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It’s About Time: Linking Happiness and the Pursuit of Sustainability

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It's About Time:
Linking Happiness and the Pursuit of Sustainability

By

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Abstract

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In the United States, typical patterns of consumption have substantial, negative environmental impacts, including but not limited to greenhouse gas emissions. While consumption and affluence levels have steadily increased in the last several decades, the well-being of the average American has, by many measures, not improved concomitantly. Indeed, certain sacrifices – including of leisure time – made to support greater levels of consumption undermine quality of life. Changing patterns of time use in favor of having more discretionary time can reduce environmental harms while improving quality of life. This dissertation considers the potential for interventions based on time use to bring gains in terms of both the environment and personal well-being. I first examine the relationship between time affluence – one's available discretionary time – and well-being. I find that more time affluence is hedonically valuable, up to 14 hours of daily discretionary time, and that the average American is living in a condition of time poverty. I next ask whether increases in time affluence that are characterized by spending more time on leisure and happiness-promoting activities could affect consumption patterns. By way of investigation, I estimate the lifecycle energy and carbon intensities of 15 routine activity categories. These calculations indicate that activities have substantially different intensity values and that highly discretionary activities tend to be less consumptive than average. I finish by examining three different policies that can expand employees' control over their time. I find that there are multiple policies that can coincidently foster greater happiness and achieve environmental gains, each with its own form of change and likelihood of stimulating significant changes in behavior. The time-use lens on consumption developed by this dissertation offers a new way of pursuing the synergistic goals of environmental welfare and improved quality of life.

To Anna

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Gratitude is a low-carbon source of happiness worth making time for.

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1 Introduction

1.1 Motivation

We live on an ecologically overfull planet. Current consumption patterns are drawing down natural resources faster than they can regenerate. At the same time, the tailpipe of the global economic system produces waste faster than ecosystems are capable of absorbing and processing them. Consuming resources of the type that we do and to the degree that we are would be a measure more understandable – though perhaps not quite justifiable – if it served to create fulfilling lives and happier people. We might reasonably and purposefully trade environmental quality for personal development; indeed, we often do. However, the fundamental assumption underlying this trade, that ever greater levels of affluence and consumption lead to growth in well-being, is shaky at best. In the United States, the flush of consumption of the post-war era has not corresponded with a rise in life satisfaction. We have more wealth and purchasing options than ever before. We also work longer hours than a generation ago, feel more stress, have more health problems, and possess less of a sense of purpose in and meaning to our lives. To wit, consumption in our affluent society has eroded ecological well-being and failed to uplift us in the process.

In a developed economy such as that of the United States, consumption and personal well-being are decoupled to a greater degree than is popularly recognized. Two tasks for proponents of sustainable consumption are to illuminate the contours of the divide between consumption and well-being, and, at the point where they diverge, to help guide movement down the more satisfying and sustainable path. This work is motivated by an interest in contributing to this effort.

1.2 Goals

The purpose of the research presented in this dissertation is to explore whether time use provides a useful mechanism for approaching pro-environmental behavior change. More specifically, this research seeks an avenue for pursuing the synergistic goals of increasing environmental sustainability and personal well-being. I employ time use as a way to bridge these two areas. To pursue this purpose, I examine the following questions:

1. How does time affluence contribute to personal well-being, particularly in the form of hedonic happiness?
2. Can *time poverty* be defined quantitatively?
3. What are the energy- and carbon-intensities of routine activities in the United States?
4. Are activities associated with happiness and leisure more or less energy and carbon intense than other categories of activity?
5. Can policies designed to increase discretionary time contribute to both happiness and environmental sustainability? If so, how are these policies distinguishable from one

another in terms of the nature of environmental impacts and probabilities of successfully altering time-use behavior?

1.3 Contributions

This dissertation makes the following contributions to the sustainability literature:

1. I hone the concept of *time affluence*, which appears in various forms in work in psychology, sociology, and economics. Time affluence is commonly used as a subjective measure of experience: how much free time people *feel* like they have. The work contained in this dissertation develops an objective measure of the concept, the absolute amount of time available for people to use at their discretion. While other studies have employed such objective measures, to my knowledge none has used a minute-by-minute accounting of time as this work does. Further, while the concepts of subjective well-being and time affluence have been related in past studies, there has been no work that examines the relationship between discretionary time and affective well-being.
2. Using a fine-grained and objective measure of time affluence, I examine the idea of *time poverty*, a term that heretofore has been vaguely defined, which may be an effective way of critiquing conventional arrangements of time. I offer a definition of the time poverty line as being a threshold of time affluence below which there is a significantly greater marginal affective benefit to more discretionary time than above this threshold. Establishing this definition of time poverty allows for a first-order assessment of the time poverty rate in the United States.
3. For the average American adult, I quantify the temporal energy and carbon footprints of 15 activities categories. That is, I calculate the per-hour direct and embedded energy consumption and greenhouse gas emissions that enable the performance of various routine activities. These average intensity values are disaggregated two ways: by income quintile and by the source of lifecycle energy use/greenhouse gas emissions. This work provides both a first-of-its-kind temporal footprinting of American consumers and an initial validation of the idea that activities associated with leisure and happiness can have relatively small environmental consequences.
4. Through the analysis of three different work-related policies – flexible work arrangements, increased vacation time, and shorter workweeks – I explore the personal and environmental cases for changing the nature of American work-life time allocations. To my knowledge, no previous work has pulled together the diverse literatures that pertain to these three policies or directly compared their effects. I argue that all three policies have definite well-being advantages and potential environmental benefits, though those of the shorter workweek might be the most robust and those of more vacation time might be most contingent on behavioral response.

1.4 Dissertation Structure

Chapter 2 delivers the contextual background for the remainder of the dissertation. It provides a working definition of the oft-used term *sustainability*, along with evidence of the unsustainability of current economic activity. Options for moving toward sustainability, including behavior change at the individual level, are also reviewed. Chapter 3 examines the concept of *time affluence*, which I argue provides a framing around which strong sustainable consumption patterns can be developed. A regression analysis examining the relationship between discretionary time and well-being serves to connect time affluence to happiness. Chapter 4 combines time-use, consumer expenditure, and lifecycle analysis data to calculate the energy and carbon intensities of everyday activities. Chapter 5 reviews policy alternatives for increasing time affluence among employees, comparing and contrasting the potential environmental, social, and personal effects of three different ways to rebalance work and non-work time. Chapter 6 concludes the dissertation with a review of findings and a discussion of their value.

2 Background: Sustainability and Consumption

Achieving environmental sustainability, maintaining the integrity of the global ecosystem in which society is imbedded, is one of this century's premier challenges. Current levels of resource consumption undermine environmental integrity and, for much of the developed world, yield poor returns in terms of life satisfaction. Despite these twin faults, consumption by and large carries on unabated. Further, fundamental assumptions about the role of consumption in establishing "the good life" – most prominently that "goods are good and more are better" – are scarcely challenged.[1]

The primary thesis of this dissertation is that happiness can be an important means of targeting efforts to promote more sustainable patterns of behavior by individuals. Behavioral interventions that leverage financial incentives, social norms, and other motivators of behavior are an important complement to the adoption of environmentally friendlier technologies and economic regulation. Though such interventions can improve consumer demand for products and services perceived to be green, they do little to revise an individual's identity as a *consumer*. That is, mainstream behavioral approaches to sustainability focus on consumption efficiency (i.e., buying goods and services produced via relatively green processes) rather than sufficiency, the idea of "enough" being preferable to "too much" that is integral to sustainable consumption (Princen 2005). Making the links between consumption and happiness more direct and explicit – the aim of this work – helps illuminate patterns of behavior that fall on the better side of the enough/too much divide in terms of both people and planet. Because how people spend their time impacts both their environmental footprint and their well-being, time use serves as a bridge that connects these synergistic domains.

This chapter provides a theoretical and contextual backdrop for the remainder of the dissertation. It only spares a few glances at two of the key concepts of this work – time use and happiness – in favor of developing a clearer understanding of sustainability and the role of the individual in supporting, enhancing, and accelerating movement toward a more sustainable economy. Concepts relating to time and well-being are reviewed in the background sections of the relevant chapters that follow. This chapter begins with an overview of the concept of *sustainability*, and then reviews evidence marking the unsustainability of the status quo, particularly with regards to energy consumption and greenhouse gas emissions. It next examines the role of technological and financial innovations in addressing sustainability issues and the importance of adding a third, behavior-based tool to the sustainability toolbox. The roles of weak and strong sustainable consumption are explored before the gaps in the literature that this dissertation addresses are discussed.

[1] There are, however, various scholars and groups giving voice to heterodox views of consumption. See, for example, Princen (2005) for an explanation of *sufficiency*, Frank (1999) for a discussion of the personal and social costs of "luxury fever," and Maniates (2002) for a history of the Voluntary Simplicity Movement.

2.1 The Concept of *Sustainability*

Sustainability is a big and semi-amorphous idea. It is a concept that is frequently invoked, often used in similar, but different, ways. Cordoning off a plot of wilderness as a nature preserve is deemed an act of sustainability, while so, too, is actively managing a pine plantation for a sustained yield of wood pulp. In the context of food, sustainability might be used as a synonym for "locally sourced" or to indicate, for example, that tilapia has been less subject to overfishing than has orange roughy. Wind energy is sustainable because its power source is renewable and its carbon dioxide emissions are low. Businesses are sustainable if they can minimize some aspect of their environmental impact. In short, *sustainability* is a word with many applications and little meaning.

Despite the fact that *sustainability* does not have a fixed or universally agreed-upon meaning, the term still captures ideas that other environmental cognates generally do not. In this section, I introduce a conceptualization of *sustainability* that informs the use of the term throughout this dissertation. The model presented here is not intended to provide a razor-sharp definition of sustainability, nor a definite picture of what a sustainable world looks like. Rather, the role of this model is to establish criteria by which the sustainability *of an economy* can be judged. With these criteria established, changes within an economy can be labeled as *sustainable* with respect to whether they move the economic system toward or away from satisfying the model of sustainability.

2.1.1 Conceptual Model

In this section, I sketch a conceptual model, based in large part on Daly's (1972, 1974) idea of a steady-state economy, to illustrate some key sustainability principles and to create working definitions of important terms. Like all models, the one presented here provides a less-than-perfect rendering of reality, simplifying system components in order to more efficiently consider and effectively communicate them. In this dissertation, I use a (simplified) steady-state economy as an "unattainable goal" in order to "stimulate the creation of long-term visions and paths in order to approach/approximate [sustainability]" (Kerschner 2010).

While the focus of this dissertation is on the individual, it is more appropriate to consider sustainability at the economy-wide level. In this model, an economy is a system for the production and distribution of goods and services and the experiences they foster.[2] The core function of an economy, economic production, is the process of using energy to transform materials into something of value, specifically, something that increases welfare of agents within the economy. This value can be generated both by physical objects such as houses or knitted toys and by services and experiences, which are not themselves tangible things but do require material goods to enact, like a haircut or a river-rafting trip. Although materials can be circulated

[2] The term *economy* can be applied to a range of geographic and political scales. For this general discussion of *sustainability*, economy is best considered on a national or aggregate global scale.

within an economy, they are originally sourced from the ecosystem in which the economy is embedded.

An ecosystem is a community of interacting organisms that is linked, through nutrient cycles and energy flows, together and to the non-living components of the physical environment that the ecosystem inhabits. Framing it in terms of the economy it sustains, an ecosystem can be characterized by its biotic and abiotic resources (Daly and Farley 2004). The biotic components of an ecosystem are renewable resources (for example, trees and cows), ecosystem services (functions that have economic value; for example, water purification or pollination), and waste absorption and recycling. Abiotic resources include energy, water, and minerals.[3] An economy draws on these biotic and abiotic resources to create the capital – including skills, knowledge, and infrastructure – required for economic production. Earth, as a whole, is for most practical purposes a closed system wherein matter is recycled and through which energy – which, by and large, comes from the Sun – flows. See Figure 1 for a conceptual diagram of the relationship between economies and ecosystems.

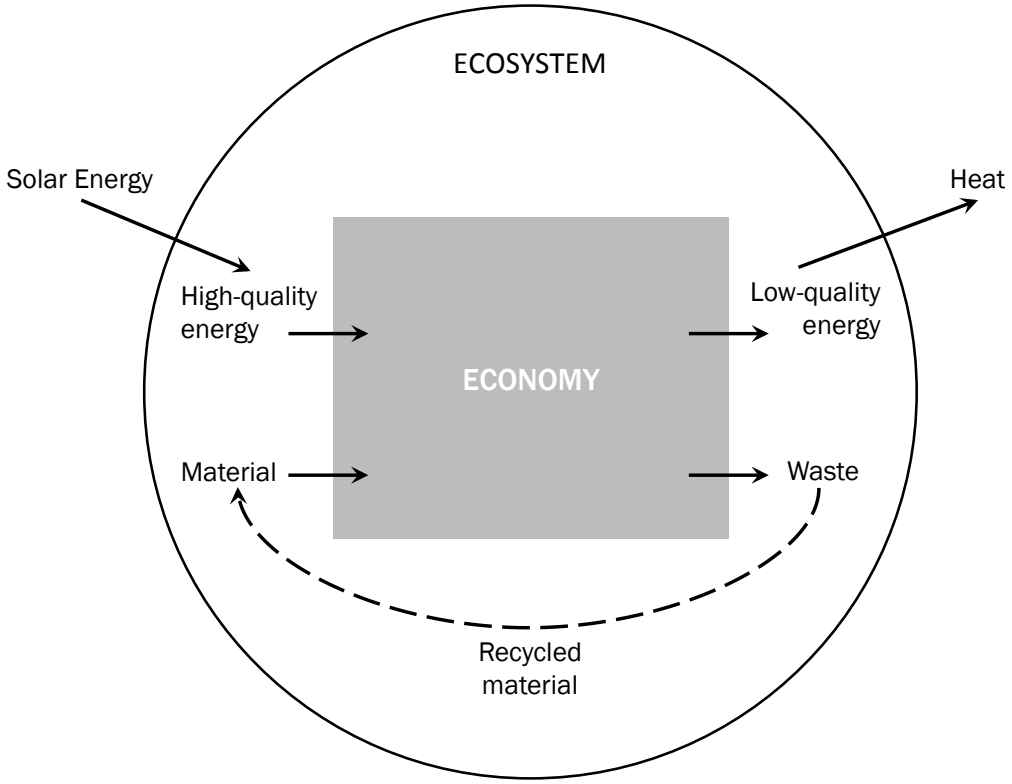

Figure 1. Conceptual map of the relationship between an economy and ecosystem.
Image based on Daly and Farley (2004).

[3] Energy resources in this representation can take the form of continuous, solar-based fluxes (e.g., sunlight, and wind), stored energy (e.g., fossil fuels and fissionable materials), and geological (e.g., geothermal, tidal).

A sustainable, steady-state economy is marked by two general characteristics. First, the economy must preserve a stock of infrastructural and human capital sufficient for maintaining a happy and healthy life for all participants in the economy. *Infrastructural capital* is the stock of buildings, equipment, and other, similar components that perform or support the work of economic production. *Human capital* is the set of skills and knowledge possessed by individuals in an economy. Combined, infrastructural and human capital can take the yield of natural capital and create goods and services that, when consumed, enhance the welfare of those within the economy. When knowledge, skilled workers, or machinery are wanting, natural resources cannot be transformed into artifacts of value, even if those natural resources exist in abundant supply. Thus, maintaining an adequate supply of human, infrastructural, and natural resources is vital.

The second characteristic of a sustainable economy is that the flow of energy and materials through it are within the regenerative and absorptive capacity of the ecosystem that supports the economy. Put another way, a sustainable economy does not undermine the conditions that support its existence. To harvest resources faster than they are naturally supplied is to deplete the stock of that resource. If this process of depletion continues long enough, then the resource stock will be eliminated and will no longer be available for the economy to draw on. Similarly, an economy invariably sheds waste in various forms, ranging from carbon dioxide to heavy metals to heat, into the surrounding ecosystem. To a degree, the ecosystem can recycle or assimilate these wastes without issue, but excess waste can overwhelm and impair the processing capacity of natural systems or degrade the capacity of natural capital to produce flows of resources.

To be sustainable, an economy cannot harvest resources faster than they are produced, nor can it dump wastes faster than nature can handle. The sustainability of a country (or planet) and its economy can be evaluated by the degree to which its operation is consistent with these principles. Various indicators can be employed to make this assessment.

2.1.2 Sustainability Indicators

Ecological footprinting is a means of quantifying and framing the magnitude of natural resource and waste flows associated with a population and its economy (Wackernagel and Rees 1997; Wackernagel and Yount 1998). In this context, the term *footprint* refers to the land area required to provide the resources used and assimilate the wastes produced by the economy under examination. When the ecological footprint is equal to or less than the physical footprint of the economy, then that economy is ecologically sustainable. That is, the economy is not demanding more of the land on which it resides than that land can provide. Conversely, when the ecological footprint exceeds the physical, the economy must be either 1) drawing resources from or exporting waste to elsewhere or 2) drawing down on the stock of natural capital within its own boundaries. While ecological footprinting at the national level has been criticized on methodological (van den Bergh and Verbruggen 1999) and conceptual grounds (Fiala 2008) grounds, as a global measure of sustainability it has utility as an indicator of resource use and waste (Ayres 2000).

The current estimate of the ecological footprint of the sum of human economic enterprise is one and a half Earths (Global Footprint Network n.d.). In other words, to sustain the current level of economic production worldwide, the planet would require more natural capital and greater waste-absorption capacity than is available on Earth. Accordingly, by the accounting of ecological footprinting, the modern global economy is decidedly unsustainable. Population and affluence have been the critical drivers of growth in the global ecological footprint in recent years (Dietz et al. 2007).

Ecological footprinting has been most rigorously criticized for its treatment of energy, including carbon dioxide emissions from fossil fuels. Energy accounts for roughly half of the footprint of advanced economies, in part because the ecological footprinting method factors in the land area that would be required for terrestrial sequestration of carbon dioxide emissions. Critics state that this approach ignores both the carbon sequestered by oceans and the potential for carbon capture and storage technology to store carbon with virtually no land use, thereby overestimating the ecological footprint of emissions (Fiala 2008; van den Bergh and Verbruggen 1999). These are reasonable concerns. However, even if the ecological footprinting method does not provide the most accurate take on the sustainability of global carbon emissions, there are numerous independent analyses that underscore the unsustainability of global greenhouse gas emissions rates.

Atmospheric concentrations of greenhouse gases have risen to levels unprecedented in the history of human civilization (Hansen et al. 2008). Carbon dioxide, a waste product associated with energy consumption, deforestation, and cement manufacturing, is being emitted from the global economy faster than it is being absorbed and recycled. Carbon dioxide levels have risen from a pre-Industrial Revolution concentration of 270 parts per million (ppm) to more than 400 ppm today (Stocker et al. 2013), a net increase of more than 250 gigatons of carbon dioxide. This fact alone highlights the unsustainability of modernity. Moreover, the climate change induced by greenhouse gas emissions will very likely erode, in a range of ways, the capacity of terrestrial ecosystems around the world to continue to function as they have historically. Global greenhouse gas emissions cuts of between 40% to 70% from 2010 levels by 2050 are needed to preserve a likely probability of holding the average amount of global temperature change to below 2 °C (Intergovernmental Panel on Climate Change 2014). Left largely unchecked, climate change-based degradation is expected to significantly worsen both human welfare and the productive capacity of natural capital (Field et al. 2014). Even absent its being a greenhouse gas, the build-up of atmospheric carbon dioxide poses a substantial threat to ecosystem health by way of ocean acidification (Stocker et al. 2013).

The greenhouse gas problem points to a second major unsustainable feature of modern economic production, namely its dependence on fossil fuels for energy. In 2012, fossil fuels accounted for 81% of total global primary energy (International Energy Agency 2014). Reliance on hydrocarbons is particularly strong in the transportation sector, where 97% of energy inputs are fossil fuel-based (International Energy Agency 2012). On the timescale of human generations, fossil fuels are a non-renewable resource, which, by definition, means that their use cannot be sustained indefinitely. Even so, fossil fuel use is growing alongside increase global

energy demand. In 2014, global energy demand reached 375 EJ and is growing at a rate of 5 EJ per year (International Energy Agency 2014). Increasingly, this demand is being met by unconventional sources (e.g., tar sands and shale gas), which tend to be more environmentally damaging to access and consume. Renewable sources of energy, including solar and wind, are also being harnessed at increasing rates. Globally, renewables-based electricity generators accounted for nearly half of new installed capacity in 2014 (IEA 2015), while in the United States the rate is approximately 33% (Energy Information Agency 2015). Even with this rapid expansion of the use of renewable energy sources, they still account for only about 1% of global total primary energy consumption (International Energy Agency 2014).

Greenhouse gas emissions and energy consumption are two outsized sustainability issues, and, accordingly, receive the most attention in this dissertation (particularly in Chapters 3 and 4). Both because of their large and direct contributions to unsustainability and because they readily connect to many other facets of sustainability, greenhouse gas emissions and energy consumption rates make reasonable first-order metrics of economic sustainability. While the socially optimal rate of greenhouse gas emissions may prove to be greater than zero, it is almost certainly less than current rates (Intergovernmental Panel on Climate Change 2014). Accordingly, a reduction in greenhouse gas emissions can be considered to be movement toward sustainability.

Similarly, the socially optimal level of energy consumption is clearly not zero, as energy is required for economic production. From a climate perspective (or otherwise), there are more and less environmentally sound means of providing energy. It is conceivable that, with intelligent deployment of clean, renewable energy technology, energy consumption at its current level could be sustainable. However, given incumbent conditions and the current rate of bringing renewable energy sources online, reductions in energy consumption should also be generally viewed as movement toward sustainability.

It would be dangerously myopic to reduce the issue of sustainability to carbon and energy, however important those issues may be. Unfortunately, several other metrics and analyses converge on the finding that Earth is an ecologically overstrained world.

Fisheries around the world are collapsing (Worm et al. 2006) and biodiversity in general is in decline (Butchart et al. 2010). Human activity has exceeded safe limits of intervention into the global nitrogen cycle and is perilously close to exceeding planetary boundaries with respect to the phosphorous cycle and ocean acidification (Rockström et al. 2009). Declines in groundwater availability and quality (Gleeson et al. 2010), continued soil erosion (Cerdan et al. 2010; Trimble and Crosson 2000), and acid precipitation (e.g., Zhang et al. 2012) are among the environmental problems operating at the local and regional scales. To wit, there is no shortage of domains in which to find patterns of consumption drawing on natural resources faster than they can regenerate or producing waste faster, than they can be absorbed by ecosystems.

The unsustainability of modern economic configurations is an increasingly well-recognized issue. Parties at various geographic and political scales have been working to address the critical

problems highlighted above and many others besides. The two types of levers that these groups are most commonly working to pull are discussed in the next section.

2.2 Conventional Levers for Pursuing a Sustainable Economy

Sustainability solutions designed to reduce the resource demands and waste production are most frequently developed in two domains: technology and finance. This section provides a review of examples – dawn primarily from climate and energy work – of how these two levers have been or may be pulled to achieve progress toward sustainability.

2.2.1 Technological Approaches to Improving Sustainability

Technological innovations can approach sustainability in multiple ways. Improvements in efficiency decrease the materials and energy required for a given amount of economic production. Technological development allows for the substitution of one economic input for another, which can potentially achieve both a reduction in the rate of drawdown of a relatively scarce raw material and improve the ecological consequences of waste production. Finally, improvements in design and manufacturing can allow for less use of raw materials and less waste at the point of manufacturing.

Technical efficiency improvements decrease the resources required to produce a given good or service. Remarkable gains in power plant efficiencies since the dawn of the electric power sector – from less than 5% thermal efficiency for single-cycle plants at the beginning of the twentieth century to 35% at century's end – substantially reduced the resource cost of a kilowatt-hour of energy (Hirsh 2002); further innovations, like combined-cycle design, have stretched the useful work extracted from energy inputs.[4] Efficiency improvements for household appliances like air conditioners and refrigerators have shaved 3% off of U.S. national electricity use since the 1970s (Geller et al. 2006). Technical efficiency measures as a climate mitigation pathway have been touted in several well-publicized studies: three of Pacala and Socolow's (2004) 15 wedges entailed efficiency improvements and numerous supply curves feature energy demand- and supply-side measures among the negative-cost options (Lutsey and Sperling 2009; McKinsey and Company 2010).

It is generally assumed that efficiency improvements reduce energy consumption and concomitant greenhouse gas emissions relative to a base case in which the improvements are not made. However, economists have long recognized that individual and economy-wide rebound effects can shrink the magnitude of net energy savings below levels forecast by engineering analysis. Rebound effects can be both direct and indirect (Sorrell and Herring 2009). Direct

[4] In recent times, however, the average thermal efficiency of the U.S. stock of power plants has shown little movement. Between 2003 and 2013, the average efficiency of nuclear power plants has remained steady at 32.7% while the fleet-wide efficiency of coal plants has declined from 33.1% to 32.6%. Single-cycle natural gas plants saw a significant improvement in average efficiency during that period, increasing from 37.1% to 42.9% (Energy Information Administration 2015).

rebound effects are a result of efficiency making per-unit-service costs less expensive, an outcome that consequently increases demand for that service. For example, improved vehicular fuel economy reduces the per-mile monetary cost of driving, which may prompt people to drive more miles or more often than they otherwise would have. Indirect rebound effects occur when financial savings realized by an efficiency measure are used to purchase other goods and services, which themselves require energy to make or deliver. An example of this would be using the reduction in heating and cooling costs associated with a new HVAC system to purchase plane tickets for a vacation. While the size of the rebound effect could conceivably be larger than the direct energy savings – an outcome termed *backfire* – a review of rebound effect estimates indicates that the typical effect size is typically well below 100% and closer to 10-30% (Gillingham et al. 2015). Consequently, even taking rebound effects into account, technological efficiency measures are expected to reduce energy consumption and greenhouse gas emissions. The size of the actual reductions (relative to the engineering analysis) depends on how people redirect their financial savings. In general, goods and services tend to be have relatively low levels of embedded carbon and energy (Erickson et al. 2012; see also Section 6 of Chapter 3), meaning that diverting dollars away from buying more energy will likely keep rebound effects on the modest side.

Like efficiency measures, technological resource substitutions can decrease the rate of consumption of a scarce or non-renewable resource. Renewable energy sources, for example, can replace fossil-based energy sources. This substitution may not curtail final energy demand but can reduce the emission of wastes associated with that demand (particularly greenhouse gases in the case of energy). Solar- and wind-based power generators have a substantial carbon mitigation potential (Kantner 2010), and biomass energy could enable a net drawdown of atmospheric carbon dioxide (Sanchez et al. 2015). Quite notably, however, the misapplication of biomass resources could lead to an increase in emissions and should be carefully evaluated as a greenhouse gas mitigation strategy (Searchinger et al. 2008). Non-energy examples of sustainable substitutions abound. For example, employing pozzolans like fly ash as substitutes for clinker could substantially reduce industrial emissions associated with cement production (Damtoft et al. 2008).

Industrial ecology design principles can also serve to decrease demand for raw materials extracted from the environment and the disposal of waste products back into the environment. Cradle-to-cradle thinking is inspired by ecosystem metabolic relationships wherein the waste product of one organism is the feedstock for another (Braungart et al. 2007). Applying this idea means shaping industrial processes and product designs so that materials circulate within an economy rather than economic production being the linear flow of extraction, production, consumption, and disposal as is common today.

One form of this design philosophy is by-product synergy, turning the waste stream of one firm into an input stream for a second firm, reducing waste and the need for raw materials (Mangan and Olivetti 2010). For example, rather than dumping recalcitrant effluent from denim manufacturing, indigo dye waste can be mixed with clay and utilized as a paint and coating pigment (Wambuguh and Chianelli 2008). Co-generation and district heating take a waste

product of electricity generation, heat, and channel it to perform useful space- and water-heating work, a system that can potentially greatly reduce carbon dioxide emissions and facilitate the penetration of renewable energy (Lund et al. 2010). Another element of the cradle-to-cradle approach is to design products so that they are readily "metabolized," either by an industrial actor or by organisms in the natural world. For example, products like computers can be designed to make end-of-life recycling easier by eliminating the use of certain toxic or recalcitrant components (Choi et al. 2004). Or, consider pharmaceutical products, which become pseudo-persistent compounds in surface and ground waters, even when used as directed (Daughton 2003). Incorporating green chemistry principles into drug designs could increase the rate of degradation of excreted compounds and ensure that this degradation results in relatively benign products.

2.2.2 Market Regulations and Reforms

As with technological approaches to sustainability, there are several categories of measures in the realm of finance and economics that can lead to improvements with respect to sustainability indicators. Standards, mandates, and bans can change the bundle of goods and services that consumers have to choose amongst, eliminating those goods and services with outsized negative environmental consequences or introducing new, more sustainable options. Changing the prices or payment options associated with market goods can also have a substantial impact on what goods are consumed in an economy and, consequently, on the substances extracted from and released into the ecosystem.

The transportation sector provides numerous examples of using standards and mandates to change the market choices that consumers can make in order to reduce resource consumption and air pollutants harmful to both the environment and public health. The U.S. Corporate Average Fuel Economy (CAFE) standards are a case in point. Enacted in 1975, CAFE standards set requirements for vehicle manufacturers in terms of the average fuel efficiency of their fleet of vehicles. While compliance with CAFE standards does not preclude the sale of low-efficiency vehicles, it does have the effect of spurring the introduction of more efficient vehicle options into the marketplace. CAFE standards led to a substantial reduction in gasoline consumption, including 45 billion gallons in the decade immediately after the first standards were set (Yee 1991). The most recent set of standards, applicable from 2017 to 2025, is forecast to save 25 billion gallons of gasoline and 190 million metric tons of carbon dioxide emissions per year between 2015 and 2030 (Karplus and Paltsev 2012).

California's Low-Carbon Fuel Standard (LCFS) further illustrates the use of technology mandates and standards for pursuing sustainability goals. Applying to on-road transportation fuels, the LCFS covers all fuel providers operating in the state, requiring each supplier to reduce the average carbon intensity of their fuels to 10% below the carbon intensity of 2010 fuels by 2020 (Yeh and Sperling 2010). In the first two years after its implementation, the LCFS decarbonized two billion gallons of gasoline, reducing greenhouse gas emissions by 1.6 million metric tons of carbon dioxide-equivalents (Yeh et al. 2013).

As with vehicles, appliance efficiency standards have had sizeable impacts on energy consumption and greenhouse gas emissions. As highlighted above, federal standards regarding the efficiency of appliances have cut energy consumption by a considerable amount. Standards can have the effect of being a *de facto* ban on certain products. For example, California's AB 1109 effectively set a minimum efficiency standard for general lighting of 25 lumens per watt (lm/W) by 2013, which is to increase to 60 lm/W by 2018 (Jackson and Papamichael 2014). As incandescent bulbs typically have an efficiency of less than 20 lm/W, AB 1109 essentially excludes those bulbs from store shelves in California.

In addition to shaping the array of available choices for products, public policy can affect the pricing of market choices of individuals and firms. Taxes, fees, and subsidies are common means for tipping the scales that economic agents use to evaluate the consumption options they face. Production and investment tax credits have been instrumental in increasing the deployment of renewable energy in the United States (Wiser and Bolinger 2014) and abroad. Property assessed clean energy (PACE) financing programs offer a novel mechanism for households to purchase energy efficiency or renewable energy upgrades for their home. Under PACE, municipal governments loan households money for clean energy upgrades, and these loans are repaid through an increase in property taxes. PACE helps to overcome two significant barriers to clean energy technology retrofitting. First, potential consumers can avoid paying a large capital cost upfront. Second, homeowners do not need to worry about moving before reaching the payback point of their investment, since the property rather than the people is responsible for the loan (Fuller et al. 2009). In recent decades, we have seen the emergence of emissions trading markets – including one for greenhouse gases in Europe and one for nitrogen oxides in the United States – set caps to provide an economic incentive to limit the production of specified pollutants.

2.2.3 Socio-technical Systems Perspective

There is no question that the diffusion of low-carbon energy technology and other innovations is essential for staving off the worst consequences of climate change and other ecological stressors. However, there are substantial institutional and economic factors that create obstacles to the adoption of clean technology. Taking a socio-technical systems perspective helps shed light on the challenges associated with sustainability solutions grounded in physical technology.

A socio-technical systems framework attempts to understand the relations of the various people, institutions, and technologies that combine to fulfill societal functions (Geels 2005).[5] A socio-technical system is the physical, social, and informational elements in a network encompassing "technology, science, regulation, user practices, markets, cultural meaning, infrastructure, production, and supply networks" (Maréchal 2010). Consider the example of transportation. The physical elements of that system include vehicles, fueling infrastructure, and a network of roads and highways. The social elements of the transportation system include regulations, policies, and the cultural and symbolic meaning of cars. This last social component can shape user preferences and affect which parts of the system's physical infrastructure are built and used.

[5] Examples of societal functions include sewage management and the transportation of goods and people (Geels and Kemp 2007).

For example, when personal vehicles represent "freedom" or "high-status," then this meaning encourages building cars and roads rather than buses and rail tracks. Information on matters like the costs of different mode choices or the time expenditures associated with different travel routes make up the third major element of the transportation socio-technical system.

A core insight from the socio-technical systems framework is that elements within the system form in a co-evolutionary process, with each piece shaping and in turn being shaped by the other elements (Maréchal 2009). The exact contouring of a particular socio-technical system is path-dependent (Arthur 1989), with positive feedbacks among elements in the system contributing to the interlocking and mutual reinforcement of all system elements (Maréchal 2009). Debate exists as to which types of elements play a more dominant role in shaping the system in which they reside. Technological determinists hold the view that technical forces are what create socio-cultural changes, while a social constructivist perspective posits that social and cultural factors are what shape technological change (Hughes 1994). Hughes's concept of *technological momentum* reconciles these conflicting theories. He argues that the relative influence of social and technical factors is time-dependent: cultural forces assert great influence during the initial adoption phase of a technology, but ultimately adapt to the presence of the newly introduced technology. For example, as historian David Nye observed, "American commitment to the automobile rather than to electric streetcars and subways has resulted in such massive infrastructure investments that it would be difficult to reverse in most cities" (Nye 1999). This pattern can be observed in other historical case studies, including those of the introduction of the telephone and electricity to rural America (Kline 2003; Nye 1990).

Regardless of the particulars of the pathway, incumbent socio-technical systems tend to be conservative in nature, or "locked-in" (Marechal and Lazaric 2010). That is, the interdependence and mutual reinforcement of elements within a system resists changes to specific elements of the system. Unruh (2000) provides a framework for understanding the durability of socio-technical systems in both the electric-power and transportation sectors. Regarding electric power networks, he writes:

> [G]overnment incentive or approval allows investment in new generation capacity, which expands the scale of the technological system. As the system expands, increasing returns mechanisms drive down costs and increase the reliability and accessibility of the system. The increased availability of cheap electricity tends to encourage increased consumption as more customers become connected and acculturated to the system, and innovators in secondary industries invest new applications and end-use technologies. In response to this induced demand, the government regulators build or approve the construction of more capacity to meet expanding needs, feeding a new growth cycle. As this feedback cycle continues, and the scale of the system increases, the technological and institutional forces of lock-in solidify.

The major energy systems in the United States can be characterized by carbon lock-in, a state consisting of the persistence and propagation of fossil fuel-based energy systems. Because these

systems are fossil fuel-based, they drive unsustainable rates of greenhouse gas emission. And because these systems are locked-in, reducing emissions from these systems is an uphill battle.

Geels and Kemp (2007) provide a typology for describing the ways by which socio-technical systems undergo change. With *reproduction*, the major elements of the socio-technical system remain in place, but incremental innovations can occur, for example, adding cup holders to cars. *Transformation* occurs when the external landscape exerts pressure on the system to change direction, for example, CAFE standards mandating improvements in fuel efficiency. A *transition* is a discontinuity in the trajectory of a socio-technical system that entails wholesale changes in technologies, infrastructures, regulations, cultural practices, and other system elements. In transportation, this is exemplified by the transition from horse-drawn carriages to automobiles. In a transition, pressures from the landscape are insolvable by mere adjustments to the existing socio-technical system, opening the door for new, niche-level innovations to replace the existing regime. (One such pressure would be the exhaustion of economically recoverable petroleum, a resource that allows for the dominance of liquid fuel-based personal vehicles.) *Strategic niche management*, the creation and protection of space for new technologies to be tested and developed, is a potentially important tool for fostering transitions to more sustainable socio-technical systems (Nill and Kemp 2009). Though niches are generally thought of in terms of physical technologies, the concept should be equally valid for social technologies (Seyfang and Haxeltine 2010).

Socio-technical systems lock-in means that there are systemic factors that create difficulties for altering the trajectory of incumbent techno-institutional complexes, even if technology alternatives are superior in terms of both financial and environmental indicators. Unruh (2000) argues that a triggering or focusing event will be required to escape the equilibrium of carbon lock-in, though there is evidence suggesting that the U.S. electricity industry is breaking away even in the absence of a precipitating event (Carley 2011).

2.2.4 Beyond Technology and Finance

Technological and economic approaches to forming a more sustainable economy are critical. With good reason, the concept of sustainable consumption first conjures images of cleaner modes of production (e.g., solar panels instead of coal power plants) and increases in material and energy efficiency (e.g., LEDs instead of incandescent or compact fluorescent light bulbs). However, for all the potential that technology- and market-based strategies possess to foster sustainability, to make progress toward a regime of sustainable consumption requires efforts to reduce levels of materials, energy, and water consumption by individuals (Jackson 2005; Lorek and Fuchs 2013; Maniates 2009).

Socio-technical systems theory indicates that new technologies must contend with economic, technical, and institutional barriers to replacing incumbent systems of provisioning. Market and policy approaches to sustainability also face challenges and delays in implementation (Dietz et al. 2009), particularly when they cover large political or economic terrain. Further, while technology can alter the environmental implications of acts of consumption (e.g., how much carbon dioxide

will be released by flicking on the lights) and financial levers can shape the consumption landscape, neither lever speaks to the crux of the sustainability problem: individual consumption behavior (Liverani 2009). Climate change and other indicators of the unsustainability of modernity are the product of countless daily acts of consumption. There has been increasing interest in engaging consumers directly, attempting to shape their beliefs, attitudes, and, ultimately, their behaviors. Such an approach has several advantages, notably including rapidity of execution. In several domains, consumers can enact changes on relatively short time scales. Significantly, such changes do not require the contentious wrangling associated with pulling technology and finance levers by centralized authorities. The next section explores the contours of this behavioral approach to pursuing sustainability.

2.3 The Third Lever: Behavior Change

Programs to change environmentally relevant behaviors and beliefs – broadly known as behavior-change interventions – implicitly or explicitly rely on a range of theories and behavioral phenomena. Interventions apply insights from behavioral sciences like psychology, economics, and sociology to find leverage points that can pivot people's actions to a more sustainable direction. Interventions work within existing infrastructures and policies; they focus on getting people to ride the bus rather than, say, adding new bus lines. Though interventions have been designed to promote pro-environmental behavior in a range of domains, the best-developed literature is centered on the topics of energy and climate change behavior. Accordingly, the majority of examples that follow highlight efforts in those domains.

2.3.1 Models and Theories Related to Environmental Behavior

The starting point for many conversations about environmental behavior is the rational choice model borne of classical economic theory. This model posits that individuals make consumption decisions by weighing the costs and benefits of competing alternatives, ultimately selecting the option that maximizes their expected gain. Underpinning this model are several assumptions. First, rational choice assumes that decisions are a product of cognitive deliberation. Second, self-interest (utility maximization) is seen as the primary motivation for these deliberations. Finally, preferences for different outcomes are fixed, context-independent, and absolute. Given perfect information, the rational actor will always choose the action or objects that lead to the most personally pleasing outcome.[6]

[6] Beinhocker (2006: 116) provides a delightful portrayal of the traditional economics' rational actor at the grocery store: "You have well-defined preferences for tomatoes compared with everything else you could possibly buy in the world, including bread, milk, and a vacation in Spain. Furthermore, you have well-defined preferences for everything you could possibly buy in the future, and since the future is uncertain, you have assigned probabilities to those potential purchases…. To calculate [a] budget you must have fully formed expectations of your future earnings over your entire lifetime and have optimized your current budget on the basis of that knowledge…. While standing there, staring at those nice, red tomatoes, you then feed all this information into your mind and perform a cunning and incredibly complex optimization calculation…." This he contrasts with inductive rationality: "'Hmmm… tomatoes. They look nice and fresh. I kinda feel like salad tonight. Price looks okay.'"

Though the assumptions of the rational actor model make it mathematically tractable, most of these assumptions break down under scrutiny. Indeed, it may only be "lower" animals that behave in a manner consistent with the rational model (Gowdy 2008). Decision-making is often preceded by, or at least heavily influenced by emotion and self-perception (Dunning 2007; Haidt 2001). Social influence and other contextual factors have the capacity to shift preferences, or at least act contrary to the transitive property of the rational actor model (Tversky 1969). Moral considerations can sometimes trump cost-benefit analyses. Habits and other forms of automaticity prompt behaviors, even those that run contrary to conscious intention, see Chapter 4. The sum of these deficiencies weigh heavily against rational choice as a fitting and functional conceptualization of human behavior. Several other prominent models from psychology, however, do incorporate these factors into their conception of behavior.

The Theory of Planned Behavior, a widely used model of behavior is, like the rational choice model, an expected-value theory (Ajzen 1991). The Theory of Planned Behavior states that intention is the immediate precursor of action, and that intentions are formed based on a weighting of three beliefs: about the behavior, about social norms relating to the behavior, and about one's own ability to perform an action. Behavioral belief is a rational cost-benefit analysis of alternative options, in essence identical to the rational choice model. Under the Theory of Planned Behavior, the expectations of referent others (i.e., the subjective norm) have an influence on intention formation, and, in this way, the theory departs from the rational actor model. While not a theory of environmental behavior per se, it has frequently been applied to environmental issues, most commonly in transportation models (Bamberg et al. 2003; Heath and Gifford 2002). Like the rational choice model, the Theory of Planned Behavior suggests that providing information and changing prices are key methods for changing behavior.

One of the deficits of the rational choice model and the Theory of Planned Behavior is that they overlook, or are at least not explicit about, the role of morality and altruism in guiding behavior. Morals and values are particularly relevant in the domain of environmental behavior, as selecting the pro-environmental choice is frequently at odds with a personal cost-benefit analysis. The Normal Activation Model (Schwartz 1977) states that personal norms – elements of one's internal value system – are the basis of pro-social behavior. Personal norms are developed from both understanding the consequences of one's actions and accepting personal responsibility for those consequences. According to the Norm Activation Model, bolstering the strength of these two antecedents of personal norms can foster pro-environmental behavior. For example, better informing people about the climate consequences of driving will lead them to reduce their use of personal vehicles. Though the Norm Activation Model has recorded some success in explaining various energy-related behaviors and intentions (Abrahamse et al. 2009; Black et al. 1985), it poorly accounts for social and institutional external factors, which frequently affect environmental behavior (de Groot and Steg 2010).

The role of personal norms in influencing behavior was specifically connected to the environment with the development of Value Belief Norm theory (Stern 2000). This theory, much like the Norm Activation Model, sees awareness of environmental consequences as an

antecedent of pro-environmental behavior. Such awareness is connected with holding biospheric and altruistic values and is negatively correlated with egoism. The Value Belief Norm theory holds that being aware of environmental consequences generates feelings of responsibility for those consequences, which in turn fosters the personal norm of pro-environmental behavior in one's public and private lives. Both the Value Belief Norm theory and Norm Activation Model have respectable explanatory power for low-cost pro-environmental behaviors, but values-based models falter with predicting high-cost actions (Bamberg and Schmidt 2003).

Triandis's (1979) Theory of Interpersonal Behavior provides one of the best models for addressing concepts that are absent from the rational choice model. In this model, intentions and habits, as moderated by contextual factors, both contribute to the selection of behaviors, see Figure 2. Though certain assumptions do not fit with current understanding of individual phenomena,[7] Triandis's conceptualization of behavior does capture many elements that in various ways prompt and influence our actions. The Theory of Interpersonal Behavior has not been widely referenced with regards to the environment or other domains, but its comprehensive view of behavior makes it valuable as a catalogue of elements when considering the origins of actions.

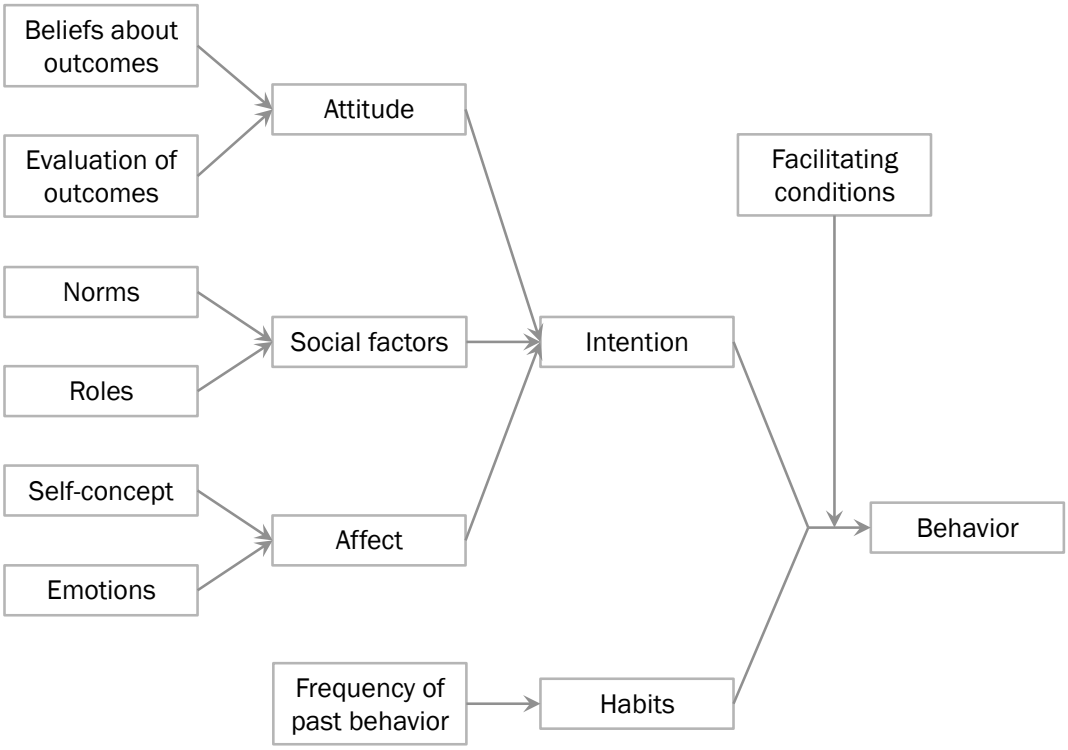

Figure 2. Triandis's Theory of Interpersonal Behavior.
This model provides one of the most complete heuristic mappings of the internal and external factors that shape behavior.

[7] For example, habits are not considered to be merely a matter of frequently repeating behaviors (Verplanken 2006), and emotions affect decisions outside of conscious awareness (Haidt 2001).

2.3.2 Behavior-change Interventions

Recent energy and climate change behavioral intervention designs have taken many forms. They have targeted many different types of energy- and climate-relevant actions, from temperature settings on washing machines (McCalley 2006) to public transit use (Cooper 2007). Similarly diverse are the leverage points on which interventions attempt to tug. Like the theories of behavior on which they are often based, interventions focus on many different factors that shape behavior, including economic incentives, information, and social norms. Broader pro-environmental interventions are designed to achieve one or both of two goals: increasing motivation to perform a behavior and lowering barriers to changing that behavior (McKenzie-Mohr 2013).

Financial incentives are used both as a motivator for sustainable behavior and as a barrier-reducer. Financial incentives can take the form of monetary rewards (i.e., a prize for achieving a predetermined task) or simply frame the benefits of adopting a behavior in terms of the financial savings that will be realized through adopting the behavior. These appeals, which draw directly from a rational-choice model of behavior, can successfully change behavior, but typically for short periods of time only (Abrahamse et al. 2005). A central criticism of financially based interventions is that they place the locus of motivation extrinsic to the individual. That is, the monetary reward becomes the reason to change behavior rather than other personal or altruistic causes (Steg and Vlek 2009). When the monetary reward is removed or no longer salient, then the motivation to persist with the changed behavior is significantly reduced. Interestingly, while financial motives can crowd out civic ones, the financial quantification of one's contributions to civic interests can be a motivator of pro-environmental behavior (Frey 1997).

Many early attempts to affect energy- and climate-related behaviors relied on an information-deficit theory of change. This model assumes that if people were to "know the facts," they would act differently. President Carter's 1977 televised address to the nation urging Americans to turn down their thermostat is one notable example. Carter's message did not have significant effect on thermostat settings (Luyben 1982), a result typical of such information-based campaigns. Information about energy consumption and climate change can increase concern about the issue, but concern does not necessarily translate into action (Kellstedt et al. 2008; Shome and Marx 2009).

As a means for building motivation to change behaviors, social norms[8] have become an increasingly common foundation for interventions. Norms have been called "conduits of influence" (Lapinski and Rimal 2005), that is, ways to gather information about how to behave

[8] There is a range of meanings associated with the term "norm," and as such any discussion of the use and usefulness of "social norms" should be careful in defining the particular type(s) of norms under consideration (Kallgren et al. 2000). Most interventions focus on two elements in the set of norms: descriptive and injunctive norms. Descriptive norms are those that speak to what people believe is commonly done in a given situation (i.e., they are the "is" norm). Injunctive norms, on the other hand, describe what behaviors are approved or disapproved of (the "ought" norm).

in ambiguous situations. As such, in situations that are without precedent for an individual or of heightened ambiguity, the influence of norms is particularly strong. Energy usage, particularly electricity consumption, is often obscured from view, both for the consumer and, especially, to outside observers. Consequently, providing normative information about energy use can clear this obscurity and pull energy consumption to more "normal," or average, levels. Interventions based on social comparisons typically produce reductions in energy use of 2-5% while the intervention is active (McKanna and DeShazo 2014). Because studies of such interventions typically measure whole-house energy or electricity consumption, it is difficult to assess how households are achieving energy reductions. Some relatively high-resolution data suggest that the reductions are a product of conservation behaviors (e.g., turning off lights) rather than investments in durable efficiency equipment, like LED light bulbs (Ayres et al. 2012). (This supposition is consistent with other work finding that Americans tend to view curtailment measures as more effective for reducing energy consumption than efficiency measures (Attari et al. 2010).) Consequently, the persistence of social normative effects post-intervention is questionable and not very well documented.

Numerous other invention techniques are deployed to address the twin issues of behavioral motivation and barriers to action. To increase motivation to undertake a given behavior, practitioners have used public commitments (Lokhorst et al. 2009, 2011; Shippee and Gregory 1982) and goal-setting (Abrahamse et al. 2007; McCalley and Midden 2002) to positive effect. Prompts (Bekker et al. 2010; Sussman and Gifford 2012) and behavior-information feedback (Fischer 2008; Hargreaves et al. 2010; Maan et al. 2010) are used to lower barriers to taking action.

Whether targeting energy use, greenhouse gas emissions, or other environmentally relevant categories, interventions make valuable contributions toward the goal of sustainability. In the domain of carbon emissions, a behavioral wedge – a set of actions designed to reduce carbon emissions – consisting of 17 household actions could realistically abate 450 million metric tons of carbon dioxide annually (Dietz et al. 2009). Similar magnitudes of impact are conceivable in areas like waste reduction and water conservation. Pursuit of research in this area is valuable; the behavioral sciences can contribute much to making pro-environmental behavior as frictionless as may be.

However efficacious these interventions may be in terms of changing behavior, they by and large foster weak sustainable consumption improvements (Lorek and Fuchs 2013). That is, they focus on consuming green products and on using resources more efficiently, as opposed to a strong focus on appropriate levels of consumption (i.e., sufficiency). Behavioral interventions leave unchallenged fundamental assumptions and norms around behavior. Instead, they work within those assumptions and norms, much like they work within existing infrastructure and laws. To borrow from socio-technical systems terminology, behavioral interventions mostly foster a *reproduction* of current consumption patterns, while sustainability likely requires *transformations* across a number of domains (Seyfang 2009).

Intervention efforts can serve to buy time for the slower deployment of technologies and policies, but they are unlikely to be up to the task of doing more than delaying the serious consequences of unsustainability. Buying time is valuable. However, a second, strong perspective on consumption acts as a hedge against a slow or incomplete technical solution to sustainability problems. Strong sustainable consumption "emphasizes social innovation as a starting point and strategically takes a technologically pessimistic position" (Lorek and Fuchs 2013). Developing this perspective, and the role of individual behavior change within it, requires understanding consumption and its drivers. Further, emphasizing sufficiency, a sense that "enough" is preferable to "too much," serves to address the question affluence, a key driver of ecological footprints (Dietz et al. 2007).

2.3.3 Defining Consumption

Consumption and production are opposite sides of the same coin. But while the concept of production is fairly straightforward, defining consumption is a somewhat hazier enterprise. *Consumption* is an "elusive" term (Wilk 2004), used in many ways in folk and academic discourses. Unlike *sustainability*, where a fairly precise definition of the term is attainable and where the multiplicity of definitions in use creates confusion, the various uses of *consumption* illustrates that the topic has a large jurisdiction. Consider the following acts of consumption:

- A driver consuming gasoline,
- A kid consuming an ice cream cone,
- A reader consuming information on a website, and
- A theater patron consuming a performance of *No Man's Land*.

The term *consumption* applies equally well in each instance, but the nature of these acts are clearly different. In the motorist's use of gasoline, we see consumption as an entropic process: useful energy is extracted and waste in the forms of heat and carbon dioxide is rejected. The same broad description applies to eating an ice cream cone, though in this instance the useful energy is used to meet physiological needs rather than satisfy economic preferences. Consumption in both cases means altering matter and energy in a way that reduces their value to other people. By contrast, neither reading nor watching a play is primarily a process of degradation; the information and the performers remain the same afterwards. Further, neither are they rivalrous experiences since the play can be enjoyed and the website can be accessed by many.[9] What differentiates the play and the website is that the play is an experience that can never be repeated in the exact same way, while the website is an information resource that can be returned to in the future.[10]

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[9] Not all experiences are non-rivalrous; private experiences like intimate relations typically preclude others from simultaneously experiencing them. Similarly, experiences can also be excludable – it requires a ticket purchase to attend the theater – or non-excludable, like walking in a public park.

[10] As a general category, experiences present a particularly interesting conceptual challenge in terms of defining *consumption*. If an experience is "something that one lives through," then applying the idea of *consumption* to experiences would seem to make *consumption* synonymous with *living* or *spending time*. However, as there are many types of experiences, each with separate environmental and personal implications,

Consumption does not occur exclusively at the point of the individual. Rather, it is in "a stream of choices and decisions winding its way through the various stages of extraction, manufacture, and final use, embedded at every step in social relations of power and authority" (Princen et al. 2002). The environmental impacts of consumption are difficult to pin to a particular stage, though lifecycle analysis can help with this. In this work, I consider consumption as the purchase or use of goods and services by individuals, since it is the individual whose behavior I am interested in understanding.

2.3.4 Roles of Consumption for Individuals

Trying to change patterns of consumption to better align them with the goal of environmental sustainability requires a degree of appreciation of the multiple roles that acts of consumption play in the lives of individuals. While consumption can be considered a functional act, a fulfillment of needs, it is also linked to less tangible concepts like status, symbolism, and identity. Each of these elements merits consideration when aiming to motivate changes in consumption, as they can provide both inertia and levers for change.

Consumption can be viewed as a utilitarian means of satisfying needs and wants. Eating food keeps me from starving, a roof over my head preserves my health, a car lets me cover distances faster than I would have other been able to cover, and an hour's rental of a paddleboat is fun. This functional view of consumption is a cornerstone of microeconomic theory and lends itself to promoting a cycle of perpetual consumption, as there will always be new and better ways of satisfying my tastes (Jackson, 2005). However, this conventional view of consumption overlooks many other reasons why people consume.

The goods that people consume hold more than utilitarian value. Evolutionary psychology and other fields that look for the primal roots of human behavior promote the idea that consumption of resources is an evolutionary adaptation. The theory goes that, particularly for males, displaying access to resources and the security they provide was an advantage in competition for mates. Accordingly, like peacocks and their ornate plumage, humans over successive generations were bred with an association between ostentatious displays of wealth and reproductive success (Sundie et al. 2011). The modern result of this selective pressure, according to this idea, is an innate pressure to buy things, such as sports cars and designer apparel, so as to impress potential mates. This theory is consonant with the frequent use of sexual imagery in advertising. That a drive to consume extensively is hardwired into humans at the genetic level by evolutionary selective pressures indicates that the task of curbing consumerism is a formidable challenge.

In a related vein, consumption can also serve to define and maintain social class distinctions. Thorstein Veblen (1898/2007) was one of the earliest notable articulators of the idea of

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there is value to the consumption literature in distinguishing different experiences from each other. Jalas's (2002) time-use lens on consumption provides one method for linking the intangible nature of experiences with the material and energy resources that enable such uses of time. (See Section 4.2.1.)

conspicuous consumption, the acquisition of goods and services, particularly luxuries, in order to display economic power. A study by Griskevicius et al. (2010) examined the motivations for purchasing "green" products, hypothesizing that buying more environmentally benign products is, consistent with costly signaling theory, a means of acquiring status through competitive altruism. They find that activating status motives tends to increase the desirability of green versions of products relative to their conventional form, especially when the price of the green good was greater than that of the equivalent non-green good. Displaying luxury can be a successful strategy for reaping social benefits. For example, status display in the form of brand-label clothing promotes more favorable treatment in social interactions (Nelissen and Meijers 2011).

Related to, but also separate from, the social hierarchy aspect of consumption is the concept that possessions are also a means of establishing and communicating a sense of identity. Evidence for the idea of possessions being integral to identity is drawn from a range of sources, ranging from self-perception research in psychology to anthropological observations of ritualistic treatment of objects after death (Belk 1988). The valence of possessions acting as identity-builders is debatable. On the one hand, being able to construct one's own identity, regardless the raw material, is usually preferable to an external derivation of identity. In a modern, consumer society, where consumption opportunities are plentiful, people have access to the means to hone their sense of self to an unprecedented degree of precision. On the other hand, when people rely on possessions to inform their self-identity, they are vulnerable to manipulation and predation by commercial interests that are keen to profit from consumers rebranding or upgrading their personas. Because the symbolic value of goods is in large part culturally derived, there is the potential to nudge the meaning of various acts on consumption so as to promote more sustainable forms of consumption.

2.4 Summary and Conclusions

Sustainability, as the term will be used in this dissertation, means living within the limits of the ecosystem that supports our species and its economies. These limits are defined with respect to the rates at which natural resources are produced and economic wastes can be recycled. Globally, economic activity is drawing on resources and producing wastes well beyond the capacity of ecosystems to sustain current consumption rates, a fact particularly evident in the domains of energy use and greenhouse gas emissions. While technological advances have been making essential strides towards decreasing energy consumption and greenhouse gas emissions, innovation and the economic policies that support it do not directly address consumer behavior, the root of unsustainability. Most behavioral interventions aim to induce more efficient consumption decisions. However, achieving *sustainable consumption* requires rethinking the patterns and levels of consumption. This rethinking must be informed by an understanding of what motivates consumption by individuals.

One of the most important general motivators of consumption is the conventional conception that "goods are good and more are better." That is, that increased levels of consumption provide for a more comfortable and satisfying lifestyle. So long as this is a truth universally

acknowledged, efforts to ground patterns of consumption in the idea of sufficiency face an extremely steep and uphill battle. A key front for sustainable consumption research concerns how to craft messages that challenge consumer's received wisdom of what consumption, as it is currently practiced, contributes to their lives.

The chapters that follow explore how happiness and time use can serve to confront consumption. Chapter 3 investigates time affluence, an analog of the standard idea of affluence, which has potential to de-materialize how people assess their quality of life. In Chapter 4, I calculate the energy and carbon footprints of different uses of time to examine whether lifestyles wherein work time is less centralized could be consistent with movement toward sustainability. The merits and challenges associated with rebalancing the relationship between work and leisure forms the core of Chapter 5.

3 Reconsidering Affluence: Time and Money as the Basis of Hedonic Well-being

3.1 Introduction

Though sustainability may best be evaluated at the national or economy-wide level, progress toward sustainability is in part dependent on strong sustainable consumption patterns at the individual level (Section 0). Reducing the flow of materials and energy through the economy requires questioning current, hyper-sufficient levels of personal consumption (Lorek and Fuchs 2013). Such questioning, particularly when answered by calls for voluntary reductions in consumption, can evoke unwelcome ideas of sacrifice and denial of self-interest. Popular conception has it that any reduction in material goods consumption must lead to a decline in quality of life. In other words, all else being equal, one is better off having more rather than less, and one is necessarily worse off having less rather than more. Financial correlates of consumption, including income at the household level and gross domestic product (GDP) at the national, are closely monitored measures of progress, and suggestions of retrenchment are, accordingly, understood as a loss of welfare. Because environmental or moral appeals do little to motivate a significant reduction in consumption for any but those who strongly and intrinsically identify with environmentalism (Bowerman 2014; Brown and Vergragt n.d.; Davis et al. 2011), another type of framing is required to countervail the normative assumptions that goad ever greater levels of consumption.

An emerging body of evidence suggests that spare or leisure time may be an important correlate of quality of life, more predictive of life satisfaction than GDP per capita or household income values. On this account, concepts like *time affluence* and *time poverty* have begun circulating to capture the relationship between time and well-being and to challenge the hegemony of money-based metrics of quality of life. The academic literature, however, lacks a precise definition of these fledgling terms, let alone a standard means of measuring each concept (Kalenkoski et al. 2011; Kasser and Sheldon 2009). Wanting for these anchors, it is difficult to build a compelling narrative about the relationships amongst time, money, and quality of life, particularly one articulating the potential of scaling back on consumption to yield more free time and, thereby, more well-being. The aim of this chapter is to hone the concepts of *time affluence* and *time poverty* so that they might be more intelligently wielded in discussions concerning sustainable consumption.

Past research has looked at how the quantity of spare time one has – that is, time that can be spent discretionarily – contributes to overall evaluations of life satisfaction. The relationship between spare time and one's experienced, moment-by-moment affective state has been largely neglected. One objective of the present study is to examine the relationship between a person's amount of discretionary time and their moment-to-moment affective experience, or experienced hedonic well-being (EHWB). I hypothesize that *time affluence* – a term I use to describe the amount of discretionary time one has – is a significant, positive correlate of time-weighted affective condition. This study examines the contributions of both material affluence and time

affluence to well-being, employing an affective measure of happiness, EHWB, rather than the more commonly utilized global assessment of life satisfaction. Because global measures of well-being have been related to time affluence in previous studies (Kasser and Brown 2003; Kasser and Sheldon 2009), I use EHWB as this study's dependent variable to contribute depth to our understanding of how time affluence influences various qualities of happiness.

A second objective of this work is to examine the accuracy of the linear model of the relationship between time affluence and well-being (Kasser and Sheldon 2009; Manolis and Roberts 2012). Of particular interest is whether there exists some minimum amount of free time below which people experience a significant drop-off in well-being, a pattern observed consistently with material affluence data. Doing so requires refining the concept of *time poverty* as it relates to EHWB, looking for indications of an objective threshold of discretionary time below which an individual might be considered time poor, that is to say, significantly impaired in terms of well-being on account of not having enough time at their disposal. A threshold can be defined as a quantitative limit above which there is a significant change in a phenomenon. Here, I use the term *time poverty threshold* to indicate an amount of discretionary time above and below which there is a significantly different relationship between time affluence and well-being. Qualitatively, one might say the threshold is the point at which there is a substantial change in the slope (derivative) of EHWB as a function of discretionary time. While it may not be useful or feasible to pinpoint an exact time poverty threshold, it may yet be informative to theorize about its location relative to the average real endowment of time affluence in the population.

The remainder of this chapter is divided into four sections. Section 2 provides the theoretical underpinnings of this work. Specifically, it reviews what is known about the relationship between money and happiness, how well-being is understood and measured, and how time affluence and time poverty have been treated in the literature. Section 3 reviews the sources of data and means of analysis used to approach questions of time affluence and poverty, while Section 4 shows the results of my analyses. To conclude, Section 5 situates the results in the context of the broader literature and returns to the idea of using *time affluence* as a policy frame.

3.2 Background

3.2.1 Global Versus Experiential Measures of Well-being

There is no standard definition of *well-being*, much less a universal metric for measuring relative or absolute levels of well-being. In a recent survey of the contemporary body of well-being literature, Kashdan et al. (2008) observe pervasive conceptual disaggregation of well-being into two forms of happiness: eudaimonic and hedonic. *Eudaimonic happiness* generally refers to living life in a personally meaningful way and fully realizing one's skills and potential, while *hedonic happiness* comprehends the presence of positive affect, the absence of negative affect, and an overall satisfaction with life (Ryan and Deci 2001). While connected, life satisfaction and affective condition are separable constructs within the larger domain of hedonic happiness (Pavot and Diener 1993). EHWB assesses the first two of these three elements of hedonic happiness, while the construct of subjective well-being (SWB) covers the third. Though some

scholars argue that these two forms of happiness should be integrated for a holistic treatment of well-being (Huta 2013; Kashdan et al. 2008), this study focuses on the hedonic facets of well-being on account of their being the more salient to public policy discourse.

There have been a variety of instruments developed to measure hedonic happiness. Almost all instruments rely on the basic assumption that individuals are capable of accurately assessing and reporting their own level of well-being. Many focus on overall satisfaction with life (i.e., subjective well-being) in preference to gauging shorter-term affective dynamics. One of the longest-used means of measuring happiness is found in the U.S. General Social Survey (GSS), which asks "Taking things all together, how would you say you are these days – would you say that you are very happy, pretty happy, or not too happy?" Diener et al. (1985) developed another frequently-used metric, the five-item Satisfaction With Life Scale (SWLS), which has been used as the measure of well-being in a variety of studies (Proyer et al. 2013; Sheldon et al. 2010) and cross-cultural analyses (Kim and Hatfield 2004; Oishi et al. 1999). The approaches employed by both the U.S. GSS and the SWLS to survey well-being can be labeled *global measures* of SWB in that they ask respondents to give a single-point estimate that generalizes their overall evaluation of how they feel about their life. In this way, such global measures of SWB assess a person's cognitive judgment of how their life compares to an internally defined standard or ideal (Diener, et al. 1985). While these measures implicitly ask respondents to ignore or overcome the effects of localized events – for example, to let their answer not be influenced by a flat tire earlier in the day – they are notoriously susceptible to the influence of moods and recent experiences (Haidt 2001; Schwarz and Clore 1983).

Another approach to measuring hedonic happiness is to assess an individual's affective states over a given period of time. In this approach, happiness is gauged not by an overall or holistic cognitive evaluation of the state of one's life but rather as the sum of experiences had on a continuous basis. In other words, while SWB measures a person's evaluative thoughts about their life, affect instruments assess the frequency and intensity of pleasant and unpleasant experiences (Kahneman and Deaton 2010). Conceivably, when a fully rational person gives a global evaluation of their well-being, they might be performing just such an integration of a long series of lived experiences. However, a person's evaluation of an event is often substantially biased by how they felt at the end of the event and at the point during the event of strongest emotion (Ariely and Loewenstein 2000; Kahneman et al. 1993). Consequently, global measures of SWB are typically unevenly weighted by certain types of events. Assaying a person's lived experience in something approximating real time might serve to reduce this bias and give a better sense of what it is to walk in their shoes, that is, how hedonically satisfying or unsatisfying one finds their lived experience.

Measurement instruments for the affective elements of hedonic happiness that have been developed recently are designed to measure well-being at a set of discrete points in time, looking for fine-scale influences on happiness. For example, Kahneman and Krueger's (2006) U-Index tracks and compiles information about a number of positively and negatively valenced emotional states – for example, "friendly" and "frustrated" – throughout the day, calculating the frequency with which negative emotional states are the most strongly felt.

Much of the work examining the relationship between hedonic well-being and various socio-economic factors have relied on measures of subjective well-being (Diener and Seligman 2004; Dolan et al. 2008; Easterlin 1995; Mochon et al. 2008), and there is a relatively scant research using the affective components of hedonic well-being. The most relevant work to the current study comes from Daniel Kahneman and colleagues, who find that higher income is predictive of a more positive global assessment of well-being but weakly associated with frequency of positive affect (Kahneman et al. 2006; Kahneman and Deaton 2010).

3.2.2 The Relationship Between Income and Well-being

There has long been academic interest in the relationship between material wealth and well-being. Philosophical inquiry into this dynamic extends even deeper into history, with Aristotle's *Nicomachean Ethics* frequently cited as a foundational text in the Western happiness catalog. Prior studies about material affluence and well-being suggest two general findings. First, there is a positive, though weak, correlation between wealth and well-being within a country at a given moment in time (Cone and Gilovich 2010; Diener and Biswas-Diener 2002; Kahneman and Deaton 2010; Kasser and Sheldon 2009). Second, rising average income levels within a country over time have little effect on the average level of self-reported well-being (Diener and Biswas-Diener 2002; Easterlin 1995). The apparent contradiction of the first and second findings is referred to as the *Easterlin Paradox*.

A number of factors may contribute to the weak correlation between money and happiness. The relationship between money and well-being exhibits a logarithmic or hockey-stick shape (Diener and Seligman 2004): at low income levels the marginal increase in well-being of additional income is high while in higher income brackets the marginal well-being benefit of more income is close to zero. The large return to well-being of money at low income levels speaks to the substantial welfare boost that comes with being able to acquire the basic necessities of life, such as food, shelter, and basic medical care. Using an absolute definition of *financial poverty*, the poverty line could be identified by calculating the sum of money required to meet basic physiological needs (Citro and Michael 1995). Given this demarcation financial poverty, we would expect households below the poverty line to see their welfare greatly increase on account of receiving extra income and, indeed, this is what the data show. Put another way, for a financially impoverished person, any added capacity to meet basic needs greatly improves quality of life and, therefore, life satisfaction.

At higher, above-the-poverty-line levels of income, we observe a much smaller rate of growth in happiness with added income. Some portion of this trend can be attributed to the finding that much of the welfare benefit of post-subsistence spending depends on what referent others are consuming. That is, once basic needs are secured, people's level of life-satisfaction is a function of relative rather than absolute consumption levels. Frank (1985) uses the term *positional goods* to characterize those goods whose contribution to well-being are in large part based on social comparisons. For example, the boost in welfare derived from owning a car comes in part from the service that that or any other car provides and in part from what can be inferred about the

consumer's status relative to people that the car owner compares herself to, like co-workers or neighbors.

The phenomenon of life satisfaction being affected by social comparisons also helps to explain the Easterlin Paradox. Although a society-wide increase in income allows for more consumption in an absolute sense, relative affluence remains static, resulting in the apparently contradictory outcome of increased income without increased well-being. After all, no matter how high incomes grow, half of the population will by definition be more affluent than someone at the median level. When society-wide relative levels of consumption do not change, reports of well-being that are linked to relative consumption remain unchanged on balance. Frank argues that people have a tendency to over-invest in positional goods[11] to hedge against the utility-decreasing effects of the consumption of others. The corollary of this over-investment is an under-investment in non-positional goods like decreased commute times and increased vacation days (Chancellor and Lyubomirsky 2011; Van Boven 2005). Although certain social norms have developed to prevent the "positional arms races" (Frank 1999) that lead to an over-investment in positional goods, the desire to keep up with or surpass the Joneses remains an important factor that decouples growth in incomes and growth in subjective well-being.

A disparity between income and income aspirations may also play a role in the nature of the income-happiness relationship. Stutzer (2004) finds that evaluation of well-being is in part dependent on the difference between income and material desires. Moreover, as income increases, the gulf between current and desired material endowments widens. Frey and Stutzer (2002) estimate that around 70% of the boon to well-being associated with rising income is taken back by inflated aspirations, marking a sort of happiness rebound effect. The concept of *hedonic adaptation* provides another means for explaining the weak correlation between income and well-being. For a range of both positive and negative life experiences, from buying a new phone to winning the lottery to getting divorced, it has been observed that, after an initial boost or decline, a person will return to her baseline level of subjective well-being (Kahneman and Krueger 2006). Though it has been argued that the hedonic treadmill may not lead to complete adaptation in all cases (Diener et al. 2006), adaptation in the domain of material goods is widely accepted (Easterlin 2003; Scitovsky 1992).

3.2.3 Time Affluence and Time Poverty

Broadly, the standard meaning of *affluence* comprehends money and possessions. *Material affluence* is the ownership of or means to consume a range of physical goods and services. Material affluence is a matter of degree, with a highly affluent person having an abundance of money, property, and material goods. In a word, they are wealthy. It is interesting to note that the term *wealth*, broken down to its Old English roots, means "the conditions of well-being" (Anielski 2007). The modern usage of *wealth* to connote well-being is consistent with the dominant perception within contemporary culture that "the good life" is synonymous with material affluence, that "goods are good and more is better." A growing body of work challenges this

[11] This is over-investment relative to utility-maximizing consumption patterns that are based on personal tastes and not subject to influence by the consumption behavior of others.

narrow conception of wealth and looks at how time, not money, can also contribute to well-being.

Time is a form of wealth, an idea captured by the term *time affluence*. Though the term has not been used uniformly, or even explicitly, recent work has emphasized the role of time affluence in creating conditions of well-being in both the hedonic and eudaimonic senses. Kasser and Brown (2003) define *time affluence* relative to the number of paid hours a person works, where greater affluence is equated with working fewer hours. This narrow definition clearly overlooks the role of gender and non-market work in the creation and distribution of discretionary time. Although women tend to work fewer paid hours per week (Huberman and Minns 2007), they are often the household member primarily responsible for necessary house- and care work. Accordingly, people with heavy, unpaid caretaker responsibilities are considered by Kasser and Brown to be much more time affluent than people who work an equivalent number of hours but are given a wage to do so. Eriksson et al. (2006) use the *time-affluence* cognate concept of *discretionary time*, which they specify as a summing of "time left over" after paid work, household labor, and personal care are accounted for. Other work relies on a subjective definition of time affluence that is based on an individual's sense of satisfaction with their pace of life and allotment of free time. For example, LaJeunesse and Rodríguez (2012) assess their subjects' time affluence by asking their degree of concurrence with statements like "My life has been too rushed" and "There have not been enough minutes in the day." Mogilner and colleagues (2012) employ a similar set of metrics, measuring whether subjects agree that "time is their scarcest resource" or that they had "plenty of spare time."

The concept of *time poverty* is a complement to that of *time affluence*. A person exists on a continuum of time affluence and, if they fall below a given level of affluence, they can be considered to be time impoverished (or "famished"). Kalenkoski and colleagues (2011) write that *time poverty*, like affluence, can be defined by either a subjective sense of feeling time pressured or by an individual falling short of an objectively defined amount of time for rest and leisure. An objective definition of *time poverty* can be further classified as either absolute, in that a person falls short of a set number of minutes, or relative, in that a person has only a fraction of the average person's amount of free time.

Time affluence and poverty in the United States have been associated with a range of well-being indicators. Kasser and Brown (2003) find a negative correlation between weekly work hours and satisfaction with life, a particularly noteworthy finding in the context of records that American work hours have increased by more than 400 per year in the last three decades (Schor 2010). Interestingly, quantity of discretionary time and household income are not significantly correlated (Kalenkoski et al. 2011). A feeling of "peace and quiet with time alone with one's thoughts" (Kasser and Sheldon 2009) correlates positively with family and job satisfaction. Among adolescents, a subjective sense of time affluence is a significant correlate of global sense of SWB and interacts significantly with measures of materialism and compulsive buying, with perceived time affluence decreasing the negative effects of materialism and buying on SWB (Manolis and Roberts 2012).

Is "discretionary time good and more is better?" The nature or shape of the time affluence-hedonic happiness relationship remains poorly understood. Evidence is conflicting, and the use of different definitions and metrics of both time affluence and SWB both reveals different aspects of the dynamic and makes a direct comparison across studies difficult. For example, Kasser and Sheldon (2009) find a linear relationship between global SWB and a subjective sense of time affluence, while Eriksson et al. (2006) find a logarithmic function for objectively defined time affluence provided the best fit for their SWB data. Relatively rare is the study that uses either an objective measure of time affluence or examines the influence of time affluence on affective experience.

The social and positive psychology literatures suggest numerous ways that time affluence may connect to well-being. That is, there are many ways in which having more free time at your disposal can support behaviors that improve happiness levels. Lyubomirsky et al. (2005) state that roughly 40% of the variance in population-wide "chronic happiness levels" is attributable to differences in intentional activities, a category including behaviors like exercising and volitional endeavors pursuing personal goals.[12] (See also Sheldon et al. 2010.) Hence, more time-affluent individuals could devote a larger share of their day to activities that foster well-being. Van Boven and Gilovich (2003) conducted a series of experiments examining the differing contributions of material and experiential goods in fostering happiness.[13] They find that subjects tend to report that recent experiential purchases – for example, going to a concert – are more satisfying than material ones and that reflecting on experiences tends to put subjects in a better mood than reflecting on material goods. Furthermore, they find that social interactions centered on experiential goods are viewed in a more positive light than those centered on material goods (Van Boven 2005). Materialistic people[14] are consistently stigmatized, and materialism is positively correlated with a number of undesirable traits and psychological conditions (Van Boven et al. 2010). One benefit of having more discretionary time is that people can more readily invest in experiences – which require time to pursue – and thereby have clearer access to a key well-being enhancer. For example, Monchon, et al. (2008) find that regular religious practice and exercise each have a cumulative positive impact on well-being. Savoring – a purposeful, conscious appreciation of positive experiences – can also enhance and extend positive affect but may be difficult to practice with limited amounts of discretionary time (Bryant and Veroff 2007).

[12] The authors also suggest that merely 10% of the variance is on account of circumstantial factors like marital status and income.

[13] From Van Boven and Gilovich (2003): "Experiential purchases are those made with the primary intention of acquiring a life experience: an event or series of events that one lives through. Material goods are those made with the primary intention of acquiring a material good: a tangible object that is kept in one's possession."

[14] Those with a strong belief that happiness can be obtained through the acquisition of money and material possessions

3.3 Methods

3.3.1 Data

The data used to examine the relationship between experienced hedonic well-being and time affluence come from the 2010 American Time Use Survey (ATUS). ATUS, a product of the U.S. Bureau of Labor Statistics, employs time diaries and questionnaires to track the market and non-market ways that Americans use their time. Respondent households are sampled from the population of households that have completed the Current Population Survey, with one household member over the age of 14 serving as the primary respondent. In time diaries, primary respondents record their minute-by-minute activities over the course of the previous 24 hours.[15] The activities are subsequently coded, first as one of 17 primary categories (e.g., Personal Care and Socializing, Relaxing, and Leisure), and then into secondary and tertiary categories (e.g., the secondary category of Attending or Hosting Social Events is further divided into Attending or Hosting Parties/Receptions/Ceremonies and Attending Meetings for Personal Interest (not volunteering)). Questionnaires collect information about demographics, household characteristics, and school and labor force enrollment status.

The Well-being Module of ATUS is a set of questions given in even-numbered years after the 24-hour diary is completed. Three activities from the diary are selected at random[16] and respondents are asked five questions about affect and four questions about health status during each of the three activities. Affect questions ask respondents to rate on a seven-point Likert-type scale the extent to which they were happy, tired, stressed, sad, and in pain during the selected activities and how meaningful they considered that activity to be. Respondents were also asked whether they interacted with anyone during the activity in question. The health status questions are concerned with the diary day and the respondent's health in general. Questions inquire whether the respondent took any pain medication on the diary day and how well-rested they felt upon waking in their diary day. For a description of the full Well-being Module protocol, see ATUS (2014).

This work uses data from ATUS, the Current Population Survey, and the Well-being Module to explore the contributions of material and time affluence to individual experienced well-being. To confine the scope of the study to adults, who have greater autonomy with regards to time than do minors, only data from respondents aged 18 and older were used, leading to a total of 9,713 diaries contributing to my analysis.

3.3.2 Calculating Time Affluence

This study uses discretionary time as an objective measure of an individual's time affluence. I define an individual's discretionary time, and therefore her level of time affluence, as the sum of

[15] The 24-hour period spans from 4:00 AM the previous day to 4:00 AM the day the diary is completed.
[16] A few activities, including sleeping and grooming, were not eligible for selection. In addition, owing to a programming error, activities taking place at the end of the day were under-sampled in the 2010 Well-being Module.

minutes in a day that are not spent on necessary activities. To do this, I categorized ATUS activity categories as either *necessary* or *discretionary*. Modifying Kalenkoski et al. (2011), activities were defined here as necessary if they involved paid labor or unpaid household labor, related to personal care (e.g., sleeping and bathing), or were dictated by significant previous life choices.[17] Table 1 shows the designation of first-tier ATUS categories as either necessary or discretionary with this analysis.

Table 1. Designation of first-tier ATUS activity categories as either necessary or discretionary.
This classification scheme is a based on, but not a replication of, that which was used in Kalenkoski et al. (2011).

ATUS Code	Category Description	Designation	Notes/Exceptions
01	Personal Care	Necessary	
02	Household Activities	Necessary	
03	Caring For and Helping Household Members	Necessary	
04	Caring For and Helping Non-household Members	Discretionary	
05	Work and Work-related Activities	Necessary	
06	Education	Either	Necessary if respondent is a full- or part-time student; otherwise discretionary
07	Consumer Purchases	Discretionary	
08	Professional and Personal Care Services	Discretionary	"Medical and Care Services" were designated as necessary
09	Household Services	Discretionary	
10	Government Services and Civic Obligations	Discretionary	
11	Eating and Drinking	Either	"Eating and Drinking" was designated as necessary, while "Waiting Associated with Eating and Drinking" was labeled discretionary
12	Socializing, Relaxing, and Leisure	Discretionary	
13	Sports, Exercise, and Recreation	Discretionary	
14	Religious and Spiritual Activities	Discretionary	
15	Volunteer Activities	Discretionary	
16	Telephone Calls	Discretionary	
18	Traveling	Either	Travel associated with necessary activities (e.g., work commutes) were label as necessary, while travel for discretionary activity was designated as discretionary

The 24-hour diary data provide an account of the respondent's activity with by-the-minute granularity. Hence, all 1,440 minutes of the diary day were labeled as either necessary or discretionary. I calculated each diary keeper's time affluence by summing the time spent during the recorded day on discretionary tasks.

[17] For example, at some stage, becoming a parent is discretionary. However, once the parental Rubicon has been crossed, it becomes necessary to care for the child.

3.3.3 Gauging Experienced Hedonic Well-being: The Affect Index

I developed the Affect Index to evaluate respondents' experienced hedonic well-being over the course of the diary day. Based on the affect questions from the ATUS Well-being Module, the Affect Index characterizes the dominant affective state of all ATUS respondents as they engage in a particular activity. For each individual respondent, a specific activity examined in the Well-being Module was given an Affect Score of 1 if the respondent reported a stronger feeling of happiness during that activity than of either stress or sadness; otherwise, it was given a 0. For example, one respondent rated their happiness while working at 5 out of 7, but rated their sadness and stress levels at 4 and 6 out of 7, respectively. Because a negatively valenced feeling (stress) was strongest during that activity, the entire activity was given an affect rating of 0 for this individual (indicating an overall negative affect during the activity). This respondent subsequently reported feeling more happy than sad or stressed while engaged in food and drink preparation, so this activity for this individual was given an affect score of 1.

The global Affect Index (AI) score for a given activity was calculated by finding the mean affect rating across all Well-being Module entries for the activity:

$$\mathrm{AI_a} = [\textstyle\sum_1^n (Affect\ score_n)]\ /n$$

where *n* is the total number of Well-being Module entries that evaluate activity, *a*. For example, shopping was evaluated 1,487 times in the Well-being Module. Of these 1,487 instances, 1,101 rated an affect score of 1 (the respondents were more happy than sad or stressed while shopping), while the remaining 486 Well-being Module entries received an affect score of 0 because dominant affective experience while shopping was negatively valenced. Given this record, the calculated overall Affect Index value for shopping is 0.74. This Affect Index score can be interpreted as a 74% likelihood that someone in the survey would have an overall affectively positive experience while shopping. For the 82 activities described by the second-tier of the ATUS coding scheme, Affect Index scores ranged from 0.00 to 1.00, with a median of 0.76. These computed Affect Index scores are in general agreement with previous research suggesting that negative emotions occur less frequently than do positive emotions (Diener, Larsen, et al. 1985; Watson et al. 1988). The Affect Index and U-Index produce similar ordinal and cardinal properties, suggesting that the use of ATUS data to construct the Affect Index provides a reasonable and economical approximation of the immediate, affective experience of various routine activities. It should be noted, though, that the particular values cannot directly be compared as the AI measures the frequency of a positive emotion being strongest while the complement of the U-Index gives the frequency with which negative affect is not strongest. A set of sample Affect Index scores are given in Table 2 along with the complement of U-Index scores, where available. The complete set of Affect Index scores is provided in Section 3.7.

Table 2. Affect Index scores for assorted ATUS activities with the complement of U-Index values provided for comparison where available.

U-Index data source: Kahneman and Krueger (2006) and author's calculations.

Activity	AI Score	1 – U-Index
Enjoying Arts and Entertainment	0.95	
Caring for Non-household Children	0.91	0.80
Household Food and Drink Preparation	0.76	0.86
Traveling for Professional or Personal Care Services	0.68	
Working	0.60	0.79
Health-related Self Care	0.45	
Activities Related to Household Children's Health	0.33	

The use of a binary evaluation of individual emotional experiences that underlies the calculation of an activity's Affect Index score requires specific justification. After all, rare is the episode in which someone feels positive emotions unalloyed by negatively valenced ones or vice versa. Use of measures like episode net affect, which is the average strength of positive emotions minus the average strength of negative emotions (Miron-Shatz 2009), allow for greater granularity than the Affect Index in measuring affective experiences. However, I expect that respondent identification of their strongest emotions is more accurate than their overall assessment of affect for two reasons. First, using average affect values neglects the capacity of one strong emotion to color an experience. For example, even if I have low levels of stress or sadness during an activity, a strong feeling of anger can cast the episode in a more negative light than an affective average would indicate. A second, related basis for emphasizing the strongest emotion is the fact that the Well-being Module data are collected at a day's remove from the events they describe, and it may be supposed that, on account of the peak-end rule (Do et al. 2008; Kahneman et al. 1993), respondents' retrospective judgment of their activities will be biased by the most pronounced affective state. Thus, I chose to base the Affect Index on the strongest emotion experienced by respondents for each activity.

The experienced hedonic well-being of an individual respondent was calculated as the average of Affect Index scores for all activities in their diary day weighted by the duration of that activity. The median EHWB score for waking hours was 0.75. Figure 3 shows the distribution of EHWB scores for ATUS respondents. EHWB scores would ideally be calculated based on Affect Index values specific to each individual respondent rather than using a sample average, as, for example, there will be those for whom caring for children is a pleasure while for others it is an odious business. Given that the Well-being Module surveys affect strength during three ATUS diary activities rather than the entire diary day, such tailoring of EHWB values was not possible with the available data.

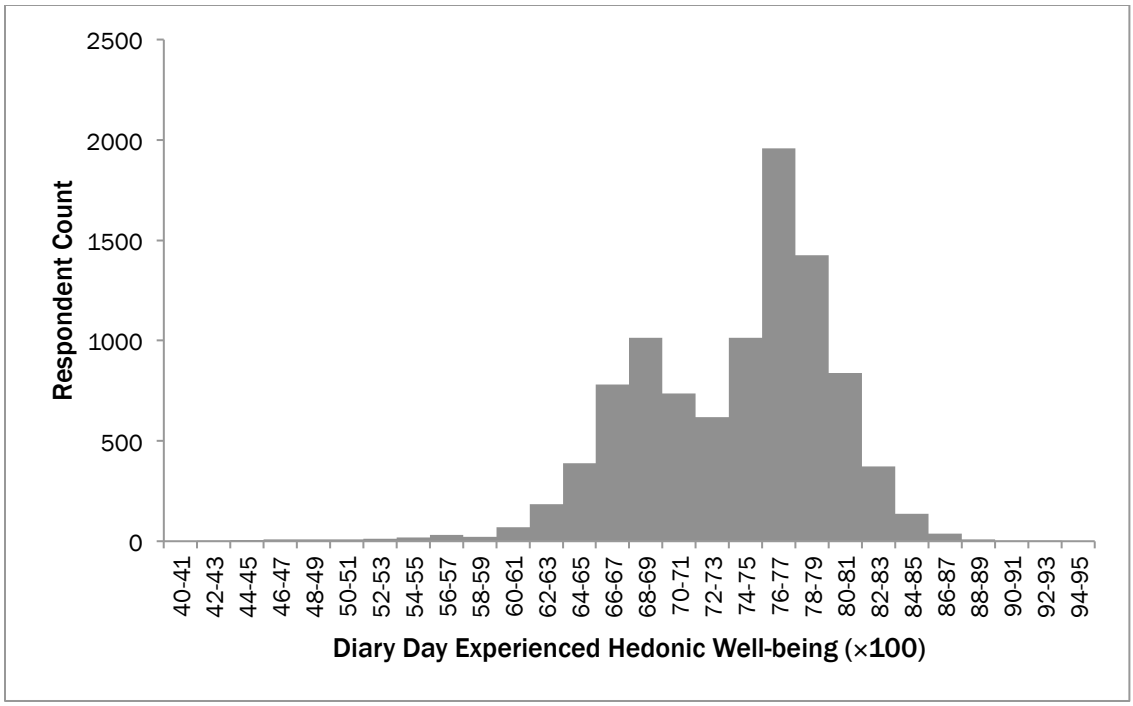

Figure 3. A histogram of the EHWB scores of 2010 ATUS respondents.

3.3.4 Additional Independent Variables and Data Analysis

ATUS assesses household income information by asking participants into which of 16 per annum income brackets, ranging from "below $5,000" to "above $150,000," their family belongs. I used these data to assign each household to an income quintile based on the distribution of household incomes in the United States in 2010.[18] Given the usual sensitivity of questions concerning income and the mixed granularity of ATUS income categories (some brackets are as small as $2,500 and others as large as $50,000, or are indefinite, in the case of the final bracket), I deemed using income quintile as a proxy for material affluence a sensible use of the data.

To determine the relationship between discretionary time and experienced hedonic well-being, I created a linear regression model with the ordinary least squares method. Of primary interest was the sign and significance of time affluence and household income as predictors of EHWB. To act as controls, several other household and demographic variables were drawn on from cross-referenced information from the Current Population Survey. These variables included age, gender, and parental, workforce, and partnership status. Descriptive statistics of the sample group are given in Table 3.

[18] First quintile: Less than $20,000 per year. Second quintile: Between $20,001 and $38,000 per year. Third quintile: Between $38,001 and $61,500 per year. Fourth quintile: Between $61,501 and $100,029 per year. Fifth quintile: Above $100,030 per year. Source: (U.S. Census Bureau n.d.).

Table 3. Demographic characteristics of diary respondents.

Independent Variable	Sample Characteristics
Age (SD)	47 (18)
% Female	56
% Parents	37
% Employed	60
% Domestic partnership	52

To address the secondary question, regarding the location of a time poverty threshold, a categorical (dummy) variable was created to denote whether a given respondent was at or below a given level of time affluence. This dummy was added to the main model. Twenty-five different time-poverty threshold values were tested for significance, spanning from 1 to 13 hours of discretionary time in 30-minute increments.

3.3.5 Testing Ordinary Least Squares Assumptions

White's General Test confirmed the presence of hetereoskedasticity in the data ($\chi^2(74) = 722$, $p < 0.001$). Accordingly, Huber-White estimators (i.e., robust standard errors) are used for a more conservative estimate of standard errors. Though the use of Huber-White estimators can mask model misspecifications (King and Roberts 2014), there was a convergence of results when using standard and robust errors, which supports confidence in the results displayed below.

While multicollinearity is not a violation of ordinary least squares assumptions, particularly those relating to collinearity, I constructed a correlation matrix for the independent variables used in this analysis to check for high levels of covariation. The result is provided in Table 4.

Table 4. A matrix of Pearson's r values for independent variables used in this study.

		1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	Discret. time	Gender	Parent	Age	Holiday	Weekend	Partner	Employed
		1	2	3	4	5	6	7	8	9	10	11	12	13
1st Quintile	**1**	1.00												
2nd Quintile	**2**	-0.28	1.00											
3rd Quintile	**3**	-0.22	-0.25	1.00										
4th Quintile	**4**	-0.26	-0.29	-0.24	1.00									
5th Quintile	**5**	-0.23	-0.26	-0.21	-0.25	1.00								
Discret. time	**6**	0.14	0.02	-0.02	-0.06	-0.08	1.00							
Gender	**7**	0.06	0.03	-0.02	-0.02	-0.05	-0.04	1.00						
Parent	**8**	-0.12	-0.07	-0.02	0.07	0.14	-0.25	0.04	1.00					
Age	**9**	0.10	0.07	-0.01	-0.08	-0.08	0.18	0.04	-0.34	1.00				
Holiday	**10**	-0.01	-0.00	0.00	0.00	0.00	0.05	0.01	0.01	-0.01	1.00			
Weekend	**11**	0.02	-0.00	-0.00	-0.02	0.00	0.26	0.01	0.01	-0.01	0.01	1.00		
Partner	**12**	-0.27	-0.09	0.02	0.13	0.22	-0.16	-0.08	0.43	0.01	0.01	-0.01	1.00	
Employed	**13**	-0.26	-0.07	0.04	0.14	0.15	-0.34	-0.12	0.23	-0.28	-0.01	0.00	0.16	1.00

In addition, I calculated variance inflation factors (VIF) for the independent variables used in this analysis to check for high levels of covariation. As the correlation coefficient values are relatively small, and no VIF exceeded 2, there is little reason to be concerned about multicollinearity.

3.4 Results

3.4.1 Amount of Discretionary Time

The mean quantity of daily discretionary time across all respondents was approximately 7.5 hours, see Figure 4. Consistent with intuition, the amount of discretionary time on weekends and holidays is significantly higher than during the workweek ($p < 0.01$).

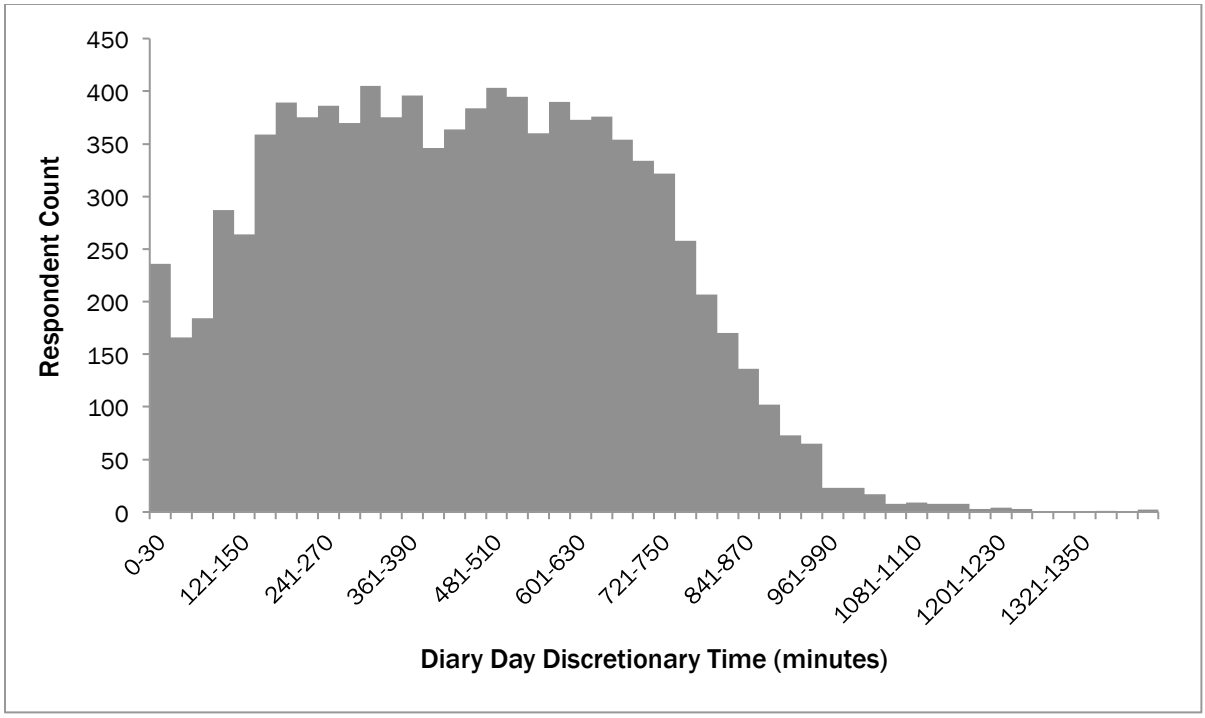

Figure 4. A histogram of calculated discretionary time.

3.4.2 Full Regression Model: Relationship Between Material Affluence and Time Affluence and Experienced Hedonic Well-being

Table 5 presents the results of the multivariate analysis of the relationships between experienced hedonic well-being and material affluence and time affluence, characterized by income quintile and quantity of discretionary time, respectively. After controlling for other variables, both linear and logarithmic relationships between time affluence and EHWB were significant (ps < 0.01), but a curvilinear (quadratic) function provided the best fit of the data (i.e., the highest R^2) with the same degree of model parsimony. A curvilinear function may also be the most theoretically

defensible form (see Section 3.5.1). Figure 5 provides a scatter plot of EHWB as a quadratic function of time affluence.

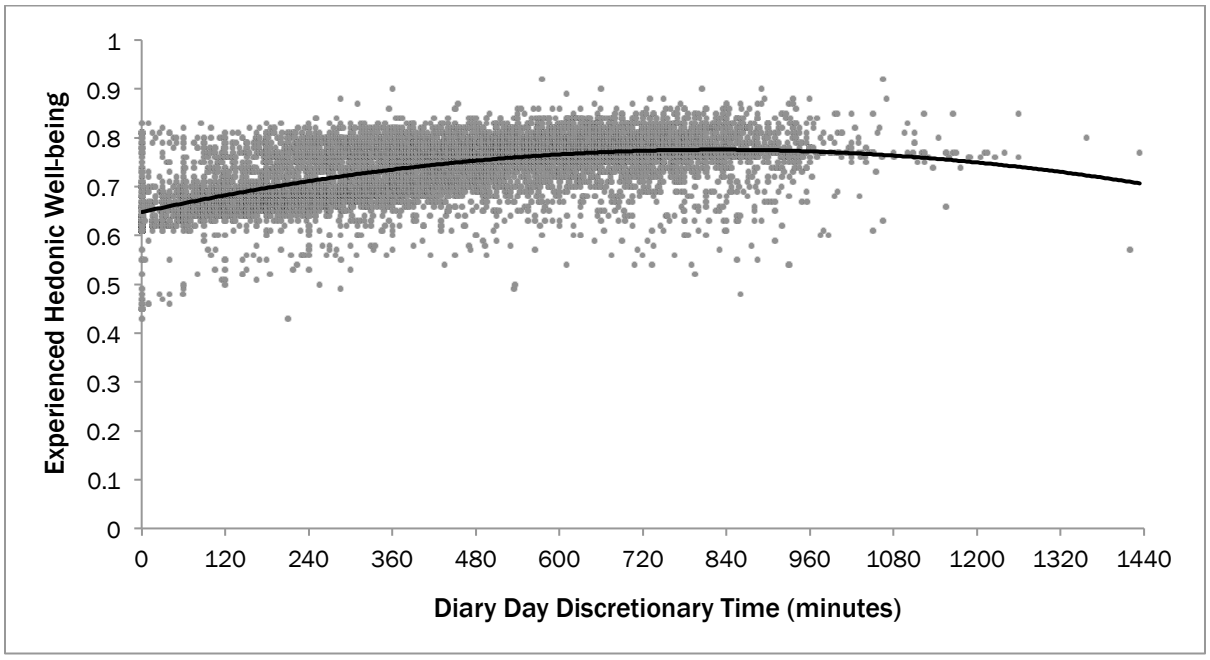

Figure 5. A scatter plot of EHWB as a function of discretionary time.
The best-fit curve is a quadratic form based on the ordinary least squares model provided in Column 1 of Table 5. The apex of the curve corresponds to approximately 14 hours of discretionary time.

Regarding the relationship between material affluence and EHWB, ANOVA ($F_{(4, 9708)} = 11.96$, $p < 0.001$) finds a main effect of income quintile on EHWB score. An analysis of main contrasts indicates that the average EHWB in the first income quintile is significantly greater than that of the second income quintile ($t = 4.12$, $p < 0.01$). The EHWB of the second quintile, in turn, is significantly greater than the EHWB in the group comprised of the third, fourth, and fifth quintiles ($F_{(1,9708)} = 4.66$, $p < 0.01$). In contrast to this analysis, the results of the regression analysis, shown in the first column of Table 5, examine the relationship between material affluence and EHWB while controlling for important mediating factors. The regression demonstrates a similar pattern of a decline in EHWB with an increase in income quintile, though only the second and fifth quintile dummies approach significance ($p < 0.06$). A test of the joint significance of the income dummies does not reject the null hypothesis of no effect ($F_{(4,9699)} = 0.94$ ($p > 0.44$). Variables related to income are dropped for models related to the time poverty line.

Table 5. Regressions of EHWB on measures of material affluence, time affluences, and control variables. The dependent variable in the regression is defined as one hundred times the EHWB value derived above. Hence, well-being scores in this model will range from 0-100 rather than 0-1. Robust standard errors for each parameter estimates are given in parentheses. Note: * $p < 0.05$, ** $p < 0.01$

	1. EHWB (Main model)		2. EHWB (Time poverty line = 8.5 hr)	
Time affluence (hr)	1.61**	(0.056)	1.09**	(0.25)
Time² (hr²)	-0.058**	(0.0033)	-0.039*	(0.010)
Time poverty (dummy)			-3.09*	(1.34)
Time × Poverty			0.35*	(0.15)
2nd Income Quintile (dummy)	-0.033	(0.15)		
3rd Income Quintile (dummy)	0.13	(0.16)		
4th Income Quintile (dummy)	0.21	(0.16)		
5th Income Quintile (dummy)	0.16	(0.17)		
Employed (dummy)	-1.63**	(0.12)	-1.58**	(0.12)
Female (dummy)	0.22*	(0.095)	0.21*	(0.096)
Parent (dummy)	1.32**	(0.12)	1.31**	(0.12)
Age (years)	0.0076**	(0.0031)	0.0071*	(0.0031)
Holiday (dummy)	2.20**	(0.34)	2.19**	(0.34)
Weekend (dummy)	2.46**	(0.10)	2.44**	(0.10)
Domestic partner (dummy)	0.73**	(0.11)	0.79**	(0.10)
Intercept	64.2**	(0.32)	67.6**	(2.15)
R^2	0.41		0.41	
n	9,713		9,713	

3.4.3 Quantifying a Time Poverty Threshold

The time poverty dummy reached the 5% significance level with three definitions of "time poverty threshold," at 8.5, 9, and 9.5 hours per day. When the poverty line was placed at 8.5 hours per day, the dummy and linear interaction parameter estimates are jointly significant ($F_{(2,9700)} = 3.06$, $p < 0.05$) while time poverty variables fell to joint insignificance with the quadratic interactor included ($F_{(3,9700)} = 2.06$, $p > 0.10$). Consequently, the model was restricted by dropping the interaction between time poverty and the square time affluence term, see Column 2 of Table 5. With 9 and 9.5 hours as the threshold definition, though the threshold dummy variable reached the 5% significance level, the interaction parameters were neither individually nor jointly significant. For all other threshold definitions, no threshold parameter achieved individual or joint significance.

3.5 Discussion

For this work, I used an amount of discretionary time to explore the relationship amongst time use, income, and experienced (emotional) well-being. While previous studies have shed light on these dynamics (Diener and Biswas-Diener 2002; Easterlin 1995; Kasser and Brown 2003;

Kasser and Sheldon 2009), this study adds depth to this body of work by using alternative definitions of time affluence (an objective rather than subjective measure) and well-being (gauging affective state rather than a global sense of subjective well-being). Both alternative measures should be considered as complements, rather than suggested replacements, of the more commonly used constructs. Just as the idea of hedonic well-being comprehends both affect and cognitive judgment, so too might objective and subjective measures of time affluence combine to provide a more complete concept. In addition to examining the significance of time affluence and material affluence to EHWB, I have attempted to hone the concept of *time poverty*, both in terms of definition and location relative to median levels of time affluence.

3.5.1 Key Findings

The results of my primary regression modeling suggest a non-linear relationship between time affluence and experienced hedonic well-being. Specifically, a quadratic function of time affluence provided the best fit of the ATUS data, trumping both linear and logarithmic forms. While previous studies have indicated that a greater subjective sense of time affluence is always better (Kasser and Sheldon 2009; Manolis and Roberts 2012), this curvilinear function implies that, measured objectively, there is such a thing as too much free time on one's hands, at least from an affective perspective.

Clues as to why more discretionary time might not always be well-being enhancing can be found in the existing literature. Manolis and Roberts (2012) suggest that an excess of free time increases the opportunity to feel and behave in ways counterproductive to well-being. Mogilner (2010) finds that activating the construct of *time* (as opposed to *money*) prompts people to spend more time with friends and family, activities that rated among the highest Affect Index scores. Potentially, a greater degree of time affluence, in either the objective or subjective sense, might reduce one's consciousness of time, and therefore reduce the drive to spend one's time in the most affectively positive way. It is worth noting that the hedonic peak of the time affluence curve is found around 14 hours of discretionary time, a level of time affluence documented in only 5% of adult respondent diaries. As such, it would seem unlikely that a large block of American adults is suffering hedonically from an excess of discretionary time.

Scitovsky's (1992) concept of *skilled leisure* may also apply to these results. To Scitovsky, a core challenge of modernity is to learn to consume intelligently, that is, to find pleasure and excitement in cultured and socially acceptable forms. Skilled leisure requires education and cultivation. One typically cannot leap into enjoying opera or Expressionist art without some preparation, as the experience is insufficiently sensible to be properly stimulating. Culture provides "the preliminary information we must have to enjoy the processing of further information" (Scitovsky 1992). Without culture, or at least a certain thoughtfulness, discretionary or leisure time may default to unskilled or low-quality leisure, which might be less stimulating or satisfying. Similarly, at excessive levels of discretionary time, people might increase their reliance on unskilled time-fillers, thereby decreasing the marginal benefit of time affluence. Conceivably, a more skilled use of discretionary time could increase the linearity of the time affluence-EHWB relationship.

The second difference between this and other time affluence studies involves the concept and definition of *time poverty*. Drawing on findings about material affluence, where a marginal increase in income has bigger returns of well-being at lower income levels, *time poverty* was here defined as a level of time affluence with a significantly higher marginal benefit of added discretionary time than is seen at higher levels of time affluence. I use this absolute, rather than a relative, definition on the theory that the well-being benefits of time affluence are not subject to the same positional effects seen in the domain of goods consumption. Based on this definition, the models developed here suggest that the absolute, objective time poverty threshold is located at approximately 8 to 9 hours of discretionary time. That is, for individuals with an endowment of discretionary time below 8 hours, the affective benefit of more time is greater than that for individuals with more than 9 hours of discretionary time. This finding contrasts with previous work that uses a relative approach to defining the time poverty threshold (i.e., Kalenkoski et al. 2011) in that it suggests that the time poverty threshold may in fact be above the median level of time affluence, which was about 7.5 hours in this sample. This finding is consistent with past observations about overworked Americans (Schor 2008). Rather than worrying about time sitting too heavy on people's hands, the relative positions of median time affluence and the time poverty threshold suggest that there are great returns to be gained from increasing people's command of their time.

The third major result of this work, the non-significance of the relationship between income and affect, is consistent with other studies of the wealth-well-being correlation. When well-being is measured with a global assessment, subjective well-being increases with income, albeit more slowly after a certain threshold. However, studies that use an affect-based, experiential definition of happiness indicate a much smaller effect of material affluence on the relative frequencies of positive and negative emotions. Here, income quintile was not an overall significant factor in time-weighted affective experience; indeed, if there is an effect, it would appear to be more likely that increasing income has a slight negative influence on affect. The different empirical results that come from using an affect- versus globally-based measure of well-being might be attributable in part to the strong material component of the standard American conception of success because material affluence is more likely to influence a person's assessment of their global well-being. In one's moment-to-moment experience of life, however, absolute and relative financial status is less salient.

3.5.2 Limitations and Future Directions

This study created the Affect Index to estimate the relative strength of positively and negatively valenced emotions during a range of daily activities. The Affect Index was based on previous efforts to track emotions over the course of a day and to evaluate hedonic happiness according to the prevalence of different types of feelings. Though each activity-average Affect Index score was based on the affect of a subsample of survey respondents who participated in that activity, the scoring and ranking of activities aligns with previous work based on more direct sampling methods (Kahneman and Krueger 2006). However, gauging an individual's time-weighted affective experience based on the average person's affective experience with the same set of

activities may still introduce bias into the calculation of EHWB. A future study employing time-use diaries that asks respondents to comment on their emotional state during every activity recorded – perhaps expanding beyond happy, sad, and stressed – would reveal whether the conclusions reached in this work might have been affected by overreliance on mean affective responses. Having respondents complete diaries for multiple days, presumably with variable degrees of time affluence, would allow future work to examine how within-subjects variation affects respondent affect.

Using an objective measure of time affluence takes time almost entirely out of context. Standardizing discretionary time, treating each free minute as the same as the next, means losing information about the quality of that time, particularly regarding its timing, duration, and frequency. This author, for example, tends to be sharper in the morning and therefore values a free hour that occurs just out of bed more than one in the mid-afternoon. Similarly, a solid hour of free time has a different character than four quarter-hour intervals. And perhaps most important, an element of the time-happiness story that does not get explicit treatment in this chapter is that of autonomy. Having a sense of personal control relates to numerous aspects of well-being (see, for example, Reis et al. 2000; Ryan and Deci 2001; Thompson and Prottas 2006), and control over time use is no exception. Such issues, obscured with an objective measure of time affluence, are more readily captured by subjective measures and are a notable limit on trying to establish an absolute demarcation of a time poverty line. Fully capturing the hedonic essence of time affluence (or poverty) may require a blend of objective and subjective measures.

The findings of this study indicate that time poverty may be a real and pervasive issue for American adults, one with negative implications for emotional well-being as well as for health, social welfare, and environmental integrity (de Graaf 2003). Even so, work is required to further refine the category of *time impoverished* in order to make it a tractable concept for public policy measures. This research used a diary study that contained a complete record of how an individual spent her 1,440 minutes of a given day. While feasible for a relatively small sample of people, such a method for identifying time-impoverished households is too cumbersome for whole-population policy work. As such, finding a means to identify likely time-poor households without a comprehensive time audit becomes instrumental to addressing time poverty. Further, additional clarity on the temporal constraints faced by time-poor households would bring new understanding of how households might respond to efforts to change behavior. For example, Druckman et al. (2012) suggest that those households with the least amount of discretionary time will be the least capable of responding to policies aimed at reducing energy use and greenhouse gas emissions, creating what they refer to as a "dual set of carbon and temporal injustices." Greater examination of the existence and effect of such dual phenomena will serve to improve the quality of policy efforts *vis-à-vis* the time poor.

3.6 Conclusion

If patterns of consumption are to become more sustainable, then the primacy of financial proxies of well-being and the materialist values they implicitly support must erode. Terms like

time affluence and *time poverty* have the potential to, if not replace, then complement or be a foil to, pervasive financial indicators like GDP and income. Time-based indicators draw direct attention to the "resource input" for a good like that, in the United States, is often in short supply, helping both individuals and policymakers focus on the ways in which free time is surrendered in current economic arrangements. While making the link between reduced consumption and increased time affluence is beyond the scope of this chapter, more firmly establishing the connection between time affluence and hedonic happiness serves to move the conversation about sustainable consumption away from material sacrifice and toward embracing the potential for a better life.

3.7 Complete Listing of Activities and Associated Affect Index Values

Table 6 provides a complete set of Affect Index scores calculated from the ATUS data.

Table 6. Affect Index values associated with the 82 activities described by the second tier of ATUS coding.

ATUS 2-Tier Code	Activity Description	Count	AI Value
101	Sleeping	0	
102	Grooming	0	
104	Personal Activities	0	
105	Personal Care Emergencies	0	
703	Security Procedures Related to Consumer Purchases	0	
803	Legal Services	0	
808	Security Procedures Related to Professions/Personal Services	0	
1304	Security Procedures Related to Sports, Exercise, and Recreation	0	
1508	Security Procedures Related to Volunteer Activities	0	
602	Extracurricular School Activities	3	1.00
904	Lawn and Garden Services (not done by self)	1	1.00
1003	Waiting Associated with Government Services or Civic Obligations	1	1.00
1205	Waiting Associated with Socializing, Relaxing, and Leisure	3	1.00
1506	Public Health and Safety Activities	1	1.00
1507	Waiting Associated with Volunteer Activities	2	1.00
1602	Waiting Associated with Telephone Calls	1	1.00
1204	Arts and Entertainment (other than sports)	100	0.95
1504	Participating in Performance and Cultural Activities	23	0.91
401	Caring For and Helping Non-household Children	172	0.91
1503	Indoor and Outdoor Maintenance, Building, and Clean-up Activities	20	0.90
1302	Attending Sporting/Recreational Events	38	0.89
1202	Attending or Hosting Social Events	100	0.89
1301	Participating in Sports, Exercise, or Recreation	608	0.88
1815	Travel Related to Volunteer Activities	185	0.87
1810	Travel Related to Using Government Services and Civic Obligations	15	0.87
1502	Social Services and Care Activities	52	0.87
1201	Socializing and Communicating	1,395	0.85
1813	Travel Related to Sports, Exercise, and Recreation	368	0.84

1811	Travel Related to Eating and Drinking	913	0.84
301	Caring For and Helping Household Children	1,811	0.83
1002	Civic Obligations and Participation	6	0.83
1401	Religious/Spiritual Practices	447	0.83
206	Animals and Pets	473	0.83
503	Other Income-generating Activities	64	0.83
1505	Attending Meetings, Conferences, and Training	29	0.83
1501	Administrative and Support Activities	86	0.83
1814	Travel Related to Religious/Spiritual Activities	314	0.82
205	Lawn, Garden, and Houseplants	393	0.81
1812	Travel Related to Eating and Drinking	1,283	0.81
1101	Eating and Drinking	5,849	0.80
502	Work-related Activities	20	0.80
801	Childcare Services	5	0.80
1804	Travel Related to Caring For and Helping Non-household Members	404	0.80
305	Helping Household Adults	39	0.79
204	Exterior Maintenance, Repair, and Decoration	115	0.79
1802	Travel Related to Household Activities	322	0.79
1803	Travel Related to Caring For and Helping Household Members	625	0.78
1807	Travel Related to Consumer Purchases	2,114	0.76
1203	Relaxing and Leisure	5,355	0.76
202	Food and Drink Preparation, Presentation, and Clean-up	3,059	0.76
208	Appliances, Tools, and Toys	33	0.76
604	Registration/Administrative Activities	4	0.75
805	Personal Care Services	40	0.75
901	Household Services (not done by self)	4	0.75
1102	Waiting Associated with Eating and Drinking	20	0.75
203	Interior Maintenance, Repair, and Decoration	110	0.75
405	Helping Non-household Adults	182	0.74
701	Shopping (store, telephone, Internet)	1,487	0.74
302	Activities Related to Household Children's Education	92	0.73
902	Home Maintenance, Repair, Décor, Construction (not done by self)	11	0.73
1601	Telephone Calls (to or from)	400	0.72
1805	Travel Related to Work	1,764	0.72
1809	Travel Related to Using Household Services	48	0.71
1806	Travel Related to Education	149	0.70
201	Housework	1,643	0.70
209	Household Management	885	0.70
802	Financial Services and Banking	42	0.69
304	Caring for Household Adults	47	0.68
1808	Travel Related to Using Professional and Personal Care Services	248	0.68
402	Activities Related to Non-household Children's Education	6	0.67
1801	Travel Related to Personal Care	63	0.67
601	Taking Class	124	0.66

207	Vehicles	85	0.62
501	Working	2,411	0.60
1816	Travel Related to Telephone Calls	17	0.59
1818	Security Procedures Related to Traveling	7	0.57
403	Activities Related to Non-household Children's Health	2	0.50
702	Researching Purchases	2	0.50
807	Veterinary Services (excluding grooming)	6	0.50
903	Pet Services (not done by self, not vet)	2	0.50
1303	Waiting Associated with Sports, Exercise, and Recreation	2	0.50
404	Caring for Non-household Adults	21	0.48
804	Medical and Care Services	113	0.47
103	Health-related Self Care	226	0.45
603	Research/Homework	177	0.40
905	Vehicle Maintenance and Repair Services (not done by self)	13	0.38
504	Job Search and Interviewing	64	0.34
303	Activities Related to Household Children's Health	18	0.33
806	Real Estate	6	0.33
1001	Using Government Services	7	0.29
1004	Security Procedures Related to Government Services/Civic Obligations	1	0.00

4 The Temporal Energy and Carbon Footprinting of Routine Activities

4.1 Introduction

Chapter 2 examined the idea of *time affluence* and its contribution to individual well-being. Within a practical range, more time affluence, that is, having more discretionary control over how time is spent, contributes to that person's happiness, in both an affective and a eudaimonic sense. *Time affluence* both complements and challenges *material affluence* as a correlate of quality of life and as a core metric of personal progress. Orienting lifestyle changes with the aim of gaining more free time rather than increasing income may, for many, be the more satisfying path. However, while pursuing material affluence is well linked to greater consumption and environmental impact, the connection between time affluence and environmental sustainability has been less well documented. Would urging people to increase their time affluence and their expenditures of time on "happier" or on more leisure-based activities prompt greater consumption in much the same way that the pursuit of material affluence does?

Traditionally, scholars of household consumption use financial indicators as their means of analysis, looking at, for example, how income and carbon footprints are related or how to shift purchasing behavior in a more pro-environmental direction (Soytas et al. 2007; Weber and Matthews 2008). A distinct and complementary approach to understanding consumption entails examining how people spend their time rather than their money (Jalas 2002; Druckman et al. 2012). A time-use lens can address questions around the consonance of leisure time and sustainability. Further, studying time use and how it links to resource consumption can contribute new insight into the roots of environmental impacts and into the design of interventions intended to promote more sustainable behavior.

This work contributes to the establishment of a time-use perspective on American household consumption. Such a perspective can foster efforts to promote more sustainable patterns of consumption, particularly by analyzing the environmental consequences of different allocations of time. Encouraging different uses of time requires sifting through a nest of behavioral, social, and infrastructural complications. However, the first stage of employing a time-use lens is to characterize the fundamental energy- and carbon-intensity values of routine activities. That is, before contemplating how changes in time use could be effected and be effective in inducing sustainable behavior, the baseline relationship between time expenditure and environmental outcome must be described. Are the energy and carbon requirements of certain activities greater than others?

While previous work has quantified the energy intensity of Finnish time use (Jalas 2005) and the carbon intensity of daily activities in British households (Druckman et al. 2012), to date no work has characterized either intensity type for American time use. Accordingly, the chief objective of the present study is to quantify the direct and embedded (i.e., lifecycle) energy and carbon intensities of routine, non-work activities performed in the United States. With this research, I

aim to address the fundamental question of whether different activity categories are associated with substantially different per-hour energy use and greenhouse gas emissions. An answer in the affirmative would suggest that there is potential environmental value in shifting personal allocations of time.

A secondary interest, closely tied to the primary research aim, is to explore how differences in income affect energy- and carbon-intensity values. *Ex ante*, we would expect the intensity values to be higher at higher income levels. Everyone operates within the same 24-hour day, but wealthier individuals, on average, spend more money during that time than those in a lower income bracket. Accordingly, wealthier households consume more per unit time. Within this general trend, some activities may be more prone to an income-based ratcheting of intensity than others. This work is meant to identify those activities where income is the greatest moderator of the energy and carbon intensity of time use.

A third motivation for this work is to examine the proposition that activities most strongly associated with leisure and/or happiness tend to be more environmentally sustainable than other pursuits (Holmberg and Nassen 2011). This appealing hypothesis states that activities that promote happiness and improved quality of life (e.g., exercise, religious practice, and hobbies) are also, on average, less consumptive. It is perhaps telling that these activities, generally speaking, are normatively the most discretionary of time uses. (See Section 3.3.2.)

If true, the idea of leisure-based, happiness-promoting activities being relatively good for the environment means that shifting time uses can yield both personal and environmental benefits. The promise of a happier lifestyle with a smaller environmental footprint has been pursued by pockets of the U.S. population, including members of the voluntary simplicity movement and other "downshifters" (Schor 1999). However, there is scant empirical work that examines increased leisure time and its potential environmental impacts in the general American population, which is unlikely to be well-represented demographically by voluntary simplifiers (Maniates 2002). The present work is intended to develop quantitative evidence to better ground speculation about the potential for energy-saving or emissions-reducing shifts in time use to yield well-being benefits as well.

The remainder of this chapter is divided into five sections. Section 2 provides the theoretical underpinnings of this work. Specifically, it connects time use both to energy use and carbon emissions and to happiness. Next, it gives a brief look at the role of habits and routines in daily life. Section 3 reviews the sources of data and means of analysis used to connect time use, consumer expenditures, and lifecycle environmental consequences. Section 4 gives the analytical results. Section 5 discusses the results, looking particularly at how a time-use lens on behavior can inform sustainable consumption and behavioral intervention design. Section 6 provides a more detailed explanation of the calculations that underlie this chapter.

4.2 Background

4.2.1 Connections between Time Use and Energy/Carbon Budgets

People's use of time and their use of energy are connected in two important ways. First, energy is often used as a sort of substitute for time in the form of timesaving practices or devices. Driving 75 miles per hour between San Francisco and Los Angeles will complete the trip about two hours faster than driving 55 mph, but also increases fuel consumption by 50%. Similarly, at home, I can spend 20 minutes hanging a load of laundry or use 3 kWh of electricity via the dryer to accomplish the same result. Time-saving practices tend to be energy-intensive, performing a given task at a greater energy cost than do conventional, non-time-saving counterpart methods (Binswanger 2001). Thus, greater proliferation of timesaving devices should in general be expected to increase total energy consumption. This relationship is particularly relevant in light of the trend in the United States of increased annual work hours (Schor 2010) and a concomitant increase in a sense of time poverty (DeVoe and Pfeffer 2011); with less time available, people will likely become more reliant on resource-intense shortcuts.

Second, time poverty not only prompts use of energy-intense goods and services, but can also influence the likelihood of engaging in behavioral efficiency and other pro-environmental acts. Using an online survey of Australians and controlling for income, Chai et al. (2014) found a significant, positive link between discretionary time – defined by the authors as time not dedicated to paid work – and degree of engagement in carbon mitigation behaviors. In disaggregating this result, they found that an increase in discretionary time corresponded with a greater frequency of conservation behaviors ("using less electricity" or "walking/biking/scootering") but had no relationship with mitigation enacted through altered purchasing behavior ("buying/using a smaller/more fuel efficient car"). Kasser and Brown (2003) surveyed Americans about work hours and the frequency with which they engage in various pro-environmental behaviors (e.g., buying organic or recycling). They, too, found that people who worked fewer hours tended to engage in more environmentally friendly activities, along with a positive correlation between work hours and size of ecological footprint.

Each of us has the same 24-hour budget of time that must be spent daily. Spending this time of necessity entails consumption of both goods and energy. A time-use approach to considering sustainable lifestyles is a framework that emphasizes temporal rather than financial constraints as the limit on consumption (Jalas 2002). Jalas (2005) states that:

> consumption should be regarded as a set of temporal activities in which consumers utilize or engage with the various products of industrial systems and through which resource flows pass…. Accordingly, resource flows enable the various ways in which consumers desire or come to spend their time and should be analyzed in respect to time use.

Consumption, in this view, is the product of human time and market inputs. Accordingly, studying how individuals allocate their time provides an instructive lens for analyzing resource use and, by extension, the environmental consequences of consumption.

A time-use approach suggests that changes in consumption patterns are marked by changes in time allocation, and also indicates a potential for time-use rebound effects. Such rebounding occurs when the introduction of an energy efficiency measure also liberates time that was previously dedicated to performing a certain task. Jalas (2009) foresees this result arising from the purchase of eco-efficient household service providers, like a commercial lawn-mowing service. A professionally delivered service can be provided more efficiently (from an energy consumption perspective) than self-provisioning.[19] Purchasing the service liberates time for the purchaser that she would otherwise have spent cutting grass, time that must be spent in one form of another. This alternative expenditure of time involves the consumption of some amount of energy, and it is this energy consumption that comprehends the rebound on the efficiency gain from the professionally delivered service. The size of the rebound effect is dependent in part on the specific use of time that replaces the self-provisioning of service by the individual.

Using Jalas's time-use perspective, Druckman et al. (2012) calculated the greenhouse gases emitted per unit time of activities performed during the non-work, non-holiday hours of British adults. Combining data from a time-use survey and various accountings of direct and indirect greenhouse gas emissions from economic activity, they found that the average carbon intensity of routine life in Britain is 1.2 kg carbon dioxide-equivalent (CO_2e)/hr. Activities involving leisure and rest were generally of below-average carbon intensity, while those relating to food, household maintenance, and commuting were among the most carbon-intense. Their findings suggest that a simple substitution of time at home or socializing with friends and family for leisure activities that involve travel would be an effective means of promoting behavior-based greenhouse gas emissions reductions. However, the authors caution that disparities in discretionary time – a term in this instance used in reference to work and non-work obligations – may lead emissions-reduction programs to create a sort of temporal injustice, where adults with the least amount of discretionary time (e.g., single mothers) have the least capacity to adopt emissions-reducing behaviors.

4.2.2 Connections between Time Use and Well-being

How people use their time also has direct implications for their well-being, both in terms of passing affective states and longer-term, chronic happiness levels. To examine how various uses of time affect an individual's moment-to-moment emotional condition, Kahneman et al. (2004) asked subjects to record the strength of various emotions (e.g., happy, depressed, and angry) they experienced during their daily activities. While they found that all documented activities had

[19] In the case of lawn mowing, the efficiency gain might come from saving the embedded energy required if every household owned a lawnmower and from the purchase and careful maintenance of more efficient equipment.

an average net positive affect,[20] there was all the same a substantial range in the net affect scores. Perhaps unsurprisingly, intimate relations, socializing, and relaxing were ranked as the most net-positive (i.e., enjoyable) experiences, while commuting, working, and housework were rated as the least enjoyable. Aaker and colleagues (2011) neatly summarize this area of research with five "time-spending happiness principles," including spending time with the right people, spending time on the right activities, and focusing on the "here and now."

Time use also influences one's subjective sense of overall well-being on longer time scales. The Sustainable Happiness Model (Lyubomirsky et al. 2005; Sheldon and Lyubomirsky 2009) states that 40% of the variance in chronic happiness levels in the population can be attributed to "intentional activities," while closer to 10% of the variation is based on life circumstances, including income and marital status. Various studies support the general assertion that volitional activities influence subjective well-being, and that enduring well-being can be cultivated by purposeful behavior (Ryan and Deci 2001; Sheldon and Houser-Marko 2001). In one concrete example, survey efforts by Mochon and colleagues (2008) show that regular attendance of religious services or participation in yoga practice are associated with high levels of reported well-being.

4.2.3 Habitual Behavior

Habits are an important and often invisible guiding factor in all behavioral domains and, consequently, a relevant factor in the consumption of energy and goods. A habit is formed when a particular behavior is prompted by the presence of environmental cues rather than initiated by conscious thought (Verplanken and Wood 2006). That is, habits are an automatic behavioral response to circumstances rather than actions that result from a thoughtful and deliberate process. Past behavior can be a significant predictor of future behavior (Ouellette and Wood 1998). The strength of this predictive power is increased when past behavior is performed in a stable context, that is, when the behavior is habitual rather than merely frequent. Nearly half of daily behaviors are repeated in stable contexts (Ji and Wood 2007) and, therefore, are potential candidates for habit development. Travel behavior is especially prone to being directed by automaticity as demands for travel to a given place are often repeated at the same time, in the same location, and/or with the same people (Aarts and Dijksterhuis 2000; Fujii and Kitamura 2003; Verplanken et al. 1997). With regards to pro-environmental behavioral interventions, habits receive little attention in proportion to their influence on everyday behavior (Maréchal 2010).

Daily life would be quite challenging if people did not have habits, routines, and other forms of automaticity. As A.N. Whitehead observed more than a century ago, "Operations of thought are like cavalry charges in a battle – they are strictly limited in number, they require fresh horses, and must only be made at decisive moments" (as quoted in Bargh and Chartrand 1999). Conscious decision-making is cognitively taxing, and relegating a large number of tasks to automatic

[20] Recall that net affect is the difference between the average strength of positive emotions and the average strength of negative emotions. A positive net affect means that, on average, positive emotions are stronger than negative ones at the documented point in time.

processing allows people to conserve their limited resources for novel or important circumstances. Habits and routines reduce the transaction costs of everyday tasks, and in this sense are freeing. Walking a known and regular route to campus allows me to turn my mind to anticipating the events of the day or to digesting my latest reading. However, that same consignment of decision-making to habit, whether originally purposeful or accidental, can constrain behaviors in a way that is restrictive rather than liberating, particularly when habits run counter to intentions (Danner et al. 2008).

4.3 Methods

The *energy intensity* of an activity is the primary energy consumption, both direct and embedded, that is required per unit time to enable that activity. Similarly, the *carbon intensity* of an activity is the lifecycle greenhouse gas emissions[21] generated from the production and use of energy and goods that are associated with an activity.[22] To calculate the intensities of everyday activities, I disaggregated both the energy and carbon intensities into three constituent parts: time use, financial expenditure, and energy/carbon cost. Accordingly, the intensity of a given activity *i* was calculated as follows:

$$I_i = (F_i \times E_i)/T_i$$

where I is the energy or carbon intensity [MJ/hr or kg CO_2e/hr], F is the average daily financial outlay for all goods and services that enable activity *i* [$/day], E is the weighted average lifecycle energy consumed or greenhouse gases emitted to produce one dollar of goods consumed [MJ/$ or kg CO_2e/$], and T is the average amount of time spent each day on the activity [hr/day].

4.3.1 Data Sources

The data on time budgets and allocations were drawn from the 2010 American Time Use Survey (ATUS), which is executed by the U.S. Bureau of Labor Statistics. The ATUS employs time diaries and questionnaires to track the market and non-market ways that Americans use their time. Respondent households are sampled from the population of households that have completed the Current Population Survey, with one household member over the age of 14 serving as the primary respondent.[23] In time diaries, primary respondents record their minute-by-minute activities over the course of the previous 24 hours.[24]

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[21] The greenhouse gases looked at in this study are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). While most data sources consulted for this work excluded chlorofluorocarbons (CFCs) from their analysis, the EIO-LCA model, which I used principally to find the carbon intensity of goods, includes CFCs. To reconcile data sources, CFC data, when available, was omitted. In most cases, CFCs emissions associated with goods accounts for <1% of total global warming potential.

[22] The end-of-life emissions associated with goods disposal were not considered. Values are given in carbon dioxide-equivalents (CO_2e), which was calculated based on a 100-year time horizon.

[23] For this study, only data from respondents aged 18 years and older were used in order to analyze the carbon and energy intensities of adults.

[24] The 24-hour period spans from 4:00 AM the previous day to 4:00 AM the day the diary is completed.

Information about financial outlays by households was drawn from the 2010 Consumer Expenditure Survey (CES), also a product of the Bureau of Labor Statistics. The CES interview survey collects quarterly expenditure data from households, detailing expenditures in categories ranging from housing to health care to reading and education. For this work, I used the Bureau of Labor Statistics's tabulated annual summary, in which average spending in each expenditure category is broken out by income quintile.[25]

Lifecycle analysis of the energy intensity of the various expenditures captured by the CES was performed with a few different tools and datasets. The most prominent among these was Carnegie Mellon University's Economic Input-Output Lifecycle Assessment (EIO-LCA) tool, which estimates the material and energy flows required to produce a given value of final economic output (e.g., $1 million worth of automobiles).[26] For this work, I used the tool's 2002 US National Purchaser Price Model, the most recent model version available. To reconcile the difference between EIO-LCA model year (2002) and the time-use and expenditure data (2010), I used a ratio of the Consumer Price Index values for those two years to adjust the economic activity input of EIO-LCA.[27] While the EIO-LCA model provided the majority of the financial energy intensity (MJ/$) data, lifecycle data were drawn from other sources to fill gaps in the EIO-LCA tool. Carbon intensity values were calculated with tools and datasets similar to that of the energy-intensity values. See Section 4.6 for further details.

4.3.2 Data Limitations and Assumptions

As with any modeling project of this nature, I needed to make various assumptions and to impose definitions and data structures. One of the more fundamental decisions entailed dividing routine actions into a set of 15 activity categories, Table 7. These activity categories – across which I divided the ATUS, CES, and LCA data – are the basis of my energy- and carbon-intensity calculations. The selection of categories, while not arbitrary, represents just one of several valid approaches to distinguishing, clustering, and labeling the activities of a routine day.

[25] Average pre-tax annual household incomes for the CES sample, by income quintile: 1st - $9,900; 2nd - $27,000; 3rd - $46,000; 4th - $73,000; 5th - $160,000

[26] For more information about the EIO-LCA tool, see Hendrickson et al. (2006).

[27] The all-item, annual-average CPI value was 179.9 for 2002 and 218.1 for 2010. Accordingly, $1,000 spent on pets, toys, and hobbies purchases in 2010 was equivalent to an $825 outlay in 2002.

Table 7. Listing of activity categories used in this study.

Activity Category Name	Activity Examples	Leisure
Socializing (at home)	Entertaining family; hosting a poker night	Yes
Socializing (away from home)	Attending a friend's party; accompanying someone while they run errands	Yes
Hobby/Spiritual/Volunteer	Knitting; attending religious services; fundraising for charity	Yes
Sports and Outdoor Activities	Playing basketball; hiking; hunting	Yes
Cultural Events	Watching a movie in a theater; attending a sporting event;	Yes
Shopping	Grocery shopping; browsing at an electronics store; researching purchases	No
Food Preparation and Dish Washing	Making breakfast; brewing tea; emptying the dishwasher	No
Eating and Drinking	Eating a meal; snacking; drinking at a bar	No
Cleaning	Doing laundry; washing windows	No
Household Maintenance	Mowing the lawn; house repairs	No
Personal Care	Shaving; dressing a wound; showering	No
Caring for Others	Dressing a child; obtaining medical care for an adult	No
Education	Taking an adult education course; doing homework; studying	No
Sleep	Sleeping; napping; dozing	No
Other Travel	Driving to jury duty	No

Factoring in both what fosters greater experienced (affective) happiness and the body of literature on improving chronic happiness, I designated five of the above 15 activities as being, on average, more particularly leisurely and/or conducive to happiness than the rest: Socializing (at home), Socializing (away from home), Hobbies/Spiritual/Volunteer activities, Cultural Events, and Sports and Outdoor Activities.

Fitting ATUS, CES, and LCA data into these 15 categories entails a degree of subjectivity. A particular challenge was allocating household expenditures to specific activity categories. Reasonable cases could be made, for example, for allocating housing costs either equally across all 24 hours of daily time or only to that time when the house is occupied (i.e., being "used"). Some CES categories, like paying for professional services, were omitted from this model because they could not be mapped to a specific use of time. Section 4.6 provides an explanation of categories, data mapping, assumptions, and limitations of this approach.

4.4 Results

4.4.1 How Americans Use Their Time

The average division of American adult time, broken down by income quintile, is given in Table 8. At around nine hours per day, sleep is the largest expenditure of the daily time budget across all income levels. Recreation/Socializing, a category that includes exercise, spiritual practice, and cultural events, accounts for the next most common time expenditure across all income levels, though the first quintile averages better than two hours more activity in this category than the richest quintile. Though not considered in the intensity analyses in this work, paid work and the associated commute is the third largest total use of time. Food preparation and consumption, household chores, and care for self and others make up most of the balance of the day, each

claiming between 1 and 2 hours per day. For all categories other than Other Travel, these total time figures include both the time spent engaged in the given category as well as the transportation time associated with that activity. (For example, 15 minutes spent driving to do 30 minutes of shopping would count as 45 minutes in the Shopping category.)

Table 8. The allocation of time across the average day of an American adult.
Lower quintile ranking corresponds to lower income level. Columnar values may not sum to 24 hours on account of value rounding.

Activity cluster	1st	2nd	3rd	4th	5th
Recreation/Socializing	6.7	5.6	5.3	4.9	4.6
Food Preparation and Consumption	1.7	1.8	1.7	1.7	1.8
Sleep	9.3	9.0	8.8	8.6	8.4
Household Management	1.6	1.7	1.9	1.8	1.8
Care for Self and Others	1.4	1.4	1.5	1.5	1.6
Other Travel	1.0	1.2	1.2	1.4	1.5
Work/Education and Associated Travel	2.5	3.5	3.9	4.4	4.6

In comparing time allocation across income levels, a few intuition-matching trends emerge. Members of higher income households tend to spend more time working and in educational settings. This time comes at the expense of time used for sleeping, recreation, and socializing tends to decrease. Time spent on food and household chores does not vary with income quintile by more than a quarter of an hour.

The values in Table 8 are sample-wide averages, dividing a 24-hour day according to aggregated data. These values represent time dedicated to each activity category on an average day rather than the amount of time typically spent on an activity. Table 9 provides values of conditional time use across different activities. That is, the given values are average or typical amounts of time to spend on an activity *if* a person were to engage in that activity on that day. Consider a person who works five eight-hour workdays and has two non-work days. Their average amount of working time is 5.7 hours per day, but the conditional temporal footprint is 8 hours. For those categories with near-universal participation (e.g., Sleep), the values of Table 8 and 9 are quite similar. For others, like Work, Education, and Caring for Others, the average and conditional time uses are quite different.

Table 9. The conditional temporal footprint of various routine activities.
Lower quintile ranking corresponds to lower income level.

Activity	1st	2nd	3rd	4th	5th
Socializing	6.1	5.2	5.2	5.1	5.2
Hobby/Spiritual/Volunteer	12.9	9.8	9.6	8.8	8.7
Cultural Events	2.4	3.2	2.9	2.7	2.8
Sports and Outdoor Activities	4.0	5.5	4.7	5.0	5.8
Shopping	2.3	1.8	4.0	2.5	1.9
Eating and Drinking	1.6	1.6	1.5	1.6	1.7
Food Preparation and Dishwashing	1.1	1.1	1.0	1.0	1.0
Cleaning	2.0	1.8	1.8	1.6	1.5
Household Maintenance	7.5	8.9	9.7	9.9	8.8
Personal Care	2.2	2.2	2.7	2.0	2.1
Care for Others	12.2	9.6	11.7	11.9	10.2
Education	9.7	13.8	11.1	11.3	9.6
Sleep	9.3	9.0	8.8	8.6	8.4
Work	9.7	10.6	11.1	10.4	10.7

4.4.2 Energy Intensity Values

Figure 6 shows the energy-intensity values of the 15 activity categories created for this study. The total energy-intensity value is disaggregated into three sub-categories. *Household energy* comprehends the direct use of energy in the home in the forms of electricity, natural gas, and heating oil as well as the embedded, or lifecycle, energy required to make the dwelling and its furnishings. *Embedded energy* signifies the energy required to make all other goods employed in the course of an activity. For example, the category Personal Care includes the energy required to make and ship the items consumed like razor blades and shampoo. The third category, *travel energy*, is made up of the direct fuel consumed by transportation, such as gasoline, as well as the embedded energy of the vehicles used for transportation. The weighted average energy intensity during the day is 33 MJ total energy per hour. This value becomes 53 MJ/hr if sleep time is omitted.

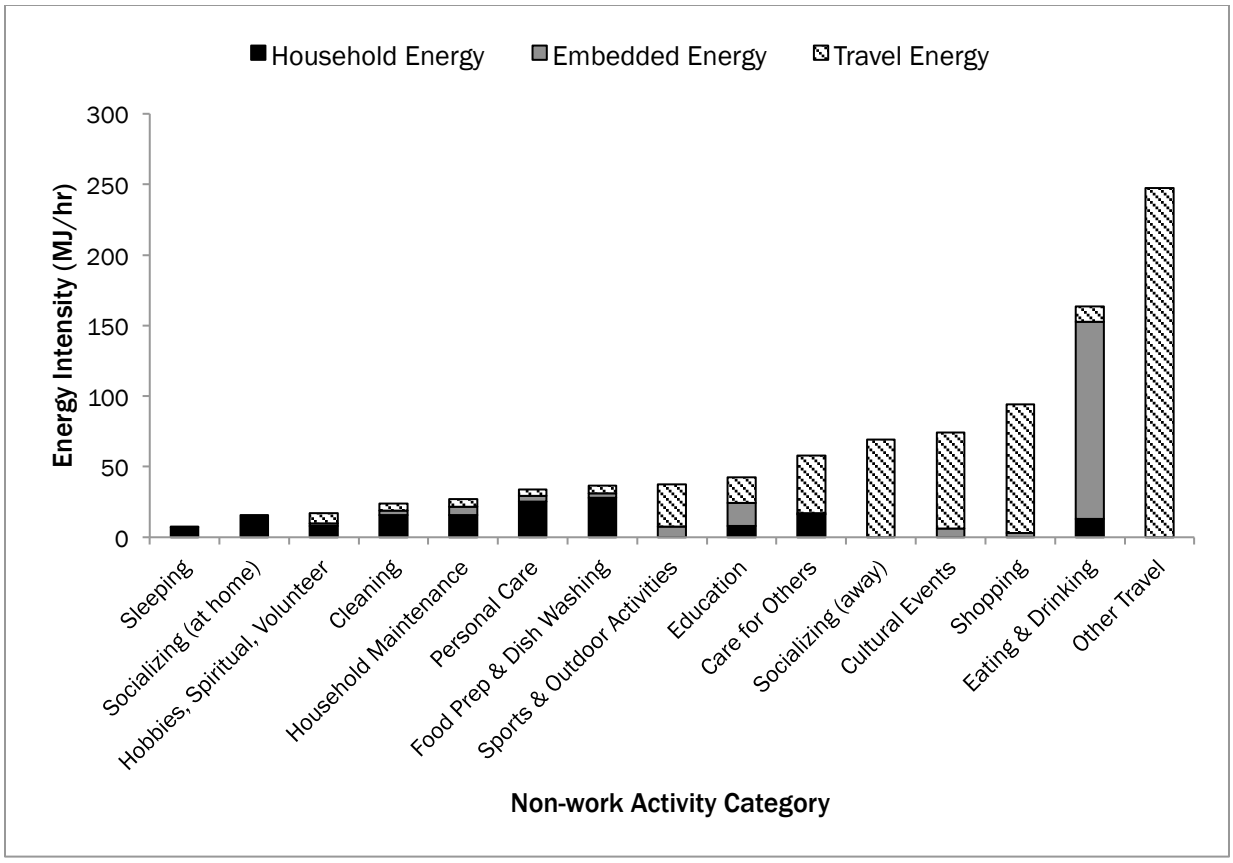

Figure 6. The average energy intensity of daily activities.

As Figure 6 illustrates, there is substantial range in the energy intensity of everyday activities, a roughly 30-fold difference between the least and most energy-intense categories, Sleep and Other Travel. This finding addresses the first objective of this research, establishing that how Americans use their time matters in terms of the associated rate of energy consumption.

The third objective of this work is to quantitatively examine the notion that happiness-boosting and leisure activities are less energy intense than other non-work activity types, including care and maintenance activities. To examine this hypothesis, I noted the location of the activity categories associated with happiness and leisure within a rank order of all activity-category intensity values. A comparison of activity-category mean-intensity values provides mixed support for the idea that happiness-promoting and leisure activities are of relatively low energy intensity. The categories Socializing (at home) and Hobbies/Spiritual/Volunteer are, next to Sleep, the least energy-consuming uses of time. The category Sports and Outdoor Activities marks the median energy intensity, while Socializing (away from home) and Cultural Events are in the top third of rank order of intensity values. Clearly, the particulars matter when examining the relative intensity of leisure as a (very broad) class of activities.

Figure 6 also makes clear the large influence of travel on the energy intensity of different uses of time. Energy used for travel accounts for the majority of the energy consumed per hour for six of the 15 categories, all of which are at or greater than the median intensity value for all

activities. It bears repeating that the intensity values presented here are average values, characterizing the typical behavior on and average day. A great deal of variance is hidden, as, for example, walking next door for a neighborly chat and driving across town for the same conversation have markedly different energy signatures with regards to travel. That is, these data indicate that, on account of the way that travel is performed, activities that take place outside the home are typically much more energy intense that those that are performed domestically.

As predicted, the energy-intensity values for many activity categories vary significantly across income levels, see Figure 7 The activity categories of Hobbies/Spiritual/Volunteer, Cultural Events, and Sports and Outdoor Activities have the largest relative difference between the energy intensity for members of the first and fifth income quintiles. For these three activity clusters, the intensity of the fifth quintile is double that of the first quintile. Socializing (at home) and Food Preparation and Dishwashing are the two activity categories for which the relative difference between high- and low-income groups is least; fifth-quintile household intensities for these categories are only one-third more than those of the lowest income bracket. Sleep and Socializing (at home) are the activities with the least absolute difference in energy intensity across income levels, while Other Travel and Eating and Drinking have the largest absolute difference.

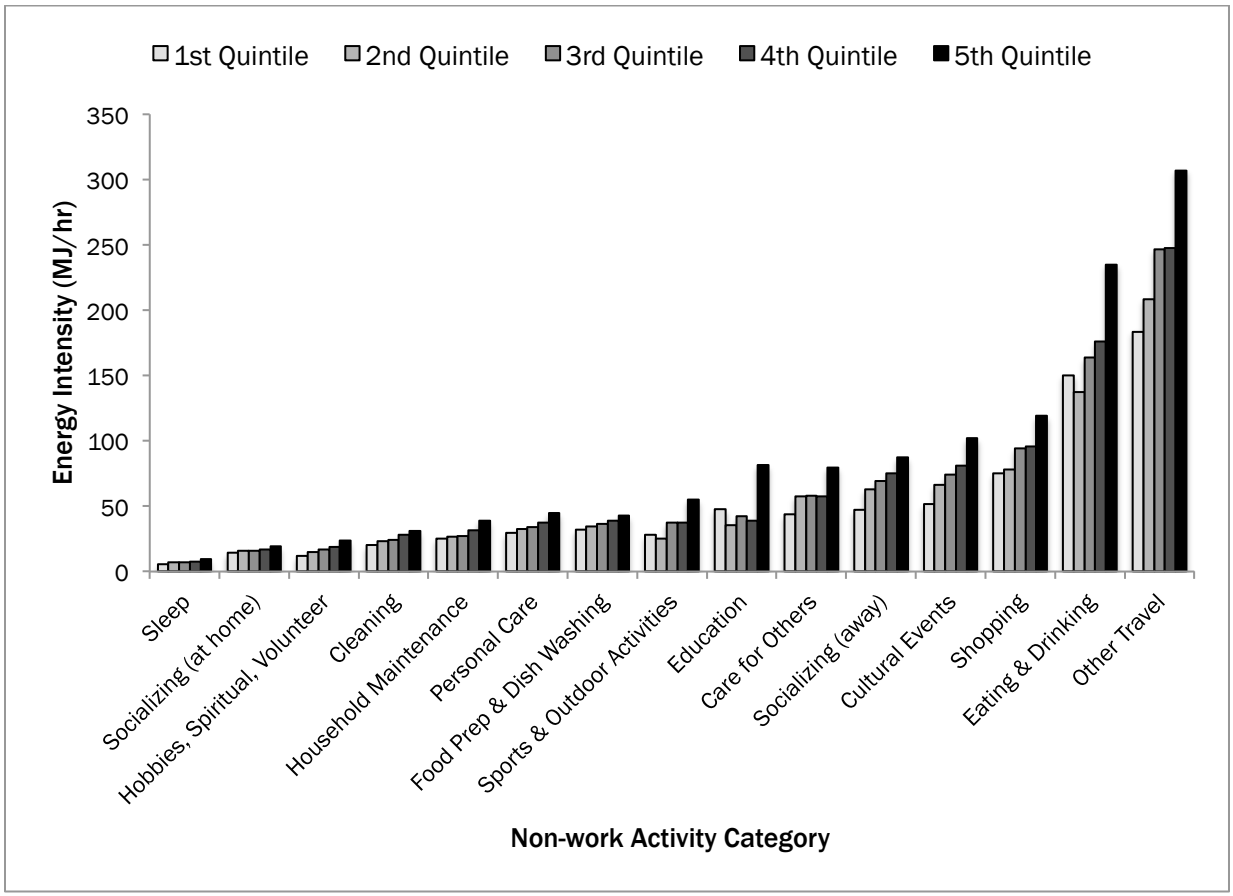

Figure 7. The average energy intensity of daily activities by income quintile.
Lower quintile ranking corresponds to lower income level.

4.4.3 Carbon Intensity Values

Figure 8 shows the carbon-intensity values of the 15 activity categories, disaggregated in the same fashion as the energy-intensity values. The weighted average energy intensity during the day is 2.8 kg CO_2e per non-work hour. (The waking-hours average is 4.3 kg CO_2e/hr.) The implied per-capita carbon footprint value of roughly 22 tCO_2e/year is consistent with Jones and Kammen's (2011) household carbon footprint modeling study, which calculated average household carbon footprints to be roughly 20 tCO_2e/year/person.

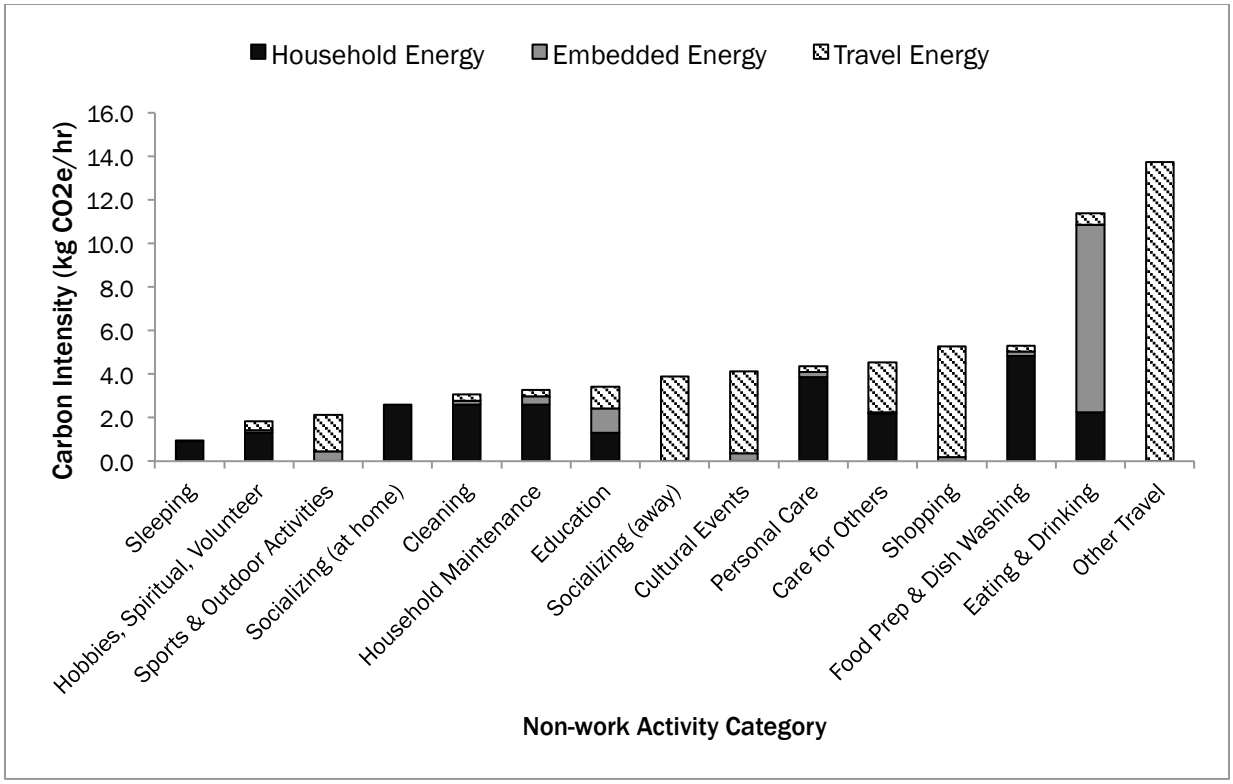

Figure 8. The average carbon intensity of daily activities.

As with the energy-intensity values, there is a decided difference in the carbon intensities of daily activities, a factor of 15 distinguishing the most- and least-carbon-intense activities. The association between leisure activities and carbon intensity is somewhat stronger than when looking at energy: the three non-Sleep categories of below-average carbon intensity are all directly associated with well-being. As with the energy-intensity model, travel-intensive activities, leisure-based or otherwise, tend to be the most carbon-intense, though a few domestic activities are on the upper end of the ranked ordering of categories.

As was the case with energy intensities, there is substantial variation across income quintiles with respect to the carbon intensities of routine activities, see Figure 9. However, the degree of variation is somewhat less than is the case with energy-intensity values. Sports and Outdoor Activities, Cultural Events, and Socializing (away from home) are the categories with the greatest

cross-income difference, with the highest income quintile being 93%, 87%, and 74% greater than the first-quintile values, respectively. On the other end of scale, Socializing (at home) and Food Preparation and Dishwashing vary by 25% or less across income levels. Just like with the energy model, sleep and socializing at home are the activities with the least absolute difference in carbon intensity across income levels, while Other Travel and Eating and Drinking have the largest absolute difference.

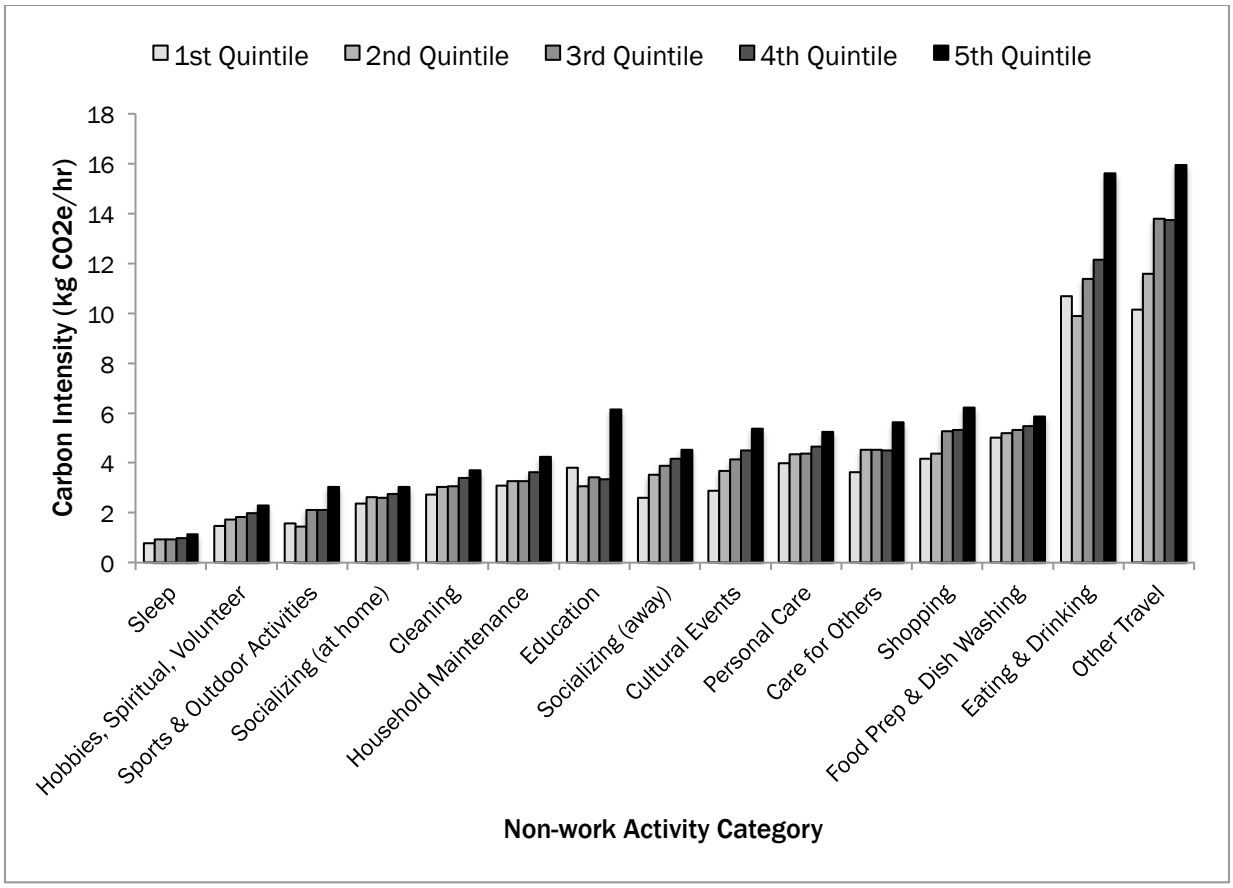

Figure 9. The average carbon intensity of daily activities by income quintile.
Lower quintile ranking corresponds to lower income level.

4.4.4 Comparison of Results with Previous Studies

This chapter's calculation of temporal energy and carbon footprints extends the time-based consumption literature in three ways. This is the first study to calculate a temporal footprint for the United States, a country that, as the world's largest economy, merits particular attention. This is also the first study of any country to calculate both the temporal energy and carbon footprints of consumers. The use of similar methods and data sources allows for a reasonable degree of comparison of trends in the two domains. Finally, this is, to my knowledge, the only study to look for trends in intensity values across income levels.

While several studies have engaged the topic of household carbon and energy footprinting, few studies have used a time-use lens to do so. The present work most closely resembles Jalas's (2002, 2005) modeling of Finnish energy consumption and work by Druckman and colleagues (2012) to characterize the carbon intensity of men and women in British households. Because these authors used different activity categories and drew on different emissions sources,[28] a direct comparison of intensity values has limited value. However, a comparison of trends in the data can still be instructive. The trends in the Finnish and British work that speak to my research questions point to the same conclusions as the current chapter. As with this work, both the Finnish and British studies calculate substantial variation in intensities across different activities. Further, they find transportation use is a key determinant of intensity values, and that categories relating to food and eating have high non-transportation-based intensities. Also consistent with the work in this chapter is their shared outlook of recreational activities, such as reading and hobbies, tending to be of below-average intensity.

4.5 Discussion

To better anticipate the environmental repercussions that increases in time affluence and time spent on leisure activities might have on environmental sustainability, I employed Jalas's (2002) time-use approach to understanding consumption behavior. In doing so, I sought to create a quantitative foundation for understanding how substituting uses of time might yield changes in energy consumption and greenhouse gas emissions. This modeling work can be used to inform future empirical or descriptive work on consumption and time use.

With these calculations of temporal intensities in hand, the question becomes one of how to make use of these values and, more generally, of the time-use lens on consumption. Such a lens can help identify barriers to sustainable behavior change and improve the design of behavioral interventions.

4.5.1 A Time-use Lens on Consumption

Tracing how people spend their time – that is, adopting a time-use lens on consumption – illuminates facets of consumption that are not directly accessed by using a standard financial approach. Further, examining time use suggests methods for disrupting status quo patterns of consumption and turning them in a more sustainable and satisfying direction.

Figure 6 and Figure 8 show that how individuals spend their time matters in terms of energy consumption and greenhouse gas emissions. These findings provide the obvious answer to the primary research question driving this work: yes, different uses of time have different energy and carbon intensities. The enticing interpretation of these results is that energy conservation gains and carbon emissions reductions are a matter of encouraging people to reduce their engagement in one form of activity in favor of another, less-intensive action. For example, spending more

[28] For example, Druckman et al. excluded volunteer work and education outside the home as activities, and did not include housing rent and household furnishings in their greenhouse gas inventory.

time at home on hobbies and less at cultural events is a first-order gain in terms of energy conservation and carbon footprint reduction. Several factors complicate this interpretation.

Shifting uses of time is in some respects outside of the immediate control of many individuals. Consider the transportation component of household energy consumption, which, as the data presented here make clear, is a substantial component of the energy intensities of activities outside the house. Combined with prior decisions made concerning housing location, incumbent infrastructure can lock households into modes of provisioning that do not easily allow for shifts in time use or energy services. While individuals can achieve a measure of energy and carbon conservation through rearrangements of time use, for example by practicing trip chaining or engaging in more e-commerce, there are constraints imposed by the prevailing transportation socio-technical system. An individual cannot, of her own volition, create more shopping options closer to home or conjure a convenient public transportation system. Absent concomitant changes in infrastructure and institutions, fundamental and extensive changes in time-use behavior may be outside of the reach of conventional behavioral interventions, even given an intention on the part of individuals to act.

In addition to the infrastructural lock-in that constrains behavior, those aiming to influence consumption behavior need to contend with the behavioral lock-in that exists in the form of habits. As noted in Section 2.3, a substantial fraction of daily behaviors are habitual, and it is likely that most direct household energy consumption is the result of automatic rather than intentional behavior. Certainly, transportation patterns are heavily influenced by habit, given that most trips are routinized (Gärling & Axhausen, 2003). Consider, for instance, your own daily routine and how much conscious thought is given to the mode and route taken to get to work. Verplanken and Wood (2006) describe two pathways by which consumer habits can be broken. They suggest that interventions designed to shape attitudes or incentivize certain behaviors are appropriate for upstream, pre-habit-formation efforts seeking either to prevent undesirable habits from forming or to encourage desirable ones to take hold. Strong habits foster biases that make it less likely that individuals will be receptive to information that is counter-habitual, so attitude-changing efforts are particularly effective in shaping behavior prior to the establishment of habits.[29]

Once a habit has been established, Verplanken and Wood suggest that interventions will be most successful when the context that cues the habitual behavior is disrupted, as happens when someone moves to a new home or changes jobs. Since habits are cued by elements in the environment – be they physical, social, or temporal – changing the environment disrupts cues and makes individuals more susceptible to the influence of new information. As such, a "downstream-plus" strategy to break habits pairs a change in behavior-performance environment with information about alterative behaviors. Field experiments of interventions designed to reduce or modify energy consumption have borne out this downstream-plus approach (e.g., Bamberg 2006; Maréchal 2010). The premise of the current work is that changes

[29] As well as diminishing receptiveness to counter-habitual information, Klöckner et al. (2003) found that strong habits are capable of preventing the activation of personal and subjective norms.

in behavior at the individual or household level are necessary for achieving sustainability goals, particularly with respect to energy use and greenhouse gas emissions. Because habits have a substantial influence as a conservative force on how people use their time, any consideration of how to change consumption via time-use patterns must contend with habit-based behavioral lock-in. Judicious application of research on habits is a necessary complement to policy measures aimed at relaxing constraints on individual behavior.

Table 8 and data in Chapter 3 indicate that the average adult has between 5 and 8 hours of discretionary time each day. Applying the terminology of Chapter 3, this means that the remaining time uses – and, critically, their associated energy consumption and greenhouse gas emissions – are necessary, or at least harder to modify than discretionary time. Given that, with the exception of sleep, necessary activities tend to be more environmentally intense than discretionary activities, the time-use lens again points to the trouble of behavioral lock-in, a feature that is harder to identify and characterize by simply examining expenditures of income. The relationship between necessary and discretionary time uses and environmental intensities suggests that opening up more discretionary time could yield environmental dividends. This topic is explored in greater depth in Chapter 5.

All the complexity of effecting shifts in time use does not negate the possibility that such shifts might both reduce energy consumption and improve short- and long-term welfare. Reducing travel times stands out in this regard because it is the most energy intensive activity category, it ranks lowest on the list of activities that foster of positive affect (Kahneman et al. 2004), and it does not seem to contribute (directly) to any of the sustainable happiness behaviors discussed in the introduction. Here again, infrastructure and consumption options may limit the availability of options for reducing time in transit, but efforts to promote more local, even domestic, social and leisure activities could still yield conservation gains.

4.5.2 Time-use Intervention Principles

A second conceptual value of employing a time-use lens on consumption is that it serves to focus attention on the lifestyle aspects of strong sustainable consumption (see Section 0). Conventional thinking about sustainable consumption and the interventions that are based on it focus on purchasing behavior and resource-consumption efficiency. In contrast, the strong sustainable consumption approach stresses non-material contributions to quality of life (Lorek and Fuchs 2013), an emphasis that *time* is well-suited to provide. Accordingly, a time-use lens can facilitate the development of interventions that affect lifestyle characteristics rather than the characteristics of purchased products.

The concepts of *time* and *happiness* provide a range of opportunities for motivating more sustainable consumption of energy. Though there have to date been no large-scale, proof-of-concept intervention campaigns executed that call on these constructs for pro-environmental ends, the literature in this area is suggestive of how such interventions might be designed and why they might succeed. Rather than focusing directly on energy consumption or carbon footprints, these interventions would be aimed primarily at affecting time use in order to achieve

secondary energy and carbon benefits. What follows are a few design elements for interventions based on time and happiness.

4.5.2.1 Activate the construct of *time* rather than *money*

An effective avenue for prompting less consumptive and more enjoyable behaviors may lie in enhancing the salience of time and downplaying the role of money in time-use decisions.[30] While many energy-focused, pro-environmental programs emphasize the financial benefits of reducing energy consumption, monetary incentives, either through savings or an externally designated reward, can have the effect of curtailing pro-social behavior and reducing the durability of any changes in behavior (Gowdy 2008; Steg and Vlek 2009). Activating a money frame can also take the happiness out of discretionary experiences. For example, when people are reminded of the economic value of their time, for example, their hourly wage rate, they derive less enjoyment from leisure activities like casual browsing on the Internet (DeVoe and House 2012). This effect is in part based on a feeling of impatience people develop, derived from a sense that they were unprofitably using their time. Increasing the salience of time, on the other hand, has been shown to make people more ethical (Gino and Mogilner 2014) and more inclined to donate to charity (Liu and Aaker 2008). More in line with the subject of this paper, activating the construct of *time* has the tendency to prompt individuals to spend more time engaged in social activities whereas *money* spurs more time working (Mogilner 2010). Ambiguity concerning the monetary value of time promotes "accommodation and rationalization" (Okada and Hoch 2004), which makes it easier to feel like one is getting their "time's worth" from both good and bad experiences.[31] Intervention designers who can get their target population to think about *time* will find it easier to persuade people to take up move social and leisurely pursuits.

4.5.2.2 Give experiences

A second intervention technique available to those interested in promoting shifts in time use to reduce environmental impacts is to promote the exchange of experiential rather than material gifts. Research indicates that life experiences, or experiential goods, tend to yield greater satisfaction, both retrospectively and prospectively, than do material goods (Van Boven 2005; Van Boven and Gilovich 2003). This finding is in part due to the socializing that experiences facilitate (Mogilner 2010; Van Boven 2005). Experiential goods also tend to be more closely associated with one's life story than are material possessions (Carter and Gilovich 2012) and may be less subject to hedonic adaptation (Nicolao et al. 2009). Gifts make up about 2% of average American household annual expenditures (Bureau of Labor Statistics 2014), a roughly $100-billion annual flow of currency that is truly discretionary and is a prime target for behavioral influence. De-materializing (or perhaps "experientializing") gift-giving holds the promise of both increasing happiness and, depending on the mode and, critically, the location of the experience, decreasing energy use.

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[30] Evoking the idea of mortality, however, may actually increase the propensity to engage in consumptive activities (Kasser and Sheldon 2000).

[31] In this light, the effect in DeVoe and House's work may be attributed to a disambiguation of the opportunity cost of leisure time.

As the current research indicates, the travel required to engage in a given activity tends to determine that activity's relative energy intensity. Accordingly, care must be taken to promote experiences that can be enjoyed as locally as possible. The "Be a Tourist in Your Own Home Town" promotions in cities like Victoria, British Columbia, and Lansing, Michigan, may in this light provide interesting case studies. These programs encourage residents to enjoy the cultural and natural attractions of their own community. Both Victoria and Lansing pair their promotions with public transit fare reductions for participants, thereby helping to cut further transportation-related emissions.

4.5.2.3 Volunteerism

This analysis shows that time spent volunteering is, on average, among the least energy and carbon intense hours of our day. Volunteering also fosters short- and long-term characteristics associated with personal well-being, including a feelings of life satisfaction, self-esteem, and self-efficacy (Gray 2010; Mogilner et al. 2012; Thoits and Hewitt 2001). In addition, the act of giving time to the service of others corresponds to an increase in perceived time affluence (Mogilner et al. 2012), which itself correlates positively with happiness (Kasser and Sheldon 2009) while substantial time poverty is associated with consumerist impulses (Manolis and Roberts 2012). The sustainable-consumption and well-being movements could gain political strength by linking their programs with those of organizations that provide social services, such as the United Way or local adult literacy programs, see Section 5.4.4. Even without such alliances, promotions to spend more time volunteering can yield great personal, social, and environmental benefits.

4.5.3 Limitations and Future Directions

Although the work in this chapter contributes to our understanding of American patterns of time use and their connections to consumption and well-being, prospective studies could correct several of this study's limitations. First, this research provides a static, *ceteris-parabis* representation of activity energy and carbon intensities, averaged across time, geography, and the American population. Shifts in how people spend their time will likely alter both the energy/carbon and the time components of the intensity calculations in ways that are not straightforward to predict. Spending less time on shopping, for example, could have implications for not only the intensities of that activity category but that of others, as well. Consider a scenario in which grocery-shopping time gets squeezed, an individual might switch from walking to the corner store several times a week to driving to the supermarket for a week's worth of ingredients. Not only would the transportation energy associated with grocery shopping increase, but buying a larger quantity of groceries might also encourage the purchase of a larger-capacity refrigerator that consumes more electricity. Similarly, less time to prepare food might result in a greater reliance on pre-packaged or highly processed foods, affecting the energy intensity of that category, as well. In both of these examples, we should also anticipate a time-use rebound effect via the energy consumption that takes place during the time liberated by the time-saving behavior or technology change (Jalas 2009). To wit, there is a dynamism in a time-based view of energy consumption that is not accounted for in this research.

One challenge associated with this time-use dynamism is the difficulty of forecasting how people will respond to changes in time use, particularly to increases in discretionary time. In surveying people about what they would do with an extra hour of spare time each time, one could reasonably anticipate that a fair number of respondents would express an interest in reading more books or going to the gym. Such noble stated intentions could be contradicted by evidence of increasing rates of watching television and surfing the Internet (e.g., eMarketer 2013). Academic and policy work related to time use would greatly benefit from reliable methods for characterizing and forecasting time-use changes.

This work develops energy and carbon-intensity values that rely on population and economic averages and that ignore regional variations in production infrastructure and consumption patterns. For example, the carbon intensity of electricity was calculated from the national-level generation mix rather than region-specific mixes. Because of this, electricity used by a household in coal-reliant Indiana is assigned the same carbon footprint for the same amount consumed in California. Similarly, no measures were taken to account for differences in public transportation availability and use between urban and rural areas. The implied homogeneity of this modeling approach is better suited to smaller economic geographies, and future temporal footprinting could be made more accurate by regional disaggregation. However, the absence of sub-national lifecycle accounting tools currently hinders efforts to probe regional differences in non-energy (i.e., goods) consumption lifecycle values.

4.5.4 Concluding Comments

The findings of this study indicate that, given how they are typically performed, day-to-day activities are substantially different in terms of energy and carbon intensities. Shifting the manner in which people spend their time holds promise as a means for moving toward more sustainable patterns of consumption, particularly if coupled with changes in physical infrastructure and economic structure. It is my hope that this micro-scale examination of time use and its implications for individual and environmental well-being can fertilize both new approaches to promoting sustainability at the household level and a broader discussion about economic priorities *vis-à-vis* time, our least renewable resource.

4.6 Detailed Energy/Carbon Intensity Calculation Method Description

As stated in Section 0, I calculated the energy- and carbon-intensity values of American households through the use of three types of data: time-use, household-expenditure, and lifecycle energy-consumption and greenhouse gas emissions. The datasets used for these three categories were collected through independent processes and with independent purposes. This independence means that categories used to structure each dataset are not mutually consistent; that is, the terms and categories used in one dataset do not necessarily match those of the other sets. Accordingly, completing this modeling work required mapping datasets onto each other. The purpose of this section is to describe this mapping and to make explicit other assumptions that informed the work presented in this chapter.

4.6.1 Mapping ATUS data to Activities Categories

This chapter divides the routine activities of Americans into 15 separate activity categories, see Table 7. The 2010 American Time Use Survey, from which data on time use was drawn, uses a two-tier coding system to divide daily activities into 108 categories.
Table 10 shows the mapping of ATUS categories to the activities categories that I used for this study.

Table 10. Mapping ATUS data on study activity categories.
Most of the 108 activities labeled by the two-tier ATUS system were organized into 15 activity categories.

Activity Category	ATUS Two-Tier Categories (Code Number)
Sleeping	Sleeping (101)
Hobbies, Spiritual, Volunteer	Relaxing and Leisure (1203); Waiting Associated with Socializing, Relaxing, and Leisure (1205); Religious/Spiritual Practices (1401); Administrative and Support Activities (1501); Social Services and Care Activities (1502); Indoor and Outdoor Maintenance, Building, and Clean-up Activities (1503); Participating in Performance and Cultural Events (1504); Attending Meetings, Conferences, and Training (1505); Public Health and Safety Activities (1506); Waiting Associated with Volunteer Activities (1507); Travel Related to Socializing, Relaxing, and Leisure (1812); Travel Related to Religious/Spiritual Activities (1814); Travel Related to Volunteer Activities (1815)
Sports and Outdoor Activities	Participating in Sports, Exercise, or Recreation (1301); Waiting Associated with Sports, Exercise, and Recreation (1303); Travel Related to Sports, Exercise, and Recreation (1813)
Socializing (at home)	Socializing and Communicating (1201); Attending or Hosting Social Events (1202); Waiting Associated with Socializing, Relaxing, and Leisure (1205)
Cleaning	Housework (201); Travel Related to Household Activities (1802)
Household Maintenance	Interior Maintenance, Repair, and Decoration (203); Exterior Maintenance, Repair, and Decoration (204); Lawn, Garden, and Houseplants (205); Animals and Pets (206); Appliance, Tools, and Toys (208); Household Management (209); Travel Related to Household Activities (1802)
Education	Taking Class (601); Extracurricular School Activities (except sports) (602); Research/Homework (603); Registration/Administrative activities (604); Travel Related to Education (1806)
Socializing (away from home)	Socializing and Communicating (1201); Attending or Hosting Social Events (1202); Waiting Associated with Socializing, Relaxing, and Leisure (1205); Travel Related to Socializing, Relaxing, and Leisure (1812)
Cultural Events	Arts and Entertainment (other than sports) (1204); Waiting Associated with Socializing, Relaxing, and Leisure (1205); Attending Sporting/Recreational Events (1302); Security Procedures Related to Attending Sporting Events (1304); Travel Related to Socializing, Relaxing, and Leisure (1812); Travel Related to Sports, Exercise, and Recreation (1813)
Personal Care	Grooming (102); Health-related Self Care (103); Travel Related to Personal Care (1801)
Care for Others	Caring For and Helping Household Children (301); Activities Related to Household Children's Education (302); Activities Related to Household Children's Health (303); Caring for Household Adults (304); Helping Household Adults (305); Caring For and Helping Non-household Children (401); Activities Related to Non-household Children's Education (402); Activities Related to Non-household Children's Health (403); Caring for Non-household Adults (404); Helping Non-household Adults (405); Travel Related to Caring for and Helping Household Members (1803); Travel Related

	to Caring for and Helping Non-household Members (1804)
Shopping	Shopping (Store, Telephone, Internet) (701); Researching Purchases (702); Security Procedures Related to Consumer Purchases (703); Travel Related to Consumer Purchases (1807)
Food Preparation and Dishwashing	Food and Drink Preparation, Presentation, and Clean-up (202); Travel Related to Household Activities (1802)
Eating and Drinking	Eating and Drinking (1101); Waiting Associated with Eating and Drinking (1102); Travel Related to Eating and Drinking (1811)
Other Travel	Travel Related to Work (1805); Travel Related to Using Professional and Personal Care Services (1808); Travel Related to Using Household Services (1809); Travel Related to Using Government Services and Civic Obligations (1810)

The raw ATUS data take the form of a minute-by-minute accounting of 24 hours in a respondent's life. Across the diaries used for this work, I calculated an average number of daily minutes spent on all 108 ATUS categories for both the whole population and for each income quintile, based on the ATUS demographic data about household income. I calculated the average time spent in each of the 15 activity categories by summing the average time expenditures of the ATUS categories associated with each activity category. In the event that an ATUS category applied to more than one activity category – for example, ATUS category 1201, Socializing and Communicating, fit both the Socializing (at home) and Socializing (away from home) activity categories – the time associated with the ATUS category was split evenly across the relevant activity categories. The total temporal footprint of each activity category [hr/day] comprehends both the time actually engaged in the activity, for example, shopping, and the time spent traveling in order to engage in the activity. In the case of shopping, this might be driving to the mall.[32]

By necessity, three different ATUS categories were not mapped into this study's activity categories. Because this is a household consumption-based study, time expenditures I associated with paid work and government services were excluded to avoid double-counting lifecycle energy consumption and greenhouse gas emissions. The primary ATUS categories Professional and Personal Care Services and Household Services were excluded from consideration as uses of time because the financial expenditures associated with those categories apply to activities other than those described by the ATUS categories. For example, the tertiary ATUS category Paying for Repair Work Done on Car is excluded because the cost of that repair work is associated with time spent driving.

The nature of the ATUS data did not permit accounting for respondents engaging in multiple activities at once, which people almost certainly do frequently throughout the day. (As I write this, I am also sipping tea and listening to music.) Rather the ATUS data characterize what people consider to be their *primary* activity at any given moment. As a result, the temporal footprints of some activities will be underestimated, consequently inflating estimates of their energy and carbon intensities.

[32] The exception to this calculation of total temporal footprint is the Other Travel activity category, which measures the time spent in travel associated with activities that are not included in the 15 activity categories.

4.6.2 Mapping EIO-LCA Data to CES Categories

The precursor step to calculating the energy and carbon intensities of the 15 activity categories [MJ/hr and $kgCO_2e/hr$] is finding the energy and carbon intensities of the financial expenditures associated with those activity categories [MJ/$ and $kgCO_2e/\$$] via lifecycle analysis. Table 11 indicates how lifecycle analysis data, chiefly drawn from the EIO-LCA tool, was mapped onto consumer expenditure data.

Table 11. Mapping EIO-LCA sectors onto CES expenditure categories.
High-level expenditure categories are given in italics.

CES Category	EIO-LCA Categories
FOOD	
Cereals	Breakfast Cereal; Bread and Bakery Product; Cookies, Crackers, Pasta
Meat	Poultry; Non-poultry Animal; Seafood
Dairy	Cheese; Fluid Milk and Butter
Fruit and Vegetables	Vegetable and Melon Farming; Fruit Farming; Greenhouse and Nursery Production
Other	Average of above food categories
Restaurant	Average of above food categories
Alcohol	Brewery; Winery; Distillery
HOUSING	
Dwellings	Residential Permanent Site Single- and Multi-
Taxes and Interest	Non-depository Credit
Maintenance and Repair	Residential Maintenance and Repair; Household Goods Repair and Maintenance; Electronic Equipment Maintenance and Repair
Other	Hotels and Motels; Other Accommodations
Natural Gas	Natural Gas Distribution; Oil and Gas extraction; Other Source
Electricity	Other Source
Fuel Oil	Petroleum and Petroleum Refining; Other Source
Telephone	Telecommunications
Water	Water, Sewage, and Other Systems
HOUSEHOLD	
Personal Services	Child Care Services; Individual and Family Care; Home Health Care
Other Household Expenses	Dry Cleaning and Laundry; Household Goods Repair and Maintenance; Electronic Equipment Maintenance and Repair; Cable; General and Consumer Goods
Laundry/Cleaning	Soap and Cleaning Compound
Other Household Products	Stationary; Sanitary Paper; All Other Miscellaneous Manufacturing; Broom, Brush, and Mop Manufacturing
Postage	Postal Service
Textiles	Curtain and Linen
Furniture	Cabinet and Countertop; Mattress; Metal Furniture; Upholstered Household Furniture; Non-upholstered Household Furniture
Floor Coverings	Carpet and Rug Mills
Major Appliances	Household Cooking; Fridge/Freezer; Laundry; Other Major Household
Small Appliances	Small Electrical Appliance Manufacturing; Cutlery, utensils, pots; Other Pressed, Blown Glass; Pottery, Ceramics, Plumbing
Miscellaneous Household	Handtools; Telephone Apparatus; Electronic Computer; Electronic Lamp Bulb; Lighting Fixture; Other Leather and Allied Products

Equipment	
Apparel	Men and Boys; Women and Girls; Footwear; Accessories; Socks and Hosiery; Other
TRANSPORTATION	
Vehicle Purchases	Automobile Manufacturing
Gasoline	Petroleum Refining; Other Source
Finance Charges	Non-depository Credit
Maintenance and Repair	Auto Repair
Insurance	Insurance Agencies
Rentals	Automotive Equipment
Public Transportation	Other Source
HEALTH CARE	
Insurance	Insurance Agencies
Medical Services	Hospitals; Healthcare and Social Assistance; Offices of Physicians; Nursing and Residential Care Facilities
Drugs	Pharmaceutical Preparation Manufacturing
Medical Supplies	All Other Miscellaneous Manufacturing
ENTERTAINMENT	
Fees and Admissions	Performance Arts; Spectator Sports; Museums; Fitness and Recreational Sports
A/V Equipment	A/V Equipment Manufacturing
Pets, Toys, and Hobbies	Doll, Toy, and Game Manufacturing; Dog and Cat Food
Other Entertainment	Sporting and Athletic Goods; Photographic Equipment
Personal Care	Personal Care Services; Soap and Cleaning Compounds
Reading	Book Publishers; Periodicals; Newspaper
Education	Elementary and Secondary Schools; College; Other
Tobacco	Tobacco Product Manufacturing
Miscellaneous	Other Personal Services

It was frequently the case that multiple detailed sector categories of the EIO-LCA tool were applicable to a single CES expenditure category. For example, within the broad EIO-LCA sector group Textiles, Apparel, and Leather, the sector categories of Men's and Boys' Cut and Sew Apparel, Women's and Girls' Cut and Sew Apparel, Footwear, Accessories, Socks and Hosiery, and Other Leather and Allied Products all fit the expenditures that describe the CES category Apparel. In cases where multiple lifecycle analysis sectors could be mapped to a single CES category, the MJ/$ and kg CO_2e/$ for the CES category were calculated by taking an average of the relevant lifecycle analysis sectors. In the above example, the financial energy and carbon intensities of apparel expenditures were calculated by taking the un-weighted average of the intensity values of Men's and Boys' Cut and Sew Apparel, Women's and Girls' Cut and Sew Apparel, etc. In order to preserve a consistent basis for comparison across CES categories, EIO-LCA was the primary source for LCA data. However, for select CES categories – namely those relating to energy and transportation – I consulted outside data sources.

The lifecycle emissions factor for electricity was based on work by Horvath and Stokes (2011; Table 15). The direct energy cost associated with a kWh of electricity is by definition 3.6 MJ. The Horvath and Stokes work provided information regarding the energy waste that results

from producing electricity in various generators (e.g., coal power plants and wind turbines). Lifecycle energy factors were derived by adding the direct energy cost (3.6 MJ) and the per-kWh energy waste. Using the same study and following a similar procedure, I calculated the lifecycle greenhouse gas emissions of electricity. The national grid mix in 2010 was 45% coal, 24% natural gas, 20% nuclear, 6% hydroelectricity, and 5% non-hydroelectric renewable energy sources (Energy Information Agency 2011). In 2010, the national average price for electricity consumed by residential customers was 11.54 cents/kWh, or 3.21 cents/MJ (Energy Information Agency 2011).

Natural gas, fuel oil, and gasoline also required drawing on data from outside of the EIO-LCA tool. The average price of natural gas seen by residential consumers in 2010 was $11.39 per thousand cubic feet (Energy Information Agency 2015). Assuming that natural gas has an energy density of 1027 Btu/ft^3, the direct energy cost of natural gas is then 81 MJ/$. Energy return on investment data suggest an indirect energy cost of 8 MJ/$ for natural gas (Murphy and Hall 2010). I assumed the CES category Fuel Oil referred to No. 2 heating oil, and that this fuel type has an energy density of 37 MJ/liter. In 2010, No. 2 heating oil had an average price of $3/gallon (Energy Information Agency n.d.-a). In that same year, the average price of gasoline was $2.84/gallon (Energy Information Agency n.d.-b). Gasoline was assumed to have an energy density of 130 MJ/gallon. Data regarding the greenhouse gas emissions and indirect energy use for fuel oil and gasoline was taken from EIO-LCA.

4.6.3 Mapping CES Data to ATUS Categories

The energy and carbon intensities of the 15 activity categories were calculated by mapping the expenditure characteristics documented by the 2010 Consumer Expenditure Survey to the 108 ATUS categories (see Table 12). The CES data, given as average dollars spent each year in various expenditure categories, are readily converted to a per-day spending rate [$/day]. Mapping CES values on ATUS categories calculates the amount of energy or carbon that is "spent" each day for each ATUS category. The subsequent mapping to ATUS categories onto this study's activity categories reveals the amount of energy or carbon spent per hour of activity. Given the method described in Section 6.2, the spending rate for each CES category was converted to the MJ/day or kg CO_2e/day associated with each category.

Table 12. Mapping CES expenditure categories onto ATUS categories.

CES Category	ATUS Two-Tier Categories Code Number
FOOD	
Food	(1101)
Alcohol	(1101)
HOUSING	
Dwellings	Background
Natural Gas	Background
Electricity	Background
Fuel Oil	Background
Telephone	(1601)
Water	Background

HOUSEHOLD	
Personal Services	(801)
Other Household Expenses	(205); (702); (901); (902)
Laundry/Cleaning	(201)
Other Household Products	(904)
Postage	(209); (504)
Textiles	Background
Furniture	(101); (203)
Floor Coverings	(203)
Major Appliances	(201); (202)
Small Appliances	(202)
Miscellaneous Household Equipment	(203); (204); (209); (504); (702); (1601)
Apparel	Background
TRANSPORTATION	
Vehicle Purchases	All transportation
Gasoline	All transportation
Finance Charges	All transportation
Maintenance and Repair	All transportation
Insurance	All transportation
Rentals	All transportation
Public Transportation	All transportation
HEALTH CARE	
Insurance	(804)
Medical Services	(804)
Drugs	(103)
Medical Supplies	(103); (303); (403)
ENTERTAINMENT	
Fees and Admissions	(1204); (1301); (1302)
A/V Equipment	(1203)
Pets, Toys, and Hobbies	(206); (602); (807); (903); (1203)
Other Entertainment	(1301)
OTHER EXPENDITURES	
Personal Care	(102); (805)
Reading	(702); (1203)
Education	(601); (602); (603); (604)
Tobacco	Background
Miscellaneous	(802); (803); (806)

Some extra consideration of the embedded energy and carbon data was required. That is, certain durable goods like houses and cars are purchased in a single year, but are used for a period that lasts longer than that year. Because the CES data provided average expenditure data for each expense category, I was able to, in a sense, amortize the embedded data across multiple years. For example, the average American household spent about $2,600 on vehicle purchases in 2010. This value represents the annualized cost of owning a vehicle rather than the full cost of a vehicle. Because the consumption data take this annualized form, the conversion of $/yr into MJ/yr represents an amortization of the lump sum of embedded energy and carbon.

CES data are aggregated at the household level. In order to calculate the per-capita expenditures in each expenditure category, I divided the household-level expenditure by the average household size, both for the general American population and for each income quintile. These values, given by the CES, were 2.5 people/household for the whole population and 1.7, 2.3, 2.6, 2.9, and 3.2 people/household for the five income quintiles, moving from lowest to higher income bracket.

The mix of transportation mode choices was assumed to be the same across all transportation-related activities. That is, I assumed that respondents used the same balance of personal vehicle use and public transit for commuting to work as they do for shopping or socializing away from home. Total transportation-related energy and carbon, direct and embedded, for the year was calculated by summing the values associated with gasoline purchases, public transportation use, and personal vehicle purchases, maintenance, insurance, and vehicle rentals. The energy and carbon factors associated with gasoline and private vehicles were calculated as described in the previous section. For public transportation, per-mile carbon and energy intensity were drawn from Chester and Horvath (2009). Following Jones and Kammen (2011), I assumed a public transportation cost of 9.4 miles/dollar spent and that 93% of "public transportation" dollars were spent on airfare, which is a mode choice excluded from analysis since this study is trying to characterize everyday behaviors. The total annual transportation energy/carbon was divided by 365 to calculate daily transportation energy use/greenhouse gas emissions. To calculate the daily transportation energy/carbon associated with specific activities categories, I multiplied the daily energy/carbon value by the fraction of transportation time associated with each activity category. For example, if a household's daily transportation energy consumption were 250 MJ/day, and they spent 10% of their travel time getting to shopping centers, then 25 MJ/day would be attributed to the activity category Shopping. If that household spent a total of 2 hours per day shopping, then transportation would account for 12.5 MJ/hr of the total energy intensity calculated for Shopping.

Utility expenditures (i.e., energy and water), like transportation-related expenses, are attributed to multiple activities, in this case to those that take place domestically. Table 13 gives the allocation of residential energy consumption of various end uses disaggregated by fuel type. Energy for space heating was allocated equally across all hours spent at home. Water heating energy was equally allocated between across all hours dedicated to Food Preparation and Dishwashing, Personal Care, and Care for Others. Refrigeration energy was proportionally split between the activity categories Eating and Drinking and Food Preparation and Dishwashing. "Other" energy was divided proportional to time spent across all domestic activities except Sleep.

Table 13. Residential energy end use by energy source.
Data from the 2009 Residential Energy Consumption Survey (Energy Information Administration 2009). Percentages may not sum to 100% due to rounding or excluded use categories.

Fuel	Space Heating	Water Heating	Refrigeration	Other (e.g., lighting)	Total
Electricity	24%	10%	11%	56%	100%
Natural Gas	63%	25%	--	11%	100%
Fuel Oil	87%	11%	--	--	99%

The CES categories Textiles, Apparel, and Tobacco were also treated as background categories. The energy and carbon associated with textiles were allocated across all hours spent in the home, while apparel and tobacco were allocated across all non-sleeping hours.

5 Environmental Time Politics: An Analytic Review

5.1 Introduction

How people spend their time affects both their moment-to-moment well-being and overall sense of life satisfaction (Chapter 3). In addition, different uses of time have substantially different environmental implications in terms of energy consumption and greenhouse gas emissions (Chapter 4). Those activities that are most strongly associated with well-being also tend toward the less consumptive end of the spectrum, though there are exceptions to this trend, especially when extensive travel is involved. These findings suggest that rearrangements of time allocation might yield environmental and well-being co-benefits. In this chapter, I explore the potential reality of this implication.

More than two-thirds of middle-class Americans list "more free time" as a high personal priority (Pew Research Center 2008) and a majority of people live below the time poverty line (Chapter 3). Today, Americans are working two more hours per week than a decade ago (Gallup n.d.) and spending more time at work than citizens of other developed economies (OECD n.d.). The combination of long work hours and constrained choices for allocating work and leisure time makes it difficult for individuals to make personally satisfying or environmentally sustainable consumption choices. By changing the terms on which work arrangements are made, Americans could potentially reduce their overall environmental footprint while also pursuing a more satisfying lifestyle.

There are three principle ways to adjust the footprints of work and leisure time for individuals: flexible work arrangements, increased vacation time, and reduced weekly work hours. If implemented broadly, each adjustment could have a substantial environmental impact. There is not, however, a mechanistic relationship between changes in work-leisure balance and improved environmental outcomes. Engaging any of these measures has the potential to realize environmental benefits, but policy agendas based on any time-based intervention can only yield reductions in consumption if certain behavioral responses follow.

Each type of change in work-time arrangement has its own specific combination of behavioral change and potential environmental gain. One aim of this chapter is to examine each of the three work-time interventions for their most likely environmentally beneficial consequences and the shifts in individual behavior required to achieve those sustainability-promoting consequences. Understanding the effects of current and prospective arrangements of time requires delving into a diverse range of fields. No work to date has sought to make a comprehensive comparison of alternative arrangements of work and leisure time with respect to their effects on happiness and sustainability, such is primary the purpose of this work.

The second aim of this chapter is to anticipate the well-being effects associated with the different shifts in time use under examination. Since well-being can be conceived of in different ways, this matter can be considered in multiple lights. One approach is to look at how policies are going to affect the lived experience of the individual, particularly the range and intensity of

emotions experienced throughout the day. (This is the experienced hedonic well-being approach employed in Chapter 3.) A second approach is to consider how overall subjective satisfaction with life would be affected by these three policies. A third lens entails examining how each policy might support greater eudaimonic happiness, or the flourishing of the individual. Eudaimonic living encompasses four overarching principles: pursuing intrinsically motivated goals; acting on one's own volition; being mindful; and satisfying needs for competence, relatedness, and autonomy (Ryan et al. 2008). This chapter will consider evidence concerning all three forms of well-being implications.

The third goal of this work is to sketch a sampling of the potential non-traditional partnerships that might be made to support the environmental movement's extension into time politics. There may be additional value in positioning environmentalism as a movement for liberating time for individuals beyond the potential environmental co-benefits. Four in five U.S. workers would like to have more flexibility in their work arrangements and nearly two-thirds desire some kind of reduction in work hours (Kelly and Kalev 2006). A pervasive feeling of time poverty means that engaging with time politics on the side of increasing time affluence would align the environmental movement with a popular position that can lead to new partnerships and political alliances. The "overworking" of America has consequences for family life, civic society, and personal health and well-being (de Graaf 2003). Accordingly, there is a potentially rich field of actors with which environmental groups might ally in pursuit of a common goal of reducing the impact of the workplace on American workers.

The remainder of this chapter is arranged as follows. Sections 2-4 canvas the literature connected to flexible work arrangements, vacation time, and shorter workweeks, respectively. Each section is further subdivided to include: 1) a discussion of the direct environmental benefits of the shift in time use, 2) a review of the personal and social benefits that might motivate adoption of the time-use change, 3) a look at the barriers, complications, and challenges to enacting the time-use shift, and 4) a listing of the social and economic benefits that might attract partners outside of the environmental space. Section 5 contains a discussion of the relative merits of the three policy levers, and Section 6 provides a brief conclusion.

5.2 Flexible Work Arrangements

Flexible work arrangements (FWA) are united in what they are not: a traditional work schedule wherein workers are required to be at work during the same hours of the same days each week. The prototypical design of a traditional work schedule entails working Monday through Friday from nine in the morning to five in the evening. In contrast to this rigid and regular scheme, FWAs take a range of forms, including:

- *Flextime* arrangements require that an employee works a fixed number of hours per week but allows the employee to choose their start and end times. Typically, such arrangements require employees to be in the office during certain core hours.

- Compressed work schedules allow employees to work their fixed number of hours in fewer days than the standard five. The most common example of this option is to work four 10-hour days per week.
- *Flexplace* arrangements, also known as telecommuting, allow employees to work from home or another out-of-office location, with information technology directly linking the employee to the central office.

For this chapter, I will use the definition of *FWAs* as "alternative work options that allow work to be accomplished outside of the traditional temporal and/or spatial boundaries of a standard workday" (Shockley and Allen 2007). My review of the subject principally focuses on flextime and telecommuting as they are the FWAs with the most well-documented records. Though firm estimates are hard to come by, recent work suggests that about half of employees are on some form of flexible work schedule (Council of Economic Advisers 2014) and that one-fifth of employers absolutely prohibit flexible work arrangements (Kelly and Kalev 2006).

FWAs most directly support environmental goals by facilitating an easing of traffic congestion and a potential reduction in car use. Along with reducing time in traffic, work-time flexibility can help employees maintain a better work-life balance, which benefits businesses as well as families. However, many employers are reluctant to grant flexibility in arrangements, and relatively low socio-economic status employees have the least access to FWAs.

5.2.1 Potential Environmental Benefits of FWAs

FWAs interact most directly with environmental goals by virtue of the potential benefit such arrangements have in terms of reducing car use and easing traffic congestion. Especially promising are flextime work policies, which can reduce congestion when implemented alone and can also synergistically improve the performance of other measures designed to manage peak traffic loads.

According to the 2009 National Household Travel Survey, more than 20% of vehicle miles traveled each year, totaling some 500 billion in the United States, are for the purpose of commuting to work. Presumably, a roughly comparable number of miles are driven to return home, making work-related travel a key source of greenhouse gas emissions along with other environmental and health stressors associated with vehicle use.

Regular work schedules require employees to be at work at relatively fixed and uniform times. The combination of so many vehicles on the road for commuting and the dominance of fixed, and coincident, work schedules is a recipe for congestion, which occurs when a roadway system approaches vehicle capacity and is characterized by vehicular queuing and reduced travel speeds. Over time, the rush hour phenomenon has increased in intensity, extent, and duration (Zhang et al. 2005). The increases in idling, decelerating, and accelerating associated with congestion in turn create a number of harms that are of direct environmental concern. In the United States, congestion wastes nearly 3 billion gallons of gasoline each year (Shrank, et al 2012), resulting in more than 25 million metric tons of carbon dioxide emissions.

Other vehicle emissions increased by congestion – including fine particles, carbon monoxide, and nitrogen dioxide (Zhang et al. 2011) – have substantial public health consequences. Pollutants from congestion have been linked to premature births and low birth weights (Currie and Walker 2009), premature mortality (Levy et al. 2010), and exposure to the carcinogen benzene (Zhang and Batterman 2009). In addition to environmental harms causing health problems, the experience of traffic itself takes a toll on well-being. Time in traffic tends to be our affectively least positive time of the day (Kahneman et al. 2004) and experiencing congestion can increase aggressive behavior (Hennessy and Wiesenthal 1999; Smart et al. 2004). For all the importance that congestion has for environmental and human health, its impacts may yet be under-incorporated in models of transportation emissions (Smit et al. 2008).

Several approaches can be employed to manage congestion and mitigate its attendant environmental and social harms. Increasing roadway capacity to better match peak demand is a common tactic. However, such expansion is both expensive and inefficient, as added capacity that accommodates peak traffic demand has limited value during off-peak times (Yushimito et al. 2014).

Congestion pricing is a demand-side, traffic-management strategy alternative to capacity expansion. In theory, special tolls for driving on congested roadways or at peak times should encourage commuters to find alternate routes, modes, or travel times, thereby easing peak congestion on specific roadways or in specific areas. Such schemes have been implemented in a handful of cities, including London and Singapore, and have had some modest-though-measurable effect on vehicle miles traveled, traffic speed, and congestion emissions (Beevers and Carslaw 2005; Tuan Seik 2000). Congestion charging can be politically contentious, especially regarding its disproportionate effects on low-income populations and how to spend the revenues. And, more to the point of this analysis, congestion pricing does not get at the root of problem: people trying to get to the same place at the same time.

One of the clearest studies of the effect of congestion pricing on commuting behavior examined the effects of time-variable pricing for the New Jersey Turnpike. This work indicates that commuters will exhibit a relatively inelastic response to time-of-day toll pricing, with only 7.4% of Turnpike travelers altering their travel behavior in any way on account of the congestion charge and with less than 1% changing the timing of their travel (Holguín-Veras et al. 2010). This temporal inelasticity is attributable to the inflexibility of when travelers could arrive at work. Commuters in the study had on average a 15-minute window on either side of their target arrival time during which they could come to work without substantially impacting their work regime. In other words, the timing of commute behavior could not change in response to the new pricing regime because of the need to arrive at a designated time. When the majority of commuters share a similar arrival time requirement and narrow tolerance for deviation, congestion is the result.

Commuter flexibility in terms of work arrival and departure time could significantly shift travel demand and ease peak-hour congestion. Greater flexibility in selecting work hours in a modeled

population corresponds to decreases in vehicle queue length and waiting times (Zhang et al. 2005). Notably, this model indicates that increased flexibility moves ahead (later in the day) and flattens the distribution of commuter departure times. This movement of drivers from the peak to the shoulder of the demand function creates a more socially beneficial distribution of traffic by reducing congestion (Yushimito et al. 2014).

Telecommuting has intuitively obvious advantages as a traffic management innovation because it should not simply shift traffic load but also lead to an overall load reduction, diminishing not just the effects of congestion but of vehicle use generally (Brewer 1998). However, modeling and survey work on both points are inconclusive. Modeled queuing delays are reduced as the option to telecommute become more attractive to individuals and is more widely adopted in the population (Zhang et al. 2005). Telecommuting may have a slight effect (<1%) on total population vehicle miles traveled (Choo et al. 2005) and can relieve pressure on those roadways most prone to congestion (i.e., rural collector roads, highways, and arterial roads) (Rentziou et al. 2012). Telecommuting as a FWA may result in fewer work-related vehicle miles traveled, but it is a strategy subject to significant behavioral rebound effects in terms of total vehicle miles traveled because telecommuters tend to choose housing farther from work (Zhu 2013) and make more non-work trips than office workers (He and Hu 2015). As a congestion-reduction strategy, however, it remains a viable option.

5.2.2 Flexible Work Arrangements, Work, and Workers

In addition to their environmental benefits, flexible work arrangements can support and enhance the welfare of employees, particularly by bolstering hedonic well-being through stress reduction and improved work-life balance. Work flexibility can yield benefits for businesses, as well, through worker retention and productivity gains.

Work-life balance, or work-family conflict, is an increasingly salient stressor of the modern economy, with nearly half of employees with families reporting "some" or "a lot" of interference between work and family obligations (Shockley and Allen 2007). FWAs, in theory, allow individuals to participate with greater ease in personal and family matters (e.g., medical appointments and ballet recitals) while maintaining a full set of work responsibilities. Daytime events that are hard to attend to under an inflexible, standard 9-to-5 regime can be attended through either rearrangements in work time or on account of reductions in commute time (Noonan et al. 2007). However, not all FWAs are created equal in terms of relieving work-family conflict. Not having a flextime arrangement is significantly correlated with the sense that work interferes with family. Flexplace arrangements, on the other hand, are not associated with improvements in sense of work-life balance because telework removes the physical boundary between work and home life so that it becomes easier for those two identities to remain in conflict (Shockley and Allen 2007). Because one's degree of family responsibility is a significant moderator of flexwork's benefit for work-life balance, women, who tend to bear a greater share of household work, have more to gain from a flexwork arrangement based on time rather than place (Byron 2005).

Along with their potential to be good for work-life balance, FWAs can also improve employee experience with work itself. Flextime arrangements are associated with reductions in work-related stress and improvements on a range of health-related metrics (Halpern 2005). Reductions in stress occur despite the phenomena of more flexible arrangements corresponding with greater work intensity (Kelliher and Anderson 2009). Flexibility creates a sense of autonomy (Halpern 2005; Kauffeld et al. 2004) that is critical to well-being – particularly in the eudaimonic sense (Ryan and Deci 2001) – because it contributes to a greater sense of control over the employee's work life. Perceptions of workplace flexibility are associated with higher job satisfaction, a boost particularly associated with those with family responsibilities (Barnett et al. 1999; Scandura and Lankau 1997; Valcour 2007).

The benefits of FWAs for employee well-being spill over to improve business performance, as well. FWAs are associated with fewer employee absences, greater organizational commitment, and less employee turnover (Almer and Kaplan 2002; Halpern 2005; Kauffeld et al. 2004). Additionally, employees with FWAs tend to be more productive than their non-flexible counterparts. For example, a study of the pharmaceutical industry estimated that workers with flextime schedules are roughly 10% more productive than comparable employees without such an arrangement (Shepard et al. 1996). Relatedly, an examination of certified public accountants suggests that FWAs can reduce employee burnout (Rogier and Padgett 2004).

5.2.3 Challenges for Implementing Flexible Work Arrangements

A recent comprehensive survey about the administration of flexible work arrangements by businesses revealed several challenges to widespread adoption of FWAs. Kelly and Kalev (2006) investigated the flexwork practices of 41 businesses across a range of sectors (manufacturing, service, non-profit, and governmental), 34 of which permitted some kind of FWA. Their set of interviews revealed a norm of *ad hoc* granting of FWAs and a hesitance on the part of organizations to adopt formal FWA policies, as official policies can create new entitlements in much the same way that the Family Medical Leave Act did. The prevailing perception among managers was that creating such entitlements would potentially conflict with operational requirements, limit managerial discretion by granting flexibility when the employer would prefer a different option, and impede the ability of workers to get their job done. Employers instead tend to treat granting FWAs as a negotiated perk, a reward for long service tenure or as a retention inducement for highly skilled workers. Consequently, though a majority of surveyed organizations allow for supervisor-negotiated FWAs, several do not attempt to make these policies widely known or available so as to reduce requests for flexibility. Additionally, there are several job types for which flextime and flexplace arrangements are infeasible (e.g., retail or synchronized assembly work).

Members of disadvantaged groups are less likely to have access to FWAs. Relative to black and Hispanic workers, white employees are more likely to enjoy flexible hours (Beers 2000; Golden 2001). This racial disparity may be explained by the fact that white workers are more likely to hold managerial and executive positions, which lend themselves more readily to flexibility (Beers 2000), or by the fact that allocating FWAs via managerial discretion heightens the opportunity

for bias to affect FWA assignments (Kelly and Kalev 2006). Either explanation highlights a key current barrier to wider dispersion of worker flexibility. Women may also have less access to FWAs than do men, even after accounting for differences in workforce participation (Golden 2001). As noted above, because women tend to shoulder a greater share of household responsibilities, their potential benefit from work flexibility is relatively high. Happily, despite concerns that flexworkers may be perceived as less committed to their jobs and therefore be less likely to be promoted – charges to which female employees are already disproportionally subject – FWAs do not seem to have the effect of exacerbating gender-based pay gaps (Weeden 2005). A push to increase access to FWAs will need to make sure that not just already privileged workers gain more flexibility, but that this opportunity be equally available to all employees (Halpern 2005).

5.2.4 Opportunities and Allies in Promoting Flexible Work Arrangements

In pursuing greater work flexibility, the environmental movement might expect to find confederates in the network of public and private actors related to worker's rights and transportation management. Given the personal benefits, green groups might first and foremost expect widespread support from workers themselves, particularly those groups that have low rates of flexibility. Because women and low socio-economic status groups have relatively little access to flexible work arrangements, a movement to expand worker flexibility should find support amongst social justice interest groups. The potential to relieve traffic congestion and its attendant harms should also attract the interest of state and local governments and public health groups. This may be especially true in locales where vehicle-related emissions contribute to violations of federal or state ambient air quality standards.

5.3 Vacation Time

This section considers the potential effects of expanding access to and use of vacation time. The United States is the only advanced economy that does not guarantee some measure of paid vacation to all workers. One-quarter of American workers have no paid vacation whatsoever (Ray and Schmitt 2008), a percentage that grows when one looks at specific demographic sections, notably women and low-income earners.

Intuition might suggest that limited vacation time is good for the environment. After all, we commonly associate vacations, particularly acts of tourism, with indulgence, consumption, and energy-intense transportation. In the broadest sense, a vacation is a break from work, a period of leisure time. Typically, regularly scheduled days without work (e.g., weekend days and annual one-day holidays) are not counted as vacations. Vacations have an implicit length of minimum time, more than a few days, required to be considered a true break from work.[33] While the term often evokes the notion of travel, a vacation need not involve any kind of geographic

[33] In this way, vacation days are distinguished from sanctioned time off in the form of sick or personal days, which are in theory reactions to extraordinary circumstances rather than premeditated disruptions of routine life.

dislocation. The travel aspect of a vacation is comprehended in the term *tourism*.[34] Acts of tourism are a dominant source of vacation's environmental footprint.

Distant travel and increased consumption, however, are not a necessary result of vacationing. Indeed, a paucity of leisure time may be what leads to "binging" on vacation, to getting one's "money's worth" via intense bouts of travel and consumption (Maniates 2009).

Increasing the supply of vacation days has some potential to reduce the environmental footprint of leisure time, to increase public support for environmental protection measures, and to foster a range of civic, personal, and economic gains. Realizing this potential, however, hinges on what people choose to make of the additional time at their disposal.

5.3.1 Vacation Time and the Environment

The potential environmental benefits associated with more vacationing come primarily from reductions in air travel and the greenhouse gas emissions associated therewith. If having more time at their disposal prompts people to take longer, slower, and less travel-intense vacations, then pushing for guaranteed vacation could well be an environmentally net-positive action. However, greater access to vacation might simply expand the ranks of long-distance travelers, increasing air miles and carbon emissions alike. The case for vacation time as a pro-environmental measure is contingent on a change of norms that may require more than just a greater availability of vacation time to come to pass.

Of the various ways that increased vacation time can connect to the environment, the carbon footprint of tourism is the most concerning. By one estimate, about 5% of total global carbon emissions can be traced to tourist activities (Scott et al. 2010). Of this 5%, transportation comprehends the lion's share, with air travel accounting for 75% of total tourism-related emissions even though planes are the primary mode of transportation for only 20% of excursions (Peeters 2013). Transportation, then, is a key component of efforts to make the tourism component of vacation more sustainable.

The carbon dioxide emissions associated with tourism are a function of the number of trips taken, distance traveled, and mode choice (Peeters and Dubois 2010). To become more sustainable, tourism needs to involve less transportation, incorporate transportation by greener modes, and – critical to the issue of vacation time – have a smaller travel-time-to-length-of-stay ratio (i.e., stays at a destination need to be longer relative to the time it takes to travel to the destination). The combination of work commitments and relatively inexpensive air travel promotes a greater incidence of short, energy-intense holidays (Pike and Ryan 2004). When vacation time is a luxury, tourists are prepared to pay a premium for both rapid travel and more time-efficient and resource-intense consumption at their destination (Dickinson et al. 2013), which translates to higher vacation greenhouse gas emissions. In the near term, technology –

[34] It should be noted that *tourism*'s use in the literature includes not just travel for pleasure and for visiting friends and family, but also business travel, as well. For the purposes of this chapter, I will consider only non-business-based trips as being *tourism*.

including biofuels and greater engine efficiency – is unlikely to have a sufficiently sizeable effect on travel's climate impacts (Higham et al. 2013; Lee-Gosselin 2009; Peeters 2013). Thus, if increased tourism means more demand for air travel, then the climate implications of more vacation are almost certainly negative. If, however, more vacationing can be channeled towards difference modes of travel (or towards the absence of travel), then environmental benefits may be realized. Given the importance of transportation to the movement toward more sustainable vacation practices, it is important to understand how "binge tourism" might be redirected to a more sustainable channel.

Scholars of tourism highlight the importance of *slow travel*, an umbrella term for the sort of tourism behavior change that aligns vacation consumption with a more sustainable path. *Slow tourism* has been used to describe various aspects of sustainable tourism, including using less impactful modes of transport (trains or bicycles as opposed to airplanes and cars) and spending more time in a particular location, living like locals and becoming enmeshed in a community.

In the standard economic framework, travel time is a source of disutility, something to be minimized. Travel is a significant tourist stressor, negatively impacting an individual's ratio of positively and negatively valenced emotions (Nawijn 2011). The capacity to partake in less stressful forms of transportation is in part based on having a surplus of time (Buckley 2010; Schor 2005). Choosing hedonically superior travel modes entails a purposeful exchange of vacation time for travel quality. While this trade-off may be relevant when vacation time is limited, increases in available vacation time could undo the speed-versus-pleasure dynamic. (However, this idea assumes that the number of vacation days available in the limited factor and not, for example, work or life commitments that constrain the length of the trip.) In addition, the practice of slow travel may serve to extend the anticipation benefit – the utility derived from the expectation of enjoyment of a future event – of tourism during vacation time (Nawijn 2011).

Using additional vacation time for outdoor recreation is another potential path to realizing environmental benefits, albeit one that is more indirect and diffuse than slow tourism. Time outdoors has documented health benefits (see Section 3.2), and, more directly relevant to pursuing pro-environmental ends, can strengthen an appreciation for the natural world.

Time in nature fosters environmental values, and more time for nature expands the opportunity to cultivate a greater valuation of nature. Studies dating back four decades have documented an association between recreation in nature and pro-environmental attitudes and behaviors. Dunlap and Heffernan's (1975) landmark survey found a positive, though weak, correlation between time outdoors and environmental values. This connection strengthens when the recreation is appreciative (e.g., hiking, bird watching) rather than consumptive (e.g., hunting and fishing) (Tarrant and Green, 1999). This distinction between recreation types matters less for the association with pro-environmental behavior; both are equally (positively) associated with pro-environmental behavior (Nord et al, 1998; Thapa and Graefe, 2003). Environmental concern developed in association with outdoor recreation is greater for issues directly connected with the subject's recreation type. For example, habitat protection likely matters more to a birder than would, say, water quality (Berns and Simpson 2009).

5.3.2 Vacation's Well-being Benefits

It should come as no surprise that vacation time tends to be highly affectively positive, particularly relative to work time, which, along with commuting, ranks at the bottom of a list of routine activities in terms of affective quality (Kahneman et al. 2004). Vacations are physically and mentally restorative (de Bloom et al. 2014), particularly when they feature free time to one's self, exercise, and getting plenty of sleep. Even so, traveling long distances (and especially crossing time zones) can leave vacationers with post-vacation exhaustion (Strauss-Blasche et al. 2005), which can mitigate some of the restorative effects of vacation. Adopting slow-travel practices further allows for more intense experience of the present, which enhances subjective sense of well-being (Killingsworth and Gilbert 2010). Less consumptive (more experiential) nature-based vacations tend to yield the greatest well-being benefits (Bimonte and Faralla 2014). Relative to urban spaces, time in the natural environment lowers blood pressure (Hartig et al. 2003), eases muscle tension and stress (Ulrich et al. 1991), and fosters a positive outlook on life (Maller et al. 2006). Time in nature is especially beneficial for the restoration of attentional capacities (Berto 2005; Kaplan 1995), a key resource for goal attainment (Dijksterhuis and Aarts 2010). There is no reason to suspect that these health benefits are less accessible at a nearby state park than at New Zealand's Middle-Earth wonders, meaning that one need not travel far to experience the restorative effects of the great outdoors. However, the health and well-being of vacationing (outdoors or otherwise) are transitory (de Bloom et al. 2012; Nawijn 2010; Westman and Eden 1997), typically not enduring many weeks after the vacation's conclusion.

5.3.3 Challenges to Realizing Sustainability Benefits Via Vacation

The direct environmental case for increasing vacation time hinges on the potential for increases in vacation time to reduce the need for or desirability of highly consumptive vacations, particularly vacations based in tourism. That is, a greater abundance of vacation time would need to help reduce the propensity for binge vacationing and, particularly, air travel. One challenge is that more people with vacation time might increase overall demand for air travel, even if there are some modest decreases among current recipients of vacation time. Realizing the potential benefits of slow tourism, greater exposure to nature, and other possible pro-environmental outcomes is, however, in no way the automatic result of an augmentation in available vacation time. There are, in fact, a range of factors that inhibit a green response to vacation-time abundance (Higham et al, 2013).

To begin with, environmental values do no typically play a central role in holidaymaking. There is a sizeable gap between awareness of air travel's negative climate implications and tourism behavior (Miller et al. 2010). Indeed, the classic environmental "attitude-behavior gap" may be more intense in a tourism context relative to domestic situations and routine actions (Barr et al. 2010). Consequently, environmental concerns are largely jettisoned during the planning and executing of tourist activities and other vacation spaces. Moreover, very few regular pro-environmental behaviors are performed while on vacation (Miao and Wei 2013; Oliver and Benjamin 2015). This phenomenon may in part be attributable to habits rather than conscious abandonment of an environmental ethos, as well as to a lack of familiarity with local pro-

environmental infrastructure. It may also be that the relative rarity of vacation time may drive the tendency to view vacations as times of release from social and personal norms (Cohen et al. 2013), including environmental ones. A greater abundance of vacation days might allow for greater parity between "home" and "away" behaviors as vacationing becomes less exceptional and more routine. However, it is unclear at what level of access to vacation days one crosses the threshold after which they no longer feel the need to binge vacation. If a guaranteed access to vacation time principally affects those who currently lack any vacation time, then the policy will expand rather than contract the binge vacation problem.

Issues of identity and status may make tourism and vacation behavior hard to change. While vacation time itself may be a non-positional good (Solnick and Hemenway 1998; Alpizar et al. 2005) – that is, the benefit someone derives from time off is independent of how much time off others have – how people spend their vacation time is still subject to status and identity concerns. Mobility is a source of status in the West (Gössling and Nilsson 2010; Urry 2012), with distance traveled for vacations ("farness") providing a way of maintaining class distinctions (Casey 2010). Mobility choices are motivated by identity aspirations, and, unlike in other domains where identity is largely socially defined, tourism provides a greater opportunity for individuals to construct their own identity (Hibbert et al. 2013). People have multiple "possible selves" that they can envision themselves to be, and consequently make travel (mobility) decisions that affirm their desired, high-status self and deny those versions that are undesirable.

If environmental gains are to be made from increasing vacation time, then "slow" may need to replace "far" as the currency of status. "Drifters" – travelers with unconventional tourism patterns, who account for ~10% of the tourist population – constitute the leading edge of social norms concerning travel modes and destinations (Nawijn and Peeters 2014). As the tourism equivalent of "early adopters," they push vacationing boundaries and, in the process of doing so, start to redefine what is normal. In recent years, drifters have been pushing the social norm toward greater distance. If there is hope of a general pendular swing toward shorter-distance tourism, then it may lie with motivating drifters to adopt more sustainable travel behaviors. At present, tourism among drifters is commonly motivated by the consumption of novel locations and experiences (Ram et al. 2013). That novelty might be found in signaling "cultural distance" rather than physical distance may be a way to frame shorter-distance slow travel and diffuse more-sustainable ideas into popular practice (Larsen and Guiver 2013). As travelers tend to choose their mode first with their destination to follow, promoting novelty in the form of more sustainable modes of transportation could also be a significant move by drifters (Nawijn and Peeters 2014).

A final barrier to realizing environmental benefits from adding to vacation allowances may in fact be the prospective recipients of more vacation days themselves. A report prepared for the U.S. Travel Association (USTA) found that, in 2013, American workers forewent 170 million days of paid time off ("America's Disappearing Vacation Days" 2014). The USTA reports that four in ten employees were not planning to use all of their vacation time either out of concern for receiving extra work upon their return from vacation or for fear of being replaced while away. More paid time off is unlikely to ameliorate either concern. A policy guaranteeing paid

vacation time might encourage low-income workers – roughly half of whom take no vacation time – to take time off, but this segment of workers may be especially exposed to, or perceive themselves to be exposed to, employer-based risks associated with taking vacations.

5.3.4 Supporters of Increased Vacation

The effort to expand access to vacation would attract several allies as a number of entities, particularly business interests, would benefit from a world where workers took more vacations. A recent commercial by the financial services company MasterCard hints at the potential. Promoting their "Concierge Service," which helps clients make travel and entertainment arrangements, the advertisement urges its viewer to take "one more day" of golfing, snorkeling, or other types of vacations (and to take the kids, as well). The benefits to a credit card company of helping customers buy leisure goods are obvious, as is the environmental peril of this particular type of ally advancing a more consumerist model of vacation time.

Sectors within the trillion-dollar American tourism and hospitality industry would be a clear proponent of increased vacation time. An increase in popularity of slow travel, for example, would make tourists more likely to look for long-term accommodations, boosting demand for discount hotels and sharing-economy services like AirBNB (Buckley 2010). Partnerships to promote "stay-cations" and "being a tourist in your own home town" promise local-economy gains that should attract municipal supporters. Further, extra vacation days could, when coupled with the proper motivation, expand the ranks of visitors to state and national parks (Maniates 2009), making park systems and the communities that service their visitors likely in favor of a policy that could expand the rolls of tourists.

5.4 Shorter Work Hours

Compared to their counterparts in other countries, American workers labor for a greater number of hours. In a ranking of 24 developed economies, the United States is third highest in terms of average annual hours worked per employee (Rosnick and Weisbrot 2006). Across these countries, there is a significant and negative correlation between worker productivity as measured by GDP per worker-hour and the number of hours worked ($r = -0.74$, $p < 0.001$; Figure 10). The United States is an outlier of this trend in which higher per-hour productivity corresponds with fewer hours worked. American workers both work long hours relative to workers in other countries and have higher rates of productivity.

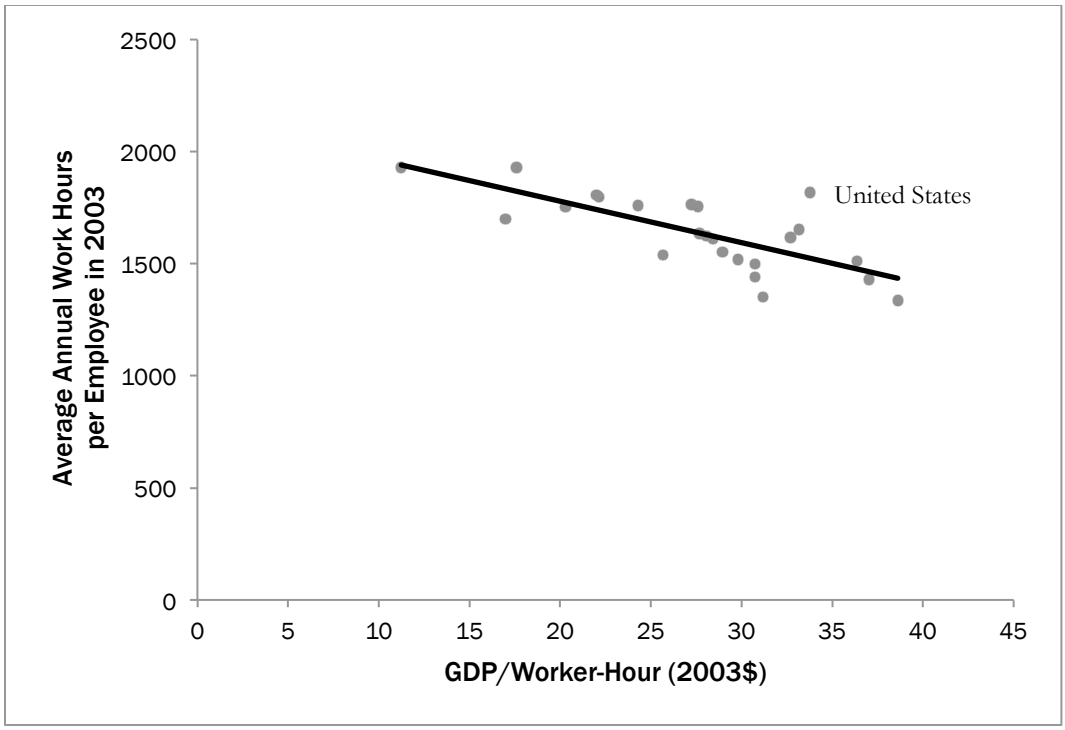

Figure 10. Average working hours as a function of worker productivity.
Worker productivity values are adjusted for PPP. Data from Rosnick and Weisbrot (2006).

These data suggest that United States is lagging behind other developed economies in terms of converting productivity gains into increases in leisure (non-work) time. In the decades following World War II, there was a general drop in annual average hours worked per employee across the advanced economies of the world. Between 1950 and 1980, all advanced economies (save Japan) saw at least a 10% decrease in annual hours worked (Schor 2005). In the United States, during this span the average annual hours worked dropped from 2166 (42 hours/week) to 1847 (36 hours/week), a 15% decline. While most economies continued to parlay productivity improvements into decreased time at work during the final two decades of the twentieth century, the average American worker added more than a week's worth of working hours to her load, a 3% increase. This rise in work hours can also be seen at the household level, as the average hours of paid work per family increased by 11% between 1975 and 2005 (Pfeffer 2010). At present, the average American employee works 300 more hours each year than her European counterpart. The difference between total annual American and European work hours is roughly equally attributable to length of work week and number of vacation/holiday days (each creating about 150 hours/year of difference) (Huberman and Minns 2007).

Two changes could lead to a decrease in the number of hours worked annually. The first, increasing the number of vacations (and holidays) allocated to workers, was discussed in the previous section. The second, decreasing the number of hours worked in a day or week, is the subject of this section. Working time reduction (WTR) entails providing employees with the option to retain their job while scaling back the position's working hours commitment with

some manner of income and benefits proration.[35] As with vacation, where providing leave days does not compel the employee to take time off, individuals with a financial need or personal desire to work what is currently deemed a full work week (or more) would not be barred from doing so.

While expanding vacation days and decreasing work hours both involve a decrease in the amount of paid work performed, there are two broad features that distinguish these two policy levers. First, WTR means reducing income. Increased vacation time, on the other hand, does not necessarily mean less income, particularly if the policy push is for guaranteed paid vacation rather than unpaid leave. Second, the time liberated by vacation days comes in different typical spans than does the free time created by reduced work hours. That is, while vacation days are most frequently used in denominations of days or weeks, the time liberated by WTR is more appropriately thought of in terms of hours or days. This unit of time distinction leads to differences in the behavioral responses that could be anticipated from the two modes of hours reduction. In addition, reducing weekly work hours is likely to make a bigger dent in terms of total annual hours worked.[36]

5.4.1 Work Hours and the Environment

Work, as an economic input, contributes to increasing GDP. Similarly, work increases income, which is transformed into consumption, another spur of GDP. Since the economic growth captured by GDP is associated with environmental harms, it follows that more working hours would contribute to exacerbating those harms. Reductions in work hours slows economic throughput, which decreases the rate of resource consumption and waste production. This effect is readily documented by national-level data on energy use and greenhouse gas emissions.

Panel data for OECD countries reveal that countries with higher annual average work hours have higher resource and carbon footprints and that, controlling for GDP, longer working hours are associated with larger ecological footprints and greater rates of energy consumption (Fitzgerald et al. 2015; Knight et al. 2013). Accounting for differences in productivity, a United States that had European-style work hours would consume 20% less energy than it currently does (Rosnick and Weisbrot 2006).

At the household level, reduced environmental impacts can be anticipated for two reasons: increased time for pro-environmental behaviors and reduced income leading to less consumption. The time impoverishment aspect of work hours can influence the energy and resource intensity of activities (Chapters 3 and 4). Ecological footprints tend to increase with weekly work hours in part because shorter work hours can enable behavior changes that reduce environmental harms (Hayden and Shandra 2009; Kasser and Brown 2003). Those with more

[35] Another version of reducing work time entails fixing the definition of a full-time workweek to a smaller value than the current 40-hour standard, for example, a 32-hour week. Many attributes of WTR discussed in this section are applicable to this policy measure, as well.

[36] For someone with a 40-hour workweek, an added two weeks of vacation time yields 80 hours of non-work time. Scaling back the workweek by 5 hours per week nets 250 hours of additional leisure time.

non-work time have a greater capacity to engage in pro-environmental modes of consumption, or, conversely, to avoid making waste on account of haste (Cooper 2005; Wann 2003). For example, those with more non-work time have, all else being equal, more time to walking or cycling rather than driving. Further, a reduction in work hours could curb unsatisfying and superfluous purchasing. High personal work hours shifts consumption patterns in favor of things that are more "comfortable" than "pleasurable" (Dickinson and Peeters 2014; Reisch 2001). Comforts are those items, like a nice couch, that we would lament losing but fade into the background in routine life. Pleasures are disruptions of routine life, like a trip to the beach (Scitovsky 1992). While the direct environmental consequences of more pleasure consumption are uncertain, hedonically speaking, the variation offered by pleasures generally is a better return on investment and less likely to promote a repeating cycle of consumption and adaptation.[37]

Because work hours are generally set based on fixed legal or normative definition of "full-time work," individuals or households can be locked into a work-and-spend cycle that may not be entirely reflective of their preferences concerning labor-market participation (Sanne 2002). This lock-in is what a codified option to scale back work hours would address. Households reducing their work hours will see a reduction in income. While it is beyond the scope of this chapter to model the dynamics of this change, it can be anticipated that the direct effect on households that reduce their work hours will be less consumption (and concomitant environmental degradation) stemming from reduced income. However, to the extent that employers compensate for reductions in work hours with new hires or longer hours for existing employees, there will be a work-hour rebound effect with regards to consumption. Someone cutting her weekly hours from 40 to 20, for example, might create a new, part-time employment opportunity. Part of the foregone consumption of the formerly full-time employee will be taken up by the new part-timer whose household now has added income. Positing an approximately linear relationship between income and greenhouse gas emissions (Jones and Kammen 2011; Weber and Matthews 2008), the take back of carbon emissions reductions gains associated with reduced income will be roughly proportional to the degree that businesses buy more labor.

5.4.2 Individual Benefits of Shorter Work Hours

The benefits of WTR for workers can be appreciated by reviewing the personal sacrifices associated with working long hours, either in a given day or over the course of a week. That is, it is in appreciating the harms that come from "overwork" – particularly in terms of employee health – that the gains from reduced work hours can be identified. What is considered overwork or long work hours varies in the health and safety literature. For some, it is a subjective term, as in a worker works more hours per day/week than they would like, while in other works, an objective measure is used, for example 48 hours per week or 12 hours per day. This inconsistency makes a direct comparison of studies difficult. Most work, however, compares an overworked population to one that works fewer hours per day/week than the average American,

[37] Further, Scitovsky observed that an abundance of comfort in consumer society leads to boredom, which is itself a driver of consumption.

thereby allowing for a general inference about the health effects of reducing work hours below the current full-time standard.

Long work hours take a toll on the health of workers. Overwork has myriad physical and mental health consequences, including hypertension, heart disease, stress, depression, and diabetes (Pfeffer 2010; Schweikert 2003; Sparks et al. 1997; Yang et al. 2006). These health risks can be attributed to a variety of stressors, including sleep deprivation, impaired cognitive capacity, increased involvement in accidents, and deficient recovery from work itself (Caruso 2006; Geurts 2014). Overwork fosters adult and (via an overworked mother) childhood obesity by crowding out exercise and sleep and incentivizing use of low-nutrition convenience foods (Courtemanche 2009; Di Milia and Mummery 2009). Extended work hours are frequently implicated in unsatisfactory work-life balance (Hughes and Parkes 2007; Tausig and Fenwick 2001), which indirectly takes a toll on employee physical and mental health (Frone et al. 1997). Overwork-induced employee burnout, marked by emotional detachment and declines in accomplishment (Maslach and Jackson 1984), can increase turnover rates and thereby increase company recruiting and training costs (Pfeffer 2010). As such, in addition to harming employee health, long work hours are detrimental to productivity and business profitability. Shortening the length of the workweek can reduce work-related stress and allow for more time to attend to health-promoting changes in diet, exercise, and sleep patterns, should individuals choose to prioritize those efforts.

5.4.3 Challenges

Despite the gains in worker productivity that could be realized when employees scale back their work hours, businesses themselves may provide the greatest opposition to an initiative to give individuals the capacity to reduce their work hours. Schor (2005) identifies three key reasons why firms benefit from engaging employees for longer work hours. First, long hours raise the cost of job loss for the employee, the earnings difference between a worker's incumbent position and their next-best alternative (i.e., another job or social safety net payments). Someone with a high cost of job loss has less leverage *vis-à-vis* their employer relative to someone with a lower cost of job loss. Longer hours tend to increase the earnings associated with a position, and long-hour positions are harder to replace than the hour-volume equivalent of short-hour positions. Second, reducing employee work hours requires hiring more workers to cover the same hours. Thus, assuming an upward-sloping labor supply curve, businesses must draw deeper into the labor pool, which means hiring less-skilled labor for the same wage, hiring more-expensive labor for the same skill level, or a combination of the two. Third, and perhaps most significant, businesses face a number of substantial expenditures, including recruitment and training costs, health insurance, and retirement/pension schemes, that are based on a per-employee rather than per-work-hour basis. Accordingly, businesses are motivated to get the biggest return on their investment by amortizing those expenditures over the greatest number of productive hours. Each of these three factors incentivize businesses to oppose giving employees the option to reduce their weekly work hours.

When wages are low and income inequality is high, people face another set of incentives to work more hours than they would like to. Clearly, the decline in income associated with working less is a deal-breaker for households already struggling to achieve subsistence levels of consumption. "Voluntary simplicity" via reduced time at work is viable for high-earners (and -consumers), but lifting one's self out of time poverty while experiencing material insecurity is a stiff challenge. While just getting by is challenge enough, a system of large disparities in consumption can induce long work hours, particularly for low-wage earners, in a Veblen-esque attempt to ape the lifestyles of wealthy households (Bowles and Park 2005).

5.4.4 Allies

People working fewer hours will be boon to organizations that profit, commercially or otherwise, from individuals spending their time engaged with them. Organizations and opportunities with which people "don't have enough time" to engage are potential winners in an economy with less time dedicated to working and therefore should be conceptually sympathetic to a movement to reduce work hours. Civic organizations and other social benefit groups that are dependent on volunteered time could anticipate more person-hours available to them, with general societal benefits accompanying group-specific ones. There are also market opportunities for facilitating socializing and other leisure pursuits that would be more readily pursued in a shorter workweek. Gyms, alcohol vendors, video or tabletop game companies, and adult learning centers are but a few of the entities that should recognize the profit in the prospect of more leisure time. Because incomes would be reduced in a shorter workweek, there could be a particular market advantage for purveyors of lower-cost leisure options.

There may be particular interest among aging employees who want to reduce work hours, but are not ready for retirement. (This arrangement may provide a rich opportunity for companies to train or mentor the next generation of employees.) Similarly, reduced work hours many appeal to parents of small children, especially when one might otherwise stay home. As with FWAs and extra vacation days, WTR means that individuals will have a greater capacity to attend to their personal and family lives. For those who can afford to do so, reducing work hours should assist efforts to improve quality of life and therefore a work-time reduction policy could attract widespread support.

5.5 Comparison of Alternative Time-Reallocation Measures

The aim of this chapter is to compare the various means by which improvements in environmental, personal, and social welfare could be secured through changes in the balance between work and non-work time. Specifically, this chapter's intention is to examine the relative merits of three such alterations: flexible work arrangements, increases in vacation days, and reductions in workweek length. The main findings of my analysis are presented in Table 14.

Table 14. Summary chart comparing three different options for altering work-leisure time allocations.

Category	Flexible Work Arrangements	Increased Paid Vacation	Shorter Workweek
Potential Environmental Benefit	Reduced commuter congestion and concomitant air pollution	Reduced resource intensity of vacation; increased use of parks	Reduced consumption and energy use
Well-being Benefit	Improved work-life balance	Increased leisure time	Increased leisure time; reduced burnout
Other Potential Personal/Social Co-benefits		Reduced work-related stress	Improved health outcomes; worker productivity; challenging "work-spend cycle"
Disruption of Status Quo	Low	Moderate	High
Geographic Scale of Environmental Benefits	Local; regional	Local; global	Local; global
Political Allies	Family organizations; city planners	Tourism industry; financial services	Civic organizations; entertainment industry
Challenges	Extending benefits to shift workers	Promoting low-consumptive uses of time (slow tourism)	Amortizing fixed costs of employees; extending benefits to low-wage earners

The policies that could be developed to pursue these work-time rearrangements are not, of course, mutually exclusive. However, absent the environmental movement developing a comprehensive time-based policy agenda, a prioritization of policies is needed. This section compares and contrasts the each time-use lever in order to determine if one lever is more deserving of emphasis than the others.

5.5.1 Environmental Benefits

FWAs and WTR create the clearest path to environmental benefits, the former on account of its capacity to reduce traffic congestion and the latter because of reductions in economic throughput and by virtue of opening up time for the daily practice of low-impact behaviors like walking or cycling in preference to driving. FWAs and WTR are most readily comparable in terms of climate implications. While the carbon emissions stemming from reduced income are potentially much greater than relieving congestion-based emissions, under a conservative estimate of emissions reduction potential,[38] the two levers are on the same order of magnitude. Given that Americans tend to be distanced from the biogeochemical consequences of their consumption (Maniates 2002), the prospective benefits (climate or otherwise) of reduced

[38] Assuming a marginal reduction in consumption-based emissions of 1 t/$1000 income (based on a national average of ~50 t/y and a median household income of $50,000), a $5000 decrease in annual household income in 2% of U.S. households will reduce CO_2 emissions about the same amount as cutting in half the emissions associated with congestion.

consumption from fewer work hours are to remain invisible to most. The gains of easing congestion, while still somewhat transparent, are more readily and locally appreciable, tightening and making more apparent the link between time use and its consequences, which could bolster support for policies that change time-use arrangements.

There are large error bars on the environmental implications of increasing access to vacation time, and no guarantee that the overall effect would be positive (i.e., more sustainable). The direction of the effect is dependent on how people adjust their vacation practices in response to increased availability of days. The adjustments of particular interest are how aspiration and social modeling might affect the vacation plans of individuals who previously had no paid vacation, and whether greater access to vacation can overcome pre-existing reservations that prevent people from using their full allotment of vacation time. Provided that people, once guaranteed and given more vacation time, do take more time off, the environmental impact of the time-use shift depends on whether more vacation would relax or encourage the impulse to binge vacation. Here, too, greenhouse gas emissions provide the most straightforward metric for scenario analysis. In an optimistic scenario, where more vacation time turns preferences to longer, slower, and more local pursuits, it would require a remarkable reduction in flight-based tourism to match the emissions reduction potential of the other two options.[39] Consequently, increased vacation time is the time-reallocation policy with the least potential to achieve environmental benefits.

5.5.2 Coalition Building

One of the core assumptions of this chapter is that, in pushing policies that seek a more favorable balance of work and non-work time, environmentalists would be able to form novel coalitions of interest groups that would also benefit from new allocations of time between work and private life. Such coalitions could strengthen the probability of achieving political traction as well as demonstrating the broad appeal of a pro-environmental agenda. The set of potential partners can be sorted into those who champion the non-environmental co-benefits of the policies and those who stand to gain financially from changes in time allocation.

Altering work-time arrangements can generate co-benefits in terms of employee and community welfare, outcomes that are of interest to the labor movement and to public health officials. Germane to labor organizations, all three options for rebalancing time can produce improved work-life balance. FWAs allow workers to partially adjust their work schedules around the needs and rhythms of their family, and vacation time and WTRs liberate new time to spend on family and other personal matters. FWAs have the surest record of work-life benefits, while reduced work hours can be considered beneficial if only because excess work hours are demonstrably *not* conducive to work-life balance. As the term is usually applied to isolated, but longer-duration periods of time away from work, vacations are a stretch to associate with work-life balance.

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[39] Based on data from Jones and Kammen (2011), 3000 miles of vacation flying emits around 0.5 t CO_2. To be roughly as good at mitigation emissions, increases in vacation would need to prompt 10 people to drop a round-distance, long-distance trip for every household that saw a $5000 decline in consumption by virtue of work-time reductions.

However, insofar as it can serve to shed work stress, vacation time might serve to affirm and strengthen family bonds, in effect improving the resilience of family life. In terms of improved health outcomes, there is the clearest link to public health via the capacity of FWAs to reduce traffic congestion, while reducing overwork is the time policy with the likeliest personal health benefits. All three rearrangements offer some relief from psychological harms, particularly in the form of stress, though the stress relief from vacations is of limited durability.

In terms of identifying groups that are positioned to profit financially under a changed work-time regime, it is hardest to map the network of those who would gain from FWAs. Variable start and end times for workdays could improve ridership of public transportation, and telecommuting could improve sales for information technology firms, but the anticipated effect size is likely small. As the options that create more free time, increased vacation time and shorter work hours generate more leisure time that firms – including those in the entertainment, hobby, recreation, travel, and tourism industries – will be happy to fill with new consumption opportunities. In this regard, vacation time likely has the most ready supporters because it (particularly if used for tourism) offers large, discrete chunks of time to fill with new goods and experiences. WTRs potentially generate more leisure time, albeit in smaller denominations than vacation. Unlike vacations, WTRs are associated with reduced income, and the combination of smaller units of time and less discretionary spending means that WTRs will likely benefit a different set of commercial enterprises than vacations. Those companies that produce goods with a long shelf life and/or low costs may be able to thrive in a reduced-work regime.

5.5.3 Well-being Implications

Each of the time rearrangements discussed in this chapter can support and enhance personal well-being in both in its hedonic and eudaimonic facets. Hedonically, vacation time tends to be much more positive than the ordinary course of life. This is hardly surprising, as vacations are (presumably) free of work (one of the least affectively pleasing activities in an adult routine), are often used as time to engage in a range of pleasures and novelties. As deviations from routine life, vacations are most likely to generate anticipatory utility. Flextime scheduling and reduced work hours help to reduce the stress of work-life imbalance, and can facilitate participation in happiness-swelling activities of the avoidance of stressors (like traffic). These two time-shifting policies are unlikely to be as hedonically intense as vacation time, but can foster improvements in chronic hedonic happiness.

Each form of time policy makes a different contribution to eudaimonic happiness. All three of the time-use shifts discussed in this chapter enable individuals to take more control over how they use their time, which can enhance a sense of volition. Beyond that, eudaimonic gains from better arrangements of time are in large part dependent on purposefully forming a lifestyle and engaging in activities that involve mindfulness, pursuing goals, and feelings of relatedness, among other qualities. An increase in absolute levels of free time, such as is provided by WTR and vacations, provides the basis for pursuing personal goals, be they in the form of hobbies, education, or health. But more time also enables less-than-edifying uses of time (e.g., aimless Internet surfing) that may in fact neutralize or undermine eudaimonia. While it does not increase

objective time affluence, having the flexibility to shift work time around other uses can all the same enable activities that facilitate personal flourishing (e.g., taking an adult education course). Because eudaimonic happiness is a product of consistent effort, time-use changes that are woven into the fabric of one's routine are more likely to yield dividends than are sporadic events. On this account, FWAs and reductions in work hours are better policy candidates for helping people realize a rich, meaningful life.

5.5.4 Size and Span of Time and Work-life Balance

There are key differences in the nature of the change in time use facilitated by these three policies. These policies vary in terms of the amount of time they would likely affect as well as the degree of fragmentation of that affected time. Working on the scale of hours, the main effect of FWAs is not a reduction in working time.[40] Rather, the chief merit of FWAs is that they enable workers to step back from the default, established during the Industrial Revolution, of structuring life around work (Klein 2004). While FWAs do not mean that work is always subordinated to one's private life, they do help individuals to prioritize personal obligations and mold their schedule to suit their needs or that of the family unit. Without decreasing the total time footprint of work in someone's life, flexwork can reduce the psychic footprint of worklife, which has direct personal benefits and may indirectly serve to undermine a "live-to-work" mentality.

Increased access to vacation time contrasts with flexible work arrangements in several regards. Vacation days provide a break from work, a reduction in the fraction of the year given to the workplace. Unlike FWAs, which affect life within a day, vacation time is more appropriately considered in units of days or weeks within a year. More to the point, rather than working within the flow of "real life," vacation time is cordoned off from day-to-day existence, a sort of wilderness preserve amidst cultivated fields. While vacations are typically quite hedonically pleasurable, its spillover into the remainder of the year is mostly limited to the days or weeks immediately before or after the event. We can suppose a parallel effect in terms of work-life balance. While vacation time is a time when non-work life fully supersedes work life, this inversion is unlikely to persist once vacation ends and the regular workweek schedule resumes. As a suspension of the ordinary, vacation time is less of a disruption to the normal course of life, a facet that might make vacations more readily partaken of than FWAs or WTRs. That is, taking more vacation is easier to conceptualize, and requires less permanent, whole-life rearrangement, than work-time interventions that apply across the entire year.

Reductions in a weekly work hours, like increases in vacation days, will shift a potentially sizeable sum of hours from the workplace to non-work pursuits. However, there is a marked difference in the timing and magnitude of this liberated time. Whereas more vacation time frees a large chunk of hours in a short length of time, work-hours reductions affect a smaller number of hours weekly over the course of the entire year. Accordingly, alterations in work hours have

[40] An exception to this statement can be found in the case of telecommuting, whereby a handful of hours per week might be saved by eliminating travel to and from work, and off-peak travel might similarly reduce the total time footprint of work.

an inherently greater capacity to alter the fabric of the everyday. Even modest bits of leisure time, when repeated daily or weekly, are more conducive to establishing and maintaining new behaviors and attitudes than are large, exceptional, and terminal events.

5.6 Conclusion

In looking for the possible consequences of social policies that facilitate new allocations of time between personal and professional uses, this chapter draws on a range of literatures. While more research that is focused on the merits of alternative work-time arrangements – particularly specific to the context of the United States – is needed, the current body of evidence allows for a set of qualitative conclusions.

FWAs and WTRs are the more robust foundations of time-based social policies to pursue in order to secure environmental benefits. As alterations of the everyday, FWAs and WTRs allow for a pro-environmental reworking of the timing or magnitude of routine consumption behavior. In contrast, adding vacation days invites changes in the extraordinary, and the direction of that change is strongly contingent on changes in prevailing tourism norms. WTRs have the greatest potential for facilitating the reworking of people's relationships with work and consumption, as opposed to, in the words of Donella Meadows, "diddling with the details" (2001).

The mere institution of any or all of these time-rebalancing policies is unlikely to itself yield widespread changes in individual time-use patterns. These policies lower barriers to behavior change, but it is not necessarily the case that these barriers are restraining time-use changes that would otherwise take place. Guaranteeing vacation time, allowing greater flexibility in work arrangements, or shortening the work week are more likely to realize their potential if they are preceded by a bottom-up cultural shift in priorities. Broadly, this shift needs to entail an interest in time affluence, a greater sense that discretionary time is necessary to purchase elements of a truly good life. These policies can serve to help meet demand for more free and flexible time, but are unlikely to by themselves create much of that demand.

Movement toward a sustainable society will be aided by a scaling back of expectations concerning consumption and consumerism. Cultural norms and values are notoriously slow and difficult to change, but if the environmental movement is to succeed, greater emphasis needs to be placed on fostering cultural changes through social policy. This chapter confirms that the same time-use rearrangements that might realize environmental benefits can also be well-being enhancing. This temporal linkage of well-being and the environment can provide critical leverage for advancing a time-based sustainability agenda. The research presented here may help activists and policy makers select and implement intervention programs.

6 Conclusion

The primary goal of this dissertation is to understand how to motivate changes in individual behavior that contribute to both movement toward environmental sustainability and personal well-being. This goal is prompted by observations that current patterns of consumption are unsustainable and fail to provide substantial improvements in quality of life. These observations suggest the potential for changes in consumption patterns to lead to both environmental and well-being benefits. I employed time use as a means of bridging sustainability and well-being, seeking to probe the prospects of alterations in time allocation – particularly with respect to the volume and use of discretionary time – as the foundation of a constructive and effective means of engaging individuals in behavior change. Chapter 1 introduces five research questions related to this area of scholarship and Chapters 3, 4, and 5 describe the research I performed to answer those questions. This final chapter begins with a review of the key findings.

6.1 Review of Findings

The first major finding of this research is that a person's endowment of discretionary time has a significant influence on their happiness, specifically their experienced hedonic happiness (Chapter 3). Up to a point, greater levels of time affluence corresponds to higher levels of experienced happiness. This time affluence-happiness relationship takes a curvilinear form, however, suggesting that there are diminishing and even negative returns to happiness associated with having too much free time, about 14 hours per day. Most adults' level of time affluence falls well short of this point of negative returns. The modeling work of Chapter 3 also allows for a new definition of the time poverty threshold that is based on differences in the marginal benefit of having more discretionary time. By this definition, the average adult, with 7.5 hours of discretionary time per day, falls below the time poverty line of 8.5 hours.

The second result presented in this dissertation is that activities vary in terms of their lifecycle energy use and greenhouse gas emissions (Chapter 4). There is more than an order-of-magnitude difference in the intensities of the least and most intense activities. The degree of an activity's reliance on transportation is a substantial determinant of the intensity of an activity, with greater transportation requirements driving intensity values higher. The most energy- and carbon-intense activities are all associated with high levels of transportation; the exception is eating and drinking, which is a category with a high embedded energy/carbon value. Activities associated with leisure and well-being are, on average, moderately less energy and carbon intense than the average activity, but there is substantial variation across activity types. Accordingly, a greater availability of discretionary time, when used for leisure and happiness-promoting activities, has the potential to reduce the environmental impacts of day-to-day life.

The final major finding of this dissertation is that alterations in work-time arrangements can both reduce the environmental impacts of personal consumption patterns and enhance well-being (Chapter 5). While each of the three broad categories of work-time alteration considered in this dissertation has the potential to have happiness and environmental co-benefits, the mechanisms and natures of their prospective effects are quite different. Flexible work

arrangements ease work-life conflict and may reduce air pollutants associated with heavy traffic congestion. Extra vacation days provide a respite from work, but their hedonic boost is often short-lived and their environmental gains are dependent on substantial shifts in tourism behavior. Reducing the length of the workweek will cut incomes and, on that account, consumption while allowing more space in everyday life for well-being enhancing activities.

The sum of these three findings indicates that our happiness and the integrity of the environment can be advanced concurrently by changing how we, individually and collectively, allocate our time. Examining time use suggests personal and private policies that can merge the pursuits of happiness and sustainability. However, making happiness a leading motivator for behavior change requires being cognizant of certain pitfalls such programs could encounter.

6.2 Cautions for Applying Results

A core idea backing this dissertation is that goods may be good, but more are not always better. Chapter 3 finds that discretionary time is good, but more likewise is not always better. It should be acknowledged that more happiness is not always a signifier of progress. This is particularly true of hedonic happiness. While moderately high positive-to-negative emotions ratios are associated with flourishing, excessively high ratios engender resistance to behavior change, which may inhibit personal growth (Fredrickson and Losada 2005). Relatedly, there are numerous instances where an investment of unhappiness is necessary to reach an important goal or to foster personal growth; the beginning of an exercise regime, for example, can be physically challenging and emotionally demanding, but, eventually, the act of exercising can become an embraced part of one's routine. Further, increased dissatisfaction with life can spur people to undertake changes that will improve their condition in life. In other words, a monotonic increase in happiness is not necessarily the pathway to the most satisfying state of being. It would be a dishonesty and a mistake to portray an increase in discretionary time as a pain-free shift.

Designing happiness-based pro-environmental inventions also introduces the risk of creating a too-narrow focus on the individual. It may be easier to change one's own behavior, but there is a substantial payoff in advocating for greater public provisioning of the conditions that foster well-being. It is a just criticism of both the voluntary simplicity movement and the policy of flexible work arrangements that they are entirely too idiosyncratic. That is, pursuing personal simplicity or flexibility can yield benefits for the individual, but does approximately nothing to alter the fundamental institutional and economic arrangements that foster unhappiness and overconsumption. In conjoining the concepts of *happiness* and *sustainability*, it would be fatal to overlook power structures, to focus on the individual to the exclusion of scrutinizing those factors beyond the control of the individual.

The pursuit of happiness may in fact make happiness, at least in its hedonic sense, more elusive (Gruber et al. 2011; Kesebir and Diener 2008). As Edith Wharton once quipped, "If only we'd stop trying to be happy, we could have a pretty good time." In some domains, one can still make progress toward a goal without actually achieving it; I can still become quite wealthy despite not becoming a millionaire. With hedonic happiness, however, if I find that I am not happy, the

disappointment of falling short of achieving that goal will in fact drive me even farther from the desired state of happiness. Care must be taken so that focusing on the goal of happiness does not undermine its actually being experienced.

6.3 A Final Reflection on this Body of Work

The economy exists to convert resources into materials that meet needs. In meeting these needs, the economy fosters well-being. The task of public policy is to improve the correlates and facilitating conditions that can be measured objectively, items like infant mortality, literacy rates, and, germane to this dissertation, time affluence. It takes happiness skills to translate these facilitating conditions into a lifestyle of happiness. These skills include sharing, savoring, gratitude, and delaying gratification and are a form of wisdom that science and spiritual traditions alike give us access to. Realizing the promise of time affluence to improve quality of life and environmental indicators pivots on relearning these skills.

In a sense, decoupling is the general theme of this work. Some of the great trends in sustainability are the decoupling of carbon and energy and the decoupling of energy and GDP. A complementary revolution entails the decoupling of consumption and well-being. This decoupling, unlike the others, is a conceptual one. What is needed is the recognition that low-impact lifestyles and an economy built around care and connection, rather than trinkets and hedonic treadmills, are enriching. What is a needed is a return to the original definition of *wealth*. Instead of believing that more is better, we must internalize that enough is as good or, often, better, than a feast. There is, at the very least, less to clean up afterwards.

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