Responsibility driven design for the future self-driving society

Autonomous systems and the complex challenges to designing a responsible, driverless future

Fabio Besti
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Fondazione Giannino Bassetti
per la Responsabilità nell'Innovazione

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Fondazione Giannino Bassetti
per la Responsabilità nell'Innovazione

Since 1994 the **Giannino Bassetti Foundation** has promoted responsible innovation. Within both the national and international setting it helps institutional, private and associational actors to orient their goals and consider them a factor of interest for the entire society.

POLITECNICO
MILANO 1863

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Art direction and graphic design by **Fabio Besti Interdisciplinary Design,** ©2018 I *www.fabiobesti.com*

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INTRODUCTION

The key role of responsibility in designing the driverless society of the future

Fabio Besti

Interdisciplinary Designer & Researcher, Senior Consultant for the Bassetti Foundation

First imagined and foreseen, then prototyped and tested, today driverless cars are real.
The inevitable transition to autonomous transportation, with its enormous potential and connected risks, has achieved awareness within the public, government, and an array of stakeholders involved in digital technology evolution. Mobility automatization will not only have an impact on the transportation industry however, it will in reality lead to the transformation of the socio-cultural fabric of countries all over the world: habits and behaviour will change, new products and services will improve people's lifestyle, cities will reshape and, above all, the society will transform itself in its complexity. The conversation cannot be limited to the driverless 'car' or autonomous 'transportation', but is more realistically addressed as what Giulio Ceppi for his course in Integrated Product Design at Politecnico di Milano, defined as the *self-driving society* as a whole. On the

one hand, this broader perspective allows stakeholders to identify a richer scenario for opportunities and innovation, and on the other, it compels all actors to develop and better articulate the discourse on the societal impact of this technological transformation, still relegated today to narrowly defined and rather isolated topics (ethics, safety, cybersecurity, etc...).

But responsibility does not only mean taking on the burden of preventing undesirable consequences; in fact, adopting a structured responsibility-driven approach could also mean **uncovering new possibilities for innovation** and the capability to **remain relevant in the long term**.

This positive positioning by the Giannino Bassetti Foundation emerges from 24 years of experience in fostering responsible innovation. This vast experience has once more been strengthened through a recent collaboration with Giulio Ceppi and the Design School of the Politecnico di Milano, within which I was invited to conduct a workshop together with Francesco Samorè in November 2017, with the aim of putting design at the service of the self-driving society of the future.

The results of the workshop (described in this paper) demonstrate how **using a design-driven approach** in conjunction **with a perspective centered on responsibility** can lead to the **envisioning of unexpected and interesting scenarios.** This white paper expands upon the experience and marks the wish of the Bassetti Foundation to continue this work and invite all interested stakeholders to join the conversation. Automotive industries, courier companies, software providers, big data and artificial intelligence corporations, designers and engineers, investors and insurers, universities and policymakers, CSOs and citizens, to name just a few of the players that will be directly involved in shaping the self-driving society of the future.

To be relevant in this new technological and cultural transition all stakeholders must embrace innovation and adopt the broadest perspective possible, but it doesn't stop there: we are entering a technological era in which automation will take control over our lives (quite literally). A **responsibility-driven approach should be the key factor to a better future**, more efficient in terms of economic growth and more desirable for societies all over the world.

The Collingridge Dilemma & Responsible Innovation

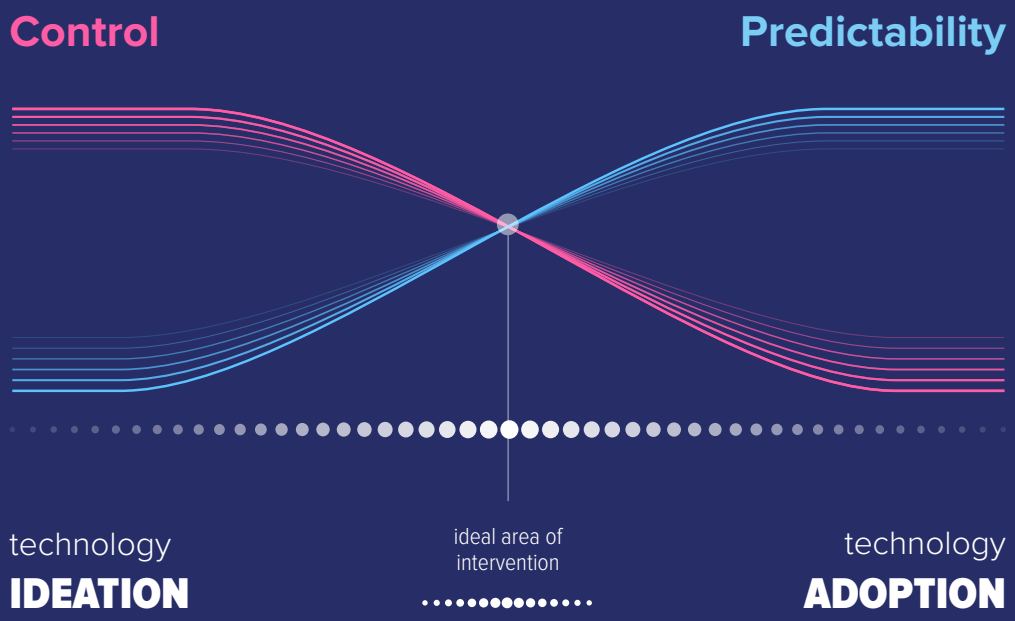
Francesco Samorè

Secretary General for the Bassetti Foundation, Adjunct Professor at Politecnico di Milano

The **Giannino Bassetti Foundation** was established **24 years** ago in the name of the Bassetti family, an important textile producer and pioneer of stakeholder integration into business production and organization. The objective of the organization is to offer **physical** as well as **virtual space**, and **expert** and **organizational capacity** to further thinking about the responsibility that innovation, and by extension innovators, hold in modern society.

The first question therefore must be what is innovation? We use the phrase **'the achievement of the improbable'**, as a representation of innovation as more than mere discovery, but the implementation of discovery into novel forms of production and organization. This implementation requires more than just knowledge itself however, but infrastructure, financial and material resources and of course the necessary will, know-how and imagination. In short, the power and capability necessary to act.

Experience has taught the Bassetti family that some



The Collingridge Dilemma. During the development of a technology, the possibility of controlling it diminish as its implications become understandable

of the innovations taking place today will change the way we live, some might change practices and lives across the entire world, leading to our framing of these developments in terms of questions around responsibility. Within this scenario responsibility is key to the process of innovation, in that it is key to the processes of the production of knowledge, power, and by extension of history itself.

This seemingly abstract concept of responsibility is easy to understand through concrete, every-day examples of technological development. The field of driverless vehicle technology addressed in this paper presents us with an obvious, common sense responsibility conundrum, in the event of an accident who will be held responsible?

If we understand technological development as sitting within a trajectory, we have to ask ourselves **at which moment responsibility both becomes a factor** and by extension should be addressed as an issue. This question forms the basis of action that might enable the innovation process to become in some way more responsible. By extension, if guidelines exist or action should be taken to affect this trajectory in terms of its responsibility content at which point should this happen?

Questions of this type lead us to considering a problem that has become known as the **Collingridge Dilemma**. Collingridge describes this dilemma as a double bind problem, relating to two issues that are directly related, in this case the factors in question being those of time and information.

Collingridge argued that as the development trajectory moves through time more information is made available about the uses, possibilities and problems associated with the process or project. As the development process becomes more refined it becomes easier to see what the technology might become. At the same time however, the trajectory itself becomes more difficult to adjust the further down the trajectory intervention is needed. In short, the earlier on in the trajectory we look the less information we have to work with, but the easier the process is to adjust and guide. Vice versa as more information comes to light through development, the process becomes ever more difficult to adjust and steer, but also to radically rethink or stop.

If we think about this dilemma in terms of regulation goals in a concrete example such as driverless technology once more, we might come to a conclusion similar to that of Collingridge, that new developments in technology can be more successfully regulated when they are still in an early developmental stage but when the consequences of their adoption, (both positive and negative), are difficult to understand and predict.

The longer regulators wait, the more information is made available and these consequences become easier to predict, but the trajectory becomes ever more difficult to regulate, leading to the real risk that effective regulation may become difficult if not almost impossible.

This dilemma does not of course call for a solution but offers **a point of view that allows innovators and regulators to calibrate their perspectives and actions** within these different development trajectories. The aim of this paper is to build upon these concepts and, by hybridizing them with the discipline of design and its principles, to provide innovators with both awareness and practical tools to design a responsible future.

01.

THE GOAL

Empowering the future stakeholders of the self-driving society through vision and design thinking

Passenger control buttons inside a Pacifica Waymo fully autonomous car. One to start ride, one to pull over before planned destination, door locks and help button to connect with Waymo for assistance.

"Design approaches are applied all over the world as a powerful approach to innovating public policies and services. But more is at stake: the future of how we run government. Bringing design methods in play, public managers can lead change with citizens at the centre, and discover a new model for steering public organisations: Human-centred governance"

Christian Bason, CEO of Danish Design Centre and author of Design for Policy

The Responsibility Matrix for the Self-Driving Society and the Collingridge Positioning

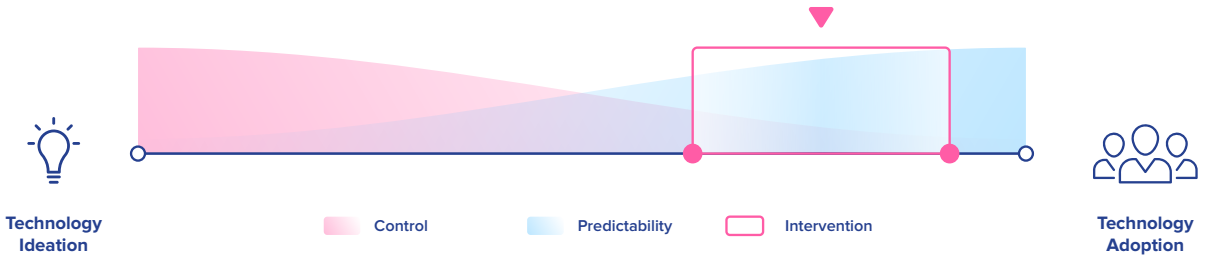
Fabio Besti

Interdisciplinary Designer & Researcher, Senior Consultant for the Bassetti Foundation

By adopting a 'lateral approach' in this paper we investigate a full spectrum of topics surrounding autonomous transportation, pursuing a diversity of perspectives and trying to foster a dialogue between different fields. Analysis and divulgation are just one of the objectives however. Through our work we would like to actively engage all actors to shape the self-driving society of tomorrow in a responsible way. In order to do so, exploiting the power of design is crucial. In the last decade, the widespread notion of design has finally changed, becoming a discipline that is universally recognized as a strategic asset allowing the deep innovation of organizations and practices of all types.

Design thinking is the method that everyone looks up to: a practice able to extract meaningful insights from complex scenarios, translating innovation from conceptual values to practical solutions. Here I present two different tools that I have developed and that I believe can be examples of how to put design thinking at the service of innovators and the self-driving society of the future.

The first tool is what I call the **Collingridge Positioning**, it is a simple area chart that prompts innovators into thinking about the Collingridge dilemma (as previously discussed) and hence, induce them to reflect upon how



The Collingridge Positioning. A tool to help innovators, designers and policymakers reflect on the Collingridge dilemma and understand how to calibrate their intervention, according to the degree of diffusion of a certain technology (in this case autonomous mobility systems).

The **Responsibility Matrix for the Self-Driving Society**, a tool that combines design requirements with responsibility topics and aims at helping designers, policymakers and other relevant stakeholders in shaping the future of a society immersed in autonomous transportation systems.

to calibrate their intervention - which could be a design solution, a technological application, a policy intervention, etc.. -, according to the degree of diffusion of a certain technology.

The second tool is the **Responsibility Matrix for the Self-Driving Society**. Its purpose is to embed responsibility into the process of innovation of autonomous transportation systems. By selecting different combinations of variables, innovators can use the matrix as a map to navigate new possible scenarios and ideas. As I mentioned before, embedding responsibility into the innovation process can be beneficial both to society - by fostering a more desirable outcome - and to entrepreneurs - by highlighting a richer scenario of opportunities.

Both tools were conceived and tested during the workshop *Collingridge Dilemma and Responsible Innovation*, that took place inside the course *Self Driving Society @2030* at Politecnico di Milano in November 2017.

In the last chapter of this paper we showcase several works that in our opinion highlight the great potential of this design-driven approach.

These tools must not be seen as definitive solutions however but rather as first attempts to unify investigation and analysis with practice and experimentation. They can serve perfectly as an example of the ultimate goal set by the Bassetti Foundation in this field: to open the discussion and engage with multiple stakeholders and encourage them to **work together towards a responsible future for a society immersed in autonomous mobility.**

- We look forward to sharing these tools to any professional, organization or university interested in using them.

To download them please visit: *www.fondazionebassetti.org/self-driving-society-matrix-positioning-tools*

02.

THE SCENARIO

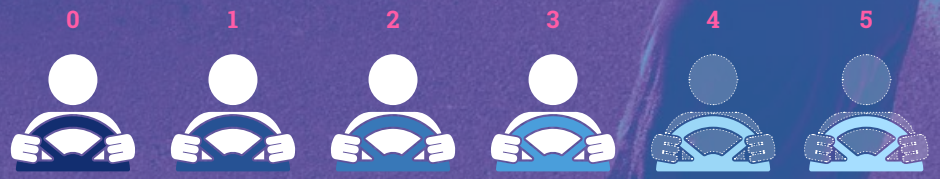
What will the future of autonomous transportation look like? Case studies

The World Economic Forum estimates that the digital transformation of the automotive industry will generate **$67 billion** in value for that sector and **$3.1 trillion in societal benefits**. That includes improvements from autonomous vehicles, connected travelers, and the transportation enterprise ecosystem as a whole.

from **Moving forward: Self-driving vehicles in China, Europe, Japan, Korea, and the United States** by Darrell M. West, Brookings Institution

Society of Automotive Engineers **(SAE) automation levels** are now the internationally accepted standard to define and differentiate different type of vehicle automation.

https://www.sae.org/autodrive



The Future of Automobility

by **IDEO**

The Future of Automobility is an online visualization of how life with driverless cars might really look and feel. It considers four scenarios: “Moving People,” which looks at how commutes will change when we can look away from the road; “Moving Things,” where we examine automated package-delivery fleets; “Moving Spaces,” where we envision mobile offices meeting people where they live and parking in underused areas of our cities; and “Moving Together,” which explores how the interior of future vehicles will be customized to meet our personal needs during ride-sharing.

https://automobility.ideo.com/

redefining the space inside vehicles and the overall experience of commuting

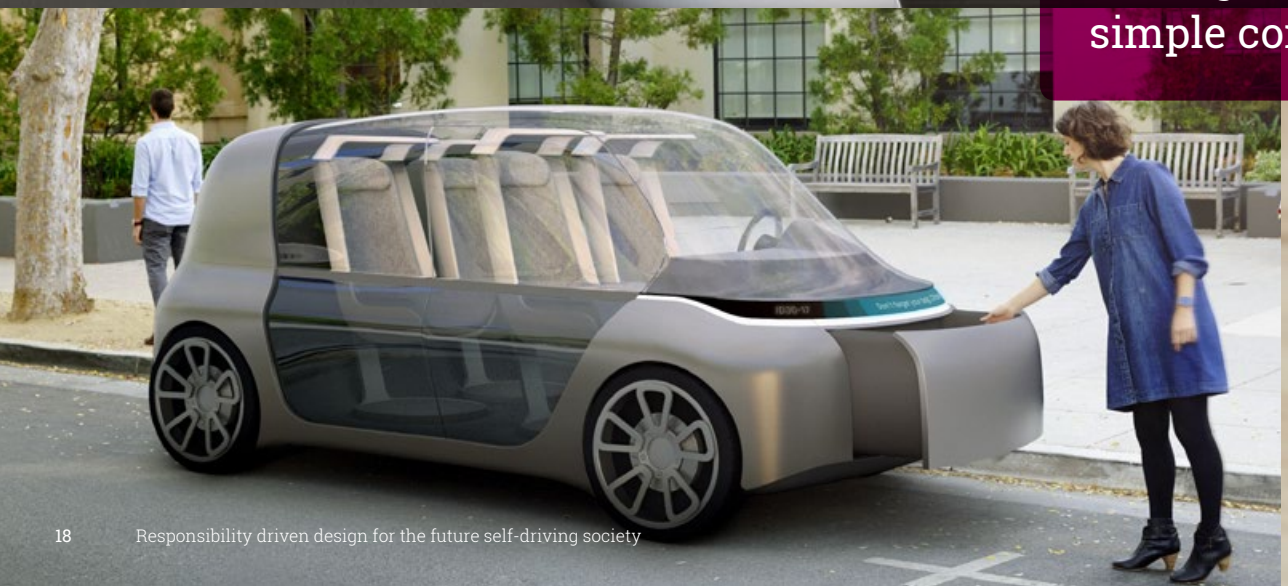
moving not only people,
but also spaces and environments,
enabling a new landscape of
products and services

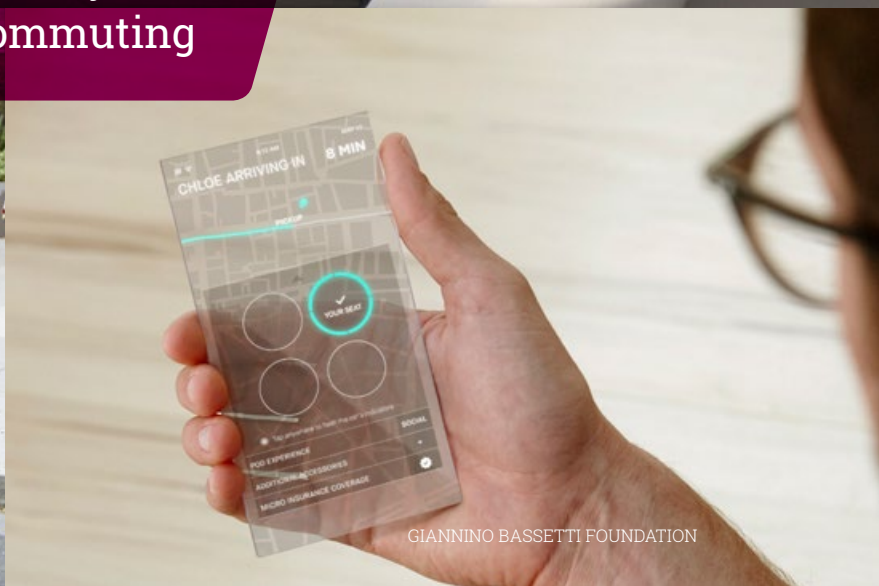
managing the transportation
of products and goods in an
innovative way

© images: IDEO

more and more shared, but with a personalized experience...

...that goes beyond simple commuting





GIANNINO BASSETTI FOUNDATION

© images: Waymo

Waymo

by **Google**

Waymo is an autonomous car development company and subsidiary of Google's parent company, Alphabet Inc.
Google had begun testing the self-driving car project in 2009. Alphabet describes Waymo as "a self-driving tech company with a mission to make it safe and easy for people and things to move around". The new company is working towards making self-driving cars available to the public soon. The company plans that [its] next step will be to let people trial fully self-driving cars to do everyday things like run errands or commute to work. [source: Wikipedia]

https://waymo.com/

potentially giving personal transportation to a much broader public...

© images: Mercedes-Benz

...while also redefining the luxury automotive market

F 015

by **Mercedes-Benz**

The Mercedes-Benz F 015 Luxury in Motion research car and its immersive user experience is an innovative perspective into the future of mobility. In order to provide a foundation for the new autonomous F 015 Luxury in Motion research vehicle, an interdisciplinary team of experts from Mercedes-Benz has devised a future scenario that incorporates many different aspects of day-to-day mobility. Above and beyond its mobility function, this scenario perceives the motor car as a private retreat that additionally offers an important added value for society at large.

https://www.mercedes-benz.com/

© images: NEXT

Next Future Transportation Inc.

NEXT is an advanced smart transportation system based on swarms of modular self-driving vehicles.
Each module can drive itself, join and detach other modules even while in motion, on every regular road.
When joined, they create an open space bus-like area among modules, which allows passengers to stand and walk from one module to another.

https://www.next-future-mobility.com

public transport becoming intelligent, modular and highly efficient

© images: Italdesign / Airbus

not only on the ground, leveraging new spaces and technologies

Pop-up

by **Italdesign** for **Airbus**

During the 87th Geneva International Motor Show, Italdesign and Airbus worldpremiered Pop.Up, the first modular, fully electric, zero emission concept vehicle system designed to relieve traffic congestion in crowded megacities. Pop.Up envisages a modular system for multi-modal transportation that makes full use of both ground and airspace. The feasible concept is the result of Italdesign and Airbus' joint reflection on how to address the mobility challenges of megacities achievable for a majority, which has become one of the most pressing issues for commuters in megacities worldwide.

http://www.italdesign.it/project/popup/

© images: DHL

Parcelcopter 3.0

by Deutsche Post DHL Group

In 2013 DHL Parcel launched a research project on the use of a special drone, dubbed the Parcelcopter, for transporting goods under real conditions to remote or geographically challenging areas. The DHL Parcelcopter is intended primarily for situations that mesh poorly with established infrastructures or where standard delivery methods are overly lengthy. Locations not linked to the standard road network are one example. “Natural barriers” such as water or mountains are not an issue for the drone. The DHL Parcelcopter is thus seen as a tool for improving infrastructure in hard-to-reach areas, improving the lives of the inhabitants there.

http://www.dpdhl.com/

allowing new logistic systems and services, also in challenging locations

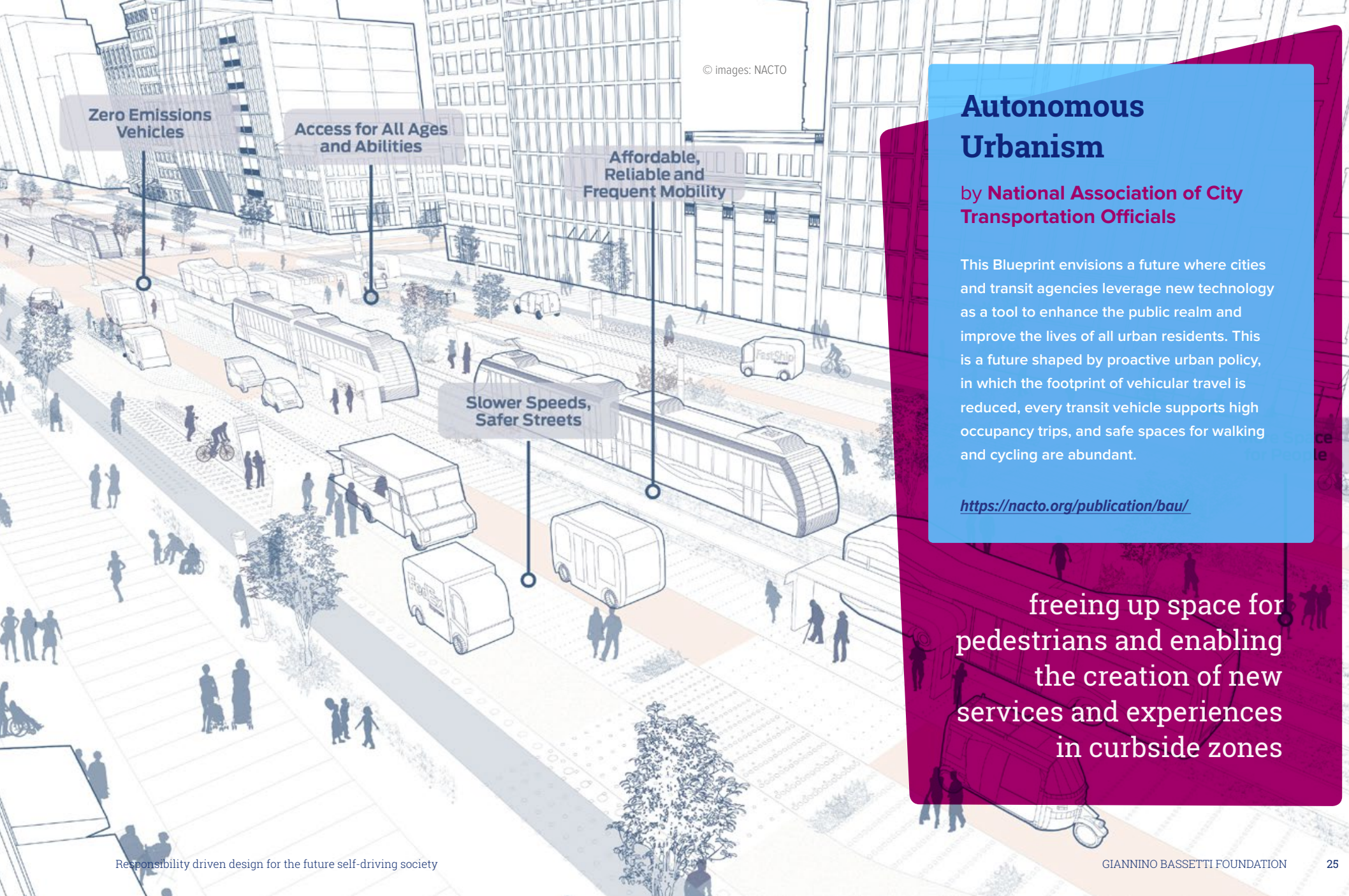
reshaping the urban cityscape and the way people live it

Public square for Driverless Future

by **FXFOWLE** with **Sam Schwartz Engineering** for **BlankSpaceNYC**

Public Square, the award-winning entry by FXFOWLE with Sam Schwartz Engineering, provides New York City a way to rethink its streets and reclaim space for pedestrians. The entry was chosen as the winner of The Driverless Future Challenge by a panel of New York City Commissioners, in front of a live audience of over 600 attendees at NYU Skirball Center.

http://driverlessfuture.blankspaceproject.com/



© images: NACTO

Autonomous Urbanism

by **National Association of City Transportation Officials**

This Blueprint envisions a future where cities and transit agencies leverage new technology as a tool to enhance the public realm and improve the lives of all urban residents. This is a future shaped by proactive urban policy, in which the footprint of vehicular travel is reduced, every transit vehicle supports high occupancy trips, and safe spaces for walking and cycling are abundant.

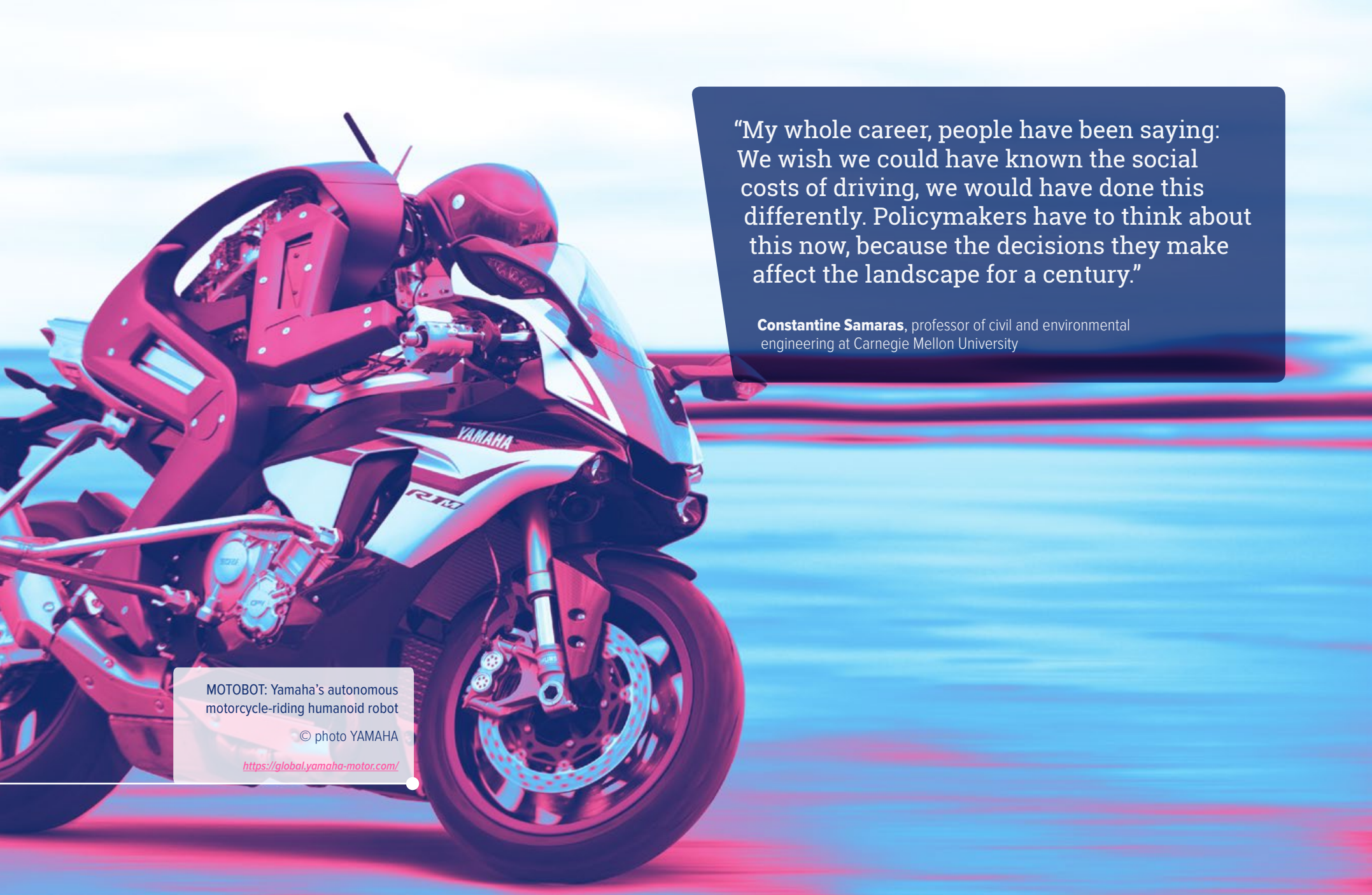
https://nacto.org/publication/bau/

freeing up space for pedestrians and enabling the creation of new services and experiences in curbside zones

03.

RESPONSIBILITY TOPICS

Key responsibility topics in the domain of autonomous transportation



"My whole career, people have been saying: We wish we could have known the social costs of driving, we would have done this differently. Policymakers have to think about this now, because the decisions they make affect the landscape for a century."

Constantine Samaras, professor of civil and environmental engineering at Carnegie Mellon University

MOTOBOT: Yamaha's autonomous motorcycle-riding humanoid robot

© photo YAMAHA

https://global.yamaha-motor.com/

First reported crash involving an Uber self-driving vehicle. On 25 March, 2017 in Tempe, Arizona the vehicle was crossing an intersection when it was hit by a Honda CR-V.
photo © Fresco News/ Mark Beach

Ethics & Safety

The ethical dilemma of self-driving cars

lesson by Patrick Lin for TED-ed

https://ed.ted.com/lessons/the-ethical-dilemma-of-self-driving-cars-patrick-lin#_=_

Self-driving cars are already cruising the streets today. And while these cars will ultimately be safer and cleaner than their manual counterparts, they can't completely avoid accidents altogether. How should the car be programmed if it encounters an unavoidable accident?

The unexpected event. A heavy object falls right in front of a self-driving car

Situation A. An SUV on the left and a motorcycle on the right

Situation B. A motorcycle at either side, one of the two drivers isn't wearing a helmet

How a Self-Driving Uber Killed a Pedestrian in Arizona

by Troy Griggs and Daisuke Wakabayashi for New York Times, March 2018

https://www.nytimes.com/interactive/2018/03/20/us/self-driving-uber-pedestrian-killed.html

A woman was struck and killed on Sunday night by an autonomous car operated by Uber in Tempe, Arizona. It was believed to be the first pedestrian death associated with self-driving technology. [...]

Elaine Herzberg was struck while walking her bike across the street

Ms. Herzberg's damaged bicycle on the sidewalk near the self-driving Uber

NTSB investigators examining the self-driving vehicle involved in the fatal accident

The first fatal accident involving a self-driving car occurred on 7 May, 2016 in Ohio, when Joshua Brown, 40, in his Tesla Model S crashed into a Truck while running in 'autopilot' mode.

Further resources

The Moral Machine

MIT Media Lab - Scalable cooperation group

http://moralmachine.mit.edu/

Tesla bears some blame for self-driving crash death

Aarian Marshall for Wired, September 2017

https://www.wired.com/story/tesla-ntsb-autopilot-crash-death/

Riders in Waymo's self-driving cars will now be insured

Andrew J. Hawkins for The Verge, December 2017

https://www.theverge.com/2017/12/19/16796370/waymo-trov-self-driving-car-insurance

Insuring Autonomous Vehicles: An $81 Billion Opportunity Between Now And 2025

Accenture, 2017

https://insuranceblog.accenture.com/series/insuring-autonomous-vehicles-an-81-billion

Security researcher Charlie Miller hacks a connected Jeep
photo © WHITNEY CURTIS FOR WIRED

Cybersecurity

Hackers remotely kill a jeep on the highway

article by Andy Greenberg for Wired, July 2015

https://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/

Two hackers have developed a tool that can hijack a Jeep over the internet. WIRED senior writer Andy Greenberg takes the SUV for a spin on the highway while the hackers attack it from miles away. [...]

Charlie Miller and **Chris Valasek** connect to a Jeep Cherokee

Breaks are disengaged during a test drive, causing the vehicle to end off road

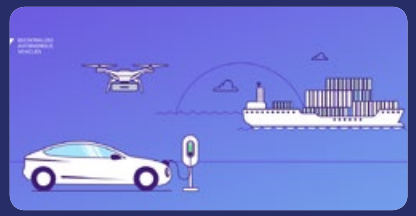
Andy Greenberg on the highway while hackers remotely take control of the car

DAV Foundation Wants To Bring Open-Source Blockchain Platform To Mobility

article by Sam Abuelsamid for Forbes, March 2018

https://www.forbes.com/sites/samabuelsamid/2018/03/13/

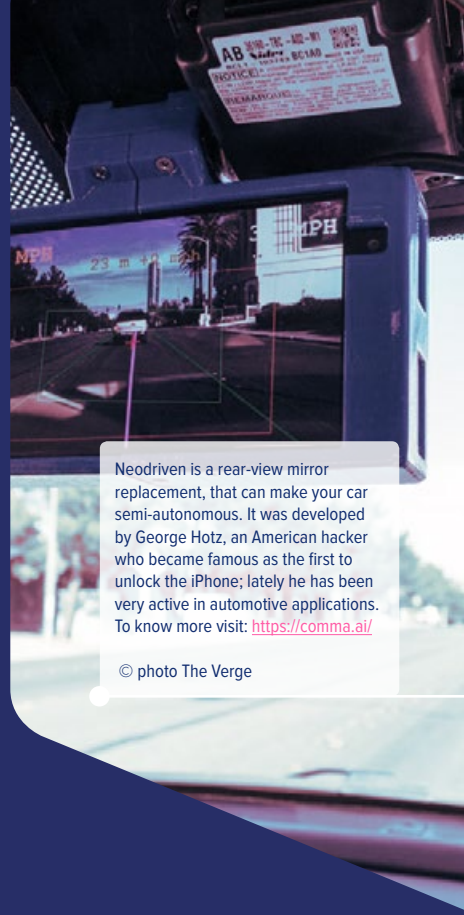
The ultimate goal is to create a decentralized transportation network that enables any number of companies to participate with any number of customers. Much like the internet, any user on this network can communicate and transact with any other user whether those users are people or vehicles. [...]



DAV is a blockchain-based transportation platform

It enables vehicles to learn, communicate and perform transactions with digital currency

Everyone in this network can buy or sell autonomous transportation services



Neodriven is a rear-view mirror replacement, that can make your car semi-autonomous. It was developed by George Hotz, an American hacker who became famous as the first to unlock the iPhone; lately he has been very active in automotive applications. To know more visit: https://comma.ai/

© photo The Verge

Further resources

Hackers Are the Real Obstacle for Self-Driving Vehicles

Simson Garfinkel for MIT Technology Review, August 2017

https://www.technologyreview.com/s/608618/hackers-are-the-real-obstacle-for-self-driving-vehicles/

Car Hacking: The definitive source - Illmatics.com

Charlie Miller and Chris Valasek

http://illmatics.com/carhacking.html

Six Ways Automakers Could Employ Blockchain

article by Kristin Houser for Futurism, March 2018

https://futurism.com/cars-blockchain-six-ways/

Auto ISAC

Automotive Information Sharing And Analysis Center

https://www.automotiveisac.com/

Voyage HDL-64E LIDAR unit, mounted on Voyage self-driving taxi
photo © VOYAGE

Privacy

Driverless cars: safer perhaps, but professor warns of privacy risks

article by Michael McGowan for The Guardian (International edition), September 2017

https://www.theguardian.com/technology/2017/sep/22/driverless-cars-safer-perhaps-but-professor-warns-of-privacy-risks

Driverless vehicles could build a “gold mine” of personal data for private companies and would make it easier for them to target people as consumers, an Australian law professor has warned.

Des Butler, of the Queensland University of Technology, said the privacy risks involved in driverless vehicles were a “sleeper issue” that regulators were yet to fully consider, even though car manufacturers say the technology could be on roads in Australia by 2020.

“These vehicles will know where you like to frequent, which businesses, and may very well build a profile of you,” Butler said. “People will go into these things not realising just how much data the vehicle will be generating about them and not knowing the extent to which the data can be used.” [...]

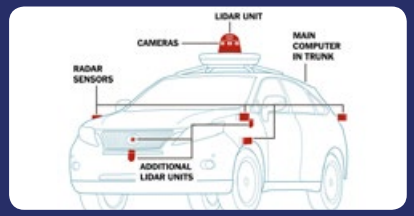
Each autonomous car will one day generate more data than thousands of people

article by Damon Beres for Mashable, August 2016

https://mashable.com/2016/08/17/intel-autonomous-car-data/#H4_SfFMVBqq3

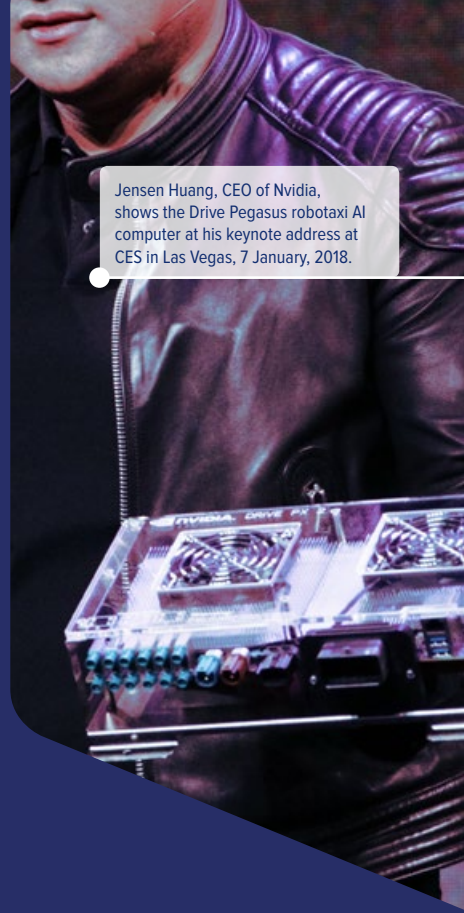
In 2020, we'll all download and upload a lot more data, and so will the objects around us. The average person will soon use 1.5 gigabytes of data daily, while autonomous vehicles will use about 4,000 [...]

Lidar Technology. How a self-driving vehicle 'sees' the environment



Self-driving car main sensor positioning
© photo New York Times

The boot of a self-driving Ford Fusion
© photo Sam Abuelsamid



Jensen Huang, CEO of Nvidia, shows the Drive Pegasus robotaxi AI computer at his keynote address at CES in Las Vegas, 7 January, 2018.

Further resources

Automotive Privacy Principles

Alliance of Automobile Manufacturers

https://autoalliance.org/connected-cars/automotive-privacy-2/

Privacy Perceptions of Networked Autonomous Vehicles

C. Bloom, J. Tan, J. Ramjohn, L. Bauer - Carnegie Mellon University

https://www.usenix.org/conference/soups2017/technical-sessions/presentation/bloom

Personal data in your car

National Automobile Dealers Association and the Future of Privacy Forum

https://www.nada.org/FPF_NADA_Consumer_Privacy_Guide/

Creating value from car data

McKinsey & Company

https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/creating-value-from-car-data

Steve Mahan, who is legally blind, was the first non-Google employee to ride alone in the company's gumdrop-shaped autonomous car. The ride took place in October 2015 in Austin. © photo Waymo

Accessibility & Equality

Are self-driving cars the future of mobility for disabled people?

article by Srikanth Saripalli for The Conversation, October 2017

http://theconversation.com/are-self-driving-cars-the-future-of-mobility-for-disabled-people-84037

Self-driving cars could revolutionize how disabled people get around their communities and even travel far from home. People who can't see well or with physical or mental difficulties that prevent them from driving safely often rely on others – or local government or nonprofit agencies – to help them get around.
Autonomous vehicle technology on its own is not enough to help these people become more independent, but simultaneous advances in machine learning and artificial intelligence can enable these vehicles to understand spoken instructions, observe nearby surroundings and communicate with people. Together, these technologies can provide independent mobility with practical assistance that is specialized for each user's abilities and needs. [...]

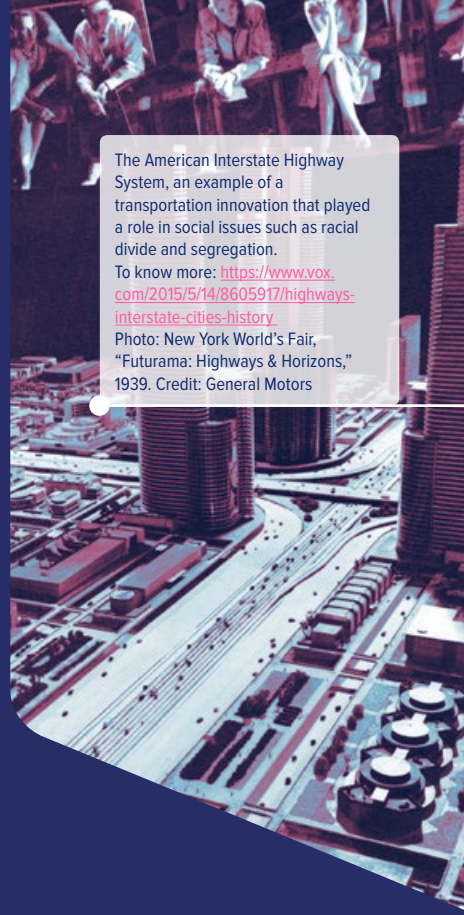
How driverless cars could drive even deeper economic inequality

article by Ralph Mclaughlin for FastCompany, November 2017

https://www.fastcompany.com/40490471/how-driverless-cars-could-drive-even-deeper-economic-inequality

The emergence of driverless cars–like past innovations in transportation technology–will actually put significant pressure on our cities to expand. As this pressure increases, rich, white-collar workers will be more likely to live in prosperous areas beyond the suburbs. This shift will bring important–but familiar–policy challenges as segregation increases across our largest cities.

Will it happen? And if it does, when? The emergence of new transport technologies will put continued pressure on cities to expand outward as households seek bigger homes on bigger lots in less developed locales. This migration, however, isn't a groundbreaking transformational shift. It's more of history repeating itself, but it's unlikely to happen quickly but rather over the coming decades. [...]



The American Interstate Highway System, an example of a transportation innovation that played a role in social issues such as racial divide and segregation.
To know more: https://www.vox.com/2015/5/14/8605917/highways-interstate-cities-history
Photo: New York World's Fair, "Futurama: Highways & Horizons," 1939. Credit: General Motors

Further resources

Blind man sets out alone in Google's driverless car

article by A. Halsey III and M. Laris for The Washington Post, December 2016

https://www.washingtonpost.com/local/trafficandcommuting/blind-man-sets-out-alone-in-googles-driverless-

Will You Ever Be Able To Afford A Self-Driving Car?

article by Chuck Tannert for FastCompany, January 2014

https://www.fastcompany.com/3025722/will-you-ever-be-able-to-afford-a-self-driving-car

Driverless Cars Won't Save Us

article by Richard Florida for Citylab, November 2017

https://www.citylab.com/equity/2017/11/driverless-cars-wont-save-us/546344/

Stick Shift: Autonomous Vehicles, Driving Jobs, and the Future of Work.

paper by Center for Global Policy Solutions, March 2017

http://globalpolicysolutions.org/report/stick-shift-autonomous-vehicles-driving-jobs-and-the-future-of-work/

Mercedes F 015 autonomous concept car: interior and control interface. © photo Mercedes-Benz

Human compliance

Automated cars can be expected to enter into a “hermeneutic mediation” with the users

excerpt from RoboLaw: Guidelines on Regulating Robotics (p. 47), September 2014

http://www.robolaw.eu/RoboLaw_files/documents/robolaw_d6.2_guidelinesregulatingrobotics_20140922.pdf

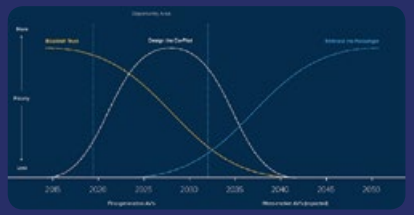
When automated cars will be a component of accepted driving practices, they will not be seen or perceived by the driver as a technological mediation with the world. This is the case, for example, when it comes to our heating or electrical systems. Once they are set up, we do not continuously check whether they work properly. In these cases, the technology disappears as far as the user is concerned. It remains in the “background” and it only brings itself to the attention of the user when it malfunctions. In this situation, the driver of an automated car could get used to the technology and trust it without exerting any control. A car, however, is not a fridge, and if the system “breaks” and becomes visible in a life-threatening situation, the road or car users can be in serious danger. Therefore, designers and regulators may want to reduce at least this type of relationship between the users and the automated system, by not allowing the user to “forget” about the system and continuously demanding attention or control. [...]

The human transition to autonomous vehicles

John Rousseau & Brad Crane, Artefact Group, October 2015

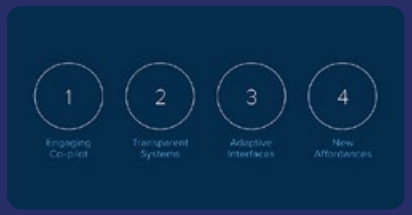
https://www.artefactgroup.com/articles/the-human-transition-to-autonomous-vehicles/

"We have a human need to understand our environment and trust the systems we depend on—particularly in an automobile where control has critical consequences. And while autonomous vehicles will redefine what it means to be a driver, they won't change what it means to be human." - Merk Dipko, Hyundai.

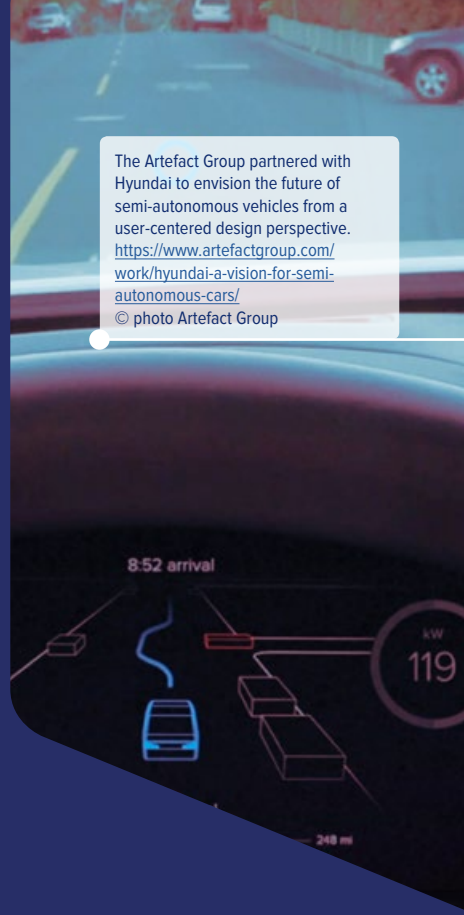


Artefact's human transition to AVs and design priorities

Array of challenges and key issues to design human trust towards autonomous vehicles



Design areas for the transition to driverless vehicles.



The Artefact Group partnered with Hyundai to envision the future of semi-autonomous vehicles from a user-centered design perspective. https://www.artefactgroup.com/work/hyundai-a-vision-for-semi-autonomous-cars/
© photo Artefact Group

Further resources

HF Auto - Human Factors of Automated Driving

European project funded by Marie Curie Initial Training Network (ITN)

http://hf-auto.eu/

New Age Poker Face: Can We Learn to Communicate with Driverless Cars?

article by Bridget Clerkin for DMV.org, September 2017

https://www.dmv.org/articles/pedestrian-communication-autonomous-vehicles

Johnnycab (Automation Paradox, pt. 2)

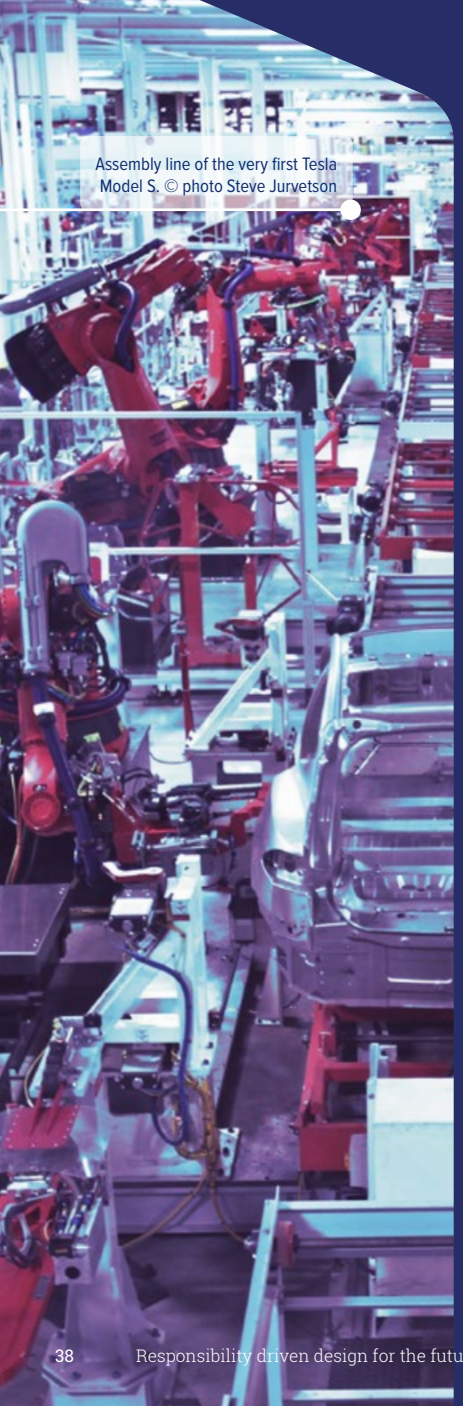
Episode by Sam Greenspan for 99% Invisible, June 2015

http://99percentinvisible.org/episode/johnnycab-automation-paradox-pt-2/

The Secret UX Issues That Will Make (Or Break) Self-Driving Cars

article by Cliff Kuang for FastCompany, February 2016

https://www.fastcodesign.com/3054330/the-secret-ux-issues-that-will-make-or-break-autonomous-cars



Assembly line of the very first Tesla Model S. © photo Steve Jurvetson

Environment & Sustainability

Autonomous Vehicles have a wide range of possible energy impacts

Scientific poster by National Renewable Energy Laboratory, July 2013

https://www.nrel.gov/docs/fy13osti/59210.pdf

AVs have the potential to make impacts on transportation energy use by individuals. Most possible effects on energy intensity are likely to lead to fuel savings, but many effects on use intensity could counteract this or even lead to increases in fuel use, depending on the specific scenario. Our estimates of possible impacts range from nearly 90% fuel savings (if only energy benefits occur) to more than 250% increase in energy use (if only energy increases are considered). This emphasizes the importance of considering energy impacts in AV deployment strategy.

The quest to design a smarter road

article by Katharine Schwab for FastCompany, October 2017

https://www.fastcodesign.com/90140902/smart-roads-are-coming-do-we-need-them

The way our roads will adapt to self-driving cars in the coming years probably won't be quite as sexy as the disruptive talking roads of futurists' dreams. Instead, it will involve small, more affordable tweaks to existing infrastructure–like specialized paint for highway markings, and even the highway signs themselves. [...]

Minor changes to street signs can fool machine learning algorithms into thinking they mean something completely different. In this example researchers have demonstrated it by modifying the stop sign.
Study: https://arxiv.org/abs/1707.08945
© photo by Evtimov, et al.

Further resources

Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles

Zia Wadud, Don MacKenzie, Paul Leiby, April 2016

https://www.sciencedirect.com/science/article/pii/S0965856415002694

How will autonomous vehicles transform the environment?

article by Annibel Rice and Adie Tomer, Brookings Institution, October 2017

https://www.brookings.edu/blog/the-avenue/2017/10/16/how-will-autonomous

The latest fake town built for self-driving cars has opened in South Korea

article by Karen Hao for Quartz, Nov 2017

https://qz.com/1121372

In 2015 the University of Michigan built M-City, a 32-acre city where self-driving cars can be tested out. It tries to replicate real-life scenarios where the vehicle is presented with unpredictable situations.
© photo University of Michigan

Towards an integrated approach...

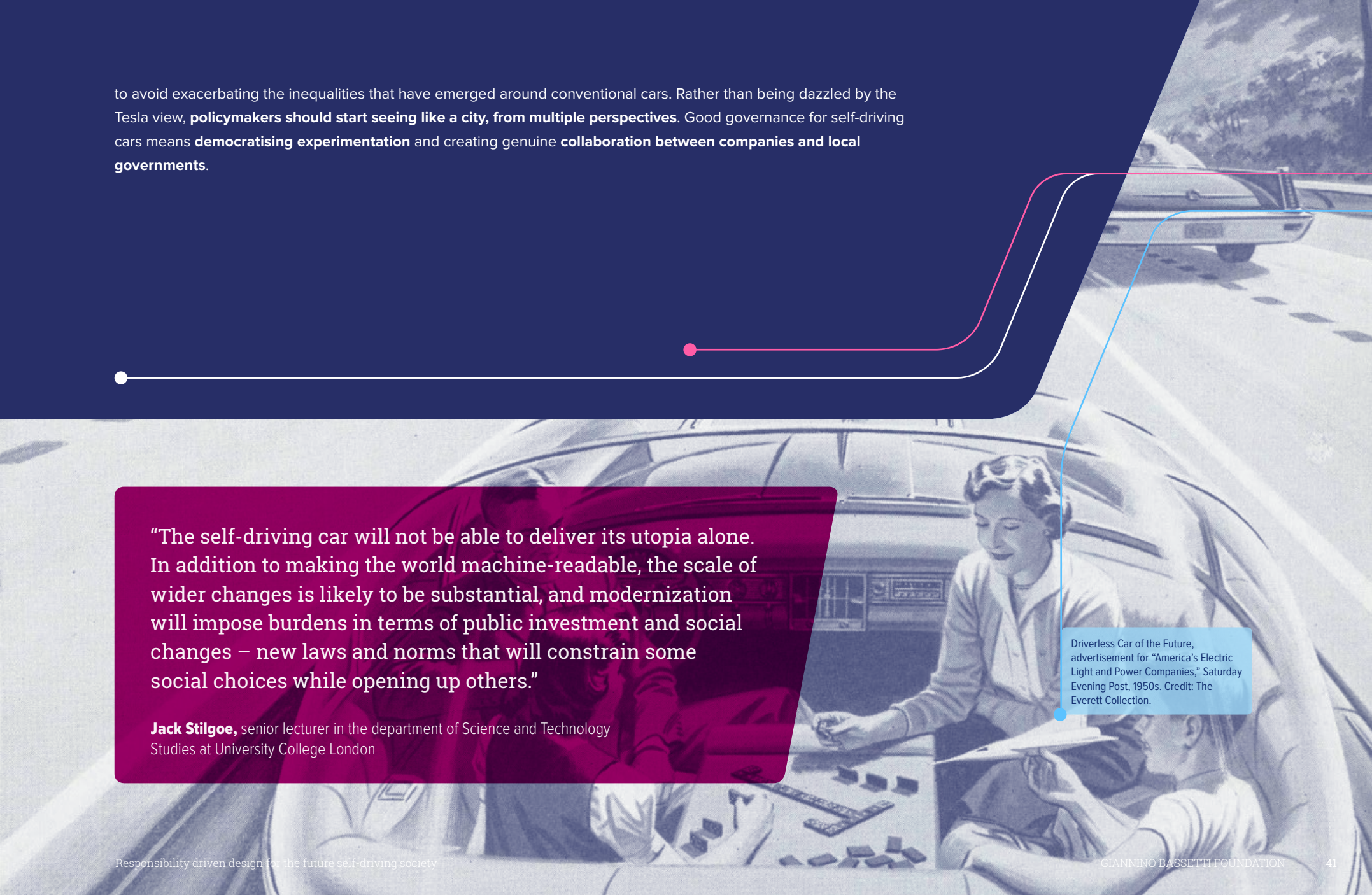
Seeing like a Tesla: how can we anticipate Self-driving worlds?

Paper by Jack Stilgoe for The Glocalism Journal, March 2017

http://www.glocalismjournal.net/issues/beyond-democracy-innovation-as-politics/articles/seeing-like-a-tesla

In the last five years, investment and innovation in self-driving cars has accelerated dramatically. Automotive autonomy, once seen as impossible, is now sold as inevitable. Much of the governance discussion has centred on risk: will the cars be safer than their human-controlled counterparts? As with conventional cars, harder long-term questions relate to the future worlds that self-driving technologies might enable or even demand. The vision of an autonomous vehicle – able to navigate the world's complexity using only its sensors and processors – on offer from companies like Tesla is intentionally misleading. So-called "**autonomous" vehicles will depend upon webs of social and technical connectivity**. For their purported benefits to be realised, **infrastructures** that were designed around humans will need to be upgraded in order to become **machine-readable**. It is vital to anticipate the politics of self-driving worlds in order

to avoid exacerbating the inequalities that have emerged around conventional cars. Rather than being dazzled by the Tesla view, **policymakers should start seeing like a city, from multiple perspectives**. Good governance for self-driving cars means **democratising experimentation** and creating genuine **collaboration between companies and local governments**.



"The self-driving car will not be able to deliver its utopia alone. In addition to making the world machine-readable, the scale of wider changes is likely to be substantial, and modernization will impose burdens in terms of public investment and social changes – new laws and norms that will constrain some social choices while opening up others."

Jack Stilgoe, senior lecturer in the department of Science and Technology Studies at University College London

Driverless Car of the Future, advertisement for "America's Electric Light and Power Companies," Saturday Evening Post, 1950s. Credit: The Everett Collection.

04.

GOVERNANCE

An overview on the current efforts in governing such a complex transformation

On 14 April 2016 at the Informal Transport and Environment Council in Amsterdam, 28 EU Ministers of Transport endorsed the **Declaration of Amsterdam** to work towards a more coordinated approach enabling the introduction of connected and automated driving.

With the **Declaration of Amsterdam** on connected and automated driving, member states, the European Commission and private sector have agreed on joint goals and joint actions to **facilitate the introduction of connected and automated driving** on Europe's roads. This should prevent a patchwork of rules and regulations arising within the EU, which would be an obstacle to both manufacturers and road users.

More information: *https://www.government.nl/topics/mobility-public-transport-and-road-safety*

Responsible governance to avert self-driving innovation

Angela Simone

Science & Technology Writer, EU and International Initiatives Designer at the Bassetti Foundation

If controversies that we have faced in the recent past when new technologies entered into our societies (for instance the GMOs case) have taught us anything, it is that **public scrutiny is a much needed and natural process of evaluation and reflection** made by citizens on the effects and the impacts of that new technologies can bring, and that it occurs even without supporting data, scientific evidences or clear rules. This societal assessment can also turn into non-acceptance, or the hostile refusal of a particular technology, especially if its introduction is perceived as having been through a top-down process, or badly governed by those who are in charge of managing and addressing all the various points made by the numerous actors within societal communities.

What the responsible governance of tech innovation should guarantee is based on three key factors: timeliness; capacity to solicit all the stakeholders involved; ability to summarize all the needs and design a regulatory framework within which innovation can prosper.

Timeliness. As already mentioned throughout the chapters in this white paper in which the Collingridge dilemma is the key element, proper governance should provide regulatory elements that are flexible but at the same time effective, also in contexts in which there is a lack of data and evidence, with the ambition of looking to the future with an informed gaze. It would be desirable that policies and rules within such contexts should be based on foresight and anticipation exercises that are able to foresee (and govern or avert if needed) any future impacts, steering society towards the future through the present.

Capacity of **soliciting all the stakeholders involved**. Those who are closely linked to newly entering technology within society, such as innovators,

U.S. Secretary for Transportation Elaine Chao presents the newly released federal guidance for Automated Driving Systems named A vision for Safety 2.0 at the M-City testing grounds in Ann Arbor on Tuesday 12 September, 2017. Photo by Max Ortiz/The Detroit News 2017

researchers, technologists, and those that we could consider the expert community, are definitely a relevant voice to be taken into account, but they cannot be the only ones listened to. Responsible governance entails wide dialogue with the whole society, and technology assessment practices – which have a lot in common with Responsible Innovation – should be methods to be consolidated in designing responsible governance actions.

The ability to **summarize needs and design a regulatory framework within which innovation can prosper.**

Within rapidly evolving contexts it is impossible to imagine the creation of rigid rules whose relevance could be made obsolete after just a few technological passes. Only a wide and flexible regulatory framework, which has at the same time clear boundaries, can both unleash the potential of innovation instead of restricting it, and safeguard its real alignment with citizens' needs, expectations and values. In order to do so the regulatory framework must stem from ethical principles that are agreed by all societal actors and stakeholders.

In different countries and across EU and extra-EU regions in which reflections and actions on enabling the introduction of technologies for autonomous transports are advanced, there are several examples of rule and governance attempts in this field. In this white paper we have collected several of them, describing their key elements. In this selection the readers can find interesting differences on how to approach and govern the transition to autonomous transportation. For instance, some countries have decided to focus their attention, and designed regulations specifically on selected relevant priorities, such as safety or cybersecurity. Other countries have preferred to introduce a more comprehensive regulatory framework, in which all of these and other issues are taken into account. We leave the question of whether these examples can represent best practices of responsible governance for self-driving societies (or not) to the readers and those who would like to discuss this issue with us at the Bassetti Foundation in the near future.

USA

Automated Driving Systems: A Vision for Safety

Federal guidance for Automated Driving Systems (ADS). U.S. Department of Transportation & NHTSA, September 2017

www.nhtsa.gov *www.nhtsa.gov (PDF)*

Document cover

Key principles

The guidance calls for automakers and other entities to focus on 12 areas related to safety:

1. System safety, or vehicles free of “unreasonable” safety risks

2. Operational design domain, or the conditions or geographic areas where the vehicles can operate (can they drive in rain, or on gravel roads?)

3. Object and event detection: Testing entities should have a documented process for assessing and testing their vehicles’ ability to avoid pedestrians, bicyclists, animals and other potential road hazards

4. Fallback to “minimal risk condition,” or, if a vehicle malfunctions, how quickly can it be brought to a state where it can’t do any harm?

5. Validation methods: Testers should develop validation methods to mitigate the safety risks of their systems

6. Human-machine interface: How do the vehicles communicate to their passengers, especially the ones that don’t have traditional controls?

7. Cybersecurity: Companies testing systems should incorporate best practices and design principles from NHTSA, the National Institute of Standards and Technology, SAE International and others to keep their vehicles from being hacked

8. Crashworthiness: What happens when non-automated vehicles run into automated vehicles, and how will the AV occupants be protected?

9. Post-crash behavior: How can AVs be made safer after an accident, such as by shutting down a fuel pump or moving the vehicle out of the roadway?

10. Data recording: Learning from crash data will be critical to the development of safe vehicles. NHTSA is working with SAE International to establish uniform data elements for crash reconstruction

11. Consumer education and training: Vehicle testers and dealers need to be able to accurately describe how their vehicles work

12. Federal, state and local laws

Short list taken from: *http://www.auvsi.org/*

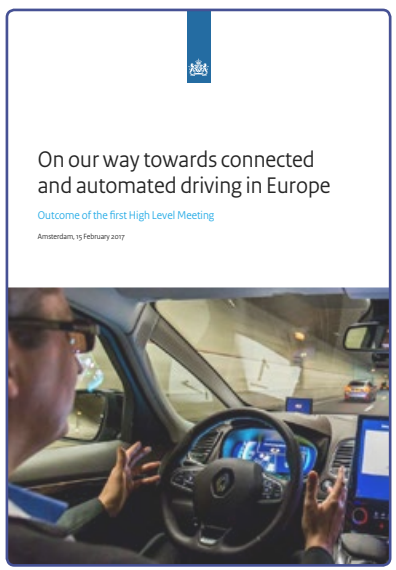
Europe

On our way towards connected and automated driving in Europe

Outcome of the first European High Level Meeting by the Dutch Ministry of Infrastructure and the Environment. 2016

https://www.government.nl/documents/

Document cover



Introduction

During the High Level Meeting in Amsterdam on 15 February 2017 the participating Member States, the European Commission and industry concluded that developments in connected and automated driving have further accelerated since the Declaration of Amsterdam. In order to be ready for the deployment of connected and automated driving in 2019 the execution of the actions in the declaration should also be accelerated. Member States should cooperate more intensively on actions that need to be executed on a national level. Therefore, the participating Member States, the European Commission and the automotive and telecom industry in this High Level Meeting arrived at the following eight conclusions:

1. Continue Informal High Level Meetings
2. Adopt a joint European approach
3. Assess the use of data
4. Develop Vehicle to Vehicle and Vehicle to Infrastructure Communication
5. Foster cross border testing
6. Close cooperation in UN-ECE34
7. Work with coherent international, European and national regulation
8. Starting work with the shared agenda

The introduction is taken from the official document (pages 10-12) and slightly readopted.

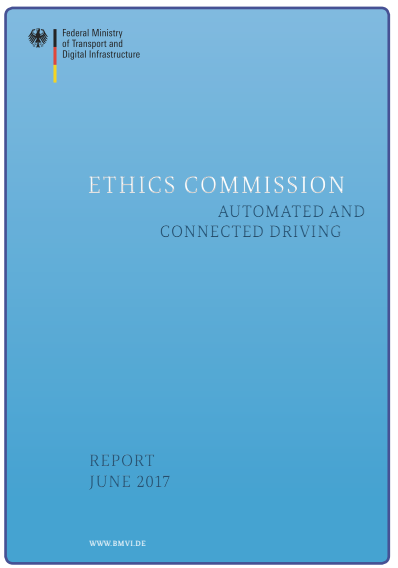
Germany

Ethics Commission. Automated and connected driving

Ethics report from German Federal Ministry of Transport and Digital Infrastructure, August 2017

www.bmvi.de

Document cover



Key principles

The Ethics Commission's report comprises 20 propositions. The key elements are:

- Automated and connected driving is an ethical imperative if the systems cause fewer accidents than human drivers (positive balance of risk).
- Damage to property must take precedence over personal injury. In hazardous situations, the protection of human life must always have top priority.
- In the event of unavoidable accident situations, any distinction between individuals based on personal features (age, gender, physical or mental constitution) is impermissible.
- In every driving situation, it must be clearly regulated and apparent who is responsible for the driving task: the human or the computer.
- It must be documented and stored who is driving (to resolve possible issues of liability, among other things).
- Drivers must always be able to decide themselves whether their vehicle data are to be forwarded and used (data sovereignty).

Short list taken from the official press release, August 2017 - *https://www.bmvi.de/SharedDocs/EN/PressRelease/2017/084-ethic-commission-report-automated-driving.html*

Great Britain

The key principles of cyber security for connected and automated vehicles

Set of guidelines issued by the British Government to encourage automakers to make vehicle cybersecurity a priority, August 2017

www.gov.uk *www.gov.uk (PDF long)* *www.gov.uk (PDF short)*

Document cover

Key principles

1. Organisational security is owned, governed and promoted at board level

2. Security risks are assessed and managed appropriately and proportionately, including those specific to the supply chain

3. Organisations need product aftercare and incident response to ensure systems are secure over their lifetime.

4. All organisations, including sub-contractors, suppliers and potential 3rd parties, work together to enhance the security of the system

5. Systems are designed using a defence-in-depth approach.

6. The security of all software is managed throughout its lifetime

7. The storage and transmission of data is secure and can be controlled

8. The system is designed to be resilient to attacks and respond appropriately when its defences or sensors fail

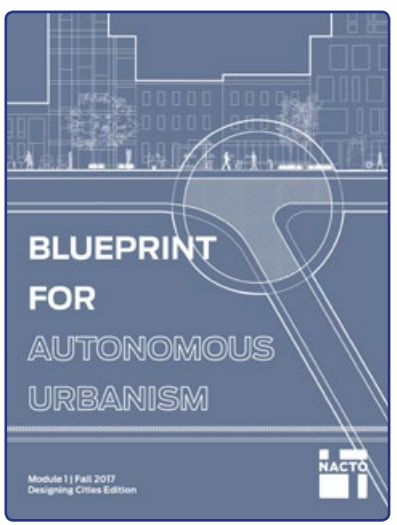
USA

Blueprint for autonomous urbanism

First module of Designing City Edition, by The National Association of City Transportation Officials, October 2017

nacto.org/publication/bau/ *nacto.org/publication/bau/ (pdf download)*

Document cover



Introduction

The first module focuses on three concepts cities are already grappling with today:

1. Designing for Safety, through streets that are designed primarily as public spaces for people, with more frequent and convenient pedestrian crossings and slower, steadier and more predictable vehicular movements. This requires updating the rules of the road to ensure that people on foot and bicycle are given priority over automated vehicles

2. New Mobility Systems, ensuring that fixed-route mass transit continues to serve as the backbone of urban transportation, while the expanding range of fleet vehicles provides flexible, equitable first- and last-mile connections

3. Curbside Management, providing guidance on policies, street designs and pricing incentives cities should implement to ensure that road space once used exclusively for parking is dynamically available for more diverse and valuable uses, including transit, bike lanes, bike share stations, parklets, green infrastructure, freight deliveries and passenger pick-up/drop-off zones.

Introduction taken from the official press release, October 2017: *https://nacto.org/2017/10/31/blueprint-for-autonomous-urbanism/*

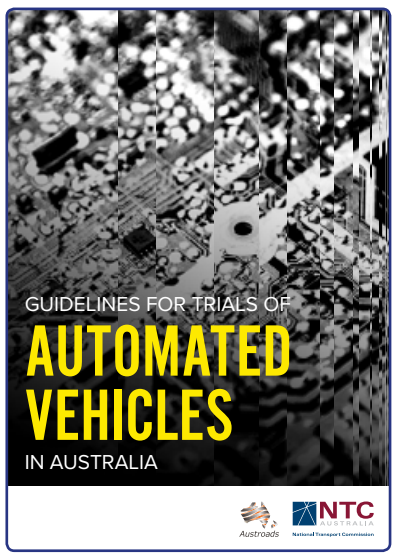
Australia

Guidelines for trials of automated vehicles

Set of guidelines issued by Australia's National Transport Commission in collaboration with Austroads, May 2017

www.ntc.gov.au (roadmap) *www.ntc.gov.au/ (PDF)*

Document cover



Introduction

Australia's transport ministers have endorsed an ambitious roadmap of reform that will facilitate the introduction of more automated vehicles on Australian roads. These guidelines represent the first step of the roadmap.

In November 2016 Australian transport and infrastructure ministers requested that the National Transport Commission (NTC) and Austroads develop national guidelines for trials of automated vehicles in Australia.

The guidelines are intended to:

1. support nationally consistent conditions for automated vehicle trials in Australia
2. provide certainty and clarity to industry regarding expectations when trialling in Australia
3. help road transport agencies manage trials in their own state or territory as well as across state borders
4. establish minimum standards of safety
5. help assure the public that roads are being used safely
6. help raise awareness and acceptance of automated vehicles in the community.

The introduction is taken from the original document, page 1 paragraph 1.1

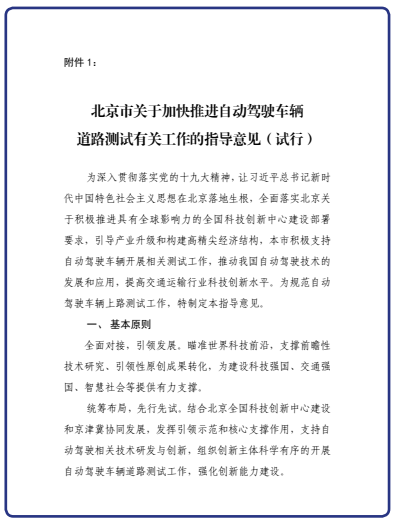
China

Guiding opinions and implementation rules for the Beijing road tests of autonomous vehicles

First set of guidelines issued by the Beijing Municipality to regulate the road testing of autonomous vehicles in Beijing

www.bjjtw.gov.cn *www.lexology.com/library/*

Document cover



附件 1：

北京市关于加快推进自动驾驶车辆
道路测试有关工作的指导意见（试行）

为深入贯彻落实党的十九大精神，让习近平总书记新时代中国特色社会主义思想在北京落地生根，全面落实北京关于积极推进具有全球影响力的全国科技创新中心建设部署要求，引导产业升级和构建高精尖经济结构，本市积极支持自动驾驶车辆开展相关测试工作，推动我国自动驾驶技术的发展和应用，提高交通运输行业科技创新水平。为规范自动驾驶车辆上路测试工作，特制定本指导意见。

一、基本原则

全面对接，引领发展。瞄准世界科技前沿，支撑前瞻性技术研究、引领性原创成果转化，为建设科技强国、交通强国、智慧社会等提供有力支撑。

统筹布局，先行先试。结合北京全国科技创新中心建设和京津冀协同发展，发挥引领示范和核心支撑作用，支持自动驾驶相关技术研发与创新，组织创新主体科学有序的开展自动驾驶车辆道路测试工作，强化创新能力建设。

Introduction

Before the Beijing Regulations, there were no regulations specifically applicable to road testing ADVs. Road testing for ordinary vehicles is permitted on public roads under Road Safety Laws and relevant regulations (Road Safety Laws), with the exception of urban expressways and highways where road testing is not permitted. Additionally, braking function testing on public roads is prohibited.

For ordinary vehicles, the company testing the vehicle must obtain a renewable provisional registration plate from the police's traffic administration department, which is valid for up to 90 days. To obtain a provisional registration plate, the following documents must be submitted:

1. proof of identity of the vehicle owner;
2. proof of road accident insurance;
3. written application;
4. proof of satisfaction of the road safety technical test. This needs to be conducted by an independent third-party testing institution in accordance with the applicable national standards, namely the Technical Conditions for Vehicle Function Safety (GB7258 Standard).

Despite the lack of road testing regulations for ADVs, there have been reports of a number of companies testing their ADVs on public roads, and even on highways.

The introduction is an excerpt of the commentary by HERBERT SMITH FREEHILLS LLP, original source: *https://www.herbertsmithfreehills.com*

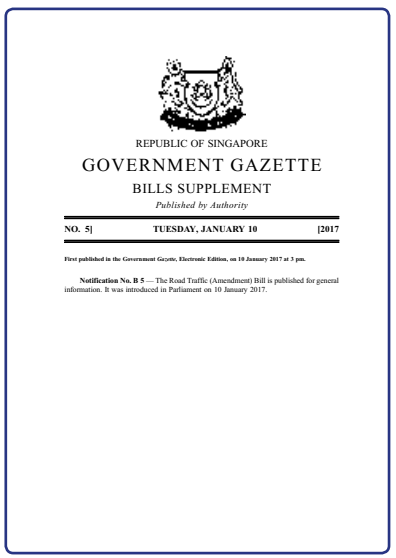
Singapore

Road Traffic (Amendment) Act 2017

Revised act by the Singapore Government to better regulate trials of autonomous motor vehicles

sso.agc.gov.sg/ *www.lexology.com/*

Document cover



REPUBLIC OF SINGAPORE

GOVERNMENT GAZETTE

BILLS SUPPLEMENT

Published by Authority

NO. 5] TUESDAY, JANUARY 10 [2017

First published in the Government Gazette, Electronic Edition, on 10 January 2017 at 3 pm.

Notification No. B 5 — The Road Traffic (Amendment) Bill is published for general information. It was introduced in Parliament on 10 January 2017.

Introduction

In order to accommodate and keep up with the development of new technology such as automated vehicle technology, the Road Traffic (Amendment) Act 2017 has been passed by the Singapore Government on 7 February 2017 and assented to by the President on 13 March 2017. Indeed, the modifications to the law are to ensure that there are regulations in place to deal with the growing field of “automated vehicle technology”, which is defined as any particular technology which “relates to the design, construction or use of autonomous motor vehicles or otherwise relates to advances in the design or construction of autonomous motor vehicles”.

The revised Road Traffic Act (the “Act”) now includes the terms “autonomous motor vehicle” and “autonomous system” in its definitions to govern the use of the same. The Act defines an autonomous vehicle as a “motor vehicle equipped wholly or substantially with an autonomous system (also commonly known as a driverless vehicle), and includes a trailer drawn by such a motor vehicle”. On the other hand, an autonomous system is defined as one that “enables the operation of the motor vehicle without the active physical control of, or monitoring by, a human operator”

The introduction is an excerpt of the commentary by Gateway Law Corporation, original source: *https://www.lexology.com/*

05.

DESIGN WORKSHOP

Envisioning and designing the responsible driverless society of the future

> "If we think of self-driving cars as regular cars with the self-driving addition, we will end up having the same traffic issues, congestion issues and pollution issues that we have today."
>
> **Tommaso Gecchelin**, founder & CTO of NEXT Future Transportation Inc.

Students working with prof. Francesco Samorè during the workshop "Collingridge Dilemma and responsible Innovation", part of *Self Driving Society @2030*, Final Synthesis Laboratory within the Master in Integrated Product Design, run by prof. Giulio Ceppi - Politecnico di Milano 2017-2018
Photo by Tommaso Correale Santacroce.

More pictures here: https://flic.kr/s/aHsksEoEUq

The design workshop and the concepts

Fabio Besti

Interdisciplinary Designer and Researcher, Senior Consultant for the Bassetti Foundation

What happens when you put **responsible innovation at the center of the development of the self-driving society?** To find out the Bassetti Foundation, in collaboration with the Design School of Politecnico di Milano, held a workshop entitled Collingridge Dilemma and Responsible Innovation. It was one of the 5 teaching modules that made up *Self Driving Society @2030*, Final Synthesis Studio at the Master in Integrated Product Design, run by prof. Giulio Ceppi, in partnership with Domus, Quattroruote, B&B Italia, Italdesign and STP electronics.

From **November 2 to November 9, 2017**, 44 students worked throughout an intense week of frontal lectures, brainstormings and project reviews, that eventually produced **44 visions and solutions** for the responsible development of the future society living in automated transportation systems.

Focusing on responsibility is always a challenge as this topic is quite often perceived as a constraint to innovation and creativity; yet again this was an experience that proved the contrary. Designers worked in a format specifically planned to combine responsibility topics with design requirements pertaining to the field of autonomous transportation. They started in **table 1** by imagining a future newspaper article identifying a responsibility issue of the self-driving society (1.1), later analyzing and describing the bigger problem underlying it (1.2); in **table 2** they mapped the concept using the **Responsibility Matrix** and the **Collingridge Positioning** (2.1) to later articulate it and visualize it (2.2).

The results gave birth to a profoundly diverse and rich panorama of concepts and visions, that interestingly

From top: Fabio Besti introduces the workshop and the Responsibility Matrix; mid-workshop revisions; Tommaso Gecchelin, founder of Future Next Transportation Inc. during his lecture; prof. Giulio Ceppi, course coordinator.
Photos by Tommaso Correale Santacroce

Workshop deliverable format

TABLE 1

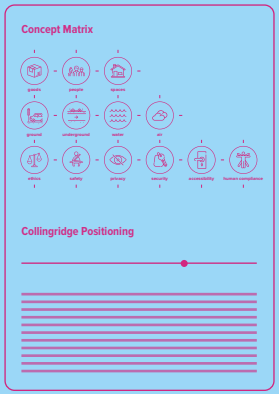
Research and problematize

1.1 Emblematic Fact

1.2 Problem Setting

TABLE 2

Solve and conceptualize



2.1 Concept Mapping

2.2 Concept Vision

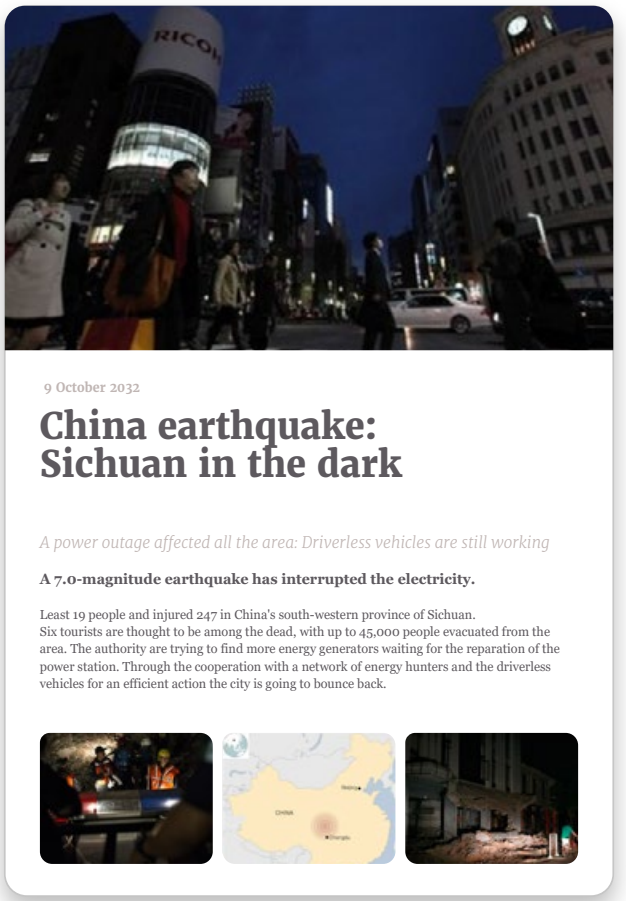
combined conventional design disciplines, policy making concerns and plausible future businesses and services' ideas.

In the following pages we showcase a selection of 7 projects that we think are particularly relevant to describe the richness and the worth of what we could call a **responsibility-driven design approach**.

Many common themes emerged from the exercises, including the use of AVs for good: **Codruta Andreea Cozma** for example provides a scenario where autonomous systems will come to **help during natural disasters and power outages**. Another pivotal concern was the misuse of AVs: clear examples are the works of **Helena Hägg** and **Fabio Iacomino** that try to solve the possible **criminal usages of autonomous transportation** by designing new technological and legislative solutions. Another key issue that emerged prominently is **privacy** and an interesting perspective is provided by **Alberto Zerbi**, who envisioned a future where each citizen will be able to choose different privacy settings when using AVs. Also the **relationship between technology and humans** is key, and a concept that provocatively works on this relation is the tech-free robocar designed by **Wanqun Zhang**. Finally, another context that catalyzed (and rightly so) the attention of the students is **the city** itself; in these regards the projects by **Shan Pengcheng** and **Suo-Yu Chang** are extremely relevant, in that they conceived new ways of organizing and experiencing the driverless urban cityscape.

Energy mobility system

by **Codruta Andreea Cozma**



9 October 2032

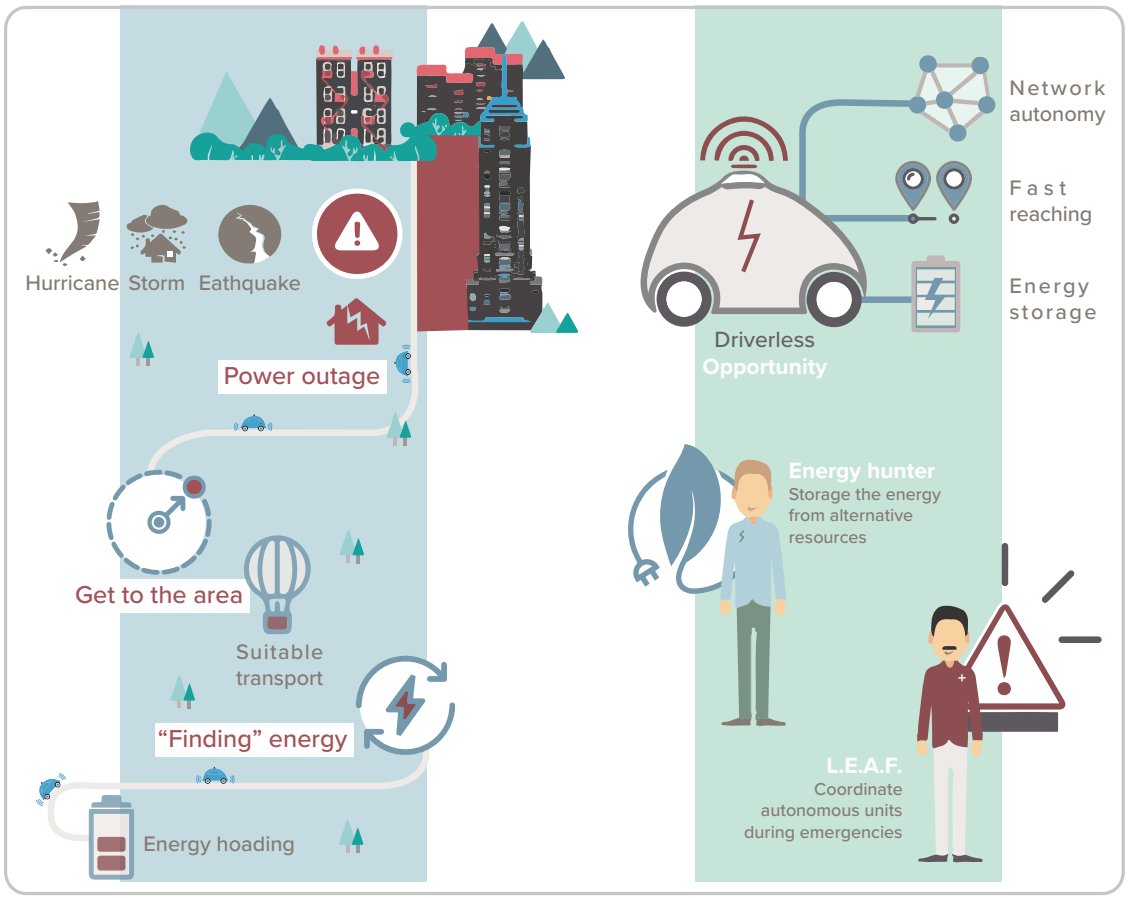
China earthquake: Sichuan in the dark

A power outage affected all the area: Driverless vehicles are still working

A 7.0-magnitude earthquake has interrupted the electricity.

Least 19 people and injured 247 in China's south-western province of Sichuan.
Six tourists are thought to be among the dead, with up to 45,000 people evacuated from the area. The authority are trying to find more energy generators waiting for the reparation of the power station. Through the cooperation with a network of energy hunters and the driverless vehicles for an efficient action the city is going to bounce back.

1.1 Emblematic Fact



1.2 Problem Setting

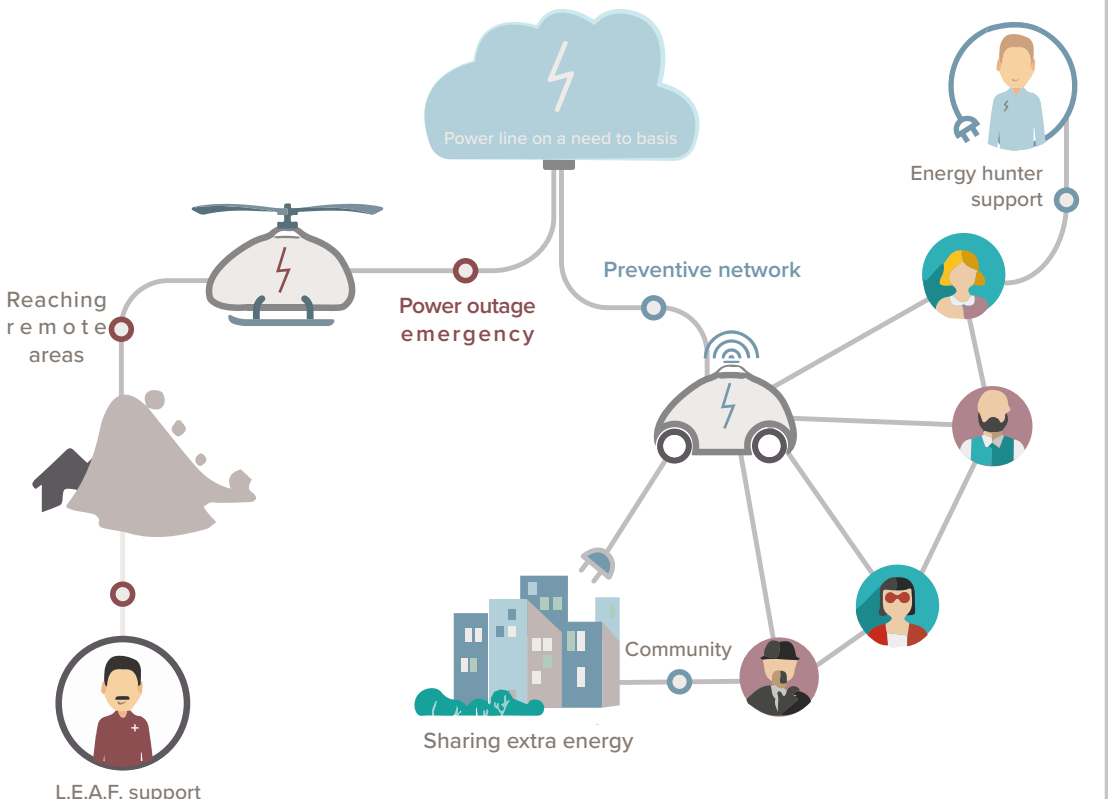
Energy mobility system

by **Codruta Andreea Cozma**

Concept Matrix

Collingridge Positioning

The concept is based on the idea of moving energy, by ground to connect a sharing network that could allow the sharing of the extra energy producted by them.
The purpose of this system is to prevent power outages in the event of disasters.
The community that will be maded will follow the trend of a sharing economy and a civic minded, where every person could contribute for the safety of the society.
At the same time the system could be used in case of disasters in remote areas, the driverless technology and the possibility to store extra energy will allow a fast and effective reaction. On the basis of the collingridge positioning the system will be at the stage of technology ideation to allow a better spread of it and to analyse the potential release of a new kind of community and the technology provided.



2.1 Concept Mapping

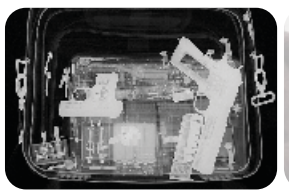
2.2 Concept Vision

2-Scale Stamp: Technology & New Legislation

by **Helena Hägg**

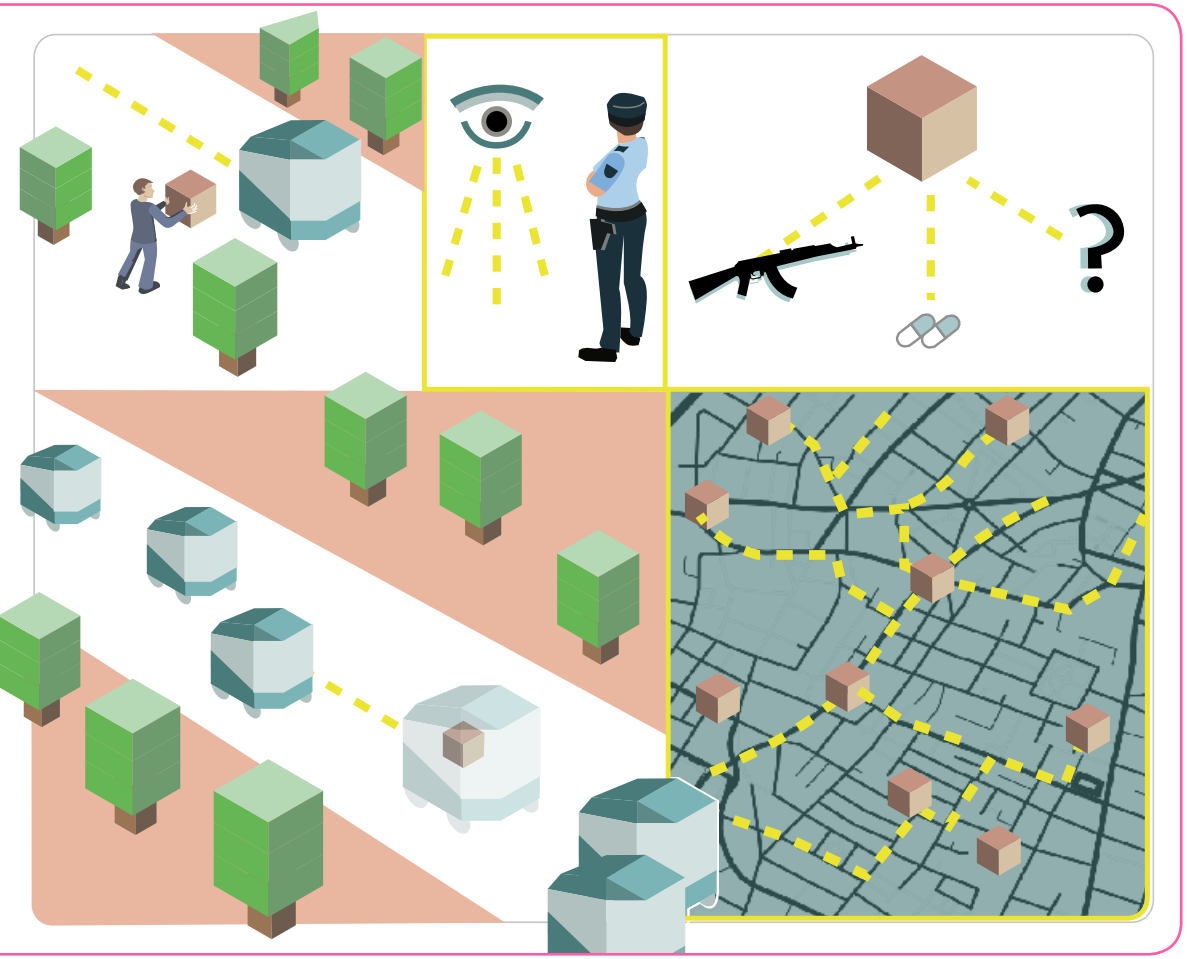
Date 2030-10-05

Police Stands Powerless as Contraband is Smuggled with Automated Couriers



"We are currently not allowed to search automated vehicles, and they do not need to pull over for random searches since this would disrupt traffic. We are caught in a technological gridlock here, where legislation falls behind", Police chief Jörgen Sörensson says . Accor ding to experts, the traditional role of the traffic policeman is completely superfluous. Since automated vehicles are not forced to include drivers in them, it is an ideal mode of transporting goods for opportunistic criminals. Some shared automated services have started to monitor their vehicles from the inside, which has received public critisism. "Our clients should feel that their integrity is respected, and although this might result in some illegal activities, we want to stay put before we take any action that might harm our regular customers" says Owner of Amazon-Automatic.

1.1 Emblematic Fact

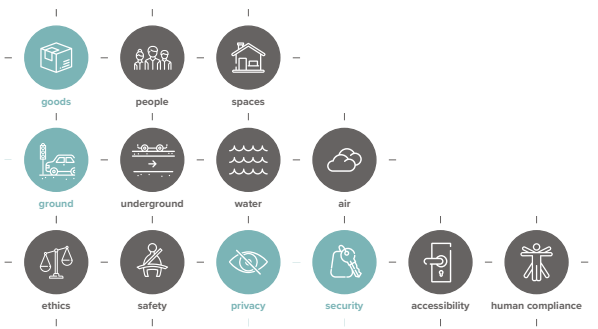


1.2 Problem Setting

2-Scale Stamp: Technology & New Legislation

by **Helena Hägg**

Concept Matrix



Collingridge Positioning

In order to preserve the democratic layout of the future infrastructure of automated car-sharing as well as ensuring some level of security for passengers, there is need for a two-part solution. The first part is a stamp, a sort of certificate of approval and quality gained by the automatic company. This offers a *weight sensor system*, which will alert you before you use the shared car if there are any *unknown dead weights in the car*. If there are and it seems suspicious, you may alert authorities or perhaps give back something which has been forgotten by the passenger before you. The second part of the solution is a *new law which defines liability of the passanger travelling from point A to B*; that is, the liability is geographic and legally bound, rather than within the vehicle itself. Through geo-mapping and enforcement of the law, police may interfer when a sufficient level of suspicion is reached. Hopefully, *rather than racial profiling, spacial profiling* and the stamp of approval offered by the automatic cars will ensure there is no need for over-the-top surveillence which might incriminate the privacy of the passengers. It will also be a safety measure for food produce and transport, a common venue of smuggling drugs.

2.1 Concept Mapping

2.2 Concept Vision

BPS // Bioterrorism Prevention System

by **Fabio Iacomino**

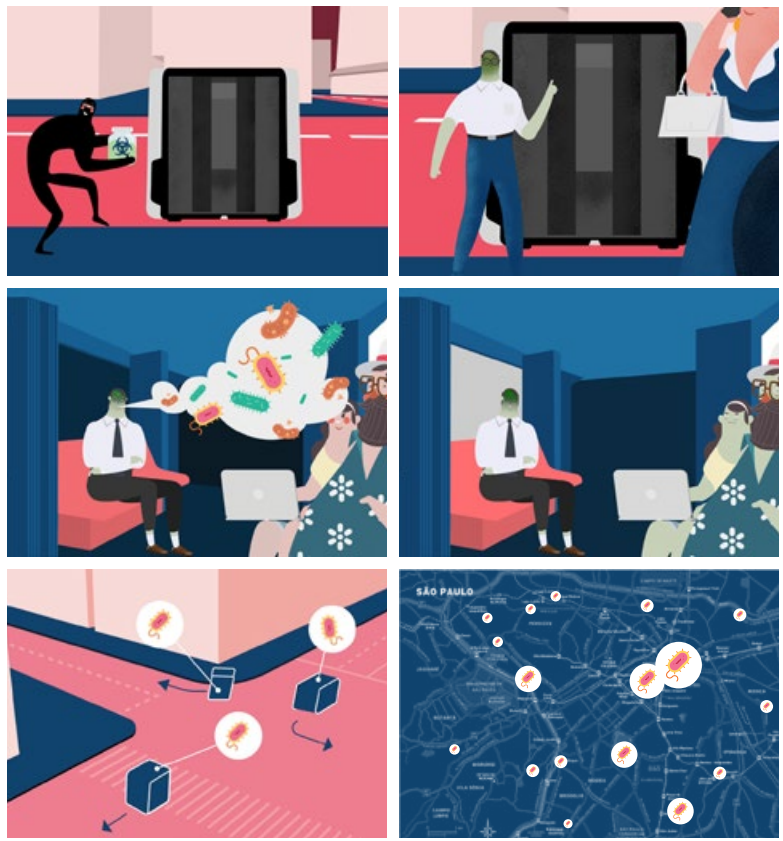
06/11/2035

Bioterrorist attack spreads deadly virus in São Paulo public transport.

The terrorist group Aum Shinrikyo has claimed responsibility for the attack.

On the 40th anniversary of the bioterrorist attack in Tokyo known also as the Subway Sarin Incident, the Brazilian followers of the doomsday cult Aum Shinrikyo have hit São Paulo with a new threat. The self driving veichles, used on a daily basis by most of the population of the megalopolis, have become the fastest and easiest way for the virus HN54R, released by bioterrorist cult, to spread. While the citizens are going to have the first vaccines, the hospitals swarm of people waiting to be cured. Few people have died but the fear of the spreading is high. The whole city has been put into quarantene and all the hyperloop lines to Europe and North America are closed until the virus will be eradicated.

1.1 Emblematic Fact



Tokyo subway sarin attack

March 20, 1995, Tokyo, Japan

AERIAL DIFFUSION

PUBLIC TRANSPORTATION

Researchers found 500 species of living organisms in New York subway. Among them the ones responsible for bubonic plague .

BIOTERRORISM

ISSUES

HIGH LETHALITY

LARGE SCALE PRODUCIBILITY

PANIC POTENTIAL

DELAYED RECOGNITION

LOW VACCINE AVAILABILITY

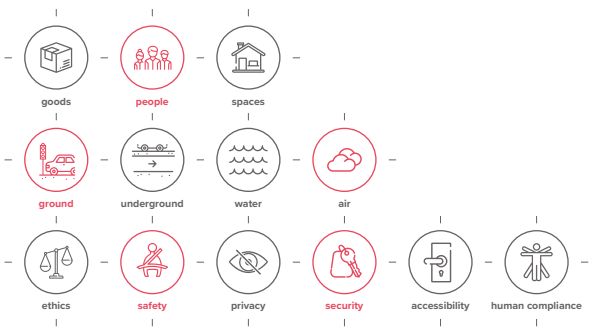
HUMAN CONTAGION

1.2 Problem Setting

BPS // Bioterrorism Prevention System

by **Fabio Iacomino**

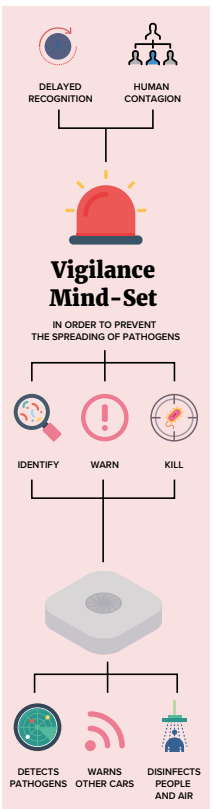
Concept Matrix



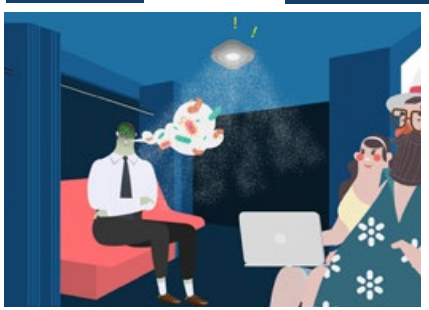
Collingridge Positioning

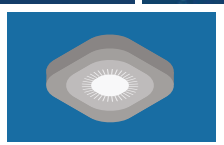
Bioterrorist attack today are an unspoken and undiscussed threat, it's possible that in the future, with proper technolgical progress, bioterrorists will be able to easily attack cities with existing or new viruses. Considering that there will be megalopolis with a high density of citizens, public transport will be probably the main target to attack and to spread the virus. Therefore it is important to prevent the possibility of an attack. The Health Care Provider will design a set of devices that will detect pathogens and sterilize the inside of the public transport, the air and the people inside. These devices will be a detector that will purify the air when it discovers the presence of viruses; it will connect to the other devices located in the other Next cars to warn them of a possible danger. There will also be the lights inside the veichle, equipped with a special rhodium based compound, that in case of emergency will irradiate the ambient and the people inside with a special frequency that will kill all the pathogens without harming the people inside.

2.1 Concept Mapping

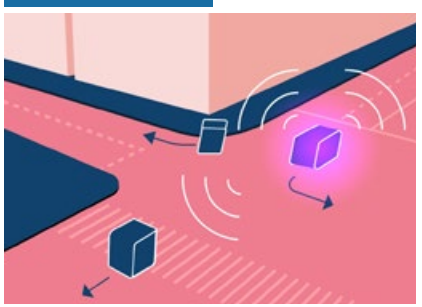


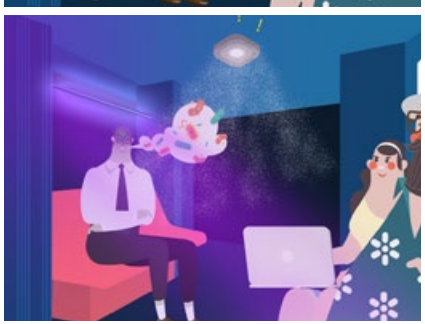
The pathogen agent is released by the bioterrorist. The virus is highly contagious and it transmits through air. The NEXT modules are the perfect veichle to spread the disease due to the fact that they are highly used by the population.



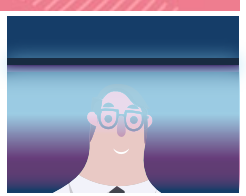


The device, equipped with sensors, can detected the presence of pathogens in the air.
It immediately sterilizes the ambient releasing special chemical compunds





The car communicates the possible presence of pathogens to the other modules in the city. Lights with a special frequence activate to kill harmful viruses and bacteria but without destroying any human cell.



2.2 Concept Vision

State Platform and Privacy Settings

by **Alberto Zerbi**

November 9, 2035

Hipster Culture stands up: stopped for police controls on average 10 times a week. The trouble is the beard.

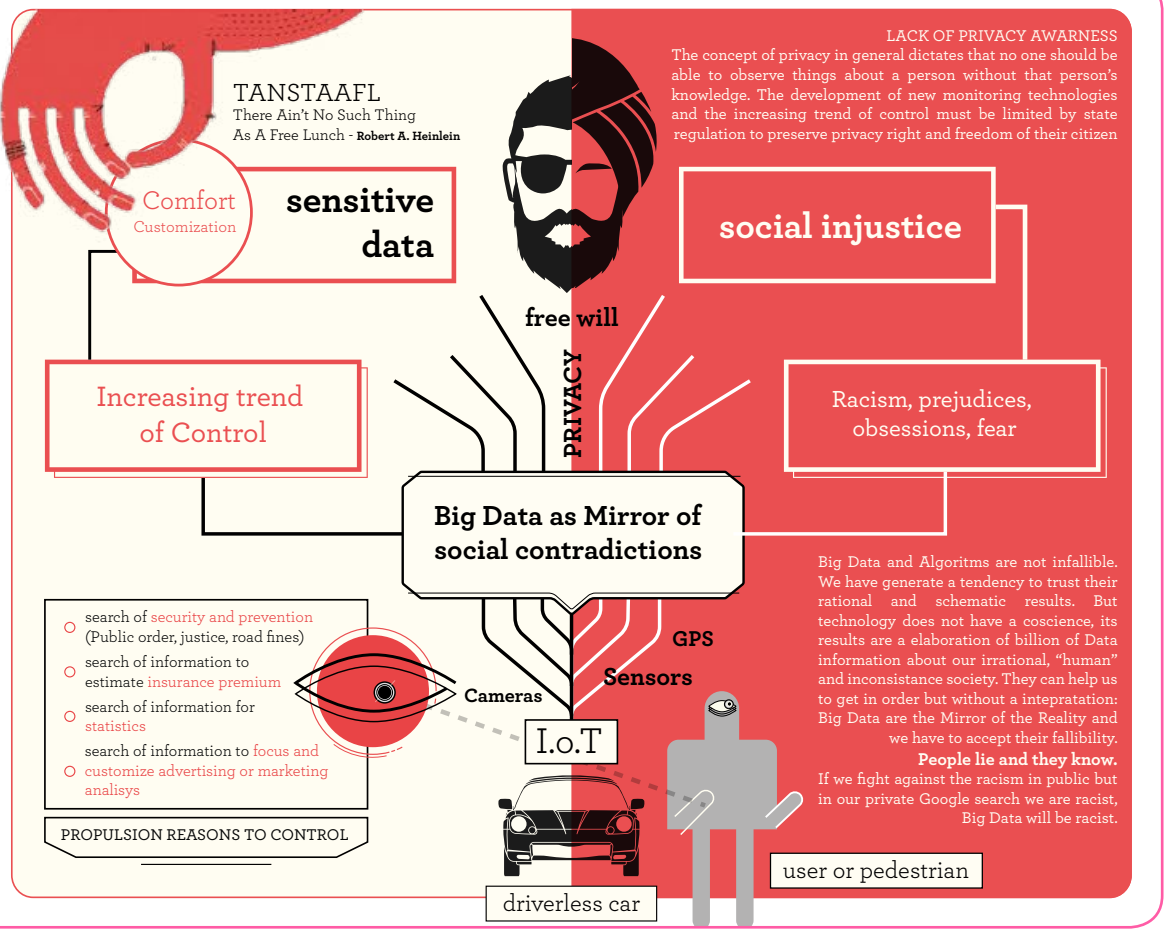
The driverless car Face Scansion incrise the bearded users probability to be checked by police. Are Big Data Racist? The new fear of Terrorism and Social Injustice, today.

John Wall, Hipster Cutlure spokesman, revealed an emblematic embarassment created by the recent transformation of our high automated society: "The first 3 weeks I thought that it could be a coincidence. But when I learned this strang situation happened also to my bearded friends I understood there is a real bug in the system. We are respectable people, we are not terrorist. Is a worrying news for every of us: this technology is superficial, idiot, blind and it is taken as absolute truth by public administration. Have I cut my beard? Where is our freedom?".

A curious fact could open a Pandora's Box. Driverless car system has created order, efficency and security, but the new question is: are we being spied? Or stereotyped? Who has access to our information?

Continued on page 5

1.1 Emblematic Fact

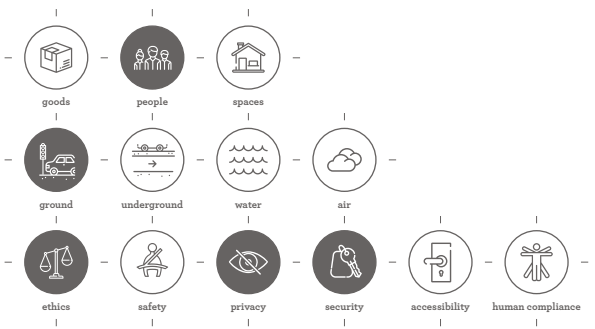


1.2 Problem Setting

State Platform and Privacy Settings

by **Alberto Zerbi**

Concept Matrix

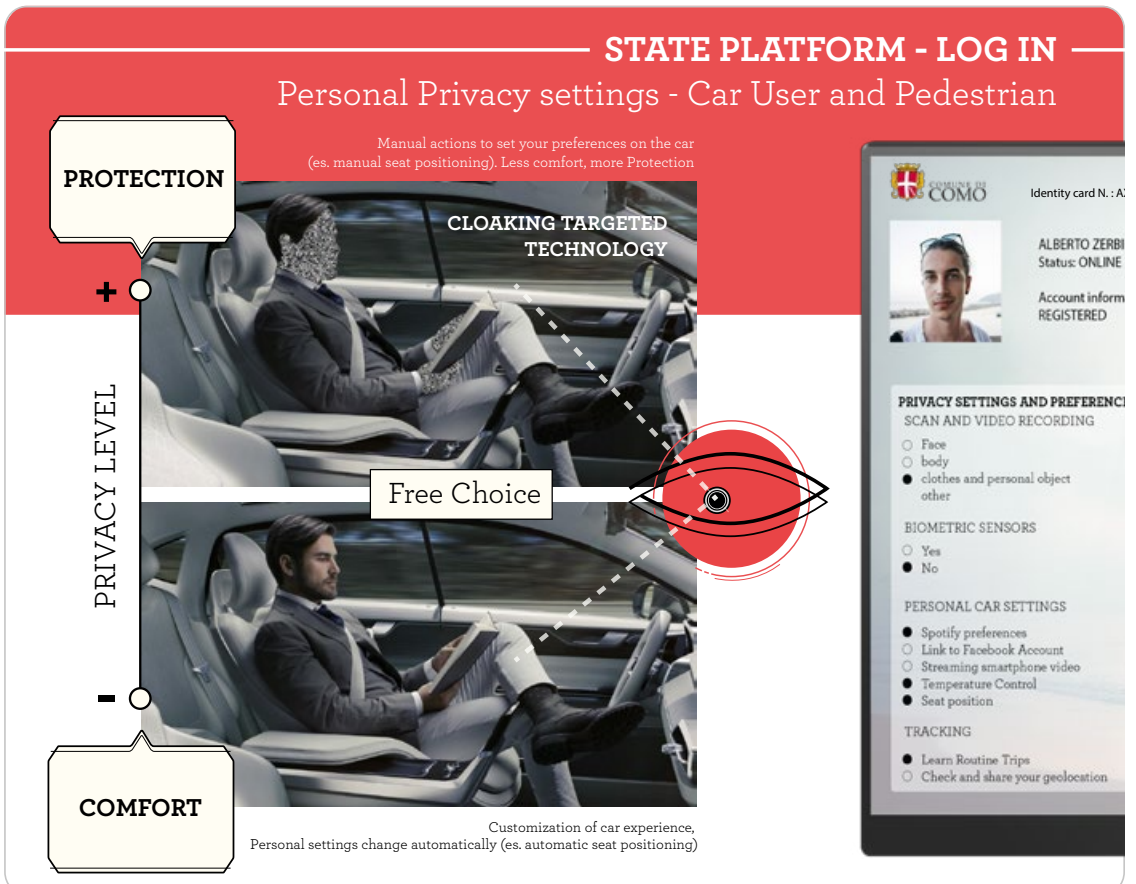


Collingridge Positioning

technology ideation — **technology adoption**

The Scenario is set in the advanced stage of Driverless technology, when the autonomous car (private or shared) will be the regularly choise to move. The Mindset revealed a lot of important issues and implications about privacy and sensitive data protection. Cars have always been the only places disconnected from Internet: people can't use their phone while their driving. But the new technology changes radically the situation: now cars could become the most connecting and smart ambient of all. User doesn't need to use his smartphone, he is INTO his smartphone. Lack of privacy awarness is a topical issue for technologies that we use every day, so it will be inevitably amplified for this newer paradigm. Also the incresing trend of control from istitutions and citizen is not a positive propulsor to establish a dialogue about regulation.

The concept is a Platform created and managed by a state and secular istitution to guaranteed the freedom of choise about personal information. As citizen you can register with Identity Card Number and all your Information to create a personal account. In your Setting Preferences you can choose what to hide and what to show to cameras, sensors and every monitoring technologies situated on every veichles (not only yours). Is your choise: more comfort or more protection level. Thanks to smartphone, when users come into a car, the vehicle understand his account profile and set itself following the privacy settings. User can also monitor from smartphone in real-time what the cameras and sensor are picking up to him. This platform will not be created only for car users but also for pedestrian. The autonomous cars can go around thanks to a lot of cameras that capture and scan the external ambient, and people. Potentially they are hide walker security cameras: not one , not two, but billion of them.



2.1 Concept Mapping

2.2 Concept Vision

Technology-free interior design of robocar

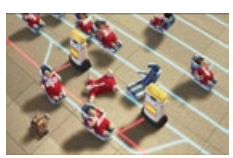
by **Wanqun Zhang**

11,2025

Robots & Us: When Machines Take the Wheel

Will the robotification ever transform human beings as in "WALL-E"?

Ahti Heinla and Janus Friis, has unveiled a product called the "Local Delivery Robot." It probably won't replace human mail delivery, but seeks to make the process more efficient. The history of mankind has been always focused on the mobility,on it perfection and acceleration.Today,autonomous driving technology could make getting around safer, more efficient, and less expensive.Unfortunately inflatable use of the robocar in all aspects of life could cause human inertia and robotification could turn people into WALL-E.



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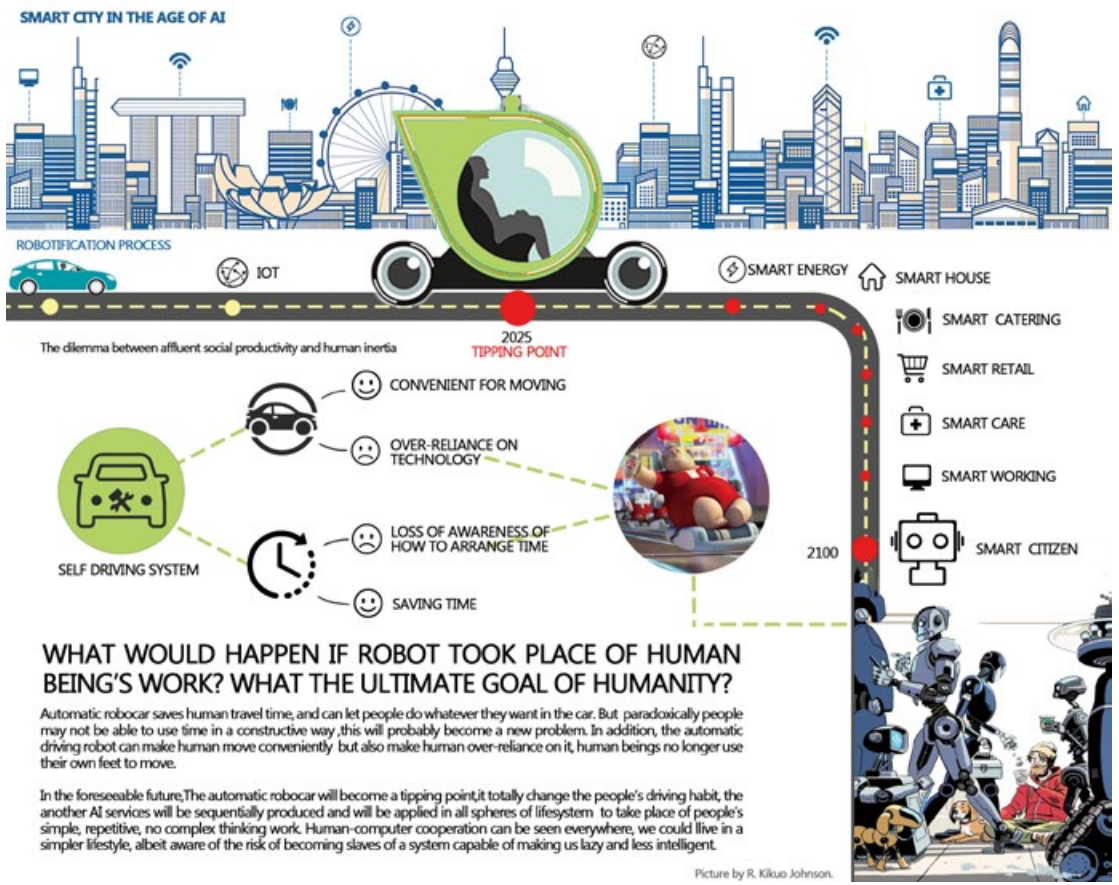
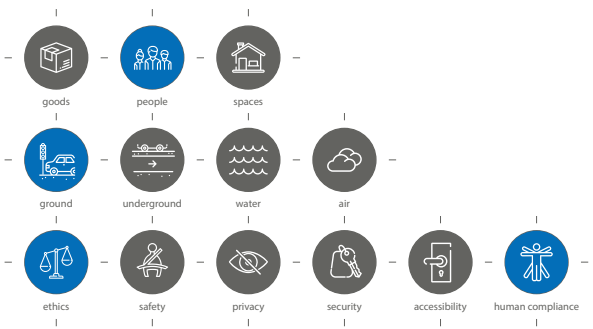


1.2 Problem Setting

Technology-free interior design of robocar

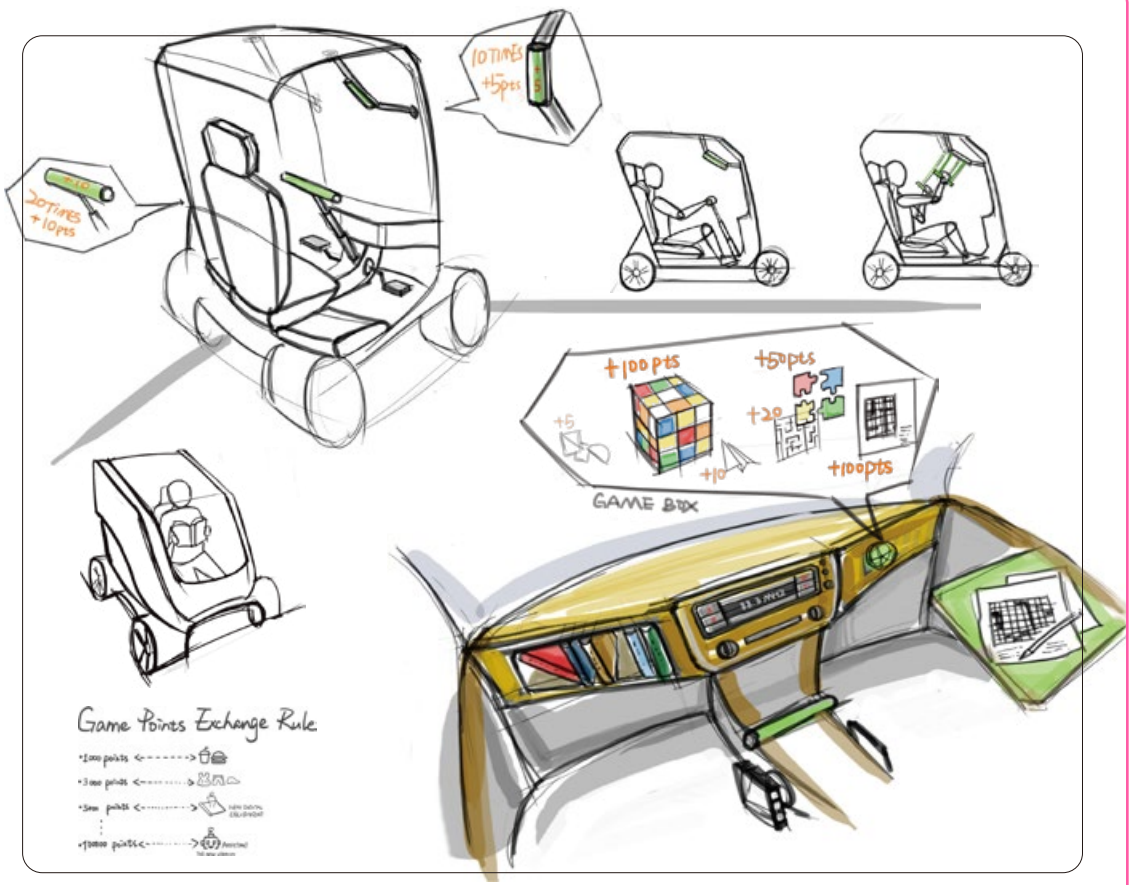
by **Wanqun Zhang**

Concept Matrix



Collingridge Positioning

In the AI era, people will lose the importance of physical activity and the sense of how life would be without robot. At the base of this project there is the intention of make people more aware about the meaning of human life and at the same time help their physical training.
In a such era it's hard to find a place without high technology, so the only possible way is doing the experience of a "technology-free life" when people move.
The profession I chose is the sensory provider. This profession can help people find the lost way. First, there will be some original things in the robocar, such as radio, paper books, CDs, while there will be some fitness equipment and original gaming box. The most important thing is to use the gaming points system of the game. Because most people are lazy at the age of AI, I want to find ways to attract their attention and guide them to use these equipment.
After complete the task of the equipment, people can get the corresponding game points, so they can use these game points to swap the goods.



2.1 Concept Mapping

2.2 Concept Vision

Super Blocks+

by **Shan Pengcheng**

Date: 22.06.2030

A self driving car was trapped in the fair, the vendor claimed for compensation

In the past few days, a vendor of the weekend fair on M street brought up a claim to the government, for the reason that the shared self driving vehicle managed by the government occupied his place of business, which made him unable to do business all day, and the loss reached up to 2000 euros.
It was reported that in the early hours of Saturday morning, an out-of-town young man parked the shared self driving vehicle on M street, but he did not know that there would be a fair on Saturday. On Saturday morning, the vendor drove his truck to M street half an hour later due to temporary emergency, and found that the self drivig vehicle had occupied his booth. However, at this time, numerous people walked on the street and kept very close to the shared vehicle. For the protection and respect to pedestrians, the vehicle was not able to move forward and thus trapped for a whole day, so the vendor could not do business.



1.1 Emblematic Fact


Because self driving cars extremely protect pedestrians, the usual character of self driving vehicle is "timid". They are extremely courteous to pedestrians, which causes them to be often trapped in the crowd and unable to move (rush hour in communities, street market etc.).

If self driving cars become brave, they can use the horn, there will be other new problems.
Self driving don't have the ability to sense the scene, can not predict the behavior of people, so when self driving cars honk the horn in inappropriate scenes, will make the pedestrian discomfort.

Discourteous

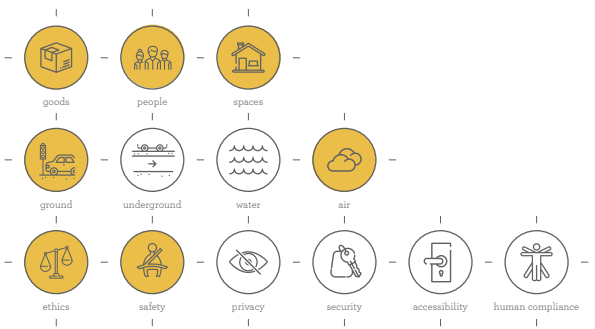
Trapped in the crowd

1.2 Problem Setting

Super Blocks+

by **Shan Pengcheng**

Concept Matrix



Collingridge Positioning

technology ideation — technology adoption

Due to probable conflicts caused by the wide popularization of autonomous vehicles and backward supporting infrastructure construction, self driving vehicles will be exposed to pedestrians with a greater possibility, which will make vehicles and people in trouble.

The project "Super blocks +" was inspired by "Super Blocks" project in Barcelona, moreover improved and innovated on its basis.
1. The motor ways are completely separated from pavement ways, and pedestrians cross the road through an underground passage or overbridge.
2. Closed community, the vehicles are forbidden to enter. All roads inside the community are used for residents' leisure activities, the stations are set up only at the junctions of roads inside the community and peripheral annular roads, for vehicles to stop and residents to get on or off.
3. Due to the closed community, the goods can not be transported directly into the community. Therefore, the special stations are set up for goods loading and unloading. Goods are delivered through unmanned aerial vehicles and intelligent express robots in the community.

2.1 Concept Mapping

2.2 Concept Vision

Jaywalking legalization

by **Suo-Yu Chang**

November 3, 2017: 10:10 AM ET

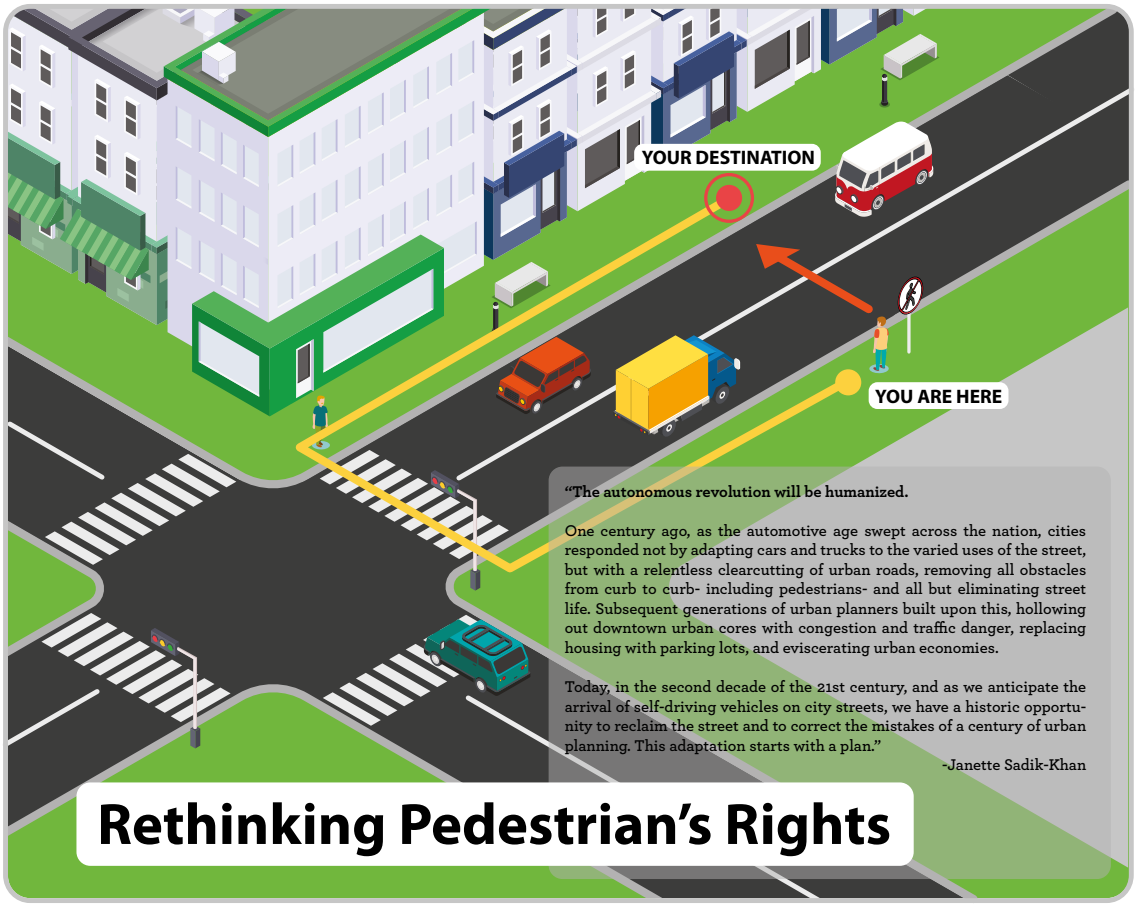
Self-driving cars could make jaywalking legal

Self-driving cars could convert cities into pedestrian paradises.

In 1920, the term "jaywalker" was controversial, according Peter D. Norton, author of "In Fighting Traffic: The Dawn of the Motor Age in the American City." It was popularized as a putdown for someone who didn't know how to walk properly in a city. In 1925, a law passed in Los Angeles making the move illegal and police arrested some offenders.

Jaywalking is still generally illegal, but not the rule is often not enforced. If streets are occupied by self-driving cars in the future, perhaps the biggest shift in city culture, according to NACTO, would be how easy it would be to cross streets.

1.1 Emblematic Fact

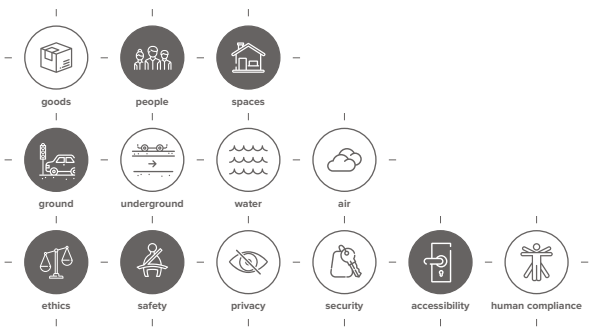


1.2 Problem Setting

Jaywalking legalization

by **Suo-Yu Chang**

Concept Matrix

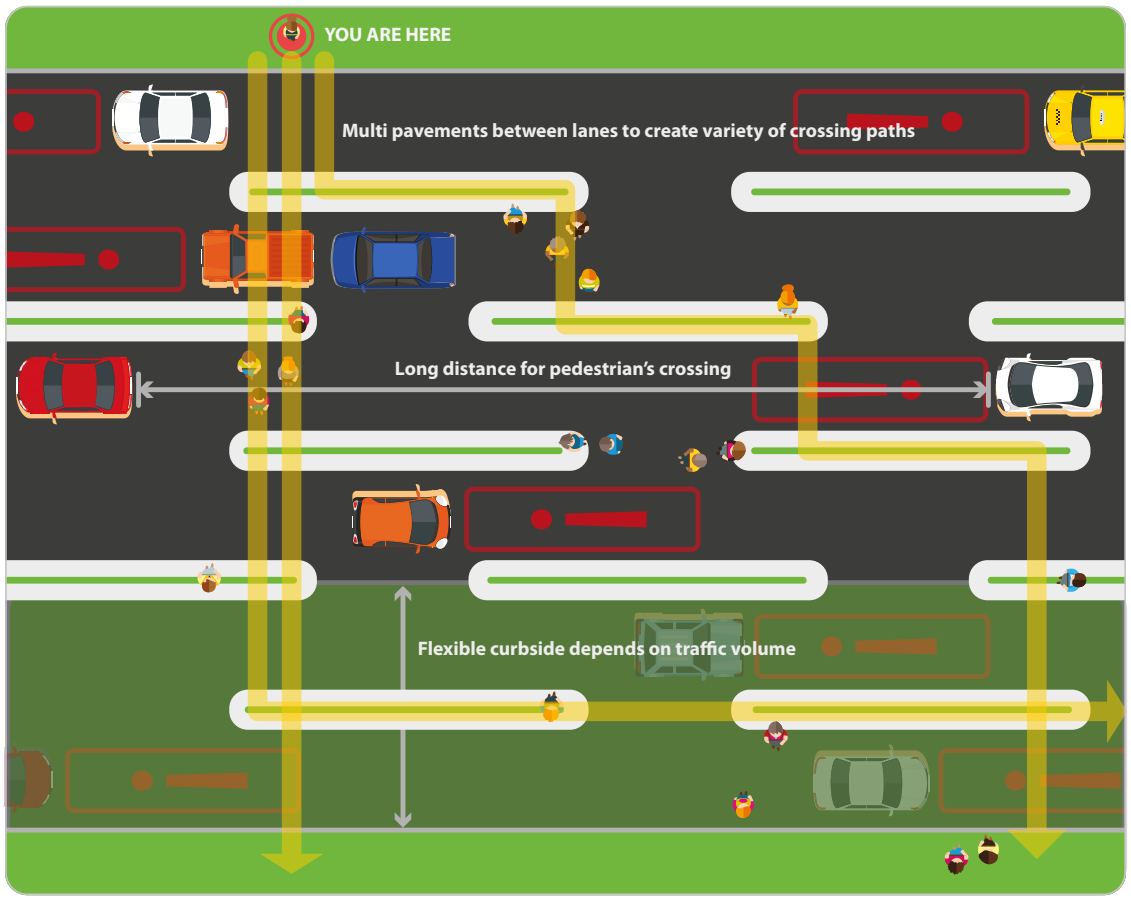


Collingridge Positioning

technology ideation — **technology adoption**

With self-driving system approach, traffic signals will be not necessary to appear for directing traffic, and vehicles will drive more carefully to ensure pedestrian's safety. To give back the freedom to pedestrians on the road, **Urban social responsibility manager** could reconsider the real thoughts of how people want in public space of the city.

Taking both people's right and traffic flow into account, the aims of this project is trying to make poeple travel in city more conveniently, but not influences the traffic. By setting up mutli-pavements between lanes and controlling vehicles' distance and speed, pedestrians can cross almost everywhere along the road. Priority will also change according to the traffic volume(divide the area by changing color), in other words the road will give more lanes to vehicles during rush hours in order to avoiding traffic congestion.



2.1 Concept Mapping

2.2 Concept Vision

CONCLUSIONS

Steps ahead in order to foster a responsible development of the self-driving society

Jonathan Hankins

Foreign Correspondent for the Bassetti Foundation, Board Member of the Journal of Responsible Innovation

As the arguments presented in this white paper and the literature cited seem to show, the responsible approach to the development of such technologies calls for a myriad of factors to be taken into consideration. One of the keys to understanding the problems involved lies in the title of this white paper itself, **the issue is the self-driving society**, and not merely that of self-driving vehicles.

These vehicles are not in fact self-driving or autonomous. **They rely on what lies outside their own structure** in order to (safely) function. They are subject to the influence of other road users as well as the roads and broader infrastructure, sign posting, levels of maintenance, recognition and user understanding of their capabilities and of course legal and governance frameworks. Design therefore is not just a matter of designing the vehicles themselves.

This interrelatedness of infrastructure, user, non-

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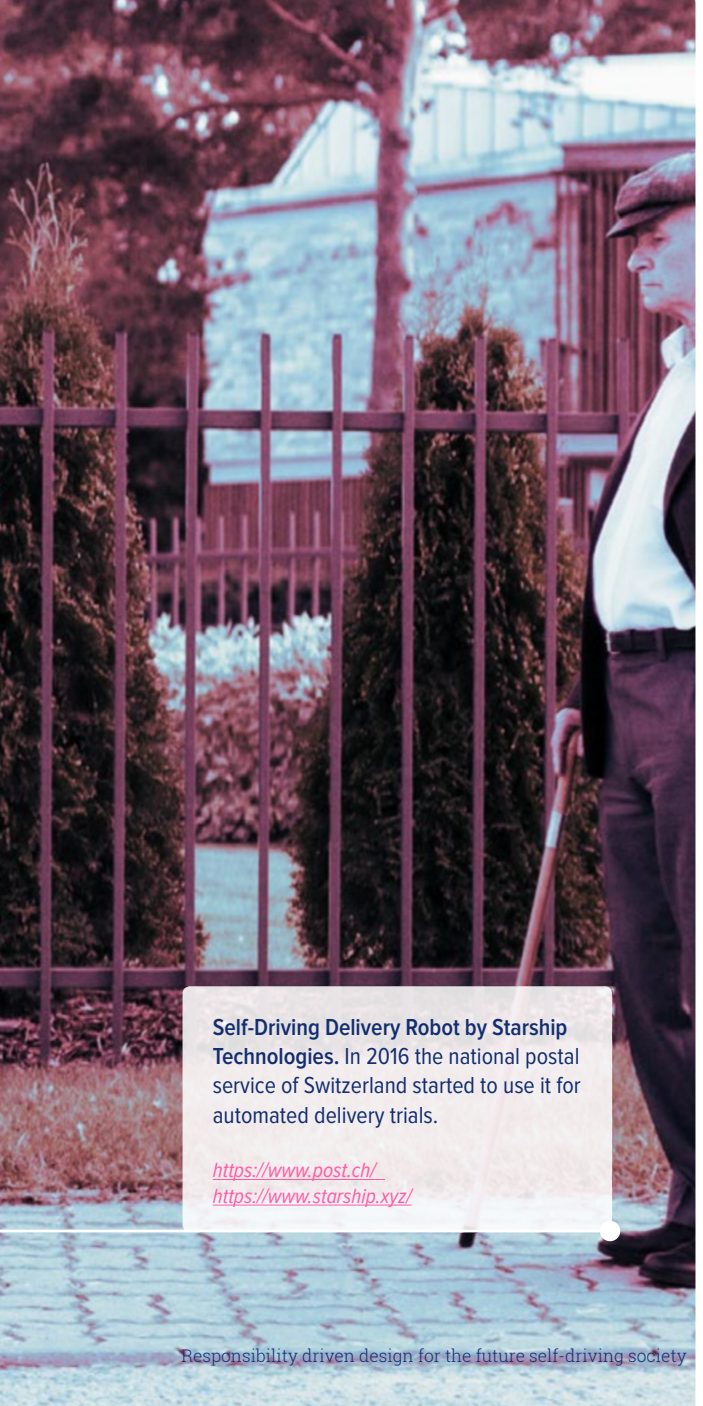

Self-Driving Delivery Robot by Starship Technologies. In 2016 the national postal service of Switzerland started to use it for automated delivery trials.

https://www.post.ch/
https://www.starship.xyz/

user, legal infrastructure and what we might call the surrounding environment also raises a host of issues from a broader moral perspective. How is legal responsibility to be ascribed? To what extent should the vehicle be programmed to protect the driver? How can decisions be made regarding inevitable accidents (who to kill and who not to kill, what to destroy and what to avoid, who is most likely to survive and impact etc.)?
In the article cited in this paper, Jack Stilgoe argues that there has been a shift in rhetoric **from problematizing the robot** (the control of the car) **to the problematization of the outside world**. Such a shift brings enormous political and ethical consequences, raising questions over the exclusion of some members of society, the funding of necessary infrastructure upgrades, and making individuals easier to recognize with all of its related privacy issues.
Once developers can demonstrate that their vehicles are safer and lead to fewer deaths the moral imperative will be towards making the roads safer for these safer cars. We will all be co-opted into this necessary improvement in the name of improvement.
All of which raises the question of how such developments could be responsibly carried out. At the moment the roads have been freely offered to the developers as a test bed, with the implicit assumption that responsibility for related problems is also passed over to the vehicle developers. Many might not see this as a responsible approach as it pinpoints the development of the driving technology as the focus for design, whereas this paper argues that the **design process needs to be much broader** if it is to be more responsible.
If we return to the Collingridge Dilemma earlier described (current developments might fit in the model presented on page six of this paper) we might come to the conclusion that the technology is far enough developed to offer a nuanced understanding of its consequences for a broader society, which if the case should mean that design intervention to address some of the issues outlined in this paper could (and we would maintain should) be addressed.
Addressing these issues will require a much broader discussion and participation in the design process involving a broad spectrum of stakeholders. Building upon its experience in responsible innovation **the Bassetti Foundation aims to open and promote this dialogue through the publication of this paper and the work that will follow.** The goal is for full societal participation in the process, and we sincerely hope that you will join us in this quest.

FURTHER READING

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IBM Institute for Business Value

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A new relationship - people and cars: How consumers around the world want cars to fit their lives

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https://selfdrivingcars.mit.edu

https://autoalliance.org/connected-cars/

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http://money.cnn.com/technology/our-driverless-future/

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Fabio Besti is an interdisciplinary designer and researcher. He holds a Master Degree in Product Design for Innovation from Politecnico di Milano. For the Bassetti Foundation he is a Senior Consultant, leading projects in the field of design and academy. He conducts teaching activities and has organized several lectures and workshops for design schools such as Politecnico di Milano and Domus Academy.
He runs his design studio in Milan, through which he has developed projects for international brands and organizations such as the European Commission, Benetton, Corriere della Sera, NicePeopleAtWork and Giunti Editore.

Francesco Samorè

Secretary General

Giannino Bassetti Foundation

Francesco Samorè is the Secretary General of the Fondazione Giannino Bassetti, whose mission is to promote responsibility in innovation. He manages relationships between the Foundation and collaborating institutions.
He holds a degree in the History of Economics and a PhD in the History of Business and Company Finance.
Since 2014 he has been Adjunt Professor for Politecnico di Milano, teaching primarily in the School of Design.

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Fondazione Giannino Bassetti
per la Responsabilità nell'Innovazione

The **Fondazione Giannino Bassetti** came to life in Milan in 1994, and became a Foundation of Participation in 2016.
In coherence with the values expressed by the Bassetti family, the Foundation's aim is to **promote responsibility in innovation within both the national and international setting**, helping institutional, private and associational actors to orient their aims and goals and in considering them a factor of interest for the entire society; both in the techno-scientific field and regarding governance models.

The Foundation of Participation aims to:

- contribute to making all of the different actors that participate in innovation decisions aware of the consequences and responsibilities that their roles entail;
- to support the relationship between civil society and its institutions, contributing to scientific research and developing tools for the spread of responsibility in the technosciences, life sciences together with biomedical and oncology laboratories, in bioethics, in governance, in finance, and in business;
- participate in international projects and consortium, contributing to the evolution and development of the definitions given to responsibility and innovation by the European Union;
- collaborate with public entities in the promotion of governance projects that lie within the specific competences of the Foundation and its collaborators, participating within organizations that operate in similar fields and forming project partnerships in collaboration with other entities tied to public administrations.

In the 1994 Statute, the objective to "create a new and renewed awareness around the memory of a precedent, a modern and widespread sense of social, civil and political responsibility amongst those who innovate" was set.

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