DESIGNING FUTURE MOBILITY: CITIES SHOW US THE WAY

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INTRODUCTION

The world is urbanising rapidly: Over **50% of us live**[1] in towns and cities already. With **64% of journeys**[2] taking place in urban areas today and this proportion set to increase, there is enormous pressure to provide a transport infrastructure which keeps business moving and creates places where human beings want to live.

Cities are both on the frontline of this mobility challenge, with city leaders everywhere naming it their top priority[3], and best placed to tackle it. But how?

"All the major global challenges – climate change, the economy, inequality, the very future of democracy – will be solved in cities."

Ada Colau, mayor of Barcelona[4]

THE ECONOMIC IMPACT OF TRAFFIC CONGESTION IN LONDON WILL RISE BY OVER 70% BY 2030, BY WHICH TIME IT WILL BE COSTING THE CAPITAL'S ECONOMY $14.5BN A YEAR

Source: London's Digital Future: The Mayoral Technology Manifesto 2016 by Tech London Advocates, techUK and Centre for London, February 26, 2016: http://www.centreforlondon.org/publication/londons-digital-future/

In this paper we explore what we believe are three important enabling factors:

1. City-created platforms for innovation on which authorities catalyse change, with smaller mobility players providing solutions
2. The embrace of the smart city, in particular the fostering of digital solutions
3. The recognition among authorities and other players that inclusion within mobility systems has not only individual and civic benefits, but also aids economic growth and innovation

Many other factors will determine how and when cities, each under different circumstances, deliver a sustainable mobility future. Amongst these, a 'just do it' attitude to trial and test strategies and pilot ideas will help. We have seen change take place quickly in New York[5], for example, through a rapid test and pilot of changing streetscapes to accommodate more walking and cycling, which have now become permanent.

However ustwo's specialism in human-centered and digital design informs this contribution to the debate and will be the basis of future mobility interventions.

In this paper we also discuss autonomous vehicles, city types and new mobility initiative Wayfindr, an ustwo-developed open standard for inclusive city navigation.

ustwo creates future-focused digital tools, services or ventures designed to make a meaningful impact and bring commercial returns.

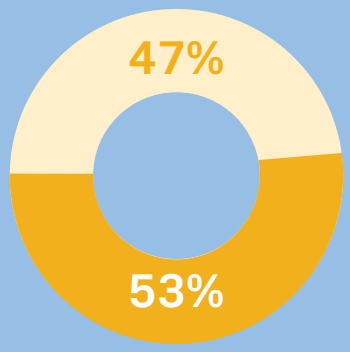
Our unique studio model sees us become deeply enmeshed in the fields we operate in, which range from health to finance. Not only do we advocate close client collaboration to the point at which joint project teams merge into one[6], but we build our own businesses and products that stand or fall on getting people and the experiences they want to have, right.

In mobility we have partnered with many players in the ecosystem including transport authorities, vehicle and equipment makers and charities. The nature of our work is such that we often facilitate partnerships between players.

Our broad perspective, not to mention first-hand experience of working in some of the world's greatest metropolises, leads us to view the city as a creative crucible where public authorities can catalyse positive change.

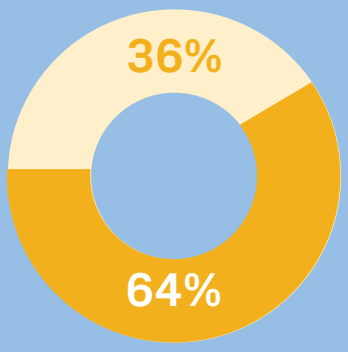
"The world's population is increasingly city-based. **53%** of the population currently lives in urban areas and by **2050** this number is expected to reach **67%**. Today, **64%** of all travel made is within urban environments and the total amount of urban kilometers travelled is expected to triple by **2050**."

Population living in Urban vs Rural area



Living in urban area
Living in rural area

Travel within Urban vs Rural area



Travel within urban area
Travel within rural area

Source: Arthur D. Little report: 'The Future of Urban Mobility 2.0', 2014: http://www.uitp.org/sites/default/files/members/140124%20Arthur%20D.%20Little%20&%20UITP_Future%20of%20Urban%20Mobility%202%200_Full%20study.pdf

Driverless cars 1, Flying Cars 0

Autonomous vehicles (AVs) along with Electric vehicles (EVs) and sharing are the three interrelated trends[7] that stand to have the most impact on how we get around in cities.

AVs will definitely beat flying cars[8] to the punch and will probably be most prevalent as a 'robotaxi' fleet that we summon at will for individual trips, although buses and trains will also be autonomous. No-one quite knows where the public / private boundary will be. Under the individual traveller-focused Mobility as a Service vision we discuss later, while it may be irrelevant to the user who provides the service, public and private providers will have to collaborate closely behind the scenes.

In this great paper[9], MIT and Stanford researchers take the robo-taxi fleet scenario to the extreme, basing their case study in Singapore. It estimates that a future autonomous shared-vehicle mobility solution could meet the personal mobility needs of the entire population with a fleet approximately 1/3 of the total number of passenger vehicles currently in operation.

However, human behaviour, regulation and the speed at which supporting connected infrastructure can be built out will determine how fast AVs appear in our transport networks and what proportion of the mix

they comprise in different places.

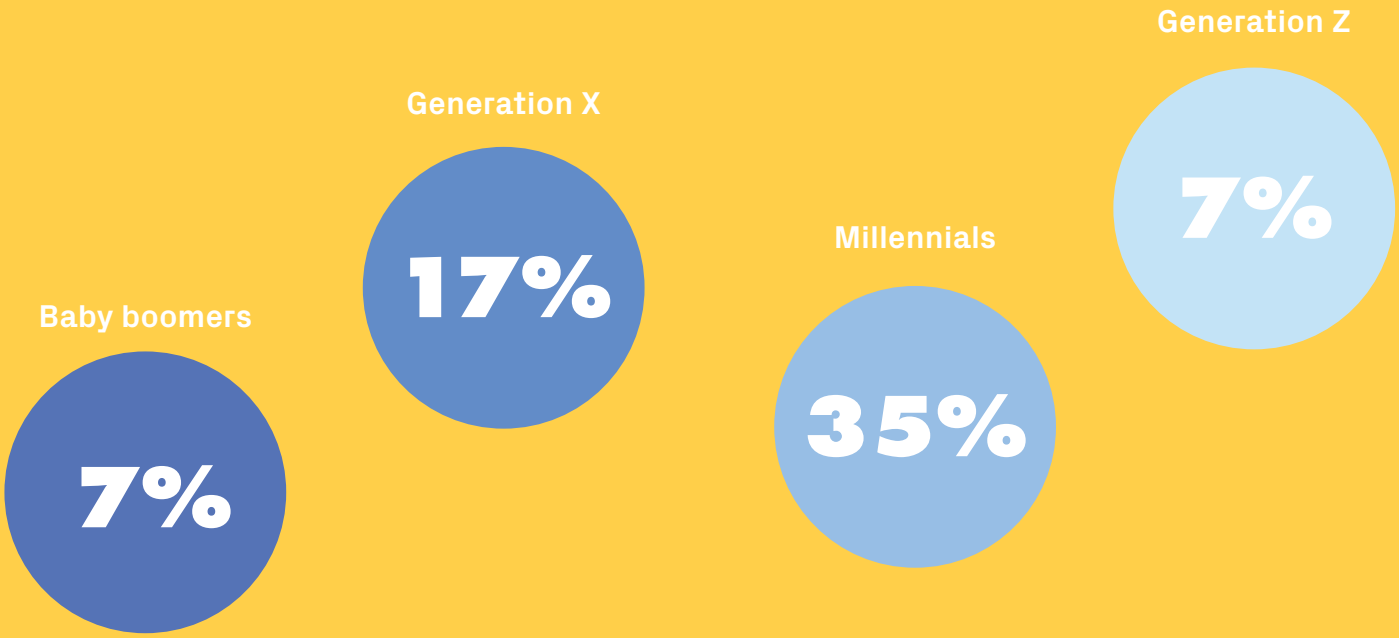
For example, regarding sharing behaviour will people relinquish the ownership of cars that have become a key signifier of status? In Singapore perhaps not so soon[10], because of an entrenched aspiration for car ownership. How will we resolve which moral imperatives need to be built into control algorithms? One MIT project, the Moral Machine[11] aims to find out. Will algorithms travel across cultural borders? Will people, both drivers and other road users trust autonomous vehicles? Currently 55% of UK drivers are uncomfortable[12] with sharing their streets with AVs, but designers are grappling with ways to achieve trust right now by building interactions that can be understood and that clearly communicate intent.

Regarding regulation, will transport authorities develop regulatory frameworks that encourage AV innovation? The UK[13] and US[14] authorities have made strides.

With these questions in mind Deloitte[15] believes that in the next 10-15 years owned vehicles, shared vehicles and vehicles offering varying degrees of autonomy will co-exist on our streets, which may even be segregated streets. The World Economic Forum projects[16], reasonably, that 10% of vehicles will have full autonomous capabilities in 2025. Our belief is that these will be concentrated in wealthier and more densely populated centres: The 'mature public' cities we focus on below.

With over 1bn cars on the roads now, and that total predicted to rise, that is still a lot of cars. That is why we are working on

The popularity of ride sharing differs across generational lines. More Millennials are willing to share cars:



Source: Goldman Sachs 'Cars 2025': http://www.goldmansachs.com/our-thinking/technology-driving-innovation/cars-2025/

human experiences around AVs and other developments such as electric vehicles that stand to deliver more convenient, safer and cleaner mobility.

Predictions about autonomous vehicles are as disengaged from reality as the technology promises to make us from driving. Imaginations run wild and foresee people gladly adopting fully autonomous futures.

But the problem is that they extrapolate from the capabilities of the vehicle itself and don't account for people's travelling preferences.

One thing our user research has shown us is the enduring variety of human preferences. People will want to have varying degrees of control, from those who will not trust the technology to those who will want to sleep on the drive to work. Those degrees of control will also be related to what it signifies about the drivers or passengers.

It would be a mistake to design for an ecosystem which forces full autonomy on everyone all of the time. We need to design for a future where there are both humans and robots at the wheel.

Tim Smith, Design Principal for ustwo Auto

1. CITIES: CATALYSING POSITIVE CHANGE

We devoted space to car ownership and what it might evolve into because individual motorised transport, the car-centric design of our physical environments and regulations is a legacy which local and national authorities have to respond within. In nations experiencing fast rising prosperity, rising rates of car ownership may mean a similar challenge will be faced by developing cities.

Shared, autonomous vehicles certainly promise to address some of the mounting problems associated with mass car ownership such as congestion and pollution with more efficient vehicle utilisation. They could also address issues of inclusion by providing a cheaper and door-to-door service. But AVs have to take their place alongside other transport modes, if only because modelling[17] suggests a parallel automated public transportation system would optimise their efficiency.

How should city plans accommodate the optimum mix of transport modes and providers while allowing for innovation? We suggest a 'city as platform' approach may be the most suitable for **'mature public'** cities. →

Mature Public cities

Every city is unique and there is no one size fits all approach to a sustainable mobility future. However, for the purpose of suggesting strategic priorities it is possible to cluster cities into three general types based on their current profiles. Our focus in this paper is on the third type, 'mature public' where the gains could be the greatest:

Type 1: *Emerging*. Cities such as Johannesburg in less developed regions with low but rising car ownership can avoid issues associated with making systems largely car-centric if they start with a sustainable core. Existing road infrastructure mean AVs will not take hold and EVs will make a small contribution to improving air quality but ride sharing, enabled by greater connectivity, has great potential to account for half of journeys by 2030, thus reducing congestion and pollution. The economic gains could be up to $2,800 per person p.a.

Type 2: *Mature Individual*. Cities, typically sprawling conurbations in the US and Canada but also like Seoul which expanded as automobile ownership did, need to rethink the system. Autonomous vehicles, complemented by some ride-sharing and hailing, are the most likely of the trends to take off, with affordability and efficiency gains. Door to door convenience and cost may however increase traffic. The gains: $3,300 p.a.

Type 3: *Mature Public*. Cities which already have a high share of sustainable transport modes such as Amsterdam and Hong Kong need to focus on integration to get more people and goods where they need to be more effectively. Several cities in Europe and Asia match this profile. The changes, as the three trends (Avs, EVs and sharing) come together in the most flexible and diverse systems serving dense populations could be the most radical. There will be more journeys but their impacts will be less. The gains: $7,400 per person p.a.

We drew on McKinsey's 'An Integrated Perspective on the Future of Mobility'[18] and Arthur D. Little's ''Future of Urban Mobility'[19] for the typology above.

"TO JUSTIFY THE ATTENTION WE GIVE IT, THE AUTO INDUSTRY VALUE CHAIN IS AN ESSENTIAL ENGINE OF GLOBAL ECONOMIC GROWTH. IN THE UNITED STATES, THE SECTOR GENERATED $2 TRILLION OF ANNUAL REVENUE IN 2014, 11.5% OF US GDP"

Source: Deloitte: 'The Future of Mobility', September 2015: https://dupress.deloitte.com/dup-us-en/focus/future-of-mobility/transportation-technology.html

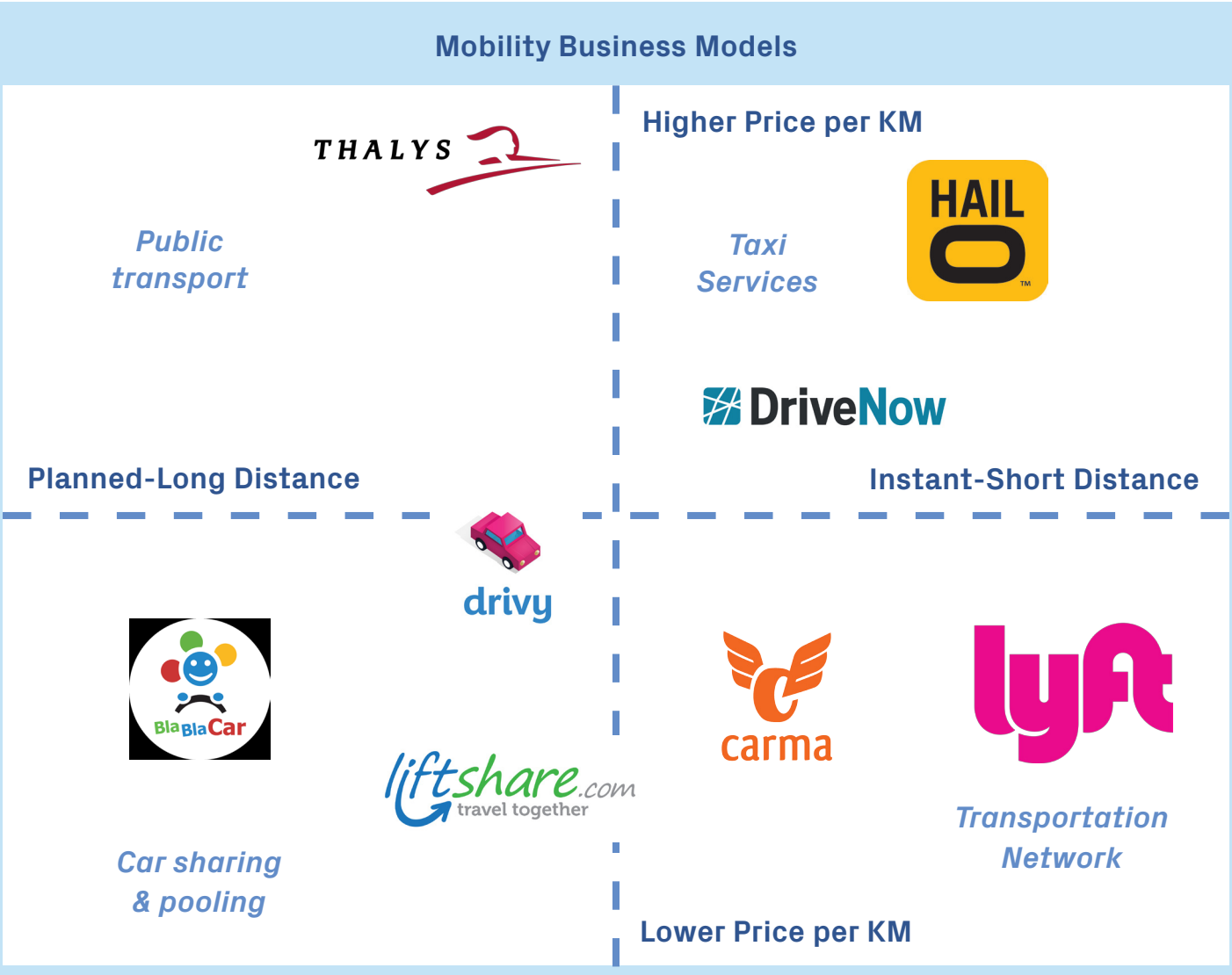
The World Economic Forum has identified an[20]: "emerging tendency towards platforms, frameworks and system architectures guiding action in addition to specified regulations, rules and official plans."

In essence, a platform approach is about flexibility: Traditional top-down planning must now be complemented with space and incentives for new mobility business models to emerge and take root in response to changing circumstances and future opportunities. With developments such as AVs, EVs and sharing in their infancy it makes sense to welcome players from all kinds of connected disciplines ranging from payment providers to automakers, to iterate on solutions which will serve demand more effectively and sustainably.

"Planning and policy need to provide the pillars and enablers upon which experimentation and innovation can take place to create new products and services that will drive future mobility. Additionally, the public sector can provide access and funding to help innovation happen on its infrastructure."

Jason DaPonte,
Strategy Principal, ustwo and previously Transport for London

We do not subscribe to Arthur D. Little's harsh verdict that currently: "the management of urban mobility operates in an environment that is too... hostile to innovation." Certain authorities have demonstrated innovation leadership, such as New York[21]. But cities must accept that they are not the only players and that ideas - and the means to develop them - will come from all quarters. A city 'platform' which enables innovation - for example through the provision of open and free to use public transport data - can help providers with solutions flourish. We need to be agnostic as to where these ideas come from, alongside regulation which levels the playing field by ensuring providers meet set standards around safety, workforce protection and so on.



Source: Frost & Sullivan (2015)

2. THE SMARTER THE BETTER

It will not have escaped your attention that many of the business models above owe their existence to new technology. Or that ustwo is a digital studio whose mission it is to get usable, useful technology into people's hands.

But there is an emerging consensus[22] that technology applied to mobility offers us: "more flexible, nimble, user-focused, connected, sustainable, customized and affordable options for moving people and goods, and even for moving less." For example, we are already seeing great gains from the deployment of open data to help commuters plan their journeys and support user information on service availability.

Technology-related businesses would find the platform approach we advocate in the previous section particularly compatible with their approach to development, which places a premium on agility and experimentation.

Cities, even smaller ones, are acknowledging this: Pittsburgh[23] struck a deal to allow Uber to trial its self-driving taxis and Milton Keynes[24] in the UK, which seeks to advance the same technology, have grasped the opportunity to be collaborators and testbeds.

But a smart city is not just a facilitator of individual solutions. It develops, or enables the development, of a virtual connective tissue to enhance the experience of physically integrated transportation modes. 'Integration service providers' may be transport authorities or trusted brands that could ultimately create inter-regional or even international virtual hubs of information, payment options and services. These user-friendly hubs will get people where they need to be more effectively and in a personalised way.

"It's interesting to see how different cities are working with their community of technologists. A city like London, for example, has a community hungry to help it solve its mobility challenges. In the Digital Manifesto for London we called for the city to be much more proactive in working with technologists, by opening up more public data, by issuing challenges and competitions and by appointing a Chief Digital Officer to build relationships with the city's technology sector. We look to the city to harness the capabilities of its technology sector to bring ideas to market."

Jess Tyrrell, Client Partner at ustwo and Associate of Centre for London

For example the Helsinki Region Transport System Plan[25] anticipates the city changing its concept of itself to become a more efficient and journey cost-reducing Mobility as a Service provider[26], whereby: "mobility will increasingly be seen as an information service with physical transportation products, rather than a transportation product with additional services." Those products will include[27] mobility options developed in the private sector.

Ultimately, a smart city not only fosters tech-related solutions in mobility and ensures they are integrated into a seamless multi-modal whole. It delivers[28]: "the integration of information, communications and technology solutions across three or more different functional areas of a city."

This definition makes it all the more important that city authorities develop an overarching and tailored digital strategy alongside a mobility strategy. The report: London's Digital Future: The Mayoral Technology Manifesto 2016[29] makes the case strongly for how London can become the 'world's leading digital city' and reap the benefits from being more connected, responsive and integrated.

Individual travellers and their preferences

are moving centre stage in strategies as the realisation takes hold that mobility is a means to many ends: Higher satisfaction levels and greater use of the system occurs when, unsurprisingly, new or upgraded options resonate with traveller aspirations.

Vienna offers a good current example through its convenient SMILE smart-card-based public transit system. It is clean, punctual and something people feel proud of, which has been attributed to the authorities identifying and serving both rational and emotional needs[30].

We have already mentioned Mobility as a Service (MaaS), a future vision that is gaining traction[31] among those shaping mobility strategies, above all in ‘mature public’-type cities. One of its key features is the flexibility enjoyed by users of the system to choose between any of several public or private modes, with transport authorities facilitating choices.

3. PEOPLE IN THE DRIVING SEAT

This trend to put people rather than modes first will only accelerate with two international movements and agreements. Firstly, the commitment by national and local authorities to the 'right to the city' (also included in the UN's recently ratified New Urban Agenda[32]). Secondly, by the UN's binding Convention on the Rights of Persons with Disabilities[33] which most countries and by extension cities have signed.

The former provides a model of sustainable urban development that emphasises citizen participation in decision making and equal access to city environments for all. The latter commits signatories to equal treatment of an underserved yet large proportion (approximately ten percent) of the world's population.

The trend entails the wider adoption of a human-centred design mindset that asks questions at the human experience level, to help planners focus on the outcome for users rather than on the system itself. This mindset seeks input from the ultimate beneficiaries of a solution at every stage, from discovery to prototyping and testing.

Human input is the vital fuel for the kind of creative problem solving where citizens buy into the result. Take the inspirational example of Reykjavik[34], which opened datasets and worked with civil society activists to crowdsource and prioritize new ideas for the city.

The pressure inherent on cities to consistently rethink and iterate on mobility solutions presents a golden opportunity for collaboration with designers focused on human needs, and on inclusivity.

“Design changes that are needed to accommodate the Convention will, over time, generate new ideas and innovations that will improve life for all people.”

The UN on its Convention on the Rights of Persons with Disabilities

To provide some context, the US Bureau of Transportation found[35] that almost 15 million people in the US, six million of whom are disabled, have difficulties getting the transportation they need. The knock-on effects are severe, with for example vision impaired people suffering from the linked problems of isolation, depression and poverty: Nearly 70% of blind and partially sighted young people in the UK are living on the poverty line[36].

A participatory and inclusive approach will satisfy mainstream and underserved transport systems users’ needs better. This is a worthy goal and there are many other benefits. For example if transport is the single largest factor in escaping poverty, according to Harvard[37] and New York[38] universities, then inclusive transport can help more people to be economically productive. As G3ict, the global initiative for inclusive ICTs, notes[39]: “there is a compelling human rights and business case for infusing accessibility into global Smart Cities programs.”

Sharing a commitment to an inclusive and human-centric design process is the basis of our partnerships with all players we're working with in this space. It's fundamental to how we approach each brief. Sometimes we are called upon to help instill this mindset, bringing our partners up to speed on such product discovery techniques as rapid prototyping and continuous user testing. But we've seen firsthand the commitment and knowledge of all mobility players rising over time. The message is spreading that a tech-first approach to problem-solving in mobility doesn't always lead to the best outcome.

Nicki Sprinz,
Business Director, ustwo

WAYFINDR

The Google.org backed not-for-profit is on a mission to empower the 285 Million people living with sight loss worldwide to navigate the world independently. It facilitates the collaborative development, publication and adoption of the Wayfindr Open Standard for Audio based wayfinding.

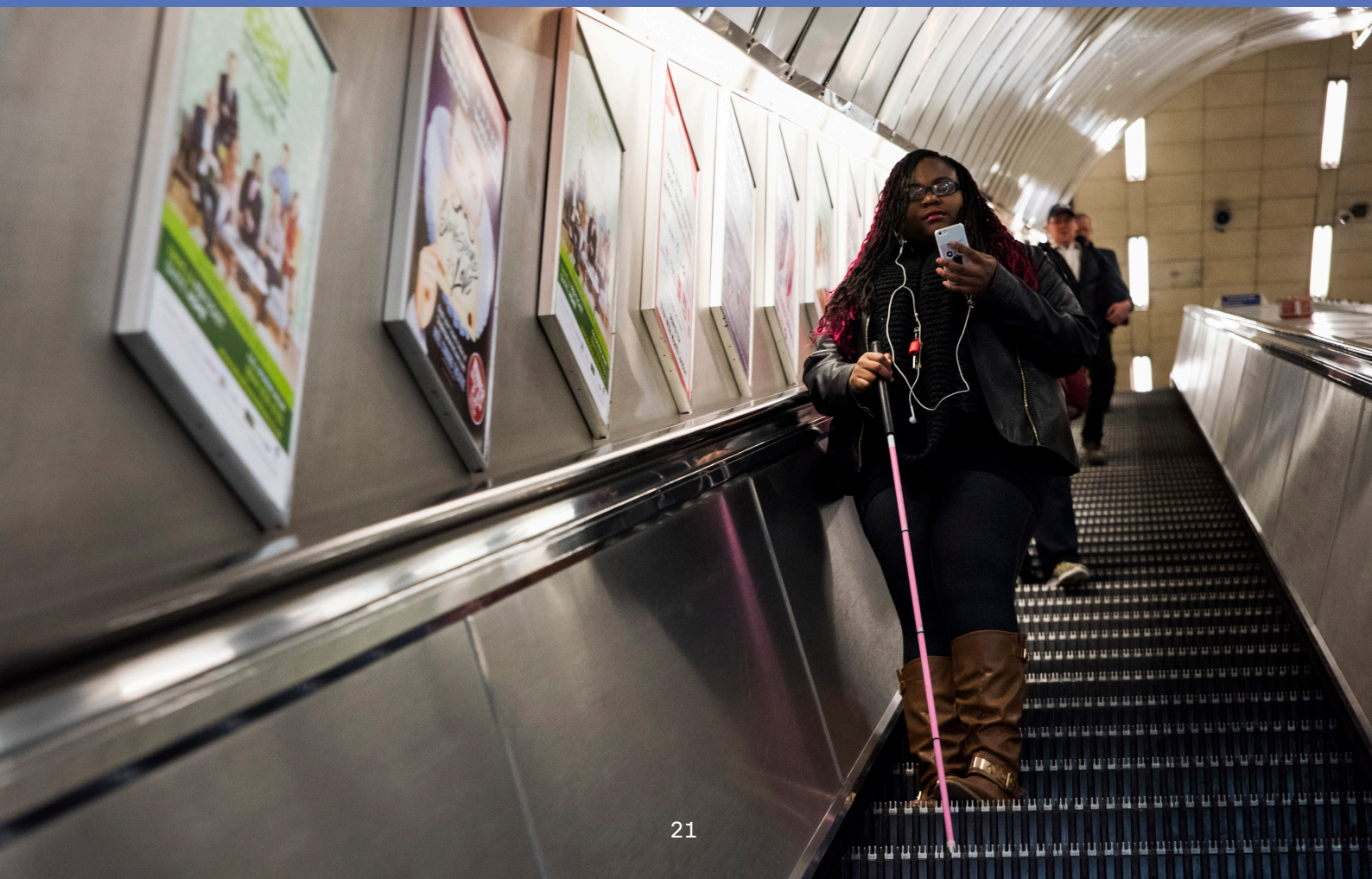
Co-founded by ustwo and the Royal London Society for Blind People in the creative crucible of London, open innovation is at the core of Wayfindr[40]. It brings together organisations from various sectors to collaborate in an open and safe environment around a shared purpose. For example it soon began working with city transport authority Transport for London as a willing sponsor for its trials.

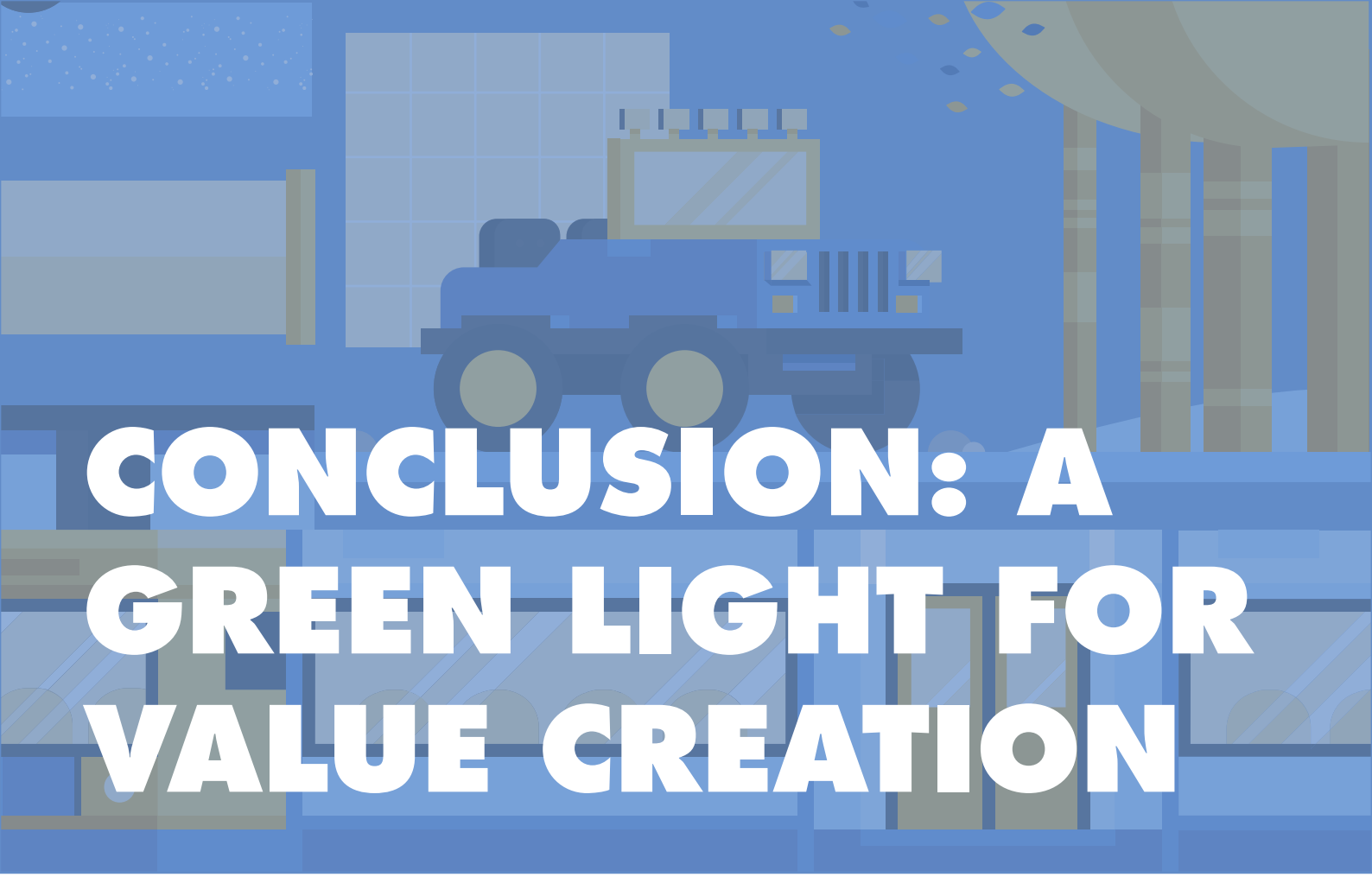
Once standard-based systems are adopted, not only citizens of cities who are living with sight loss benefit. The same infrastructure can be extended for use by tourists, people with cognitive impairments and new visitors in unfamiliar indoor/outdoor environments.

We are already on the path to weaving computers into the fabric of our environment and our very being. This is being accelerated by low cost, small, powerful technology.

Wayfindr believes that as this future unfolds, we should take this great opportunity, and use this technology to make our cities inclusive to all. Taking an inclusive approach, from the outset when designing your product, service or system widens your product's reach, and on some occasions brings clarity. Let's make digital products that are inclusive not exclusive.

Umesh Pandya, Co-founder and CEO at Wayfindr





CONCLUSION: A GREEN LIGHT FOR VALUE CREATION

We are on the verge of a new epoch in mobility. Change will not happen suddenly but there has been a flurry of recent advances, in technology and attitudes, that mean the next generation's experience and understanding of mobility will be significantly different.

That is not something we have been able to say since the first commercial jetliners graced the skies in the 1950s and, before that, the Model T started rolling off the global production lines in the 1910s or the Stephenson's Rocket smashed the locomotive speed record in 1829 (29mph if you are asking).

Horizons will again be expanded, lives will be improved and business will be boosted: That's the promise of some of the most significant trends such as vehicle sharing, as well as technical moonshots such as Hyperloop[41].

We are on the verge of a new epoch in mobility. Change will not happen suddenly but there has been a flurry of recent advances, in technology and attitudes, that mean the next generation's experience and understanding of mobility will be significantly different.

But the pace and direction of travel will be set where the needs and opportunities for change are the greatest, where innovation is welcomed and where everyone is included because “Transport isn’t just a technical problem: It’s a human and social one.”[42] In short, they will be set in the most progressive cities, with the first movers inspiring others to emulate them.

We have touched upon the quality of life and economic benefits that should arise for ‘mature public’ cities if they get their sustainable mobility strategies right.

But there is another prize for first movers. Global urban mobility investment is projected[43] to be 829bn euros in 2050, up from 185bn euros in 1990. The opportunity is such that several cities - and the designers and providers of solutions within them - could build thriving new industries to serve a global transport market looking for effective products and services. The journey for these cities has just begun...

Notes

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To comment, ask questions or talk mobility with us, contact us directly:

mobility@ustwo.com

Nicki Sprinz, Business Director –

nicki@ustwo.com

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