Targeting a Luxury Driver Experience: *Design Considerations for Automotive HMI and Interiors*

Sevcan Yardım [1] and Owain Pedgley [2]

[1] *University of Liverpool, UK*
[2] *Middle East Technical University, Ankara, Turkey*

Luxury car design feeds on traditions of performance, quality, precision, craftsmanship, and unique or expensive materials. More recently, interactive technologies have become a variable for automotive human-machine interface (HMI) and interior design. Still, the criteria for their successful implementation in a luxury context are unclear. This research aimed to reveal the facets of a luxury driver experience in the current digitally progressive era, contributing to the field of *design for luxury* (DfL). In-car interviews were performed with staff from Bentley Motors (n = 28), creating a driver-based dataset of luxury appraisals. The results are distilled into DfL-driver cards that communicate design considerations under ten headings: comfort, ease of use, customization, smartness, connectivity, form, materials, realization, perspectives, and trends. The results inform discussion on the multifaceted challenge of luxury automotive HMI and interior design, the transferability of results across international markets, and temporal effects on luxury. By cross-comparing luxury user experience goals stated on each card, six strategies for targeting luxury driver experiences are proposed: financial/status symbol, physical embodiment, automotive concierge, flow, convenience and leisure, and compatibility. The DfL-driver cards are worded carefully so that they can be used or adapted for other industries and luxury product sectors.

Keywords **–** Automotive, User Experience, HMI, Design for Luxury, Design Considerations.

Relevance to Design Practice **–** The concept of automotive luxury is defined and put into practice mostly intuitively by designers, who interpret marketing research from a design perspective. This paper counteracts by offering designers and design managers *design for luxury* (DfL-driver) cards based on evidence from a systematic study of driver experiences.

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Introduction

The commercial automotive sector defines luxury through common qualities, such as performance (Porsche, n.d.); iconic design features (primarily visual), outstanding quality, precision, and detailed craftsmanship (Aston Martin, n.d.; Rolls Royce, n.d.); and use of unique and expensive materials (Bentley, n.d.). Luxury brands offer fast, powerful, and nimble driving experiences associated with dream scenarios. These scenarios include challenging drives on unique terrain (such as Bentley's promotions in Oman) or the allure of an iconic cinema character (such as James Bond's association with Aston Martin). Automotive brands re-interpret their cars' qualities and dream scenarios across generations of new vehicles.

Evidently, luxury car brands have substantial design experience in using high-quality interior materials (e.g., leather, wood), as well as precise craftsmanship and vehicle performance (Vigneron & Johnson, 2017; Warren, 2015). However, interactive technologies are changing the landscape of luxury. In a car, the feeling of luxury depends not only on the interior's physicality but also on how electronic interactive systems are designed and presented. The driver's interaction is made possible through the human-machine interface (HMI), which refers to the arrangement of controls, feedback and feedforward systems that support the driver's interactive experiences. Automotive HMI has evolved broadly from analog instruments, dials, and mechanical controls to a current state of integrating digital componentry and technological assistance (Feld & Endres, 2010; Meixner et al., 2017; Schnelle-Walka & Radomski, 2019).

Automotive HMI includes componentry such as knobs, buttons, touchscreens, and displays, as well as features such as voice user interfaces (VUIs) and gestural interaction (Bengler et al., 2020; Hwangbo et al., 2016; Meixner et al., 2017). With the integration of interactive technologies, the role of the car has evolved from a simple tool for travelling to a companion for driving (Kern & Schmidt, 2009). Considering the number of components, their characteristics, and the technologies behind the HMI, it can be regarded as a complex system that requires a comprehensive user-centered design to be successful. Moreover, since the interior design of luxury car brands is heavily influenced by traditional materials and craftsmanship, there is a necessity not to spoil a brand image through premature or poorly applied new and emerging interactive technologies.

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Corresponding Author: sevcanyardim@gmail.com

Various professionals, including engineers, designers, psychologists, and marketers, are required to work together to build a successful and unified driver experience (Gkouskos et al., 2014). Luxury has been intensively studied within marketing, where a luxury spectrum is defined based on values and properties. Marketing research and advertising campaigns present some clues for designers on how to build a luxury experience, but with little detail. For example, De Barnier and Valettte-Florence (2013) highlight the originality of design, color, style, and tactile qualities of luxury goods. Overall, the process of manifesting luxury—deciding on the design details and product qualities intended to deliver a luxury experience—is poorly understood and is a somewhat mysterious subject (Yardim Sener et al., 2016). Luxury is often realized via designerly reflexes and intuitions (Cizgen & Uraz, 2019; Durling, 1999) but is known to span financial, experiential, functional, and symbolic factors (Berthon et al., 2009; Kapferer & Bastien, 2009; Reddy & Terblanche, 2005; Wiedmann et al., 2013).

This paper focuses on the luxury driver experience, defined as the user experience a driver has whilst seated in their car and interacting with the HMI and interior. This contrasts with *driving experience*, which focuses on the primary task of controlling the movement of a vehicle. Therefore, apart from driving, the luxury driver experience includes secondary tasks such as infotainment interaction, climate control interaction, interior mood setting, etc. It also extends to experiences of services and products that are part of the car ecosystem but do not necessarily require the driver to be physically in the car (e.g., at-home car connectivity; key fob functionality). It will be appreciated that the scope of user experience defined here extends well beyond the *UX/UI* or *UX Design* terminology that has regrettably become synonymous in recent years with the narrow field of graphical user interfaces (GUIs) and specifically mobile app design.

An essential user experience term of relevance to the work is *aesthetics of interaction* (AoI) (Hummels & Overbeeke, 2010; Lenz et al., 2014; Locher et al., 2010), referring to pleasure or attraction in what we sense when interacting with (using) a product or interface. This contrasts with a traditional view of aesthetics in design, focusing on visual properties. AoI originates from user-product interaction and the engagement of multiple senses—hence the word aesthetics (Forlizzi & Ford, 2000)—but can have consequences on affective and cognitive aspects of experiences such as joy, reassurance, and flow, as well as behavioral aspects such as interaction aversion or irresistibility. In related early work, Øritsland and Buur (2000) described "the language of dynamic aesthetic experiences"(p. 29), mainly referring to movement and kinaesthetic experience. Before AoI became an established term, researchers inspired by gestalt principles were defining how unity and harmony could be communicated through design solutions. Even though the ideas were mainly based on form-giving and visual aesthetics, the process was named *interaction gestalt* (Lim et al., 2007; Svanæs, 1997). The interaction gestalt focused on each element of product use and how different sensory modalities could be activated. Having connections to dance practices, the related term "choreography of interaction" was coined, referring to users' movements to achieve unity between form, function, and interaction (Klooster & Overbeeke, 2005, p. 23). Another related term, "beauty of interaction" (Djajadiningrat et al., 2004, p. 296), includes how the affordances of independent product elements can be linked so that they support a flowing (rather than stop-start) interaction.

Sevcan Yardım is a user experience researcher at Jaguar Land Rover, UK. She completed her Ph.D. studies in collaboration with Bentley Motors at the University of Liverpool. Previously, she was a Lecturer/Researcher in Industrial Design at TOBB University of Economics and Technology, Turkey. Her research focuses on user experience in the automotive industry and, more recently, the integration of luxury in user interfaces within the context of driving. Other research interests are designing smart products and utilizing virtual prototyping for product evaluation processes.

Owain Pedgley is a full professor of Industrial Design at Middle East Technical University, Turkey. His academic expertise centers on design for product interaction and experience, notably within the emerging domain of materials experience. Between 2014-2017 he was a founding member of the Industrial Design program at the School of Engineering, University of Liverpool, UK. He is a strong advocate and early practitioner of academic research conducted through design. Before his academic career, Owain worked as a product designer in the sports equipment and musical instrument sectors and co-founded the guitar innovation venture Cool Acoustics.

Hassenzahl's (2010) three levels of interaction considerations are directly relevant to planning AoI: the *do-level* (what…), referring to the end task a user wants to achieve; the *motor-level* (how…), referring to the physical process to accomplish the task (includes product and interface design); and the *be-level* (why…), referring to underlying user needs and motivations behind the task. Pleasure in use and emotional responses (Desmet & Hekkert, 2007; Jordan, 2002; Norman, 2004) can be effective measures for AoI. In the context of automotive HMI and interior design, AoI can relate to materiality (e.g., touching material surfaces, grasping forms, moving components, pressing controls, activating mechanisms) and digitality (e.g., selecting information, swiping pages, navigating menus, activating features).

Considering the topics raised in this Introduction, the research set out to identify design considerations for luxury driver experiences. It was guided by the question: *what are the characteristics of automotive HMI and interiors associated with luxury driver experiences?* The work was carried out in collaboration with Bentley Motors Ltd, a famous British luxury car brand owned by the Volkswagen Group.

Methodology

A fieldwork approach was taken based on an analysis of real-time HMI and interior interactions. Alternative methods, such as driver diaries or retrospective reviews, were considered less effective for capturing interaction storylines or reliably linking user experience appraisals to specific features and functions of a car. As raised by Roto et al. (2011), fieldwork studies on user experience are generally carried out either in real-life contexts or carefully simulated conditions. Two situations were considered when planning the fieldwork: a driving/mobile situation, and a static/non-driving situation. The latter was chosen for two reasons: (1) the research focus was on a general evaluation of the driver area HMI and interior, which could be achieved in a static situation;

(2) the act of driving was outside the scope of the research, so there was no necessity to investigate driving-related interactions in real-time. Furthermore, in the safety-conscious environment of driving, asking drivers to make car interface evaluations whilst driving would be distracting.

The final choice was to generate data through interviews, carried out in the familiar surroundings of participants' own cars in a parked position, with an activated HMI system. This approach allowed participants to safely point out, replicate, and elaborate on their real-life HMI and interior experiences rather than rely on memory. Their own parked car was used as the highest quality physical cue for driver experience recollection and reporting, thereby probing each driver's experiences of the automotive HMI and interior as fully as possible.

Interview Plan

Interviews were carried out with individual driver participants, one at a time. Photo, video, and audio recordings were made inside the car, capturing not only steps of HMI interaction but also areas of the car interior that participants interacted with or pointed out. The interview plan is explained in Figure 1, which included securing informed consent. Participants were asked to sit in the driver's seat so that they could reach and interact with the driver's area HMI and interior. The researcher sat in the front passenger seat to conduct the interview and manage the recording process (Figure 1).

The interviews commenced with sensitization questions on the general concept of luxury and outside of automobiles, followed by three stages of focused questioning, described below. Stages 1 and 2 involved participants in a retrospective driver experience review, self-reporting experiences of using their current vehicle from any time in the past up to the moment of the interview. Stage 3 involved participants in future prediction, providing suggestions on how to achieve a more luxurious driver experience. A semi-structured interviewing technique was used, which allowed for follow-up explanations to be asked on demand. The participants' responses were taken at face value and collected without prejudice.

Stage 1: Luxury in Current Car. This stage aimed to establish a driver's perspective on what constitutes a luxury automotive HMI and interior. Participants were asked if they found anything specifically luxurious (or not luxurious) about the HMI and interior of their own car. Follow-up explanations regarding how the luxury manifested or failed to be achieved were requested.

Interview Overview & Structure

Interviews took place in participants' cars in Bentley facilities

Each interview took about 30-40 minutes (all interviews took 5 days)

28 participants, Bentley employees

All sessions were recorded (photographs, video and audio)

Meeting with participants (Bentley main reception)

Introducing the interview structure, aim and consent

Interview in participant's car about his/her experiences with his /her car HMI and interior

1 Luxury properties in their car

2 Luxury properties of their HMI

3 Luxury experiences within different contexts

Figure 1. Interview plan and example video stills showing in-car interview set-up.

Stage 2: Effect of Context on Luxury. This stage aimed to generate additional comments on how changes in context can support or detract from luxury driver experiences. A provocative visual cue, in the form of a pre-prepared image board, was shown to participants and used to jog their memory towards contexts that may, on some occasions, have affected the quality of their driver experience, either positively (reinforcing a luxury narrative) or negatively (detracting from a luxury narrative). In an adaptation from Roto et al. (2011), the image board covered four contextual factors affecting the driver experience, including environmental, technical, personal, and social factors. The images were obtained via Google image search, using keywords agreed through discussions with Bentley Motors Ltd. The image board can be seen in the hands of participants in Figure 1.

Stage 3: Suggestions for Elevated Luxury. In contrast to stages 1 and 2, the final stage asked participants to imagine the future, suggesting how the luxuriousness of driver experiences might generally be improved.

Selection of Participants

Securing the participation of drivers of luxury cars proved difficult. Through discussions with Bentley Motors Ltd, it became apparent that the firm could not share customer database information because of confidentiality. Therefore, participants for the interviews were chosen from amongst Bentley staff, who were sampled based on employment within design-related departments (interior architecture, design, marketing), voluntary involvement, and availability. In total, 28 participants were recruited, with their profile information summarised in Table 1. The professional automotive industry experience of the participants was seen as a virtue for the research, helping to generate high-quality data benefiting from expert opinion and an elevated awareness of automotive luxury. Furthermore, almost all participants owned cars in premium or luxury categories (except for mid-range cars owned by P1, P7, and P24). Participants had diverse brands. Only P4 drove a Bentley.

Data Preparation and Analysis

Participants' responses were transcribed from the audio recordings and then compiled into a spreadsheet as verbatim comments (passages/sentences). Administrative information was added to each entry: participant number, comment number, interview stage (1, 2, or 3), and reference location if the participant interacted (if at all) with the car's HMI or interior while making the comment. The transcription resulted in 645 rows of data. An example of how the reference location was cojoined to the audio transcription **(using bold parenthesis)** is shown below:

> That's why I would prefer more buttons here **(steering wheel)** because you're interacting with this screen **(instrument cluster).** I'm less inclined to use the central screen. (P7, row 21)

The transcripts contained no evidence that participants found it difficult or avoided thinking about the luxury driver experience. In this regard, participants responded on-topic and

Table 1. Participant age, gender, driving experience, and car age/model/year (all figures expressed in years).

Partici-pant	Age	Gender	Driving Experience	Cars' Age	Car Model/Year
P1	41	F	23	2	Vauxhall Corsa 2015
P2	36	M	19	0	Audi Q5 2017
P3	48	M	31	13	Jaguar X Type 2004
P4	42	M	24	0	Bentley Bentayga 2018
P5	46	M	29	0	Audi A5 2017
P6	44	M	26	0	VW Scirocco 2017
P7	50	F	33	0	Seat Ibiza 2017
P8	44	M	22	0	VW Tiguan 2017
P9	37	M	19	0	Audi S3 2017
P10	41	M	24	0	Audi A4 2017
P11	25	M	8	0	VW Golf 2017
P12	36	M	19	0	Audi A5 2017
P13	53	F	35	4	Mazda MX 5 2013
P14	45	M	27	0	Audi S5 2017
P15	51	M	34	6	VW Passat 2011
P16	49	M	32	0	Audi A6 2017
P17	47	M	20	9	Land Rover Discovery 2008
P18	50	F	33	2	Volvo XC70 2015
P19	33	F	14	0	VW Touareg 2017
P20	45	M	29	0	VW Golf 2017
P21	39	F	21	0	Audi A4 2017
P22	44	F	27	2	Range Rover Evoque 2015
P23	52	F	29	0	Audi A5 2017
P24	43	F	24	0	Seat Leon 2017
P25	40	F	22	1	Audi Q3 2016
P26	43	F	25	1	Audi Q5 2016
P27	40	M	23	0	Audi Q5 2017
P28	63	M	46	0	Mercedes 350S E Class 2017
MEAN	44	(17M/11F)	26	1.4	

opportunities for luxury driver experience were duly identified. However, participants often offered comments from an opposing direction: they criticized aspects of their own cars that either failed to deliver a premium (not even luxury) experience or seemed to have low perceived quality or usability.

The transcripts were analyzed by assigning hierarchical classifications through the established procedures of content analysis (Krippendorff, 2004) and emergent open coding (Saldaña, 2009) within the general frame of grounded theory (Glaser & Strauss, 1967). Content analysis reduces unorganized textual data into an organized structure around patterns and categories. Grounded theory stipulates that qualitative data are coded in such a way that allows participants' responses to lead the emergence of structure and meaning from the data, in contrast to fitting data to predefined categories. Two principal advantages of using grounded theory for studies in new areas of user experience are (1) the user's voice is strongly revealed, and (2) preconceptions about the data content are avoided. However, the approach necessitates a relatively intense and time-consuming coding process. The data analysis was carried out cyclically at four levels, each defining a hierarchy of the data (see Appendix 1 for final categories). It was a collaborative effort between the research project members, implementing a quality control process that led to a consensus on data structure and categorization.

Analysis Level 1: *Raw Transcript→Codes*

Level 1 identified various dimensions of luxury driver experiences within each participant dataset. Codes were assigned to factually similar or semantically similar transcript comments. In accordance with the grounded theory research's convention, our coding followed a cyclic process of re-reading, re-naming codes, and re-coding individual participant transcripts, to build an internally consistent set of codes. For example, the tentative codes of *readability* and *integration* were eventually scrapped in favor of the codes of *interaction/interactivity* and *physical controls*. It became clear that during all stages of the interviews, participants talked not only about luxury (or its absence) within their own cars but also (on their own initiative) referred to other cars they had experienced. At various times they mentioned *my current car* (their own vehicle), *another car* (a specific vehicle that is not their own), or *cars in general* (making no reference to a particular vehicle). On completion, analysis level 1 organized participants' raw transcripts into a set of codes (n = 43, with additional codes flagged as sub-codes, see analysis level 2).

Analysis Level 2: *Codes→Concerns*

During analysis level 1, some codes remained outside the set (n = 43) because they were considered as sub-codes that elaborated upon the finalized codes hierarchically. They did not justify existence as a separate code; in which case, analysis level 2 organized each of these remaining codes as concerns. On completion, analysis level 2 resulted in concerns (n = 36) linked to some of the codes (n = 13).

Analysis Level 3: *Codes→Headings*

Level 3 categorized the codes (from level 1) under conceptually related headings (Hatch, 2002). A cyclic process of data structuring was again employed, starting tentatively, and moving towards finalized headings applicable for the full dataset, aiming to capture general themes amongst participants' interview transcripts. Analysis level 3 did not make use of emergent open coding, but instead used commonly-in-use terms within product, service, and system design. It is important to state that none of the headings are claimed to be novel, nor specific to luxury user experience (either generally, or in the automotive sector). Instead, they provide a familiar design-relevant structure for organizing the data and reporting the results.

The frequency of assignment of headings amongst participants' datasets was an important consideration in the analysis process. Basing frequency of allocation on the total number of times a heading was assigned to a participant's dataset was considered invalid since it did not consider interview response characteristics. For example, some participants explained their thoughts with a few sentences, whereas others were talkative and elaborated on a single issue on multiple occasions (each of which was assigned the same codes and headings, repeatedly). Therefore, a special *frequency of assignment metric* (f) was calculated for each heading, based on the number of unique participants whose analyzed transcript contained a particular heading, irrespective of the number of times the heading was used. Using this metric, draft headings assigned to fewer than 25% of participants were canceled, with the codes under those headings redistributed as members of more frequently assigned headings. In some cases, headings needed to be renamed to reflect the diversified membership. For example, *exclusivity* and *rarity* headings were canceled and absorbed into the final heading *perspectives*. On completion, analysis level 3 resulted in a set of ten headings: ease of use, perspectives, realization, materials, comfort, smartness, customization, trends, form, and connectivity.

Analysis Level 4: *Headings→Clusters*

Level 4 organized conceptually related headings into a purposefully small number of clusters (n = 4) so that the research results could be communicated in an organized manner. Three specification-oriented clusters were defined using well-known design terminology, namely: human factors (containing *ease of use*, and *comfort*), functions and features (containing *smartness, customization*, and *connectivity*), and physical embodiment (containing *realization, materials*, and *form*). A separate general directions cluster was defined to contain the *trends* and *perspectives h*eadings.

Dataset Overview

Figure 2 provides a numerical summary of the analyzed data, containing headings (rows), frequency of assignment within each participant's dataset (columns P1-P28), and frequency of assignment metric, expressed as total number of participants (f #) and percentage of participants (f %). The headings are color-coded to clusters. The population mean (μ) for the frequency of assignment metric was 61%; the difference between *f* % and μ is stated for each heading.

The results under each heading are presented in the forthcoming sections. Each heading is introduced with an operational definition, followed by a review of its associated codes and concerns. The design considerations related to each heading are summarised as a design for luxury (DfL)-driver card. The general layout is described in Figure 3. Each card contains explanations and examples of how a luxury driver experience might be achieved, derived from participants' interview comments. The set of ten DfL-driver cards helps bring forward characteristics of a luxury driver experience over and above the experience expected from good cars in general. The codes and concerns contained in the cards describe touch points where the luxury user experience is especially relevant, requiring creative design solutions.

Results

Human Factors Cluster

The Human Factors cluster contained the most frequently assigned heading (Ease of Use, *f* = 89%, μ + 21%) alongside one above-average assigned heading (Comfort, *f* = 64%, μ + 3%). Both headings refer to classic ergonomics criteria concerned with fitting a design solution to the capabilities and anthropometric measurements of drivers. Whilst there are crossovers between the headings, participants associated ease of use mostly with cognitive load (whilst interacting with the HMI) and associated comfort mostly with general physical interaction experiences in the car.

Ease of Use

The general definition of ease of use regarding user-product interaction focuses on the meaning of the word *ease*, namely freedom from great effort (Davis, 1989; Venkatesh, 2000). The effort may be physical and/or mental, but discussions around perceptual motor skills and physical controls are dominant. Ease of use is not always desirable, for example, in cases where the difficulty of operating a product is viewed as a virtue or challenge (Overbeeke et al., 2002); or where a concerted effort must be made to avoid potentially catastrophic unintentional interactions (Norman, 2013). Djajadiningrat et al. (2007) suggest that aesthetic considerations should be made only after determining easy-to-use solutions since frustrating interactions will override aesthetic qualities. Ease of use also relates to driving conditions, such as the grand tour experience (Hull & Reid, 2003).

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	f (#)	f (%)	f-μ (%), μ=61%
EASE OF USE	1	5	2	0	2	0	9	4	7	1	7	2	6	4	7	4	15	5	6	7	13	17	8	11	5	2	0	3	25	89%	28%
LUXURY UX	5	0	1	3	1	4	2	4	0	2	2	1	6	3	3	8	18	10	0	8	14	4	0	2	5	0	0	2	22	79%	18%
REALISATION	1	3	0	0	2	8	0	3	1	3	0	1	2	3	4	6	0	1	1	1	0	1	1	0	1	1	2	2	21	75%	14%
MATERIALS	2	4	4	5	6	2	1	12	0	7	0	6	5	2	1	17	0	5	12	5	1	0	1	0	0	0	0	0	19	68%	7%
COMFORT	3	1	0	2	2	5	5	0	3	0	3	0	3	7	0	4	4	9	0	0	0	3	2	3	0	2	0	1	18	64%	3%
SMARTNESS	0	0	1	6	0	0	2	0	0	0	0	1	0	1	0	2	2	2	1	6	3	4	1	0	3	4	5	0	16	57%,	-4%
CUSTOMISATION	0	0	0	2	0	0	1	1	0	5	0	2	1	4	0	0	2	0	0	3	3	3	1	5	5	0	6	12	16	57%	-4%
TRENDS	1	0	0	0	0	0	0	4	4	1	0	1	0	1	1	0	4	0	1	5	1	1	0	0	0	0	1	0	13	46%	-15%
FORM	0	0	0	0	0	5	0	3	0	0	1	0	1	0	0	0	0	2	0	4	0	1	1	2	1	0	3	2	12	43%	-18%
CONNECTIVITY	1	0	1	0	0	0	0	1	7	0	0	1	0	1	0	0	0	0	0	0	0	2	1	3	4	0	0	0	10	36%	-25%

HUMAN FACTORS PHYSICAL EMBODIMENT FUNCTIONS AND FEATURES GENERAL DIRECTIONS

Figure 2. Assignment of headings across the full dataset.

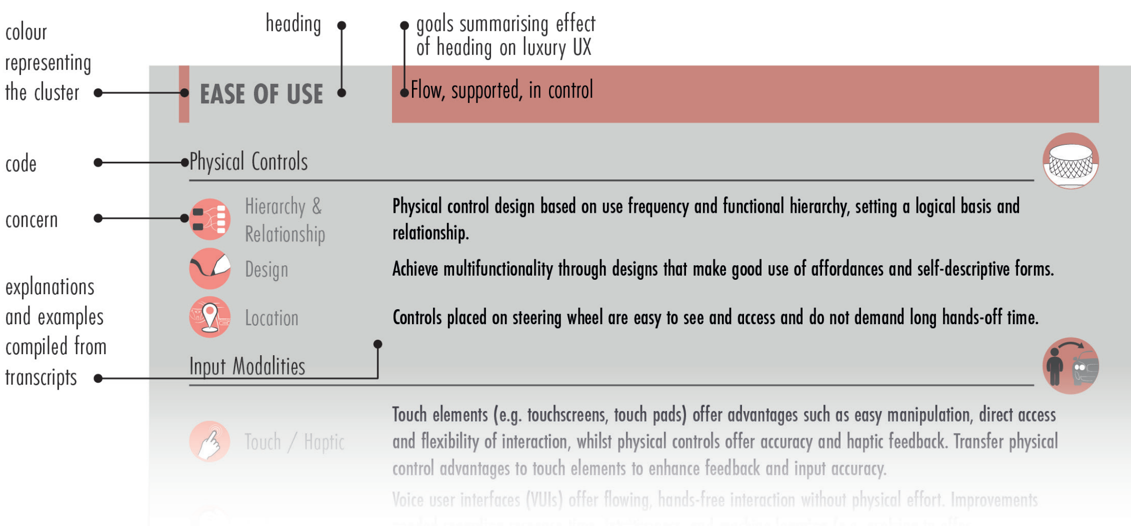

Figure 3. Annotated layout of a DfL-driver card.

The DfL-driver card for ease of use is provided in Figure 4. The codes and concerns (in parentheses) are (1) physical controls (hierarchy and relationship, design, location), (2) input modalities (touch/haptic, audio, gestures), (3) information, and (4) interaction/interactivity (accidental interactions, number of steps, visibility, responsiveness). The goals for luxury ease of use are: flow, supported, and in control.

An HMI's ease of use is expected to be elevated in a luxury car. A key concept raised under this heading is flow, defined as "the common characteristics of optimal experience: a sense that one's skills are adequate to cope with the challenges at hand, in a goal-directed, rule-bound action system that provides clear clues as to how well one is performing" (Csikszentmihalyi, 1991, p. 71). In this respect, luxury ease of use is experienced as *seamless* (P17), *flowing* (P16, P17, P20), *natural* (P20), and *feeling part of one machine* (P16). It is experientially the opposite of an awkward, cumbersome, or interrupted interaction that requires too much attention from the driver. For example, some functionality, currently accessed in a rather cumbersome way through a touchscreen, may be more easily accessed in an *effortless* way whilst driving using a different sensory modality, such as VUIs (voice user interfaces). A touchscreen may be considered luxurious if it supports a *visual choreography* (P15) during interaction. The HMI was suggested to offer luxury ease of use when it is supportive in tasks, helps reduce cognitive loads, makes time-consuming activities easier, and provides possibilities and solutions through information.

Comfort

Comfort is considered as "a pleasant state or relaxed feeling of a human being in reaction to its environment" (Vink & Hallbeck, 2012, p. 271). It is experienced subjectively and is contextually affected by physical, psychological, and physiological factors that make a universal definition difficult (Ahmed-Kristensen &

Figure 4. DfL-driver card: Ease of use.

Stavros, 2012; De Looze et al., 2003; Helander & Zhang, 1997; Vink et al., 2005). Following Mansfield et al. (2014), comfort is said to be achieved through the non-activation of pain receptors, taking into account factors such as form, fit between the body and a product, thermal environment, mechanical changes (i.e., vibration, shocks), and length of experience.

The DfL-driver card for comfort is provided in Figure 5. The codes and concerns (in parentheses) are: (1) scenario and context (length of journey, social experience), (2) physical effort, (3) seats, (4) environment (temperature, interior), (5) left/right problem, (6) steering wheel, and (7) reach and position. The goals for luxury comfort are: physical ease, effortless driving, and flow.

Overall, comfort within the luxury driver experience is not limited to traditional ideas of anthropometric fits or within-reach controls but extends to subtle considerations of even the smallest physical efforts spent interacting with the HMI system and interior. The interior and surface temperatures impact the feeling of comfort, not just in relation to the achievement of a comfortable body temperature (through air conditioning or heating) but also warm or cool material surfaces of controls or seats impart a sense of high quality. Consistency in the reach and position of HMI elements compared with the same manufacturer's predecessor models supports familiarity (cognitive comfort) as well as muscle memory for drivers. For some regional right-side driver markets (e.g., UK, Ireland), achieving luxury comfort can be problematic since controls requiring precision and coordination (especially central-placed touchscreens) need left-hand interaction during driving, despite the majority of drivers being right-handed. On the topic of aesthetics of interaction, access and activation of controls should be *effortless* in the sense of requiring minimal physical input. P18 used the useful phrase *ergonomics bringing joy* to describe luxury comfort.

Figure 5. DfL-driver card: Comfort.

Physical Embodiment Cluster

The Physical Embodiment cluster contained two above-average assigned headings, namely realization (*f* = 75% µ + 14%) and materials (*f* = 68%, µ + 7%), as well as the second least assigned heading (i.e., form, *f* = 43%, µ - 18%). The headings under the Physical Embodiment cluster are related through their focus on materialisation. They are crucial for the way in which a planned luxury experience does or does not physically manifest within the car. A large proportion of the codes and concerns become active from the moment of acquaintance with the vehicle interior and its HMI, prior to any driving.

Realization

Realization refers to how well a design proposal is physically embodied, for example, through manufactured parts, electronic hardware, or screen graphics. Car manufacturers focus effort, for instance, on the sound of mechanical elements and the smell of materials (Schütte, 2002) as well as the reduction of gaps and misfits between parts (Stylidis, 2019), as ways to increase perceived quality and embody specific experiential characteristics. Such fine-tuned details deliver the designers' intended experience to the user (Camere et al., 2016; Hassenzahl et al., 2015; Khalaj & Pedgley, 2014). Pye (1978) emphasizes the importance of multiple stakeholders for good realization, using an analogy to a musical piece, which depends not only on the composer but also on the interpretation by the musician (as well as the effect of the instrument played).

The DfL-driver card for realization is provided in Figure 6. The codes and concerns (in parentheses) are: (1) controls (visual, touch/haptic, audio), (2) craftsmanship and handmade, (3) graphics and labeling, (4) screen resolution, and (5) interior lighting. The goals for luxury realization are a feeling of expensiveness, refinement, and wow effect.

Concerns for the aesthetics of interaction were highly implicated under the realization heading. The phrase *interaction choreography* (P15) was volunteered, implying that every movement required for interaction within the car should be realised in a graceful and captivating manner for a luxury experience. For example, some interactions are best realized with mechanical resistance controls, smooth and slow movement, and a physical sturdiness that communicates trustworthiness and confidence (P2, P19, P26, P28). In contrast, others require nimble and precise interaction with multisensory feedback.

Materials

Materials create a fundamental base for experiencing physical products (Karana et al., 2014), providing not only product functionality but also contributing to product personality (Karana et al., 2008; Van Kesteren et al., 2005). Stylidis (2019) emphasizes that visual and tactile sensations are impacted by genuine/faux materials, with reference to colors, textures, gloss levels, etc. Bhise et al. (2005) identify material selection as a significant challenge for the automotive industry, requiring decisions on combinations of sensory qualities that deliver an intended experience while achieving brand differentiation.

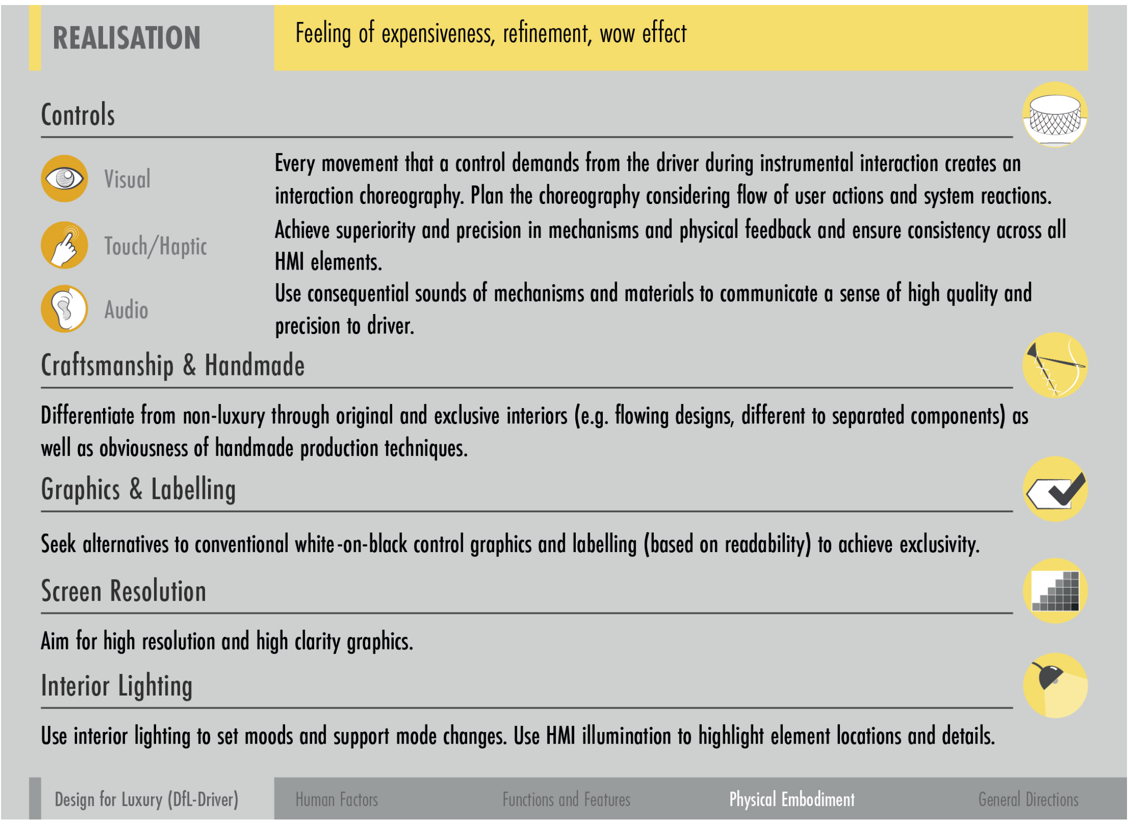

Figure 6. DfL-driver card: Realization.

The DfL-driver card for materials is provided in Figure 7. The codes and concerns (in parentheses) are (1) material sensations (visual, smell, touch/haptic), (2) authenticity, (3) meanings and associations (metal, plastic, leather), (4) harmony, and (5) brand associations. The goals for luxury materials are opulence and refinement.

Participants raised connections between material expense, sensory qualities, and a feeling of luxury. The financial value, rarity, uniqueness, and sensory qualities of certain materials (e.g., leather, wood, chromed metal) tie these materials legitimately to luxury, whereas plastics are appraised as feeling cheap and associated with lower market segment products (P10, P15, P19, P20). Surprisingly, participants did not mention carbon fiber composites or other higher-value synthetic materials commonly used in luxury cars. Material combinations should achieve a visual harmony and a congruous tactual experience. Material-based multisensory experiences can be used to set a brand identity such that different generations of cars offer their drivers some welcomely familiar material experiences. However, since trends and fashions can influence material choices, maintaining consistent meanings using different materials from one car generation to another can be challenging.

Form

Form refers to a product's three-dimensional definition and structural characteristics (Townsend et al., 2011). Form can communicate aesthetic, functional, ergonomic, and symbolic information (Creusen & Schoormans, 2005), provide a route for differentiation within a crowded market, and provoke sensory pleasure, especially to the eye (Bloch, 1995).

The DfL-driver card for form is provided in Figure 8. The codes are (1) styling (holistic), (2) styling (elements and controls), and (3) challenge of large screen. The goals for luxury form are integration and excitement.

Participants defined a luxury form as integrating different elements harmoniously, especially to create visual flow (P8, P20, P24, P28). P6 stated that form within the luxury car industry should be *challenging* and *more than functional* to stimulate excitement. This critical point illustrates the unique role of luxury in going beyond conventions and being at the forefront of initiatives to set new design directions, including interior, product, and componentry form.

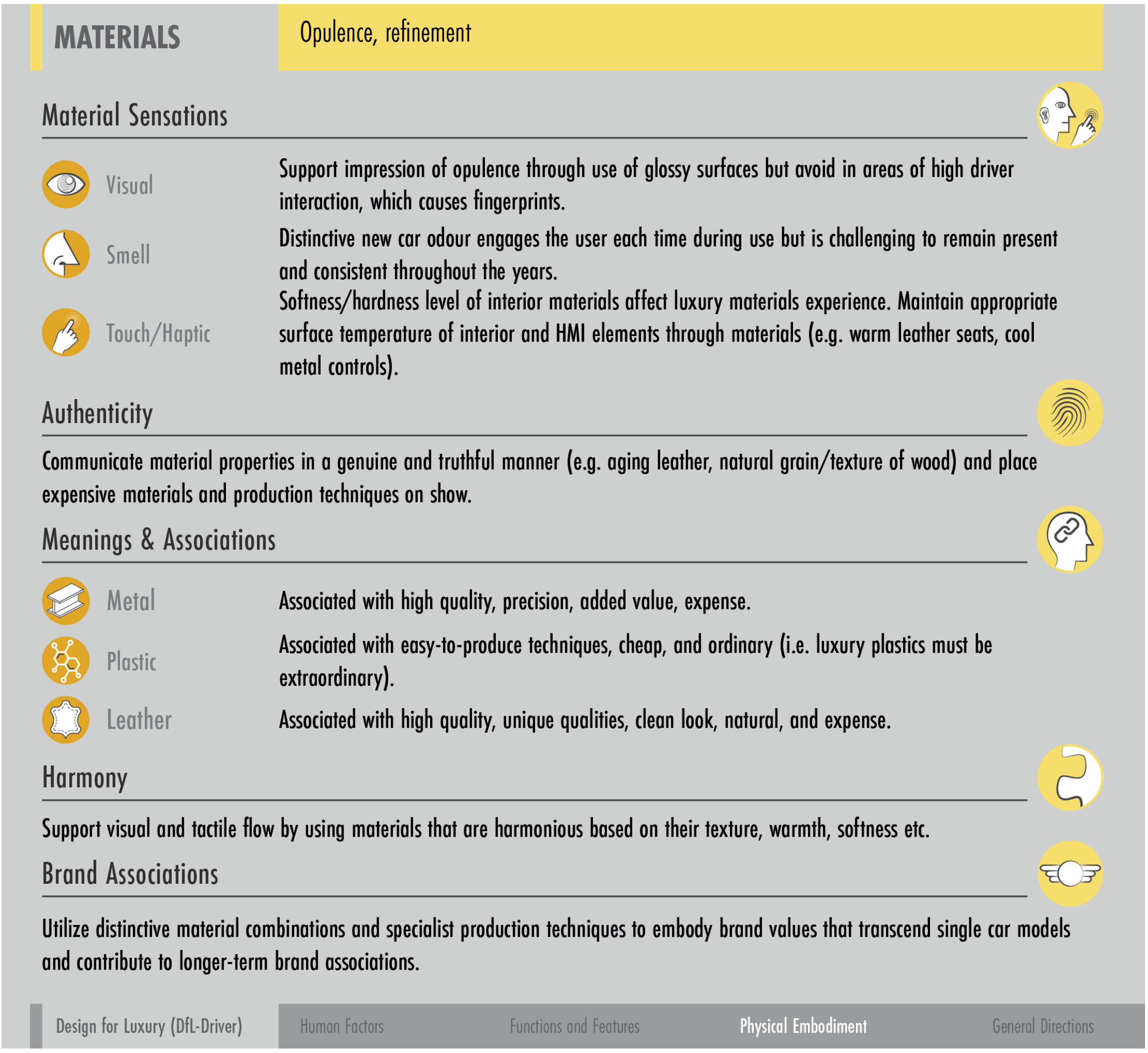

Figure 7. DfL-driver card: Materials.

Functions and Features Cluster

The Functions and Features cluster contained three below-average assigned headings, namely smartness ($f = 57\%$ μ - 4%), customization ($f = 57\%$, μ - 4%), and connectivity ($f = 36\%$, μ - 25%), which was the least assigned heading. The common theme amongst headings is the careful use of technology, particularly context-sensing and context-awareness, to provide drivers with a luxury experience.

Smartness

Smartness within a product is defined as *human-like intelligence* (Lee & Shin, 2018), referring to the ability of an artificial system to gather data, make sense of it, and act accordingly (Maass & Janzen, 2007). Siegemund (2004) identified qualities for smart objects to become a part of everyday life through (1) unobtrusiveness (not distracting from the primary task that it is designed to do) and (2) integrity (perceived as a single and consistent unit). Schifferstein et al. (2015) criticized the intrusiveness of some smart products and introduced the alternative concept of *wise products*, referring to objects that accumulate information and evolve according to the experiences of users.

The DfL-driver card for Smartness is provided in Figure 9. The codes and concerns (in parentheses) are: (1) recognise (user, context), (2) decide and suggest, and (3) automate. The goals for luxury smartness are: saving time, efficiency, and being looked after.

Participants summed-up luxury smartness as situations where the car thinks on their behalf (P7, P16, P25, P26): *taking pressure off the driver* (P4) by proactively deciding what is important for the driver at any given moment (P20, P21, P26). Smartness delivered at a luxury level will create a special trust or bond between the driver and the car (P12, P27). Automation was welcomed when it relieves driving duties, such as keeping the correct speed, dipping headlights, or responding to traffic regulations (P3, P4, P7, P17, P22, P26). Some caution was also evident in the participants' comments. Smart functions should not be intrusive and should know the right time to intervene or make themselves known (P20, P21), analogous to a well-trained *personal assistant* (P14, P20). Furthermore, P4 provided an important insight of smartness: whenever desired, a cancellation feature for smart functions should be possible to allow drivers to feel *fully in control* (P4) and closer to the driving experience of a classic luxury car, devoid of technological interventions.

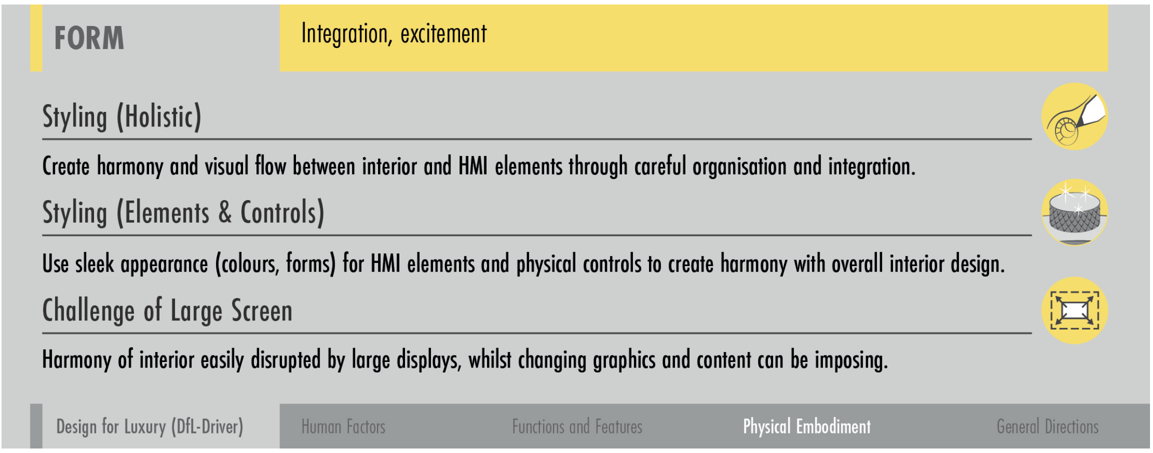

Figure 8. DfL-driver card: Form.

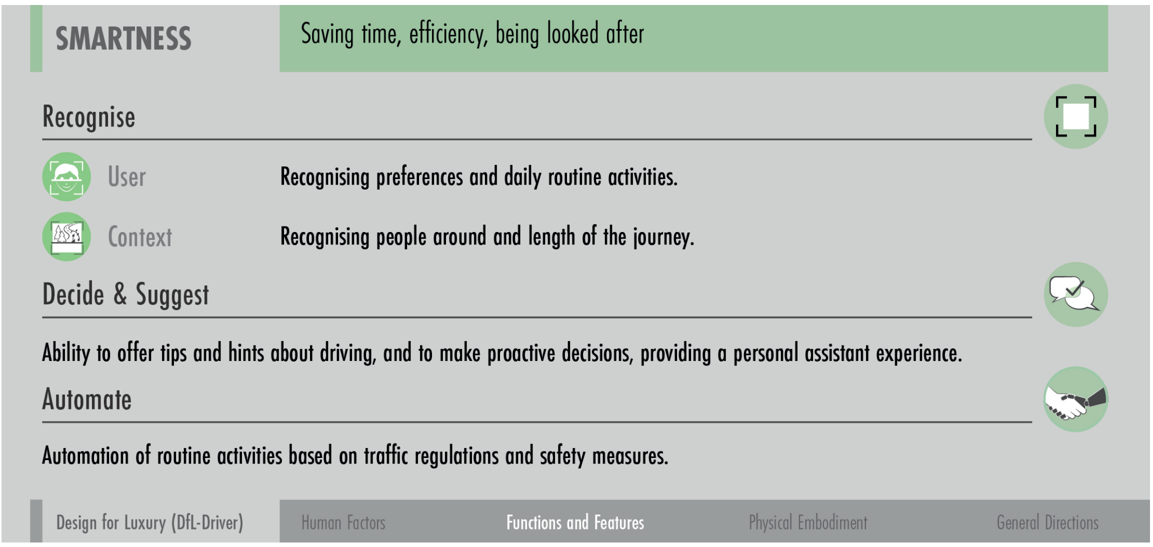

Figure 9. DfL-driver card: Smartness.

Customization

Customization is a way to achieve differentiation and to increase perceived value in marketplaces where basic product functionalities are similar or the same (Kratochvíl & Carson, 2005; Pakkanen et al., 2016). Mugge et al. (2009) define personalization—a close concept to customization—as the opportunity to "partly determine the appearance or functionality of the product [that people will purchase]" (p. 79). To achieve customization, production technologies must be sufficiently flexible to create component or product variations without compromising feasibility and efficiency (Fettermann et al., 2017). Pine and Gilmore (1997) offer different types of customizations: collaborative (designing in collaboration with the user), adaptive (maintaining customisability through use), cosmetic (offering customization during purchase, i.e., personalised packaging) and transparent (observing customers to identify customization needs prior to product development). In the luxury automotive industry, customization has long been used to deliver personalised cars that are exclusive to their owners (Bastien & Kapferer, 2013).

The DfL-driver card for customization is provided in Figure 10. The codes and concerns (in parentheses) are (1) options at production, (2) physical controls and input (location, functionality), (3) visual qualities (screen-free, information presentation, interior), and (4) information (context-based, content presentation, location, voice). The goals for luxury customization are personalization and driving joy.

The customization heading contained a vibrant mix of codes and concerns, reflecting the multiple ways—physical and digital—that luxury driver experiences can be adjusted or tailored to individual needs and desires. Indeed, customization was used as an umbrella term to capture participants' comments regarding three closely related but distinct terms: reconfigurability

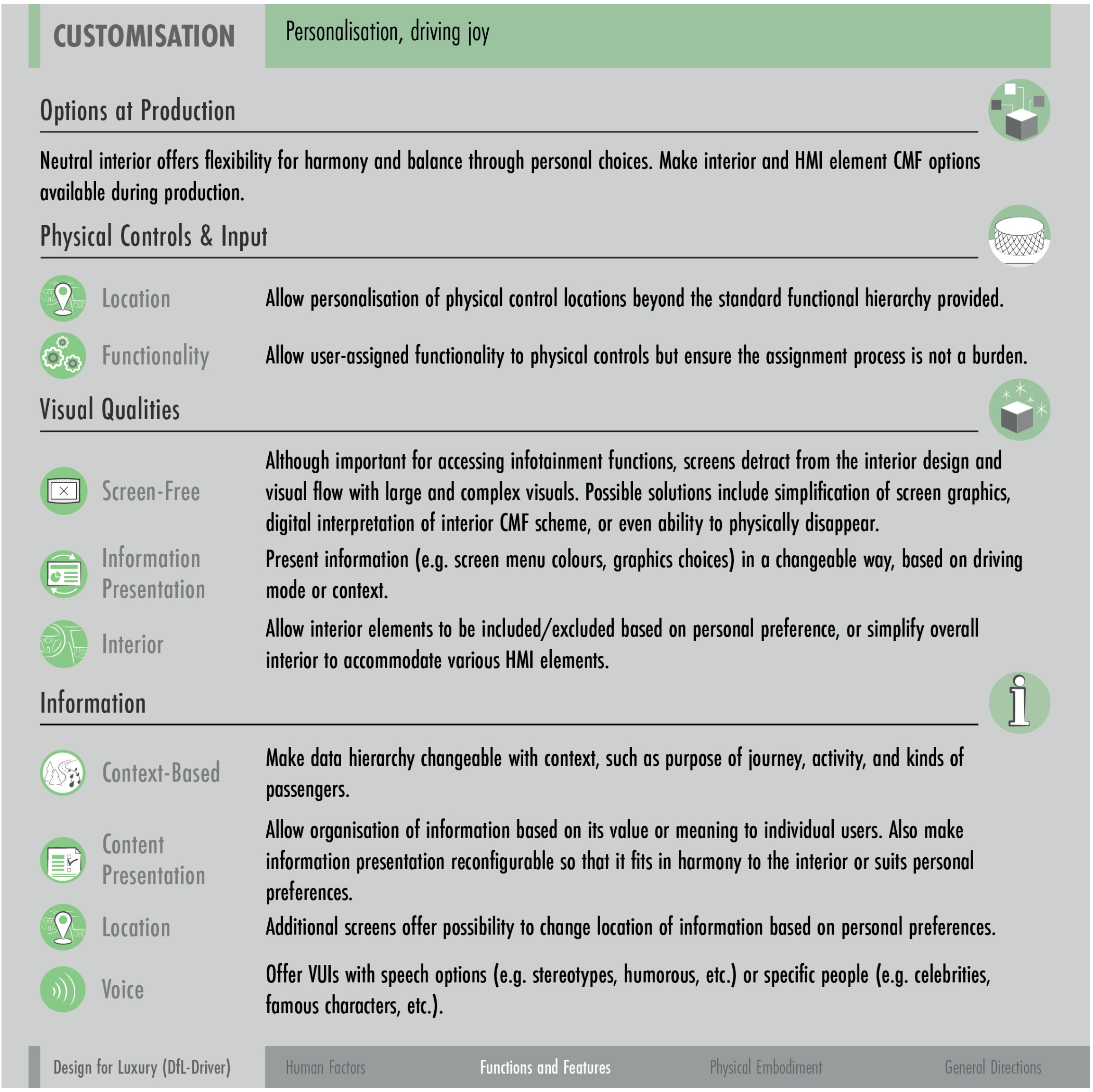

Figure 10. DfL-driver card: Customization.

(adjusting something about the HMI or interior from one provided state to another), personalization (allowing drivers to change the provided HMI or interior to fit as well as possible to their personal preferences, post-purchase), and customization (choosing which elements of the HMI or interior should be included, excluded or modified during car manufacture, before taking ownership).

Luxury customization at the stage of production centers on selecting from various physical interfaces/controls and interactive technologies to create a rare/unique combination. Participants referred to customizing a relatively neutral or understated interior through choices of HMI components and interior features. They also expressed a desire to have some input into the CMF choices of HMI control caps and surfaces, or accent components in the interior. Additionally, customizing *ways of having information* (P22) was mentioned, for instance, options of integrating audio commands, vibro-tactile elements, or head-up displays to create a *custom cockpit.*

Personalization was considered as a luxury if it allowed opportunities to personalise more than would be normal in automotive HMI and interiors. For example, a recurring request was the possibility to minimise, at will, the visual impact of the HMI, not only to simplify the interior but also to support a distraction-free (and minimalist) driving experience. This was expressed as *switching off the [HMI] system* or *hide the screen physically* (P23, P25, P28). Personalisation of the HMI could also be possible according to the purpose of the journey or the presence of other people in the car (P4, P8, P12, P21). Within all this, the process of tailoring the experience should itself be delivered in a way that demands very little time and effort (P24). It was suggested that a particular personalisation page could be provided on the primary digital display, or personalization could be programmed via a specialized mobile application.

Connectivity

Connectivity refers to the ability of products to connect and coordinate with other products or systems (Bécsi et al., 2015). Connectivity provides the necessary network to accumulate, process, and transfer data between physical objects (Rahman et al., 2021). The network is a crucial part of the infrastructure towards car automation and autonomy, providing safer, more comfortable, and more efficient solutions (Martínez de Aragón et al., 2018).

The DfL-driver card for connectivity is provided in Figure 11. The codes are: (1) what to connect, and (2) how to connect. The goals for luxury connectivity are flowing experience, platform choices, and borrowing information.

For a luxury experience, participants expected car systems to be able to connect to mobile apps on their personal devices, thereby allowing sharing and interaction with personal data. Drivers are already familiar with their mobile apps: such connectivity would likely achieve more efficient and effective personal data exchange than having to input the same data manually into their car systems (manual input was considered as opposing a luxury experience). An additional facet of luxury connectivity would be to allow drivers to *carry the information anywhere after driving* (P22)—an insightful comment that implies any information or data generated during a journey should be seamlessly accessible from drivers' mobile devices.

General Directions Cluster

The General Directions cluster for achieving luxury driver experiences contained the second most assigned heading (Perspectives, $f = 79\%$, $\mu + 18\%$) and one below-average assigned heading (Trends, $f = 46\%$, $\mu - 15\%$). Rather than offering specific design considerations for automotive HMI and interiors, this cluster helps raise designers' awareness of contemporary trends and general concepts towards luxury user experience and helps product managers plan priority areas for design effort.

Perspectives

This heading brings together participants' general concepts about what the luxury experience is, highlighting the various dimensions that can make or break a luxury driver experience. No operational definition is provided since the heading itself contains multiple definitions.

The DfL-driver card for perspectives is provided in Figure 12. The codes and concerns (in parentheses) are (1) functionality, (2) harmony and consistency, (3) relativity (luxury moving on), (4) use of / embracing technology, and (5) exclusivity (comparison, extras). The goals for luxury perspectives are feeling special, use of skills, sense of control, performance, progress, and calm-relaxed.

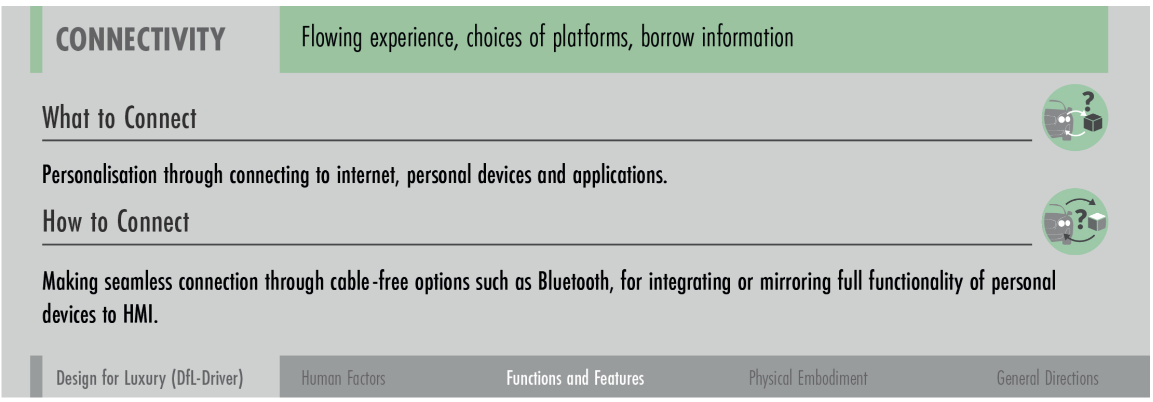

Figure 11. DfL-driver card: Connectivity.

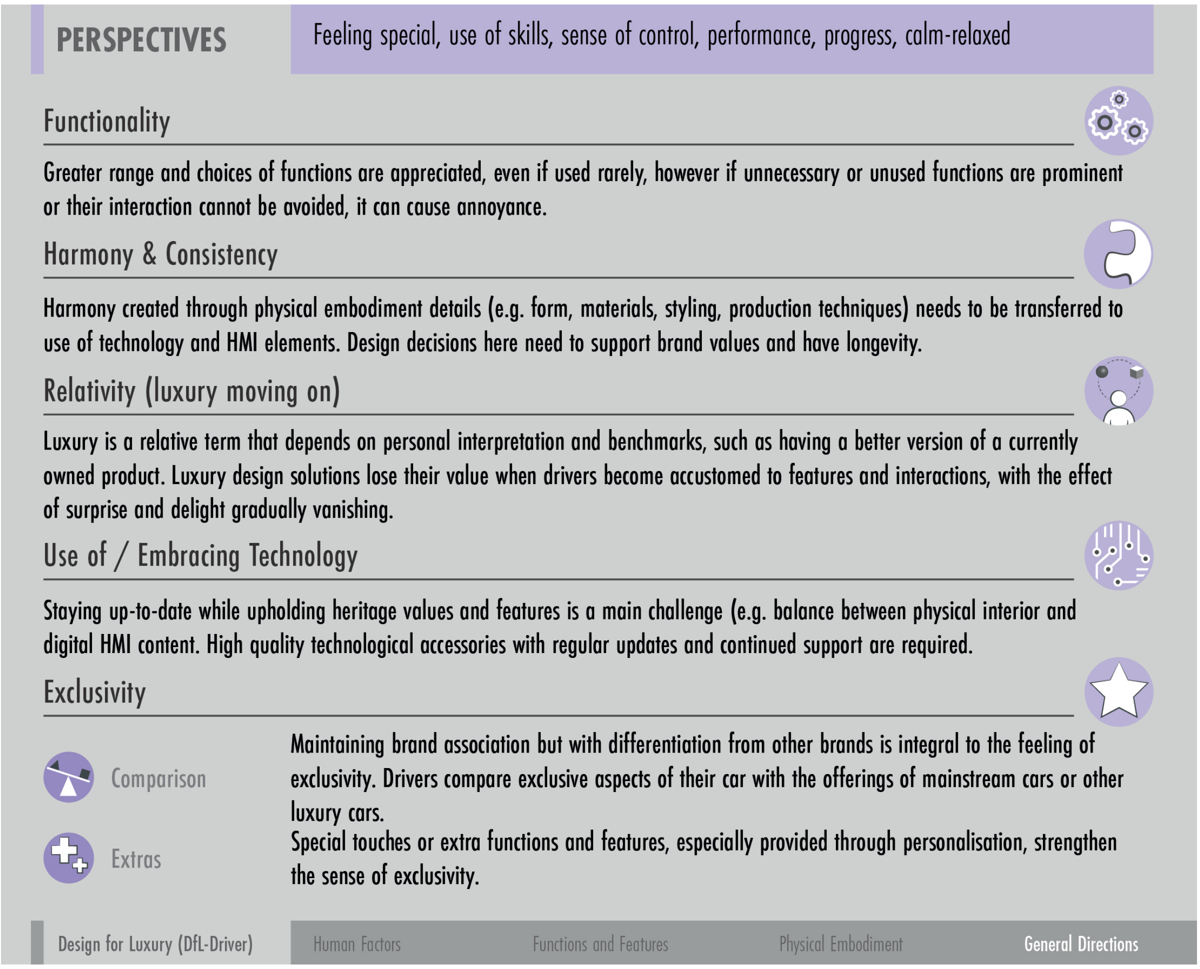

Figure 12. DfL-driver card: Perspectives.

As a general term, perspectives were considered a relative concept, moderated by individual factors such as how one defines luxury, age-related expectations, and personal experiences of luxury (or not) in cars and other product sectors. Elaborating on the six goals associated with luxury perspectives can be helpful in building a holistic view of the total driver experience in a luxury car, namely: (1) feeling special, in the sense of being served by the car; (2) use of skills, for driving the car and maintaining ongoing communication between the car and the driver; (3) sense of control, with the driver having an awareness of everything occurring in and around the car and having responsibility for decisions; (4) performance, related to what happens under the pedals (outside the scope of this paper); (5) progress, with the HMI offering time-saving solutions or information relevant to the here-and-now; and (6) calm-relaxed, keeping the driver in a comfortable environment with valuable and accurate information and support.

Trends

Trends refer to medium-to-long-term forecasted changes in a sector, a practice, a product type, and so forth, which can be detected today but will be more prominent in the future. The changes are driven by issues that are often world-influencing, such as technological advancements, sustainability challenges, energy supplies, local/global supply chains, digitalization, AI, etc. Trends are much more robust and reliable than fashions, which easily switch from current, to out-of-date, and possibly back to current again. To identify trends, brands constantly monitor their users, lately through Internet databases and social media (Kotler et al., 2018). However, in addition to observing sector-specific changes, it is important to consider the general direction which society moves (Kjaer, 2014). Trend monitoring can *unlock opportunities* (Mason et al., 2015) and trigger processes of change, often initiating a product development process that results in next generation products (Vejlgaard, 2008).

The DfL-driver card for trends is provided in Figure 13. The codes are (1) surrounded by screens, (2) big data collection and analysis, (3) borrowing good/luxury practice from other sectors, (4) new interaction modes, and (5) autonomy.

The primary sources of participants' comments on trends were technologies they had witnessed at industry events or online sources of inspiration. Screen-based interaction is common in everyday products, with participants noting that being surrounded by screens in a car interior would be an expected trend in car design (though, as mentioned previously, somewhat in tension with a luxury driver experience). Trends in touch-free HMI solutions

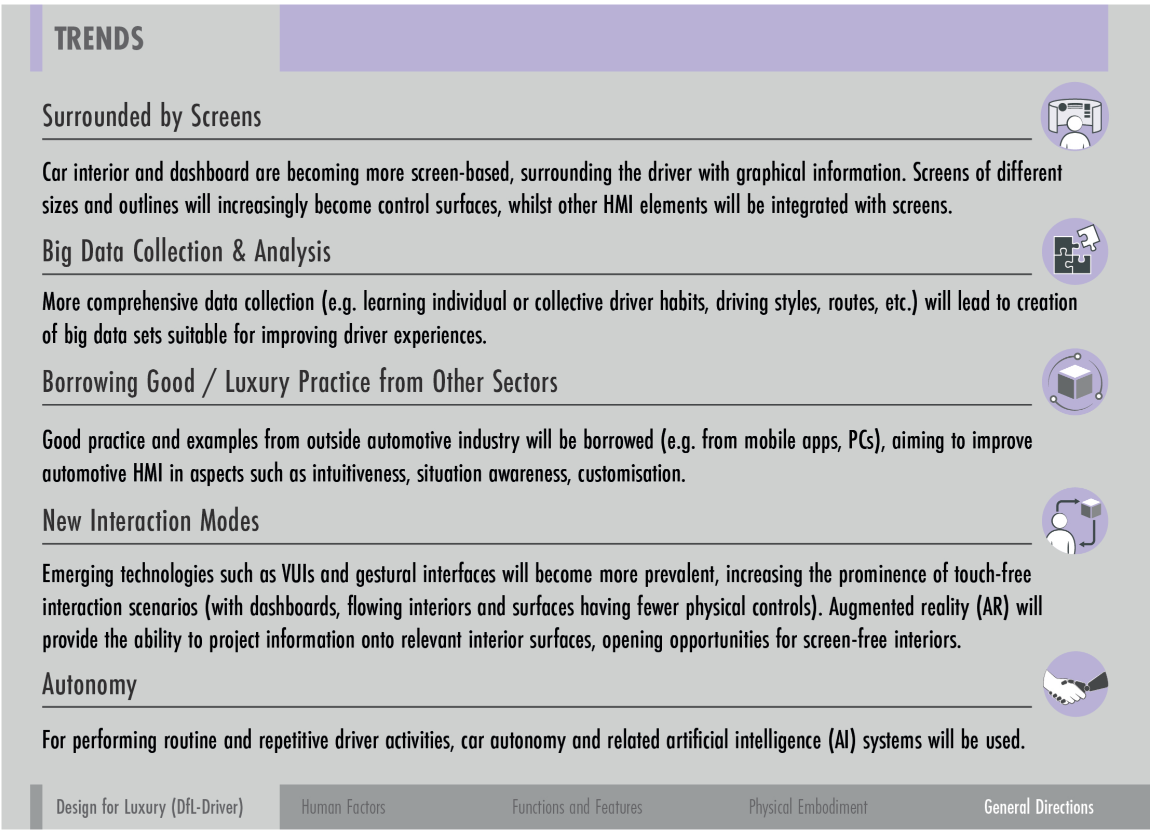

Figure 13. DfL-driver card: Trends.

(based on gesture detection or VUIs) may be accepted as a luxury only if the accuracy of spatial gesture and audio input interactions and conversations can be improved (P1, P8, P14, P20). Trends towards autonomous driving systems were predicted to reduce or even remove the driving joy that luxury cars can provide, leaving designers to concentrate on non-driving luxury experiences.

Discussion

The scope of this paper was to uncover and organize design considerations pertinent to luxury driver experiences rather than to identify design solutions that deliver luxury experiences or to report on design processes that may deliver as such. The ten DfL-driver cards outline principal design considerations. Nevertheless, there remain several topics (and limitations) to be discussed regarding the practical implementation of the design considerations.

Design Challenges

In combination, the DfL-driver cards present design considerations for achieving a luxury driver experience through automotive HMI and/or interiors. They significantly expand and give detail to some of the five factors Bavendiek et al. (2020) identified for designing a successful automotive HMI system (societal, legal, human factors, economical, and technical). Each DfL-driver card opens a clear pathway for automotive designers and product managers not only to critique their current offerings but also to decide on priority areas for improvements. Furthermore, each card and its associated codes and concerns can be considered within the frame of brand identity to create a unique blend of luxury experiences.

However, as is to be expected, the creative skill of a designer is needed to translate the DfL-driver card content into design solutions. Furthermore, the cards inevitably have intra-cluster and inter-cluster links that must be attended to. In other words, design considerations in one heading can have supportive or contradictory effects on design considerations in different headings. Some codes, concerns, and user experience goals across the headings are closely related (Figure 14). Inter-cluster relations are essential in this regard since they can reveal design considerations with potentially the highest impact. Although no specific advice will be provided here in relation to the required multicriteria decision-making, the DfL-driver cards purposefully contain many statements that suggest possible routes for ideation.

One important point of discussion relates to how the results in Figure 14 might fit or be reinterpreted within formal design approaches such as the Kano model, Kansei Engineering, or Quality Function Deployment, each of which aims to bring a high level of rationalization and transparency to experiential (particularly aesthetic) multicriteria decision-making. To do this justice would require a dedicated follow-up study. However, it is worth making an initial review. Explaining the work of Kano et al. (1984), Chen and Chuang (2008) introduce the Kano model as having three distinct qualities, linking product criterion performance and customer satisfaction.

- Must-be / basic quality. Customer dissatisfaction is expressed when the performance of a product criterion is low or the product criterion is absent (the maximum satisfaction level that can be achieved is only moderate).
- One-dimensional / performance quality. Customer satisfaction is a linear function of product criterion performance (poor performance, poor satisfaction; excellent performance, excellent satisfaction).
- Attractive / excitement quality. Customer satisfaction increases super linearly with increasing product criterion performance (a little more performance, a lot more satisfaction; however, dissatisfaction does not occur).

The mapping would likely be more intricate than simply cluster-based or code-based. For example, under the heading comfort, physical ease would probably map to a basic quality, but flow is more complex and might be mapped to either a one-dimensional or attractive quality. Under the Physical Embodiment cluster, the materials and form headings are too broad to imply any of the three Kano qualities. In contrast, codes under the Perspectives heading focusing on extraordinary experiences (such as feeling special and calm-relaxed) might well map to attractive qualities.

Effect of Corporate 'Bentley-ness' on Participant Appraisals

It is not possible to say with certainty the extent to which participants' responses (and therefore the design considerations defined through the analysis process) were conditioned by (a) working in the automotive industry and (b) working specifically for Bentley. Participants will have been car users before employment at Bentley (only 1 of 28 participants owned/drove a Bentley), as well as general consumers of products who will have had wide-ranging experiences of entry-level, mid-range, and high-end offerings. Furthermore, the participating employees were

Figure 14. Design considerations for achieving luxury driver experiences through automotive HMI and/or interiors.

from departments where it is expected to possess a good general knowledge of the luxury automotive sector and its variants, not just a solid understanding of *Bentley-ness*. From these perspectives, it is doubtful that corporate *Bentley-ness* had a significant influence on the results. Moreover, had the research been conducted without automotive industry employees, it is likely that participants' comments would have been limited in scope (unless, for example, conducted with automotive enthusiasts, car retailers, or other groups with an elevated interest in the industry).

Transferability of Results Outside of the United Kingdom

One of the most prominent limitations of the research is that in the United Kingdom, drivers are seated on the right of the car, with most HMI elements being placed to the left of the driver. This causes problems with interaction accuracy and precision (i.e., human factors, comfort, left/right problem), since the HMI elements must be interacted with the driver's left hand, which for approximately 90% of the population is the non-dominant hand. Drivers seated on the left of the car have a considerable advantage regarding the efficiency and effectiveness of HMI interaction.

It can be helpful to speculate how well the results might transfer to different cultures, outside of the British context. Firstly, a review was made to see if anything was inherently *British* about the content of the DfL-driver cards. At the level of codes and concerns, nothing was identified—the analysis terms were purposefully universal in their meaning. None of the descriptions/examples could be described as tied to a specific market. However, in different cultures and nations, it is expected that the luxury automotive HMI and interiors will need to be adjusted, for example, according to regional driving contexts/modes, regional routines and practices around using the car, different cultural acceptance of gestural/voice inputs, and local preferences for CMF and screen information presentation/graphical styles. In the literature, studies looking at cultural or national differences in luxury perception tend to be concerned with the marketing stage of luxury goods (e.g., Godey et al., 2013; Hennigs et al., 2012) and do not offer insights into design or embodiment. Naumova et al. (2019) and Shukla and Purani (2012) provide some evidence that Europeans focus on functional values and experiential benefits of luxury (closely tied to design considerations and interaction). In contrast, Asian and Arab regions are more sensitive to the social value and prestige of owning luxury items. Further research is needed on luxury product design for distributed markets.

Temporal Effects on Automotive Luxury

The feeling of luxury is relative depending on an individual's personal experience and interpretations and is susceptible to vanishing as one gets used to product features. As a result, concepts of luxury and the latest trends need to be updated and re-interpreted over time. This issue was raised in the Perspectives DfL-driver card. New and emerging technologies can be employed to maintain a feeling of exclusivity in each new generation of cars. Still, designers must be mindful of possible risks that negatively impact on heritage, visual flow, and ease of use. The integration of interactive technologies without in-depth research risks breaking the technical and experiential harmony necessary for good HMI systems (Gáspár, 2013): This would be disastrous for luxury automobiles. Through a proper R&D process, the risks can be mitigated, perhaps to such a degree that technological interfaces provide a playground for luxury car designers to create what may be termed 'a heritage of technology use' that becomes associated with a luxury brand.

One follow-up issue that is valuable to consider is whether the design considerations put forward through this research will be valid for many generations of automotive to come. In general, this should be the case. The codes are purposefully *timeless* because they are not tied to any particular technology. This is also generally the case for the concerns, except perhaps where interaction modalities are mentioned (e.g., brain-computer interfaces may be added) or where specific materials are mentioned (e.g., additional families such as carbon fiber, natural fiber composites, or sustainable luxury materials in general may be added). The DfL-driver card content most susceptible to temporal effects is the example solutions and descriptions provided for the codes and concerns, which should be reviewed every 3-5 years for possible revisions. Of course, the creative HMI and interior solutions that are proposed in response to the design considerations will be different over time, reflecting obsolescence and innovation in technologies, as well as changes in materials, styling, fashions, and trends. In this regard, the Trends DfL-driver card must be more regularly reviewed.

Conclusions

Luxury has long been discussed in marketing terms, but its conceptualisation as a particular type of user experience that can be designed for has remained unresearched. The main aim of this paper was to build a hierarchy of the design considerations (clusters, headings, codes, concerns) that can lead to a luxury driver experience through automotive HMI and interiors. Automotive HMI design is firstly dictated by safety concerns and conventions linked to the activity of driving. However, beyond this, and since the HMI extends throughout the dashboard and the driver's area, design details of the HMI are highly influential in maintaining a luxury driver experience.

The research question posed in the paper was: *what are the characteristics of automotive HMI and interiors associated with luxury driver experiences?* The ten DfL-driver cards developed through this research are proposed as helpful in answering the question, providing a helping-hand to designers responsible for achieving a luxury driver experience. By compiling the luxury user experience goals stated across the cards, six strategies for achieving luxury driver experiences can be proposed, focusing on (1) financial/status symbol (expensiveness perception, opulence); (2) physical embodiment (refinement, wow effect, excitement, driving joy); (3) automotive concierge (being looked after, supported, feeling special); (4) flow (flowing experience, calm-relaxed); (5) convenience and leisure (saving time, efficiency, physical ease, effortless driving); and (6) compatibility (choices of platforms, borrow information, personalization). A key message to take away is that superior functionality alone is not sufficient to achieve luxury. It must be supported with experiential details and, particularly, careful attention to the aesthetics of interaction for creating a sense of exclusivity.

As the main contribution, the research has provided considerations of designing for luxury derived from evidence and analysis rather than mystique and intuition. By organizing *design for luxury* considerations in such a complex case as automotive HMI and interiors, it can be reasonably expected that more straightforward cases from other product sectors will have crossovers with the DfL-driver cards, or at least the cards and the methodology by which they are created may be adapted as a starting point for luxury product design more generally.

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Appendix

Appendix 1. Analysis Hierarchy.

<table>
<tr><th>Level 2 Analysis:
Concerns (n = 36)</th><th>START: Level 1 Analysis:
Codes (n = 43)</th><th>Level 3 Analysis:
Headings (n = 10)</th><th>Level 4 Analysis:
Clusters (n = 4)</th></tr>
<tr><td>Hierarchy & Relationship, Design, Location</td><td>Physical Controls</td><td rowspan="4">Ease of Use</td><td rowspan="11">Human Factors</td></tr>
<tr><td>Touch/Haptic, Audio, Gestures</td><td>Input Modalities</td></tr>
<tr><td></td><td>Information</td></tr>
<tr><td>Accidental Interactions, Number of Steps, Visibility, Responsiveness</td><td>Interaction / Interactivity</td></tr>
<tr><td>Length of Journey, Social Experience</td><td>Scenario & Context</td><td rowspan="7">Comfort</td></tr>
<tr><td></td><td>Physical Effort</td></tr>
<tr><td></td><td>Reach & Position</td></tr>
<tr><td>Temperature, Interior</td><td>Environment</td></tr>
<tr><td></td><td>Left/Right Problem</td></tr>
<tr><td></td><td>Steering Wheel</td></tr>
<tr><td></td><td>Seats</td></tr>
<tr><td>Visual, Touch/Haptic, Audio</td><td>Controls</td><td rowspan="5">Realization</td><td rowspan="10">Physical Embodiment</td></tr>
<tr><td></td><td>Craftsmanship & Handmade</td></tr>
<tr><td></td><td>Graphics & Labelling</td></tr>
<tr><td></td><td>Screen Resolution</td></tr>
<tr><td></td><td>Interior Lighting</td></tr>
<tr><td>Visual, Smell, Touch/Haptic</td><td>Material Sensations</td><td rowspan="5">Materials</td></tr>
<tr><td></td><td>Authenticity</td></tr>
<tr><td>Metal, Plastic, Leather</td><td>Meanings & Associations</td></tr>
<tr><td></td><td>Harmony</td></tr>
<tr><td></td><td>Brand Associations</td></tr>
</table>

Appendix 1. Analysis Hierarchy (continued.)

Level 2 Analysis: Concerns (*n* = 36)	**START: Level 1 Analysis: Codes (*n* = 43)**	**Level 3 Analysis: Headings (*n* = 10)**	**Level 4 Analysis: Clusters (n = 4)**
	Styling (Holistic)	Form	Physical Embodiment
	Styling (Elements & Controls)		
	Challenge of Large Screen		
User, Context	Recognise	Smartness	Functions and Features
	Decide & Suggest		
	Automate		
	Options at Production	Customization	
Screen-Free, Information Presentation, Interior	Visual Qualities		
Location, Functionality	Physical Controls & Input		
Context-Based, Content Presentation, Location, Voice	Information		
	What to Connect	Connectivity	
	How to Connect		
	Use of / Embracing Technology	Perspectives	General Directions
Comparison, Extras	Exclusivity		
	Functionality		
	Harmony & Consistency		
	Relativity (luxury moving on)		
	Surrounded by Screens	Trends	
	New Interaction Modes		
	Big Data Collection & Analysis		
	Autonomy		
	Borrowing Good / Luxury Practice from Other Sectors		