

Exoticness, High-performance, and Luxury: Design of a brand-specific supercar interior using the PPE framework

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Abstract

Purpose: This paper presents a design study undertaken to develop a concept motorcar interior based on the Hulme F1 supercar exterior prototype. The study focused on generating an appropriate visual design proposal with the support of the Perceptual Product Experience (PPE) framework to guide design progress and validate design work.

Methodology/approach: Throughout the project, the PPE framework was used as a tool to specify, direct and evaluate design work and to support design decision making. Design research work was categorised in the stages of contextual research, contemporary design analysis, design development, and design evaluation. Evaluation was done using a small quantitative-qualitative survey with external respondents, employing VAS scales, Likert scales and open ended questions.

Findings: This paper illustrates how the PPE framework can be applied as an effective tool for establishing an appropriately and creatively managed design direction during the design development process. Providing a number of benefits for design research, the framework helps position, benchmark and develop visual design characteristics within a contemporary market context. The framework also supports the development of appropriate, valid and measurable experience design criteria, which traditionally is difficult due to the subjective nature of design perception. The outcome of the external evaluation indicated that intended experiential design criteria had successfully been transformed as perceived by the respondent group.

Originality/value: The structure and tools of the PPE framework to analyse, categorise, specify, direct and evaluate creative design work in an area where design work traditionally relies on intuitive and subjective approaches. This is of value for communicating, managing and direction design work on operational and strategic levels of design, and has the potential to contribute to the quality assurance of design processes.

Keywords: Perceptual product experience, PPE framework, automobile design, interior design, method, evaluation, design project

Paper category: Research paper

Introduction

The importance of design to create pleasurable product experiences is well known. For example, Givechi and Velasquez (2004) showed that product design is capable of eliciting positive reactions such as joy, inspiration and achievement. Mano and Oliver (1993, p. 451) emphasized the interrelationship between product satisfaction and product-elicited emotions, acknowledging the importance of the subjective, experiential response for product satisfaction. They report that the dimension of 'hedonic' or 'aesthetic' performance, which includes the valuation of products for their intrinsically pleasing properties, is one of the two major dimensions of product relevance; the other being the notion of instrumental or utilitarian performance.

Authors in a number of fields, from psychology (e.g. Norman, 2004) to design have offered a variety of viewpoints which provide insights into the complex nature of product experience and its relation to, e.g., meaning (Vihma, 1995; Monö, 1997), formal aesthetics (Muller, 2001; Warell, 2001), emotions (Desmet, 2002), and brand specific product design (Karjalainen and Warell, 2006). Seva et al. (2007) found that affect created by product design strongly influence purchase decision. Kansei Engineering represents yet another approach to capture the emotional experience of product design. Clearly, desirable experiences are created through a range of aspects related to the experience of the product.

While approaches reported in literature tend to focus on the analysis and evaluation of product experience, the real problem for design often lies in the specification and generation of concepts that create intended experiences as perceived by users. The act of designing products with an appropriate, desirable and meaningful visual appearance is often a difficult and arduous task. Due to the often ill-defined nature of design, designers often experience difficulties with respect to knowing how customers perceive, 'read', the product; designing for specific experiences; and prioritising between desired experiences. The predominately intuitive and subjectively oriented processes of designers offer limited communicable rationale in terms of motivating and externalizing design decisions. The difficulty to objectively and transparently communicate design criteria and present rationale for decision making makes justification and validation of visual design an inherently difficult activity.

In this paper, an approach for design work that facilitates the above issues is presented and exemplified through application in a conceptual motorcar interior design project. Based on the structure and tools offered by the PPE framework (Warell, 2008b), the approach offers direction and support for establishing visual design decision making, and for assessing a design against existing designs, criteria and themes.

The Framework of Perceptual Product Experience (PPE framework)

Treating perceptual experiences involving any or all senses, the PPE framework (Warell 2008a, 2008b, Wang 2008, Young 2008, Warell 2007, Warell et al. 2006, Warell 2006, Warell 2005) offers a comprehensive and analytical structure for understanding product perception. Product experience is subjective and specific to each perceiver, and depends

on personal factors (experiences, background, cultural values and motives), product related factors (type of product, properties and characteristics, brand), and external factors (environmental, social and economic context).

The framework considers perceptual product experience as composed of three core modes; the sensorial, the cognitive, and the affective modes of experience, and two dimensions; the dimension of presentation and representation (See Figure 1). In the following sections, the modes and dimensions of the PPE framework are briefly described (for more detail, see Warell, 2008b).

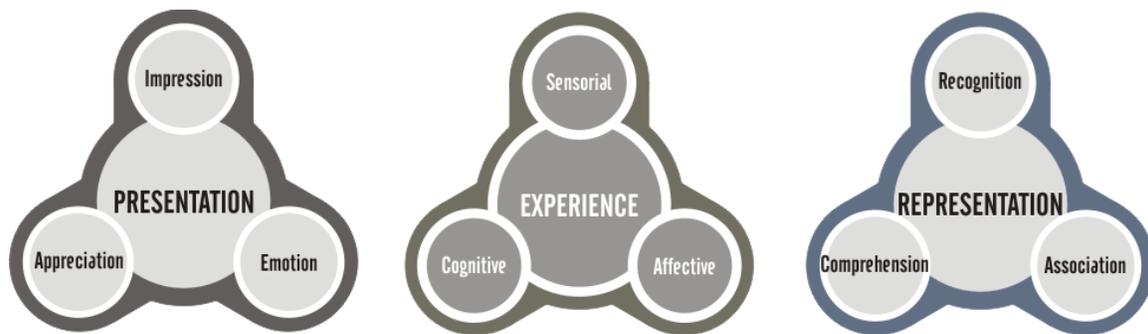


Figure 1. Framework of perceptual product experience (PPE framework), with core modes (centre) and the two dimensions of presentation (left) and representation (right) with submodes.

The three core modalities recognise all possible types of perceptual experience; including initial impression and recognition of product existence and specific perceptual characteristics (the sensorial mode); making sense of the product, its manifestation, structure, use, origin and purpose (the cognitive mode); and the affective response, attribution of value to, and judgement of the product (the affective mode).

The *sensorial mode* includes perceptions of stimuli experienced with any of the senses; vision, hearing, smell/taste, touch, or balance (Mather, 2006). Physiologically, vision can be regarded as the most highly prioritised sense. Sensory perception of the product leads to a range of experiences, including aesthetic, emotional (see, e.g., Desmet 2002, Norman 2004) and pleasurable (see, e.g., Jordan 2000) experiences.

In the *cognitive mode*, we understand, organise, and interpret and make sense of what we perceive. The cognitive part of the product experience processes and categorises sensory input, stores, creates and retrieves information and knowledge from memory, and supports in decision making, judgement and inferences (see Reisberg, 1996).

The *affective mode* concerns itself with experiences that are affective in nature, i.e. the give rise to feelings, emotions, and mood states, based on product perceptions (see e.g. Crilly et al. 2004, Visser 2006, Schütte 2005). As the affective system is judgemental (Norman, 2002), the affective mode includes associations and notions that people

attribute to products, such as brand associations based on personal beliefs, values and emotions (Abbot et al., 2006).

Apart from the core modes, the PPE framework recognises that the experience has a dual nature; that is, that the experience can be presentational as well as representational, as suggested by Vihma (1995). This inherent duality of the experience is made explicit in the two *dimensions of presentation and representation*. In the PPE model, the two dimensions 'map' to the sensorial, cognitive and affective core modes such that each of these modes are manifested in the presentation as well as the representation dimension. Thus, each core mode has a 'pleasurable' as well as a 'meaningful' dimension.

The dimension of presentation is concerned with the direct, 'pure' sensual stimuli related side of the experience. In short, presentation may be seen as the 'pleasurable' side of the experience, related to the direct, non-interpretative experience, i.e. experiencing the product for 'what it is'. The experience submodes in the dimension of presentation are described in the following:

Impression is the essential and first part of the experience, which in turn can lead to any, or all, of the other experiences. In the PPE framework, impression is the purely sensorial experience of becoming aware of a product as a result of it being sufficiently 'different' to stand out, be noticed and attended to, referred to as 'active selectivity' by Arnheim (1970, p.20).

Appreciation is about recognition of aesthetic values. In the PPE framework, appreciation engages cognitive processing of what we perceive through our senses. Part of the appreciation is the composition and order of perceived stimuli (Muller, 2001). The pleasurable experience of visual composition of detail and unity in product design can be enhanced by the creation of coherence and resemblance between elements within each structural level of the visual composition, as well as between the hierarchical levels of holistic and atomistic structure of form (Warell, 2001).

Emotion is the affective response evoked by the combination of product stimuli, subjective concerns and an appraisal (Desmet, 2002). According to Visser (2006, p.7), emotion is involved in the control of activity and thus influences decision making (Tversky & Kahnemann, 1981).

The *dimension of representation* regards the product experience as a meaning-making phenomenon that can be described by the three submodes of 'recognition', 'comprehension', and 'association'. The process of meaning making is socio-culturally contextualised and can be seen from the perspective of the producer (e.g., the designer or company) and the perceiver (e.g., the customer or user). The experience submodes in the dimension of representation are described in the following:

Recognition is based on familiarity, resemblance or similarity, and requires previous precedents to compare with. Thus it is dependent on the existence of pre-established references stored in long term memory (Simon 1992, p.132; Solso, 1999, p.78). Recognition of product type and brand requires resemblance to other products through

similar sensorial elements. In the visual domain, such elements are known as ‘signifiers’ (Warell *et al.* 2006), or ‘design cues’.

Comprehension is about making ‘sense of things’, such that products are “understandable to their users” (Krippendorff, 2006, p.xv). Through comprehension, we understand characteristics such as level of quality and the nature of the product; the product describes its operation, expresses its properties, and exhorts certain types of action or even non-action; it informs and advises about itself. In comprehension, perceivable references in the product point towards the product itself, providing meaning related to the nature, behaviour, properties and essential characteristics of the product as such.

Association is about communication of, e.g., values, origin and heritage, and is dependent on subjective and socio-culturally conditioned processes of coding, which determine how we associate references with meaning through symbolic signs within target market groups with similar values and aspirations; interpretative communities (Chandler 1994). In association, meaning is created (encoded) and interpreted (decoded) from two perspectives; from the point of view of the manufacturer, who uses the product to convey strategic brand messages and build brand values (see, e.g., Karjalainen, 2004); and from the point of view of the customer or user, who communicates personal values and preferences through ownership or use of the product.

Design Study Outline

In the study presented in this paper, the focus was on the visually perceived aspects of the product experience. Thus, during initial research, development and evaluation, emphasis was placed on the exploration and design of visual elements to support the establishment and communication of visual design format, brand signifiers, product semantics and core brand values.

The aim of the design study was to develop an appropriate conceptual motorcar interior for the Hulme F1 Supercar (Figure 2). The Hulme F1 Supercar exterior concept was designed to express ‘luxury’, ‘high-performance’, ‘exoticness’. As the Hulme F1 brand is still in the process of being developed, these expressions were considered the core values for the Hulme F1 brand for the purpose of this design research study. Furthermore, the exterior prototype was designed to provide visual references to contemporary Formula One race cars.



Figure 2. The Hulme F1 supercar exterior prototype (Autocar, 2005).

The interior concept design work aimed at developing an appropriate visual aesthetic in context to the existing exterior. This included designing a pleasurable interior that provided appropriate references, connotations and expressions for a vehicle of this type. Emphasis was also placed on basic ergonomic and functional requirements of the interior workspace in order to support the practicality of the design.

Methods and Results

During the design process, a range of methods and tools were employed to develop and assess the concept interior. The design work was characterised by four distinct stages; contextual research, contemporary design analysis, design development, and evaluation. In the following sections, the purpose, approach and results of each stage are described. Emphasis is also placed on use of the PPE framework and associated tools employed for the stages of contemporary design analysis, design development and evaluation.

Contextual research

Purpose

The first stage of research focused on establishing a general understanding for the core values in relation to this study. Additionally, research into areas such as the exterior form language, driver ergonomics, appropriate technologies and materials and the functional requirements of the interior cabin was undertaken. Exploration into these areas was carried out in order to establish experience and performance criteria to appropriately direct and support the design development of the concept interior.

Approach

This stage focused primarily on secondary sources of literature. Visual examples were established through image boarding and the identification of key motifs or themes in order to explore and describe the established core values. Definitions for each motif were developed based on a variety of sources as well as a review of contemporary product design.

Results

Motifs representing the three core values were established according to the following.

The concept of luxury is highly subjective by nature, and dependent on personal preferences as well as socio-cultural values. Attributes associated with luxury included a high purchasing price, exquisite presentation and quality of materials and high levels of hedonic value. Size, scale and weight are also factors but vary depending on the nature of the product. The results of this analysis indicated that to imbue the concept interior with a 'visual' sense of luxury materiality, creating strong associations with the exterior and expressing comfort would be of great importance. From this research, the following definition for luxury was developed:

Luxury: *'Something expensive, desirable, and comfortable, that uses expensive or desirable materials and has a degree of meaningful familiarity (or association) with the user'*.

Similarly, the following definitions for the two remaining motifs were established:

High performance: *'A machine with great or above average capabilities, designed with an emphasis on utility and functionality for professional users'*.

Exotic: *'Unusual, attractive and rare, but comprehensible within its surrounding environment and/or design type'*.



Figure 3. Visual design analysis of Hulme F1 exterior design

The analysis of the exterior form language of the Hulme F1 Supercar highlighted a strong referencing of contemporary Formula One race cars as seen in Figure 3. Notably, similarities between the exterior and contemporary Formula One race cars focused on the overall silhouette and packaging characteristics. Design detailing on the Hulme F1 Supercar is markedly simple in comparison to the Formula One race cars.

Contemporary Design Analysis

Purpose

A general understanding for the motifs of luxury, high-performance and exoticness were established in the previous stage of research. However, their visual implications for the concept interior remained relatively undefined and therefore did not adequately define an appropriate visual design direction.

In order to deepen the understanding of these motifs and thus reduce the degree of 'fuzziness' surrounding the definition of an appropriate design direction for the interior concept, this stage focused on exploring specific motifs and creating valid criteria for aesthetic design decisions made for the concept interior. The results from this stage were used as a benchmark for the generation of design criteria for the concept interior.

Two categories of design criteria were developed for this study. Experience criteria focused on desired experiential and perceptual based design attributes for the concept interior. Performance criteria focused on the desired functional, ergonomic and technological qualities for the concept interior. Each criterion was given a priority rating in terms of importance. This rating system included required criteria and criteria with a high, moderate and low level of desirability.

In relation to the PPE framework (see Figure 1), the analysis of contemporary car design focussed on the modes of impression and appreciation of the presentation dimension. The analysis did not focus on the emotion mode, as the understanding and analysing the emotional response elicited by a product requires participatory surveys with a wide range of respondents and therefore was considered beyond the scope of this investigation.

Approach

This stage focused on the analysis of a range of contemporary motorcar exemplars which were considered to carry appropriate expressions of luxury, high-performance and exoticness in relation to this study. The interior and exterior design of each exemplar were analysed using the structure of the PPE framework. Analysis focused on identifying interior as well as interior-exterior related visual design elements. The Design Format Matrix tool (Warell, 2001) was used to map and identify these elements. Corresponding to the identified motifs, the analysis of exemplars was structured into the three categories of luxury, high-performance and exotic.

Luxury exemplars

A selection of four-door saloons (Bentley Flying Spur, Mercedes-Benz S-Class, and Audi RS4) was used as the exemplars for luxury. This category of cars is generally recognised

for excellent ride comfort and spacious interior, making them an ideal package for expressing luxury. Consequently, these exemplars offer an ideal starting point for understanding luxury in context to contemporary motorcars.

High-performance exemplars

To broaden this study's understanding of high-performance motorcar aesthetics beyond the Formula One race car, this analysis focused on LeMans prototype race car exemplars (Bentley Speed 8 and Porsche RS Spyder). The LeMans 24 Hour racing series is considered one of the most prestigious classes of motor sport. LeMans prototype race cars share many similarities with the Hulme F1 supercar exterior. For example, they are both designed to accommodate two occupants and have similar packaging characteristics. As a result, these race cars were considered appropriate for furthering this study's knowledge into high-performance aesthetics.

Exotic exemplars

A selection of contemporary supercars (Bugatti Veyron, Ferrari Enzo and Pagani Zonda F) was considered ideal for understanding motorcar aesthetic motifs of exoticness. Their rarity, distinct aesthetics and exclusivity ensure clear exotic attributes.

Results

The visual experience of all exemplars was analysed with respect to the PPE modes of impression, appreciation, recognition, comprehension, and association. Figure 4 exemplifies the results of the PPE analysis conducted on a 'luxury' based exemplar, the 2006 Mercedes-Benz S-Class. The analysis revealed notable findings such as the repetitive use of form elements shared between the interior and exterior design. This was of interest since, despite the distinct differences in visual structure between the interior and exterior, the design of the interior and exterior shared many similar form elements. The results from this analysis gave strong indication that the interior concept could share similar aesthetic values to the exterior yet still be visually distinct.

The results from the analysis of the appreciation mode of the PPE framework were mapped using a Design Format analysis matrix (Figure 5). The design format analysis identified the following significant trends:

- Luxurious motor cars tend to have simple interior/exterior visual compositions and make frequent use of form element repetition.
- High-performance race cars typically have complex interior/exterior visual compositions and a minimal amount of form element repetition.
- The visual qualities of exotic supercars tend to exhibit a balance between expressions of high-performance and luxury. Thus, depending on the overall expression of the supercar, the visual composition and repetition of form elements will differ. For example, the Ferrari Enzo expresses a high level of high-performance and consequently has a higher degree of composition complexity and minimal level of form element repetition, while the Bugatti Veyron has sharply contrasting visual characteristics.

Furthermore, the results also indicated that differing features within the interior can exhibit distinct visual expressions. Functional features such as controls often afford high-performance orientated aesthetics with contrasting materials and complex visual compositions. In contrast, other functional features such as seating afford more luxurious expressions with curvaceous inviting forms, soft leather trim and simple compositions.

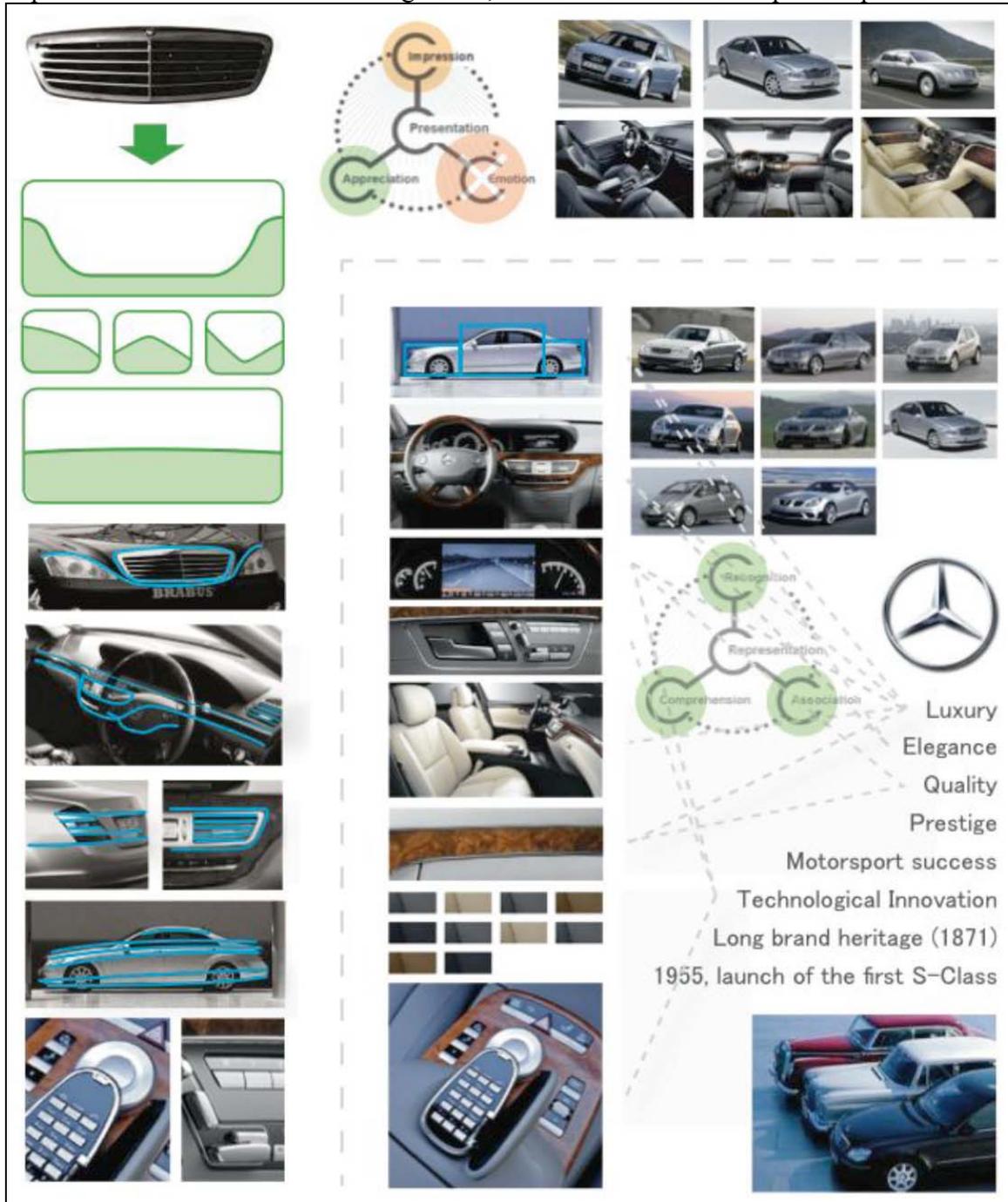


Figure 4. PPE analysis of the 2006 Mercedes-Benz S-Class.

These trends along with the knowledge generated in the background research stage were used to generate experience and performance based design criteria. In total, 14 experience design criteria and 17 performance design criteria were developed.



Figure 5. Visual element analysis based on the Design Format method (Warell, 2001).

Design development

Purpose

This stage of research focused on design development of the concept interior.

Approach

Creative practice was used as a research method to obtain new knowledge (Downton, 2003) and iteratively develop the concept motorcar interior. Commonly used design approaches were employed to generate the concept motorcar interior. These included concept sketching, rendering, form studies, basic ergonomic testing, elevation cross-section drawings, and the development of a half scale hard model.

In the design process, design criteria produced from the previous stages were utilised in order to appropriately direct the development of the concept interior. In terms of experience criteria, particular emphasis was placed on visual complexity and appropriate use of form elements in association to luxury, high-performance, exoticness, and contemporary Formula One race cars. To this end, concepts were constantly screened against the performance and experience design criteria.

With respect to performance criteria, ergonomic design focused on driver posture, vision, static and dynamic reach, control positioning, ingress, egress and accessible areas for storage of personal items. Testing employed two participants, a 95th percentile stature male and a 5th percentile stature female. In context to the scope of this study, these participants adequately represented a range of typical users for the concept interior.

Results

As this stage employed a variety of methods, a wide range of results were produced. These results were predominately expressed as visual design outputs. Initial concept work generated a wide range of proposals for the concept interior. These concepts were assessed against the experience and performance design criteria. Specific emphasis was placed on determining whether concepts fulfilled the 'required' and 'highly desirable' design criteria.

The final design (see Figure 6) focused on expressing appropriate levels of 'luxury', 'high-performance' and 'exoticness'. The expression of luxury was expressed through an overall simple visual cockpit aesthetic, soft-grain leather trim and form language which referenced the exterior surfaces. High-performance was expressed through visually complex detailing highlighting functional features such as the steering column, centre console and foot pedals.

Features from contemporary Formula One race cars were referenced within the design. Formula One race car cockpits inspired the sparse cocoon-like interior. The steering column drew inspiration from Formula One race car suspension arms (an example of the recognition mode of the PPE framework). This reference was considered appropriate for the steering column, as both relate to vehicle steering. Additionally, the grooves within the seat back, seat pan and foot wells relate to Formula One race car tyre tread (recognition). These references were also used as a means of eliciting exoticness (comprehension) due to their distinct semantic qualities.

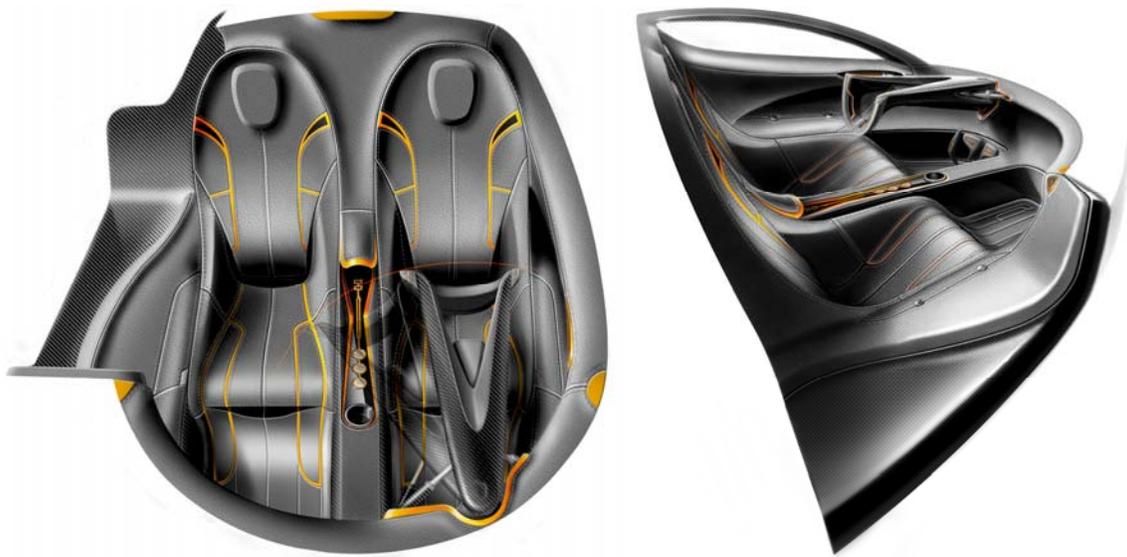


Figure 6. Final renderings of the Hulme F1 concept interior.

Other significant design features included:

- A steering column that pivots towards the centre of the cabin for greater entry/exit space.
- A hubless drive-by-wire steering wheel designed with a bevelled top edge to improve forward visibility.
- Longitudinally adjustable steering wheel and foot pedals cater for a range of users.
- Integrated occupant bucket seats with four-pointed safety harnesses.
- Vertically exposed and visually prominent foot wells.
- Passenger footrest designed to provide support from extreme breaking forces.
- Occupant sun visors have integrated touch OLED screens to access additional cabin controls and in-car entertainment.

Design Evaluation

Purpose

This stage focused on evaluating whether the concept interior successfully fulfilled the design criteria and aim of this design research work. Furthermore, the objective was to assess how the interior concept was perceived in relation to the desired key expressions of luxury, high-performance and exoticness. Assessment of the concept interior was considered to be significant in order to illustrate whether an appropriate (or inappropriate) design development process aided by the PPE framework was undertaken.

Approach

The design evaluation stage of the concept interior was divided into an internal and an external part. The internal evaluation focused on establishing whether the concept interior

had fulfilled the established experience and performance design criteria. During the assessment process, the experience as well as performance based criteria were evaluated using a success or failure rating (see Figure 7).

Experience criteria	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)	Key: Criteria fulfilled Criteria not fulfilled
Repetition of higher order form elements			Refer to diagrams on the right.		
Repetition of lower order form elements			Refer to diagrams on the right.		
High-performance design elements should be styled to appear complex in composition and use minimal form element repetition			High-performance elements use a variety of trim and colour contrasts. Strong surface transitions are also used.		
Luxury design elements should be styled to appear simple in composition and use frequent form element repetition			Elements intended to express luxury were the forward dash, door shoulder line and seats. Their simplicity was visually expressed through the repetitive use of higher order form elements.		
High-performance design elements should reference contemporary F1 race cars			Refer to diagrams on the right. For further details, refer to 7.1 and 7.3.		
Interior design proposal expression should compliment the existing exterior aesthetic expression	Use of higher and lower order form elements identified in the exterior, a strong F1 theme and use of negative space gives this interior a similar expression to the exterior.				
Secondary control features should be easy to comprehend.			Use of commonly recognised ISO 2575 control icons (Figure 056).		

Figure 7. An example of the internal evaluation of experience criteria of the concept interior.

The external evaluation employed a qualitative-quantitative questionnaire. In total, nine respondents participated in the evaluation. The respondent group, consisting of sales representatives for six premium and high performance car brands (Audi, Bentley, Ferrari, Lamborghini, Mercedes Benz, and Porsche), was chosen to represent a valid consumer group in terms of sensitivity and knowledge of exotic cars.

The evaluation questionnaire employed three evaluation techniques in a total of five questions. Visual analogue scales (see, e.g. Küller 1975, Gould *et al.* 2002, Schütte 2005) were used for subjective rating of visual product experience with respect to the degree respondents perceived the interior design to express the three core values luxury, exoticness and high performance (questions 1-3). For question 4, a five point Likert scale (see, e.g., Osgood *et al.* 1957) was used to rate the degree to which the interior design was perceived to complement the exterior design. For each question, an open ended response opportunity provided respondents to qualitatively explain their response. The questionnaire concluded with an opportunity to provide general comments regarding the interior concept.

The evaluation procedure was initiated with an introduction and the presentation of visual imagery of the interior design proposal. Questionnaires were then given to the participants. Participants were invited to answer questions 1 - 3 in reference to imagery of the interior design proposal. After question 3, participants were shown imagery of the existing exterior. Participants were then invited to answer question 4.

Results

The results from the internal evaluation indicated that, in total, 47 out of the 49 established design criteria were successfully fulfilled. Of these, all experience criteria were fulfilled, while two of the performance criteria were not fulfilled by the design concept. Of the two considered unfulfilled, their exclusion can be summarised by the identification of unforeseen design issues making them inappropriate to achieve within the scope of the project.

The results from the external evaluation are illustrated in Figure 8. The mean VAS response for question 1 was 61%, indicating that the interior design proposal has a moderate level of perceived visual 'luxury'. Consequently, this result suggests that the interior design proposal successfully achieved its desired visual expression with regard to 'luxury'.

The mean VAS response for question 2 was 76%, suggesting that the interior design proposal had a high level of perceived visual 'high-performance'. This result validates earlier background research stating that the visual expression of the design proposal should have strong references to 'high-performance' but not be an actual 'high-performance' interior.

The mean VAS response for question 3 was 79%, indicating that the interior design proposal had a high level of perceived visual 'exoticness', suggesting the interior design proposal successfully achieved its desired visual expression in terms of 'exoticness'.

The mean response for question 4 was 4.6/5.0. This suggests that the interior design proposal is highly appropriate in relation to the existing exterior.

Discussion

The results from this study generated a range of insights. The PPE framework provided a highly effective structural approach to research, identify, map and define contemporary motorcar visual design motifs. These motifs proved to be an effective starting point for the discussion, generation and justification of experience based design criteria to support and direct the development of the concept motorcar interior. Furthermore, the identification of these motifs illustrated the effectiveness of the PPE framework as a tool for building a visual design format within a contemporary market context.

Evaluating the interior design proposal against performance design criteria was a straight forward task due to the quantifiable nature of the established performance criteria. Despite their subjective nature, evaluating the experience criteria proved similar in ease to the performance criteria. Much of this is attributed to the use of the PPE framework, where its strong analytical structure underpinned much of the experience criteria. For example, the framework denotes the analysis of aesthetic characteristics through higher and lower order form elements. Analysing the interior design proposal for these higher and lower form elements made it simple to discern whether it had a similar exterior form language characteristics to the existing exterior.

Question:	How do you think this interior rates in terms of 'luxury'																								
1A	<p>Not at all To a great extent</p> <p style="text-align: center;">$\bar{x} = 60.7\%$</p>																								
1B	<p>" Would like to see a greater level of 'plushness' "</p> <p>" Ultra contemporary "</p> <p>" Not luxury due to its hard edged look "</p>																								
Question:	How do you think this interior rates in terms of 'high-performance'																								
2A	<p>Not at all To a great extent</p> <p style="text-align: center;">$\bar{x} = 75.8\%$</p>																								
2B	<p>" Colours work well, seat design looks sporty "</p> <p>" Purposeful, non cluttered design. No frills. "</p>																								
Question:	How do you think this interior rates in terms of 'exoticness'																								
3A	<p>Not at all To a great extent</p> <p style="text-align: center;">$\bar{x} = 79.0\%$</p>																								
3B	<p>" Very unusual looking steering column "</p> <p>" Exotic interior ambiance "</p> <p>" Harness seat belts "</p> <p>" Steering wheel setup unusual "</p>																								
Question:	How well does the interior concept compliment the exterior design?																								
4A	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 20%;">Tick-box rating assessment</td> <td style="width: 10%;">High</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;">Low</td> </tr> <tr> <td></td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> </tr> <tr> <td>Participant responses</td> <td>6</td> <td>2</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>Mean response</td> <td colspan="5">4.6 / 5.0</td> </tr> </table>	Tick-box rating assessment	High				Low		5	4	3	2	1	Participant responses	6	2	1	0	0	Mean response	4.6 / 5.0				
Tick-box rating assessment	High				Low																				
	5	4	3	2	1																				
Participant responses	6	2	1	0	0																				
Mean response	4.6 / 5.0																								
4B	<p>" ...interior is a cockpit as expected. "</p> <p>" ...compatible DNA "</p> <p>" Same design cues, colour and shape "</p>																								

Figure 8. Results from the external design evaluation.

The scope of this study did not allow for a statistically valid evaluation of the interior design proposal. Consequently, the results from this study were focused towards overall impressions of the design proposal. Due to the limitations of the questionnaire, there was no analytical means of discerning whether participant answers referred to formal aesthetic qualities, semantic qualities, or a combination of both, or what specific features they were referring to. The evaluation tools employed have been successfully used in previous PPE studies to evaluate participants' perception of products in relation to a range of PPE experience modes (see Warell 2008a, Wang 2008, Young 2008, Warell 2007, Warell *et al.* 2006). Although the sample group size for the questionnaire was limited, their expertise in the areas of luxury, high-performance and exoticness in context to motorcars indicate that the final design successfully embodied intended syntactic and semantic references, and provided intended experiences as perceived by users.

Conclusion

This paper illustrates how the PPE framework can be applied as an effective tool for establishing an appropriately and creatively managed design direction during the design development process. Providing a number of benefits for design research, the framework helps position, benchmark and develop visual design characteristics within a contemporary market context. The framework also supports the development of appropriate, valid and measurable experience design criteria, which traditionally is difficult due to the subjective nature of design perception.

The results from the external evaluation indicated that the PPE framework was useful as an effective tool for semantic and syntactic transfer; i.e. to convey intended expressions and achieve a pleasurable visual aesthetic, as perceived by external respondents representing the target consumer group. Expressions and appreciations of the concept motorcar interior as perceived by the expert respondent group were aligned with the intended PPE specifications as outlined by the experience design criteria.

Furthermore, this paper demonstrates that many of the theoretical aspects associated with the PPE framework can be transferred into design practice to elicit desired visual product expressions. The successful application of the PPE framework also illustrates its usefulness as a tool for integrating intended visual presentational and representational qualities such as appreciation, expression, and meaning within products in a validated way. The effectiveness of the framework and associated tools is illustrated in the way that criteria were established and used to direct ongoing design work, leading to an evaluated design outcome that was perceived and assessed according to desired key brand values and expressions. Implications for quality management and affective engineering includes the potential to use the framework as a tool to improve process quality in design management, and the use of the framework to support the design of Kansei Engineering studies, particularly with respect to identifying and categorising relevant experience aspects. This is of value for communicating, managing and direction design work on operational and strategic levels of design, and has the potential to contribute to quality assuring design processes.

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