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Prospective Automobile Design Trends

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Abstract

The automotive industry is always on the move. It is a world of constant change and improvement. In this light a description of the current situation is a snapshot of where the current trends have led to. There are short lived trends and trends of today that will continue long into the future. Sustainability is such a long term megatrend. It determines most automotive developments including those on Design and Materials. Sustainability has been a major driver of innovation for decades and will continue to be for the foreseeable future.

Keywords: LED technology, Aerodynamics, Femininity, Electric drive, Light design, Biomaterials, Rapid Manufacturing.

1. Introduction

Design and Materials are two different worlds and still strongly related. Each very different in their being and both equally important in shaping the physical world around us. Design creates products and products are made of materials. Design gives functions to products and materials are chosen and formed to best incorporate those functions. Design can also relate to graphics and the virtual world observed on displays or advanced visualization techniques. This trend study however focuses on Design of the physical world, shaped in 3D.

2. Technology as Driver

Designers are looking for new possibilities and technology can provide what they are looking for. New technology can be an option; it can also be a mandatory road to follow. LED technology is an example of the first, aerodynamics of the latter. Technology is a driver for Design.

2.1 LED technology

Lights are very important styling elements on the exterior of a car. They started as true add-ons, mounted on a bracket, were than fluently integrated in the body shape and today stand out as true eye catchers dominating the front end. Chromed lighting technology is dressed to its best behind full transparent glass. The design in no longer the shape of the body, but in the interior of the light; the bulb, the lenses. LED lighting adds an enormous design freedom in arranging multiple small light units into strings or clusters. The looks in the dark, when lighted, become more important than during daytime. Some brands started to use lights this way to make their cars very recognizable. LEDs are very energy efficient and add to fuel economy but the benefits in styling and image seem to have gained more importance then the functional benefits and outweigh the on cost.

2.2 Aerodynamics

Aerodynamics has been very important in car design since the fifties. First as a gimmick, later as a serious means for fuel efficiency. The ideal aerodynamic shape is still that of droplet, but technology has found ways of making aerodynamic shapes of much more diverse nature. Aerodynamics no longer makes all cars look alike. It is now clear that much can be gained by attention to detail (gaps), underbody. Huge wings or spoilers have been replaced by a subtle radius in tailgate design to free the airflow.

2.3 Legislation

The recent legislation on pedestrian protection dictates a softer front-end that is less harmful in impact. This requires more space between the hard steel power train parts and the outer skin. It is one of the reasons for the large front overhangs that we see on many of today's cars. The same goes for the higher hoods that not only change the car silhouette but also have inspired the use of vertical headlights often seen in current car design.

2.4 Roominess

The higher comfort requirements of customers today have a.o. been translated into more roominess. This has considerably influenced car design. Cars have become much wider (+10 cm) and higher (+10 cm) to create interior space (and accommodate safety and technology). Compare the new and the original Mini. The feeling of roominess can also be achieved by light. Glass surfaces have grown. Sunroofs today are more a means to let light in than air out. The Citroen Picasso introduced the front screen that runs into the roof.

3. Future Perspectives

Describing the future is describing the unknown. It is necessarily indicative based on developments we see today, combined with logic derived from history and professional views. This way the trends below have been selected.

3.1 Designs by Tiers

Like R&D Design is all about product creation. In the automotive world R&D has traditionally been done by OEM but has over the last three decades moved largely from OEMs to Tiers. Applied research for component and system development is almost in all cases the terrain of Tiers. The early research phase and the last stage of vehicle integration are a joint field of action. OEMs expect their Tier-1s to come up with ideas on how their product and systems should evolve over time and make proposals on how this would fit the OEM product line-up. As a result a likewise development is taking place between Tier-1s and Tier-2s and further down the line. One example is suppliers of sunroofs like Inalfa and Webasto that propose new solutions to OEMs to enhance their product offer. A remarkable front runner in this development is Apollo-Vredestein. As tire manufacturer they supply products that are necessarily circular and still they have decided to hire top designer Giugiaro to make Design a prime market profiling tool for their brand. It has brought them name, image and sales.

3.2 Design trends

Design is a sign of the times. It is in a constant change, influenced by trends with often a much wider base than the world of products. They can reflect social developments and feelings around emancipation, sustainability or economics. There is a relation with fashion on the one hand and with technology on the other.

3.2.1 Inspired by nature

Sustainability is by far the most important megatrend in automotive product creation in the western world. It is mainly a technical issue but also an inspiration to designers like Laurens van den Acker who translated patterns of deserts and sea life into automotive design. Adrian van Hooydonk takes the air patterns of wind tunnels as an inspiration for the Vision concept car. In a more subdued form this trend can be recognized in the natural curves of interior handgrips and instrument panels.

3.2.2 Floating elements

Designers translate functions into shapes that seem to float in their surroundings, like islands. This can be seen in centre consoles or instrument clusters or in the way light clusters appear in body shapes. A very good example is the Renault Zoe. The seats are shaped as pebbles (nature) that seem to float in the air. On the exterior lights and even door handles appear as leaves floating in the water. It is the translation of a Japanese garden incorporating 'inspired by nature' and 'floating elements'.

3.2.3 Sculpted surfaces

Surfaces are no longer nicely curved and integrated to make a nice overall form. German design was traditionally characterized as 'aus eimem Guss' until Chris Bangle set BMW design upside down by creating complex surfaces with sharp lines and a mix

of convex and concave shapes. SEAT, Mazda, and Opel have since followed with sculpted side panels.

3.2.4 Individuality
People not only want 'a' car, they want 'their' car. Individually styled to their taste as a means of personal expression. Individual, low volume, body shapes are enabled by modern production technology and platform based architectures. Further individualization can be done by extensive option packages and individualized color and trim. Prime examples are the new Citroen DS derivatives of volume models and the extensive range of accessories the Fiat 500 was introduced with.

3.2.5 Femininity
Emancipation is a social issue that translates to marketing that clearly addresses the female buyer and show women in role models traditionally held by men (and vice versa). We recognize this trend in automotive design by the use of soft and very outspoken, accentuated design in, mostly, small cars. Feminine shapes, strong colours, glossy chromed elements. Like make-up, sometimes deliberately over the top. The Mini brand very successfully uses this theme. Another example is the Citroën Révolte concept car with sofa-like rear seating and lip-stick colored elements.

3.3.6 Electric drive
Electric drive offers new options to package a car with fewer and/or smaller power train components with flexibly routed wired connections. This will lead to other vehicle layouts and new styling. We will see even more emphasis on the interior and another treatment of the front. Designers will have to create family identity that does not need a grille. Pininfarina explores these possibilities with the BlueCar concept.

3.3.7 Light design
LED technology has already been mentioned as a technology driver for the design of front and rear light clusters. LED lighting will also be used in new applications for instance to light elements and surfaces to add to the atmosphere and comfort of the car. OLEDs (organic LEDs) will make it possible to create light emitting surfaces. The complete surface becomes a source of light. The same technology will enable flexible displays to be used on so far unfamiliar places. Light can be everywhere, new IP architectures will be possible. OLEDs have no problem with direct sunlight. They have a great potential for use in cars. The technology is already on the market in smart phones (a.o. Samsung). Automotive applications await further development for automotive specifications, larger components and lower prices.

4. Sustainability Trends

4.1.1 Further weight reduction

The future perspective is a widespread use of composites to deliver the substantial weight reduction cars are waiting for. The most promising in this respect is carbon fiber. Today the cost of a CFRP (Carbon Fiber Reinforced Plastic) component is at least ten times that of metal, even though carbon fiber costs have dropped ten-fold in the last decade. New technologies will bring the cost down further. Benteler SGL in Germany is working hard to reduce handling costs by further automation of production lines and has cut cycle times from 20 to 5 minutes to enable large series production. The application of composites will grow from body parts (SMC, GMT) to construction parts like leaf springs, crash cones and drive shafts. BMW has announced to build the body structure of their new Megacity vehicle completely in carbon composites. This will be a true breakthrough for car industry; a milestone for the future. Special grades of composites are the new monomaterial composites. These materials contain one base material, like PP, in two forms. When extremely stretched PP fibers become very strong. These fibers can be embedded in normal PP as bonding element. Mats of this combination can be to components by carefully controlling the temperature in order to prevent relaxation of the fibers. The result is a strong monomaterial composite part that can easily be recycled by melting. Weight reduction can also be achieved with more simple means and optimizing of today's technologies. Styron uses blow molding technology to produce the backrests of Audi rear seats and now works on upgrading to belt in seat constructions as part of the HTAS innovation program. Fontijne Grotnes, also HTAS partner, takes the chance to take 30% of the weight of steel rims by optimizing material thickness. TATA Steel does the same for body work with tailored blanks. ApolloVredestein works on a new tire concept with very innovative use of materials. This HTAS project not only aims to make tires 30% lighter, but also reduces rolling resistance and makes the tire quieter. It is a threefold approach to sustainability.

4.1.2. Cradle to cradle

The use of recycled materials in cars has substantially grown over the last few years since car manufacturers use it as a possibility to create a better public perception. Cars are 95% recyclable but OEMs have long time preferred virgin materials for more secure product properties while recycled materials offered little cost benefit. The scale has tipped the other way, a.o. because well to wheel analysis is taken into account showing a benefit in production energy for reused materials. Ford is reported to use 25% of recycled materials in their cars and VW even 40%. Most recycled materials are metals and plastic.

4.1.3. Biomaterials

Biomaterials have a long history in the automotive industry. Leather upholstery has been there from the start. Paneling has long been made of pressed wood fibers and cotton and wool are well known as isolation materials. New is the use of bioplastics. The technology to produce bioplastics started with (non automotive) degradable

materials and has advanced to the point that is possible to make parts up to automotive standards. DSM has launched EcoPaXX in 2009 as a bio-based, high performance engineering plastic. Approximately 70% of the polymer consists of building blocks derived from castor oil. DSM proved EcoPaXX™ to be 100 % carbon neutral from cradle to gate. Castor beans are not fit for human consumption and hence the material does not disturb the food production chain. A relatively new trend in composites is to replace glass or carbon fibers with natural fibers from plants. There are various plants suited for this purpose. Most used is hemp. Hemp fibers can be cut to be used as filler in thermoplast injection molded materials. The PP blend with 50% hemp fibers produced Greengran creates parts that are stiffer, comparably strong, and cheaper than the conventional glass filled alternatives. The composite has fogging and humidity characteristics and odor emission levels within present norms and a further advantage in better sound deadening. Hemp can also be used as base for long fiber reinforced composites. The company Hempflax produced mats and parts this way. As with Greengran physical properties are very comparable to glass filled alternatives while these products are half made from plants. The next step is the resin. In 2010 DSM introduced a biobased resin for automotive composites. Palapreg is 55% biobased and this content of renewable material can be increased in the years to come. Palapreg also offers a solution to the recycling of composites. Since it contains short cycled carbon incineration can be regarded as CO_2 neutral in terms of climate change. When combined with hemp fibers this opens the perspective that composites components can be fully recyclable. OEMs that promote the use of biobased materials are Toyota, BMW and Daimler.

4.2.1 Downsizing

Sustainability is a driver for making cars smaller. It is as well rational as an emotional issue. Smaller cars are lighter, smaller engines more efficient and small cars occupy less space where room is scarce. A smaller car is also a way of showing a more modest way of consumption that fits with the philosophy of sustainability. Downsizing calls for optimal vehicle efficiency in all aspects and hence is a challenge for engineers and for designers alike. An inspiring and extreme example of how downsizing can look in the future is the Peugeot BB1 (French: Bébé). It is an out of the box idea for a four seater car that is 20 cm (!) smaller then a Smart for Two.

4.2.2 Cost down

Another megatrend of very different nature that affects both Design and Materials is the never wavering pressure on cost reduction in the very competitive automotive arena. In terms of materials this trend is visible in the shift to PP as 'default' plastic material for many automotive parts. Many special grades of PP have been developed to meet the high requirement levels. The relevance of this trend for Design is that a good design does not need to cost more. Design is a way to improve product value without increasing cost. On the other hand designers will have to work with cost limitations in

their choice of materials. Cooperation between designers and material engineers has led to new, innovative, developments in for instance interior trim materials.

4.2.3 Rapid manufacturing

Laurens van den Acker, in his time at Mazda, has said that the ultimate future of car design is that everyone has his own individually styled car. New manufacturing techniques should make this possible. He pointed at moldless rapid manufacturing using 3D printing techniques. It is certainly an image of a far ahead future but less science fiction as it may seem.

5. Conclusion

The Netherlands have a strong raw material industry and a lot of design creativity. Hundreds of Industrial Design graduated enters the market place each year. It is a chance for the automotive industry to attract them and give them a place to develop their skills. Their creativity can be put to use to generate new ideas for better products. Many Dutch automotive companies work with materials, but many more of them can benefit by using the creativity of designers. Design and materials shape the world around us. But designers can do much more. Designers are trained to think from the customer point of view. They can think about how to improve the functionality of the product, also when it is a technical component. New create thinking on functions can improve the product concept. Design is a way to communicate quality. Design expresses care and dedication to the product. The Dutch automotive industry can benefit from the results of strong Dutch material suppliers, creative research of knowledge institutes and professional serve suppliers.

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