**Clark, J** and Minton, J. Driving Segregation: Age, gender and emerging inequalities. Chapter for *Geographies of Transport and Ageing.*Palgrave.

**6-8000 words including references. End of April**

***Q: is the issue word count or space (ie a word equivalent per table or image)***

***Q: is there any online appendix we could link to? Would it be ok to include in image a link to colour versions***

**Mobility [inequality by age, class - implications]**

**Gender**

**Generation**

**Cohort (increasing equality followed by increasing inequality (moving equal high to equal low by gender….implications; convergence on lower mobility cohort, for the future?)**

**- sub-issue of conversion of license holding to driving**

1. **Schematic table?  (cohort,  gender, broad characterisation)**
2. **Numeric table proportion of driving licence by age…also conversion**

**Add urban space issue transport poverty/ forced car ownership/ pushed to the periphery**

**[rethink the ‘public’ aspect of public transport?] – implications of the sharing economy? Resource managed more efficiently used by more people**

**INTRO:**

**Establish mobility and inclusion, multiple conceptualization of ‘age’ and car as ultimate mobility**

**LIT:**

1. **Proxy for intergenerational disadvantage**

**RQs: key importance of mobility and accessibility in social exclusion; amplified in later years. Young people as old people in waiting and recursive relationship between urban space and transport implications. Infrastructure changes have long term implications**

**CORE DATA:**

1. **Schematic table?  (cohort,  gender, broad characterisation)**
2. **Numeric table proportion of driving licence by age…also conversion**

**DISCUSSION:**

* **Urban space and transport**
* **Q of Age and physical isolation**
* **£££ Funding of transport and spatial dispersion of amenities**

**THE FUTURE:**

* **Platform economics (blur of private and public) and sharing economy as potential cures (Under-utilisation of assets relative to full capacity; more self-driving cars?). Active travel and greater longevity**

# Acronyms

BHPS British Household Panel Survey

UKHLS United Kingdom Household Longitudinal Survey

ISCED International Standard Classification of Education

# Introduction [300-600 words]

Many preferences, attitudes, skills, competencies, propensities, proclivities, vulnerabilities and behaviours become established at a particular age or stage in the life course, then are largely maintained without substantial modification throughout later life. Stages in the life course in which these sustained patterns of being are particularly likely to be established, and then subsequently maintained, have been called ‘critical periods’ in life course epidemiology, in which the first few days, weeks, months and years of life are often considered of particular importance. The transition from childhood to adulthood should also be considered a critical period for adoption of a great many social skills and habits, including both the acquisition of a vehicle driving licence, and the propensity, amongst those licenced to drive, to own a car and drive on a daily basis.

The concept of critical periods in a life course perspective highlights the importance of understanding the conditions which people are exposed to at key life course stages. Exposure to favourable conditions during a critical period can help ensure a positive transition leading to better outcomes at all subsequent stages in the lifecourse; conversely poor conditions during a critical period can lead to individuals setting off on a much less favourable lifecourse trajectory. The concept of critical period within the life course can therefore provide important insights into two related substantive issues: firstly, the many differences in behaviour and outcomes that are often observed to operate across generational lines; and secondly, the persistence and apparent transmission of relative advantage or disadvantage from one generation to the next. Thinking about critical periods is therefore vital for helping to understand both large scale patterns of persistent differences, and persistent continuity, which exist when comparing generations.

In the UK, as in much of the rest of the affluent world, the acts of learning to drive, acquiring a driving licence, and subsequently owning a car and adopting a car-dependent lifestyle, all tend to begin around the critical period of the transition from childhood to adulthood, with the 17 the age at which people can first apply for, take, and potentially pass, a driving licence test. At this age both one’s peers and one’s parents comprise much of the ‘environment’ within which the critical period occurs, with both peers and parents likely exerting strong influence on the habits and preferences of young adults, and parents – through additional intermingling paths of genetic and economic transmission – likely a key influence on whether these preferences can be acted upon. In the case of learning to drive, a key factor is therefore affordability, and whether, regardless of the level of mobility preference in those making the transition from childhood to adulthood, the level of opportunity to act on such mobility preferences, to afford the increasing and increasingly expensive number of lessons required to pass a UK driving test, is equally available to all wishing to acquire this skill, and if not whether these inequalities of opportunity at a critical period have changed over time.

We also argue that placing an emphasis on childhood-to-adulthood as a key critical period for the acquisition of a driving licence, and subsequently to drive, is important for thinking about the kinds of mobility challenges and opportunity that may emerge over subsequent decades. From a critical-period focused life course perspective, the young adult is the parent of the middle aged adult and the grandparent of the pensioner. If vehicle-related mobility is not acquired by someone as a young adult, therefore, what might the implications be for mobility at older ages?

# Methods

### Data

The British Household Panel Survey (BHPS) was a large longitudinal panel survey first carried out in 1991, and then in every subsequent year up until 2009. In the first year, known as a ‘wave’, a representative series of over 5 000 households were selected for interview from the postcode address file, producing a total sample size for individuals of over 10 000. In each subsequent wave attempts were made to interview all adult (16+) members of the initially selected household; if original sample members moved to form new households then attempts were made to interview them and all members of their new households. Additionally, from wave 9 (1999) a ‘booster’ sample was conducted of additional households living in Scotland and Wales; and in wave 11 (2001) a booster sample was collected for households living in Northern Ireland.(Taylor et al., 2011)

Because a different set of questions was used to elicit information from individuals about driving licence ownership and car access in the first two waves compared with all subsequent waves, all results and analyses presented begin with the third wave (1993). The questions used are discussed below.

### Questions used

The BHPS variables DRIVER and CARUSE were used to establish firstly whether an individual possessed a driving licence, and subsequently whether they had access to a car. From the third wave of the survey onwards adults are first asked “Do you have a full driving licence” (the DRIVER variable), and subsequently asked “Do you normally have access to a car or van whenever you want to use it” (the CARUSE variable) only if they respond to the DRIVER question in the affirmative. Within the first two waves respondents were first asked “Do you have a full driving licence?”, and then “Have you got a car or van, or is there one you have use of?”. This slightly different phrasing, along perhaps with a paper-based rather than computer-based interview system, meaning more individuals may have been asked the second question even if they answered ‘no’ to the question on licence ownership, led to very notable differences in the proportions of people who reported both owning a licence and having car or van access.[[1]](#footnote-1) Because of this inconsistency only data from the third wave onwards were used.

The International Standard Classification of Education (ISCED) classifications were used to produce a three-fold grouping of populations by highest educational qualifications. Being an international classification system, this allowed people who had not received their education within the UK to be included in the analyses. Throughout the period in which the BHPS was run, ISCED used a seven-tier grouping of educational classifications, with the following designations: 0: pre-primary education; 1: primary education or first stage of basic education; 2: lower secondary education or second stage of basic education; 3: upper secondary education; 4: post-secondary non-tertiary education; 5: first stage of tertiary education; 6: second stage of tertiary education.[[2]](#footnote-2) The seven-fold ISCED groups were categorized into the following three groups for the purposes of this analysis: groups 0, 1 and 2 were collapsed into the category ‘no further’ education (‘Low’); groups 3, 4, and 5 were grouped into the ‘further vocational’ education group (‘Med’); and 6 and 7 were grouped into the category ‘further non-vocational’ (‘High’).

## Method of Analysis: Lexis Surfaces

Within our paper we explore the data descriptively using a visual tool known as a Lexis surface. Within Lexis surface many complex and subtle patterns, relating to age, period and cohort effects and interactions, can be identified. Though we use quantitative data, our interpretation of these trends is in effect qualitative and subjective. Further analysis of this and other data can develop models and formal hypothesis tests for our interpretations, but for now what we present is necessarily somewhat impressionistic.

In a Lexis surface, a variable (‘Z’) is arranged visually on a data surface comprising age (‘relative time’) on one axis and year (‘absolute time’) on the other axis. Conceptually, a Lexis surface can be thought of as visual representation of a temporal surface much as a topographic map is a visual representation of a spatial surface, with age substituted for latitude, year (or period) for longitude, and the variable Z substituted for the surface’s ‘height’. Within the Lexis surfaces presented here, the variable Z is either: the proportion of the BHPS sample, of a given year and age, who have a driving licence; or the proportion of those BHPS sample members who have driving licences, who also report having access to a car or van. Substantively, the former may be considered a measure of *potential* auto-mobility, and the latter a measure of *realized* auto-mobility.

# Results

Figure 1 shows Lexis surface level plots for both the proportion of BHPS sample members who have a driving licence (subfigures A, B and C); and the proportion of those BHPS sample members with a driving licence who also have access to a car or van (Subfigures D, E and F). Subfigures A and E show levelplots separately for each gender (females on the left and males on the right), whereas subfigures B and E show the levelplots further subdivided by highest educational qualification. Subfigures C and F contain a number of simple labels and divisions, indicating different regions within the Lexis surfaces, which will be referred to in this discussion of the results. Within each levelplot the shade of a cell indicates the proportion, with black indicating 100% and white cells indicating less than 50%.

## Driving Licence Ownership by gender and generation

Figure 1A shows the proportion of the adult BHPS sample who report having a driving licence, from 1993 to 2008, and for all ages from 17 to 80 years of age. It is clear from the difference in the shade of the right sub-panel (males) compared with the left sub-panel (females) that, historically, a larger proportion of adult males tend to have driving licences than females. A more subtle pattern in this figure is suggested by noting that in both panels, and in particular for the female panel, the cell shades tend to be darker near the bottom of the panels than at the top, when looking at both panels from the top to around one third of the way from the bottom. This indicates that, above around the age of thirty years, younger adults tend to be more likely to have a driving licence than older adults. As largely the same panel of individuals are being followed each year, and only a very small proportion of people possessing driving licences then have these licences revoked and have to take the test again, this difference in shades is suggestive of changes in driving licence ownership rate by cohort, with successive cohorts being more likely by a given age to possess a driving licence than earlier cohorts at the same age. By comparing similar regions (combinations of age and year) in the male and female panels it is also apparent that levels of driving licence ownership between males and females have tended to converge over successive generations. To look at this further, consider the region indicated by the letter A in figure 1C, and above the first diagonal dashed line in the figure; this broadly demarks cohorts born before around 1940. Within this broadly defined region of the Lexis surfaces, the cells are much darker for males than for females, with the proportions of males with driving licences around 90%, and the proportions of females with driving licences from similar cohorts ranging from around 55% to 70%. Next consider the region indicated by B in figure 1C, demarcated by the first dashed line above and another parallel diagonal dashed line below. This broadly indicates cohorts born between around the early 1940s and the late 1950s. The figures. The difference in the cell shade in this region between the male and female panels has reduced, with the proportions of males with driving licences increasing slightly from around 90% to 95% and above, and the corresponding female driving licence ownership rates increasing from around 70% to over 80%. The region indicated by the letter C in the Figure 1C indicates cohorts born from around the early 1960s to around 1975. For these cohorts the proportion of males with driving licences has remained high, at around 95% or above, whereas the proportion of females with driving licences has increased further, from around 80% to around 90%. Finally, we can consider the bottom right corners of the panels, indicated by letter D on figure 1C. This shows driving licence rates for people born after around 1975. What is striking about these younger cohorts is that driving licence rates have fallen for both genders compared with earlier generations, reversing a trend towards higher driving licence ownership which had been continuing for many generations. It is also noteworthy that these falls in licence rates have been in both genders, reaching around 75-80 for some of the newer cohorts within this Lexis surface region.

The complex patterns can to an extent be simplified into a series of broad generational ‘pen portraits’, each differing in terms of auto-mobility and gender equality. From the BHPS sample it appears that generations born before the Second World War (the region A in Figure 1C) tended to have mixed mobility and high gender inequality, with around 90% of males from this generation possessing a driving licence but only around 70% or so of females likely to have a driving licence; put another way, by the time this generation had reached old age, women were around three or more times more likely not to be able to drive than men of the same age, with important implications for how reliant both older women and older men are on either public transport or friends and relatives with access to a car to travel substantive distances from their homes. The implications of this historically high disparity in auto-mobility by gender are likely to have been felt both during working life, with women less able to travel without (in many cases) the support of their husbands, and in old age, where the shorter life expectancy of men means many elderly women from this generation would have outlived their husbands, and because of this experienced not just profound personal bereavement, but also a sharp fall in their capacity to travel far from home. Differential auto-mobility and differential longevity therefore created the conditions for the loss of a husband to be both a primary and a secondary cause of isolation for elderly women from this generation.

For generations born after the Second World War, and up until the start of the 1960s (region B in Figure 1C), there was a catch-up in auto-mobility between the genders, with both genders more likely to own a licence by the time they reached middle age, but with greater increases in women’s auto-mobility than men’s. The decades after the Second World War can, from the perspective of UK households, be considered an extended period of inclusive economic growth, with successive governments committed to broadly Keynesian economic programmes of investment in people and places, with relatively high levels of economic growth per capita, increasing median wages, and falling income inequality. Though the 1950s are considered by contemporary standards to have high levels of structural and cultural inflexibility regarding gender norms and female participation in the workplace, increasing affordability of car ownership at household level, due both to rising household incomes and falling vehicle costs through greater industrialization, led to both ‘two licence’ households and then ‘two car’ households becoming increasingly common. With increasing rates of female auto-mobility, as well as higher social mobility more generally, the costs of moving to the car dependent suburbs from denser and less car dependent urban core fell, and opportunities for increasing female participation in the labour force increased, leading to both less female dependence on males for auto-mobility and economic security. Within the household there was a movement away from conditions of gendered dependence in the fields of mobility and earnings, and towards equality and interdependence.

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| A) The proportion of BHPS sample respondents with a driving licence, by gender | B ) Driving licence ownership, by gender and highest qualilfication. | C) Driving licence ownership. Annotated. | D) The proportion of driving licence owners with access to a car or van, by gender | E) The proportion of driving licence owners with access to a car or van, by sex and highest educational qualification. | F) Drivers who drive. Annotated. |

Figure 1 Lexis surfaces showing the proportion of BHPS sample members who have driving licences (A-C); and, of those sample members with driving licences, who also have access to a car or van (D-F). In all figures year runs horizontally from left to right, and age runs vertically from bottom to top. Within each levelplot the shade of a cell indicates the proportion, with black indicating 100% and white cells indicating less than 50% or missing values.

If the generation born from after the Second World War to the start of the 1960s can be characterized by both increasing mobility and increasing equalization of auto-mobility between genders, the generation born from around 1960 to the mid 1970s (area C in figure 1C) may be thought of representing an end point in this journey towards a high mobility and high auto-equality society. Within this high mobility, high auto-equality generation both males and females were highly likely to possess driving licences, though the proportion of females with licences still remained somewhat lower than for males. This high mobility, high auto-equality generation experienced both the tail end of a decades’ long social democratic commitment to high quality while being educated in primary and secondary school as children, then the transition and embedding of neoliberalism under Thatcher and Major while of working age; put another way, this generation (or at least the start of this generation) both gained from the relatively high tax and high social investment policies of the post-War post-Keynesians while economically dependent children, and to some extent from the low tax and low regulation policies of Thatcherism while income-generating and tax-paying adults. Increasing job insecurity, or ‘flexibilisation’, after Thatcher therefore made traditional single-earner households less economically stable, and so less common, so creating both the opportunity and the necessity for dual-earner households to proliferate. This was both enabled by and helped consolidate the previous generation’s progress towards high female auto-mobility rates, as both the ability to work, as well as to balance work with other commitments, can depend on auto-mobility, and so on possessing a driving licence.

For the generation born after 1975 (Region D in figure 1C), the trend towards increased auto-mobility seems to have gone into reverse, more quickly than it rose for either gender over previous generations. Although we cannot know the proportions with driving licences in old age, the proportion of both genders with driving licences around the age of 20-25 years is falling, and does not appear to be increasing as this generation enters their thirties. Interestingly, though the fall in driving licence rates occurred in both genders, and from levels that were around 5% points higher for males than females, it appears they may be falling to similar levels for both genders, of around 80%. This nascent generation therefore appear from the BHPS data to be characterized by both low auto-mobility and high gender equality in this domain.

## Driving licence ownership by gender, generation, and highest educational qualification

Figure 1B shows how rates of driving licence ownership vary by year and age, and further by both gender and highest educational qualification class. The top row shows rates for those with the highest educational grouping (‘Further non-vocational’, labelled ‘High’); the middle for intermediate qualifications (‘Further vocational’, labelled ‘Med’) and the bottom row for those with ‘no further’ education (labelled ‘Low’). As before, the left panels show the rates for females and the right panel shows the rates for males. Though each panel is smaller than before, and so it is harder to make out the details of each panel, a number of broad trends and differences between panels are clear, revealing important information about the complex relationship between gender, generation and income.

To learn more about the moderating influence that higher qualifications appear to have on gender differences in auto-mobility, we can compare the overall shade of the left and right hand panels in each row. For the top row, for those whose highest educational qualification is a degree, there is very little difference in shades between these two panels, indicating very little difference in auto-mobility by gender within this high educational subpopulation. The overall shade also tends to be uniformly darker than in any of the other panels, indicating higher driving licence rates overall, which are close to 100% for either gender, at almost all ages, and in almost all years. There are, however, notably more missing values (blank, white cells) for older females than older males, because historically fewer females than males attended university, and so for particular combinations of age, year, gender and educational qualification there were simply no observations in the sample.

By contrast, within the lowest educational qualification group (bottom row panels), there is both a lower proportion of people with driving licences overall than in the other panels, as well as the greatest difference between male and female rates of driving licence ownership. Historically, male levels of driving licence ownership tended to be at around 90%, increasing steadily up to around 95% or above for those cohorts born up to around 1970-75; by contrast female rates in the earliest cohorts were only slightly above 50%, rising to around 80% by the end of the ‘Catch up’ generation (bottom of region B in figure 1C).

Within the intermediate qualifications group (middle row panels), there is both an intermediate level of overall disparity in gender mobility (difference in shade between left and right panels) as well as perhaps clearer diagonal ‘striation’ then in the other panels, suggesting that cohort effects are particularly important in explaining mobility in people with intermediate level qualifications, and that the generational patterns and changes described above for the whole BHPS sample are particularly the case for the intermediate qualification sub-population.

It is worth noting that the fall in auto-mobility seen for post-1975 cohorts (triangle D in figure 1C) is very clear for both the Low and Med qualification panels, but not very pronounced for the High qualification panels. This could partly be because this trend covers younger ages, and the time taken to complete university degrees mean almost no one in the High group is under 20 years of age, so there are fewer observations with which to try to discern this pattern in High educational groups than in the other groups. A more substantively important implication, however, is that whatever changes have occurred that have led to less auto-mobility overall have had less of an impact on those with degrees or above. By comparing the shades of the bottom right triangles for males and females in the Med panels, with males and females in the Low panels, it also appears that gender differences in auto-mobility have further equalized for those in the former, whereas they have remained or become exacerbated for the latter, with a fall to lower levels for females with the lowest qualifications compared with males.

## Drivers with access to a car or van

We will now look at trends and patterns in the proportion of the BHPS sample with a driving licence who also state they have access to a car or van (‘Drivers who drive’). For the whole of the relevant BHPS subsample this is shown in figure 1D, with the female panel on the left and the male panel on the right. Figure 1E labels some of the regions within the panels, A to E, which will be referred to in the discussion of Figure 1D and figure 1E. As with Figures 1A-1C, the shade of cells within the panels indicates proportions, with proportions below 0.5 represented by white cells, and higher proportions ranging from 0.5 to 1.0 by successively darker shades.

We will begin by considering the region A, representing those (now elderly) cohorts who were around 50 years old or older in 1993, and therefore cohorts born either before or during the Second World War; the very earliest cohorts visible in region A are persons aged 80 years in 1993, and so region A includes some cohorts born from the 1910s to the 1940s. Region A in figures 1D-F therefore covers a similar range of cohorts to region A figures 1A-C, and a somewhat similar pattern of change is seen.

For women and within region A there is evidence of successively higher proportions of those with driving licences also having access to a car or van, but with higher proportions of males than females of the same age and in the same cohort. For cohorts born in the 1910s, around 20% of women with driving licences, and around 50% of men with driving licences, had access to a car or van. For cohorts born in the 1920s, the proportion of licenced females with car or van access rose from slightly under 30% to around 60%; the corresponding change for men in these cohorts was between around 55% and about 80%. For cohorts born in the 1930s the proportion of licenced females with car or van increased to around 80%, whereas for licenced males it increased to around 90%. Within region A, therefore, the proportion of female drivers with car or van access increased from around 20% to 80%, and for males from around 50% to 90%.

It is important to note that, within the age range 60 to 80 years, an age effect is not observed, i.e. the proportion of people with licences with car access does not diminish between ages 60 to 70 or 70 to 80. Within the UK, drivers aged 70 or older need to renew their driving licences every three years, as well as to state if they have developed any medical conditions which may affect their driving, but are not required to retake a driving test.[[3]](#footnote-3) Even though rates of impairment which may affect driving can be expected to increase with old age, there is no indication, at least up to age 80 years, that this substantively affects auto-mobility.

We now consider changes in the proportion of drivers with car or van access aged between around 30 and 55 years of age, how this proportion has changed from the early 1990s to 2008, and how this change has differs from males and females. This particular pattern of change is represented by the letters B and C in figure 1F, along with the arrow going left to right. We can see a notable increase in the proportion of licenced women in this age bracket with car or van access, from around 80% to around 90%. Most of this increase appears to occur fairly suddenly, around 2001-2002, rather than being a gradual change. For men in the same age-bracket there is no equivalent change, with rates between remaining around 90-95% throughout the period of observation.

Finally, we can look at how the proportion of people with licences with access to a car or van changes with age from around the age of 17 to 30 years, as indicated by the letters D and E in figure 1F, and the vertical arrow pointing upwards. We can see that, within this age range, there is very little difference between genders, and instead age effects dominate. At around 20 years of age, around 55% of those with driving licences also have access to a car or van. By the age of 25, this has increased to around 75-80%, and by the age of 30 to around 90-95% for men throughout the period 1993-2008; for women, rates increased to around 80% by age 30 up to around 2001, and to around 90% from around 2004 to 2008, due to the period-driven change represented by the vector from B to C.

The age-based pattern of increasing car or van access in young adulthood is important for understanding that rates of gender inequality in *realized* auto-mobility (‘drivers who drive’) only tends to emerge after the age of 30, and that up until this age, age tends to be a much stronger determinant than gender. Since the early 2000s, it is also apparent that rates *realized* auto-mobility from the age of 30 to 55 years tend to be very similar between the genders, although we saw some persistent though diminishing gender differences in rates of *potential* auto-mobility (proportions of sample with a driving licence) within Figures 1A-C.

## Drivers with access to a car or van, by highest educational qualification

Figure 1E shows how the proportion of registered drivers with access to a car or van varies by highest educational qualification as well as by gender, age and year. As with figure 1B, Figure 1E allows the mediating and moderating role of educational qualification on auto-mobility patterns to be better understood. As with Figure 1B, we can see, by comparing the shade of cells in the top left with the top right panels, that gender differences in this auto-mobility outcome (*realised* auto-mobility) are very low amongst those with a degree or higher qualification, with car or van access levels typically above 90% at all ages above around 30 years for both genders. There is also no apparent historic cohort pattern (region A in figure 1F) whereby *realised* auto-mobility increases over successive cohorts born from the 1910s to the 1940s; instead, rates of car or van ownership amongst both males and females with degrees from these cohorts tended to be close to 100%, though with fewer observations for females, leadings to a larger number of missing cells. If anything, amongst those with degrees and driving licences, rates of car or van ownership decreased slightly for cohorts born after World War 2, from around 95-100% for pre-War cohorts, to around 90-95% for cohorts born after 1945.

Both the subpopulations with lower and intermediate highest educational qualification (middle panel and low panel), differ from the ‘high’ qualification group in a number of ways. Firstly, the progressive increases in realized auto-mobility in the oldest cohorts with each successive cohort (region A, covering cohorts born from the 1910s to the mid 1940s), which are seen in the population overall, are clearly evident through the diagonal striation within this region. Comparing equivalent cohorts (for example looking at the very top left corners of each panel to compare the 1915 cohorts), we can see both that realized auto-mobility tended to be lower for females than for males, and for the low education compared with intermediate educational qualification group. For example, rates of realized auto-mobility amongst the oldest cohorts were around 20% for females with ‘low’ qualification, around 50% for males with ‘low’ qualifications, around 40% for females with intermediate qualifications, and around 70% for males with intermediate qualifications. For each of these groups, with the exception of females with low qualifications, rates of realized automobility reached around 90% or higher for those born after World War 2 (bottom of region A); for females with low qualifications levels reached levels of between 60 and 80% instead.

A second way in which the two bottom rows of panels differ from the top row is that there tends to be more of a difference between females and males in realized auto-mobility rates, with these disparities greatest in the lowest educational group, and smaller in the intermediate educational group. A third observation to note is that the rapid rise in auto-mobility rates seen for females overall after around 2001, characterized by the vector B to C in figure 1F, is clearest to see in the panel for females with intermediate qualifications, though to some extent also evident for females with ‘low’ qualifications.

Finally, it is important to note that the increasing levels of realized auto-mobility seen between around the age of 20 and 30, as characterized by the vector D to E, is seen for all educational subgroups, and does not appear to differ strongly by gender.

# Discussion

Highest educational qualification is both an indicator of both the earnings potential of households that form as people form as they enter adulthood and the workplace, and also of the types of households they were part of as children. Though there have been large-scale structural changes in both the levels of qualification, and proportion of the UK population possessing degrees, over the many generations included in the BHPS sample, children from households where one or both parents had a degree are often likely to go to university themselves, and those from backgrounds where parents left school at an early age less likely to get a degree. Also, like gender, a highest educational qualification tends to remain fixed throughout most of adulthood. In earlier explorations of the data, we also looked at occupation and household earnings as a means of stratifying the overall population, and found highest educational qualification to be a more informative way of subdividing the population with regards to auto-mobility outcomes. This makes sense when we consider how average household earnings are likely to vary over the life course, with those going to university likely to earn less in early adulthood than those who leave full time education at an earlier age; occupation, similarly, is highly fluid over the life course, has become more so, and is arguably less hierarchical than highest qualification.

Interestingly, we found highest educational qualification to better explain, and more strongly moderate, both gender differences and differences in auto-mobility between the generations, than urban-rural classification. Whereas urban-rural classification to some extent characterizes the differential *need* of individuals to have their own form of transport, highest educational qualification, as a stable proxy for both future household and parental household earning potential and economic stratification, characterizes the differential *means* with which people can afford both to learn to drive, and then to own a car. The importance of age on differential *need* is clearly seen by looking at how the proportion of ‘drivers driving’ (Figure 1D) changes from the twenties to the thirties (as indicated in the arrow from label D to E in figure 1F), and this differential need does not appear to vary substantively between educational strata (Figure 1E).

Thinking about differential *means*, however, may go far to explaining both persistent and emerging differences between educational strata, and within each strata differences by gender. For example, we can expect that both the costs of learning to drive and owning a car will be more unaffordable for lower income households, with the former cost more likely to be borne (at least initially) by parents, and the latter costs by newly formed young adult households. Highest qualification, as we have suggested, can be a proxy for both parental and new household income, and the relatively constrained budgets of such households may explain both why the relatively low level of auto-mobility, its further decline, and also the large gender differences in auto-mobility within this educational strata. Like eyes per person, cars per household have diminishing marginal returns: the difference in geographic accessibility and opportunity for a household going from no cars to one car likely to be much greater than the additional opportunity made available from one car to two cars. In households that are only just able to afford one car, it is often the (male) main earner of the household who tends to be the car owner and driver.

## The concept of mobility

Mobility is a multi-faceted concept that can be considered along socioeconomic, geographic and temporal dimensions, and within these latter two dimensions at a range of distinct scales. At a broad geographic scale the concept of mobility is linked to processes and preferences towards both international and intra-national (‘internal’) migration, the willingness or need for individuals to relocate to new countries or regions; long-distance movements are known to be more likely in early adulthood than at other stages in the life course, with further education at university often both forming a need for individuals to leave their familial household in the first instance, and then further incentives to relocate longer distances in search of appropriate graduate employment.(Findlay et al., 2015) Socioeconomic and geographic mobilities are therefore intimately linked and mutually reinforcing concepts. If migration is mobility at the macro-scale of geography and time, concerning hundreds of kilometres and geographic transitions at the scale of years or decades, then auto-mobility represents the micro-scale, concerning quotidian movements at the scale of kilometres or tens of kilometres. Whether people choose to move to a new region, and where within this region people choose to live, is both affected by and affects everyday mobility, with access to a car a vital factor in such decisions. As we have seen in the BHPS data, auto-mobility is itself strongly determined by educational background, as well as decreasingly by gender, and persistently, though with differential force, by generation.

Auto-mobility is a paradoxical form of mobility, as it both greatly decreases the friction of physical distance, while also competing for other modes of self-conveyance – walking, cycling, and using public transport – that necessarily involve greater levels of physical activity, and so potentially confer greater health benefits. Auto-mobility is therefore both the most mobile, and the most sedentary, of travel modes encountered on a daily basis. The trends we saw in region DE of figure 1D-E, showing that rates of realized auto-mobility (‘drivers driving’) increase from the start of adulthood until the early thirties, suggests that rates of active travel decrease throughout young adulthood due to increasing car use. Rates of physical activity tend to decrease with age,(Bauman et al., 2012) and increased car dependency is likely an important contributory factor in this trend.

## Choice or constraint?

The fact that most rich nations, including the UK, have already passed ‘peak car’ is well established, as is the role of generational differences in emerging auto-mobility and the identification of the ‘Millennials’ as a distinct cohort in their licence and car ownership trends. The reasons for these trends, and the implications for the health, social and economic opportunity, and wellbeing of future generations, are still being debated. One interpretation of these trends is that they reflect active and positive choices made by new generations, away from car use and towards reduced travel in daily life as a result of reduced need for travel; a common reason given for this reduced need is the increasing ubiquity of information and communication technologies (ICTs), meaning that people no longer need to be physically proximate to communicate, collaborate and affiliate with one another. In addition to reducing the need for travel, ICTs and related electronic devices are a form of entertainment in their own right, which cannot be engaged with while in charge of a vehicle; from this perspective, the opportunity cost of vehicular travel is therefore increased, and the appeal of this travel modality, compared either with not travelling or travelling by public transport, is reduced. We will refer to this optimistic interpretation of the trends as the ‘Choice’ model of reduced auto-mobility.

An alternative explanatory model for the trends is what we call the ‘Constraint’ model of reduced auto-mobility. This posits that a variety of socioeconomic factors have simply made first learning to drive, then having access to a car, a more distant and unaffordable prospect for newer generations. Such economic factors include increasing fuel costs, costs of insuring younger drivers, increasing costs associated with passing driving tests, and more insecure forms of employment with stagnant wages, each of which have affected Millennials more so than previous generations, and we could also posit have particularly adversely affected those without further education due to falling demands, relative to supply, for manual labour occupations.

Of these two types of explanation, we believe the data from the BHPS broadly supports the ‘Constraint’ explanation more so than the ‘Choice’ explanation, although the two are not mutually exclusive.

## Limitations

The BHPS was superceded in 2008 by the UK Household Longitudinal Study (UKHLS), also known as Understanding Society. From the second wave onwards, original sample members from the BHPS were incorporated into the UKHLS, meaning the same households and individuals who first joined the BHPS in 1991 can be followed for a number of additional years. Unfortunately, many of the questions and classifications of responses are inconsistent between BHPS and UKHLS, meaning it has proved problematic to ‘extend’ the observations shown above beyond 2009 using the UKHLS. This is particularly the case when seeking consistent categorization of highest educational qualification, which we found to be a powerful means of distinguishing between sub-populations in terms of APC trends; the ISCED categorisations used in the BHPS were asked only in wave F of the UKHLS, and only as part of an immigrant and ethnic minority booster sample, with regards to qualifications obtained abroad.[[4]](#footnote-4) In principle, however, the period of observation can be extended to more recent years using UKHLS. This could be particularly informative as the UKHLS covers the period after the 2008 Global Financial Crisis and subsequent UK-wide recession; this recession is notable for its sluggish recovery, including a continued stagnation in wages and living conditions for much of UK society. We expect the trends towards decreasing mobility amongst those with lower educational qualifications to have worsened as a result of these changes, and so it should be a priority to explore this further.

The complex sampling and questionnaire design of the BHPS has both advantages and disadvantages, with the main advantage being that individuals can be tracked through time and so the effect of changes in individual circumstances on other outcomes estimated. A disadvantage is that, though the BHPS was initially drawn from a representative sample of the UK population, both selective attrition and the booster samples mean it can become somewhat less representative of the UK population over time.(Uhrig, 2008) Within the analyses presented here, the BHPS is presented ‘as is’, without attempts to explicitly follow the same individuals over time or to analyse the influence of specific changes in household or individual circumstance on mobility outcomes; however the BHPS has been used to allow these analyses to be explored in subsequent research.

CHUNK 10

WORDS AT START 7390

THE AIM OF THIS CHUNK OF TIME, AND THE NEXT CHUNK OF TIME, WILL BE TO SUMMARISE RELEVANT LITERATURE RELATING TO A NUMBER OF IMPORTANT ISSUES. THESE ISSUES ARE

1 PEAK CAR – WHAT HAVE BEEN THE TRENDS IN CAR OWNERSHIP OVER THE LAST FEW DECADES, IN THE UK AND INTERNATIONALLY? WHAT EXPLANATIONS HAVE BEEN GIVEN FOR THESE TRENDS? WHAT IMPLICATIONS HAVE BEEN SUGGESTED FOR IMPORTANT SOCIOECONOMIC AND HEALTH OUTCOMES

2 PLATFORM ECONOMICS AND DRIVERLESS CARS – WHAT DISCUSSION HAS THERE BEEN ABOUT CARS AS A RESOURCE THAT CAN POTENTIALLY BE SHARED BETWEEN MORE THAN JUST A SINGLE HOUSEHOLD? WHAT PROJECTIONS HAVE THERE BEEN ABOUT FUTURE TRENDS AND THE POSSIBLITY THAT CAR ACCESS BECOMES MORE AFFORDABLE FOR CURRENT HOUSEHOLDS IN LATER GENERATIONS?

3 ACTIVE TRAVEL AND HEALTH – WHAT DEBATES HAVE BEEN HAD ABOUT THE HEALTH IMPACTS OF MULTIMODALITY

4 CAR USE AND AGEING – WHAT DOES THE LITERATURE SAY ABOUT CAR USE AND CAR DEPENDENCY IN OLDER AGE? TO WHAT EXTENT ARE PROCESSES OF HABITUATION AND LIFE COURSE APPROACHES CONSIDERED WHEN UNDERSTANDING EXISTING TRENDS AND POSSIBLE FUTURE TRENDS?

5 DECENTRALISATION OF POVERTY AND CAR DEPENDENCY – HAVE CHANGES IN CAR USE BEEN LINKED TO PROCESSES OF DECENTRALISATION OF POVERTY? (SUMMARISE JULIE’S AND ANGELA’S PAPER ON THIS IN GLASGOW)

6 LIFE COURSE APPROACHES TO HABITS AND HEALTH – WHAT DISCUSSION HAS THERE BEEN ABOUT YOUNG ADULTHOOD AS A CRITICAL PERIOD IN WHICH PARTICULAR HABITS BECOME ESTABLISHED AND EMBEDDED, AND SO THE IMPORTANCE OF UNDERSTANDING THE CONDITIONS FACED IN YOUNG ADULTHOOD WHEN CONSIDERING HOW PEOPLE AGE

7 CAR DEPENDENCY AND ISOLATION IN OLD AGE – WHAT DOES THE LITERATURE SAY ABOUT THE FACT MEN HISTORICALLY WERE MORE LIKELY TO HAVE DRIVING LICENCES, AND ALSO TO DIE BEFORE WOMEN, IN TERMS OF A POTENTIAL DOUBLE-DISADVANTAGE FACED BY ELDERLY WOMEN IN OLD AGE WHEN THEIR (MALE) PARTNER DIES

FOR EACH OF THESE CHUNKS, I WILL PRODUCE A SPREADSHEET MARKING OUT THE PROGRESS THROUGH THE LITERATURE I HAVE MADE. THE STEPS WILL BE:

* 1. WIDE NET SEARCH INCLUDING SEARCH TERMS
* 2. IDENTIFICATION OF ONE OR TWO MOST PROMISING CLUSTERS
* 3. COPYING OUT OF RELEVANT ABSTRACTS FROM MOST PROMISING CLUSTERS
* 4. HIGHLIGHTING OF RELEVANT TEXT
* 5. IDENTIFICATION OF TEXTS TO READ IN FULL, PRINTING THESE OUT AND READING THEM FOR ADDITIONAL INFORMATION
* 6. ADDING OF REFERENCES TO RELEVANT TEXT TO MENDELEY
* 7. PRODUCTION OF DECLARATIVE STATEMENTS BASED ON RELEVANT TEXTS, INCLUDING REFERNECES
* 8. CONSOLODATION OF RELEVANT STATEMENTS INTO DECLARATIVE STATEMENT CLUSTERS

# Declarative referenced statements (unordered)

CHUNK 11 – THE AIM OF THIS CHUNK WILL BE TO PRODUCE A SERIES OF DECLARATIVE STATEMENTS, UNTIL I HAVE REACHED THE END OF THE CORPUS. AT THE START OF THE CHUNK I HAVE COMPLETED 8 DECLARATIVE STATEMENTS. [End chunk 11: 12616 words; 57 declarative statements]

CHUNK 12 – CONTINUE!

1. England and Wales remains car dependent, with 67% of commuters using cars or vans as their main commute mode in 2011. (Goodman, 2013)
2. In England and Wales, poorer socioeconomic groups tend to walk, but not cycle, more than richer socioeconomic groups. (Goodman, 2013)
3. In Montreal, Canada, use of public transport tends to fall as people enter their early thirties, consistent with patterns of realized auto-mobility in the UK. (Grimsrud and El-Geneidy, 2014) In the USA, where mass transit users are disproportionately likely to be non-white as well as younger adults, there are concerns that similar falls in transit use may occur in newer cohorts in the USA as they age. (Brown et al., 2016)
4. ICTs may both reduce the need for motor travel, and also allow for better organization and utilization of private vehicle stock through apps and information sharing platforms like Uber, enabling what’s sometimes referred to as ‘collaborative consumption’. (Hamari et al., 2016)
5. Automated vehicles offer not just the possibility for replacing or blurring the public/private distinction in car ownership, but for augmenting train and coach use as well. (Yap et al., 2016)
6. Preferences for cycling can be influenced by substantial changes in life circumstances or environments. (Chatterjee et al., 2012)
7. Disabilities and impairments, which can adversely affect educational outcomes, can also adversely affect the ease of learning to drive, of driving, and the ease of using other transport modes. (Durkin et al., 2016; Pyer and Tucker, 2017)
8. In the UK, there was some hope in the early 1990s that privitisation of British Rail’s assets would lead to an improvement in quality of service and so increasing attractiveness of rail as an alternative travel mode to car use. (Harman, 1993) Though passenger numbers increased, quality did not and ticket costs increased. [REFS]
9. Vehicle registration taxes increased in the USA in the 1980s; these increases were found not to have decreased the proportion of people registering for new vehicles, but to substitution of newer and more expensive vehicles for older and cheaper priced vehicles, (Pritchard and DeBoer, 1995) suggesting both that cars were a somewhat inelastic commodity, and that there can be unintended consequences, in terms of moving to more polluting and fuel inefficient vehicles, to incentive structures intended to reduce car use.
10. The attractiveness of travel by rail can be increased somewhat by providing additional transport, such as electric station cars, from train stations to final destinations, but unless end-to-end public transport solutions are widely available cars may well remain much more attractive and convenient means of conveyance. (Cervero, 1997)
11. Car sharing schemes long predate autonomous vehicles as a viable means of shifting car use towards being a shared commodity. In 1999 around 38,000 people were registered in car sharing schemes in European cities. (Prettenthaler and Steininger, 1999) Increasing car sharing scheme adoption could potentially save around 84,000 tonnes of CO2 being emitted in Dublin per year, and over 200,000 tonnes of CO2 emission per year in Ireland as a whole. (Rabbitt and Ghosh, 2016)
12. Analysis of data from the British Social Attitudes survey in 2000 suggested high levels of car preference amongst working age men, people with higher incomes, people living in rural areas, and in particular in people with children; these groups were both most responsible for vehicle pollution, as well as least concerned about their impact. (Huby and Burkitt, 2000) Such concerns relate to broader issues of environmental and social justice, where households exposed to higher levels of vehicle-produced air pollution also tend to be less likely to be car-owning producers of such pollution. (Mitchell and Dorling, 2003)
13. Auto-mobility has long been the dominant transport mode in rich countries, to such an extent that it has been argued demand for car use has become self-reinforcing, in opposition to a more sustainable ‘postautomotive mobility paradigm’.(Beckmann, 2001). It has been argued that the ‘car system’, or ‘automobile society’ is a key element for understanding processes of globalisation more generally, and exhibits a high degree of both path dependent and autopoietic (self-reproducing) qualities;(Urry, 2004) these qualities create a societal ‘lock-in’ which may be strongly resistant to external factors which could otherwise bring paradigmatic change, such as urban transport planning policies, vehicle use saturation, and reducing car use amongst young adults. (Cohen, 2012) Some recent academic commentary has suggested, however, that we may be undergoing a long-term and large-scale paradigm shift in both levels of and preferences towards car ownership. (Jones, 2014; Lee-Gosselin, 2017)
14. The UK, more so than many other European countries, is characterized by many decades of increasing physical separation between homes, workplaces and other trip destinations after the Second World War, in part due to long-term processes of housing de-densification and suburbanization, both causes and effects of increased car dependency. Schemes to increase the cost, if not the friction, of travelling greater distances, such as road pricing, are likely to be met with stiff public opposition in much of the UK. (Cooper et al., 2001)
15. More compact urban forms, which reduce the physical distance between trip destinations, are known to encourage lower car dependence and greater use of multi-modal transportation. (Dieleman et al., 2002)
16. As well as travel to work being a key driver of private vehicle use, the workplace has also been considered as an important place from which greater active travel can be encouraged. (Wen, 2005) The evidence base in support of such workplace (or school) interventions, referred to as ‘organisational travel plans’ (OTPs) as a means of reducing car dependency, is currently mixed and of poor quality. (Macmillan et al., 2013)
17. People living in inner cities in Denmark tend to travel less by car to work, and less overall, but somewhat more at weekends for leisure purposes. (Næss, 2006)
18. Staff travelling to work at universities have been found to be less than half as likely to use active travel modes as students travelling to study at the same institutions. (Shannon et al., 2006)
19. Policies to promote infill and redensification of urban places through re-use of brownfield sites may lead to more sustainable and less car dependent travel behaviour. (Donegan et al., 2007)
20. Amongst older people, car ownership has been shown to be a more consistent predictor of quality of life in European cities than home ownership. (KNESEBECK et al., 2007)
21. Preference for travel by car, like many other preferences, is culturally transmitted, and so it is important to understand the role of childhood socialization in the development of such preferences. (Baslington, 2008, 2009)
22. In the USA, both type of residence and the life-stage of household members are shown to influence how often and how far people tend to travel, as well as each other. (Lin and Long, 2008)
23. In Germany, as well as the UK, there is no compulsory medical retesting of elderly drivers, leading to some concern about elderly driver safety given the effects that diseases of old age may have on driver aptitude. (Buchholtz and Herrmann, 2009) Neuropsychological testing of nearly 500 older drivers in Sweden found that increasing age was associated with deterioration in performance in all seven of the domains tested to assess driving performance. (Bergman et al., 2016)
24. In North America there is a strong preference for ‘ageing in place’, and remaining in car dependent residences even as capacity for personal mobility and auto-mobility starts to deteriorate has been described as a ‘symbolic goal’ for many elderly suburbanites. (Lord et al., 2011; LORD et al., 2009) A similar preference for continued car ownership and use amongst the old has been found in Australia, despite the greater viability and availability of public transport as an alternative travel mode, and private car use still considered a more convenient mode of travel. (Buys et al., 2012)
25. Time use studies in the UK in 2005 have shown that young people, those without access to a car or van, the unemployed, and those from less affluent backgrounds, were all more likely to engage in active travel and meet recommended physical activity targets than the general population. (Adams, 2010)
26. Car dependency tends to increase in households after the birth of a child. (Lanzendorf, 2010)
27. The weather can have a greater influence on the decision to travel by foot rather than car than fear of crime. (Walton and Sunseri, 2010) In Greater Rotterdam in the Netherlands, sunny, dry and warm but not hot weather was found to stimulate a preference for cycling over other transport modes. (Böcker et al., 2016)
28. A comparison between Germany and the USA, both countries with very high vehicle ownership, shows that Germans travel less by car and much more by other modes, and that American preferences to drive persist even for those living in dense, mixed use areas with close public transport. (Buehler, 2011)
29. Even in high density inner city areas, car use can be considered a more convenient travel mode than public transit or walking. (Buys and Miller, 2011)
30. Large scale adoption of more sustainable, active travel modes can lead to large scale improvements in public health; if some but not most people switch to active travel modes, however, cyclists and walkers experience higher risks of harm from air pollution and traffic accidents due to the car-using majority. (de Nazelle et al., 2011) A cost-utility analysis of cycling in the USA has, however, estimated that the health benefits of cycling are still likely to outweigh the additional health risks of these factors. (Edwards and Mason, 2014)
31. Car use as the predominant travel mode is habit-forming, and has been likened by public health researchers to tobacco use, in terms of both dependence and damage to the health of both users and those nearby. (Douglas et al., 2011) [Something about cohort effects in tobacco use]
32. At least one car manufacturer has entered the car-sharing market, with a marketing strategy focused on ‘selling mobility instead of cars’.(Firnkorn and Müller, 2012)
33. A noted irony in the auto-mobility story is that concerns about the poor air and disease associated with high density living contributed emergence of proto-suburbs like Letchworth and Welwyn in the late 19th century century through the Garden City movement, and now concerns about the public health and environmental concerns created by the vehicles driven by and to suburbs developed in their image are partly behind programmes of re-densification and Back to the City movements. (Howard, 1898; Newman and Matan, 2012)
34. It has been found amongst Cyprian teenagers that provision of cycle infrastructure can increase preferences to cycle, and that increased cycling and walking preferences also lead to increased preference for additional travel mode alternatives to private car use. (Kamargianni and Polydoropoulou, 2013)
35. A large study of Dutch individuals between 2004 and 2009 found notable differences in active travel preferences for a range of trip purposes between genders and age groups, with women more likely than men to choose active travel modes for shopping or transporting other people, and men more likely than women to use active travel to get to sports facilities; younger adults were also more likely than older adults to use active travel to transport goods or other people. Both higher educational qualifications and living in urban centres were also found to increase the likelihood of using active travel. (Scheepers et al., 2013)
36. Being the dominant travel mode in the USA, as well as the UK, car users are more likely to be mono-modal than multi-modal in travel model choice. (Lavery et al., 2013) This is in contrast to China, where most people do not own cars, and so car use is associated with greater multimodality. (Mao et al., 2016)
37. Health economic modelling suggests that reducing car use and increasing walking and cycling could lead to substantive increases in disability adjusted life years (DALYs) in UK populations, by reducing exposure to harm from air pollution, road traffic injuries, and low physical activity. (Woodcock et al., 2013) Similar research based on a cross sectional survey in Melbourne, Australia, has also estimated potential health benefits of increasing active in DALYs, and noted that people living closer to urban centres are more likely to have adequate levels of physical activity. (Beavis and Moodie, 2014) A similar exercise to estimate the health impacts (in DALYs) of road transport in New Zealand found lower levels of harm to health from air pollution and noise than in many other countries, but that heavy good vehicles were responsible for a disproportionately large share of attributable deaths. (Briggs et al., 2015) A similar health impact assessment in the Belgian city of Flanders, which has both high air pollution but also high rates of cycling, also estimated that a modal shift from car use to active travel would confer greater health benefits than harms. (Buekers et al., 2015) A large scale EU-funded project to explore these issues throughout Europe is currently in progress. (Gerike et al., 2016)
38. Though many trips by car are of short distance (8km or less), they are often multi-purpose (such as involving the transport of heavy goods or passengers), and as a result it is estimated that only around one tenth of such trips can be easily substituted for active travel modes. (Beckx et al., 2013)
39. Around two thirds of adults in the UK use cars or vans as their main transport mode, with those from more socioeconomically deprived areas more likely to walk or use public transport, but not to cycle, than those from less deprived areas. (Goodman, 2013)
40. Conditions experienced in both midlife and childhood can strongly affect outcomes at older age, including physical mobility and risk of depression. (Groffen et al., 2013) A decades long longitudinal study of nearly 5,000 people in Reykjavik, Iceland, found lack of car ownership in middle aged predicted depressed mood thirty years later. (Groffen et al., 2013) Similarly, older residents of Mediterranean islands were also assessed to have better levels of ‘successful ageing’ including lower prevalence of obesity and hypertension, as well as higher rates of physical activity, if they were regular car users, than similarly-aged residents without car access. (Tyrovolas et al., 2017)
41. Car-sharing schemes have been shown to be more attractive to people who are already multi-model in their travel behaviour, rather than mono-modal car users. (Efthymiou et al., 2013)
42. Transport mode ‘inertia’ has been demonstrated in travel behaviour to work. When a workplace was relocated from an out-of-town location to the city centre in Lisbon, Portugal, for example, little change was found in rates of commuting to work by car, while residents of the inner city experienced additional inconvenience as a result of increased traffic. (Vale, 2013)
43. In England, car use trends from the 1970s, defined as miles driven per person per year, differ depending on whether people live in Greater London, other cities or conurbations, or elsewhere. Car use peaked in Greater London in the early 1990s and in other cities in the early 2000s; in less urban areas they have plateaued rather than fallen substantially since the early 2000s. (Headicar, 2013) The changing shares of the population living in these three urban groupings of place is therefore expected to influence the extent of future trends in car use. (Headicar, 2013) Like Greater London, car ownership in and around Paris, France, peaked in the 1990s. (Cornut and Madre, 2017) Regional lags in Peak Car have also been found in the USA, with peak car travel being reached in Washington State in 1992, another 10 states by 2000, and almost all states by 2011. (Garceau et al., 2015)
44. While car use is reducing in much of Europe and North America, it is increasing substantially in China, (Mao et al., 2016) creating competing demands on urban land currently used for walking and cycling. (Feng et al., 2013)
45. A complex model designed by Gordon Stokes to produce long-term estimates of car use incorporates cohort membership in its inputs alongside differences by gender and by age within cohorts. Even with lower car use amongst more recent generations, given the persistence of car use preference into old age, increasing longevity, and increasing female driving trends likely to compensate for slightly reducing female driving trends, it estimates overall car use to remain broadly stable for around twenty years, before falling in the mid 2030s. (Stokes, 2013)
46. There is evidence that, in the UK, people who start driving at later ages tend to then drive less per year once they have a vehicle, suggesting that even if there is a catch-up in licence rates amongst Millennials, there may still be less road use amongst this cohort. (Stokes, 2013)
47. It has been noted that, though median incomes for many households have fallen, and fuel prices risen in recent decades, not all populations – defined by cohort membership, geographic location and other attributes – have responded to such changes in the same way. (Goodwin and Van Dender, 2013)
48. Long term trends in per-capita car use in France, Germany, Great Britain and the USA suggest car use increased from the 1970s to the mid-1990s in all four countries, before stagnating or decreasing from around 2000 onwards. In each country, sustained high levels of car use amongst older drivers have partially or wholly offset reduced levels of car use amongst young adults. (Kuhnimhof et al., 2013) Within Great Britain and amongst young adults, increasing levels of female car use have partially offset falling levels of car use amongst males. (Le Vine et al., 2013) In recent years, young adult females now have greater weekly mobility than young adult males of the same age. (Tilley and Houston, 2016)
49. One UK-specific explanation for reduced car use amongst young is changes in taxation policy less favourable to users of company cars, and related to this falling trends in company car use. (Le Vine et al., 2013)
50. Falling levels of driving licence ownership have been identified in at least nine developed world countries, with the largest declines reported in Australia, one of the most car dependent countries in the rich world. (Delbosc and Currie, 2013) A synthesis of extant research identified six broad categories of potential explanation: life stage, affordability, location and transport, driving licence regulation, attitudes, and e-communication; it found somewhat stronger evidence for life stage explanations (such as having children later, and staying with parents and in full time education longer), and affordability explanations (such as rising costs of insurance, licencing, petrol, vehicles; against falling or stagnant household incomes) than other types, but with no clear single cause. (Delbosc and Currie, 2013) Analysis based on panel data in the USA also found lower incomes and delay in major life events (leaving parental homes later, having children later) largely explained lower car ownership amongst Millennials, and that after controlling for these factors Millennials were slightly more likely than expected to be car owners. (Klein and Smart, 2017) Amongst these explanations, insurance costs may be a particularly strong factor in the UK, as they have risen particularly sharply in recent years. (Milligan, 2015; Noble, 2005)
51. Walkability of places, in terms of dense urban form, tends to influence adults of working age away from car use and towards active travel much more than adults above retirement age. (Figueroa et al., 2014)
52. Although in the UK lower socioeconomic status (SES) is associated with less car access and car use, as well as with higher rates of overweight and obesity, [REFS] multivariate analysis of the UKHLS, controlling for these confounders, has shown public and active travel to be associated with lower BMIs for both males and females. (Flint et al., 2014) Longitudinal analysis of individuals in the BHPS found that, after controlling for SES, found that switching from private car use to public transport or active travel was associated with reduced BMI (-0.32 kg/m2), and converse switches to private car use associated with increased BMI of almost the same magnitude (0.34 kg/m2). (Martin et al., 2015)
53. The kind and scales of policies required to bring about substantial vehicle-based emission reductions may be untenable in the modern political climate both within the UK and the rest of Europe. (Gössling and Cohen, 2014)
54. Within the Netherlands, a famously cycle-friendly country, younger people tend to cycle more than older people, but rates of cycling are increasing amongst the elderly, including ‘Baby Boomers’ found resistant to modal change in the UK, partly due to increasing availability of e-bikes, as well as better cycle infrastructure more generally. (Harms et al., 2014)
55. With ever improving ICT, teleworking has ever more potential to reduce the need for physical travel long distances for work purposes, but remote working remains marginalized in Ireland. (Hynes, 2014)
56. Car sharing could encourage other transport modes, including active travel, and so has potential health benefits, as well as allowing an expensive and rapidly depreciating asset to be used more efficiently. (Kent, 2014)
57. Structural equation modelling based on four decades of data from many cities suggests that increasing urban density, as well as improving public transport, may both have a causative effect on reducing private vehicle use per capita, and that these effects may be stronger than reducing levels of car ownership or parking spaces. (McIntosh et al., 2014)
58. One reason why cohort membership is predictive of auto-mobility could be due to homophily, the tendency for people to affiliate and associate themselves with others who are in many ways like themselves, and one of the important ways people distinguish themselves is by cohort membership, as such membership may also be predictive of having broadly similar experiences at various stages in the life course, and broadly similar attitudes and beliefs. This suggests there may be a complementary role for social network analysis alongside cohort analysis. Indeed, an analysis of Dutch commuting behaviour based on a survey of around 750 people in 2011 suggested that both social network composition and life-cycle events, such as moving home or forming a partnership, influenced levels of active travel, as well as each other. (Sharmeen et al., 2014) Amongst these life-cycle events, starting university and residential relocation were found to lead to the largest change in composition of social network in terms of both the number of existing social ties lost and new ties established. (Sharmeen et al., 2014) In the UK it is more common than in many other European countries for people to relocate when starting university, meaning that this life cycle event in particular can influence transport mode preference through both changing social network composition, changing residence, and through this also changing urban form. [NOTE: Summarise Salomon 1983; Lanzendorf 2003; Brown 1970; Oakil 2011; Sharmeen 2013]
59. There is evidence that walking, travelling by train, and cycling are more satisfying modes of travel than driving, travelling by bus, or travelling by underground. (St-Louis et al., 2014; Thomas and Walker, 2015) However, in China, where most people are not car users, there is evidence that both driving and walking have amongst the highest satisfaction levels, whereas travelling by bus or underground amongst the least. (Mao et al., 2016)
60. Analyses of car users with caring responsibilities in rural Austria suggested that the responsibility to care for elderly relatives and children, and to try to balance caring with work commitments, is disproportionately borne by women, and may create an additional level of car dependency for many daily tasks. (Unbehaun et al., 2014)
61. Econometric modelling of Swedish car use trends found per capital GDP and fuel price alone may explain up to 80% of the decline since the 1980s. (Bastian and Börjesson, 2015)
62. In addition to simple measures of urban density, postcode level estimates of ‘walkability’ have been developed, with people in Ontario living in highly walkable neighbourhoods tending to be less likely to be overweight or obese than those living in more car dependent ‘low walkability’ areas in the same city. (Chiu et al., 2015)
63. The link between living in low car-dependent neighbourhoods with good mass transit alternatives (called transit oriented developments, TODs), individual preference towards or against such neighbourhoods, and modal choice has been explored in a panel survey of ‘baby boomers’ (born between 1946 and 1965) in Brisbane, Australia in the late 2000s. This found that more car-inclined residents of low car-dependent areas (called ‘TOD dissonants’) had odds of car use 2.2 times higher than less car-inclined residents of the same neighbourhoods (‘TOD consonants’); such findings were taken to suggest that attitudes to car use or alternative modal choice may matter more than availability of alternative modes, that these attitudes remain fairly fixed over the life course, and perhaps that greater multi-modality in low car dependent areas may be due to selective relocation amongst those already inclined to multi-modality towards such areas. (Kamruzzaman et al., 2015)
64. Lack of car access increases reliance on public transport, and so increasing public transport costs, which in Australia were found to be less cost-effective than private transport, can compound other forms of socioeconomic household disadvantage. (Li et al., 2015)
65. In terms of travel behaviour, the Millennials have been described as the ‘Go-Nowhere’ generation. (McDonald, 2015) Although in the USA there have been some falls in auto-mobility from the mid 1990s onwards in many cohort groups, Millennial-specific factors such as changing attitudes to car use and increasing ICT use may also have a significant role in their declining auto-mobility. (McDonald, 2015)
66. In Canada, young adults are now making the decision to locate to high density areas more than in previous generations, leading to the suggestion that many inner cities may not be undergoing a process of ‘gentrification’ as much as ‘youthification’. (Moos, 2015) The declining economic prospects of today’s young adults, of which reduced car ownership may be both a consequence and a cause, could be an important explanation for these trends. (Moos, 2015)
67. In the USA, nearly 90% of shopping trips are made by car, (Popovich and Handy, 2015) and so increasing use of online shopping amongst young adults may be one reason for declining car use overall.
68. The UK population is ageing, with important implications for both social care and transport planning. (Shergold et al., 2015)
69. The price of ride-sharing could be reduced, and so the attractiveness of ride-sharing more attractive, if the dominant platform operators (such as zimride, blablacar, and carpooling.com) who provide the information infrastructure to enable such schemes, were to improve their algorithms to better accommodate ‘multi-hop’ ride sharing. (Teubner and Flath, 2015) Higher densities of both asset providers (car users) and asset providers (passengers) can also be expected to reduce prices and waiting times for this emerging travel mode, and so make them more economical and attractive in comparison to fully private car use.
70. There is evidence that broader environmental concerns are not a substantial reason for not travelling by car, with no significant differences in environmental concerns identified between people using cars compared with other travel modes in a sample of commuters to a UK university. (Thomas and Walker, 2015) Qualitative research focusing on the relationship between auto-mobility and environmental concerns amongst younger adults (18-35) in New Zealand did not reach any definitive conclusions about this relationship. (Hopkins, 2016)
71. Autonomous car use and technology is still in its infancy, but offers the potential for cars to become more of an efficiently used shared asset rather than a private asset parked, and so not used, for most of the day. (Thomopoulos and Givoni, 2015)
72. It is estimated that, amongst commuters to a UK university who use the bus as their dominant travel mode, around two fifths of trips could be substituted for active travel. (Bösehans and Walker, 2016)
73. In Western Scotland, lack of car access remains associated with poorer general health, and in particular with increased prevalence of depression and anxiety. (Ellaway et al., 2016)
74. Households with high income tend to be ‘car loyal.’(Fatmi and Habib, 2016) Households with no children are more likely to use bikes and other modes of active travel, and households with children more likely to be car users.(Fatmi and Habib, 2016) Analysis of car registration data for Dutch young adults in 2012/2013 found that the effect of living in more urban areas on car ownership was much weaker for young adult couples with children than without children. (Oakil et al., 2016)
75. Comparisons in the USA between ‘younger millennials’ (born 1999-1994) and ‘older millennials’ (born 1979-1985) suggest that many important life events – such as finishing fully time education, marrying and having children – occur at later ages for this generation than earlier generations, but that once such events occur, auto-mobility increases. (Garikapati et al., 2016)
76. A paper published in the Lancet in 2016 identified eight city planning initiatives considered likely to improve public health by encouraging switching to active travel. (Giles-Corti et al., 2016)
77. In Beijing, China, most people use public transport rather than private vehicles to travel to work, although car use is increasing rapidly. (Mao et al., 2016)
78. A survey of nearly 900 individuals with cars in Norway found that perceptions about the social status of different transport mode users was important, with car users who did not consider public transport users to be of low social status also more likely to use public transport themselves. (Nordfjærn et al., 2016)
79. Given that most, but not all, car trips by elderly people in the USA are of relatively short distance (8km or shorter), electric vehicles may be attractive within a car-sharing fleet for older drivers as long as non-electric vehicles are also available in the fleet for longer trips. (Shaheen et al., 2016)
80. In Japan, it is estimated that falling population size and household size may both lead to increasing car ownership. (Yagi and Managi, 2016) It is also estimated that the average age of cars, like the average age of the population, is increasing in Japan, and that use of older cars (12 or more years old) is more sensitive to increase in fuel price than use of newer cars. (Yagi and Managi, 2016)
81. In and around Paris, inequalities in car ownership between richer and poorer households tend to be greatest in more urban areas, as in less urban areas higher car dependence tends to homogenise levels of car use. (Cornut and Madre, 2017)
82. In the USA, falling levels of driving levels in the 2000s have not been accompanied by commensurate increases in use of alternative travel modes, leading to reduced mobility overall. (Manville et al., 2017)
83. It has been argued that much of the difference in auto-mobility between different cohorts in the UK and similar countries could be due to each cohort’s differential experiences and exposure to a range of multi-level forces, each operating over broadly different timescales. Faster-acting changes include periods of economic growth and recession, referred to as ‘period effects’; changes operating at intermediate rates include changes in technology, demography, and average household income and wealth, collectively referred to as ‘structural effects’; and changes operating over the longest timescales including changing gender roles, and changing cultures of mobility and social/familial relations, collectively referred to as ‘deep structure’. (Tilley, 2017)

LAST REF CHUNK 12 – GARIKAPATI 2016. WORDS AT END 14931. STATEMENTS, 75

END CHUNK 13: 16396 WORDS

# References

Adams, J, 2010, “Prevalence and socio-demographic correlates of ‘active transport’ in the UK: Analysis of the UK time use survey 2005” *Preventive Medicine* **50**(4) 199–203, http://linkinghub.elsevier.com/retrieve/pii/S0091743510000125.

Baslington, H, 2009, “Children’s perceptions of and attitudes towards, transport modes: why a vehicle for change is long overdue” *Children’s Geographies* **7**(3) 305–322, http://www.tandfonline.com/doi/full/10.1080/14733280903024472.

Baslington, H, 2008, “Travel Socialization: A Social Theory of Travel Mode Behavior” *International Journal of Sustainable Transportation* **2**(2) 91–114, http://www.tandfonline.com/doi/abs/10.1080/15568310601187193.

Bastian, A and Börjesson, M, 2015, “Peak car? Drivers of the recent decline in Swedish car use” *Transport Policy* **42** 94–102, http://linkinghub.elsevier.com/retrieve/pii/S0967070X15300135.

Bauman, A E, Reis, R S, Sallis, J F, Wells, J C, Loos, R J, and Martin, B W, 2012, “Correlates of physical activity: why are some people physically active and others not?” *The Lancet* **380**(9838) 258–271, http://linkinghub.elsevier.com/retrieve/pii/S0140673612607351.

Beavis, M J and Moodie, M, 2014, “Incidental physical activity in Melbourne, Australia: health and economic impacts of mode of transport and suburban location” *Health Promotion Journal of Australia* **25**(3) 174, http://www.publish.csiro.au/?paper=HE14057.

Beckmann, J, 2001, “Automobility—A Social Problem and Theoretical Concept” *Environment and Planning D: Society and Space* **19**(5) 593–607, http://journals.sagepub.com/doi/10.1068/d222t.

Beckx, C, Broekx, S, Degraeuwe, B, Beusen, B, and Int Panis, L, 2013, “Limits to active transport substitution of short car trips” *Transportation Research Part D: Transport and Environment* **22** 10–13, http://linkinghub.elsevier.com/retrieve/pii/S1361920913000424.

Bergman, I, Johansson, K, Almkvist, O, and Lundberg, C, 2016, “Health-adjusted neuropsychological test norms based on 463 older Swedish car drivers” *Scandinavian Journal of Psychology* **57**(2) 93–107, http://doi.wiley.com/10.1111/sjop.12273.

Böcker, L, Dijst, M, and Faber, J, 2016, “Weather, transport mode choices and emotional travel experiences” *Transportation Research Part A: Policy and Practice* **94** 360–373, http://linkinghub.elsevier.com/retrieve/pii/S0965856416306206.

Bösehans, G and Walker, I, 2016, “‘Daily Drags’ and ‘Wannabe Walkers’ – Identifying dissatisfied public transport users who might travel more actively and sustainably” *Journal of Transport & Health* **3**(3) 395–403, http://linkinghub.elsevier.com/retrieve/pii/S2214140516301943.

Briggs, D, Mason, K, and Borman, B, 2015, “Rapid Assessment of Environmental Health Impacts for Policy Support: The Example of Road Transport in New Zealand” *International Journal of Environmental Research and Public Health* **13**(1) 61, http://www.mdpi.com/1660-4601/13/1/61.

Brown, A, Blumenberg, E, Taylor, B, Ralph, K, and Voulgaris, C, 2016, “A Taste for Transit? Analyzing Public Transit Use Trends among Youth” *Journal of Public Transportation* **19**(1) 49–67, http://scholarcommons.usf.edu/jpt/vol19/iss1/4/.

Buchholtz, U and Herrmann, R, 2009, “Fitness-Check für ältere Kraftfahrerinnen und Kraftfahrer” *Zeitschrift für Gerontologie und Geriatrie* **42**(3) 212–219, http://link.springer.com/10.1007/s00391-009-0037-5.

Buehler, R, 2011, “Determinants of transport mode choice: a comparison of Germany and the USA” *Journal of Transport Geography* **19**(4) 644–657, http://linkinghub.elsevier.com/retrieve/pii/S0966692310001171.

Buekers, J, Dons, E, Elen, B, and Int Panis, L, 2015, “Health impact model for modal shift from car use to cycling or walking in Flanders: application to two bicycle highways” *Journal of Transport & Health* **2**(4) 549–562, http://linkinghub.elsevier.com/retrieve/pii/S221414051500674X.

Buys, L and Miller, E, 2011, “Conceptualising convenience: Transportation practices and perceptions of inner-urban high density residents in Brisbane, Australia” *Transport Policy* **18**(1) 289–297, http://linkinghub.elsevier.com/retrieve/pii/S0967070X10001095.

Buys, L, Snow, S, van Megen, K, and Miller, E, 2012, “Transportation behaviours of older adults: An investigation into car dependency in urban Australia” *Australasian Journal on Ageing* **31**(3) 181–186, http://doi.wiley.com/10.1111/j.1741-6612.2011.00567.x.

Cervero, R, 1997, “Electric station cars in the San Francisco Bay Area” *Transportation Quarterly* **51**(2) 51–61.

Chatterjee, K, Sherwin, H, Jain, J, Christensen, J, and Marsh, S, 2012, “Conceptual Model to Explain Turning Points in Travel Behavior” *Transportation Research Record: Journal of the Transportation Research Board* **2322**(2322) 82–90, http://trrjournalonline.trb.org/doi/10.3141/2322-09.

Chiu, M, Shah, B R, Maclagan, L C, Rezai, M-R, Austin, P C, and Tu, J V, 2015, “Walk Score® and the prevalence of utilitarian walking and obesity among Ontario adults: A cross-sectional study.” *Health reports* **26**(7) 3–10, http://www.ncbi.nlm.nih.gov/pubmed/26177041.

Cohen, M J, 2012, “The future of automobile society: a socio-technical transitions perspective” *Technology Analysis & Strategic Management* **24**(4) 377–390, http://www.tandfonline.com/doi/abs/10.1080/09537325.2012.663962.

Cooper, J, Ryley, T, and Smyth, A, 2001, “Contemporary lifestyles and the implications for sustainable development policy” *Cities* **18**(2) 103–113, http://linkinghub.elsevier.com/retrieve/pii/S0264275100000627.

Cornut, B and Madre, J L, 2017, “A longitudinal perspective on car ownership and use in relation with income inequalities in the Paris metropolitan area” *Transport Reviews* **37**(2) 227–244.

Delbosc, A and Currie, G, 2013, “Causes of Youth Licensing Decline: A Synthesis of Evidence” *Transport Reviews* **33**(3) 271–290, http://www.tandfonline.com/doi/abs/10.1080/01441647.2013.801929.

Dieleman, F M, Dijst, M, and Burghouwt, G, 2002, “Urban Form and Travel Behaviour: Micro-level Household Attributes and Residential Context” *Urban Studies* **39**(3) 507–527, http://journals.sagepub.com/doi/10.1080/00420980220112801.

Donegan, K S, Adamson, G, and Donegan, H A, 2007, “Indexing the contribution of household travel behaviour to sustainability” *Journal of Transport Geography* **15**(4) 245–261, http://linkinghub.elsevier.com/retrieve/pii/S0966692306000895.

Douglas, M J, Watkins, S J, Gorman, D R, and Higgins, M, 2011, “Are cars the new tobacco?” *Journal of Public Health* **33**(2) 160–169, https://academic.oup.com/jpubhealth/article-lookup/doi/10.1093/pubmed/fdr032.

Durkin, K, Toseeb, U, Pickles, A, Botting, N, and Conti-Ramsden, G, 2016, “Learning to drive in young adults with language impairment” *Transportation Research Part F: Traffic Psychology and Behaviour* **42** 195–204, http://linkinghub.elsevier.com/retrieve/pii/S136984781630208X.

Edwards, R D and Mason, C N, 2014, “Spinning the wheels and rolling the dice: Life-cycle risks and benefits of bicycle commuting in the U.S.” *Preventive Medicine* **64** 8–13, http://linkinghub.elsevier.com/retrieve/pii/S0091743514001091.

Efthymiou, D, Antoniou, C, and Waddell, P, 2013, “Factors affecting the adoption of vehicle sharing systems by young drivers” *Transport Policy* **29** 64–73, http://linkinghub.elsevier.com/retrieve/pii/S0967070X13000607.

Ellaway, A, Macdonald, L, and Kearns, A, 2016, “Are housing tenure and car access still associated with health? A repeat cross-sectional study of UK adults over a 13-year period” *BMJ Open* **6**(11) e012268, http://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2016-012268.

Fatmi, M R and Habib, M A, 2016, “Life-Oriented Approach of Modeling Commute Mode Loyalty and Transition Behavior” *Transportation Research Record: Journal of the Transportation Research Board* **2565**(2565) 37–47, http://trrjournalonline.trb.org/doi/10.3141/2565-05.

Feng, J, Dijst, M, Prillwitz, J, and Wissink, B, 2013, “Travel Time and Distance in International Perspective: A Comparison between Nanjing (China) and the Randstad (The Netherlands)” *Urban Studies* **50**(14) 2993–3010, http://journals.sagepub.com/doi/10.1177/0042098013482504.

Figueroa, M J, Nielsen, T A S, and Siren, A, 2014, “Comparing urban form correlations of the travel patterns of older and younger adults” *Transport Policy* **35** 10–20, http://linkinghub.elsevier.com/retrieve/pii/S0967070X14001061.

Findlay, A, McCollum, D, Coulter, R, and Gayle, V, 2015, “New Mobilities Across the Life Course: a Framework for Analysing Demographically Linked Drivers of Migration” *Population, Space and Place* **21**(4) 390–402, http://doi.wiley.com/10.1002/psp.1956.

Firnkorn, J and Müller, M, 2012, “Selling Mobility instead of Cars: New Business Strategies of Automakers and the Impact on Private Vehicle Holding” *Business Strategy and the Environment* **21**(4) 264–280, http://doi.wiley.com/10.1002/bse.738.

Flint, E, Cummins, S, and Sacker, A, 2014, “Associations between active commuting, body fat, and body mass index: population based, cross sectional study in the United Kingdom” *BMJ* **349**(aug19 13) g4887–g4887, http://www.bmj.com/cgi/doi/10.1136/bmj.g4887.

Garceau, T J, Atkinson-Palombo, C, and Garrick, N, 2015, “Peak Car Travel in the United States” *Transportation Research Record: Journal of the Transportation Research Board* **2531**(2531) 36–44, http://trrjournalonline.trb.org/doi/10.3141/2531-05.

Garikapati, V M, Pendyala, R M, Morris, E A, Mokhtarian, P L, and McDonald, N, 2016, “Activity patterns, time use, and travel of millennials: a generation in transition?” *Transport Reviews* **36**(5) 558–584, http://www.tandfonline.com/doi/full/10.1080/01441647.2016.1197337.

Gerike, R, de Nazelle, A, Nieuwenhuijsen, M, Panis, L I, Anaya, E, Avila-Palencia, I, Boschetti, F, Brand, C, Cole-Hunter, T, Dons, E, Eriksson, U, Gaupp-Berghausen, M, Kahlmeier, S, Laeremans, M, Mueller, N, Orjuela, J P, Racioppi, F, Raser, E, Rojas-Rueda, D, Schweizer, C, et al., 2016, “Physical Activity through Sustainable Transport Approaches (PASTA): a study protocol for a multicentre project” *BMJ Open* **6**(1) e009924, http://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2015-009924.

Giles-Corti, B, Vernez-Moudon, A, Reis, R, Turrell, G, Dannenberg, A L, Badland, H, Foster, S, Lowe, M, Sallis, J F, Stevenson, M, and Owen, N, 2016, “City planning and population health: a global challenge” *The Lancet* **388**(10062) 2912–2924, http://linkinghub.elsevier.com/retrieve/pii/S0140673616300666.

Goodman, A, 2013, “Walking, Cycling and Driving to Work in the English and Welsh 2011 Census: Trends, Socio-Economic Patterning and Relevance to Travel Behaviour in General” *PLoS ONE* **8**(8) e71790, http://dx.plos.org/10.1371/journal.pone.0071790.

Goodwin, P and Van Dender, K, 2013, “‘Peak Car’ — Themes and Issues” *Transport Reviews* **33**(3) 243–254, http://www.tandfonline.com/doi/abs/10.1080/01441647.2013.804133.

Gössling, S and Cohen, S, 2014, “Why sustainable transport policies will fail: EU climate policy in the light of transport taboos” *Journal of Transport Geography* **39** 197–207, http://linkinghub.elsevier.com/retrieve/pii/S0966692314001586.

Grimsrud, M and El-Geneidy, A, 2014, “Transit to eternal youth: lifecycle and generational trends in Greater Montreal public transport mode share” *Transportation* **41**(1) 1–19, http://link.springer.com/10.1007/s11116-013-9454-9.

Groffen, D A, Koster, A, Bosma, H, van den Akker, M, Aspelund, T, Siggeirsdóttir, K, Kempen, G I, van Eijk, J T, Eiriksdottir, G, Jónsson, P V, Launer, L J, Gudnason, V, and Harris, T B, 2013, “Socioeconomic factors from midlife predict mobility limitation and depressed mood three decades later; Findings from the AGES-Reykjavik Study” *BMC Public Health* **13**(1) 101, http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-13-101.

Hamari, J, Sjöklint, M, and Ukkonen, A, 2016, “The sharing economy: Why people participate in collaborative consumption” *Journal of the Association for Information Science and Technology* **67**(9) 2047–2059, http://doi.wiley.com/10.1002/asi.23552.

Harman, R, 1993, “Railway privatization: Does it bring new opportunities?” *Public Money & Management* **13**(1) 19–25, http://www.tandfonline.com/doi/abs/10.1080/09540969309387744.

Harms, L, Bertolini, L, and te Brömmelstroet, M, 2014, “Spatial and social variations in cycling patterns in a mature cycling country exploring differences and trends” *Journal of Transport & Health* **1**(4) 232–242, http://linkinghub.elsevier.com/retrieve/pii/S2214140514000802.

Headicar, P, 2013, “The Changing Spatial Distribution of the Population in England: Its Nature and Significance for ‘Peak Car’” *Transport Reviews* **33**(3) 310–324, http://www.tandfonline.com/doi/abs/10.1080/01441647.2013.802751.

Hopkins, D, 2016, “Can environmental awareness explain declining preference for car-based mobility amongst generation Y? A qualitative examination of learn to drive behaviours” *Transportation Research Part A: Policy and Practice* **94** 149–163, http://linkinghub.elsevier.com/retrieve/pii/S0965856415303323.

Howard, E, 1898 *Garden Cities of To-morrow* S. Sonnenc (London), http://en.wikipedia.org/wiki/Garden\_Cities\_of\_To-morrow.

Huby, M and Burkitt, N, 2000, “Is the New Deal for Transport really better for everyone? The social policy implications of the UK 1998 White Paper on transport” *Environment and Planning C: Government and Policy* **18**(4) 379–392, http://epc.sagepub.com/lookup/doi/10.1068/c9901j.

Hynes, M, 2014, “Telework Isn’t Working: A Policy Review” *Economic and Social Review* **45**(4) 579–602.

Jones, P, 2014, “The evolution of urban mobility: The interplay of academic and policy perspectives” *IATSS Research* **38**(1) 7–13, http://linkinghub.elsevier.com/retrieve/pii/S038611121400017X.

Kamargianni, M and Polydoropoulou, A, 2013, “Hybrid Choice Model to Investigate Effects of Teenagers’ Attitudes Toward Walking and Cycling on Mode Choice Behavior” *Transportation Research Record: Journal of the Transportation Research Board* **2382**(2382) 151–161, http://trrjournalonline.trb.org/doi/10.3141/2382-17.

Kamruzzaman, M, Baker, D, and Turrell, G, 2015, “Do dissonants in transit oriented development adjust commuting travel behaviour?” *European Journal of Transport and Infrastructure Research* **15**(1) 66–77, http://eprints.qut.edu.au/80172/1/Journal 2015 Do dissonants in transit oriented development adjust.pdf.

Kent, J L, 2014, “Carsharing as active transport: What are the potential health benefits?” *Journal of Transport & Health* **1**(1) 54–62, http://linkinghub.elsevier.com/retrieve/pii/S2214140513000054.

Klein, N J and Smart, M J, 2017, “Millennials and car ownership: Less money, fewer cars” *Transport Policy* **53** 20–29, http://linkinghub.elsevier.com/retrieve/pii/S0967070X16305571.

KNESEBECK, O VON DEM, WAHRENDORF, M, HYDE, M, and SIEGRIST, J, 2007, “Socio-economic position and quality of life among older people in 10 European countries: results of the SHARE study” *Ageing and Society* **27**(2) 269–284, http://www.journals.cambridge.org/abstract\_S0144686X06005484.

Kuhnimhof, T, Zumkeller, D, and Chlond, B, 2013, “Who Made Peak Car, and How? A Breakdown of Trends over Four Decades in Four Countries” *Transport Reviews* **33**(3) 325–342, http://www.tandfonline.com/doi/abs/10.1080/01441647.2013.801928.

Lanzendorf, M, 2010, “Key Events and Their Effect on Mobility Biographies: The Case of Childbirth” *International Journal of Sustainable Transportation* **4**(5) 272–292, http://www.tandfonline.com/doi/abs/10.1080/15568310903145188.

Lavery, T A, Páez, A, and Kanaroglou, P S, 2013, “Driving out of choices: An investigation of transport modality in a university sample” *Transportation Research Part A: Policy and Practice* **57** 37–46, http://linkinghub.elsevier.com/retrieve/pii/S0965856413001742.

Lee-Gosselin, M E H, 2017, “Beyond ‘Peak Car’: A reflection on the evolution of public sentiment about the role of cars in cities” *IATSS Research* **40**(2) 85–87, http://linkinghub.elsevier.com/retrieve/pii/S0386111216300115.

Li, T, Dodson, J, and Sipe, N, 2015, “Differentiating metropolitan transport disadvantage by mode: Household expenditure on private vehicle fuel and public transport fares in Brisbane, Australia” *Journal of Transport Geography* **49** 16–25, http://linkinghub.elsevier.com/retrieve/pii/S0966692315001830.

Lin, J and Long, L, 2008, “What neighborhood are you in? Empirical findings of relationships between household travel and neighborhood characteristics” *Transportation* **35**(6) 739–758, http://link.springer.com/10.1007/s11116-008-9167-7.

Lord, S, Després, C, and Ramadier, T, 2011, “When mobility makes sense: A qualitative and longitudinal study of the daily mobility of the elderly” *Journal of Environmental Psychology* **31**(1) 52–61, http://linkinghub.elsevier.com/retrieve/pii/S0272494410000277.

LORD, S, JOERIN, F, and THÉRIAULT, M, 2009, “La mobilité quotidienne de banlieusards vieillissants et âgés: Déplacements, aspirations et significations de la mobilité” *Canadian Geographer / Le Géographe canadien* **53**(3) 357–375, http://doi.wiley.com/10.1111/j.1541-0064.2009.00269.x.

Macmillan, A K, Hosking, J, L. Connor, J, Bullen, C, and Ameratunga, S, 2013, “A Cochrane systematic review of the effectiveness of organisational travel plans: Improving the evidence base for transport decisions” *Transport Policy* **29** 249–256, http://linkinghub.elsevier.com/retrieve/pii/S0967070X12001138.

Manville, M, King, D A, and Smart, M J, 2017, “The Driving Downturn: A Preliminary Assessment” *Journal of the American Planning Association* **83**(1) 42–55, https://www.tandfonline.com/doi/full/10.1080/01944363.2016.1247653.

Mao, Z, Ettema, D, and Dijst, M, 2016, “Commuting trip satisfaction in Beijing: Exploring the influence of multimodal behavior and modal flexibility” *Transportation Research Part A: Policy and Practice* **94** 592–603, http://linkinghub.elsevier.com/retrieve/pii/S096585641630341X.

Martin, A, Panter, J, Suhrcke, M, and Ogilvie, D, 2015, “Impact of changes in mode of travel to work on changes in body mass index: evidence from the British Household Panel Survey” *Journal of Epidemiology and Community Health* **69**(8) 753–761, http://jech.bmj.com/lookup/doi/10.1136/jech-2014-205211.

McDonald, N C, 2015, “Are Millennials Really the ‘Go-Nowhere’ Generation?” *Journal of the American Planning Association* **81**(2) 90–103, http://www.tandfonline.com/doi/full/10.1080/01944363.2015.1057196.

McIntosh, J, Trubka, R, Kenworthy, J, and Newman, P, 2014, “The role of urban form and transit in city car dependence: Analysis of 26 global cities from 1960 to 2000” *Transportation Research Part D: Transport and Environment* **33** 95–110, http://linkinghub.elsevier.com/retrieve/pii/S136192091400114X.

Milligan, B, 2015, “Care Insurers charge eye-watering fees, claims Which?” *BBC News*, http://www.bbc.co.uk/news/business-33937806.

Mitchell, G and Dorling, D, 2003, “An environmental justice analysis of British air quality” *Environment and Planning A* **35**(5) 909–929, http://www.envplan.com/abstract.cgi?id=a35240.

Moos, M, 2015, “From gentrification to youthification? The increasing importance of young age in delineating high-density living” *Urban Studies*, http://usj.sagepub.com/cgi/doi/10.1177/0042098015603292.

Næss, P, 2006, “Are Short Daily Trips Compensated by Higher Leisure Mobility?” *Environment and Planning B: Planning and Design* **33**(2) 197–220, http://journals.sagepub.com/doi/10.1068/b31151.

de Nazelle, A, Nieuwenhuijsen, M J, Antó, J M, Brauer, M, Briggs, D, Braun-Fahrlander, C, Cavill, N, Cooper, A R, Desqueyroux, H, Fruin, S, Hoek, G, Panis, L I, Janssen, N, Jerrett, M, Joffe, M, Andersen, Z J, van Kempen, E, Kingham, S, Kubesch, N, Leyden, K M, et al., 2011, “Improving health through policies that promote active travel: A review of evidence to support integrated health impact assessment” *Environment International* **37**(4) 766–777, http://linkinghub.elsevier.com/retrieve/pii/S0160412011000341.

Newman, P and Matan, A, 2012, “Human mobility and human health” *Current Opinion in Environmental Sustainability* **4**(4) 420–426, http://linkinghub.elsevier.com/retrieve/pii/S1877343512001017.

Noble, B, 2005, “Why are some young people choosing not to drive?”, in *European Transport Conference* (Strassburg), http://abstracts.aetransport.org/paper/download/id/2097.

Nordfjærn, T, Simsekoglu, Ö, and Rundmo, T, 2016, “Active transport, public transport and electric car as perceived alternatives in a motorized Norwegian sample” *Transportation Research Part F: Traffic Psychology and Behaviour* **42** 70–79, http://linkinghub.elsevier.com/retrieve/pii/S1369847816301371.

Oakil, A T M, Manting, D, and Nijland, H, 2016, “Determinants of car ownership among young households in the Netherlands: The role of urbanisation and demographic and economic characteristics” *Journal of Transport Geography* **51** 229–235, http://linkinghub.elsevier.com/retrieve/pii/S0966692316000119.

Popovich, N D and Handy, S, 2015, “Downtown, strip centers, and big-box stores: Mode choice by shopping destination type in Davis, California” *Journal of Transport and Land Use* **8**(2) 149–170, https://www.jtlu.org/index.php/jtlu/article/view/739.

Prettenthaler, F E and Steininger, K W, 1999, “From ownership to service use lifestyle: the potential of car sharing” *Ecological Economics* **28**(3) 443–453, http://linkinghub.elsevier.com/retrieve/pii/S0921800998001098.

Pritchard, T and DeBoer, L, 1995, “The Effect of Taxes and Insurance Costs On Automobile Registrations in the United States” *Public Finance Review* **23**(3) 283–304, http://pfr.sagepub.com/cgi/doi/10.1177/109114219502300301.

Pyer, M and Tucker, F, 2017, “‘With us, we, like, physically can’t’: Transport, Mobility and the Leisure Experiences of Teenage Wheelchair Users” *Mobilities* **12**(1) 36–52, https://www.tandfonline.com/doi/full/10.1080/17450101.2014.970390.

Rabbitt, N and Ghosh, B, 2016, “Economic and environmental impacts of organised Car Sharing Services: A case study of Ireland” *Research in Transportation Economics* **57** 3–12, http://linkinghub.elsevier.com/retrieve/pii/S0739885915301293.

Scheepers, E, Wendel-Vos, W, van Kempen, E, Panis, L I, Maas, J, Stipdonk, H, Moerman, M, Hertog, F den, Staatsen, B, van Wesemael, P, and Schuit, J, 2013, “Personal and Environmental Characteristics Associated with Choice of Active Transport Modes versus Car Use for Different Trip Purposes of Trips up to 7.5 Kilometers in The Netherlands” *PLoS ONE* **8**(9) e73105, http://dx.plos.org/10.1371/journal.pone.0073105.

Shaheen, S, Cano, L, and Camel, M, 2016, “Exploring electric vehicle carsharing as a mobility option for older adults: A case study of a senior adult community in the San Francisco Bay Area” *International Journal of Sustainable Transportation* **10**(5) 406–417, http://www.tandfonline.com/doi/full/10.1080/15568318.2014.962675.

Shannon, T, Giles-Corti, B, Pikora, T, Bulsara, M, Shilton, T, and Bull, F, 2006, “Active commuting in a university setting: Assessing commuting habits and potential for modal change” *Transport Policy* **13**(3) 240–253, http://linkinghub.elsevier.com/retrieve/pii/S0967070X05001368.

Sharmeen, F, Arentze, T, and Timmermans, H, 2014, “An analysis of the dynamics of activity and travel needs in response to social network evolution and life-cycle events: A structural equation model” *Transportation Research Part A: Policy and Practice* **59** 159–171, http://linkinghub.elsevier.com/retrieve/pii/S0965856413002322.

Shergold, I, Lyons, G, and Hubers, C, 2015, “Future mobility in an ageing society – Where are we heading?” *Journal of Transport & Health* **2**(1) 86–94, http://linkinghub.elsevier.com/retrieve/pii/S2214140514000899.

St-Louis, E, Manaugh, K, van Lierop, D, and El-Geneidy, A, 2014, “The happy commuter: A comparison of commuter satisfaction across modes” *Transportation Research Part F: Traffic Psychology and Behaviour* **26** 160–170, http://linkinghub.elsevier.com/retrieve/pii/S1369847814001107.

Stokes, G, 2013, “The Prospects for Future Levels of Car Access and Use” *Transport Reviews* **33**(3) 360–375, http://www.tandfonline.com/doi/abs/10.1080/01441647.2013.800614.

Taylor, M F, Brice, J, Buck, N, and Prentice-Lane, E, 2011, “British Household Panel Survey: User Manual, Volume A: Introduction, Technical Report and Appendices”.

Teubner, T and Flath, C M, 2015, “The Economics of Multi-Hop Ride Sharing” *Business & Information Systems Engineering* **57**(5) 311–324, http://link.springer.com/10.1007/s12599-015-0396-y.

Thomas, G O and Walker, I, 2015, “Users of different travel modes differ in journey satisfaction and habit strength but not environmental worldviews: A large-scale survey of drivers, walkers, bicyclists and bus users commuting to a UK university” *Transportation Research Part F: Traffic Psychology and Behaviour* **34** 86–93, http://linkinghub.elsevier.com/retrieve/pii/S1369847815001205.

Thomopoulos, N and Givoni, M, 2015, “The autonomous car—a blessing or a curse for the future of low carbon mobility? An exploration of likely vs. desirable outcomes” *European Journal of Futures Research* **3**(1) 14, http://link.springer.com/10.1007/s40309-015-0071-z.

Tilley, S, 2017, “Multi-level forces and differential effects affecting birth cohorts that stimulate mobility change” *Transport Reviews* **37**(3) 344–364, https://www.tandfonline.com/doi/full/10.1080/01441647.2016.1246487.

Tilley, S and Houston, D, 2016, “The gender turnaround: Young women now travelling more than young men” *Journal of Transport Geography* **54** 349–358, http://linkinghub.elsevier.com/retrieve/pii/S0966692316303581.

Tyrovolas, S, Polychronopoulos, E, Morena, M, Mariolis, A, Piscopo, S, Valacchi, G, Bountziouka, V, Anastasiou, F, Zeimbekis, A, Tyrovola, D, Foscolou, A, Gotsis, E, Metallinos, G, Soulis, G, Tur, J-A, Matalas, A, Lionis, C, Sidossis, L S, and Panagiotakos, D, 2017, “Is car use related with successful aging of older adults? Results from the multinational Mediterranean islands study” *Annals of Epidemiology* **27**(3) 225–229, http://linkinghub.elsevier.com/retrieve/pii/S1047279717300285.

Uhrig, S C N, 2008, “The Nature and Causes of Attrition in the British Household Panel Survey”, Essex, https://www.iser.essex.ac.uk/files/iser\_working\_papers/2008-05.pdf.

Unbehaun, W, Uhlmann, T, Hössinger, R, Leisch, F, and Gerike, R, 2014, “Women and Men With Care Responsibilities in the Austrian Alps: Activity and Mobility Patterns of a Diverse Group” *Mountain Research and Development* **34**(3) 276–290, http://www.bioone.org/doi/10.1659/MRD-JOURNAL-D-13-00095.1.

Urry, J, 2004, “The ‘System’ of Automobility” *Theory, Culture & Society* **21**(4–5) 25–39, http://journals.sagepub.com/doi/10.1177/0263276404046059.

Vale, D S, 2013, “Does commuting time tolerance impede sustainable urban mobility? Analysing the impacts on commuting behaviour as a result of workplace relocation to a mixed-use centre in Lisbon” *Journal of Transport Geography* **32** 38–48, http://linkinghub.elsevier.com/retrieve/pii/S0966692313001397.

Le Vine, S, Jones, P, and Polak, J, 2013, “The Contribution of Benefit-in-Kind Taxation Policy in Britain to the ‘Peak Car’ Phenomenon” *Transport Reviews* **33**(5) 526–547.

Walton, D and Sunseri, S, 2010, “Factors Influencing the Decision to Drive or Walk Short Distances to Public Transport Facilities” *International Journal of Sustainable Transportation* **4**(4) 212–226, http://www.tandfonline.com/doi/abs/10.1080/15568310902927040.

Wen, L M, 2005, “Promoting active transport in a workplace setting: evaluation of a pilot study in Australia” *Health Promotion International* **20**(2) 123–133, https://academic.oup.com/heapro/article-lookup/doi/10.1093/heapro/dah602.

Woodcock, J, Givoni, M, and Morgan, A S, 2013, “Health Impact Modelling of Active Travel Visions for England and Wales Using an Integrated Transport and Health Impact Modelling Tool (ITHIM)” *PLoS ONE* **8**(1) e51462, http://dx.plos.org/10.1371/journal.pone.0051462.

Yagi, M and Managi, S, 2016, “Demographic determinants of car ownership in Japan” *Transport Policy* **50** 37–53, http://linkinghub.elsevier.com/retrieve/pii/S0967070X16302840.

Yap, M D, Correia, G, and van Arem, B, 2016, “Preferences of travellers for using automated vehicles as last mile public transport of multimodal train trips” *Transportation Research Part A: Policy and Practice* **94** 1–16, http://linkinghub.elsevier.com/retrieve/pii/S0965856416307765.

1. Authors’ analysis [↑](#footnote-ref-1)
2. <http://uis.unesco.org/en/isced-mappings> Accessed 18 April 2017 [↑](#footnote-ref-2)
3. <https://www.gov.uk/renew-driving-licence-at-70> - IMPORTANT TO KNOW IF THERE HAVE BEEN ANY CHANGES IN THE LAW BETWEEN 1993 ONWARDS. [↑](#footnote-ref-3)
4. <https://www.understandingsociety.ac.uk/documentation/mainstage/dataset-documentation/wave/6/datafile/f_indresp/variable/f_isced11_dv> Accessed 18 April 2017 [↑](#footnote-ref-4)