENGINES

FREEDOM PARK FOR V12

Daily traffic will become depersonalised, self-driving and combustion engines will become leisure pursuits

Fully standardised electrical and autonomous vehicles will shape the traffic network of the future; driving oneself has been forbidden for years. But because the new vehicles are not in a position to satisfy people's desire for control and self-determination, leisure parks will offer sentimental lovers of combustion engines the possibility to do a few laps on special circuits.



PLAYTIME!

INTERVIEW WITH BJARKE INGELS
By Simone Achermann

The future city won't have to look much different from today's, but the way we use and move in it has to change. The shift from the monoculture of cars to a set of various ways to move in urban space will play a major role. As will a built environment that is more playful and flexible to our changing needs.

Mobility is one of the big challenges cities are facing today. What is the role of architecture in tackling this?

Architecture, for me, is the science of designing our cities the way we want to live our lives. With architecture, we have the power to reverse the Darwinian concept of evolution: we are no longer forced to adapt to our environment, because our environment adapts to us. Nevertheless, how we shape our physical environment has a great impact on how we live – which makes architecture a key driver for the evolution of society.

Looking at today's overcrowded, polluted and congested cities it is hard to believe that we humans built them – in order to have a good life.

When judging the mobility infrastructure of contemporary cities, we have to take into consideration that urban space evolves over time. All the means of mobility available have created their own paradigm in the history of a city from narrow streets in the old city districts that allow only humans to pass to wide roads with six car lanes, they have all left a huge impact on the urban fabric. The way our cities look today, however, is largely influenced by post-war urban development, which was almost exclusively shaped by the availability of the car. This is changing today through a more differentiated understanding of

urban mobility and planning: we are slowly moving away from the monoculture of cars to a set of different ways to move around – in which walking, biking and using driverless cars will play a major role. Copenhagen is a good example of this development. Since the 1950s the use of bicycles in the city has increased by 50 percent. Traffic lights on highways exclusively for bikes make sure that travelling by bike is safer than it used to be - and faster than by car! As a result, many commuters prefer the bike to the car. The future city, I believe, will not have to look much different from today's in order to be good to live in. But the way we 'use' our cities and how we move in them will have to change.

For the Audi Urban Future Initiative BIG 's proposal was a driver-less city – not a car-less one. Are autonomous cars the answer to urban mobility problems?

We have to criticise post-war city development for prioritising cars over any other means of transport. But there is nothing wrong with the car itself. It's an amazing tool providing great individual freedom, giving access to sparsely populated areas that can't be reached by any other form of transport. The car is and will remain a great invention. But if it is the only way to get around, it causes damage. Also, the way we use the car can be radically improved. Most of the time cars are in traffic jams or parked, unnecessarily consuming city space. The driverless car can help us there. We will no longer lose time when driving, we will have fewer or no accidents and we will share the car with others whenever we don't need it. The most fascinating thing about driverless cars is that they actually combine freedom of individual transportation with the sustainable concept of sharing.

Many of your projects have been dedicated to making suburban areas more attractive. Is this another solution to urban mobility problems – to make the outskirts worth living in?

I believe that the old model of the city as synonymous with its centre makes less and less sense. Five years ago, the world crossed a threshold. More than half of the world's population lives in cities. But by "cities" we no longer exclusively mean the centre, but also the vast metropolitan regions. Today, the city no longer means the Champs Elysées or Central Park, but the fast and diverse dynamics of different degrees of density and walkability in the various urban fabrics. More and more people live in one city neighbourhood, work in another and go to school in a third. The linear movement from the outskirts to the city centre and back has given way to a multipolar movement in urban and suburban territory. And this will of course decrease our traffic problems by easing the burden on the way into and out of the centre.

Let's take a look at mobility inside buildings: how can the various ways of movement in offices encourage innovation?

First, it is vital to create space that is as open as possible. The structure of an office building should always facilitate spontaneous encounters with colleagues in order to maximise the exchange of ideas. Furthermore, the building, if the company's policy allows it, should also be permeable or semi-permeable for its neighbours. This is what we are planning with the Google campus in Silicon Valley. The building is not only designed as an office but also as a neighbourhood. The various open sites allow Googlers and Non-Googlers to walk freely in and around the Campus. This way, the transport of ideas flows in and out

without any boundaries. Second, architecture needs to be flexible. As we discussed before, the built environment should adapt to us and not the other way round. The Google Campus consists of block-like structures that can be moved around, offering a maximum of flexibility as the company invests in new product or activity areas.

In designing open and flexible buildings that adapt with time and changing purpose we are imitating the way nature works. In nature, everything is in a continuous process of change, nothing is fixed. Fixed always means a dead end.

The way we move through cities also has a major effect on how we interact with their inhabitants. How can we strengthen social participation through mobility?

One important way is to create various niches in and around work and living space. The so-called in-between-spaces – which are neither exclusively public nor exclusively private – play a major role in this. One example is the 8 House in a relatively new suburb of Copenhagen. For this building, we created a path that extends from the street up to the penthouse. This allows residents to walk and cycle all the way from their apartment to meet their neighbours in the building or on the street. A young girl on the ninth floor, for example, can jump on her bike if she sees a neighbour in the street or can play with a friend on another floor – without ever using an elevator. Another example of in-between-spaces are court scrapers. A court scraper is a mixture between a skyscraper and a courtyard building, meaning you have a skyscraper with a huge courtyard designed as a communal space for 800 apartments. It is a place where you can meet neighbours

and where children can play and leave their toys over night to find them in the same place the next morning. These kinds of in-between spaces are vital to maximise social encounters in neighbourhoods.

Good as urban infrastructure may be, it also needs the inhabitants to change the 'usage' of the city to the better.

Absolutely. It has been proven that we humans have the capacity to cause massive impact on a planetary scale. But with great power comes great responsibility–to quote Spider-Man. We finally have to accept that responsibility. However, I believe in a hedonistic sustainability. This is the idea that you can actually live sustainably but also improve the quality of your life while doing so. It is the goal behind many of our projects to show how this could work: with a ski slope built atop a waste processing plant, a factory chimney that blows smoke rings, reminding people of pollution in an artsy way, or with the 8 House, encouraging people to cycle from their penthouse to work. Sustainable life cannot be a punishment, if we want it to work. It must be fun.

// *BJARKE INGELS* is a Danish architect. He is the founder and co-owner of the architectural firm BIG, with offices in Copenhagen and New York. Ingels' award-winning projects are characterised by the sustainable use of resources and a playful approach to buildings' potential purposes: they are living space, experience and symbol in one. For Audi's Urban Future Award, Ingels developed the concept of the "Driverless City", a futuristic city with vehicles, but without drivers. Ingels is currently working with BIG on the new Google Campus in Silicon Valley, which is designed as both a workplace for "Googlers" and a neighbourhood for "non-Googlers".

THE NOMADS OF THE 21st CENTURY

Places of residence will be linked to workplaces

Instead of commuting to work every day, the next generation of the mobility system will open up the possibility of choosing a place of residence for the period of employment at the workplace. Instead of always redesigning our homes, our own four walls will accompany us on the geographic meanderings of our career.

PIMP MY PUBLIC RIDE

/

ESSAY BY SEBASTIAN MOFFETT

Critical mass will soon be reached. More and more people are prepared to do without a car of their own. However, switching to public transport is difficult because there are only a few places in the world where it meets current needs. New user-oriented technologies and a look at Japan as a model will help the unpopular infrastructures to be appreciated more at home.

The bus was stuck in traffic on Brussels' inner ring road, about 500 metres from my destination. I had to be at an event in five minutes, and we hadn't moved for 15. I asked the driver to let me out onto the verge. "I can't," he said. "It's dangerous."

I'd forgotten my phone and couldn't warn the event organisers I'd be late. So I asked again. This time he shouted back. "If you were run over it's me who'd get the blame!" I walked back down the bus, and brooded on the consequences: probably no more work from this event-organiser. I began to rock back and forth miserably.

Suddenly, the doors opened. I froze for a moment, and then jumped out, raising my hand to thank the driver. I arrived five minutes behind schedule, out of breath and full of apologies. "Don't worry," said one of the organisers. "We're starting late. Everyone's stuck in traffic."

Why are pathetic, little stories like this still common in the second decade of the 21st century? While the likes of Brussels, Moscow and perhaps most developing-world cities are notoriously clogged, there are cities that get it right. Parisians are rarely more than 300 me-

tres from a metro station. Greater Tokyo has 4,700 km of rail tracks, more than 2,000 stations and 40 million train users a day. Copenhagen has its "green wave" of tens of thousands of cyclists for whom the traffic lights stay green, so long as they pedal at 20 kph.

The key appears to be enthusiasm for the post-car era. Some urban areas have seen transit systems as engines of growth, and developed housing, offices and shopping centres close to stations. Many of these are thriving, as citizens appreciate the stimulation and convenience of city life without the stress of driving. But for other cities, public transport has merely been a way to relieve congestion – that is, to facilitate driving. These cities continue to be polluted and gridlocked. They could eventually face economic decline as a result – but new technology is providing hope even for the laggards.

NO MORE SPACE FOR CARS

Cities, already home to half the world's population, are growing fast. In developing countries they are beacons of economic opportunity. In mature economies, city centres have been revived in the past three decades as people seek out the stimulation and connectedness of city life.

Half a century ago, urban life was thought to be compatible with mass car use, resulting in networks of highways – on viaducts, in tunnels or just through neighbourhoods. But it's become clear that there isn't the space for car-based travel. There are too many people, and rising incomes mean that they all want to get around town. To transport 1,000 people, according to Sydney Trains,

requires one train, 15 buses – or up to 1,000 cars, which would need more than a hectare of parking space. To cope with the rising demand, Paris is building new tram lines and planning a "Grand Paris Express" for its outskirts. London's Crossrail commuter service is scheduled to open in 2019.

Public transport not only moves people. It also gives them the essential urban experience of sharing public space. "On the train, you get to know people. On the train, kids wave at you and you wave back," wrote Taras Grescoe in "Straphanger", a history and celebration of public transport: "Tracks stitch places together; freeways tear them apart." Cars provide a contrasting experience, as Pascal Smet, transport minister for the Brussels regional government, pointed out to a newspaper recently: "You know how people interact with each other in cars? With their middle fingers."

But many people don't like public transport, partly because it can be so bad. It often involves waiting for a bus. Then mothers with pushchairs struggle to get aboard in a crowd. Underway, people stand uncomfortably, shaken and pushed around. You can feel like a victim rather than a customer.

There are also plenty of entrenched interests. Motorists campaign against tram projects or bike-share stations because street parking places might be sacrificed (though one car parking space can fit about 10 bicycles). People of a certain age or outlook would rather not get to know people in the train: many transit projects in the U.S. are said to be opposed because they might bring in the "wrong" kind of folk. In Brussels, a group called "Droit de

Rouler et de Parquer – Right to Drive and Park" claims that public transport is "a source of virus and germs in winter" and has a "noisy and insecure atmosphere". Until the terrorist attacks on 22 March, no user of Brussels public transport had been killed since a single death in 2013.

Financing is another headache. Politicians are reluctant to spend on projects that will come to fruition only after they leave office. And since the financial crisis started in 2008, public investment has fallen 8% a year in the European Union, according to Paul De Grauwe, an economics professor at the London School of Economics. "Who organises demonstrations in favour of public investment?" he wrote recently. "Those who demonstrate are those who fear reductions in their pensions and salaries."

STATIONS = BUSINESS

Smart new innovations – from road charging to e-hailing services – can make better use of roads. But larger cities don't have the space to get everyone to work at the same time without public transport. There are two ways to make it work: one that needs ambitious thinking; and another that might happen with a bit less effort.

I lived in Tokyo for a long time, and mostly had jobs where I could avoid the rush hours. I commuted on clean, velvety benches, reading or watching the city go by. Trips out of town meant beer and rice balls as a bullet train whizzed past tea fields, or a country train wound through the mountains. No litter. No dirt. No delays.

Japanese railways appear simply to do a great job of getting people from A to B. But their real trick is to have decided where A and B are. The country's first "terminal department store" was built in 1920 – a store built at a station for easy access. Now, termini in Tokyo and Osaka prop up vertical malls bearing the names of the rail companies: Seibu, Tokyu, Tobu, Keio, Hankyu. Advertisements on trains tout new condo developments close to stations, giving the precise number of minutes (walk to station plus train ride) to reach central Tokyo. Real estate guides are divided up according to the rail line accessible from a property. In Japan, rail projects are seen as growth drivers, not as burdens on the taxpayer.

Japan is exceptional, but other cities have used public transport for economic development too. Stations become centres for shopping, housing, and offices, and the cities expand along radial mass transit routes – known as the "constellation plan" in Singapore and the "finger plan" in Copenhagen. A century ago, London, Paris and New York expanded as new districts became accessible by tram and metro.

Successful, transit-inspired cities have also restricted car use. Japan requires proof of an off-street parking place in order to buy a car. Copenhagen has cut central parking by 3% annually, and nearly half of its journeys to work and school are now carried out by bicycle. Morten Kabell, Copenhagen's mayor in charge of the environment, was asked last year whether cities shouldn't give cars at least some consideration. No, he said: "A city has a finite space, and we can't just tear down blocks. You have to tell people: 'No, you can't bring your car. That was the era of the fifties and sixties.'"

NEW TECH, NEW CHOICES

But what about cities without this kind of ambition, vision and political will? Fortunately, new technology is enabling a range of services that enhance and supplement public transport. Waiting for a bus or tram is frustrating. But expected arrival times can now be seen on smartphones, giving users greater control over their journeys. E-hailing services – Uber and Lyft in the U.S. and Didi Dache in China – make it easier to combine public transport with other modes. Tech developer TransLoc said in January it would integrate Uber into its route planning app. The American Public Transportation Association said this would make public transport more attractive.

Other new alternatives to cars are blossoming too. E-bikes make cycling easier for older people and in hilly areas. The earliest bicycle-sharing plans flopped when people stole or destroyed the bikes. But recent schemes have electronic locking systems operated by smart cards, and availability at different bike stations can be seen online.

Car-sharing has been made practical through online reservations systems and small on-board computers that open the cars and monitor distance travelled. Navigant Research reported that worldwide car-sharing membership was 2.3 million in 2013 and forecast it would exceed 12 million by 2020. One shared car is thought to replace about 10 privately owned, reducing street parking. Sharers tend to drive less than car owners, reducing traffic.

For the most part the new services will complement and improve public transport. Even if e-hailing reduces demand for night services and congestion charges make traffic flow better, public transport will still be essential for rush-hour commuting. But there's a possibility that future technology might displace public transport in smaller cities.

Autonomous cars, if they work as hoped, could offer many of the advantages of trains: remote parking would mean they did not clog city streets; smarter driving could use roads more efficiently; they might free up a driver's time for work or relaxation; and if they're powered by batteries, they won't pollute. Bigger cities don't have the space, but the mass use of self-driving cars might function OK in smaller ones. For shorter inter-city journeys too, door-to-door journeys by autonomous cars might work as well as trains.

CRITICAL MASS?

The Los Angeles area is the template for the American dream of a motorised, suburban lifestyle. But one of the most popular destinations in the past 20 years has been Santa Monica's Third Street Promenade, an open-air shopping complex where you can walk around among other people, a bit like an old city centre. OK, most people go to these places by car, but LA County has built six subway lines since 1990 and plans to expand them.

Even in supposedly car-addicted Belgium, the number of young people getting driving licences has fallen by a tenth since 2010. Because the country is densely

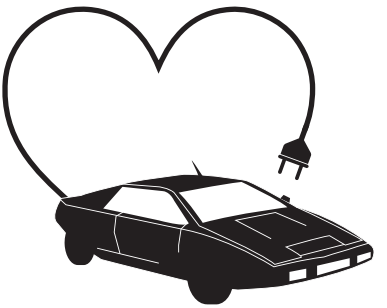
populated, it should be easy – in theory – for most people to function without a car. So critical mass might not be that far away. Until then, I'll mainly walk around Brussels, or weave through traffic on a bicycle, trying not to breathe too much diesel exhaust. Occasionally, I'll take the bus.

// *SEBASTIAN MOFFETT* is a freelance journalist and consultant. He worked with the Wall Street Journal and Reuters news agency from his homes in Brussels, Paris and Tokyo for many years. He authored the Rethinking Urban Mobility study, which was conducted for the Friends of Europe think tank. Moffett appreciates good public transport and has never owned a car.

Scenario #4

SEA OF DATA FOR DIGITAL FREIGHT
3-D printers replace physical logistics

The transport of goods by truck and container ships will become superfluous. 3-D printers will produce consumer goods where they are needed, and food cultivation takes place locally. Streets will be dismantled and converted into public spaces for citizens.



VISION ZERO

INTERVIEW WITH RICHARD BRANSON
By Simone Achermann

If we manage to make electric cars zero carbon, we will have the key to most of our mobility problems. Yet people will have to want to buy them. Formula E, the international racing series for electric-powered cars, is paving the way for more popularity, says Richard Branson, owner of Virgin Group.

Let's start with the big picture: What is your personal vision of the future of mobility?

First, I hope that we will fully switch from fossil fuels to renewable energy sources - even though we might not run out of oil in the near future. Electric vehicles are the likely candidate for the future of mobility. However, they are still charged by grid electricity which has a large portion sourced from fossil fuels. But I have high hopes that we will manage to find ways to improve the technology soon. Second, I am a big fan of the growing trend towards the sharing economy, where access beats ownership. Already, the world's most valuable retailer, Alibaba, owns no inventory and the world's largest taxi company, Uber, owns no vehicles. I don't think future generations will need to own cars but instead use them if and when they need to.

With Virgin Racing you are participating in the Formula E championship. Is it for fun or because Formula E can really make a difference?

In all the business ventures Virgin enters into, we are looking to demonstrate how business can be a force for good. Virgin Racing is no exception. The Formula E race championship is highlighting to a global audience the capabilities of electric vehicles and appealing to a young audience. This coming season we are working with Citroen

DS to further develop this important technology and make it even more high profile. This will be an important step towards making them more efficient and faster and it will be crucial in encouraging people to buy more electric vehicles – the only way our society is going to transition away from petrol or diesel vehicles. Formula E is a great test-bed for this innovation.

What will come after the electric car – or does the story of sustainable cars end here?

If we can get electric cars to a point they are carbon zero and practical, I don't think we would need any other form of car travel.

What do you think about intelligent or self-driving cars: The solution to gridlocked cities or is AI highly dangerous, as Elon Musk says?

I think in principle there are some big benefits to self-driving cars. Many car accidents are caused by human error and complacency. If self-driving cars can reduce the number of accidents on the road, this can only be a good thing. It is plausible to envision a day where you request from Uber a self-driving electric car to pick you up and this may even indicate Google and Tesla to design their own Uber-like software to deploy the vehicles they are building. Hacking is a big issue and we have already seen how hackers were able to remotely shut down a Jeep. As more services become online the need to build greater cyber security systems is apparent.

No doubt, mobility is facing radical disruption. But what will remain the same?

What won't change is the need for dedicated roads to drive on and keep vehicles away from pedestrians. The roads may change though. I have seen a great concept for a road which charges an electric vehicle as it is drives along it!

// *RICHARD BRANSON* is a British entrepreneur, investor and adventurer. He is famous as the founder of the Virgin Group, which consists of around 400 companies. The Group owns several airlines as well as Virgin Galactic, which aims to operate and market commercial space flights, and DS Virgin Racing, with which Branson participates in the FIA Formula E Championship, a class of racing for electrically powered cars. Branson has attempted several world records in his life to date, including making the first Atlantic crossing with a hot air balloon and achieving the fastest crossing of the English Channel by an amphibious vehicle. In the year 2000, the British Crown conferred a knighthood on Richard Branson for his services to entrepreneurship.

LEISURE TIME THROUGH ALGORITHMS
Learning to use the new time in independent vehicles

Self-driving cars are the core of how people design their time.
The auto mode opens up time not only for sleeping or for reading a book.

WE'LL NEVER LEAVE EARTH

INTERVIEW WITH KIM STANLEY ROBINSON

By Mikael Krogerus

The future of mobility extends far beyond the planet Earth. Even today, organisations are vying with each other to set dates for the first settlements on Mars, the Dutch foundation Mars One being one example. Science fiction author Kim Stanley Robinson talks about the merits or otherwise of our plans and explains why Earth stands to benefit if we even just think about colonising Mars.

Mr Robinson, 30 years ago you wrote the "Mars Trilogy", a science fiction series about colonising Mars that won popularity all over the world. What would you say today: is travel to Mars science now, or still fiction?

That depends on the time horizon we're talking about. It's theoretically conceivable for us to send a manned spaceship to Mars in the next 100 years, but in practical terms it's impossible. First of all, it would fall down on the costs: a colony on Mars would cost around 500 billion dollars. The next hurdle is getting there. At the present time it's expected to take nine months. Nine months without gravity would have disastrous effects on our body. Our muscles and bone structure deteriorate without pressure.

If you get into a spaceship at the age of 40, you land nine months later on Mars as a physical geriatric?

This process could be combated with intensive training, as practiced by today's astronauts, who sit on an ergometer for four hours a day. However, we now know that there are also chemical processes involved that damage the heart. The solution would therefore be the old SciFi idea of creating artificial gravity by rotation, but we haven't got that far yet.

Just assuming we got to Mars in good health, what can we expect there?

It's cold, between -30 and -120 degrees Celsius. There's no atmosphere, no gravity and no global magnetic field, only weak, local magnetic fields offering little protection from cosmic radiation. The soil is contaminated with perchlorate, a highly active substance that does considerable damage to humans. In short, it's a place that's hostile to life. For people ever to settle there, the Mars colonies would have to be built metres under the earth. All the same, Mars is still the best candidate for colonisation. There's a lot of water, though it's frozen, there's carbon dioxide – likewise in the form of ice – and there's sunlight. These are three important ingredients for life! What there's not, however, as far as we know, is life itself, for example in the form of bacteria. That's where we humans come in.

The keyword is "terraforming". What does this term mean?

The word comes from science fiction literature and describes the attempt to "create a planet Earth". For Mars, that requires a highly complex industrial process: first of all there's this thing about the toxic soil, the entire surface of Mars would have to be sown with a mixture of sand and bacteria so that the highly toxic salts could be consumed and transformed. Then we'd have to cause something that we want to prevent on Earth: an artificial greenhouse effect to release the frozen CO_2 and warm up the climate. That's the only way to make plants grow and, in turn, produce oxygen through photosynthesis. However, at this point we still haven't solved the problem that plants need nitrogen to live, but there's practically none on Mars. You see, terraforming is conceivable in theory, but virtually impossible to implement in practice.

Maybe we wouldn't have to go there at all. NASA's Adam Steltzner is talking about a kind of 3D printing where we would start by releasing bacteria and later, when conditions are friendlier to life, "print" human DNA locally.

I know and admire Adam Steltzner, but I consider sending human DNA into space a crazy idea. On the other hand, ecopoiesis is an interesting idea. We would establish bacteria and then leave evolution to do the rest. In theory, plant cover could increase to the extent where most of the CO_2 atmosphere would be converted into biomass. However, it's likely to take more than 100,000 years for that to become reality.

Let's think the conceptual experiment through to its logical conclusion: humans can – under whatever conditions – live in colonies on Mars, feed themselves, multiply. Such people would be exposed to an entirely different kind of evolution. Would they still be people, or would they be Martians?

I think Martians would be something like super-Tibetans. Tibetans have passed through an amazing evolution within a very short time that enables them to increase the supply of oxygen to their blood cells. Life on Mars could possibly be like life at an altitude of 30,000 kilometres, people would probably adapt by evolution, they would perform better, but possibly also be more susceptible to certain diseases.

They would be humans biologically, but what about culturally? What kind of a value system would people who've moved 400 million kilometres away from Earth have? Would human rights apply up there?

We can only ever think of Mars as a mirror of the world. Mars may be colonised in 1000 years' time, in other words at a time when most of what we believe in today – capitalism, for example, or democracy – will no longer function here on Earth. When I describe the colonisation of Mars in my books, I'm not thinking about a distant planet, but using the idea of Mars as a metaphor for a different Earth. How would we live? How would we organise ourselves? Are there alternatives? Because that's more and more difficult to imagine in our world, I extrapolate the question into space: how would we organise ourselves on Mars, for example? Now, I assume that we would try to develop an alternative economic system on Mars. Because what drives us here on Earth also digs our graves: capitalism. We are destroying our resources with our growth logic. We would therefore need an economic system that allows everyone to share and that protects natural resources. And if you change the economic system, you would also have to change the education system. And if you change the schools, you automatically change a society's values and norms. To answer your question: yes, Martians would still be people. They would have the same needs, fears and hopes – that's embedded deep in our DNA – but they would live in a completely different culture and would therefore have different values and basic rights.

Your answer to the present crises is not the anti-progress degrowth that a lot of left-wingers advocate, but a Marxism that has faith in progress.

Correct, we can't turn the clock back. We have to use our present technological capabilities to save our world. You could translate that as: we don't need to terraform a new planet, but to establish "Mars colonies" in the world. Islands that provide social, crisis-independent basics.

Who would actually have the right to colonise Mars?

Space belongs to everyone and no one. The Outer Space Treaty – that is, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, which all UNO member states have signed – claims that outer space and all celestial bodies with it are common property, in the same way as the world's oceans are claimed as "the common heritage of mankind".

The fishing industry ignores such treaties and considers international waters as a legal vacuum. Could something similar happen in space? To put it another way: do we have the right to claim Mars for ourselves just because it is presumed to be uninhabited?

The Outer Space Treaty is worded in very vague terms and contains no enforcement provisions. However, I don't think there'll be a fight for Mars, because you have to bear one thing in mind: it has no resources at all that are of value on Earth. It has no economic value to offer. That protects it from exploitation.

To sum up: colonising Mars is neither easy nor profitable. And nevertheless both government and private programmes exist and we are seeing growing public interest in the subject. Where does our fascination for this planet come from?

I think there are two very different reasons for it. First, feasibility: some of the things we writers merely imagined thirty years ago are now technically possible. Mars is still far away, but it has come closer technologically. The second reason for the new enthusiasm for Mars is pure escapism: we've run the Earth down so much that a lot of people feel they want to seek a new opportunity on a new planet. I think the first motive is sound and just, the second is flawed reasoning as far as I'm concerned. We'll never be able to leave the Earth. We are a product of this Earth. We have to rescue it. The crisis on Earth is acute; it has to be resolved in the next hundred years. However, it will be 1,000 years before we can colonise Mars. So I don't see my science fiction novels as space scenarios, but as conceptual experiments that could help us to create a better world here.

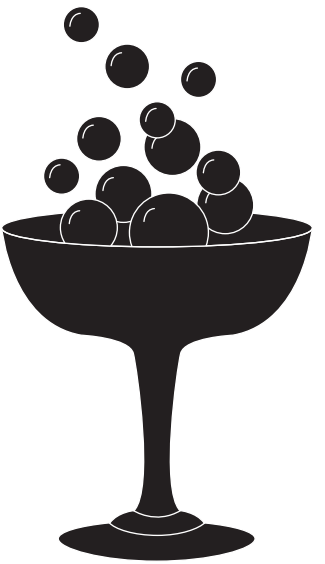
How will later generations look back on our idea of wanting to colonise Mars?

They'll think it's a senseless, naïve idea. But people are rarely interested in sensible ideas and often keen on the technologically most extreme possibility, and at the moment that's journeying to Mars.

// *KIM STANLEY ROBINSON* is an American science fiction author. He rose to fame for his award-winning Mars trilogy (Red Mars in 1997, Green Mars in 1997, Blue Mars in 1999), based on 15 years of research work and Robinson's life-long fascination with the red planet. In this series of novels, written to a high technical standard and with meticulous attention to detail, Robinson considers the technical possibilities and social consequences of the colonisation of Mars by man. Prior to becoming a writer, Robinson taught literature and English at a number of US universities. He lives with his wife and two sons in Davis (California).

TRANSFORMERS IN MULTIMODE
Systemic mobility is based on changeable vehicles.

The linking of different modes of transport – cars, bicycles, trains and ships – is a key vision for a sustainable mobility system. Instead of exchanging vehicles, modular, intelligent materials will enable vehicles to transform into any mode of transport in just seconds – from a bicycle into a private submersible.



THE NEW HUMILITY

INTERVIEW WITH DAVID YOUNG
By Simone Achermann

The automobile industry is facing radical disruption. To survive, it needs to move way beyond selling cars. The coolest part of our future journeys will not be the vehicles themselves, but the ways all forms of mobility will interconnect to provide a new range of travel experiences, says designer David Young.

Mobility poses huge challenges to our cities. Mr. Young, how optimistic are you that we can solve these problems in the near future?

We've reached a point where the traditional notions of mobility aren't working any more. Nobody is happy with the current and projected levels of congestion. Traffic has made our cities unpleasant places and limits what people are able to do. But from this stress is emerging an incredible range of innovation and experimentation. Suddenly, it seems, everyone is working to make things better. Start-ups are designing new services and apps that disrupt stagnant mobility industries and are providing a huge range of new services. Cities, realizing how stressed their populations are, have started engaging with their communities to understand local needs. And automakers are realizing that their futures depend less on selling cars, but enabling people to get from place to place. The role for designers like me is to put all of this change into a user-centred context. We're on the verge of some pretty radical changes to the design of our cities and how we get around in them. There's a real belief that what's next is going to be a lot better. I share this belief.

What are the key shifts in mobility that we will witness in the next 10 years?

It seems like, almost overnight, everyone is talking about self-driving cars. And, considering the smartphone has only been around for 10 years, it's not unreasonable to believe a similar sudden transformation can happen with mobility. But auto manufacturers move much more slowly than electronics companies – it can take over a decade for a vehicle to go from initial concept to production. Autonomous vehicles will be a huge change, but their real impact will probably be past that ten year horizon.

The most interesting shifts in the near future, I believe, are going to happen through the design of new tools and services that personalize and optimize our mobility. Every city, every person, even every individual journey, has unique needs. New leasing, sharing and public transportation services should enable better journeys for everyone.

You are creating innovative mobility solutions for some of the biggest car companies in the world. What ideas do you find most promising?

The automotive industry is facing radical disruption. To survive, it needs to learn how to adapt. It is amazing, for example, how Ford, a company that democratized mobility over 100 years ago, is acknowledging that its future might be something other than automobiles. Rather than developing a new product, Ford has announced a wide range of experiments that are testing new concepts of mobility. GoDrive, for example, is the first pay-per-minute car-sharing service that offers one-way trips with guaran-

teed parking. There is a shared leasing program that allows a group of people, who don't need a vehicle full-time, to own a vehicle together. The Dynamic Shuttle pilot reroutes vehicles to optimize travel time and rider comfort. We're doing a lot of new research to understand commuter behavior and journey needs. And the new FordPass app will bring together a suite of services that includes car sharing and electronic payments for parking.

Nobody knows what projects will last, but there is an openness and humility to the approach that is admirable. We're doing research, developing new technologies, and launching test services around the world – and we do this in public, engaging other companies and cities to join in the journey.

Parking is a big issue with regard to congestion challenges in cities. What are possible solutions?

There are studies that suggest that 30% of traffic in cities is from cars searching for parking. And that number can go a lot higher at peak times. There are a lot of different approaches to solving the parking problem. For example, if we have better data about what parking spots are available, then we can direct drivers to free spots, or to the areas that are more likely to have available parking. Or we can make it easier for drivers to reserve parking in advance, so they can park as soon as they arrive at, or near, their destination. There's another class of solution that entirely removes the responsibility of parking from the driver. This approach is similar to traditional valet parking, where you get out of the car and someone parks it for you. For example Luxe's on-demand service brings a valet to you, no matter where you are, and then parks the car.

Similar services could eventually be built right into self-driving vehicles, so the car just goes away and parks itself. If we can better manage parking, we'll make driving more pleasant, we'll have less congestion on our roads, and reduce pollution.

Letting users move between multiple means of transportation seems to be the key in increasing sustainability and efficiency. Will transport systems need to be interlinked in the future?

Absolutely. Effective interlinking can make a huge difference in the quality and efficiency of each journey. But the ways in which we interlink will vary significantly. Every city is different – each has different public systems, different densities and geographies, different customs. And thus populations have diverse ranges of needs. With things changing so fast, any form of interlinking needs to be incredibly flexible. Nobody wants to build a system that will be obsolete by the time it's launched. Right now we're seeing a lot of smartphone apps and services that help people navigate across transport systems. But these are for what I'd call «mobility nerds» – they're incredibly narrow in what they provide and require a lot of effort to use. The Apple Watch's haptic navigation – different taps that tell you when to turn right vs left – is a step away from the app-centric approach. Emerging technologies – such as big data, artificial intelligence and augmented reality – and the new interface experiences they enable, will allow quicker and more seamless ways for us to move through our cities.

You worked for BMW over many years, thinking about advanced vehicle concepts. What will the car of the future look like?

At BMW the «i» cars were a significant future-forward move. They incorporated a lot of thinking about how you could develop a radically new design language that was inspired by new technologies, new ways people lived in cities and sustainability. They're part of a larger change in how people choose cars. Appearance is becoming less important. It's no longer about buying a beautiful object. Instead, people want connectivity, access to their apps and data, and comfort. As we develop new models for car sharing, leasing and usage, there are going to be a lot of new possibilities for what it means to be both a driver and a passenger. The coolest parts of future cars will be the sorts of experiences people can have inside them. They'll be spaces we can work, play, and relax.

Will cars still be emotional objects in the future?

With any new technology there's a period where people actively and passionately embrace the newness. We're excited about how it changes things from the way they were before. Electricity, the telephone, recorded music, the smartphone – these were all things that were once revolutionary, but we now take for granted. It's easy to forget that the car is still a pretty recent invention. And one that hasn't changed much since it was introduced. Cars have required us to remain a culture of drivers. Autonomous vehicles as well as sharing are going to change that. We won't need to be sitting behind the wheel, spending so much mental energy on driving. We can do other things. Vehicles will fade into the background, as will our emotional attachment to cars. The world has changed. We've

become an urban population, and our cities are only getting denser. Ideas like joyriding or cruising down the street in your car are going to seem like relics from a long distant era. There may still be auto enthusiasts, but they're going to be a fringe group.

Do you still have a dream car of the future?

It may be heresy to say this – having worked for automotive projects for so many years, but I would be perfectly happy if cars disappeared. While I do have moments of driving bliss, sadly they are the exception. The reality is that most of my driving experiences involve being stuck in traffic, stressed or bored.

So, my dream car? How about something autonomous (I'm fine giving up driving) that I can get on very short notice (like a taxi), use for trips both inside and outside the city, and has a good sense of privacy (I don't mind sharing if it makes sense). I wouldn't mind being served a glass of champage, too!

// *DAVID YOUNG* is a designer working at the creative intersection of design, technology and innovation. As Triplecode he has worked with a wide range of clients including BMW, for which he developed advanced in-vehicle interaction strategies and design concepts, as well as a company-wide open-innovation platform. Most recently he has been working with Ford, supporting a wide range of global projects and experiments that explore future mobility services and customer experiences.

MY CAR IS MY CASTLE
Entering the age of customised vehicles

Forms of locomotion have always been an expression of personality. As a countertrend to standardisation, vehicles will become completely customised. Not only the shape corresponds to the driver's ideas, the driving behaviour is also linked to the dominant characteristics of the person at the wheel.

NO CRIME OR PUNISHMENT FOR CARS

ESSAY BY STEFAN PABST

Self-driving cars will make our roads safer. But they will also kill people. The question of which life to risk or to spare when an accident occurs confronts software manufacturers and moral philosophers with new dilemmas. Their answers will one day form the legal foundations of a new era of mobility.

The motor car has been a symbol of individual freedom for 130 years. James Dean in his Porsche 550 Spyder, Route 66 stretching to infinite horizons, legendary racing drivers like Ayrton Senna or your own driving licence on reaching that special birthday – a car grants independence and widens the horizons of your mobility, as the master in your own human mind of unbounded technological power. Though cars have evolved technologically and aesthetically, a 100-year period has seen no fundamental changes: a car still has an engine that drives four wheels and a human steers it through a network of streets and roads. Now, however, everything points to a paradigm shift: it won't be long before humans abdicate and leave the control of their cars to computers. A possibility born out of digitalisation, self-driving cars will become part of our lives in the next 20 years. Huge investments are being poured into all-out efforts to banish the steering wheel and eradicate sources of human error on our roads at this very moment.

The developers expect autonomous vehicles to deliver ground-breaking opportunities: an 80% reduction in road traffic accidents, highly efficient and economical freight transport, the prospect for disabled people of being able to use individual transport and, in particular, an array of chances to use travel time in new ways: reading books, writing e-mails, drinking beer, sleeping, knitting and much more.

DILEMMAS FOR MACHINES

However, there are still a few hurdles to overcome before we can board a car half asleep and venture out in automated hands. Firstly, the technology has to be reliable. Above all else, however, people have to develop faith in the new machines. And not least, this faith has to be justified before the legislature will give the green light. The ethical dimension of self-driving cars when accidents occur is one of the trickiest and so far unresolved challenges. True, the new generation of cars can prevent an enormous number of the accidents that are caused today by human errors such as inattention, the influence of alcohol or nodding off at the wheel. Nevertheless, even the best algorithms can't anticipate every development in time to prevent damage entirely: unpredictable actions by pedestrians, deer unexpectedly crossing the road or hopeless traffic situations caused, for example, by faulty autonomous vehicles. Decision-making algorithms that will weigh up the pros and cons of different evils have to be created – strange as it may sound, machines will find themselves faced with dilemmas.

WHEN COMPUTERS DECIDE WHO LIVES, WHO DIES

Humans act in the heat of the moment when an accident occurs. An algorithm, in contrast, takes totally planned decisions on the basis of pre-set, rational models.

This raises two central questions: 1) What is the ethical basis for an algorithm that has to decide between two evils? 2) Who takes responsibility for predefined decisions: the vehicle's keeper, the manufacturer, the software programmer or perhaps no one? We need clear answers to these questions: they are the basis of people's faith, they are essential for legislation, and insurance companies will not issue policies for autonomous vehicles without them.

Extreme situations that may occur in road traffic merit scrutiny in this quest for solutions. Should a car drive into a wall and kill its passengers, or is it better to steer into a crowd of people? Should the car collide with an SUV or with a small car, with less risk to itself? In an emergency, will the car aim for the cyclist with or without a helmet? Should it injure that elderly lady, or would a group of young schoolkids be better? Let's run the possible scenarios for one thought experiment in more detail: it's a lovely August morning and you're being carried through the Swiss Alps in your self-driving car, enjoying the impressive scenery. From round a hairpin bend, a group of 35 racing cyclists appears, filling the entire breadth of the carriageway. You're in the middle of proposing marriage to your partner and are oblivious to what's going on. The car has to make a decision autonomously. Without one, 15 cyclists are likely to be fatally

injured. If the vehicle deliberately steers into the group, 5 cyclists will probably die. The alternative is to plunge down the slope, whereupon you and your co-passenger would die. None of the three options stands out as the obvious choice. Of course it is desirable for as few people as possible to die. However, that's far from deciding the best trade-off between 15, five or two fatalities on the moral and legal levels, because there's a difference between letting a person die and killing one. The 15 cyclists would die because an unfortunate situation turned into a tragedy. On the other hand, if the car deliberately steers into the group it will deliberately kill five people. Who takes the responsibility for that? The third option is for you yourself and your companion to die. Will people be happy enough to get into cars that will actively choose their passengers' death as the best option in an emergency? It seems doubtful, even though this would obviously minimise the number of victims.

Therefore, before we can say how the machine should decide, we have to be clear about what the "right" decision means for us humans in such a context. A number of options as to how and on what principles self-driving cars could take ethical decisions is discussed below.

The Swiss Alps example shows that a decision based on a simple headcount of human lives is not without its conflicts. The scenario is even trickier if we don't just count heads, but quantify human characteristics, an essential assessment should the car have to choose between risking the life of an elderly lady or that of a handicapped child in an accident. To tell a machine which is the more valuable life and therefore the one to be saved, we have to be able to assess the value of each. That's an unattainable goal for a number of reasons. However we quantify the value of lives, consensus is impossible – even within a single society, let alone on the global level.

Apart from the lack of clarity, any trade-off between human lives inevitably leads to discrimination. We violate the fundamental human right of equality by taking age, gender, nationality, disability, religion etc. as a basis for evaluating deliberate life or death decisions. Major controversies are sparked off by radical ethical positions in the debate on active euthanasia - such as that adopted by the Australian philosopher Peter Singer, who weighs the value of new-born babies in the balance against that of a certain number of pigs, taking their respective sufferings as a measure. The question is not whether there are situations which allow a quantitative trade-off, but whether the approach fails because it doesn't work as a norm. Accordingly, two options remain: either we drop the attempt to trade off human lives against one another or we do it anyway and are perfectly clear in our minds that there will be victims whose value is based on rules that a software manufacturer has defined together with an insurance company.

ROLE-BASED ETHICS FOR COMPUTERS

Apart from the assessment of consequences, however, there is another possible way of making decisions: setting mandatory rules. Let's assume the supreme law for any autonomous vehicle is: "You shall not murder". The car would first of all have to recognise when a dilemma had arisen, in other words when it had to decide between letting someone live or die. At the crucial moment, the car would have to give up its role as an actor and let things happen. People would still die, but the cause would be force majeure or third party error and not an active decision. This scenario sounds plausible, but it reaches limits where a choice can be made, as in the example above, between the deaths of 15, five or two people and where the largest number of people will die without an active decision.

SETTING THE COMPUTERS AN EXAMPLE

The scenarios outlined above fail mostly because they don't work as norms. But what if we drop the requirement of general acceptance and concentrate on how each of us would decide as individuals? What if keepers of autonomous vehicles could decide for themselves what rules their cars should follow? They could possibly use questionnaires similar to that of living wills, in which people solve the dilemmas of road traffic and use the results to personalise the software for their vehicles. Alternatively, the rules could be set on the basis of the driver's actual reactions during a virtually simulated drive. That way, people could weigh up the moral price of spur-of-the-moment, intuitive decisions versus considered convictions.

This option would also put a higher price tag on insurance policies in the event of egoistic behaviour. An autonomous car whose supreme goal was to save its keeper from harm might then become unaffordable. However, the boundaries of personalisation will be reached where several people with different ethical convictions share one autonomous vehicle.

PROGRAMMING RANDOM CHANCE

One final suggestion: random chance, normally a thing to be avoided in technical products, is not a flaw when applied to ethical decisions by autonomous vehicles. It may in fact be of use as a problem-solving principle. As we have seen, ethical dilemmas cannot be resolved by algorithms, regardless of their logical capabilities. If, then, the choice between options A and B is made at random, the question of moral guilt would be eliminated. We would be taking account of the fact that neither absolute certainty nor complete safety can ever exist. Terrible accidents with many deaths would still happen this way, but there is a possibility that we will be able to process these events just as we do tragic plane crashes.

All the above leads to at least three essential demands on our society.

1) If we take on board such powerful technologies that make decisions with an ethical dimension, we have to accept that tragic errors will necessarily be part of the story. True perfection remains an unattainable ideal.

2) Like pre-implantation diagnostics and euthanasia, the ethics of self-driving cars have to be negotiated on the societal level. And because of the very rapid progress of technological development, it has to be done fast.

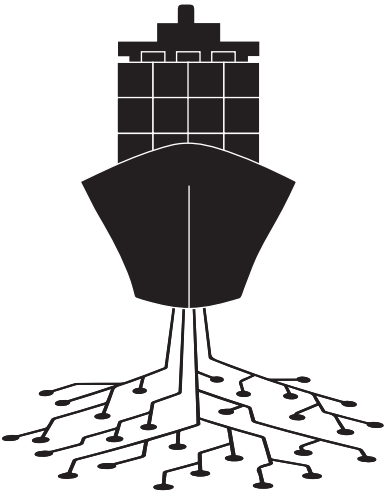
3) More and more of the new generation of inventors come from the design and computer sciences. Transdisciplinary cooperation has to be increased to ensure that they will always include the ethical dimension in the development of their ideas. If we integrate insights from the humanities and social sciences rather than restricting innovation to novel technological developments, sustainable ideas can arise that include general social issues.

Jean-Paul Sartre defined dilemmas as the source of human morality. On that basis, the rise of autonomous vehicles tells us a great deal about our own convictions. All of us now have the chance to help shape morality.

// *STEFAN PABST* is a researcher with the W.I.R.E. think tank. His work centres around social and cultural transformations caused by technological progress as well as innovation management in the context of shifts in social values. Before joining W.I.R.E. the graduate philosopher and physicist worked as a copywriter and innovation consultant.

LIVING ON FIJI
Virtual communication opens up autarchic life and working models

The abolition of mandatory presence at the workplace opens up completely new perspectives for employees in the 21st century in terms of how they shape their lives. Work can be done anywhere with a connection to the World Wide Web. This gives companies access to the best employees in the world. Places of residence can include mountain peaks and South Sea islands.



OF WORLD OCEANS AND MICRO DISTRIBUTION

INTERVIEW WITH KARL GERNANDT
By Stephan Sigrist

The logistics industry has come off a winner from the globalised markets. To keep things that way, the industry has to keep developing, says Karl Gernandt, Executive Chairman of Kühne + Nagel. However, the growth potential and challenges of the future don't lie in technological innovations, but in metropolisation and the emerging economies' growing middle class. The ability to control networks and knowledge of regional specifics will become core competences.

Mr Gernandt, not only passenger transport is being transformed, but goods transport as well. In your view, what are the most important drivers of change in global trade and logistics?

In my view, the current changes are overrated. We're not developing in disruptive steps, and neither is mobility. Mobility has been a key feature of our history for 5000 years. What we're experiencing today is simply a further evolution, and not something fundamentally new. That makes not disruption, but adaptability and building on what we already have the characteristics of successful business models, strategists, managers and entrepreneurs.

In the context of mobility, the core drivers of change are free access to education and technology as well as rapid population growth combined with the ageing of society. Added to these is the increasing affluence that is associated with metropolisation.

What do adaptability and building on the status quo mean to the logistics industry in the light of these global changes?

We're experiencing a significant shift in demand towards emerging economies, whose middle class and con-

sumer class are steadily increasing as a result of population growth and rising affluence. The demand for food and consumer goods is increasing accordingly. The Association of Southeast Asian Nations (ASEAN) already numbers more than 600 million inhabitants today. The proportion of the working population is rising faster in these countries than the proportion of over 65-year-olds – in Europe and the USA it's the other way round.

Markets have been globalised in the last 30 years, now we'll benefit from the immanent effects of this dynamic for the next 100. The increased complexity and the diversity of markets on both the supply side and the demand side are moving regional value chains and decentral supply systems into the foreground. Traditional freight forwarding now has to develop an understanding of these new markets, because this is the only way for highly detailed door-to-door delivery solutions to be created. In contrast to the past, seaports and airports are no longer the final destination for our services, but retail distribution, e.g. right through to chemists' shops or consumers.

How can a European logistics company successfully occupy these new markets with their specific regional features?

In the same way as the automotive and aircraft industry accomplished it: logistics companies have to transfer their knowledge and experience from Europe to other locations and build on it there. The development of freight forwarding from pure transportation to logistics service provision is still very new, but it is the crucial dynamic. Although logistics has a long history, particularly in the military sphere, companies often position the logistician

on a subordinate level of the purchasing department. In future, however, he will be having meetings with the head of distribution or production on the top floor. The status of logistical issues will rise enormously and as a result will enthuse talented young people all over the world. For that reason, it is essential to strengthen logistics as an academic discipline. Of course, that's more difficult in our industry than in glitzy consumer goods sectors. Since, however – as described - the core competence of a logistician will be to control networks, we will be dealing with the most exciting challenges in a digitalised world. We will create attractive international training programmes and work in collaboration with universities and educational institutions.

How do you rate the development of 3D printing methods, which are used to manufacture goods where they are needed? Will decentral production permanently alter the transportation of goods?

Although 3D printers are a development that has to be taken seriously, they will not be a relevant or even fundamental driver for the logistics industry in the foreseeable future. The main reason is because the parts produced are still very small and mainly have a role to play where structural requirements or weight reduction have to be considered. That includes spare parts in the aircraft industry, for example. Prototyping and medical technology are other possible areas of application. The new technology actually will revolutionise these sectors – Airbus saved over a tonne of weight per aircraft in the A380 by 3D-printing connecting parts. However, since logistics is about the transportation of large volumes of goods, the influence is evidently not very significant. Nevertheless, the logistics industry has to keep a close watch on this de-

velopment, because one of these days large industrial companies that currently have their parts delivered directly to the production line may make them themselves by additive production processes.

Other technologies, such as self-driving cars or drones, will change mobility more directly. What impact on freight forwarding do you see in these?

Self-driving lorries will definitely become established. It will be possible to use the motorways more efficiently with reduced distances between vehicles and no more rest periods for drivers. However, I would like to emphasise here, too, that it won't be a revolution, but a change. A locomotive used to have a fireman and two engine drivers, nowadays only one person is needed, but it still runs on rails– the utilisation has just been optimised. Drones can be taken less seriously for two reasons: it's strangely ironic when an unsecured airborne mode of transport is used to transport goods. It would hardly be surprising if the recipient kept not only the goods, but the vehicle as well, which may possibly be worth more. In addition, security issues and protection of the private sphere will not allow for the wholesale use of drones. These devices only work with cameras, and they won't get overfly clearances for 20 million homes in a city whose residents would potentially be subject to their surveillance.

A digital infrastructure enables the logistics sector to have more efficient processes and increased planning capability, particularly for deliveries to production where the shortest possible storage times are targeted, as in just-in-time or just-in-sequence processes. How do you assess the resulting dependency on digital technologies?

Digital technologies will indeed become more relevant, particularly where merchandise categories don't permit any delays, you only have to think of perishables, fresh goods which will simply go bad if they don't arrive in good time. Logistics is becoming more and more demanding and IT-based as industries reduce their current assets further, in other words they want to have as little goods as possible on the road or in the air. If you do that it's no longer possible to put buffers in place for unexpected events such as the reactor accident in Fukushima, the embargo on supplies to Russia or natural disasters. For these cases, risk analysis has to go back to using emergency stocks and emergency capacities. And one basic rule applies: the longer the transport distance, the greater is the probability that incidents will happen.

As far as consumers are concerned, does that mean they should also go back to keeping emergency stores in case the international supply chains break?

It's impossible to predict whether there's a limit to optimisation at some point at which we will all have to start hoarding a kilo of sugar and strategic spare parts in the cellar again. However, it is absolutely essential for logisticians to be able to use alternative strategies in such emergency situations. Of course, these will have to be coordinated at a higher capital investment and in a more sophisticated way. Basically, however, it can be said that

we are optimising in ever finer dimensions, but at the same time constantly have to put better safeguards in place. Global markets' increasing complexity, more controllable now as a result of IT, leads to hedging costs, so that we will arrive at a zero sum game at some stage.

Five years ago, this interview would have addressed different topics: sustainability, ecological challenges and clean energies. Has the importance of environmental risks declined?

It has never proved possible so far to integrate ecological aspects satisfactorily into the economic system on the global level. World trade operates on the basis of price advantages, and environmental pollution and the use of natural resources don't play a decisive role there. Ships definitely need to be improved from the ecological point of view and are a major task within the logistics chain – and are also responsible for 90% of world trade. Although the pressure on shipping companies to stop using low-quality refined oil is constantly increasing, no organisation in the world could lay down binding standards that apply equally to the Port of Hamburg and the Indian Ocean – the high seas are still practically a legal vacuum. The initiative would have to be taken by one of the main centres of world trade which other ports could then align with. However, the risks to an individual business location are too high for that.

That means that ocean shipping will remain the central means of transport?

Yes, absolutely. The transport cost advantages of ships are immense and they are the only way to shift large volumes and heavy loads. Air freight can only be considered when speed, security, freshness or temperature are important and rail only when security requirements are low. The product category determines the type of physical transport.

Thinking one step beyond the near future: what major changes do you see for the coming 20 years? And where are the growth areas for the logistics industry with regard to these changes?

There are already signs that the subject of reverse logistics will be one of the future's most significant challenges. The organisation of returns affects everyone from small businesses to large Internet providers, it includes the distribution and taking back of outer packaging, clothing, and much more – not just when someone doesn't like the product that was ordered, but also when it is no longer used. How to handle electronic waste, for example, is one of the biggest unsolved issues.

I see the second challenge in the logistical needs of the growing metropolitan regions. The importance of flows of goods will rise sharply as the density of urban developments increases. Why are there only tower blocks for people, and not for warehousing or agricultural production? And how will individualised goods reach their consumers?

It can basically be said that the logistics industry is one of globalisation's winners, and that we will continue to profit from increasing trade growth in the next 30 years. Now we have to understand the finer points of regional differences on the planet. The logistician working in oil exploration in north Siberia knows when the ice is thick enough for a heavy-duty transporter to deliver heavy spare parts. However, that knowledge is irrelevant to a drilling platform in Saudi Arabia.

Naturally, you can send employees all over the world, but there will always be regional specifics that are only understood by those who have got to know a culture very intimately - whether in Zurich, Sakhalin, Vietnam or Mongolia. And that is and will remain the unbelievable fascination of a logistics service.

// *KARL GERNANDT* has been Executive Chairman of Kühne Holding AG, the majority shareholder in Kühne + Nagel International AG, since May 2016. He previously served five years as Executive Chairman of the Board of Directors of the global logistics company. He started his professional career with Deutsche Bank, where he worked as the assistant to the CEO and Supervisory Board chairman and also held positions in Tokyo, Singapore and New York. Before Karl Gernandt was appointed by Klaus-Michael Kühne as his successor in key functions of his field of interest in 2008, he held leading roles at Holcim Ltd. Today, he is also Vice-Chairman of the Supervisory Board of Hapag-Lloyd AG and Chairman of the Supervisory Board of HSV Fussball AG.

THE NEXT MIGRATION OF PEOPLES
Conquering the interstellar space takes the pressure off earth

The earth cannot handle the environmental pollution caused by the volume of passenger traffic. As part of the search for new living space, the old dream of settling on Mars with less expensive spaceships and the implementation of “terraforming” ideas are being revived – championed by the visionaries from Silicon Valley.

Flavio Montiel is an illustrator and concept designer from São Paulo. In his graphic works he combines the here and now with elements of science fiction to create contrast-laden studies of human possibilities. His works show optimistic scenarios that also consistently generate a sense of strangeness. *www.flaviomontiel.com*

THE FUTURE OF YESTERDAY

The history of mobility is full of innovation-related milestones. But the history of ideas to do with transport also includes numerous magnificent inventions that failed due to the reality of physics or a lack of demand. But we should nevertheless not forget them. Because the courage to think the impossible lays the cornerstone for progress, both today and tomorrow. A homage to the inventive spirit of the past.

THE UNICYCLE
Large wheels as a status symbol prior to "Pimp My Ride"

A TRICYCLE FOR A LARGE FAMILY
A precursor to the popular family vans of the 19th century

PROPELLER-DRIVEN MONORAIL
Conceived for the Paris-London route (approx. 1930)

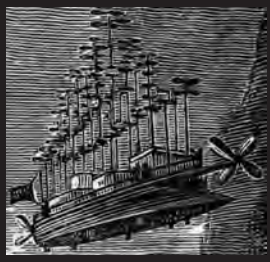
Alternatively in combination with horsepower

And motorised with a speed of 190 km/hr

ELEPHANT BALLOON
The origin of sustainable engines

WATER BICYCLE
In the Belle Époque a way to escape the smells of cobblestone streets

EDISON'S ANTI-GRAVITATION UNDERCLOTHING
Still unfortunately in the realm of science fiction



AIRSHIP
a transport vision of Jules Verne and Albert Robida during the Belle Époque

¡COPTER VERSION 0.1
The civilised way for a couple to take a walk

VEHICLES FOR THE INDIVIDUAL AGE
A prerequisite for mobility in times of denser habitation

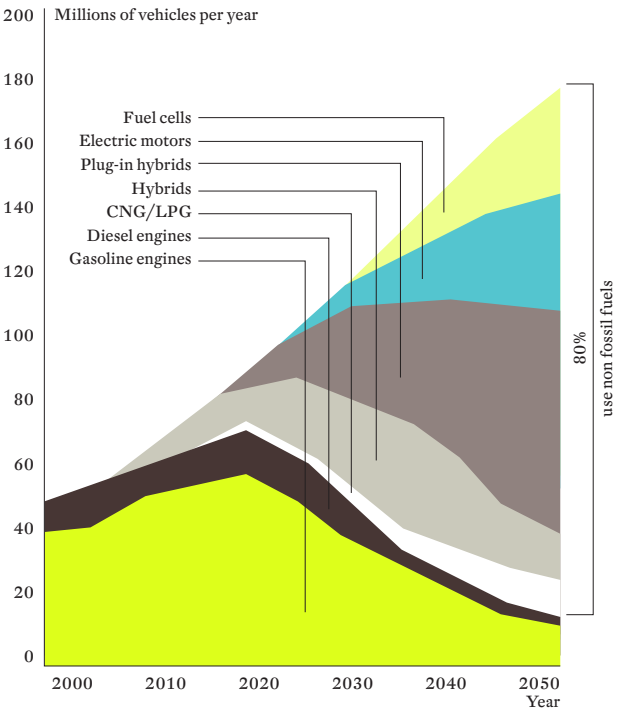
Pontiac advertisement from the heyday of the US automotive industry

FLYING CARPET MADE OF STEEL
A precursor to Back to the Future from the 1950s

In addition to the essays and discussions with experts, W.I.R.E. has compiled fundamental, surprising and inspiring statistics and facts relating to the mobility sector.

Diesel engines may still be on our streets in 2050

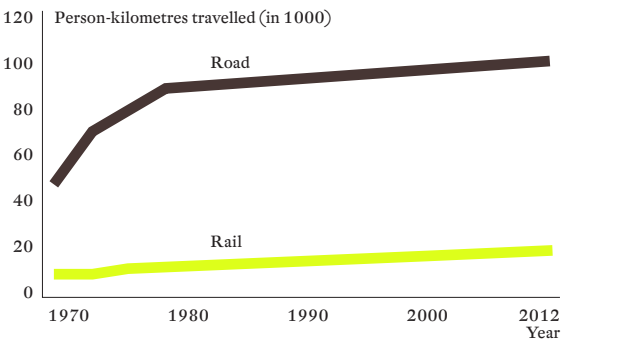
Sales of drive technologies over time (global)



International Energy Agency IEA (2010). Energy Technology Perspectives 2010

The ratio of train travellers and drivers in Switzerland has remained constant for 40 years

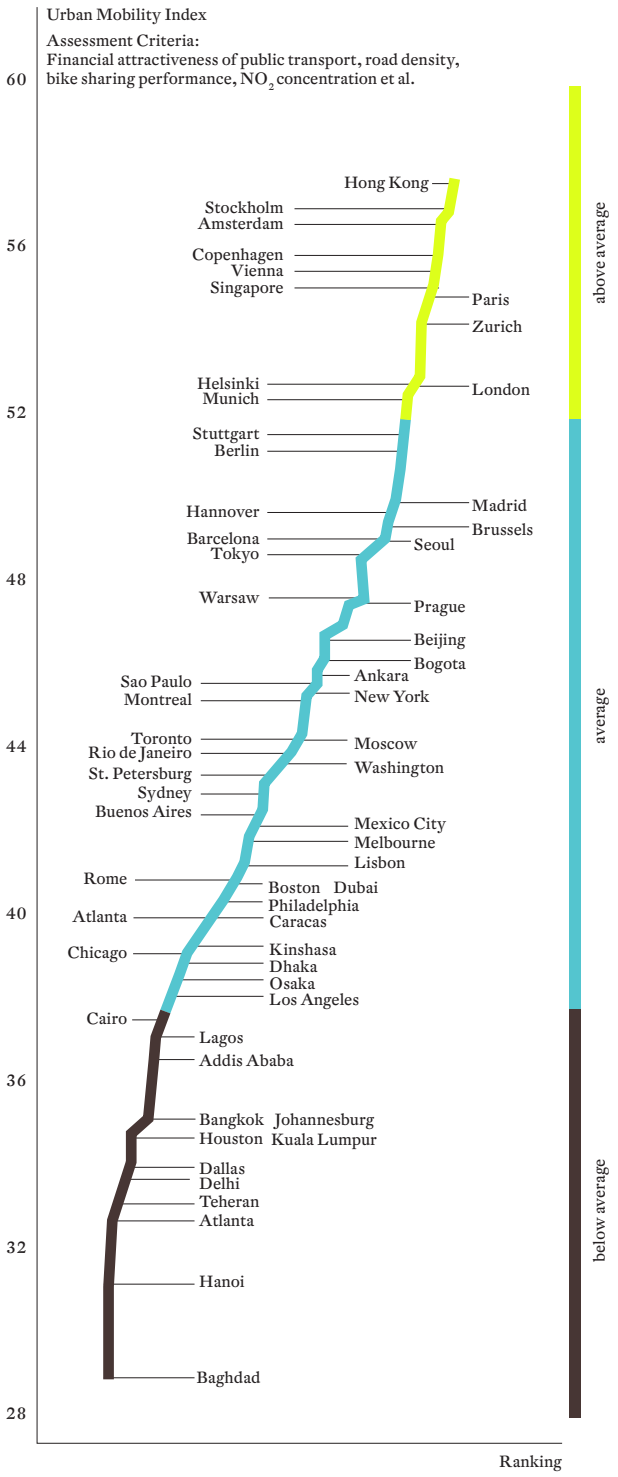
Person-kilometres travelled by rail and road in Switzerland, 1970–2012



FEDRO – Federal roads office (2014). Performance of passenger traffic

Traffic keeps moving in European cities but it does so best in Hong Kong

Attractiveness of urban transport: an international comparison



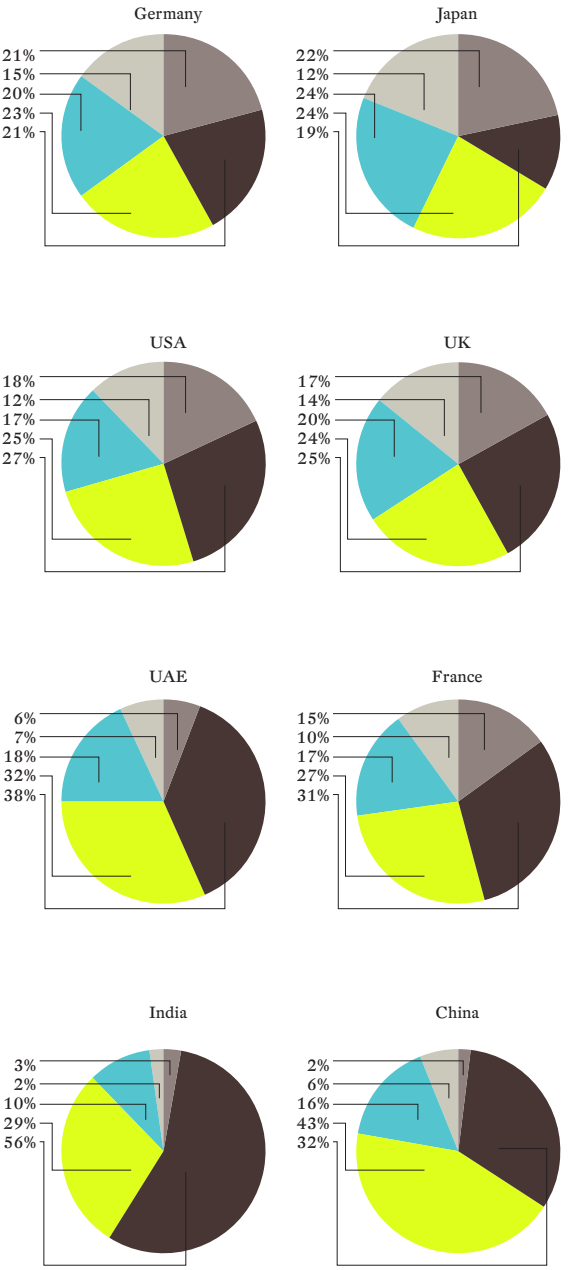
Arthur D. Little (2014).
Urban Mobility Index 2.0

Low interest in self-drive cars in Japan and Germany

Willingness to take a test drive in an autonomous vehicle: an international comparison

Survey question:
«Are you interested in testing a self-driving car?»

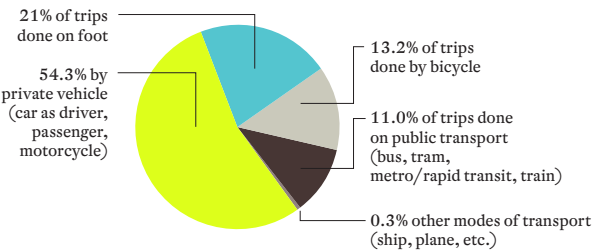
very unlikely
unlikely
neutral
likely
very likely



World Economic Forum WEF (2015).
Self-Driving Vehicles in an Urban Context

More than 50% of all trips are done by car

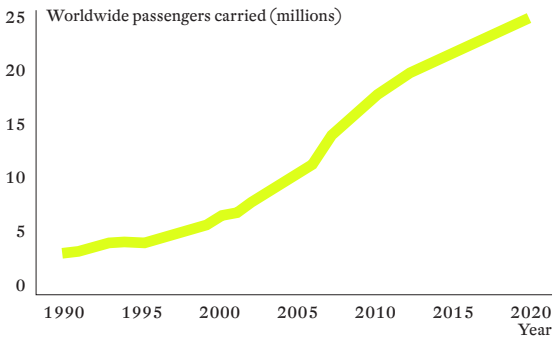
Modal split (2014)



Karlsruhe Institute of Technology (2015). Annual Report German Mobility Panel – Survey Wave 2014/2015

More and more people are taking cruises

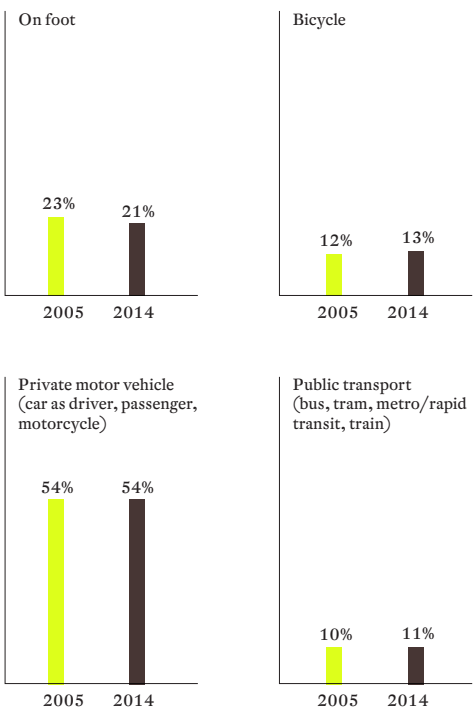
Cruises: numbers of passengers worldwide (1990–2020)



Cruise Market Watch (2015). Growth of the Cruise Line Industry

People are loyal to their mode of transport

Choice of transport mode in Germany (2005–2014)



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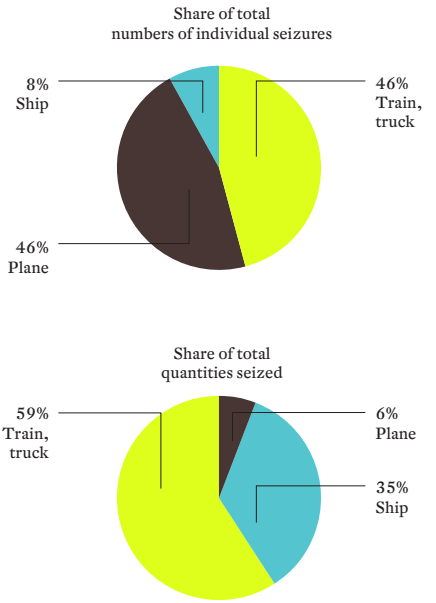
Most drug shipments take place by rail or road – but the largest quantities are carried by ship

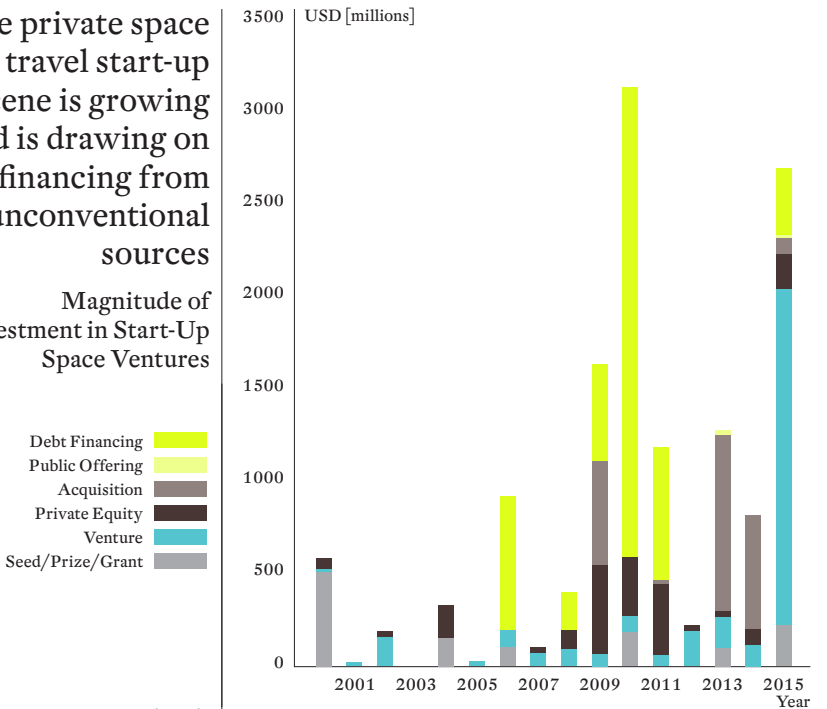
Drugs smuggling by mode of transport



United Nations Office on Drugs and Crime UNODC (2015) – World Drug Report 2015

The private space travel start-up scene is growing and is drawing on financing from unconventional sources

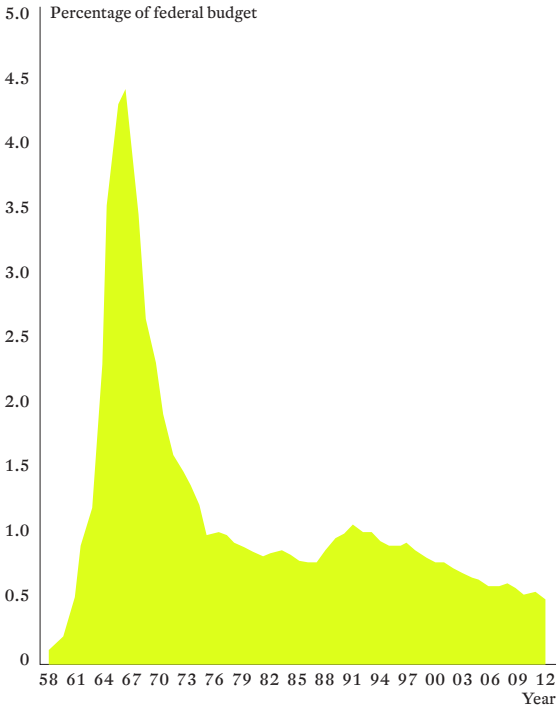
Magnitude of Investment in Start-Up Space Ventures



The Tauri Group (2016). Start-up Space

Since the moon landing, NASA has had less and less money to explore space

NASA budget as a percentage of the US budget



U.S. Government Publishing Office (2015)

Mankind as a whole has only been in space for 130 years

People in space

By June 2016 553 had been in space.

There are currently six people in space (June 2016).

The longest period a person has spent in space at one time was 437 days (Valeri Polyakov).

Total time spent by people in space: 130 years.

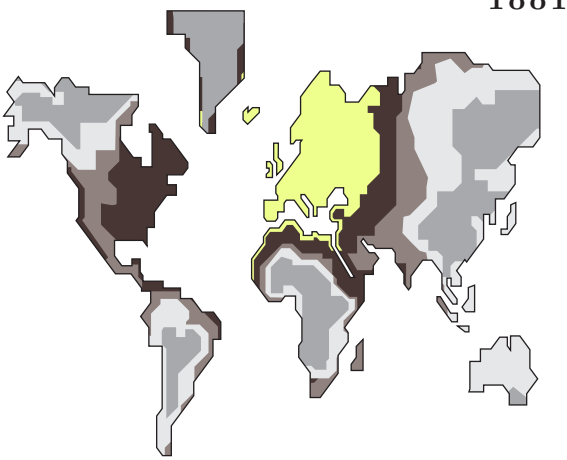
World Space Flight (2016). How many people are currently in space, and who are they? www.worldspaceflight.com

Today, you can get just about anywhere in the world in 1.5 days

Comparison of global travel times departing from London in 1881, 1914 & 2016

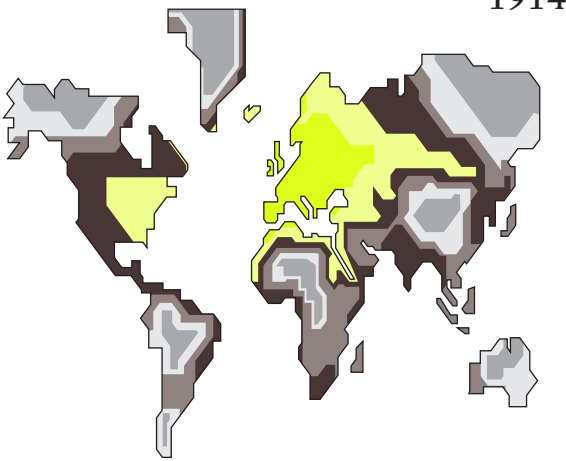
1881

Distances in days from London
- Within 10 days
- 10 to 20 days
- 20 to 30 days
- 30 to 40 days
- over 40 days



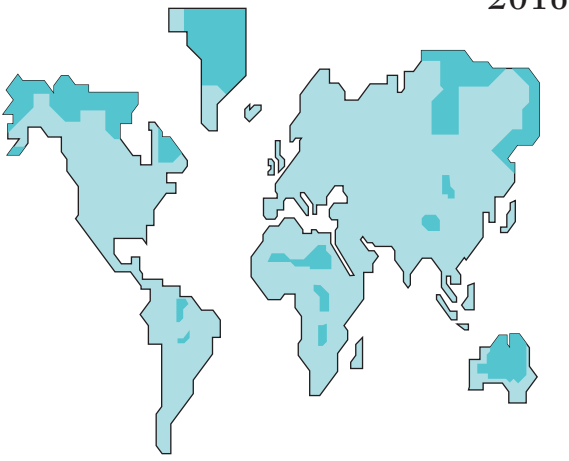
1914

Distances in days from London
- Within 5 days
- 5 to 10 days
- 10 to 20 days
- 20 to 30 days
- 30 to 40 days
- over 40 days



2016

Distances in days from London
- 0.5 day to 1.5 days
- more than 1.5 days



Zukunft Mobilität (2016).
Immer schneller und weiter:
Reisezeiten im Jahr 1881, 1914 und 2016.
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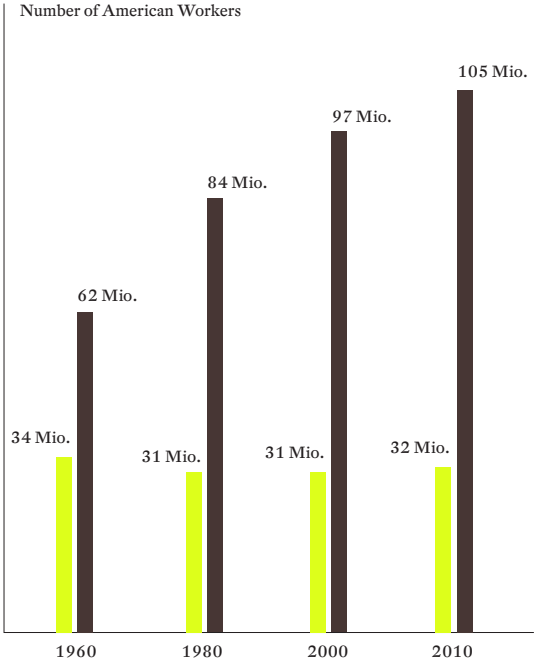
More and more people prefer travelling alone by car

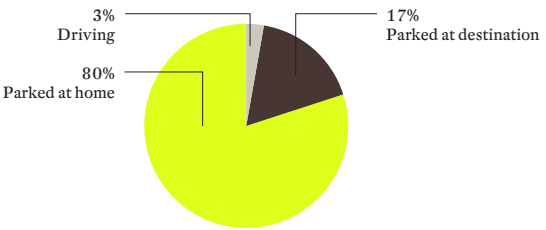
Percentage of US workers who travel alone by car (1980-2010)



U.S. Census Bureau (2014). Decennial census and American Community Survey

Cars spend 97% of their useful lives parked

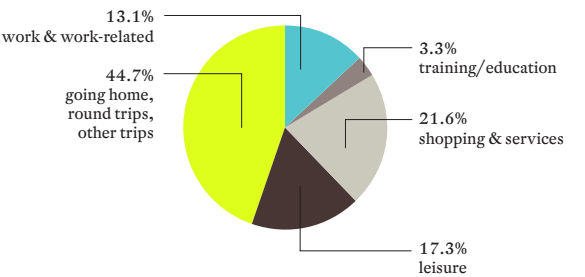
Active use of cars in the UK



The Royal Automobile Club Foundation for Motoring (2013). Spaced Out. Perspectives on parking policy

Routes to work and the shops account for 65% of trips

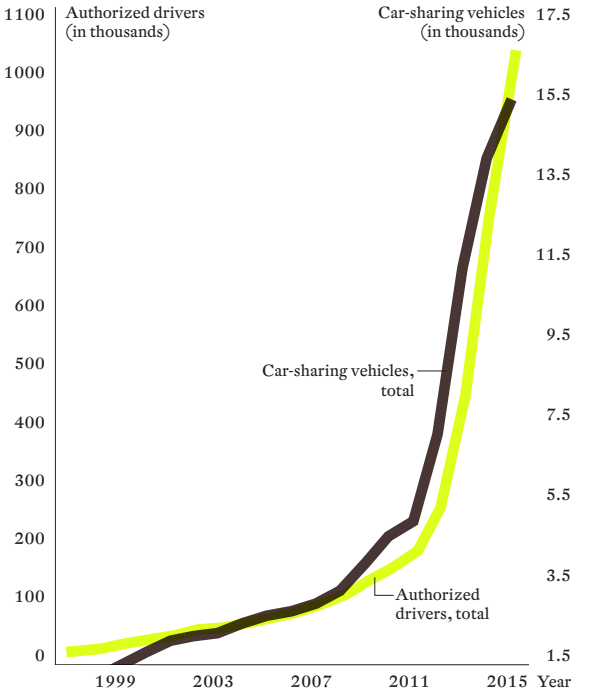
Traffic volumes by route purpose in Germany, 2014



Karlsruhe Institute of Technology (2015). Annual Report German Mobility Panel – Survey Wave 2014/2015

Use of car-sharing schemes has increased over 16-fold in the past 10 years

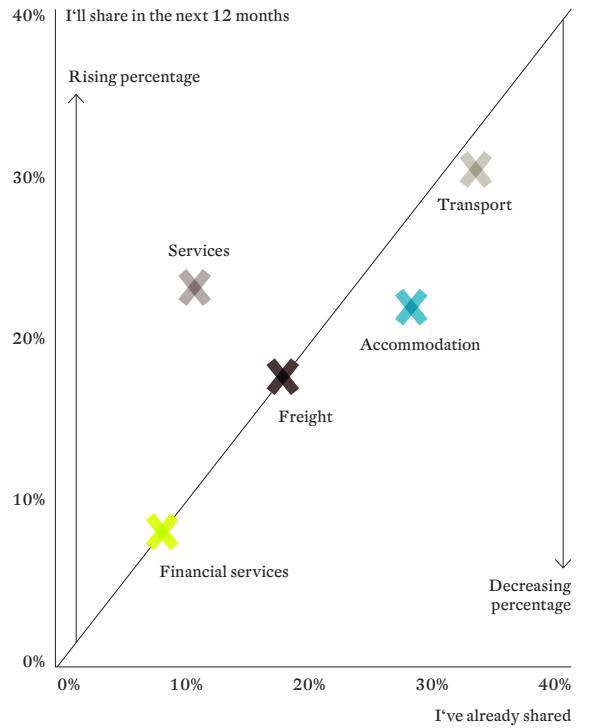
Car-sharing in Germany (1997–2015)



Bundesverband CarSharing (2015). Annual report 2014/15

Switzerland has the highest rate of transport sharing

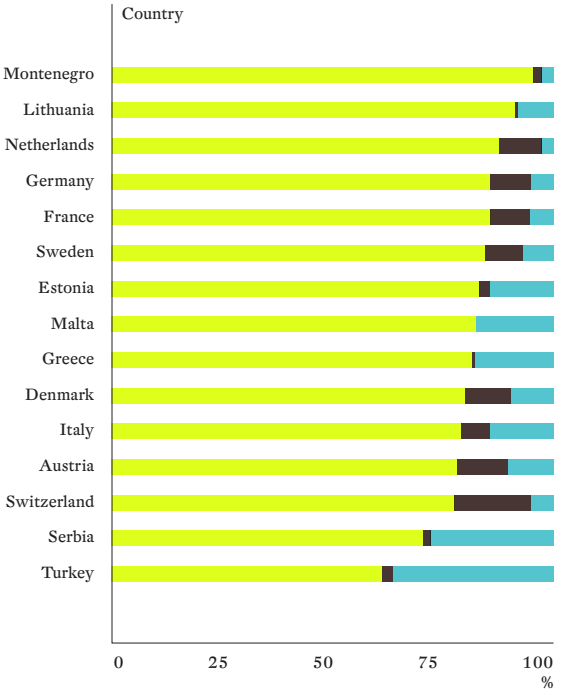
Products on sharing platforms in Switzerland



Deloitte (2014). Sharing Economy: Teile und verdiene! Wo steht die Schweiz?

Although cars are in vogue all over Europe, Montenegro is highly car-focused. The Swiss trust in trains, and in Turkey buses are a widespread transport option

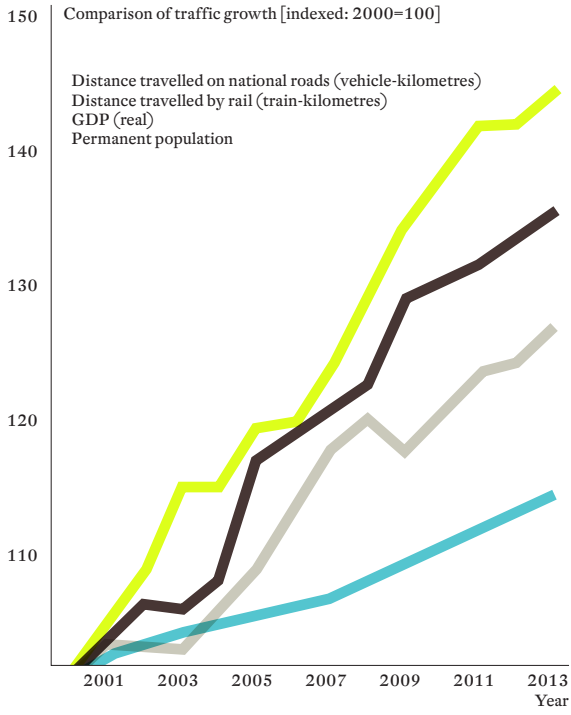
Modal split of passenger transport in 35 European countries in 2012



Anton Gunzinger (2016).
Wie viel Mobilität braucht der Mensch?

Traffic on Switzerland's national road network has increased by almost 50% since 2000

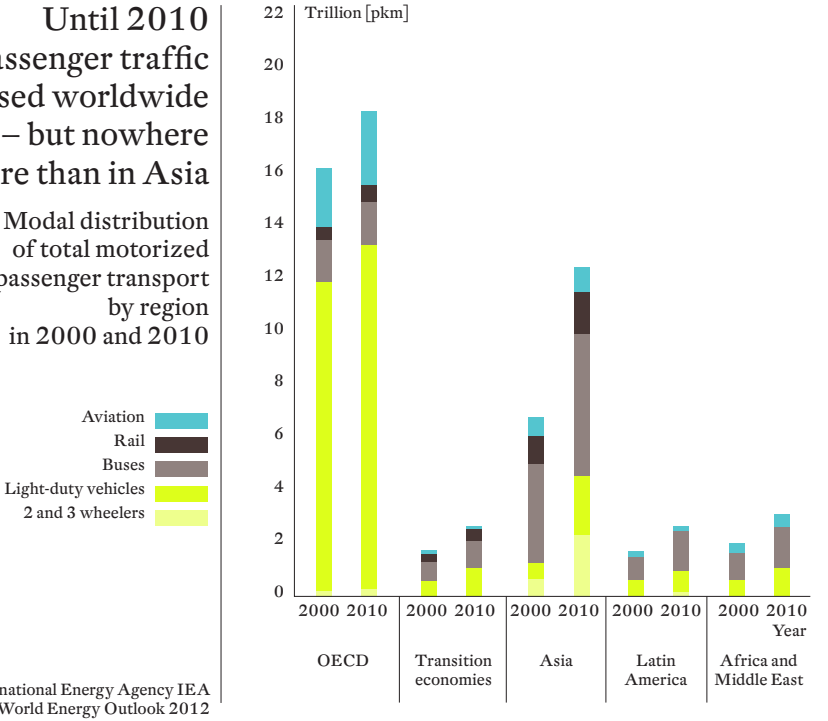
Traffic and population growth in Switzerland



economiesuisse (2016).
Infrastrukturbericht – Wettbewerb stärken und digitale Chancen nutzen

Until 2010 passenger traffic increased worldwide – but nowhere more than in Asia

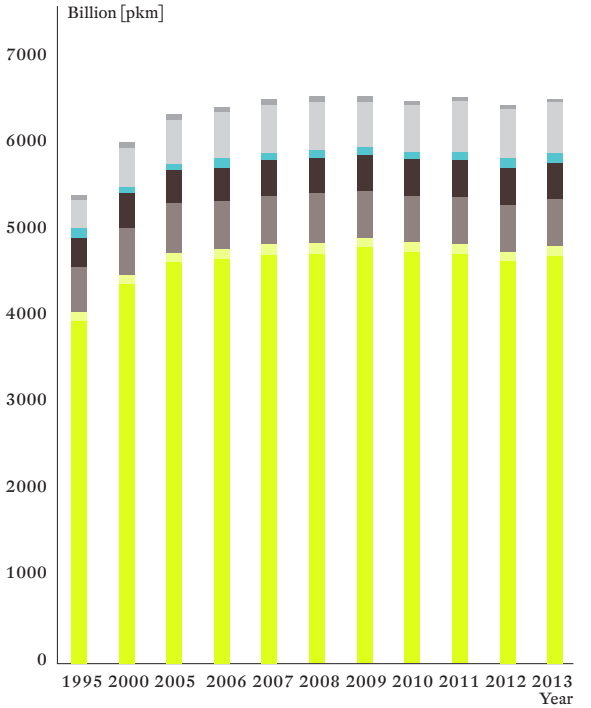
Modal distribution of total motorized passenger transport by region in 2000 and 2010



International Energy Agency IEA (2012). World Energy Outlook 2012

Since 2009, total traffic volumes in Europe have remained relatively constant

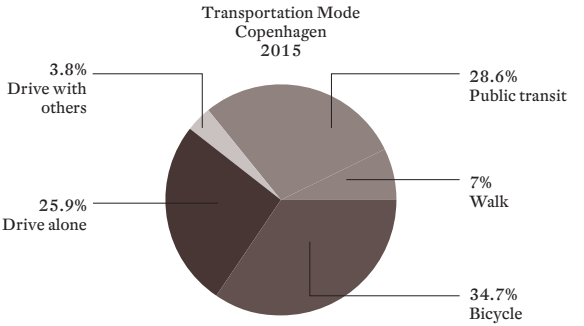
Passenger traffic in Europe by mode of transport

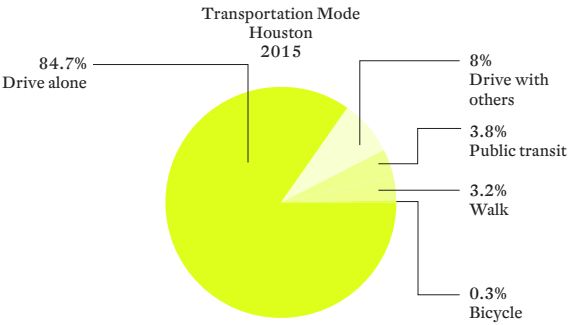


European Environment Agency (2015). TERM 2015

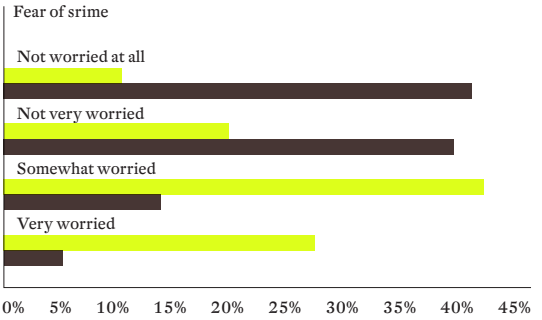
In Copenhagen, people are not afraid of crime and like to travel by bicycle – in Houston, people are more fearful and prefer to travel alone by car

Modes of transport and fear of crime in Copenhagen and Houston





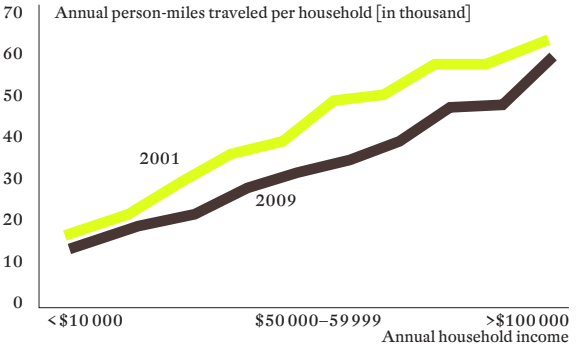
Houston
Copenhagen



The Kinder Institute for Urban Research (2015). Copenhagen Area Survey 2015

Higher earners cover more kilometres

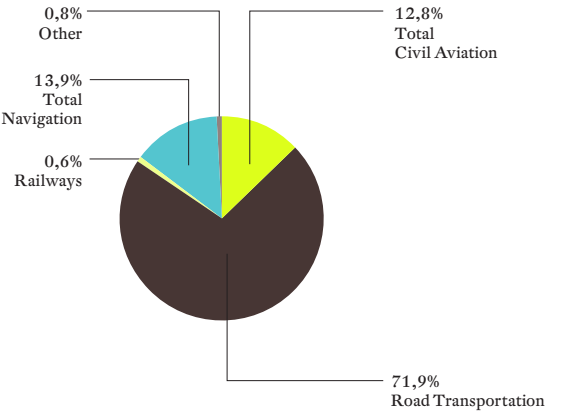
Average distance travelled per person in relation to income, 2001 & 2009



U.S. Department of Transportation (2014). National Household Travel Survey

Shipping and aviation are responsible for 25% of air pollution – road traffic for almost all the rest

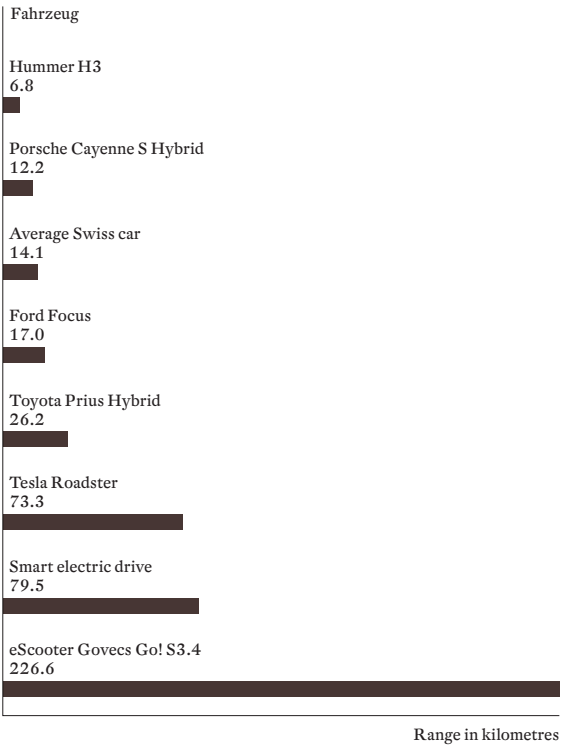
GHG emissions from transport by mode in the EU



European Commission (2015).
EU transport in figures 2015

An e-scooter travels 33 times further than a Hummer

Vehicle range on one litre of petrol or the equivalent amount of electricity

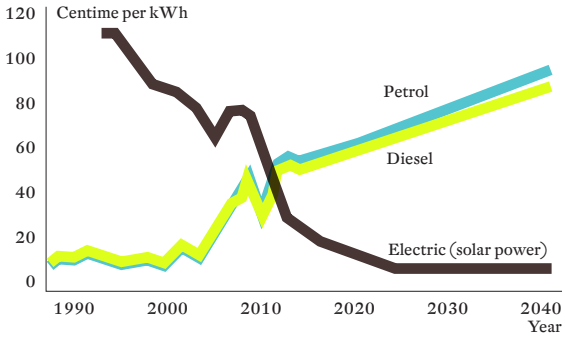


Anton Gunzinger (2016).
Wie viel Mobilität braucht der Mensch?

In Switzerland, electric transport has been cheaper than petrol or diesel-powered transport since 2011

Energy costs for travel in Switzerland, 1996–2014

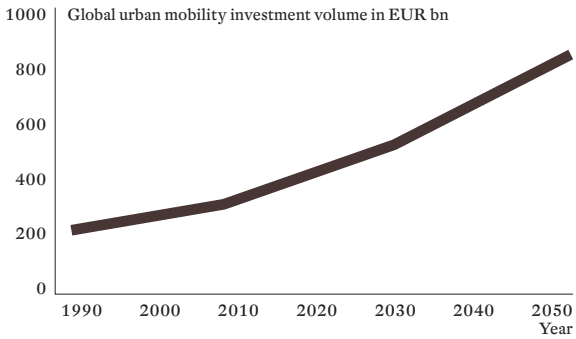
Anton Gunzinger (2015). Kraftwerk Schweiz



Investments in urban transport will more than double in the next 40 years

Global investment in urban transport

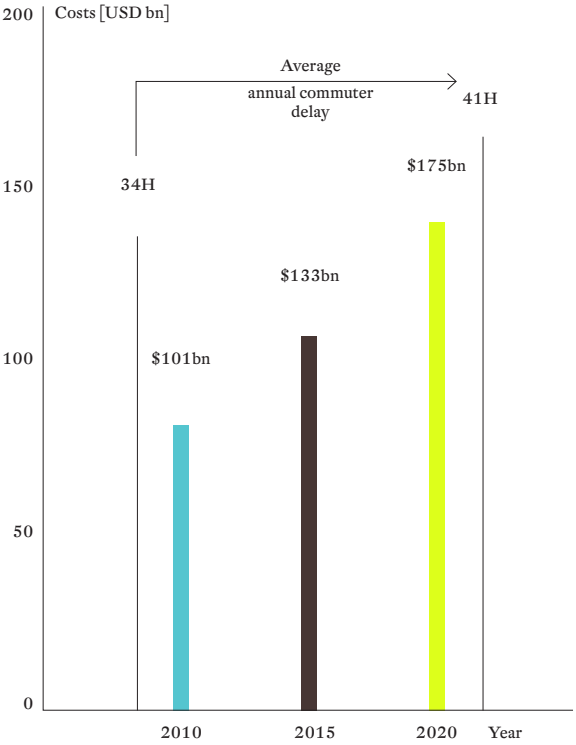
Siemens Bureau of Transport Statistics (2014). How Transport drives Growth



US drivers sit in traffic jams for close to 40 hours a year

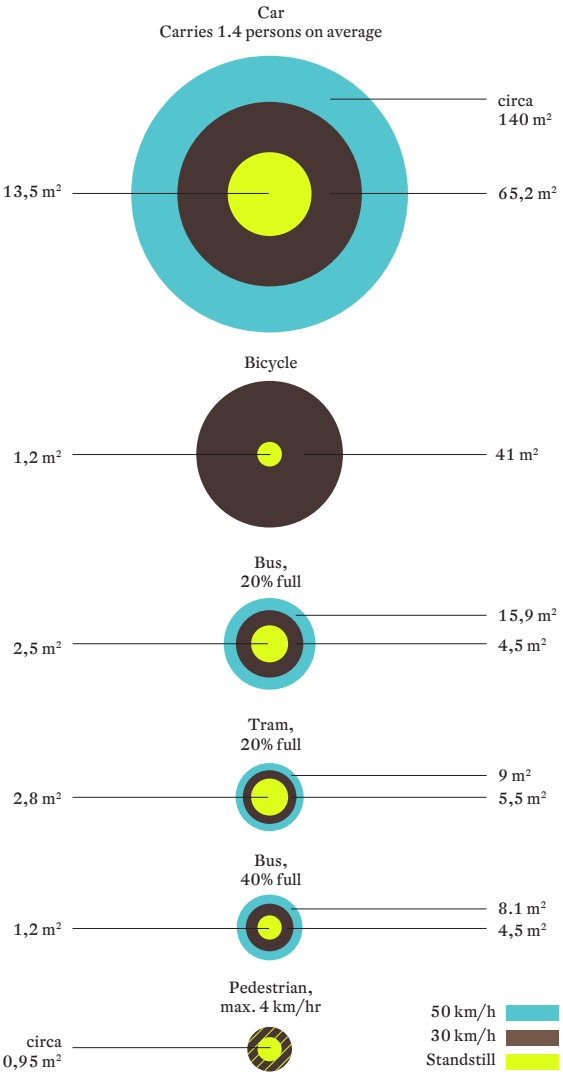
Costs of traffic jams in the USA (2010, 2015 & 2020)

Texas Transport Institute (2011). 2011 Urban Mobility Report



A car in city traffic requires 15 times more space than a tram and can only carry 4 people

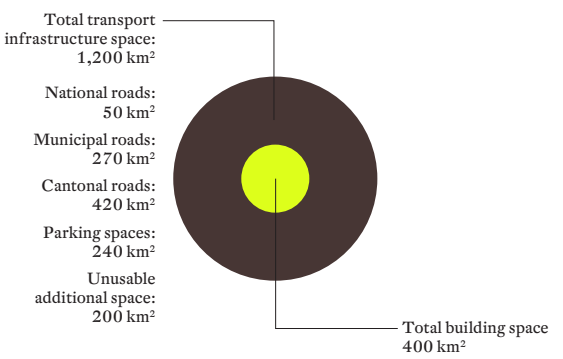
Space requirements per person for different transport modes (calculated on basis of vehicle length and width of the required traffic space, appropriate braking distance and double the reaction distance as a safety buffer, and number of persons carried)



Zukunft Mobilität (2014). Vergleich unterschiedlicher Flächeninanspruchnahmen nach Verkehrsarten. www.zukunft-mobilitaet.net

Transport infrastructure in Switzerland occupies three times more space than buildings

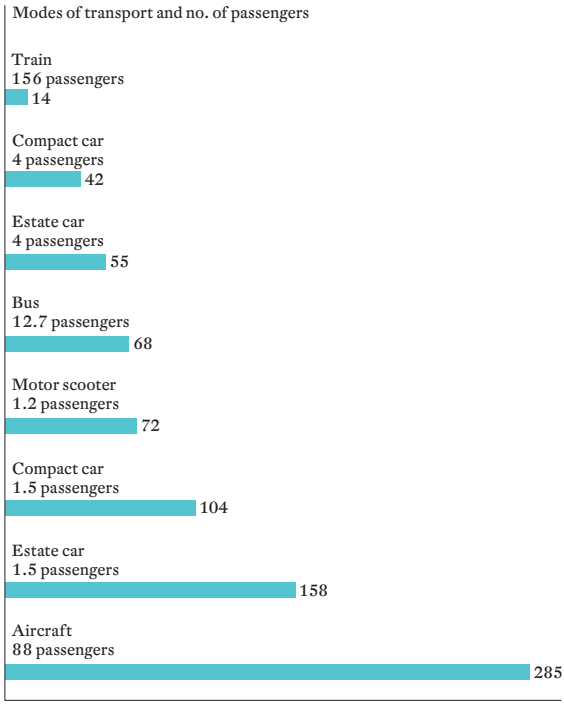
Space in Switzerland occupied by transport infrastructure



Swiss Federal Statistical Office (2010). Strassenrechnung der Schweiz 2010

Full aircraft and poorly filled cars impact the environment to a similar degree

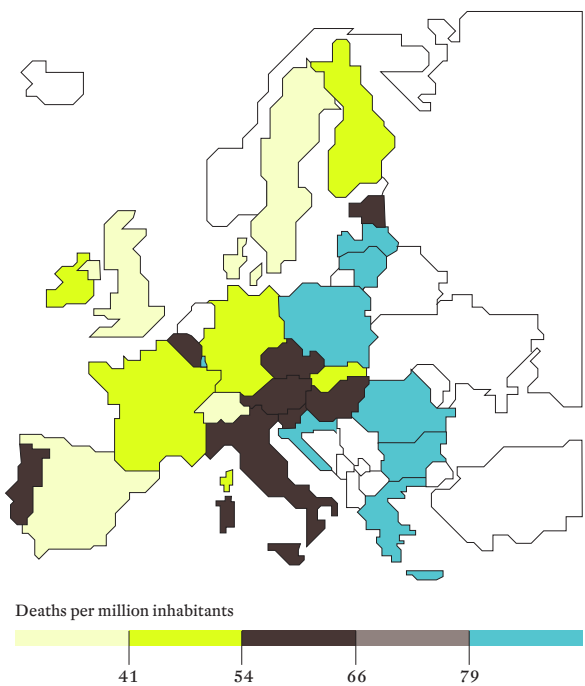
CO_2 emissions in passenger traffic per km (in g)



European Environment Agency (2015). TERM 2015

Roads in eastern Europe and Luxembourg are dangerous

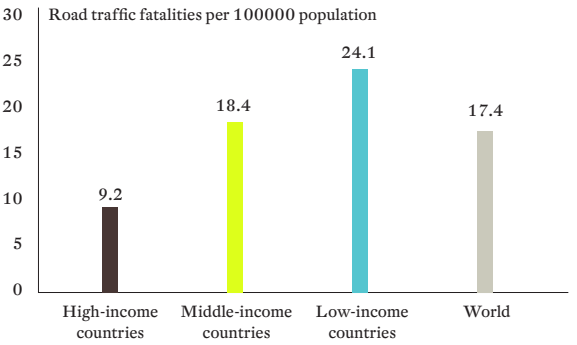
Fatal traffic accidents per million inhabitants in Europe



European Commission (2014). Road safety in the European Union

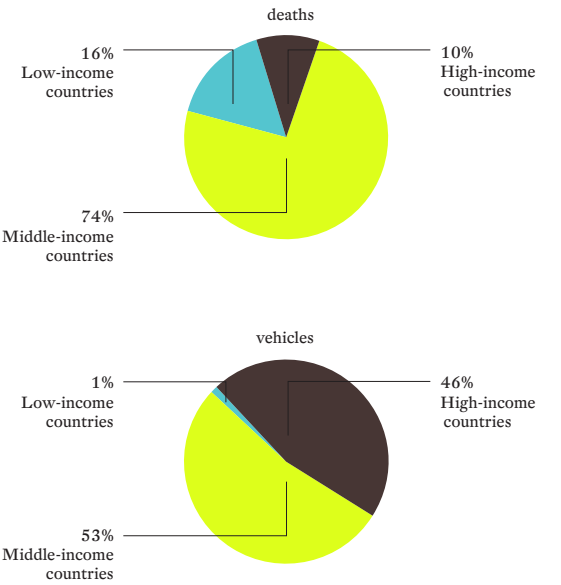
Low-income countries have the highest road death rates

Number of road fatalities by distribution of wealth



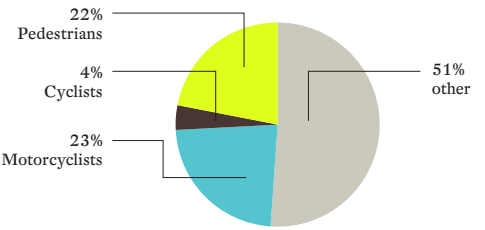
Although low- and middle-income countries have only half of the world's vehicles, they account for 90% of the world's road deaths

Global split of vehicles, road traffic deaths and wealth



49% of all road road deaths are among pedestrians, cyclists and motorcyclists

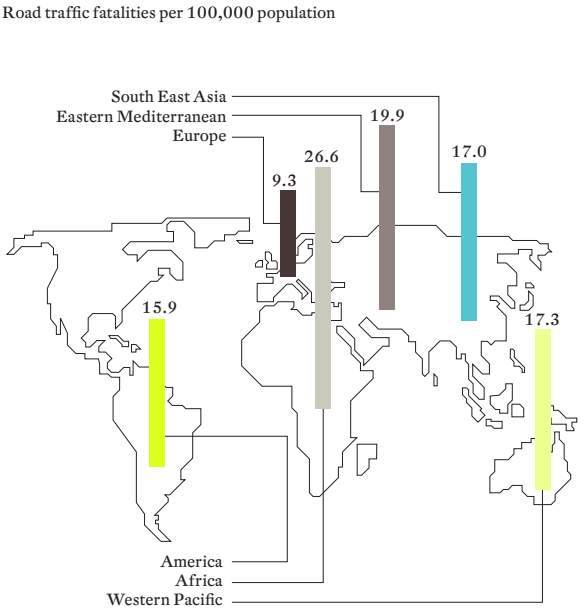
Modal split of road deaths



World Health Organization WHO (2015). Global status report on road safety 2015

The chance of dying in a road crash depends on where you live

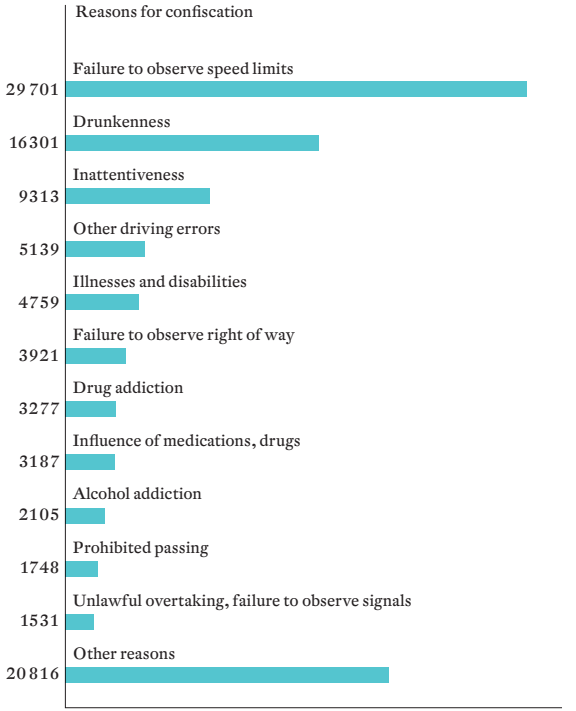
Number of traffic fatalities by region



World Health Organization WHO (2015). Global status report on road safety 2015

Alcohol and speeding are the most frequent traffic offences

Reasons for driver's licence confiscations in Switzerland, 2013



FEDRO – Federal roads office (2014). Performance of passenger traffic

The future of mobility is much more than the development of self-driving vehicles and new battery systems – it also concerns city planning, new work models and aviation. W.I.R.E. has put together a selection of the most unusual and boldest concepts that could make small or large changes to mobility.

#1 | Three time zones in one city

Tailbacks in commuting hours take big-city traffic systems to the verge of breakdown on a daily basis. To tap into the potential of a flexible working world, a student project at Parsons School of Design developed the "Interzone" concept: it divides New York City into three time zones with an hour's time difference in each case. The traditional working hours are from nine till five in every zone as they are today, however, they would be staggered within the city and commuter traffic would be equalised since only one third of employees would be on the road at any given time. What effect the time lag might have on people's personal lives and whether it would become a privilege to live in one particular zone as opposed to another would presumably have to be discovered in a test run.

www.mobilityspeculations.com/interzone

#2 | Salt asphalt

Once asphalt is covered with snow and ice, the only remedy is the snowplough and huge quantities of road salt. A research group from Turkey's Koc University has turned the tables and developed an asphalt mixture containing potassium salts which dissolve as soon as the snow lands, immediately preventing icing. The abrasion of the asphalt by road traffic would also constantly expose new salt layers, as a result of which roads would remain ice-resistant for many years.

www.acs.org/content/acs/en/pressroom/presspacs/2015/acs-presspac-december-16-2015/deicing-roads.html

#3 | The rediscovery of the maglev

It's not just the car. Rail transport has also been waiting for decades for a genuine innovation to come along. Repeated attempts have been made. Back in the year 1974, Swiss engineer Rodolphe Nieth designed the underground magnetic levitation system "Swissmetro". However, the company had to be dissolved in 2009 because of financial difficulties and the idea was never implemented. Elon Musk has now staged a revival with his concept of the hyperloop: capsules accelerated by magnetic fields move in an evacuated tube at speeds of up to 1200km/h. Its realisation has been organised as a crowdfunding project and a prototype has been undergoing tests in the Nevada Desert since May 2016. The first goods transport lines are planned for completion by 2019.

hyperloop-one.com

#4 | Standard platform for all vehicle classes

Faraday may be the most ambitious automotive start-up in the world. Financed by Chinese billionaire Jia Yueting, the company has started to build a 900-hectare factory in Nevada after less than two years. It is developing a platform for electric vehicles that can be used for all classes – from sporty two-seaters to family vans with three rows of seats. The plan is to substantially reduce the development cycles for new vehicles. Faraday wants to present the first model in just two years' time. There is still some cause for scepticism – Tesla also had to defer the sale of its first cars several times.

www.ff.com

#5 | Autonomous racing cars in competition

It will be a few years yet before self-driving cars define road transport. However, the signs point to autonomy in motor sport even in the year 2016. Formula E, the international race series for electrically powered sports cars, has announced a new series with autonomous sports cars in addition to the races with human drivers for the end of 2016. There will be no human intervention from start to finish – forms of artificial intelligence will compete for the first place on the podium, round by round.

roborace.com

#4 | Journeyman's work

Thanks to the World Wide Web, many jobs can theoretically be done anywhere. But regardless of where you're working on the computer, you'll be sitting or standing in front of the display and at most moving your hands on the keyboard. Programmer Benoit Pereira de Silva's profession caused him to put on more and more weight. But instead of jogging after work, he designed an apparatus with which he can carry his computer in front of him and work at the same time. He pulls a wagon behind him with a solar panel that generates power for his computer and modem. He's covered more than 6000 kilometres with it so far – and lost 25 kilos.

pereira-da-silva.com

#7 | A bus above the cars

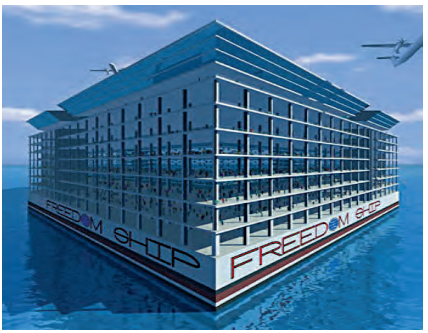
The concept of the “Transit Explore Bus” was presented at the Beijing International High-tech Expo in 2010 – the official opening of the first pilot track will be in Changzhou in 2016. The Chinese vehicle is a mixture of bus and train that runs above the road. The tracks are on the edge of the road and the bus’s underside is at a height of two metres so that cars can pass under it. Each bus can carry up to 1400 people and the costs to build one will be just 10% of those of an underground train.

www.hsfuture.com

#8 | Road glow

Once you’ve left the city, the roads at night can be very dark. As an alternative to complex lighting and a power supply, the Dutch design company “Studio Roosegarde” has developed glowing lines that charge up using daylight during the day and trace the carriageway for up to eight hours at night. The lines provide guidance and can also become an aesthetic experience, as on the Van Gogh-Roosegarde cycle path.

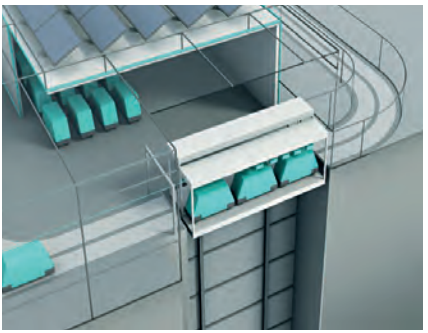
www.studioroosegaarde.net



#9 | The floating city

As early as 1895, Jules Verne in his novel "Propeller Island" created the idea of a motor-driven artificial island of steel on which wealthy citizens lived and were conveyed across the oceans of the world. The "Freedom Ship" is a contemporary design that has been awaiting implementation for several years now. The goal is to build a 1.3-kilometre-long floating city for more than 50,000 people, that will travel around international waters and offer all the infrastructure needed for a community. So far, it is not clear who will supply the USD 10 billion to fund this self-imposed isolation.

freedomship.com



| 10 Underground goods transport

Goods transport accounts for the most of the traffic across the world. In Switzerland, the assumption is that the transport of goods will increase by up to 45% by the year 2030. There is therefore a need for alternatives to the road and rail network, which cannot be extended at liberty. "Cargo sous terrain" is an underground automated logistics system that moves electrically driven containers on three tracks at a constant speed of 30km/h. Small goods are carried faster, at 60km/h, on a track system on the roof of the tunnel. The goods are loaded and unloaded by lifts at hubs integrated into the surface transport network. The first line, between Härkingen/Niederbipp and Zurich city centre, is to be completed in 2030.

www.cargosousterrain.ch

#11 | Quietly breaking the sound barrier

In the 1950s and 1960s, American jet planes flew over the entire country at supersonic speeds, leading to more than 40,000 complaints against the Air Force in the same period. The bang when the sound barrier was broken caused windows to shatter, pets to die and people to suffer from mental stress. The legendary passenger jet Concorde was only allowed to fly at top speed over the sea for that reason. NASA has now resumed its old "X-plane" research project and is planning to develop a technology by 2028 that will physically neutralise the bang and at the same time reduce emissions by up to 75%. If the engineers reach their target, it would be the start of a new generation of passenger aircraft with no speed limits.

www.nasa.gov

#12 | Cycling under the underground

Line 1 of the Berlin underground railway runs above ground for almost nine kilometres – between the Zoological Gardens and the Warsaw Bridge. The "Radbahn" ("Cycle Railway") project has discovered a treasure that was never really hidden: the longest cycle path in the city could be built beneath the track, connecting the districts of Charlottenburg, Schöneberg, Kreuzberg and Friedrichshain. The elevated railway viaduct would protect cyclists from rain and snow, establish the bike as a genuine mobility option and bring a touch of Copenhagen to the Spree.

www.radbahn.berlin

OVERVIEW

On the basis of discussions with experts as well as essays, research and findings drawn from the literature, five over-arching theses can be derived which – from the point of view of W.I.R.E. – characterise the future of mobility. This in turn results in fields of action for companies and public

THESES FOR

MOBILITY WILL BECOME AN ECOSYSTEM #1
The prerequisite is a comprehensive understanding of user behaviour

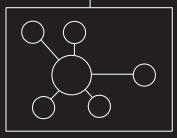
AUTONOMOUS VEHICLES ARE REDEFINING THE JOURNEY #2
Relinquishing responsibility requires more time than expected

ACCESS WILL REPLACE MOBILITY #3
Physical exchange will remain relevant

ACTION

ENCOURAGE IMAGINATION AND EARLY DETECTION

GEAR INNOVATION TO PEOPLE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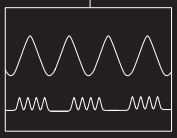
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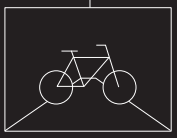
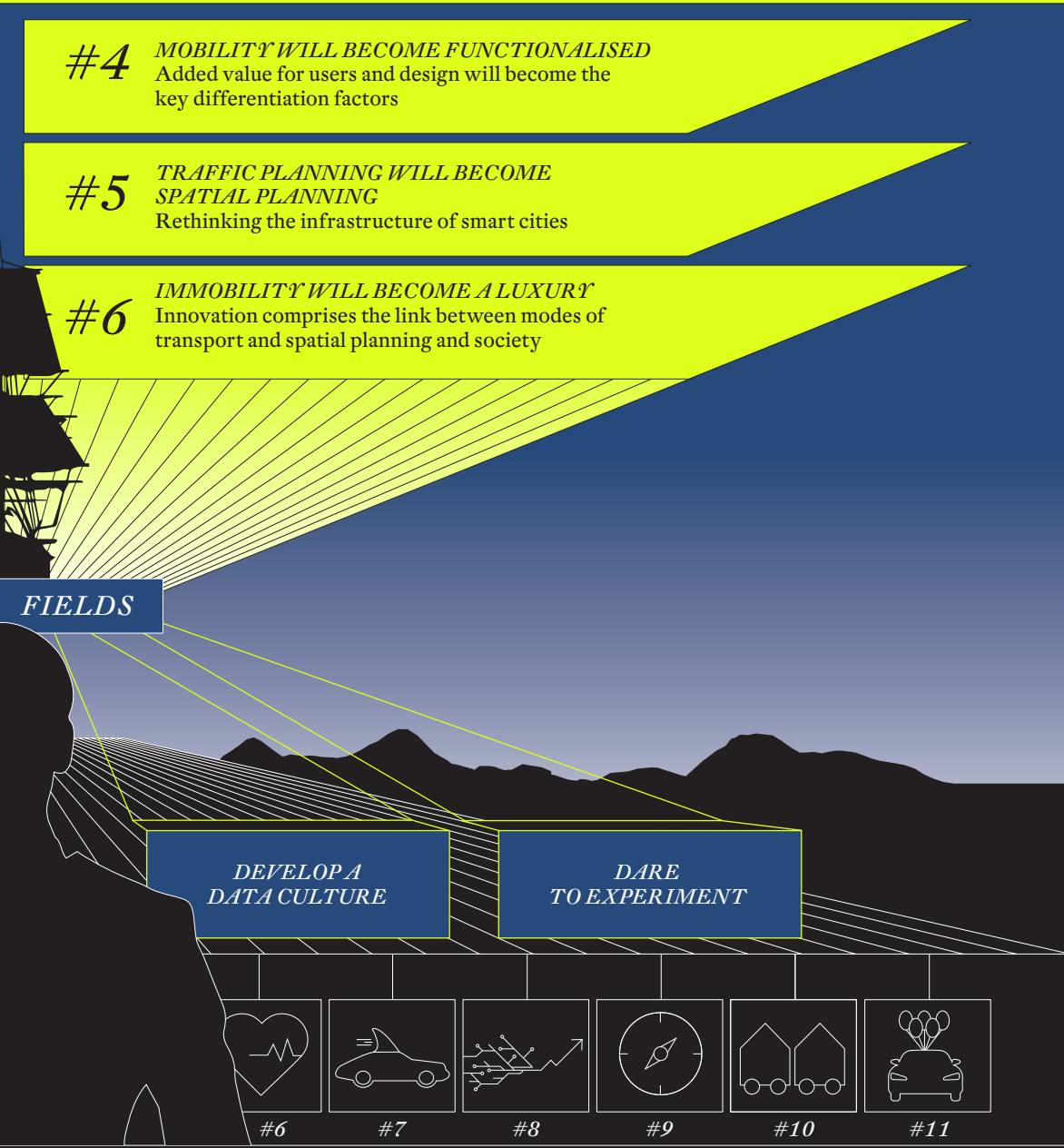

#4


#5

OF RESULTS

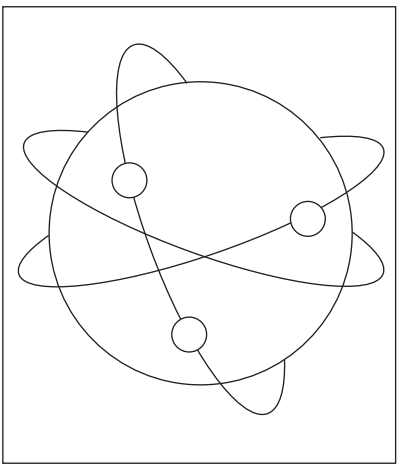
institutions dealing with the future trends in the mobility sector. Finally, the last section of this chapter includes a short selection of specific, future-oriented ideas which arose during the work on this book.

INTELLIGENT MOBILITY



AS

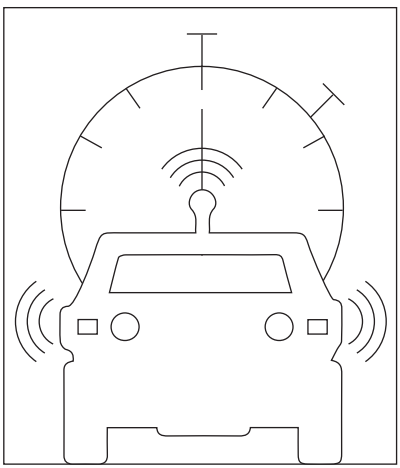
On the basis of the critical research and discussions with experts, as well as the evaluation of research results and essays, W.I.R.E. has derived six theses which describe the key changes relating to mobility in the future.



#1 MOBILITY WILL BECOME AN ECOSYSTEM

The prerequisite is a comprehensive understanding of user behaviour

The need for mobility will continue to increase in the next few years. The reasons for this are population growth, the coupling of mobility and economic growth, the need for self-fulfilment in industrialised countries and for food and safety from a global perspective. A large part of global mobility – in particular the transport of goods by rail or sea is likely to be only partially affected by the above-mentioned transformations. In the field of individual mobility and regional logistics, however, fundamental changes are on the horizon. These centre around the link between different modes of transport and a shift in competition from products to services. What people will buy in future is the journey, which is offered via different modes of transport. The sale and ownership of individual cars, bicycles and flight tickets will make way for a comprehensive mobility ecosystem. Digital platforms will play a key role here: they will optimise the use of transport resources and adapt the ways that people get around to individual travellers' needs. This will increase both efficiency and sustainability, thanks to a better utilisation of individual modes of transport. The development of a networked infrastructure and the establishment of databases on customers' travel preferences will thus become core requirements. For European countries, and in particular for Germany – which has both a sophisticated infrastructure and a long tradition as a car manufacturing country - this will result in opportunities to take up a position in the new mobility market. The doors will open up to new providers too: from software companies through start-ups to suppliers. The value chains of the conglomerates will thus be challenged by small providers, which could lead over the long term to a fragmentation of the mobility sector.

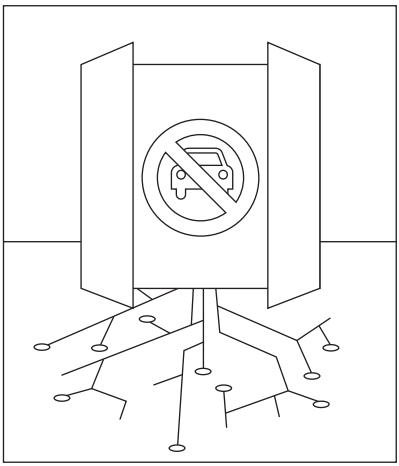


#2 *AUTONOMOUS VEHICLES ARE REDEFINING THE JOURNEY*

Relinquishing responsibility requires more time than expected

Self-driving vehicles are a key component of mobility of the future, as seen in the increased efficiency and safety of the journey as well as the time saved for the travellers. Introduction of these vehicles will create a new basis: cars will be competing directly with public transport; undeveloped geographic regions will become more attractive in the real estate market. However, this transition to a new era of mobility will take longer than is currently assumed. There are a number of different reasons for this. Firstly, technical limitations and steering complexity are likely to mean that initially only selected routes on motorways can be considered as suitable for self-driving trucks. The act of getting around in towns and cities, and especially the act of interpreting and anticipating human behaviour in traffic will continue to exceed the capacity of algorithms for some considerable time. Secondly, the question arises as to insurance models and responsibility in the event of accidents. It would seem clear that there will be a shift from personal liability to product insurance; the question remains as to whether this will be issued directly by the manufacturer, the software developer or the insurance companies. Thirdly, ethical issues will have to be clarified: how does a vehicle decide in an accident situation if the driver or the pedestrian should be protected? Fourthly, giving up control over the vehicle requires a lengthy social adaptation process. The number of accidents will be reduced, but we will have to accept that there will be fatal accidents caused by machines. And an autonomous transport system reduces personal freedom when travelling: it will no longer be possible to choose the speed or route oneself. To prevent people from being completely at the mercy of artifi-

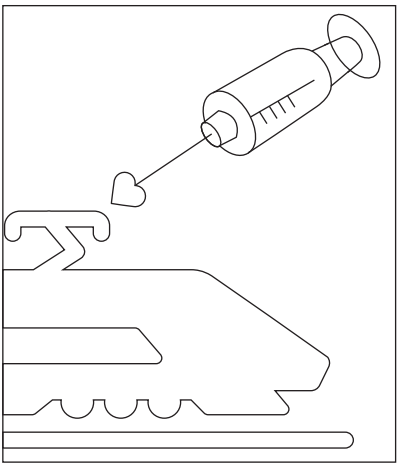
cial intelligence, the steering wheel is likely to remain a key means of control for some time to come, in contrast to the statement by Elon Musk, who assumes that we will soon no longer be allowed to steer ourselves. And fifthly, we still have to find out how data-based mobility works. The traditional supplier, the automotive industry, has so far not exhibited much expertise in the software field but in future it will have to develop away from the production of cars to the processing of data. The question of who the data belong to will also have to be clarified: the user, the manufacturer of the hardware or software, the insurer or the state? A vehicle produces up to 3 GB of data every day. Furthermore, by being connected with a digital infrastructure, the transport network will be susceptible to system errors and hacking attacks; if the Internet goes down it will be not only offices but also traffic that comes to a standstill. The prerequisite for the introduction of autonomous vehicles is thus more than the construction of vehicles that are theoretically able to travel a route on their own and to avoid obstacles. At stake is no less than the reinvention of individual transport based on alternative business models, regulatory principles and the societal outsourcing of responsibility to machines.



#3 ACCESS WILL REPLACE MOBILITY

Physical exchange will remain relevant

In future, even more needs which were previously satisfied by physical transport will be handled digitally. The private and professional exchange between people will largely take place by means of virtual communication in a reality-like way. In recent years, various technological solutions have arisen that permit new access to goods and persons: from home delivery services that deliver consumer goods or food directly to a person's front door through to 3D scanners and printers that are beamed as data packages around the world in real time and are produced locally. Virtual reality glasses will open up new opportunities for the entertainment industry and tourism: realistic trips to the Himalayas or a trip to the moon will be possible from a person's living room. Consumers will have considerably more possibilities in terms of access to services and products. Accordingly, "access" will replace a part of physical mobility. At the same time, the shift into an abstract, virtual space will give rise to a yearning for a direct exchange with people and a chance to experience real objects. In response, spaces will be created in cities and buildings which enable targeted or coincidental interactions – for social contact, an exchange of knowledge, and as a basis for innovation. In future, people will exhibit a different type of behaviour as regards digital and physical mobility channels which they use to satisfy their needs. For providers, this means putting themselves in their customers' shoes early on and, based on their expectations, developing customised offerings as a comprehensive mobility ecosystem. This in turn requires the expansion of existing networks and setting up cooperations between the digital and analogue world.

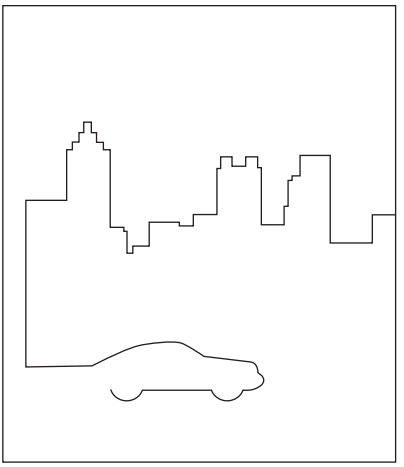


#4 *MOBILITY WILL BECOME FUNCTIONALISED*

Added value for users and design will become the key differentiation factors

Transport is currently a basic service with little potential for creating a distinctive profile. In the overburdened transport system, innovation focuses primarily on efficiency. The needs for social interaction and relaxation have been largely ignored. But in a context of low capacity, they could become key added value components. With trains, for instance, the distinctive characteristics are currently limited to details such as the amount of legroom or the seat upholstery. And this despite the steady rise in travellers' needs to make the best possible use of their time. The expanded functions of travel as a place for social contact, relaxation or concentrated working are considered to be a core advantage of autonomous vehicles. However, the same applies to public transport, which is facing competition from precisely these vehicles. And it is precisely in times of social fragmentation that a traditional characteristic of public transport is likely to take on an important social function: social interaction with unfamiliar people. In a scenario in which a large part of social mobility is shifting away from the public sphere in trains or trams to the private cocoons of vehicles, interaction with people of other professional groups or social classes declines, as does social solidarity in the long run. A second distinctive factor is delimitation through design. Although there is much to advocate increasing standardisation and homogenisation of modes of transport, car exteriors are becoming more similar owing to pressure on costs and energy efficiency as well as owing to global aesthetic trends. This trend – claims the general assumption – is likely to be accentuated by the introduction

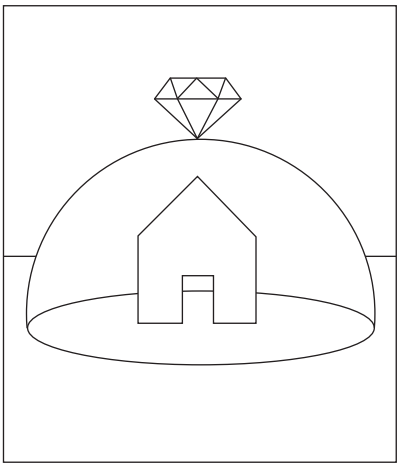
of self-driving cars and contribute to vehicles being used only for transport from A to B in a few years' time. However, there is little to indicate that human nature will undergo a fundamental change. The need for status and social recognition, which are reflected in the choice of brands and designs, will continue to characterise the mobility market. And because the interiors of vehicles can hardly be told apart by algorithms and electric engines, an independent exterior will become important again. The possibilities provided by 3D printers could conceivably give rise to customisation of shapes, with users being able to determine to a greater extent how their vehicle should look. Or even how it drives: the software would adapt a car's driving style to the temperament or current state of mind of the driver, thus enabling a real blending of man and machine.



#5 *TRAFFIC PLANNING WILL BECOME SPATIAL PLANNING*

Rethinking the infrastructure of smart cities

The rise of "smart mobility" will also change the claim to and use of space, especially in towns and cities. The influence will go far beyond the prevention of accidents and shortening travel times and will affect virtually all areas of the infrastructure: from pavements and streets, from architecture of houses to the availability of electricity connections. In the USA, only six percent of cities have addressed the possible framework conditions of new mobility, in Europe the figure is likely to be similar. At the centre are a large number of unanswered questions: do we still need parking spaces and garages? What will autonomous vehicles do when they're not being used? Will they park themselves or will they move in the flow of traffic – thus again increasing the risk of traffic jams? And how much space do our roads take up? Because wireless communication between cars will enable a closer and more precise use of space, we don't know today how they will move on the roads. We will also need to establish whether traffic signals will still be necessary. And where filling stations and loading stations should be placed. The answers to these questions will have a direct or indirect impact on urban and infrastructure planning. How a city functions and what it looks like could then undergo a fundamental change. What is clear is that while the cities of the last century were planned for the car, the urban and spatial planning of the 21st century will be built around humans' habitat.



#6 *IMMOBILITY WILL BECOME A LUXURY*

Innovation comprises the link between modes of transport and spatial planning and society

The widespread visions of a "smart" mobility based on autonomous vehicles, clean engines and sharing concepts will make us more mobile with lower costs and less of a burden on the environment. But this does not mean we will abandon the culture of the 20th century: developing our living spaces with even more mobility. Even with artificially intelligent cars and networked transport systems, certain basic parameters cannot be excluded. We will still need space and time; we will move around faster but will not be on the move less. Already today a longing for more peace and quiet can be seen. Consequently, in future it will not be more mobility but more immobility that will become a luxury. The goal of the next stage in being mobile will be to strive for a reduction in movement. Economic and social players are called upon to reduce the pressure to be mobile and to decouple economic growth at least to a certain extent from transport. The digitisation of work and communication will take on at least part of this task. But we will not be able to do without embedding mobility in the expanded framework conditions of the economy and society. The focus of innovation is shifting away from the product to the intelligent linking of transport, space and the population. This does not mean turning our backs on profitability. On the contrary; those factors will be taken into account that ultimately contribute to the productivity of a location and to the satisfaction of a population.

Future trends in the mobility sector will open up four action fields for companies and public institutions for the development of new ideas and fields of activity.

1. IMAGINATION AND PROMOTION OF AN EARLY DISCUSSION OF FUTURE FRAMEWORK CONDITIONS

The same applies to mobility today as to other sectors shaped by digitisation: continuing the past is not enough in order to be equipped for the operating conditions of the future. Instead, the aim is to develop a medium to long-term perspective. This requires a systematic discussion of central trends from various spheres of influence. This may take place either by involving employees in a company's own early identification processes or by working together with universities and think tanks. At the same time, it requires the courage to exercise more imagination, for instance by involving designers or sci-fi authors when creating product and service concepts.

2. GEARING INNOVATION TO PEOPLE, INFRASTRUCTURE AND SOCIETY

Innovation has to be defined through technology and geared to people's mobility needs. This includes, first and foremost, determining future customer needs as the basis for product development. At the same time, the various sub-systems that affect mobility have to be taken into account. Urban planning, architecture, health, location promotion, and the supply of food stuffs and consumer goods are part of networked mobility. This calls for the establishment of expanded networks with companies and other experts.

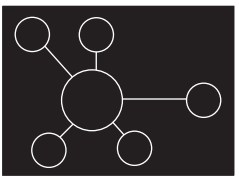
3. IDENTIFYING CUSTOMERS' NEEDS AND DEVELOPING A DATA CULTURE

Mobility is becoming data-based. The requirements for succeeding against this background are a knowledge of users' needs, the creation of the relevant expertise and the development of new business models. The first step is based on the determination of relevant data that help to understand customers and provide them with the corresponding added value. This includes creating clear and easy-to-use interfaces to reduce the flood of data for users. The development of business models that ensure data security and offer customers a benefit for sharing their personal details are among the key added value components in the mobility market of the future. Generally speaking, the aim is to analyse value chains systematically in terms of their usage potential to understand in which step in the process from production to distribution and in which digital applications added value is generated and, on the other hand, where human expertise will be required in future.

4. CREATE PLATFORMS FOR EXPERIMENTS

Because the future of mobility can ultimately only be described by hypotheses and is shaped by many unknown factors, companies and public institutions need scope and platforms to experiment. For existing providers this means creating test spaces within or outside their own structures where new products and services can be developed as prototypes and tested. These are intended not only to optimise conventional products and services but also to re-think traditional business models. In this context, cooperation alliances with partners who contribute new forms of expertise play a key role – whether in the field of software, design, trends or production methods. Moreover, responsibility must be outsourced from the existing hierarchies: as a result of the growing complexity of the mobility markets of tomorrow, it will no longer be possible to concentrate knowledge within a company or solely among the members of management.

During the work on this book, W.I.R.E. developed its own forward-looking ideas for mobility in the future.

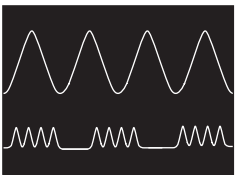


#1 | Hub system for urban transport

Inner cities can be relieved of chronic traffic congestion by initially linking key towns and cities in the type of hub system that already exists with high-capacity trains and motorways. In order to keep private traffic out of city centres, large car parks would be built on the outskirts with fast trains providing efficient transport to the car-free city centre.

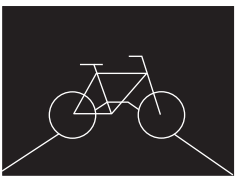
#2 | Setting up a regional office infrastructure

Instead of obliging employees to travel long distances and having to cope with high costs resulting from lost time due to traffic jams and crowded trains, companies will do away with centralised work premises. On the one hand, home office solutions will become standard, and on the other, employees from different companies will meet in regional co-working spaces. This will reduce the burden of commuting and also promote the exchange of employees with people in different professional groups and companies.



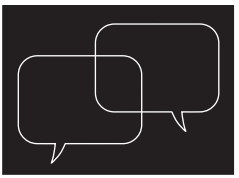
#3 | Abolition of interval-based train timetables

Anyone who regularly travels on popular train routes will have noticed that trains are often crowded at peak times and empty in between. However, owing to planning limitations, we are still tied to regular, often hourly, interval-based timetables. The availability of high-performance planning software could make it possible to do away with fixed timetables and to adapt use of trains to demand – based on expected peaks and in future even on actual demand.



#4 | Bicycle roads

Not all cities are well developed for bicycles. Some roads could be blocked to car traffic, thus giving rise to “bike motorways” as a fast and safe way to get around. In parallel, new traffic light systems could identify cyclists and give them priority over cars.

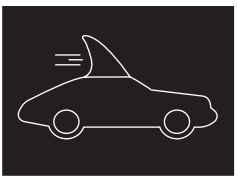


#5 | Using public transport for social interaction or health

The introduction of self-driving cars is likely to prompt some passengers who previously used public transport for time-related reasons to switch to using cars. A key function of public transport will thus be lost: social interaction. A solution would be to consciously reinforce trains and trams as public spaces. Digital reservation systems could be used to take personal preferences for social interaction with like-minded or differently minded people, singles or sociophobes. Alternatively, the time spent on commuter routes could be used as a business model for sports activities, for example by integrating stationary bicycles that would produce part of the energy required for the journey.

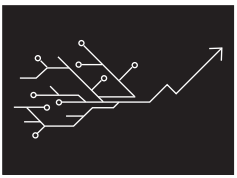
#6| Mobility-based offices

Office work has a negative effect on health. Provocative warnings talk about sitting as the new smoking. The goal would be to increase mobility in work spaces, for instance by regularly changing to another workplace within the office or by integrating fitness equipment that enables employees to make phone calls or type e-mails while training. One advantage of movement is that employees who stand up during meetings and present their proposals while walking around are perceived as more intelligent.



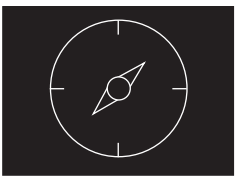
#7| Rediscover vehicle design

Convergence in terms of modern car design has advanced to such a degree that vehicles made by different manufacturers on different continents can hardly be distinguished. New production methods based on 3-D printers could contribute to cars in the medium to high-end price segments being made more individual again. Another possibility would be to revive classics in automotive history and equip them with standardised, efficient engines and electronics. The result would be a new type of diversity on the road. For electric cars this would include the development of individual sounds – a topic that has been incorporated into some early approaches but which is still not really used. A vehicle would then have not only a visual but also a tonal identity.



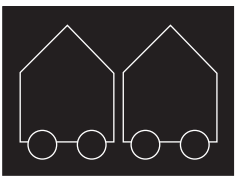
#8| Open access data infrastructure as an economic driver

We are at the beginning of the process of creating digital infrastructure for cities and road systems. It is not yet clear to whom these data belong. This opens up an action field for the public sector: all the relevant infrastructure data would be systematically gathered, clearly structured and securely managed in order to enable new data-based business models in an open access model. The municipal administration would, for instance, monitor the parking situation and make the relevant data available to mobility providers. At the same time, personal mobility data could be managed in a cooperative in which citizens control their data but also have the possibility of making them available to private providers – and, depending on the use – being compensated either financially or with customised offerings.



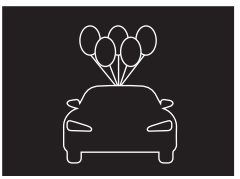
#9| Alternative navigation for experiences and gaining knowledge

Electronic navigation systems will no longer be programmed to only use the fastest route along roads and motorways. Alternative route planning systems will help people to get to know their own areas and to discover new things as they travel through the region.



#10 | Mobile settlements

Instead of building towns and cities with buildings that tie up space for several decades and thus diminish the flexibility to use space in line with current needs, it would be conceivable to earmark large areas for mobile settlements. These could consist of modular buildings that could be composed of individual residential or work units, thus enabling employees to move flexibly to the town of their choice. If demand increases, the buildings would be increased; if there are fewer jobs, the buildings could be reduced in size. A version closer to reality would involve creating wheeled living space. We would then live more in expanded mobile homes with flexible mini-apartments. As we will need less space in future anyway because we dine, work and interact socially outside the home, flexibility and proximity to the workplace would make up for the disadvantages of smaller rooms.



#11 | Flying cars

There are numerous, well-founded reasons that militate against flying vehicles ever being used as an individual mode of transport. Independently of this, new prototypes are presented each year that could fulfil one of the oldest dreams that man has had in the cultural history of the 20th century. This could doubtlessly solve the traffic problem in one fell swoop from a number of points of view, apart from the barely imaginable freedom of being able to activate the “Hoover drive” in the next traffic jam and head for one’s destination on the horizon. Reason enough not to abandon the dream.

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