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To cite this article: Lina I. Brand-Correa , Giulio Mattioli , William F. Lamb & Julia K. Steinberger (2020) Understanding (and tackling) need satisfier escalation, Sustainability: Science, Practice and Policy, 16:1, 309-325, DOI: [10.1080/15487733.2020.1816026](https://doi.org/10.1080/15487733.2020.1816026)

To link to this article: <https://doi.org/10.1080/15487733.2020.1816026>



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Published online: 23 Oct 2020.



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Understanding (and tackling) need satisfier escalation

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ABSTRACT

Contemporary consumption patterns, embedded in profit-maximizing economic systems, are driving a worsening socio-ecological crisis, in particular through the escalating production and consumption of goods with high material and/or energy intensity. Establishing minimum and maximum standards of consumption (or “consumption corridors”) has been suggested as a way to address this crisis. Consumption corridors provide the normative basis for sustainable consumption, that is, enough consumption for individuals to satisfy needs, but not too much to collectively surpass environmental limits. Current consumption patterns (especially in the global North) do not yet fall within consumption corridors, and standards are not fixed over time. Consumption is socially constructed and can escalate due to socio-economic, technological, or infrastructural influences. In this article, we propose a framework to understand such escalating trends. This approach can be used as a tool for comprehending how consumption evolves over time, as well as for identifying the most effective leverage points to intervene and prevent escalation from happening in the first place. We build on theories of human-need satisfaction and combine these conceptual understandings with insights from research on socio-technical provisioning systems, sociological approaches to consumption, and perspectives on infrastructure lock-in. We illustrate our framework by systematically considering escalation for a specific technological product – the private car.

ARTICLE HISTORY

Received 12 September 2019
Accepted 25 August 2020

KEYWORDS

Wellbeing; satisfiers;
systems thinking;
consumption corridors;
human needs

Introduction

Societies are failing to protect people from current and future harms. We are fast approaching very serious consequences of climate change if we continue with business as usual, as evidenced in the latest report by the Intergovernmental Panel on Climate Change (IPCC 2018) on the difference between 1.5° and 2° C of warming. This is coupled with high levels of global inequality and absolute poverty worldwide (Hickel 2017). Even in countries in the global North, such as the UK, neoliberal social policies in times of austerity have been associated with tens of thousands of avoidable deaths (Watkins et al. 2017). The current COVID-19 pandemic has highlighted the inequalities and insufficiencies of many nations

The challenge that we face is one of staying within environmental limits while improving people’s lives (Raworth 2017). This is not easily achieved in the current socio-political and economic system, with no country meeting both goals at the same time (O’Neill et al. 2018). An absolute and rapid decoupling of wellbeing outcomes from environmental impacts needs to occur. Despite this

situation, the global long-term trends of production and consumption of material- and energy-intensive goods continues apace (with only temporary reductions due to global financial or health crises), with ensuing environmental and social impacts. For example, in the case of the private car in member countries of the European Union, vehicle registrations have been increasing year on year after a dip caused by the financial crisis in 2008 (ACEA 2020). The size, and, hence, material and energy intensity, of vehicles is also increasing, partly due to a rapid uptake of sport-utility vehicles (SUVs) and off-road vehicles (ICCT 2018; IEA 2019a).

What impels consumption is a rich area of consideration within social sciences. From an economic perspective, consumption is often presented simply as the satisfaction of individual preferences. Sociological “treadmill of production” theories rather place consumption as the necessary induced outcome of a productivity- and growth-driven production sector. Individual households also encounter ubiquitous advertising with the purpose of inducing consumption, and face social pressures to maintain social status through consumption (Jackson 2005).

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This Special Issue is sponsored and supported by the University of Geneva.

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Di Giulio and Fuchs (2014, 187) generally view consumption as acts that individuals perform in pursuit of individually perceived needs, which in turn are informed by their understanding of what is a “good life.”

However, as many scholars have pointed out, there is a key distinction to be made between consumption which aims to satisfy basic needs and other types of consumption (Shue 1993; Reinert 2011). The key difference between these types and levels of consumption is what happens in the case of deficiency. For example, where consumption supports the satisfaction of basic needs, decreasing consumption results in deficiencies in human-need satisfaction in the form of objective harm and deprivation to the individual’s life chances and social participation. In the case of overconsumption or luxury consumption, the decline in consumption might result in subjective discomfort at loss of convenience or social status, but does not result in increased physical or mental harm, or in the decrease of a person’s ability to participate meaningfully in their society.

To achieve the goal of remaining within environmental limits while improving people’s lives, Di Giulio and Fuchs (2014) propose the concept of “sustainable consumption corridors,” where minimum and maximum levels of consumption of goods and services are collectively agreed according to social and cultural specificities. In this context, it is important to study and understand the types of goods that might be associated with need satisfaction (that form part of “satisfiers”) and which are growing, or which the general population is considering ever more essential to basic life in society. Our specific focus in this article is the dynamics of corridors, especially the minimum level associated with the consumption that is sufficient to live a good life. Since social, economic, and cultural specificities change over time, the level of what is considered sufficient might grow or decrease over time. If this minimum sufficient level is increasing, we would be in the situation where need satisfaction requires an *escalating* level of resource use, which may well be beyond what is environmentally and socially sustainable.

Therefore, in this article, we propose a framework to analyze “escalation” trends (Walker, Simcock, and Day 2016), which allows a systematic exploration of the myriad factors involved in the escalation and of consumption. Importantly, we intend this framework to be used as a tool for identifying the most effective leverage points to change a given situation or even prevent an escalation from happening in the first place. In other words, we present this framework as a tool to analyze escalating

trends in consumption and to explore mechanisms for attaining or remaining within sustainable consumption corridors.

In this article, we expand on the relationship between consumption and wellbeing, starting from a human-needs perspective. We then propose a systemic way of analyzing need satisfiers to understand escalating trends. The case of escalation in the production and consumption of the private car illustrates our approach. We selected this case because transport is highly consequential to both wellbeing and environmental impacts in a large variety of ways. Finally, we discuss how to intervene and de-escalate need satisfier trends from a systems perspective.

Wellbeing matters

It is important to distinguish consumption that serves to satisfy human needs from other types of consumption. To make this distinction, a fairly rigorous understanding of what human needs are, and how their satisfaction contributes to human wellbeing, is necessary. In this article, we do not have the space for a detailed overview of wellbeing theories and how they relate to energy or climate-change mitigation and instead refer the reader to previous contributions (Gough 2015; Brand-Correa and Steinberger 2017; Lamb and Steinberger 2017).

In societies, behind every decision-making process, every policy, every evaluation measurement there is an underlying worldview. Even if economists like to argue that (economic) tools are value-free, they are always value-laden (Beckerman 2011). A central component of this underlying worldview consists of understanding what constitutes a “good life” or, in other words, what it means to “be well.” We chose here to make our underlying worldview explicit from the beginning, but also to make our choice of wellbeing understanding deliberately normative: a perspective on how things ought to be rather than justifying how they are.

We, thus, adopt a eudaimonic (flourishing within society) conception of wellbeing. The most recognized modern example of a eudaimonic-based policy tool is the Human Development Index (HDI) based on Sen’s (1999) and Nussbaum’s (2015) work on capabilities. Using a eudaimonic conception implies that “well-being is not just a matter of subjective experiences, it is a matter of what one can do or be in one’s life” (O’Neill 2008, 165). Eudaimonic wellbeing is concerned with enabling (or removing barriers for) people to be able to effectively participate in their society, which entails providing at least some “basic capabilities” (Sen 1999; Nussbaum 2003) or “human needs” (Doyal and Gough 1991;

Max-Neef 1991). We argue that, normatively, this is what societies ought to aim for, for all people.

Within eudaimonic conceptions of wellbeing, we favor a human-needs perspective, whereby “there are a finite number of self-evident (i.e., universal, recognizable by anyone), incommensurable (thus satiable, irreducible and non-substitutable) and non-hierarchical needs, which encompass the range of capabilities or dimensions of [human wellbeing]” (Brand-Correa and Steinberger 2017, 46). These characteristics mean that human needs are amenable to minimum and maximum standards (as in lower and upper “consumption corridors”), and that there is a saturation phenomenon when needs are fully satisfied.

In particular, we favor the human-needs perspectives of Max-Neef (1991) and Doyal and Gough (1991). These theories are not identical, and they differ in terms of their exact definition of human needs. However, they have significant overlap in the overall core dimensions of wellbeing that they propose (see Alkire 2002). Indeed, they are also roughly consistent with capabilities approaches as outlined by Nussbaum (2000) and with the United Nations Sustainable Development Goals (SDGs) (see Gough 2015; Lamb and Steinberger 2017 for a comparison). Therefore, our framework is not dependent on a specific theory of human need. A summary of both Max-Neef’s and Doyal and Gough’s human-needs theories is given in Figure 1, showing their overlaps.

The human-needs approaches of Max-Neef and Doyal and Gough share a core concept which is central to our further discussion: the concept of “satisfiers” of human needs. The idea of satisfiers is that while human needs themselves may be finite in number, universal to all people, and invariant over

time, the ways in which they are satisfied may be infinitely diverse, changing across individual circumstances, technological availability, geography, culture, and, importantly, over time. The concept of “satisfier” thus captures the flexibility of socio-technical arrangements in the satisfaction of human needs.¹ According to Max-Neef’s (1991) definition, need satisfiers are the beings, havings, doings, and interactings that allow human needs to be actualized. They include market-exchanged goods and services, but also personal and collective attitudes, institutions, norms, values, activities, and infrastructures.

Importantly, these satisfiers can be positive or negative in the effect they have on need actualization according to Max-Neef (1991). In other words, not all satisfiers are unequivocally “good for us.” Some satisfiers, for instance, might satisfy a need, while unknowingly preventing the satisfaction of other needs. For example, “car ownership” can be considered a need satisfier in terms of meeting needs of understanding, identity, creation, idleness, and freedom. At the same time, car ownership can actively hinder other human needs, due to high financial costs (potentially conflicting with subsistence – see e.g., Mattioli 2017), or via their contribution to air pollution, accidents, and sedentary lifestyles (conflicting with protection).²

From the perspective of Max-Neef (1991), we can see the interlinkages (and, thus, contradictions) between needs and satisfiers if we use a participatory and holistic approach, bringing together experts and communities to deliberate on why some consumption pathways are chosen over others. From the standpoint of Di Giulio and Fuchs (2014), we can address those contradictions by transdisciplinary

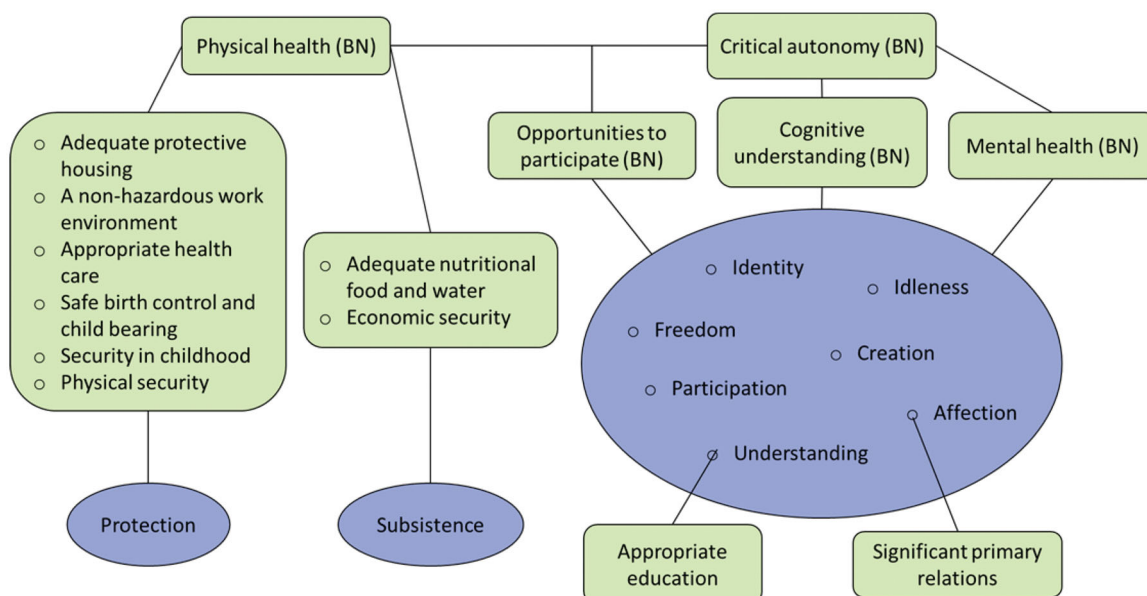


Figure 1. Mapping the theories of human need by Doyal and Gough (1991) and Max-Neef (1991). Note: Squares correspond to Doyal and Gough (1991). Ovals correspond to Max-Neef (1991). BN is “basic need.”

debates on minimum and maximum standards of consumption, which are informed by environmental and social limits. In this article, we propose a complementary analytical tool to study the complex and highly interlinked nature of need satisfaction, by categorizing understanding of need satisfiers into different conceptual “orders.”

Different orders of satisfiers

The satisfaction of a specific need often involves many different satisfiers (or what we term a “bundle” of satisfiers). For example, satisfying the need for economic security (Doyal and Gough 1991), which in the global North is inextricably linked to employment,³ can involve many satisfiers: existence of a job market, suitable skills, and training, but also physical access to work, which could be through public transit, car ownership, and or other means. These satisfiers are not the same, however. Some of them relate to mainly institutional arrangements, while others relate to activities (e.g., flexible working, driving) or objects (e.g., a computer, a private car). If we want to understand how different satisfiers have changed over time, especially how they might have escalated in terms of their energy and material intensity, having a clearer sense of what exactly they consist of will be necessary.

Thus, in this article, we propose a categorization of satisfiers into four different “orders” (see Table 1), from the broader (first order) to the more specific (fourth order). This is inspired by the analytic level framework proposed by Mattioli (2016) to understand the role of car use in need satisfaction. This framework was aimed primarily at highlighting the full range of opportunities for decoupling between need satisfaction and carbon emissions, in contrast with prevalent approaches in social exclusion research where these opportunities tend to be obscured. The framework was subsequently used by Gough (2017, 159) to illustrate how “systems of provision’ lock households into patterns of consumption that are largely outside the scope of individual choice.” We note that other broadly similar tiered frameworks have been proposed in the literature (Day, Walker, and Simcock 2016; O’Neill et al. 2018).

In this article, we further develop Mattioli’s framework (and specific example around economic security) by linking the four orders of need satisfiers to specific theoretical concepts and related analytic theories and methods (as illustrated in Table 1), thus, enhancing the theoretical robustness of the framework. The core goal here is to enable the study of the change of satisfiers over time, to study satisfier escalation, and more importantly, to find

effective entry points to de-escalate satisfiers, with the ultimate purpose of bringing consumption within environmental limits while achieving sufficiency in human-need satisfaction. To describe and analyze these different satisfier orders, we draw from varied theoretical backgrounds and conceptual contributions that are appropriate to each of the respective domains. We address the different ontological, epistemological, and theoretical overlaps in the next two sections.

Theoretical overlaps

The main theoretical overlaps exist in relation to the systems of provision (SoP) approach. This is because the “SoP for a good is understood as the integral unity of the [material], economic and social factors that go into its creation and use” (Bayliss, Fine, and Robertson 2013, 2), taking a holistic approach to studying consumption. Thus, there is overlap between some elements of SoP that are very well aligned with theories of social practice with respect to the meanings created around the consumption of particular goods (Bayliss, Fine, and Robertson 2013, 5). However, we contend that studying the meanings and cultural elements around the consumption of a particular good in the context of a routinized practice opens up areas of analysis that might be overlooked by SoP and its focus on structures, processes, and agents. Another area of overlap is the fourth satisfier order in relation to both SoP and theories of social practice. The SoP approach and theories of social practice take into account the material features of the goods or practices they are analyzing. However, we consider that looking at the specific products of technologies by themselves, how they coevolved to where they are (including the specific technological developments), and the lock-ins they imply gives more richness to the analysis. Despite these theoretical overlaps, we argue that having different units of analysis and different epistemological and ontological viewpoints, strengthens our understanding of the dynamic nature of satisfiers.

Ontological and epistemological conundrums

It is important to stress that our contribution is not an attempt to develop a complete social theory. We are not claiming that our satisfier orders will provide a full picture of how society works. Instead, we propose it as a useful empirical and analytical tool to study past trends, and future possibilities of change, in satisfier evolution.

Our ontological perspective draws from critical realism, which combines elements of positivism and constructivism/interpretivism. Following Krauss

Table 1. Satisfier orders.

Satisfier order	Description	Proposed analytic theory	Relevance to satisfier escalation and change	Example with relation to satisfiers for the need of economic security (see section A, short story of escalation: the case of cars for a more detailed description)
1st: Socio-technical provisioning systems	Broad physical (infrastructures, land use patterns, supply chains) and social elements (institutions, power relations) in which 2nd, 3rd and 4th satisfier orders operate.	The first satisfier order is the domain of heterodox and political economics, in particular around provisioning systems. There is a range of ways in which these broad physical and social elements enable (and constrain) the operation of lower satisfier orders, ranging from the private to the public sphere and from the individual to the collective realm (Gough 2019). In the systems of provision approach (SoP) consumption is studied "vertically," placing due importance on production and thus understanding consumption as an issue of provisioning. Thus, SoP re-introduces the material to the (cultural) study of consumption and allows for attention to be paid to historical developments in provisioning (Fine and Leopold 1993; Fine, Bayliss, and Robertson 2018, see Mattioli et al. 2020 for an application on car dependence).	The systemic analysis of power and economic value extraction along a supply chain in SoP makes it a useful theory to draw upon. It provides a clear methodological tool to answer recent calls in sustainability literature to address capitalism more directly (Feola 2020). To understand satisfier escalation we must study these broad infrastructures and institutions. They are fundamental in enabling specific lower order satisfiers, and in driving escalating trends.	Provision of car infrastructure, car-dependent land-use patterns, (under) provision of public transport (see Mattioli et al. 2020).
2nd: Activities	Socially and culturally constructed and reinforced activities, performed using specific products or technologies (4th satisfier order) resulting in a particular service (3rd satisfier order).	For the analysis of second satisfier elements of theories of social practice (Hui et al. 2016; Reckwitz 2002), particularly from a consumption perspective (Shove, Pantzar, and Watson 2012). From this perspective, consumption of a specific product or technology is part of broader practice, of a routinized activity. The practice involves materials, meanings and competences, which are key in maintaining stability and reproducing the practice across society (Røpke 2009)	Theories of social practice make everyday activities the focal point. Specifically, the meanings routinely associated with certain activities, as well as the need for defined abilities (competences) to perform them, are aspects we consider important to make explicit, given that they are usually overlooked under the veil of rational economic actors. To understand why certain satisfiers have escalated, it is important to understand how the use of that satisfier is itself part of a broader activity, which has meanings and competences associated with it, rather than a decision taken by an isolated rational actor.	Car-dependent practices (Mattioli, Anable, and Vrotsou 2016) and related cultures of car use

(continued)

Table 1. Continued.

Satisfier order	Description	Proposed analytic theory	Relevance to satisfier escalation and change	Example with relation to satisfiers for the need of economic security (see section A, short story of escalation: the case of cars for a more detailed description)
3rd: (energy and material) services	The services provided by the energy and materials involved in building and running the specific products or technologies we use (4th satisfier order).	Here we can draw on a "service perspective" on energy and material use. A service perspective focuses on what people demand from energy and material use, rather than on specific technologies and ways of delivering such services. Common energy and material services include things such as illumination, thermal comfort, mobility, information, and communication, and are the things that we actually want from energy and material demand (Steinberger, van Niel, and Bourg 2009; Cullen and Allwood 2010; Roelich et al. 2015; Kalt et al. 2019)	By using a "service perspective" on energy and material use (Cullen and Allwood 2010; Roelich et al. 2015), we learn to separate the specific products or technologies (which have varying levels of material and energy use associated to them) from the services they provide. Therefore, a service perspective can help us open the possibility space for providing the same service, albeit using less energy and materials. These do not only relate to efficiency improvements (more service with less energy and/or material use), but also to different business models and associated incentives (e.g., energy-services companies) (Steinberger, van Niel, and Bourg 2009)	Mobility
4th: Specific product or technology	These are the specific things, objects, materials (they can be goods exchanged in the market, but also other material objects obtained differently) that we use to satisfy our needs.	For the analysis of fourth satisfier order, we take elements from the conceptual contributions of technological lock-in and co-evolution theory (Umrh 2000; Foxon 2011). From technological lock-in (Umrh 2000), we find particularly useful the insight that all product design and technological decisions have long-term implications for related infrastructure and industries	When thinking about need satisfaction, technological lock-in reminds us that we should not analyze particular products or technologies in a vacuum, but rather consider what lock-ins would be involved. Furthermore, we should also consider the business strategies, user behaviors, political settings, social norms, and institutions related to any technological development, which wider co-evolution theory prompts us to remember (Foxon 2011). In other words, specific products or technologies are developed in co-evolving contexts and have long lasting lock-in implications	Car

(2005), in critical realism, there is a single and mind-independent reality, and there are multiple perceptions of that reality which are shaped by specific values and actors involved in the knowledge-creation process. In the context of our framework, we take climate change as that reality and try to take a value-cognizant approach to our perception of the elements that are involved in need-satisfier escalation. In other words, we are conscious and explicit about the underlying values and concepts that inform our choice of theories. In other words, we prioritize research into structures, institutions, and systemic change over marginal, individualistic, or market-based “solutions” grounded in neoclassical economic thinking. We further acknowledge the role of power in creating the socio-ecological problems we experience and in obstructing solutions to them (Steinberger et al. n.d.) and take a well-being-centered approach to justice.

Furthermore, by combining different theories into one analytical framework, our approach ends up merging different ontological and epistemological traditions. However, we see these differences as analytically useful, given that they provide a range of perceptions of reality that are complementary and enrich our understanding of that reality. We embrace here DeForge and Shaw’s (2012, 93) invitation to “bring a diversity of paradigms together in conversation to develop new approaches and perspectives to research and social life, thus affording ourselves *new and broadened insights along horizons that extend beyond any singular paradigmatic location*” (emphasis in original). Importantly, mixing different theories and their respective ontological and epistemological traditions does not mean they have to become subsumed under other theoretical paradigms.

For instance, we are aware that using practice theory concepts as part of an ordered framework might not sit well with proponents of this approach who typically promulgate a “flat ontology” – a conception whereby the entire social reality is constituted of *horizontally organized* practices – as opposed to ordered levels of reality and it should be investigated as such (Schatzki 2016). We reiterate, however, that our ordered categorization of satisfiers does not mean that we are situating social practices on a different *ontological* level. We rather consider our proposal to specify different *analytical* levels, especially when thinking about change. In other words, we pragmatically suggest that everyday activities should be one of the levels of the analysis of need satisfaction, and that research on this would benefit from being informed by the concepts and findings of social practice research – while being

aware that these are not easily subsumed under other theoretical paradigms (Shove et al. 2011).

A short story of escalation: the case of cars

In this section, we analyze a *subset* of the bundle of satisfiers that are related to economic security with particular attention devoted to satisfiers that are related to escalation in energy use and climate impact associated with passenger transport. As such, we do not look at elements in this bundle of satisfiers that are related to the job market, for instance. Instead, we examine the case of cars as a specific product or technology (a fourth-order satisfier) which over time has escalated in terms of overall use, and, thus, in its environmental impact. In the global North, car use and related emissions use have reached levels that are not compatible with the Paris Agreement, and must thus be rapidly reduced (Anable et al. 2012; Goulden, Ryley, and Dingwall 2014; IPCC 2014; Creutzig et al. 2015; Transport and Environment 2020; Anable and Goodwin 2019; CCC 2019). For this reason, our discussion in this section focuses on car use in the global North, particularly on the UK and the United States. This phenomenon could also be described in relation to sustainable consumption corridors (Di Giulio and Fuchs 2014), where car use has gone beyond a maximum level for a specific consumption corridor for achieving human wellbeing now and in the future. In particular, we focus on car use in the context of satisfying the need for economic security.

The nexus of car use and employment (for economic security) provides an excellent illustration of how the energy requirements of need satisfaction can escalate over time. In the UK, for example, historical research shows that in the first half of the twentieth century, electric tram networks offered a ubiquitous and accessible form of travel in British cities (Pooley 2016), notably for the journey to work. As in other developed countries, motorization and car use increased rapidly in the second half of the century, and in 1983 a total of 22% of the UK population considered the car “a necessity.” By 2012, this figure had doubled (44%) (Mattioli, Anable, and Vrotsou 2016). Comparable figures for EU countries (in 2007) show values in excess of 50% in most countries (Fusco, Guio, and Marlier 2013). While we are not aware of similar survey data for North America, car ownership is associated with better labor-market outcomes and social mobility in the United States (Taylor and Ong 1995; Cervero, Sandoval, and Landis 2002; Kawabata 2003; Lucas and Nicholson 2003; Blumenberg and Manville 2004). The association between lack of a household car, poverty and social exclusion was

already noticed in 1970s in the United States (Paaswell and Recker 1976), and has dramatically strengthened since then (King, Smart, and Manville 2019).

Road transport is currently responsible for a high share of greenhouse-gas emissions (GHG) in the UK and in other developed countries, and is considered to be one of the hardest sectors to mitigate. Transport emissions are distributed across millions of vehicles that have long lifetimes, with only limited (and largely premature) options for direct technological substitution. Thus, in addition to electric vehicles, reducing emissions in this sector at appropriate timescales will also require absolute reductions in travel demand (e.g., distance traveled), as well as a switch to alternative transport options such as walking, cycling, and public transport (Anable et al. 2012; Creutzig et al. 2015; Anable and Goodwin 2019; Hill et al. 2019). This situation contrasts with the fact that large sectors of the population are in a situation of “car dependence” and that car use has become essential for need satisfaction, as it provides, for example, for many people access to employment (for economic security). Therefore, direct attempts at reform bring the risk of public and political backlash, while raising issues of fairness and equality (see, for example, the *Gilets Jaunes* (Yellow Vest) movement in France in 2019).

From a historical perspective, the rise of car dependence has been paralleled by important changes in socio-technical provisioning systems (Geels 2005; Cohen 2012; Geels et al. 2011), everyday-life activities (Shove 2002; Kent 2014; Cass and Faulconbridge 2016; Mattioli, Anable, and Vrotsou 2016; Pooley 2016), and cultures of consumption (Dowling 2000; Gartman 2004; Sheller 2004; Seiler 2009; Wells and Xenias 2015). These can be analytically distinguished, although they are deeply and recursively related. We draw heavily here on other work from the same research project discussed here (Mattioli et al. 2020), where we explored this topic from a political economy perspective, categorizing the contributions of Mattioli et al. and adding other elements into our satisfier orders.

First order – socio-technical systems of provision: There are three main elements to highlight here:

- The *provision of car infrastructure*: since the early phases of motorization governments have accommodated mass-vehicle production in two main ways. First, through the physical and social reconstruction of city streets which shifted from being a space more or less “shared” by different modes and activities to one that is “dominated” by cars (used primarily as thoroughfares for motorized vehicles) (Norton 2008). This has resulted in restrictions and immobilizations for

other modes which were put at a disadvantage versus the car and contributing to conditions that created the need for car ownership and use (Ishaque and Noland 2006; Pooley and Turnbull 2005; Mees 2010; Pooley et al. 2010; Oldenziel and de la Bruhèze 2011; Cox 2012; Buliung, Shimi, and Mitra 2015). Second, huge amounts of public funds have gone into road-network expansion which has tended to fuel a self-reinforcing cycle of increased supply, “induced demand,” and calls for more road construction (e.g., to ease congestion) (Goodwin 1996; Dudley and Richardson 2004). This process is arguably one of the main drivers behind the escalation of car use for transport (Dupuy 1999; Newman and Kenworthy 1999; Urry 2004).

- The rise of *car-dependent land-use patterns* characterized by low density, low-street connectivity, and monofunctionality, also known as “urban sprawl” (EEA 2006; Jaeger et al. 2010). This is typically presented as the unintentional outcome of market, policy, and planning deficiencies. Yet an alternative eco-Marxist perspective (Gonzalez 2005, 2006) holds that sprawl is promoted/subsidized by government with “hidden welfare state” instruments (Howard 1993; Logemann 2012) and constitutes a form of “stimulus” to demand for consumer durables and energy, helping absorb overproduction in related industries. From this perspective, the environmental inefficiency of car-dependent land-use patterns is a feature more than a “bug.” The self-reinforcing dynamics between sprawl (which makes the car more of a necessity) and car ownership and use (which facilitate people’s relocation to car-dependent areas) is another important driver of the escalation of car use in the transport sector.
- While the *provision of public transport* is relatively straightforward in traditional, higher density cities, car-dependent land-use patterns put a higher coordination burden on viable public transit. The sort of “anywhere-to-anywhere” public transport service that can compete with the car requires “multi-modal network planning” that enables a system based on high frequency, transfers, coordinated timetables, multi-modal integration, and cross-subsidization (Mees 2010). Yet public transport systems are often caught in a “death spiral” whereby increasing car ownership and use reduce revenue, which results in contracted and poorer services, which in turn make people even more dependent on cars. This sort of development has been integral to the escalation of car use for transport over the twentieth century.

Second order – activities: The development of *cultures of car consumption* refers to the meanings associated with car ownership and use that have evolved to include freedom, modernity, and (sub)cultural distinction, as well as flexibility, convenience, privacy, protection, and even mere “normality” (Gartman 2004; Sheller 2004; Seiler 2009; Wells and Xenias 2015). This is particularly important for access to employment (for economic security), as people in temporally or spatially flexible jobs tend to be more car dependent (Kent 2014). Since flexible employment practices have co-evolved with increasing car ownership and use, this constitutes another mechanism for the escalation of car use for transport. There are also more embodied and “emotional” aspects of mobilities that are a co-constituting part of the establishment of automobility (see e.g., Dowling 2000; Bull 2004; Sheller 2004; Merriman 2009; Hagman 2010; Kent 2015). These characteristics have become associated with the private car, providing a certain way of satisfying needs that appeals to its users, contributing substantially to the lock-in of car ownership and use. Furthermore, a key element underpinning the car dependence of the journey to work is the parallel development of competences and skills. As car ownership and use increased, some skills (e.g., those around car driving) became widespread, while the competences required to commute by other modes (e.g., being able to navigate public transport networks or to maintain comfort in all weathers) withered (Dant 2004; Shove, Pantzar, and Watson 2012; Cass and Faulconbridge 2016). Here theories of social practice adds to the SoP approach a more nuanced understanding of the meanings and competences around car ownership and use, how they have evolved over time, and how they contribute to lock-in.

Third order – (energy and material) services: Car use provides the service of mobility in a very flexible and fast way from the perspective of individual users, when compared to other modal options. This advantage is not *entirely* inherent to the car, but rather is explained by the first satisfier order that has already been mentioned above (e.g., when car-dependent land-use patterns make car use *de facto* the only practicable option). Yet flexibility and speed are part of the services provided by the private car, which help to explain its escalation. Other services might include capacity for storage (Mattioli, Anable, and Vrotsou 2016) or comfort, personal safety, and protection from the outside environment (Wells and Xenias 2015). However, from the perspective of energy and material intensity (and even physical space use), (low occupancy) private car use is a highly inefficient way of providing the service

of mobility, of moving people and things from one place to another. Here the service perspective adds to the SoP and the theories of social practice contributions in pointing out what other services are provided by the private car, albeit enabled by higher satisfier orders.

Fourth order – specific product or technology: The broad history of the evolution of the car, from a technological perspective, started with steam power, had a brief period of electric power during the turn of the nineteenth century, and then was locked into the internal combustion engine. The latter has had a terrible record in efficiency improvements (Ayres and Warr 2009), stalling quickly at around 30–35%. A key factor that links this specific product to socio-technical provisioning systems is the global automotive industry. For reasons having to do mainly with high capital intensity and large economies of scale, this industry is characterized by endemic overproduction, with the resulting need for continuous expansion of the market and steady price reductions (Nieuwenhuis and Wells 2003; Wells and Orsato 2005; Orsato and Wells 2007; Wells, Nieuwenhuis, and Orsato 2012; Wells 2010, 2013). Mainly as a result of economies of scale, the industry focuses on the production of “all-purpose,” generic passenger vehicles, characterized by redundancy or “excess” in terms of, for example, number of seats, driving range, and speed (Freund and Martin 1993; Orsato and Wells 2007; Wells 2013) which contribute to low energy efficiency. Here our proposed approaches explain that alternatives to the internal combustion engine were locked-out of the market and add to the SoP that the business models and institutions that have co-evolved with the car contribute to their low efficiency.

Overall, these interrelated developments have resulted in a situation where employment and residences are increasingly concentrated in edge-of-town developments in the middle of urban sprawl, conveniently served by high capacity (albeit congested) road infrastructure. Consequently, accessibility by other modes is poor to non-existent (commuting by, e.g., walking or cycling is often-times regarded almost as deviant and dangerous behavior). At the same time, technological improvements in cars are only marginal and their overproduction has led to historically declining real prices, and a range of positively valued cultural “meanings” (e.g., flexibility, comfort, convenience, and independence) are now firmly associated with car commuting.

Nowhere is this picture more evident than in the United States, perhaps the most car-dependent country in the world. Indeed, studies over the last 20 years have highlighted how car ownership and

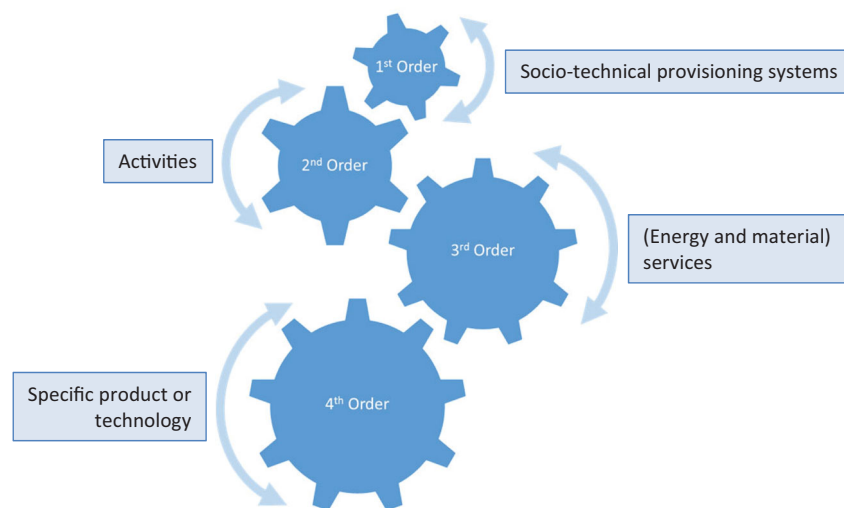


Figure 2. Different orders of need satisfiers. *Note:* The ordered structure of need satisfiers reflects the leverage (or “impact”) that a change in a particular order satisfier can have on the rest of satisfiers in a specific bundle. Thus, the satisfier orders do not reflect a ranked sequence of importance or of chronology. Satisfiers are highly interlocked, reinforce themselves, and co-evolve over time. Lower satisfier order is determined by higher satisfier order, but the reproduction of lower satisfier order further perpetuates and reinforces the higher satisfier order.

use is associated with better labor market outcomes and social mobility, notably among lower income households and public-assistance recipients (Taylor and Ong 1995; Cervero, Sandoval, and Landis 2002; Kawabata 2003; Lucas and Nicholson 2003; Blumenberg and Manville 2004; King, Smart, and Manville 2019; Bastiaanssen, Johnson, and Lucas 2020). Even in European countries such as Sweden (Berg and Ihlström 2019) and the UK (Crisp et al. 2018) car access is in many places essential for access to a range of activities, including travel to work.

Nonetheless, the picture for many countries in the global North is bleak – the historical escalation of car use has followed a reinforcing feedback loop, resulting in a lock-in situation. How can this be stopped or reversed? In the following section we use insights from systems thinking to highlight the effects that changes in this complex and tightly interrelated system can have (see Abson et al. 2017 for another application of systems thinking to sustainability transitions).

Discussion: places to intervene in a system

To tackle the escalation phenomenon of certain fourth-order satisfiers, we took inspiration from Meadows (1999, 2008) systems thinking.⁴ Here we discuss the efficiency of “turning” different “cogs” (leverage points) to intervene in a bundle of satisfiers (see Figure 2) to specifically stop or reverse the escalation trend in the use of private cars in the global North. Our contention is that the higher the order of the satisfier at which you intervene the better, but the harder it is to change things. It is,

therefore, no coincidence that most policy proposals and community initiatives are being aimed at fourth- and third-order satisfier changes, as we show below.

The cog analogy is useful in conveying the inter-linkage of different satisfier orders. For any given need, there will be satisfiers that fit each of these orders. They will tend to determine and reinforce each other. Like with a ratchet mechanism, once a trend toward escalation has happened, it is very difficult to reverse it. Moreover, the size of the cogs relates to two elements. First, the potential effect of changing the trajectory in one of the cogs on the rest (the leverage potential of each cog). For example, moving the “first order” cog a little bit results in a big movement in the “fourth order” cog, while a big movement in the “fourth order” cog would result in just a small movement in the “first order” cog. Second, the size of the cogs highlights the relative difficulty in moving each of the cogs: the smaller the cog the harder it is to move it.

In this sense, the ordered structure is not related to which satisfier is causally determining the other. Instead, the ordered structure is a useful visual aid for determining the potential impact (or leverage) of an intervention to change particular satisfier trends. We propose that the study of each satisfier order can draw eclectically from varied theoretical backgrounds and conceptual contributions. The satisfier levels are described below, starting from the higher order.

The first satisfier order is the most effective place to intervene. Changes would include a shift in the provision of non-automobile infrastructure, improved and integrated public transport systems,

and changes to urban planning and design, including a relocation of workplaces to more easily accessible areas. However, as the example of infrastructure and the built environment suggests, change at this level is hard to bring about and can take a very long time to be enacted. By using SoP to analyze first satisfier order, our framework reveals what is usually a blind spot when thinking about sustainability transitions: the role of power and the importance of tracing all the elements along the supply chain that condition (unsustainable) patterns of consumption. Therefore, changes in first satisfier order not only go beyond infrastructure and institutional and policy interventions and also entail deeper changes in the economic and political logics that perpetuate the socio-technical provisioning of car dependency.

The second satisfier order (activities) is still an important place to intervene, and much more effective than the following two levels. But understanding how to change activities is challenging. For example, car-dependent working activities are hard to change as they are interlinked to a range of other temporally (in)flexible practices such as school schedules (see Shove 2002). Furthermore, interventions pertaining to the norms and meanings around car ownership fit within this category including, for example, regulations on advertisement and positive promotion of alternative transport modes. Thus, by using some elements of social practices to understand second satisfier order, our approach highlights the role of meanings and competences in the routinized perpetuation of an escalating trend. Changes in this satisfier order are likely to require looking beyond the individual as a rational agent (e.g., pricing, awareness campaigns) and toward ways to disrupt meaning-making and competence-building. These types of disruptions can be instituted by governments at any level, non-governmental organizations, or even interest groups and activists.

The third satisfier order (energy and material services) allows for further improvements, but are not likely to be very effective in terms of stopping or reversing escalating trends. Changes at this level would include adaptations like car-sharing (either formally or informally arranged) where the same service of mobility is being provided but with reduced energy and material use. However, despite recent hype, the uptake of car-sharing services has remained very limited – only 1% of the population in the UK (Birch and Bullock 2019). A similar proposal is related to the automation of the vehicle fleet, an innovation for which the energy and carbon impacts are highly uncertain (Wadud, MacKenzie, and Leiby 2016; Taiebat, Stolper, and Xu 2019), but could possibly result in even more

car-dependent transport systems (Papa and Ferreira 2018).

The service of mobility could, of course, also be provided by active travel modes or public transport. However, we contend that such outcomes are better initiated by interventions at the level of first and second satisfier orders such as road-space reallocation. In fact, we have seen this happen in the context of the COVID-19 crisis where several cities have started to promote active travel through interventions at the first order in the form of pop-up bike lanes and road closures (Büchs et al. 2020). It is difficult to obtain the same level of service with other modes of transport when infrastructure and day-to-day practices are car-dependent. A service perspective reveals the myriad ways in which the same service could be provided, but, as shown by the car-sharing and automated vehicle examples, on its own cannot make significant changes to the escalating trend in private car ownership and use.

The fourth satisfier order (specific products or technologies) is the least effective place to intervene in a bundle of satisfiers. Shifts in this category are often touted as a big step toward tackling unsustainable consumption. Examples of interventions in this satisfier order include improving the engine efficiency of a car and switching to hybrid or electric vehicles. However, by being embedded in a reinforcing feedback loop, these kinds of interventions do not change the overall escalating trend. For example, historically, exponential growth in car use has more than offset any efficiency improvement at the vehicle level (Grübler 1998; Schäfer et al. 2009; Bigo 2019; IEA 2019b). Moreover, the push toward electrification of the car fleet has other environmental effects that are not negligible (including those related to the production and disposal of batteries). Nor does the push for electrification of the car fleet solve the negative social effects of car dependence, including the domination of public space by private cars. Finally, by lowering motoring costs, car electrification could even result in increased car use (Anable and Goodwin 2019).

As we have shown above, our categorization of satisfiers into different orders can provide insights into historical trends in satisfiers. This is possible not only for escalating satisfiers, but also for any other type of satisfier trend. Additionally, this ordered categorization can be used to analyze new technologies, proposed policies, and community initiatives. For example, a policy actor can determine whether a proposed intervention affects a higher or lower satisfier order and, thus, understand the potential efficacy of the intervention in moving toward sustainable consumption corridors.

Conclusion

Taking a eudaimonic understanding of wellbeing as our conceptual and normative framework, we highlighted the key difference between human needs and need satisfiers. The latter were the object of our analysis. We categorized different types of satisfiers into four orders. Our aim was to understand satisfier evolution better (loosely drawing from diverse theoretical and conceptual contributions) and to propose effective ways to shape satisfier evolution toward minimum social thresholds and within environmental limits; that is to shape satisfier evolution to be in line with sustainable consumption corridors.

In this article, we argued that consumer goods (as part of the fourth satisfier order) can be part of broader bundles of satisfiers. Therefore, our framework could be used as a tool for understanding the evolution in time of particular elements of consumption. But perhaps more importantly, this approach could also be used to identify places to intervene in order to bring that element of consumption toward sustainable levels, for instance, within a consumption corridor.

Our proposal indicates that changes in first and second satisfier orders (socio-technical provisioning systems and activities, respectively) are the most effective “cogs” to influence the evolution of a particular satisfier. While we do not set out a detailed plan on how to effect these, we contend that concrete changes to first and second satisfier order should be determined through deepened and alternative democratic processes, given the wide scope for potential conflicts and profound social challenges. Deeper and alternative democratic processes can be developed by governments at all levels, but also grassroots actors. Truly profound changes in first and second satisfier orders via participatory means will likely require those involved to confront the interests of economic elites that actively profit from escalating energy-use patterns, and in doing so, those involved will also likely have to challenge their existing perceived notions of a good life. These deepened and alternative democratic processes are in line with Max-Neef (1991) and DiGulio and Fuchs’ (2014) proposals of participatory and trans-disciplinary methods to identify satisfiers and consumption corridors respectively.

To corroborate our conclusion on the importance of first and second satisfier orders, we suggest that this work is taken forward empirically in several ways. First, there is a need for comparative case studies of escalation that compare in detail the same fourth satisfier order, where in one case escalation has been observed and in the other it has not. Comparisons across the other orders (first, second, and third) would enable an

assessment of the importance of different satisfier orders in affecting fourth order satisfier evolution.

Second, we encourage studies that seek to assess decline by selecting a fourth order satisfier trend that have weakened over time and to analyze the changes in first, second, and third satisfier orders to corroborate their relative impact on the fourth satisfier order.

Third, there is a need for evaluating interventions by selecting a fourth order satisfier that has escalated and has been the object of several improvement efforts. This type of evaluation could study the different interventions for reducing the environmental impact of the selected fourth order satisfier, classify them into first, second, third, or fourth order satisfier interventions and assess their efficacy.

Finally, in our example of car use, the framework and categorization allowed us to explain, from a systems-thinking perspective, why current policies around electrification, automation, and car-sharing may not have a very big impact on bringing car use in line with social thresholds and ecological limits. Rather, broader changes in the spatial structures and practices underpinning high levels of car use, as well as the power structures surrounding the car industry, will be needed.

To conclude, this categorization points to the most effective areas for change and action, namely in the first satisfier order of provisioning systems. As long as this higher leverage point does not change, changes in lower leverage points will have limited impact. However, the changes in the lower leverage points are key to enable and prepare the ground for broader system changes. Thus, in terms of development and analysis of policy initiatives, our main message is for policy makers not to be complacent and stop at the lower level changes, because they will not be enough to change satisfier trends or ensure that we remain within the normative range of sustainable consumption corridors. It remains an open question whether the time required to bring about changes in first satisfier order can be squared with the urgency of the current socio-ecological crisis.

Notes

1. Incidentally, the clarity that the human-needs perspectives provide around need satisfiers is the main reason why we favor it over the capabilities approach. Other reasons include the difficulty of identifying basic universal functionings and capabilities and the challenge of operationalizing capabilities (for a fuller discussion see Gough, 2015).
2. Arguably, the urgency of climate-change mitigation magnifies such trade-offs. While most satisfiers are associated with at least a certain amount of GHG emissions, the absorptive capacity of the atmosphere is constrained, and the resulting warming effect has a

range of important negative effects on need satisfaction. This tends to reduce the scope for “purely positive” satisfiers, so that the question is more about how carbon intensive a specific bundle of need satisfiers is as compared to possible alternatives.

3. Employment is a need satisfier rather than a human need. It is only one of many different ways to achieve certain needs. Doyal and Gough would describe employment as an intermediate need for economic security. Max-Neef would describe employment as a key satisfier in Western capitalist economies for the needs for protection and creation.
4. Systems thinking is about describing and analyzing complex systems, where the behavior of the whole cannot be explained by the sum of the behavior of its parts, and thus unexpected outcomes are usually present. Moreover, the structure of complex systems usually causes their own behavior, i.e., most of the elements of a system are endogenous. We view need satisfiers as a case of a highly complex and interrelated system for need satisfaction.

Acknowledgments

The authors thank the participants of the Sustainable Consumption Corridors Workshop held in Geneva in April 2019 for fruitful discussions on a previous version of this article. The authors also thank the journal editor, the special issue editors, and two reviewers for their careful and constructive comments which have helped shape this article into its current form.

Disclosure statement

The authors declare no conflict of interest.

Funding

This work was supported by the Living Well Within Limits Research Leadership Award funded by the Leverhulme Trust [RL2016-048].

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