New Sensorial Vehicles - Navigating Critical Understandings of Autonomous Futures

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Abstract

If there has been one paradigm that has defined urban development throughout the twentieth century, it has been the car. Yet despite evidence of the multiple downsides of car-centric mobility in cities and urban regions, fresh speculation abounds as to the role of autonomous vehicles in future urban mobility, with significant vested interest from automakers and technology companies alike. Considering what we now know about the cars relationship to the city, do we even want the car to stay or is the autonomous vehicle an example of an outdated model that will persist due to the promise of technological progress? This paper maps out the contemporary discourses and critiques around autonomous vehicle adoption specifically in the context of cities. It questions the multiple narratives and assumptions sustaining the model of the car and examines the ways by which the proliferation of autonomous vehicles might reconfigure spaces and produce new kinds of epistemologies and urban cultures. Drawing on seminal works by architects in their observations of how the car shaped not just the built environment but societal and cultural ways of life, this paper argues for reflective, embodied, ethnographic, sociological and political thinking in determining future urban modalities. In order to overcome the perceptual risks and interpretive shortcomings posed by both the autonomous vehicle technology itself and the auto and technology industries at large, it advocates for the inclusion of more diverse thinkers into the process of understanding, imagining and designing for the complexity, unpredictability and irregularity of real-world environments.

Keywords: urban mobility; automonous vehicles; speculative futures; technology; urbanism

Intentional Capture, A Sensibility Primer

In the early 1970s, the architect Alison Smithson documented her experience of several car journeys as she traveled from London to her Wiltshire cottage in the English countryside. The resultant publication *AS in DS: An Eye on the Road*, is an illustrated diary featuring the texts, photographs and sketches of the surrounding environment as observed by Smithson (AS) from the front seat of her Citroën DS 19 (DS).[1]

Figure 1. AS in DS: An Eye on the Road, Alison Smithson, 1983.

The documentation featured in the book is an embodied attempt to capture detailed impressions of a modality that had been so seamlessly adopted by the generation at that time that few had stopped to consider the spatial and environmental changes as well as the new behaviours which were unconsciously developed as a result. By recording the journeys, Smithson wanted to uncover the lost ability to observe the multivariate

changes wrought by the car. As Peter Smithson, describes what he believed to be the contribution of the book:

> This is a diary of car-movement recording the evolving sensibility of a passenger in a car to the post-industrial landscape…In the last quarter of the twentieth century, we have inherited a literature of man and machine in nature but there is as yet no equivalent of the eighteenth century's understanding which penetrated to all levels of society through the work of writers, artists, landscape designers, and architects. This primer is a document reaching out towards such an understanding." [2]

With *AS in DS*, Smithson developed new notions about the role of the car in architecture and town planning, as seen from the motorway, the road, the street, the parking lot, and right up to the entrance of the house. But beyond changes to the physical environment, she also sought to parse the ways by which the car had fundamentally changed human behaviour:

> The mobility that the car has given to everyone has helped to change our social patterns and progressively, our social needs; for example, we no longer need to go to the centre we move to many centres … and out of the city … and out of the country altogether. Our social activity has adjusted; instead of sitting in a public auditorium or walking a city street, we are as other people in a similar vehicle: social contact is by implication … we are told about it; watch it, occasionally read about it; but our physical experience of community adhesion is that 'we drive it'. [3]

Years earlier, in 1968, Robert Venturi, Denise Scott Brown, Steven Izenour and a group of students from the Yale School of Art and Architecture took a trip to Las Vegas to study the architecture and form of a city that was regarded as a "non-city", the outgrowth of a "strip", along which were placed parking lots and singular frontages for gambling casinos, hotels, churches and bars.

The aim of the study was twofold. They sought, firstly, in an unbiased manner, to begin to understand the recently emerged physical form and secondly, to start to

develop analytical methods to deal with these new forms and spaces. Overlooked by other architects at the time, the group believed that the study of the architecture of commercial strips and types of spaces created as a result of the car was as significant as those of ancient and medival cities had been for previous generations of architects and urbanists. [4]

Figure 2. Learning from Las Vegas: The Forgotten Symbolism of Architectural Form, Robert Venturi, Denise Scott Brown, and Steven Izenour. 1972.

The research group carefully defined the components of strip and sprawl and considered the factors that caused the form and the aesthetics of the built environment to be as they were – primarily the car, the geometry induced by its motion and the ability of the human brain to react to communication from the environment while the body is travelling at approximately thirty-five miles per hour. Famously, they "saw and collected things that others had missed in their haste to get out of the 'ugly', debased commercial environment."[5] By looking coldly and analytically at their subject matter,

they were able to demonstrate the strip's logic and validity as a system, taking a pointed acceptance of American sprawl and vernacular architecture, as well as accounting for the human activities and interactions it created.

What the Car Did - And What It Might Do

After a century during which the car dramatically reordered city streets, urban form and land use, not to mention society at large, it became increasingly obvious that it was not the future of urban mobility. As the physical and social impacts of widespread car ownership unfolded, the costs of environmental pollution, public health issues, social isolation, and congestion began to outstrip the benefits. From the early 1980s onwards, many cities and urban regions were quickly overwhelmed by the downsides of car-centric mobility. It seemed as if the motor had reached the end of the road. But now the car, with the help of a technological reboot, has been steered toward a fantastical future, as fresh speculation abounds as to how autonomous vehicles (AVs) might reconfigure urban spaces and produce new modes of mobility and inhabitation.

Contemporary Speculation

According to members of the Institute of Electrical and Electronics Engineers (IEEE), by 2040, 3 out of 4 vehicles will be autonomous.[6] A report jointly published by Bloomberg Philanthropies and the Aspen Institute on the future of AVs in cities, claims that the adoption will not primarily benefit rural areas but instead *cities.* This it claims, is due in part to the *"*new opportunities to right-size vehicles for urban use", liberating cities from the past struggle with the car's demands for space.[7] The global consultancy firm, McKinsey, too purport that the onset of AVs will herald a great spatial liberation, claiming that by 2050, the uptake of shared AVs will cut parking needs by some 1.4 million acres in the US.[8] Aside from freeing up space for better uses, many believe that

AVs will be the answer to a whole host of wicked problems, including easing congestion, shortening commutes, reducing fuel consumption, slowing global warming, enhancing accessibility, as well as improving public health and social equity.[9] When Mercedes-Benz announced its fully autonomous multipurpose vehicle earlier this year, the company proclaimed it would "enables on-demand, sustainable and efficient movement of people and goods" and "reduce traffic flows, relieve inner-city infrastructures and contribute to an improved quality of urban life."[10]

The AV is commonly presented as pragmatic and politically benign. This resonates with what Kitchin and Dodge argue is common with the introduction of automated technologies:

> different groups with vested interests using "discourses relating to issues such as safety, security, efficiency, anti-fraud, empowerment, productivity, reliability, flexibility, economic rationality, and competitive advantage, to induce a process of interpellation, wherein the large majority of people willingly and voluntarily subscribe to and desire their logic, trading potential disciplinary effects against benefits.[11]

In this sense, the narrative of progress offered by AVs is commonsensical, it is a future to good to refuse. Writer Adam Greenfield warns of the dangers of succumbing to the promise of automation that is ideologically driven by certain actors with deep investments. Acknowledging that emerging automated technologies have the potential to changes how people engage with the world, he insisted that we must develop "some sense of what they do is critical to understanding the deal we strike whenever we surrender control of a situation to the judgment of algorithms."[12]

Fantastic Technology

Perhaps it should not be surprising that the promise of the AV has garnered as much attention as it has. The imaginary of cars that drive themselves has been around almost as long as cars have — from Bel Geddes concept for automated highways at the 1939 World's Fair, to the more far-fetched concept like in Disney's "Magic Highway, U.S.A." Shannon Mattern believes that "the self-driving car has captured the public imagination like few devices since the smartphone", suspecting that its popularity lies with a general fascination with the vehicle's "powers of perception, which are largely derived from 19th-century technologies that are familiar enough to be relatable." [13]

Outlandish fantasies or not, the autonomous vehicle is a future that nearly every major car company is betting on. Most of the major automakers say they expect fully autonomous vehicles to be available fifteen years from now, and many are backing that prediction with corresponding capital, from GM's $1 billion acquisition of a self-driving start-up, Cruise Automation, to Ford's equally large investment in the A.I. start-up, Argo.

These efforts of the automotive industry dovetail neatly with a new generation of technology companies who believe technology really *is* the answer to our urban problems. Many in Silicon Valley see AVs as the future of the internet, and a massive business in their own right. In the past five years, the self-driving challenge has swept up Google, Uber, Amazon and Apple. There is also a sense that the know-how gained in building global networks for electronic commerce and communication can be retooled to re-engineer urban transportation systems from the ground up.

In the past decade, most AV pilots focused on high-speed highways. But the AV's future is in cities, where both the technology industry and traditional automakers see great opportunities and the biggest market demographics are concentrated. Although

city driving will be a tough technical challenge, there will still be a huge commercial prize for facilitating AV adoption in cities. The world's largest megacities now represent auto markets that are larger than many countries. According to another McKinsey study on changes in the automotive industry, as a result "[c]ity type will replace country or region as the most relevant segmentation dimension that determines mobility behavior and, thus, the speed and scope of the automotive revolution."[14] This demand will in turn increase the need for testing in different real-world urban contexts. Perhaps a likely strategic response from automakers is even the creation of vehicle models that are designed for individual cities or city types.

Urban Transformations

Knowing the vested interests in AV adoption in cities, the question of how they might reorder spaces and produce new kinds of epistemologies and urban cultures, remains an open one. Will the AV alter the built environment as radically as the manually driven car did over the last century? And perhaps more fundamentally, considering what we know now about the cars relationship to the city, do we even want the car to stay? Is the AV an example of an outdated model that should by right fizzle out but will persist due to the promise of technological progress?

Researchers at MIT's 'Senseable City' lab, Ratti and Claudel demonstrate bountiful optimism towards the 'imminent generation' of AVs in the city. While having acknowledged that 'automobile-centric transportation systems … are insensitive to the subtleties of urban space and, at worst, destroy the fabric of the city,'[15] they somewhat contradictorily, see the AV as "bringing the death of the car culture but a rebirth of the (new) car."[16] With rose-tinted foresight not dissimilar to the early emancipatory visions of the automobile, they predict that 'self-driving vehicles could be programmed according to a variety of different criteria, for example, comfort, fuel efficiency, or

shareability. Self-driving could have tremendous impact at the urban scale, where telemetry and big data analytics might optimise vehicular flows throughout the city."[17] For Ratti and Claudel, AVs are key to enabling a new era of shareability, a modality that they believe will in turn optimise systems and eliminate redundancy of space. But as recently proven with the case of shared car services in the US, the likes of Uber and Lyft are not reducing traffic in cities but instead actively contributing to it. A report by the San Francisco County Transportation Authority, concluded that ride-hailing services contributed approximately fifty percent of the overall increases in congestion in San Francisco between 2010 and 2016.[18] Similarly, a 2017 traffic study of New York City, found that ride-hailing services had put an additional 50,000 vehicles on the road over the previous four years, added 36 percent to the total miles traveled by for-hire vehicles, and added to a 15 percent increase in passenger trips.[19] As mobilty scholar Mimi Sheller notes, even if there were some efficiencies as a result of AVs, they could also unleash "a growing undifferentiated sprawl of quasi-urbanization."[20]

Others imagine a world of reconfigured aesthetics and form factors, all bent towards the legibility of machine learning. Considering the sensory shortcomings of AV technology, writer Geoff Manaugh speculates that "in an urban world filled with complex architectural forms, reflective surfaces, unpredictable weather and temporary construction sites… cities may have to be redesigned, or may simply mutate over time, to accommodate a car's peculiar way of experiencing the built environment."[21] In a similar vein, Florian Cramer suggests that "all cars and highways could be redesigned and rebuilt in such a way as to make them failure-proof for computer vision and autopilots … For example, by painting all cars in the same specific colors, and with computer-readable barcode identifiers on all four sides, designing their bodies within tightly predefined shape parameters to eliminate the risk of confusion with other objects

... by straightening motorways to make them perfectly linear and moving cities to fit them."[22] In a video entitled *(Driver)Less is More* produced for Audi, the Danish architecture studio, Bjarke Ingels Group (BIG) seems to capture what Cramer talks about with eerie precision. In line with that of Ratti and Claudel, BIG's driverless city is a vision of shared mobility, 'a prim dream of pure order'. The "result is an elastic urban space that can expand and contract to accommodate peak traffic hours or allow a park or plaza to invade the car lanes to fit the demands and desires of its citizens." [23] The only problem being that this city seems devoid of humans.

In a somewhat dystopian yet not entirely unrealistic take, Dunne and Raby imagine a fictional world whereby the 'Digicar' is the main form of transport. While having many similarities to what we commonly imagine as an AV, in the case of the Digicar, the vehicle has evolved from an object for navigating space and time, to being an interface for navigating tariffs and markets. Every square metre of road surface and every millisecond of access, at any moment, is monetized and optimised. Passengers are required to stand to minimise the vehicle's footprint, and are happier to communicate virtually with distant friends than fellow commuters. While many contemporary ideas for AVs are presented as social spaces for relaxing commutes, Digicars are closer to economy airlines, offering the most basic, but humane experience. The Digicar is essentially a mobile computer, constantly calculating the best, most economic route. The roads are still owned by the state but companies buy bulk access and offer it to customers, much in the same way that telecom companies manage spectrum.[24]

Figure 3. United Micro Kingdoms, Dunne & Raby, 2016.

Of course, AVs are only possible given huge amounts of collected and processed data ,which begs the question as to how these exhaustive amounts of information might in turn have implications for the design and use of the space. Maya Ganesh considers how the resultant mapping data from AVs will drive and shape new forms of ethics and uneven geographies. Quoting comments by Seda Gurses on the racial discrimination in way-finding apps like Waze that "help" stay out of "high crime neighbourhoods, Ganesh asks "What kind of new places will be created, and discriminations perpetuated, by autonomous driving that identify people and neighbourhoods as criminal or threatening?"[25]

Magical Thinking

In her book, Artificial Unintelligence, Meredith Broussard is more skeptical still about the future of AVs. She believes that there are fundamental limitations when applying

computation to aspects of our everyday lives and that includes driving. To illustrate this theory, she takes the case of her own personal experience of participating in the Grand Challenge, the prize competition for AVs, funded by the Defense Advanced Research Projects Agency (DARPA) in the US. Boussard describes how in the 2005 challenge, the task was to create a robot that could navigate 175 miles through the Mojave desert. Quoting Stanford Professor of Computer Science, Sebastian Thrun, also a competition participant, as he described the task in the desert, "it didn't really matter whether an obstacle was a rock or a bush because either way you'd drive around it."[26] When the competition moved from the desert to an urban setting in 2007, the 'challenge' became much more complicated. In this context, the cars had to make 'intelligent' decisions in real time by performing sophisticated interactions with other vehicles, negotiating right-of-way and obeying rules of the road. Highlighting the cognitive jump from completing the task in a friction free space like the desert to an urban setting, Thrun conceded that "The challenge is to move from just sensing the environment to *understanding* the environment."[27] The core problem then for AVs, Boussard points out, is that they are without sentience or understanding, and so "replicating the process of human perception and decision-making is both complicated and impossible (with current technology)."[28]

Figure 4. DARPA Urban Challenge, 2007. http://archive.darpa.mil/grandchallenge/

Three Point Turn

In retrospect, the now historical, observational studies of Smithson and Venturi el al offer some parallels to the contemporary technological tools used by AVs in order to navigate the environment. Both employ techniques of scanning, sensing, tracking, categorising and mapping as they monitor the landscape at high resolution from the perspective of a car, trying to capture a complete awareness of the surrounding environment around them. Yet the work of Smithson and Scott Brown offer more than efficiency of data and statistical estimates. They bring a much needed, reflective, embodied, ethnographic, sociological and political thinking to the complex ways by which the technology of the car has shaped the built environment and human behaviour.

Figure 5. Learning from Las Vegas: The Forgotten Symbolism of Architectural Form, Robert Venturi, Denise Scott Brown, and Steven Izenour. 1972.

This prehistory of sensing the environment from the perspective of the moving car had a completely different set of objectives than that of the contemporary mobile sensing vehicle. Instead of sensing the environment in order to successfully navigate from A to B, as is the case with AVs, Smithson and Venturi el al sensed the environment to understand how the car has altered the urban fabric. For Venturi et al the study of the 'as found'environment while in motion was important because 'it teaches us … to be more understanding and less authoritarian in the plans we make."[29]

If there has been one paradigm that has defined urban development throughout the twentieth century, it has been the car. The resultant culturally and spatially entrenched patterns of automobility are undeniable. Looking forward, the discourse about its future as shaped by automakers and technology industry is focused on

deterministic solutions with values of logic, predictability and efficiency, as the primary objective functions. But in order to overcome the perceptual risks and interpretive shortcomings posed by both the AV technology itself and the auto and technology industries at large, we need to include a more diverse array of thinking into the process of understanding, imagining and designing for the complexity, unpredictability and irregularity of real-world environments. As architecture professor at the Illinois Institute of Technology, Marshall Brown, reminds us, "a society is cultural, and political, and aesthetic, and about desires — it's not just how you solve problems."[30]

Notes

[1] Alison Smithson, *AS in DS: An Eye on the Road* (Baden, Switzerland: Lars Muller Publishers, 1983).

[2] Ibid., 1.

[3] Ibid., 23.

[4] Robert Venturi, Denise Scott Brown and Steven Izenour, *Learning from Las Vegas: The Forgotten Symbolism of Architectural Form* (Cambridge, MA: MIT Press, 1972).

[5] Nigel Bertram, *Furniture, Structure, Infrastructure: Making and Using the Urban Environment* (Surrey, England: Ashgate Publishing, 2013).

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[11] Rob Kitchin and Martin Dodge, *Code/Space: The Software of Everyday Life* (Cambridge, MA: MIT Press, 2013).

[12] Adam Greenfield, Radical Technologies: The Design of Everyday Life (London: Verso, 2017), 474.

[13] Shannon Mattern, "Mapping's Intelligent Agents," Places Journal, September 2017. https://doi.org/10.22269/170926 (accessed Nov 01, 2018).

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[16] Ibid., 103.

[17] Ibid.

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[23] Bjarke Ingels Group, (Driver)less is More (Denmark, 2013)

[24] Anthony Dunne and Fiona Raby, *Speculative Everything: Design, Fiction, and Social Dreaming* (Cambridge, MA: MIT Press, 2013).

[25] Maya Indira Ganesh 2016. "Cities After Cars, Places After Data" Dec. 1, 2016 https://thesocietypages.org/cyborgology/2016/12/01/cities-after-cars-places-after-data/

[26] Meredith Broussard, *Artificial Unintelligence:How Computers Misunderstand the World* (Cambridge, MA: MIT Press, 2018), 124.

[27] Ibid.

[28] Ibid., 132.

[29] Venturi, Scott Brown and Izenour, Learning from Las Vegas: The Forgotten Symbolism of Architectural Form, 6.

[30] Anna Wiener, "Full Tilt:When 100% of Cars are Autonomous", *The New York Times.* Nov. 7, 2017 https://www.nytimes.com/interactive/2017/11/08/magazine/tech-design-autonomous-future-cars-100-percent-augmented-reality-policing.html#picturing-the-self-driving-city (accessed Nov 01, 2018).

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