The (possible) future of electric vehicles

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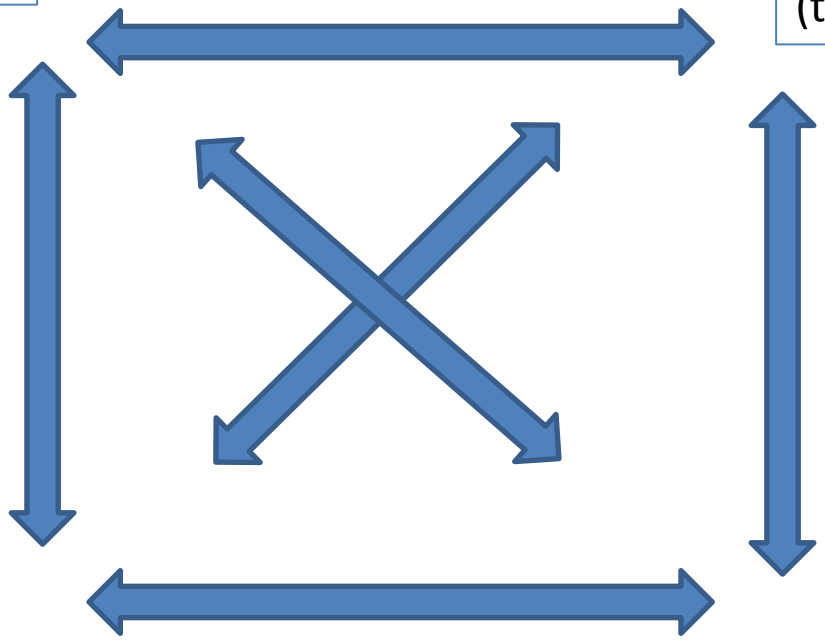
Why predicting the future of transportation is so hard: 4 revolutionary technologies developing simultaneously

Autonomous vehicles

Vertical transit (think drones)



Transit-as-a-Service (TaaS) platforms (Uber today; AirBnB for cars coming soon)

Electric vehicles (focus for today)

- …all interacting with each other…
- …disrupting pretty much everything.

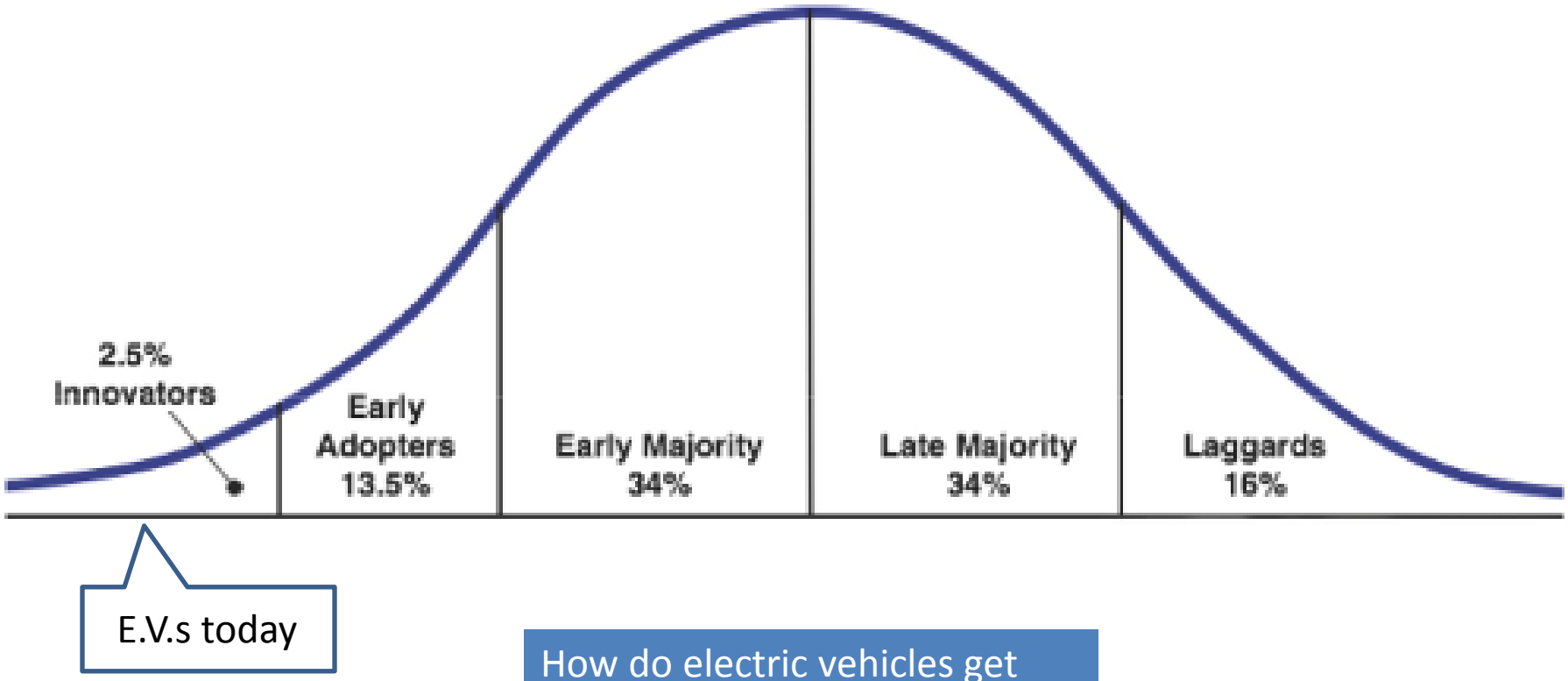
The emerging view

Dino-cars:

- Powered by dinosaurs
- Headed for extinction?

Is the emerging view right?

The innovation adoption lifecycle



How do electric vehicles get over the “adoption hump”?

Dino-cars vs E.V.s today

	Dino-cars	E.V.s
Percent of cars on road	99.8%	0.2%
Percent of new car sales	99%	1%
Range	Bugatti Veyron Grand Sport @255 miles per hour/2 miles per gallon – 51 miles	Nissan Leaf - “up to 107 miles” – “actual range may vary with driving conditions”
Power locations	Gas station	Attached home garage; few outside charging stations
Time needed to power up	In the time it takes you to fuel 87 dino-cars…	…you can slow-charge 1 Tesla.
Models offered	Petite to XXXL	Size comes in regular ($100K Tesla) and circus clown car (everything else)
Price	Lower	Higher (even with subsidies)
Total cost of ownership	Lower	Higher (yes, higher…)

E.V. adoption will hinge on comparison with dino-cars on…

1. Range
2. Cost and ease of powering up
3. Models offered
4. Price and cost of ownership

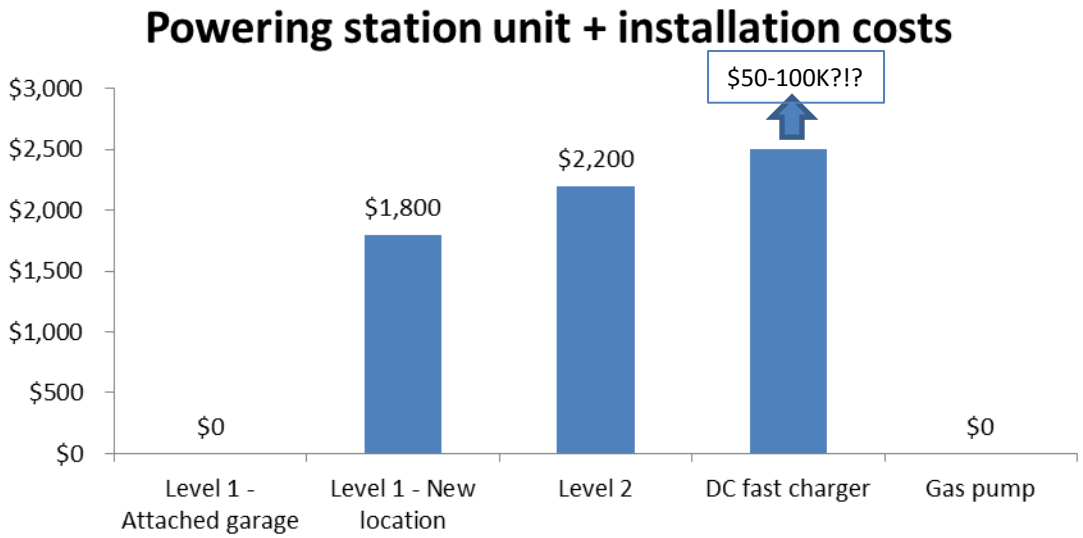
1. E.V. range: the ideal vs. the real world

	How the EPA drives*	How I roll
Age of car	New; still has new-car smell	7-year-old car; crumbled Doritos and spilled Hawaiian Punch smell
Highway speed	55 miles per hour-ish	85 miles per hour (faster when I will get yelled at for being late)
Passengers	1?	As many as 5, not including dog
Cargo	Not sure	2 full bags of kids' hockey gear, Costco groceries, broken umbrella, cassette tapes, Nordstrom returns never returned, junk
Auxiliary stuff	Unclear	AC/heat/defrost/navigation screen/radio/DVD player…sometimes AC with windows open
Tires	Fully inflated, probably	I should get around to doing that.
Tires (continued)	Low resistance?	High resistance - i.e. snow/all-weather (Chicago) tires
Pushing your luck on range	Is the EPA range the point where car rolls to a stop?	I can coast into the gas station on fumes.

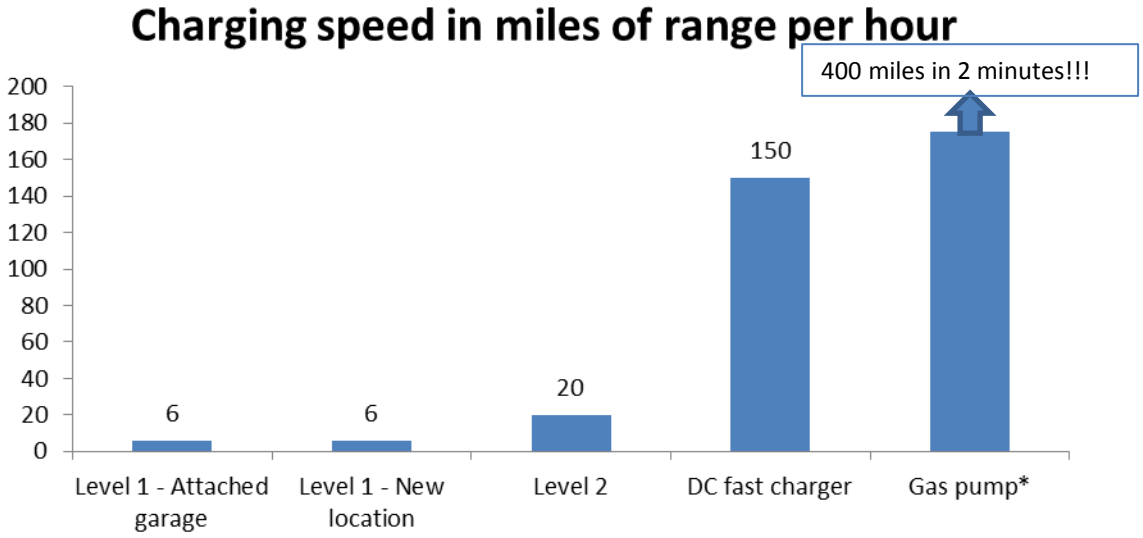
Hey, EPA—what's the range for how **I** roll?

*I tried to figure out all the technical details behind the EPA tests. Failed. They don't make it easy.

2. Current state of charging



- Cost estimates vary wildly depending on what you read.
- All-in costs may be much higher this.



- Charging speeds are not even in the same solar system as gas pumps.

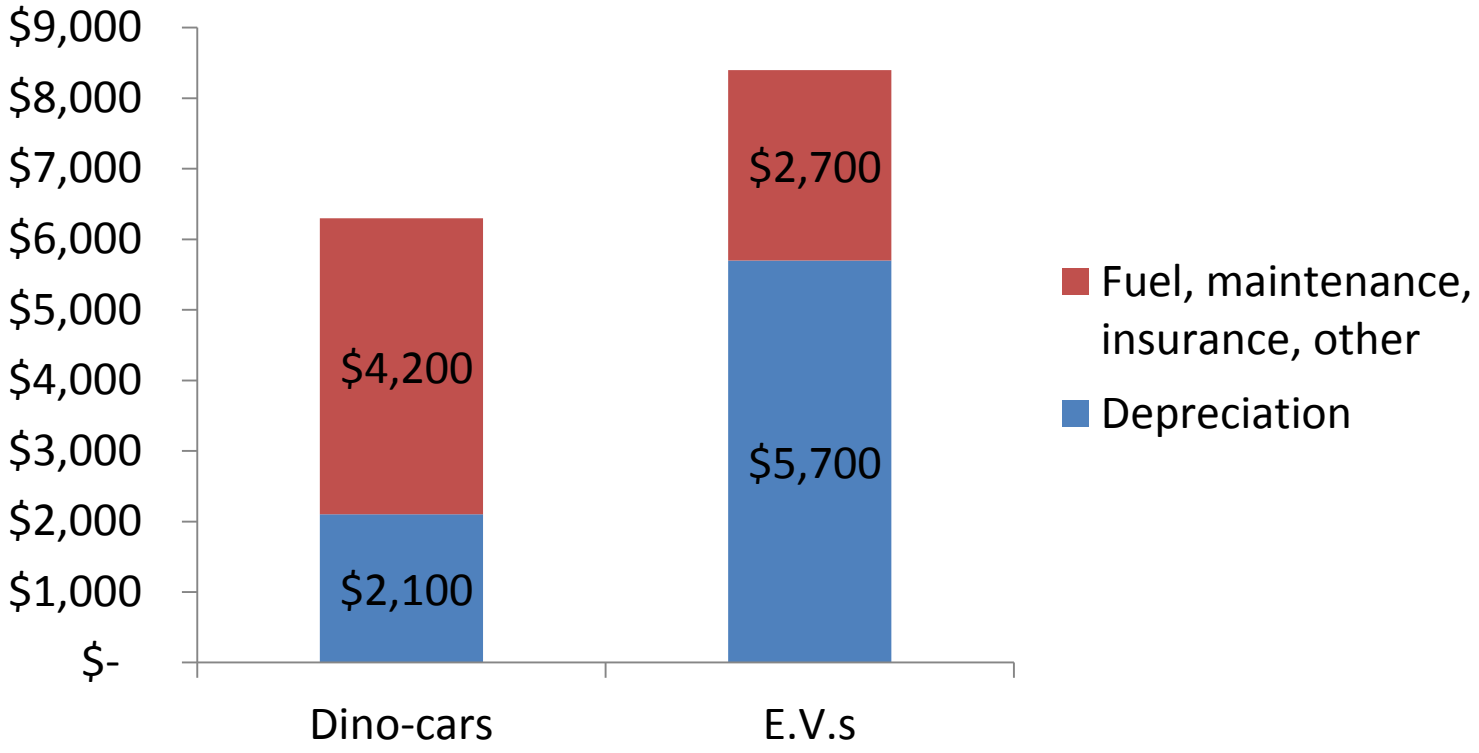
3. Models offered

Model	Dino-cars	E.V.s
Ultra-luxury	Sure.	Tesla model S is pretty much it, but does have “Ludicrous Mode”
Econo-box	Yep.	A few – Leaf, Volt, Spark
SUV	We got ‘em	Work in progress
Pick-up truck	You betcha!	Coming soon...
Van	What color do you want?	Prototypes out there, according to the Internet
18-wheeler semi tractor trailer	Pimp my ride	Tesla press release (actual vehicle would “defy the laws of physics”)

EV sticker price is higher than dino-car price, even with subsidies. But what about…

4. Total annual cost of ownership

Dino-cars - $6,300
E.V.s - $8,400



E.V. adoption will hinge on comparison with dino-cars on…

1. Range
2. Cost and ease of powering up
3. Models offered
4. Price and cost of ownership

Where we are now:

- Sorry, everyone--Dino-cars are better than electric vehicles. A lot better.
- Absent significant change, E.V.s won't spread much beyond Innovators

Now, where are we headed?

Brainteaser: Range

What is the #1 factor that will increase the range of E.V.s in the next 10 years?

Ok, what's #2 and #3?

1. Better batteries
2. Lighter cars
3. Autonomous vehicles

E.V.s may never catch up to dino-cars on range, but they may improve to "good enough" for the Early Adopters, Early Majority.

Brainteaser: Cost and ease of powering up

Who will make the biggest investment in charging stations and infrastructure in the next 10 years?

Answer: Gas stations

- Shell Oil just announced a partnership with several automakers to build 80 charging stations at existing gas stations in Europe.
- If charging gets exponentially faster, gas stations will be perfectly situated to take advantage.
- (And here come autonomous vehicles…the ultra-fast charger configured for A.V.s at gas stations may win the standards and location battle.)
  - ….without A.V.s, how are the cars parked on the street going to charge?
  - Are we really going to have one charger per car for every car in Chicago? No way.

Brainteaser:
What model of electric vehicle will "Early Adopters" buy?

- ❑ Compact cars
- ❑ SUVs
- ☑ Pick-up trucks
- ☑ Vans
- ❑ 18-wheeler semi tractor trailers

Government and corporate fleets and craft trades are great candidates for E.V. trucks and vans. (They are coming…)

- Stable home base
- Small range needed
- Eliminates work time lost to fueling gas vehicles

City of Chicago just received $15M to convert 25% of its fleet to E.V.s

Brainteaser: Price and cost of ownership

How many electric vehicle trips were there in Chicago in 2016?

Answer: At least 240 million!

- Do we want to maximize the number of electric vehicles or the number of electric vehicle rides?
- If rides, then consider:
  - Encouraging E.V. use and discouraging dino-car use, not necessarily ownership.
  - Providing incentives for Transit as a Service (TaaS) for E.V.s, including public transit.

The next 10 years

Top down

Electric vehicles promoted /mandated by governments to reduce local pollution and global warming and manufactured by automakers looking to get ahead of the mandates.

Optimizing E.V.s and A.V.s

Transit as a Service reducing cost of ownership and increasing flexibility in transit choices

Drones

Delivering your pizza

Autonomous vehicles demanded by drivers. Endless customization possible (cars with workstations? Exercise bikes? Hot tubs?)

Bottom up

Thanks!

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Sources

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