Milburn, C., and Childs, P.R.N. The Styling Process. In Childs, P.R.N., and Stobart, R.K. (Editors), Total Vehicle Technology, Professional Engineering Publications (PEP), pp. 275-287, 2001.

The styling process

C MILBURN[1], and **P R N Childs**[2]
[1]TWR, Worthing, UK, [2]University of Sussex, UK

SYNOPSIS

The automotive sector is a mature market with the consumer having increasingly more choice and as a result a greater influence on the design of new products. This paper outlines the complexity of the design process, the importance of image and branding and suggests, using an example, a possible way forward to meet the needs of the sophisticated consumer. In particular the trend for consolidation in the automotive sector is challenged as an avenue for success in favour of a leaner design process to meet the timescales of consumer interest.

1 INTRODUCTION

The creation of new and successful products in a mature market is by no means an easy task. Automotive designers today face a difficult challenge as we witness an increase in consumer expectations as, in the majority of cases, manufacturers' margins are eroded in a highly cost competitive market place. Consolidation in the motor industry may answer a number of the commercial issues faced by the global auto industry, but the ability to succeed with innovative products is increasingly more challenging. The complex issues that designers and stylists contend with to support the more intangible aspects of automotive design and styling are explored using a design perspective in Section 2. An example of design undertaken to match the increasing consumer sophistication is explored using the Mirae concept study in Section 3.

2 DESIGN

Traditional models of design, starting with the recognition of a need, followed by specification, concept development and detailed design, Figure 1, suggest a largely product led approach to the creative design process. However, a revolution has taken place within the market for goods and products. As it matures it has granted the consumer more choice and consequently more influence in the design of new products. The automotive customer is a

very sophisticated consumer with, in most cases, a high level of product knowledge. It may not all be of a technical nature but the customer will have a good appreciation for the emotional and perceived image attributes that a product communicates.

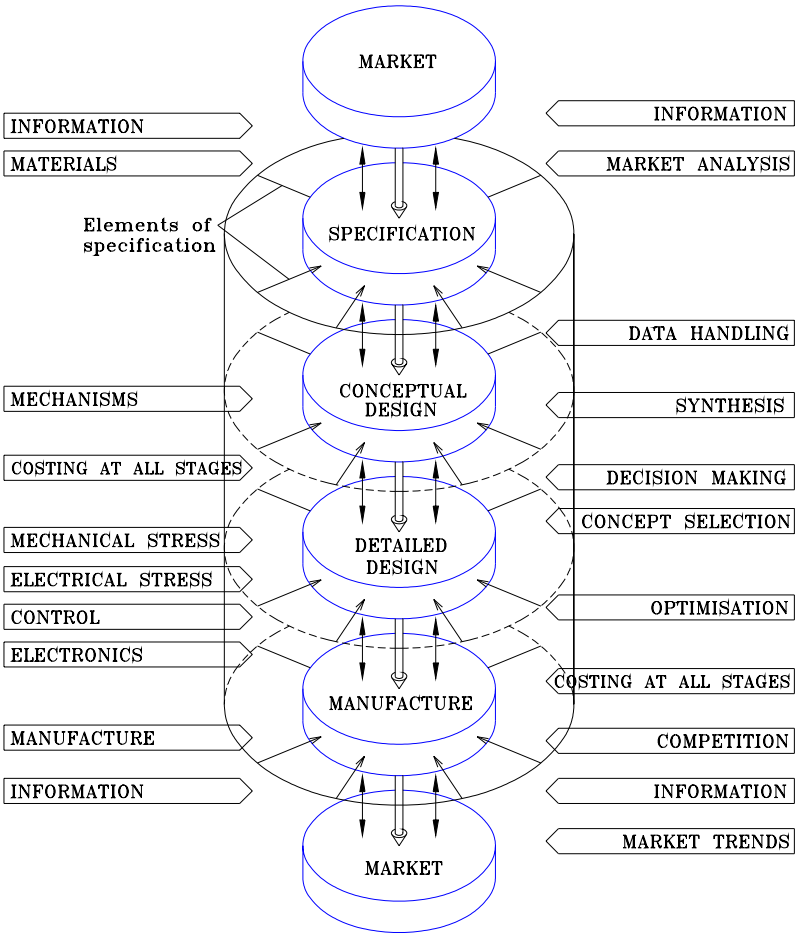


Fig. 1: The total design model (after Pugh [1])

In Maslow's 'hierarchy of needs', Figure 2, he argues that we all have basic needs such as food, shelter etc.; these are described as physiological needs. To seek a greater fulfilment we seek safety needs for our family and ourselves. We also seek social needs including a need to feel a sense of belonging. Many of us seek self-esteem, recognition and status, ultimately self-actualisation needs of self-development and realisation.

Using Maslow's 'hierarchy of needs' framework [2], it is clear that all cars fulfil our basic need for reliable transport, most fulfil our requirement for safety and protection, a number of the more popular brands help support our social need for a sense of belonging. The more elite brands provide a means of demonstrating recognition of status and self esteem. From the manufacturers' point of view, each level brings with it the ability to differentiate and warrant premium pricing.

So how should we maximise the impact of design to elevate this sense of fulfilment and satisfaction with the products we surround ourselves with? To explore this further it is

necessary to uncover the design language and what design can communicate. However, first it is necessary to understand our customers;

- who they are,
- where they are and
- what influences their purchase decisions.



Fig. 2 Maslow's hierarchy of needs [2]

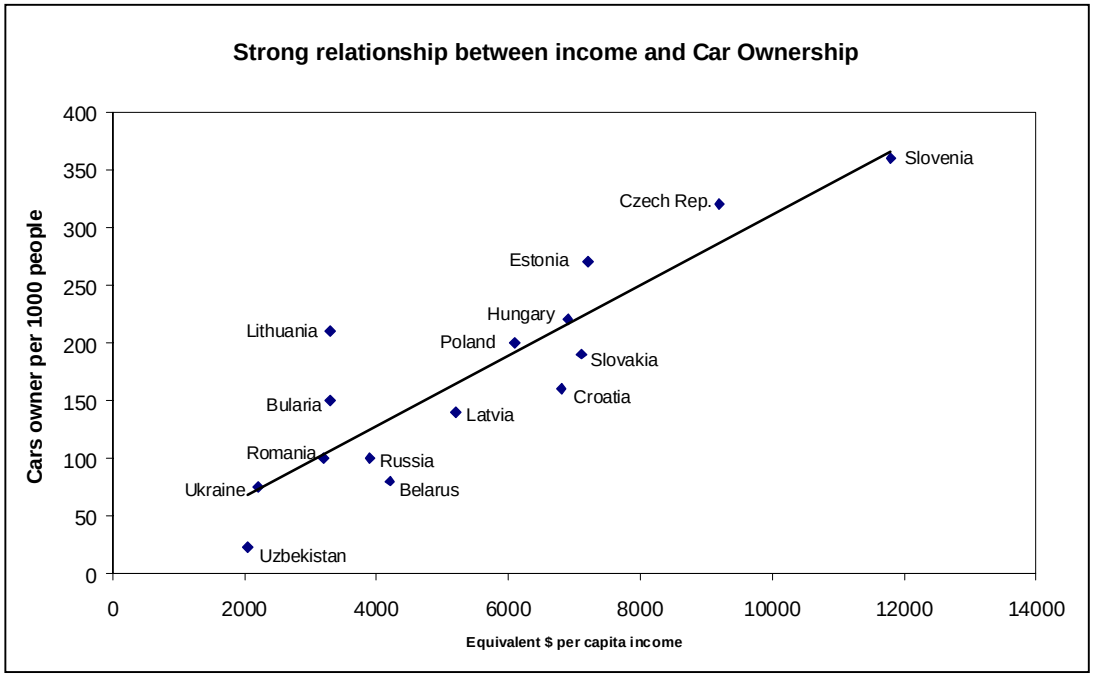


Fig. 3 Relationship between average income and car ownership (Source: Standard & Poor's DRI – 1997 Data)

In the sophisticated markets of Western Europe, America and Japan, the motorcar entered the mature stage of its product life cycle some time ago. At the current levels of market saturation and competitiveness, it is clear that virtually all automotive products meet the first three basic needs outlined by Maslow. A good number, it could be argued, address the requirements of self-esteem and status. These assumptions are relative, as many of the world markets have unique characteristics. Wealth has a direct link to car ownership as one might expect, illustrated by example in Figure 3, and this influences the level of status or belonging.

2.1 Image

In the wealthiest nations such as the United States, families typically own a number of vehicles for different occasions and uses. In Western Europe we tend to have fewer cars per household and therefore expect more all round performance from our vehicles. In Central Europe where car ownership is low, customers are looking for a car for all uses and consequently with lower incomes the choices are more limited. An overriding common issue, regardless of the national market concerned, and that is image. Asian markets such as South Korea look for status. The car symbolises success. In India customers are also looking for status and prefer 'three box' saloon cars, however lower wealth levels inevitably dictate a smaller car. European markets are more focused on national characteristics of

- Italian flair,
- Spanish excitement,
- German precision,
- British refinement,
- Swedish durability and safety and
- French inventiveness.

All these national traits emphasise the many emotional attributes of the 'global consumer'. We all surround ourselves with objects that in some way depict the many facets of our character, Figure 4.

The proliferation of these products and objects is driven by many influences, not least of which are demographics. The 'baby boomers' of the 1960s were responsible for the high sales of pop music and high fashion in the sixties, rebel culture in their teenage years in the 1970s, respectability as they started careers in the 1980s and created the 'yuppie' culture. Research shows that baby boomers are an attractive market for high-tech products, branded merchandise, quality durable goods and investments such as securities, insurance and real estate. These baby boomers are now having children; more babies were born in the US in 1990 (4.2 million) than at anytime since the baby boom peak of 4.3 million in 1957. Hence it is not surprising that an increase in MPV and estate cars in Europe and an increase in SUV/MPV (sports-utility vehicle/multipurpose vehicle) products in the United States has been experienced.

Demographic, cultural and financial factors all play a significant part in the development of new products. Faced with this multitude of factors the designer has to style a product that represents the most appealing aesthetic characteristics within a tight framework of commercial and engineering constraints.

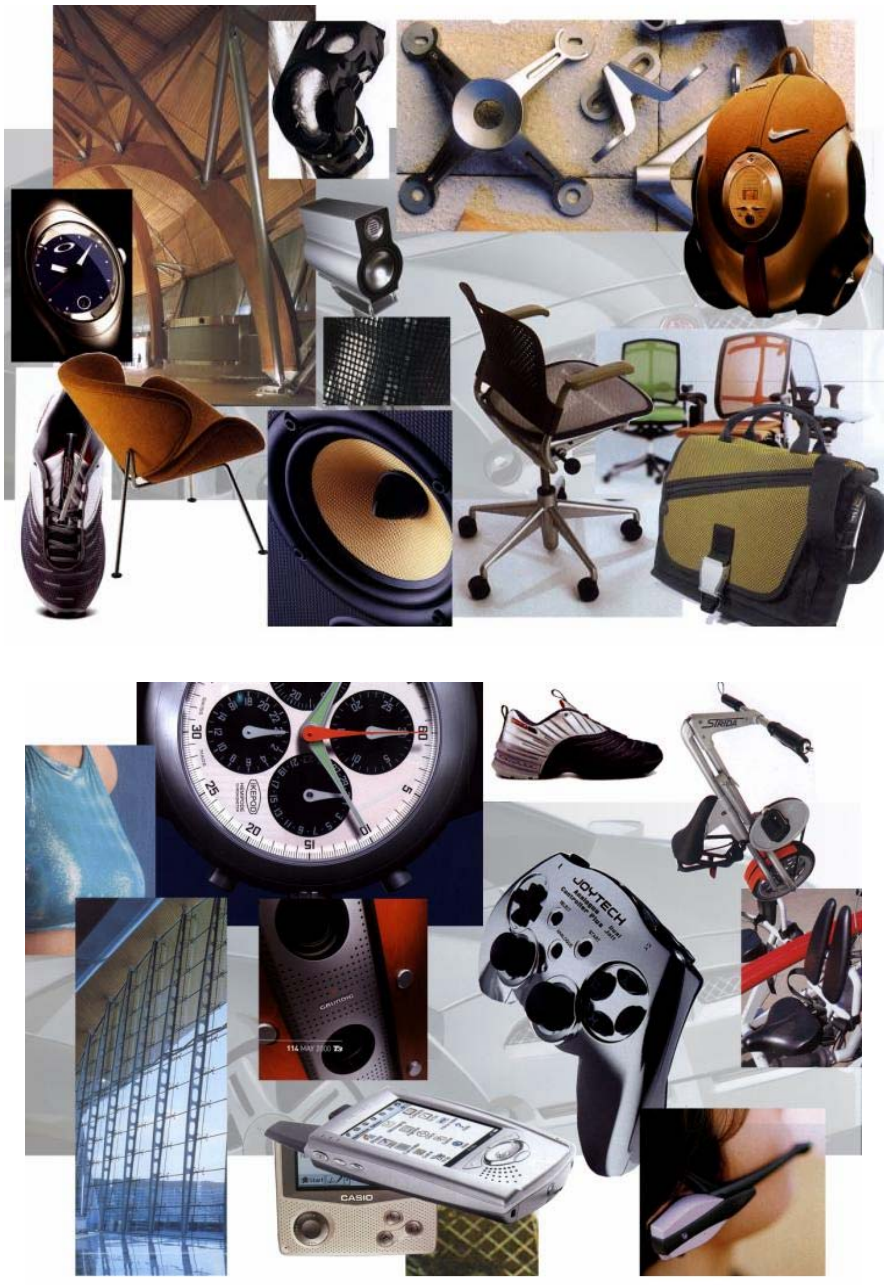


Fig. 4 Image boards

2.2 Brand

Design has language. It is a visual communication tool. The information gleaned from market research is a common denominator across the automotive industry. The key differentiator therefore is brand.

Following the approach of [3] brands can be quantified in terms of weight, length, breadth and depth. Weight reflects dominance over a particular category or market. Length refers to a brand's stretch into new categories and markets. Breadth refers to the age spread of appeal, number of customer types and international appeal. Depth defines the commitment or loyalty to a particular brand. Through innovation and brand focus a brand that is a standard setter in

its own market can have as much influence over the market as the market leader. An example of this was the influence of Apple in the computing sector during the 1980s.



Fig. 5 Brand creation

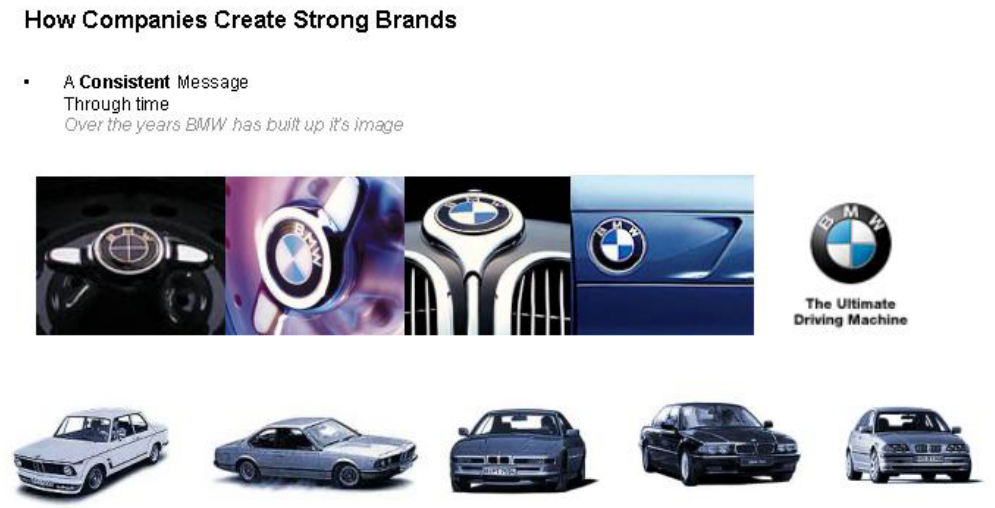


Fig. 6 Brand history

A brand has to be developed through a consistent message throughout the brand's 'communication chain'. The strongest brands have established a consistent message through time. This chain starts with style and design identity through exterior and interior design, product engineering and advertising. The design should communicate visual attributes that support the marque values. From an engineering point of view the brand values are

communicated as much by the sound of the door shutting and the speed at which the damped cup holder moves as it is by the vehicle's dynamic characteristics. The secret is consistent and non-contradictory subliminal messages.

BMW, for example, has a clear reputation for refined engineering. Since the 1980s BMW has been a marque of aspiration for drivers who wish to be associated with an excellent status-rich example of machinery, Figures 5 and 6. The sector influence of one company over another is exemplified by the so-called ring of steel quintet: BMW, VW, Audi, Mercedes and GM/Opel.

From an aesthetic viewpoint a vehicle communicates attributes including those of performance, safety, excitement and sophistication through a series of aesthetic metaphors. These metaphors can be described as having two extremes. On the one hand there is the ornamental metaphor concerned with the decorative effects and on the other the analogical or rational metaphor. The isolated pictorial metaphor involves a relation of isolated images. This tends more to the ornamental end of the spectrum. The structural metaphor involves the relation of structures. Both the ornamental and structural metaphors make reference to the associated characteristics of a vehicle and its symbolic identity. The relationship between the detailed planning requirements and the symbolic identity designed into a vehicle's character is shown in Figure 7.

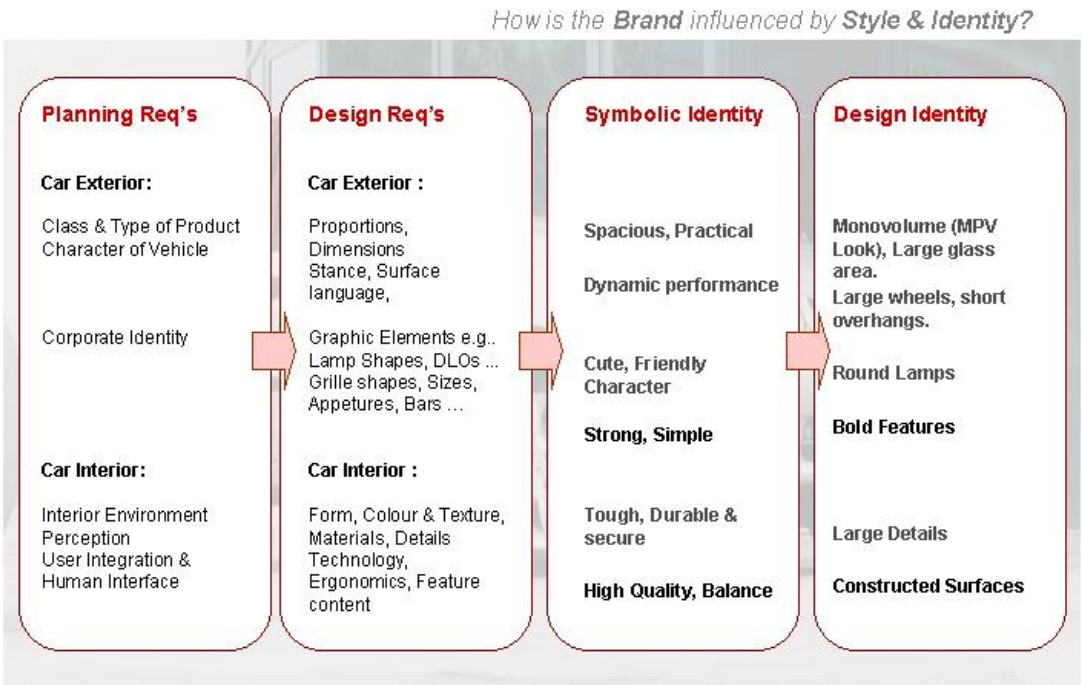


Fig. 7 Influence of style and identity on branding

These key character attributes need to be supported by all the experiences the customer has with the product. Having formed an opinion of the aesthetic communication on the exterior, the customer's expectations and impression of the cars attributes need to be confirmed by the interior. Here the environment should support the levels of quality, safety and excitement already experienced. The tactile and total sensory nature of the interior materials and functions all reinforce the message. The sound of the door shutting, the preciseness of the

starter, the sound of the engine and ultimately the driving experience. All these attributes are then reinforced by the advertising and point of sale service experience.

All these elements make a brand that is both believable and trusted. So many brands fail on one or more of these elements due mainly to a lack of planning and understanding of how carefully this needs to be controlled and integrated into the whole development and sale process. The message then is that brand values must be nurtured and developed with care and communicated with clarity, conviction and consistency; a challenge to the designers, engineers and complete business team.

2.3 Vehicle development

We are witnessing a high speed of change in both current and new automotive market sectors. Demographic and cultural diversity is changing the market requirements and increasing the speed at which products exhaust their product life cycle, putting pressure on manufacturers to respond quickly. This requires some radical changes, both in the structure and culture of vehicle development. An automotive stylist needs to embrace concept development from a more holistic perspective. They need to adopt a role that is multi-functional, understanding the issues of marketing, strategic planning, brand management, commercial planning, engineering and manufacturing.

So much emphasis rides on the ability of organisations to create the most appealing designs that meet a multitude of customer driven requirements that most large OEMs are now looking to create high profile ‘styling boutiques’ or ‘inspiration centre’s’, such as Ford’s new design centre in London and Honda’s recently announced centre in Milan.

TWR, for example, is well aware of these issues and has created a highly advanced design facility in Sussex (Worthing Technical Centre (WTC)) drawing upon design influences from transport and non-transport industries, as well as drawing upon the design culture present in Brighton. The importance of careful planning to preserve brand values and responding quickly to market changes is understood. With an independent view it is possible to inject new concept thinking into the heart of client’s design strategies. The Centre has been quick to adopt a highly digital approach to vehicle development. Through the use of digital design techniques and Virtual Reality visualisation the Centre is able to generate highly complex design concepts engineered and tested through simulation techniques at a much earlier stage of the development process. This integrated approach to design and engineering brings with it great dividends in reduced prototype build and testing, thus reducing time and development cost to market. This approach is explored by example in the next section where the development of a concept vehicle to meet the changing aspirations of customers is described.

3 CUSTOMER BASED DESIGN

It is believed that the future for the automotive industry lies is in innovation and the ability to identify new niches or potential changes in the market place. Testing these ideas is often explored through the use of concept vehicles. For Daewoo Motor Company the WTC developed a vision of the road ahead. The concept was a car that meets the ever changing aspirations of the customer and his or her desire for a bespoke product, whilst satisfying the requirements of the OEM for standardisation and high volume. The car was the ‘Mirae’ meaning ‘future’ in Korean, Figure 8, and was built around the principles of reconfigurable dynamics and structure.

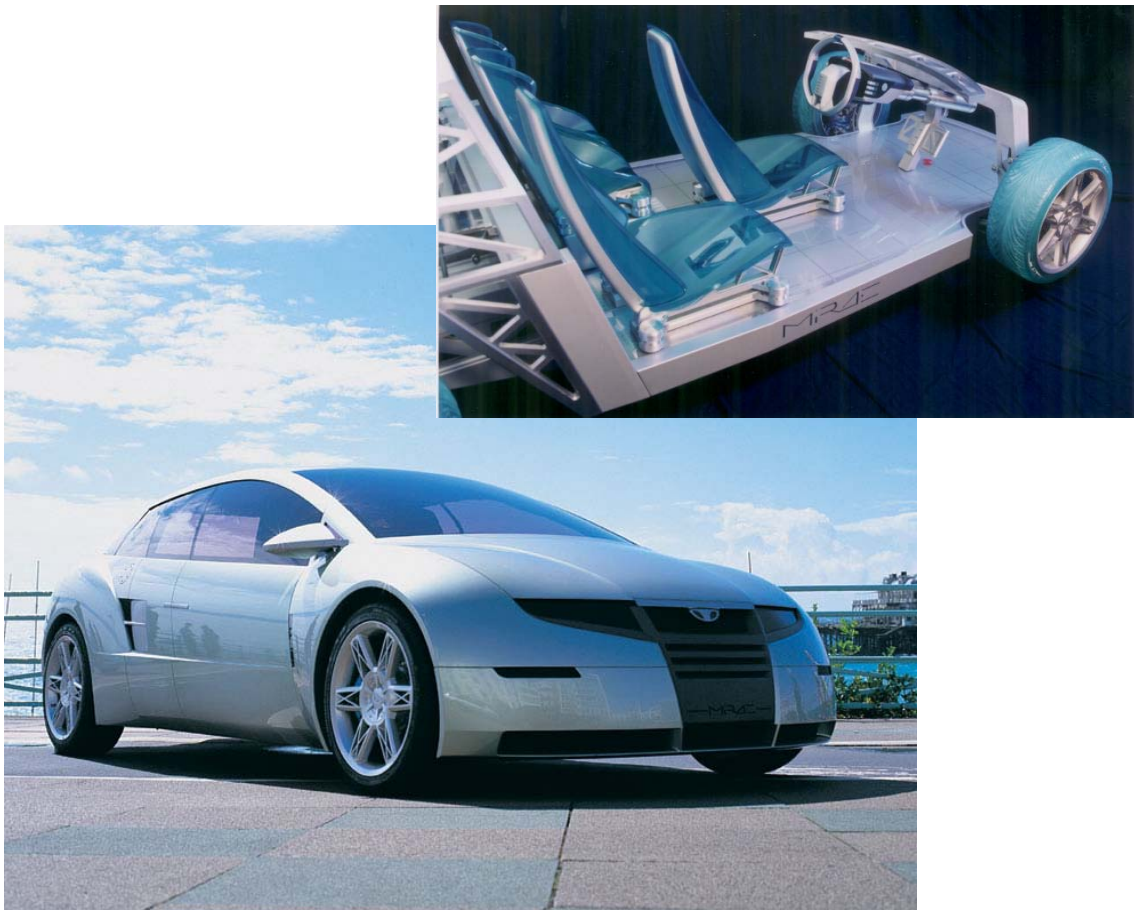


Fig. 8 The Daewoo Mirae concept car

Mirae responds to transport needs for the future and showcases the thinking, design and technologies that pave the way forward in this new millennium. Created to appeal to the car buyer of 2010, Mirae was an all-new car developed on an all-new platform. Practical cars have recently evolved to embrace higher performance, but the performance car has yet to evolve to offer practicality and this is just one of the criteria the Mirae concept car had to meet.

The concept behind this car was to:

- combine the fun and sophistication of a sports car with enough space and practicality to accommodate a young family or a couple with sporting lifestyles,
- allow for flexible seating arrangements, such as those in people carriers, which could be repositioned or removed completely,
- give the maximum amount of interior space and comfort within compact exterior dimensions,
- eliminate the need for traditional switchgear so that the dashboard could be tailored according to the driver's taste,
- accommodate the paraphernalia of modern, active lifestyles, such as skiing, snowboarding, wind surfing and mountain biking,
- use technologies which reduce environmental impact and increase safety,
- be affordable.

3.1 Conceptual design

Mirae was the result of clear understanding of the balance between the functional design and the aesthetic communication of the car's identity. The long wheelbase (2730mm) gives more interior space, while the 'wheel at each corner' look aids handling and visual appeal. However, compact overall dimensions were vital in providing a lightweight product , thus reducing environmental impact and initial purchase price. The front doors open conventionally, but the rear doors slide back to reveal no B-pillar, creating both wide door apertures to aid ingress and egress, as well as increasing the sense of space in the cockpit. Inside, translucent HDPE (High Density Polyethylene) seats with trimmed cushion inserts use 'water bed' concepts, with fluid-filled pockets adapting to the ergonomic and heating/cooling needs of the occupant. The seats themselves have independent four-point suspension, meaning the chassis can incorporate stiffer springing without interfering with occupant comfort. The main luggage area features a sliding tray to enable easier access to contents from the rear, while the load area can be extended by lowering a glass partition between the boot and passenger area. Conventional 12 V electrics are used for exterior lighting, but a 42 V system is used within the car to enable use of 'mood' lighting and accommodate the projected electric load. Lighting control can be used to promote driver alertness or a feeling of security. The entire pedal and steering wheel assemblies can be moved to provide left-hand, right-hand, or even central driving positions and have been designed to 'torpedo' away from the driver in a crash.

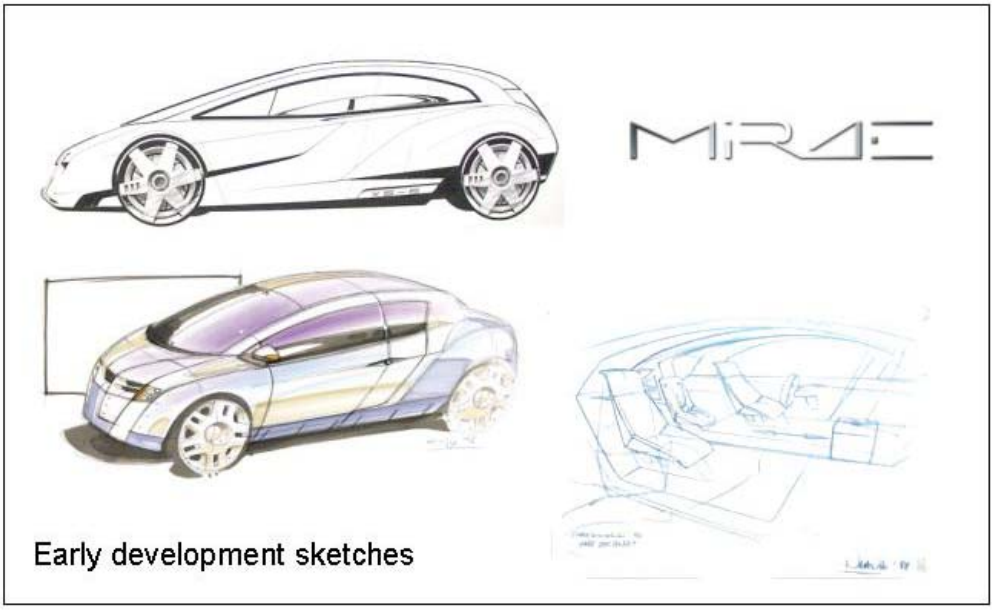


Fig. 9 Early development sketches

The communication of the car's identity to user and audience is a critical element of the design of any vehicle and has particular relevance to a sports car. Accordingly, Mirae has external aesthetics that communicate its role perfectly. It is futuristic and forward looking and from every angle it is clearly a serious sports car. It is capable of high performance and cornering forces, but falling just short of 'super car' status.

3.2 Programme development and new technologies

The UK is steeped in a tradition of specialised automotive engineering companies, and is also home to globally renowned automotive design courses, such as those run by the Royal College of Art. This has enabled the Worthing Technical Centre to work in partnership with academic institutions and engineering partners, in conjunction with government-funded programmes to develop new technologies as a solution to the problems of modern motoring. The technologies pioneered by the WTC are expected to be commonplace in automotive manufacturing within the next ten years.

Mirae has been developed as a showcase for advanced technology, which could well reshape the way cars are designed and built in the future. Among the most significant programmes are ACTIVE, using digital camera technology to replace conventional switchgear in the cockpit; drive and steer by wire; investigations into zero failure rate electronic design opportunities (ZEFREDO); and advanced safety and personal security systems.

3.2.1 ACTIVE

ACTIVE, which stands for Advanced Camera Technology in Vehicle Ergonomics, is being developed as a new in-vehicle control system to replace conventional switchgear. At its heart lies advanced digital technology that uses miniature cameras to detect the position of the driver's hand or fingers. The system then uses this information to initiate the non-safety related controls - so to lower the side window, for example, all the driver has to do is point.

The key objectives of ACTIVE are to advance the state of the art in UK vehicle control systems and to make a significant contribution to road safety by reducing the driver's need to take his eyes of the road when attending to the vehicle's minor controls. Once fully developed, the system would be very cost effective by being more economical to manufacture than today's dashboards. It would be more customer orientated (a significant point given the increasing number of elderly drivers) and would be notably lighter than a conventional dashboard which has vehicle economy and efficiency implications. WTC believes this technology would help to improve interior ergonomic control and contribute to a safer environment for the driver.

ACTIVE would also help vehicle security. A PIN number has to be activated before the system is fully functional, while the lack of a conventional in-car entertainment system would reduce the car's appeal to the break-in thief.

3.2.2 Drive-by-wire

Drive-by-wire and steer-by-wire technology mean there is no need for a physical link between control and effected element - direction change, acceleration, deceleration and gear changes for example - as they are all controlled electrically. Drive-by-wire systems have been used in the aircraft industry for many years.

The benefits are that without cumbersome mechanical linkages to get in the way, the controls can be positioned more freely in the cockpit. They can also be 'movable' to accommodate different seating positions and to ease ingress/egress or rescue in a crash. This system is far more versatile than conventional mechanical connections allowing the car to have a left, right or even central driving position.

The feel and response of these controls can be tuned to replicate the same characteristics as today. However the ability to tune the feel of the controls will allow satisfaction of a broader

range of customer requirements. Quite simply these controls can be designed around the customer to suit personal preferences.

3.2.3 ZEFREDO

The aim of the ZEFREDO research programme is to evaluate the potential enhancement in vehicle design, engineering and manufacturing created by the incorporation of ZEro Failure Rate Electronic Design Opportunities. The potential benefits are:

- improved structural performance
- lighter vehicle structures
- improved occupant protection
- simplified vehicle manufacture and assembly
- reduced whole-life costs.

If the electronic components that control a vehicle never malfunction, there is no need for the driver to open the bonnet. The need for the engine bay aperture, which compromises crash-worthiness and complicates the manufacturing process, no longer exists, so the manufacturer and buyer benefit again. A consortium comprising Mayflower Vehicle Systems plc, WTC and Coventry University undertook a 12-month research programme into ZEFREDO.

3.3 The future of manufacturing

In common with other observers, the WTC believes cars in the future will be built to order once a customer has chosen the car and specification from an Internet-accessed virtual showroom or from a real dealer showroom. The action of ordering sets off a chain of events that starts by alerting component suppliers. The system then selects the most suitable assembly plant, based on location and capacity. The plant is notified of the order, and the suppliers and customer given scheduled build and delivery dates. Just before assembly starts, suppliers deliver components to the production line. Production starts with a semi space frame construction assembled from light weight non-corroding material which is built up to a full rolling chassis decked with a flat composite floor fastened to the frame.

The rolling chassis is then fully trimmed prior to fitting the upper body which has been trimmed and glazed separately. The two major components come together at a marriage station where they are mechanically fastened and service connections made. Two stations after joining, the car is driven from the line.

This new process cuts conventional assembly and plant throughput time by around 60 per cent. The use of pre-coloured body panels and advanced joint design eliminates sealing and painting. Facility investment is less than 50 per cent of a conventional car plant and enjoys high variable utilisation of the facility. Low volume production close to the end market becomes a practical reality.

4 CONCLUSION

The automotive market is now at a mature stage in most of the world’s developed markets. The automotive consumer in many cases has a high degree of choice, is relatively well informed and sophisticated in his or her purchasing decision. The majority of vehicles on the market today satisfy the basic functions of transport. The key differentiator therefore is in the more intangible elements of branding. Consolidation in the industry well may improve the

ability of the large manufacturers to reduce cost through economies of scale and increase buyer power. However, the increased volumes and risk require significant attention to creative and comprehensive planning and design to achieve innovation and differentiation. The use of a more integrated design process combined with digital methodologies and the resulting design agility may help to address the balance.

REFERENCES

[1] Pugh, S. Total design. Addison Wesley, 1990.
[2] Maslow. Motivation and personality, pp. 80-106. Harper and Row, New York, 1956.
[3] Kochan, N. The world's greatest brands. Macmillan Business, 1996.