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Car careers: A socio-psychological evaluation of aspirational automobile ownership

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ABSTRACT

There is a general consensus that private car ownership is a significant barrier to transport system change, specifically in regard to injuries, space, air pollutants, or greenhouse gas emissions. Observed changes in automobile characteristics also suggest that the system is becoming less sustainable, given trends towards larger cars with greater mass and horsepower. It is thus relevant to understand how the automobile system progresses. National statistics provide data on the technical side of car ownership, such as changes in vehicle specifics or national fleet size. This paper complements this view with a socio-psychological perspective on aspirational car ownership, i.e. the type of car people preferred to drive if given a free choice. Data is derived from an online panel (n = 1,211) representative of the German population, and also contains information on current car ownership, use, driving style, traffic behavior, attitudes towards traffic risks and safety measures, as well as political orientation. This allows for a discussion of driver segments in relation to the characteristics of cars, and hence to better understand the socio-psychological drivers of the development of the automobile system.

1. Introduction

There is much recent debate about the future of the car, as many cities have taken measures to limit automobile access, or to make car ownership more expensive (Nieuwenhuijsen & Khreis 2016). During the COVID-19 pandemic, a wide range of cities established pop-up cycle tracks (Buehler and Pucher 2021; Kraus and Koch 2021), as well as legislation reducing road space and favoring active transport modes (Khalaj et al. 2020). Yet, car bonds appear to have increased during the pandemic, as public transport modes came to be seen as loci of exposure, justifying – if not demanding – the use of the private car (Das et al. 2021; Eisenmann et al. 2021). Even before the pandemic, car numbers continued to rise globally (OICA 2020). This apparent paradox – societies seeking to turn away from the car while vehicle numbers continuing to rise – is characterized by complexity, specifically when also considering changes in automobile characteristics towards larger cars.

Global passenger car numbers now approach one billion (OICA 2020), and their size and average horsepower has continuously

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grown. This trend is evident in the EU, where the share of SUVs in new share registrations was 25 % in 2017, and 31 % in 2018 (European Commission 2019). It can also be observed in Germany, where net vehicle numbers have recently increased by more than one million per year, to 48.2 million in 2021 (KBA 2021a). Large vehicles including SUVs are sold disproportionally more often (Statista 2021a): Passenger cars change in regard to size (height, width and length), mass (weight), and engines (horsepower) (KBA 2021b). All of these aspects have relevance for traffic safety, as larger vehicles negatively affect visibility (also when parked), while increasing crash risks related to acceleration, top speeds and mass-impact related collisions (NHTSA 2016). In cities, larger cars require more space, which in chronically dense cities in Europe has had outcomes from delays to growing aggression (Deffenbacher et al. 2003; Shinar and Compton 2004).

Transport systems, particularly in regard to car ownership, develop in ways that deserve to be better understood if transport systems are to change; in Germany, this public ambition is colloquially known as "Verkehrswende" (the 'transport turn'). While it has been long recognized that the car has instrumental, affective and symbolic values (Steg 2005), i.e. functions beyond transportation, there is a more limited understanding of how safety-related attitudes, driving style and perspectives on car ownership influence and shape the automobile system. Based on survey data, this paper explores the perspectives of car owners in relation to an automobile utopia, represented by the hypothetical free choice of a desirable automobile, and the analysis of socio-psychological characteristics related to these desires. Given the political struggles over changes in the German transport system, the political orientation of respondents is also investigated. The study of these aspects is relevant to understand interrelationships of car model progression, driver psychology, traffic safety, and interventions to support transport behavior change. Two research questions serve as an inroad to the discussion of relationships, i.e. *Which car brands and models would people choose as their dream cars, if given the free choice?*, as well as *How can the drivers of large cars be characterized socio-psychologically?* To answer these questions, a large representative survey was conducted in Germany that collected details about actual and desired car ownership and driver characteristics. Findings are discussed in an analogue to the "housing career" concept (Kleinhans 2003), which proposes that people have an ambition to improve on their housing situation. With growing financial resources, people will seek to climb up the career ladder. The concept of "car careers" is introduced to reflect on the potential development of an automobile system that is currently primarily restrained by monetary considerations.

2. Background

2.1. Large car interest

Large vehicles have key relevance in the development of the automobile system, and have been mostly studied in the context of sport utility vehicles (SUV). Research has examined aspects as diverse as semiotics, functionality, personal space, dominance, and safety and fears (Gössling 2017). Emerging in the 1930 s, early SUV models such as the Chevrolet Suburban in the USA were marketed to portray affluence (Lauer 2005). These wealth-related symbolic functions of private cars have persisted for more than a century, and have been discussed extensively (Sheller 2004; Steg 2005): 'car pride' continues to have great relevance for transport behavior even today (Moody and Zhao 2020).

Historically, it was in the post-WWII period that the interest in four-wheel-drive vehicles increased, and in close association to specific brands, such as the Jeep in the USA and the Land Rover in England (Lauer 2005). SUVs, in their original form, communicated military reliability in all terrains and weather situations. However, it was not before the 1980 s that SUVs became a major market segment in the USA. As Lauer (2005) emphasizes, the trend towards larger cars coincided with high crime rates in US cities, and the expansion of gated communities in the suburbs. SUVs became increasingly more popular and their features more militarized. As one example, Lauer (2005) cites the Hummer, with a design that was derived from the Humvee, a military vehicle known to the American public through images of the 1991 Gulf War. The growth of interest in SUVs thus reflects on particularities of the American psyche, where fears co-evolved with vehicle characteristics, in what is arguably the world's most car-attached nation (Norton 2008).

These developments were not restricted to the USA, however. German sociologist Ulrich Beck noted the emergence of a global "risk society" (Beck 1992), in which threats are increasingly global and outside the sphere of influence of the individual. Risks included environmental pollution and nuclear accidents (Chernobyl in 1986), which since then have come to also include the 2008 financial crisis, climate change, refugees, economic migrants, SARS, MERS, the COVID-19 pandemic, and, most recently, the Russian invasion in Ukraine and its repercussions for geopolitical safety perceptions in Europe and elsewhere. As global risks have become more immediate, if not tangible, so have associated fears. This would seem to be one explanation for the observed prevalence of fear-stimulating features in automobile marketing, in which the car is often presented as a protective capsule, carrying its passengers through dystopic environments (Gössling 2017; Wells and Xenias 2015).

As Bauman (2007) concluded, the interest in large cars and in particular SUVs may to a large degree be explained as a reaction to a society and outside environment perceived as unsafe. Lauer (2005: 149) also sees the interest in SUVs as a "risk management" response, in which the car functions as a "defended personal space". He notes that definitions of "safety" and "space" have changed, from road safety to personal safety, and from the option to transport cargo to the vehicle as a social and personal space. Through their size, SUVs also work on the basis of intimidation (Bradsher 2002). Dominance is established through mass/volume, horsepower, or names associated with "conquest and imperialism", such as Trooper, Blazer, Pathfinder (Lauer 2005: 158). SUVs often have "aggressive" designs, and offer elevated seating positions (Lauer 2005).

As this discussion indicates, notions of safety may have great influence on car choices. Safety also implies a desire to sit comfortably in elevated positions, an issue again related to changing Body-Mass-Index ratios (Li et al. 2011). Where an automobile system evolves towards greater mass, there may also be psychological tipping points, characterized by the perceived need to "upgrade" to a larger car

that is better aligned with the development of the wider fleet (Gössling 2017; Mattioli et al. 2020). These developments may have been aided by company car benefits, which have been found to coincide with larger car choices (Gössling and Metzler 2017). Other factors may include the low real cost of fuel, which declined up to the Ukraine war (Kalkuhl et al. 2022). Car ownership is also heavily subsidized (Gössling et al. 2022).

2.2. Car choices in the context of driver characteristics

Previous research has found interrelationships between driver and car characteristics, specifically in regard to large, high-status cars and risky or aggressive driving. Yet, there has been a discussion of causality: do people with specific personality traits (e.g. disagreeableness), who generally show more aberrant behavior, choose larger/high-status cars or do specific car characteristics lead to more aggressive and risky driving? There is support for a relation of personality traits and car choice (e.g. Lönnqvist et al. 2020; Haustein et al. 2022) as well as car characteristics (large size, high performance) and risky driving (Claus and Warlop 2022; Horswill and Coster, 2010).

Paleti et al. (2010) also found that young drivers of SUVs or pickup trucks are prone to more aggressive driving, and that SUV drivers in general are more likely to engage in traffic violations (Wallner et al. 2017). SUV drivers also cause more injuries (Robertson, 2006). Both sense of safety and elevated seating positions, along with feelings of superiority, may be determinants for risky behaviors (Ulfarsson and Mannering 2004; Wallner et al. 2017). Notably, perceptions of being protected by the car are deceiving, as SUV occupants are significantly more likely to die in traffic crashes (Lauer 2005). This illustrates the potentially complex interrelationships of aggressive driving, traffic risks, and large car ownership with safety attitudes.

2.3. The German automobile system

The development of the automobile system towards larger cars may be best studied in a national context. Germany self-identifies as a car-country that is also the home of several major global car makers, including Mercedes, Audi, Porsche, Volkswagen, BMW, and Opel (Mögele and Rau 2020). German car statistics illustrate the automobile system's evolution, both in the number of registered cars, as well as their characteristics. The annual net growth in passenger car numbers in Germany has in recent years exceeded one million, with a car density of 712 vehicles per 1,000 residents (KBA, 2021a). Large cars in particular have become more attractive, and their share in the car fleet has grown constantly. Compact cars are the most popular, followed by subcompact cars. Together, these segments represent more than 40 % of the fleet. Mid-size cars and SUVs are also popular, accounting for another 22 % of the fleet. Within this current distribution, considerable shifts have occurred in comparably short periods of time. The KBA (2021c) reports a disproportionally large growth in new registrations in SUVs as well as off-road vehicles (+10.5 %; 2020 over 2019). Mid-sized (+21.3 %) and compact car preferences (+15.1 %) also have seen strong growth. SUVs and off-road cars, the segments with the largest cars, now represent about one in seven cars (Fig. 1). Along with this development, horsepower also increased (Fig. 2), with newly registered cars exceeding an average horsepower of 160 in 2020, compared to<120 in 2009. Fig. 2 confirms that this has been a largely linear development, interrupted only by the very high oil price in 2007 that prompted purchases of more fuel-efficient, smaller cars. Notably, changes in horsepower, providing an opportunity to drive faster, has also influenced transport demand. For each kW in additional horsepower, travel distance increases by 0.3 % (Gössling and Metzler 2017).

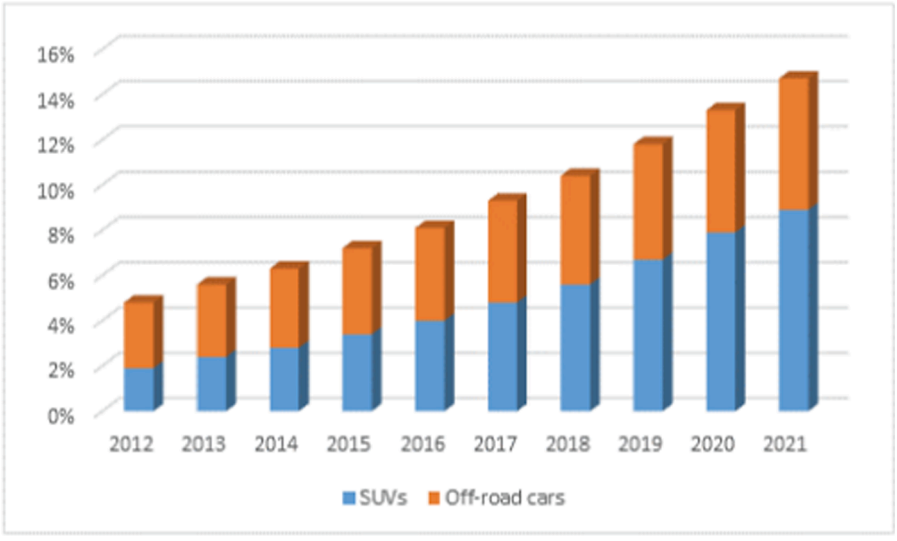

Fig. 1. Share of SUVs and off-road vehicles in the German car fleet.
Source: Statista (2021a).

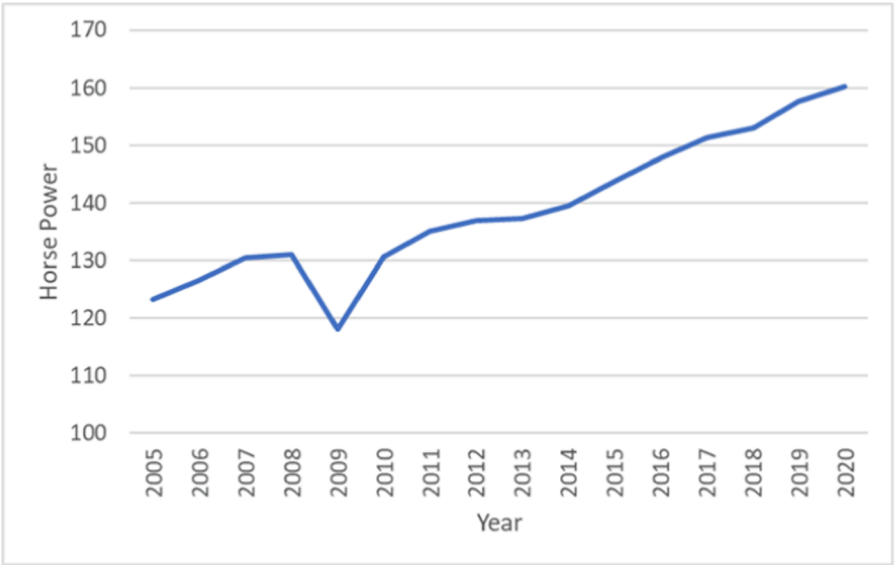

Fig. 2. Horsepower in the German car fleet.
Source: KBA (2021b), Statista (2021b).

3. Method

3.1. Procedure and participants

To collect data, a survey was conducted among German citizens. A representative sample of the driving population was drawn from the Norstat online panel (n = 1,211), between 25 February and 9 March 2021. Participants were paid an incentive of EUR 2.95 for

Table 1
Socio-demographic characteristics of the quota sample.

Sample characteristics, percentages (n = 1211).		
Gender	male	47.6
	female	52.4
Age	18–29	19.6
	30–39	16.3
	40–49	24.7
	50–59	20.9
	+60	18.6
Population place of residence	Below 5′000 residents	15.7
	5′000 to 19′999 residents	19.2
	20′000 to 49′999 residents	14.1
	50′000 to 99′999 residents	9.2
	100′000 and more residents	41.8
Number of cars in household	One	51.8
	Two	38.9
	Three or more	9.3
Personal monthly net income	Below € 500	8.3
	€ 500 to € 899	7.5
	€ 900 to € 1′299	9.8
	€ 1′300 to € 1′499	6.9
	€ 1′500 to € 1′999	14.5
	€ 2′000 to € 2′599	18.0
	€ 2′600 to € 3′599	11.8
	€ 3′600 to € 4′999	6.9
	€ 5′000 to € 9′999	2.6
	€ 10′000 to € 24′999	0.7
	€ 25′000 and more	0.2
	Don't know / not specified	12.8

answering a self-administered questionnaire of approximately 20 min. Representativeness was achieved by using a quota sampling strategy with respect to age (18 years and above), gender, income, marital status, education, and regional distribution. Only respondents with a driving license and at least one car in the household were included. Table 1 describes the socio-demographics of the sample.

3.2. Measures

Car-related measures. Questions related to cars in the household covered the number, brand and model of cars. Participants were also asked about their dream car, i.e. the brand and model ("Which car would you like to own, if money was not an issue?"). Cars are classified in twelve segments by the Federal German Motor Transport Authority (Kraftfahrt-Bundesamt, KBA). These include microcars (German: 'Mini'), subcompact cars ('Kleinwagen'), compact cars ('Kompaktklasse'), mid-size cars ('Mittelklasse'), large family cars ('Obere Mittelklasse'), large cars ('Oberklasse'), compact SUVs ('Geländewagen'), sports cars ('Sportwagen'), mini MPV ('Mini-Van'), large MPV ('Großraum-Van'), mid-size SUV ('Utility'), mobile homes ('Wohnmobil') and full-size SUV ('SUV') (KBA 2020). Individual car models in these segments can be categorized depending on their weight, engine power and fuel use. The distribution of cars in the sample is shown in Fig. 3. It compares the car listed by survey respondents - in case of more than one car in the household, the car that is used most frequently by survey participants – and shows the equivalent share in national statistics (KBA 2021c). While there is an overall good match in distributions, compact cars, mid-size cars, and SUVs are slightly overrepresented in the sample, while utilities and mobile homes are slightly underrepresented. This is expected, as mobile homes are unlikely listed as a respondent's most utilized car.

For the analysis, various car segments were integrated. Full-size SUVs, large family cars and large cars are combined in the category "large cars" (Table 2). SUVs, mid-size cars and compact cars are summarized as "medium cars", and subcompact cars and micro cars as "small cars". This omits four car segments in the German statistic that are difficult to integrate, including sports cars (small, but powerful) and mobile homes (large, but not powerful). The categorization presented in Table 2 may be counter-intuitive, as it includes SUVs in "medium cars". This is because the German classification of "SUV" includes rather small cars with a weight that is lower than that of mid-sized cars. Table 2 thus distinguishes car segments on the basis of weight and fuel economy: large cars have an average weight of almost two tons, average medium cars of about 1.5 ton, and small cars of 1.2 ton. Weight and fuel (petrol) consumption are averaged over the included segments; these values also serve as a proxy for horsepower.

Safety perceptions, attitudes and driving style, and political preferences. Driving behavior, driving style, attitudes towards road traffic legislation, law enforcement and perceived road safety were measured using standardized rating scales. Aberrant driver behavior was measured with the sub-scale *violations* of the Driver Behavior Questionnaire (DBQ, Reason et al. 1990), using a short validated German version of the scale (Glaser and Waschulewski 2005; Vöhringer-Kuhnt and Trexler-Walde 2005). Items were rated on a 5-point frequency scale ranging from 1 ([almost] never) to 5 ([almost] always). Driving styles (risky/anxious) were measured using parts of the multidimensional driving style inventory (MDSI, Taubman-Ben-Ari et al. 2004). Here, the three items with the highest loadings on both factors based on a study by Wang et al. (2018) were included in the questionnaire, and assessed on a 5-point Likert scale ranging from 1

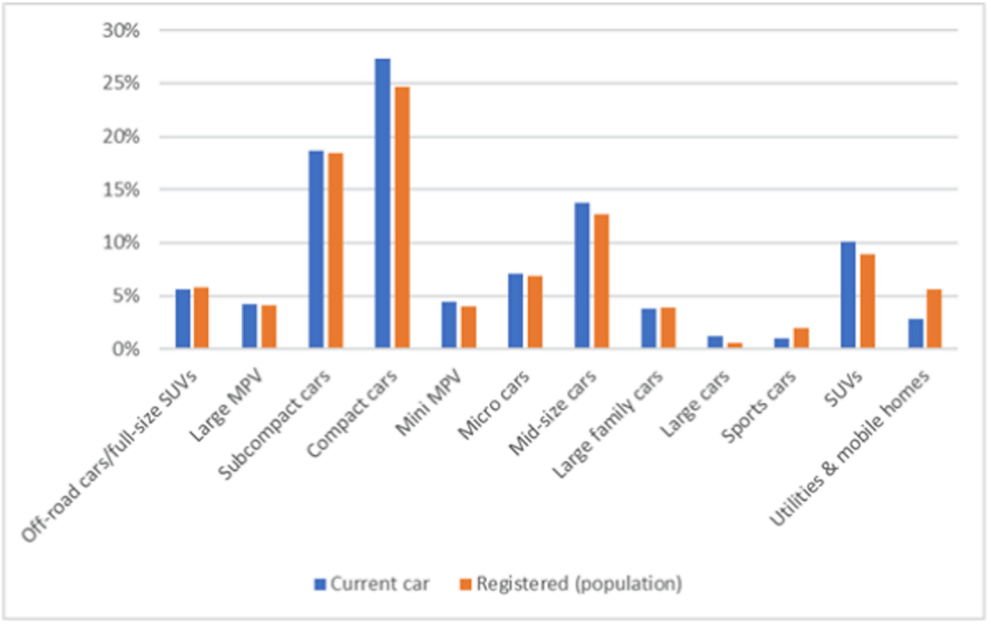

Fig. 3. Distribution of cars by segment, sample and registration.
Source: KBA 2021b.

Table 2
Weight in kg and fuel consumption of different car categories.

Categories	Segments included	Car model examples	Empty weight (kg)	Fuel economy (petrol, L/100 km)
Large cars	Off-road, full-size SUVs	Land Rover Defender, Mercedes G-Klasse	1,956	8.7
	Large family cars	Audi A6, BMW 5er, Mercedes E-Klasse	1,925	9.0
	Large cars	Audi A8, BMW 7er, Mercedes S-Klasse	2,136	11.2
Average large cars: 1.965 kg, 9.1 L				
Medium cars	Compact cars	Audi A3, BMW 1er, Mercedes A-Klasse	1,461	6.3
	Mid-size cars	Audi A4, BMW 3er, Mercedes C-Klasse	1,694	7.4
	SUVs	Audi Q2, BMW X1, Opel Mokka	1,565	6.7
Average medium cars: 1.544 kg, 6.7 L				
Small cars	Subcompact cars	Audi A1, Ford Fiesta, Opel Corsa	1,260	5.7
	Micro cars	Renault Twingo, FIAT Panda, Citroen C1	1,102	5.4
Average small cars: 1.216 kg, 5.6 L				

Source: based on KBA 2021c.

(strongly disagree) to 5 (strongly agree). Cronbach's alpha of the three scales are 0.84 (violations; anxious driving style) and 0.85 (risky driving style). The respondents' agreement to changes in traffic legislation and enforcement was assessed based on eight single items (Gehlert and Kröling 2020), using a 5-point Likert scale. Perceptions of safety in traffic were noted with a single item using a 5-point scale from 1 (not safe) to 5 (very safe). The political leaning of all respondents was considered by including all major parties in Germany, i.e. far-right (AfD), conservative (CDU/CSU), liberal (FDP), social democrat (SPD), left (Die Linke) and pro-environmental (Grüne). Respondents were asked to indicate their current preference.

3.3. Analysis

To test for differences in driving behavior, and socio-demographic characteristics between drivers of small cars versus large cars, t-tests, Mann-Whitney-U-tests and Chi^2 tests are carried out, to identify relevant variables. Furthermore, in a multivariate framework, binary logistic regressions in combination with a general to specific approach are used to find the significant variables describing large and small car drivers, as well as between people that would upgrade from a small car to a larger car in the absence of monetary constraints and people that would hold on to their small car choice. Finally, differences between small and large car ownership by political orientation are analyzed with Chi^2-tests and Cramer's V to measure the effect size.

4. Results

Respondents were asked to state the type of car they currently own, to then indicate the car they would like to drive if they had a

Table 3
Favored car models.

Car model	Dream car %	German registrations %
TESLA MODEL X	3.71	0.01
PORSCHE 911	3.47	0.26
PORSCHE CAYENNE	2.06	0.12
TESLA MODEL S	1.90	0.02
AUDI A8, S8	1.82	0.06
BMW 5ER	1.82	1.14
VW GOLF	1.73	7.81
VW TRANSPORTER	1.65	1.18
ASTON MARTIN V8	1.57	0.003
MINI MINI	1.49	1.00
FORD MUSTANG	1.32	0.07
AUDI Q5	1.24	0.37
AUDI A6, S6, RS6	1.16	0.98
AUDI E-TRON	1.16	0.01
AUDI Q8	1.16	0.02
BMW 3ER	1.16	2.24
BENTLEY CONTINENTAL	1.07	0.01
LAMBORGHINI AVENTADOR	1.07	0.003
MERCEDES AMG	1.07	0.02
MERCEDES E-KLASSE	1.07	1.41
PORSCHE MACAN	1.07	0.07
AUDI A3, S3, RS3	0.99	1.59
BMW 7ER	0.99	0.06
MERCEDES A-KLASSE	0.99	1.45
AUDI A1, S1	0.91	0.40

Source: own results, KBA (2020) for German car model prevalence.

free choice. Results show that a wide range of car models have an appeal, with two brands and four models (Tesla's X and S; Porsche's 911 and Cayenne) receiving 11.1 % of the overall vote (Table 3). Results also show a strong preference for German car makers, as well as large or expensive cars (Audi A8; Aston Martin; Bentley Continental; Lamborghini Aventador). Some models (VW Transporter; Mini) are not necessarily very expensive, but seem to cover niche interests. Table 1 also shows that "dream car" choices include many models that are rare to find in the national car fleet. For example, the prevalence of Aston Martin V8s is 0.003 % in the fleet, but considered the most desirable car by more than 1.5 % of respondents. VW Golf, BMW3er, as well as Mercedes E and A class are more often registered than desired, yet for a considerable share of respondents, these are "dream cars". Results also foreshadow a growing preference for electric cars, as revealed in Tesla choices. This trend is mirrored in the national statistic, as electric car registrations have tripled between 2019 and 2020 (from low numbers, KBA 2021c).

Table 4 provides an overview of current car ownership in relation to desired cars. Results suggest that of those currently driving small cars, about one quarter would continue to drive a small car even when given a free choice. Three quarters would like to upgrade to a medium (41.7 %) or large car (33.2 %). A similar relationship is evident for drivers of medium-sized cars, with half of the drivers staying with their current car choice (47.3 %). The other half (48.7 %) would like to drive a large car, and only 4 % would like to downgrade. For the large car drivers, more than two thirds (68.1 %) remain with their car choice, though 28.6 % express an interest in a medium-sized car, and 3.3 % in a small car. Results show that for the majority of respondents, there are car career stages, i.e. an interest to advance to a larger car.

Two binary logistic regressions were conducted: one predicting large versus small car ownership and the second predicting whether drivers of small cars desired to upgrade their car size or not (see Table 5). In both regressions, DBQ violations, risky driving style, anxious driving style, gender, age, education and income were entered stepwise. Results suggest that in comparison to drivers of small cars, large car drivers engage in more traffic violations and risky driving, are older, more often male, and have higher incomes.

The second regression (Table 5) indicates that small car owners who strive for a larger car, show a riskier and less anxious driving style than people who are satisfied with their small car choice and similar to large car owners, they are more likely men. It is interesting to note, that age and income are not significant for upgraders, which suggests that large-car aspirations are prevalent in the entire (male) population, irrespective of income or age.

Further insights can be derived from attitudes to traffic rules and legislation, as well as driver behavior (Table 6). The t-tests and Mann-Whitney-U-tests show significant differences between drivers of small and large cars, as the latter are more likely to engage in risky driving styles and rule violations, while they are also less likely to support zero alcohol limits, penalties for driving under the influence, or highway speed limits of 130 km/h. While large car drivers represent a greater traffic safety threat, they nevertheless feel safer in traffic than small car drivers. This suggests an inverse relationship with safety, in that large car owners travel more safely in their more protective cars, while imposing traffic risks on other road users.

The analysis shows that drivers of large cars are older, have a higher income, and a better education than those driving small cars. These aspects are interrelated. They are also more likely men (Table 6). Politically, large car ownership points to a tendency to vote for the far-right (AfD), conservative (CDU/CSU) and liberal (FDP) parties, while the voters of the left (Die Linke, SPD) and pro-environmental (Grüne) parties more often own small cars (Table 7). An accumulated view of CDU/CSU, FDP and AfD as politically "right", and SPD, Grüne and Die Linke as "left", suggests that large car ownership is significantly higher for the right parties with a medium size effect. The same tendency is confirmed for aspirational car choice. Yet, effects are smaller than those for gender and income.

5. Discussion

Statistical data for Germany shows that there is an evolution of the automobile system towards greater car numbers, more horsepower, acceleration, maximum speeds, weight, and height. Results from this research suggest that, albeit unsustainable, this development is *limited* by disposable financial resources, as in particular the male population expresses desires to drive larger and more powerful cars. This has implications for virtually all aspects of relevance for transport planning, policy, and practice. For example, there is no evidence of climate change mitigation, as transport emissions have risen slightly over the past 30 years, in stark contrast to stated decarbonization ambitions. The German Environmental Protection Agency (UBA 2022) reports that emissions from transportation amounted to 164.9 Mt CO_2-equivalent in 1990, and 165.5 Mt CO_2-equivalent in 2019. Unless there are major changes in car model choices and driver behavior, it is not realistic to reduce national transport emissions to 95 Mt CO_2-equivalent to 2030, the stated goal of the ministry of economics (BMWI 2022). This is equally true for accident rates, noise, and other issues (Gössling and Metzler 2017).

As Germany does not seem to make progress towards transport system change, the study of car preferences and attitudes gains importance. One central finding in regard to the socio-materiality of automobility can be conceptualized as evidence of 'car careers'. A

Table 4
Aspirational car choices.

Current car	Dream car		
	Small car	Medium car	Large car
Small car	25.1 %	41.7 %	33.2 %
Medium car	3.9 %	47.3 %	48.7 %
Large car	3.3 %	28.6 %	68.1 %

Table 5
Characteristics of drivers.

	Large vs small car		Upgrader vs small car remainers	
Variable	Coefficient (S.E.)	Wald (Sig.)	Coefficient (S.E.)	Wald (Sig.)
DBQ violations	0.53 (0.25)	4.53 (0.043**)		
Risky driving	0.30 (0.18)	2.91 (0.088*)	0.37 (0.20)	3.50 (0.062*)
Anxious driving			−0.43 (0.17)	6.44 (0.011**)
Gender	−0.91 (0.26)	12.66 (0.001***)	−1.13 (0.40)	8.21 (0.004***)
Age	0.03 (0.01)	8.58 (0.003***)		
Income	0.36 (0.08)	18.36 (0.001***)		
Constant	−4.90 (1.08)	20.77 (0.001***)	3.59 (0.90)	15.88 (0.000***)
Chi-Square		71.22 ***		20.87 ***
Cox & Snell R^2		0.175		0.072
Nagelkerkes R^2		0.248		0.113

Estimated parameters in binary logistic regression models.
* (**, ***) indicates that the coefficient is distinct from zero at the 0.1, 0.05 and 0.01 significance level.

Table 6
Differences between small and large car owners.

		Large cars	Small cars	Large vs Small cars		
		Mean		*t*-value	p-value	Sig. Mann-Whitney-U-Test
Risky driving		2.20	1.78	4.47	0.000***	0.000***
Anxious driving		1.80	1.89	−1.04	0.301	0.074*
DBQ violations		2.00	1.68	4.93	0.000***	0.000***
How safe do you feel on the road driving a car?		4.01	3.82	2.55	0.011**	0.005***
Zero-alcohol-limit		3.78	4.17	−3.08	0.002***	0.006***
Mandatory eye test for driver's license every 15 years		3.80	3.88	−0.64	0.520	0.321
Speed limit on freeways of 130 km/h		2.54	3.21	−4.29	0.000***	0.000***
Speed limit on rural roads of 80 km/h		2.72	2.83	−0.74	0.463	0.412
Speed limit in cities to 30 km/h		2.24	2.13	0.80	0.424	0.700
Penalties for speeding should be increased		3.04	3.19	−0.99	0.323	0.330
Penalties for drunk driving should be increased		4.05	4.41	−3.41	0.001***	0.011**
More frequent police controls		4.05	4.41	−0.52	0.606	0.676
Age		47.25	43.30	2.57	0.010**	0.000***
Gender (%)	male	62.30	33.90	Chi^2		31.479***
	female	37.70	66.10	Cramer's V		0.266***
Income (%)	< 1500 EUR	22.30	47.20	Chi^2		57.047***
	1500–3600 EUR	45.50	47.50	Cramer's V		0.384***
	> 3600 EUR	32.20	5.30			
Education (%)	low/medium education	33.30	46.60	Chi^2		14.993***
	higher education	24.60	29.30	Cramer's V		0.184***
	bachelor/master's	42.00	24.10			

Significance calculated as 2-tailed *t*-test and Mann-Whitney-*U* Test: *** p < .01, ** p < .05, * p < .10.

Table 7
Party preference in relation to car type (small/large).

	CDU/CSU	SPD	Grüne	FDP	DIE Linke	AfD	Other	Total	Chi^2 / Cramer's V
Large current car	38.1 %	22.6 %	23.3 %	44.7 %	18.4 %	39.1 %	31.8 %	31.0 %	14.60**
Small current car	61.9 %	77.4 %	76.7 %	55.3 %	81.6 %	60.9 %	68.2 %	69.0 %	0.181**
Total	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	
Large dream car	88.9 %	79.7 %	74.4 %	90.5 %	75.0 %	87.8 %	82.5 %	82.9 %	12.48*
Small dream car	11.1 %	20.3 %	25.6 %	9.5 %	25.0 %	12.2 %	17.5 %	17.1 %	0.162*
Total	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	
	Right (CDU/CSU, FDP, AfD)			**Left (SPD, Grüne, Die Linke)**					**Chi^2 / Cramer's V**
Large current car		39.7 %			22.1 %				13.717***
Small current car		60.3 %			77.9 %				0.190***
Total		100.0 %			100.0 %				
Large dream car		88.9 %			76.3 %				11.602***
Small dream car		11.1 %			23.7 %				0.168***
Total		100.0 %			100.0 %				

*p <.10; **p <.05; ***p <.01 (two-sided significance).

large share of car owners expresses preferences for larger cars than they currently drive. This reflects on an aspirational advancement in automobile hierarchies, where it is attractive to own specific models with symbolic and affective values (see Steg 2005). Car careers are notional, in that real-world upgrades to larger cars are limited by monetary constraints, but they indicate the direction in which a system is headed if given free reign. This raises a related issue, i.e. the drivers of the observed progression of the automobile system and whether these result in self-reinforcing cycles.

Mobility choices are to a large degree influenced by discretionary income, as there is evidence that a share of personal income is invested in transport (Zahavi 1974; Schafer and Victor 2000). Income is thus widely considered the single most relevant variable determining transport demand (Schäfer et al. 2009), which is also true for the car (Liddle 2009). This gains importance in light of the very significant subsidies forwarded by the government to German car owners. There are incentives for purchases of electric cars, tax rebates for diesel fuel, company car benefits, and commuter flat rates (Deutscher Bundestag 2017). In cities, parking is often free (Scheiner et al. 2020), incurring only modest service charges. Emissions of greenhouse gases are priced at a fraction of their likely cost. Taken together, these subsidies significantly reduce the private cost of car ownership, by an estimated 29 % – 41 % for different car models, or an estimated €5,000 per year (Gössling et al. 2022). This suggests that a share of car owners may already drive considerably larger cars than they would in the absence of these subsidies, given the evidence of large car desirability as found in this research.

These findings are also related to driver personalities. This research finds that drivers of large cars drive more aggressively and violating and feel safer in traffic, yet such driver segments are more likely to be involved in crashes (Martinussen et al. 2017). Given the evidence of relationships between personality traits and car choice (e.g. Lönnqvist et al. 2020; Haustein et al. 2022), and large car characteristics and risky driving (Claus and Warlop 2022; Horswill and Coster, 2010), this indicates that there is a technological and socio-psychological co-evolution of the automobile system. While causalities need to be confirmed, results open for a situation in which policies designed to support car ownership economically have implications for the wider fabric of society, as they also influence individual socio-psychology and resulting transport behavior.

This points to a relevant political dimension. Larger cars are driven disproportionally more often by voters of the conservative, liberal, and far-right parties, who oppose speed limits, block science-based legislation, question climate change, or reject limitations to the automobile system. There is thus evidence that the development of the automobile system towards larger and more powerful cars reflects on political decisions that have supported these trends. At the time of writing, the war in Ukraine caused fuel-price hikes that prompted country-wide calls to introduce a 130 km/h speed limit, and a reduction of oil imports from Russia. In response, the conservative and far-right parties called for and implemented tax rebates on fuel, while rejecting speed limits (Autobild 2022). It is obvious that the conservative, liberal, and far-right parties appeal to those parts of the electorate that represent a barrier to transport system change, with the consequence of nurturing and legitimizing specific views on speed, traffic violations, or necessary change in regard to climate change.

It is paramount that these complexities of the automobile system are properly understood. From any health, economic, or environmental perspective, it is desirable that a transport turn gains momentum (Gössling et al. 2021; IEA 2019; Khomenko et al. 2021). Without recognition of the socio-psychological barriers the system constitutes, and the political landscape that is exploiting these barriers, it is difficult to see how transport systems will change.

6. Conclusions

Statistical evidence suggests that the automobile system continues to evolve in directions that contradict national German transport goals. The system grows rapidly in vehicle numbers, and private cars grow in size, weight and horsepower. These changes are embedded in complexities, as vehicle characteristics predict negative externalities (crashes, pollution, space requirements), that are also associated with driving styles and driver self-perceptions. Socio-psychological perspectives as investigated in this paper suggest that the automobile system evolves on a trajectory that may be described as founded in aspirational car ownership, with large shares of the owners of smaller and medium-sized cars expressing an interest in larger vehicles. For many drivers, this suggests an implicit understanding of car careers, in which individuals can ‘move up in the system’, with the goal to own large and powerful cars. This evolution is closely aligned with driver psychologies and political views that are empowered through these developments, contradicting social norm change in favor of smaller cars and alternative transport modes. Car careers may underlie the development of the national car fleet, and their understanding is of considerable importance for transport planning, policy and practice.

The research also points at a wide range of unresolved research questions. For instance, it remains unclear whether car careers are stable over time, or if disruptive innovations such as electric cars do push the system in specific directions. This research also revealed that a small share of large car owners expressed preferences for smaller cars. Is this driven by environmental concerns, awareness of the high cost of owning a car, or a growing perceived density in cities, where it is increasingly unpractical to own a large car? To better understand the reasons for ambitions to drive smaller cars may provide important inroads for the design of policies supporting system change. A related issue concerns traffic safety, as drivers of large cars feel safer while their driving style is riskier and a safety threat to other road users. Future research may investigate whether large cars support self-perceptions of being a safe driver, for instance because of elevated seating positions or more imposing car characteristics, prompting riskier driving styles. More broadly, there is a related question of cause and effect between driving style and car choice: Do larger or more powerful cars support the development of driving styles characterized by greater levels of aggressiveness and risk-taking or do people with aggressive driving styles aspire to larger car ownership, as our results suggest? These issues may be addressed in future research, ideally based on longitudinal data.

CRediT authorship contribution statement

Andreas Humpe: Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Stefan Gössling:** Conceptualization, Writing – original draft, Writing – review & editing. **Sonja Haustein:** Conceptualization, Methodology, Formal analysis, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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