Picture credit: Juli Eberle

“We need to find different incentives”

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Interdisciplinary thinking is the key to developing new mobility concepts – that’s the view of automotive engineer Prof. Markus Lienkamp, political scientist Prof. Miranda Schreurs and traffic planner Prof. Gebhard Wulfhorst.

Gesamter Artikel (PDF, DE): www.tum.de/faszination-forschung-28

„Wir brauchen andere Anreizsysteme“

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Der Fahrzeugtechniker Prof. Markus Lienkamp, die Politikwissenschaftlerin Prof. Miranda Schreurs und der Verkehrsplaner Prof. Gebhard Wulfhorst sind sich einig: Fachübergreifendes Denken ist der Schlüssel für die Entwicklung neuer Mobilitätskonzepte. Smart Mobility bedeutet für sie, vernünftig unterwegs zu sein mit einer Mobilität, die klima- und zeitfreundlich ist und Spaß macht. Sie sehen eine Zukunft, in der weniger Fahrten stattfinden, mit mehr Insassen pro Fahrzeug und – gerade in den Städten – mehr Mobilität mit dem Fahrrad oder zu Fuß. Verbesserung von Luft, Raum und Zeit, so bringt es Lienkamp auf den Punkt. Ohne die Einbeziehung der Bürgerinnen und Bürger wird es nicht gehen, sagt Schreurs. Die Gesellschaft muss sich mit Mobilität auseinandersetzen und sich fragen, was sie erreichen möchte, meint sie. Smart Mobility ist nicht nur eine Technologielösung, erklärt Wulfhorst. Die Konzepte können nur dann erfolgreich sein, wenn sie in ein öffentliches Verkehrsnetz, den öffentlichen Stadtraum, integriert werden. □

What does “smart mobility” mean for you?

Gebhard Wulfhorst: In Munich, we would say, “gscheit mobil” – mobility needs to be enjoyable and reliable. It is more than just a technological solution. Public acceptance and strategic planning in municipal politics are critical. That is why we are linking multiple disciplinary perspectives when we research mobility at TUM through our TUM.Mobility research platform.

Miranda Schreurs: It’s not just about getting from A to B, it’s about how we can create a climate-compatible and eco-friendly system while also actively integrating business and local citizens’ perspectives. Smart mobility is a sensible use of mobility solutions; it is environment-friendly, efficient and based on forward-looking technologies.

Markus Lienkamp: I’d like to highlight three points about our research. First, our Smart Mobility research team is recording and analyzing how people get around. Second, we are striving to improve the quality of air, space and time. Third, we want to prevent unnecessary journeys. For those journeys that need to happen, we need to increase occupancy levels above the 1.3 people transported on average per vehicle today.

Terms such as “transport transition” and “mobility transition” have become commonplace in public discourse. How would you define them?

Wulfhorst: I would differentiate between a drive transition – that is, a change in the technical and energy-related aspects of transport – and something I would refer to as a mobility shift. The term “traffic” refers to people and vehicles moving from A to B, including on foot. “Mobility” is a much broader term; it incorporates use of space, personal circumstances and social aspects.

Lienkamp: There is a common perception that all we need is a switch from combustion engines to electromobility. But this is a misperception. While this is a small part of the solution, it is only a very small part. If we want to achieve 80 % decarbonization of the transport sector through electromobility alone, the costs will be enormous. What we need to do is to take cars off the roads, expand local public transport networks, and encourage active mobility, such as walking and cycling.

Schreurs: Decarbonization is an important part of the solution from an environmental perspective. Another issue is about how we use space. Cities are full of ▷

“It’s about how we can create a climate-compatible and eco-friendly system while also actively integrating business and local citizens’ perspectives.”

Miranda Schreurs

Picture credit: Juli Eberle

parked cars. We need to consider: How can we go shopping responsibly? How can elderly people get around cities easily? All of these facets are part of the transition that is so vital for us.

Wulfhorst: Actually, it's about arriving at the right place at the right time. That's why we're currently working on accessibility planning. An example would be the concept of a 15-minute city in which all key amenities – supermarkets, kindergartens, and so on – are reachable within 15 minutes of the place you live.

Lienkamp: Just think about how time-consuming mobility is for so many. Take my day today, for example. It only took me 5 minutes to cycle to the university. I went home at midday and did a little shopping on the way back here. After that, I cycled 10 minutes to where I go horse-back riding. That means that by the end of the day today, I won't have driven a single kilometer – instead, I'll have spent 40 minutes on my bicycle, enjoyed myself in the process and gotten everywhere I needed to be on time. Other people might take as many as 3 hours to make the same journeys because they live far away. Deciding where we live and work determines a great deal about our mobility and our use of time. ▷

Prof. Dr. Miranda Schreurs

researches environmental, climate and energy policy. She studied at the University of Washington, the University of Michigan and, thanks to a Fulbright scholarship, Keio University in Japan, before spending three years researching at Harvard University's Kennedy School of Government. From 2007 to 2016, Schreurs headed up the Research Center for Sustainability (FFN) at FU Berlin. She has held the Chair of Environment and Climate Policy at TUM's Hochschule für Politik since 2016.

Prof. Dr.-Ing. Gebhard Wulfhorst

studied civil engineering at RWTH Aachen. He furthered his interest in urban and transportation planning at the École Nationale des Ponts et Chaussées in Paris. After obtaining his doctorate from RWTH Aachen, he moved to Strasbourg in 2004 to take up a position as a Marie Curie Fellow at the EU Commission, and later worked for a planning agency in Karlsruhe. He has led the Chair of Urban Structure and Transport Planning at TUM since 2006.

Prof. Dr.-Ing. Markus Lienkamp

has led the Institute of Automotive Technology at TUM since 2009. His research focuses on autonomous driving, electromobility and other mobility topics. After studying mechanical engineering at TU Darmstadt and Cornell University, Lienkamp obtained his doctorate in Darmstadt. This was followed by a position at Volkswagen, where he led the “Electronics and Vehicle” department in the Group Research division before moving to TUM.

Picture credits: Juli Eberle

What other challenges do we face when it comes to mobility? We've already mentioned the climate crisis, traffic congestion, space and time problems.
Lienkamp: In a nutshell, it's about improving the quality of space, air and time.

Wulfhorst: Social sustainability and affordability are issues that are often overlooked. We have to ask, who will be the winners and who the losers? And we have to pay attention to how can we provide safety for poorly protected groups in traffic.

Lienkamp: There are too many situations where gas prices don't really influence driver behavior because users don't feel the costs. When it comes to company cars, for example, it's the companies that pay for the fuel.

Lienkamp, Wulfhorst and **Schreurs** simultaneously: We have the wrong incentive systems.

Prof. Lienkamp, as an automotive engineer, you specialize in vehicles. So, why are you advocating so strongly for a reduction in car traffic?
Lienkamp: The term "vehicle" is overarching; it includes bicycles, motorbikes, trucks, buses, and so on. We will still need cars, of course, but I would seriously question whether we still need so many cars. Take Singapore for example: They have 5 million residents but only a million cars. Traffic flows well, as cars are expensive and their numbers are limited. And the flexible congestion charge increases when traffic begins to flow more slowly. Translating this to Munich with 1.5 million residents, this would mean that we should only have 300,000 cars on the road rather than the current 750,000.

Schreurs: We often look to Singapore and other cities that have already developed a certain image in terms of mobility, such as Copenhagen and Amsterdam for cycling, or Vienna for completely novel concepts for a city with fewer cars. I ask myself how we can achieve something like that for Munich. Creating a location that is genuinely future-oriented, develops exciting concepts and attracts young people – these are important goals.

"What we need to do is to take cars off the roads, expand local public transport networks, and encourage active mobility, such as walking and cycling."

Markus Lienkamp

How can we get there?

Schreurs: Munich and Bavaria have some ambitious targets but we haven't always achieved targets we've set in the past. One problem is that political decisions don't always match the interests of industry and society. We need to find ways to convince policymakers and industry to embrace changes that also incorporate citizens' perspectives; we should develop mobility ideas together. That's where the university can play an important role.

Wulfhorst: Trying things out helps a lot. The coronavirus pandemic has given us all a more flexible mindset. This has also been applied to our city streets. Right next to our office in downtown Munich is Theresienstrasse, a two-lane, one-way street. Although there were plans for a third lane to go in the opposite direction, during the pandemic the city authorities instead replaced one of the traffic lanes with a pop-up cycle lane. After some controversy, a court decided that the cycle lane can stay permanently. So, a transport transition has already taken place here and will likely occur in many other places too. Through our EU-funded project, Street Experiments, we see that there is a strong European trend toward more room on the roads for cyclists and less for cars.

Schreurs: That's a great example – we need much more of that. A lot of innovative concepts have been created here in Munich and it's important that we actually implement them, too. If we do, Munich can become a model for others.

TUM.Mobility –
an interdisciplinary research platform

TUM.Mobility combines the expertise and resources of 40 professorships in various disciplines, facilitating interdisciplinary collaboration at TUM on the future of mobility. It aims to address global social challenges with a holistic approach in order to develop successful innovations, generate momentum for economic transformation processes, bring about socially fair mobility systems, and minimize the environmental pollution and health impacts of transport.
TUM.Mobility covers eight main topic areas: urban mobility, low-carbon power systems, autonomous driving, integrated transportation systems, urban development, transport modeling and simulation, governance and participation, and business models and entrepreneurship.

www.mobility.tum.de

Prof. Lienkamp, what are your expectations for autonomous vehicles? Could you briefly explain two terms for us: autonomous and automated?

Lienkamp: Autonomous vehicles don't have a driver; automated ones do, but the vehicles perform certain tasks. Simply automating every car won't achieve anything. We need to think about things differently. Automation will allow us to replace sparsely occupied 50-seater buses with more compact, autonomous transport vehicles that carry smaller numbers of passengers. These will be considerably more flexible and will be able to overcome one of the major drawbacks to local public transport – long journey times due to the sheer number of stops – in an affordable way. In our experience, you need an average of 4 to 6 people per journey to make this system work. For Munich, we've calculated that if we were to get rid of all private car traffic and replace it with small shuttles, we would need at most 16,000 vehicles. We're actually not so far from that already, as Munich currently has 3,300 taxis.

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Picture credit: Juli Eberle

“Society needs to discuss mobility much more and ask itself what it wants to achieve.” Miranda Schreurs

Prof. Wulfhorst, you’ve said that, for many new mobility technologies, we need to take the public realm into account. What exactly do you mean by that?

Wulfhorst: That’s the finding of our projects, particularly for the European context. There, the focus is on start-ups, technological development and economic success. We believe that new mobility concepts need to be integrated with a public transport network serving the urban public space. There are also legal issues to consider. For example, streets are a common good. We need to be mindful of who is using them and for what purposes. What we certainly don’t want is to develop a system where children can no longer walk to school because autonomous shuttles, sharing services and so on are taking up so much room that the remaining space is unsafe. Car sharing and shuttle services will only contribute to genuine sustainability when they are connected with the local public transport network via mobility stations. In the future, regional authorities will have to provide these kinds of private services as supplementary mobility services at these hubs, just as they do with buses today.

Schreurs: Sharing concepts are becoming more popular but there are not enough cars available. That is why car sharing is not particularly easy to use. Many people continue to reject car sharing due to a lack of vehicle availability.

Lienkamp: If a lot of people were to use sharing services, the networking effect for everyone would be a huge advantage. It would ensure that there are plenty of locations where you can find shared cars and this would make car sharing convenient.

Prof. Schreurs, you conduct research into environmental and energy policy. Electromobility is the key to harnessing renewable electricity for use in transport through sector coupling. Germany aimed to have a million EVs on the road by 2020 – and missed this target. What do you see as effective levers we can pull to bring about a mobility transition?

Schreurs: The horrific situation unfolding in Ukraine should be taken as an opportunity, even a necessity, to rapidly reduce our gas consumption (we spoke early April – Ed.). This means we will have to change our thinking significantly. We also know we're facing a climate crisis. The younger generation is genuinely fearful for their future. Yet crises create new opportunities. We have a window open for change right now if we choose to use it. Decision-makers in the worlds of politics, industry and NGOs must come together to review existing concepts and discuss alternatives for the future, before then implementing them expeditiously.

For that to happen, the right incentives must be in place. Public transport needs to be cheaper, company cars more expensive, and shared mobility more attractive. We must rethink our priorities. To date, our priorities have been individual freedom tied to private cars. Society needs to discuss mobility much more and ask itself what it wants to achieve. I don't know how many people are actually engaging with the idea of autonomous, shared vehicles. However, if society doesn't consider it a viable concept, it will be very difficult to implement. Technological development should not take place in the lab but rather in dialog with society. We need to come together to discuss which direction we want development to go – whether we want to invest in a certain technology and, if not, to look for alternatives. ▷

Picture credit: Juli Eberle

"Streets are a common good. We need to be mindful of who is using them and for what purposes."

Gebhard Wulfhorst

Do you think we need more citizen engagement, perhaps in a different form?

Schreurs: Citizen engagement is hugely important. There are already a few excellent examples; for instance, there were eight citizens' conferences held as part of the Bavaria 2030 survey. We should have similar town hall-type meetings across Bavaria. We should discuss various mobility options for municipalities, urban districts, and rural communities. Digital twins for regional mobility would be good, so that people could consider different alternatives directly.

Lienkamp: One goal would be to convince people that, while they obviously need access to mobility, this does not necessarily mean a car of their own. There was a study in which participants were paid to stop using their cars for a period and to instead use other mobility options, such as public transport. After the study, two-thirds of the participants indicated they planned to do away with their cars.

Schreurs: That's why we have test beds.

"Deciding where we live and work determines a great deal about our mobility and our use of time."

Markus Lienkamp

We're speaking today on April 5. The war in Ukraine is now in its sixth week. Germany's dependence on Russian oil and gas is the subject of much discussion. Do you expect to see an acceleration in the decarbonization of the transport industry?

Schreurs: I hope this terrible war will at least contribute to a quicker transition to renewables. In the energy sector, we're going to see a significant expansion of wind and solar energy, and battery research and development will be propelled forward. We can also expect big strides towards sector coupling, linking mobility to smart cities. How quickly we expand electromobility and the accompanying infrastructure will determine how quickly change will be realized in this dimension of mobility.

Lienkamp: OK, but remember that vehicles have a useful life of around 15 years. Even if, starting tomorrow, we decided to manufacture only electric cars, we would only be able to achieve a maximum change of about 7 % per year. The only thing that can really help a mobility transition in the short term is a speed limit and fuel-saving incentives. People with company cars need to be the ones paying at the pump – that would have real impact, even if the company reimburses the cost.

Schreurs: You're right. Filling the car with gas is, relatively speaking, still far too cheap and is one reason the mobility transformation hasn't really progressed very far. There are many great concepts out there, but change has been far too slow.

Lienkamp: Everything we improve as engineers is immediately eaten up by the rebound effect, such as bigger cars and higher mileage.

Wulfhorst: A doctoral thesis on electromobility in our group showed that it isn't technology that will solve the CO_2 problem, but trade in emissions certificates that could have a real impact. With CO_2 as a key performance indicator, we could achieve the transformation without

"For the city of the future, we need to develop integrated mobility concepts that look at the overall picture." Gebhard Wulfhorst

any subsidy programs for electric cars. That's why it's so important to keep the actual objectives in mind.

Lienkamp: We're currently looking into the true costs of mobility, including all the various secondary impacts. As it turns out, some modes of transport are surprisingly expensive. Electric scooters, for example, are the most expensive form of transport because they are associated with so many accidents. Accidents, of course, have major economic impacts. We need to make such costs more transparent. The cheapest form of transport is walking – and that's without even factoring in the positive effects on health. Factoring health into the equation makes walking and cycling actually have negative costs.

Schreurs: Until now, our thinking has been too sector-specific; we haven't been focusing enough on interrelationships, such as the links between health, mobility, education, and so on. A holistic perspective would enable us to develop far better systems.

Wulfhorst: We really should be structuring our cities around walking. Munich has some good examples of walker and cycler friendly districts. In these areas, over half of all journeys are completed by bicycle or on foot. For the city of the future, we need to develop integrated mobility concepts that look at the overall picture. In our notes on local mobility, we've also emphasized that long waiting times at traffic lights make journey times far longer for pedestrians and cyclists. In Copenhagen, for example, the traffic lights turn green when a given number of cyclists are waiting at an intersection. Everything is possible; you just have to want it to happen.

Interview by Christine Rüth

MCube – Munich Cluster for the Future of Mobility in Metropolitan Regions

MCube brings together a unique network of actors from the fields of science, business, the public sector and society in the Munich region. Its goal is to develop sustainable solutions for mobility in metropolitan regions. The cluster program aims to establish Munich's position as a pioneer of sustainable and transformative mobility innovations. Its current projects focus on three main fields of innovation: (1) electrifying and automating transport systems, (2) developing and integrating mobility options, and (3) networking and shaping mobility spaces. MCube is part of the Clusters4Future initiative operated by the Federal Ministry of Education and Research (BMBF). Launched in 2021, it will receive annual funding of up to €50 million for up to nine years. TUM coordinates the cluster, while TUM professors Gebhard Wulfhorst, Markus Lienkamp and Sebastian Pfotenhauer lead the MCube Strategy team.

www.mcube-cluster.de