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Rethinking embodied knowledge and household consumption

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ABSTRACT

Mainstream theories on household energy consumption are characterized by reductionist assumptions about consumers and the socio-material contexts of choice. Much of the social science attention on consumption has focused on mental states, meaning, cognition, and rational choice. In mainstream theory, body is collapsed into mind and the demand for goods is both disembodied and decontextualized from social and material worlds. These reductions hinder the development of a robust theory of consumption and new thinking in energy savings policy. In this paper we bring the body back to consumption. We argue that people's exposure to practices, both in the form of personal and culturally mediated experience, embodies knowledge (and meanings) and this in turn affects the ways we perform energy-consuming acts. We draw on work on body, habitus and perception by anthropologists Marcel Mauss, Pierre Bourdieu, Jean-Pierre Warnier, and philosopher Bergson, as well as more recent perspectives framed under the heading of social practice theory.

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1. Introduction: the plasticity of bodies

Despite a quarter century of critique, a theory of household consumption based on rational choice and methodological individualism has stripped consumption from its grounding in historical processes and has ignored the capacity of the material world, including human bodies to affect consumption. In mainstream theorizing about energy consumption, body is collapsed into mind and the demand for goods is both disembodied and decontextualized from social and material worlds. Yet, bodies are repositories of a unique and explicit form for knowledge about the world and this knowledge affects the ways we consume. Concrete experiences, involving both body and perceptions are always brought to bear in learning and adapting ourselves to new environments. The escalation of energy consumption can be interpreted as a transformation of bodies. The modern body is increasingly re-equipped and reshaped through new perceptions of comfort.

The co-evolution of bodies and the material world thus affects the ontology of energy consumption as well as providing an interesting approach to conceptualizing changing consumption practices. Further, a theory of body is highly relevant for a policy domain interested in reducing the energy intensity of everyday

practices. The body perspective opens policy for new forms for experimentation beyond the usual market experiments in which consumers are presented with new products and either select or reject them. Our intention in this chapter is to attempt to reposition the body in the theorizing of energy consumption and to infer how this could create new, fertile ground for policies directed at reducing energy consumption. Along with other papers in this inaugural issue that discuss various elements of household energy consumption [1–4], our ambition is to contribute to the development of a pragmatic theory of energy consumption relevant for both academics and policy makers.

In developing a theory of body and consumption, we draw on work on body and habitus by anthropologists Marcel Mauss [5], Jean-Pierre Warnier [6,7] and Pierre Bourdieu [8,9]; work on perception and memory by Bergson [10]; as well as our own previous work on the body-consumption relationship [11–13]. Reflections will be made on the relative strength of embodied knowledge in actions such as transportation, cleaning, preparing (and eating) food and achieving thermal comfort. We will relate the embodying of knowledge to repetition, social complexity, as well as to the geography of the space in which the action takes place and the numbers and kinds of material objects involved in the practice.

We will aim at avoiding the mind/body duality introduced by Descartes, who proposed that all thought is disembodied and logical. We will argue that the habits of language intellectually design our bodies as well-defined entities, yet the boundaries between thought and reflex, body and mind are malleable and overlapping.

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We do not consider the body as a natural and fixed entity, or a passive slate on which the social is recorded [e.g. 14,15]. Rather, the body is a methodological and conceptual tool that extends the grammar of social practices. We will take on the task of enriching these insights on bodies in order to make links between disciplinary approaches rather than juxtaposing them. We propose that bodies are at the intersection of the cultural and natural, the human and non-human, the individual and collective. In this chapter, we aim to begin an exploration of these intersections.

Bodies are part of the material world and continuously exchange energy with their environment. Like the bodies of all living beings, human bodies have to reproduce themselves everyday through the finding of a favorable environment, the acquisition of food, the creation of comfort and eventually by the physical act of procreation. Anthropology and philosophy provide ways of seeing and conceiving bodies (the plural is important) within practices. In order to avoid reduction to a particular discipline or knowledge tradition, however, we will theorize the body in its articulation with all of the other dimensions of human practices, including materiality, embodied knowledge and habits. Bodies are thus inserted into practices without subtracting any of the other relevant entities. A human being results from other bodies, and is formed with and through a body. Bodies have to reproduce themselves regularly to be preserved, but humans have developed many ways to conserve themselves. Anthropology shows how bodies are variably shaped through time and space [12] and phenomenology has shown how diversely we are in the world through our affections and perceptions. We suggest that this diversity of bodies can be understood through the mutual fashioning of practices and bodies. Practices require skilled bodies, and bodies are shaped by practices [16].

We explain this diversity of bodies-in-action in the next section by developing the characteristic of bodies as both sites of habits and of processes. On one hand, the constitution of habits is elucidated by the reproduction and embodiment of situations. On the other hand, embodiment is described as the passage of perceptions into memories. In order to account for embodiment, which is a process of accommodation, we need a theory of perception—a profound exercise that will be only sketched out in this paper. In the following section, we examine how bodies co-evolve with a changing material world. We develop the point that bodies can be described as inertial and resistant to change, or as possibilities for new forms for experimentation. We explore this ambivalence in the section “bodies as policy subjects” in order to emphasize the experimental aspects. We conclude that we know little about the limits of the plasticity of the human body or, in the words of Spinoza, “no one has hitherto laid down the limits to the powers of the body” [17: *Ethics*, III, prop. 2].

2. Bodies as active entities in practices

Bodies are constitutive of practices in two distinguishable but overlapping ways, first as entities that interact with other objects in a practice and second as the sites of actions or activities. Thus, a body is a spatiotemporal entity that can to some extent be identified by coordinates (we will see later that bodily boundaries are sometimes unclear). Second, a body is a place where activity and events occur. Considered as a delimited entity, the body can be passive or active. Bodies participate in actions and are a constitutive part of the practices which in turn constitute social life. Bodies are a necessary component of a practice, or to put it another way, there is no such thing as a practice without at least one body. Bodies have experiential histories and are not only physical, material entities but are also vessels for experiential knowledge. This knowledge is brought to bear in practices.

Bodies are also sites in which actions or events occur. The malleability of bodies appears clearly in the diverse capacities and shapes which they can take on. For instance, sleeping can be seen variously as an action, an activity and a practice. As Mauss observed, there are many different ways of sleeping, linked to conventions and to the configuration of the material accompaniments and surroundings [5]. Sleeping, sitting or walking is not more ‘natural’ than eating or talking. Simple practices such as these have complex geographies and histories, and are “culturally” shaped by the use of objects and infrastructures. Boltanski shows that the usages of the body vary with social class [18]. Foucault analyses how bodies are fashioned within disciplinary practices [19]. He regards practices as the processes by which bodily properties crucial to social life are formed. Thus on the one hand, bodies are constitutive of practices, but on the other they are constituted through practices. Seen this way, bodies are not limited to the physiological body, but can be considered as extended through objects and materialities. This conceptual maneuver provides a new perspective on experimentation that is interesting for the theory and policies of energy consumption and energy savings. We develop this point below.

2.1. Bodies as sites of habits

When bodies are considered as spatiotemporal entities with relatively well-defined boundaries, they engage in social life through practices. Bodies are part of the material world. Bodies interact with other entities that are more or less predictable. This interaction is affected by the cultural and individual histories of the body, through which knowledge is embodied and made agentive, as well as places where knowledge is deposited through the repetition of actions. Even though some of the bodily actions associated with the accomplishment of household tasks have been simplified through the increasing use of complex technologies, bodies are still involved in producing services such as clean clothes, meals, indoor comfort and so on, even if it is at the level of minimalist action such as pushing a button on a household electrical appliance. In the activities of a modern household, many actions (and knowledge) have been surrendered to technological systems which begin in the home but extend outward through infrastructures and technologies of provision. Nonetheless, in any activity, from speaking, to writing, to sharing a meal or playing sports, our bodies are always present to our actions. This is also true of actions usually associated with cognition, such as taking an exam or playing a game of chess; therefore, we can say that bodies are constitutive of human practices.

In order to understand practices, we need to look at bodies, their interaction with other bodies and with things. If bodies are reduced to the visible or observable human part of a practice, we stray into behaviorism. By this we mean that behavior is made synonymous with visible action: it can be said to be the uppermost layer of a practice. But many processes and elements are not visible (meanings, competences, embodied knowledge). Further, the body is only one agent among many in the performance of a practice. The capacity to enact practices (agency) is the result of the coordination of different agents, both human and non-human. In other words, agency in practices is distributed among the entities that are enacted in a practice [11,20], of which the body is a crucial entity. Any action involving a body has to be analyzed within the assemblage of elements that contributes to the performance of a practice.

Not all forms for practices are economically rational or even instrumental. Humans engage regularly in inexplicable behaviors, mysterious purchases, odd uses of objects and baffling forms for waste. There are countless examples of this from the energy consumption literature. But we can make better sense of an action

if it is linked to other actions and related to a recognizable pattern of agents. An action is meaningful once it is inscribed into a practice. For example, when we observe someone buying vegetables in a shop, we understand this action in the perspective of preparing a meal. This involves a purposive shopper, but will only be consummated if the right shop is located within the shopper's geographical range and the foods being sought are available. Similarly, the use of a transport mode can only be fully explained if constraints and infrastructures are included in the elements that determine final individual choices. For example Kaufmann shows that the choice of transport mode is chiefly determined by the constraints, such as the availability of parking spaces at the destination [21]. Another important consideration is the negotiation involved as the consumer chooses among the range of choices available. The result (consumption) depends on the chooser's capabilities, which are largely determined by her/his practical experiences. Practices are thus the units of analysis that allow us to understand how daily life is reproduced.

An interpretation of the active body in practice requires openness to social meaning. This is in line with the ethnomethodological principle that practitioners make sense of their activities through common sense methods [22,23]. This 'sense' consists of both reflexive and non-reflexive elements which generate the meaningful and patterned character of everyday life, actively produced through recurrent practices. Our recognition of a practice is usually through an identification of the movement of a body in relation to objects in a pattern of activities. This recognition allows us to state that, for instance, this person is cooking, that one is sleeping, these people are playing football, and those people are driving. However, we should not confuse the moving body with the practice, nor should we assume that those movements are generated through a series of cognitive and reflexive decisions.

Bodily movement relies on reflexive decision making, but also on the deployment of knowledge embedded through interaction with other bodies and things in practices. The implications of this line of reasoning is that 'practical knowledge' [9,24] or 'practical consciousness' [25] is not separate from mental processes, but neither should mind be regarded as transcendent to practice and accorded an ontological privilege in theories of action (as is the case in mainstream energy research and policy). In theorizing consumption-related practices, we must avoid both cognitive reductionism and methodological individualism. The former discards the body while the latter discards the multiple contributors to the practice. Methodological individualism precludes us from conceiving a given practice as a multiplicity, or a plurality of actualizations of what looks like similar action patterns.

Theories of practice have attempted to explain how habits are formed through the joint re-creation of place and memory [5,9,27]. We find Bourdieu's conceptualization of habitus to be valuable for understanding how memory affects the reproduction of practices. Drawing on Marcel Mauss' work on embodiment, Bourdieu developed a theory of habitus that translates variously into an organizing capacity, a habitual state, and a way of being, a predisposition, or a tendency [27]. Habitus is central in the Bourdieu's explanation of how conduct becomes regulated. It is a scheme that converts the sediment of past experiences into dispositions for future actions. Habitus is the process by which knowledge acquired from experience, and thereby having both internal and external sources, is made one's own, namely embodied. "The habitus – embodied history, internalized as a second nature and so forgotten as history – is the active presence of the whole past of which it is the product. As such, it is what gives practices their relative autonomy with respect to external determinations of the immediate present" [9].

The body is conceived as a repository of past experiences, both individual and collective, and as such, affected by social relations

and cultural learning. The body is thus not only the site of action, but also of dispositions for future actions. A large part of habitus is unconscious, implying that the sources of agency for actions are not always transparent to the subject. The body makes possible actions that are accomplished without conscious direction, but also allows purposive actions (such as typing, sports, dance) to be carried out without conscious intervention. Heating, cooling, switching lighting on and off, closing doors and showering are examples of actions that often run on automatic. Habitus is not repressive and constrictive as has been construed in some post-modern critique (see [28]), but rather allows individuals to negotiate everyday life without the need for repetitive and constant sense-making. Repetition creates interactive convenience between a "socially informed body" and its environment; this contributes to the formation of dispositions for future actions.

Aside from the issue of regularity of bodily practices, it is also important to account for the creation and evolution of new practices. All practices are not regularly performed. The repetition of the same practice is always embedded in uncertainty; practice trajectories show that practices evolve and that habits are diversified. De Certeau emphasizes that everyday practices are replete with creative strategies [29]. Thévenot also contests the idea that practices are solely the result of repetition [30]. He wrote that "The notion of habitus, which Bourdieu elaborated as the centerpiece of his theory of the reproduction of social order, short-circuits the analysis of the personalized and localized dynamics of familiarity" [27:74]. Within his notion of pragmatic regime, Thévenot describes these dynamics, including personally inventive adjustments that allow people to pursue new directions while being absorbed in routines. In our contemporary societies, human beings constantly change the scope of their engagement, shifting from one pragmatic regime to another according to the demands or conditions specific to the situation.

From a Science and technology Studies (STS) perspective, Pickering claims that habits and skills are gained through a process of accommodation between a body and a material arrangement, in other words, through mutual adjustments [31]. Practices are formed and changed in a permanent action and reaction between the practitioner's body and the objects involved in the practice. If practices are construed as sheer regularities or as shared habits, it is not possible to understand how varied material arrangements are created and how they can shape human activity.

2.2. Bodies as processes

In order to account for the inventive strategies and permanent negotiations between the body and objects, we have to move from the body as a spatiotemporal entity to the setting in which events take place. We can thus complete the relatively fixed feature of the habitus by introducing the idea of an "active present", a duration in which events occur. This allows us to describe the process of embodiment. As we will elaborate, the plasticity of bodies explains how capacities can be embodied and the contributions to embodiment of perception, memory and tacit knowledge. A theory of body useful for analyzing consumption requires an acknowledgment of the contribution of perceptions.

Bodies are shaped through learning and sensory-motor experiences. Warnier defines this shaping as 'motoricity' and explores the possibility of an ethnography of motoricity within a given material setting [6]. He claims that "it is not possible to divorce material culture studies from the study of the body" (p. 10). He is interested in learning processes that show how the techniques of the body incorporate material arrangements. Apprenticeships and games are his favorite examples as they display how motoricity is at the basis of

the embodiment of habits. This can be applied to the ways we move (with or without equipment) and to the ways we use objects.

Perceptions are active in the conduct of a practice. To sketch a theoretical framework that links body, perception and action, we turn to Bergson's book, *Matter and Memory* [10]. Bergson's philosophy is relevant for a practice approach inasmuch as it does not start with a reflexive subject who structures the world. In contrast to the reflexive philosophy of Kant or Husserl, Bergson is not concerned with a self who contemplates the world and searches for the conditions of knowledge. He assumes that (1) the world is given as a bundle of multiplicities that cannot be reduced to spatiotemporal extensions, (2) life is a vital impulse, a creative energy, a strength of acting, with the body as the center of action, (3) living beings interact with their environment through a mix of perception and memory, but only human beings can learn the true distinction between them, thanks to language.

Perception and memory play chief and complementary roles in the re-articulation of the body. According to Bergson, there is no neat separation between the things with which the body interacts and our perception of them; things are in perception but perception is in (or dependent upon) things. Perception is always oriented toward action; in other words, perception is the preparation of a possible action. Perception modifies the body because it enables a new disposition to act. Pure perception gives us a world without subject and without past, always in the present. Perception can be distinguished from memory, which is dependent on experience and is of two kinds: habits and images of past events. Memory is directly linked to the body and its actions: the body condenses its past into motor habits. Memory is produced through the replaying of the same action (as the learning of a text by heart), through the repetition of the same causes and effects. Memory has a practical function. It discovers in the present situation elements that resemble a former situation. In this sense, memory is similar to Schatzki's notion of practical understanding [24] and to Bourdieu's dispositions [9]. It is relational because it links former situations to present objects. Pure memory retains in all its details the picture of our past life. Memory allows us to make distinctions and choices.

According to Bergson, consciousness oscillates between pure perception and pure memory. Applying this to action, the performance of a practice can be said to draw on a mix of perception and memory. A practice is performed in a given place, but the perception of this place depends on the body performing the practice. In a practice, a place looks like the *Umwelt* described by von Uexküll: any animal perceives only a limited set of entities, namely those that are relevant for the reproduction of its life [32]. Similarly, in a practice, many objects are not really present to the practitioner. Those properties that are perceived are those that are useful for the enactment of the practice. Following Bergson, we propose that memory is distributed between the perceiving body and the elements of a practice. Memory is present in the body (perception) but also in the social and physical contributors to the practice. For example, the habits of eating may be disturbed when moved from the kitchen to a restaurant or formal event such as a wedding, where there are different arrangements of cutlery and different social conventions on their proper use. Another example of an external perturbation of memory is when a kitchen is reorganized and cooking utensils are moved to new locations. It may take several days to get used to the new placement. For most of us, wedding attendance will never be regularized to the extent that wedding habits form. In the case of the reorganized kitchen, once the new arrangements have been incorporated into memory, the stage is set for the formation of new habits.

Armed with these reflections on memory, perception and habit, we can now better describe the process of the embodiment of tacit

knowledge. Practices are both the producers and the products of memory. Bodily experiences are always a mix of perception and memory, and embodiment is the process that engraves knowledge into habits. Embodiment is the creation of a memory by repetition. Body is the site of the knowledge and skills used in executing routines. Collins makes the distinction between somatic tacit knowledge and collective tacit knowledge [33]. Somatic tacit knowledge is knowledge which is linked to actions such as balancing on a bicycle, which are performed automatically and defy explanation by the performer. Collective tacit knowledge is gained through negotiation with social conventions. Thus riding a bike in Tokyo, Oslo or Brussels draws on both somatic and collective tacit knowledge, the latter making the practice of biking in each of these places different. These forms for tacit understanding, skills and differentiated knowledge are dependent on the plasticity of bodies. In the performance of practice, perception plays the role of the motor and memory the selector. As active elements of a practice, perception and memory yield to adjustments and accommodations between bodily gestures and a material arrangement. Furthermore, bodies are guided by a wide range of sensorial data, including not only visual but also tactile, auditory, olfactory and proprioceptive hints.

To sum up this section, we have outlined a non-dualistic approach to the body in order to establish an interdisciplinary frame that would embrace both theoretical and experimental aspects of consumption. We want to avoid considering mind as something radically different (or transcendent) from the body. Differing practices involve differing assemblages of heterogeneous entities. No entity is given an ontological privilege over the others when we are attempting to unfold the routines and other daily activities of householders. Obviously we do not state that mind and body have the same reality. But in focusing on bodies, we have teased out important properties of practice that are highly relevant to theorizing consumption. The reproduction of practices is a mix of permanence and invention. This interplay is indispensable to understanding change.

Acknowledging the dynamics of practice could lead to new ways to design policy interventions. At the level of the body this change of frame would encompass perceptions and memories. Not only is the object constructed in perception, but so are also the subject and the body. Bodies are affected and changed by experiences. The repetition of a pattern of action establishes progressively a convenience between a body and its environment. Normality is socially constructed through the repetition of similar perceptions and memories. Thus practices evolve with bodies through two mechanisms: perception and the embodiment of capacities. Transforming practices requires the creation of new perceptions and memories within bodies. In a practice, perception is oriented toward what is happening now. However, this orientation depends partly on a memory of past events. When perception is engaged in a practice, some memories are activated. Memory is distributed to the extent that some embodied memories (explicit or tacit knowledge) are convoked in tandem with entities that have crystallized in a social memory. In the next section we explore the implications of these insights on body and memory for a deeper understanding of energy consumption.

3. Body and energy consumption

Our development of a theory of body in consumption thus far may seem to be abstract and distant from the issue of energy consumption and savings. We insist that this theoretical detour has been necessary in order to seek inspiration for a stubborn research discourse. In this section we will attempt to ground these new

perspectives on body and practice in new research questions and policy tracks relevant to transforming energy consumption.

3.1. *Bodies as the sites of social reproduction*

From our conceptual development of bodies, we can draw some methodological lessons. Not only are bodies irreducible to any simple discipline, they should also be fully present in theorizing any facet of human action. People perceive, remember and act with the full participation of their bodies. Turning things around, bodies are shaped through perception and memory. Perception however should not be reduced to vision and cognition. Current energy policy largely collapses perception into visual and cognitive learning (relative prices, rebates, payback times, colored and numbered energy efficiency rating systems), ignoring the other senses (including proprioception and sensory-motor perceptions) that are involved when a practice is performed. When reading or listening to a paper which aims at theorizing social change, we might ask: where are the bodies in the description? Which qualities or properties are they endowed with? Are they conceived as something malleable or, on the contrary are they treated as being fixed and inertial?

As we developed above, the variability of practices through space and time is evidence of the fact that both societies and individuals change perceptions and memories, both collective and individual. It could be said that the evolution of a culture over time is synonymous with, or at least reflected in the transformation of bodies [12]. From a consumption perspective, the changing body represents the continuity of an individual and the reproductive site of daily life. For each individual body, perceptions and memories evolve through the encounter with miscellaneous situations and the reproduction of some of these situations. Practices change through social relationships, either by imitation or by contrast. Furthermore, perceptions and memories vary from person to person. Bodies with differing cultural and individual histories are able to see, hear, smell, and perceive some details in their surroundings whereas others are not perceived. These capabilities are not only physiological but often result from formal education.

Bodies are the sites of social reproduction because they both experience situations and incorporate past experiences. Practical understanding is the medium through which entities present in a situation are actively linked, drawing on perception and memories of past arrangement. Bodies perform and are performed by practices, and habits are formed through recurrent patterns of action. Whatever they are called—practical understanding, habitus, tacit knowledge, skills, competences—capabilities are embodied through practices. These capabilities both enable and disable change, depending on the situation [34]. Habits are ‘locked into’ bodies through the learning of gestures in interaction with a cultural history and a material environment. “Incorporated material culture reaches deep into the psyche of the subject because it reaches it not through abstract knowledge, but through sensory-motor experience” [6]. Therefore the cognitive digestion of information is not the only cause, or source for the formation of practices.

Acknowledging the importance of practical understanding and cultural learning would have important consequences for energy savings policies. Bodies need to be engaged and people need to be exposed to, or to experiment with new forms of practices (engaging both body and mind) if policy interventions are to be successful in transforming practices. Marres draws attention to two opposite forms for policy intervention regarding material devices such as household appliances. The first, which is dominant in mainstream energy policy “aims at the minimization of effort, cost and disruption. It enacts the ‘change of no change’” [35], encouraging the

purchase of energy efficient appliances using economic arguments and “small tips” on how to save energy. This strategy of ‘no change’ does not aim at a transformation of practices, habits and bodies, but rather focuses on the insertion of a more energy efficient device into a given practice. Marres’ second strategy, by contrast, aims at transforming the material contributors and creating new perceptions (including the insertion of CO₂ into everyday settings). This change cannot be achieved without a policy goal to reduce consumption and a concerted effort to engage the body in experiments with new practices. In fact, it can be said that a policy intervention is always an experiment of which the outcome is not certain. That does not prevent us, however, from trying to encourage the development of new perceptions and memories. Perceptions are shaped through material arrangements and memories are articulated through narratives. Since as we have argued, agency and memory are distributed, changing mind-sets is not enough. We have to look at how we could produce new material arrangements and new narratives with the purpose of reducing the energy needed to sustain everyday life. We begin with a very sketchy account of the evolution of energy consumption from a body perspective.

3.2. *How bodies and consumption are transformed*

From an energy consumption point of view, we discern three important dynamics in the transformation of bodies: standardization, extension and delegation (to machines). At the global scale, standardization policies have shaped and transformed perceptions and memories. The evolution of home comfort is a good example of this. Elizabeth Shove has shown how the ASHRAE standards for indoor comfort have had a significant effect on building designs and on the ways that buildings produce heated and cooled indoor climates. These changes have affected the comfort perceptions of the people living in the buildings [36]. Shove and Wilhite demonstrated how several generations of life in air conditioned homes, shopping centers and cars have transformed perceptions and expectations about bodily comfort in the Southern USA [37]. They pointed out that in many southern US cities, sidewalks are being removed because few dare to expose their bodies to the natural elements, preferring to drive from their air conditioned home, in their air conditioned car to their air conditioned place of work, occasionally by way of the local air conditioned shopping center. The transition from lives that involve movement between contrasting climatic spaces, to lives in thermally homogeneous spaces leads to a reconfiguration of the body and its sensations, and even a kind of oblivion of the body. We see the beginnings of this bodily comfort transformation in other parts of the world, as building standards and designs are transformed into those which accommodate air conditioning [38]. Changes affect perceptions of health and wellbeing, the types of clothing worn, and the ways the various rooms in the home are used. Shove demonstrates similar bodily developments in cooking, cleaning and bathing as homes are configured for modern electric appliances [36]. For example, in the course of one generation, bodily cleaning in Europe has been transformed from weekly bathing to daily showering. Shower gels, hair treatments and deodorants have been added to eliminate smells and add sheen, both of which have become essential elements of the presentation of the clean body. The standardization of comfort and cleanliness norms in the latter 20th century has fixed the achievement of both at high levels of energy intensity. In policy, the improved efficiency of comfort and cleanliness related devices has been encouraged but not changes in bodily perceptions of comfort. The result is that contemporary buildings of all types have been designed and built to provide 22 °C year round, whereas people have been reported to be comfortable at a wide range of temperatures, from 6 °C to 31 °C [36]. Standardization has decreased people’s capacity for developing

creative strategies to satisfy their own comfort needs. Moving into a dwelling built for air conditioning severely restricts the capacity to achieve cooling comfort using non-mechanical cooling techniques [39]. This form for standardization of bodies and buildings is synonymous with the elimination of contrasts and the weakening of adaptive capacity.

Moving to the second important dynamic of body transformation, Wallenborn's theory of extended body [13] proposes that in modern households, bodily interactions with energy-using artifacts often involve a delegation of enactment from body to artifacts. The extension of bodies through different "prosthesis" (cell phones, computers, cars, heating systems etc.) is a challenge for sustainability. We have replaced unencumbered extended bodies (walking and running) by heavier ones (e.g. bikes by cars). The 'skins' of our homes have been extended and this extension requires more energy for heating and lighting. With electricity we can accomplish many things, some very useful and basic, others more superfluous or even extravagant. When energy consumption is disconnected from the presence of a body through automation it usually leads to waste (lighting, heating, standby). Moreover, we have to remember that energy for these extensions is cheap given the environmental consequences. A human body consumes around 400–3000 MJ per year through eating, depending on the sorts of diets and level of physical activity. By contrast, an average Belgian consumes around 100,000 MJ per year for heating, electricity and motor fuel. While the body energy costs the equivalent of 15% of the average Belgian household budget, the delegated energy to heat, electricity and automobility is equivalent to half [40]. Obviously one does not eat petrol or gas and food is a qualitatively different form of energy than a fossil fuel, but this example illustrates how much added energy we use through the delegation of bodily tasks to engines and appliances, and how little we pay for it.

Through consumption, bodies are not only extended by the so-called energy 'end-use' appliances in our immediate sphere of practices, but further into networks of provision and production [41]. People's awareness of these extensions and their contributions to consumption are minimal. Automated thermostats are a good example of a near total delegation of knowledge in the production of an energy service. Further, a single individual cannot be actively involved in the production of the objects they use every day, nor in the infrastructures and networks that deliver their components, including energy. Infrastructures delivering energy and water have in fact been built to be invisible and disconnected from use—and 'in-home displays' alone will not inspire significant changes in home energy practices [42–44]. Some feedback experiments have led to energy savings on the order of 5–15%; however, many of these experiments were conducted with small samples of motivated people, giving good reason to question the generalizability and durability of these changes [45].

We can only expect bodily perception to accommodate distant and hidden infrastructures if they become more active aspects of practice. However, urban consumers will not likely become "prosumers" unless they have more to say about how their electricity is produced and delivered. Germany offers an interesting case in prosuming, where municipalities (e.g. Hamburg, Berlin) are reassuming control over distribution grids and co-managing them with citizens [46]. Hielscher et al. provides insights into community-based initiatives that are trying to integrate local renewable energies and low-carbon energy systems into their community practices [47]. These successful grass root actions are characterized by the necessity for dedicating a significant amount of time and for perseverance in order to produce new relations between people and infrastructures. These are examples of the acquisition of bodily knowledge through participation in new consumption experiments. We will

develop this point and provide further examples in the next section.

4. Bodies as policy subjects

In this section we briefly analyze how bodies have been treated—or more accurately, absent from treatment—as subjects of energy policy, and how the collapse of bodies into minds impedes the development of policies that encourage experimentation. We contend that experiments provide the conditions for the formation of new habits, and that policy needs to engage bodies through providing opportunities for encountering and experimenting with new practices.

4.1. Practices change through experiences and experiments

Changing beliefs, attitudes and motivations are important catalysts for individual change, but it is fallacious to assume that a change in practice must be preceded by a change in beliefs or that a change in attitude will necessarily lead to a change in practice. There are numerous empirical studies showing that the greening of attitudes leads to the greening of consumption practices for only a very limited segment of the population [48–50]. Furthermore, these changes are usually rather superficial when measured against the planned or anticipated decrease in energy use. This is because green information alone is seldom sufficient to create new perceptions. Many of these attitudinal-based policies rely on visual consumption, which has increasing importance in our relations to the world (through for instance the proliferation of screens and monitors). We capture a lot of information through our eyes: colors, shapes, readings, measures, images, films etc. However, through these visual media we see behaviors but not practices. We see patterns of movements but can only begin to intuit the practices behind them if we engage our memories. Practices involve the whole body with all its senses, including proprioception. Gender studies have understood this and recognized that different bodies feel differently and perform practices in different ways.

Concrete experiences immerse bodies in new perceptions. Significant changes in practice will be more likely to come through participation in practices than by exposure to arguments for or images of new practices. In fact we suggest that participation in new practices can reverse the belief-practice causality. Participation can lead to a body-close understanding and demystification of the consequences (for example that biking in Paris is dangerous) and lead to further experimentation with other low-energy practices. In the exposure to a new action or practice, the body/mind participates, learns and accepts or rejects. Dispositions for action embedded in past experience get reassessed through what Lave calls practical learning [51]. Future actions are then refreshed with new possibilities. The process by which experiences are explicitly and voluntarily transformed into new habits can be called an *experiment*. To balance the mind-centered, body-absent theoretical approach on which public policies are mainly based, an experimental approach is required. We are not referring to laboratory experiments in which the conditions of everyday life are approximated and reduced to games, nor are we referring to models in which bodies are replaced by numbers. We refer to experiences in real life in which there is a measure of the outcome and an associated learning process. An experiment is a kind of event: even at a small scale, it brings something new. An event is what makes a difference between past and future in creating new memories or narratives. An experiment involves an effort, notably to extricate oneself from habits, so that a new configuration of the

body-environment can happen and create the conditions for the formation of new habits.

4.2. Different kinds of experiments

Experiments are bifurcations in the routine course of actions, and always occur with some effort. There are many different kinds of real life experiences and experiments. They can be classified into unexpected, voluntary, and planned. They can occur at individual or collective levels. They are occasions for new perceptions and the creation of new memories. Involuntary experimentation with energy consumption practices can be initiated by events that are either unplanned or accidental. Power blackouts are an example [52]. Kilpinen has written about how unplanned blackouts in Finland have forced people to find new ways of producing home comfort with little or no energy and how these experiences have resulted in some households changing their lighting and heating practices [53]. Nye shows that blackouts are “collective experiences” that reflect the social conditions of the community: they can be either a moment of joy and solidarity, or the opportunity for riots and plundering [54]. The ‘shocks’ emanating from the oil embargos of the 1970s and the subsequent rationing of oil products including gasoline, provide other examples of involuntary experiments. Transport was severely affected by empty petrol stations and some countries rationed petrol. People were forced to find alternative means of transport. This led to practical experiments by both communities and households. Some of these endured (for example the Bart metro system in San Francisco), and others died out when cheap and abundant petrol was restored (the popularity of small, efficient cars).

Enforced blackouts and complete bans are obviously dramatic (so far) and disruptive, but they give some indications of how experimentation can lead to reassessment and change. The only example of an energy policy intervention of this kind we are familiar with is the Japanese tariff-contract that offers companies a reduced tariff in return for allowing the energy utility to turn off central air conditioning systems at periods of peak load. According to Shove et al., this has led to extreme discomfort on the part of building residents but has also led to experimentation and change in both conventions and practices regarding workplace clothing and thermostat settings [55]. The longstanding Japanese practice of wearing business suits is being replaced by more casual and lighter clothing amenable to higher indoor temperatures.

In short, though disruptions are often brutal and inconvenient, they bring with them opportunities to explore new bodily configurations. Blackouts are generally transient but they afford ways of experimenting with what we really need and can do without when it comes to electricity consumption. Households experience disruptions with the birth of a child or a move to a new dwelling. Perceptions are refreshed, material settings change and opportunities for new practices develop. In the new setting, walking or biking may be chosen as a means of commuting to work rather than driving, organic foods given priority over ready-made dishes, or new windows or wall insulation installed, all of which are examples of small experiments that have the taste of mini “adventures” and expose bodies to new gestures and perceptions. These may reshape the body and can bring new pleasures with less energy. From a policy perspective these insights offer policy makers “more creative ways to appeal to positive connections between embodied selves and everyday environments to rethink (and reduce) consumption” [56:8].

We have written above that standards reduce human agency and the capacity for experimentation and further, that standardization in domains important to energy use have either encouraged or been indifferent to energy and resource consequences. Given

the urgency of reducing climate emissions and the necessity for deep reductions in energy consumption, there are good arguments for policy standardization aimed at reducing consumption (not just reducing energy intensity), thus forcing the creation of new environments to which bodies would be forced to adapt. For example, consumption-reduction standards should replace or supplement efficiency standards for buildings and appliances [11,57]. This reduction-orientation would engender experimentation with new practices at all stages from provision to consumption.

There are softer policy approaches to encouraging experimentation that create potentials for change without regulatory forcing. These involve public support for exposure to new ways of doing things, such as demonstration projects allowing people to observe and experience new technologies and life in low energy houses. Policy support for energy service sharing has shown promise in the domains of cars, laundry services and food preparation. Urban infrastructural changes enable experimentation with alternative transport. There has been a surge in bicycling in many European cities because of the building of safe and convenient infrastructures for biking, as well as making it possible to combine public transport with biking (on trains, buses and ferries). Many European cities have experienced a surge in bicycling after the building of safe and convenient infrastructures. Copenhagen was one of the early cities to build an extensive bicycle infrastructure. Today, 40% of commuting within Copenhagen is by bicycle. Stockholm has 750 km of bike paths, and Gothenborg 450 km. Paris has built 600 km of bike paths over the past 10 years. San Francisco recently evaluated its plan for making 10% of all trips within the city by bicycle in 2018 and reported that building of safe infrastructure beginning in 2010 had led to a 14% increase in cycling within in a two year period and up to 80% increases in parts of the city that had installed bike-friendly traffic signals (in addition to bike lanes) [58]. Lisbon is a typical example of a place where pessimists predicted that investments in a bicycle infrastructure would be a waste of money and urban space. In fact, in the first half-year after its completion in 2010, there were very few people bicycling. However, as people began to experiment with and experience the use of bicycles for training, commuting and other tasks, the numbers of people bicycling has increased rapidly (www.ecologicalurbanliving.com). In Oklahoma City, where car culture reigns supreme, a successful program for the building of bicycle infrastructure was driven by a weight-reduction campaign initiated by the city government, where the advantages of biking to bodily health were central to the campaign [59].

These are some examples of policy directions that result from a refreshed theoretical platform encompassing body. We admit that these examples are tentative and underdeveloped, ranging into unexplored territory for energy efficiency theorists and policy makers. The point is to initiate new narratives for change and to stimulate policy experimentation in order to refresh stagnated agendas. By interrogating the relationship between bodily knowledge, experimentation and change, we hope to contribute to a critique and assessment of their importance for sustainable energy research and policy.

5. Conclusion

In this paper for the inaugural issue of Energy Research & Social Science, we have endeavored to develop ideas that might frame new research approaches to the way people consume energy. We suggest the need for new research questions regarding the role of bodies in consumption and change. For example, we suggest that researchers should address these questions as they shape their inquiry: Are bodies present in your narrative? With which capacities are they endowed?

We have argued that bodies are more malleable than it is usually assumed because material worlds and bodies coevolve. We have put forward the perspective that infrastructures and objects can be regarded as body accessories. These body perspectives suggest a new way at looking at energy consumption. Energy consumption is experienced by bodies in cultural settings and shaped by material environments. Thus embodiment is a spatial and temporal process. Embodied knowledge and skills are shaped conjointly with material spaces. Energy using habits are acquired through the repetition of similar practices. Practices are always performed in the present, though they are disposed to endure into the future. This is because practical understanding is made in situ, in a given practice; therefore it is essentially relational and present. The place where a practice is performed is constituted during the performance. Place and body fashion one another. Energy consumption happens in this place and if performed regularly enough will be durable.

Conceptualizing bodies as repositories of experiences in the form of memory and perception allows us to escape from the model of rationally calculated action that dominates energy policy. However, thinking in terms of practices leads to inconvenient questions. There is virtually no energy-related practice that can be analyzed in isolation. Practices are interrelated and coevolving with social norms and material environments: in analysing how energy is used and how energy intensity of practices can be reduced, how do we determine the boundaries on the unit of analysis? And given the urgency of climate change would it not be appropriate to simply redesign technologies and material infrastructures in order to limit material extensions of body?

Getting comfortable with the notion that bodies absorb and exercise knowledge raises questions about the way we frame energy policy. Rather than relying on information directed to disembodied persons, we contend that bodies need to be engaged through experimentation. To prepare experiments, we will have to refresh our narratives and the selection of memories relevant for acting on an earth in severe environmental crisis. It requires a recognition that minds themselves are embodied and that the world consists of a diversity of bodies sharing a finite planet. We are discovering that the ever-growing numbers and kinds of energy using equipment that accessorize bodies in every conceivable sort of task from eating to moving to sheltering have fatal ecological limits. Not only is the health of our environment damaged through this delegation and extension of body, but so is the health of our bodies. We must apply our collective creativity to find new human-material interfaces and interactions that will lead to improvements in the health of both.

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