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An Interdisciplinary Conversation

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IDEAS IN MOTION

Theorizing Mobility Transitions

An Interdisciplinary Conversation

Cristina Temenos, Anna Nikolaeva,
Tim Schwanen, Tim Cresswell, Frans Sengers,
Matt Watson, and Mimi Sheller

Abstract

Despite a surge of multidisciplinary interest in transition studies on low-carbon mobilities, there has been little evaluation of the current state of the field, and the contributions of different approaches such as the multi-level perspective (MLP), theories of practice, or the new mobilities paradigm. As a step in this direction, this contribution brings together scholars representing different theoretical perspectives and disciplinary fields in order to discuss processes and uneven geographies of mobility transitions as they are currently theorized. First, we reflect upon the role of geographers and other social scientists in envisioning, enabling, and criticizing mobility transitions. Second, we discuss how different theoretical approaches can develop mobility transitions scholarship. Finally, we highlight emerging issues in mobility transitions research.

Keywords: low-carbon mobility, mobilities, multi-level perspective, new mobilities paradigm, sociotechnical transitions, theories of practice

Introduction (*Cristina Temenos and Anna Nikolaeva*)

How people will move, en masse and individually, is a key question facing a transition to a post- or low-carbon future. While measures seeking to reduce mobility-related emissions are embedded into many climate mitigation policies, agendas on access inequalities, health, and air pollution remain as relevant as ever and often animate demands for transitions to low-carbon mobilities across the world. Within academic literatures, a focus on low-carbon transitions has emerged, engaging a variety of approaches that aim to understand and influence discourses on mobility and mobile practices, yet a cross-disciplinary dialogue in the field is only just beginning to develop.[1] This contribution presents a conversation on the state of the field, analyzing the contributions of different disciplines and theories to current understand-

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ings of mobility transitions, and outlining key directions for future research. The forum emerged from a panel on "Theorizing Mobility Transitions: Scales, Sites and Struggles," which we—Cristina Temenos and Anna Nikolaeva—organized at the Annual Meeting of the Association of American Geographers in San Francisco in 2016.[2]

Our intention with the panel and this contribution to *Transfers* is to bring together scholars working on transitions and mobility in order to draw out explicitly spatial connections between the two concepts and among the two research areas. Transition is a process; there is a particular moment of assembled technologies, infrastructures, societies, and economies (i.e., the present day) that bases its ability to function on carbon-intensive materialities. There is an acknowledgment among policy makers, activists, and some private-sector stakeholders that the carbon base of societies will eventually change. Transition scholars are interested in how this process will evolve. What kind of movements, be they technological transfers, attitudinal shifts, or policy mobilization, are involved in a transition to low- or noncarbon societies? What kind of societal changes will this entail? What has to change, in what way, and where should and where will changes happen in order for this shift to occur?

Transitions to sustainable mobility have often been theorized through the multi-level perspective (MLP). In this approach, originating in innovation studies, sociotechnical transitions are understood as nonlinear processes that occur through interactions between developments at three analytical levels: niches, sociotechnical regimes, and sociotechnical landscapes.[3] Radical innovation, according to MLP, occurs within "niches," which are protected spaces that allow for experimentation (e.g., research and development projects). They have a potential to change existing sociotechnical systems, such as the mobility system comprised of technologies, infrastructures, regulations, policies, values, and practices that together enable mobility in a given society.[4] Yet such change is slow and difficult to achieve, as the introduction of electric cars illustrates: though driven more and more widely, electric and hybrid cars have thus far not threatened cultures of automobility or those with vested interests in perpetuating it. The difficulty of shifting such a culture speaks to the strength of the second analytical level—the "sociotechnical regime" that comprises a "set of rules," from cognitive routines to technical standards and laws, on which various social groups rely.[5] Regimes are also shaped by "sociotechnical landscapes"—wider, global conditioning contexts such as climate change or macroeconomic trends. Thus, fluctuating oil prices and economic crises influence mobility-related policies and broad developments in industry and markets, which may facilitate or preclude uptake and distribution of innovations generated in niches.[6] The MLP thus can help explain both change and stability in existing mobility systems.

Despite the inherent "politics of mobility"[7] within transition, the field has yet to fully engage with a mobilities perspective, which views mobility as movement imbued with meanings that are embodied, differentiated (gendered, racialized, classed, etc.), and political.[8] The contributions by Schwanen, Cresswell, Sengers, and Sheller make a step forward in this direction and shift scholarly attention to the spatialities of transitions, mobilities as they are experienced, and questions of difference and justice. Another approach to transitions that has challenged the MLP perspective is associated with theories of practice, which focus attention on the everyday as the realm where change is (or is not) happening. Matt Watson's contribution advocates bridging the two approaches for a more comprehensive understanding of societal change. Finally, "policy mobilities" perspectives[9] gain influence in the debate on low-carbon transitions, and in their contributions Schwanen and Sengers call for including it in the theoretical and methodological toolkit of transition researchers as a way to spatialize the mobility of ideas, processes, and decision-making practices of low-carbon transitions.

Our aim in the panel, and in this contribution to *Transfers,* is to advance dialogue between different approaches, clarify relationships between existing takes on mobility transitions, and identify key questions that have received less attention. The discussion is opened by Tim Schwanen, who reflects on the advantages of bringing a geographical perspective to transition studies. He joins other geographers' recent calls for "slow research"[10] to critically interrogate certain assumptions, in this case, within transition theory and the impacts and rationales behind "ready-made solutions" that flood emerging markets, low-carbon development policies, and technologies. He questions ways of identifying transitions as an object of research and warns of the dangers of ignoring slower and subtler processes of change. Tim Cresswell continues this line of inquiry, questioning how mobility transitions are identified and understood through an analysis of a bottom-up movement that succeeded in making more just and sustainable mobilities in Los Angeles, which is far from the classical understanding of a "niche" development as described by MLP. His example reinforces the value of a geographical perspective in transition studies by demonstrating how such a perspective can include the politics inherent in mobility when environmental justice is considered alongside historically situated fights for social justice. Following this, Frans Sengers sets out the differences and similarities between mobilities research and MLP, highlighting MLP's strengths and the empowering possibilities of spatializing the "niche" narrative in particular.[11] Adding a new perspective to practice theory, Matt Watson proposes looking at "systems of practice" to focus on the challenge of understanding change as both rooted in people's daily activities throughout the "levels" of sociotechnical systems. Finally, Mimi Sheller sets out the integrative framework of the new mobilities

paradigm to understand transitions, bringing together complexity theory, MLP, and social practice theory. With this discussion, we hope to provide a short yet succinct overview that suggests some approaches to the challenges of understanding and planning mobility transitions within their multiscalar, uneven geographies.

The Role of Geographers (*Tim Schwanen*)

At the forefront of the mobilities turn[12] and long since interested in innovation, sustainability, and transformational change,[13] geographers are uniquely placed to advance the theorization and enactment of mobility transitions. Not only can they contribute the latest thinking on spatial politics, place, scale, subjectivity, and urbanization to transition research and praxis; geographers are particularly well equipped to enact Deleuze and Guattari's persona of the "idiot."[14] They can—and should—slow down reasoning by demanding a suspension of taken-for-granted assumptions among transition scholars, professionals, and activists alike about how mobility systems as a species of sociotechnical configuration function and change.

It seems paradoxical to demand a slowing down when radical reductions in transport's carbon emissions are needed so urgently. However, it is exactly that urgency that leads scholars, professionals, and activists to resort to ready-made solutions and seemingly universal strategies for reducing emissions like electric vehicles, bike sharing, and transit-oriented development. Across the globe these and other initiatives are frequently pursued enthusiastically by policy makers and others with little knowledge of either the often-ambiguous effects on mobility elsewhere, or the institutional complexities associated with appropriation and implementation. Transition scholars also often lack particular, in-depth knowledge about mobility and consequently make similar mistakes, as transport planners have often commented. Examples include the common belief that the provision of mobility alternatives is enough to make people use other modes of transport or travel shorter distances, and the at best superficial engagement with the heterogeneity in needs, capabilities, and experiences of mobility system users.

The effects of geographers performing the role of Deleuze and Guattari's "idiot" are situation- and place-specific, but some broader expectations can be articulated. For one, they can draw attention to a tension in much research on (mobility) transitions. While transition theorists hold that transitions entail major changes in almost all components of a sociotechnical system, empirical research tends to foreground technological artifacts and physical infrastructure (e.g., electric vehicles) or specific institutional arrangements (e.g., car sharing). Other system components, such as cultural meanings and

formal expertise, are given much less attention and are often only addressed indirectly. This is a significant shortcoming, as the value of transitions thinking lies in its comprehensiveness and the opportunity to focus on more than technological artifacts, physical infrastructure, or ownership regimes.

Second, the question of who benefits and in what ways is often sidelined in transitions research and praxis. More than once it seems to be assumed that the benefits are more or less evenly distributed in terms of gender, class, race/ethnicity, and other processes of social differentiation. Yet, the vast majority of initiatives to encourage cycling or electric vehicle use cater to specific needs and capabilities, thereby disadvantaging particular groups. There is also a nascent academic literature that elaborates how the so-called rail renaissance and cycling boom are entangled with capital-intensive real estate (re)development, gentrification, and the displacement of poorer households under neoliberal urbanization.[15] Geographers are particularly well-placed to raise questions about how mobility transition trajectories are linked to and co-opted by uneven urbanization processes.

They are, third, well-placed to problematize the implicitly assumed transferability of transition theory and governance approaches like transition management. Is it not the case that some things get lost or rendered imperceptible when concepts and ideas that are inevitably situated in European—more specifically Dutch—traditions of knowing and engaging the world travel elsewhere as transferable ready-mades? It is certainly reasonable to ask whether transition thinking needs to be "worlded" and provincialized, in the words of Ananya Roy and Eric Sheppard, once it is moved to non-Western contexts.[16]

Finally, geographers can trigger reflection on the concept of (mobility) transition itself. This comes, after all, with intellectual baggage. It is derived from versions of complexity theory that assume nonlinear phase shifts between relatively stable domains, which is also popular in ecology.[17] This mode of thinking is inevitably performative. It, for instance, creates an "other"—mobility systems that are not in transition—and thus risks rendering periods in the history of a particular place-specific mobility system overly stable. Subtle forms of change, as well as the emergence of the precursors to or conditions favorable to the formation of niches in which more radical innovations can develop, may well remain below the radar. The concept of transition is also intrinsically future oriented. Not only does it make the future governable; it also actualizes the future in particular ways in the present. It thereby also forecloses certain courses of action. These are likely to be the more radical ones offering the promise of genuine change when spatial transferability of emissions-reducing initiatives is simply assumed and the possibility of co-optation by neoliberal, uneven urbanization and need for change beyond the hardware of technology and physical infrastructure are disregarded.

A Mobilities Approach to Mobility Transition (*Tim Cresswell*)

Despite the criticisms of the multilevel perspective on transition for being insensitive to the importance of practice, of politics, and of geographical scale, and despite the constant adaptation of transition theory to account for these criticisms, my argument is that work on transitions to forms of mobility that produce fewer greenhouse gases and use less fossil fuels still remains overly centered on the issue of technology. This fixation on technology is fettering the development of work on mobility transitions unnecessarily. What I would propose instead is a "mobilities approach"[18] to mobility transitions in which technology is only one possible (and not always necessary) aspect of transition to low-carbon mobilities. A mobilities approach to mobility transitions means starting with movement, meaning, and practice as central and interconnected components of mobility as it exists today and mobility as it will exist after transition, and to ask what changes need to happen in these three realms in order to reduce carbon emissions and dependence on fossil fuels. Sometimes the answer will include technology, and sometimes it will not.

The multi-level perspective on transitions (MLP) is centered on the sociotechnical niche as a space from which change originates. Clearly there are other spaces that are neither sociotechnical nor a niche that can enact transitions in mobility. Governments, for instance, with the appropriate will, can legislate transition from above by, for instance, insisting on large reductions in carbon emissions or subsidizing alternative forms of energy. At the other end of the political spectrum, social movements and grassroots organizations can insist on transition from below. Neither of these is, strictly speaking, a "niche," and neither is necessarily centered on technology. One example of transition to lower-carbon mobilities that illustrates these arguments is the Bus Riders Union of Los Angeles.[19]

The Bus Riders Union (BRU) is not primarily an organization focused on transition to low-carbon mobilities. Neither is it focused on the development of new technologies or new sociotechnical systems. The BRU is a collection of grassroots activists who protested the development of a light rail initiative in Los Angeles which was, on the face of it, a "green" development in a city overwhelmingly dominated by automobiles. The BRU is made up of radical activists, including significant numbers of African Americans, Korean immigrants, and women who were dependent on buses to go about their daily business. They were collectively outraged by the development of a light rail line that moved people (disproportionately white and well-off) from the suburbs into the city. In order to build this line, the Los Angeles County Metropolitan Transportation Authority, (MTA) would have to divert funds from buses, which did not primarily move between the suburbs and the city center, but rather across the city in ways that were more helpful to people who did not

work downtown but were more likely to be moving across town to service the lives of the wealthier commuters as, for instance, domestic servants.

The BRU fought the MTA through the legal system and in a landmark case in 1994 forced the MTA to spend money on buses, as to do otherwise would place an unacceptable burden on the poor, people of color, and women. In response, the MTA proposed expanding the existing bus service with conventional diesel buses. Once more the BRU intervened, pointing out that the poor, people of color, and women were disproportionately affected by the emissions of diesel buses and that the MTA should instead purchase lower-emission hybrid buses. Once again, the BRU was successful. In its arguments, the BRU tackled mobility holistically, asking who was using buses, why they were using them, what impact they had on communities, and how their use impacted people environmentally. The BRU is not a sociotechnical niche. It might be possible to discuss grassroots activism as a "niche" activity, but this would surely serve to depoliticize their actions. It is certainly the case that their actions can be thought of as contributing to lower-carbon transitions, even if this was not their primary intent. They were arguing for a "just transition"[20] that included emissions as part of a holistic argument about movement, meaning, and practice in the context of power.

In its political struggle, the BRU connected things that are often left disconnected. This contrasted with the MTA, which repeatedly promoted a view of mobility that was largely technical in nature. The MTA looked at transit in LA as a set of functional problems with technical solutions. The original light rail proposal was promoted in terms of greener public transit provision but was completely disconnected from any sociocultural consideration of meaning and practice. Perhaps most revealingly, the MTA would frequently deny that its plans for public transit provision had anything to do with race. The BRU, on the other hand, constantly insist that it had everything to do with race, placing the history of mobility, and particularly public transit, at the center of their case. The MTA would argue that this was about buses and trains, while the BRU would insist it was part of a struggle that included Jim Crow Laws, Rosa Parks, and the spatiality of American cities.[21] This politics of mobility[22] as a set of connections between movement, meaning, and practice is very different from the kind of processes that are described by the multi-level perspective on transition.

Mobility Transitions in a Multi-level Perspective (*Frans Sengers*)

In recent years, new conceptual perspectives about mobility and transformative change have burst onto the scene. Both the mobilities paradigm and analytical frameworks from the field of transition studies—in particular the multi-level perspective (MLP)—have attracted a widespread following among

social scientists. My aim here is to highlight the key elements that make a transitions perspective so valuable, as well as some fruitful crossovers with a mobilities perspective.

First, at the heart of a transitions perspective is the idea of the sociotechnical system. This points to the insight that social and technological developments are intertwined; the development trajectories of material artifacts should be seen as shaping and shaped by the social world. Most MLP analyses conceive of a mobility regime dominated by the private car. This is then summarized in pictures that position the "technological" artifact of the car in the center with its specs and standards, flanked by a set of "social" elements such as the user experience and cultural meanings attached to the car. This is compatible with the ideas of mobilities scholars such as Tim Cresswell, who argued that studies of mobility should incorporate meanings and experiences of mobility beyond the "brute fact" of movement,[23] and John Urry, who talked about "the system" of automobility and the need for a sociology of game-changing objects such as the car.[24] From a mobilities perspective, a point of criticism that can be leveled against the MLP here is that it leads to an impoverished concept of mobility as such. In this perspective the social world is compartmentalized into sectors or societal functions of which mobility or transport is positioned as but one distinct domain. This directs attention away from how a multitude of mobilities in the broad sense are an integral part of our lives, thus ignoring how changing practices in one domain (say, teleworking) reshape practices in another domain (say, commuting or transport).

Second, a transitions perspective engages with the power struggle between the forces of stability versus the forces of change. In the MLP this struggle becomes apparent in the distinction between the regime level (structures representing the status quo) and the niche level (agency representing transformative change).[25] From a mobilities perspective (which does not presuppose fixed levels), a point of criticism that can be leveled against the MLP here is that the conceptual dichotomy between regimes and niches is sometimes hard to maintain in reality. For instance, the wider political context in which transport planning and infrastructure development are situated often makes it difficult to "locate" certain actors and practices at the regime or niche "level." Yet, it should be noted that this is more than a mere analytical distinction. In fact, this way of positioning the actors who are supporting a promising green technology as the pioneers who are spearheading the grand-scale shift to a future sustainable society makes for a very empowering narrative—this is at least how many practitioners themselves experienced it when they attended workshops organized by transitions scholars.[26]

Third, a final element that sets transitions thinking apart from the wider literature of social change and policy theory is its engagement with the process of sociotechnical experimentation. As precious yet-to-germinate microcosms of sustainable systems and practices, the alternative sociotechnical configu-

rations embodied in pilot projects or "living labs" are applied and tested in real-life contexts with the aim of technological and social learning. The promise is that learning and demonstration effects of such experiments add to the momentum of emerging sustainable configurations (niches), which are geared to transform unsustainable sociotechnical systems (regimes). The protective spaces in which experiments can take place are often conceptualized as geographically "bounded" sites, and most of the attention is directed at how the lessons from these sites can be institutionalized or otherwise embedded in mainstream policy at the national level. The added value of a mobilities perspective here, or to be more precise, what Eugene McCann has called a "policy mobilities" perspective,[27] is to focus on the horizontal flows of knowledge between several experimental sites instead of upward aggregation. This focus on how policy-relevant knowledge is exchanged in practice between experimental sites might help to lay bare the more complicated geographies tied up with niche building.

To summarize, taking a transitions perspective means moving the following center stage: (1) sociotechnical systems, (2) stability versus change, and (3) experimentation. This results in an analysis that has some major strengths, as well as some clear weaknesses when viewed from a moblities perspective. I think there is great potential for fruitful cross-fertilization between these two perspectives.

Systems of Practice and Transition (*Matt Watson*)

We can only enable mobility to move towards being sustainable if we recognize that its patterns, and changes to those patterns, are profoundly embedded. Changes in mobility are inextricable from both the dynamism and obduracy of so many other aspects of people's lives, collective social rhythms, norms, and purposes, and broader sociotechnical systems. The principal challenge for theory and methodology in this field is therefore to meaningfully comprehend these complex interdependencies, and to do so in ways which can usefully inform transitions in mobility.

It is this imperative that got me started on articulating an approach, under the name of "systems of practice."[28] This approach springs from a grounding in practice theory, which presents a distinctive understanding of why people end up doing what they do; and how those doings relate to broader social relations constituting social order and change. This understanding contrasts with orthodox accounts of behavior, which characterize what people do as a matter of individuals making choices consistent with their attitudes. Instead, human action is understood as the performance of social practices.[29]

So, for example, we can talk of cycling as a practice. In talking or thinking of it, we know the elements that constitute it as a practice: the materials in-

cluding technologies like bicycles, accessories, road signs; the competences and ways of using the body; the social meanings, norms, and rules that are carried with it. But the practice of cycling as a social entity we can think of in the abstract continues to exist as an identifiable practice only in and through its performance by practitioners—primarily through people riding bicycles.

By drawing attention to the diversity of relations that come together in any recognizable pattern of human activity, and in highlighting how such patterns of activity are socially collective rather than simply individual, this understanding of practice helps us to understand why so much of daily life stays surprisingly obdurate. But it also provides distinctive means for understanding how change happens,[30] particularly through appreciation of the ways practices interrelate with each other. So, we can understand codependent relationships between practices, such as how patterns of mobility enable an individual to accomplish the coordination of different practices across spaces of home, work, shopping, or leisure and more. In principle, through attending to relationships between practices, social change on any scale could be accounted for in terms of changes in practices.

However, despite this theoretical potential, empirical applications of practice theory struggle to go beyond accounting for particular strands of change, often staying close to the detail of everyday doing in relation to particular practices. It is this which motivated me to seek to develop this approach of systems of practice, drawing on understandings of sociotechnical systems and transition. The basic contention is that practices are partly constituted by the sociotechnical systems of which they are a part; and those sociotechnical systems are constituted and sustained by the continued performance of the practices that comprise them. Consequently, changes in sociotechnical systems only happen if the practices which embed those systems in the routines and rhythms of life change; and if those practices change, then so will the sociotechnical system.[31]

So systems—say, the system of automobility[32]—persist and change only through the flow of practices—of action and doing—which comprise them. These practices clearly are not restricted to "user" practices, or only the distinctive practices of identifiable innovators (in their niches). Principally, systems persist through the routinized actions of actors throughout the system, as they perform the practices which reproduce the institutions and relations comprising that system. So, the system of automobility clearly depends on the continued performance of car driving. But car driving can only recruit and retain practitioners so long as multiple codependent practices continue to be performed, including those of car production, car maintenance, transport planning, road building, fuel provision, and many more. These interdependencies between practices develop and are maintained over time through continued performance of the practices themselves. Those interdependen-

cies can extend and stabilize, progressively conditioning the reproduction of constituent practices.

Practices can therefore be in systemic relations with other practices directly; and also with the infrastructures, technologies, institutions, regulations, and more which represent the accretion and durability of past performances of other practices. So, this represents one area of current theoretical development that can help us understand and inform transition towards sustainable mobility—one which seeks to tackle the profound interdependencies that hold mobility patterns in place while holding on to the grounding of mobility systems in the mundane actions of daily life.

Theorizing Complex Transitions in Mobile Social Practices (*Mimi Sheller*)

The new mobilities paradigm draws on and develops three areas of theory: complexity theory, multilevel transitions theory, and social practice theory, which together are especially relevant for theorizing technological transitions. I describe these here in relation to thinking about reducing the deeply engrained automobile dependence in the United States.

First, complexity theory suggests that the social world is constituted by complex, adaptive systems stretching over time-space, and such systems are both robust and fragile.[33] Complex systems—including the dominant system of automobility-highways-oil-suburbs in the United States—are dynamic, in process, and unpredictable. Positive feedback can move systems away from equilibrium, so small changes may bring about big, nonlinear system shifts, as well as the converse. That line of theory influenced John Urry's late work looking at complexity, climate change, and postcarbon transitions.[34] He argued that while a system such as automobility may be stabilized for long periods of time through lock-ins, small causes may prompt the emergence of a new path. Moments of rapid change are difficult to predict, but it is possible that the system (e.g., of automobility) might reach a tipping point where everything ratchets in a new direction. Complexity theories therefore suggest the need to move away from business as usual within urban planning and transport planning. This implies the end of the "predict and provide model" of transport behavior. It also recognizes complex interdependencies of multiple mobility systems, including transport, communication, energy, and power distribution.

Second, mobilities research focusing on postcarbon transport systems draws on multilevel transition theory to interpret past transitions, analyze current processes, and predict future change. Both theories agree that system innovations are fundamentally social and cultural, not technologically deter-

mined. "They are not merely about changes in technical products, but also about policy, user practices, infrastructure, industry structures, and symbolic meaning, etc."[35] Both approaches try to describe the cracks in the dominant system of automobility and to foresee the potential openings for societies or urban systems to transition away from automobile dependence. In contrast to rational choice theory's focus on user behavior or behavioral psychology's emphasis on nudging individuals, multilevel transition theorists instead consider the complex embedding of sociotechnical systems in interlocking state and corporate regimes, and the influence of larger landscape-level factors such as oil price changes and climate change policies. Niches such as "active transport," bicycle coalitions, or advocates for complete streets may emerge with alternative projects. However, the new mobilities paradigm also challenges transition theory by placing more emphasis on the cultural aspects of change: how narratives, stories, meanings, practices, and performances of mobility actually influence regimes. It also examines wider transition processes beyond transportation alone, including mobile communication, securitization, new state forms, resource extraction, and so forth. All of these also affect mobility transitions.

Third, the new mobilities paradigm draws on social practice theory. It posits that there are unstable and ever-changing interrelations of places, persons, technologies, and natures connected through performances and practices. Systems change through transforming wider sets of social practices beyond transportation choices and behavior. In relation to energy, for example, Elizabeth Shove criticizes what she calls the ABC idea of attitudes-behavior-change driving transition.[36] Social habits and practices, Shove argues, are derived from systems lying outside of individuals, such as those that generate particular levels of comfort and hence the apparent demand for heating or air conditioning within a building, for example. And on this account people can be imagined as bearing social practices and enacting them, and not as their originators. Stopping oil companies might be more important than encouraging consumers to turn the lights off, and this would have an impact on transportation and food systems as well as wider business practices. If we want to transform or replace high-carbon social practices, then we need to unmake the existing energy regimes in a more radical way.

So everything from resource extraction to militarization to "smart" connected technology and collaborative economies is part of mobility transitions. The mobilities paradigm presents a new configuration for applied research, integrating these three theories of complex systems, transition theory, and social practice, and together it offers a more powerful framework for analyzing a wide range of contemporary transitions. It ties mobility transitions to low-carbon energy transitions, to understanding mitigation and adaptation to climate change, and ultimately to what could be understood as the twin problems of planetary urbanism and mobility justice.

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Notes

1. Tim Schwanen, "The Bumpy Road toward Low-Energy Urban Mobility: Case Studies from Two UK Cities," *Sustainability* 7, no. 6 (2015): 7086–7111, http://www.mdpi.com/2071-1050/7/6/7086 (accessed 1 October 2016); Elizabeth Shove, Mika Pantzar, and Matt Watson, *The Dynamics of Social Practice: Everyday Life and How it Changes* (London: Sage, 2012).
2. Cristina Temenos and Anna Nikolaeva would like to thank Peter Adey, Jane Yeonjae Lee, and Andre Nóvoa for their intellectual engagement on mobility transitions and to acknowledge the financial support of the Mobile Lives Forum–funded project "Living in the Mobility Transition," which supported attendance at the AAG conference in 2016. Authorship for this piece is in order of appearance.
3. Frank W. Geels, "A Socio-technical Analysis of Low-Carbon Transitions: Introducing the Multi-level Perspective into Transport Studies," *Journal of Transport Geography* 24 (2012): 471–482; for a recent overview of the theory and responses to most common criticisms, see Frank W. Geels, "The Multi-level Perspective on

Sustainability Transitions: Responses to Seven Criticisms," *Environmental Innovation and Societal Transitions* 1, no. 1 (2011): 24–40.

4. Tim Schwanen, "Innovations to Transform Personal Mobility," in *Low Carbon Mobility Transitions,* ed. Debbie Hopkins and James Higham (Oxford: Goodfellow Publishers, 2016), 206–212.
5. Frank W. Geels, "Technological Transitions as Evolutionary Reconfiguration Processes: A Multi-level Perspective and a Case-Study," *Research Policy* 31, nos. 8–9 (2002): 1257–1274.
6. Schwanen, "Innovations to Transform Personal Mobility," 206–219.
7. Tim Cresswell, "Towards a Politics of Mobility," *Environment and Planning D: Society and Space* 28, no. 1 (2010): 17–31.
8. Mimi Sheller and John Urry, "The New Mobilities Paradigm," *Environment and Planning A* 38, no. 2 (2006): 207–226.
9. Cristina Temenos and Eugene McCann, "Policies," in *The Routledge Handbook of Mobilities,* ed. Peter Adey, David Bissell, Kevin Hannam, Peter Merriman, and Mimi Sheller (New York: Routledge, 2013), 575–584.
10. Merje Kuus, "For Slow Research," *International Journal of Urban and Regional Research* 39, no. 4 (2015): 838–840. "Slow research" is distinct from "slow scholarship" and advocates intellectual reflection on the relationship between scholars' ontological and methodological commitments.
11. See also Frans Sengers and Rob Raven, "Toward a Spatial Perspective on Niche Development: The Case of Bus Rapid Transit," *Environmental Innovation and Societal Transitions* 17 (2015): 166–182.
12. E.g., Tim Cresswell, *On the Move: Mobility in the Modern Western World* (New York: Routledge, 2006); Peter Merriman, *Driving Spaces: A Cultural-Historical Geography of England's M1 Motorway* (Malden, MA: Blackwell, 2007).
13. E.g., Torsten Hägerstrand, *Innovation as a Spatial Process* (Chicago: University of Chicago Press, 1962); John Pickles and Adrian Smith, eds., *Theorising Transition: The Political Economy of Post-Communist Transformations* (London: Routledge, 1998); Noel Castree, David Demeritt, Diana Liverman, and Bruce Rohoads, eds., *A Companion to Environmental Geography* (Malden, MA: Blackwell, 2009)
14. Gilles Deleuze and Félix Guattari, *What Is Philosophy?* (London: Verso, 1994); Isabelle Stengers, "The Cosmopolitical Proposal," in *Making Things Public: Atmospheres of Democracy,* ed. Bruno Latour and Peter Weibel (Cambridge, MA: MIT Press, 2005), 994–1005.
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16. Ananya Roy and Aihwa Ong, eds., *Worlding Cities: Asian Experiments and the Art of Being Global* (Malden, MA: Blackwell, 2011); Eric Sheppard, Helga Leitner, and Anant Maringanti, "Provincializing Global Urbanism: A Manifesto," *Urban Geography* 34, no. 7 (2013), 893–900.
17. E.g., Lance H. Gunderson, "Ecological Resilience—In Theory and Application," *Annual Reviews of Ecology and Systematics* 31 (2000): 425–439.

18. John Urry, "Do Mobile Lives Have a Future?," *Tijdschrift voor Economische en Sociale Geografie* 103, no. 5 (2012): 566–576; Cresswell, *On the Move,* 327; Peter Adey, *Mobility* (London: Routledge, 2009).
19. Cresswell, *On the Move,* 327.
20. Mark Swilling and Eve Annecke, *Just Transitions: Explorations of Sustainability in an Unfair World* (Claremont, South Africa: UCT Press, 2012).
21. Robert D. Bullard, Glenn S. Johnson, and Angel O. Torres, *Highway Robbery: Transportation Racism & New Routes to Equity* (Cambridge, MA: South End Press, 2004).
22. Cresswell, "Towards a Politics of Mobility," 31.
23. Cresswell, *On the Move,* 327.
24. John Urry, "The 'System' of Automobility," *Theory, Culture & Society* 21, nos. 4–5 (2004): 25–39.
25. The idea of putting the tension between two opposing concepts at the heart of the narrative is also what underpins a mobilities perspective, with its central tension between mobility and immobility.
26. Many transitions scholars involved in action research activities, such as events and workshops with mobility practitioners, are at the forefront in the development sustainable alternative mobility systems. Examples include the Dutch TRANSUMO program (http://www.transport-research.info/programme/transumo-transition-sustainable-mobility) and the EU program Pioneers into Practice (https://pioneers.climate-kic.org). Throughout my research, many of these "pioneers" or "frontrunners" have told me, through personal communication, that they find the multi-level perspective narrative of transitions both empowering and convincing in providing a broader context for their struggle. The multi-level perspective narrative states that transitions happen when there is sufficient "landscape" pressure to dislodge "regimes" that structure unsustainable sociotechnical systems and when "niches" that afford protective space to alternative sustainable sociotechnical systems are sufficiently developed.
27. Eugene McCann, "Urban Policy Mobilities and Global Circuits of Knowledge: Toward a Research Agenda," *Annals of the Association of American Geographers* 101, no. 1 (2011): 107–130.
28. Matt Watson, "How Theories of Practice Can Inform Transition to a Decarbonised Transport System," *Journal of Transport Geography* 24 (2012): 488–496.
29. Andreas Reckwitz, "Toward a Theory of Social Practices: A Development in Culturalist Theorizing," *European Journal of Social Theory* 5, no. 2 (2002): 243–263.
30. For understanding how practices change, see Shove et al., *The Dynamics of Social Practice,* 208.
31. Watson, "How Theories of Practice Can Inform Transition to a Decarbonised Transport System," 496.
32. John Urry, "The 'System' of Automobility," 39.
33. John Urry, *Global Complexity* (Cambridge: Polity, 2003).
34. John Urry, *Climate Change and Society* (Cambridge: Polity, 2011); John Urry, *Societies beyond Oil* (London: Zed, 2013).
35. Frank Geels, "Multi-level Perspective on System Innovation: Relevance of Industrial Transformation," in *Understanding Industrial Transformation: Views from Different Disciplines,* ed. Xander *Olsthoorn* and *Anna Wieczorek* (Dordrecht:

Springer, 2006), 163–186, here 165. See also Frank Geels, "Energy, Societal Transformation, and Socio-technical Transitions: Expanding the Multi-level Perspective," *Theory, Culture and Society* 31 (2014): 21–40.

36. Elizabeth Shove, "Beyond the ABC: Climate Change Policy and Theories of Social Change," *Environment and Planning A* 42 (2010): 1273–1285. See also Elizabeth Shove, Heather Chappells, and Loren Lutzenhiser, eds., *Comfort in a Lower Carbon Society* (London: Routledge, 2009).