COURSE:

## Planning for Autonomous Vehicles: Contexts, Challenges, Opportunities

Many cities around the globe ask what automated vehicles will mean for their transit planning, traffic management, infrastructure, and their land use. A decade of unabashed hype has promised "full automation arriving shortly", but this cannot be right because what will arrive will be constrained to specific areas, roadways, times, distances, weather, and speeds for some time — likely decades.

But automation is coming, and one of many urgent questions we can ask is:

> *What should cities and stakeholders involved in future mobility be aware of and how can they prepare, in spite of the extraordinary uncertainty about the nature, variability, and diffusion of Autonomous Vehicle technology?*

The immersive course offered by Harmonize Mobility, "Planning for Autonomous Vehicles: Contexts, Challenges, Opportunities" consists of multiple lecture-plus-discussion modules provided in tailored formats over a two- or three-day period. Below is a full outline of its modules and associated discussion topics.

The course is designed for transportation, transit, and urban planners seeking to be prepared for the design and governance matters associated with a shift away from personal vehicle ownership and toward vehicle automation, digitalized transit systems and increasingly transit-oriented approaches to urban organization.
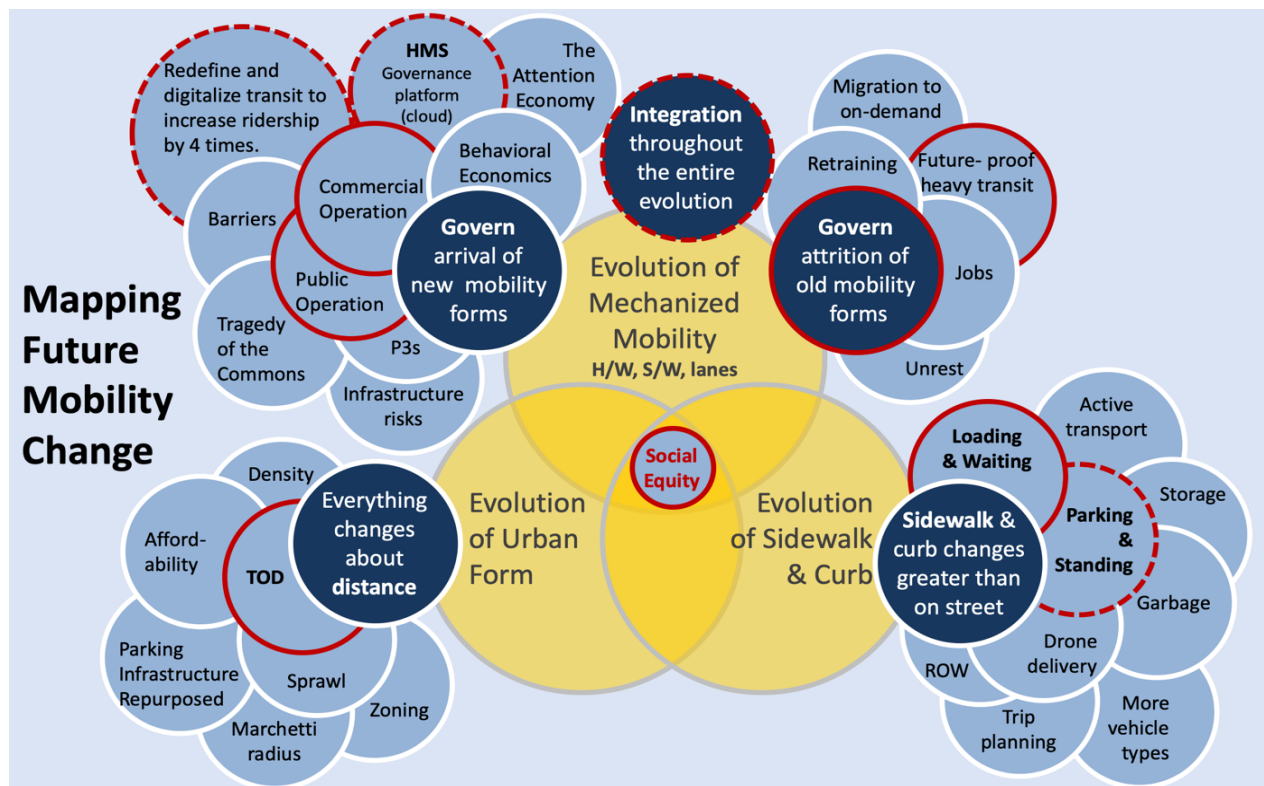
COURSE MODULES

CONTEXT

Two Markets. Critical distinctions are drawn between markets for car buying and ride buying to help understand whether we can or should plan for what will happen to cities or whether we should plan for what we want to happen. This module sets the stage for pro-action rather than re-action.

Discussion: How and by how much can our regulatory response push things in an intended direction?

Multiple Transitions. Mobility systems will be going through multiple concurrent changes – each of which will be interacting with many other changes in hard-to-predict ways. This will have significant and *wicked* impacts on planning.

Discussion: What are the two most difficult and the two most promising transitions? How might they unfold?

Conflicting Narratives. We hear a great number of oft-repeated narratives about the future of automobility and its automation. These polarize and create dissonant understandings of possible, realistic, desirable or unacceptable futures which, in turn, tend to confuse, dilute and delay planning responses to these potential changes. Where possible we seek a middle ground among these narratives to neutralize their power.

Discussion: What are the two most problematic narratives, and how might they be resolved?

Contexts of Change. The changing system of "driving" is only one of several contexts of change. It is the totality of contexts — social, built environments, technical, digital, jobs, monetization, intensification, disruption, transit, etc. that will influence how vehicle automation will change our cities, our societies, and our lives.

Discussion: What are the two most important contexts for your work? How will they influence your planning future?

Digitalization and New Mobility. We know what digitalization has done to print, retail, leisure, and many other industries. This is just beginning to happen to mobility. What is the full path this will take? Can we prepare for it, even while we cannot predict its changing form?

Discussion: Should digitalization be slowed or encouraged? How can it be governed or exploited?

CHALLENGES

Diffusion. We look at two theoretical diffusion models and a practical model on which staged and evolutionary plans can be built. This practical model will inform a tool for the 50%-City module to follow.

Discussion: What do you see as the first stages of autonomous fleet deployment for public access in your planning jurisdiction?

Barriers. There are barriers to the *acceptance* of automation, carsharing, and ridesharing. There are also independent barriers to the *deployment* of automation, and the diffusion of carsharing and ridesharing. These barriers comprise personal, social, regulatory, and infrastructural factors. Can we understand enough about these to work through them over the coming decades?

Discussion: How can we exploit or diminish two or more key barriers to get closer to a preferred outcome?

Mobility Justice. Mobility Justice and its four pillars of employment, environmental, social, and urban justice are reviewed. Can we address all these facets? How?

Discussion: What do you see as two or three of the most important mobility justice aspects to focus on in your planning jurisdiction?

Infrastructure Risks. This module looks at infrastructure development risks for autonomous vehicle deployment: Political & Regulatory, Governance, Funding & Financing, Industry Capacity, Innovation and Technology, as well as Environmental Sustainability & Climate Change.

Discussion: What do you see at the top two risks for your planning jurisdiction? How might they be mitigated?

50% Percent City. We consider what needs to be done to prepare a city/region to realize 50% of its motorized passenger travel in shared, driverless (non-rail) vehicles. We examine a recent proposal to the ISO that describes the wicked problem of standardizing curbs and sidewalks for automated vehicles for both passengers and goods.

Discussion: What are the most important aspects of preparing for the full, mature deployment of automated vehicles during this initial period? How long might this take? Can any aspects be ignored until later periods?

OPPORTUNITIES

Land Use. We consider that both intensification and sprawl will almost certainly happen. How might transit-oriented-development be re-interpreted? In what order will parking attrition roll out? How will parking garages be repurposed?

Discussion: What is a specific example of how you can take advantage of fixed or on-demand, automated, short-haul fleets to reduce car-ownership and increase transit ridership?

Autonomous Transit Fleets. Governments may wish to — or be forced to — own-and-operate fleets of autonomous buses, shuttles or robotaxis. A system for spatial diffusion of such fleets is described, including how it could be phased to be most effective in attracting ridership away from private vehicles and not simply cannibalize existing bus- and rail-transit systems.

Discussion: As new transit systems are phased in, legacy systems will undergo attrition. How can this massive dual shift be governed?

Software-Defined Transit. We review existing, digitalized programs used to integrate commercial, for-hire-vehicle (FHV) services with public transit. This allows cities and regions to extend and enhance current transit. "*Platformizing"* this approach allows us to build an optimized and integrated system under local jurisdictional governance in a new "specify-and-operate" model called Software-Defined Transit. This method *future-proofs* transit efficacy in an automated taxi and shuttle future.

Discussion: What are the most important demographics (by volume) in your planning jurisdiction that can be addressed early by the methods of Software-Defined Transit?

Behavioral Economics. We look at aspects of human economic and psychological behavior that can be relied on to avoid change or to cause many people to behave in apparently economically suboptimal ways. There also consider ways to use these human features to mitigate those same behaviors. This module focuses on ways to have automation, sharing and zero-ownership become more widely acceptable.

Discussion: Choose two or three of the BE principles shown, and discuss some ways to leverage them to nudge behaviour in desired directions.

What About Rapid Transit? If the municipal bus is threatened, does that mean rapid transit (heavy rail) is also threatened? How can we defend future ridership on our urban train systems?

Discussion: What are some ideas you would suggest to ensure that urban heavy transit (subway, LRT, BRT) remains viable in the face of cheap FHV services?

One City's Way Forward. As an example of one city's way forward, Toronto has begun to "plan for planning" for Autonomous Vehicles. This initial work is laudable and can teach us much. We review Toronto's overall "Tactical Plan" and touch on a few example elements.

Discussion: Which aspects of this Tactical Plan do you see as the most appropriate take-away for your city or region?

INSTRUCTOR

Bern Grush is Chief Innovation Officer at Harmonize Mobility and Automated Fleet Strategist with Grush Niles Strategic. An inventor and entrepreneur, Bern co-authored "The End of Driving: Transportation Systems and Public Policy Planning for Autonomous Vehicles" (Elsevier, 2018). He was named Toronto Star Wheels' Newsmaker of the Year for his research on vehicle automation. A Maclean's magazine editorial called his work "fascinating and carefully argued". In 2016, Gridlock Sam Schwartz, past NYC traffic commissioner, described Bern as the top, current independent thinker on autonomous vehicle deployment. Bern's recent innovation — software-defined transit — manages the social, spatial, and environmental policy performance of massive, competing fleets of TNCs and robotaxis. Bern's degrees include Cognitive and Human Factors Psychology from the University of Toronto and the MaSc in Systems Design Engineering from the University of Waterloo.

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READING RECOMMENDATIONS

The course is based on the textbook (available, but not required):

- The End of Driving: Transportation Systems and Public Policy Planning for Autonomous Vehicles (Elsevier, 2018)
- https://www.elsevier.com/books/the-end-of-driving/niles/978-0-12-815451-9

The following are also recommended reading:

- http://transweb.sjsu.edu/sites/default/files/1740-Niles-Automated-Vehicles-Transit-Agency.pdf
- https://transweb.sjsu.edu/sites/default/files/1903-Niles-Robotaxis.pdf
- https://www.linkedin.com/pulse/vehicle-automation-evolution-we-control-bern-grush/
- http://rccao.com/research/files/RCCAO_Vehicle-Automation_OCT2016_WEB.pdf
- http://rccao.com/research/files/RCCAO_Vehicle-Automation_Part-2_OCT2017_WEB.pdf
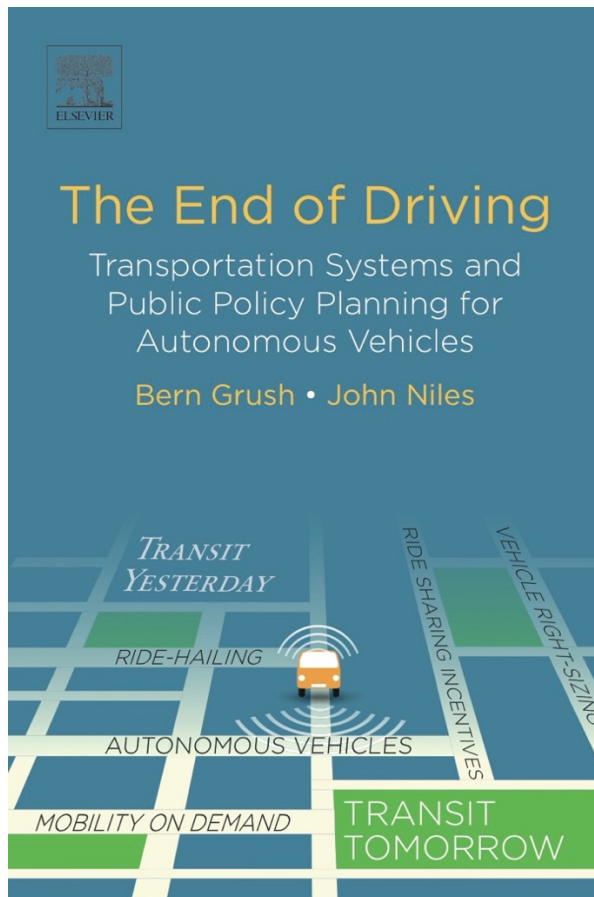
The principal source book for the course is available on both Elsevier & Amazon retail websites.

PARTICIPANT FEEDBACK

"excellent; very good information"

"thorough deconstruction of claims about AVs"

"the instructors are very passionate"

"good foundation for automation and its consequences for transit systems"

"reveals our actual state of preparedness"

"refreshing to hear about social challenges instead of focussing on the technology"

"in-depth… detailed; well-organized"

"good crash course on AVs"

"forward-thinking"

"fresh perspective on how AVs can be an opportunity or detriment to cities"

"extremely knowledgeable presenter"

"an entire book's worth in 12 hours"

"dense, fascinating, and multifaceted"

"Enjoyed it! Comprehensive overview of future scenarios, including projections, assumptions, and policy direction considerations"

tremendous amount of content, arranged and presented well and interestingly"

"valuable for planners and transit strategists"

"timely for challenges planners face from AVs"

"complete overview of AVs; informed, well organized, and with a lot of resources"

"excellent synthesis of up-to-date sources of information on AVs and associated fields"

"Not just technology … but focussing on the understanding of interconnectivity"

"diverse range of opinions/approaches"

"vast amount of perspective shared"

"ideas for short-range & long-range planning"

"good discussion of pitfalls"

"removed rose-colored glasses"

"backed by research, articles, reports, etc."

"exposure to challenges we face with regulation, infrastructure, and socioeconomic effects"

"appreciated the public private partnership discussions and the physical and digital infrastructure analysis"

"comprehensive collection of information, examples, data, and trends"

"a ton of ground in a short time; including inter-related problems across a broad spectrum of professions"

"critical, big picture thinking"

"vision of how we might think/plan for future of transportation regardless of uncertainties"

"a university course on AVs in just two days"