

The compulsive habit of cars

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The car dependence of people living in contemporary cities is a major concern for policy makers, who often find it difficult to persuade people into more sustainable transport modes. By contrast, recent insights from neuroscience have shown that a broad spectrum of behaviors can become habitual and, thus, resistant to change. Here, we outline the potential of collaboration between neuroscience and human geography aiming at a better understanding of habits that determine everyday commuting routines.

In a recent Science and Society article in *TiCS*, Seymour and Vlaev argued that, despite the growing ‘neuromania’ observed in policy circles, actual public policy rarely takes its evidence from neuroscience [1]. Taking up the challenge highlighted by the authors, we point to the sustainable transport agenda as one domain where neuroscience can make a tangible contribution to public policy. We turn to the example of car commuting, a key preoccupation for transport geographers and urban planners. Routine travel for work and study accounts for approximately one-fifth of the total distance that the average person in the UK travels in a year [2]. Commuting is also a research and policy issue that could benefit from fresh insight into how habits, specifically travel habits, are formed, sustained, and disrupted. Combined with geographical knowledge on how people interact with their everyday environments, innovative policy can be formulated where it is urgently needed.

The car dependence of those living in contemporary cities has long been a concern for urban researchers and policy makers. The huge environmental, psychological, social, and health costs of car dependence have been demonstrated empirically in a range of global contexts [3]. However, moving beyond identifying the problem to practicable ideas for solving it has proved challenging. A range of measures has been applied independently and in combination, including parking restrictions, car-free days, expanded cycling, walking and public transport infrastructure, and various awareness campaigns. In most cases, the ability of such measures to achieve broad behavioral

change has proved disappointing [4]. In explaining the inability of existing policy measures to get people out of their cars and into more sustainable modes of transport, transport researchers have pointed to several factors, both individual and environmental. Along with the qualities of the urban environment, the convenience of public transport systems, their cost, speed, and safety, one of the most frequently encountered concepts is that of habit. The notion of habit has been used to explain away the gap between the behavioral change predicted in transport policies and the ‘inertia’ of how we choose to carry out our everyday journeys.

How useful is the current way in which geographers use the concept of habit to explain everyday behaviors? In most models of transport choice, habit is just another factor alongside factors such as ticket price, sociodemographic characteristics, and distance [5]. From this perspective, commuters behave as agents who rationally weigh up changes in the environment and their own behavior, whereas the power of habit holds them back from changing. In itself, this view of habit as a black-boxed independent variable is not helpful in understanding the mechanisms through which people abandon old behaviors, adapt them, or adopt new ones. As a result, some transport geographers have come to consider the potential of neuroscience to expand geographical understandings of the role of habit in everyday urban travel [6].

Indeed, one intensively studied area in neuroscience is the dichotomy of reflective versus reflexive or goal-directed versus habitual behavior [7]. Rodent as well as primate experiments have investigated the different aspects of this dimension and come to the conclusion that a broad spectrum of behaviors can become habitual and stereotyped through experience-dependent learning. Habits are performed repeatedly over the course of time and are usually triggered automatically, almost nonconsciously. Furthermore, they comprise one or more action sequences, which tend to be elicited by a particular context or stimulus [8].

Although before automatization the behavior is regulated mainly by brain regions, where evaluation processes drive the output, after extensive practice a distinct shift of the balance occurs towards circuits where the outcome of a particular action is less important. Instead, it is the learned association between the triggering stimulus or context and the corresponding action that now guides the behavior [8,9]. Thus, the pattern of neural activity matches eventually the explore–exploit transition in behavioral output from a testing, exploratory mode to a focused, exploitive mode as habitual behaviors emerge [8]. It is in this context that interdisciplinary research can make a

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contribution. As geographical theoretical perspectives place greater emphasis on the circumstances of the stimulus in everyday life, highlighting the variability of the contexts in which even routine habits are experienced, a more embodied and situated understanding of habit can be elaborated.

However, both disciplines agree that the power of habits can become so great that a behavioral change may be difficult. Given that evaluation processes are of less or no importance for an established habitual pattern of activity, simply providing alternative choices for the individual can be a disappointingly unsuccessful method for reshaping particular behavioral patterns. In some cases, even consequently punishing the individual for performing the automatized action may not change significantly the already deeply embedded behavior [10]. A particularly instructive example is offered by drug addiction, where the memory and learning systems of the brain are hijacked by drugs of abuse [9,11]. Chronic self-administration of drugs of abuse can induce neuroplasticity, which can eventually result in a habitual pattern of drug-seeking and drug-taking. This behavior can be persistent and become compulsive, resisting any change even in the face of harmful consequences, such as punishment [12]. Last, but not least, both animal and human studies have shown that stress facilitates a shift from flexible reflective to rigid habitual memory systems [13]. This stress-induced reorganization of cognitive resources is highly relevant for contemporary society, where the routine travel for work and study is often experienced as stressful and, thus, might be more prone to automatized, less flexible behavioral patterns.

Therefore, it is unsurprising that simply providing alternative urban transport options or applying penalties for unnecessary car use may not be sufficient to reduce the car dependence of contemporary cities. One of the challenges that interdisciplinary research combining insights from neuroscience and geography can address is the identification of the most significant habit-triggering stimuli as well as the main stress-eliciting aspects of the urban commuter's environment. Exploring the critical situations, encounters and pressures of individuals' commuting routines (e.g., waking-up times and office hours, vehicle crowdedness, and timetabling reliability, among others) can

inform more effective policy-making for sustainable urban mobility. A fertile opportunity to research this in a 'natural experiment' setting are the disruptions to habitual behavior that are created by infrastructural breakdowns and construction projects. Also, a careful attempt to conduct an 'out-of-the-lab' study using modified experimental paradigms seems to be a promising perspective. Recent technological advances, such as the functional near-infrared spectroscopy (fNIRS) or ecological momentary assessment (EMA), allow the non-invasive studying of brain and behavioral processes in subjects' natural environments [14,15], which can be essential for investigating the compulsive habit of cars and identifying interventional opportunities.

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