



# Should the wheel be reinvented? Market-referencing in the electric vehicle market charging infrastructure

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## ARTICLE INFO

### Keywords:

Market-referencing  
Market infrastructure  
Market-making  
Market-shaping  
Practice theory  
Electric vehicles

## ABSTRACT

Market-referencing helps market actors learn from what has gone before – saving them from reinventing the wheel. While extant studies show that market-referencing is essential for stabilising and legitimising new markets, little is known about how market-referencing is used to infrastructure consumer serving markets. This paper reveals the mechanisms through which market-referencing enacts infrastructure a new consumer market, as a stable, legitimate, functioning market. Using a theories-in-use approach, we analyse how exchange, representational and normalising practices from a referent market are picked-up, extended, and modified to transform, the Electric Vehicle (EV) charge point infrastructure in the UK. Infrastructural objects (charge points, rules, and exchange terms) manifest referent market practices in the new market, resituating and entangling them with new practices and materialities. In the process, the EV market charging infrastructure is reordered to constitute a functioning market.

## 1. Introduction

Markets are continuously in the making, at least in part, through the purposeful efforts of market-makers, to alter or create them anew (Araujo, 2007; Goulding & Saren, 2007; Sandikci & Ger, 2010). However, not all efforts to proactively modify or make markets, are successful (Geiger et al., 2012). Take, for example the EU's effort to create a Guarantees of Origin (GO) market aimed at generating revenues for expanding a renewable energy infrastructure. This market has worked from an economic purview: since 2023 it has raised 57 billion EUR. Yet, the investment promissory of this market has, so far, failed to materialise (Mulder & Zomer, 2016). While it is difficult to say how many market-making endeavours fall short or misfire (cf. Callon, 2010), product failure rates of around 40 % are indicative of the challenges that market actors face (Castellion & Markham, 2013).

One way that market actors have avoided market failure has been to legitimise markets through referencing and mimicking practices from one market in another (Hietanen & Rokka, 2015; Weber et al., 2008). As Sprong et al. (2021) point out, self- or market-referencing<sup>1</sup> can act as a stabilisation and legitimisation tool for a variety of market facets,

including for market infrastructures (Chiles et al., 2004). In each case, existing practices or practice elements, (for example, routine physical or mental activities and their supporting materials (Reckwitz, 2002), are adopted and adapted in the process of building markets and market infrastructures (cf. Araujo & Mason, 2021).

Market infrastructures can be understood as the sociomaterial practices upon which new markets are made and shaped, and as such, provide a critical resource to those seeking to innovate, stabilise or, at worst, repair new markets. Only with market infrastructures in place can the markets of the future be established. These market infrastructures need to be constructed by arranging practices and materials in a way that support the functioning of a market – a process known as infrastructuring (Araujo & Mason, 2021). Market infrastructures thus form the backbone of a market, determining whether a market is future-proof and able to cope with or survive future crises, such as the climate emergency. Despite recognition of the significant role that market infrastructures and their establishment play in markets (Araujo & Mason, 2021; Kjellberg et al., 2019), we know little of how market actors engage with, and enact, market-referencing when working to infrastructure markets that are yet to be stabilised.

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<sup>1</sup> The transformation literature refers to the term “self-referencing” (Chiles et al., 2004). Because this study investigates referencing in a market context, we use the term “market-referencing” instead.

As with the consumer renewable energy market, some markets, require additional markets to underpin and infra-structure their functioning. Infra-structuring efforts require complex sociomaterial (and often technical) arrangements, to act as building blocks for market exchange (Kjellberg et al., 2019). Yet, we have little understanding how these infrastructures are created, to support new markets or market infrastructures, providing limited explanations for practitioners. Adopting a markets-as-practices approach (Araujo, 2007; Kjellberg & Helgesson, 2006), this research sets out to ask: 1. *What form does market-referencing take?* and 2. *How is market-referencing enacted to infrastructure markets?*

To address these questions, we studied the emerging electric vehicle (EV) market, in the UK; a market where infrastructure for charging is critical but, in places, obviously absent (EVA England, 2021). Adopting a *theories-in-use* approach (MacIntosh et al., 2021; Zeithaml et al., 2020), we worked with a variety of market actors (consumers, site managers, charging point operators, and policymakers) to develop key theoretical propositions to explain how market-referencing occurs and infrastructures the market. Our *theories-in-use* include: Kjellberg and Helgesson's (2006, 2007a, p. 145) market practices frame, to examine *what* kinds of "practice classes" infrastructure markets; Chiles et al.'s (2004) referencing theory to examine *what* enacted referencing looks like; and Araujo and Mason's (2021) market infrastructuring theory to examine *why* and *how* these new market practices are enrolled and knitted together.

## 2. Literature review

### 2.1. Conceptualising markets

To understand the form and enactment of market-referencing in the process of market infrastructuring, we must first understand how markets have been conceptualised as bundles or "classes" of practice (Kjellberg & Helgesson, 2007a, p. 145), and the implications of this for the market-referencing mechanisms that enable market actors to stabilise and legitimise new markets.

From a *markets-as-practice* perspective, markets are emergent, dynamic systems of the production, distribution and exchange of goods (Callon et al., 2002; Callon & Muniesa, 2005), recursively performed through the routinised, sociomaterial, expert and meaningful activities of market actors (cf. Reckwitz, 2002; Shove & Pantzar, 2005). Our approach affords the study of market-making at multiple scales: from individual, micro practices, to the collective macro, plenum of practice (cf. Schatzki, 2005) that is the market. This multi-scale approach enables us to see what market actors do, and the individual and collective outcomes of those doings, generating important insights and relevance for society (Goffman, 1974; Hagberg & Kjellberg, 2009).

Rather than focusing on economic outcomes, this markets-as-practice conceptualisation, draws attention to the unfolding nature of markets (Araujo, 2007; Humphreys, 2010), performed by marketization models as theories-in-use (cf. Palo et al., 2019). As such, marketization theories are represented and circulated, acting as objects of contestation and consensus, working to enrol and mobilise collective and coordinate actions to make and maintain markets (MacIntosh et al., 2021; Mason et al., 2019; Zeithaml et al., 2020).

Further, a markets-as-practice conceptualisation recognises the performativity of marketization models and theories producing misfires or unintentional effects (Geiger & Kjellberg, 2021). Many market performances are the outcomes of proactive attempts to change the market and its entities to generate socio-economic value (Diaz Ruiz et al., 2020; Nenonen et al., 2014). They do this by bringing to the fore the role of actors, generating meanings from the various interest groups, and performing those meanings through their practice (Kjellberg et al., 2012). However, these market studies rarely take the state of the market into account, when considering such interventions (cf. Callon, 1998).

For Storbacka and Nenonen (2011, pp. 258–259), state or "market maturity" can be understood as progress along a continuum of market

practice alignment, and is central to *how* markets are made and shaped. A well-established or developed market is characterised by clear standards, coordination practices that enable the exchange of defined market objects, and established infrastructure (see also, Araujo et al., 2008; Callon, 2010; Mason & Spring, 2011). A nascent or emerging market, in contrast, has evolving exchange practices, lacks norms and regulations, and requires significant effort to shape the market's mental image (Storbacka & Nenonen, 2011). But these conceptualisations of market states tend to focus on a single layer of market activity, and ignore the infra-structures that sit below them, and make market action possible.

Finally, a markets-as-practice conceptualisation sees market infrastructures, as central to how markets function. Market infrastructures are defined as the "... materially heterogeneous arrangements that silently supports and structures the consummation of market exchanges" (Kjellberg et al., 2019, p. 209) and as such, make an important contribution to the legitimisation of new markets (Huff et al., 2021; Humphreys, 2010). Drawing on Star and Ruhleder (1996), we conceptualise market infrastructures as relational. That is, for something to be considered as infrastructure it must support or structure market practice. This suggests that market practices are likely to play a critical role in market infrastructures; however, there is little empirical research to evidence how or why, with extant research on market infrastructures being limited to knowledge-based infrastructures (Araujo & Mason, 2021), infrastructure classification systems (Azimont & Araujo, 2010), and market infrastructure enactments (Kjellberg et al., 2019). These studies provide preliminary insights into how infrastructures can be used to develop and establish new markets but say little of what it means to infrastructure consumer markets.

In sum, the relationship between market practices, market infrastructures and the process of infrastructuring consumer markets is lacking in extant conceptualisations of markets (Cass et al., 2018). For this reason, we now first reflect on what market practices are, before considering how market-referencing practices seek to resituate them from one market to another, in a consumer market-making endeavour.

### 2.2. Market practices

The notion of market practices, is embedded within broader conceptualisations of practice including those developed by Bourdieu (1990), Latour (2005), Schatzki (2001), and Reckwitz (2002). While each offers its own definition, there are important commonalities. For example, practices are generally understood as being composed of multiple elements that pertain to activities, their performance and the material objects and knowledge/know-how required for this performance. Practices are additionally associated with some form of routinised, patterned action which establishes the 'practice' as a recursive undertaking.

Market practices then, are a particular category of practice associated with the performance of markets (Araujo et al., 2008; Callon, 1998), and have been described as the doings of market actors (Mason & Spring, 2011) through their engagement in market context-related activities (Geiger et al., 2012). Market practices are thus multifaceted and have a dual role: making, shaping and transforming markets through their performance, while at the same time maintaining markets by anchoring operations in the status quo.

To explore this duality, we use Kjellberg and Helgesson's (2006, 2007a) market practices model, which has found application among existing market-making studies (e.g., Azimont & Araujo, 2007; Ottosson et al., 2020). We use it to understand the tensions between market stability and innovation, and as a valuable lens for empirical analysis. In their model, Kjellberg and Helgesson (2006, 2007a), distinguish between *exchange*, *representational*, and *normalising* market practices. *Exchange* practices make transactions happen, including their conduct and idiosyncratic activities, for example, specifying terms of delivery (Alderson & Cox, 1948). *Representational* practices, encompass practices aimed at the transformation of markets as abstract entities into

comprehensible images used to guide action. Finally, *normalising* practices are the normalised patterned practices that hold the production, distribution, and exchange of goods in place. They are the market rules, (voluntary) standards and guidelines on how a market should function and how market actors should behave in it (Araujo et al., 2008; Hagberg & Kjellberg, 2009; Kjellberg & Helgesson, 2007a, 2007b). These three distinct classes of market practice are understood to be entangled with each other through traceable *chains of translation* (Kjellberg & Helgesson, 2007a; Latour, 1999). Translation chains are not causal relationships. Rather they act as devices for holding patterned practices together in a mobile and fluid plenum of practice, creating a mechanism for mimicking, resituating, adopting and adapting practices from one market to another.

When market actors bring their exchange expertise from an established market, to a new and emerging market, they can act to stabilise or disrupt the normalised practices of the emerging market (cf. Kjellberg et al., 2015; Mason & Spring, 2011). Claims about exchange consequences can therefore, be illustrative of translation chains that run across markets. Translation chains that work across markets can link normalising and representational practices and in so doing, reveal the similarity and difference between markets (Kjellberg & Helgesson, 2007a; Kjellberg & Olson, 2017). Table 1 provides an overview of the different types of market practices and their translation chains across markets.

While Kjellberg and Helgesson's (2007a) market practices model is useful because of its focus on what markets are and how they work, the model has less to say about how market infrastructures are made and shaped. We see the concept of translation chains as particularly useful in considering market infrastructures. Rather than simply showing connections and linkages across markets (Kjellberg & Olson, 2017) as a tool to compare market practices and their manifestations between specified markets, we posit that translation chains have the potential to explain the mechanisms through which market practices are resituated. We turn next to the market-referencing literature to explore extant understandings of this process.

### 2.3. Market-referencing

As Plowman et al. (2007) point out, a new and emerging market can be made more stable and legitimate by referencing existing, deep-seated market practices in other markets. This positions market-referencing as a tool that impacts how the market (and necessarily, the market infrastructure) is made (Chiles et al., 2004). Thus market-referencing seems particularly pertinent to understanding how new markets are established, stabilised enough to give consumers access to new, complex but critical goods and services, such as EV powered mobilities (Mordor-Intelligence, 2023). But market-referencing has been understood differently in different bodies of literature.

In the Consumer Culture Theory (CCT) literature, market-referencing is understood as a mechanism through which market practices can be resituated, reimagined, and reconnected. For example, Coskuner-Balli and Ertimur (2015) show how a new American yoga culture is built by deliberately omitting some market practices, while adding others; or Martin and Schouten (2014) show how extant materials are recombined to equip actors to create a motorbike add-ons market. In each case, core sociomaterial elements of extant market infrastructures are selectively enrolled to support and (re)configure the emerging market.

In contrast, the market category literature uses market-referencing to explain how market actors demarcate or create new market categories by adding external market elements to an existing market system (Durand & Khaire, 2017), such as the adoption of truck features by the market for cars (Rosa et al., 1999). While in the market emergence literature, the adoption of market practices and the active non-adoption or rejection of market practices are used to show that market actors actively seek to converge or differentiate original and emerging market structures and infrastructures (e.g., Choi & Burnes, 2022; Hietanen & Rokka, 2015).

Finally, market-referencing has been used to create a reference or orientation point for consumers. For instance, Baker et al. (2019) show, how market-referencing of the material aspects of the traditional circus, (for example, the circus tent), has served as an orientation point for the new circus to be acknowledged as such. While Schouten et al. (2015) show how the organic food market has many of the same material tropes as any other food market. What is particularly interesting in Schouten et al.'s work (2015) is how the new market is initially limited by the extant infrastructures of related markets; restricting farmer's distribution channel options and market growth. In other words, market-referencing required engagement with the well-developed market structure that was already in place (Schouten et al., 2015).

Market-referencing studies, though fragmented, provide insights into the use of market-referencing practices to establish new consumer cultures, and to structure, harmonise or delimit markets. As such, market-referencing is understood as a bundle of market-making and shaping practices that form part of overall market arrangements. Yet, these studies say little of how market-referencing comes about or how it is enacted.

Fig. 1 presents an analytical framework to further explore the enactment of market-referencing. We anticipate that the forms and enactment of market-referencing depends on the state of the transferring (referent) and receiving (new) markets, their market's infrastructures and the affordances sociomaterial practices have for their enrolment in the new/emergent market. Our aim is to reveal where market infrastructures come from and how their resituation is enacted; as Kjellberg et al. (2019) point out, market infrastructures do not materialise out of thin air. Rather, we want to understand how market-referencing foregrounds absence and omissions of critical elements of market

**Table 1**  
Conceptualisation of market practices and translation chains (Araujo et al., 2008; Kjellberg & Helgesson, 2007a, 2007b; Kjellberg & Olson, 2017)

| Class of market practices         | Description of market practices  | Market-spanning translation chains   |
|-----------------------------------|--|--|
| <b>Exchange practices</b>         | Activities related to the performance of individual transactions<br>Efforts to stabilise or configure exchange conditions (e.g., pricing, terms)<br>Idiosyncratic activities related to transactions (e.g., specifying products, organising the distribution of goods) | Exchange process translation or parts of it (e.g., charging point design similar to fuel pump); actor experience translation from original to new market; claims about exchange consequences |
| <b>Representational practices</b> | Activities that contribute to representations of a market, its structure, and functioning<br>The transformation of markets as abstract entities into images (e.g., symbols)  | Actor experience translation from original to new market for market representations; claims about market similarities/differences (e.g., EV market as an environmentally conscious market)   |
| <b>Normalising practices</b>      | Rules, norms, and (voluntary) standards (e.g., reforms)<br>Normative objectives<br>Guidelines on how a market should work and how to behave in it (e.g., rules of competition)   | Template for new regulations; claims about market similarities/differences (e.g., EV market as an environmentally conscious market)  |

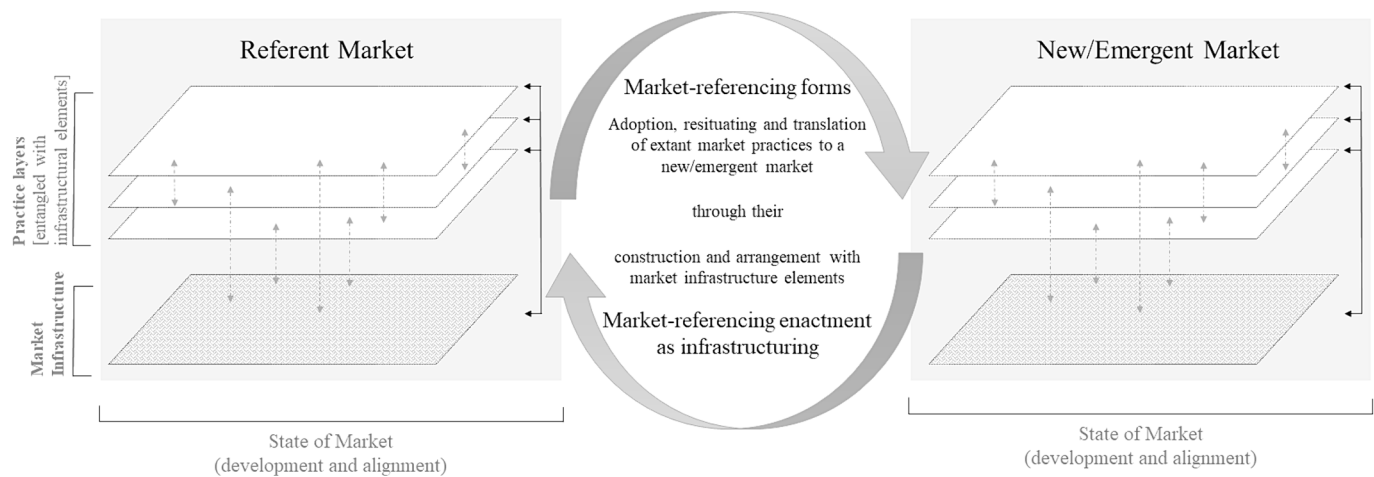


Fig. 1. Analytical framework to explore the forms and enactment of market-referencing practices to infrastructure a market

infrastructures, and the challenges faced by those seeking to enrol and enact sociomaterial practices adopted from one market and resituated in another. As the enactment of market-referencing practices is often an active and deliberate effort, we suggest that some form of judgement or evaluation practice is performed to help market actors work out what is to be referenced, copied and adopted and how. We found no studies that explicitly looked at this element of practice, despite calls from Market Studies scholars to deepen understanding in this area (cf. Kjellberg et al., 2012; Sprong et al., 2021).

### 3. Method

Given the forms and enactment of market-referencing practices to infrastructure consumer markets are not well understood, we use an exploratory research method following a theories-in-use approach. A theories-in-use approach requires a mental model on how market(ing) phenomena work in a particular setting (Zeithaml et al., 2020, p. 32). In concrete terms, we use three related conceptualisations – markets, market practices and market-referencing – to explore the electric vehicle (EV) market and its emergent EV charging infrastructure, in the UK (see Fig. 1).

#### 3.1. The UK electric vehicle market as a site of inquiry

We selected the EV market charging infrastructure as a suitable site of inquiry, because while being modelled on extant and established combustion engine refuelling markets, it remains problematic, is still in flux; its legitimacy as a dependable and viable alternative to the combustion vehicle remains in dispute. In 2020, the UK Government became the first in the world to introduce a future ban on the sale of combustion-engine vehicles, with effect from 2035 (Department for Environment, Food & Rural Affairs, 2017). This ‘future ban’ has driven significant innovation in vehicle markets, not least in the development and offer of electric cars for the consumer market (MordorIntelligence, 2023). The UK EV market is different from EV markets in other countries. For example, in contrast with the South African EV market, where consumers can visit ‘battery swapping stations’ (see for example <https://charge.co.za/electric-cars-and-charging-stations/>), UK consumers must park and charge, waiting an hour or so as they use the charging point infrastructure (Department for Transport, 2022). The global EV market lacks the consistency and to some extent, the stability of an established market, with some market practices considered as misaligned. An essential factor for the EV market’s further development is the establishment of its charging infrastructure (ACEA, 2022; EVA England, 2021).

Despite their newness, EV market structures (and supporting

charging infrastructures) seem familiar to consumers. New EV drivers fundamentally know how to recharge their vehicles even for the first time, as the process appears similar to that for refuelling a combustion vehicle. In this regard, the UK EV market exhibits mimicked infrastructural elements from the combustion vehicle market, carrying deep-seated market practices into this emerging market. However, many EV market practices are not yet well-established or seem somehow temporary. Inconsistent and unreliable charging infrastructures do not help (The Economist, 2021). Improvements will require coordination across a number of market actors; investors, regulators, service providers etc. Such teething troubles mark out the UK EV market as a most suitable site of inquiry to understand how market-referencing is engaged with, enacted and coordinated among market actors seeking to stabilise, legitimize and make use of what this market can offer.

Because the EV market cannot function without the underpinning market infrastructure for refuelling/charging EVs, what might have been considered two distinct markets, become inseparable – interweaving infrastructural elements that span these markets, such as service stations, with elements (such as fuel pumps and charging points) that are combustion engine or EV specific. This entanglement of multiple layered market infrastructures has received little attention in the extant literature (Araujo & Mason, 2021). Instead, much of the literature relating to EV markets has predominantly focused on addressing questions on transportation planning (e.g., Giménez-Gaydou et al., 2016; Pagany et al., 2019). Thus, the EV market promises an interesting setting for the examination of market-referencing forms and enactments to identify classes of practice that are being transferred and transformed from a referent market (the combustion vehicle market and its supporting market infrastructure for refuelling), into the emerging EV market charging infrastructure.

#### 3.2. Data collection and sampling

In line with a markets-as-practices approach, we collected data through observations at charging sites, and conducted in-depth interviews and document analysis; a common approach in market-making research (e.g., Andersson et al., 2008; Tóth et al., 2022). In combination, these data collection methods allowed us to capture the forms that market-referencing and its enactment can take (covering the practices of enrolling these forms into the EV market charging infrastructure [referred to in Fig. 1. as the *new or emergent market*] and the emergence of new or resituated sociomaterial (infra)structures). We briefly describe all data collection methods below. Details can be found in Appendix A.

We conducted a seven-day naturalistic observation at the UK’s largest EV charging site (Oxford City Council, 2022), totalling 20 h, to understand everyday charging practices. Observations acted as an initial



familiarisation technique, enhancing the study’s credibility (Shenton, 2004). We adopted an observer-as-participant role, complementing the observation with 24 interviews, recorded in field notes (Gillham, 2000), and took 45 photos of charging sites in action. A photo selection can be found in Appendix B Fig. B.1–3.

We recognise that short-term observations coupled with short interviews may not provide an overall picture (Baker, 2006). To address this shortcoming, we additionally conducted 18 in-depth interviews with various EV charging infrastructure actors (Table 2). Market actors are understood to be all those who are active or engage with the market, e.g., providers, companies, customers, public authorities, etc. (Storbacka & Nenonen, 2011, p. 242). We used theoretical sampling, starting with actors who were part of the market-referencing phenomenon, such as charge point operators/manufacturers and EV drivers, and subsequently expanded our search to include other actors (e.g., energy suppliers, government departments), who provided further insights (Coynne, 1997; Zeithaml et al., 2020). Interviews, both in-person and digital, lasted approximately 45 min each and were audio-recorded and transcribed.

Finally, to better understand the wider EV market context, we carried out a document analysis covering company documents, websites, newspaper articles, and consulting reports. We collected and analysed over 40 documents to build a broad description of the market, using our analytical frame (Fig. 1) to search for and identify market actors and their sociomaterial practices. We then worked to systematically close any gaps left by other data collection methods (Bowen, 2009). For example, documents were particularly helpful in tracking early practice evolutions, alternative sites of adoption (e.g., rural/urban), as well as standard/regulatory developments. Appendix C Tables C.1–3 provide an overview of all data collection sources and outlines the most important document sources.

3.3. Data analysis

Consistent with the exploratory nature of the research, which draws on existing constructs, we use Mayring’s (2004, 2014) qualitative content analysis. Prior criteria were formulated, against which the gathered

materials were examined. We also developed inductive categories drawing on the market practice classes identified by Kjellberg and Helgesson (2006, 2007a) to fathom the market-referencing process and its mechanisms, iterating between theory and research material.

To arrive at our results, we analysed all three market practice classes in terms of (1) its underlying practice manifestations (covering the original combustion vehicle market infrastructure and the new EV market infrastructure), see Table 3 for an outline of EV infrastructure specific practice manifestations; (2) its market-referencing form and (3) market-referencing enactment, outlining how the EV infrastructure gets configured and whether the market-referencing is actor driven or ‘feral’.<sup>2</sup> We applied the model’s translation chains to identify the market-referencing forms, tracing how original practices were translated into the new market (i.e., takeover, extension, modification, extended modification, or new) and how these translations were knitted together to enact the market. We used translation chains to compare all market practice classes and their arrangements across the market infrastructure for refuelling and for charging, deviating from existing practice to outline within or across market (practice) connections; see Appendix D for an exemplary data analysis structure.

Following current practice, an independent researcher recoded 25 % of the data to ensure the reliability of the analysis (O’Connor & Joffe, 2020). Cohen’s Kappa ranges between  $\kappa = 0.83$  and  $\kappa = 0.98$  for all three market practice classes with an average value of  $\kappa = 0.89$ , indicating an almost perfect level of agreement (Landis & Koch, 1977).

4. Findings

We first present our findings on the forms that market-referencing may take as practices are translated and resituated. We then outline the enactment of referenced practices by looking at how market infrastructures get configured and how these configurations are actively brought about. We support these findings with interview (I) or observational short interview (SI) excerpts. An overview of our findings, supported by sample statements from the (short) interviews, is given in Table 4.

4.1. Market-referencing manifestations

We identified several market-referencing forms covering the simplest form of practice takeovers, to takeover forms where practices are more fundamentally altered, to new practices.

Takeover

Market-referencing, most straightforwardly, involves the adoption of practices in their original form. We refer to this type of market-referencing as a “takeover”. While we recognise that resituating a practice renders it altered, we use the term ‘core practice’ to refer to the purpose and meaning of the practice remaining the same, and the term “takeover” to describe the core practice’s adoption and re-situation in the new market.

We observed market-referencing takeovers across all three market-practice classes: exchange, representational and normalising practices. Exchange practices required the maintenance of charging points (which frequently broke down). In this instance, the site of the charging points could be similar (on garage forecourts) or different (in supermarket or service station car parks), but the practices of checking, repairing, and servicing were recognisable. Maintenance practices ensure the EV market infrastructure is safe, reliable and useable. We also observed representational practice takeovers, with easily copied design elements (similar design of fast charging points to fuel pumps) providing reference points to consumers while charging. Similarly, media coverage and

<sup>2</sup> The term ‘feral’ is used in line with Diaz Ruiz and Kjellberg (2020), who refer to market processes that take place ‘in the wild’. These processes are not actively steered by market actors and beyond marketing control.

Table 2  
Overview of interviewees

| No. | Company        | Position   | Market actor   |
|-----|----------------|--|--|
| I1  | Alpha          | CEO  | Charge point operator and manufacturer                       |
| I2  | Beta           | Former chairperson   | Charge point operator  |
| I3  |                | Marketing officer  |  |
| I4  | Gamma          | Senior electrical engineer   |  |
| I5  | Delta/<br>Beta | Project manager  | Charge point management software/prior charge point operator |
| I6  | Epsilon        | Chairperson  | Energy supplier and charge point infrastructure              |
| I7  | Zeta           | External affairs manager   |  |
| I8  | Eta            | Flexible solutions manager, distribution system operation transmission |  |
| I9  | Theta          | Project manager in sustainable energy & air quality                    | City council   |
| I10 | Iota           | Senior electric vehicle project officer                                |  |
| I11 | Kappa          | Senior policy advisor  | Office for Zero Emission Vehicles                            |
| I12 | Lambda         | Head of the rapid charging fund  | Motorway maintenance   |
| I13 | Mu             | Business park owner  | Charging site host   |
| I14 | Nu             | Hotel owner  |  |
| I15 | –              | –  | EV driver  |
| I16 | –              | –  |  |
| I17 | –              | –  |  |
| I18 | –              | –  |  |

**Table 3**

Overview of context-specific market-referencing manifestations in the EV market infrastructure for charging

| Market practice class   | Exchange practices   | Representational practices  | Normalising practices   |
|-------------------------|--|---|---|
| Practice manifestations | <ul style="list-style-type: none"> <li>- Charging process</li> <li>- Terms of exchange</li> <li>- Place of exchange</li> <li>- Pricing/payment</li> <li>- Maintenance</li> </ul> | <ul style="list-style-type: none"> <li>- Physical EV infrastructure</li> <li>- Actor interconnectivity</li> <li>- EV labels/terminology</li> <li>- Mental EV market representations</li> <li>- Media</li> <li>- Funding/demonstrator projects</li> <li>- Market research</li> </ul> | <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Charging standardisation</li> <li>- Regulations</li> <li>- Voluntary charging standards</li> <li>- Charging norms</li> </ul> |

market research practices take on a form that is almost indistinguishable from those seen in other markets. For instance, respondents referred to the use of “social media platforms” to influence public sentiment on EVs (#19) or to making “final project reports” (#17) and “best practice guides” to share their work outcomes (#111).

We also observed normalising practice takeovers. We found multiple government funded schemes for EV charging and battery technologies. Such schemes enacted market-referencing using investment mechanisms to promote technological and market infrastructure development – common in technology-development markets. Such investments often take the form of ‘grants’. As respondent #13 explained: “Grant[s] tend to ease the way and oil the mechanism of approvals from banks, so grants do help”.

#### Extended or modified takeover

Market-referencing takeovers were not always straightforward. Sometimes, they were *extended*, *modified* or both. Extended and modified market practice takeovers occurred within all three market practice classes. Extended practice takeovers occur when the core practice remains intact but new practice elements are added. Extended representational practice takeovers manifest as “zooped-up Sat Nav maps” (respondent #118). The material object – the map – was extended to provide additional charging point numbers, locations, and occupancy information to EV drivers. Such maps are central to an EV driver’s ‘good experience’ (respondent #118). This type of accurate information can enable their journey. Absence of this information constitutes the EV market as dysfunctional. We also found market practice takeover extensions to EV charge point regulations. The Town and Country Planning (General Permitted Development) Order 2015, extended the normalising refuelling rules, pertaining specifically to charging point installation (Tunbridge Wells Borough Council, 2020) in an effort to further develop the EV market infrastructure.

Modified market practice takeovers occur when practices are more fundamentally changed to fit and develop the new market infrastructure. For example, when charge point operators modified the terms of exchange by altering charging duration of stay or charge levels during peak energy times, by imposing restrictions: “It takes 20 min to charge our car. You cannot stay longer than that at the bay, otherwise you will get fined...” (respondent #S12). These modifications are designed to enable a smoother charging process (i.e., ensuring the provision of sufficient energy to supply EV drivers, and that charging stations are not congested). Overall, extended and modified market practice takeovers were observed most frequently as part of the exchange practice, the socio-material EV charging infrastructure, and EV regulation.

#### New market practices

Finally, where appropriate referent market practices were absent or failed, new market practices emerged. This was observed for normalising and representational practices. When the absence of a comprehensive, national charge-point infrastructure was identified as a point of market shortfall, the Department for Transport (2018) stepped in, establishing a new EV market objective – to deliver a green economy. At the same time, the government introduced a “2030 petrol and diesel car ban”: “When they [the UK Government] first announced that ban of petrol and diesel vehicles in 2030, that was the straw that broke the camel’s back...” (respondent #13).

To foster the emerging market transition, market actors introduced voluntary ‘accessible charging’ standards, codes of conduct, and charging guidelines at all charging point installations. As respondent I1 described: “We got people to test if it is easy to get to... ‘Can you actually reach, unplug, and plug it into your electric vehicle?’” These newly introduced standards went beyond existing market requirements, first imagining and then performing a “better future” (respondent #I18).

New practices are also introduced to compensate for dysfunctional market practices. In the EV market, we saw the emergence of new practices designed to compensate for unreliable EV charge point infrastructures, and for the technical limitations of charging point technologies: consumers told us that charge points were “not easy to use” and “are frequently out of order” (respondent #I16). A new charging norm, known as ‘scattering’, emerged among EV drivers: “There is a general understanding among EV drivers to spread out as far as possible and not to use the next charging point if someone is already charging. Otherwise, you get a nasty sideways glance from your charging neighbour. If that [charging side-by-side] happens, it takes ages [to charge]” (respondent #S17). Multiple-vehicle, multipin-sockets, simultaneous charging, severely reduces energy output and significantly prolongs the charging process. After having established how market-referencing manifests, we now move to its enactment.

#### 4.2. Market-referencing enactments

Market-referencing enactments act as a mechanism through which market infrastructures are (re)arranged and reordered. That is, when market practice takeovers (including those that are extended and/or modified), are connected to and entangled with new market practices and infrastructures, they rearrange and reorder how the market functions – this may or may not be actively steered.

##### (Re)arranging market infrastructure

EV market actors first, takeover, extend and modify market practices and then connect and combine them into new market practice arrangements. These practice arrangements are held together through their entanglement with emergent market infrastructures. For example, charge point installation at home, at work and in car parks. Rearrangement is the process by which actors and their relations are reconfigured or shifted. This involves changes in the role of refuelling points (drivers now take a break for an hour: this is more than a refuel stop). Such arrangements can reveal further absences (e.g., the need for fast charge points), and so enrol new elements into the market infrastructure as drivers make more use of service station restaurants, workstations and shops in their extended ‘break’ period. Market practice takeovers are thus used to rearrange and infrastructure emerging markets. We see this as a specific kind of market-making work that we term market infrastructuring (cf. Araujo & Mason, 2021).

Referent market practices do not always prevent consumers from feeling alienated by a new market situation: “They’re [new EV drivers] not used to it. People are used to just picking petrol up, plugging it in and squeezing a trigger. They’re not used to all of the different reasons and the different things behind the charger” (respondent #1). While many market-referencing efforts set out to support consumer enrolment (EV charging cables were designed to look like fuel pumps, to act as a reference point

**Table 4**  
Overview of market-referencing forms and enactment

| Findings                            |                                     | Translation chain  | Market practice classes | Sample statements   | Market practice manifestation(s) – if applicable, with specification  |
|-------------------------------------|-------------------------------------|--|-------------------------|---|---|
| <b>Market-referencing forms</b>     | Takeover                            | The core of the original or referent market practice remains unchanged when translated to the new market space                       | EP<br>RP<br>NP          | I11: “When OZEV ended the plug-in car grant, the announcement went out at seven in the morning and was on the national broadcaster of the United Kingdom’s website within the hour, alongside sites for industry stakeholders.”<br>I7: “There will be a final project report...making sure that the learnings get captured but also that they get shared.”  | Media   RP<br><br>Market research   RP  |
|                                     | Extended takeover                   | The core of the practice from the original or referent market is preserved, whilst new practice elements are added                   | EP<br>RP<br>NP          | I5: “I think there are still a lot of people that think: ‘If you have an electric vehicle, you can plug it in everywhere’.”<br>I16: “I think it is down to the speed of charge and the number of charging stations.”  | Charging process – increased complexity of top-up procedure   EP<br>Place of exchange – charging choice   EP  |
|                                     | Modified takeover                   | The core of the practice from the original or referent market is altered   | EP<br>RP<br>NP          | I5: “So one of the big criticisms by most EV drivers is that on your mobile device, you have a folder of your EV charging apps, and there would be about 20 in.”<br>I16: “People who are thinking about electric vehicles have so-called ‘range anxiety’... That is the only thing which I hear a lot by people.”   | Physical EV infrastructure – accumulation of charging apps   RP<br>EV labels/terminology   RP   |
|                                     | Extended/modified takeover          | Combination of practices consisting of core practices that have been extended and core practices that have been altered              | EP<br>NP                | I14: “Yeah, we do charge at home, but we do not have a charge, and we just use an old plug from the garage.”<br>I5: “Incentivising the driver to become a subscriber by taking a regular payment via subscription and then getting a certain allowance every month, just like you have on your mobile phone.”   | Charging process – several usage scenarios   EP<br>Pricing/payment – movement towards subscriptions   EP  |
|                                     | New                                 | Practices that arise in the new market and have not been adopted from the original market  | RP<br>NP                | I5: “And then there are a whole bunch of new regulations that come in December regarding physical and cyber security of charging networks.”<br>I14: “I think the best source of information is electric vehicle owners and groups on social media. That has been the best source of information, without doubt.”  | Regulations   NP<br><br>Actor interconnectivity – active exchange among drivers   RP  |
| <b>Market-referencing enactment</b> | (Re)arranging market infrastructure | Rearrangement of market practices into new market practice arrangements for the purpose of boundary setting                          | EP<br>RP<br>NP          | I15: “So it really is led by the drive, what is it 2030? The fact that combustion engines are being phased out and electrics are coming in.”<br>I1: “So people that cannot charge their vehicle at home have easy access to the car parks. Then we looked at security. So we wanted car parks, which had a low crime rate, which had CCTV, so people would feel comfortable leaving their car in... Then we also looked at local amenities. So, is there a coffee shop nearby so people can leave their cars and get a coffee? Is there a supermarket so they can go shopping? We also then looked at the wealth of the area... But then the other thing we have to look at was the availability of power.”   | Objectives   NP<br><br>Place of exchange   EP;<br>Charging process   EP;<br>Physical EV infrastructure   RP;<br>Voluntary charging standards   NP   |
|                                     | Reordering market infrastructure    | Combination of multiple referent and new market practices with infrastructure materialities to achieve reordered plenum of practices | EP<br>RP<br>NP          | I9: “... one of the first things was a parking permit for city residents so that anyone who had an electric vehicle... could park free in council car parks or on street parking... subsequent, we have been delivering public charging infrastructure..., utilising some government funding, local transport funding and investments in the private sector... We also delivered charging in different ways... residential charge hub and worked on expanding our charge offering across the city centre and multi-storey car parks, and Park & Rides.”<br>I12: “This pot of money is in particular dedicated to the Strategic Road Network. So where it’s appropriate, where it’s good value for money, where it can be done, and where you’re digging already to, to put the network in.... It is largely anticipated that distribution network operators, DNOs, will create the enhancements | Funding/demonstrator projects   RP;<br>Physical EV infrastructure   RP;<br>Charging process   EP;<br>Terms of exchange   EP;<br><br>Funding/demonstrator projects   RP;<br>Physical EV infrastructure   RP;<br>Charging process   EP; |

(continued on next page)

Table 4 (continued)

| Findings                 | Translation chain                                      | Market practice classes | Sample statements   | Market practice manifestation(s) – if applicable, with specification             |
|--------------------------|--|-------------------------|---|--|
| Feral market-referencing | Enactment of market-referencing without initial intend | EP<br>NP                | around the grid structures... There might be independent DNOs and private line networks, and other solutions. So motorway service area operators would be expected to apply. Then later, smaller stopping points on dual carriageways and some of the main roads, subject to policy...”<br>S110: “You need to queue when no charge points are available, there is no organisation, but EV drivers seem to be well-behaved.”<br>I2: “You see where the local charge points are, what the current status is, they might be charging, or they might not be working.” | Charging norms – queuing   NP<br>Place of exchange – charge point selection   RP |

EP = exchange practices, RP = representational practices, NP = normalising practices, OZEV = Office for Zero Emission Vehicles, DNO = Distribution network operator.

and guide new users amidst unfamiliar refuelling elements), the new materialities designed-in to the EV charging process do not fully resemble the combustion vehicle refuelling. Many EV points require consumers to have an app, pre-register a payment card, be a member of a user club and stand in the rain while attempting to connect to the charge point (unlike petrol pumps, charge points are rarely under-roof). Combustion vehicle consumers do not have to engage with such niceties: “I remember the first time I pulled up at a public charge point. It was horrible, I had no idea what to do.... once I’d plugged the damn thing in, the fun began.....” (respondent #I18). EV market infrastructure practices have been extended, modified (or both) to fit the new EV charging situation decoupling the new market from its referent. Owning, using and charging an EV is now quite different from owning a combustion vehicle.

**Reordering market infrastructure**  
Context-specific referent practices manifest differently, in different market settings, to reorder markets. We use the term reordering to imply a more significant infrastructural change. A typical EV scenario, different from “just running around town” (respondent #I18), is a long-distance drive in which the EV driver cannot reach their destination without recharging, “for at least an hour” (respondent #I18). An ‘on-the-go, fast-charge’, manifests as specific interlinked practices. For example, specific charging practices involve connecting the fast-charging point cable to the car, and starting and stopping the charging process via an app, preregistering and paying via a digital interface. Other market practice classes are also at play (see Appendix D). As the number of EV cars has increased, these practices have led to driver tensions at busy charging stations: “...if there are two cars in front of you, you’re suddenly looking at a three or four hour stop!” (respondent #I18). Service stations begun to manage queues at busy times and the absence of chargers has become a national issue (Strudwick, 2023). This has provoked a £89bn government investment in the EV market infrastructure (Department for Business & Trade, 2023). All of which evidences the far-reaching practice changes set in motion by a reorganisation of market infrastructure, indicating its level of complexity.

**Feral market-referencing**  
In some cases, market-referencing is ‘feral’. That is, market-referencing is not actively steered by market actors but unfolds through an accidental chain of translation. The adoption of market practices is independent of deliberate market making efforts: whereas the selection process of petrol stations in the combustion vehicle market is determined by fuel prices and their location, the selection process for charging points depends on location, number, speed and type of charge point, and reviews on EV apps such as Zapmap. No specific market actors conceptualised these criteria; each was born out of technical limitations (most EVs have a maximum range of 250 miles), market misfires (charge

points break down) and necessity. As described by respondent #I4: “When companies first started to put all these chargers in, there were no engineers to maintain them. So, there are a lot of chargers out there that are broken and that are still on the map, and you do not know till you get there that they are broken”.

5. Discussion

This study set out to reveal how market-referencing takes place and is enacted by a variety of market actors, to put in place and manifest a complex consumer market infrastructure for EVs, without reinventing the wheel. In the following, we propose how market-referencing occurs through its (1) practice takeover forms, and how it is enacted through (2) practice (re)arrangements and reorders, and (3) feral practices. We compare these insights with the existing literature.

5.1. Propositions on market-referencing forms

By examining how market-referencing manifests, this study provides insights on the origins of a market’s infrastructure – taking into account that a market infrastructure does not emerge out of thin air, but rather its development is a complex undertaking involving various market players. This study thus builds on the limited literature on reconstructing the origins of a market (e.g., Baker et al., 2019; Humphreys, 2010) and shows the critical role of materiality in the establishment and enactment of market practices. To this end, a system of context-specific practical manifestations of the EV market infrastructure is developed and traced back to the original market using translation chains across markets. In this way, we illuminate the building blocks of the present on which conceivable future markets are built (Chatterton & Newmarch, 2017). Further, insights are gained on how market infrastructures are leveraged to establish nascent markets (Araujo & Mason, 2021; Kjellberg et al., 2019).

Looking at our results, it becomes evident that market-referencing takeovers (the core practice remains intact after being resituated in the new market) occurred when the referent practices were deeply embedded (Chiles et al., 2004; Plowman et al., 2007), translatable and easily imitable (Kjellberg & Olson, 2017), and already established as market-spanning practices. That is, these practices have already been adopted by market actors acting in multiple, different markets before they are referenced and resituated by the new market. These might be of vital importance, as with market development investments, which can be conceptualised as market-spanning flagship catalysts. These catalysts are critical for markets that are still unstable and in a state of early development (cf. Storbacka & Nenonen, 2011) as they also set out the rules of the game and act as normative precepts for technology-dependent



markets in an early development state. Thus, we propose:

**P<sub>1a</sub>:** Referent market practice takeovers are enacted in new market infrastructures when the referent practices are: a) aligned to new market infrastructure function and needs; b) already deeply embedded in the referent market, c) easily imitable, d) market-spanning and e) are in a technology-development dependent state.

However, it is not always possible to simply transfer practices to the new market. As our data shows, extensions or modifications of practices are necessary for them to manifest themselves in the infrastructure of the new market, for instance, if they are highly specific. These findings are consistent with the extant literature in which practice adaptations from a referent to a new market are deemed necessary if their local legitimacy and suitability are otherwise not given (see for example, Choi & Burnes, 2022; Coskuner-Balli & Ertimur, 2015). Our findings indicate that this is not only true for countercultural or consumer markets in general, but also for a market's infrastructure:

**P<sub>1b</sub>:** Referent market practice takeovers are extended or modified when highly market-specific referent practices are not aligned with the new market infrastructure function and needs.

Lastly, our results further extend current insights on the adoption of new practices in emerging markets. While Baker et al. (2019) point out that the introduction of new practices in an emerging market foregrounds the limitations of an original or referent market, our findings additionally show that new practices reveal absences, as well as practical limitations of the emerging market infrastructures, designed to underpin the EV market and make it work. These sites of market misfires are opportunities for market-making interventions, each bearing their own affordances and potentialities. As such, new practices perform market transformations and act to delineate the emerging market from the referent market. Thus, adding to our understanding of how actors construct demarcations between related markets (Diaz Ruiz & Makkar, 2021). We propose that:

**P<sub>1c</sub>:** Referent market practice takeovers are *not* enacted in new market infrastructures when the referent practices are usurped by the emergence of new practices that transform and delineate the new market from the referent market.

## 5.2. Propositions on market-referencing enactment

Further, our study extends extant understanding of market-referencing as a market legitimisation and stabilisation device (Chiles et al., 2004; Sprong et al., 2021), by revealing how a consumer market infrastructure is legitimised via a) the situated enactments of referent practices, b) their establishment through their entanglement with new practices, and c) their ability to rearrange and reorder the socio-materiality of market infrastructure. As such, we extend market-making research, by foregrounding market infrastructures as objects of market-making (Kjellberg et al., 2019), highlighting B2B and B2B-(2C) market infrastructures, which operate behind the scenes.

As shown in the data, market-referencing is enacted by recombining new, existing, and extended elements of practices aiming to redraw the boundaries between the EV and combustion engine market. While such decoupling strategies have been associated with the development of hybrid markets (Geiger & Kjellberg, 2021), we evidence this decoupling in new markets and their infrastructures. In this sense, our results go beyond the familiar use of market-referencing as a legitimisation tool (Chiles et al., 2004; Plowman et al., 2007). Instead, we propose a dual role for market-referencing in infrastructures: in addition to legitimising the market (by adopting known practices and integrating them into a new market), market-referencing can also be used as a tool for boundary setting – helping to establish a market's distinction. Thus, we propose:

**P<sub>2a</sub>:** Market-referencing and market-reference points act as a rearrangement mechanism for new market infrastructures, helping the market function as a distinct market, decoupled from the referent market(s).

By reordering market infrastructure, a multitude of translation chains are set in motion. These chains of translation are rearranging market infrastructure materialities, and are forming a reordered plenum of practice. It evidences the complexity of establishing a working market infrastructure through the enactment of market-referencing, and the significance of the coordination required from different market actors (cf. Kjellberg et al., 2019). While it is recognised that this is a labour-intensive process (Geiger & Kjellberg, 2021), our work contributes to the understanding of how this is done by looking at the infrastructure work of market actors. We therefore propose that:

**P<sub>2b</sub>:** Market-referencing acts as a reordering mechanism by combining multiple referent practices with new market practices and infrastructure materialities, manifest within a specific market setting.

Finally, our results show that market-referencing is not always enacted purposefully. Although market-referencing is most commonly associated with purposeful market-making efforts (Diaz Ruiz et al., 2020; Nenonen et al., 2014), our data show feral market-referencing as EV drivers enact market-referencing without initial intent (cf. Diaz Ruiz & Kjellberg, 2020). An occurrence that has, so far, received limited consideration in the market-shaping literature, but whose understanding deserves serious attention if market-shaping is to be understood more clearly (Tóth et al., 2022). Thus, we propose that:

**P<sub>2c</sub>:** Market-referencing can be 'feral' and take place through accidental consumption-practice enactments.

To conclude, this study contributes empirically to understandings of market-referencing by revealing the chains of translation that act as mechanisms for practice adoption. This re-situating of practices from one market (the referent market) into another, gradually unfolds and (re)arranges a functioning and so legitimate, market infrastructure. Unlike the extant literature, which conceptualises market-referencing as a means of forming holistic market arrangements (e.g., Hietanen & Rokka, 2015; Weber et al., 2008), our study offers insights into how market-referencing is enacted as a coordination mechanism to arrange and reorder the market infrastructure. By revealing which referent market practices are adopted, in what form, by whom, and how they become enacted in relation to those that arise independently of the referent market, we show how an emerging market infrastructure unfolds and how it can be consolidated. This establishes market-referencing as a strategic tool or device for innovating and performing new future markets that depend on a well-functioning infrastructure to operate and keep pace with technological developments and an ever-increasing risk of crises. This new understanding of market-referencing is needed to accelerate the development and reorganisation of future (sustainable) market infrastructures in a fast-moving and increasingly volatile world. After all, infrastructure precedes a market's establishment and is regarded as a powerful lever for market innovation (Geiger & Kjellberg, 2021; Kjellberg et al., 2019) – given it has been put in place through joined market actor efforts.

## 5.3. Managerial implications

Practically, this study contributes to the transformation of market societies towards sustainability by aiding in the establishment of future market infrastructures. Leveraging market-referencing mechanisms enables the adoption and engagement in new (infrastructure-dependent) markets. By utilising market-referencing to create a new access language, a better understanding of market infrastructures is achieved, thereby establishing confidence among actors to enter markets of the

future, which requires substantial investment and risk. By tracing the actions and processes of market actors to build a market infrastructure as the underlying backbone of a market, we provide a toolbox for practitioners to think about how to build or repair market infrastructures – essential for the persistence and reconstruction of markets in a (climate) crisis-ridden world requiring faster market transformations. Our investigation into market-transformation mechanisms thus offers a new agenda to the fundamental shift to live in a sustainable world. There are practical implications beyond the scope of this paper which are addressed in another piece.

## 6. Limitations and future research opportunities

This study shows how market-referencing takes place and is enacted in the EV market charging infrastructure, limiting identified market-referencing propositions to the examined context. Consequently, we advise future researchers to examine market-referencing across multiple markets, and beyond a single market infrastructure for more general conclusions for (future) sustainability market transformation. Additionally, exploring the temporal course of market-referencing through longitudinal studies could provide valuable insights on how mechanisms

take effect at different times. Finally, future research should evaluate market-referencing as a market-making activity and outline under which market conditions market-referencing should be encouraged or discouraged. We hope that this paper inspires others to take up this important mantle.

## CRediT authorship contribution statement

**Nicole Bulawa:** Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization, Writing – review & editing. **Katy Mason:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization. **Frank Jacob:** Writing – review & editing, Supervision, Methodology, Funding acquisition, 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 A

### Additional information on data collection and sampling

Over the course of several days, a naturalistic observation at the largest EV charging point in the UK ([Oxford City Council, 2022](#)) was conducted for a total of 20 h, serving as a familiarisation technique. In addition to the short-term observation as observer-as-participant, we also conducted short interviews with charging point users, totalling 24 interviews. This approach was chosen to gain an understanding of the charging process as part of market exchange practices as well as physical market representations in terms of infrastructure. The short-term observation resulted in 19 pages of field notes, which were taken during the observation and edited into a fair copy post-observation (comprising running descriptions of what was done and said; the observer's thoughts, reflections and provisional explanations; and methodological aspects of the observation [[Gillham, 2000, p. 24](#)]).

Beyond that, 18 in-depth interviews were conducted with EV market actors involved in the market's infrastructure. The interviews served several purposes: first, to gather knowledge on how market practices have manifested in the EV market infrastructure; secondly, to understand in how far these manifestations can be traced back to practices of the combustion vehicle market infrastructure and, if so, how were referent and new market practices knitted together and was this actively encouraged. The interviews were semi-structured to cover the main research themes while also being responsive to participants' answers. Following the practice of theoretical sampling, market actors who are at the heart of the EV infrastructure and its exchange processes, such as charge point operators/manufacturers and EV drivers, were first interviewed. These first participants were recruited through the network of one of the co-authors. These initial participants were asked about potential further interview participants and, if suitable, established the contact. In this way, interviews could be held with city councils and charging site hosts, who are highly involved in normalising market practices and the realisation of physical infrastructure. Through the interviews, additional relevant market actor groups were identified, such as government departments, energy suppliers, or motorway maintenance — who were subsequently targeted and provided further insights into market-referencing across market practices (ranging from mental and physical representations to normalisation in terms of objectives or norms, among others) ([Coyne, 1997](#); [Zeithaml et al., 2020](#)).

## Appendix B



Fig. B.1. A charging hub



Fig. B2. Various charging stations



Fig. B3. Charging plug standardization

Appendix C

Table C.1  
Outline of data collection sources in analysis for exchange practices

| Practice manifestation | I no.                               | O | D | Document title   | Document type   | Source              | Year |
|------------------------|-------------------------------------|---|---|--|-----------------|---------------------|------|
| Charging process       | I1-I3; I5-I7; I9; I11; I13-I16; I18 | X | X | Guide to charging electric vehicles  | Guide           | Energy saving trust | 2022 |
|                        |                                     |   |   | Design considerations for electric vehicle charge points   | Guide           | OZEV                | 2022 |
|                        |                                     |   |   | Connector types for EV charging around the world   | Website         | EV Expert           | 2022 |
|                        |                                     |   |   | The evolution of public EV charging  | Grey literature | Krug et al.         | 2020 |
| Terms of exchange      | I1; I5-I6; I8; I14-I15              | X | X | The Traffic Signs (Amendment) (No. 2) General Directions 2011  | Amendment       | DfT                 | 2011 |
| Place of exchange      | I1-I3; I6; I9; I12-I18              | X | X | Electric car charging stations surpass number of fuel stations in less than 100 years since UK's first petrol pump installed | News article    | Nissan              | 2019 |
| Pricing/payment        | I1-I6; I14-I17                      | X | X | UK's first all-electric car charging forecourt opens in Essex  |                 | The Guardian        | 2020 |
|                        |                                     |   |   | Tax on shopping and services: Fuel duty  | Website         | GOV.UK              | 2022 |
| Maintenance            | I1-I6; I10; I14-I17                 | X | – | Taking charge: selling electricity to electric vehicle drivers   | Guide           | Ofgem               | 2022 |

I no. = Interview number, O = Observation, D = Documents, OZEV = Office for Zero Emission Vehicles, DfT = Department for Transport, Ofgem = Office of gas and electricity markets

**Table C.2**

Outline of data collection sources in analysis for representational practices

| Practice manifestation           | I no.                 | O | D | Document title   | Document type      | Source                                 | Year |
|----------------------------------|-----------------------|---|---|--|--------------------|--|------|
| Physical EV infrastructure       | I1-I16; I18           | X | X | Design considerations for electric vehicle charge points   | Guide              | OZEV                                   | 2022 |
|                                  |                       |   |   | Recharging and refuelling stations map   | Map                | European Alternative Fuels Observatory | 2022 |
| Actor inter-connectivity         | I2-I3; I11; I14-I17   | X | X | Map of electric car charging points in the UK  | Guide              | ZAP MAP                                | 2022 |
|                                  |                       |   |   | The Traffic Signs (Amendment) (No. 2) General Directions 2011 – Annex A2 – Traffic Signs and Recharging Infrastructure |                    | OLEV                                   | 2013 |
| EV labels/terminology            | I2; I11; I14; I16-I17 | – | X | Electric vehicles conferences 2023/2024/2025   | Website            | Conference Index                       | 2022 |
|                                  |                       |   |   | Electric vehicles initiative   | Website            | IEA                                    | 2022 |
| Mental EV market representations | I2; I11; I14; I16-I17 | – | X | EV Dictionary  | Website            | Myev.com                               | 2023 |
| Media                            | I9; I11; I14-I15      | – | X | You are what you drive: environmentalist and social innovator symbolism drives electric vehicle adoption intentions    | Scientific article | White & Sintov                         | 2017 |
|                                  |                       |   |   | How electric cars became the new status symbol   | News article       | Enjoli                                 | 2023 |
| Funding/demonstrator projects    | I1-I3; I5-I15; I18    | X | X | In Britain, car appreciation is ingrained in their culture   | Website            | Clark                                  | 2017 |
|                                  |                       |   |   | Electric cars  |                    | BBC                                    | 2023 |
| Market research                  | I3; I5; I7; I9-I11    | – | X | Electric, hybrid and low-emission cars   | Website            | The Guardian                           | 2023 |
|                                  |                       |   |   | £ 49 million uplift drives automotive industry towards green future  | News article       | GOV.UK                                 | 2020 |
| Market research                  | I3; I5; I7; I9-I11    | – | X | Grant schemes for electric vehicle charging infrastructure   | Website            | GOV.UK                                 | 2022 |
|                                  |                       |   |   | The evolution of public EV charging  | Grey literature    | Krug                                   | 2020 |
| Market research                  | I3; I5; I7; I9-I11    | – | X | Winning the battle in the EV charging ecosystem  | literature         | BCG                                    | 2021 |
|                                  |                       |   |   | Charging ahead! The need to upscale UK electric vehicle charging infrastructure  |                    | PWC                                    | 2018 |

I no. = Interview number, O = Observation, D = Documents, OZEV = Office for Zero Emission Vehicles, OLEV = Office for low Emission Vehicles, IEA = International energy agency

**Table C.3**

Outline of data collection sources in analysis for normalising practices

| Practice manifestation       | I no.                       | O | D | Document title  | Document type      | Author                          | Year |
|------------------------------|-----------------------------|---|---|---|--------------------|---------------------------------|------|
| Objectives                   | I2-I10; I13; I18            | – | X | UK plan for tackling roadside nitrogen dioxide concentrations. Detailed plan  | Plan               | DEFRA                           | 2017 |
|                              |                             |   |   | The Road to Zero. Next steps towards cleaner road transport and delivering our Industrial Strategy  | Strategy paper     | Department for Transport        | 2018 |
| Charging standardisation     | I2; I4; I8; I14; I17-I18    | X | X | EV connector types and speeds   | Website            | Pod Point                       | 2022 |
|                              |                             |   |   | Standardisation of UK electric vehicle charging protocol, payment and charge point connection   | Scientific article | Chamberlain & Al-Majeed         | 2021 |
| Regulations                  | I3-I5; I7-I8; I10; I12; I15 | – | X | Complying with the electric vehicles (smart charge points) regulations 2021. Guidance for sellers of electric vehicle charge points in Great Britain. | Guide              | OPSS                            | 2022 |
|                              |                             |   |   | Electric vehicle charging points for new development  | Guide              | Tunbridge Wells Borough Council | 2020 |
| Voluntary charging standards | I1; I5; I7-I10              | X | X | Regulations: EF smart charge points   | Grey literature    | OPSS, BEIS, OLEV                | 2022 |
|                              |                             |   |   | A roadmap to EV regulations in the UK   |                    | Mason                           | 2022 |
| Charging norms               | I2-I3; I5-I6; I12; I14-I18  | X | – | Code of practice for electric vehicle charging equipment installation, 4th edition  | Guide              | IET                             | 2020 |
|                              |                             |   |   | Best practice for future proofing electric vehicle infrastructure   |                    | BEAMA                           | 2020 |

I no. = Interview number, O = Observation, D = Documents, DEFRA = Department for Environment, food and Rural Affairs, OPSS = Office for product safety & Standards, BEIS = Department for Business, energy and Industrial Strategy, OLEV = Office for low Emission Vehicles, IET = Institution of engineering and Technology, BEAMA = British electrotechnical and allied manufacturers' association.



## Appendix D

**Table D**  
Exemplary data analysis structure

| Market practice class      | Practice manifestation   | Practice state in the...   |   | Market-referencing form   |                            | Market-referencing enactment        |  |
|----------------------------|--|--|---|---|----------------------------|-------------------------------------|--|
|                            |  | Combustion vehicle market infrastructure   | EV market charging infrastructure   | Translation chains a/markets  | Specified                  | (Re)arranging or reordering         | Actor driven versus feral  |
| Exchange practices         | Charging process   | Fuel pump cable to enable top-up   | CP cable to enable top-up   | COP unchanged: top-up cable   | Takeover                   | Reordering of market infrastructure | CP manufacturer, OZEV, Royal College of Art, and PA Consulting partnership |
|                            |  | Standardised top-up procedure  | Increased complexity of top-up procedure regarding configurations, technical alignments, and capacities                           | COP: top-up procedure<br>EXT: via configurations  | Extended takeover          |                                     | CP operator  |
|                            |  | Single usage scenario at petrol stations   | Several usage scenarios covering:<br>– Public charging (park and go; top-ups on the go)- Private charging (at home; fleet depots) | COP: top-ups on the go<br>EXT: top-ups via park and go<br>MOD: private charging at home/ fleet depots | Extended modified takeover |                                     | CP operators, government, and local authorities                            |
| Representational practices | Analysis steps are repeated for all practice manifestations...This pertains to: terms of exchange, place of exchange, pricing/payment, maintenance |  |   |   |                            |                                     |  |
|                            | Actor inter-connectivity   | Single customer contact with petrol stations   | Single customer contact (common for rapid/fast CPs) or membership with CP operator  | COP: single customer contact points<br>EXT: membership option   | Extended takeover          | (Re)arranging market infrastructure | CP manufacturers, CP operator  |
|                            | Actor exchange among car drivers is limited  | Formation of car enthusiasts' groups/ associations   | Active exchange among drivers during charging process and beyond  | N/A   | New                        |                                     | EV drivers   |
| Normalising practices      | Charging norms   | Formation of car enthusiasts' groups/ associations   | Formation of EV enthusiasts' groups/associations  | COP unchanged: group/association formation  | Takeover                   |                                     | EV manufacturers, EV drivers   |
|                            |  | Realisation of car/ transportation trade fairs   | Realisation of EV/transportation trade fairs  | COP unchanged: trade fairs  | Takeover                   |                                     | Alliances of various EV market actors                                      |
|                            |  | Analysis steps are repeated for all practice manifestations...This pertains to: physical EV infrastructure, EV labels/terminology, mental EV market representations, media, funding/demonstrator projects, market research |   |   |                            |                                     |  |
| Normalising practices      | Charging norms   | Queuing at petrol stations   | Queuing at CPs  | COP unchanged: queuing  | Takeover                   | N/A                                 | Feral  |
|                            |  | Use of the nearest free fuel pump  | Scattering of EV drivers to avoid simultaneous CP use (severe reduction in energy output and prolonging of charging)              | N/A   | New                        |                                     | EV drivers   |
|                            |  | Analysis steps are repeated for all practice manifestations...This pertains to: objectives, charging standardisation, regulations, voluntary charging standards  |   |   |                            |                                     |  |

EV = electric vehicle, CP = charging point, COP = core practice, EXT = extension, MOD = modification, N/A = not applicable, a/markets = across markets; OZEV = Office for Zero Emission Vehicles.

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