Stuck in Traffic: Steering Offbeat Transportation Solutions through Human Pushback

From cars and bicycles in Norway and Denmark to motorbikes and gondolas in Vietnam and Brazil, countries around the world each have distinct approaches to transportation. I will experience the peculiarities of these systems and how transportation is evolving through the emergence of new technologies. Projects like self-driving cars in Singapore and autonomous drones in Rwanda signal the beginning of rapid and controversial changes in transportation. My Watson Fellowship will be spent investigating the fascinating ways in which governments solve traffic and transportation problems, and how citizens react to these changes through advocacy or resistance.

I'm a computer engineering major. I have not been trained to consider citizens' approval for my computer chip designs. Traffic and transportation problems, however, are often wrapped up in public debate. I'm interested in how traffic and transportation change over time, but this is one of those fields of engineering where there will be pushback from citizens. This pushback is what actually prevents the evolution of the system. I want to spend my Watson year exploring the engineering aspects of transportation, but they can't be fully understood without taking into account transportation's deep entanglement with culture, history, and communities worldwide. New technologies are enabling developments in all modes of transportation, from self-driving cars and drones to traffic direction and public transit. The countries I hope to visit — Denmark, Norway, Rwanda, Singapore, Vietnam, and Brazil — all have fascinating pasts and futures in transportation.

In Rwanda, for instance, many mountainous villages and homes are only accessible by foot, especially in the rainy season. The undeveloped roads often prevent the delivery of medical supplies, even in an emergency situation. The solution is a system of airborne, autonomous drones that are able to circumvent the issues on the ground. As an engineer, the application of drone technology is intriguing to me, but this solution couldn't be implemented without public support and approval from local communities. This program has had success in Rwanda, and effective community engagement is a part of that.

Just as local involvement is necessary for evolution in transportation in Rwanda, citizen input has shaped the development of city design elsewhere in the world. For example, in the 1970s, Curitiba, Brazil, was dealing with major congestion issues in its rapidly growing downtown area. People were unable to drive to anything located in the city center due to poor infrastructure and a lack of parking. The mayor's solution: ban cars. When citizens indicated they would use the courts to stop this law if it were passed, the mayor responded creatively. He passed the law at 5:01 p.m. on Friday, after the courts had closed, and spent the weekend erecting barriers around the city's roads. Citizens were furious at first, but the bold solution helped foster enormous growth in the city center, developing the city into one of the nicest in Brazil.

In contrast, the city-state of Singapore is looking for ways to use its crowded streets more efficiently as it rapidly grows. It's taking the drastic step of mandating tracking devices in each car to toll its drivers by precise distance travelled in order to reduce congestion. However, this will also enable Singapore to create an idyllic traffic control system. This is a big step for traffic infrastructure, but it leaves many of Singapore's citizens with serious privacy questions. They are concerned about the possibility of their government abusing the knowledge of their day-to-day travel.

In both Singapore and Curitiba, citizens have reacted to a significant change in transportation infrastructure with frustration caused by changes to their existing systems. São Paulo, another city I'll be visiting, has been one of the least welcoming cities to most transportation advancements in the world; bike infrastructure and public transportation are consistently shunned in favor of larger roads, something that is proven not always to be the most effective solution for hundred-mile long traffic jams, like those in Brazil. This resistance to change is fascinating to me. I want to get the perspectives of the citizens of São Paulo, Singapore, or Curitiba to see how they feel about the way their governments are approaching innovation.

I am interested in these perspectives because I get so frustrated by traffic and have learned that getting people around isn't as easy as finding an efficient solution. The people have to want the transportation you're providing them, and that isn't always the case. Uber drivers around the world have been ambushed or attacked at often-violent protests by taxi drivers. Bike clubs in Copenhagen and taxi companies in Singapore will have different perspectives on the advent of autonomous vehicles, and I'll consider both. While I can learn about traffic solutions in a classroom, this project will teach me the attitudes toward those solutions. I can't learn in a

classroom why biking is so important to Copenhagen or citizens of Vietnam resist buying cars even as they increasingly have the capacity to do so. These are culture issues, and their pertinence to these solutions is complex.

I can explore these innovations and related viewpoints by talking to the engineers, politicians, and everyday citizens who have been involved in changes as they've occurred. I'll reach out to local universities and those who have fostered projects in city government. I hope to integrate myself into the infrastructure of each country I visit, riding on every transportation option I can find. The world is full of imaginative infrastructure to make the transportation system work: bridges, tunnels, ports, train stations, and others all play an important role in the system, and they are also worth my attention. I'll visit a mix of developed and developing nations to get a sense of how their transportation options differ from those to which I've always had access. My project contains a mix of transportation options, including bicycles, cars, buses, trains, motorbikes, and drones. To study these methods, I will visit six different countries:

- For bike infrastructure, nowhere in the world can compare to Copenhagen, **Denmark**, where a combination of political incentives, substantial infrastructure, and cycling culture have created a city in which over half of the citizens commute to work by bike, 7 times as many as the best US city.
- Many cities across the globe have certain areas in which cars are banned, like old historical city centers or pedestrian malls, but most of those are rooted in precedent from before the automobile was so ubiquitous. Oslo, **Norway**, however, is making a sudden and drastic change to remove cars from a significant percentage of the city. Additionally, the country as a whole is attempting to end the sale of gasoline-powered vehicles by 2025, despite being one of the world's largest oil producers. These developments stem from a dedication to sustainability and will be coupled with investments in public transport and biking infrastructure.
- **Rwanda's** distinct and extreme rainy and dry seasons mean long periods of inaccessibility for many rural Rwandans, especially those living in the country's mountains. When it rains, it pours, and when it pours, the mountains' dirt roads become impassable . As a result, citizens might be left isolated, sometimes to the detriment of their safety. A startup working with the Rwandan government, called *Zipline*, is creating a truly unique solution: blood,

vaccines, and medicines delivered by drone. This innovation is already saving lives and could be the beginning of an entirely new form of package delivery.

- Extreme policy solutions are common in **Singapore** due its nature as a highly international city-state, which enables the government to take more risks than larger and more bureaucratic nations. New ways to track vehicles for efficient tolling and traffic management, as well as the biggest push for self-driving cars anywhere in the world, make Singapore the gold standard for exceptional technological innovation.

- The motorbike is the primary form of transport for most people in **Vietnam**. Its ubiquity is a product of a nation whose government developed road infrastructure for cars that were too expensive for many Vietnamese citizens, so roads were filled with this cheaper solution. The smaller vehicles are able to flow through intersections very efficiently, not stopping despite large volumes of traffic.

- Some cities in **Brazil** are known for their innovation in city design and transportation infrastructure, while others are known for their lack of it. Curitiba had one of the world's first pedestrian-only downtown areas, which was established in the '70s. The city also pioneered Bus Rapid Transit, a series of bussing-specific infrastructure developments that use buses to simulate rail for a fraction of the cost. Curitiba is countered by São Paulo, which struggles to implement relatively common solutions to traffic issues, like ride-sharing programs or biking infrastructure, due to resistance from its citizens.

I will spend my Watson Fellowship exploring the ways in which governments create fascinating solutions to traffic and transportation problems, and how citizens and communities inevitably take part in the process. I want to witness innovations in transportation, both from the past and present, but understanding traffic is not enough to appreciate the evolution of transportation today. Without considering local communities, and without public engagement, truly revolutionary change cannot happen.