

Design and Development of a Futuristic Car Seat for Cadillac

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Abstract

In a fully- autonomous vehicle, where the very act of driving recedes to the background or an option, there is more and more opportunity for innovation in the interior of vehicle. The interior of the car may be adapted into spaces that meet our needs: a living room on wheels, a place for relaxation and entertainment or even an office on wheels. Therefore automobile manufacturers are concentrating more on innovation in the interior of the vehicle. This paper focuses on the interior designed for the brand Cadillac, therefore following the brand language and their motto and theme. The seat is designed keeping in mind to stay on par with the future trends and autonomous scenario. This design process includes deduction of brand language, creating theme board and colour board, incorporating new technology and better and sustainable materials as a proposal. A math model is created and is rendered and animated for visualisation. Later a physical model of the seat was developed. The proposed concept seat is designed in line with the Cadillac brand language to seat a larger range of people that is 95th percentile male to 5th percentile female comfortably. The functionality of the seat comes with various seat configurations. The concept wears substitute materials for a green status. The product complements itself with a fresher aesthetic styling for a car seat.

Key Words: Cadillac, Autonomous Interior, Innovative Car Seat

1. INTRODUCTION

This is the age of radical change in the automotive sector. As stated by Mary Barra - CEO, General Motors; the Auto Industry will change more in the next five to ten years than it has in the last 50; the world is ready to see it. The car of the future is electrified, autonomous, shared, connected and yearly updated. The focus is on the user. Younger, technical savvy generations will play a key role in driving the transformation of the automotive industry [1].

With the arriving of these disruptive trends, our mobility habits will have a change. With the autonomous vehicle trend, the users will spend less time in driving and doing other things while seated in the car. Therefore, it offers manufacturers to look more into the interior design, to come up with more innovative designs. The interior design will be not just limited to more and more screens and ignoring people and outside world but rather would be a place of connectivity to the nature and people.

The seating, primarily the most important aspect of interior of a vehicle, is designed to give the maximum comfort to the user. Physical constraints in the design of the seat can cause pain, soreness, numbness and stiffness, which lead to the feeling of discomfort. In addition, comfort is a feeling influenced by the surrounding and aesthetics of a product and ambience. Reducing feelings of discomfort doesn't necessarily mean higher comfort level, but to give more comfort, discomforting factors should be reduced [2].

1.1 Problem Definition and Objective

To conceptualize a design of a car seat for an autonomous type 5 vehicle for the brand Cadillac, for the year 2030 taking user as the main focus and exploring new and innovative features of the seat in terms of function, form and aesthetics following the future trends.

1.2 Methods and Methodology

The methods and methodology used is represented in table 1.

Table 1 Methods /Methodology

Objective No.	Statement of the Objective	Method/ Methodology	Resources Utilized
1	Literature study	Literature review on automotive scenario, market trend and future trend, and ergonomic considerations	Secondary Research Data
2	Concept Design and Design Proposal	To generate concepts using theme boards and design philosophy of the brand Cadillac	Computer, Photoshop Software
3	3 Dimensional Design and Surface Analysis	Surface Sculpting, Surface Quality testing Tools	Alias Software
4	Design Detailing and Ergonomic Consideration	Dimensioning, Drafting, Ergonomics Approach	Unigraphics NX Software
5	Physical Modeling	To build a prototype in 1:1 scale	Wood work, Foam and Leather Upholstery

1.3 Market Study

The Fig. 1 shows where General Motors, the parent company of Cadillac stands in filing new autonomous technology patents [3].

2. DESIGN PROCESS

Design process involves breaking down the project into smaller steps to define an outcome. The steps involved in this project are; defining the problem, brainstorming, Brand styling study, Concept Ideating, selection of Concept, 3D visualization and physical prototyping.

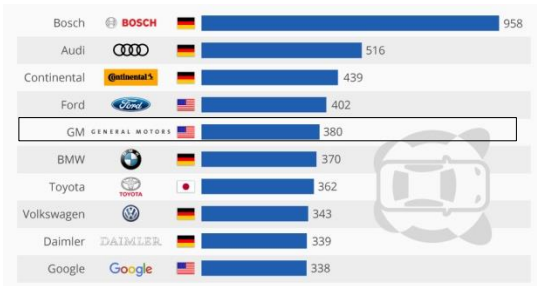


Fig. 1 Autonomous Driving Patent Race (Jan 2010 to July 2017) [3]

2.1 Problem Statement Hierarchy

A problem hierarchy explorer as shown in Fig. 2 is used to understand the problem statement.

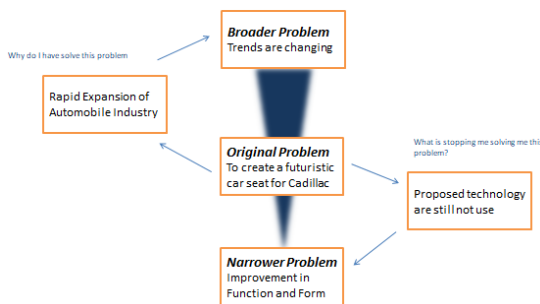


Fig. 2 Problem hierarchy Explorer

With the automotive trends changing, car manufacturers are adapting towards the change, to stay ahead in the market. Futuristic concept models are proposed and with the developed technology, the road towards the realization of these concepts is not far.

2.2 Concept Generation

For generation of Concepts SCAMPER technique and Mind mapping is used.

2.2.1 SCAMPER

SCAMPER stands for Substitute, Combine, Adapt, Modify, Put to other use, Eliminate and Reuse/Recycle.

The concept is explored by Substitution of Material, Combining entertainment, Adapting it as a Sleeper, Modifying the aesthetics (a fresher look), At End of Life (EOL) can be used in homes and Reduce the volume

2.2.2 Mind Mapping

Mind mapping technique is a diagrammatic representation to represent ideas for developing a concept. As Cadillac stands for luxury, brainstorming other words which relate to or signify luxury and thus can be used in developing concepts as shown in Fig. 3.

2.3 Cadillac Design Language

Exterior Styling

The Fig. 4 shows the exterior Cadillac lines, pointed vertical headlight and taillight connected by a full body line signifying longer lines with shorter radius depicting edginess and elegance.

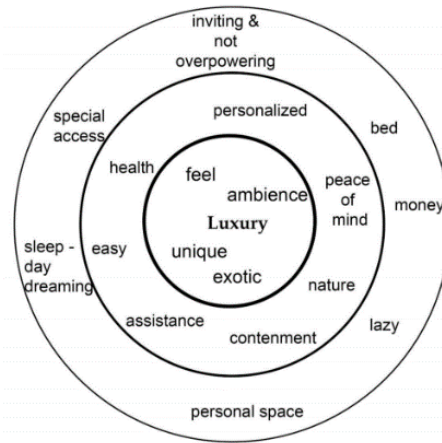


Fig. 3 Mind Mapping

Pentagonal and trapezoidal shapes of the logo are usually prevalent on the front and rear. Front sweeping lines giving an expression of faceted surface.

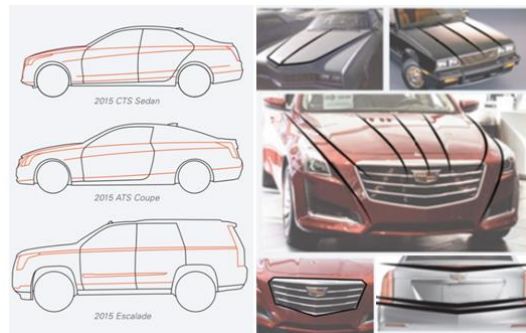


Fig. 4 Cadillac Exterior Lines [4]

Interior Styling

Cadillac logo shape is prevalent in the interior also; the OLED screen of the Escala, the headrest, the steering wheel. The lines are prevalent on the seat trims.

Cadillac uses a combination of luxury wood, leather and metal in crafting a breathtaking interior styling as shown in Fig. 5



Fig. 5 Cadillac Interior Styling [5]

2.4 Concept Generation:

Concept 1

Concept 1 explores a fixed social seating setting as shown in Fig. 6. The seat can provide movements for active and relaxing posture.

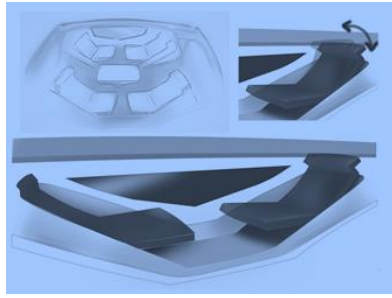


Fig. 6 Concept 1

Concept 2

Concept 2, as shown in Fig. 7, explores the seat fixed to the door. The door is an outward sliding door. When the door opens the seat comes along inviting the passengers.

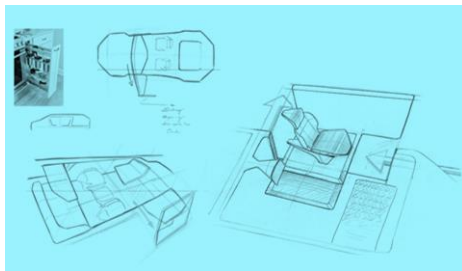


Fig. 7 Concept 2

Concept 3

Concept 3, as shown in Fig. 8 explores the front facing seating scenario, with a driver seat which is part of the dash can be pulled out in driving mode. The second row allows a pet space and couple seats with comfort functionalities.



Fig. 8 Concept 3

Selection of Concepts

Pugh matrix is used for comparing a number of design candidates for finding the one that best meets the criteria.

From the Pugh matrix (Table. 2), Concept 3 is selected out of the three concepts for acquiring the highest score for fulfilling the criteria.

2.5 Final Concept

The seat shown in Fig. 9, complements itself with the form designed in line with cadillac's exterior styling. Faceted accents, dynamic lines and edged elegance define the seat form. The leather is styled as layers, sharp and crisp assymmetrically fashioned, as the theme chosen.



Fig. 9 Seat styling

Table 2 Pugh Matrix

Criteria	Standard Concept	Concept A	Concept B	Concept C
General User requirements				
Provide Outside View	S	S	S	+
Support Relaxing/ Sleeping Mode	S	+	+	+
Criteria	Standard Concept	Concept A	Concept B	Concept C
Provide social environment	S	+	-	+
Provide Active Movements	S	S	S	+
Provide convenience (cup holder/slide tables)	S	S	S	+
Provide green status	S	+	+	+
Express Freshness	S	+	+	+
Dimensional Constraints				
Fit for small to large	S	S	S	S
Fits in the defined area with all the functional movements	S	S	S	+
Ergonomics				
Stability	S	S	S	S
Spacious	S	-	+	+
Support Head	S	S	S	S
Support Thigh	S	-	+	+
Support Lumbar	S	S	S	S
TOTAL +	0	4	5	10
TOTAL -	0	2	1	0
TOTAL SCORE	0	2	4	10

The concept shown in Fig. 10 is designed in accordance to the Cadillac brand language. This concept has two front facing seats. The seats have active functional movements such as pivoting, side ward movement to get the seats together, and forward and backward movement, controlled with gesture movements.

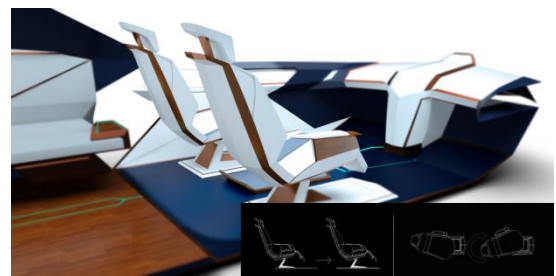


Fig. 10 Rendered Car seat Model

The concept shown in Fig. 11, wears substitute materials for a green status. The product can be used at the end of life where it can be modified for homes.

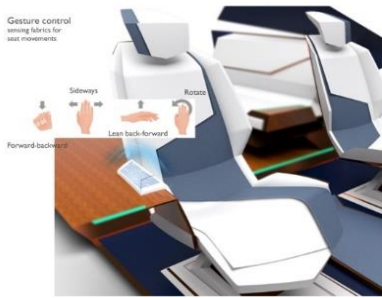


Fig. 11 Gesture Movements

2.6 Ergonomic Consideration

The seat is designed for the 95th percentile male and 5th percentile female according to the guidelines presented in [6] as represented in the Fig. 12 to 14.

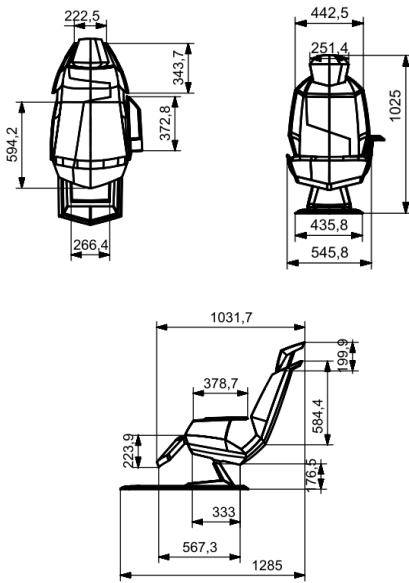


Fig. 12 Top View, Front and Side View



Fig. 13 Seating postures side views

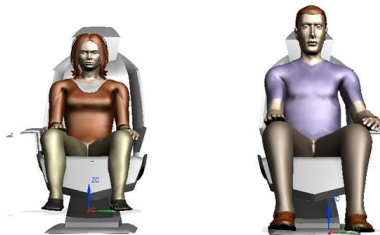


Fig. 14 Seating postures front view

2.7 Physical Model

The physical model is made with combination of plywood, foam and leather upholstery in full scale dimensions as shown in Fig 15



Fig. 15 Physical Model

3. CONCLUSION

The concept is designed for the brand Cadillac. Brand research and language is studied extensively to conceptualize the aesthetic styling and the feel of luxury and elegance which the brand stands for. The product is ergonomically designed to accommodate both the 95th percentile man and 5th percentile female anthropometric data. The functionality comes with seat movement configuration, with additional entertainment feature with VR.

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