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The Car Is to Advance to the Watershed Next Phase

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The Car is to advance to the watershed next phase

Electro-Mobility 2.0 holds the promise of massive change for the better.
Could electronics engineers succeed where traditional carmakers have failed?

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ABSTRACT: Does tackling the car's emissions mean that we are done with its impact on our living environment? No. There are way too many 'auto-mobility' related issues which remain unsolved. But that may well be a good thing for the industry. Instead of being taken by surprise by what governments will regulate next, the electric car itself can evolve as a problem solver, as a smart device. But in order to smarten up, it better go through the same process the mobile phone went through. Questions. How might such a 'smart device on wheels' work? Why is it key to the Holy Grail in personal mobility, driverless? People derive a lot of pleasure from their car. Let's bring that back, and at the same time have it 'clean up its act'.

KEY WORDS: *Climate Change, Autonomous Vehicles, Ride-Hailing, Micro-Mobility, Safety, Space Efficiency, Energy*

1. Who will take the initiative?

1.1 To be Focconn'd or To Disrupt?

Ever since the car has shed its (complicated) ICE engineering and hardware, it holds the promise of becoming an oversized appliance on wheels, so to speak, for more efficient transportation. There was even talk about a sort of role reversal, namely that big OEMS such as Google and Apple would, what's called Foxconn[1] the traditional carmakers into a Tier1 role - they basically taking over the role of principal providers in the world's biggest consumer industry. After all, there is so much more to Personal Mobility than making and selling cars. What happened? Carmakers learned to adapt and to adopt, taking over or working together with tech firms that are into developing connectivity and self-driving technology. Successfully? Well, it all depends. Except for electrifying drivetrains and introducing lots of gadgets (which causes distracted driving), the same old problems not only remained unsolved, they became worse. Traffic has grown, there are more road accidents, driverless proves to be nowhere near what was promised a decade ago, despite the industry spending over $100 billion[2]. Electrification still has a lot of hurdles to overcome to really make a difference - think of battery production, charging infrastructure, grids that can't cope, selling affordable EVs (without having to lean on $ multi-billion costing EV tax credits). I'd call that a MASSIVE challenge. What could be done? Is there something that all these issues have in common that will enable us to tackle them in one fell swoop? *Reader may fast-track to paragraph 2.4.*

1.2 Car needs a New Mindset and Narrative

It is my firm belief that if the car industry does not succeed in solving or at least seriously addressing the issues that have been bothering car users and governments for decades, it may lose out to newcomers. First of all, many of the typical automotive engineering challenges[3], such as the ones regarding suspension and propulsion, can now be tackled by new technology. Israel-based company REE approaches car platforms and vehicle dynamics from an electronics engineering angle - setups can be made to client OEM's specs.

Then there are the two developments that already held the promise of taking on the car industry's monopoly: car- and ride-sharing and autonomous driving. Both are more software- and network-based undertakings, aimed at using hardware (cars) more efficiently. What happened? Billions went into Silicon Valley's almost archetypically wishful engineering to make ride-hailing and self-driving work and make them profitable. So far not that successful. UBER sold its AV division[4] for instance, and is still not making money from its ride- hailing business.

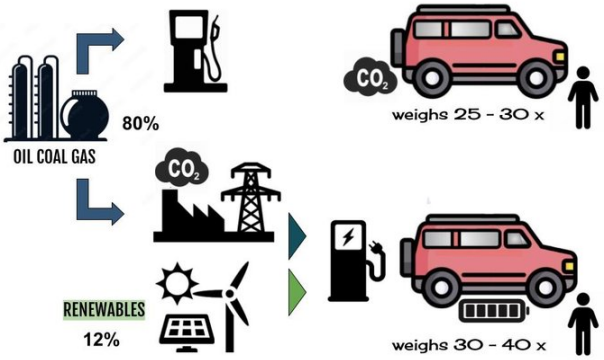


Figure 1. What electric car producers have done so far is displace the emissions issue from local to regional, by eliminating car exhausts, not the emissions from power plants. Electrification on top of the SUV trend contributed to making the car overweight. As the average car occupancy[5] hasn't changed, the vehicle mass per person traveled goes up. The higher the mass, the more energy is required. The war in Ukraine makes us aware to put an end to importing fossil energy.

1.3 Urban Mobility massive challenge

Another threat is looming more prominently, this time of a more existential nature. We have created a world that is built around cars first. More than 75% of the population in the EU and US resides in and around cities. Major cities like Paris, Barcelona, Amsterdam, London, Berlin, Oslo tend to curb car traffic and car parking. More and more city councils and urban planners start to object to the car's intrusiveness because of what it does to our living environment, and tend to favor micro-mobility solutions[6]. That should raise considerable concern to the auto industry. What we need is an alternative mindset, a new perspective on mobility. There is still so much to do, gain, make better. Tesla's success story should tell us something. Having tackled just ONE aspect (swapping the ICE for an electric motor), this complete newcomer to the auto industry grew out to become the world's most valuable car brand.

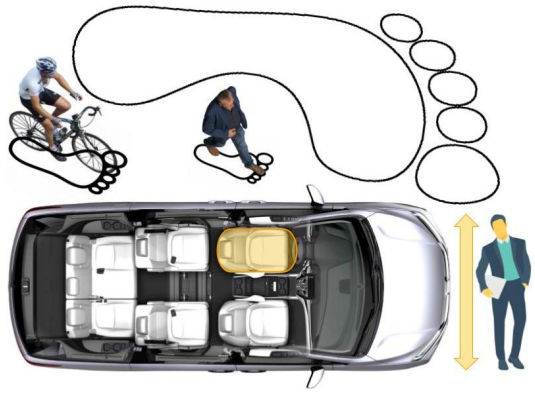


Figure 2. Transit Footprint. Most people sit alone in their car, that's a whopping 100-250 m2 road space during transit: lane width times the usual (speed-related) car-to-car spacing including the car. There's a trend to reclaim urban space on the car; some advocate banning SUVs[7] from inner cities altogether. For this reason, Swedish Uniti[8] has been working on tiny EVs to be used by one person only. The problem is that pursuing single-seaters may add to the total number of passenger vehicles cluttering our inner cities: tiny ones to be used in and around town, full-size cars for all-purpose use.

2. Climate Change - Game Changer

2.1 Ahead of the 'game' instead of complying

Extrapolate, anticipate developments especially in the legislative[9], isn't something automakers have been very good at. The way authorities cracked down on the emissions (testing) violations, is proof of that. It took the industry by surprise. The EU proposed a ban on the sale of new petrol and diesel cars from 2035, aiming to speed up the switch to EVs as part of a broad package of measures to combat Climate Change. The European Commission, proposed a 55% cut in CO2 emissions from cars by 2030 versus 2021 levels, much higher than the initial target of a 37.5% reduction. It also proposed a 100% cut in CO2 emissions by 2035, which would make it impossible to sell new fossil fuel-powered vehicles in the EU. Carmakers signaled they would only accept tougher emissions targets in return for massive public investment in chargers. EU's Green Deal is simple: penalize polluting, reward those who don't emit and work/innovate towards achieving zero emission. President Biden wants the U.S. to become the world's Nr. 1 EV producing nation. Until 2020, selling zero-emission credits was Tesla's main source of income. Imagine going beyond this. The best way to meet new challenges and regulations, is to widen the whole idea of what personal transit is about, thereby opening up new mobility markets.

Figure 3. Left: VW Passat. Right: Tesla Model 3. Besides replacing the ICE for electric drive, Elon Musk never came to rethinking and reformatting the electric car. What a huge opportunity!

2.2 Zero Emission - just one challenge down

NINE more to go. Tesla is a car like any other; the main difference is its battery drive. When everyone will be using electric cars, will this mean that we are done yet? Of course not. Even if renewable energy takes over (differs per country), why would you waste energy? Efficiency gains in using an electric motor are largely offset by putting batteries with their inherently low-energy density, in the types of cars that already have a weight problem (SUV trend). A small ICE car with 25% thermal efficiency may be called greener than a big electric SUV. Then there are the problems we have been dealing with for decades, and that automakers including Tesla haven't exactly made great strides in:

1. safety vulnerable road users
2. leave room for cyclists
3. gridlock (use infrastructure more efficiently)
4. profitable ride-hailing
5. demand on the grid
6. road space key to Fahrvergnügen
7. self-driving (remember: was to solve 1-3-4)
8. intermodality with Public Transport ('1st and last mile')[10]

Figure 4. **Global Warming: Global Warning to the car industry?** Has the time come for more imaginative or even draconic measures? When the electrical grid is down and wildfires render solar panels useless, there's no recharging of your electric 'the survivalist edition' SUV, let alone

escaping, as people already found out in California. Better work on how to keep grid demand manageable.

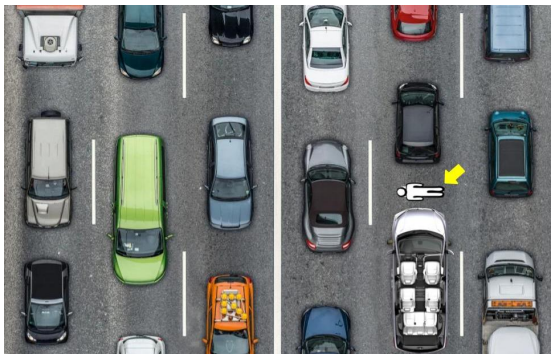


Figure 5. Most people sit alone in their car, particularly during the daily commute. Most cars are wider than the average driver is tall, the lanes approximately twice as wide as the average car. Effectively, that is like lying across a freeway lane, slowly moving sideways - not a very efficient use of costly road infrastructure. Ergo: gridlock.

2.3 Gaping Void between Car and Bicycle

Plenty of opportunity to bring something new and exciting if we are prepared to think outside the proverbial car box, reassess the whole notion of a car that outweighs the driver 20-40 times over, is wider than he/she is tall. The bigger the cars, the more drivers (usually the car's only occupant) box themselves in on the road, the more energy those cars need, the costlier it is to put them on batteries, the higher the grid demand, the harder it is to realize self-driving. Reducing vehicle footprint and mass not only makes sense in many ways, we also get the chance to bridge the growing gap between cars (which have grown bulkier, particularly with the whole SUV trend) and micro-mobility (two-wheelers). **Bicycles** are great, and usage should be stimulated. But they do have their limitations when it comes to comfort, range, safety and carrying capacity. What would be more logical than to downsize the car, ditch weight, make it shrink-to-fit both the infrastructure as well as the car's usual occupancy rate?

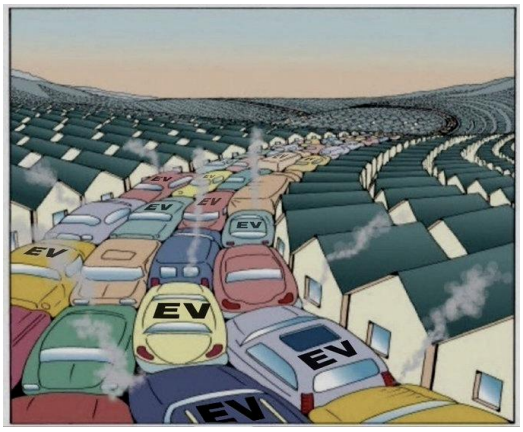


Figure 6. Mobility is a Matter of Mass - Energy - Emissions - Space - Safety - Time - Fahrvergnügen. They are all interrelated. Better start working on bringing down the Electric Car's 'calorie intake' (kWh) and footprint. After all, vehicle size not displaced means potentially better space usage of the infrastructure, such as via dual-lane use in a bricklayer formation, smaller lanes, etc. Vehicle length is less of an issue than vehicle width (hourglass principle).

2.4 Size key to much-needed change

Vehicle size is THE ONE factor in the equation that has the potential to dramatically change Personal Mobility for the better. Cars have become bigger and bigger, which is a handicap in most respects. Since carmakers haven't done anything to reverse this 'car obesity' trend, electronics engineers should step up to the plate and start out with a clean slate, and reboot developments. After all, they are quite familiar with "doing more with less" and with new technology and new possibilities influencing product formats.

The smartphone is an excellent example of this. Steve Jobs used to say: "design is not just what it looks like, design is how it works". At the time, Jobs knew exactly what the iPhone should look like and work like, even before all underlying technology had been fully matured. Jobs realized that new possibilities should bring Apple to altogether rethink and reformat the phone. It had to be rectangular, flat, have rounded edges with specific radius, combine different functions, have a (relatively) big screen and no keys. Since then, the basic shape hasn't changed that much. Could there be such a thing as an optimum format for the car as well? Author thinks so.

Figure 7. The huge problem with Climate Change and subsequent rising temperatures is that we will have way more AC units AND cars dependent on the electrical grid. The EV is to become a household's Nr. 1 energy-consuming 'appliance', so to speak.

3. EV is to become the #1 home appliance

3.1 Roadmap to EV acceptance and sales

A lightweight, sleek car is able to overcome the three hurdles to EV acceptance, which is particularly a problem in the U.S. where gasoline prices[11] are 50-70% cheaper than they are in the EU.

1. EV purchasing price (still depends on billions in subsidies). The less an EV weighs, the lower the drag, the less kWh is needed. The smaller the battery, the more affordable the EV.

2. Level 1-2 (home) charging may well compensate for the lack of charging infrastructure[12]. Experts say that major investments are required in strained power grids[13], especially in the U.S.

3. Range anxiety. Vehicle weight and drag co-determine how far the EV is able to go on 1 kWh.

3.2 Smartphone should inspire

Instead of taking lessons from what has propelled the Personal Communication sector (downsizing and reformatting), Personal Mobility went quite the opposite way: adding size and weight, which ruins energy- and space efficiency, the greening of car travel, road safety as well as the whole process of going from A to B. Putting cars on batteries made this even worse[14]. Also: the heavier the car, the more wear and tear of roads and bridges, the more micro-particulate[15] matter airborne from tires and brakes, the more rare metals need to be mined, etc.

3.3 Full Autonomy harder than anticipated

In the feverish quest for driverless vehicles, automakers and tech funds have already lost billions trying to make self-driving work. Have they been overlooking the obvious: as going from A to B is primarily a physical matter - vehicle size, footprint and shape are of importance. Is hubris perhaps involved, namely that a vehicle's dimensions should not make a difference? Several companies have already backed away from plans to put self-driving cars, by many considered a multi-billion dollar market, into use in the near future, due to complications in dealing with the unpredictability of traffic that keeps baffling autonomous vehicle developers. UBER even gave up on its dream of robo-taxis. The ride-hail giant reportedly invested more than $1 billion in self-driving cars it always considered quintessential to its business model of price-competitive ride-hailing services for a long time. It sold its unit to self-driving tech firm Aurora.

Billions of brain cells multiplied by tens of thousands of synapses in each individual brain make for *more* instant connections than there are stars in 20 to 40 thousand galaxies. Housed in a roundish 'cockpit' capable of swiveling (the human head), equipped with two amazingly effective optic and ditto hearing sensors (eyes, ears) and a hard-drive full of constantly updatable learning material, topped off by the human intuition, they enable all of us to split-sec reference what we see, hear and feel. Hard to beat those, if ever.

Figure 8. Waymo was on to something when it brought its robotic two-seater. Later on, Waymo started experimenting with self-driving taxi services on the basis of the Chrysler Pacifica. Mimicking the human brain proved to be harder than anticipated though. Better bring the type of car and its displacement characteristics into the equation.

3.3 Breaking the vehicle autonomy impasse

We have boxy cars for hauling purposes, low-slung, low CoG cars for sporty use. Can it be that a certain shape is just more conducive to using Automated Driving Systems (ADS is the NHTSA's preferred acronym) than other ones? This division of the U.S. Department of Transportation (DOT) is concerned[16] about what to allow not to interfere with technological progress, and what to regulate in order not to risk safety? Can a reshape, a reformat aid in developing ADS, reduce risks beforehand, break the 'technological vs regulatory' vicious circle? The answer is: Yes. Instead of putting autonomous hard- and software in conventional cars as add-ons, reformat the vehicle first to have it benefit optimally from AV technology.

The smaller / sleeker the vehicle:
1. the more margin to maneuver and evade other road users;
2. the more effectively the ADS technology can scan, sensor and image the car's vicinity;
3. the better the all around view of the person behind the controls (in case manual input is needed or preferred 'recreationally').

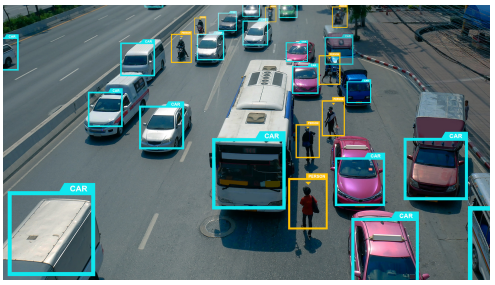


Figure 9. Size matters also in maneuvering autonomously, through dense city traffic in particular.

3.4 The Shape to Shape Safe Self-Driving

Motorcycle helmet makers already introduced the helmet with 360 degree vision[17]. Now transfer this idea to a road vehicle. The 'helmet-on-wheels' depicted on this page, is stretched to carry three. Due to its passenger layout and a cabin which tapers toward the rear, there are NO blind spots. Not for the driver, nor for the scanning and imaging equipment, which is already able to 'see around' more clearly because of the vehicle's roundoff and sloping outer contour. Less fragmented imaging than when having the same ADS tech on board of a big, boxy SUV such as the Volvo XC90, which UBER had used. On top of this, SUVs contributed to the increase in pedestrian fatalities over the past decade, according to ETSC, NHTSA and IIHS[18].

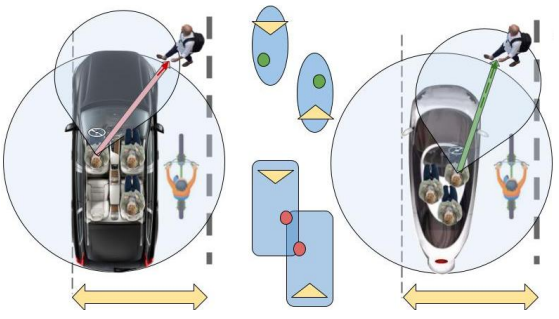


Figure 10. Can a Next-Gen EV provide more outside-the-vehicle as well as more onboard (NCAP) safety? Yes[19]

3.5 Ride-Hailing made profitable

The types of SUVs and MPVs deployed by ride-hail providers are not exactly conducive to autonomously maneuvering. What's more, they make ride-hailing costlier than necessary, since the average trip consists of 1.2 passengers[20], according to BCG, Boston Consulting Group. Developments like the cautiously slow-moving robo-vans some AV developers are pitching may make things even worse. They are unnecessarily big blocks of rolling real estate, out to invade even more precious public space. They will increase transit times, which adds to more gridlock[21]. What's more, vulnerable road users like pedestrians and cyclists should of course not become casualties of driverless taxis that can't cope with traffic, because of its complicated and unpredictable fluidity.

You don't use a big truck to carry a few parcels around town. You send in a delivery van. Likewise, inner city ride-hail trips will be over relatively shorter distances. There's where a sleek 'Next-Gen rickshaw', which is better able to slice through traffic than an MPV or SUV can, will do nicely. Only having to deploy ONE cumbersome, power-hungry, more costly, 5-seat SUV or MPV on maybe twenty to thirty three-seaters, means higher profit margins to the provider and/or substantial savings, especially in driverless mode when all three occupants are paying passengers.

4. Smart-Mobility 'apps' - Who'll make them?

Ever realized what an amazing feat it is that Tesla started out in the U.S. where gasoline prices are less than half of those in the EU, the domestic market share of U.S. carmakers has more than halved in half a century, distances tend to be bigger and therefore a bigger hurdle for EVs? Tesla not only became the most valuable car brand in the world in record time, it forced other brands to make the switch to electric drive as well. But there is more to 'being mobile' than reducing car emissions. Now imagine a Next-Gen EV that tackles all other issues in personal mobility. Problems that have been left unaddressed, already invited us to do things differently. Climate Change now urges us to come up with concrete solutions. Electric drive alone is not enough.

Figure 11. Distracted driving - a major concern to authorities.[22] Will electronics engineers and companies reach beyond the Tier1 role of merely supplying electronics and gizmos to the car industry?

However, the established car brands (Tesla included!) may not be the most suitable to make this next, significant transition, given their emphasis to sell as many cars of preferably considerable size (more margin) as possible. Think of automakers as the phone companies that weren't prepared and were caught off guard when Apple launched the first smartphone! With new contenders from outside the auto industry like Huawei, Xiaomi, Foxconn, Sony, Samsung, Waymo, Apple, perhaps more Tier1's and newcomers should lay aside their reservations to directly compete, and step up to the plate of producing Smart-Mobility app(liance)s.

Conclusion: Car needs a Reformat

It goes both ways. The urge to green personal mobility may well run parallel to the quest for automation in car travel, and vice versa, driverless is brought closer by deploying sleek-footprint vehicles. Going from A to B is a Matter of Mass - Energy - Space - Time. As long as we don't sin against this 'equation', we are not only left with options, but can also create whole new opportunities. End the clumsiness of the overweight car and have the best AV tech match the best car format. It may bring about a whole new ecosystem in Personal Mobility, comparable to what Silicon Valley achieved in new media. To avoid staying too academic, author extrapolated developments and came up with a blueprint of what a Next-Gen EV may look like and how it will work.[23] [24]

NOTES

Although most of the underlying information may be considered familiar, I nonetheless hereby provide sources, with an emphasis on more recent material, to keep this outline as fresh as possible, and on the two largest car consumer markets in the world: the U.S. and EU.

1. Foxconning. The advent of electric vehicles is turning the structure and inner workings of cars upside down. In the process, it is creating a much stronger fusion between two of the world's biggest industries — autos and electronics.
https://www.ft.com/content/b229250d-5d9e-4bb1-bb91-e57888233a98

2. Investors have sunk more than $100 billion into building cars that can drive by themselves. Yet despite a decade and a half of development and untold miles of road testing, driverless tech is stuck in the pilot phase. "We are seeing extraordinary amounts of spending to get very limited results,"

https://www.technologyreview.com/2022/05/27/1052826/ai-reinforcement-learning-self-driving-cars-autonomous-vehicles-wayve-waabi-cruise/

3. Traditional automotive skills
Suspension technology is an excellent example of what used to be a typically 'hands-on' engineering skill and discipline, but that can now be provided for by electronics engineers. Expect computer simulation to deal with all suspension geometry and vehicle dynamics related issues and every conceivable variable, without the need to experiment with full-scale models. Read for instance:
https://www.electronicdesign.com/markets/automotive/article/21160151/electronic-design-reecorners-bring-fully-flat-platforms-to-commercial-evs

4. UBER's counting on vehicle autonomy to make its taxi services price-competitive as well as profitable, did not pan out. Uber lost $6.7 billion in 2020, while Lyft lost $1.8 billion.
https://www.wired.com/story/uber-gives-up-self-driving-dream/
https://www.theverge.com/2021/2/11/22277043/uber-lyft-earnings-q4-2020-profit-loss-covid
When it comes to revenue, robotaxi apps show that companies are still heavily subsidizing rides. For now, self-driving technology means selling software.
https://latestusnewshub.com/latest-business-news/robotaxis-is-not-the-first-step-of-self-driving-car-companies-to-make-money/

5. Car Occupancy (daily commute)
The majority of Americans continue to drive to work alone in their cars. Over three-quarters (76.3%) choose to commute this way. That translates into nearly 115 million vehicles transporting exactly one person each.
https://www.usnews.com/opinion/economic-intelligence/articles/2017-09-18/what-new-census-data-reveal-about-american-commuting-patterns
https://www.census.gov/content/dam/Census/library/publications/2015/acs/acs-32.pdf
https://www.greencarcongress.com/2018/07/20180731-fotw.html
The rate of car occupancy continues to decline, but at a slower rate than during the 1980s and 1990s. The most recent data for the average number of passengers per car (including the driver) for the countries sampled is approximately 1.45 passengers per vehicle (in the UK - 1.58; Germany - 1.42 and Netherlands - 1.38 passengers accordingly) (see Figure 1)
https://www.eea.europa.eu/data-and-maps/indicators/occupancy-rates-of-passenger-vehicles/occupancy-rates-of-passenger-vehicles
The Reign of Single-Occupancy Vehicles for Greater Urban Access.
https://www.bcg.com/publications/2020/ending-single-occupancy-vehicles

6. Micro-Mobility has been receiving increased attention in cities all over the world. How four European cities are embracing micro- mobility to drive out cars. A look at urban transformation in Paris, Barcelona, London and Milan. Cities like Paris and Amsterdam plan to dramatically reduce the number of parking spaces for cars. Micro-Mobility also has its strong proponents in the U.S.
https://techcrunch.com/2020/11/20/how-four-european-cities-are-embracing-micromobility-to-drive-out-cars/
The rise of micro-mobility has been an unexpected grassroots success story of recent years in the urban transport sector, giving rise to the fastest-growing mode of transport ever documented: electric scooters (e-scooters). These e-scooters are just one of a growing range of shared micro-mobility options in cities across Europe, the US and Asia. Electric scooters have become a mainstream part of daily travel in metropolitan areas all over the world, available in 626 cities in 53 countries, according to the NUMO mobility alliance.
https://www.ey.com/en_gl/automotive-transportation/how-micromobility-is-moving-cities-into-a-sustainable-future

7. Ban SUV trend
Stereotype of the 'Chelsea tractor' is true – and these vehicles are a primary contributor to urban air pollution, traffic deaths and climate change. SUVs are a paradox. While many people buy them to feel safer, they are statistically less safe than regular cars, both for those inside and those outside the vehicle.
https://www.energylivenews.com/2021/04/08/calls-to-ban-suvs-as-carbon-intensive-cars-clog-city-streets/
https://www.fastcompany.com/90420280/should-we-ban-suvs
https://www.theguardian.com/cities/2019/oct/07/a-deadly-problem-should-we-ban-suvs-from-our-cities

8. Uniti
https://www.intelligentliving.co/uniti-disrupt-car-world-debut-new-ev/

9. Climate goals - "In der Beschränkung zeigt sich der Meister"
https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en
https://www.politico.com/news/2021/04/22/biden-climate-goal-congress-484141 https://www.docdroid.net/hEiiuXi/decision-tree-pdf
https://eelp.law.harvard.edu/2021/03/new-auto-era-biden/

10. Intermodality with Public Transport in a late night first and last mile (autonomous) capacity, when buses, trams etc. are out of service.
https://www.docdroid.net/SrZEVHh/bus-vs-van-vs-3-seater-pdf

11. EV sales related to gasoline prices
If gas prices hit $4 per gallon, a quarter of the people surveyed would consider an electric car. At $5 per gallon, that number soars to more than double.
https://insideevs.com/news/508327/rising-gas-prices-ev-adoption/

12. Charging infrastructure
EV rollout requires huge investments in strained U.S. power grids.
https://www.reuters.com/article/us-usa-weather-grids-autos-insight-idUSKBN2AX18Y
The European Court of Auditors (ECA) looked at how the European Commission supports member states in expanding electrical charging infrastructure as well as how it manages EU funding. It found that availability of public charging stations varies significantly between member states and that payment systems are not harmonized, forcing drivers to use multiple subscriptions or payment methods to charge their cars if they travel in different EU countries.
https://www.euractiv.com/section/electric-cars/news/deployment-of-eu-electric-vehicle-charging-stations-too-slow-auditors-say/

13. Strained power grids
The crushing heat smothering the U.S. Northwest is offering yet another stark reminder that the nation's aging power grids weren't built to withstand temperatures unleashed by global warming.
https://www.bloomberg.com/news/articles/2021-06-29/power-grids-getting-fried-by-heat-in-preview-of-what-s-to-come

14. As EVs get bigger, they consume more energy—and, indirectly, generate more carbon emissions. EVs charge their batteries by plugging into power grids, which generate most of their electricity by burning fossil fuels.
https://qz.com/2154558/big-electric-trucks-and-suvs-are-the-new-gas-guzzlers/

15. Particulate emissions. Putting bigger battery packs in EVs can boost range, but a new study suggests it could also lead to a major increase in particulate emissions—from tires. The study comes from Emissions Analytics, a U.K.-based independent emissions testing firm. It first began sounding the alarm in 2020, publishing a study showing that tire-wear particulate emissions were 1,000 times worse than tailpipe emissions.
https://www.greencarreports.com/news/1135856_bigger-batteries-evs-boost-particulate-emissions-from-tires-study

16. The Dilemma of Regulatory 'versus' ADS Development
The NTSB (National Transport Safety Board) chief published a letter critical of the NHTSA for what it views as a hands-off approach to regulating self-driving testing on public roads.
https://www.caranddriver.com/news/a35844915/ntsb-letter-nhtsa-self-driving-vehicles/
The dilemma the National Highway Traffic Safety Administration (NHTSA) faces, it described as follows: "Establishing FMVSS* prior to technology readiness hampers safety-improving innovation by diverting developmental resources toward meeting a specific standard. Such a regulatory approach could unnecessarily result in the Agency establishing metrics and standards without a complete understanding of the technology or safety implications and result in unintended consequences, including loss of potential benefits that could have been attained absent government intervention, a false sense of security, or even inadvertently creating additional risk by mandating an approach whose effects had not been known because regulation halted the technology at too early a stage in its development." ***FMVSS**: Federal Motor Vehicle Safety Standards
https://www.crowell.com/files/202105-NHTSA-Proposes-Rule-On-Safe-Deployment-Of-Self-Driving-Vehicles.pdf

17. The 360 degree vision helmet
https://newatlas.com/crosshelmet-hud-noise-cancelling-motorcycle-helmet/54413/

18. SUVs cause grave concern for pedestrian safety
The European Transport Safety Council (ETSC) has called for a ban on SUVs in towns and cities in a bid to cut cyclist and pedestrian fatalities. "Research shows that the risk of severe injury or death for a pedestrian is higher in collisions with Sport Utility Vehicles (SUVs) and vans compared to passenger cars."
https://www.rac.co.uk/drive/news/motoring-news/a-european-safety-council-wants-to-ban-suvs-from-built-up-areas/
Pedestrian fatalities have spiked in recent years, even as overall traffic fatalities have declined. Fatal crashes involving SUVs striking pedestrians has increased 81% from 2009-2016, according to the IIHS. The spike in pedestrian fatalities coincides with the rise in SUVs on roadways, which account for more than 40% of new car sales in 2020.
https://www.thecarconnection.com/news/1128503_crossover-suvs-deadlier-to-pedestrians-iihs-study
NHTSA Too Slow in Response to Surging Pedestrian Fatalities, Federal Watchdog Says. SUVs, speed, and older cars are factors, but the GAO says new technologies and updated vehicle designs can save lives. https://www.gao.gov/assets/gao-20-419.pdf

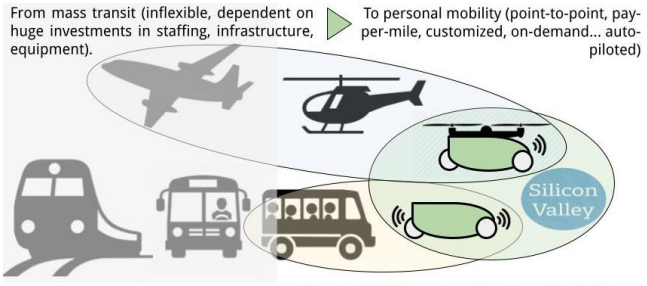
19. Engineering premisses and safety
Have largely been confirmed by various experts in their respective disciplines. As a matter of fact, the 3-seat, (semi) 3-wheeled, concept received recognition at NAIAS (aka the Detroit Auto Show) and has been IP registered. Since it awaits further development, the author decided to use it to help illustrate his viewpoint ("show, don't just tell"). Panhuyzen's comments on autonomous vehicle development and regulations have been filed with the U.S. Department of Transport (DOT). The three-wheeler promises to be safer than any similar-sized four-wheel car. His Next-Gen NCAP considerations and suggestions have been formally filed with the NHTSA.
https://www.regulations.gov/comment/NHTSA-2021-0002-1665

20. Average occupancy (ride-hail) taxis
In the NY example, the cost of conveying one passenger one mile by robo-taxi would be 35 percent less than doing so by conventional taxi at the average taxi occupancy rate of 1.2 passengers. From a provider's perspective—and factoring in the full cost of public transit, including government subsidies—robo-taxis would become competitive with mass transit at an occupancy rate of 2 passengers.
https://www.bcg.com/publications/2015/automotive-consumer-insight-robo-taxis-new-mobility

21. Ride-Hailers contribute to more gridlock
Uber and Lyft have long argued that ride-hailing apps have the potential to make cities better by ameliorating traffic and reducing personal car ownership. But there is a growing body of research that suggests the opposite is taking place. A study, published in the journal Science Advances, underscores how Uber and Lyft are worsening traffic in the city that gave birth to the ride-sharing phenomenon.
https://www.theverge.com/2019/5/8/18535627/uber-lyft-sf-traffic-congestion-increase-study

22. Distracted Driving
https://usa.streetsblog.org/2022/06/10/why-apple-shouldnt-be-allowed-to-turn-a-car-dashboard-into-an-iphone/

23. Seamless 2D and 3D Transit - The Bigger Picture?
In 2018 Panhuyzen gave a presentation for NASA Ames Research and the Vertical Flight Society formerly known as the AHS on the subject. Panhuyzen outlined his vision on '2D & 3D' transit, the logistical and real estate aspects of linking (sleek-footprint) ground transportation and aerial vehicles.



Autonomous vehicles is where car makers, aircraft industry and Silicon Valley intersect

There's a lot Personal Communicating and Personal Mobility have in common. Autonomous vehicles is where different types of industries and disciplines come together, the pinnacle being the modular deployment of road and aerial vehicles. Tech funds are fixated on on-demand personal mobility (service-oriented). Carmakers want to broaden their business model, that used to be hardware-based (selling cars). Aircraft builders ask themselves: can the eVTOL succeed where the helicopter was never able to outgrow the role of costly, standalone transport mode.

For Whom (initially)? - the '1 in 900' rule
'Greening' how we displace ourselves AND Fahrvergnügen together make for an extremely marketable combination. Unless your sense of fun is getting stuck in traffic in a box as big as possible. Global car sales are around 75 million each year. Annually convincing 1 out of 900 prospective car buyers suffices to have a viable production. Think singles, couples, one-child families, early-adopters, urbanites, greenies, techies, two-car households (60% in the US), ride-hail providers together already constitute a much larger group. Global branding is a prerequisite however.

24. The Author
Ralph Panhuyzen is auctor intellectualis of new-iSetta.com, the (IP reg.) vehicle format which is to address all personal mobility and car travel related issues simultaneously. Author of 'The M-Factor - Mobility now, soon and in the future' and a survey on the Port of Rotterdam. Wrote articles regarding mobility for Dutch engineering magazine De Ingenieur. Before that, he was managing director of an intermodal distribution center - linking seashipment, inland barges, rail transport, trucking, warehousing - in the Port of Amsterdam.

Author Panhuyzen participated in dozens of meetings and webinars and has read even more articles and reports. Anyone who did too, must have noticed the discrepancy between academics theorizing and the auto industry's 'business as usual' attitude towards mobility. You can't keep theorizing and discussing mobility without at least having some idea how transport modes can be configured and arranged differently.
What had already been acknowledged on various occasions - Fisita World Congress (green car development), NHTSA filings (Next-Gen NCAP safety), Detroit Auto Show (space efficiency), even NASA and the American Helicopter Society (modular use in UAM) - author has extrapolated into a blueprint, to avoid staying merely academic.