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Car-reduced neighborhoods as blueprints for the transition toward an environmentally friendly urban transport system? A comparison of narratives and mobility-related practices in two case studies

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ABSTRACT

In the pursuit of sustainability, the concept of 'car-reduced neighborhoods' promises to decrease car ownership and increase car-independent mobility. However, mobility is not only designed from 'above' by planners and policymakers, but also shaped from 'below' by its practitioners and their contexts. Only a few studies currently bring together the perspective from 'above' and 'below' regarding car-reduced neighborhoods. This article therefore combines both perspectives by contrasting the narratives and the mobility-related practices of two German car-reduced urban residential areas. Firstly, we conduct interviews with various actors involved in the planning and implementation of both neighborhoods to identify the narratives. Secondly, we interview the residents to determine the mobility-related practices. Finally, we compare both empirical investigations to analyze the commonalities and differences of the 'planning vision' and the 'lived practice' of car-free living, car-independent mobility, and restrictive car parking. Although this study identifies differences between the two perspectives, the discrepancy is smaller than evaluated in earlier studies. After relocating to a car-reduced neighborhood, residents tend to maintain, strengthen, and adapt car-independent mobility practices rather than weakening car-independent mobility practices and maintaining car-dependent ones. Thus, residents seem to be encouraged to drive less and to leave their cars parked for most of the time. However, relocating to a car-reduced neighborhood does not automatically initiate full demotorization. Furthermore, residents' parking practices also sometimes deviate from the planning vision. Consequently, the article concludes that overcoming the 'system' of automobility for a 'post-car system' requires continuous (i) *material* and (ii) *immaterial change* fostered by *political and planning readiness,* as well as *local willingness* and *public acceptability*. In this regard, car-reduced neighborhoods can be seen as blueprints for a mobility transition.

1. Introduction

To overcome 'automobile dependence' (Newman and Kenworthy, 1999) and the hegemonic 'system' of automobility (Manderscheid, 2014; Urry, 2004), planners and policymakers "stag[e] [mobility] from above" (Jensen, 2013, p. 4; Larsen, 2017, p. 72) by designing infrastructures and shaping laws, norms, and policies (Banister, 2011; Buehler et al., 2017). The concept of 'car-reduced neighborhoods' is an example that combines incentive-based and restrictive policy measures to support demotorization and car-independent mobility (Nieuwenhuijsen, 2020). Transport planning literature and transport policy studies on car-reduced neighborhoods highlight how environmentally friendly mobility can be achieved by planning and policy strategies. They conclude that such developments are worthwhile to meet emission reduction guidelines and to transform cities into places less dominated by cars (e.g., Melia, 2014). From a 'planning-critical' perspective (Growe and Freytag, 2019), various authors assume that the implementation of such sustainable developments produces narratives that indicate a gap between the 'ideal vision' and the 'lived practice' of the residents (Andersen and Skrede, 2017; Freytag et al., 2014; Mössner, 2016). This shows that mobility is also "staged from below" (Jensen, 2013, p. 4; Larsen, 2017, p. 72) by its practitioners and their contexts. Research on travel behavior and mobility practices in car-reduced neighborhoods analyzes the determinants of mobility changes after relocating to such neighborhoods (e.g., Johansson et al., 2019) or motivations and strategies of voluntarily car-free households (e.g., Baehler, 2019). Consequently, this presents if and how residents appropriate the ideal vision of car-free living, car-independent mobility, and restrictive

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car parking. This can, in turn, reveal what supports people's car-independent mobility or discourages car-free living. We understand car-independent mobility as being mobile by alternative, environmentally friendly transport modes, such as cycling, walking, and public transport, and not by shared or private car. Car-free living is practiced by car-free residents who voluntarily choose to live without a car.

To date, only a few studies have combined the perspectives from 'above' and 'below' on car-reduced neighborhoods and have requested further research (Freytag et al., 2014). Hence, this study asks to what extent the narratives of car-reduced neighborhoods coincide with the mobility-related practices in such residential areas and what conclusions can be drawn for the future planning of car-reduced concepts at the neighborhood level. The case studies used are two residential areas in the City of Darmstadt (Germany): The completed development of K6-Kranichstein (hereafter referred to as K6), and Lincoln, which is still under construction. First, we carried out expert interviews with actors involved in planning and implementing the two neighborhoods to explore the narratives of car-reduced concepts. Second, we conducted interviews with the residents to determine the mobility-related practices and to show whether and how the ideal vision of car-free living, car-independent mobility, and restrictive car parking is pursued. This article compares both empirical investigations to, first, identify the commonalities and differences of the 'planning vision' and 'lived practice', and, second, to draw conclusions for future car-reduced planning. This in turn supports the change toward car-reduced planning principles as the 'new standard' and car-independent mobility and car-free living as the 'new normal'.

The remainder of this paper is organized as follows. Section 2 reviews the state of the art. Section 3 describes the research approach. Section 4 focuses on contrasting narratives and practices regarding car-free living, car ownership, and car parking (Section 4.1) as well as changes in car use toward car-independent mobility after residential relocation to a car-reduced neighborhood (Section 4.2). Section 5 discusses the commonalities and differences between the two perspectives with reference to previous studies. Section 6 draws conclusions for a mobility transition.

2. Transport studies and mobility research for a change toward a system beyond the car

A high potential for decreasing car ownership and use, and, thus, solving car traffic problems in cities, is attributed to the place of residence and its materiality designed with incentive-based and restrictive measures (Ornetzeder et al., 2008). 'Car-reduced' or 'low-car' housing developments are one example aiming at car-free living and car-independent mobility, as they provide infrastructural conditions and an urban physical structure that supports demotorization and the use of alternatives to the car (Melia, 2014). Consistent with Melia et al. (2010), we understand these developments as housing areas with limited parking compared to 'car-free' neighborhoods that offer no parking at all. However, the degree of reduction varies depending on national or local parking standards.

It is well known that higher density, land use diversity, and, thus, shorter distances, a good walking and cycling infrastructure as well as access to alternative transport modes, and the availability of sharing services provide a more suitable context for car-independent mobility and demotorization (Ewing and Cervero, 2010; Hickman et al., 2013). Furthermore, fewer guaranteed and cost-free parking rather than 'parking convenience' at home reduce households' car ownership and use (Guo, 2013a, 2013b; Manville, 2017; Weinberger, 2012). Moreover, parking management not only intensifies the shift toward more car-independent mobility and car-free living (Christiansen et al., 2017; Ison and Rye, 2006; McCahill and Garrick, 2010; Nash and Whitelegg, 2016; van der Waerden and Timmermans, 2013), but also creates living environments with more space for residents instead of parking (Rye and Koglin, 2014; Shoup, 2018). Accordingly, Antonson et al. (2017) conclude that parking regulations have more positive than negative consequences for residents' everyday life. 'Mobility convenience' is provided (Gunnarsson-Östling, 2021) to increase public acceptability of restrictive policy measures, such as reducing car parking spaces, pricing them, and decoupling them from housing (Steg, 2003). Although incentive-based measures have a positive effect on the use of non-motorized and public transport modes (Oostendorp et al., 2020), restrictive measures are also needed (Knoflacher, 2006; Melia, 2014; Nieuwenhuijsen et al., 2019) to decrease car ownership and use (Erikson et al., 2008; Gärling et al., 2009; Klementschitz et al., 2007). However, Leibling (2014) does not observe a decline in car ownership for residential areas in outer London as a result of reduced parking spaces due to lack of public transport access and land use diversity. Consequently, restrictive parking policies must be integrated into an overall transformation of the urban transport system to increase their public acceptability and success in terms of supporting car-independent mobility and car-free living (De Gruyter et al., 2020; Mingardo et al., 2015; Ruhrort, 2019).

Public acceptability of parking regulations also varies because people have different attitudes. Kirschner and Lanzendorf (2020) summarize that public acceptability of reduced on-street parking policies in a German urban residential area increases if parking space is reused for other purposes and, thus, better liveability. Another German study (Seemann and Knöchel, 2018) concludes that people with a greater need to use their private car tend to prefer residential areas with a corresponding parking supply. Stubbs (2002) shows that home owners in the UK perceive a parking space as important to property values, even if they do not own a car or use it infrequently. Ever more studies are examining the transformation potential of car dependency from the perspective of individuals or households (e.g., Aguilera and Cacciari, 2020; Schwedes and Hoor, 2019). They conclude that, on the one hand, the car has lost prestige – especially among young adults in urban areas – but, on the other hand, its ownership and use continues to be associated with freedom and autonomy (Puhe and Schippl, 2014). Hence, car ownership and use cannot be explained exclusively by 'instrumental' motives (e.g., convenience), but is also motivated by 'symbolic' (e.g., expression of a social position) and 'affective' functions (e.g., emotions related to car driving, Steg, 2005). Urry's (2004) concept of the 'system' of automobility illustrates the broad complexity of car dependency by a 'socio-technical system' built around the car. Hence, as Laakso (2017) observes, abolishing a car and, thus, travelling by alternative transport modes is connected with processes of 'de- and re-routinisation'. Residential relocation is seen as a 'key event' for changes in mobility and car ownership because it can lead to a rethinking of routines (Müggenburg et al., 2015). Therefore, various studies are looking at the circumstances for 'partial' or 'full demotorization' (Dargay et al., 2003) or changes in mobility after a relocation (e.g., Farinloye et al., 2019; Maller and Stengers, 2013).

Previous studies on car-reduced neighborhoods either focus on their spatial design and facilities or analyze their residents' transport mode choices, motivations, and strategies for living car-free. Oostendorp et al. (2020) conducted a quantitative expert survey on motivations and challenges as well as expected effects of implementing such 'integrated mobility concepts' in German urban residential areas. It shows, consistent with studies in other spatial contexts (Borgers et al., 2008; Foletta and Henderson, 2016; Nieuwenhuijsen and Khreis, 2016), that from above it is assumed that the combined implementation of restrictive and incentive-based measures reduces car ownership and use, and, instead, increases car-independent mobility. Other empirical studies reveal the perspective from below and confirm this change after a relocation to a car-reduced neighborhood (Antonson et al., 2017; Baehler, 2019; Johansson et al., 2019; Nobis, 2003; Scheurer, 2001; Sprei et al., 2020). In addition to the material context of the residential location, residents' social contexts and individual characteristics, attitudes, habits, and personal preferences regarding transport modes and car-free living possibly present before the relocation also influence these changes, thus

Table 1
Material context of Lincoln and K6.

			Lincoln	K6
Availability and quality of alternative transport modes to the private car within the neighborhoods	Public transport accessibility	Service level (on weekdays)	Two streetcar stops within walking distance	One streetcar stop within walking distance
			Direct connection, every 15 min. to the city center, every 30 min. to the central railway station	Direct connection, every 7 min. to the city center and to the central railway station
		Travel time	12 min. to the central railway station 10 min. to the city center	18 min. to the central railway station 12 min. to the city center
	Walking and cycling accessibility	Travel time by bicycle	Approx. 15 min. to the city center	Approx. 10 min. to the city center
		Travel time on foot	Approx. 45 min. to the city center	Approx. 40 min. to the city center
	Mobility services (station-based)		Car sharing and e-car sharing (4 h cost-free/month/household)	Car sharing
			Bike sharing, cargo bike sharing (cost-free), e-cargo bike sharing	Cargo bike sharing (cost-free)
Network of alternative transport modes to the private car beyond the neighborhood boundaries	Public transport		Dense network of buses and streetcars within Darmstadt. Connection to the region and surrounding cities (e.g., Frankfurt/Main) via the central railway station and further train stations.	
	Cycling		Continuous improvement of bicycle infrastructure within Darmstadt and into the region for better accessibility to surrounding places.	
	Walking		Compact European city offering short distances to daily amenities in most parts of the city. The density decreases from the city center to the outskirts.	
	Mobility services		Network of station-based car sharing, bike sharing, and cargo bike sharing (cost free).	
Built environment factors	Distance to other destinations in Darmstadt		Approx. 3 km to the city center of Darmstadt	Approx. 4 km to the city center of Darmstadt
			Supermarkets within walking distance	Supermarkets, kindergartens, and schools within walking distance
			Recreation space within walking distance	Recreation space within walking distance
	Diversity and design		Residential land use only (in planning: supermarket, kindergarten, school, common areas)	Residential land use only
			Traffic-calming measure: speed limit (30 km/h)	Traffic-calming measures: speed limit (30 km/h), home zones
			Covered and secured spaces for bicycle parking	Shared amenities
			Playgrounds	Playground

showing 'residential self-selection' effects (Nobis, 2003; Johansson et al., 2019; Scheurer, 2001).

Recent studies conclude that the motivation for voluntarily car-free living is driven by a combination of 'personal conviction', attitudinal changes toward car ownership, and 'practical considerations' related to the material context, residents' travel needs, and social contexts (Baehler and Rérat, 2020a; Sprei et al., 2020). Sattlegger and Rau (2016) conclude that social acceptance is the decisive factor for the 'normalization' of car-free living. Baehler and Rérat (2020b) also derive 'contextual conditions' for car-free living, which they divide into two dimensions: First, individuals who develop certain strategies to practice car-independent mobility, despite the context of a "hegemonic car culture" (Sattlegger and Rau, 2016, p. 26); and, second, a certain 'territory's hosting potential' (Kaufmann, 2012), which includes both 'material' and 'immaterial' aspects. Material aspects are the availability of alternative transport modes to the private car, networks of these modes, and the built environment. Immaterial aspects are "social, cultural, political and economic contexts which play an important role in mobility" (Baehler and Rérat, 2020b, p. 3). As examples, Baehler and Rérat (2020b) cite laws, social or cultural norms, or 'mobility cultures' (Klinger et al., 2013) that enable individuals to consider car-free living. Consequently, they deduce four principles of a 'post-car system' (Dennis and Urry, 2009) that together "encourag[e] residents to live car-free in a pragmatic way and without being restricted in their daily life" (Baehler and Rérat, 2020b, p. 15). These principles are: (i) availability of alternative transport modes to the private car at the residential location, (ii) their spatial and functional organization beyond the neighborhood boundaries, (iii) a built environment that makes the alternatives more attractive, and (iv) measures that support the development of skills for multimodal rather than monomodal mobility.

3. Research approach

3.1. Case studies: K6-Kranichstein and Lincoln

K6 and Lincoln are both located within the City of Darmstadt with a population of 161,620 (as of December 2020, Darmstadt City of Science, Department of Economy and Urban Development, 2021a). As part of the Rhine-Main metropolitan region, Darmstadt is located in the south-west of Germany in the state of Hesse. In 2020, Darmstadt's motorization rate of 460 cars per 1000 inhabitants was below both Hessian and German values (599/575 cars per 1000 inhabitants respectively, Darmstadt City of Science, Department of Economy and Urban Development, 2020). In Darmstadt, 22% of all households live car-free, 59% own one car, and 19% more than one. Darmstadt's residents undertake two out of three trips by using environmentally friendly modes: 18% public transport,

22% cycling, 25% walking (as of 2018, Gerike et al., 2019, pp. 4/5). Compared to 2013, the proportion of trips made by car declined from 37% to 35% and cycling increased by five percentage points. Supported by a Green-Party mayor and a cycling referendum, the local government's aim is to further reduce the share of car traffic and, instead, increase the share of cycling (Darmstadt City of Science, 2020).

The new development area of K6 was built from 1998 to 2015 as part of the district of Kranichstein in the north-east of Darmstadt. On an area of 17 ha, mostly detached houses but also apartment buildings were built to prevent Darmstadt residents from relocating to the suburbs. In K6, housing for socially mixed groups, and an ecological traffic and open space concept were implemented. Today, 1204 residents live there (as of December 2020, Darmstadt City of Science, Department of Economy and Urban Development, 2021b).

The Lincoln development is a former US Army housing area on 25 ha in southern Darmstadt. Due to population growth and an increase in car traffic, Lincolns' development pursues the aim of building as much housing as possible while generating as little additional car traffic as possible. Accordingly, Lincoln is much more densely developed compared to K6 and only offers apartment buildings. In 2014, the first residents moved into renovated buildings. In 2028, 5000 people are expected to live there. Today, Lincoln is still under construction, but already inhabited by 1850 residents (as of December 2020, Darmstadt City of Science, Department of Economy and Urban Development, 2021b).

Both residential areas have been developed in a 'car-reduced' way, which implies the planning goal of reducing car ownership and use, enabled by a certain material context and incentive-based measures (see Table 1). Additionally, restrictive measures are applied. First, the compulsory number of parking spaces per housing unit generally provided in Darmstadt is reduced from 1.0 to 0.9 in K6 and to 0.65 in Lincoln. Second, most parking spaces – except metered on-street parking for visitors and those with disabilities – are considerably decoupled. This means, firstly, that the parking spaces are not located near the housing, but in collective garages; and, secondly, that they must be rented or purchased separately from the housing, both of which are still uncommon in Germany. Consequently, in Lincoln, parking spaces are rented from a 'central car parking space allocation scheme' to prevent a 'first come, first served' basis. The monthly costs for one parking space vary between 60€ and 135€. In K6, car owners either purchase a parking space for 9000€ or sign an annual 'car-free declaration', if they do not own a car. Third, on-street parking is metered, which is not yet common in German residential areas either.

3.2. Perspectives, data, and methodology

This study compares two empirical investigations using a 'thematic qualitative text analysis' (Kuckartz, 2014) to explore the commonalities and differences between the *narratives* and the *mobility-related practices* of car-reduced neighborhoods.

To approach the *narratives*, we carried out 15 qualitative expert interviews in fall 2018 with actors involved in planning and implementing the two case studies. We categorized the interviewees into four professional groups: (i) local planners and policymakers of the City of Darmstadt; (ii) housing developers; (iii) private consultants for urban and transport planning, and mobility service providers; and (iv) civil society and community organizations (see Selzer and Lanzendorf, 2019 for more information). In our understanding, narratives are embedded in the social, political, and cultural context in which they are told (Abbott, 2002; Brockmeier and Harré, 2001). Hence, the narratives of both car-reduced neighborhoods produced by the actors mirror the perspective from above and reveal how and by whom the car-reduced concepts are discussed and what expectations are placed on the prospective residents. This shows both underlying goals and obstacles to planning and implementing such concepts. This study focuses on the narratives of the ideal vision of both neighborhoods as potential role models for sustainable development. Since we identified a clear dichotomy of actors into those who regard the car-reduced concept as an opportunity to change mobility-related practices, and those who see the concepts as doomed to failure, this juxtaposition is chosen in Section 4, knowing that behind each actor is an individual with his or her different social, cultural, and professional background.

To uncover the *mobility-related practices*, we conducted 22 qualitative interviews with Lincoln and K6 residents, all of whom were still living there at the time of the interviews in fall 2019 (see Table 2 and Selzer and Lanzendorf, n.d. for more information). Among the respondents, nine live in a household that voluntarily lives car-free, eleven own one car, and two own two cars in their household. K6 respondents are slightly older than Lincoln respondents, reflecting the general age structure of the neighborhoods: 25% of all K6 residents are under the age of 18, 26% are between 18 and 45, and 49% are older than 45; 32% of all Lincoln residents are under the age of 18, 51% are between 18 and 45, and 17% are older than 45 (as of December 2020, Darmstadt City of Science, Department of Economy and Urban Development, 2021b). This can be explained by the different ages of the developments. Lincoln respondents represent more diverse household types and show a higher social mix, which can be explained by the different housing types of both neighborhoods. The distribution of income among the K6 and Lincoln respondents does not reveal significant differences. None of the respondents mentions their income level as a constraining factor neither for owning a car or not nor for using one specific transport mode.

In our understanding, practices are routinized, knowledge-based, and emotional, "defined by interdependent relations between material, competences and meanings" (Shove et al., 2012, p. 24). In that sense, we understand mobility-related practices as embedded in other daily practices as well as material, personal, social, and cultural contexts (Heisserer and Rau, 2017; Rau and Sattlegger, 2018). Thus, the residents' mobility-related practices mirror the perspective from below and show whether and how the ideal vision of car-free living, car-independent mobility, and restrictive car parking is appropriated. By applying a 'type-building text analysis' (Kuckartz, 2014) to the resident interview material, we compared and contrasted the individual cases with each other according to the following criteria: (i) which transport modes the respondents mainly used in their everyday life before and (ii) which they use after their residential relocation, as well as (iii) motivations for possible changes in their mobility. Thereby, we deduced different changes in residents' mobility practices after relocating to Lincoln and K6 compared to before. We grouped these changes into five types: (i) maintained car independence, (ii) strengthened car independence, (iii) adapted car independence, (iv) weakened car independence, and (v) maintained car dependence (see Section 4.2).

4. Contrasting the narratives and mobility-related practices of car-reduced neighborhoods

To explore the commonalities and differences between the narratives and mobility-related practices of the two car-reduced neighborhoods of Lincoln and K6, we contrasted the expectations regarding the implementation of restrictive parking regulations and incentive-based policy measures identified in the expert interviews with the meanings of car use and parking, car-independent mobility, and car-free living as well as car ownership, abolishment, and purchase identified in the interviews with the residents. Section 4.1 contrasts the ideal vision and lived practice regarding changes in car ownership and car parking. Section 4.2 compares the ideal with the lived reality regarding changes in car-dependent toward car-independent mobility after relocating.

4.1. Changing car ownership level and car parking

The narratives of Lincoln and K6 as sustainable developments uncover great disagreement about whether prospective residents will accept the reduction in parking spaces per housing unit, their pricing,

Table 2
Characteristics of the Lincoln and K6 residents interviewed.

ID[a]		Lincoln residents (n = 12)												K6 residents (n = 10)									
		AmL	BmL	CmL	DmL	EwL	FmL	GwL	HmL	IwL	JwL	KwL	LwL	MmK	NwK	OwK	PmK	QwK	RmK	SwK	TmK	UwK	VwK
Gender	Female					x		x		x	x	x	x		x	x		x		x		x	x
	Male	x	x	x	x		x		x					x			x		x		x		
Age	Under 30	x						x															
	30–40		x						x	x													
	40–50			x	x		x				x				x							x	x
	Over 50											x	x	x		x	x	x	x	x	x		
	No indication					x																	
Employment status[b]	Retired													x									
	Working part-time					x						x				x		x		x		x	x
	Working part-time and in education/ doing a PhD/ studying		x					x							x								
	Working full-time	x		x	x		x			x			x				x		x		x		
	Working full-time and in education/ studying								x		x												
Household type	Living alone	x		x					x		x		x										
	Childless couple									x				x									
	Single parent family															x					x		
	Couple with child		x		x										x		x	x		x			
	Couple with children					x	x												x			x	x
	Flat shares							x				x											
Duration of residence	Less than one year	x	x	x		x	x		x	x	x	x											
	One to two years							x															
	Two to three years				x								x										
	More than three years													x	x	x	x	x	x	x	x	x	x
Previous residence	City of Darmstadt		x	x	x				x	x	x	x		x	x	x		x		x	x	x	x
	City in the Rhine-Main region	x						x											x				
	Rural area in the Rhine-Main region												x				x						
	Other German city					x	x																
Car-owning household		x	x		x	x		x		x			x		x	x	x	x	x			x	
Personal bicycle ownership		x	x	x		x	x	x	x					x	x	x	x	x	x	x	x	x	x
Personal car sharing membership			x	x			x				x	x				x	x		x	x	x	x	x
Personal public transport season ticket		x	x				x	x	x	x	x		x			x		x	x	x		x	x

[a] The interviewee IDs are structured as follows: A, B, C, etc. = interview order; w/m = gender (female/male); L/K = Lincoln/K6 resident.
[b] One respondent has a higher personal net income (> 4000€), thirteen have a middle income (2000-4000€), four have a lower income (< 2000€), and four do not provide any information.

and their decoupling from housing. Private consultants for urban and transport planning, mobility service providers, civil society and community organizations, and, in particular, local planners and policy-makers interviewed argue that many urban households live car-free voluntarily and so will benefit from these policies. Furthermore, they believe that households' car ownership level will decrease as a consequence of these parking regulations. For legitimization, they argue that these measures correspond to the "zeitgeist" (civil society and community organization) or are the "only alternative" (local planner of the City of Darmstadt) to advance the change from a more car-friendly toward a more human-friendly living environment. In contrast, some housing developers insist that it cannot be assumed that prospective residents will voluntarily give up their cars. They rather argue that all households own at least one car, wherefore "having one's own parking space [free of charge] is a must" (housing developer). In K6 today, one could see that "the cars are only hidden in the garages, but not reduced" (housing developer).

The interviews with K6 and Lincoln residents reveal that some households voluntarily live car-free. However, many already did so before their relocation (see Table 3). They support the car-reduced concept as "future-oriented" (HmL) and value the economic benefit of living car-free, which is even higher in K6 and Lincoln where the price of parking is not included in the housing's rental or purchase price. Thus, the parking policies of both neighborhoods are an incentive to maintain car-free living, but also an impetus to get rid of a car (see Table 3). Some households sell one car in parallel with their relocation, but keep the second. This 'partial demotorization' is triggered in Lincoln by its early promotion as a car-reduced neighborhood, shown by the following quote.

> *"We rethought our situation and asked ourselves, do we really need two cars? In our case, we sold one […] because we do not need two. […] If it had not mattered how many cars you are allowed to have here and if there were more parking spaces available, then we would not have done it." (IwL).*

However, Lincoln and K6 residents mainly reduce their car ownership level due to better accessibility to daily destinations after the relocation (e.g., workplace). They recognize that two cars in one household are "not necessary anymore" (PmK) due to the neighborhoods' location and good walking, cycling, and public transport infrastructure. In retrospect, they acknowledge that the second car was mainly parked before its abolishment. Thus, those who have already experienced car-independent mobility seem more likely to get rid of a car. Similarly, in some cases, a (cost-free) public transport season ticket provided by an employer supports car abolition. One K6 household sold

Table 3
Changes in car ownership level among Lincoln and K6 households.

		Lincoln households	K6 households
Decreasing households' car ownership level after the residential relocation	From two to one car	1 (IwL)	1 (PmK)
	From two to zero cars	0	1 (SwK)
Maintaining households' car ownership level after the residential relocation	Zero cars	5 (CmL, FmL, HmL, JwL, KwL)	3 (MmK, TmK, VwK)
	One car	3 (AmL, DmL, LwL)	4 (RmK, UwK, QwK, OwK)
	Two cars	0	1 (NwK)
Increasing households' car ownership level after the residential relocation	From zero to one car	2 (BmL, GwL)	0
	From one to two cars	1 (EwL)	0

its two cars one after the other after living there for a while. Therefore, 'full demotorization' takes time and is driven by its association as a burden regarding costs and obligations. Instead, car-free living is seen as a benefit because it confers a financial advantage and increases flexibility of transport mode choice. K6's car-free declaration is described as an incentive and the neighborhood as supportive because "so many live that way" (SwK).

Several Lincoln and K6 households, however, also keep their car(s) (see Table 3). It is seen as a "luxury good which is not going to be sold" (EwL). Instead, living car-free "would be too high a sacrifice, which is therefore out of the question" (DmL). These personal reasons contrast with practical ones stated by those who rarely use their own cars: The car "has just been purchased" (BmL) or "because of its age, it hardly costs anything" (LwL) and so is kept.

Lastly, some Lincoln households purchase a new car or move in with someone who owns a car (see Table 3). The purchase is either justified by childbirth or that the alternatives in Lincoln are not yet equivalent to a private car. Although the purchase is described as a "pragmatic decision" (EwL), a lack of knowledge of the city and its surroundings is noticeable, as a resident declares it is "easier to rely on the proven system of automobility" (EwL) when relocating to an unknown city.

As parking regulations are currently largely uncommon for German residential areas, car-owning households have to change their parking practices after relocating to Lincoln and K6. So, some car-owning households do not comply with the parking regulations (see Table 4). Residents who mainly leave their cars parked and practice car-independent mobility do comply. They rent (Lincoln) or buy (K6) a parking space as suggested by the neighborhood developers. Some K6 car owners bought a parking space immediately after they moved in, instead of parking on the street on cost-free and vacant space, which was still available at the time due to construction works. These residents already desired to live in a car-free and, thus, quieter and safer living environment even before they relocated to K6, which is why they intentionally parked their cars in the collective garages.

Other K6 and Lincoln car owners comply with the parking regulations only once collective garages are open and on-street parking is metered. In K6, controls by the authorities and neighborhood self-monitoring additionally contributed to compliance. Today, K6 car owners report they are much more satisfied with their living environment since "the initial chaotic parking situation has been resolved" (VwK). They also note that paying for a "guaranteed, dry parking space" (OwK) is worth it because it avoids the "annoying search" for one (QwK), and in return one "always knows where and how far away the car is parked" (QwK).

Some households, who own (more than) one car and prefer to use their car(s) regularly for specific trip purposes (e.g., commuting, shopping, leisure) rather than relying on alternative transport modes, evade the regulations. They (i) park on vacant, cost-free space in Lincoln under construction, (ii) rent a parking space (for the second car) outside the neighborhood at a lower cost, or (iii) park the car at their workplace free of charge. Lincoln's ongoing construction means that they still perform evasive car parking practices and will do so "as long as possible" (GwL). As parking controls can so far only be partially implemented, there is almost no threat of consequences. Additionally, residents report that "it does not feel wrong" (DmL) because so many still park where they want.

4.2. *Changing from car-dependent to car-independent mobility*

The narratives of Lincoln and K6 as sustainable developments reveal a discussion about whether the idea of voluntary car-independent mobility after relocating to Lincoln or K6 is either part of an ongoing social change or a utopian vision. Private consultants for urban and transport planning, mobility service providers, civil society and community organizations, and, in particular, local planners and policy-makers interviewed argue that offering incentive-based measures (e.g., public transport access, sharing services) is not only a necessary response to urban mobility trends, but also increases public acceptability of the restrictive measures and encourages a change in residents' mobility toward greater car independence. K6's streetcar access and car sharing station were only implemented after residents had already been living in the neighborhood. Lincoln's responsible planners remember this failure and claim to provide a wider range of alternative modes and travel demand management as soon as the first residents move in to trigger the rethinking of routines through additional incentives (e.g., cost-free e-car sharing). In contrast, some housing developers expect this vision to be doomed to failure, as "the car is the usual mode of transport" (housing developer) on which people rely. Nevertheless, the narratives show unanimity that even car owners occasionally use transport modes other than the car. Thus, all actors support the idea of providing 'mobility convenience'.

Table 4
Car parking practices of Lincoln and K6 households.

		Lincoln households	K6 households
Compliant car parking practices	Based on their conviction, directly after residential relocation	0	2 (UwK, RmK)
	After the parking policies were implemented	2 (IwL, BmL)	4 (OwK, PmK, QwK, NwK)
Evasive car parking practices	On vacant, cost-free space within the neighborhood under construction	3 (DmL, EwL, GwL)	0
	Renting a (second) parking space outside the neighborhood at a lower cost	1 (LwL)	1 (NwK)
	Parking at the workplace free of charge	1 (AmL)	0

Table 5
Five types of changes in mobility practices after residential relocation to Lincoln and K6.

	Lincoln residents	K6 residents
Maintained car independence	2 (BmL, CmL)	2 (QwK, VwK)
Strengthened car independence	3 (AmL, IwL, LwL)	6 (MmK, PmK, SwK, TmK, UwK, RmK)
Adapted car independence	4 (GwL, HmL, FmL, JwL)	1 (OwK)
Weakened car independence	2 (EwL, KwL)	0
Maintained car dependence	1 (DmL)	1 (NwK)

The interviews with K6 and Lincoln residents reveal five types of changes in their mobility practices after relocating (see Table 5). Overall, car ownership does not equal everyday car use. Many car-owning residents, just like car-free residents, use alternative transport modes in daily life. A mobility change occurs when either a resident's personal, social, or material context changes along with their relocation, resulting in attitudinal changes toward the transport modes used. The contextual determinants and specific ways in which Lincoln and K6 residents change their mobility, or not, will now be described on the basis of the five types.

First, *'maintained car independence'* includes car-owning and car-free residents who already traveled mainly on foot, by bicycle, or public transport prior to their relocation. Hence, they have gained personal experiences and competences for performing car-independent mobility over their lives and have already developed positive attitudes toward alternatives to the car. Although a 'residential self-selection' effect is evident, the materiality of the new residential location stabilizes the practice of car-independent mobility and the decision to maintain living car-free.

Second, *'strengthened car independence'* includes car-owning and car-free residents who occasionally or regularly used a car before relocating. Afterwards, they either no longer use a car at all – in two cases not even car sharing anymore – or drive much less. Positive attitudes toward less car use increased over time, resulting in a growing willingness to use environmentally friendly transport modes. Accordingly, the desired change has taken place. Since living in Lincoln or K6, some residents walk, cycle, or use public transport more often, and instead leave their cars parked more frequently. This in turn also triggers 'partial' and 'full demotorization'. The effect of 'residential self-selection' is evident among those who now completely forgo car use because they had sought a home from which they could reach any destination by bicycle or public transport. Reduced car use often follows relocation also being a move closer to the workplace. However, the neighborhood's location and accessibility, the social context in K6, the early promotion of Lincoln's restrictive parking regulations, and broader changes in the city's transport policy regarding a stronger call for a mobility transition are identified as particularly conducive to strengthening car independence. Additionally, a (cost-free) public transport season ticket provided by an employer increases public transport use. Perceived short distances within the city, the continuous improvement of bicycle infrastructure, and resulting greater safety increase cycling.

Third, *'adapted car independence'* includes car-owning and car-free residents who were and still are predominantly mobile without a car, but by alternative transport modes. After the relocation, instead of walking or using public transport, they are more likely to cycle; instead of cycling and walking, they are more likely to use public transport. For instance, where commuting distances have lengthened after the relocation, residents no longer walk or cycle to work, but use public transport or combine it with cycling. Others combine their commute with a trip to the kindergarten, which is quicker by bicycle than by public transport used for commuting at the previous residence. Overall, these residents have the skills needed to be mobile in a multimodal way and the willingness to use environmentally friendly transport modes. This allows them to adapt their mobility practice without giving up car independence.

Fourth, *'weakened car independence'* includes only Lincoln residents, owning a car or not, who were predominantly mobile with environmentally friendly alternatives to the car prior to their relocation. Afterwards, in one case, car sharing is used more often, since it is on the doorstep and allows more flexibility – especially for trips outside the city – due to the more decentral location of Lincoln than the former residential location. Another case uses her own car for almost all trips because she is not yet familiar with the new residential area and also commutes to another city, which is faster to reach by car, but also makes work and family life easier. Consequently, these residents are dissatisfied, not with the car-reduced concept per se, but with the ongoing construction of Lincoln and the associated slow improvement of alternative mobility services (e.g., perceived low service level of public transport). They report both personal and practical reasons for using a car instead of alternatives.

Fifth, *'maintained car dependence'* includes car owners who traveled mainly by car prior to their relocation and show little or no decrease in their car use today. They report both personal motivations for using a car instead of alternatives and reasons related to the material context. However, trips already made using alternative transport modes before the relocation will continue to be made. In one case, after a longer residential duration in K6 and due to perceived social pressure, a change in awareness toward less car use is evident. The other case in Lincoln insists on the necessity of the car for the daily organization of work and family life, resulting in dissatisfaction with the car restrictions.

5. Combining the perspective from above and below: What are the lessons learned?

Contrary to Freytag et al. (2014) and as feared by some housing developers, by combining the perspective from above and below, this study firstly observes that the discrepancy between the 'planning ideal' and 'lived practice' of car-independent mobility is smaller than expected. Our study shows two urban neighborhoods that are well developed, as they provide spatial and infrastructural conditions that support car-independent mobility. Thus, Lincoln and K6 are places that suit people who practice car-independent mobility and car-free living. The prerequisite for this was the mindset of local policymakers and planners to apply car restrictive measures that were outside the 'usual' planning practices and transport policies of the time. Thus, the car-reduced concepts emerged during times of political and social change in Darmstadt. Hence, their planning can be seen in the context of a paradigm shift away from car-friendly to car-reduced planning and as a reaction to demands from some parts of society for a mobility transition. Consequently, local policymakers and planners received backing from other actors (e.g., civil society and community organizations) as well as 'bottom up' support from local society, indicating a supportive 'mobility culture' (Klinger et al., 2013) in Darmstadt.

As identified in other studies, a large proportion of residents shares the idea of car reduction, both in their living environment and mobility (Kirschner and Lanzendorf, 2020), thus showing willingness for change toward car independence (Baehler and Rérat, 2020b). Almost all residents are in favor of decoupling housing and parking, as it creates a more

human- and child-friendly living environment, offering reuse of 'lost' parking space (Kirschner and Lanzendorf, 2020). Car-free households are especially attracted, as the housing price or rent is lower (Manville, 2017). This is because included parking spaces usually automatically increase the overall rent or housing price. Some car owners also consider off-site parking convenient because they have a guaranteed parking space (Antonson et al., 2017). Evasive parking within K6, and to some extent also in Lincoln, decreased since parking restrictions have been more consistently implemented with additional regulatory and social controls. Restrictive measures are accepted once the materiality leaves no other option, after a certain period of familiarization, and appropriation of the incentive-based measures. Therefore, this study argues that public acceptability of restrictive measures increases if 'mobility convenience' is provided (Gunnarsson-Östling, 2021; Oostendorp et al., 2020; Steg, 2003) and if the restrictive measures are communicated early and constantly. When Lincoln residents move in, care is taken to communicate the emotionally fraught issue of parking early on. Furthermore, the mobility concept is promoted as 'mobility-enhancing' rather than 'car-restrictive'. This storytelling and, thus, portrayal of car-free living and car-independent mobility as something feasible can be seen as having a positive influence because it "challenge[s] pro-car values or reduce[s] their impact on society-wide mobility practices" (Sattlegger and Rau, 2016, p. 39).

Many residents are multimodal and fulfill their daily mobility needs without using a car, showing the car's loss of prestige in urban contexts (Puhe and Schippl, 2014). Many car owners use their cars only for certain trip purposes (e.g., bulk shopping), indicating a tendency toward car-free living (Schwedes and Hoor, 2019). Thus, car ownership does not equal everyday car use when the materiality supports car independence. Consequently, this study shows the importance of incentive-based measures in addition to restrictive ones, not only to maintain car-independent mobility, but also to first reduce car-dependent mobility (Antonson et al., 2017; Oostendorp et al., 2020) before a possible transition to car-free living. Finance-related measures (e.g., cost-free public transport season tickets) seem to be a particular incentive.

Moreover, this study observes that the material and social context in car-reduced neighborhoods not only stabilizes car-independent mobility and car-free living, but also strengthens car-independent mobility (Baehler and Rérat, 2020b; Sprei et al., 2020). The provision of different alternatives to the car also enables residents to easily adapt car independence. Combined with restrictive measures and the proximity of their residence to daily destinations (e.g., workplace), some households are also encouraged to partially demotorize and others to maintain their car ownership level. Relocation to the outskirts, for example, could instead have resulted in purchasing a second car. By comparing K6 and Lincoln residents, their progress toward car-independent mobility, car-free living, and compliant parking practice shows that K6 residents' behavior has developed further in line with the planning vision. This illustrates the effect of the social context in addition to the material one. K6 residents have lived together for many years, supporting each other and developing a common understanding of the neighborhood. Hence, the change observed, e.g. in parking, also arose from the neighbors themselves. Additionally, the car-independent mobility practices of K6 residents seem to be more routinized, resulting from the older age of the residents and their longer duration of residence. Lincoln residents have recently relocated and are comparatively younger, therefore in different life phases. This can lead to other disruptions besides residential change that potentially influence mobility (Müggenburg et al., 2015). At the same time, Lincoln residents show greater adaptability in their mobility (e.g., switching from using public transport to cycling).

Besides 'practical considerations' related to material, personal, and social contexts, all these positive changes in both neighborhoods build on existing preferences regarding transport modes, showing 'residential self-selection' effects (Baehler and Rérat, 2020a, 2020b; Johansson et al., 2019; Nobis, 2003; Scheurer, 2001; Sprei et al., 2020). In line with previous studies (De Vos et al., 2012; Schwanen and Mokhtarian, 2005), our results indicate that some Lincoln and K6 residents select themselves into these neighborhoods facilitating the use of their preferred transport mode. Both neighborhoods enable them to travel in their desired way with active and public transport modes. Most of the residents interviewed already lived in an urban context, and so already showed a greater aversion to cars before their relocation (De Vos et al., 2018). For example, some residents decided to relocate to Lincoln or K6 to live closer to their workplace with a better cycling and public transport accessibility. Consequently, commute distance decreased and the feasibility of using active and public transport modes increased. In this case, the use of active and public transport modes was not an option before the relocation, but is afterwards and valued since. Attitudes toward cycling or public transport improved and car-dependent mobility decreased. Consequently, this study shows both the influence of attitudes and the material context of the residential location on mobility. Hence, we support Næss's (2009, p. 293) argument, "if households self-select into areas that meet their travel preferences, it seems self-evident that urban structure matters." Therefore, the residential self-selection effect identified does not diminish the importance of such developments because, unlike other places, they provide a context that enables car-independent mobility and car-free living rather than hindering it. Accordingly, they "make more visible the on-going trend towards de-motorisation in big cities and sho[w] that this choice is also possible and attractive in other contexts" (Baehler and Rérat, 2020b, p. 14).

Second, this study also identifies differences between the 'planning vision' and 'lived practice' (Freytag et al., 2014), especially regarding car parking and full demotorization. Challenges for implementing a car-reduced concept already arise in the materialization of car-restrictive planning goals, as the actors involved in the planning and implementation process follow different rationalities and can influence success if they do not consult each other (Antonson et al., 2017; Baehler and Rérat, 2020b; Freytag et al., 2014). As Oostendorp et al. (2020) elaborate, this study also shows that housing developers follow market-driven interests and, thus, lack experience in developing car-reduced neighborhoods. This is why they are uncertain about public acceptability and again rely on the conventional way of building housing bundled with parking. Therefore, as Klementschitz et al. (2007) suggest, a strong political will is needed to break with well-trodden planning paths in order to implement car restrictions. Similarly, existing laws and regulations still favor car use, ownership, and parking (Oostendorp et al., 2020). For example, according to the local building regulations when K6 was developed, the amount of parking spaces could only be reduced by 10% in residential areas. Even for this small deviation, the planners had to justify themselves because it was something 'special' at the time. When Lincoln's development started, its reduction could be implemented more significantly due to modified regulations and gained experience. Thus, this study confirms that the 'immaterial context', more precisely the planning practices, laws, regulations, and also political as well as social acceptance regarding restrictive measures, needs to be further altered (Baehler and Rérat, 2020b) to be able to support car independence materially from above. However, this also illustrates that actors involved in planning and implementing housing developments as individuals, with their attitudes, perceptions, and experiences, as well as different backgrounds, can change their opinions over time.

As discussed in previous studies (Mingardo et al., 2015), some car owners criticize the restrictive parking regulations. They are mainly ambivalent about the pricing of parking (Kirschner and Lanzendorf, 2020). However, by means of this study, it cannot be conclusively determined whether parking fees will not or cannot be paid. If residents drive more frequently, they tend to disagree with reduced parking spaces (Seemann and Knöchel, 2018). This results in parking dissonance because cost-free parking is desired but not allowed. Hence, Lincoln residents in particular perform evasive parking practices, as the ongoing construction enables the potential for evasion. Implemented parking restrictions are still regarded as something 'special' because they are not

implemented throughout the city. Just as many people view not owning a car as a deviation from the social norm (Baehler and Rérat, 2020b; Sattlegger and Rau, 2016), this can be cited as an example of how a practice that deviates from the 'known' leads to less acceptance. Thus, while enough, cost-free parking supply is available within and outside the neighborhood boundaries, and as long as it is socially accepted, evasive parking is practiced, and spillover parking cannot be excluded. The process of 'normalizing' metered, off-street parking instead of cost-free, on-street parking appears to be more progressed in K6 due to the longer duration of shared residence. This has resulted in a common attitude regarding car parking.

Although very few rely exclusively on a car for their daily mobility, some K6 and Lincoln residents maintain car-dependent mobility practices (e.g., commuting). Thus, this study identifies, in line with Johansson et al. (2019), that car-dependent mobility practices are also maintained after relocating to a car-reduced neighborhood. Some residents even weaken their car independence due to the lack of land use diversity and the perceived unsatisfactory service level of Lincoln's streetcar access due to the ongoing construction. This confirms that public transport access is particularly decisive for reducing car dependency (Leibling, 2014). However, if 'mobility convenience' is truly implemented, weakened car independence can be reversed because those residents are experienced in car-independent mobility. Nevertheless, one Lincoln resident feels restricted in his preferred car-dependent mobility and therefore expresses dissatisfaction and the desire to relocate again.

Moreover, many car-owning Lincoln and K6 households are unwilling to transition to car-free living due to the car's persistent association with flexibility and comfort (Puhe and Schippl, 2014). Although the car frequently remains parked, 'full demotorization' rarely occurs (Dargay et al., 2003). The modest parking space reduction in K6 means that all car owners can easily get a parking space in the collective garages. This leads to 'parking convenience' that should actually be prevented, but instead encourages maintaining car ownership (Guo, 2013a, 2013b; Weinberger, 2012). Furthermore, our study confirms subjective attachment to car ownership and personal preferences for car use. 'Symbolic' and 'affective' functions identified by Steg (2005) also appear in our study and need to be considered as determinants of changes in car ownership and car-dependent mobility. Car-owning K6 residents come from a generation for whom the car was a status symbol. Over time, the bond has solidified, which is why life without owning a car is considered 'not normal'. The feeling of being able to go on vacation by car with the whole family is another example in favor of sticking with car ownership. Moreover, 'key events' already known in the literature, such as childbirth, lead to car purchase (Lanzendorf, 2010). Other personal circumstances, such as ensuring the compatibility of family and work, lead to car use (Heisserer and Rau, 2017).

6. Conclusions: The exemplary role of car-reduced neighborhoods in a *material* and *immaterial change* toward an environmentally friendly urban transport system

In the pursuit of sustainability, the concept of 'car-reduced neighborhoods' promises to decrease car ownership, increase car-independent mobility, and, thus, transform cities into places less dominated by cars (Melia, 2014). However, mobility is not only designed from 'above' by planners and policymakers, but also shaped from 'below' by its practitioners and their contexts (Jensen, 2013). To date, few studies have brought together the perspective from 'above' and 'below' on car-reduced neighborhoods (Freytag et al., 2014). This article therefore combines both perspectives by contrasting the narratives with the mobility-related practices of two German car-reduced urban neighborhoods. We conducted interviews with actors involved in planning and implementing the two housing developments to identify the narratives and interviewed the residents to determine the mobility-related practices. The narratives highlight challenges in planning and implementing a car-reduced neighborhood and the practices reveal obstacles residents face in complying with the car-reduced vision. This study compares both empirical investigations and observes that, although differences between the 'planning vision' and 'lived practice' emerge, the discrepancy is smaller than evaluated in earlier studies (Freytag et al., 2014).

After relocating to a car-reduced neighborhood, residents tend to maintain, strengthen, and adapt car-independent mobility practices rather than weakening car-independent mobility practices and maintaining car-dependent ones. As an explanation, we deduce that, first, travel attitudes, existing travel preferences, and personal experiences with using alternative transport modes to the car have an effect on residential location choice, showing residential self-selection. Second, both housing areas provide a material and social context supporting a change in mobility toward car independence and, thus, strengthening attitudes toward less car use. However, although residents seem to be encouraged to drive less and leave their cars parked for most of the time, relocating to a car-reduced neighborhood does not automatically initiate full demotorization due to subjective car dependency and the pending 'normalization' process of car-free living in a 'hegemonic car culture' (Sattlegger and Rau, 2016). Likewise, restrictive parking regulations are not yet fully accepted and lived, as they demand parking behavior that differs from the known.

We draw conclusions on two dimensions that are consistent with Kaufmann's (2012) concept of 'territory's hosting potential' used by Baehler and Rérat (2020b). First, this study uncovers the need for a continuous *material change* in order to overcome car dependency and enable a mobility transition. Attractive, high-quality alternative transport modes to the private car should be available at the residential location as soon as the first residents arrive. Furthermore, mixed land use and dense built environments ensure proximity to daily destinations along with flexible and secure accessibility by public transport, bicycle, and on foot. To provide alternatives to the car not only at the place of residence, but a whole system beyond the neighborhood boundaries (Baehler and Rérat, 2020b), car-reduced neighborhoods should be included in the 'integrated urban and transport planning' of the entire city (Antonson et al., 2017; Schwedes and Hoor, 2019). This in turn increases public acceptability of car restrictions (De Gruyter et al., 2020; Ruhrort, 2019). Moreover, citywide parking management is needed to reduce car ownership (Antonson et al., 2017; Rye and Koglin, 2014), to hinder evasive parking practices (e.g., in surrounding areas or at the workplace), and to avoid parking policies within the neighborhood still being seen as something 'special', which perpetuates the disconcerting impression for visitors and new residents.

Second, this study reveals the importance of a continuous *immaterial change*. So far, both planning for car-independent mobility, as well as being mobile without a car, are surrounded by an 'immaterial context' that still favors cars (Baehler and Rérat, 2020b), limiting the scope of action. Thus, the biggest obstacle to developing an entirely alternative 'post-car system' (Dennis and Urry, 2009) that supports 'full demotorization' and car-free living continues to be car-dominant mobility images that surround us, in other words 'cultural and social barriers' (Sattlegger and Rau, 2016). However, our study shows factors that can trigger immaterial change. The residential planning process already needs the vision of car reduction to provide 'from above' a supportive material context for car-independent mobility and car-free living. This *political and planning readiness* to rethink past transport policies, laws, and regulations, as well as planning practices seems crucial, also to convince other actors involved in implementing car restrictions. Furthermore, continuous support in the form of neighborhood management and mobility counseling that brings neighbors together can strengthen togetherness and establish a common feeling regarding car independency. *Local willingness* to live car-free and be mobile without a car can also foster immaterial change. People who practice car-independent mobility act as role models for others, which can inspire social change in the neighborhood 'from below' (Baehler and Rérat, 2020b). This, in

turn, can encourage *public acceptability* of car restrictions and promote change in a broader socio-cultural context (Baehler, 2019). People who hitherto rarely engaged in car-independent mobility especially need support in building up competences to do so because the former practice of monomodal car use required fewer skills than being multimodal and car-free mobile (Baehler and Rérat, 2020b; Laakso, 2017). Therefore, living in an environment where many people live car-free and are mainly mobile using active, public, or shared transport modes can foster the shift away from associating car-free living as a sacrifice toward seeing it as 'normal' or at least 'feasible'.

All in all, our study shows that the transition from the 'system' of automobility (Urry, 2004) to a 'post- car system' (Dennis and Urry, 2009) can be triggered 'from above' and 'from below'. Finally, our results are consistent with Baehler and Rérat's (2020b) conclusion that a favorable spatial and social context is needed for individuals to consider living car-free. However, we extend their conclusion by arguing that it already requires a favorable social and political context to plan and implement car restrictions. Consequently, the development of car-reduced neighborhoods is so important in terms of a mobility transition because they improve materiality for car independence, change the meanings of car-dependent planning and mobility, and build competences for car-reduced planning and car-independent mobility.

By combining the perspectives from above and below, this study contributes to a more comprehensive and integrative understanding of car-reduced concepts at the neighborhood level. Moreover, it provides a deeper understanding of what hinders and supports car-reduced planning practice as the 'new standard' and car-independent mobility and car-free living as the 'new normal'. However, our study also has some limitations. First, since the results are based on qualitative interviews, conclusions are drawn based on qualitative instead of quantitative analysis. Second, we cannot fully exclude a social bias in our results, as we neither interviewed the whole population of both case studies nor all actors who were possibly involved in their planning and implementation. Younger people and people living in poverty tend to be underrepresented in our study. Third, since our work is based on two case studies, certain spatial and cultural characteristics emerge as a matter of course. Nevertheless, our overall results are in line with trends currently being observed in other big German cities, such as an increase in the share of (i) cycling and (ii) car-free households (Follmer and Gruschwitz, 2019), as well as (iii) a greater willingness for a change toward car reduction in mobility and in the living environment (Baehler and Rérat, 2020b; Kirschner and Lanzendorf, 2020). Anyway, further research should take place in other geographical contexts and with other social groups to verify our findings regarding transferability. Additionally, future studies should look more closely at the interaction between household members by conducting interviews with all members rather than just one. Further insights into differences between the ideal vision and lived practice of car-reduced neighborhoods could be generated by interviewing people who used to live in such housing areas but felt too restricted in their mobility and therefore relocated again.

Author statement

Sina Selzer confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Declaration of Competing Interest

None.

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