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National College of Art and Design

Faculty of Design

Department of Industrial Design

Green Car Design - Design Process and Responsibility

by

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Table of Contents

	Page No.
Table of Contents	1
List of Illustrations	2
Acknowledgements	4
Introduction	5
Chapter 1. Socio-political Issues and Design	7
Chapter 2. Industrial Design - Job Description	17
Chapter 3. The Design Process - Working within a Company	20
Chapter 4. Green Car Design - Design Concepts	24
Conclusion	40
Appendices	
Appendix A - Statistics	42
Appendix B - Technical Information	44
Bibliography	
Books	46
Journals	46
Letters	48
Brochures	48

List of Illustrations:

Figure (1): The Ford GT90 - irresponsible design?

Figure (2): This advertising clashes strongly with the concept of the GT90

Figure (3): Many car designs are frivolous and do little to advance the quality of design standards.

Figure (4): The Mazda 121 is simply a rebadged Ford Fiesta. 'Badge Engineering' makes a mockery of the qualities of any one design by presenting the same or similar car to the public as different or individual.

Figure (5): The Plymouth Prowler is an example of an Industrial Design led product that would not have gone into production but for the enthusiasm of Industrial Designers .

Figure (6). The BMW Z13 which uses a motorcycle engine as a power source.

Figure (7): The interior of the BMW Z13 has a central driving position that increases safety, visibility and creates a sporting character in a small car.

Figure (8): The BMW 5 series displays typical BMW virtues of power, Teutonic engineering and distinctive style.

Figure (9): The BMW Compact is an example of where a larger car has been shrunk down to a smaller size and the resulting car does not achieve its potential as a small BMW.

Figure (10): Pininfarina Ethos a ' Green' sports car.

Figure (11): The Opel Twin was a clever concept that allowed. interchangeable modules to be use as power packs.

Figure (12) : The GM Impact - the electric car that out paces a petrol car.

Figure (13): The Volvo ECC.

Figure (14): The Pininfarina Ethos III - novel packaging makes for a friendlier product.

Figure (15): The 'Smart' is a new concept in how cars are meant to be perceived.

Figure (16): Designers and engineers display their own home-grown concepts for 'Green' car design and also their personal commitment to the welfare of the environment.

Figure (17): Despite the continuous increase in the number of cars in the UK Carbon monoxide figures have decreased since 1990.

Figure (18): Despite the continuous increase in the number of cars in the UK Hydrocarbon and Nitrogenoxide figures have decreased since 1990.

Figure (19): The vast majority of Britain's and indeed the world's power comes from fossil fuels, this casts doubt over the environmental merits of electric transport.

Figure (20): Power Stations are the greatest source of the 'Green House' gas Carbon Dioxide in West Germany, a change to electric vehicles would not make cars any cleaner.

Figure (21): The change from fossil fuel to automotive power is less efficient than internal combustion if the electric route is taken as power is lost at two additional transmission points - the charger and power lines
Figure (22): Fuel consumption figures have continued to improve as a result of many small achievements, not radical change.

Figure (22): Fuel consumption figures have continued to improve as a result of many small achievements, not radical change.

Figures (23-24): Savings in car weight have to come from some part of the car here we can see that there is more scope for weight reduction through the Body and Chassis than through the drive mechanism. This would suggest that there will be greater engineering demands on the designer in the future to balance structural safety and body styling/aerodynamics.

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Introduction

Consumer culture (upon which Industrial Design depends) relies upon a momentum of mass consumption and never ending growth for its' survival. The past ten years has seen the questioning of our consumption patterns and responsibilities become more common and public than ever before. The public is now more aware of the cost of consumer lifestyle. The provision of products and services related to transportation are an intrinsic motive for and result of present consumption patterns. This places the car industry at the centre of our environmental crisis.

The Industrial Designer is pivotal to the philosophy of all consumer products, including their environmental stance. The media or 'Green' movement may try to inform the public of the virtues of a product or lifestyle, and politicians may legislate for the public. It is however the Industrial Designer that must transform the aspirations of the 'Green' movement from an engineers raw technology into a saleable product while respecting the wider publics right to a clean , safe environment. This is the task that the Industrial Designer must master - it is not simply a 'design' task; but one of understanding your responsibilities as a designer , of working with people who have different mindsets within company power structures and of transforming ideology into reality.

This thesis is about the responsibilities and tasks that face the Industrial Designer in 'Green' car design in the light of current environmental trends.

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I have a number of questions to ask through this thesis :

1. What are the environmental issues that affect the Industrial Designer and how do they affect his work ?
2. Where does the Industrial Designer stand with regard to environmental concerns in design?
3. What position does the Industrial Designer have within a company ?
4. How can the Industrial Designer improve or contribute to the design of 'Green' cars.
5. Is the Industrial Designer fulfilling his potential as a 'Green Designer' ?

Since the designer makes decisions based upon knowledge of issues, this shall be an issues based thesis. These issues range from socio - political topics at the macro level, issues of the designers own identity, what he stands for and to technical and design based issues. As the amount of thought that goes into any one of these issues and the priorities of the designer and his company can be seen through the designs that a company will produce an examination of the products and concepts produced by a company will give an insight into the companies design direction.

Chapter 1

'Socio-Political Issues and Design'

What are the issues that affect the Industrial Designer and how do they affect his work ? These are the current affairs issues that a designer must be aware of in order to fully understand the repercussions of his designs. This is background knowledge that puts design decisions and a designers role in society into perspective.

Design and environmental problems

The extent of environmental problems can be put in perspective from these few statistics. Traffic jams cost £15 billion a year in UK (1989 figures), there has been a 153% increase in car ownership world wide since 1965. World wide one in twelve people have a car , one in 2.7 in the UK have a car , one in 1.7 in the USA have a car which is stable at this rate (BUTMAN, 1991, p.16). If one considers a world population of nearly 5.5 billion people then there is a possible market of 3.2 billion cars - today there are around 500 million cars in the world. That would be a worst case scenario (if the worlds consumer population were constant). However mass industrialisation in the developing world especially in Asia is already increasing demand for vehicles. An important concern for designers is that many countries wish to achieve our standard of living but can not afford the relatively clean methods of manufacture that we in the west use. As a result of this many of the west's cast-offs are reborn in either Eastern Europe, India or Far east Asia. The responsible

a lot longer than its design life span . The issues that concern the designer should not be confined to the needs of the 'First World' but also to the needs of the 'Third World'.

The Industrial Designer and 'Car culture'

The car has become not just a consumer product, but part of our culture and way of life. The designer should be aware that people especially in the 'developed' nations have come to depend more and more on the car for daily existence .

The car industry is without doubt one of the most successful industries in the world - this is problematic. 15% of the United States work force are employed in automobile related industries, in 1988 seven of the world's top ten companies were either car or oil producers and in the United Kingdom 11.5% of all taxes came from the car industry. There are around 500 million cars in the world - an enormous amount . In 1989 sales of 38 million cars were predicted for 1995, however sales of 40 million cars were recorded. (Butman, 1991, p. 14-27).

These few statistics show that the car industry is very important, it provides both direct and indirect employment for millions of workers. Modern society has come to rely on the automobile industry as a source of wages, taxes and mobility. Indeed we have let the automobile become almost a necessity for daily life .The car industry realises its own importance and has very strong lobbying powers. These lobbying powers along with peoples own need for the independence that a car gives has slowed the rationalisation of the industry.

Governments who try to improve the environment and reduce car dependence through public transport face the problem that public transport is generally dirtier than more modern private transport, so negating the benefits of the reduced congestion public transport brings. The symbiotic relationship between the car industry and the public means that sweeping abandonment of private transport is not viable for many countries or cities.

The Industrial Designer and public relations

The transport industry in general has a public relations problem. Although it is in the car industries own interest to be environmentally friendly (customers are demanding 'Green' cars) it still looks like an environmental demon.

The public have not been educated properly as to their environmental responsibilities. Advertising has made 'Green' issues a commercial commodity and so people expect environmentally friendly products like they expect any other product - many consumers feel that they should not have to be concerned or responsible for how the product was made or is to be used. Many consumers are hypocritical in their attitude to the car industry as it is they themselves who purchase and drive these products, while being fully aware of the environmental damage that they cause. It seems that the car industry is a convenient scapegoat for those who wish to have the benefits of a modern lifestyle but don't want to face up to its responsibilities ,

Many advertising campaigns on behalf of both car companies , government and green interests have focused on the issue of unleaded fuel. The problem of unleaded

fuel was presented as an problem that the public could help solve. The public did take the issue to heart but the widespread adoption of unleaded fuel has been led the public to believe that they have fulfilled their part of the bargain, and that they now have less responsibility for the environment as have made sacrifices for it.

Many cars are given a public evaluation of their environmental record. However the way cars are graded is not as transparent as it would seem. Each year the ETA (Environmental Transport Association) publishes a list of cars that it considers to least harmful. The factors they use to grade the cars by are engine size, power, top speed, noise, fuel consumption and exhaust emissions. However they leave out many other factors like the way the car is used and the way the car was made:

‘They take no account of driving style or use’, claims the AA. ‘ Small cars may be fine in town but on the open road they offer less accident protection and are often thrashed to compensate for their lack of power. The ETA is also unpopular among car makers. It claims the pollution generated during manufacture makes buying used cars - even those without catalytic converters - kinder to the environment than ordering new models.

(Anon. 16 August 1995 , p.11.).

Such narrow minded and technically inaccurate research on behalf of an organisation that claims to support the environment provokes anger among car lovers and scepticism among those who would have doubts about the motives of the green movement. The attitude of the car press can be seen through the reaction of Gavin Green when positive environmental figures were released:

Representatives of the Society of Motor Manufacturers and Traders, who released the figures - compiled by the governments own soon to be privatised Warren Spring laboratory - were in a morose mood at the press conference. ‘We invited Fleet Streets environmental writers to an earlier conference, but they didn’t bother to attend,’ said SMMT PR boss Roger King. ‘ They just don’t want to write good - news stories about cars’.

Much better , surely to (because it's more sensationalist - hang the accuracy !), to print stories about exhaust fumes killing 10,00 people every year, or about cars causing asthma, colds, influenza, cancer, brain damage and, for all I know, elephantiasis, beri - beri and the plague.

(GREEN, June 1994, p. 5)

Despite the fact that a catalytic converter reduces emissions by up to 95% and the fact that pollution figures have actually fallen, (FEAST, June 1994, p. 24 - 25) the car industry can not sit back and relax. Car companies must presume that the public will abdicate their responsibility, so the only ones who can make a significant contribution are the car companies.

If the public in general does not have the time or the commitment to educate themselves so as to make responsible decisions and purchases it is then the designers responsibility to act on behalf of the customer. This does not just entail the designing of sounder cars, but also the way in which those designs are presented to the public. The customer will project this responsibility onto the designer - he is supposed to be their champion.

This is a responsibility that should be valued, too often however designers and engineers are asked to produce designs that fly in the face of such responsibility.

Case study Ford GT90

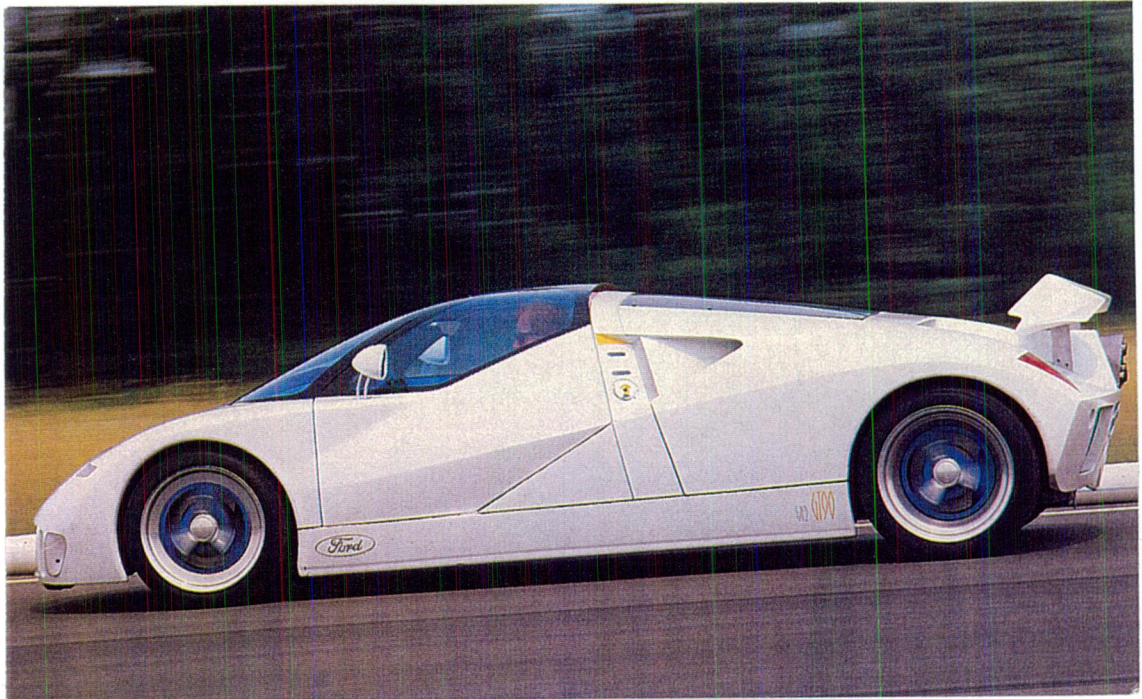


Figure (1): The Ford GT90 - irresponsible design?

This is a concept for a possible Ford supercar, it is meant to act as promotional material for Ford's advertising department. It sports a 6 litre V12 engine that develops 720 bhp and will propel this car from rest 60 mph in 3.1 seconds and on to a top speed of 235 mph. In a world of dwindling resources and environmental concern the whole concept of the 'supercar' is irresponsible and tasteless. The designers of the Ford GT90 have let themselves down on two fronts. They have ignored their responsibility to the customer by designing a car that has no green attributes. While accepting that the designers were probably given a brief and that they had to do this job, the way in which they have designed the car damages the credibility and integrity of the entire design community. This car is visually different and it stands out, however it is by no means original - the 'edges' theme of the design is an almost direct copy of the F1 - 117 stealth fighter. This 'edges'

theme is a backlash against the current 'aero/bio' look . There is no deep reason for this style , it seems that the designers of these car chose to be different for the sake of it. The Ford GT90 is an example of how Industrial designers can lose sight of their responsibilities to the environment and to their own professionalism as designers.

Such designs can only serve to hurt a company in the long run as they make a mockery of environmentally aware advertising.

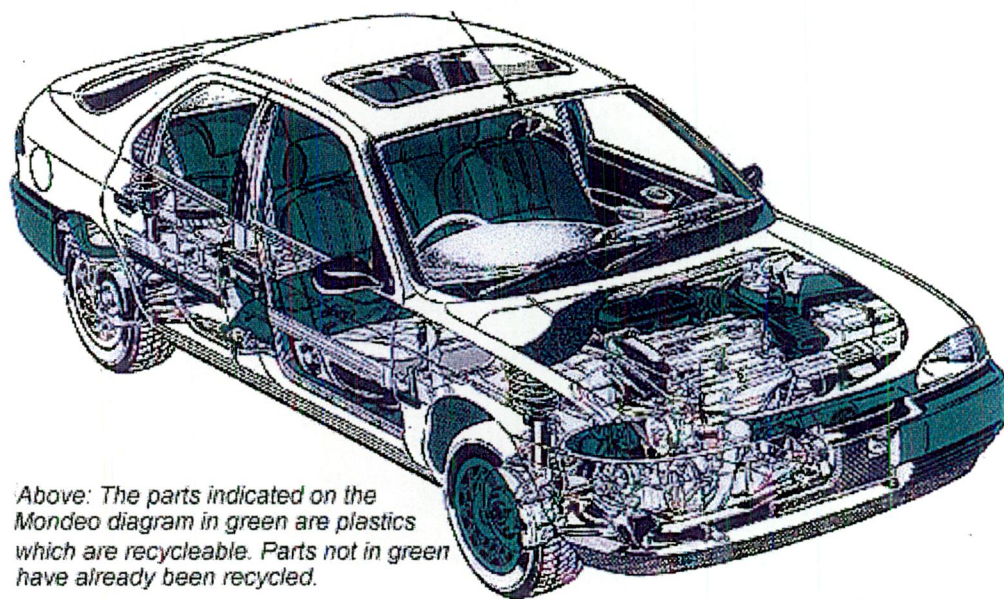


Figure (2): This advertising clashes strongly with the concept of the GT90

Environmental legislation and the Industrial Designer

The 'Clean air act' was passed by California in 1990, it stated that all car makers who wished to trade in California would have to sell 2% of their production as 'Zero emissions vehicles' by the year 1998 and 10% by the year 2003. This was the law that to a large degree started the car industry to take note of the environment

However under pressure from the car manufacturers California has decided to delay the deadline to 2003 , and no specific percentage is required.(Mc CORMICK , 29 November 1995, p. 11).

The Royal commission on pollution released its findings on a whole range of pollution issues , not just the car industry in 1994. The main findings of this report are:

- Effective local / Euro transport policies integrated with land use policies.
- Reduce the need for transport both commercial and private.
- Encourage trips by environmentally less damaging methods - go by bicycle or walk.
- Reduce urban car journeys; reduce traffic speed and density in town and residential roads.
- Use trains , buses and trams instead of cars and lorries; put freight on trains or water(Canal) to avoid more road building.
- Stiffen resistance to new roads projects on tighter environmental grounds.
- Halve government (Tax payer) money spent on road building and divert saving to subsidise public transport.
- Reduce carbon dioxide levels, “ it is reasonable [for motor industry] to aim for 40% less average fuel consumption by 2005” (20 per cent for light goods vehicles 10% for H.G.V.'s)
- Reduced transports demands for materials by building smaller, lighter, longer lasting vehicles and by recycling more.
reduce vehicle noise.
- Increase tax on fuel throughout Europe to double price per gallon in real terms by 2005 .

(RENDELL , 2 November 1994 , p. 8 - 9.)

One interesting statistic that the commission discovered is that 82% of motorists would still use their cars despite a doubling of the price of fuel. This shows that the public at large is willing to pay a tremendous amount for transport if they must. If governments were to suddenly act upon such a statistic then car companies and their designers would be forced to re-evaluate the design of private transport.

At the Earth summit in Rio de Janeiro in 1992 all countries agreed to try to stabilise CO₂ at 1990 levels by the year 2000. At present growth rates in car sales, the car industry would have to achieve pollution cuts of 35% through two new generations of cars. Many car companies realise that from a strictly engineering point of view this is not possible to improve today's large cars by such a margin, and so they plan to produce a wider range of small cars. It will fall on the Industrial Designer to design these products and to more clearly generate product variety and identity even though the average size of cars will be smaller.

Very strong safety legislation is in place in both Europe and North America. This legislation poses major problems for companies that are trying to reduce the weight and thus increase the efficiency of their cars. Weight reduction is key to efficiency, but it is also needed for safety. Unfortunately without either significant design of the concept of the car, or the use of modern complex materials, the prospects for resolving these two opposite necessities are limited.

The 'Prometheus' programme is a joint programme between car companies, research institutes and governments to develop an efficient traffic management, driver safety and road pricing - any attempt to try to solve a vast problem alone would be foolish and so all of the relevant parties are co-operating.

Demographic trends play an important role in car design. The most significant trend is that of our ageing population. This wealthy (and growing) group is demanding more and more labour saving devices in cars like power steering, electrically adjustable seats and steering column (for ease of entry). These features all add weight and complexity to already inefficient machines.

Of what relevance is legislation to the 'Green' Industrial Designer ? Car design is a very complicated process - a new safety or pollution standard can very easily affect the choice of materials that a designer has at his disposal or the features that he can include . Regulatory changes can have unforeseen knock on affects on designers. The designer may be forced to compromise his design to accommodate the needs of engineers who will have definite quantifiable requirements - in a trade of between a subjective design feature and an objective requirement the designer may loose if he was not aware of the standards that were required. It is imperative for the designer to be familiar with all standards such that he can avoid any difficulties that his concepts may generate.

Chapter 2

'Industrial Design - Job Description'

Who is the Industrial Designer ? Where do and should the priorities of the Industrial Designer lie ? Is there any difference between an Industrial Designer and a Car Designer ?

Who is the Industrial Designer ? This may at first seem a silly question. The answer is 'Those who design products'? He is but I the Industrial Designer is more important than just that. The way an Industrial Designer designs a product can have a tremendous effect on the lives of all those who use our products.

A team of artistic engineers would be quite capable of producing a green car that would look reasonably well. This poses the question of what need there is for the Industrial Designer. It could be said that our role in ergonomics could be more efficiently handled by an ergonomist and that our abilities in specifying products for a customer could be catered for by a marketing person. The real value of the Industrial Designer lies as a product planner. The Industrial Design profession is the only profession that is required to be familiar with every facet of a business, that is required to have knowledge of the wider social implications of micro design decisions, and so is the only one that is qualified to plan the future direction of products.

The primary responsibility of Industrial Designer is the quality of life of both the customer who buys my product and those who are affected by it. The primary concern of Industrial Designer is not for the company - it's market needs will be

catered for if the designer is allowed focus his attention on the broader needs of the customer. The needs of the customer include the need for a clean environment.

There are subtle but important differences between the Industrial Designer and the car designer. The Industrial Designer generally deal with smaller products than does the car designer. What difference does this make ? The car designers scope for innovation and control over a project is limited in comparison to that of an Industrial designer, simply because the car is an extremely complicated product . The car designer has been relegated to the role of 'detail stylist' or mood generator. In 1990 I wrote to International Automotive Design regarding college course options for car design International Automotive Design, 26 July 1990, In that letter they explained that the role off a car designer was:

Aesthetic Designers (Stylists) or Automotive Designers as they are sometimes known are the people involved in shaping the concept and the look of cars, trucks etc.

I strongly suggest that you study transportation industrial/product design to start with, as it offers perhaps a wider training which may be a good idea, as I feel environmental issues may change the car industry in the next few decades.

("Brown D", 26 July 1990,)

Unfortunately the driving force behind the car designer does not seem to be the needs of the customer or the environment but rather for the sake of design itself. Car Designers are given the opportunity to try out new ideas through the use of prototypes and concept cars. They concentrate too much on the styling and thematic aspects of cars. The situation is so bad that the motoring press has begun to joke about designers and what they perceive as an endless wave of frivolous cars that are all basically alike.

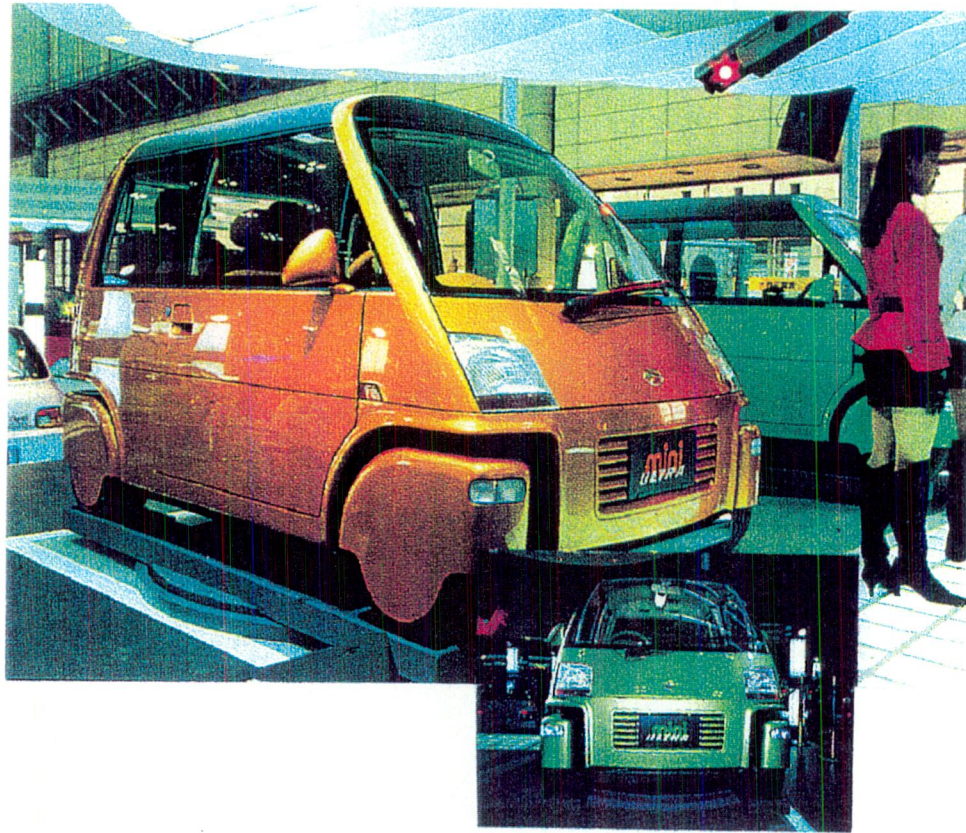


Figure (3): Many car designs are frivolous and do little to advance the quality of design standards.



Figure (4): The Mazda 121 is simply a rebadged Ford Fiesta. 'Badge Engineering' makes a mockery of the qualities of any one design by presenting the same or similar car to the public as different or individual.

Chapter 3

'The Design Process - Working within a Company'

How does the Industrial Designer work within a company - does (s)he have the authority to do his/her job effectively ? Who are those who influence and control the direction of the Industrial Designer ?

The situation at present for the Industrial Designer is that he is not really allowed to do what he should be doing for the company. The environment in which an Industrial Designer works varies, some are free lance some work in consultancy some work in a car companies regular studios and some work in car companies' special 'Think Tanks'. In all but the case of special 'Think Tanks' the designer is given a brief by the marketing or sales department or by management - they do not instigate new programmes or briefs on their own behest .

There is a lack of confidence in designers on behalf of companies. Paolo Cantarella is MD. at FIAT the Italian car company . He is a man who realises the contribution of designers and how critical their role is in both detail design as well as overall concept:

Cantarella says that he has been designing the same car since he was 14 . The only difference is that now he is paid to do it. He says he never thought himself good enough to try his hand at design, but that working with designers is the next best thing. Cantarella's ability to gain the trust confidence and respect of his designers is legendary.

He meddles certainly, and admits to it, but his ideas seem welcome . His support, too. Senior engineers in Fiats competitors cannot believe the cost and complexity of some of the details on some of Cantarella's designer's cars; the rear lights on the Bravo are an example. The purchasing department appealed to Cantarella to get him to change the designers minds... You know who won.

The heart of a car company is in its design studio. Empower the designers, make them believe they can do anything and you'll get great cars.

(HARVEY, 1995 , p. 46 - 51).

One would think that most companies would realise the potential of their designers and would give them the power to do their jobs. However this is not always the case . A customer clinic is a tool used by marketing departments to evaluate a design through private previewing of the product to the customer. This practise shows a lack of confidence on behalf of marketing departments in the abilities of designers, it also shows marketing departments don't understand good design. If marketing departments were properly versed in design they would be able to recognise a good product themselves. It also shows that their goals are short term , they are concerned with the winning of market share not long term strategic planning. It also seems that design is subordinate to marketing , this should not be the case as the companies are in the business to design a product that will sell to the customers. A car is a designed product that must be marketed not a piece of marketing that has to be designed . For this reason designers should have much more power in companies than they do at present. A good example of where a designer was not trusted was in the design of the Rover 200:

Saddington set about convincing the engineers that it could be made and the marketers that it could be sold. The latter prompted the 200's one and only customer clinic.

(ROBERTSON, 1995, p. 34 - 37).

Why should an Industrial Designer have to convince an engineer that a design could be made ? Is it not the job of the engineer to be able to decide if something is feasible to make. Obviously the designer knew that it could so what was the need for

engineers ? If the designer was confident that it could be made, and he had the skills necessary to prove that it could , why then did he have to consult an engineer? Did he not have the authority to take it straight to a tool designer ? The same applies for marketing. They proved their own incompetence through the fact that the car only needed one clinic. The only reason that a car would only have one clinic is if the public really liked it. They did. The marketing people did not have the knowledge to recognise a good design. Is it wise that people who do not know the tastes of their customers or who can't tell good design when they see it should be in positions of power?

It is arguable that the task of designing a car is so complex that each department must do a single specific task, and this is the reason that Industrial designers don't have as much control as they could. This is untrue as many cars have been designed totally from research and sketches through to production by a single Industrial Designer working with a small team (3-4) of engineers. For the design of the McLaren F1 only one designer - Peter Stevens was involved. (ROBINSON ,1994, p. 28). The complexity of car design is a very good reason to use small teams as in a small team it is less likely that design direction will be lost or compromised.

Throughout the history of car design many initiatives taken up by designers in their own free time have gone on to be highly sought after, in the past five years many concepts that were totally apart from mainstream work or from a marketing departments need for an image boost have been so popular that the companies were convinced by the popularity of the cars to produce them. Such cars include the Jaguar XJ220, the Porsche Boxster, the Volkswagen Concept 1, the Plymouth

that Industrial Designers are people whose commitment goes beyond that of a profession. It also shows that Industrial Designers when given a free hand created new markets through their understanding of the desires of the customer. It should be of concern however that many of the projects that designers choose to invest their own time in are of a decadent, environmentally unfriendly nature.



Figure (5): The Plymouth Prowler is an example of an Industrial Design led product that would not have gone into production but for the enthusiasm of Industrial Designers .

Chapter 4

‘ Green Car Design - Design Concepts’

What contribution can the Industrial Designer make to ‘Green Car Design’ ? In what areas can the Industrial Designer provide solutions to problems at the micro level , but also alternative perspectives at the macro level ?

The Industrial Designer is not an engineer and he is not capable of making significant changes to the technology of the car. Does this mean that he can’t really have any direct impact on the environmental qualities of a car ? No . The Industrial Designer can have a valuable contribution by :

- 1. Investing and preserving the consumer qualities of the product.**
- 2. Suggesting and exploring alternative ways of approaching a problem.**

Investing and preserving the consumer qualities of the product.

The Industrial Designer and the preservation of company image

Case study BMW Z13



Figure (6). The BMW Z13 which uses a motorcycle engine as a power source.

The BMW Z13 is a concept which among other things deals with maintenance of company image. It proves that a company such as BMW can through their designers produce a small 'Green' car and still keep it's corporate family look intact. The corporate family look of a company is important , but is only a single component of the image of the company . A car can easily look like a BMW and still be 'Green' the skill of the Industrial Designer is in the interpretation of the concept of what it is makes a particular product desirable . The BMW Z13 does this by reinterpreting the images that go together to form the company look and then restyling the product

accordingly . However the Industrial Designers could easily have just down sized an existing car. They did not do this; instead they reinterpreted how to invest the attributes associated with BMW in a 'Green' car. The traditional BMW attributes of power, Teutonic engineering and distinctive style are not incompatible with either a small or 'Green' car. The designers opted for a central driving position which creates a more 'in control' feeling for the driver. The small size and weight of the car gave advantages in terms of manoeuvrability and the amount of power needed to achieve sporting performance . No BMW before this has had side air intakes, but in this scenario they are appropriate as they enhance the sporting character of the car as does the 'shoulder' at the rear of the car. This design approaches safety by placing the driver in the centre of the car and placing two passengers behind at either side of him. This gives more space in the case of a side or three quarters impact. This also has the added benefit that it does not need separate left and right versions. The power for this car comes from a motorcycle engine which can power this car to 120 mph and yet still environmentally friendly motoring.

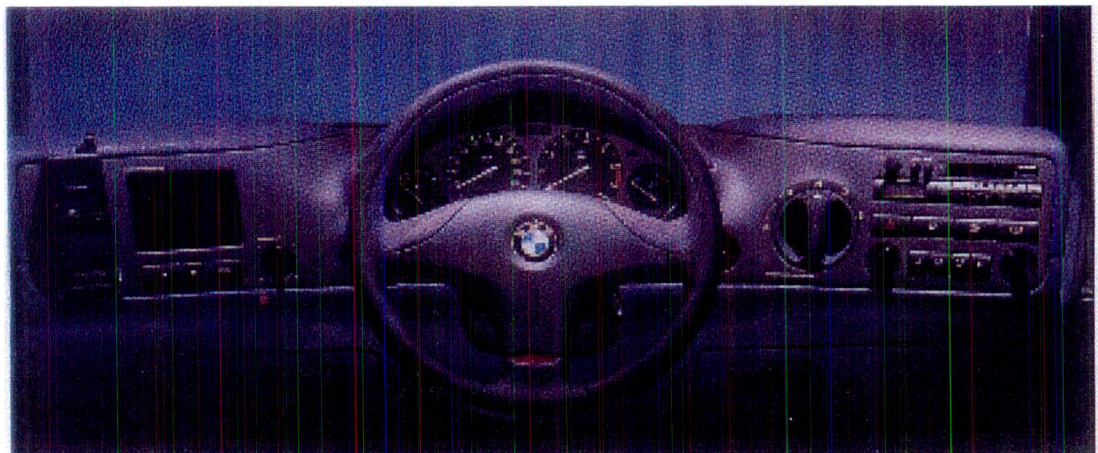


Figure (7): The interior of the BMW Z13 has a central driving position that increases safety, visibility and creates a sporting character in a small car.

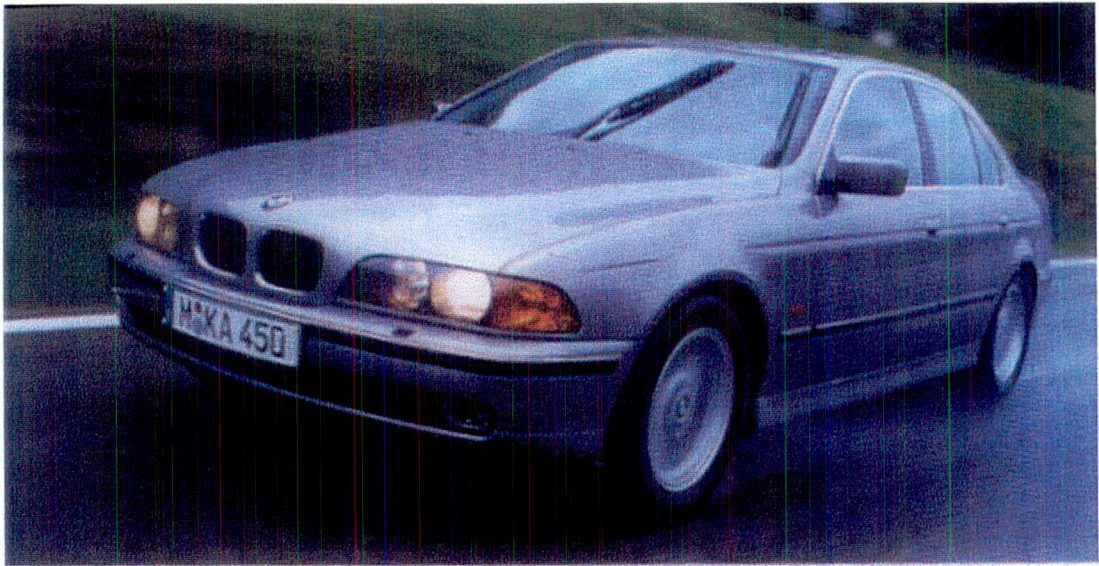


Figure (8): The BMW 5 series displays typical BMW virtues of power, Teutonic engineering and distinctive style.



Figure (9): The BMW Compact is an example of where a larger car has been shrunk down to a smaller size and the resulting car does not achieve its potential as a small BMW.

Case study Pininfarina Ethos

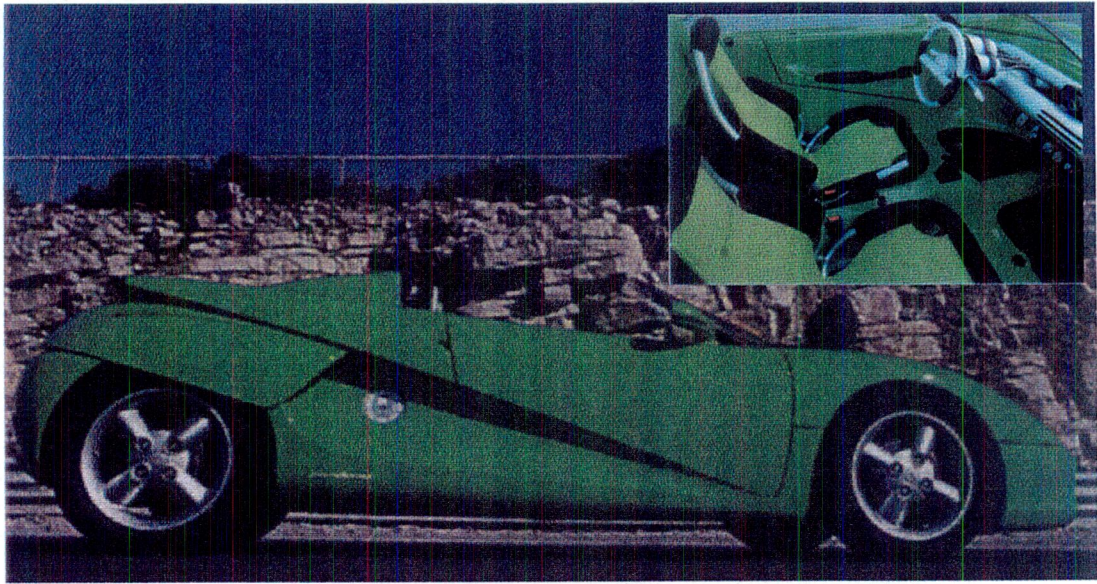


Figure (10): Pininfarina Ethos a 'Green' sports car.

The mission of the Pininfarina Ethos was to prove that green cars do not have to be banal. The Pininfarina Ethos is not just a concept car but a working prototype for an efficient internal combustion engine (the Orbital two stroke). What makes the Pininfarina Ethos special is that it's designers realised that the shortcomings inherent in green cars can be put to use. The Pininfarina Ethos uses the fact that green cars have to be light to its advantage. The car uses a very open , Spartan yet sporting aesthetic which marries well with the cars lightness. It is through the skill of the Industrial Designer that this frugal car has been made desirable for the public. It can be seen through this example that what would appear to be a problem (the issue of weight) can be turned into a saleable feature .

Demographic and fashion trends - Design relevance

The most significant trend that Industrial Designers must cater for is that of our ageing population. Elderly buyers of cars are demanding more and more labour saving devices in cars like power steering, electrically adjustable seats and steering column (for ease of entry). These features all add weight and complexity to already inefficient machines. Older customers also prefer taller cars for ease of access. Fashion trends in themselves are what drive the car industry , people have an insatiable appetite for the new, this is what keeps the designer in business. It is hard to tell if environmental concern is long term or is just another trend. It is the designer who must cater for these trends for if the car is not current it will not sell in great numbers no matter how green it is. It is valid to say that to interpret the market is the job of marketing firms. However marketing firms can not accurately predict new directions for a company. Market research of any particular car market is of limited value in determining company strategy . The policy of asking the customer for design direction always pushes the design of a concept back to that which preceded it. As most of the products that are on the market were conceptualised around five years before they were released, a customer will evaluate a new design that may appear in two or three years with a frame of reference that was created by designers possibly eight years previously. While this does tend to produce products that are tolerated by most it very rarely produces concepts that are highly desirable. The generation of new ways of approaching car design is an area where marketing firms must realise that design should lead the public not be lead by it , otherwise the market will not get the products it deserves.

Suggesting and exploring alternative ways of approaching a problem.

The role of the Industrial Designer as an evaluator of technologies should be given more weight than it is, as the engineers assess a design's performance in purely numerical terms while product planning departments are to too large an extent concerned with honing the product range to suit market tastes to evaluate the overall impact of design changes.

Internal combustion engines - Design implications

Strictly speaking this is not the Industrial Designer's responsibility. However the scientific facts do play an important role in the generation of concepts. Automobile internal combustion engines have been with us now for over one hundred years, and they have changed very little since then. The reason they have survived so long is that they have a very high power to weight ratio. In general the emissions for internal combustion engines are quite high but with the aid of a catalytic converter they are much lower than those of an electric car whose energy was generated in a coal or oil fired power station. The success of internal combustion engines is of great relevance to Industrial Designer, their continued use will mean that radical rethinks of the concept of the car will not be feasible in the foreseeable future.

Electric engines - Design implications

There are 6 main problem areas with regard to electric engines that the bring the entire concept of electric vehicles into doubt, these are the areas that the Industrial Designer can play a productive role.

- Electric cars will cost a lot more than their internal combustion alternatives because of the cost of the motor and most significantly the cost of the battery power pack . The designer will have to find ways of increasing the perceived value of the product while reducing the actual cost so that the cost of the power pack can be absorbed.
- Modern petrol engines are less environmentally polluting than most electricity plants . In effect you are replacing one dirty source of power with another (which can not be updated as often because of power plants cost).
- The most significant problem facing the pure electric car is the fact that you are merely relocating the pollution, while the car may not be polluting the atmosphere through its use it is storing power that had to be generated somewhere in the first place .
- From a psychological point of view the electric car poses problems because the pollution that the car generates is invisible to the user and so they will not be as aware of the environmental cost of their product.
- The life time of batteries is quite short when compared with that of an internal combustion engine . The most advanced batteries would have to be replaced every 40,000 miles (about one third the life span of an internal combustion

engine). The Industrial Designer could ease this problem by making access too and the replacement of power units more practical.

- Electric cars are only practical as city cars because of their limited range. The fact that such cars will rarely need to travel outside a city can dramatically affect the conceptual design of the car this is an area where Industrial Designers have a role.

Case study: Opel Twin

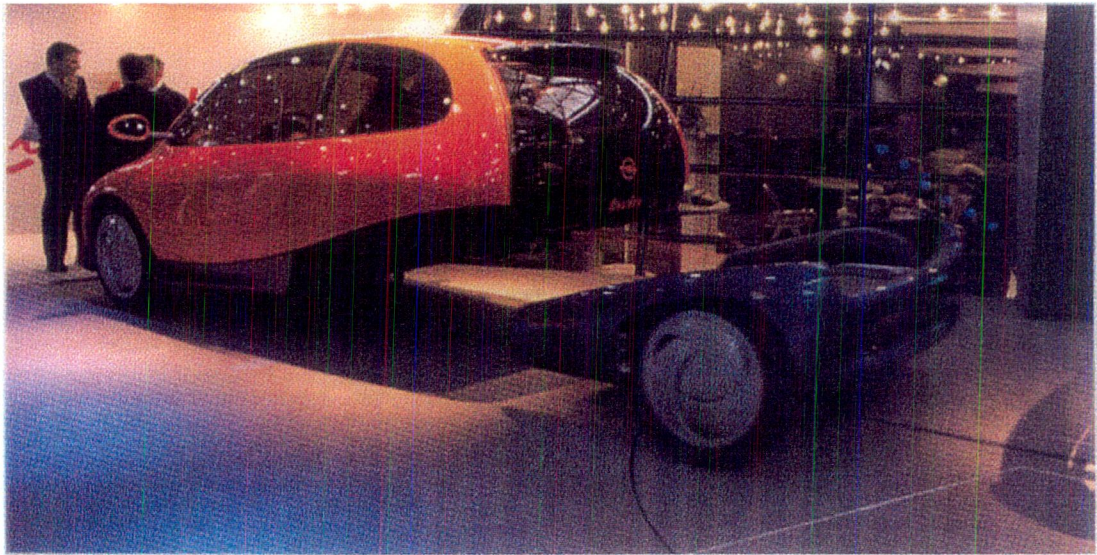


Figure (11): The Opel Twin was a clever concept that allowed interchangeable modules to be use as power packs.

The Opel Twin is an example of where lateral thinking on the part of the Industrial Designer can broaden the concept of what a car is and how it operates. This concept addresses four main issues. This concept addresses the range of the batteries very efficiently. Inconvenience of charging batteries would and is a major headache for

consumers the average time to recharge a battery that could drive a car is two hours. This is far too long for customers to wait so the idea of interchangeable modular power packs was devised. When you are low on power you can exchange your module for one that has already been recharged. The cost of batteries could be another major concern for customers as a battery that could drive a car costs around £17,000, (ROBINSON, 14 August 1991, p. 4-5). This concept removes that problem because you do not own the drive unit at all, you just pay for the energy contained within. This concept also gives you the option of a small petrol motor for long distance travel.

Electric cars are perceived to be lacking in performance and or rather staid, this perception has been perpetuated by the mooring presses macho love for loud engines - electric cars have often been compared with milk floats - clearly electric cars have an image problem in terms of desirability but they need not have one in pure performance terms.

Case study GM IMPACT

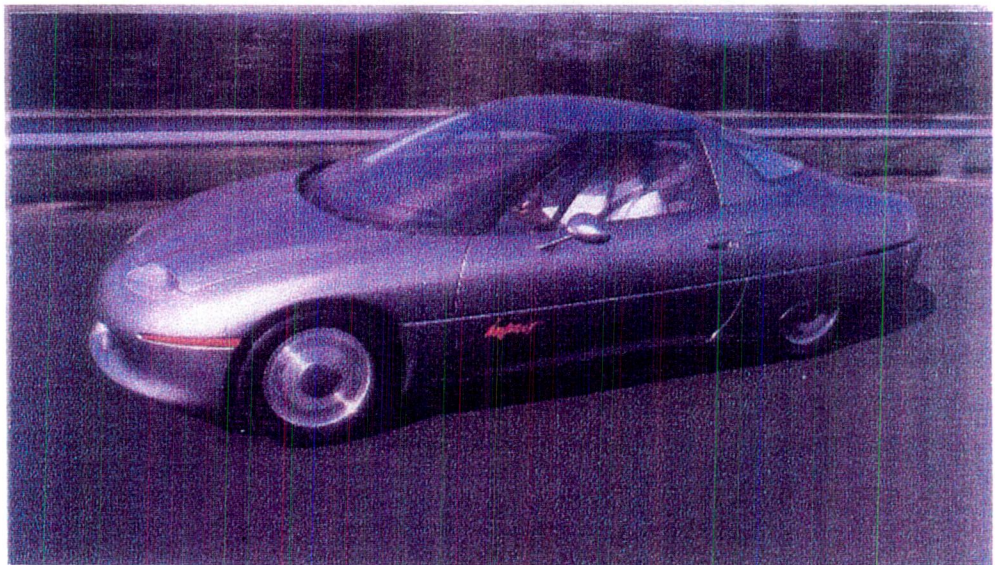


Figure (12) : The GM Impact - the electric car that out paces a petrol car.

The GM Impact addresses one very important fact - it is designed to be electric. Most concepts or prototypes for electric cars are modified petrol cars that have batteries and motor instead of engine and tank. The Impact on the other hand was a clean sheet design that had nothing to do with any previous design. Its aim was push the frontiers of technical knowledge rather than to appeal to motorshow viewers. It achieves performance figures that would be fine for everyday use. It's top speed is 100 mph it can accelerate from rest to 60 mph in 8 seconds and can travel up to 120 miles on a single charge (BURN, 18 April 1990 , p. 50 - 53). This has been achieved through excellent aerodynamics that allow it to travel through the air very efficiently, it has a coefficient of drag of .19 (BURN, 18 April 1990 , p. 50 - 53) which equates to it having only about half the resistance of a normal family car.

Hybrid engines and the Industrial Designer

Hybrid cars are those that use both an internal combustion engine and a battery or other electrical power source for locomotion. Depending on your outlook one could say that hybrid engines offer either all the advantages or disadvantages of both electric and internal combustion engines. The concept behind a hybrid car is that you can use the electric drive unit in the city so as not to pollute in heavily populated areas and that you have a small backup internal combustion motor if you run out of power or wish to drive long distances in the country side. Hybrid cars are expensive by virtue of the fact that they contain more than one type of power source. The opportunity for the Industrial Designer when designing an hybrid vehicle is to give

it the maximum flexibility possible while not compromising its environmental attributes.

Case study VOLVO

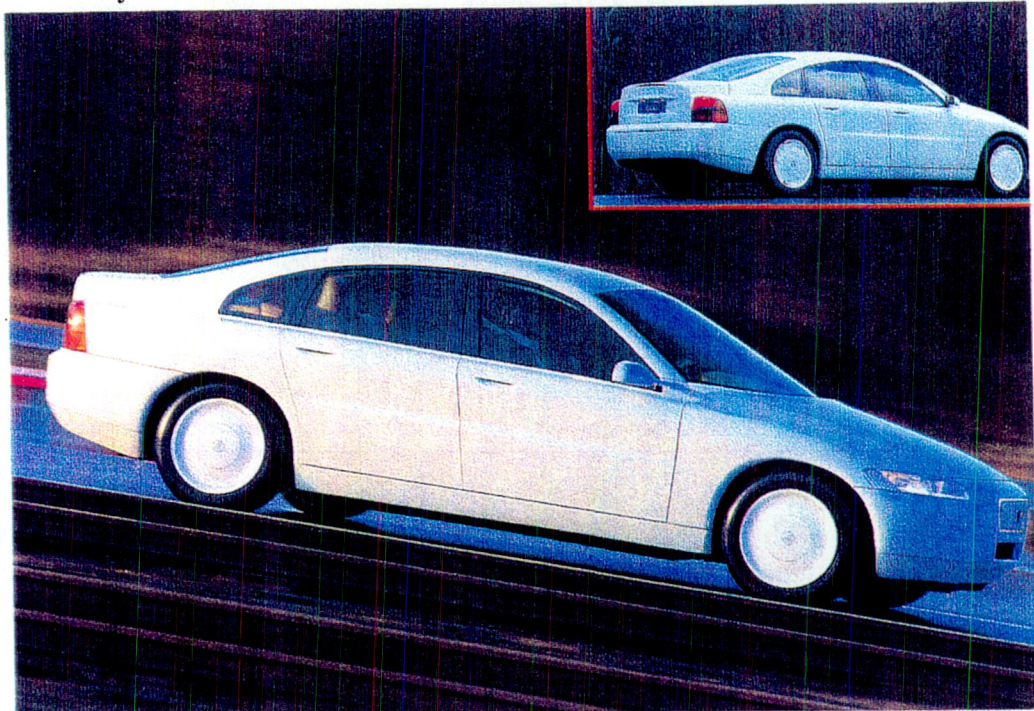


Figure (13): The Volvo ECC

The ECC is a hybrid prototype that tries to maintain all of the features of a contemporary family saloon. This car is unusual in that it uses a diesel fuelled gas turbine to deliver performance that is similar to conventional cars, what makes this car different is that the designers decided not to make a small city runabout but they decided to see what could be achieved if the car was to remain as close to the size and shape of a normal car. The fact that this car has enough power to truly satisfy customers needs means that it is a relevant possibility not just another fanciful showcar. What makes this concept relevant from a design point of view is that life-cycle analysis was used by the designers to assess statistically what the impact of this

car would be. This means that the designer can begin to build up a statistical database from which he can choose materials , processes etc.

Case study PININFARINA ETHOS III



Figure (14): The Pininfarina Ethos III - novel packaging makes for a friendlier product.

The Pininfarina Ethos III is a concept that shows that design as well as engineering make for a more environmentally friendly product. This car has a tall body in which passengers can sit more upright than in conventional cars. This makes for a shorter car which can ease urban congestion. This car has bench seats as opposed to bucket seats, this allows an extra passenger to sit in the car and so in this situation a small design decision could possibly earn savings in car numbers. A novel feature of the car is its adjustable steering wheel which allows the car to be driven from either the

left, right or centre of the car , this has an environmental impact in that separate versions of the car don't have to be made for different markets.

Car weight - Design relevance

One of the greatest problems that faces engineers and product planners is the issue of safety . Electric cars or indeed any car that is going to be energy efficient does so primarily by means of weight reduction . Reductions in weight have to come from some where in the car . The body of the car is a prime target for weight reduction. By their nature fuel efficient cars are very small and light, therefore there is very little room at the front of the car to absorb the impact of a crash. Engineers can design crumple zones to absorb the impact of a car but they can only do so if they are given sufficient space to work with. Another drawback of small cars is their lack of power to overtake or the power to get you out of a dangerous situation . One could always put in a more powerful drive unit but that would either increase weight or consume more power. There has been a tendency on the behalf of car manufacturers to equate 'green cars' and 'city cars'. They reason that these cars don't need much power because they won't travel very fast in the city. As such cars travel quite slowly in the city they don't need to be as strong as cars that travel quickly, these cars are tall and thin so as to take up as little space as possible on the road yet provide enough passenger space. Such cars are to be found in Japan where the government exempts cars under 600c.c. from tax and the need to purchase a parking space. While these cars are relatively safe within cities, they are very unsuitable for motorway or fast driving .

Case study SMART

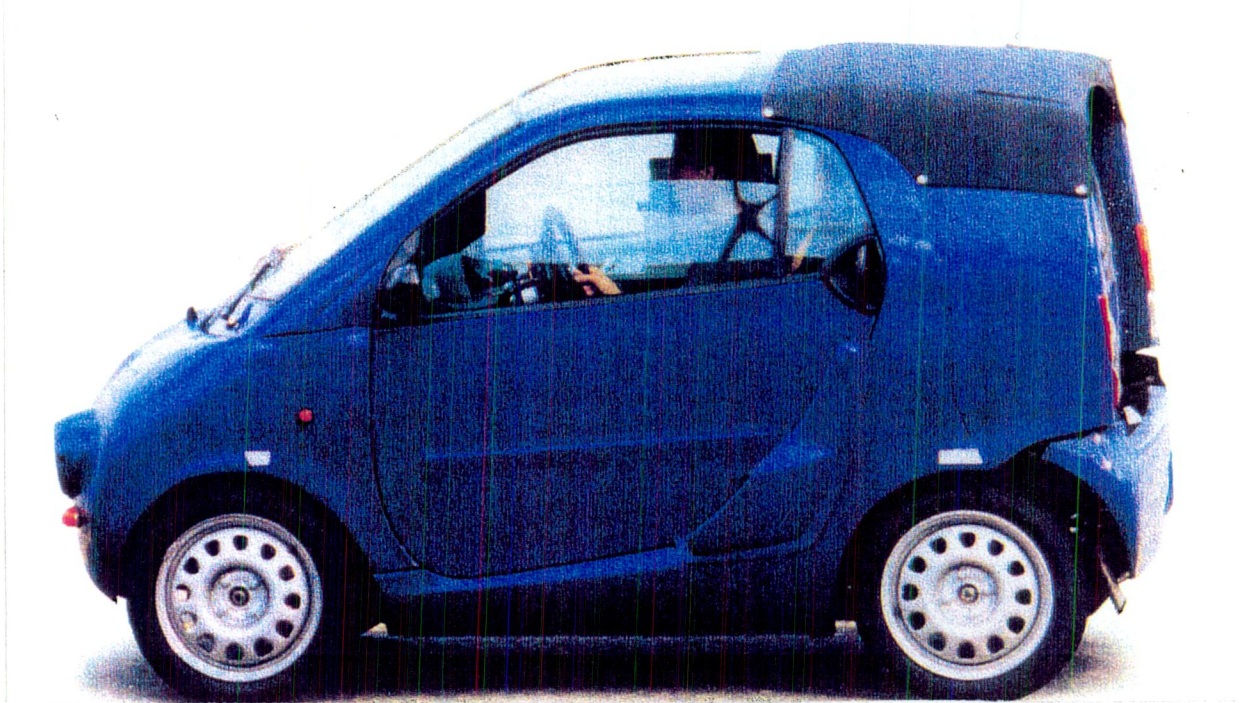


Figure (15):The 'Smart' is a new concept in how cars are meant to be perceived.

The 'Smart' is a car that has been jointly developed by 'Swatch' the Swiss watch company and Mercedes - Benz . It addresses three major issues , safety, how green cars are perceived and the desire for cars among 'Third world' and newly industrialising nations. This car should be perceived as a guiltless purchase you can enjoy this 'pop - culture' product and be secure in the knowledge that it cares for the environment. It addresses the needs of 'Third world' markets by being easy and cheap enough to manufacture in vast numbers for the entire world. It cares for the environment by being extremely small and basic with a hybrid engine for power. The way it addresses safety issues is different as well. Since there is not enough room for crumple zones to be designed into the car, it is designed to transmit the impact of a crash to the other car, which in theory would be bigger than the smart and would be big enough to absorb the impact. The reason that these two companies

have collaborated is that 'Swatch' has the marketing expertise to promote this car as a 'pop - culture' item and Mercedes - Benz has the technical knowledge to make it safe despite its tiny size.

Conclusions

The role of the Industrial Designer in 'Green' car design as it stands at present is not clear. I think that there is a large divide between the role the industrial designer should be playing and the role that he is playing.

At present the car designer is not contributing as much to the development of green designs as he could be. He seems to be confined to a very tight job description - that being the development of a product to fit criteria from a design brief. Those who employ Industrial Designers do not seem to appreciate that the skills that make a designer capable of doing his job also qualify him to examine more fundamental questions about the type of life we wish to lead. The Industrial Designer is committed to the quality of life of his customer, in a most competitive world the Industrial Designer must not treat cars design as a profession but as a way of living and thinking .



Figure (16): Designers and engineers display their own home-grown concepts for 'Green' car design and also their personal commitment to the welfare of the environment.

Is the Industrial Designer doing enough ? Are they fulfilling their responsibilities to both the public, their employers and to the environment ? I feel that designers are in general doing quite a good job. The cars that are being produced today are much friendlier to the environment than those ten or even five years ago. I do however think that they could be doing much more. Only so much progress can be made through scientific and engineering approaches. Even if car emissions were to drop by 80% the growing markets of the third world will erode those efficiencies. The worlds car population is rising very quickly more quickly than improvements can be made.

If an Industrial Designer is to serve the public, his employer and the environment , then he must not only design greener cars but also make his employers aware that he has possibly the most relevant perspective on how to reconcile the needs of the customer and the environment. It is not through the design of any single product or collection of products that the Industrial designer will have the most impact; but through the moulding of how we perceive ourselves in relation to our products.

Appendices

Appendix A: Statistics

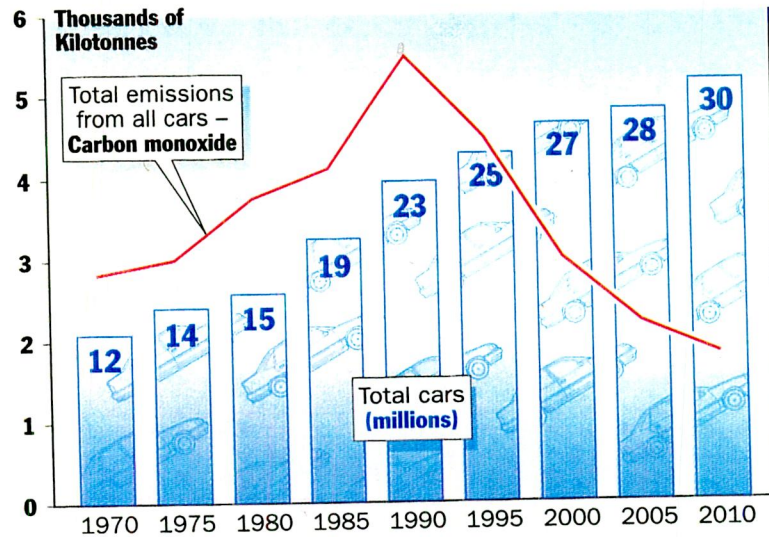


Figure (17): Despite the continuous increase in the number of cars in the UK Carbon monoxide figures have decreased since 1990.

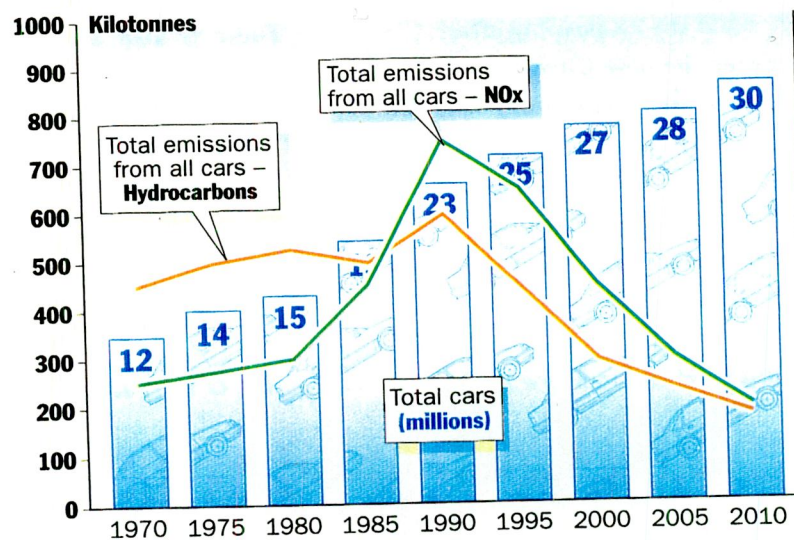


Figure (18): Despite the continuous increase in the number of cars in the UK Hydrocarbon and Nitrogenoxide figures have decreased since 1990.

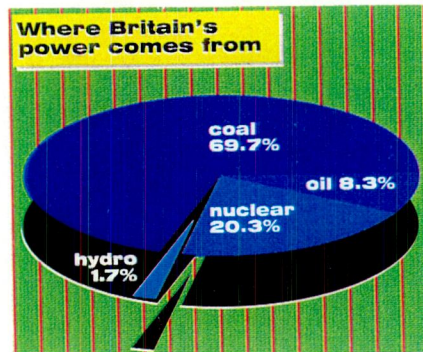


Figure (19): The vast majority of Britain's and indeed the world's power comes from fossil fuels, this casts doubt over the environmental merits of electric transport.

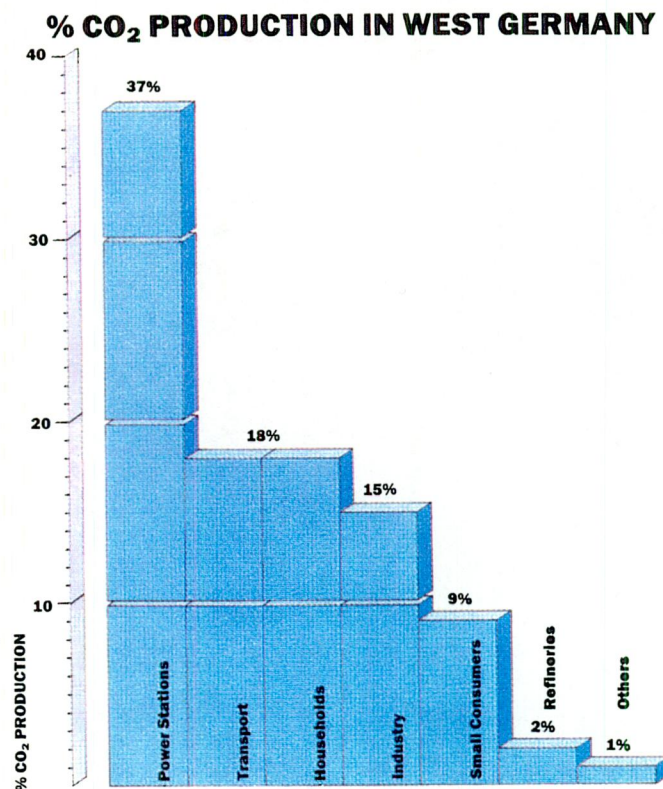


Figure (20): Power Stations are the greatest source of the 'Green House' gas Carbon Dioxide in West Germany, a change to electric vehicles would not make cars any cleaner.

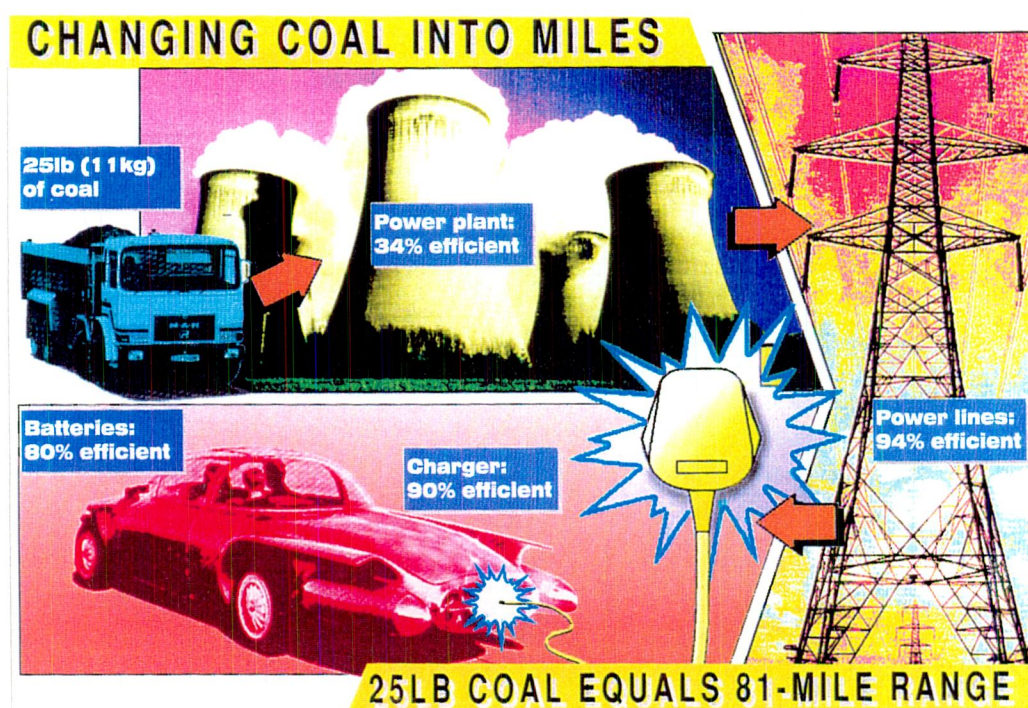


Figure (21): The change from fossil fuel to automotive power is less efficient than internal combustion if the electric route is taken as power is lost at two additional transmission points - the charger and power lines

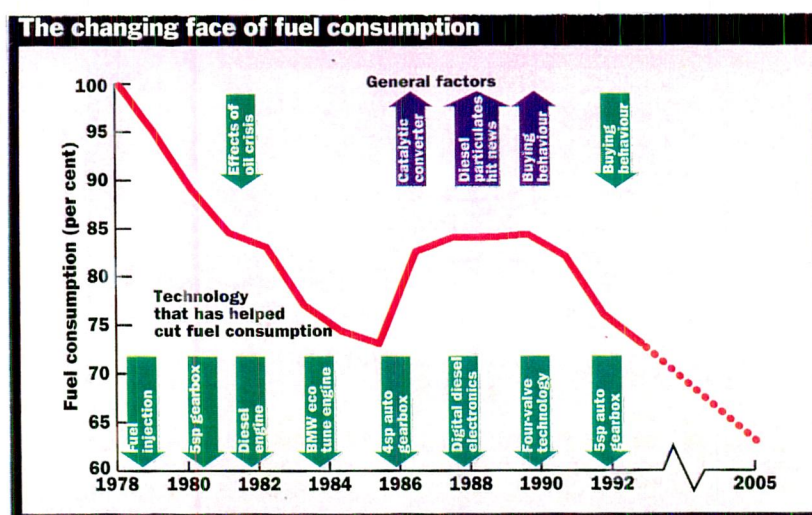
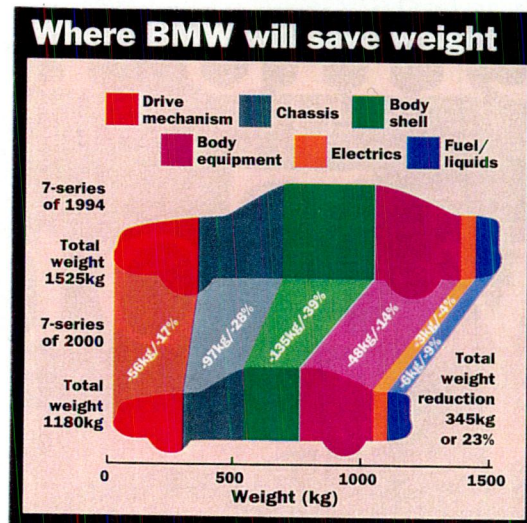
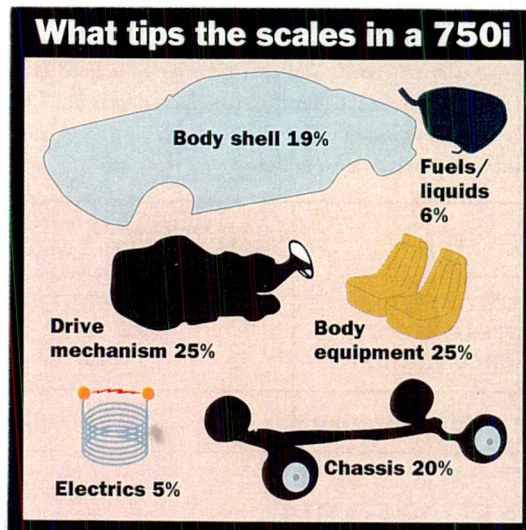


Figure (22): Fuel consumption figures have continued to improve as a result of many small achievements, not radical change.



Figures (23-24): Savings in car weight have to come from some part of the car. Here we can see that there is more scope for weight reduction through the Body and Chassis than through the Drive mechanism. This would suggest that there will be greater engineering demands on the designer in the future to balance structural safety and body styling/aerodynamics.

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