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Changing Minds and Autonomous Vehicles

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Abstract: This article aims to catch a glimpse of the changes on the driving culture that are about to come and attempt to sketch the contours of these changes. The thoughts I would like to share are more exploratory reflections than an argument, on the possible ways the Autonomous Vehicle's new technology would disrupt and transform material world, patterns of behaviour and cognitive awareness of the urban landscape. Mainly I am interested in the social and cultural implications of using Automated Vehicles; how the car-bots will transform our urban cognition and ultimately our spatial and temporal perception.

Keywords: Cultural Change; Autonomous Vehicles; Human Factor; Cognitive Effects.

1. INTRODUCTION

Driving, is a practice that ease our daily lives by transporting us to and from work to social or other activities necessary to maintain our daily routines. Transportation has created an urban landscape of dense mobility, separating work from home, social life from everyday life. Cities reflect this complicated pattern of daily movements and have grown to the point that the transportation services are the sole mean of our mobile selves. Routes and routines have created the current form of our urban space. Most of the analyses on Traditional or Autonomous Vehicles are viewed from the point of changes on this practical aspect of our lives and how to better correspond to our ever-changing everyday needs. But automobiles either in its traditional or in its autonomous version are much more than a transportation tool. Automobiles influence our identities, who we are and what this identity tells about us as social subjects either by using a private car as a medium of social competition (Miller 2001), or to move freely, by reflecting on our way of living or cementing cultural attributes on driving behavior. Cultural attributes refer to patterns of inclusion and exclusion of social groups based on gender, ethnic, age and ability to move around as well as on reinforcing or diminishing social segregation. Mobility is an activity that reflects our cultural and social practices and thereby these practices influence our mobility practice and urban setting.

This paper would share first some theoretical suggestions and then it will attempt to contour the changes on the embodied and sensorial understanding of driving culture, on the cognitive awareness of driving and the changes that might take place, such as how time and space are constructed through our mobility patterns. My aim is to provide a path to understand changes in a much broader perspective than looking at how technology will influence each strand of human activity namely on equity, environment, demography, or economy.

I will attempt to sketch the changes in human's cognitive awareness. How this awareness becomes apparent as a living experience, and how this experience is constantly informed by the changes of innovative technology in transportation.

The aim in this paper is to be anthropological and to be that means to look at technology by focusing on human practices. At the heart of this problematization is how technology might influence not only the conduct of people but how people interact with technology to accommodate their needs. My attempt is to enrich the interdisciplinary dialogue on the impact of CAV technology. How these new environmental factors and material worlds will affect human cognition is not yet known, but we can make some precarious predictions, running a high risk to be mistaken.

If the mind is relationally affected by collective and environmental factors which is turn shape our cognition and interaction with the social, material and biological environments, then how the emergent technology of the Connected and Automated Vehicles would affect human cognition and embodied minds? This new technology can change our perception of urban space in multifarious ways, whilst creating new relational connections between mind, material culture and bodily practices.

My interest is to explore along the lines of cognitive approach, the way these new environmental factors and new material worlds interact with and in turn affect human cognition. As the automated technology influences nearly every aspect of everyday practices, anthropologists should pose questions on how this new artificially intelligence such as autonomous agents would affect cognition related to various aspects of human life like spatial perceptions,

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memory practices, emotions, embodied practices, creativity and imaginary perspectives.

Amidst growing concerns over the implication of such technology in human life social scientists point to the fact that the use and implementation of technology is viewed linear, while human practices and social implications aren't linear. There are some suggestions that social forces like environmentalist, concerned citizens, government regulators, state mechanisms should regulate and control these technologies (Brown and Duguid, 2017). Although, these are legitimate concerns over the social implications of this new technology, they only highlight the external restrictions and control mechanisms for regulating autonomous technology. The implication of Automated Vehicles on cognition, on the aspects of human mind that would be affected like the embodied practices, knowledge patterns and memory mechanisms calls for anthropological attention.

In this essay, I will try to provide a general understanding of these changes and how they interrelate with other embodied and sentient practices like the sense of vision, correlating thus the vision with mobility practices. In this emerging reality the conflation of real and virtual would produce new mindsets and new ways of transportation which although it is limited and influence our daily routines and habits, it nevertheless produces a different understanding of what constitutes home, working space and finally our agency in this new transportation materiality. Anthropology, therefore, aims at analysing these imaginary landscapes only to create mindful and knowledgeable citizens.

2. THEORETICAL PROPOSITION

This article stems out of the need to address the rise of the recent technological advances on CAV and its impact on human culture. Cruising the cities on CAV influences patterns of behavior as many researchers have pointed out. The recent technological advancements such as IoT, Big Data and the increasing influence of algorithms in our lives point to the need of finding a new paradigm of understanding the impact of these technological transformations. The matter of adaptation to new patterns of behavior is important but does not shed light to the processes of this adaptation. In other words, how the CAV would impact spatial and temporal perception and how mobility practices of CAV will affect memory patterns, imaginative procedure, and sensorial attributes?

This paper will view CAV as part of material culture that influences our everyday practices and becomes an agent to view changes in our cognition and everyday practices (Horst et al.2012, Miller 2001). Daniel Miller suggests considering the "humanity" of the car, meaning the cultural setting used, or the network of agents the car is embedded in (Miller, 2001: 2). From this perspective, driving a car includes many cultural variants like people's disposition towards the practice. Driving as an embodied practice depends on different skills, modes of behavior, and the cultural context of the transportation system, i.e., on the ethics of driving (Buckley et al. 2018). The body is a sentient agent, restrained and fragmented in the limited space of the car, forced to comply with certain rules and regulations common to all those who share the road, being attentive and cautious, observing the space and avoiding obstacles on the way by granting primacy to the sight (Urry 2004:82).

Driving is about getting knowledgeable of the space around, create mental and embodied maps of the city and at the same time classify culturally and socially our experiences in our mindscape. Mindscape refers to what we come to perceive, attend, classify, remember, or assign meaning to places (Zeruvabel, 1999: 112). What takes place inside our heads is deeply affected by our social environments. Cognition is not a representation system that internalises external stimuli, but it is a system operating between minds, material culture and bodies, as researchers in cognitive anthropology and sociology suggest (Zeruvabel ibid, Malafouris 2013).

Since cognition occurs in the nexus between bodies, minds and things, changes in material culture, i.e., in cars, affect the neurological and physical substrate of humans (Malafouris ibid: 60). Materials structure thus, a situated cognitive process. Therefore, the car becomes a cognitive agent that helps us to classify mental and real templates of the world, solidify cultural codes, who had access and under what circumstances, or what needs are met. It creates a mobility culture which is consisted of private and shared cars, public transportation, passengers, drivers, pedestrians, and bikers.

But what does it mean to drive a privately owned car? As a metaphor, to drive a car promises individuality, independence, and social mobility. Meaning is not automatically generated but it is culturally mediated, the cultural values are encoded in the practice of driving. As any artifact the cars becomes the agent through which people use to produce social and cultural categories, reinforcing gender roles, driving behaviour, trust and liability on driving behaviour.

Thus, as an embodied practice driving a car suggests variant skills and modes of behaviour. There are different driving modes in Athens, Cairo, Istanbul, Stockholm, London or Helsinki. These sensorial experience of different modes of driving varies according to our cultural disposition and cognitive behaviour.

To drive a car is a complex operation which not only function on an individual account but with other individuals interacting with each other to co-develop the means by the which this driving culture becomes intelligible. Driving is the enactment of interrelated human practices, it creates an experiential base in understanding transformation on the nexus of technological, social, and cultural aspect (the nexus between car-humans-space). Driving is about control over 1) the material attributes of the practice like road safety, interaction with other drivers, observance of the geographical space, 2) knowledgeability of cultural and social practices identified with the driving styles of different gender, ethnic, age and social group.

2.1 Changes in the sensorial experience of perceiving space and embodied practices

New forms of conduct between human and vehicles, different spatial and temporal perception might emerge, which could set in motion changes in a series of cognitive skills like memory, spatial and temporal perceptions, sensorial understanding, and embodied practices. These cognitive adaptations to a hybrid world which is found in the nexus of real and virtual reality, it appears to us through smartphones screens, GPS, and driverless cars that monitor the urban landscape and the traffic through the sensors of a CAV and communicate with other driverless cars and with a control centre. This hybridity will change our relationship with mobility infrastructures and with the other users of the road. The vision so far is the main sensor that most drivers are relying on to drive around the city, to observe and memorize routes or signs on the street that guides the routes of driving to and from work or drive for leisure. The communication with other users of the road, pedestrians or bikers are based on eye's contact and on the development of an embodied understanding between the drivers and the rest of the road users to communicate. But with the advent of CAVs this kind of communication would change. There would be no drivers upon whom the pedestrians or other users would interact sensorial. So, people would adapt their movement and rely their trust on other sources such as on that of AI of the CAVs. The reality would be mediated through screens and sensors, visual communication will blend uniting thus, the virtual and the real world. Thus, this computerised hybridity will change our relationship with mobility infrastructures, will remove part of our control over the material attributes of road safety, while our interaction with other users and with the urban roads will be through a screen and reliance on the AI of the vehicle. Cultural variability and particularised modes of driving would decrease as a result, creating a unified code across the globe.

2.2. Changes in the navigation process

The introduction of CAV will drastically change the way we perceive urban space. At this point, it is useful to analyze the term navigation and mobility. Navigation refers to the engagement of spatial exploration, the ability of knowledge to determine one's current position, while mobility refers to the purposeful activity of getting from one place to another physically or metaphorically.

The use of a medium to navigate through the landscape has had a long history in human transportation systems. Within this process, the mode of transportation became a medium of understanding and perceiving the world from the perspective of space and matter. Various transportation mediums call for different sensorial disposition and embodied practices, spatial understanding, attention, and cognitive awareness. Navigation is an operation that requires our active engagement to translate posts, roads and landscape features into measurable and possible signs that would eventually simplify our routes (Mitchell 1996; 28). Such action demands our participation to comprehend and translate the landscape features on perceptual patterns. Navigation involves three components: 1) self-localization, 2) map-building and map planning, and 3) path-planning. All of these are cognitive processes that humans have performed until recently. With the rise of AI, Big Data science and GPS (Global Positioning System) technology, machines perform tasks like planning, mapping, and deciding the best and fastest routes. The robot can perform all these operations based on algorithms. They have sensors to identify their exact location, optimize the routes to reach a destination based on stored digital maps and continuous receipt of real-time travel-time data, while every move is stored in a memory disk rather than in the human brain. As a result, the *skills* needed to enhance memory, reading, and understanding spatial signs have now become external tools for people to use. The borders between internal imagery and external reality blur to create new possible ways of understanding of the world as a *hybrid* existing in two different dimensions at the same time, decreasing the need for people to memorize routes or practice their navigation skills, which in the long run will affect cognitive spatial awareness.

When we drive, we test, evaluate, learn, and memorize procedures in our mind and body. Thus, our embodied mind is affected by external stimuli and stores information in the brain, which in turn changes the brain's plasticity its bodily (driving) and learning abilities, as well as its corresponding memories. The body is not a mere interface of the world, but it produces meaning through representational frameworks that inform cognition. There is a list of practices, both consciously and unconsciously performed, which influence our abilities, emotions, feelings, and sensorial awareness when we use the car, or any other transportation mean. Maguire et al. (2000) have shown in their research on London taxi drivers, that the hippocampus in human's brains, associated with navigation skills, was significantly larger than those of non-taxi drivers. These results show that environmental stimuli affect the plasticity of the brain and the associated memory skills. Thus, driving a car leaves a mark on our brain and teaches our bodies to navigate in space. The plasticity of the brain is related to regular and not so regular routes through the town, village, or a city; in a similar manner, the vision of a cityscape is animated and perceived through our embodied experience of driving. By contrast, cruising around the city by other means of transportation such as buses, or taxis or on driverless cars involves different sensorial and cognitive procedures. Having someone else driving around, being a passenger, influences our city imagery, memory, orientation processes and navigation skills. We learn to become *spectators* rather than *actors*. Human driving and navigating through space include our input or mental processing on a two-dimensional spatial map contributes to traffic conditions awareness and cultural codes. On the other hand, when we gaze out of the window or work on a mobile device, we are not consciously engaged or actively being in the physical environment, but we become passive agents of external stimuli. Like when we gaze outside the window on a train or a taxi without being able to identify our exact position on a map. We are only aware of the starting or debarkation point and therefore no need to memorize a route, to actively engage with the landscape. CAVs would simulate a train but on an individualized mode of mobility.

Hoodgendorn et al. (2014:117), Endsley and Kiris (1995) have drawn the attention to this passive processing of data in operating automated systems, such as the one that is included in a CAV's control system, that delays operator's responses to a system failure with fatal consequences. As many researchers have noticed, the (former) driver is now released from his/her duties behind the wheel and conducts other activities, while being on the road (Adnan et. al 2018: 824). Thus, turning the driver, who is actively engaged with the urban environment, to a passenger and spectator who passively moves around, means that understanding spatial signs, creating mental maps of urban space, optimizing the best through different routes, is no longer necessary for any daily activities and not just driving. In short, changing the driver from a car controller to passively processing data and driving systems, will affect human sensorial awareness, embodied knowledge of the space and vigilance skills (Endsley and Kiris 1995).

Allocating more time on working or socializing through the media, while being on the move, diminishes the importance of the place, as we knew it, as a self-contained space, identified with certain practices and laden with history and collective or individual memory. CAV does not unbundle work from leisure and home, but re-organizes space based on driverless mobility. The car becomes a non-spatial place which is self-contained, temporal, fleeting, and surrenders to solitary individuality through the connection to a borderless world through the web, "which sometimes puts the individual in contact with another image of him/herself" (Auge 1995:79).

CAV becomes a "dwelling cocoon" (Laurier and Dant 2012: 237), a private zone in which people would interact over the cloud servers installed in the car between and across space and different places, like home, or work. Besides the ethical considerations of the situational awareness of people routes and daily habits that raises concerns of privacy, this constant monitoring of people's activity will lead to a *re-cognition* of what is private and shared space. CAV mobility will refashion the perception of the place which will mean to stay connected in and with far remote places across space through mobile devices in a world with diminishing physical boundaries, limits, and privacy.

2.3. Changes in temporal perception

The perception of time is changing accordingly with that of space; this concerns the time that measures duration through the motion, in Newton's terms, but also the time that underpins relations between individuals, classes and nations through temporal concepts and devices (Fabian 1983:x). The car is a medium for such measuring the time according to distance.

Analyzing the concept of time in terms of duration and mobility, it is interesting to understand the sensorial disposition of humans in different modes of transportation. Varied embodied practices are linked with the sensorial experience of humans, a way of being in the world, understanding the world through the senses. Therefore, as human beings, our disposition and relation to the world are formed through the sensory experiences, which in turn shape our embodied practices. From that perspective, the time of driving is an experience to our senses and bodies, which range from alert to relaxation when we drive on regular routes; from boredom, agitation to sleepiness when we are stuck in traffic congestion; or excitement, nervousness, fear, all connected to the time allocated to this activity. In contrast, there is a difference in function, perception, and understanding of time when we ride on a train, a bus, or an airplane. On these modes of transportation, people are passengers; there is time to spare on talking, working, sleeping, watching a movie, or looking out of the window, therefore, the experience created in this latter mode of transportation is qualitative different from riding on a privately owned car.

One of the reasons for the implementation of automated vehicles in the context of "smart cities" stems out of the need to increase traffic efficiency and car safety, and to reduce road accidents caused by humans. One of the basic principles is to substitute human drivers, to reduce the errors and the labor involved in the practice of driving and allocate this time spent, in other activities, such as mobile working or socializing over the web. Accordingly, with the implementation of the CAV, time spent in the car would become a "productive time", meaning that being in the car will reduce stress caused by delays due to traffic congestion and instead transform the time spent on the car to a quality time for work, leisure, or socializing over cloud servers, reading, or eating (Schoettle and Sivak, 2014). Moreover, as Elliot and Urry have pointed out with the communications technologies in hand and installed in CAVs, people will stay networked across the world, thus, the perception of time as a process of coordination and synchronization with others open the possibility for a shift on to how time is perceived that is, from the actual time to the negotiated time (2010). This practice might redefine the meaning of working time, leisure and socialization while riding on a CAV.

3. CONCLUSIONS

The need to reduce accidents and environmental pollution, as well as the need to create a sustainable transportation future that best accommodate people's needs have driven the changes in vehicles automation. This innovative driving technology anticipates bringing many advantages like road safety, environmental and financial advantages, reallocation of time and resources to other activities, more eco-friendly urban centres. But most of the analyses so far, examine how to overcome ethical dimensions, environmental and infrastructures issues by focusing on the technological side of CAV. For anthropologists however, the research on the CAV technology offers an advantageous point to view, analyse and comprehend the extent of these technological changes in human lives and how the new driving practices will shape new type of experiences and forms of conduct, while at the same time it will redefine driving experience in urban settings. CAV technology creates a series of challenge which will force us to reconsider long-established values, like outsourcing part of human control to AI operated systems, what constitutes private or public space, home from office, ownership and sharing practices, the role and relation of technoscience in our lives, but also new ways to interact

sensorially with urban reality and with other users of the road.

Trust to this new technology is one of the major prerequisites for a successful coexistence between different users and for a seamless flow of transportation, redefining previous practices and creating new forms of conduct and perceptions to accommodate the new driving patterns. But trust entails an understanding of how these new driving practices would possibly affect people's minds, integrate in human lives, and alter the relationship between people and the urban landscape.

This paper provides a theoretical proposition of the possible changes that will occur with the integration of CAV in our lives. Empirical data and fieldwork in anthropology is needed to understand and elaborate in various cognitive effects and novel sensorial disposition towards the new technoscapes that are about to emerge.

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