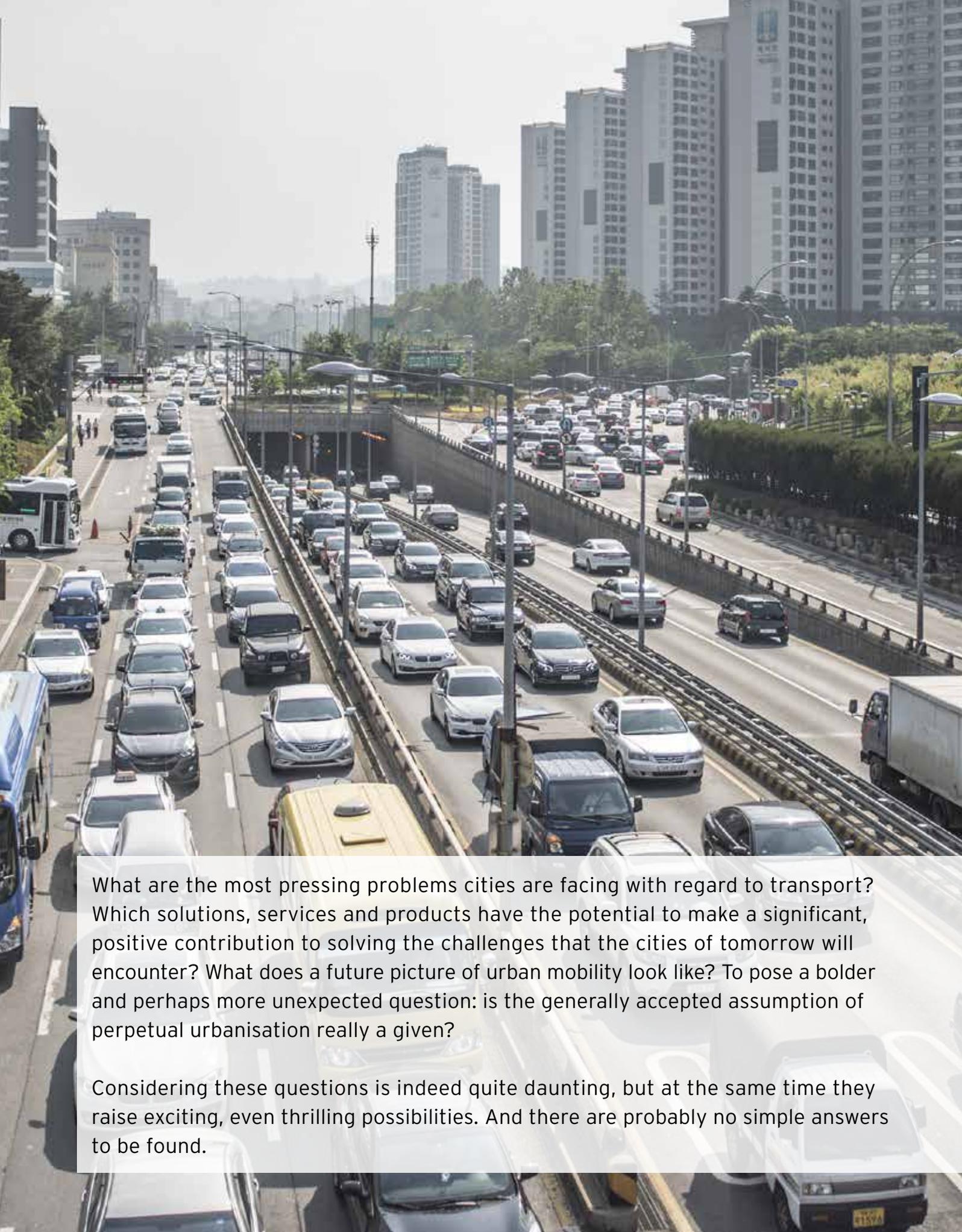# WILL AUTONOMOUS MOBILITY CONCEPTS ULTIMATELY PAVE THE ROAD FOR... DE-URBANISATION?

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What are the most pressing problems cities are facing with regard to transport? Which solutions, services and products have the potential to make a significant, positive contribution to solving the challenges that the cities of tomorrow will encounter? What does a future picture of urban mobility look like? To pose a bolder and perhaps more unexpected question: is the generally accepted assumption of perpetual urbanisation really a given?

Considering these questions is indeed quite daunting, but at the same time they raise exciting, even thrilling possibilities. And there are probably no simple answers to be found.

These topics were addressed to the wide expert network of the Institute for Mobility Research (ifmo). The requested areas of expertise included transport,[1] relevant industries and public transport providers. This allowed for a holistic, differentiated view and an extensive exchange of knowledge on the subject. The main findings are introduced in this article.

The unique and open atmosphere of the discussions allowed the experts to openly address the questions detailed above, and to exchange their deep insights into the topics of autonomous driving, e-mobility, and both present and future urban mobility concepts. One major insight here is surely the pivotal role played by the new business models which will ultimately shape both the existence of and the method of collaboration between service providers, transport suppliers, small & large OEMs and – last but surely not least – the customers of the future mobility landscape.

[1] This discipline meant the involvement of members of the ifmo Board of Trustees as well as US players and city representatives from trendsetter metropolises such as Singapore, London and Copenhagen.

"New business models will ultimately shape both the existence of and the method of collaboration between service providers, transport suppliers, OEMs and - last but surely not least - the customers of the future mobility landscape."

Quite unsurprisingly, the experts' opinions proved to be quite diverse, which fuelled a lively and quite controversial exchange of opinions on the introductory questions and other topics. This diversity of views developed a great dynamic and ultimately led to the emergence of a variety of scenarios for probable future developments.

The initial question, on the cities' challenges, has been the easiest to answer, and there was a fairly broad consensus on the two following conclusions:

1. The most pressing issue cities are facing today with regard to transport is **air quality.**

It seemed quite clear to the expert group that air quality is the issue of top priority for today's cities, because the current air quality levels[2] in most European cities do not meet the recommended health standards set by the World Health Organization (WHO, 2018). The anticipated bans on diesel cars in various major cities of Europe will shortly underline this fact (Cremer, 2018; Garfield, 2018; Leggett, 2018).

air quality

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[2] More (real-time) details on air quality are available on the European Environment Agency website: https://www.eea.europa.eu/themes/air/air-quality-index

2. The most pressing issue cities will be urged to solve in 2030 is **space.**

It is evident that the lack of sufficient air quality is today's most pressing urban transport issue. The experts equally concurred that this challenge will be solved by 2030 with electric mobility sweeping the roads. This issue will thus be solved by technical means, without the need for reshaping either the mobility behaviour or the consumption patterns of the customers.

"What does the future picture of urban mobility look like?"

Unfortunately, the space shortages will not be remedied simply by means of the advancement of (as yet only partly developed) technologies (Copley, 2018; Sanfeliu Arboix & Martín, 2017; Price, 2018). We must not forget that this aspect of the urban mobility landscape is rooted in a much more complex interaction of technological tasks and technology development, economic and regulatory interdependencies, and the vested interests of the parties involved, to name but a few.

That's why the short- to medium-term solution to the space issue is quite a bit more demanding than the solution to the issue of air quality.

As the problem of space cannot be solved simply by technological approaches alone, there is a consensus that it will pose a challenge for some time, as mobility behaviour is not likely to change dramatically before 2030.

Automated driving will certainly eventually contribute to a more efficient use of road space, but by 2030 the share of automated (urban) vehicles will not have a significant positive impact on the availability of road space. In fact, just the opposite might prove to be the case (Moavenzadeh & Lang, 2018: 26).

Particularly in the early stages of automation we will probably face mixed traffic scenarios encompassing both manually driven and automated vehicles. This implies that the use of road space would be less efficient and less balanced than in today's setting (Makridis et al., 2018). It is quite conceivable that even more people might once again begin to use the car more often as their preferred mode of transport, for example because they do not need to drive the vehicle themselves any more. Hence, the contribution of autonomous driving technologies to a freeing up of a notable share of precious urban road space will not be really evident for the foreseeable future. The modal split (the percentage of users choosing each of the various transport modes), and the car's portion therein, is most likely to stay stable, if not actually increase owing to the attractiveness of automated driving.

To put it in other words, we expect the race for space to get even more intense when automated driving is introduced in urban areas.

Is the oft-heralded megatrend of urbanisation actually a given under any and all circumstances? We are all familiar with the generally accepted assumption of the ongoing relocation of humanity towards urban environments, and the consequent endless growth of the urban population. In the context of urban mobility this implies that the rising demand for limited urban space will make it even more expensive, and that room for transport infrastructure will become even more contested than it is today.

With all of this to consider, as previously indicated, the experts, whilst unanimously agreeing on the critical issues, also bring their own diverse perspectives to the table. Urbanisation is one of these. For this reason we pose a bold and perhaps unexpected question: is urbanisation really a given?

In our opinion this issue deserves much attention, and because there is very little 'out there' on the countertendencies to urbanisation, we would like to delineate this opposing scenario in more detail.

Various reports on population development, for example by the UN (2018), suggest that urbanisation trends will remain stable for the foreseeable future. Even though we are focusing on the future – which by its very nature holds many uncertainties – this point of view is often put forward as a seemingly indisputable fact.

Confronting the experts with this counter-hypothesis gave rise to a wide spectrum of hypotheses. For instance, the introduction and rapid uptake of new technologies might lead to a dramatic change in consumption patterns in the future, and have radical consequences for the way of life in urban areas.

Let's take online shopping as an example. Online shopping disrupts the previously widespread consumption patterns of traditional 'offline' shopping (Evans-Cowley, 2016), and is revolutionising the purchasing experience all over the world. While Amazon is now omnipresent, with its tremendous growth rates (Forbes, 2018), traditional retail is under profound pressure. Even the classic retail giants are not immune to the effects of this all-consuming trend. In the United States the last major book retailer, Barnes & Noble, has had no other choice than to give up its business; Toys 'R' Us, **the** number one chain of toyshops, is also closing its remaining shops in the States (Corkery, 2017). It is clear that before long this tremendous wave of closures will reach Europe.

It is clear that before long this tremendous wave of closures will reach Europe. We can already discern the early signs of it: small local retail shops are coming under ever-increasing pressure from their digitised competitors.

Up to the present day, the cost of housing (Maciag, 2018) and office space within urban areas worldwide has risen sharply, due to a continuing influx of city-dwellers, companies and labour. These price hikes are often the motivation behind a firm's decision to choose an office/shop location outside the inner city.

So, **what if** more and more firms start to relocate their headquarters and other office buildings outside of the city centres? And **what if** more and more retail shops, grocery stores, restaurants, cafés, bakeries, garages and dealerships in inner-city areas are closing down? And what is going to happen to all the wining and dining establishments? Will they maintain an inner-city presence without the other shops nearby? Most probably, we will see a domino effect, meaning the shopping experience in the urban areas will disappear and will no longer act as an effective people magnet. This could, in addition, lead to a chain reaction such as shutdowns of adjacent and interdependent shops, flagship stores, offices and the like.

And if, in the event, a significant part of shops, offices and cafés – together with the associated jobs – end up disappearing, will the overall attractiveness of cities remain unchanged? Will it be the case that the essence of what is meant by 'the city' does indeed change, but its inherent attraction remains intact because the urban lifestyle is not dependent on the unique city shopping experience and on most employers being located there? Is the urban lifestyle something that remains appealing to many people even if the amenities of the area gradually disintegrate? Moreover, if we factor in autonomous driving, the prospect of living near the city centre might lose even more of its appeal.

...What if autonomous driving is capable of eliminating the more painful aspects of manual driving, such as desperately searching for a parking space over and over again, or being stuck in traffic without having the option of using your time productively during your more or less stationary car journey?

Will we still be willing to pay significantly higher rents for being part of a gradually socially decaying urban area? Or will the city landscape simply see the disappearance of one sector, namely retail, only to have another sector, perhaps some provider of leisure activity or community resources or co-working, take its place and its space? And what happens if we also factor in the way that commuting could get so much more convenient with a little help from autonomous vehicles?

Unfortunately, most papers on the subject do not address those countertendencies to urbanisation. In our opinion their existence should not be dismissed, since they actually seem to portray quite a viable vision of the future – if you take the trouble to look more closely. They deserve to be discussed extensively by governments, by the private sector and by experts from various disciplines.

The continuation of the trend towards urbanisation is not necessarily set in stone. There are various countertendencies that are able to balance this ongoing trend, if not actually turn it on its head. Nevertheless, despite de-urbanisation being a possible scenario, there is still a fairly broad consensus that continued urbanisation is the baseline scenario that we must consider when discussing developments in mobility and transport concepts in urban areas.

On the assumption that urbanisation is most likely to increase at a global level, we have to discuss the issues of the changing face of urban transport, the associated choices in favour of or against the various transport modes (the 'modal split'), urban infrastructure requirements and boundary conditions. When discussing the modal split there is broad agreement that we need to take into account a new segment of transport that will blur even further the boundaries between public and private transport. The name of this new player? Autonomous on-demand fleets (Trommer et al., 2016).

Autonomous on-demand fleets will dissolve – or at least heavily blur – the boundaries between public and private transport.

These fleets could be configured in various ways, ranging from mass transport capabilities made up of units such as minibuses or van-like pods, to fleets of highly individualised cars that clearly incorporate a luxury component setting them apart from today's premium cars. But these innovative pods might not look at all the same as the cars we drive nowadays.

Service cars might be another viable on-demand variant. The service car will provide you with your favourite morning coffee for your trip… croissant on the side, if you fancy one, giving you the benefit of not needing to stop at a coffee shop and queue, and the option of making productive use of the gained time. You could also think of sleeper cars, which take you from one city to another overnight in comfort without imposing on you the hassle of a red-eye flight.

How large this segment of on-demand fleets ends up will depend on three principal factors:

1

Pricing and total cost of ownership (TCO): what is the price per kilometre to the end customer going to be? How are on-demand prices going to evolve in comparison to public transport and the private car? The composition and shares of cost components within the TCO will change quite dramatically, with fixed costs rising in the first years of adoption as a result of electrification and autonomous driving, and variable costs dropping sharply because of the greater energy efficiency of electric cars and a possibly higher rate of occupancy.

2

Boundary conditions: these are set by the city government and are regarded as a decisive factor when it comes to the convenience and associated cost of using either the on-demand transport or the privately owned car, or the public transport system. Will there be licensing fees that make on-demand fleets relatively more expensive? Will there be (dynamic) road pricing for on-demand fleets, or for privately owned vehicles only? How will parking fees evolve? How can autonomous cars be utilised intelligently during the timeslots for which they are not in use? Will they drive around empty or will they be parked outside, or even be smartly repositioned by artificial intelligence / machine learning algorithms to designated zones to take into account predicted fluctuations in demand, such as rush hour peaks?

3

Overall mobility experience: this is a controllable and crucial factor which will end up lying somewhere between the two extremes. In the end, it all comes to relative attractiveness: how pleasing or displeasing is the overall customer experience with on-demand fleet cars compared to the overall advantages/disadvantages of being the user of a privately owned car?

The individualisation, the comfort and the cleanliness of a private premium car that you can drive your-self offers a totally different customer experience to using a standardised, autonomous fleet car. Yet we have to consider the present trade-offs between individualised comfort, the TCO and also the possibility or otherwise of using the vehicle at all, which will depend on the boundary conditions set by the municipality and/or other regulatory authorities.

In summary, how large this on-demand segment will grow is bound to be dependent on the 'battle of attractions', i.e. on the overall user experience as an on-demand customer versus the experience of driving a private car.

To sum up, we can conclude that there will be autonomous cars in place in the future. Additionally, we argue that the autonomous fleets will lead to a growth in the car's overall modal share, even though the share for the private car is likely to drop slightly. This was agreed by all of the experts.

Autonomous fleets will attract customers away from all other modes, but there will still remain a significant share for rail-based public transport in dense urban areas, simply because the throughput performance of rail is unbeatable by comparison with even the most efficient road paired with the capabilities of autonomous cars.

On the other hand, buses will probably be under significant pressure from on-demand fleets. There is basically no real use case left for an inflexible timetable-bound transport service. Autonomous fleets can react much more flexibly to peaks and troughs in demand, so buses roaming the streets virtually empty will be a thing of the past as soon as autonomous fleets become widely available.

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The Institute for Mobility Research is a research facility of the BMW Group. Its main task is to initiate cross-modal and interdisciplinary research with an international perspective in the domain of mobility and transport.

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