

Well-being and Mobility: A New Perspective

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Abstract

The connections between transportation and subjective well-being have received increasing attention in the transportation literature. Yet there are few studies on the relationship between objective well-being and transportation. Objective well-being is the achievement of a persons' potential in knowledge, health, friendship, and other life domains, through the development of their embodied capacities to know, create and be sociable. The value of these achievements is objective, in the sense that it is not derived from a person's attitudes or mental state. Thus, objective well-being adds an important dimension to the study of well-being and transportation, as it can explain why active, embodied mobility modes such as walking and cycling—offer more opportunities for human capacity development, compared to sedentary modes such as driving and riding in a driverless car. Embodied mobility modes activate a well-rounded combination of human capacities thus contributing to better understanding of one's environment, creative flow and sociability, in turn enhancing one's overall well-being. This may add important information for transportation planners and urban designers in design and evaluation of mobility environments.

Keywords: Well-being, Active travel, Walking, Cycling, Autonomous vehicles, Vehicle occupancy

Introduction

The past decade has seen a growing interest in the relationship between transportation and well-being. While the growing body of research acknowledges this relationship, studies focus almost exclusively on subjective dimensions of well-being. This paper argues that well-being is not exclusively constituted by subjective emotions, attitudes or mental states, and that it is therefore important to capture well-being's objective dimension in transportation research and practice.

According to 'objective accounts' of well-being, life satisfaction, or even happiness, are not the whole of well-being (Haybron 2011). Certain things are good or bad for persons, independently of whether they are desired or whether they give rise to pleasurable experiences (Angner 2010; Chappell and Crisp 1998, 553). Objective well-being, in this paper, is defined as the ability to engage with things that are objectively valuable, such as knowledge, friendship, love and human achievements, through the development and exercise of our essentially human capacities (Bradford 2017): our sensory, affective and physical capacities (Kraut 2007). This view of well-being adds a new perspective to the literature on

transport-derived well-being. In particular, by linking transportation to objective well-being, this paper urges planners and transportation experts to incorporate objective well-being considerations in transportation planning and policy, and complement the subjective well-being dimension.

Discussions on the objective dimension of well-being in transportation studies are few and far between. Reardon and Abdallah address objective well-being explicitly as a source of well-being, alongside other conceptions of well-being. Their conception of objective well-being includes a list of objectively-valuable goods such as income, health, education, housing, and community and those items deemed necessary for basic human needs (Reardon and Abdallah 2013, 636). However, their paper aims at introducing a dynamic model of well-being, which highlights the different domains that make up well-being, only one of which is objective well-being. On a different vein, Shliselberg and Givoni (2018) implicitly address objective well-being. They defend a view of motility (capacity for mobility) that has important eudaimonic well-being dimensions. Their account focuses on well-being that derives from personal autonomy and social capital.

This paper aligns with Nordbakke and Schwanen's call to explicitly adopt an approach to well-being with the deepest Aristotelian roots (2014, 124). It focuses explicitly on objective well-being, discussing how active and sedentary transport modes enable or limit the development of human capacities while in motion. One of the main motivations for this sort of inquiry is the emergence of smart mobility and in particular autonomous vehicles (AVs). There are relatively few accounts of how AVs will affect well-being, and they mostly focus on AVs' potential to enhance personal autonomy and accessibility to new destinations for the aging population and persons with disabilities (Bradshaw-Martin and Easton 2014; Crayton and Meier 2017; Fitt et al. 2018; 2019). Prima facie, the relief from the need to drive and the growth in the range of destinations provided by the AV seem like things that would contribute to well-being. Nevertheless, as will be argued in the following discussion, a mobility paradigm based on low-occupancy AVs will likely restrict the potential development and exercise of human capacities, especially when compared to active transport modes such as walking and cycling. Thus, an investigation of the objective dimension of well-being is timely, in order to inform the design of future mobility systems and mobility landscapes, and create appropriate regulatory interventions that enhance human well-being.

The argument begins with making distinctions between subjective and objective well-being and motivating the focus on objective well-being. Subsequently, I develop the concept of objective well-being manifested in human capacities. The argument then proceeds to discuss the extent to which active and sedentary modes enable the development and exercise of human capacities while in motion.¹ I end with a reflection on potential research directions.

¹ The discussion does not account for objective well-being that may be derived from transit mobility, for two main reasons: first, lack of space prohibits developing a comprehensive account of human capacities' potential in transit mobility. Second, while the active modes display a clear advantage over sedentary modes in terms of objective well-being, well-being generated from transit mobility seems to display both well-being benefits of active mobility and well-being reductions similar to those that result from riding in a sedentary mode. For example, public transit enables one to exercise sociability, yet it does not offer opportunities for embodied motion which triggers the capacity to create and know. Providing a comprehensive analysis of human capacity exercise in public transit would complicate the present analysis such that to do it justice requires a separate text.

Subjective vs. objective well-being

Subjective well-being

Well-being is standardly considered to be an evaluative or normative concern. Because well-being is a value, it concerns what is *good for* people, what makes them *better off*, what *benefits* them, what *harms* them, what *serves their interests*, what makes their lives *go well for them*, and so forth (Haybron 2011). *Subjective* well-being is a family of views that approach these questions from the point of view of a person's attitudes, preferences and mental states. On these views, what makes a person's life go well depends on what the person's mental state is, or their attitudes regarding how well their lives are going. In other words, on the subjective well-being view, "how well you are doing is entirely a function of how well your life is going relative to what you care about" (Haybron 2011, 254). The subjective accounts of well-being provide an account of self-interest which does not appeal to facts about value, but to what a person does and would prefer, given full knowledge of the purely non-evaluative facts about the alternatives (Parfit 1984).

In a retrospective and prospective analysis of travel and well-being, Mokhtarian (2019) explicitly frames the discussion of travel and well-being within the subjective well-being paradigm. Well-being generated from travel has two conceptually distinct sources, according to this account: hedonic motivations (pleasurable experiences) and eudaimonic motivations for travel (providing meaning or purpose in life) (Mokhtarian 2019, 495). Eudaimonia is an Aristotelian concept for human flourishing or 'living well' (Kraut 2018). Within this lens, analyses of travel and subjective well-being concern questions such as: what types of people enjoy travel, and under what circumstances is travel enjoyed (Ory and Mokhtarian 2005); cognitive judgments of travel satisfaction combined with dimensions of mood (Ettema et al. 2011); the relative importance that people attach to various affective journey attributes when commuting or travelling for leisure (Anable and Gatersleben 2005); how congestion, crowding and unpredictability during the commute affects mood and stress and whether the commute has "spillover" effects into people lives (Chatterjee et al. 2019); how the length of commute and commute mode affects life satisfaction, strain and mental health (Clark et al. 2019); the effects of active transport modes—walking and cycling—on the pleasantness of the commute (hedonic well-being); the degree of arousal (being bored or stressed during the commute) and on feelings of confidence, physical and mental health (Gatersleben and Uzzell 2007; Singleton 2019b).

These issues can be categorized into three types of relationships between transportation and well-being (Singleton et al. 2020): (i) travel satisfaction: the *emotions* people experience during trips and how they evaluate these trips; (ii) access to activities: the participation in (and performance of) out of-home activities and having access to transportation options and the knowledge and skills to use them can generate *feelings* of satisfaction, freedom, competence, and belonging; (iii) Spill-over effects: the performance of (and satisfaction with) out-of-home activity can be influenced by *perceptions* of the preceding travel episode. Notably, the relationship between travel and well-being, as conceptualized in these categories, is grounded in the emotions, feelings and perceptions of the traveler, and is therefore subjective.

Objective well-being

Studies that address objective well-being in the transportation literature approach the concept as a dimension of ‘quality of life’ that is represented by observable standard-of-living indicators like good health or gainful employment. On this view, quality of life represents a broader understanding of more objective dimensions of life and is often used in health-related quality of life research (Goodman, Kroen, and Davern 2021). Standard-of-living indicators represent ‘basic needs’ (food, shelter, education), having adequate material resources necessary or gaining control over one’s life (Nordbakke and Schwanen 2014), or broad societal indicators such as household income, crime rate, or divorce rate (Lee and Sener 2016).

The distinction between the subjective and the standard-of-living objective approaches is as follows: 1) subjective indicators are generated from self-reports whereas objective indicators are selected by researchers or public servants (Nordbakke and Schwanen 2014; Schwanen and Wang 2014), and 2) objective indicators are more stable and easier to collect and analyse than self-reported, survey-based measures (Delbosc 2012). The standard-of-living approach reflects earlier attempts by social scientists to measure quality of life at a community level. However, since the standard-of-living approach ultimately reflects society's values rather than those of the individual, it needed to be supplemented by subjective well-being in order to provide an insight into how individuals assess their own well-being (Lee and Sener 2016).

In contrast to the standard-of-living approach, I propose using the concept of objective well-being in a different sense, as it is used in the philosophy of well-being and value theory literature (Hurka 2006). On the philosophical, value-theory account, objective well-being is a family of views that hold that well-being is achieved by engaging with things that are good, valuable or worthy *in themselves*. The value of these things is intrinsic, that is, not dependent on people liking them or desiring them. On this view, well-being is not simply a psychological matter, if it is psychological at all, but rather an evaluative matter (Haybron 2000). Because it is evaluative, it is important to know how things really are in our lives, and not just how they seem to be (i.e. how we feel about them). In other words, there needs to be an objective standard to determine how things really are in our lives.

Objective well-being, therefore, is well-being that is derived from things that are valuable in themselves. In contrast to the subjective accounts, the objective account appeals directly to facts about *value* (Parfit 1984). Thus the important distinction between the objective and the subjective view of well-being is that according to objective accounts of well-being, certain things are good or bad for persons, independently of whether they are desired or whether they give rise to pleasurable experiences (Angner 2010; Chappell and Crisp 1998, 553).

For Aristotle, the concept of eudaimonic flourishing or happiness meant that flourishing is living in a manner that actively expresses excellence of character or virtue (Haybron 2000, 209–10; Kraut 2018). On the objective well-being view, therefore, well-being is the result of actively seeking the excellence of character and virtue. Humans achieve excellence by developing and exercising their human capacities (Hurka 1993). This is often interpreted as meaningful engagement with the things that are considered *objectively* valuable: friendship, achievement, knowledge, moral goodness and true beauty (Fletcher 2016; Parfit 1984). On the objective view, therefore, humans flourish and do well when their human capacities are developed and engaged with things that are intrinsically valuable (Ferdman 2019a), that is, valuable in and of themselves and not in virtue of being desired. In

attaining these things, we are exercising our human capacities and fulfilling our flourishing potential (Bradford 2017). Thus the objective well-being approach as it is used here is not intended to invoke a set of standard-of-living indicators determined by experts or scientists (Delbosc 2012; Nordbakke and Schwanen 2014). Rather, it is a conceptualization of things that have intrinsic value, that are valuable *in themselves*.

Objective well-being derived from travel activities, therefore, is well-being that is the result of the successful development and exercise of our human capacities while we are on the move. Thus the relationship between travel and objective well-being will focus on questions such as: what human capacities do we normally exercise when we are travelling? What combination of human capacities do we exercise while we are travelling? How do different travel modes affect the combination of human capacities that travelers are exercising while on the move? Do some travel modes actively restrict or limit the development and exercise of our human capacities?

One example of this type of approach focuses on objective well-being and walking. Walking is a mobility mode in which the capacity to know, create, be sociable and achieve are developed and exercised in varied and combined ways (Ferdman 2019b). Another example concerns the capacity for sociability and connectedness while travelling (te Brömmelstroet et al. 2017). The social capacities exercised while travelling that enable connectedness are valuable in themselves, and contribute to well-being directly, when considered from the objective well-being perspective. The purpose of this paper is to expand on the relationship between travel and objective well-being, and specifically to argue that active mobility modes (e.g. walking, cycling) present more opportunities for humans to develop and exercise a combination of human capacities compared to sedentary modes (e.g. driving, travelling in an AV).

Why is it important to make a distinction between subjective and objective well-being in the context of transport policy? This paper makes the distinction in order to add another dimension to our understanding of the relationship between transportation and well-being. Delbosc, for example, holds that it is not so clear how physical mobility may contribute to subjective well-being independent of its role in facilitating access. She holds that active transport may increase subjective well-being through its influence on physical health and through encouraging a sense of autonomy and control over one's life, yet these are indirect effects on well-being (Delbosc 2012, 28). This paper, on the other hand, establishes a direct relationship between physical mobility and (objective) well-being, independent of its role in facilitating access. Thus, adding the objective dimension to the discourse both expands our theoretical understanding of transportation and well-being, and it may provide crucial information for urban planners and urban designers when articulating principles for high-quality mobility environments.

The Human Capacities

One way to unpack the concept of objective well-being is by examining what it is for a human being to flourish properly. By answering this question, we can then analyse how active and sedentary mobility modes contribute or hinder proper flourishing. Martha Nussbaum conceptualizes objective well-being as the exercise of 10 human basic capabilities: life, bodily health; bodily integrity; senses, imagination, and thought; emotions; practical reason; affiliation; other species; play; control over one's environment (Nussbaum 2000, 78–80). The capabilities approach is objective in the sense that it defines a set of minimum capabilities that should be satisfied irrespective of time and place (Nordbakke and Schwanen 2014), and irrespective of the attitudes persons have towards having those capabilities.

According to the objective well-being approach, human beings flourish when they are developing and exercising these capabilities, when they are “developing properly and fully, that is, by growing, maturing, making full use of the potentialities, capacities, and faculties (under favourable conditions) they naturally have at an early stage of their existence” (Kraut 2007, 131). ‘Developing properly and fully’ entails the development and exercise of the capacities for rationality, innovation, growth, imagination, creativity, insight and understanding (Kraut 2007, 178). In other words, Nussbaum’s capabilities list, may be translated into a list of human capacities that contains the capacity to know, create, be sociable and the capacity to will (Bradford 2015; Hurka 1993; Ferdman 2019a). The human capacities are a concretization of the 10 capabilities, which themselves are a concretization of ‘objective well-being’, offering a way forward in the attempt to unpack how travel affects objective well-being.

Also relevant to the examination of travel-derived well-being is the notion of embodiment. An essential part of being human is to be an embodied being (evident in Nussbaum’s capability list, most notably ‘senses’). It is through our bodies, on the move, that we make sense of our surroundings. Since the development and exercise of our human capacities is what makes for a flourishing life, to live an embodied life is part of our well-being. Therefore, to develop and exercise our capacities properly is to do so using our body (Ferdman 2019b). In one sense, all mobility types are embodied. Nevertheless, as will be argued extensively below, active modes like walking and cycling provide a unique opportunity to engage with the things that make embodiment essential for well-being: to do things, be a certain person and have contact with a deeper reality. Thus, by offering a human capacities approach, this paper addresses the challenge put forth by Nordbakke and Schwanen (2014), namely to develop an explicitly Aristotelian-Capability Approach to well-being and transportation.

The capacity to know

Knowledge is one of the building blocks of our well-being. Humans educate themselves to gain important skills, but as importantly, because it’s good in itself for humans to know about the laws of nature, and the history of our culture, and our place in the world, and to have moral knowledge (Hurka 2011, chap. 4). Further, the capacity to know contains the capacity to know highly abstract principles, for example the knowledge sought by a theoretical physicist. It also includes the capacity to know a multitude of particular facts, such as those of a biologist studying a particular forest. The best kind of knowing or understanding is a combination of both types of knowledge—the abstract and the particular, (Hurka 2011, 83) since it requires arranging our knowledge in a hierarchical explanatory structure of abstract principles (Hurka 1993).

When on the move, individuals make observations that may increase their knowledge about their environment. Therefore, information gain and novelty seeking are thought to generate positive trip utility (Arentze and Timmermans 2015). Getting to know one’s environment is one important way of developing and exercising the capacity to know and arrange knowledge in hierarchal structures of meaning and understanding. “Moving elements in a city, and in particular the people and their activities, are as important as the stationary physical parts. We are not simply observers of this spectacle, but are ourselves a part of it, on the stage with the other participants... Nearly every sense is in operation, and the image is the composite of them all” (Lynch 1960, 2). Moving and travelling, therefore, are an important way to develop and exercise the capacity to know, both particular facts and abstract structures of knowledge.

Capacity to create

Csikszentmihalyi (1998) categorizes the creative processes into four phases: preparation, incubation, insight and verification. Active travel modes are especially well-placed to generate creativity within the incubation phase. This is because uninterrupted walking or cycling creates a state of ‘flow’. Flow has the capacity to separate two forms of effort: concentration on a difficult task and the deliberate control of attention. In a state of flow, maintaining focused attention requires no exertion of self-control, thereby freeing mental resources to be directed to solving problems (Kahneman 2011, 41).

The capacity to be social

Exercising our social and affective capacities is an essential part of our well-being. The successful development and exercise of these capacities enable us to cultivate friendships, have loving relationships and participate in public life, things which, according to the objective well-being approach, are valuable in themselves. Mobility is central to sociability, since “Being a social and embodied practice, mobility in part influences the sense of being connected to people and places through which an individual travels” (te Brömmelstroet et al. 2017, 4). As soon as persons leave their door, they are “linked-in-motion”, negotiating their way through spaces, forming “mobile agoras” (Jensen 2008).

Combining Capacities

Objective well-being improves when we develop and exercise our capacities in combination. It is rare for our physical, sensory, affective, social and cognitive powers operate independently from each other (Kraut 2007, 166). Human achievements are usually valuable when they involve a multitude of skills, talent, resolve and the capacity to wield the successful exercise of different intrinsically good things in a complex combination. For example, climbing Mt. Everest, playing chess or organizing a community activity is more valuable than tying one’s shoelaces, because it requires the skilful combination of a variety of human capacities, compared to tying shoelaces which only requires manual dexterity (Hurka 2016). As the following sections will argue, active modes (walking, cycling) present more opportunities for developing and exercising multiple combinations of our human capacities, compared to sedentary modes which generally present diminished opportunities for developing the capacities or exercising them in combination.

Active modes and the potential for developing and exercising human capacities

This section analyses how the human capacities to know, create, achieve and be sociable manifest in active and sedentary travel modes. In this analysis I address only well-being that is generated during the actual travel. The spill-over effect of travel, i.e. well-being generated from being able to access out-of-home activities, is not accounted for here. The reason for focusing on the travel itself is that this offers an opportunity to examine more closely how human capacities manifest themselves during active or sedentary travel. This is a novel perspective of well-being generated during the travel itself. As mentioned above, there are many studies on the subjective dimension of travel, i.e. how people *feel* during travel, yet there are none that examine the objective dimension during travel, i.e. the *intrinsic, non-attitudinal* value of what they do and achieve during travel. Furthermore, an analysis of how

humans develop and exercise their capacities due to the spill-over effect (i.e. participating in out-of-home activities) requires much more space and breadth, as it requires analysing how the environments in which out-of-home activities take place affect our potential to develop and exercise our human capacities. A framework for addressing this broader issue has been proposed elsewhere (Ferdman 2018).

The capacity to know as manifested in walking and cycling

Active mobility modes create a unique combination of embodied physical movement in an environment that triggers the human senses in multiple ways. The active modes—walking and cycling—involve kinaesthetic apprehension which yields a richer and more nuanced acquisition of knowledge. Walking is a mobility mode that affords many opportunities to develop and exercise the capacity for knowing (Ferdman 2019b). Walking allows the pedestrian to process knowledge at a pace that is more favourable to understanding. One reason for this is that walking enables immersion: the speed of walking allows the pedestrian to digest more complex information about the place one is inhabiting. The particular type of knowledge is acquired by the pedestrian in the act of walking, from observing and being immersed in the material and social environment of the streetscape (Pinder 2011). When walking, humans make new connections, physical and conceptual, over time and space (Rendell 2006, 153). Together with particular facts about the place, observations are organized, gradually, into higher-level system of knowledge (Ferdman 2019b).

In cycling there is a similar process, occurring at a faster pace. Cycling enables “general awareness” in that it triggers cognitive stimulation. As in other types of exercise, cycling triggers thoughts via physical movement or endorphin release (Krizek 2019, 74). Cycling is an overlearned physical skill that improves brain connectivity (Svatkova et al. 2015). Stationary cycling is associated with significantly greater semantic memory activation in healthy older adults (Won et al. 2019), which makes it plausible to assume that non-stationary cycling also contributes to memory activation. A study of the effect of e-biking in older adults found that it is not just the physical component of the activity but several different aspects of cycling that may improve cognition and mental health, such as engagement with the outdoor environment and the sense of independence (Leyland et al. 2019).

The combination of exercise, being outdoors and being on the move means that the cyclist is absorbing many types of new information and overtime arranging them in hierarchical systems of knowledge. Cyclists have their own view of travel and cities (Forsyth and Krizek 2011), both metaphorically and materially. Due to the pace of cycling, cyclists are able to absorb more fine-grained information than car drivers or passengers. Their sensory experience is not confined just to noise, traffic and weather, but also encompasses architecture, rhythm and chaos (Liu, Krishnamurthy, and van Wesemael 2018). te Brömmelstroet et al. (2017) note that there is a trade-off between the depth of interactions, which are relatively superficial, and the number of interactions, which is high and distributed over a large terrain. This combination enables the cyclist to build a rich and large cognitive ‘image of the city’ (Lynch 1960) and as such develop a rich sense of connectivity (Liu, Krishnamurthy, and van Wesemael 2018). Commuters organize identifiable objects, motions, spaces, orientated structures and meanings into complex sequences (Appleyard, Lynch, and Myer 1964). When cycling, knowledge is gained through kinaesthetic responses to the body of mass, texture, smell and weather. Since the landscape is changing frequently, the cyclist’s stimulation and curiosity are roused more often. Therefore, when commuting regularly,

cyclists are likely to have grouped the elements of the environment into a general, yet coherent sequence (Stefansdottir 2014). In sum, walking and cycling can offer a unique opportunity to develop and exercise the capacity to know.

The capacity to create as manifested in walking and cycling

Recall that the creative process includes preparation, incubation, insight and verification (Csikszentmihalyi 1998). Walking and cycling are especially relevant for the incubation phase because they create ‘flow’: they allow the mind to relax and to let the unconscious work on the problem, which is essential for insight—the subsequent stage in creativity (Keinanen 2016). The synchronization of the rhythms of the body with the rhythm of walking contributes to enhanced memory and creativity (Keinanen 2016; Kuo and Yeh 2016; Oppezzo and Schwartz 2014). Cycling is also well placed to contribute to flow and the creative process. Skills such as playing an instrument or riding a bicycle are anchored in a system called procedural memory. This type of memory is responsible for performance (Suchan 2018). The kinaesthetic benefits of cycling will be highest if the cyclist attains a certain rhythm at a level where the technical activation is no longer a limitation and a feeling of ‘flow’ occurs (Stefansdottir 2014). Once a suitably accurate procedural memory is formed, conscious resources can be freed up to deal with problems that do not (yet) have habitual or purely procedural solutions (John 2018).

Flow improves the generation of novel yet appropriate ideas. Recent studies indicate that walking enhances cognition, ideation and creativity (Weuve et al. 2004; Schaefer et al. 2010; Erickson et al. 2011; Oppezzo and Schwartz 2014; Aspinall et al. 2015; Labonté-LeMoyné et al. 2015). The neurological processes that might explain the relationship between walking and creativity are as follows: the physical aerobic activity enhances cognition by increasing blood flow and neurotransmitter activity, and decreasing stress hormones in the brain (Ferris, Williams, and Shen 2007; Hillman, Erickson, and Kramer 2008; Salmon 2001). The motion in space creates a state of “flickering”, a process of wandering between the mental state of episodic memory and spatial navigation. The state of flickering is enabled in walking, because walking creates immediate changes in blood pressure and oxygen intake that help spread activity across more distant brain regions. In turn, flickering enables the process of making associations necessary for creativity (O’mara 2019). Walking is advantageous for the capacity to create, because it may be exercised even when the explicit intention of the travel is instrumental—to get from A to B. As one walks one may find that in the process, they are generating new thoughts and ideas (Ferdman 2019b).

The capacity for sociability manifested in walking and cycling

Active mobility modes like walking and cycling are advantageous for the development and exercise of the capacity to be social, because they are operationalized in the public sphere where other people are occupying the same shared space (Ferdman 2019b). Walking, for example, provides the opportunity to develop and exercise our social capacities in public spaces through the nurture of trust and social engagement (Leyden 2003), as well as a sense of community (Brown and Cropper 2001; Wood, Frank, and Giles-Corti 2010).

Walking and cycling trigger trust-enhancing social interactions. In order for pedestrian order to be possible, the existence of a tacit contract between users of public space must be created, through social and collaborative processes by which users of public space come to trust each other to act like competent pedestrians (Wolfinger 1995). Goffman (1972)

argued that streets are ‘trust-building’ environments. When two strangers encounter one another on the street, both have the same conception of how matters ought to be handled between them. This is a manifestation of voluntary coordination, whereby both parties believe that there exists a conception of how things need to be handled, and each party acknowledges that the other holds the same belief. The public order in which body techniques are exercised (in this case, walking in a public space) is not only a practical order, it is equally a moral order. For example, if rules are broken (e.g. a pedestrian transgressing into another pedestrian’s path), then the actor must adopt corrective measures. An apology functions to demonstrate one is aware of the rule one has just broken and that one is not the sort of person who usually wilfully breaks such rules. Body techniques, in this respect, are oriented to a moral order to which they both respect and reproduce (Crossley 1995).

In cycling too, the street or the road are a social space. First, Cyclists continuously (un)consciously negotiate with others and with their surroundings to prevent collisions or mediate traffic flows. Second, cyclists are structurally open for interaction as all their senses are exposed and they are not visually or physically shielded in any way (te Brömmelstroet et al. 2017).

Walking or cycling enable the creation of a rich social public space, because of being co-present while on the move (te Brömmelstroet et al. 2017). Being co-present requires the development and exercise of non-verbal communication, eye contact, social gestures, exposure to other lifestyles and learning to respectfully co-habit shared spaces. While not all social interaction in walking or cycling is positive (Middleton 2016; te Brömmelstroet et al. 2017), it is still the case that the conditions for developing and exercising social capacities exist in walking and cycling to a greater extent than driving or riding in an AV, as will be discussed later.

Combining capacities in walking and cycling

Walking and cycling present opportunities for using the capacity to know, by enabling to digest more complex information about the place one is inhabiting, thus creating new connections, physical and conceptual, over time and space, and organizing facts about the place and its other inhabitants into higher-level system of knowledge. It seems logical that active mobility utilizes the capacity to know in combination with the capacity to create, since organizing information into higher-level system of knowledge contributes to the creative stages of preparation, incubation, insight and verification. In addition, the capacity for sociability requires the creation and recreation of knowledge about the material and social environment one is inhabiting, which in turn informs the capacity to know. Thus walking and cycling present an opportunity to develop and exercise the capacities to know, create and be sociable in combination, thereby enhancing objective well-being.

Sedentary modes and the challenge for developing and exercising human capacities

Sedentary behaviours and sedentary mobility are increasing (Giles-Corti et al. 2016). In addition, there is growing speculation that the introduction of AVs will prompt people to travel longer distances for their daily activities (Singleton et al. 2020), thus increasing the likelihood of persons choosing sedentary mobility at the expense of active mobility.

Because AV mobility is expected to provide a different experience from driving, in terms of what passengers can be and do during the ride, it is important to consider the

phenomenology of riding in an AV. Future AVs include, at least in theory, many types of vehicles, from a driverless fleet of transit vehicles (high-occupancy or micro-transit) to single-rider pods (low-occupancy). On the one hand, the transport policy discourse posits Shared Autonomous Vehicles as a sustainable solution for future road automation technology (Paddeu, Shergold, and Parkhurst 2020). On the other hand, the AV industry is setting its goals towards a transportation system that elevates low-occupancy AVs, including those with zero occupants, to the top of the planning hierarchy, as evident in its vehicle-centred infrastructure terminology such as “vehicle-to-everything” and a vehicle “green wave” (Murphy 2019), and in its marketing materials which graphically depict the AV interior with a single passenger reclining comfortably and surrounded by sleek computer screens. Literature on adoption of AVs speculates that AVs could lead to a higher mode share for private cars (Pakusch et al. 2018; Singleton et al. 2020) strengthening the likelihood of single-occupancy travel. In the discussion that follows, I therefore focus only on single-rider or low occupancy AVs.

There are competing visions in the literature regarding how AV mobility will impact well-being. While AVs are presented as a silver bullet solution for the key problems experienced in the transport sector, it may not be aligned with the public interest (Ferreira et al. 2020; Cohen et al. 2020). Optimistic visions highlight AV health benefits in potentially improving safety and providing greater access to activities, especially for people with disabilities, the elderly and all those unable to drive (Pettigrew, Talati, and Norman 2018). Nevertheless, while there appear to be likely benefits (in improved safety, satisfaction, and access) as well as disadvantages (reduced physical activity), much about these effects remains unknown (Singleton et al. 2020).

On the face of it, the release from the need to drive seems to free up mental efforts and cognitive capacities to other uses, which could increase positive utility (Singleton et al. 2020). One of the popular narratives regarding the AV is that it will convert wasted time into productive or fun time. The AV is described in industry reports and marketing efforts as a revolutionary technology, in that it will allow the passenger to work, read books, watch movies or sleep during the commute. For example, participants in one focus group envision several potential activities: working (write emails, participate in a work meeting), doing business (beauty salon in the car), sleeping, preparing dinner, washing oneself, brushing teeth, attending to children, doing administration, exercising, singing karaoke, playing board games or computer games, sewing, watching movies, spending time with friends, video calling or using a massage chair (Pudāne et al. (2019). If passengers actually engage with these activities, they may develop and exercise their capacity to know, for example by reading, listening to podcasts or simply spending more time on thinking.

Yet there is reason to be sceptical regarding the positive utility derived from AV mobility (Ferdman 2020). Singleton (2019a) speculates that positive utility of AV trips is overestimated, as most of it will derive from the reduction in drive-related stress², the ability to transition between roles, or from the enjoyment of a private space to be alone. Conversion of travel time to more productive time, however, is less likely.

First, the AV travel experience will likely resemble that of being a passenger in a car, and less than a train ride where working and reading is possible, limiting the potential of multitasking (Singleton 2019a). Furthermore, short-duration trips make it less likely to convert travel time to productive time (Singleton 2019a, 56). Second, it is likely that activities like gazing, conversing, or listening to music, which is what people now do when

² Stress reduction would tend to impact mood in the short term, but in the long term mood affects subjective well-being (Tomyn and Cummins 2011; Yardley and Rice 1991).

driving or riding a train, would continue to be important when riding an AV, and would not be converted into work instead (Cyganski, Fraedrich, and Lenz 2015).

However, there is a further worry regarding the use of time during AV trips. The AV industry and entertainment companies have realized that the interior of the vehicle is going to be a hugely lucrative market for personal advertising (Tumlin 2016). AV operators will have access to the passenger's preferences, purchase history and movement and will want to capitalize on this information in order to create revenue. This is an instance of a more general political economy phenomenon termed "the attention economy" (Kessous 2015): a fast-growing industry with an explicit interest in harvesting persons' attention through digital content, and repurposing it for financial gain. The attention economy has an explicit interest in harvesting attention by penetrating the internet-ready car, as this is a lucrative source of revenue (Lyons 2018). The attention economy could harvest attention through passengers' hand-helds or by designing the interior of the vehicle as a 'car-immersive' environment that focuses the passenger's attention on entertainment services and consumption (Digital Humanities Institute 2017). It is also plausible that in an unregulated market, AV operators will push for a single-rider AV fleet, to offer tailored routes based on a passenger's purchase history (Ferdman 2020).

Given that the attention economy is in the business of capturing persons' attention, this will make it difficult to convert travel time into productive time, since it will become harder for the passenger to disengage from personal digital targeting. While the industry narrative is that AV travel will enable the passenger to engage in new and meaningful activities, it is unclear to what extent passengers will *actually* engage in these activities. Overestimating one's willpower is a human tendency (Loewenstein and Schkade 1999) in particular overestimating one's willpower to resist temptation (Hesmat 2012). The implication is that while persons may imagine or even fully intend to be active and productive during AV trips, in reality they may be tempted away from doing things that require willpower. Since the attention economy is precisely in the business of taking advantage of the difficulty to resist temptations, it is plausible that despite AV passengers' intention to do productive or meaningful things, in reality, the all-too-human weakness of will may be exploited by the attention economy, reducing the prospects of positive utility even further (Ferdman 2020).

The capacity to know manifested in sedentary modes: the car and the AV

In a car, bodily sensations become strong only at points of abrupt change in speed or the angle of climb and fall (Appleyard, Lynch, and Myer 1964). Furthermore, driving requires keeping track and speed on a straight and blocked course, which appears to demand little attentional resources (Protzak and Gramann 2018). On the face of it, this might suggest the possibility of marshalling attention for other activities such as thinking or understanding. Nevertheless, the mental processes engaged in driving suggest otherwise. Driving performance with distractions can reduce brain resources (Just, Keller, and Cynkar 2008). To drive safely requires that the driver concentrate, by dividing attention between multiple sensory events across visual and auditory modalities, and making fast cognitive decisions in a complex and rapidly changing environment. Even undistracted driving does not enable diverting mental resources for developing and exercising the capacity to know. Undistracted driving triggers the posterior brain which is responsible for the basic brain functions. It does not demand the same level of engagement from the anterior frontal system, which is responsible for more effortful mental processing (Schweizer et al. 2013). The anterior brain is responsible for the higher functions such as attention allocation, decision-making, working

memory processes, ethics and morality, and emotion. This suggests that the anterior brain is engaged mostly in safety-related decision making, which does not leave room for the development of the capacity to know through deep observation, moral reasoning or memory retention.

Recall that active mobility is immersed in an open environment, which triggers all the senses, creating a much greater diversity of information that the traveller unconsciously digests and organizes in hierarchical structures. In contrast, inside the car, knowledge acquisition is restricted to two senses only: sight and sound. The landscape is inaccessible to the other senses. Inside the vehicle “[t]he sights, sounds, tastes, temperatures and smells of the city are reduced to the two-dimensional view through the car windscreen” (Sheller and Urry 2000, 747), making the interior of the vehicle poorer in terms of exposure to things that trigger the human capacity to know, compared to a lively, outdoor urban environment.

It might be argued that for some people (e.g. taxi drivers) driving may present an opportunity to develop and exercise their capacity to know by forming a detailed ‘image of the city’. In general, however, this might not reflect a universal phenomenon. There are two important questions to ask in this regard: 1) whether the capacity to know while driving is exercised in combination with other capacities, and 2) whether for all drivers, the act of driving provides *more* opportunities for knowing compared to active mobility. Given the analysis here, it is likely that while for some individuals (e.g. taxi drivers) driving presents an opportunity to exercise the capacity to know, in general, it presents less opportunity for drivers and passengers to exercise this capacity (compared to active mobility) because the interior of the vehicle is poorer terms of exposure to things that trigger the human capacity to know.

It also remains an open question whether the capacity to know can be developed and exercised in an AV. This depends on whether low-occupancy AV passengers will *in practice* convert travel time into activities that develop and exercise the capacity to know. Given the distractions imposed by the attention economy, as mentioned above, it may prove difficult for AV passengers to disengage from the attention economy in order to engage in activities that develop and exercise the capacity to observe, understand, and organize information in a hierarchy of abstract principles.

Capacity to create manifested in driving and riding in an AV

The capacity to create benefits from the process of flow, which is more pronounced in active travel modes. While some people might be able to solve problems (consciously and unconsciously while driving), there is nevertheless a difference in the phenomenology of the travel that affects the capacity to create. Sitting in a moving vehicle like a car or an AV does create a sense of motion, but the process of flow is not as pronounced as in the active modes, because flow requires the activation of the body, which in turn triggers the appropriate neurological processes in the brain.

Furthermore, the design and operation of the AV interior contribute to an environment that will likely inhibit the development and exercise of their human capacities. Absent regulation and policies that favour high-occupancy vehicles, the attention economy will likely design the interior in ways that encourage passengers to consume passive content. This, in turn, may result in persons spending their ride scrolling their handhelds or watching the interior screens, rather than clearing up mental space for the generation of novel ideas. Together, the combination of sedentary motion that limits the potential of creative flow, and

the distractions of the attention economy, likely decrease the potential development and exercise of the capacity to create while travelling in an AV.

Capacity for sociability manifested in sedentary mobility

In contrast to walking or cycling where persons inhabit shared spaces with others, persons in a car or an AV are shielded from outside interaction. So in order to determine whether the car offers opportunities for sociability, we need to examine the capacity for sociability when there are other passengers in the vehicle, and the capacity for sociability with persons outside the vehicle.

Social interaction in the car is facilitated when the car contains multiple passengers. The car becomes a dwelling space where friends share their news, parents hear about trouble in classrooms and car sharers live out their relationship as occupiers of a shared space. People occupying the car are engaged in things like story-telling, planning together, caring, listening, telling jokes, singing and more (Laurier and Dant 2012).

The prospects for sociability with persons outside of the vehicle may not be very promising. Driving or riding in a single-occupancy AV primarily offer solitary mobility experiences, in which social interaction with persons outside of the vehicle is limited to brief encounters through the reflective glass of a car windshield or windows. Such separation limits the contact and sensory potential of the trip (te Brömmelstroet et al. 2017).

Furthermore, an enclosed 'iron cage' creates a physical barrier between the driver and other drivers (Urry 2006), which makes it easier to treat others with less respect compared to face-to-face interactions. Another indication of the anti-sociability of road mobility is the phenomenon of 'road rage'. Road rage is highest in sprawled areas that have little or no public transport, and is lowest in areas with gridded street patterns, sidewalks, and low amounts of driving per person (Jackson 2003). Furthermore, coordination of driving requires top-down regulation and punitive incentives, leaving little room for voluntary action and trust-building that are present in walking and cycling social interactions. Finally, levels of trust and the quantity of friends that persons have are higher the lower the level of traffic where people live, whereas heavy traffic reduces levels of trust and sociability (Appleyard, Gerson, and Lintell 1981).

Possibly, the vehicle may be a site of sociability if it transforms from a space of competition to a space of sharing. Perhaps, when AV travel will replace driving, the freedom from the need to drive might make passengers less aggressive, as the underlying causes of 'road rage' will disappear. Furthermore, when persons belong to a community with a common purpose, a 'collaborative consumption' paradigm becomes possible, where shared mobility occurs within a community with long-established relationships of kinship, and sharing is primarily undertaken to benefit the community (Haerewa, Stephenson, and Hopkins 2018).

Nevertheless, there are a few reasons to be sceptical about the degree to which the AV may transform to a space of sociability. On the one hand "transit offers the potential to engage in deep conversations with "strangers" around you or observe interactions of others, getting a glimpse of social worlds they are unfamiliar with" (te Brömmelstroet et al. 2017, 7), yet on the other, if indeed the AV market will tend towards low occupancy vehicles this opportunity to engage with others will be low. Separation and the retreat to privatized spaces make it difficult for people to recognize commonalities and accept differences (Kohn 2004). A mobility paradigm that is dependent on single-occupancy AV travel is likely to make it more difficult to recognize commonalities and accept differences.

Furthermore, Fitt et al. consider the implications of single-occupancy AV travel on sociability for older adults. While AV travel may provide independence and autonomy for older adults, a single-occupancy AV paradigm might diminish connections with others in shared travel, and opportunities for social interaction could be enhanced or lost (Fitt et al. 2019). Overall, a private AV paradigm, or a corporate-owned single-occupancy AV paradigm is likely to discourage sociability.

The social public space that persons create when inside a low-occupancy vehicle is not as rich in comparison to the social public space that is created when walking or cycling. The affective and embodied experience of being co-present on the move (te Brömmelstroet et al. 2017) is more pronounced in the active modes compared to the sedentary modes, because active modes require the development and exercise of non-verbal communication, eye contact, social gestures, which are not required when driving or riding in a single-occupancy AV.

Finally, recall that objective well-being is enhanced when the human capacities are utilized in combination. The analysis so far points to the lower potential of sedentary mobility environments (the interior of the car or the AV) to trigger the use of all our senses and utilizing a combination of the capacity to know, create and be sociable. This is due both to the micro-environment where travel is occurring, which is a small, enclosed space, and relatedly, a space which inhibits kinesthetic motion, thus reducing the potential to exercise capacities by combining both mind and body.

Conclusions and directions for future research

This paper argues that active mobility modes such as walking and cycling are potentially beneficial to objective well-being, since they enable more and more diverse opportunities to develop and exercise our human capacities, compared to sedentary modes like driving and travelling in an AV. The upshot is that transportation planners and urban designers have reason to incorporate human capacity considerations, alongside other objective and subjective indicators (e.g. standard of living and satisfaction). Adding the human capacities perspective may provide crucial information for policy makers when designing mobility environments and when choosing between alternatives. One important policy implication is that it is necessary to pay attention to the creation of interesting environments, such as streetscapes that contain a visual attraction every four seconds at eye level, unnecessary clutter is removed, and lighting is designed for night-time usage (Gehl Architects 2009). Adding urban nature elements in pedestrian environments can also contribute to the creation of a sequenced visual attraction experience. Other design elements, relevant for walking environments in particular, are pleasant streetscapes, wider sidewalks and more direct crossings (Hillnhütter 2016). On a similar vein, planning and design needs to pay attention to avoiding active mobility environments that are boring or monotonous, such as sidewalks facing blank façades (Ferdman 2019b).

The discussion in the paper is for the most part conceptual, suggesting that further research is required to verify its analysis. Empirical research on objective well-being derived from travel activities could follow two directions. One direction is to look at ways in which pedestrians, cyclists, drivers and passengers *actually* develop and exercise their human capacities to know, create, achieve and be sociable while on the move. In addition, a similar analysis could examine the potential for capacity development in other mobility modes, not discussed in this paper, such as e-bikes, scooters, ride-sharing, micro-transit and high-occupancy transit.

Another direction for further research is to look at the relationship between objective well-being and transport from a social perspective. Such a perspective already exists for subjective well-being, for example in Reardon, Mahoney and Guo (2019), who apply a subjective well-being lens to transport equity. Their analysis looks at how environmental conditions affect individuals' own assessment of how they feel their life is going according to their commute modes. The objective well-being lens provides a reason to expand this type of investigation into transport and equity by asking how environmental conditions would affect the development and exercise of individuals' human capacities using different mobility modes.

Given that the mobility terrain is on the verge of disruptive changes, owing to rapid technological innovations and new operation modes (e.g. Mobility as a Service, car sharing, micro-mobility), and given that single-occupancy AV mobility is likely to decrease objective well-being, looking more closely at the relationship between objective dimensions of well-being and transportation is timely, if not urgent.

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