Re-Programming Mobility: How the Tech Industry Is Driving Us Towards A Crisis in Transportation Planning

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Abstract: New digital technologies are transforming why, where, when, and how people travel to their destinations. In recent years, these technologies have turned transportation from a physical infrastructure business into an information and informatics-based activity. Despite solving issues in some regards, this shift is introducing a number of new challenges for transportation planners, who need a comprehensive understanding on how they can accommodate the potential of these services while mitigating their unintended consequences.

An Epiphany

In late 2012, I spent a week in Israel on business. Over lunch one day, one of my clients - an experienced engineer in the tech industry - recounted a shocking story.

The previous summer, he told me (I later surmised it was around August 7 or 8, 2011), there had been a thunderstorm in Northern Virginia. Wind blew a tree down, a tree fell on a wire, and one of Amazon’s massive data centers went offline. The incident occurred around the morning rush hour in Israel. Now, at the time, something like 20 percent of Israeli drivers were daily users of Waze, a crowd-sourced traffic reporting and way-finding service. But the fast-growing company, founded just two years earlier, relied on Amazon Web Services’ (AWS) shared cloud-computing infrastructure to run its software.

When Amazon went down, so did Waze, and Israel’s drivers were blacked-out. Without the app’s turn-by-turn directions and jam-avoiding route planners, gridlock quickly set in across the tiny nation.

While AWS certainly did fail that day, and Waze reported service disruptions on its blog, no one at Waze will confirm or deny any aspect of the story. And both English and Hebrew language media coverage are non-existent. So despite rather vigorous attempts to do so, I’ve never been able to verify the scope of what actually happened and if my colleague’s story of mass national gridlock really took place.

But the veracity of this anecdote is beside the point...because it is totally plausible. And that plausibility speaks volumes about how Israel’s entire surface transportation system had literally
been re-programmed by a startup that had introduced a single critical point of failure thousands of miles away in another country, with apparently zero awareness on the part of the Israeli government’s transportation planners or defense strategists. (And no doubt, if the traffic was as bad as reported, this was certainly a national defense concern.)

**Technological Disruption Across the Value Chain**

Waze is just one of thousands of new digital technologies and services that have come to market in recent years that are turning transportation from a brick-and-mortar business into an information-based and informatics-based activity. Disruption is happening throughout the value chain. Some examples include:

- infrastructure networks: adaptive traffic signaling, dynamic electronic road pricing
- vehicles: autonomous motor vehicles, autonomous aircraft, programmable vehicle performance characteristics
- business Models: car sharing, peer-to-peer taxi services
- interfaces: electronic taxi hailing, crowdsourced traffic reporting, integrated multi-modal services (route planning, booking, and payment)

The result of all this investment and innovation is that city dwellers are increasingly dependent upon a growing array of digital services and technologies to make and manage their travel choices, and often to actually take the trip. These services are having real impacts on travel behavior - changing why, when, where and how people take journeys to work, home and other locations and activities. They are changing both the supply and the demand side of the mobility equation.

**The Coming Crisis in Transportation Planning**

The technological transformation of travel behavior is a rather new thing for transportation planners to grasp intuitively. Until now, transportation systems have largely been planned, designed and managed as purely physical infrastructure systems. Both supply and demand were treated as largely static, and demand forecasts were pretty crude and episodic. You basically designed the system, built it, and let it run, making infrequent adjustments.

Beginning in the 1980s and accelerating in the 1990s, transportation planning organizations began integrating digital technology into operations, developing a growing body of research, education and training, and prototypes they call “Intelligent Transportation Systems” (ITS for short). In the U.S., investment in ITS is almost exclusively focused on roads and motor vehicles, and the development of large-scale improvements to existing publicly-owned transportation systems such as automated toll collection, signal controls, dynamic road pricing schemes, and anti-collision technologies.

From a broader perspective, ITS misses the forest for the trees. As an operations technology, it isn’t focused on anything other than increasing throughput and improving safety, in the process neglecting broader transportation planning goals such as sustainability, livability, and accessibility. Often, a successful ITS deployment actually exacerbates the problems planners seek to address.
Ironically, where ITS has failed to address the complex transportation-land use nexus, recent private-sector innovation in transportation technologies and services are actually starting to address key concerns of transportation planning. For instance, carpooling services like Zimride, launched at the University of California Berkeley, but later deployed for two large music festivals (Coachella and Bonaroo), highlight potential business models for new mobility technologies. By providing tools to incentivize carpooling, services like Zimride could allow large amounts of parking to be freed up for development - potentially creating a virtuous circle of densification that could support transit. Similarly, the first autonomous features widely deployed in private vehicles may simply be for remote parking, or high-density garages with less area wasted on circulation. To an urban planner’s eye, it seems then that the true killer app for such technologies is unlocking hidden land value. Is Google really in the real estate business?!

Transportation planning is only slowly waking up to these developments. Internal debates in the field remain focused on infrastructure and urban form rather than the direct behavioral impacts of these new technologies. As a result, these high-value, high-impact innovations in transportation are coming from the private sector with little coordination or planning. And their collective impact and potential unintended consequences are not being adequately explored.

Take, for instance, the conflicts between Uber and local regulators. It is clear that the conflicts between innovators and regulators that we are seeing now are just an early indicator of much larger challenges to come. Modern urban transportation systems are being quite literally re-programmed by a new wave of information and communications systems developed and deployed by new technology firms directly to consumers. These are just the initial skirmishes in much bigger conflicts that will arise over how transportation systems work in 21st century cities, and the roles and relationships between public and private sector providers.

Why are planners not paying attention? It’s important to distinguish between the terms mobility and transportation. When we talk about mobility, we are talking about the potential to move. When we talk about transportation, we are talking about the system - and the use of that system - to actually move. Very little of the innovation we have seen in recent years is in transportation; most of it is in mobility via tools that allow us to navigate the options and opportunities in the transportation system. It’s a subtle distinction, but one that highlights where planning is falling short: it mostly focuses on the transportation, not the mobility. Startups are building services, not infrastructure, so they focus on the mobility piece.

**Equipping the Field for Disruption**

All of this raises some very serious existential questions for transportation management and planning. Why invest in formal transit when informal systems can achieve a similar impact? How can capital investment plans be made as revenue sources and forecasts change day-to-day due to disruptive innovations? How can exhaust data from private-sector operations be used to inform long-term planning?

Challenges to the status quo in transportation are emerging faster than we can even formulate these questions. Existing priorities are sure to shift, yet scholars and practitioners lack the capacity to assess and incorporate the implications of rapid advances in informatics. The transportation planning field’s focus on ITS has been myopic at best. To expect that fiscally-
strapped public sector organizations burdened by long planning cycles will lead is an act of hubris. The re-programming of mobility isn’t something that is being engineered by planners; it will be something they respond to on a constant crisis basis. For years, transportation planners have resisted this change, but this is no longer a tenable position.

Yet as much as these new technological band-aids are filling gaps in older physical networks, making up for 50 years of transportation planning failures, they are inadequate for the future. Transportation planning is just as important, if not more so, but the kinds of plans and their areas of inquiry must adapt to this new reality. There have been promising advances, such as using mobile phone location records to improve demand modeling, and using GPS trace data to map informal jitney networks in the global south. But transportation planning remains largely siloed within specific modes such as road or rail, while the greatest potential positive impacts of re-programmed mobility systems may be in the power to shift people between modes and make multi-modalism more feasible. This threatens planning organizations and planners embedded within that institutional structure.

Finally, in the U.S., transportation policy continues to revolve around investments in different modes and infrastructures and continues to treat ITS as just another type of infrastructure investment. There is no scope for dealing with the transformational aspects of new technologies, leaving efforts to deal with the public consequences of largely private actors in the arena to ad-hoc state and local efforts such as the lawsuits against operators of electronic hailing systems or bans on texting while driving.

**Ongoing Research**

At the Rudin Center, through a generous grant from the Rockefeller Foundation, we are collecting a database of several hundred new technologies and services, expert forecasts and speculation about their impact on transportation and land use, and emerging conflicts with regulatory and planning agencies. Over the coming summer, we will be clustering and synthesizing this information into a set of scenarios for the metropolitan U.S. in 2030 that illustrate:

- likely or possible shifts in the market for mobility, public financing schemes, and the overall structure and function of the U.S. transportation system at a metropolitan level,

- the organizational changes that transportation regulators, funding agencies, and public planning institutions need to begin preparing for now, and

- the skills and practices that will be required of transportation planners in the future.

Our goal is to spark a national debate about the potential impacts of these new technologies and services, and how government can accommodate their vast potential to improve transportation and anticipate and mitigate their unintended consequences.