Routledge Equity, Justice and the Sustainable City series

DISRUPTIVE TRANSPORT

DRIVERLESS CARS, TRANSPORT INNOVATION AND THE SUSTAINABLE CITY OF TOMORROW

Edited by
William Riggs

ROUTLEDGE

Disruptive Transport

With the rise of shared and networked vehicles, autonomous vehicles, and other transportation technologies, technological change is outpacing urban planning and policy. Whether urban planners and policymakers like it or not, these transformations will in turn result in profound changes to streets, land use, and cities. But smarter transportation may not necessarily translate into greater sustainability or equity. There are clear opportunities to shape advances in transportation, and to harness them to reshape cities and improve the socio-economic health of cities and residents. There are opportunities to reduce collisions and improve access to healthcare for those who need it most—particularly high-cost, high-need individuals at the younger and older ends of the age spectrum. There is also potential to connect individuals to jobs and change the way cities organize space and optimize trips.

To date, very little discussion has centered around the job and social implications of this technology. Further, policy dialogue on future transport has lagged—particularly in the arenas of sustainability and social justice. Little work has been done on decision-making in this high uncertainty environment–a deficiency that is concerning given that land use and transportation actions have long and lagging timelines.

This is one of the first books to explore the impact that emerging transport technology is having on cities and their residents, and how policy is needed to shape the cities that we want to have in the future. The book contains a selection of contributions based on the most advanced empirical research, and case studies for how future transport can be harnessed to improve urban sustainability and justice.

William Riggs is an Assistant Professor at the University of San Francisco, USA.

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Disruptive Transport
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Part I

The big picture

1 Introduction

William Riggs

A new story emerges daily about disruptive transport—be it ride services, scooters, dockless bikes, or self-driving cars. Such changes can seem overwhelming, particularly with how quickly technology is evolving. The auto industry is rapidly embracing a broader mobility concept (not just making cars) and competing with technology companies to deliver smart and on-demand mobility services as quickly as possible. Government at all levels is working to ease vehicle requirements of the emerging platforms and relax safety standards for vehicles to encourage innovation (McKay 2017) while at the same time being pressured to grapple with new mobility services and an increasing number of things like e-bikes and scooters flooding streets in many cities.

Many societal benefits result from this accelerated vehicle design innovation and evolution in the mobility sector—including the potential for saved lives, due to reduced collisions, and increased productivity while driving (Riggs and Boswell 2016), but there is a flaw in this vehicular focus. It is a dialogue that focuses solely on the vehicle and not on the city around it.

While this may sound simple, our cities are complex organisms that support more than just automobiles. Yet disruptive transportation could dramatically reshape them, for good and for bad. For example, personal transportation devices like e-scooters or Segways could provide cheap mobility to people at the fringes of cities, providing greater access to jobs and housing.

Likewise, technologies like Hyperloop could reshape the cost of long-range travel between cities. There are also exciting possibilities for cities to rethink streets as autonomous vehicles become more prominent. Consider the width, traffic direction, and allocation of road space for vehicles. Might cities optimize space for bicycles and pedestrians in an autonomous future? Does two-way traffic really matter in an algorithmically-driven traffic system?

Alongside these travel shifts, possibilities exist to change how cities support logistics and deliveries. Might cities more aggressively zone deliveries by time, type, and location in the future? There are also opportunities to rethink urban land use and growth, for example, developing parking lots and auto servicing real estate into new uses. Or perhaps we might prioritize housing on former roadway parcels to help address the housing crunch that many of our cities face. We might consider suburban growth or encourage dense downtown.

We might set up standards to ensure transportation accessibility at all socio-economic levels in the autonomous future.

If any of this interests you, then you are in the right place. There are many impacts of new transportation innovations, and this book focuses on those that impact the city and its environs, and how we plan and grow a future for us all that is both sustainable and socially just. We are already seeing increases in driving caused by transportation network companies like Uber and Lyft, and changes to how most of us travel because of mobile phones and e-commerce (Clewlow and Mishra 2017; Clark and Larco 2018). Now is the time for us to start a conversation about these changes and to map out policy for our cities. If not dealt with thoughtfully, disruptive transport could pose a major challenge to the livable, sustainable, and equitable future of cities.

Richard Florida (2017) recently suggested that we may be near the end of the urban century, documenting a revival of suburbanism and alluding to the fear that millennial preferences toward urbanism are overstated. This is a pessimistic view of the future, yet within this pessimism I believe there is some hope.

If our society is really at the apex of the urban century, a century that has brought us a more just and prosperous city, then we need to consider what kind of future we want—and clearly this future involves creative, dynamic, and disruptive transportation. But we need to have dialogue about more than vehicles—and that's the point of this book.

But before we jump to that conversation and an outline of the book, I think it's important to frame some terms and transportation speak that will come up as a part of this book, as well as a key assumption. Let's start with the terms.

Key terms

First and foremost, my authors and I will use the terms new mobility, disruptive mobility, and future mobility synonymously and interchangeably. The goal in using these terms to describe one thing is to provide you, the reader, a little variety but also to be encompassing of many new and emerging forms of transportation. In this book we talk about bikes, scooters, trains, shuttles, cars that drive themselves, and touch on drones. We don't pretend that this encompasses all of the crazy and cool transportation innovations that will arise in the next twenty years, but hopefully, we can have more long-term impact on things like land use, housing, social equity, and the environment by starting a broader discussion about new and disruptive transportation that "jump-starts" action.

Key acronyms

AV:	autonomous vehicle
ART:	autonomous rapid transit
CEQA:	California Environmental Quality Act
LiDAR:	light detection and ranging
MaaS:	mobility-as-a-service
MPO:	metropolitan planning organization

OEM: original equipment manufacturer
RTP: regional transportation plan
TNC: transportation network company

Second, we are all excited about the promise of autonomous vehicles, and we talk a lot about that in this book. We use the term autonomous rather than automated, which is more proper, and self-driving, which is less formal. We abbreviate it AV, but as for the term, it's a bit of hybrid between the formal and informal, yet it has a whole background in itself. Here's an excerpt from a recent American Planning Association report I authored with Jeremy Crute, Tim Chapin, and Lindsay Stevens that provides more information on how autonomous cars work and how they are classified.

What is an automated vehicle?

> Automated vehicle technology is an umbrella term that includes a wide variety of features and technologies that enable vehicles to take control of some or all of the major driving functions normally completed by the driver. This includes fully autonomous vehicles that no longer require a human driver to operate them, as well as a range of advanced driver assistance systems (ADAS) that enhance driver safety by taking temporary control of one or more driving functions (speed, lane position, braking, etc.).
>
> An autonomous vehicle no longer requires a human operator to drive. Instead, the vehicle navigates streets safely and efficiently through a complex mix of software and hardware that combines remote sensing, recognition algorithms, network analysis, and "experience" drawn from millions of hours of driving that is shared across AVs. The vehicle's combination of sensors, cameras, light detection and ranging (LiDAR or light radar), high-definition maps, and advanced software creates a digital picture of its surroundings and makes intelligent driving decisions on routing and maneuvering without any input from an operator or information broadcast by infrastructure or other vehicles.
>
> More specifically, just as radar does with radio waves, LiDAR shoots pulses of light and measures how long it takes for the light to return to the sensor to assess how far away an object is. Placing an array of rotating lasers on top of an AV provides a continual 360-degree "point cloud" or picture of the vehicle's surroundings. The vehicle's central computer can then be programmed to recognize specific LiDAR returns as another car, a pedestrian, or even a stop sign. LiDAR systems are typically supplemented by cameras and other sensors to provide redundant detection systems that will not fail to detect objects that LiDAR could miss, particularly in the area immediately surrounding the vehicle. More sophisticated systems add another layer to this by assessing how surrounding vehicles and pedestrians are moving and predicting where they will go next. In the case of a pedestrian crossing the street, the vehicle can predict the pedestrian's movements and begin slowing down before the pedestrian enters the street instead of waiting until the pedestrian is directly in the vehicle's path.

Unfortunately, whether an AV uses LiDAR or cameras or both, it is very difficult for these systems to work properly in inclement weather conditions and poor visibility. Rain and snow refract the laser returns, and cameras struggle to identify objects accurately through precipitation, functionally blinding the AV.

Most of the attention on AVs is centered around fully autonomous vehicles because many of the technology's most significant effects on the transportation system and the built environment will only be viable when fully autonomous vehicles are adopted. However, AV technology includes a range of levels of automation. It is important for planners to be familiar with the full array of AV technology, because many semi-autonomous features and applications are already available today and will likely play a major role in the transition to a fully autonomous world.

In addition to autonomous vehicles, there is a wide range of automated technologies that can operate as standalone features. These range in sophistication and complexity from cruise control to autopilot. To classify these ever-evolving technologies, the National Highway Traffic Safety Administration (NHTSA) and the Society of Automotive Engineers (SAE) International developed a classification system that divides automated technologies into six levels of vehicle automation. These range from 0, where the driver is in complete control of all driving tasks at all times, to 5, where the vehicle is designed to perform all driving tasks without an operator (SAE International 2016).

With Level 1 automation, the driver remains in control of the vehicle, but the technology can assist the driver by controlling one of the vehicle's functions, either its speed or lane position. Level 2 takes this a step further by allowing the vehicle to control two driving functions at the same time. A vehicle with Level 3 automation can take full control of the vehicle for certain parts of a trip, but drivers must be ready to take back control of the vehicle when the vehicle prompts them. The vehicle takes full control of all major driving functions in Level 4. Level 4 vehicles can even drive themselves for the entire trip, but they are only able to do so under specific conditions. Finally, Level 5 automation refers to fully autonomous vehicles that can operate without an operator in all conditions and without the capability for a human to retake control.

Automated driving features that aid the driving process but do not fully control the vehicle (Levels 0, 1, and 2) are generally referred to as advanced driver assistance systems (ADAS). Even though fully autonomous vehicles have received most of the attention and are the focus of this report, ADAS can significantly improve driver safety, thereby improving user mobility.

Assumptions

Now that we covered a couple of key terms I'd like to run by one key assumption—that of the idea of an ecological consciousness. What do I mean by that? I mean that each of the authors in this book likely has a bias toward environmental stewardship in a way that preserves the planet for generations to come. The term ecological consciousness comes from esteemed Jesuit scholar Thomas Merton. In 1968 he wrote to Barbara Hubbard, who was then director of the Center for American Living in New York (Merton 2008). He discussed the advent of the millennial consciousness that was driving innovation like the space race and the emerging digital revolution, and he noted the importance of a balanced "ecological consciousness" in the face of this new technological innovation. He called for a balanced exuberance saying,

> The real thing is about to happen: the new creation, the millennium, the coming of the Kingdom, the withering away of the State, etc. But if you want to entire into the Kingdom there are certain things you have to do. They consist partly in acts which destroy and repudiate the past (metanoia, conversion, revolution, etc.) and partly in acts which open you up to the future.… The ecological consciousness says: look out! In preparing this great event, you run the risk of forgetting something. We are not alone in this thing. We belong to a community of living beings and we owe our fellow members in this community the respect and honor due them… we must not try to prepare the millennium by immolating our living each, by careless and stupid exploitation for short-term commercial, military or technological ends which will be paid for by irreparable loss in living species and natural resources.… Life is sacred… that of plants and animals (as well as that of our) fellow man.

I am pretty confident that all of my co-authors share this love of life, the planet and their fellow humans, and we also believe that there has been very little discussion about the secondary impacts of disruptive transport, that grapples with issues of sustainability and social justice. We hope we can fill that role. So, with that, let's talk about how this book is structured.

Book outline

This book has sixteen chapters divided into three sections: a focus on the big picture (Chapters 1 to 3); then going small and exploring changes at the city scale (Chapters 4 to 9); going big again with ideas for the regional scale (Chapters 10 to 13); and then concluding with a vision for livability and sustainability (Chapters 14 to 16).

The first three chapters deal with the big picture of what is happening and what it means. This includes this introduction, which is followed by Chapter 2. In that chapter, Will Baumgardner, Christa Cassidy, and Melissa Ruhl from Arup talk about the promise of new mobility and what paradigm cities will follow in the disruptive transportation future. They grapple with the potential for urban accessibility gains and the idea of planning for multiple scenarios in an uncertain environment.

This is followed by Chapter 3, in which Ron Milam and I talk about new mobility that balances both promise and peril. The two of us attempt to balance between promise and peril focusing on some of the principle functions of transportation engineering and trip generation. The chapter talks about the essential factors transportation professionals consider in planning for development. It dialogues the way new mobility changes that paradigm and pulls out key principles and considerations that need to be considered in light of new and disruptive transport.

Chapter 4 moves from this broad topic to the city scale. Michael Johnson from Smithgroup works with me to write the kind of land use and design we should be engaged in, in light of disruptive transport. We explore how we might rethink open spaces around cities that are sometimes used to limit urban growth, and we offer insights on what kind of landscapes, urban infrastructure, and land uses planners should be considering in cities.

I then work Marc Schlossberg, Adam Millard-Ball, and Elizabeth Shay on Chapter 5, which focuses on the street itself. The chapter dialogues how a community might envision future streets and allocate the space on the road differently. It also explores programs that might be used to encourage more walking and cycling at the same time as supporting new forms of transportation from TNCs to automated vehicles. It concludes with key lessons for engineers exploring what neighborhood streets might look like in the future.

Chapter 6 with Deborah Stamm stays at the city scale and looks at the real estate implications of new mobility and the ways the technology will impact the space outside the vehicle—the urban environment itself. The chapter evaluates how the land currently dedicated to streets might be reused and how streets can become real estate assets that can be used for societal good, as things like parks, bike lanes, or affordable housing.

In Chapter 7, Ben Clark and Rebecca Lewis, from University of Oregon, focus on budgets at the city scale and how cities can get smart with revenue. This includes things like parking, the transit business, and speeding tickets. This is followed by Chapter 8 in which Josh Karlin-Resnick, Jeff Tumlin, and Meg Merritt talk about global examples of policies to direct new mobility. This includes inventory and curb management, along with best practices to begin planning for autonomous vehicles and prepare for changes in the way transit is delivered. The authors end with suggestions about how policy or programs may need to evolve to address the increasing challenges of technology-enabled transportation in cities large and small around the globe.

Chapter 9 provides a more data-driven and theoretical look at jobs and local economies. My University of San Francisco colleague Shivani Shukla and I look at the potential for increased revenues and the broader impacts on the economy. We grapple with the idea that even as our society becomes more technical, humans play a large role in the sustainability of our cities.

After that we jump back to the big picture on a larger regional scale. In Chapter 10, we hear from Greg Griffin who talks about co-producing mobility and ridesharing. He emphasizes the importance of governments collaborating with and listening to consumers. Chapter 11 then focuses on the electric and shared aspects of future transport. Stephen Zoepf and I focus on how these two factors can work in concert to promote social justice.