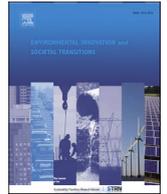




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Research article

The polysemous nature of the German Verkehrswende—Exploring the role of floating signifiers in shaping mobility futures

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ABSTRACT

The German transportation sector's negative contribution to climate change amongst broader social, environmental, and economic problems is applying evermore pressure to the prevailing automobility regime to bring about its transformation. However, the vision of this transition, referred to as the *Verkehrswende* or *Mobilitätswende*, is highly contested, with varying conceptions of different actors about the future of mobility in Germany. A discourse network analysis (DNA) is performed to examine the development of the related policy debate, identify key problem and solution framings and analyse the overall discourse evolution from 2018 to mid-2023. The findings highlight how recent exogenous events shape and reframe the discourse, inciting debates around viable mobility futures. Further, our analysis uncovers a novel discursive strategy termed repugnant framing, through which incumbent actors aim to oppose the framings of other discursive agents, leading to increased lines of conflict and polarisation, thus possibly hindering effective policy implementation.

1. Introduction

Despite a broad understanding in Germany amongst politicians, industry actors, and the wider public that reducing transport-related emissions is urgently needed and legally justified, the transport sector's emissions continue to grow (UBA, 2022). In 2022, 68,4 million private cars populated German roads and cities, most of which were propelled by fossil fuel-powered internal combustion engines (ICEs) (KBA, 2022). Beyond its contribution to climate change, the unsustainability and persistence of a prevailing 'regime of automobility' in the face of massive social, environmental, and economic consequences make apparent the necessity of its fundamental transformation (Böhm et al., 2006; Paterson, 2007). In recent years, an intensifying debate around plausible and desirable futures for a *Mobilitätswende* or *Verkehrswende*¹ can be observed. Still, the future of the German mobility sector remains highly contested, with vastly varying conceptions of different actors regarding how a transition towards more sustainable mobility practices can occur and precisely what such a transition might entail (Ruhrt, 2023; Manderscheid, 2020). Literature portrays Germany's mobility future as dominated by incremental technology improvements and moderate shifts towards eco-friendly drivetrains, preserving the car's hegemonic status (Wentland, 2017; Haas, 2020; Manderscheid, 2020). However, mobility futures that would constitute a significant decline in the car's privileged position in the mobility system can be imagined (Hawxwell et al., 2024). Mobility futures that constitute wider-reaching

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E-mail addresses: sophie-marie.ertelt@oru.se (S.-M. Ertelt), tom.hawxwell@hcu-hamburg.de (T. Hawxwell).¹ Throughout the text, the German mobility transition is referred to by the term *Verkehrswende*; however, analytically, the related signifier *Mobilitätswende* and its varying meanings are also investigated.<https://doi.org/10.1016/j.eist.2025.100963>

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modal shifts, more profound spatial transformations, and broader cultural and political-economic changes are possible (Wentland, 2017; Haas, 2020; Manderscheid, 2020). The socio-material arrangements that would eventuate from the *Verkehrswende* hence will differ significantly depending on the extent to which particular imagined mobility futures emerge as dominant. Nevertheless, these mobility futures are largely still uniformly debated under one all-encompassing ‘transition’ signifier.

The word *Verkehrswende*, which signifies the urgently needed transition of the German mobility sector, can, therefore, be considered a floating signifier: a term that different discursive agents “struggle to invest with meaning in their own particular way” (Jørgensen and Philips, 2002, p. 28). Floating signifiers are effective mechanisms for coordination because different actors with potentially divergent interests can mobilise around a common concept. However, such floating signifiers are also susceptible to capture. Their lack of clear definition and lack of commonly agreed upon problem and solution framings allows actors with varying interests to challenge prevailing understandings and explore new ideas and practices (Christensen, Morsing and Thyssen, 2015). The German mobility transition, in particular, has become a discursive battleground (Rurhort, 2023), where varying actors with different vested interests jostle to impart their understanding of a mobility transition in the broader transportation policy arena (Haas, 2020). However, the investigation of different discursive strategies (Lee and Hess, 2019) that actors may utilise to influence transition discourse and the policy-making process (Rosenbloom et al., 2016; Kuokkanen et al., 2018; Markard et al., 2021) represents an emerging yet under-explored research topic. A systematic analysis of the competing content ascriptions to the floating signifier *Verkehrswende* is thus warranted to improve our understanding of how these discursive framing struggles may affect the directionality and speed of socio-technical change. Terms such as the ‘circular economy’ (Rödl et al., 2022; Niskanen et al., 2020), the ‘bioeconomy’ (Mijailoff and Burns, 2023), ‘sustainable development’ (Kögle and Kurze, 2013) or ‘frugal innovation’ (Tesfaye and Fougère, 2022) have previously been investigated through the lens of the floating signifier to better understand the ambiguity of these terms. However, enquiries into the notion of the ‘transition’ itself (e.g., energy transition, mobility transition, food transition) as floating signifiers, to the best of our knowledge, have not yet been done.

To address this gap, this study aims to increase the conceptual understanding of the functioning of floating signifiers in sustainability transitions by unpacking the discursive contestation and framing struggles around the German mobility transition, specifically by investigating how the term *Verkehrswende*—and the ideas transported through its use—is mobilised by different actors over time to promote varying mobility futures. Empirically, we draw on text data from German newspaper articles published between 2018 and mid-2023 to conduct a discourse network analysis (DNA). DNA is a mixed method approach wherein, as a first step, we performed a content analysis of selected newspaper articles to detect actor statements on the German mobility transition that were then aggregated into networks utilising social network analysis tools (Leifeld, 2016; 2017). Using DNA allowed us to examine the development of the public debate and its connected actor networks and thus draw insights into how these impact continuity and change (Eder, 2023). We focused primarily on three dimensions to examine key problem and solution framings within the evolving public discourse: (1) changes in framings of sustainable mobility over time and the events that influenced these changes, (2) the role of different actors, discursive strategies and coalitions in shaping mobility discourse, and (3) the dominance of certain framings that support specific mobility futures over time.

Our study makes three broad contributions: First, it showcases how the floating signifiers *Mobilitätswende* and *Verkehrswende*, embodying a myriad of evolving interpretations, play an important role in shaping the directionality of socio-technical change in the German mobility sector by representing a discursive platform upon which several mobility futures can be identified. Second, the study sheds light on the argumentative tactics of discursive agents in transitions by identifying two discursive strategies of actors, including polarising the discourse through repugnant framing storylines and strategic switching of discursive positions by actors to align with the changing discourse. Beyond the empirical case, we call attention to the ambiguous nature of floating signifiers within the discourse dynamics of transition processes by highlighting how they represent common terms that create grounds for consensus-building yet simultaneously pose the risk of strategic exploitation and can cause discursive fragmentation that might delay policy action.

The paper is structured as follows: Section 2 introduces our theoretical background, including relevant discourse analytical concepts for this study and presents a literature review of previous research on discourse in the German mobility sector. Section 3 presents the methodology and operationalisation of the DNA approach, followed by the results (Section 4), discussion and concluding remarks in Sections 5 and 6, respectively.

2. Theoretical background

2.1. Discursive framing struggles in sustainability transitions

Researchers aiming to better understand sustainability transitions have begun to pay more attention to the discursive dimensions of socio-technical change (Simoens et al., 2022; Rosenbloom, 2018; Geels, 2014). A discursive perspective acknowledges that public policy problems and potential solutions are socially constructed as actors participate in an argumentative exchange in which they continuously modify and adapt their problem and solution framings in response to actors with competing transition narratives (Späth, 2012; Rosenbloom et al., 2016). Sustainability transitions, therefore, can be conceptualised as evolving fields of discursive framing struggles of actors over desired future pathways (cf. Späth, 2012; Funke and Ruppert-Winkel, 2020; Markard et al., 2021). The power of discourse consequently lies in its ability to legitimise specific problem definitions and solution framings at the expense of others, and thus both enables and restricts action (Feindt and Oels, 2005). Therefore, by examining how problems and solutions are being framed and reframed by these different actors, discursive approaches can offer insights into the underlying dynamics that influence socio-technical change (Geels, 2014; Kuokkanen et al., 2018; Brugger and Henry, 2021).

Following Hajer (2006; p. 59–60), discourse is defined as “an ensemble of notions, ideas, concepts and categorisations through

which meaning is allocated to social and physical phenomena, and which is produced and reproduced in an identifiable set of practices". According to this view, discourse extends beyond language, including practices, assumptions and power relations that shape how issues are discussed and understood. To make sense of the role of discourse for stability and change, [Hajer \(1995\)](#) further differentiates between three forms of storylines, condensed statements of factual information intermixed with normative assumptions and value orientations that assign meaning to specific terms: (1) Dominant storylines, (2) marginal storylines and (3) radical storylines. Dominant storylines represent a particular meaning of an issue that prevails over other possible interpretations within a given societal context. Marginal storylines can be understood as those whose meaning systems do not diverge as significantly from the dominant storylines. The resulting interaction can potentially lead to shifts in understanding and changes in the configuration of a socio-technical system ([Simoens et al., 2022](#)). Radical storylines counter the dominant ones by proposing a significant departure from the status quo, which fundamentally challenges the assumptions, practices and power relations embedded in the dominant discourse ([Hajer, 1995](#)). However, these alternative storylines are subject to a "discursive dilemma" ([Hajer 1995](#), p. 57), as marginal storylines risk 'capture' if they align too closely with those terms of the dominant storylines while risking the loss of legitimacy altogether if they stray too far from these. Capture of potentially transformative storylines by dominant arrangements and the consequent incremental change has been identified as an important discursive lock-in undermining transformative change ([Simoens et al., 2022](#)).

As individual actors engage in meaning-making through discursive exchanges, discourse coalitions may form amongst actors that share similar views and common understandings of the issue at hand ([Hajer, 2006](#)) and try to leverage larger networks to create public acceptance of their preferred direction of socio-technical change ([Kuokkanen et al., 2018](#)). Discourse coalitions are actor configurations that repeatedly evoke a particular set of storylines ([Hajer, 1995](#)). Discourse coalitions seek to dominate the discourse by shaping a particular view of reality and, in turn, the policy-making process ([Hajer, 2006](#)). Meanings assigned to a signifier, such as the *Verkehrswende*, are thus neither neutral nor objective but are constructed based on different actors' views on reality, their interests ([Barnes and Hoerber, 2013](#)) and problem framings ([Benford and Snow, 2000](#)). If a signifier is articulated in several discursive formations, its discursive meaning gets blurred as it oscillates between different discursive contexts ([Barnes and Hoerber, 2013](#); [Mijailoff and Burns, 2023](#)). This is conceptualised as the *floating* of a signifier ([Jørgensen and Philips, 2002](#)). In this process of meaning-making, actors draw on different storylines and through these storylines, actors can frame how certain problems should be perceived and solved ([Smith and Kern, 2009](#)) and convince decision-makers of their favoured course of action ([Stone, 2001](#)). Storylines, thus, represent strategic tools that actors can evoke to give signifiers specific meanings, impact policy-making processes ([Hajer, 2006](#)) and, ultimately, influence the directionality of socio-technical change ([Rosenbloom et al., 2016](#); [Kuokkanen et al., 2018](#)).

During times of significant exogenous landscape developments, shocks, and societal or political shifts, floating signifiers often undergo rapid re-articulation as different actors struggle to impose their preferred meanings ([Hall, 1988](#); [Howarth et al., 2000](#); [Farkas and Schou, 2018](#)). Such specific, observable events where the established order is challenged, also referred to as critical moments, open up opportunities for discursive battles that can shift dominant storylines and alter socio-technical trajectories ([Hajer, 2009](#); [Yuana et al., 2020](#)). During such periods of intensified discursive struggles, actors may draw on various discursive strategies to frame issues and influence the meaning-making process ([Simoens and Leipold, 2021](#); [Rosenbloom et al., 2016](#)). Previously identified strategies in the transition literature include (1) diagnostic framing as attempts to define prevailing problems, (2) prognostic framing as attempts to propose solutions to such problems, (3) motivational framing including storylines that offer a rationale for action ([Geels 2014](#)), (4) delegitimising framing towards the dominant discourse and its proponents ([Markard et al., 2021](#); [Simoens and Leipold, 2021](#)) and (5) (re)legitimising framing to support the dominant discourse ([Markard et al., 2021](#)).

2.2. Discourse contestations around mobility futures for Germany

Although mobility futures are contested in (and beyond) any national context, the shaping of meaning around the mobility transition in Germany can be considered to be of particular interest because of the embeddedness of the automobile industry in the national economy. Germany is among the top three vehicle producers in the world, with an annual turnover of approximately €422.8 billion and 820,000 workers directly or indirectly employed in the German car manufacturing industry ([VDA, 2022](#)). The result is the presence of powerful actors with strong vested interests in particular mobility futures over others.

In recent years, the concept of the *Verkehrswende* has become a mainstream term in the German transport policy discourse and has been utilised by a broad range of different actors, such as political parties, NGOs or research institutes, to describe varying visions of how to transform the transport sector ([Ruhrtort, 2023](#)). The term embodies a transformation of transportation, advocating for systemic changes in transport infrastructure, policies and technologies towards more sustainable, efficient and environmentally friendly modes ([Canzler et al., 2018](#)). It emerged in response to the environmental movements of the 1960s and 70s, initially suggesting a shift from car dependency towards active forms of mobility and public transport ([Urry, 2004](#)). While the compound noun is frequently translated to 'mobility transition', its direct translation, 'mobility turnaround',² gives a better understanding of the required departure from the prevailing arrangements of the car-centric mobility regime ([Haas, 2020](#)). In parallel with the emergence and growing importance of the field of mobility studies, a second term, *Mobilitätswende*, has become more commonly utilised, reflecting a paradigm shift away from the vehicle-centric notion of 'transport' to a more human-centric notion of 'mobility', combined with a deeper appreciation of the social, cultural, ecological and behavioural aspects associated with (non-)movement ([Sheller and Urry, 2006](#); [Banister, 2008](#); [K.](#)

² Others have translated '-wende' this way. As 'turnaround' is not commonly referred to in the English language in reference to changes in socio-technical systems and because the terms 'Mobilitätswende' and 'mobility transition' perform essentially the same function in their respective languages, we see '-transition' as a more suitable translation.

Manderscheid, 2022). However, the two terms are frequently used interchangeably (Manderscheid, 2020; 2022), and the signalling of change is inherently embedded in both terms. Which dimensions of socio-technical change (technological, behavioural, political-economic, cultural, etc.) will manifest as the promised ‘mobility transition’ nonetheless remains contested and likely dependent to some extent on which meanings of the signifier *Verkehrs- or Mobilitätswende* will become fixed.

Recent academic work on the *Verkehrswende* has been important for highlighting the spectrum of mobility futures deemed plausible within prevailing discourses. Manderscheid (2020) differentiates between three types (or extents) of change to the mobility system. According to the first (*Antriebswende*), changes are mainly limited to the technology that propels the vehicle (such as through a replacement of ICE with electric drive-trains). According to the second (*Verkehrswende*), the envisioned changes would include broader shifts in transport modes, such as through a replacement of trips by car with more sustainable modes such as cycling and public transportation. The third (*Mobilitätswende*) envisions more radical changes in movement patterns as people might travel less (such as through the substitution of physical with virtual meetings or even through having the freedom to be less mobile). All these envisioned futures would have to be accompanied by changes to the wider material, institutional and cultural contexts that would make such shifts in everyday mobility practices possible.

Haas (2020, 2021) develops a similar differentiation from a political-economic perspective, demonstrating how the respective plausible mobility futures are not politically neutral and that powerful actors will have an interest in particular futures over others. He highlights how activities conducted in the name of the *Verkehrswende* tend to reinforce the prevailing hegemonic status of the automobile and allow for the capture of attempts at its transformation by powerful industry actors. The articulated mobility futures for the German regime of (auto)mobility thus limit the *Verkehrswende* to incremental improvements of existing technologies and the “renewal of car hegemony” through electrification (Haas, 2020). Similar observations have been made elsewhere, referring to *rearticulating the old promise* (Wentland, 2017) as narrow ecological modernisation through the uptake of post-fossil drivetrains.

However, the renewal of car hegemony is not inevitable. Futures that decentre the car have also been articulated. Such futures could include a detachment from status expressions through individual car ownership, a shift away from private car ownership, a wide-reaching redefinition of the mobile subject (Wentland, 2017), and a radical reduction of car traffic in cities (Haas, 2020). Those mobility futures also entail a move towards a more just and equity-informed mobility regime (Wentland, 2017; Haas, 2020; Manderscheid, 2020). Table 1 offers an attempt to synthesise these different possible mobility futures. These different typologies help orientate plausible mobility futures through the articulation of potential trajectories of a mobility transition in Germany.

As seen in Table 1, the articulation of such varying meanings of the *Verkehrswende*, each underpinned by different assumptions and values, not only draws attention to the polysemous nature of the German mobility transition but also reveals how deeply the term has

Table 1
Articulated possible mobility futures in the literature.

	Name and author	Description of articulated mobility future
Car continuity	<i>Antriebswende</i> (Manderscheid, 2020)	Decarbonisation of the automobility regime through substitution of propulsion technologies (predominantly electrification). Adjustments needed to the urban built environment are in the realm of public and private charging infrastructure. Urban issues such as traffic congestion and space constraints remain unaddressed.
	Rearticulating the old promise (Wentland, 2017)	EVs are perceived to be inferior to their ICE counterparts. Focus on incremental improvements to existing technologies and vehicle designs that deviate as little as possible from the dominant artefact.
	Renewal of car hegemony (Haas, 2020)	Continuous renewal of the symbolic significance of the car. Slow shift to battery electric vehicles Continuous renewal of the symbolic significance of the car
Modal transition	<i>Verkehrswende</i> (Manderscheid, 2020)	Increasing intermodality yet still car-dominated regime Intermodality and sharing as the new central paradigms. Clear modal shift away from car-centric forms of mobility. Focuses on a modal shift in favour of public transport, cycling and walking and related infrastructure.
	Moderate <i>Verkehrswende</i> (Haas, 2020)	Restricted car use in cities. Expansion of low-carbon infrastructures. Modal shift in favour of public transport, cycling and walking. Mobility services such as car sharing powered by digital technology Clear modal shift away from car-centric forms of mobility.
Mobility transformation	<i>Mobilitätswende</i> (Manderscheid, 2020)	Emphasises a broader understanding of mobility and extends beyond the physical movement of people and goods on the roads to include social and spatial implications. Clear departure from car-centric forms of mobility.
	Redefining the citizenship of mobility (Wentland, 2017)	Detaching the car from the perception of socioeconomic achievement Shift away from private ownership of cars. Sharing through new forms of digital mobility as the central paradigm. Fully Electrified but mostly car-free cities. Strong focus on social inclusiveness.
	Radical <i>Verkehrswende</i> /car-free society (Haas, 2020)	Marginalisation of cars that promotes a shift away from private car ownership. Degrowth of the transportation system (<i>Verkehrswende</i> as an element of a socio-ecological transformation). Commoning of transportation.

become entangled with broader power struggles. Different actors, ranging from policymakers, the automotive industry, and environmental organisations to urban planners and citizen movements, vie to inscribe their preferred meaning into the signifier to steer the *Verkehrswende* towards a desired mobility future that serves different (both more private and more collective) interests to different extents (Ruhrt, 2023). While each author considers possible mobility futures through different theoretical lenses, their analyses collectively address diverse dimensions of these futures, including economic, technological, and social implications, as well as those pertaining to the built environment. Despite their distinct perspectives, as demonstrated in Table 1, there is considerable overlap in their typologies, highlighting common themes in the articulated mobility futures.

To generate an in-depth understanding of how varying ascriptions of meaning to the floating signifier *Verkehrswende* may result in the articulation of vastly different mobility futures, we, therefore, propose three overarching analytical categories aimed at capturing the level of transformative impact and deviation from prevailing arrangements. We refer to these as ‘car continuity’, ‘modal transition’ and ‘mobility transformation’ (see Table 1). It becomes clear that the *Verkehrswende* is floating between multifaceted interpretations of possible mobility futures, and analysing it provides valuable insight into the contested nature of sustainability transitions and the role of discourse and meaning-making in shaping these processes. Consequently, our research contributes by investigating how a transition-related term may act as a floating signifier by analysing the emerging and shifting framings of the *Verkehrswende* in German public discourse. It covers three different analytical dimensions of the discourse developments on the German mobility sector, each with related research questions.

- (1) Evolving content of the discourse. What interpretative problem and solution frames about the conceptions of a sustainable mobility transition have emerged, and how have these changed over time in relation to different events? To answer this research question, we identify the key problem and solution framings and their related mobility futures in the German mobility discourse, map their evolution and consider the events that influenced these changes.
- (2) Actors, discursive strategies and coalitions. Different societal actors have vastly differing power to shape transition narratives (Beck et al., 2021; Simoens et al., 2022) and may form coalitions over particular problem and solution framings and, thus, discursively seek to promote, from their standpoint, desirable future pathways (Markard et al., 2021; Ohlendorf et al., 2023). We, therefore, investigate how varying actors shape the mobility discourse through different strategies and the extent to which associated discourse coalitions can be identified based on shared framings over possible mobility futures. We thus also respond to the question: Who participates in the German sustainable mobility transition discourse, and to what extent can coalitions around shared problem and solution framings be identified?
- (3) Discourse structuration and discursive closure. To what extent do specific framings dominate during certain points in time? Previous policy discourse studies have highlighted the role of discursive closure - the reinforcement of a particular problem and solution-framing storylines in the discourse that manifests in concrete political action (Barnes and Hoerber, 2013; Markard et al., 2021). Hence, we examine how the structure of the discourse networks evolves, if a mutual alignment of problem and solution framings can be observed amongst actors and if certain conceptions of desired mobility futures become dominant or polarisation occurs.

3. Methods

3.1. Data sources, article selection and time sequences

To investigate what different problem and solution framings can be ascribed to the signifier *Verkehrswende*, our analysis draws on German newspapers as a data source. Newspapers have previously been acknowledged as a reliable source to map changes in the wider public discourse (Markard et al., 2021), particularly because, compared to policy documents, they capture a broader range of actors participating in a political debate (Leifeld, 2013). The national daily editions of *Süddeutsche Zeitung* (SZ), *Die Welt*, and the weekly national edition of *Die Zeit* were selected as outlets for the data collection. SZ is known for its centre-left editorial stance, while *Die Welt* has a centre-right orientation, and *Die Zeit* can be considered a somewhat centrist publication (Kranert, 2020; Wallaschek et al., 2023; Secen, 2022). Together, SZ and *Die Welt* represent two of the most circulated daily newspapers in Germany, and *Die Zeit* is Germany’s most-sold weekly newspaper (Statista, 2021, 2022). Consequently, drawing on these three newspapers allowed for the development of an ideologically balanced data set whilst capturing the mainstream public discourse.

Articles of the respective outlets were accessed through the LexisNexis database (*Die Zeit & Die Welt*) and the SZ Archive (<https://archiv.szarchiv.de>). The search strategy to identify relevant articles was developed inductively through experimentation with different keywords and keyword combinations over different periods by both authors and was refined iteratively. Table 2 lists our final search string used to identify articles during a period of increased discursive debates on the directionality of the German mobility transition starting from the year 2018. This year can be considered significant because the German government introduced the first sectoral climate change mitigation goals, thus marking a pivotal shift in policy that sparked intensified discursive debates around plausible mobility futures for the country. Focusing on this year, hence, allowed our analysis to capture the critical moment when these discursive struggles gained prominence. After removing doubles and false positives, as well as applying a range of selection criteria (see Table 2), our final data set comprised 456 articles.

Following Belova et al. (2023), we utilised a discourse sequencing approach. This approach offers several advantages over previous studies that focus on synchronic analyses (cf. Ohlendorf et al., 2023). First, it enabled us to trace the temporal development of the discourse, revealing how the meanings of the *Verkehrswende* and related storylines developed and changed in response to different events. It also enabled a comparative analysis of the evolution of the discourse. Second, it allowed for the identification of such events

Table 2
Overview of the search parameters for the text corpus creation.

Sources	Period	Search String	Selection Criteria
SZ Archive (<i>Süddeutsche Zeitung</i>) LexisNexis (<i>Die Welt & Zeit</i>)	Jan. 2018-until Aug. 2023	Verkehrswende* OR Mobilitätswende*	<ul style="list-style-type: none"> - Print articles only - Keywords in text or title - ≥ 300 words - Must contain at least one full sentence of relevance - Must refer to Germany - Must allow for a clear identification of a relevant actor
		$n = 1114$ (SZ 593, Welt 361, Zeit 160)	$n = 456$ (SZ 211, Welt 183, Zeit 62)

(i.e., critical moments) and helped better understand their impact by providing insights into how they influenced policy debates. Sequencing, thus, contextualised discourse content regarding political, societal, and economic circumstances, avoiding misinterpretations of discourse evolution as static conflicts (Belova et al., 2023). Based on our initial screening and subsequent coding of the articles, we identified the Corona pandemic as a critical event that significantly influenced the discourse around the *Verkehrswende*. Consequently, we divided our analysis into three phases: pre-COVID (2018–2019), COVID (2020–2021), and post-COVID (2022–mid-2023). However, within each phase, we further identified several other events that influenced the meaning-making around plausible mobility futures in Germany, and these are elaborated in Section 4.1.

3.2. Discourse network analysis

For the data analysis, this study employed the discourse network analysis (DNA) (Leifeld, 2009; 2017) approach, which examines actor-based debates in policy discourse and generates relational data on actors with congruent arguments or policy stances over time. The method has been previously applied in transition studies to investigate public policy debates (Schmidt et al., 2019; Schmid et al., 2020), explore discourse coalitions around the German coal phase-out (Markard et al., 2021) as well as lines of discursive conflict (Ohlendorf et al., 2023) and the evolution of the discourse structure (Belova et al., 2023) in the German hydrogen debate.

As a first step, the application of DNA and subsequent content analysis of selected text material required the set-up of a coding scheme for the following variables: (1) specific storyline(s) revealed in a statement and (2) name and potential organisational affiliation of the actor making the statement. Storylines in a statement are analysed based on their problem framing: what actors perceive as the problem that the *Verkehrswende* must address, and their solution framing: how actors envision a sustainable mobility transition and which solutions the *Verkehrswende* should involve (Geels, 2014). Thus, unlike some previous DNA studies in transition research (cf., Markard et al., 2021; Ohlendorf et al., 2023), our coding framework did not focus on specific storylines that represented points of controversy or conflict. The aim of developing our coding framework was instead to capture the ongoing discursive framing struggles around the German mobility transition in their entirety to be able to systematise patterns of discursive evolution (Buckton et al., 2019).

The coding scheme was developed by randomly selecting 10 % of articles and independently eliciting problem and solution-framing storylines and actor categorisations. The coding scheme was developed following an abductive approach and iteratively refined based on the text data, emerging storyline patterns, and existing work on the German mobility sector and previously outlined possible mobility futures. Identified storylines could consist of one or multiple sentences, and in the case of long paragraphs that covered several problem and solution frames, the different storylines were coded separately. After this first round of coding, the authors compared and discussed their identified storylines and actor categorisations to establish an initial coding scheme, which was then applied to the entire data set with equal coding contributions from both authors.³⁴ Inter-coder reliability was ensured through frequent meetings and iterative adjustments to the coding scheme.

Once the coding process was completed, the resulting structured data set was exported into a social-network mapping software⁵ to visualise the discursive framing struggles and related actor coalitions and their evolution over time through network graphs. To focus the networks on the most relevant aspects of our analysis, we excluded storylines that were only evoked once and did not visualise actors that made less than three statements during any of the three time periods. To systematise the analysis, further structured data sets were created that grouped the storylines into one of the three possible mobility futures categories (i.e., ‘car continuity’, ‘modal transition’, ‘mobility transformation’) previously proposed based on the literature review in Section 2.2. Accordingly, Fig. 1 shows a classification tree based on which the different problem solution and repugnostic storylines were allocated to the different mobility futures. However, it is worth noting that overlap between the three classifications exists. For example, concerns about the negative impact of the prevailing regime on climate change are present in all three futures, and both the ‘modal transition’ and ‘mobility

³ Following (Miörner et al., 2022), the developing data set data was exported several times into social network software to generate network visualisations of the emerging affiliation and congruence networks around different discursive meanings of the *Verkehrswende* to receive feedback on the coding scheme.

⁴ All articles were manually coded using the qualitative data analysis software MAXQDA.

⁵ For data visualisation and network analysis, both Visone & Kumu were utilised.

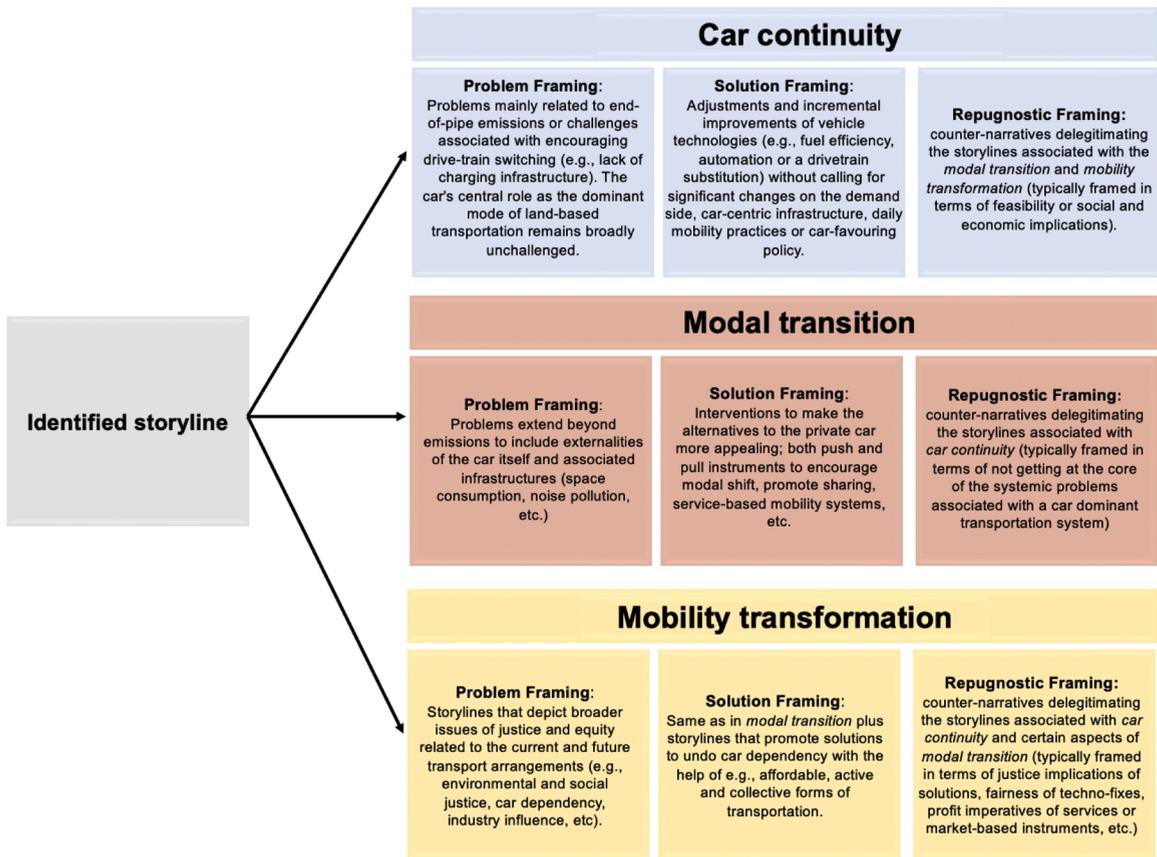


Fig. 1. Storyline allocation tree for different mobility futures in the analysis.

transformation' include storylines that promote alternative forms of mobility such as cycling or public transport.⁶

As seen in Fig. 2, DNA can be used to produce congruence networks in which actors are connected through the shared use of storylines and actor-concept networks that visualise the relationship between actors and storylines by connecting the former with the latter. We first generated both congruence and actor-concept networks for each time phase to gain an understanding of the overall discourse structure, its evolution, which actors promote which storylines and potential discourse coalitions. For the three mobility futures across the different time phases, only congruence networks were created.

Lastly, we employed Social Network analytical measures (Leifeld, 2017) to investigate the evolution and structuration of networks from 2018 to 2023. Beyond identifying top discursive agents and storylines for each of the three periods, we focused on potential discourse coalitions, clusters of nodes in congruence networks that are more densely connected due to shared storylines. However, the core-periphery structure typical in congruence networks, characterized by central actors with high discursive engagement, such as government bodies and political parties (Leifeld, 2017), complicated the identification of such coalitions. To address this, we corrected for potential biases by adjusting edge weights (Markard et al., 2021; Ohlendorf et al., 2023), employed a backbone visualisation algorithm⁷ to highlight significant connections, and applied the Louvain clustering algorithm to detect clusters within the resulting networks (Leifeld, 2017; Blondel et al., 2008). While Louvain clustering provided modular groupings, interpreting these clusters required a qualitative analysis, we thus systematically reviewed the associated storylines to identify recurring framings that aligned actors within the same coalition. We reflect on the implications of our approach in Section 5.3.

In addition, we analysed the congruence networks for ideational congruence, assessing how many actors used shared storylines to gauge discursive closure within each network. Following Markard et al. (2021) and Brugger and Henry (2021), we used network density as an indicator, with higher density scores reflecting greater congruence in storyline usage. To account for differences in network size across phases and mobility futures, density scores were normalised. To further examine polarisation within the networks, we combined network diameter, which measures the maximum distance between nodes, with average path lengths, providing insights into actor separation and interconnection (Yang et al., 2016). A shorter average path length indicated stronger interconnection

⁶ A full classification table can be found in Appendix I.

⁷ For the backbone strength, we used non-parametric redundancy which does not rely on predefined thresholds, thus minimising the risk to introduce bias.

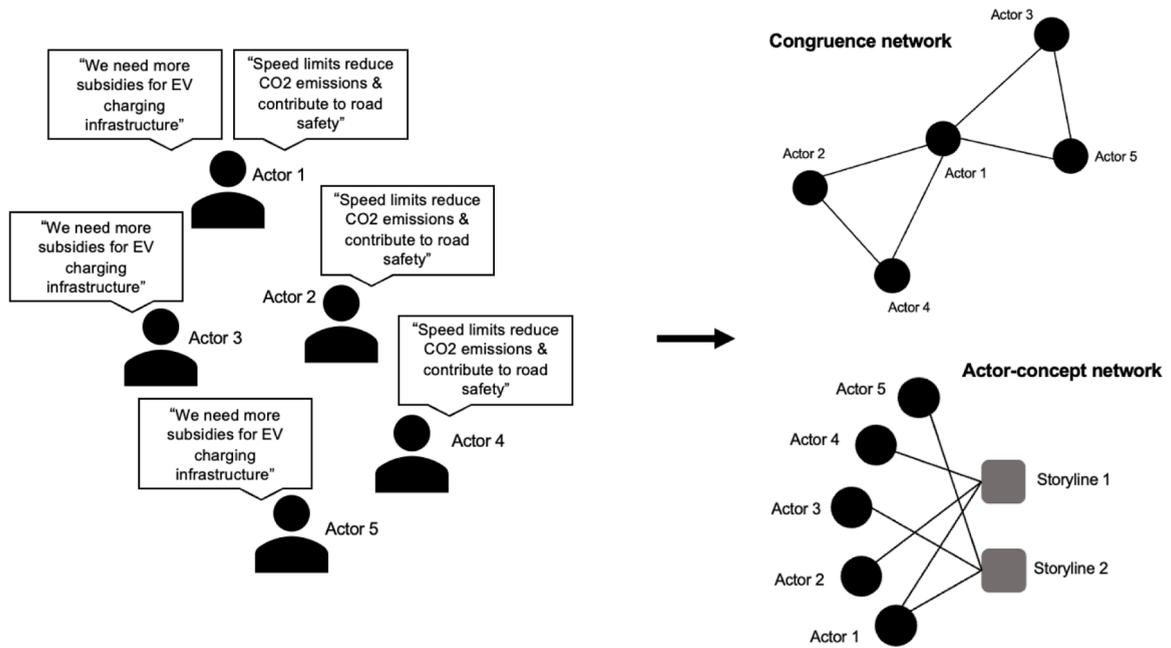


Fig. 2. On the left, actors evoke a certain storyline in the discourse. On the top right, based on the analysis of the shared storylines amongst actors, congruence networks can be visualised in which actors are connected with other actors based on their use of the same storylines. On the bottom right, actor-concept networks can be visualised in which actors are connected to the storylines they draw upon.

through shared storylines, whereas a longer one suggested greater separation, thus highlighting polarisation tendencies. By considering both measures, we ensured a balanced understanding of polarisation, accounting for both storyline separation and overall interconnectedness through shared storylines among actors in congruence networks.

Moreover, degree centrality, measuring the extent to which actors connect through shared storylines, was used to reveal actor influence in congruence networks (Eder, 2023; Brugger and Henry, 2021). In our analysis a higher centrality indicates greater influence, as actors with more connections evoke more shared storylines. was used for both actors and storylines, indicating how many storylines an actor is connected to and how many actors discuss a particular storyline. A higher degree of centrality suggests that a storyline is more frequently drawn upon and thus has higher support (Brugger and Henry, 2021). Lastly, average degree, representing the mean number of shared storylines per actor, was also used as an indication of the presence of influential actors in congruence networks (Yang et al., 2016). Table 3 sums up all network and node-level measures employed and their interpretations in this study.

4. Results and analysis

4.1. Evolution of problem and solution framings in the German mobility transition discourse

In analysing 406 newspaper articles, over 4000 passages were coded. The term *Verkehrswende* was invoked 576 times, while *Mobilitätswende* was referred to 159 times by discursive agents when making statements about Germany's mobility transition. Across all three periods, 17 problem-framing storylines and 46 solution-framing storylines were identified, thus giving a first indication that the discursive framing struggles around the *Verkehrswende* predominantly occurred over *how* a sustainable mobility transition may be brought about and *what* concrete solutions (i.e., technologies and policies) such a transition should entail. Additionally, the period 2022–2023, in particular, sees the emergence of a novel discursive strategy that cannot be categorised under diagnostic or prognostic framing (as defined by Geels, 2014). Instead, these actor statements in the discourse are aimed at pointing out potential flaws, questioning feasibility or disputing the perceived benefits of proposed solutions of other discursive agents. Therefore, we refer to this as repugnostic-framing (Latin for fight back, oppose), and 28 were identified over the analysis. This framing builds upon the previously expressed characteristics of delegitimising framings (cf. Markard et al., 2021) but evolves into a more targeted and confrontational discursive strategy. While delegitimising framings broadly undermine the legitimacy of a policy or technology by highlighting its flaws or contradictions, repugnostic framing directly opposes specific solutions to address identified problems, portraying them as fundamentally undesirable or harmful. This distinction reflects an intensification of conflict, where discursive agents perceive immediate threats posed by concrete solutions and escalate (discursive) opposition accordingly. The number of evoked storylines increased from period to period from 2018–19 (38), 2020–21 (49) and 2022–23 (58), which has led to the presence of a large variety of different problem, solution and repugnostic framings around the German mobility transition. Fig. 3 illustrates the overall evolution of the share of the three different framings throughout the three time periods and highlights that while the number of evoked solution-framing storylines remained relatively stable over time, the number of problem-framing storylines declined throughout and is surpassed by

Table 3
SNA measures and our interpretations of them in the analysis.

Network level measures	Interpretation	Node level measures	Interpretation
Network Density	Ideational congruence (Congruence networks)	Degree centrality	Influence of actors (Congruence networks) Level of support for a specific storyline (Actor-concept networks)
Louvain clustering algorithm	Identification of potential discourse coalitions (Congruence networks)	Average degree	Number of influential actors present in the network (Congruence networks)
Network Diameter+Average path length	Degree of polarisation in evoked storylines (Congruence networks)		

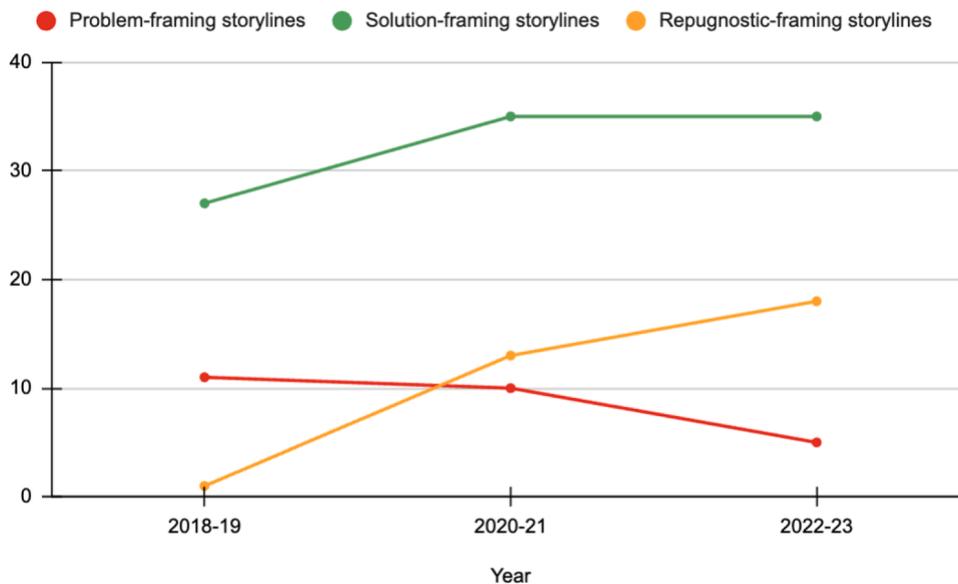


Fig. 3. Share of different framings throughout the three periods.

a rise in repugnostic-framing storylines.

Table 4 gives an overview of the condensed storylines. Where multiple similar storylines exist, aggregated themes are listed (text in italics), and the number of storylines for each theme is indicated in brackets.⁸

Comparing the discourse content and the prominent storylines across the three phases, the COVID-19 pandemic can clearly be identified as a pivotal event that influenced the evolution of the discourse and consequently, the meaning-making around the floating signifier *Verkehrswende* has become subject to change and contestation over time. For example, in the COVID-19 pandemic phase (2020–2021), the dominant storylines that legitimised the hegemonic status of the automobile were initially strengthened as cars represented a ‘safe space’. *To avoid infection, people might think it is much safer to sit alone in their own car than to take a crowded subway – Knie, mobility researcher. (Die Welt, 2020)*. Nonetheless, during this phase, the lockdowns also led to a redistribution of urban spaces, such as parking lots, in favour of, for example, distanced outdoor restaurant seatings and re-dedicating car lanes to active transport modalities such as pop-up cycling lanes. *It was a simple administrative act, implemented overnight; the bike paths were already planned. All it took was a little yellow paint and traffic cones – it might not look pretty; however, it is very low cost and can be actualised in no time. Berlin’s cyclists finally have the space they deserve – Hermann, Green Party member (Die Zeit, 2020)*. These developments gave rise to a broader debate around mobility sufficiency, avoiding unnecessary trips and reclaiming the spaces occupied by cars, catalysing an increase in storylines around a more fundamental transformation of the prevailing (auto)mobility regime in the following phase (2022–mid2023).

However, a range of other political, societal, and economic events that shaped the discourse around the *Verkehrswende* can also be identified. Fig. 4 shows an overview of these events derived through the initial content analysis of the newspaper articles.

The pre-COVID period (2018–2019) was marked by a significant focus on legislative and regulatory actions: The introduction of the “Federal Climate Change Act” and the “NOx Emission Regulation” of the European Union highlighted the need for stricter environmental standards, leading to the prominence of storylines that problematised local air pollution and the adverse effects of a car-centric mobility system on climate change. The diesel driving bans (“*Diesel-Urteil*”) that restricted diesel vehicle usage in certain urban areas to

⁸ A full list of all problem, solution and repugnostic-framing storylines of this study with illustrative text examples can be found in Appendix II.

Table 4
Storyline overview.

Problem-framing storylines	Solution-framing storylines	Repugnostic-framing storylines
<i>Required advancement of economic structures</i> (3) Local air pollution is not a problem Traffic congestion Carbon emissions and climate change Human health and safety Local air pollution Noise pollution <i>Negative effects of the rising stock of passenger vehicles</i> (45) High attractiveness of passenger car ownership <i>Need for a fair allocation of resources across mobility modes</i> (3)	<i>Fuel source switch</i> (7) Optimised vehicles and incremental improvements to ICE Optimise existing and build new car infrastructure Autonomous vehicles <i>Policy measures and initiatives to support EV deployment</i> (53) Clear political direction on the federal level EU ETS Electric vehicles (EVs) <i>Low and zero-emission mobility modes (excluding EVs)</i> (45) <i>Low and zero-emission mobility infrastructure (excluding EVs)</i> (2) <i>Measures to encourage a modal shift</i> (5) <i>Policy measures to support EV deployment</i> (5) <i>Policy measures and initiatives to reduce car fleet size in cities</i> (4) More sharing and less ownership Reduce car dependence Speed Limits Redistribute urban space <i>Low and zero-emission mobility modes (excluding EVs)</i> (4) <i>Policy measures and initiatives to reduce car ownership</i> (4) <i>Policy measures and initiatives to encourage & enable a modal shift</i> (75) Increased transport equity Integrate private mobility service providers into public transport Low-car and car-free cities Strassenverkehrsordnung (German general traffic law) must change	No CO2 tax <i>Cities should remain accessible to all cars</i> (2) No ICE ban No Speed Limits <i>Economic concerns with EVs</i> (3) Transition should not be a war on cars Freedom of mobility must be sustained Cars are the symbol of individuality & freedom Do not build new car infrastructure No E-fuels for cars Only subsidies for EV company cars CO2 price leads to justice problems CO2 price mechanism is not enough <i>Cutting tax privileges and incentives for cars</i> (5) Fuel-source switch is no transition <i>Resource and justice concerns of EVs</i> (2)

improve air quality highlighted the need for cleaner mobility alternatives. Concurrently, the founding of the National Platform Future of Mobility by the German government aimed to reduce transport emissions, and the increased production and marked availability of German EVs prompted the prominence of storylines advocating for a drivetrain transition in the form of EVs. However, the rise of the Fridays for Future movement further brought climate issues and the (auto)mobility regime to the forefront of the discourse and highlighted alternative storylines such as cycling and modal shifts. The latter was strengthened by micro-mobility developments in this period, such as the introduction of e-scooter-sharing services in German cities.

In the post-COVID phase (2022 until mid-2023), the discourse diversified with new storylines emerging from a change in government, which brought about new legislative actions, including phasing out EV subsidies and delaying the vote on banning ICE vehicles, which influenced the reduced emphasis on environmental and climate change related storylines. However, there was a notable rise in storylines opposing the building of new car infrastructure and advocating for low-car and car-free cities, driven by the success of urban mobility experiments, such as pop-up bike lanes and pedestrian zones, implemented during the pandemic phase (2020–2021). The geopolitical crisis caused by Russia's invasion of Ukraine further exposed the automobility regime's unsustainability, particularly concerning energy dependence. *Hundreds of millions of dollars are flowing to Putin for gasoline every day. This money directly finances a large part of his war – Reemtsma, climate activist (Die Zeit, 2022)*. The introduction of a nationwide valid flat-rate public transport ticket, the 9€ ticket, as a response to hamper the socio-economic impact of the war and its successor, the 49€ ticket, propelled by debates around transport equity and the cost of mobility. Fig. 5 provides an overview of the most frequently coded storylines across these periods, showing changes in the deployed storylines across the investigated periods.

4.2. Actors, coalitions and discursive strategies in the mobility discourse

The analysis encompassed 181 discursive agents from diverse social backgrounds. To facilitate a better overview, individual actors were aggregated into an actor group, namely national (Federal) and state (*Länder*) governments, industry actors, actors from scientific institutions or think tanks, NGOs and industry associations and lobbies.⁹ As seen in Fig. 6, the dynamic of the discourse around the German mobility transition has fluctuated across different actors and periods, with the federal and state governments, industry and science and think tanks representing the most active actor groups, while the participation of industry associations and lobbies and NGOs varied across the analysed periods.

Initially, the public debate was dominated by politicians at the national government level. However, this dynamic experienced a

⁹ A full list of all identified actors and corresponding groups can be found in [Appendix III](#).

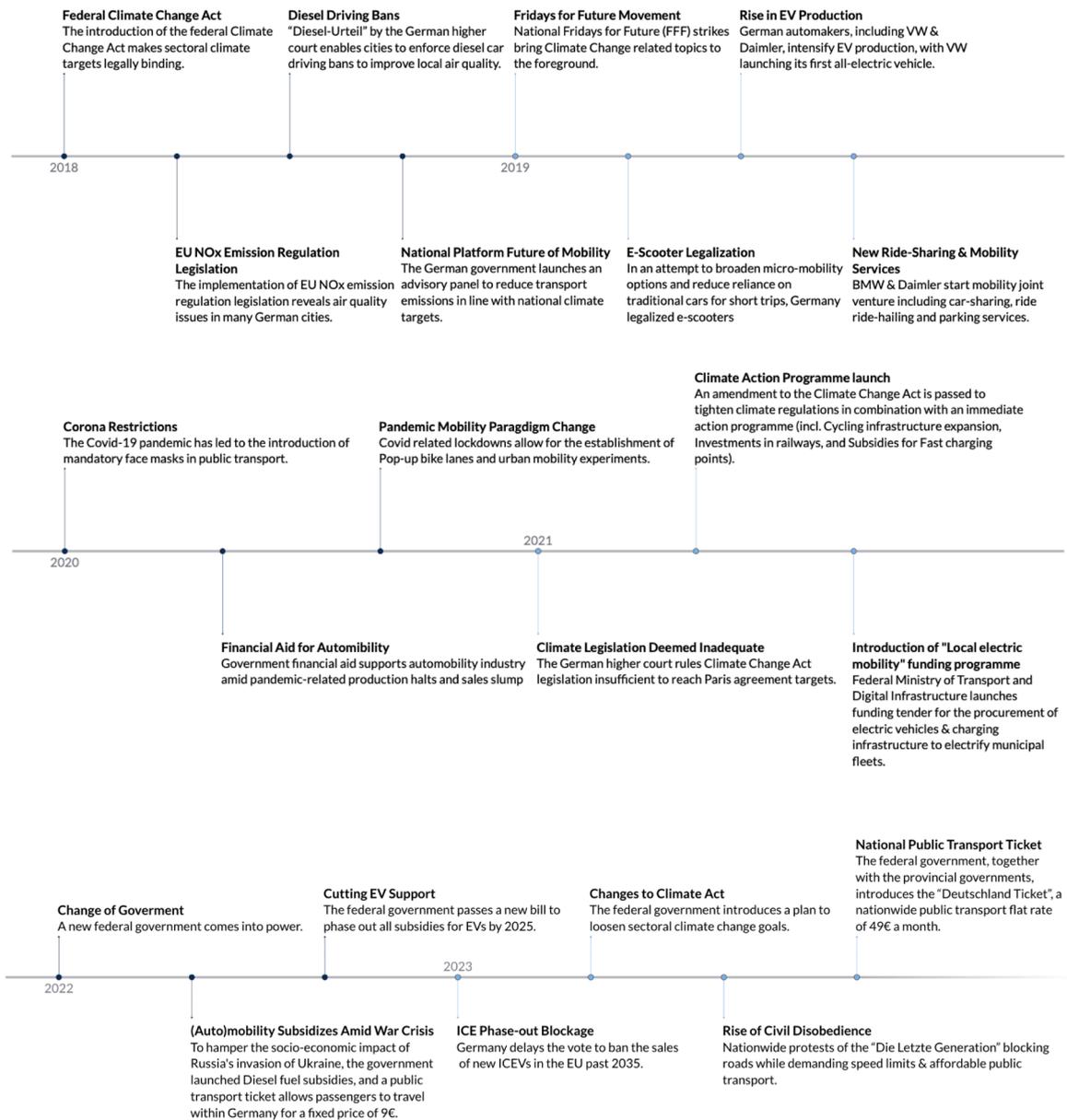


Fig. 4. Critical events in Germany that affected the transport sector from 2018–mid-2023.

shift in the subsequent period during the COVID-19 pandemic, with state politicians and industry actors increasing their discursive engagements. This shift likely reflects the decentralised nature of pandemic responses in Germany, where Länder governments took on greater responsibility for localised mobility measures and pandemic management. Simultaneously, actors representing industry associations and lobbies increase their engagement substantially. For instance, industry associations like the VDA intensified their efforts to secure financial support and policy commitments, framing the automotive sector as essential to economic recovery. During the most recent period, national politicians regained some of their initial prominence, while provincial politicians remained active in the discourse and industry actors were less engaged. After a phase of notably diminished participation, NGO actors experienced a resurgence in activity in the last period. Actors affiliated with scientific institutions or think tanks maintained a relatively steady level of engagement.

Fig. 7 shows the full actor congruence network graphs (all positive congruence) for all three periods. Different types of discursive agents (nodes) are depicted through different shapes and colours. The connections (edges) represent shared storylines, and the node size indicates an actor's influence level in the network based on degree centrality. The congruence networks reveal that the discourse around the *Verkehrswende* is not very stable over time, as the changing shapes of the graphs suggest (see Fig. 7). In addition, the number of actors and their positioning and the number of connections change dynamically from period to period. Further, across all three

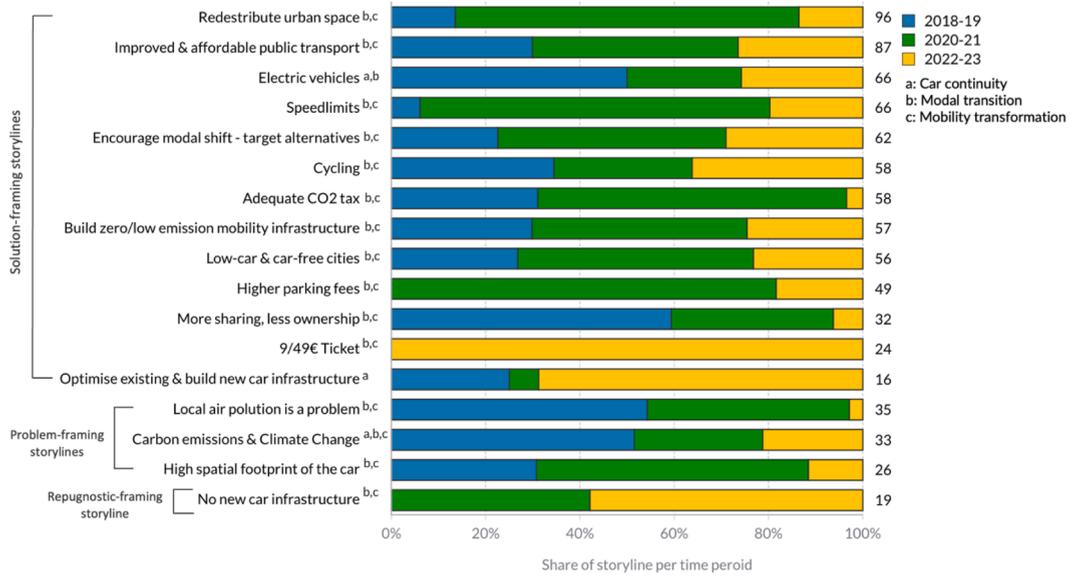


Fig. 5. Top-coded storylines across the three periods. The total coding frequency of each storyline can be seen next to the bar.

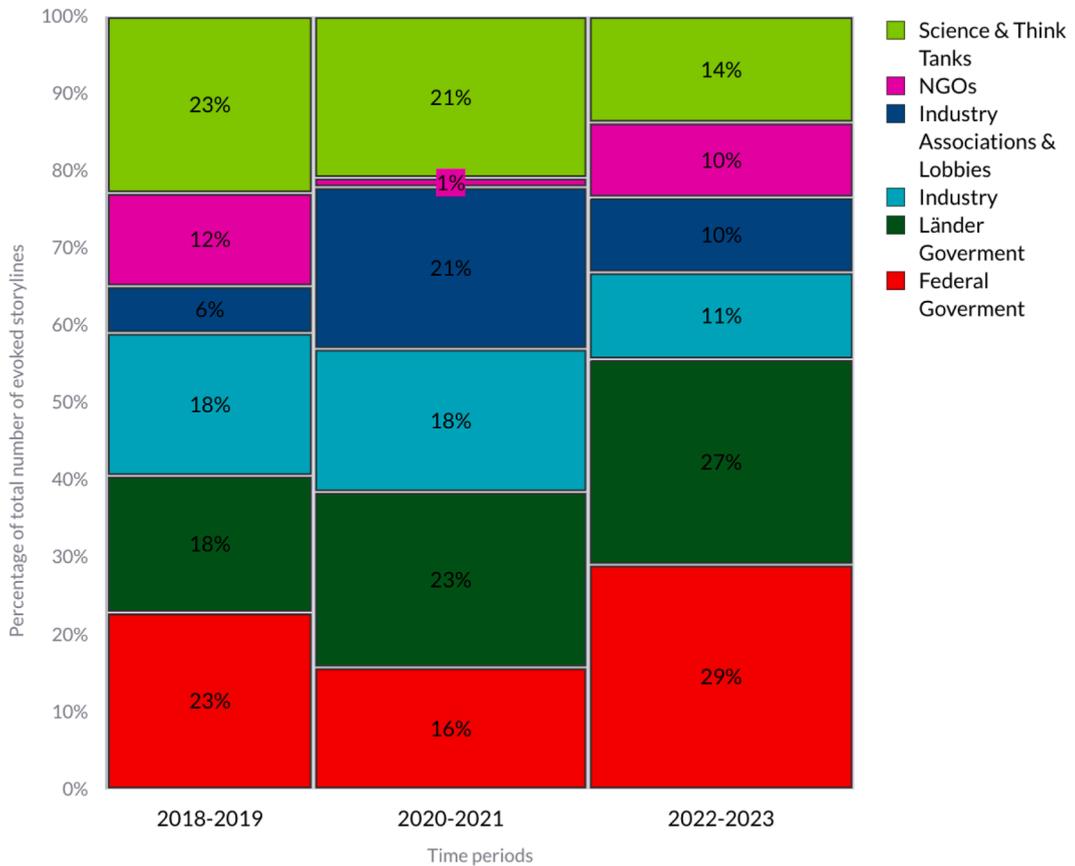


Fig. 6. Number of storylines evoked by shares of actors grouped across the three time periods.

periods, discursive agents of the same type, such as science & think tanks (light green), the federal government (red) and industry actors (blue), tend to form clusters of the same actor types as they are frequently drawing on the same storylines.

Next, for the analysis of potential discourse coalitions, actor congruence networks that focus only on structurally important ties

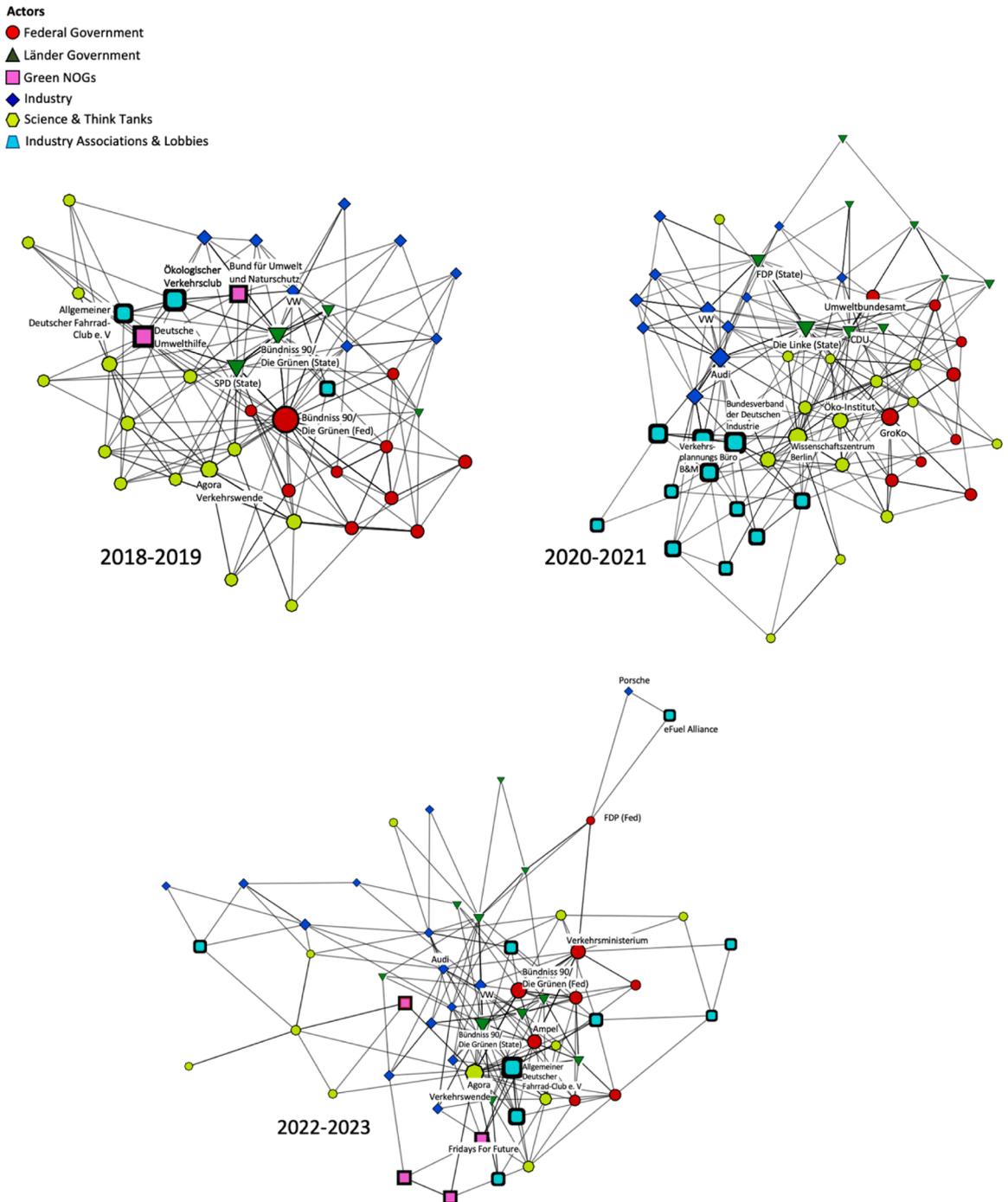


Fig. 7. Full actor congruence networks of 2018–2019, 2020–21 & 2022–2023. The size of the actor nodes is based on degree centrality.

were visualised for each time frame. Fig. 8 illustrates these networks organised by clusters for each period. Taking a closer look at the structural properties of these networks for 2018–2019, the graph displays four distinct discourse coalitions. However, the proximity of clusters and the substantial overlap between them imply that while distinct coalitions exist, there is considerable shared use of storylines within the discourse around the *Verkehrswende*. In 2021–2022, the network expands to five coalitions and exhibits significantly less overlap between coalitions. The network structure for this period reflects a shift from a broader alignment on problem and initial solution-framings in the earlier phase to more diversified and contentious discourse, as actors align with specific visions for a mobility transition while distancing themselves from competing storylines. Also, in the 2022–2023 network, five coalitions are observable. However, compared to previous periods, the separation between coalitions is more pronounced, and overlaps are further

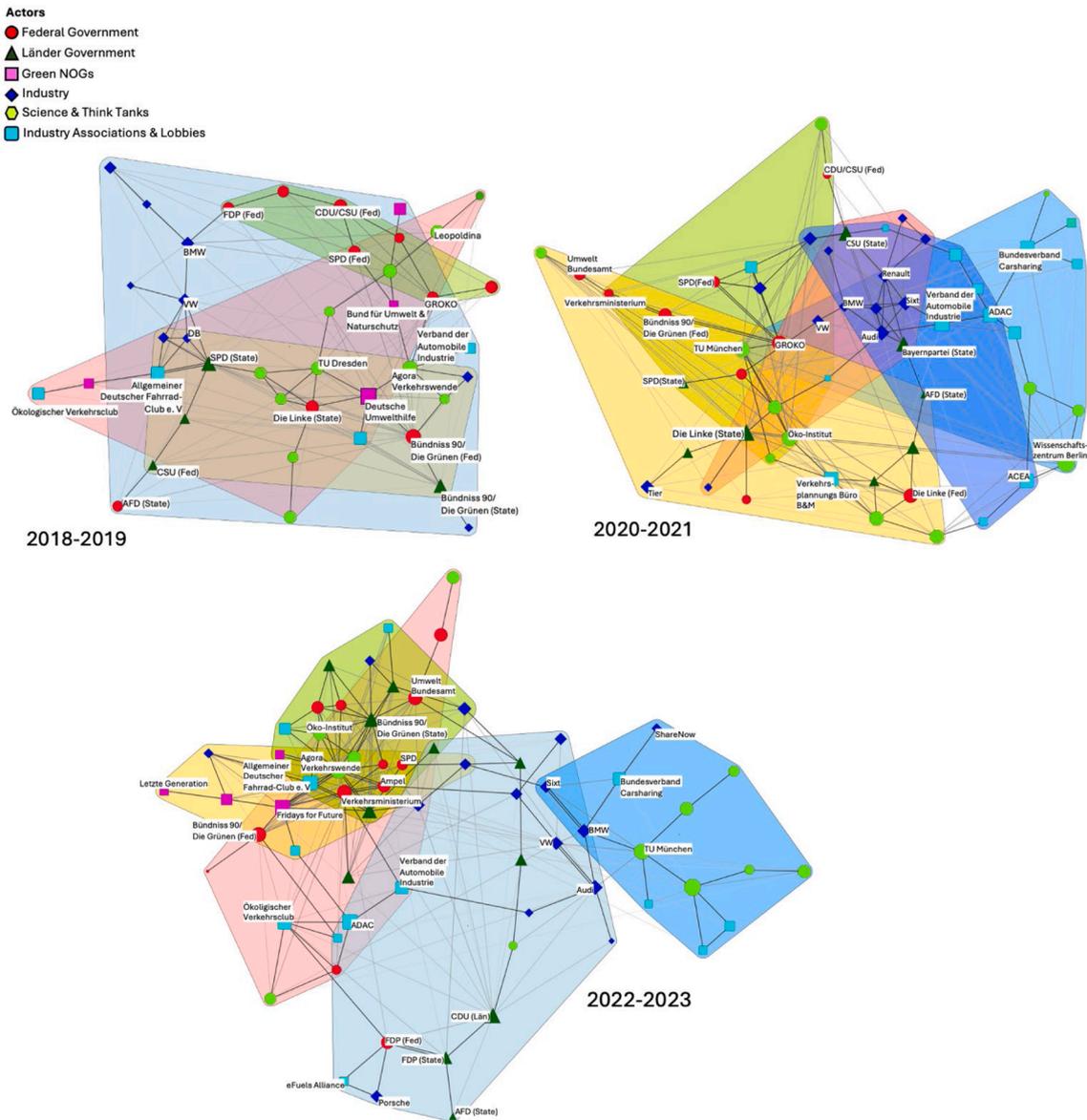


Fig. 8. Discourse coalition networks of 2018–2019, 2020–21 & 2022–2023. The size of the actor nodes is based on degree centrality. Shaded areas in different colours represent discourse coalitions, illustrating clusters of actors with strong internal congruence based on shared storyline use. The size and density of coalitions, along with the degree of overlap between them, provide insights into discourse structure. Overlapping shaded areas indicate shared use of specific storylines between coalitions, while greater distances between clusters reflect fragmentation and polarisation. Increased distances between nodes within a coalition suggest reduced discursive cohesion (i.e., limited use of the same storylines) among its actors.

reduced, thus indicating growing fragmentation. Especially, the two coalitions on the right (Blue & Light blue) are positioned more isolated from the rest of the network, and these actors in these coalitions are only loosely connected, indicating a weaker alignment around shared storylines. In contrast, the coalitions on the left (Red, Yellow and Green) exhibit tighter clustering of nodes within their boundaries, reflecting more frequent shared use of the same storylines.

To help understand these structural observations, Table 5 provides an overview of the characteristics of coalitions (in terms of used storylines) and their associated mobility futures (according to 2.2) across the three periods. For each period, at least one coalition aligns with a previously discussed mobility future, while overlaps between coalitions and shifts in actor alignment reveal evolving dynamics of the discourse around the *Verkehrswende*. In 2018–2019, coalitions were characterised by overlapping problem framings, such as the need to reduce emissions. However, the use of diverging solution-framing storylines (see Table 5) led to the formation of distinctive clusters. Additionally, the green cluster that included a high share of relevant political parties bridges the ‘car continuity’ coalition and ‘modal transition’ coalition by integrating storylines from both coalitions. In 2020–2021, coalition dynamics became more fragmented, with the ‘car continuity’ coalition splitting into two distinct clusters, largely made up of industry actors, associations

Table 5

A comparative overview of key storylines underlying the identified clusters and their associated mobility futures.

Period	Cluster color	Characteristics (in terms of top storylines used)	Associated mobility future
2018–19	Blue	CO2 & Climate Change; Traffic congestions; Electric vehicles (EVs); Subsidies for EVs & charging infrastructure; Need for new business models	Car continuity
	Red	CO2 & Climate Change; Cycling, Improved & affordable public transport; Encourage modal shift; High spatial footprint of the car; Redistribute urban space	Modal transition
	Yellow	CO2 & Climate Change; High spatial footprint of the car; Car-centric urban development; Cycling; Low car & car-free cities; Reduce car dependence	Mobility transformation
	Green	CO2 & Climate Change; Traffic congestions; Electric vehicles (EVs); Subsidies for EVs & charging infrastructure; Need for new business models; Encourage modal shift	Mixed alignment (Policy actor coalition)
2020–21	Light blue	Optimise existing & build new car infrastructure; Sharing solutions; Carsharing subsidies; Electric vehicles (EVs); Subsidies for EVs & charging infrastructure; No Speed limits	Car continuity
	Blue	Optimise existing & build new car infrastructure; High attractiveness of passenger car ownership; Technological openness; No Speed limits; Subsidies for EVs & charging infrastructure;	Car continuity
	Red	Encourage modal shift; Redistribute urban space; Improved & affordable public transport; Build low/zero emission infrastructure; Cycling; Electric vehicles (EVs); Low-car & car-free cities	Modal transition
	Yellow	Redistribute urban space; Low-car & car-free cities; Improved & affordable public transport; Higher parking fees; Speed limits; Cycling; Build low/zero emission infrastructure	Mobility transformation
2022–23	Green	Build low/zero emission infrastructure; Subsidies for EVs & charging infrastructure; Encourage modal shift; Cycling; Technological openness	Mixed alignment (Policy actor coalition)
	Light blue	Sharing solutions; Carsharing subsidies; Need for new business models; Cities should remain accessible to cars; Electric Vehicles (EVs)	Car Continuity
	Blue	Optimize existing & build new car infrastructure; Electric Vehicles (EVs); No Speed limits; No ICE ban; Synthetic & E-fuels; Cities should remain accessible to cars	Car Continuity
	Red	Improved & affordable public transport; 9/49€ Ticket; Encourage modal shift; Cycling; Redistribute urban space; Speed limits	Modal Transition
	Yellow	Redistribute urban space; Encourage modal shift; Cycling; 9/49€ Ticket; Speed limits; Cut company car subsidies; Do not Build new car infrastructure	Mobility Transformation
	Green	Improved & affordable public transport; 9/49€ Ticket; Build low/zero emission infrastructure; Cycling; Electric Vehicles (EVs)	Policy mediation (Mixed alignment)

and lobby groups who emphasised diverging solution-framing storylines (see Table 5). The light blue cluster focused on shared mobility and electrification through business models like car-sharing, while the dark blue cluster emphasised traditional car ownership, opposing bans on internal combustion engines and promoting incremental changes such as e-fuels. Both clusters share the use of repugnostic-framing storylines, such as “No Speed limits,” While the ‘mobility transformation’ coalition (Red cluster) still exhibits continuous overlap with both of these coalitions and thus sees increasing industry actor membership, the ‘mobility transformation’ coalition (Yellow cluster) started to separate itself more distinctly from the ‘car continuity’ coalitions and concurrently, saw increasing overlaps with the policy actor coalition (Green cluster).

By 2022–2023, both ‘car continuity’ coalitions are increasingly isolated within the discourse network, connected with each other through shared repugnostic storylines (see Table 5). However, the solution-framings further diverged, e.g., actors in the bottom-middle of the light blue cluster focused on promoting e-fuels as an alternative to electrification, while the connected actors on the top of the same cluster concentrated on electrification, also including shared mobility solutions. In contrast, actors within and across the ‘modal transition’ coalition and the ‘mobility transformation’ coalition became more densely connected, indicating a higher alignment around shared storylines. Additionally, both coalitions share a broad overlap with the policy actor coalition, while almost no overlap remains between this coalition and the ‘car continuity’ coalitions. Therefore, in terms of the success of the identified discourse coalitions, these findings suggest that the ‘modal transition’ and ‘mobility transformation’ coalitions have gained greater traction by achieving higher ideational congruence and attracting politically powerful actors. In contrast, the fragmentation and isolation of the ‘car continuity’ coalitions suggest that these coalitions are becoming more disconnected from mainstream policy discussions and are losing influence in shaping the dominant discourse around the floating signifier.

Additionally, to gain insights into the level of support for specific storylines by certain actors and changes in dominant discursive actors, actor-concept networks were visualised for each phase. In Fig. 9, actors are depicted as circles and according to the same colour classification as in the congruence networks above; storylines are depicted as squares and mapped according to their degree centrality (i.e., most central concepts are supported by the highest number of actors) while the line weight of the connections illustrates how often an actor draws on a specific storyline. Initially, from 2018 to 2019, the three most discursively active actors were *Bündnis 90/Die Grünen* (federal Green Party), their state-level counterparts, and the federal Social Democrats party (SPD). The most prominent storylines included electric vehicles, improved and affordable public transport, and cycling. Electric vehicles are strongly supported by the automotive manufacturer Volkswagen, the Ministry of Transport (*Transportministerium*), and the federal Green Party. Improved public transport was also advocated by the federal Green Party and the governing coalition of the time (*GroKo*). While cycling was promoted significantly by the federal Green Party, the Ministry of Transport, and the cycling lobby group *Allgemeiner Deutscher Fahrrad-Club e. V.*

During the COVID period (2020–2021), the top three discursive actors were the Left party (*Die Linke*) at the state level, the automotive manufacturer Audi, and the governing coalition (*GroKo*). The top three storylines were improved, as well as affordable public transport, cycling, and the need to redistribute urban space. Improved public transport was primarily supported by the Left

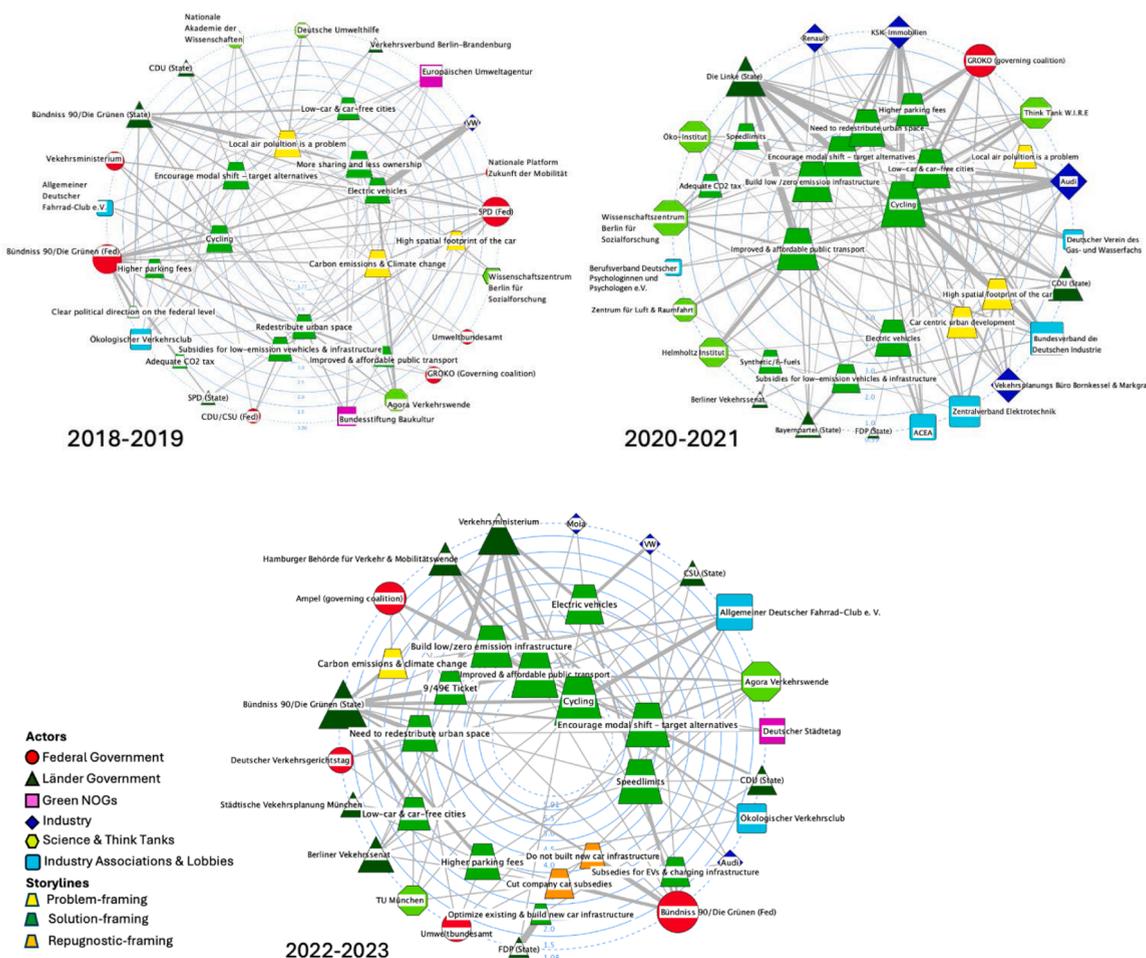


Fig. 9. Actor-concept networks of 2018–2019, 2020–21 & 2022–2023. Showing the top 15 storylines and top 20 actors.

party and actors affiliated with scientific institutions. Storylines in support of cycling were strongly promoted by the Left party and actors of scientific institutions, think tanks, and Audi. At the same time, the need to redistribute urban space was frequently advocated by the Left party and the governing coalition (*GroKo*).

During the post-COVID phase (2022 until mid-2023), the top three discursive actors were the Ministry of Transport, the federal Green Party and the new governing coalition (*Ampel*). The three most frequently drawn-up storylines included improved and affordable public transport, cycling, and electric vehicles. Improved public transport was strongly supported by the top three discursive actors. The cycling storylines received support from the federal Green Party and the cycling lobby group (*Allgemeiner Deutscher Fahrrad-Club e. V.*). While the electric vehicles storylines were most supported by VW, the Ministry of Transport, and the governing coalition.

Our analysis uncovered two important discursive strategies of actors: First, notwithstanding the shifts in discourse over the three phases, actors such as those belonging to liberal (FDP) and conservative (CDU/CSU) political parties both at the federal and state level and The German Association of the Automotive Industry (VDA) who initially heavily utilised storylines promoting ‘car continuity’ have exhibited persistent discursive involvement, and by drawing on repugnostic-framing storylines in the post-COVID phase attempt to polarise the discourse by deligitimising the solution-framing storylines of their discursive opponents. Here, discursive agents often perceive themselves as defenders of vital principles such as individual mobility freedom: *The car represents the freedom of individual mobility – the ability to get to any place anytime. We should not pit climate change mitigation against principles of freedom – Lindner, Liberal Party (Die Welt, 2019)* or technological openness: *Following the principle of technology openness, we must also allow sales of ICE vehicles after 2035 as long as they run on climate-neutral fuel sources – Wissing, Liberal Party & Transport Minister (SZ, 2022a)*. Such discursive moves have led over the investigated periods to increased discursive push-back from actors, including the Green party, think tanks and activist groups that support less car-centric framings of the *Verkehrswende*. More specifically, a hardening of positions and seemingly unresolvable lines of conflict emerge around the following topics: (1) the potential ban on ICE vehicles, (2) the use of e-fuels or synthetic fuels for cars, (3) the expansion of car-centric infrastructure, (4) low-fare public transport, (5) a potential speed limit on German motorways and (6) the continued accessibility of cities for cars. See, for example, in the actor-concept network for 2022 until

mid-2023 (Fig. 8), *Bündniss 90/Die Grünen* frequently evoke storylines that call for no additional car infrastructure to be built while the FDP draws on storylines that support the optimisation of existing and the investments into new car infrastructure.

Second, other discursive proponents of storylines related to a ‘car continuity’ strategically switch sides and adapt their storylines to the shifting discourse that occurred over the analysed phases. Particularly, key industry actors, such as automobile manufacturers VW and Audi, co-opt the floating signifier to ostensibly support a broad shift away from the car-centric mobility regime. For example, Audi CEO Diesch stated: *Better mobility alternatives to the car must be developed quickly. It is definitely not the philosophy of my company to block up cities with cars* (SZ, 2022b). This is reflected in the actor-concept network for 20,219–2020, in which VW strongly promotes storylines related to electric vehicles, but by the last phase (2022 until mid-2023), Audi includes storylines such as low-car and car-free cities and cycling in their discursive repertoire (see Fig. 8). While this discursive support for cycling, low-car and car-free cities, as well as improved and affordable public transport, may signal an alignment with the mobility transformation discourse, it exists alongside sustained company investments in electric vehicles and ICE drivetrain technology. Such investments are further complemented by strong support for storylines advocating subsidies for adequate EV charging infrastructure to electrify all of Germany’s ever-increasing car fleet. If implemented, this would likely reinforce the hegemonic status of the car for decades to come. The incorporation of such transformative storylines into their discursive repertoire thus can be viewed as an attempt by Audi to maintain their legitimacy and relevance in the shifting discourse around the Verkehrswende.

4.3. Discourse structuration and the evolution of dominant mobility futures

Analysing the congruence networks of the three phases (see Fig. 7) for indications of discourse structuration or even discursive closure reveals that the degree of separation between actors in the network due to using different storylines is relatively high from the beginning. In addition, the network diameter increases significantly in the last period (2022 until mid-2023), indicating a low ideational congruence amongst discursive agents and no structuration around a particular meaning of the floating signifier. Instead, an increasing separation between actors within the congruence networks over the three phases can be observed, as indicated by the consistent rise of the average path lengths in the networks. Furthermore, the normalised network density initially rises from 2018–19 to 2020–21 but then drops sharply for the post-COVID phase network. This significant decrease in density, in combination with the increased path length in the last period, suggests growing storyline polarisation among discursive agents.

During the pandemic phase, mobility restrictions, changes in transportation behaviour and opportunities for experiments likely shifted priorities and concerns within the discourse network. This might explain the temporary increase in network density for this phase, as actors coalesced around common immediate concerns. However, as the pandemic’s immediate effects waned in the next phase, longer-term conflicts and differing visions for the future of mobility became more pronounced, leading to a sharp decrease in density. This development can be further attributed to intensified framing struggles and clearer lines of conflict during the post-COVID phase. This is marked by the emergence of repugnant-framing storylines as certain actors align more strictly with distinct and opposing storylines and polarisation within the network increases. Overall, in the 2018–19 network, there might have been a broader consensus on the need for a mobility transition brought about by the ‘Federal Climate Change Act’ and indicated by the higher number of problem-framing storylines. However, as the discursive focus shifts towards solution-framing storylines and specific policy measures, technologies and implementation strategies are debated, increasing separation between actors is observed, and the discourse becomes more fragmented. Table 6 summarises the above-described network measures for each phase.

Moreover, Fig. 10 zooms into these discursive framing struggles to gain a better understanding of whether certain meanings of the floating signifier have become more prominent than others despite the lack of discursive closure. Fig. 7 illustrates congruence networks in which actors are grouped based on their use of storylines related to one of the three possible mobility futures. Looking at the structural evolution of these networks, it becomes evident that while both the ‘modal transition’ and ‘mobility transformation’ future remain relatively stable over time, the ‘car continuity’ future is considerably less stable, as indicated by its change in structure. Similarly to the related discourse coalition above, the network for the ‘car continuity’ future across the three-phase shows discursive work predominantly from industry actors, industry associations and lobbies, as well as national and provincial policymakers from conservative as well as liberal parties and a few research institutes, while the ‘modal transition’ and ‘mobility transformation’ futures see a wide variety of different types of actor groups.

Fig. 10 further presents network and actor-level measures of the different mobility future congruence networks. In examining the number of actors participating in the discourse for each mobility future, an initial surge was followed by a more recent drastic decline for the ‘car continuity’ future. In contrast, the ‘modal transition’ and ‘mobility transformation’ futures have seen continuous growth in actor involvement, signifying sustained and expanding involvement of various discursive agents. The ideational congruence among actors based on shared storylines within the discourse nevertheless decreases across all three possible mobility futures (see Fig. 11). This decreasing normalised network density suggests a potential divergence in the utilised storylines among actors despite increasing actor participation. The average degree, which serves as a measure of the presence of influential actors (i.e., the number of highly

Table 6

Network measures of the full congruence networks depicted in Fig. 7.

Time phase	Network diameter	Average path length	Normalised network density
2018–19	4	2.05	2.8
2020–21	4	2.23	3.1
2022–mid23	6	2.54	1.6

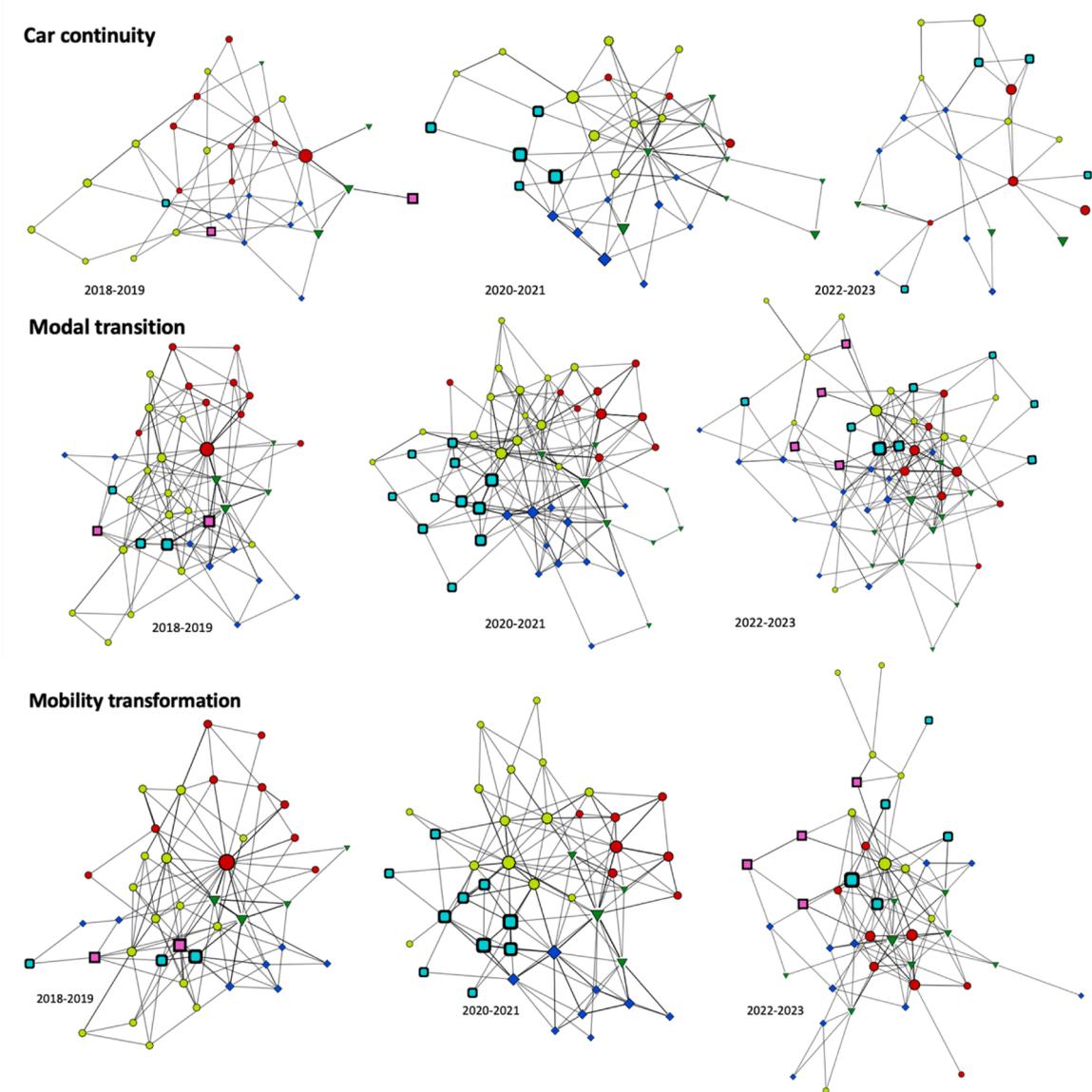


Fig. 10. Evolution of the actor congruence networks for the ‘car continuity’, ‘modal transition’ and ‘mobility transformation’ futures across the three time periods. The node size indicates an actor’s influence level in the network based on degree centrality.

discursively active actors) within each of the mobility future congruence networks, initially increased for the ‘car continuity’ future but has faced a decline in the last period. The ‘modal transition’ future witnessed a steady rise before a slight decline; however, the ‘mobility transformation’ future remained on the rise.

Based on the most recent period, 2022–2023, it may be inferred that the discursive developments around the *Verkehrswende* are leaning towards a structuration around a ‘modal transition’ as exhibited by its relative stability over time and consistent growth in actor involvement. However, as also highlighted in the discourse coalition graphs (Fig. 8), it is worth noting that the ‘mobility transformation’ future gained more influential actors throughout each period.

5. Discussion

5.1. The significance of floating signifiers for transition processes

Studying the discursive framing struggles around the *Verkehrswende* through the concept of the floating signifier (Jørgensen and Philips, 2002) has offered novel insights into the evolving discourse on the German mobility transition. Understanding such terms as ‘floating’, (i.e., their meanings being constantly in flux) thus, provides an opportunity to investigate the making-possible of mobility

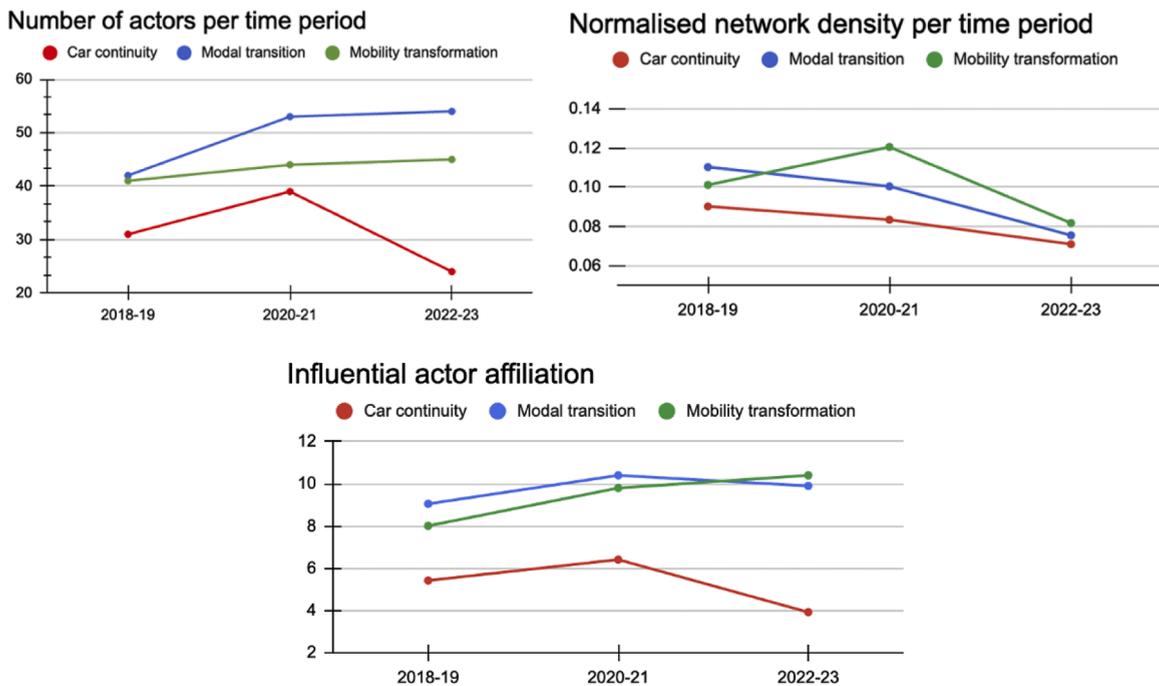


Fig. 11. Network and actor-level measures of the different possible mobility future congruence networks over the three time periods.

futures. The approach exemplifies how differing interpretations of transition-related terminologies shape socio-technical change. Beyond the case of the German mobility transition, our analysis has suggested that the flexibility of such terms generally warrants more analytical attention.

Our DNA results highlight the wide variety of societal actors who engage in discursive struggles to shape the meaning of the term to fit their visions of the future of mobility in Germany. In line with previous findings on floating signifiers, the lack of a strict definition allows discursive agents—often with fundamentally opposing perspectives, values, and ideologies—to commonly mobilize such terms (Rödle et al., 2022; Kögl and Kurze, 2013). The floating nature of such transition-related terms consequently can be considered an important underlying characteristic that allows to mediate interactions between different actor groups by providing a common signifier that each can adapt to their own understanding and agenda. Moreover, our findings indicate that the breadth of articulated meanings associated with the *Verkehrswende* became especially prominent during times of crises, such as the COVID-19 pandemic, in the sense that the more radical understandings of the mobility transition started to gain traction in the political discourse. During the phase 2020–2021, the discourse around the *Verkehrswende* experienced rapid re-articulation and a separation of discourse coalitions was observed as different discursive agents imposed their preferred interpretations of the changed conditions. The lack of fixed meaning of floating signifiers thus allows for more flexibility in defining the directionality of socio-technical change in times of crisis by sparking increased debates that can open the realm of possibilities. However, also less disruptive events, such as legislative changes, the rise of activist movements like Fridays for Future, and the introduction of new technologies like e-scooter sharing services, have also shaped the meaning-making process and contributed to the continuous re-articulation of the term's meaning. Therefore, unlike put forward in discourse theory (cf., Farkas and Schou, 2018), the contestation of meanings around a floating signifier was not confined to periods of crisis, but its ongoing meaning-making process was continuously influenced by a range of societal political, technological and economic developments.

Beyond the polysemous nature of the term *Vehrkerswende*, our analysis also revealed the discursive framing struggles and conflicts inherent to floating signifiers. Such conflicts amongst discursive agents, as they attempt to fix the meaning of a floating signifier, have been reported in previous discourse analyses on the circular economy (Niskanen et al., 2020) as well as the bioeconomy (Mijailoff and Burns, 2023) and can be considered a defining feature of floating signifiers (Jørgensen and Philips, 2002). However, despite the fact that our analysis of the different possible mobility futures and associated discourse coalitions indicates that the 'car continuity' future has lost discursive support throughout the three periods while the 'modal transition' and 'mobility transformation' have experienced growing support from key political actors, these struggles and intensified conflict have not (yet) resulted in discursive closure (i.e., no one meaning of the *Verkehrswende* becomes dominant, nullifying other forms of meaning). Instead, along with this evolution increasing discursive polarisation around the floating signifier's differing interpretations and the emergence of repugnostic-framing storylines coincide with ambiguous policy objectives and an absence of unifying strategies of how to achieve a sustainable mobility transition in Germany. These insights highlight that the ongoing discursive struggles around the floating signifier reflect a broader societal indecisiveness, which in turn affects the ability to foster coherent policy pathways. The terms *Verkehrswende* and *Mobilitätswende* are increasingly being pulled in diverse directions by various discursive agents, contributing to a more dispersed and fragmented discourse

over time, without a shared understanding emerging that could drive collective action. Furthermore, the decline in legitimacy for car-centric mobility discourse, while hopeful, alone seems like an insufficient condition to leverage action that signals a real departure away from the prevailing regime of automobility. The discourse related to a 'modal transition' and 'mobility transformation' future still lack the dominance or the strategic unity required to materialise in policy action. This suggests that although there is increasing discursive support for more transformative change, its scope is still contested (and fought against by powerful 'car continuity' proponents), which may at least provide a partial explanation for the lack of significant progress of the German mobility transition.

Both in 2022 and 2023 German transport sector missed all its national decarbonisation targets. Nevertheless, the transport ministry has developed no strategic action plan to close this emission reduction gap swiftly (Zeit, 2023a), resulting in the activist group Fridays for Future proposing their own strategic action plan while simultaneously requesting the resignation of the minister (Die Zeit, 2023b). Consequently, struggles around the meaning-making of floating signifiers may reinforce political paralysis as reflected in the lack of coherent policy interventions and the political reluctance to embrace more radical systemic changes of the mobility system. Unending disagreements on what precisely the problems are that should be addressed by precisely what kind of 'transition' can hinder policy-making processes. If such framing struggles and interpretative disputes over viable mobility futures persist, they may lead to discursive stalemates that could constrain the progress of socio-technical change. Additionally, this increasing polarization might also contribute to weakened public trust in governmental capabilities (e.g., see Statista, 2023), as the absence of an actionable strategy becomes increasingly evident. On the other hand, whilst an absolute consensus around the more radical mobility futures might appear highly challenging within the current political arrangements, more radical change is necessary to address the systemic injustices that are inherent to the car-based automobility regime (Sheller, 2018). Therefore, transitions research could benefit from critical investigations into the (im)possibilities of car continuity to consider the implications (and missed opportunity) of a mobility transition manifesting largely in the substitution of the drivetrain (Hawxwell et al. 2024).

Lastly, our analysis reaffirms that incumbent actors, such as actors from the automotive industry and lobby groups, can refer to more radical associations with the *Verkehrswende*, such as speaking up for "car-free cities" to appear supportive of more transformative mobility futures while still stabilising the prevailing car-centric arrangements both discursively and through their political influence and production practices. The discursive flexibility of floating signifiers, therefore, enables actors to present themselves as aligned with more radical changes than their activities might lead one to believe. The outcomes can be a greater dissonance between discourse and material change. This, in turn, can give the impression that significant progress is being made towards realising the promised 'transition', thereby potentially reducing the pressure on these actors to implement substantive action. These findings thus complement previous work that highlights the risk of strategic manipulation, co-optation and capture of floating signifiers (Tesfaye and Fougère, 2021) and their ability to enable an illusion of discursive commitment to an issue despite business-as-usual practices (Methmann, 2010; Blythe et al., 2018).

5.2. Limitations

While our study provides important insights into the discursive framing struggles around the German mobility transition from 2018 to mid-2023, a few methodological limitations and challenges bear mentioning.

First, solely relying on newspaper articles as a data source may not fully capture the spectrum of public discourse. Other sources of public discourse, like parliamentary debates or social media, could offer additional valuable perspectives (Leifeld, 2011). Similarly, relying on newspaper databases such as LexisNexis runs the risk of introducing biases due to the limitations of the search algorithms, which might restrict the scope of retrieved articles and potentially affect the comprehensiveness of the analysis. Second, focusing on storylines and discourse dynamics of a contemporary transition might overlook material aspects, such as the economic viability or technological feasibility of the proposed solutions (Markard et al., 2021). Any discourse analysis, therefore, may not fully reflect the intricacies of policy outcomes. Moreover, our results demonstrate that discursive support for more radical forms of socio-technical change can diverge from real-world actions. Thus, this highlights the need for a research design that integrates both discourse and empirical analysis of actions to mitigate the risk of overestimating rhetorical commitments and provide a more accurate assessment of the actual progress and challenges of transition processes.

Third, while the use of the Louvain clustering algorithm allowed us to identify discernible discourse coalitions, this approach has inherent limitations. As noted by Belova et al. (2023), any methods that simplify network structures, such as clustering algorithms, may risk misrepresenting the dynamics of discourse coalitions by artificially creating clusters. To mitigate this, we complemented the clustering algorithm with a qualitative analysis of the storylines within each cluster, ensuring that the identified coalitions were meaningfully interpreted. Furthermore, the identified coalitions were consistent with previously described mobility futures in the literature, which reinforces the validity and relevance of our findings. Nevertheless, caution must be applied to avoid overinterpreting the results. Lastly, the study's time frame, while spanning six years, inherently only captures the discourses in a specific temporal context. As discourses are dynamic and evolve, this temporal restriction may not fully represent their longitudinal development or potential future trajectories.

6. Concluding remarks

The aim of this study was to explore the contested nature of the German mobility transition through the discourse theoretical concept of the floating signifier. We applied discourse network analysis to 456 news articles from 2018 to mid-2023 to trace how problem- and solution-framings, actors' positions, discourse coalitions and the overall discourse structure evolved. In doing so, this paper makes three contributions to our understanding of the discursive dimensions of sustainability transitions: First, it demonstrates

how the polysemous nature of transition-related terms such as the *Verkehrswende* allows a variety of actors to engage in shaping the directionality of socio-technical change, therefore facilitating both consensus-building and framing-struggles. Second, it identifies how the term's ambiguity allows for rapid re-articulation during periods of crisis, but also reveals its risks of increasing polarisation and strategic co-optation. Especially the latter offers a direction for future research that critically examines the discursive underpinnings of transition-related terms—their various meanings, assumptions, interests, and power dynamics—to further our understanding under which circumstances such terms may be co-opted to mask the continuation of unsustainable practices under the guise of transition discourse. Third, this study has enabled a better understanding of how floating signifiers can contribute to the disconnect between discourse and real-world policy action. Our findings reveal that while there may be growing discursive support for more radical forms of socio-technical change (e.g., the 'mobility transformation' future), this does not necessarily translate into decisive policy measures. Instead, increased fluidity of these signifiers can amplify fragmentation and potentially prolong delays in achieving coherent action, especially when unresolved conflicts over their meaning persist. Future research could, therefore, investigate the relationship between discursive coalitions, institutional decision-making processes, and the material constraints that shape the implementation of more radical forms of socio-technical change. Such research could critically assess how power asymmetries among actors and coalitions impact the ability of transformative discourses to drive systemic change, as well as how and under what conditions fragmentation might be mitigated.

CRedit authorship contribution statement

Sophie-Marie Ertelt: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Tom Hawxwell:** Writing – review & editing, Writing – original draft, Software, Resources, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

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.

Appendix I. Storyline classification

	Car continuity	Modal transition	Mobility transformation
Problem-framing storylines			
<i>Required advancement of economic structures</i> (3)	x	x	
Local air pollution is not a problem	x		
Traffic congestion	x	x	x
Carbon emissions and climate change	x	x	x
Human health and safety		x	x
Local air pollution		x	x
Noise pollution		x	x
<i>Negative effects of the rising stock of passenger vehicles</i> (45)		x	x
High attractiveness of passenger car ownership		x	x
<i>Need for a fair allocation of resources across mobility modes</i> (3)		x	x
Solution-framing storylines			
<i>Fuel source switch</i> (7)	x		
Optimised vehicles and incremental improvements to ICE	x		
Optimise existing and build new car infrastructure	x		
Autonomous vehicles	x	x	
<i>Policy measures and initiatives to support EV deployment</i> (53)		x	
Clear political direction on the federal level	x	x	x
EU ETS	x	x	
Electric vehicles (EVs)	x	x	
<i>Low and zero-emission mobility modes (excluding EVs)</i> (45)		x	x
<i>Low and zero-emission mobility infrastructure (excluding EVs)</i> (2)		x	x
<i>Measures to encourage a modal shift</i> (5)		x	x
<i>Policy measures to support EV deployment</i> (5)	x	x	
<i>Policy measures and initiatives to reduce car fleet size in cities</i> (4)		x	x
More sharing and less ownership		x	x
Reduce car dependence		x	x
Speed Limits		x	x
Redistribute urban space		x	x
<i>Low and zero-emission mobility modes (excluding EVs)</i> (4)		x	x
<i>Policy measures and initiatives to reduce car ownership</i> (4)		x	x
<i>Policy measures and initiatives to encourage & enable a modal shift</i> (75)		x	x
Increased transport equity			x
Integrate private mobility service providers into public transport		x	

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	Car continuity	Modal transition	Mobility transformation
Low-car and car-free cities		x	x
Strassenverkehrsordnung (German general traffic law) must change		x	x
Repugnant-framing storylines			
No CO2 tax	x		
<i>Cities should remain accessible to all cars (2)</i>	x		
No ICE ban	x		
No Speed Limits	x		
<i>Economic concerns with EVs (3)</i>	x		
Transition should not be a war on cars	x		
Freedom of mobility must be sustained	x		
Cars are the symbol of individuality & freedom	x		
Do not build new car infrastructure		x	x
No E-fuels for cars		x	
Only subsidies for EV company cars		x	
CO2 price leads to justice problems			x
CO2 price mechanism is not enough			x
<i>Cutting tax privileges and incentives for cars (5)</i>			x
Fuel-source switch is no transition		x	x
<i>Resource and justice concerns of EVs (2)</i>		x	x

Appendix II. Full list of storylines

Problem-framing storyline short	Storyline long
Local air pollution	The air quality in cities is severely impacted by vehicle exhaust emissions of carbon-fueled ICEs.
CO2 & Climate Change	CO2 emissions of the transport sector are continuously rising, and the sector thus has a direct negative impact on climate change.
High spatial footprint of the car	Cars and their related infrastructure are taking too much space away from other forms of mobility.
Car-centric urban development	Urban planning has for too long prioritised the private automobile as a primary transportation mode.
Human health & safety	Car-related emissions and accidents are a threat to human health and are costing society significant health damage costs.
Cars are getting bigger, heavier & faster	SUV-ation of the private automobile is exacerbating existing car-related problems (e.g., taking up more space, producing more emissions, causing more severe accidents)
Traffic congestions	Existing road network capacity is exceeded, leading to increased vehicle queuing.
Space scarcity	Urban space in cities is becoming increasingly scarce, and parking spaces for cars compete with living spaces for citizens.
Livability & atmosphere	Rising vehicle stock is impacting the livability and atmosphere of cities.
Overfinancing of automobility	Historically, the regime of automobility has received more financial benefits than other modes of transportation (e.g., more tax benefits for cars, more R&D funding for cars)
Need for new value creation & jobs	The German car industry is of great economic importance to the country, and new forms of value creation around sustainable mobility solutions are needed to ensure the job safety of current workers.
Need for a strong economy	The automotive industry is one of our most important economic sectors in the country, and, for many in our society, the car is a symbol of our engineering skills and will ensure Germany's economic success in the future.
Need for new business models	Instead, the carmakers and the federal government continue to rely on the business model, which has remained essentially unchanged since the early days of the car. It consists of three pillars: the fossil combustion engine, manual control and individual ownership, but this has to change now.
Noise pollution	Car traffic has become a major burden in many cities. In particular, noise pollution and nitrogen oxide emissions are responsible for massive negative externalities.
Rising stock of passenger vehicles	There are currently around 46 million passenger cars in Germany – and the trend is rising. This is becoming an issue that can no longer be ignored.
High attractiveness of passenger car ownership	So far, we have made the car more and more attractive, with much political support, but it cannot go on like this.
Cemented landscapes	Every parking space is fought over as if the public space today just because the space in the city belonged forever to motorists and not to all road users. Cities are not parking lots but places to live.
Solution framing-storyline short	Storyline long
Electric vehicles EVs	Electric vehicles are the key to climate-friendly mobility.
Improved & affordable public transport	To make public transport attractive, the current offering must be extended and priced at an affordable price point.
Cycling	Changes in transport behaviour towards an increase in cycling play an important role in the sustainable mobility transition.
Sharing solutions	A mobility transition requires the development and promotion of shared mobility services that create alternatives to private cars, such as car sharing.
Adequate CO2 tax	An adequate CO2 tax based on the actual damage costs that fossil fuels cause is needed to accelerate the mobility transition.
Subsidies for low-emission vehicles (LEVs)	LEVs will become more attractive for consumers with the help of strategic subsidies for both the vehicles and their related infrastructure.

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Solution framing-storyline short	Storyline long
Low car & car-free cities	Removing/lowering the number of cars from urban areas would lower carbon emissions, air pollution, and road traffic accidents, as well as improve the overall livability of cities.
Modal shift	A mobility transition requires a shift from private vehicles to other transport modes like cycling or varying forms of public transport.
Redistribute Urban space	Citizens must claim back the space that cars take up in cities.
Clear political direction on the federal level	Politicians must make courageous decisions and create reliable regulatory frameworks that can guide the future of the German transport sector.
Public Transport	To reshape the mobility sector, a large increase in public transport users will be needed.
Fair allocation of resources across modes	These subsidies for cars alone have a volume of 30 billion euros a year nationwide. The money could be used to achieve much in the mobility transition, but in the mind of the state government, Bavaria is a pure "car country". The mobility industry, however, includes not only car manufacturers but also many other sectors, from rail to bicycle retail, that deserve subsidies.
Increased transport equity	Even outside cities, all citizens should be able to enjoy affordable and climate-friendly mobility suitable for everyday use.
Integrate private mobility service providers into public transport 9/49€ Ticket	We will develop a commercially viable business model for Moia to integrate the service into the HHV. This also includes the low-priced 49-euro monthly ticket, which will come next year and be valid nationwide on local transport. This is according to the motto, "One ticket for everything, from the bus to the tram and subway to the S-Bahn and the regional train". The successor model for the summer nine-euro ticket is intended to help, for example, commuters who complain about high petrol and diesel prices and could then travel to work more cheaply.
Pop-up cycling lanes	It was a simple administrative act, implemented overnight; the bike paths were already planned. All it took was a little yellow paint and traffic cones - it might not look pretty; however, it is very low cost and can be actualised in no time. Berlin's cyclists finally have the space they deserve.
(Hybrid) Electric Trains	Battery-powered hybrid trains are an important bridging technology in transitioning towards a climate-neutral railways sector.
(E-)Cargo bikes	Cargo bikes can contribute to a sustainable mobility transition. Like some municipalities, the Bavarian state capital Munich, therefore, provides financial support for the purchase of cargo bikes for its citizens.
Intermodal Maas	At the heart of the new mobility is the idea of transporting people and goods multimodally: quickly, easily, safely, cheaply, CO ₂ -neutrally and without unnecessary transfers. This requires overarching mobility platforms that can be used to plan, book and pay for trips.
Build zero/low-emission mobility infrastructure	We are now expanding the bicycle network again. In the past legislative period with Green participation, it was 30 to 40 kms a year, less than promised. I promise 60 to 80 kms a year and 100 kms as a long-term perspective. It's a process, as always, in politics.
E-scooters	E-scooters facilitate short-distance travelling, so we must take advantage of the current boom and integrate them into the transport network so that they contribute to a sustainable mobility transition.
Reducing car dependence	We need to shape the transport transition in such a way that more people do without their own cars because they simply don't need them anymore.
Strassenverkehrsordnung must change	Again and again, citizens ask us that a speed limit of 30 km/h should be introduced in their street or neighbourhood – and again and again, they are annoyed when we must explain to them that this is not possible at this specific point because of the road traffic regulations, this must be changed.
Changing car benefitting tax structures & incentives	In principle, it would make sense to change the tax structures: The green bonus for hybrid electric vehicles should be withdrawn, and the VAT rules for public transport and the electricity tax regulation for electric public transport should finally be changed.
Subsidies for e-bikes & cargo bikes	A transport policy geared to environmentally friendly modes of transport would also subsidise the purchase of pedelecs and electric bicycles.
Diesel driving bans in cities	We stand behind the driving bans for older diesels. It is supposed to go in quick succession; in February, it will catch the vehicles with the Euro standard four, and in October 2023, almost certainly also those with emission class five. More than 100,000 vehicles from Munich alone will no longer be allowed to drive into the city centre via the Ring and will no longer be allowed to drive on the Ring itself.
Congestion charge zones	Another political measure would be much better: a city toll. Every driver would have to pay this daily fee, regardless of whether they are driving a diesel or gasoline car in a city. This way, the so-called 'polluter pays' principle would be implemented.
Speed limits	I want a speed limit because I believe that the incentive to build big cars with huge engines will then be less. Besides, it would make a strong contribution to greater road safety.
Subsidies for zero-emission mobility & infrastructure	Despite our differing views on how quickly and how much car traffic must be reduced, we have agreed that a mobility transition is only possible when funding the expansion of public transport and cycle paths has priority and must also reach beyond the city's outskirts.
Increase bus/train personnel	Given the shortage of public transport drivers, concepts would be needed on how to attract staff through training and how to keep them, namely through better employment conditions.
Drastically improve public transport capacity	However, in the bus sector, there are huge gaps in the network coverage and frequency, especially in rural areas. Without increased capacity in rural areas, however, there is no mobility transition.
Autonomous vehicles	Road safety and sustainability will increase sharply in Hamburg due to the adoption of tele-driving and autonomous driving.
Carsharing subsidies	Car sharing is an indispensable building block for the climate-neutral transport of the future and should be funded by the future federal government over the next four years in support totalling 500 million euros.
Subsidies for EVs & charging infra	Every euro of funding for charging infrastructure increases the attractiveness of the electric car, almost more than a purchase subsidy for the vehicle itself. We can only achieve the energy transition by joining forces. The charging infrastructure plays a key role in this.

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Solution framing-storyline short	Storyline long
Higher parking fees	Parking space in the city centre will be scarce and more expensive across the board; if you live within the S-Bahn ring, you should pay ten euros per day as a long-term parker, and short-term parkers at least five euros an hour.
ICE ban	That is why we are calling on politicians to ban the sale of new vehicles with combustion engines from 2025.
Smart parking management	Information about where a space is currently available could also be exchanged between vehicles. At the same time, it must also be possible to differentiate parking prices depending on the time of day. Traffic flows and volumes could be controlled in this way.
Climate-neutral fuel sources	Synthetic fuels, and those in green hydrogen and biogas, are a solution for climate-neutral mobility.
Hydrogen fuel cell vehicles	I also call for much more passion when it comes to hydrogen. Battery-powered electromobility will not be suitable for everyone. In the future, too, there will be people who prefer to refuel rather than charge, so hydrogen is needed.
Technology openness	All modes of transport and technologies are needed for climate neutrality - we must remain completely open.
Synthetic & E-fuels	That's why I'm also in favour of e-fuels, because they can be a solution to reduce emissions of the existing vehicle fleet.
Optimised vehicles & incremental improvements to ICE	Internal combustion engines should be further developed to exploit their full efficiency potential.
Optimize existing & build new car infrastructure	Even in ten or twenty years, there will still be cars. It makes sense to continue the construction and expansion of selected roads to close gaps around major traffic axes.
Plug-in Hybrids	We need the electrification of passenger cars through hybrid and electric drivetrains, as no other scalable technology is available to achieve the 2030 climate targets.
Lowered energy tax for EVs	We need a lower energy tax. This would lower the price of electricity and encourage more people to switch to more environmentally friendly EVs.
EU ETS	It is also important to take advantage of the beneficial effects of capitalism. There is currently a growing interest from companies to invest in CO2 avoidance technologies. The EU emissions trading scheme plays an important role in this. Companies from industry and the energy sector in Europe are currently taking part. They are obliged to purchase a certificate for every tonne of CO2 emitted.
Repugnostic-framing storyline short	Storyline long
Do not build new car infrastructure	We can still stop this madness. We are in exactly the right place to end this building sin and to streamline the motorway lanes into a smaller network. It is a question of political will.
Fuel-source switch is no transition	There is no mobility transition if we replace every combustion engine with an EV. The aim must be to "snatch" public spaces from the car.
No COVID support for ICEVs	Now, it is a matter of defending the ongoing mobility transition and preventing purchase premiums for new combustion engines. Just because the car lobby shouts the loudest doesn't mean you have to reward them.
E-SUVs not sustainable	E-SUVs are not eco-friendly cars and do not contribute to climate change mitigation.
EVs not affordable to the masses	Only 24 % of the population is considering buying an EV in the next few years, and 69 % of those surveyed still do not see battery models as an alternative to the combustion engine because the acquisition costs are simply too high.
No E-fuels for cars	Hydrogen and e-fuels are the champagnes of the energy transition. They belong in hard to decarbonising ships and planes, but not the car tank.
No CO2 tax	We want to get to the root of the problem and demand the abolition of the CO2 tax. This way, the fuel cost will decrease on its own.
Cut the commuter allowance	We need to make the commuter allowance more ecological and reduce it. Politicians must make it clear that all means of transport are on an equal footing when it comes to commuting.
Do not cut the car commuter allowance	If the price of gasoline increases by ten cents, the commuter allowance must be increased by one cent. The commuter allowance remains in place. This is a coalition demand of the CSU, from which we will not move away.
No ICE ban	Banning the internal combustion engine is completely unnecessary for a functioning climate or environmental protection.
No diesel driving bans in cities	I do not consider such far-reaching restrictions on diesel vehicles proportionate and would concentrate all efforts on avoiding driving bans through air pollution control plans.
No Speed limits	We are against a general speed limit on German motorways. That's not the real issue when it comes to CO ₂ reduction. Over the decades, our cars and our product image have become a kind of seal of approval for German engineering.
Transition should not be a war on cars	A vocal and sometimes aggressive minority is waging a war against cars, motorists and the automotive industry. In the guise of apparent progressiveness, re-education is demanded. I observe a desire for the demise of a key industry instead of climate change mitigation.
Electric vehicles not resource & energy efficient	Because the production of large battery capacities is energy-intensive, the production of an electric car produces significantly more greenhouse gases than vehicles with conventional engines – on average, 1.5 times the amount. This is a major reason why the carbon footprint of EVs is even bigger than that of diesel cars.
Electrification should not lead to unemployment	If the competitive situation of the German industry in the field of electromobility does not improve in the coming years and the import demand for battery cells and electric vehicles continues to increase with the market ramp-up of electric vehicles in Germany, the impact on employment structures will be considerable.
Do not build new car infrastructure	I call for a paradigm change in the German transport policy and a moratorium on all motorway and federal road projects, including further construction of the A49.
CO2 price leads to justice problems	It seems plausible to me that a higher CO ₂ price helps to reduce CO ₂ emissions, but there is a social issue associated with it. We cannot simply raise the prices of CO ₂ and, for example, leave commuters with older cars, small wallets and oil heaters in the countryside to their own devices. These questions must then be answered in one breath.
CO2 price mechanism is not enough	Subjectively, there has been little decline in traffic since the higher prices – regardless of new price records at the petrol station. For many commuters, price is not the decisive criterion in their choice of means of transport.

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Repugnostic-framing storyline short	Storyline long
Cut the Green tax bonus for EVs	Premiums for the purchase of electric cars must be abolished. Germany simply can no longer afford misguided subsidies.
No more company car tax privileges	The general public also uses taxpayers' money to excessively promote cars for top earners, who have luxury company cars at their disposal as an attractive salary extra. Germany must no longer incentivise the purchase and use of cars with high fuel consumption by companies.
Cut diesel owner tax privileges	Anyone who is serious about the mobility transition from an economic point of view and wants to keep costs as low as possible must first create equal opportunities among the drivetrains. As long as fossil fuels have an advantage, there is no need to discuss openness to technology. That is why we favour abolishing all state subsidies for petrol and diesel cars.
Free/affordable ÖPNV only benefits the urban population	If citizens in rural areas did not receive the same or similar offer as people in the city with the €49 ticket, then this is a blatant violation of the constitutional principle of the equivalence of living and working conditions in urban and rural areas.
Only subsidies for e-company cars	Passenger car emissions in Germany could be reduced by almost a third, and the national climate targets in the transport sector could be achieved if all company vehicles were electrified by 2030.
Not enough capacity for free/low public transport	Tariff measures alone are not enough. The most important thing is to expand the range of bus and train connections in the city and the rural district of Regensburg. Here, too, the long-term support through financing commitments is absolutely necessary.
EV subsidies must continue	Consumers will be left in the lurch, and the ramp-up of e-mobility will be slowed down without a continuation of the EV premiums.
Consumer preference for SUVs	In any case, for us, SUVs are the models that customers love and have the largest margins, and given the uncertainties surrounding the switch to electric mobility, it would be economically irresponsible to say that we are leaving this lucrative business to our competitors.
Charging/refueling infrastructure is lacking	To reach one million public charging points by 2030, around 2000 new charging points would be needed from now on – per week. That's ten times what it is today.
Cities should remain accessible to cars	Car-free inner cities are completely out of touch with reality. There are people on the road here who transport more than themselves, who can't ride a bike because they're older or frail, who work in delivery traffic, who can't cycle through the streets on a cargo bike as craftsmen. But I am very much in favour of focusing on clean drives, hydrogen, electric cars, e-fuels. Offers instead of bans – that should be our motto.

Appendix III. DNA Actor List

Actor name	Actor group
Ampel Regierung	Federal Government
Bundesministerium für Wirtschaft & Klimaschutz	Federal Government
Wirtschaftsministerium	Federal Government
Wirtschaftsweisen	Federal Government
Bundesumwelt Ministerium	Federal Government
Bundesministerium des Innern, für Bau und Heimat	Federal Government
GROKO Regierung	Federal Government
Bündniss 90/Die Grünen	Federal Government
Verkehrsministerium	Federal Government
Verbraucherzentrale Bundesverband	Federal Government
Umweltbundesamt	Federal Government
Klimaliste 2021	Federal Government
Die Linke	Federal Government
FDP	Federal Government
CDU	Federal Government
CSU	Federal Government
SPD	Federal Government
AFD	Federal Government
Deutscher Verkehrsgerichtstag	Federal Government
Deutscher Städtetag	Federal Government
Nationale Plattform Zukunft der Mobilität	Federal Government
Städtischen Verkehrsbetriebe der Stadt Monheim	Federal Government
Nationalen Plattform Elektromobilität (NPE)	Federal Government
Münchner Stadtraat	Federal Government
Straßenamt Berlin	Federal Government
Hamburger Behörde für Verkehr & Mobilitätswende	Federal Government
Städtische Vekehrsplanung München	Federal Government
Landesregierung Bremen	Federal Government
Bayerische Staatsregierung	Federal Government
Hamburger Behörde für Stadtentwicklung und Wohnen	Federal Government
Berliner Vekehrssenat	Federal Government
Senat des Stadtstaats Bremen für Umwelt	Federal Government
FDP (Länder)	Federal Government
AFD (Länder)	Federal Government

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Actor name	Actor group
Bayernpartei	Federal Government
Die Linke (Länder)	Federal Government
CSU (Länder)	Federal Government
Bündniss 90/Die Grünen (Länder)	Federal Government
CDU (Länder)	Federal Government
SPD (Länder)	Federal Government
Ionity	Industry
Renault	Industry
Tier	Industry
Brose	Industry
Moia	Industry
Vay	Industry
Trumpf	Industry
L'Oréal	Industry
Sixt	Industry
Telefonica Deutschland	Industry
Argus	Industry
Hamburger Hochbahn	Industry
Kwiggle	Industry
Share Now	Industry
Verkehrsverbunds Berlin-Brandenburg (VBB)	Industry
Münchner Verkehrsgesellschaft (+)	Industry
Lime	Industry
Volvo	Industry
TomTom	Industry
Beratungsgesellschaft Aengevelt Immobilien	Industry
ECE	Industry
Autobahn GmbH	Industry
Porsche	Industry
e.GO Mobile	Industry
EnBW	Industry
Mercedes-Benz Group	Industry
FlixBus	Industry
Bosch	Industry
Sonnen	Industry
Deutsche Bahn	Industry
Buro Happold	Industry
DPD	Industry
BMW	Industry
Baron Cars	Industry
Apcoa Parking Group	Industry
VW	Industry
Audi	Industry
KSK-Immobilien	Industry
eFuel Alliance	Industry Associations & Lobbies
Bundesverband Deutscher Omnibusunternehmen	Industry Associations & Lobbies
Verband Deutscher Vehrkehrsunternehmen	Industry Associations & Lobbies
Handelsverband Deutschland	Industry Associations & Lobbies
Bundesverband der Deutschen Industrie	Industry Associations & Lobbies
Arbeiterwohlfahrt	Industry Associations & Lobbies
Radlogistikverband	Industry Associations & Lobbies
Verbunds Service und Fahrrad	Industry Associations & Lobbies
Autofahrerclub	Industry Associations & Lobbies
Bundesverband Carsharing	Industry Associations & Lobbies
Zentralverband Elektrotechnik- und Elektronikindustrie	Industry Associations & Lobbies
Arbeitgeberverband Gesamtmetall	Industry Associations & Lobbies
Zentralverband Deutsches Kraftfahrzeuggewerbe	Industry Associations & Lobbies
IG Metal	Industry Associations & Lobbies
Verband der Immobilienverwalter Deutschland	Industry Associations & Lobbies
Verbande der Metall- und Elektroindustrie BW	Industry Associations & Lobbies
Deutscher Gewerkschaftsbund	Industry Associations & Lobbies
Cargo-Gesamtbetriebsrats	Industry Associations & Lobbies
Bundesverband Zukunft Fahrrad	Industry Associations & Lobbies
Ökologischer Verkehrsclub	Industry Associations & Lobbies
Bundesverband für Wohnen und Stadtentwicklung	Industry Associations & Lobbies
Deutscher Verein des Gas- und Wasserfachs	Industry Associations & Lobbies
Allgemeiner Deutscher Fahrrad-Club e. V.	Industry Associations & Lobbies
Verband der Automobilindustrie	Industry Associations & Lobbies
Bundesverband der Deutschen Industrie	Industry Associations & Lobbies
ADAC	Industry Associations & Lobbies

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Actor name	Actor group
Vehrkkehrs Club Deutschland	Industry Associations & Lobbies
European Automobile Manufacturers Association	Industry Associations & Lobbies
Letzte Generation	NGO
Lebenswerte Städte	NGO
Deutsches Verkehrsforum	NGO
Naturschutzbund	NGO
Bundes Naturschutz	NGO
Runter vom Gas	NGO
Changing Cities E.V.	NGO
Extinction Rebellion	NGO
Greenpeace	NGO
Ökologischer Verkehrsclub Deutschland e.V.	NGO
Sand im Getriebe	NGO
Deutschen Städte- und Gemeindebunds	NGO
Fridays For Future	NGO
Domagkpark e.V.	NGO
Bund für Umwelt und Naturschutz Deutschland BUND e.V.	NGO
Deutsche Umwelthilfe	NGO
Institut für Umwelt Medizin	Science & Think Tanks
Universität Kassel	Science & Think Tanks
Deutschen Akademie für Städtebau & Landesplanung	Science & Think Tanks
Institut für Stadtbaukunst TU Dortmund	Science & Think Tanks
Acatech	Science & Think Tanks
Arbeitsmarkt-und Berufsforschung	Science & Think Tanks
TU Berlin	Science & Think Tanks
TU München	Science & Think Tanks
Mobility Institute Berlin	Science & Think Tanks
FU Berlin	Science & Think Tanks
Karlsruher Institut für Technologie	Science & Think Tanks
Future Mobility Lab Uni St. Gallen	Science & Think Tanks
Otto-von-Guericke-Universität	Science & Think Tanks
Kompetenzzentrums Öffentliche Wirtschaft, Infrastruktur	Science & Think Tanks
Deutsches Institut für Wirtschaftsforschung	Science & Think Tanks
Transport & Enviroment	Science & Think Tanks
Wuppertal Institute	Science & Think Tanks
Agora Energiewende	Science & Think Tanks
Helmholtz-Zentrum Hereon	Science & Think Tanks
Wissenschaftszentrum Umwelt der Universität Augsburg	Science & Think Tanks
Hochschule Rhein-Main	Science & Think Tanks
Frauenhofer-Institute	Science & Think Tanks
Vekehrsplanungs Büro Bornkessel & Markgraf	Science & Think Tanks
RWTH Aachen	Science & Think Tanks
Institut der deutschen Wirtschaft	Science & Think Tanks
Umwelt- und Prognose-Institut	Science & Think Tanks
Münchner Ifo-Institut	Science & Think Tanks
Center of Automotive Management	Science & Think Tanks
Center Automotive Research	Science & Think Tanks
Nationalen Akademie der Wissenschaften (Leopoldina)	Science & Think Tanks
Zentrum für Luft & Raumfahrt	Science & Think Tanks
Mercator Research Institute on Global Commons & Climate Change	Science & Think Tanks
Institut für Zukunftsstudien und Technologiebewertung	Science & Think Tanks
Alianz Pro Schiene	Science & Think Tanks
Bundesstiftung Baukultur	Science & Think Tanks
Deutsches Institut für Urbanistik	Science & Think Tanks
GEOMAR	Science & Think Tanks
Wissenschaftszentrum Berlin für Sozialforschung	Science & Think Tanks
Helmholtz Institut	Science & Think Tanks
Die Deutsche Rohstoffagentur DERA	Science & Think Tanks
Öko-Institut	Science & Think Tanks
Institut UPI	Science & Think Tanks
Hochschule Trier	Science & Think Tanks
Hochschule für Technik und Wirtschaft	Science & Think Tanks
Leibniz-Institut für Wirtschaftsforschung	Science & Think Tanks
TU Dresden	Science & Think Tanks
Deutsche Verkehrswissenschaftliche Gesellschaft.	Science & Think Tanks
Europäischen Umweltagentur	Science & Think Tanks
Agora Verkehrswende	Science & Think Tanks
TU Harburg	Science & Think Tanks
Think Tank W.I.R.E	Science & Think Tanks
IHS Market	Science & Think Tanks

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Actor name	Actor group
Zukunftsinstitut	Science & Think Tanks
Allianz pro Schiene	Science & Think Tanks
ICCT	Science & Think Tanks

Data availability

Data will be made available on request.

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