Faster, Smarter, Greener
The Future of the Car and Urban Mobility

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My Aspirations

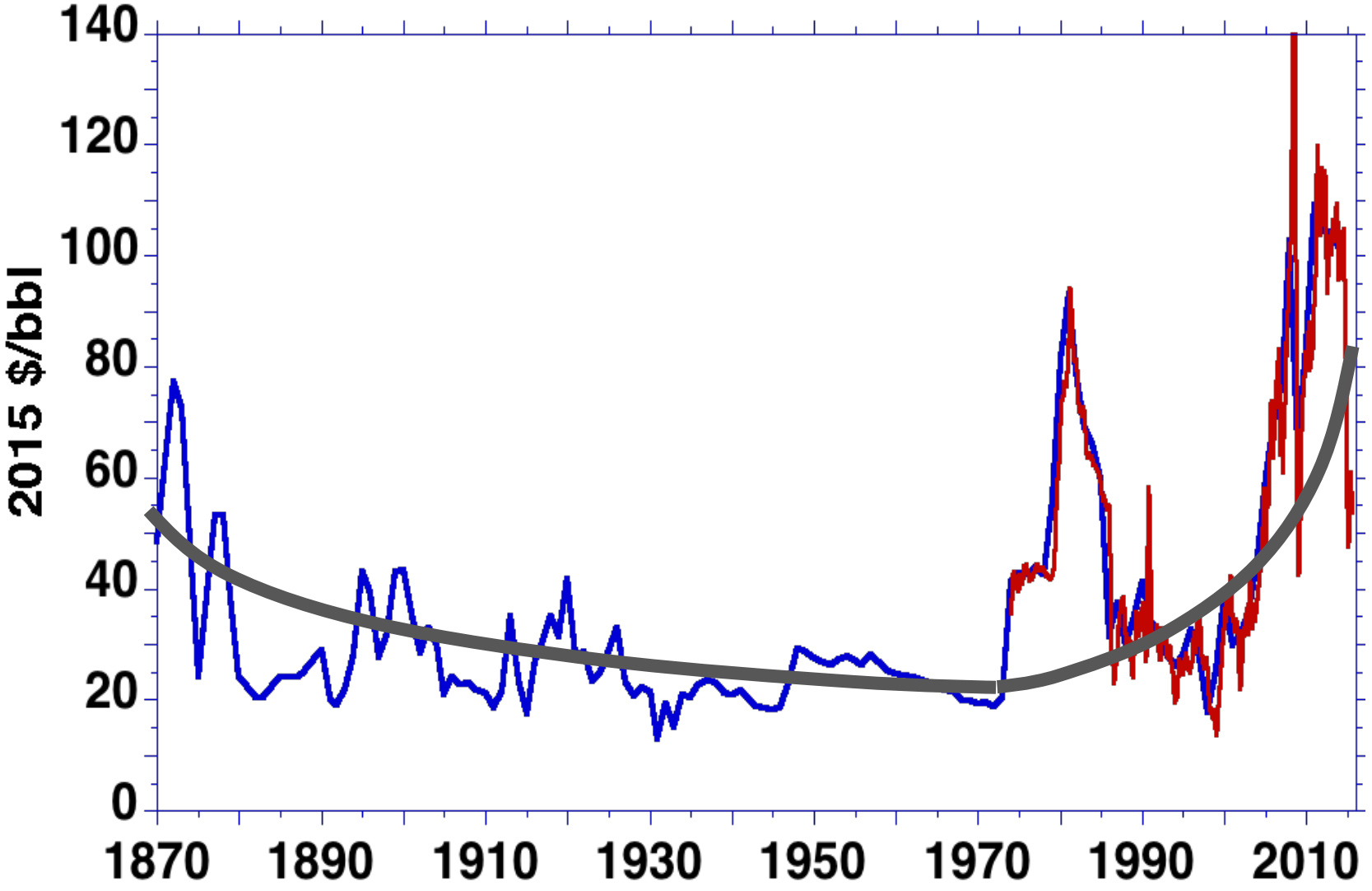
Say something useful and universal

My Expectations

To get feedback on how the work could be improved

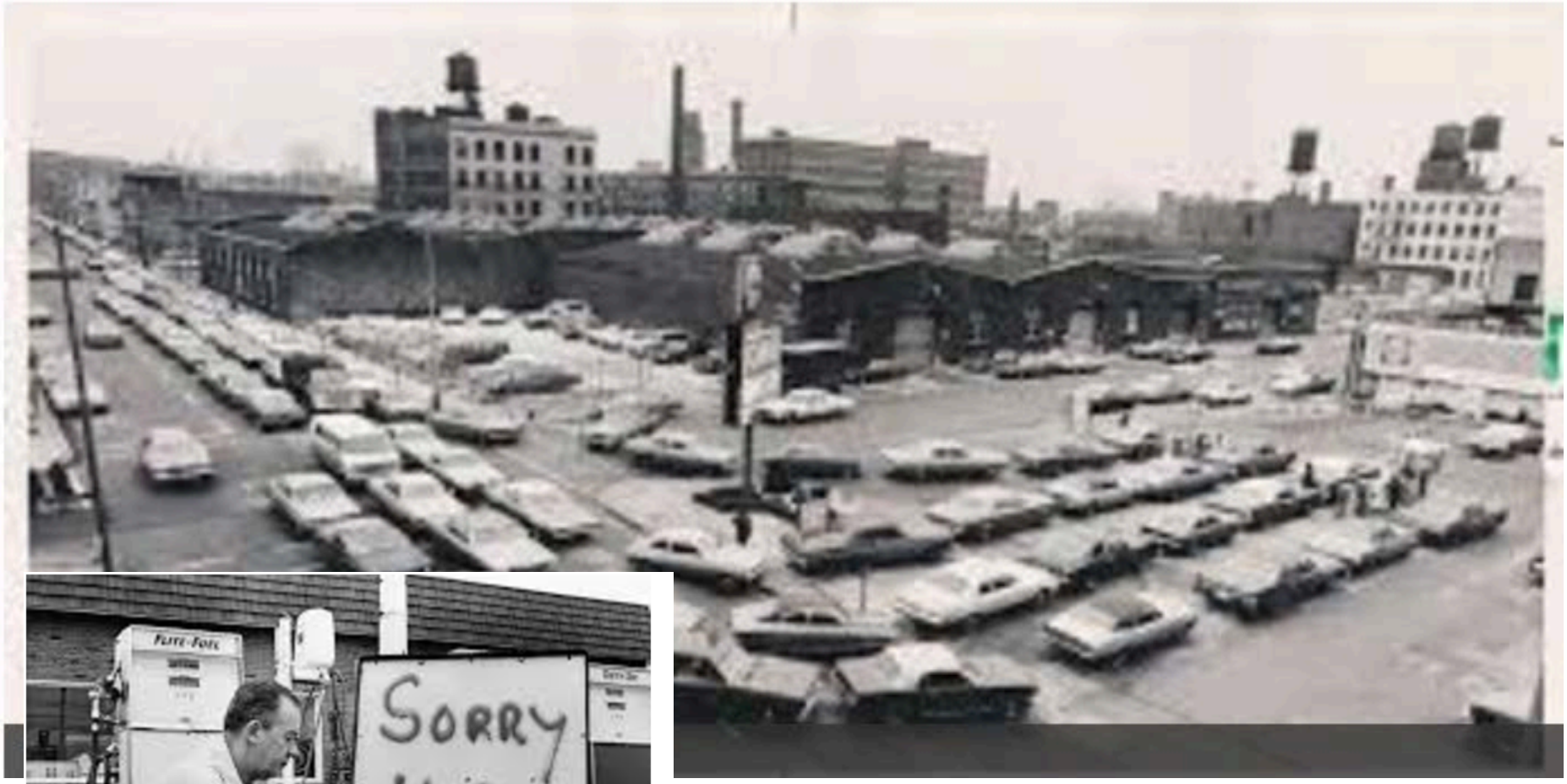
-- to be more useful and universal ??

Real Petroleum Price (2015$)



The Triple Crises of the 1970's

1. Energy Crisis
2. Pollution Crisis
3. Manufacturing Crisis




SORRY
NO
GAS

Figure 1.1 A view of the Los Angeles skyline, typically smothered in smog.
Source: Flickr. Photograph by J. Barreiros (CC BY-SA 2.0)


BEIJING 2016


TOYOTA
KILLING
AMERICAN
JOBS


U.A.W. says
"IF YOU SELL
AMERICA, BUILD
AMERICA"

Compulsory Trends Slide

Urbanization

- Density, Congestion, Local pollution

Climate Change –need to reduce energy use

- vehicle electrification, light-weighting,
- ride sharing, non-car modes

Ground Level pollution – Beijing, London, Los Angeles, Delhi, etc.

Consumers – love phones more than cars

-- use apps for every function

Technology – the rise of the robots – making cars, driving cars

Globalization vs. Anti-Globalization

Auto accidents kill more than wars and terrorism

Consumer Behavior

Is the love affair over?

Has the mobile phone replaced the automobile as the *Objet d'affection ?*

How much emotional attachment to your elevator?

Figure 4.1 Car culture in America. Cars emerged as central to many forms of social interactions and daily life. *Source:* (CC BY 2.0) simon17964.

Consumer Behavior:
“I want what I want and I want it now”

Figure 6.4 A digital generation demands a seat at the drawing board to create its own unique products and express its own personality. Certain product categories have successfully involved customers in custom-designing the products they purchase.

Source: Shoes of Prey.

Figure 6.1 The smart car from Mercedes-Benz is amenable to customization by its users. In an age of growing popularity for tattoos, it is no surprise that cars are getting to sport tattoos as well, perhaps matching that of their owners.
Source: (CC BY-SA 2.0) Kristin Ausk.

Consumer Behavior

Cars used to be employed to market everything from expensive luggage to designer sunglasses.

Now 4G LTE connectivity is being used to promote car models.

Where automakers used to boast of horsepower and acceleration times, now they trumpet data speeds, and seamless connectivity.

Per Capita distance driven in USA

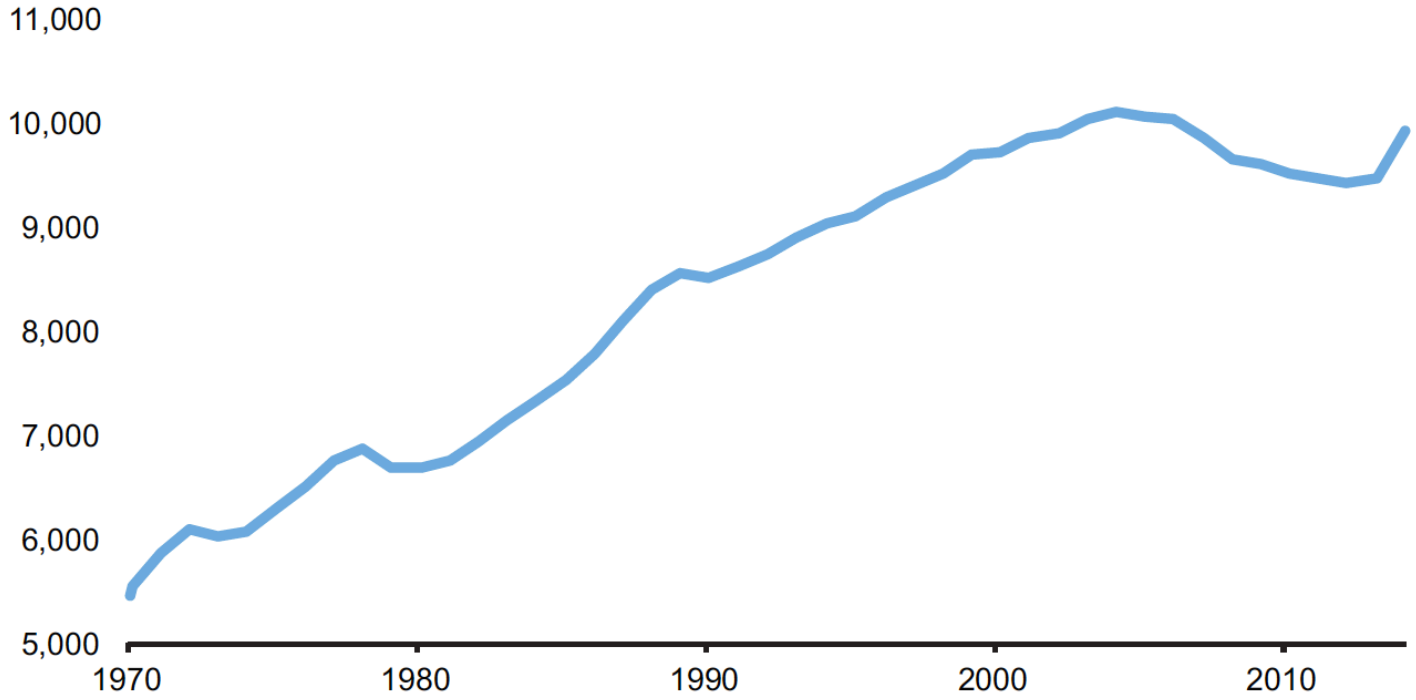


Figure 4.2 After secular growth for decades, per capita distance traveled annually by car in the U.S. shows signs of having peaked.

Sources: U.S. Department of Transportation, U.S. Census Bureau.

“Imagine, . . . no possessions”

The average consumer owned car is used for 4% of the average day.

Car sharing and ride sharing can dramatically increase capital productivity and e-connectivity with thick markets will improves the precision of deployment.

Congestion

In 2011, urban drivers in the US spent an average of almost a week trapped in their cars.

Driving time takes away from surfing time.

Home / Viral /

12 die in 3-day traffic jam at Indonesian junction called 'Brexit'

Published time: 8 Jul, 2016 15:33

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Technological Innovation: Fuel Efficiency

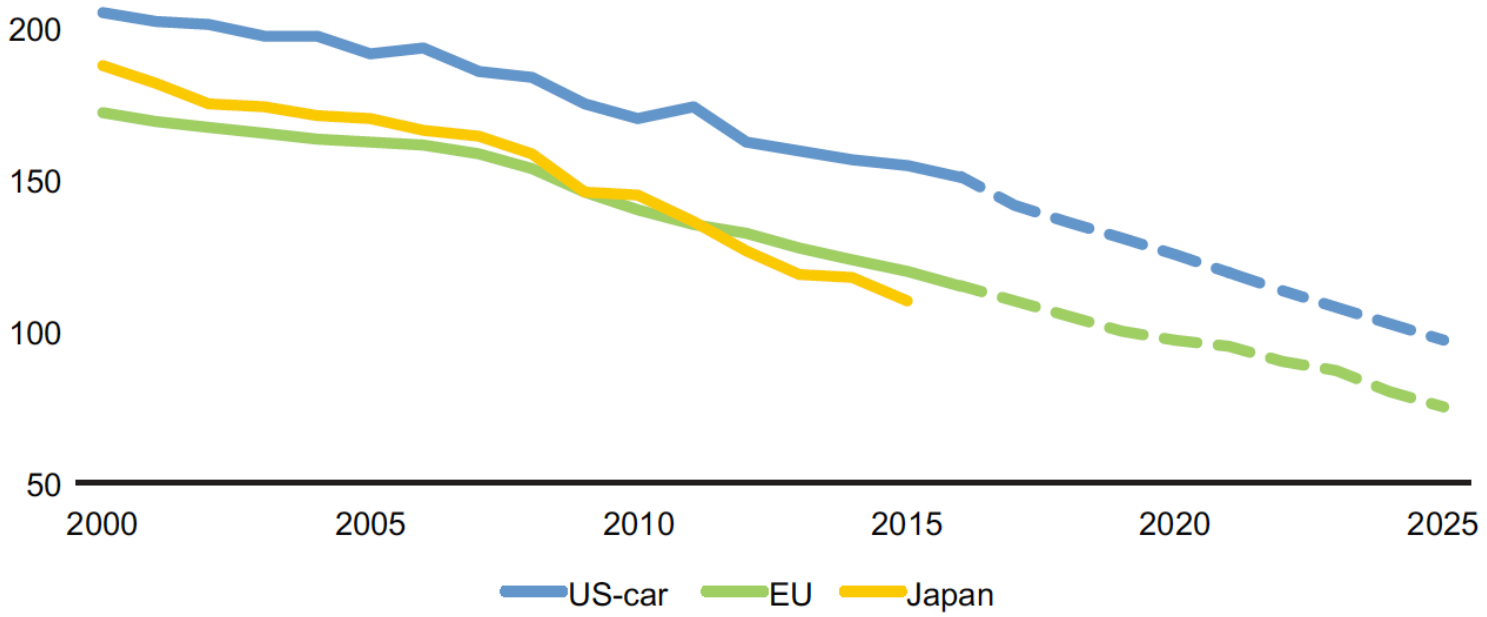


Figure 3.4 Grams of CO_2 per kilometer. Fuel economy improvements in the U.S., Europe, and Japan have been improving and new targets for 2025 promise substantial gains.
Source: International Council on Clean Transportation.

Technological Innovation: Electric Powertrains

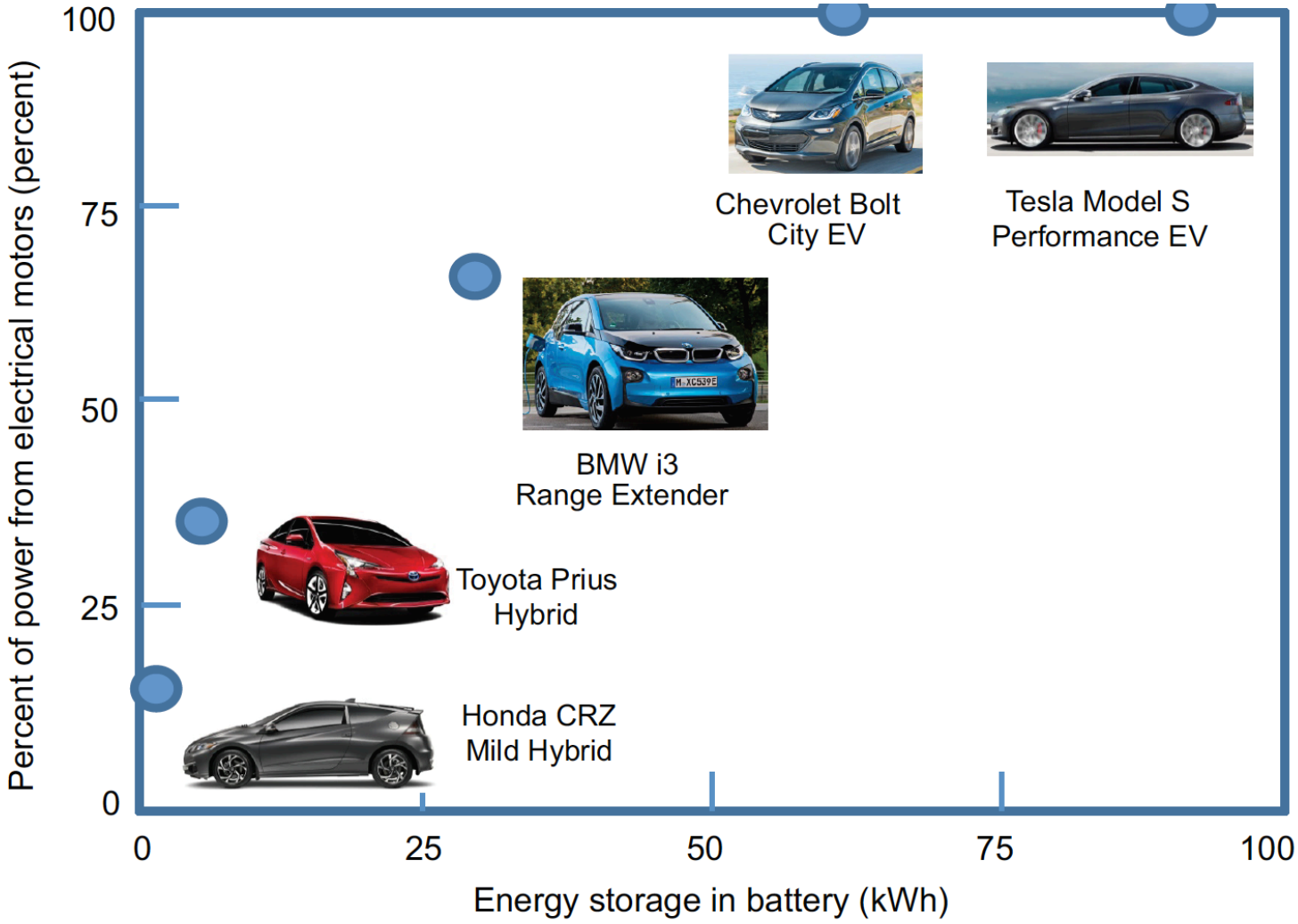


Figure 5.7 Electric and hybrid-electric vehicles come in various shapes and configurations, recognizing very different needs for users.

b.

Technological Innovation: Smaller, lighter footprints

Figure 9.3 a. The Renault Twizy. b. The Toyota i-Road. Slotting between scooters and small cars, these microcars are well suited to electrification and have a compact parking footprint. *Sources:* Renault and Toyota.

Technological Innovation: Autonomous Driving

Figure 8.5 Google has been betting on reaching SAE level 5 autonomy to avoid dealing with ambiguous human interfaces. While this remains a challenging goal, the company is betting that once this is mastered, its system will carry less risk.

Source: Google

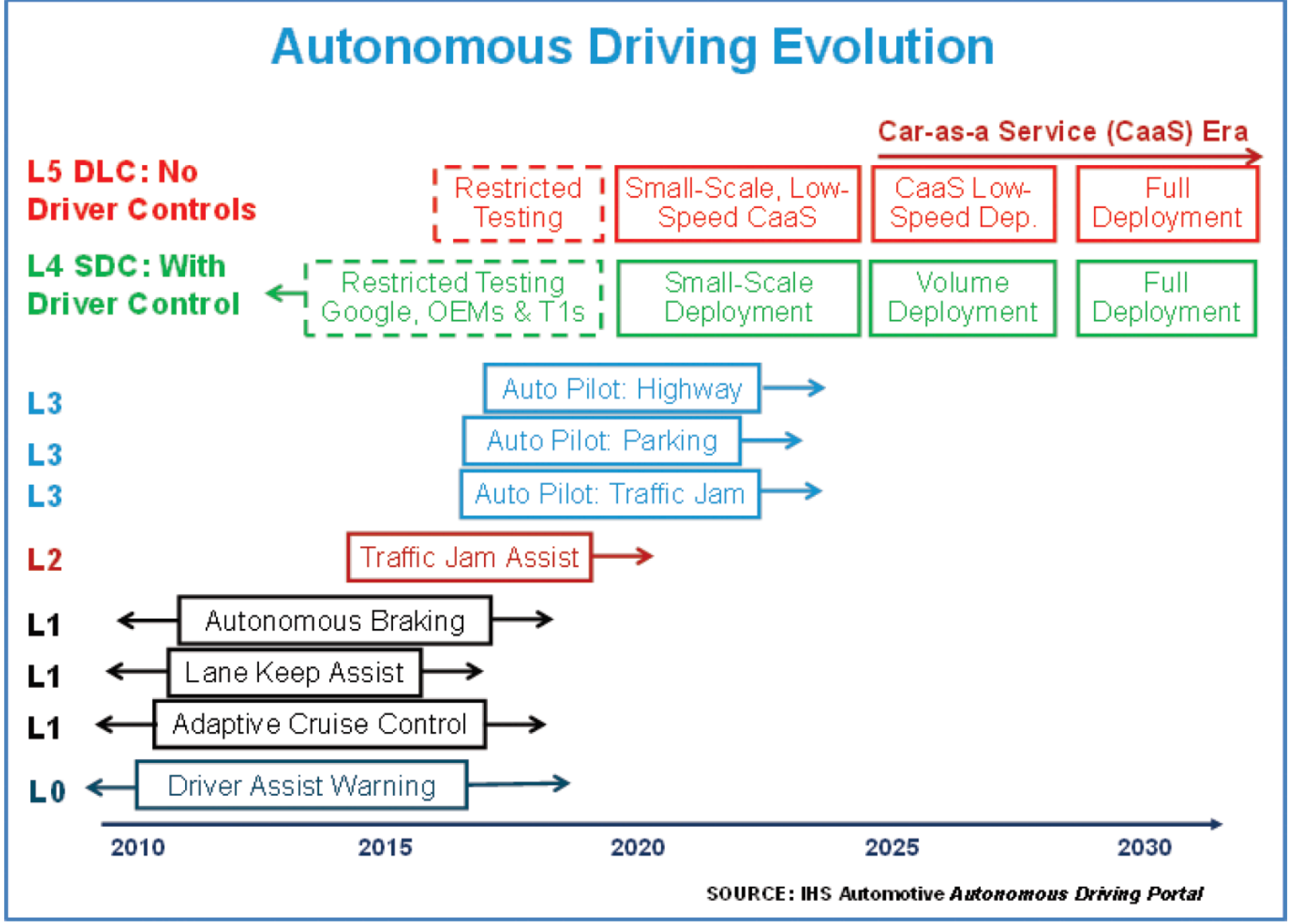


Figure 8.4 The degree of autonomous capability has been formally classified by the SAE. Parallel activities are under way across almost all the functions. Their deployment is expected to be phased in over the next decade.

Source: IHS Automotive.

Heterogeneous Modes

Welcoming Walking: Seoul, Korea

a.

b.

Welcoming Walking: Guangzhou, China

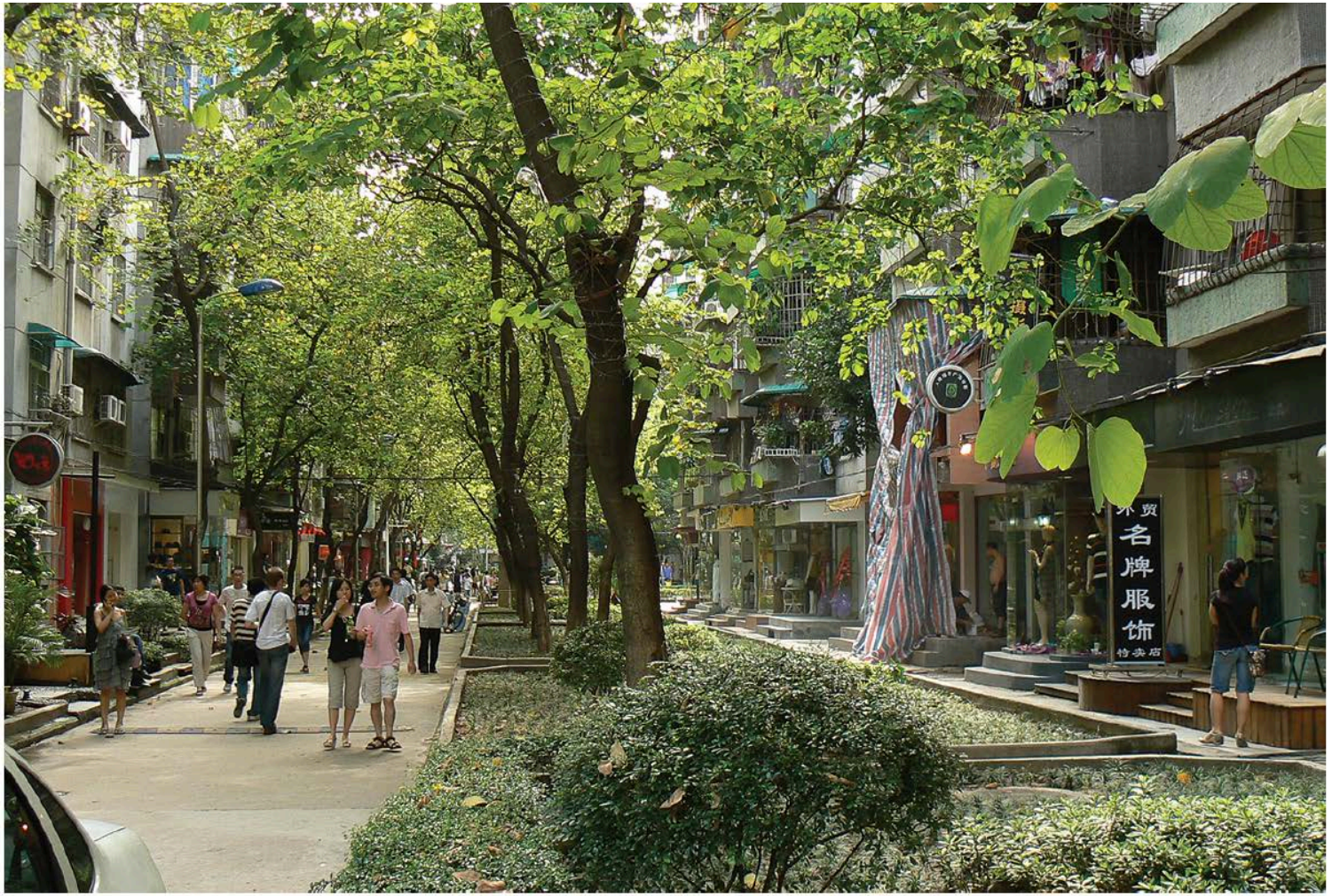


Figure 9.1 Many cities have taken advantage of unused urban spaces and converted them to attractive areas for exercise, recreation, and even pedestrian commuting. a. Seoul. b. Guangzhou. *Source:* ITDP and Karl Fjellstrom, New York.

Welcoming Biking

Figure 9.2 Some cities have elevated the importance of bicycles on their thoroughfares. The additional level of safety and ease of use draw more commuters away from their cars.
Source: Flickr CC0 1.0 Michael W Andersen.

Smaller Footprints (again)

Figure 9.4 Premium auto manufacturers are expanding their product portfolio to pay attention to urban commuter demands. Small city cars are valued for their ability to fit within crowded city streets with limited parking spaces.

Source: Car2Go, Daimler Mobility Services.

Making Buses Attractive to All

Figure 9.6 A modern city bus can employ a lot of the same technology that modern show cars boast—electric propulsion, zero emissions, semi-autonomous operation, and fully connected. *Source:* Daimler.

Connectivity: Buses & Bikes

Figure 9.7 Modern bus rapid transit systems can offer high-capacity mobility for medium-density routes at much lower investment than underground metros.

Source: ITDP, New York.

Connectivity: Buses & Bikes

Figure 11.2 Bike racks fitted on buses are a common sight in many university towns. They help expand the catchment area for public transit.

Source: Flickr CC0 1.0 Martin Ljungqvist.

Uberpools, Chariot, and Bridj (RIP)

Figure 10.3 Smartphone-hailed, crowd-sourced van rides are helping to blur the divide between public transit and private cabs.

Source: Ford Smart Mobility LLC.

Giving up car ownership

Figure 10.1 Zipcar boosted the popularity of shared vehicles by leveraging a network-connected customer, simplifying the transaction, offering local pickup spots, and allowing very short periods of use.

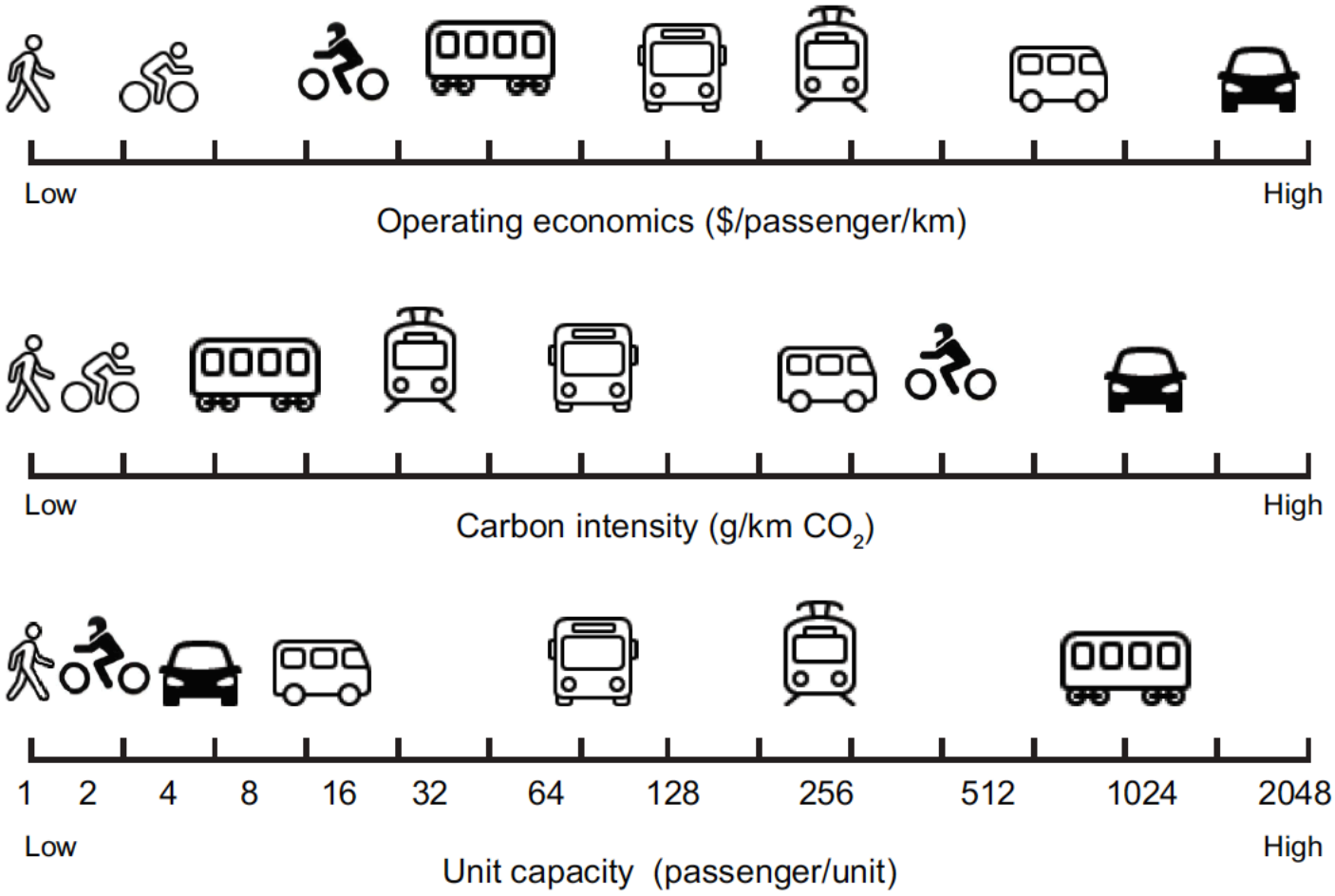
Source: Zipcar.

Ford MoDeMe: Car + Bike + Parking

Figure 11.3 Ford's MoDe:Me concept. These e-bikes are folded and transported in a car and used to overcome a common hassle in cities: the lack of proximate parking.
Source: Ford Motor Company.

Heterogeneous modes with different operating characteristics

a



Political tussles:
London taxis block roads to protest Uber

Figure 10.2 Protests like the one shown in London have emerged out of a sense that there is an uneven playing field for operators like Uber and traditional taxis.
Source: (CC BY 2.0) David Holt.

Connected nodes and Heterogeneous Paths

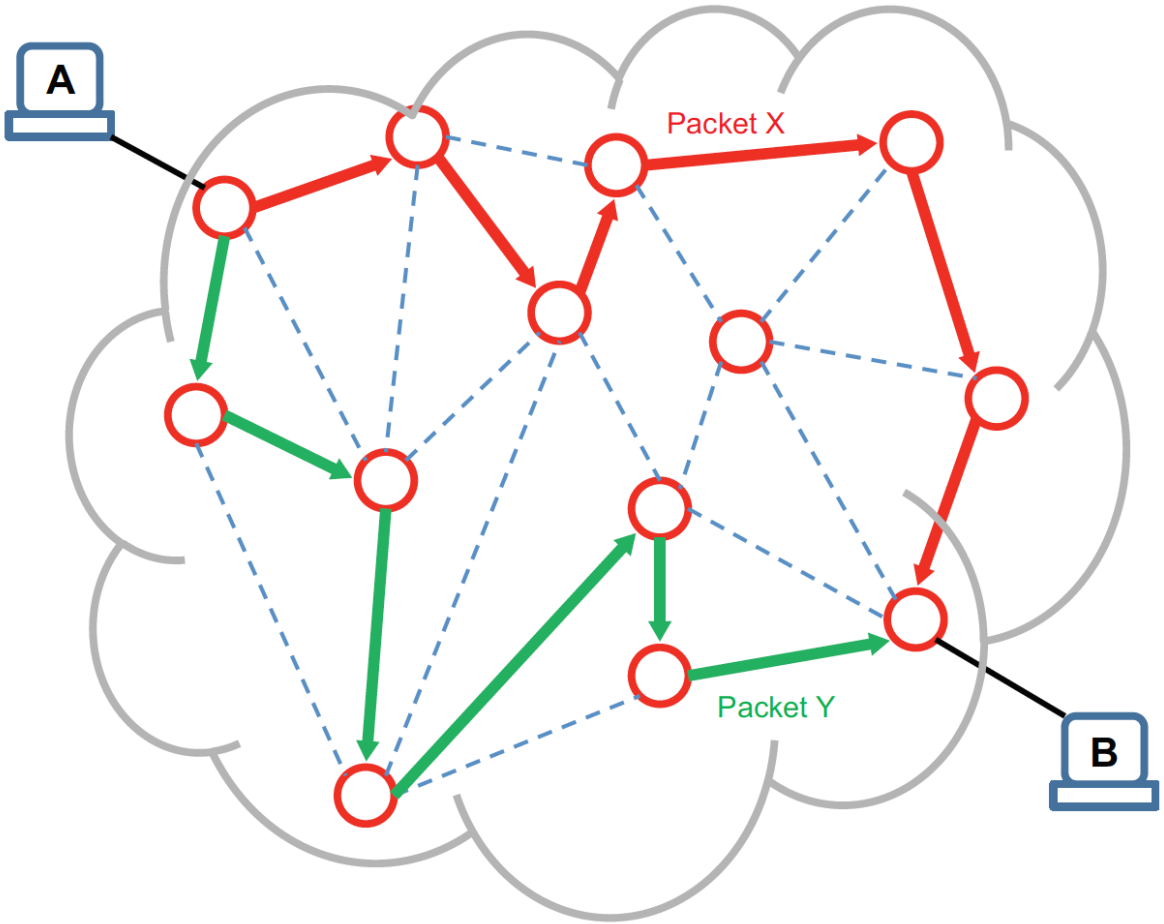


Figure 11.1 Paul Baran's concept of packet switching underpins the Internet. It is dependent on subdivision of the data string, the use of multiple alternative path segments, and system redundancies.

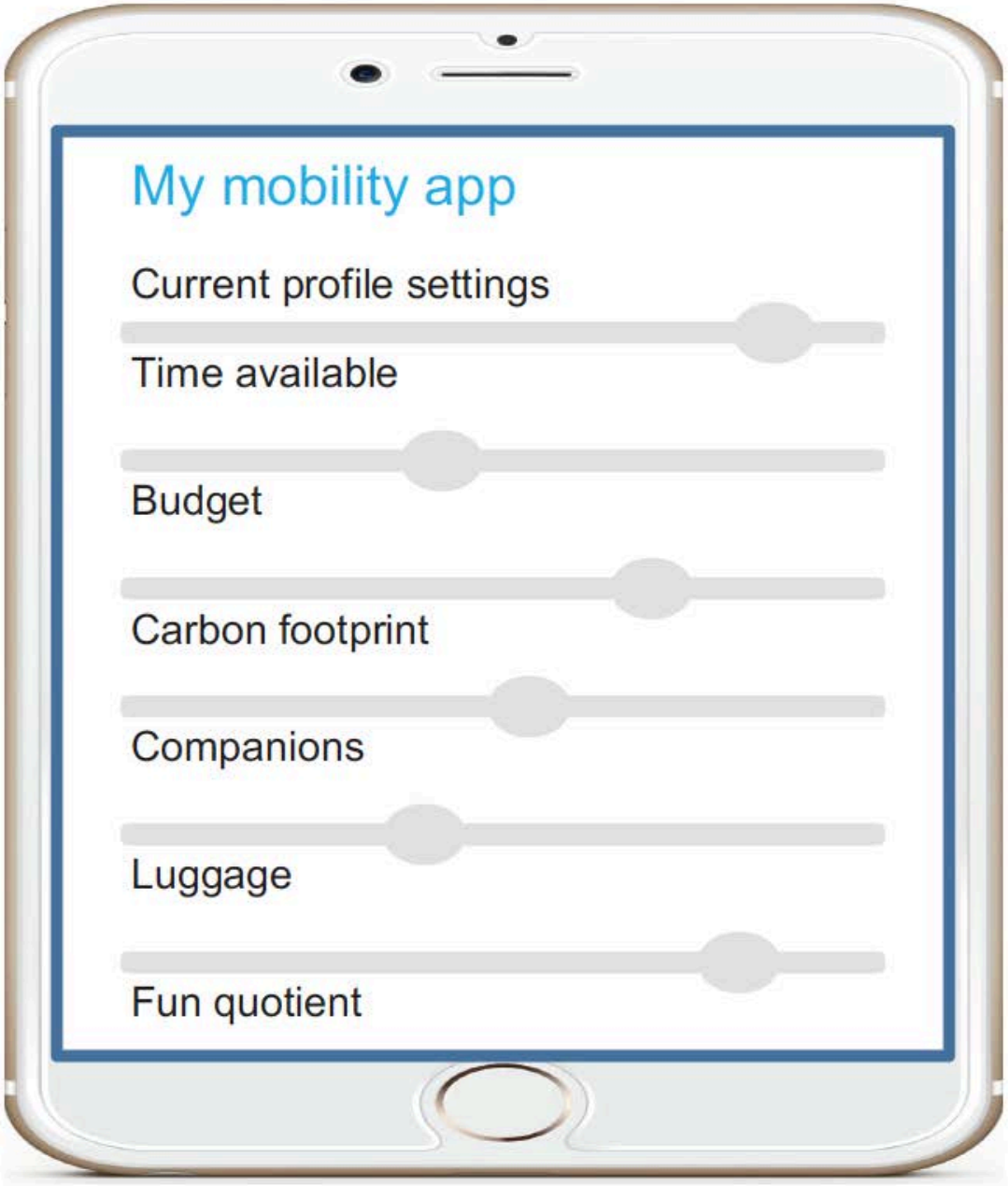
CHIP Mobility

Connected – physically and electronically

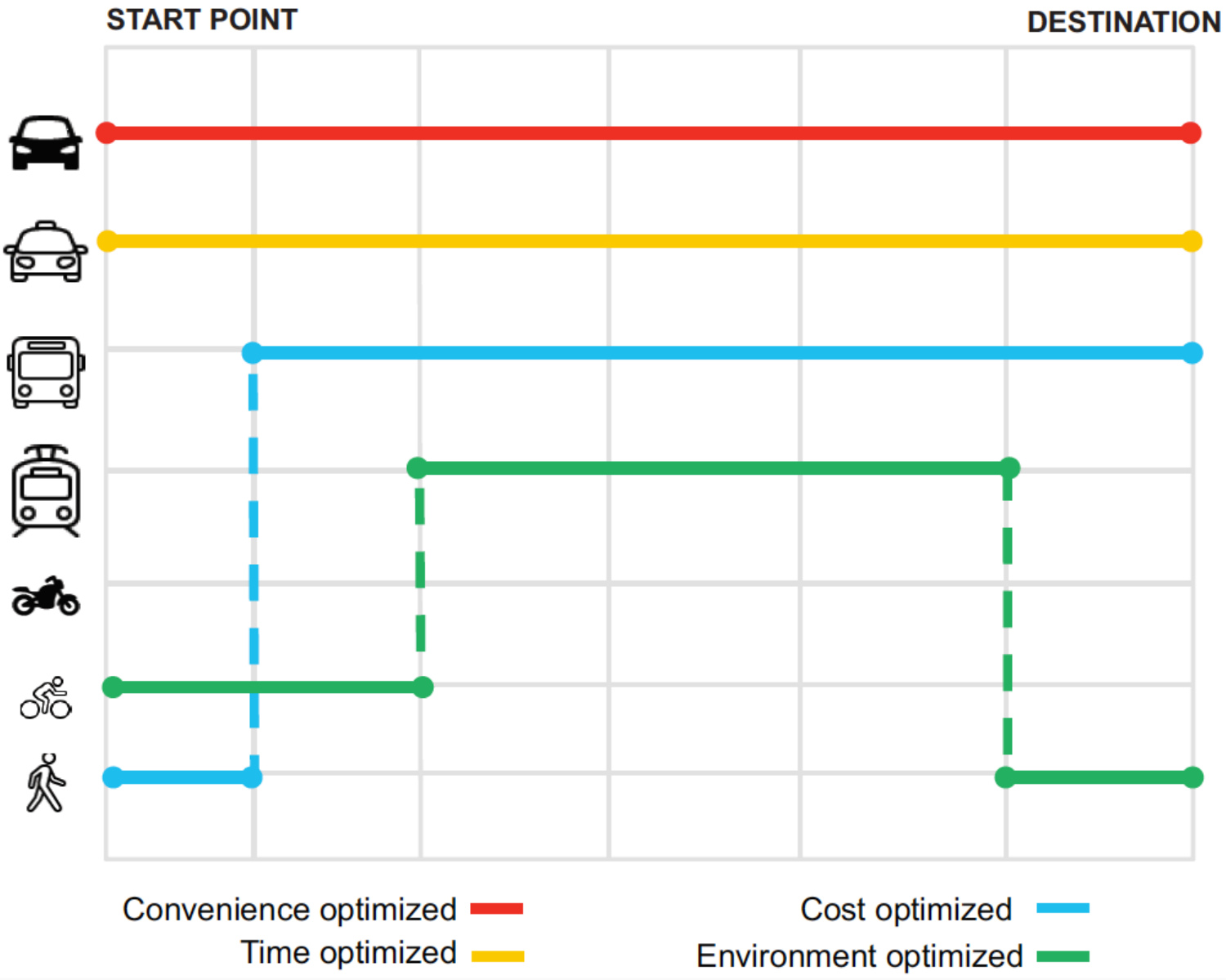
Heterogeneous – train, bus, car, share, bike, foot

Intelligent – analyze big data for best trip design across speed, cost, eco-footprint, aesthetics

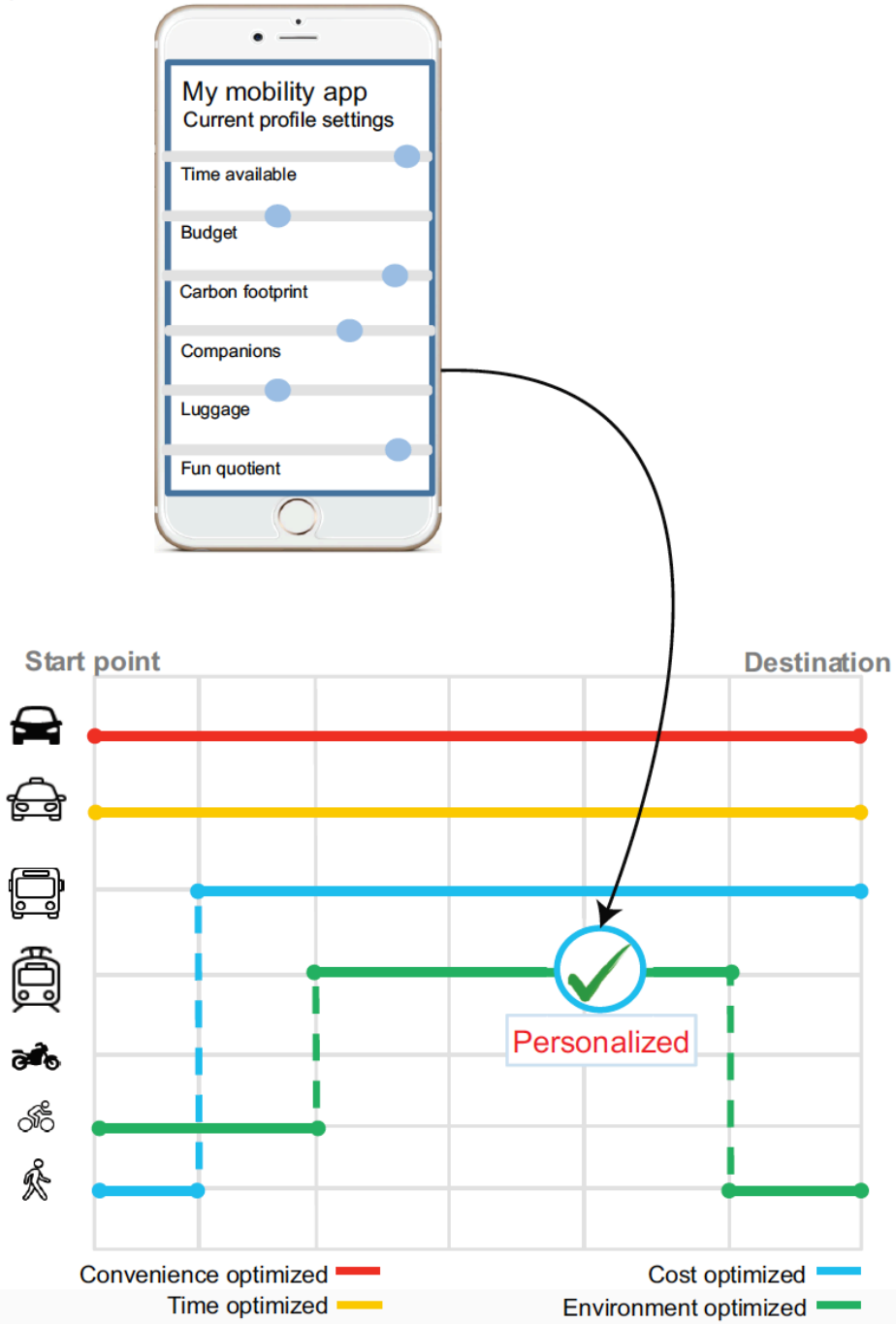
Personalized – you tell the app where you want to go, what are your metrics and it designs your trip for you -- and it learns your tastes and needs over time


My mobility app
Current profile settings
Time available
Budget
Carbon footprint
Companions
Luggage
Fun quotient

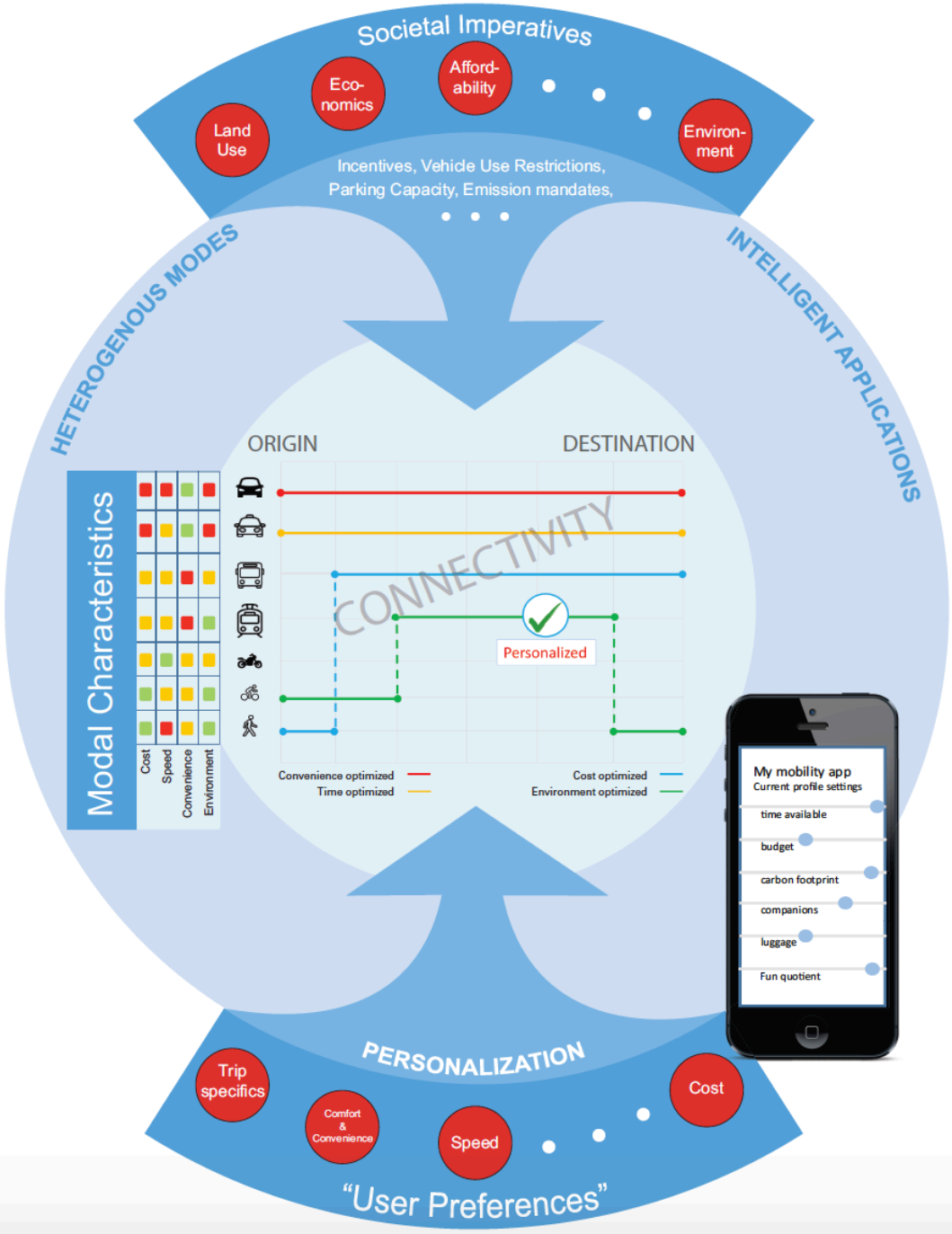
Intelligent analysis



d.


My mobility app
Current profile settings
Time available
Budget
Carbon footprint
Companions
Luggage
Fun quotient
Start point
Destination
Personalized
Convenience optimized
Time optimized
Cost optimized
Environment optimized

The CHIP Mobility Framework



Players

Big Car Companies – trying to change to mobility providers
–Integral vs Modular?

Consumers – want to optimize travel and economics (and sustainability?)

Big Tech Companies – want a piece of the eCar and iCar – WayMo Inside?

Entrepreneurs – Creators of the Zipcars, the Ubers, the Teslas, Apps, etc. (UberPool, BlaBla Car, etc., etc.)

City Planners and Government officials – will drive the heterogeneity of results – differentiation will be local

-transit investments, parking, road usage, bike lanes, bus lines, car pool incentives

Technology and Industry Disruptions

	Industry Disruption	No Industry Disruption
Technology or Process Disruption	• Weak Incumbent Network Effect • Strong Entrant Network Effect • Consumer highly price sensitive and willing to risk adopting innovative service with low quality and compatibility	• Incumbents can affect switching behavior • Incumbents innovate while maintaining quality • Incumbents control complementary assets • Entrants struggle to offer quality due to lack of functional control or market power
No Technology or Process Disruption	Quadrant Not Relevant	• Strong Incumbent Network Effect • Consumers value quality and compatibility over innovation and low price

Digital music

Electric vehicles

Linux vs. Windows