

therefore excluded from the data used to obtain the results presented in this paper. The 2002 and 2008 MiD surveys are comparable. However, the 2008 microdata analysis was publicly released for analysis during the time that the present study was undertaken. Therefore, only supplementary analysis was carried out with the MiD 2002 and 2008 data.

German Mobility Panel

Travel data for the time period after 1990 originate from the German Mobility Panel (MOP). MOP is a multiday and multiperiod travel survey that has been conducted annually every fall since 1994. The survey comprises a 7-day trip diary and repeated participation of the same respondents in three consecutive years. The MOP sample size is about 750 households, or 1,800 individuals per year.

By contrast to the 24-h survey design of Kontiv and MiD, MOP collects data for one travel week, leading to an annual trip database with about 45,000 trips (7). Because of the multiday design, MOP can be used to analyze individual mode usage over 1 week and identify multimodal travelers (8). Moreover, MOP has been conducted without changes in methodology since 1994. Hence, MOP data can be used to generate comparable time series for times since the mid-1990s (7).

The small sample size of MOP suffices to make estimates about travel at the national level, but it hinders meaningful disaggregate analysis of subgroups of the population. To overcome this shortcoming for the analyses presented here, MOP data from five consecutive years were pooled. Most MOP analyses presented in this paper use results for the 1997 (comprising data from 1995 to 1999), 2002 (2000 to 2004), and 2007 (2005 to 2009) surveys.

British National Travel Survey

Like MOP, the British National Travel Survey (GB NTS) captures travel behavior during an entire week by use of a mobility diary design (9, 10). However, unlike the respondents to MOP, respondents to GB NTS are asked to report on short walking trips only on Day 7 of the reporting week, resulting in a bias that is corrected by weighting.

This study uses GB NTS data that were collected in 1975 (sample size, 34,000 people), in 1985 (person sample size, 26,000 people), and from 1995 onward on an annual basis (annual sample sizes, approximately 8,500 people before 2002 and 21,000 people after 2002).

During these four decades, methodological changes to the GB NTS have been such that the comparability of survey results is largely ensured (11). To achieve a better statistical representation, GB NTS data from consecutive years were also pooled. Here, three consecutive years were chosen in each case: 1996 (1995 to 1997), 1999 (1998 to 2000), 2002 (2001 to 2003), and 2005 (2004 to 2006). Since 1995, respondents to the GB NTS have been asked to record their long-distance travel activities retrospectively. These data were also used in our study. Both the long-distance travel record and the daily travel record cover only travel within Great Britain.

Approach for Harmonization of Data Analysis

Comparisons of travel data across different surveys are often hampered by differences in survey methods and definitions of pub-

lished data (12–14). For example, Kontiv 82 reports a share of trip makers of 75%, whereas the share of trip makers is 92% according to the 1997 MOP. This large difference cannot be attributed solely to behavioral changes, but differences in survey methods play a significant role.

Against this background, the study described in this paper is based on harmonized analyses of survey microdata. The objective of the analysis was to obtain key mobility figures that were as harmonized and comparable as possible, not only internationally but also over time. Therefore, differences in definitions had to be overcome and heterogeneous impacts of survey methodology on survey outcome had to be minimized. To achieve both goals, the following steps were important:

1. Selection of travel indicators least affected by survey methodology. The effects of the survey methodology on the share of trip makers (14) affect key mobility indicators per person and per day. To work around this problem, the results of this study are based on data for individuals who made at least one trip per day. Short trips are more likely to be underreported in surveys because of recall error (15). However, omission of short trips leaves reported total daily travel distances largely unaffected. Therefore, most of the findings from analyses of travel behavior presented here are based on travel distances and focus on car and public transport travel. Hence, relatively rough proxies were selected for the purpose of this study, even though a greater degree of detail is often desired to understand travel behavior. Even though the selected indicators are not ideal, they are the best comparable data.

2. Definition of least common denominators. “Car availability” was defined as the coincidence of a person having a driver’s license and the existence of at least one car in the household. Travel modes were categorized into foot; bicycle; motorcycle; car driver; car passenger; and public transport, including long distance rail, coach, and air travel. GB NTS 1976 did not distinguish between car driver and car passenger. Therefore, some of the findings of the analysis presented do not differentiate these two categories of car users. Traveled distances for both countries were cut off at 500 km to take account of the fact that GB NTS includes only journeys within Great Britain. If a trip was longer than 500 km, it was counted only as 500 km. A focus was set on the group of individuals ages 20 to 29 years. This focus is because for data privacy reasons, age is available only by age group in GB NTS. Under this limitation, the common age group definition of 20 to 29 years proved to show the most significant changes in travel behavior trends.

TRENDS OF YOUNG TRAVELERS

Evaluation of the entire population in Germany and Great Britain shows that the average distance traveled per mobile person per day rose from about 30 km in the 1970s to over 40 km in the 1990s. This increase was mainly related to an increase in the number of trips and the distance traveled by automobile. Figures 1 and 2 illustrate how per capita travel demand by car increased significantly for all age groups in both countries during this time period. Germany saw an additional increase in the mileage traveled by public transport that cannot be observed to a similar extent in Great Britain.

In addition, demographic shifts partially explain the overall growth in per capita travel demand: between 1975 and 1995 the baby boom generation reached driving age, started their professional careers, had

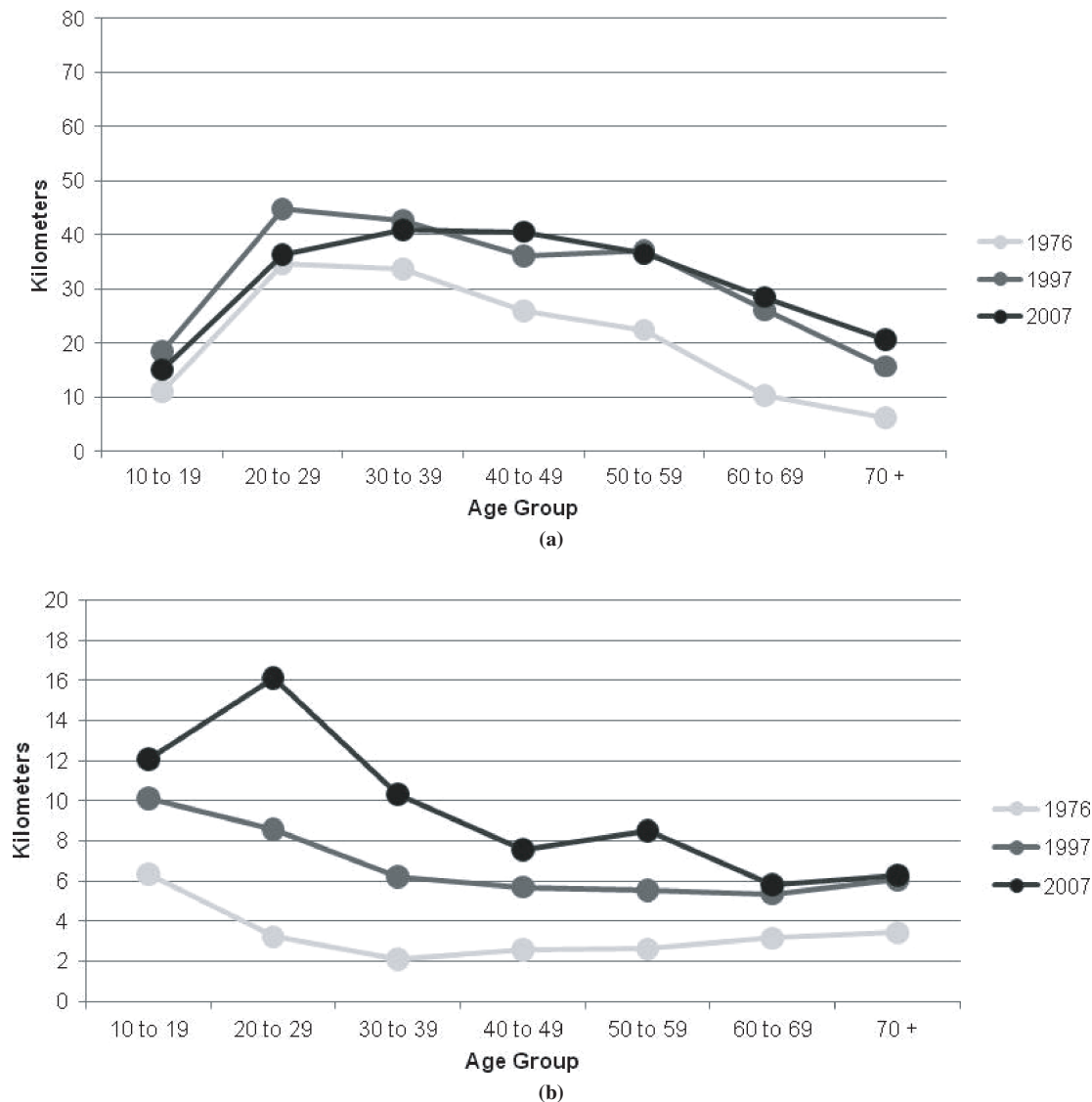


FIGURE 1 Distance by motorized modes per trip maker and day, by age, 1976 to 2007, Germany: (a) kilometers traveled by car (driver and passenger) and (b) kilometers traveled by public transport.

increasing incomes, and led increasingly active lifestyles, thus contributing to an increase in overall travel demand, but particularly by automobile (16).

Since the mid-1990s, overall per capita travel stagnated in both countries at about 40 km per day (2). However, aggregate measures hide heterogeneous trends for different age groups and modes of travel. Automobile travel more or less stagnated in both countries for the population between 30 and 60 years of age and increased slightly for individuals older than 60 years of age. This increase suggests that today's elderly maintain their more automobile-oriented mobility patterns into old age and lead more active lifestyles than previous elderly generations.

In sharp contrast, for travelers between 20 and 29 years of age, automobile travel demand has declined significantly in Germany as well as in Great Britain since the mid-1990s. In Germany, the 2007 level of car travel for this age group had almost returned to the level of 1976. However, the distance traveled by public transport has almost doubled for this age group in both countries. Today, the mode

share of public transport among trips by travelers between 20 and 29 years of age in both countries is about 18%.

Figure 3a depicts the trend of car travel by age in Germany in past decades by distinguishing different generations by year of birth: At age 10 years, the generation that was born in about 1960 traveled by car less than 10 km/day. They increased their car travel with age until it reached about 40 km/day in their late 20s. Since then, car travel for this cohort has seen little change.

The generations born 10 and 20 years later display a slightly higher level of car travel in younger years and steeper increases than the generation born in the 1960s. The generations born in 1970 and 1980 reached 40 car kilometers per trip maker and per day when they were in their early 20s and have sustained this level ever since.

The generation born in about 1990 has so far not been observed for more than 20 years. However, data indicate that this younger generation has increased its car travel not as dynamically as the two preceding ones: having started at the same level as the earlier generations, at the age of 19 years, the generation born in 1990 lags

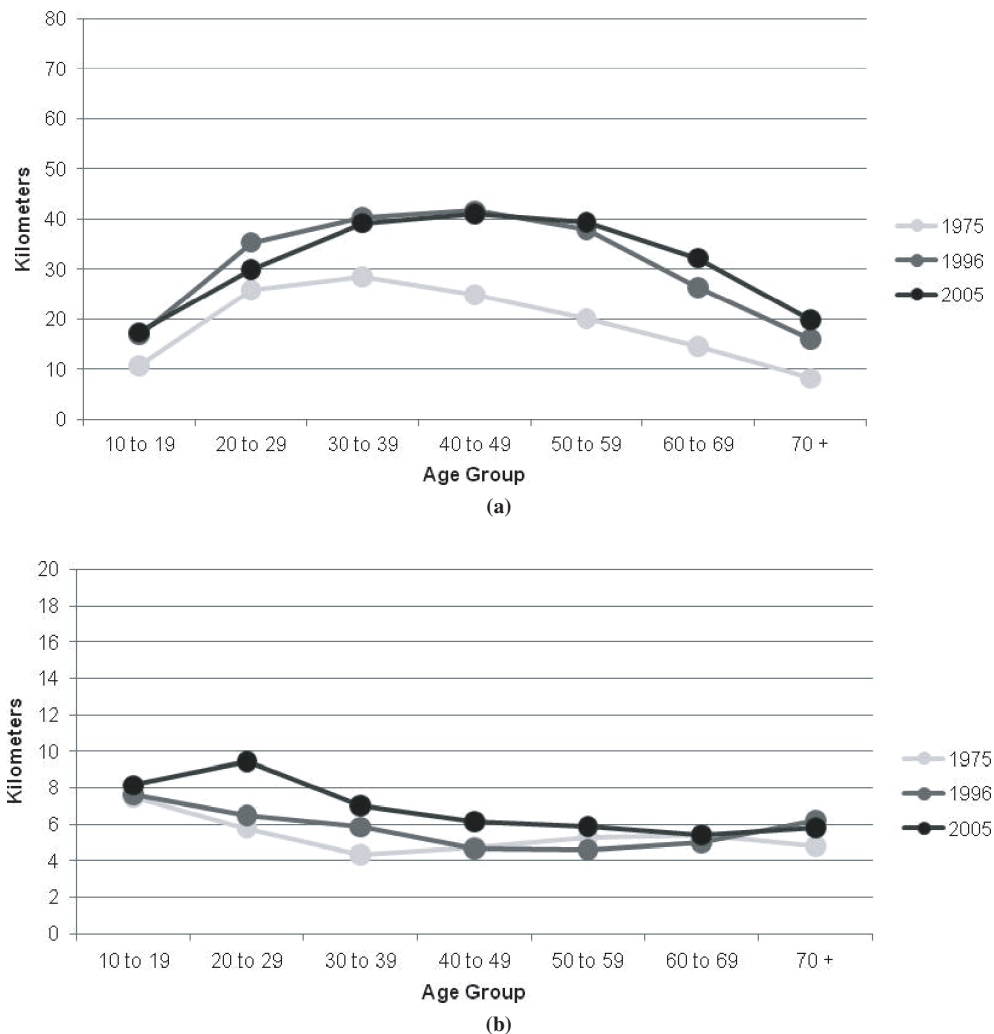


FIGURE 2 Distance by motorized modes per trip maker and day, by age 1975 to 2005, Great Britain: (a) kilometers traveled by car (driver and passenger) and (b) kilometers traveled by public transport.

behind by more than 5 km their counterparts' car travel 10 years before.

Different storylines underlie this overall change in travel behavior by young Germans and Britons. These trends will be discussed in the following. Not all of them occur to the same extent in both countries. In addition, not all of the trends discussed are phenomena only of the last decade. However, during the last decade, changes in key mobility indicators became evident.

Decreasing Car Availability

Driving has two prerequisites: having a driver's license and access to a car. For driver's license, in Britain the share of licensed drivers in the group ages 21 to 29 years decreased from 75% in 1993 to 64% in 2008. This decline was greater for men (from 80% to 67%) than for women (from 67% to 61%) (17, 18). For Germany, official statistics for license holding by young people exist only since 2006 (19). Since then, the share of women between 18 and 24 years of age with a driver's license has stagnated at 69%, whereas the share for men in this age group has decreased from 69% to 66%.

Vehicle registration statistics have been indicating a decrease in car ownership by young men in Germany for a long time (Figure 4). Young women who were still catching up to men in motorization in the 1980s and 1990s joined in this decrease after the year 2000 (20). Nevertheless, these vehicle registration statistics allow only limited insight into the car availability of young adults because automobiles are often registered in a parent's name to avoid high insurance rates. Also, a study by the German Ministry of Education showed that in 2009 only 34% of students had expenses for a car, whereas in 1991, 54% did so, but these data might be misleading if parents finance automobile-related expenditures (21).

However, analyses of the national travel surveys in Germany and Great Britain strongly confirm the hypothesis that car availability is indeed decreasing for those in young age groups: in both countries, national travel surveys indicate a significant decline of the share of people in the age group 20 to 29 years with car access (Figure 5). Although motorization levels for this age group were higher in Germany than in Britain, the decline in recent years was also much stronger.

Again, Figure 3 decomposes this trend for different generations in Germany: when reaching the age of driving (18 years in Germany), people in the generation born in 1960 could not easily use their

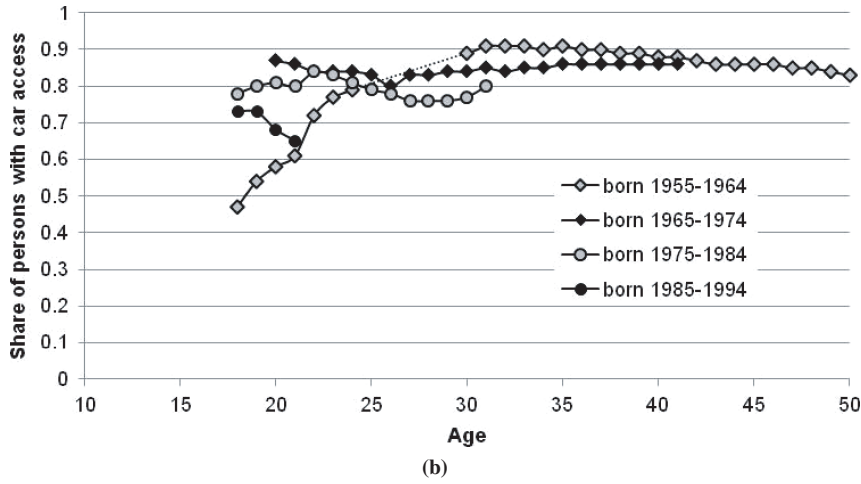
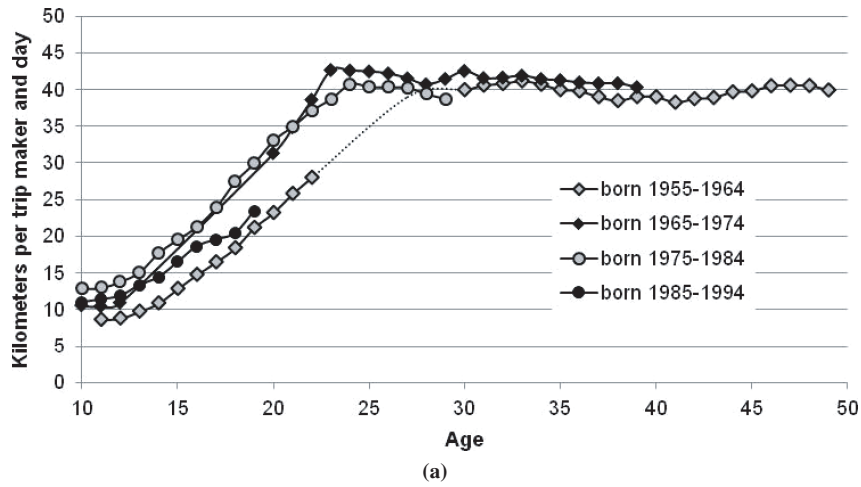


FIGURE 3 Trends of (a) car availability and (b) car kilometers per trip maker and day, by age and year of birth, Germany (no suitable data to describe mileage for ages of 23 to 30 years available for generation born between 1955 and 1964; missing data points indicated by a dotted line).

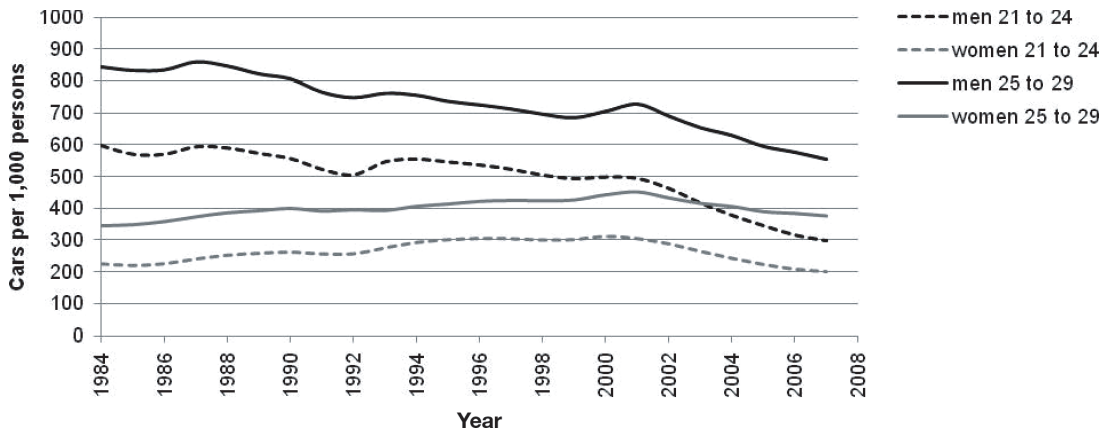


FIGURE 4 Car registrations of young drivers by gender in Germany (20).

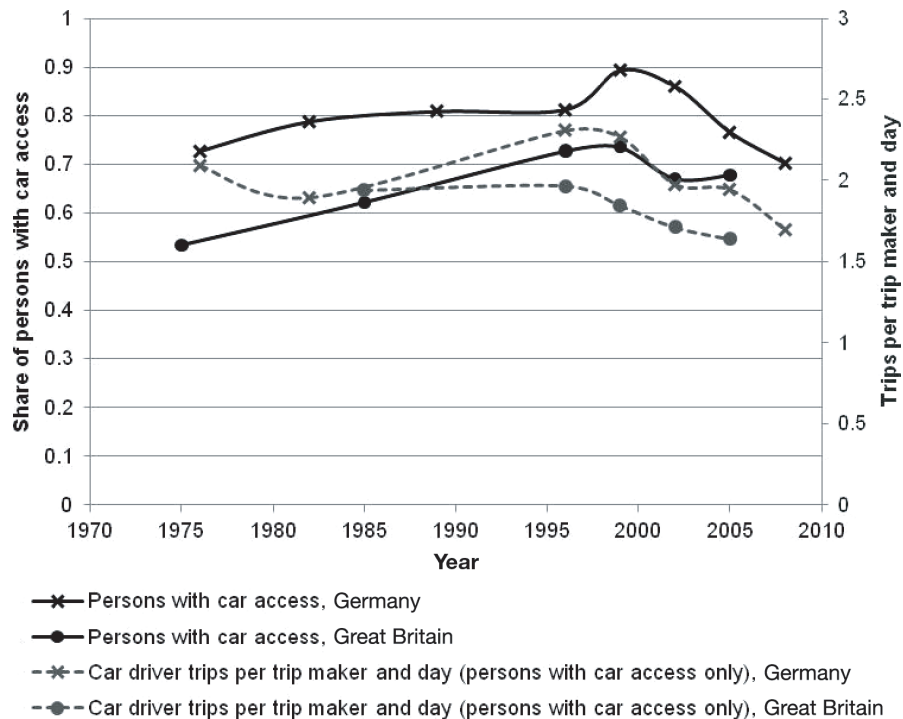


FIGURE 5 Car availability and car driver trips per day in Germany and Great Britain.

parents' car, if their parents had one. Car ownership levels were lower and many households had no or only one car. Young adults bought their first car during their 20s. This generation reached a level of motorization of 90% at the age of 30 years. In contrast, the generations born in 1970 and 1980 had very high levels of car availability as soon as they reached the age of driving. Many of them were able to use cars that were present in their parents' household. Later, they sustained this high level of motorization.

The generation born in 1990 appears to be the first one that shows decreasing levels of motorization after the first years of driving. Drivers in this generation most likely first use their parents' cars but do not acquire their own automobile when they move out of their parents' household. Accordingly, in Germany the group of young travelers that shows the highest decrease in car availability between 1997 (77%) and 2007 (53%) comprises the one with individuals who have left their parents' household but who have not yet started their own families.

Decreasing Car Use and Shifts to Other Modes

Decreasing car availability leads to a decline in the use of the car. Differentiating the modes in more detail indicates that the car driver mode and the car passenger mode have declined to similar extents. For Germany, the decrease in car use is also confirmed by a finding based on the MiD survey series: in 2002, 88% of travelers aged 18 to 24 years stated that they used the car (driver and passenger were not differentiated) at least once a week. In 6 years (2008), this figure declined to only 82%.

Significant shifts to public transport use have also been seen in Germany and Great Britain (Figures 1 and 2). However, despite possible biases because of different recall error selectivity influencing the representation of short trips, strong indications that nonmotorized modes have benefited from recent developments in car use also exist.

In both countries, people aged 20 to 29 years have returned to walking. For Germany, the mode share of walking in this age group was 23% in 1976. The mode share declined to 16% in 1997 and returned to 20% in 2007. Young Britons made 20% of their trips on foot in 1975. In 1999 this figure was down to 16% but rose to 18% in 2005.

In Germany, cycling appears to have continuously grown among individuals in this age group since the 1970s. In 1975, the bicycle mode share was barely 4%. In 2007, the share was almost 10%. In Great Britain, changes in cycling levels (about 2% of the mode share in this age group) are too small to be able to identify a significant trend.

Motorcycling has not profited from the decrease in car travel: motorcycling represented about 2% to 3% of the mode share in both countries in the 1970s and has now almost disappeared.

Increasing Multimodality

The decrease in car travel, however, is caused not only by declining car availability. Even car owners make fewer trips by automobile, as shown in Figure 5. This decrease in trips indicates that drivers have increasingly taken on using other modes as well. Hence, multimodal behavior, that is, a mode use pattern in which travelers use different modes of transport over the course of time, has increased (22, 23). This behavior is illustrated in Figure 6, which shows how often people aged 20 to 29 years with access to a car drive and use public transport. In Germany, about 90% of those with car availability drive at least once a week, which is slight decrease since the 1990s. The decline in the share of those who drive every day is more pronounced: from about 60% in the 1990s to under 50% today. During the same time, the share of occasional public transport users (at least once a week) increased from 25% to about 40%. The share of frequent public transport users is about 10% and has not changed

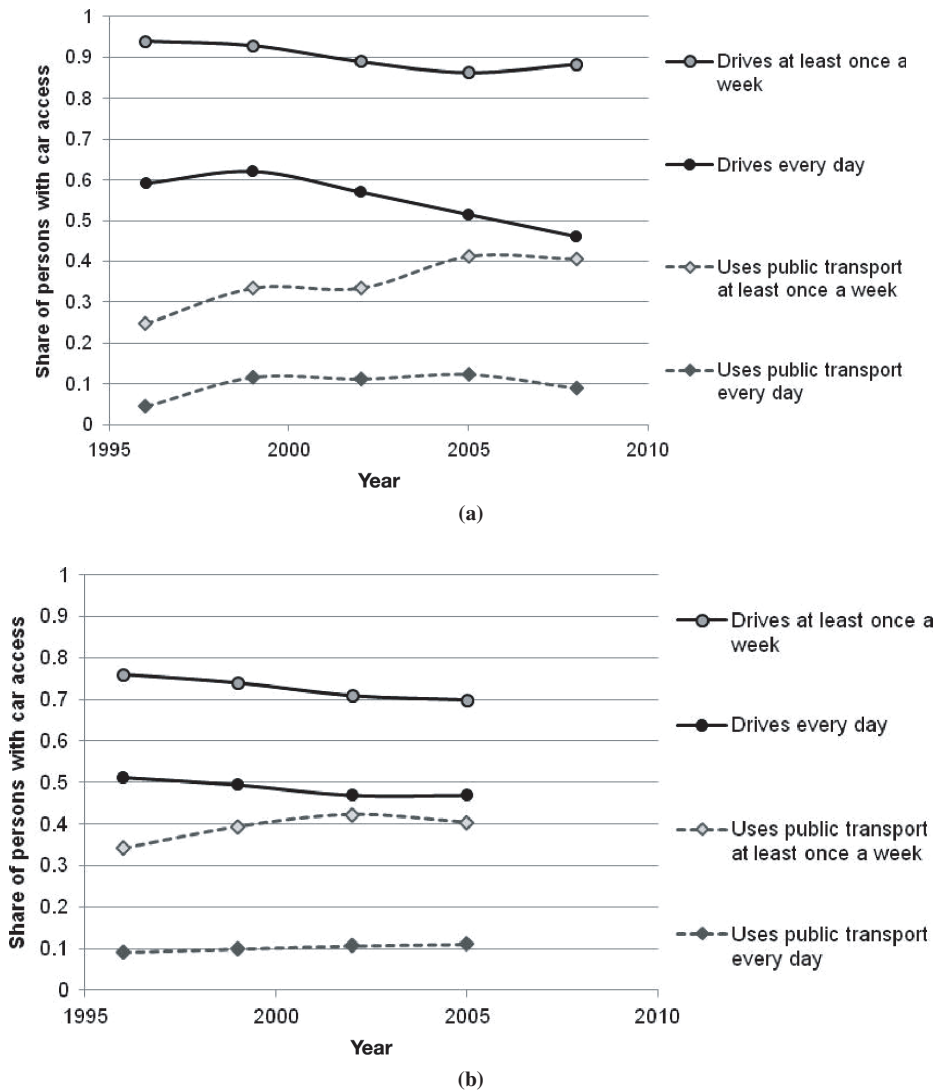


FIGURE 6 Frequency of car and public transport use by young car owners (ages 20 to 29 years) in (a) Germany and (b) Great Britain.

much. In Great Britain, the development points in the same direction but is not as pronounced as in Germany.

Mode Shifts in Long-Distance Travel

In addition to the modal shifts—which mostly affect everyday travel—discussed so far, mode usage for long-distance travel has changed significantly as well. To trace behavioral changes in long-distance travel in Britain, the GB NTS long-distance travel record was analyzed. According to this analysis, the number of car journeys over 50 mi per person per year by travelers aged 16 to 29 years decreased from 14 in 1996 to 10 in 2005. The number of rail and coach journeys has more or less stagnated. Because the GB NTS covers only travel within Great Britain, air travel, which has presumably seen a significant increase, is, unfortunately, not adequately represented in these data. It seems likely that an increasing share of the long-distance travel destinations is outside Great Britain, which leads to demand shifts from the car to air travel.

For Germany, a tourism survey covering holiday journeys with multiple overnight stays was used to establish the development in long-distance travel demand (24). A development similar to that in Britain can be seen in Germany: although in 1997 16% of tourism destinations were outside Europe, this figure had increased to 20% in 2007, indicating a significant shift toward longer journeys. Accordingly, the mode share of the car for this type of journey decreased from 50% to 47% during the same time. Air travel is the main beneficiary of this development, with an increase from 36% to 45%.

The decision to invest in a car is presumably often influenced by the perspective of using the car for long-distance travel. Against this background, the decreasing importance of the car as a mode for long-distance travel most likely has repercussions on car ownership and, consequently, car use in daily travel.

Men Losing Their Advantage over Women

Over the past 40 years, Western societies have seen a decline in the lifestyle differences between men and women, for example, because

the share of women who work has increased (1). At the same time, the age for starting a family rose significantly (25), leading to a longer period during which differences in lifestyles by gender for young people are not very pronounced. Against this background, diminishing gender differences in travel behavior were mostly interpreted as a process of the women catching up with the men.

However, in the last few years a new facet of this development is becoming more apparent: men—who have traditionally been more automobile oriented, with higher levels of motorization and longer travel distances by automobile—seem to have given up this advantage and have developed a mobility style that is more similar to that of women, with a lower level of automobile orientation. For Germany, vehicle registration statistics (Figure 4) suggest this trend. Both Germany and Great Britain have seen the rate of license holding of young men drop under that of young women in recent years (see above). Moreover, this development is confirmed by the trend in the number of car kilometers per capita by men and

women in Germany and Great Britain (Figure 7): since the 1970s, car travel by women increased until the 1990s in both countries, but the male advantage prevailed. Thereafter, both men and women reduced their driving, with the decline in car travel by males being much steeper. This decline by males has nearly resulted in the disappearance of gender differences in driving in both countries today.

The availability of transport options that are alternatives to the car and the affordability of automobiles appear to have influenced car travel by men and women in the last decade. It is possible that these different factors affect men and women alike. This might have been compensated for by women who still caught up to men in their rates of motorization and car use. However, in the preceding two decades, women experienced significant increases in car travel without the gender gap closing. Hence, it seems more likely that the changes in automobile travel during the last decade indeed affect men more than women.

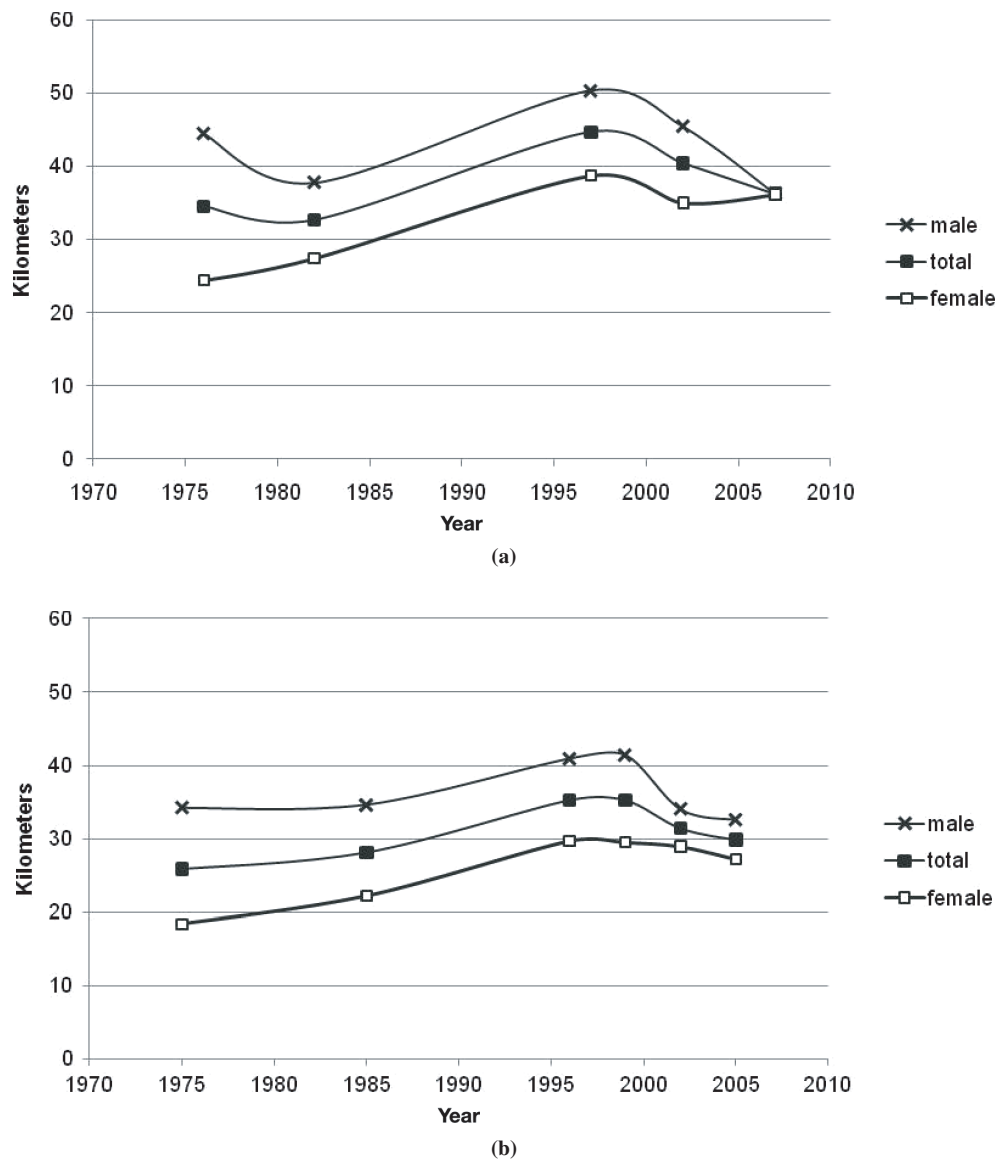


FIGURE 7 Car travel distance (kilometers) per trip maker and day by gender (ages 20 to 29 years) in (a) Germany and (b) Great Britain.

DISCUSSION OF POSSIBLE EXPLANATIONS

The changes in mobility patterns by young travelers observed in Germany and Great Britain have a number of possible explanations. Some important ones are briefly presented in the following. The purpose is not to quantify the explanatory contribution of influential factors but to discuss possible explanations for the observed trends and to provide a basis for further research on this issue. The explanatory contribution of some of the following explanations—specifically, some relevant structural changes to the population—might be quantifiable with the available data. However, the influence of other factors—specifically, those that cause young adults today to behave differently from young adults under similar circumstances 10 years ago—might not be quantifiable without extensive additional data.

Structural Changes in Population

Both Germany and Great Britain are undergoing structural changes leading to an increasing share of young people belonging to a segment of society that is less automobile oriented. This leads to decreasing average car availability and car travel. The most important development here is probably the increasing level of education. Increased education has contributed to a larger share of young people living in urban agglomerations (26), decreasing participation in the workforce by young adults, and starting a family at an older age (1). Moreover, multimodal behavior has been observed more often among travelers with a higher level of education (9). One possible explanation is that graduates are more familiar with alternative modes because they have experienced using those modes during their time at university or college.

With the exception of short fluctuations, Germany and Great Britain have experienced stable economic growth since 1990 (1). Nevertheless, it is possible that the share of young people for whom mobility by automobile is not affordable has increased. However, the economic situation of young travelers is difficult to assess, partly because important sources of their income are inadequately covered in surveys. The unemployment rate of youth aged 15 to 24 years might serve as a proxy for the economic situation of young people. However, this figure has developed in two different directions in Germany (8% in 1993, 15% in 2005) and Great Britain (17% in 1993, 12% in 2005) (1). In short, the contribution of trends in the economic situation of young people to changes in their travel behavior remains murky.

Possible Causes for Behavioral Changes

Other factors also contribute to young Germans and Britons showing less automobile-oriented travel behavior than individuals in comparable life circumstances 10 years before. Both countries have seen steep fuel price increases: the gasoline price at the pump increased from \$1.10 in 1995 to \$1.50 in 2005 in Germany and from \$0.90 to \$1.60 in Great Britain over the same period (1). These increases exceed those of public transport fares and have made public transport a more economical transport option.

At the same time, driving in urban areas is discouraged by parking policies, traffic calming, pedestrianized downtowns, and other measures. The London congestion-charging scheme is probably the most famous example. Public transport systems have also

improved their services in many urban areas, for example, through the introduction of integrated ticketing and monthly and annual tickets.

In Germany, many universities have implemented so-called semester ticket schemes in which a 6-month public transport pass is included in the tuition fee. This semester ticket lets students ride for free in areas sometimes as large as a federal state, such as in the case of North Rhine-Westphalia. Correspondingly, according to MOP, the share of Germans aged 20 to 29 years with a monthly or annual public transport ticket has more than doubled, from 25% in 1996 to 52% in 2008. This might help to explain why the shift in travel demand toward public transport is more pronounced in Germany than in Great Britain.

Moreover, in Germany car-sharing schemes have developed enormously. Their membership rates have increased fourfold since 2000, but with rates of less than two car sharers per 1,000 people, this membership is still a niche (27). However, the success of car sharing might also indicate a decreasing importance of the private car as a status symbol (28).

At the same time, information and communication technologies (ICTs) have developed dynamically. Gadgets such as iPhones and iPads and virtual activities might withdraw time and attention from physical travel. In addition, it is possible that intelligent transportation systems, ranging from real-time traveler information at bus stops to the ability to purchase tickets via mobile phone—have influenced travel habits and mode choice behavior. Much has been speculated about the impact of ICT on travel behavior, with few concrete findings are available (29, 30). This issue should possibly be revisited with a focus on the digital natives: the generation that grew up with ICT and developed their mobility habits in the presence of such technology.

CONCLUSIONS AND OUTLOOK

This paper substantiates findings that the historic trend toward increasing motorization and automobile use may have come to an end for young Germans and Britons. According to data from national travel surveys in Germany and Great Britain, young travelers have decreased their automobile travel within the last decade. These trends in travel behavior are mirrored by statistics indicating decreases in vehicle registration and declining shares of licensed drivers in this age group.

The overall trend is composed of the following developments: private car availability is decreasing among young travelers. Significant reductions in automobile mileage in daily travel and increases in other modes, predominantly public transport, have occurred. These reductions are caused not only by the decline in car availability but also by the increasing multimodal behavior of car owners. Moreover, as long-distance travel journeys get longer, a shift from the automobile to air travel for long-distance travel has also occurred. Finally, men have reduced their automobile travel more significantly than women.

Some of the trends in travel and explanatory factors are not phenomena of only the last decade. However, since the end of the 1990s these different developments have reinforced each other, so that the change in travel behavior resulting in a decreasing automobile orientation has become more visible. The paper illustrated that remarkable similarities in travel behavior changes exist between Germany and Great Britain. These similarities suggest that the observed changes in travel behavior may not be an idiosyncratic development

taking place in a specific environment. Instead, the changes indicate a structural change in travel behavior that is likely to occur in other societies as well.

Aside from the issue of what the decisive causes for this development are, this trend raises other interesting questions: are young travelers in selected highly industrialized countries forerunners of a new travel behavior? Will this behavior penetrate through societies as this new generation ages, or will young travelers finally adopt similar mobility patterns as their predecessors? The coming years will show if this evolution of travel behavior continues and how it spreads to other age groups or across cultural and national borders.

The findings in this paper and the questions that arise are relevant for policy makers and providers of all transport services and products. Results indicate that a large share of the next generation of travelers might have other needs, attitudes, and experiences and may be more flexible and pragmatic than previous generations. Given suitable infrastructure, services, and products, this generation might cultivate a mobility that is more efficient as each mode of travel is used where it is most useful.

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