Motor car aesthetics : The contexts of design.

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MOTOR CAR AESTHETICS

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The contexts of design

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Abstract

The original, probably naive, aim of the research was to quantify the proportions of car bodies and plot these graphically, with a view to extrapolating future developments. There are a number of objections to such a scheme, the most fundamental being that it pre-supposes an evolutionary process which does not in fact obtain except in certain periods between design revolutions whose incidence cannot be predicted by the model. Neither can such revolutions be related to technological change. Rather, they seem to result from changes occurring on an ideological level; and it was to this level that research was directed.

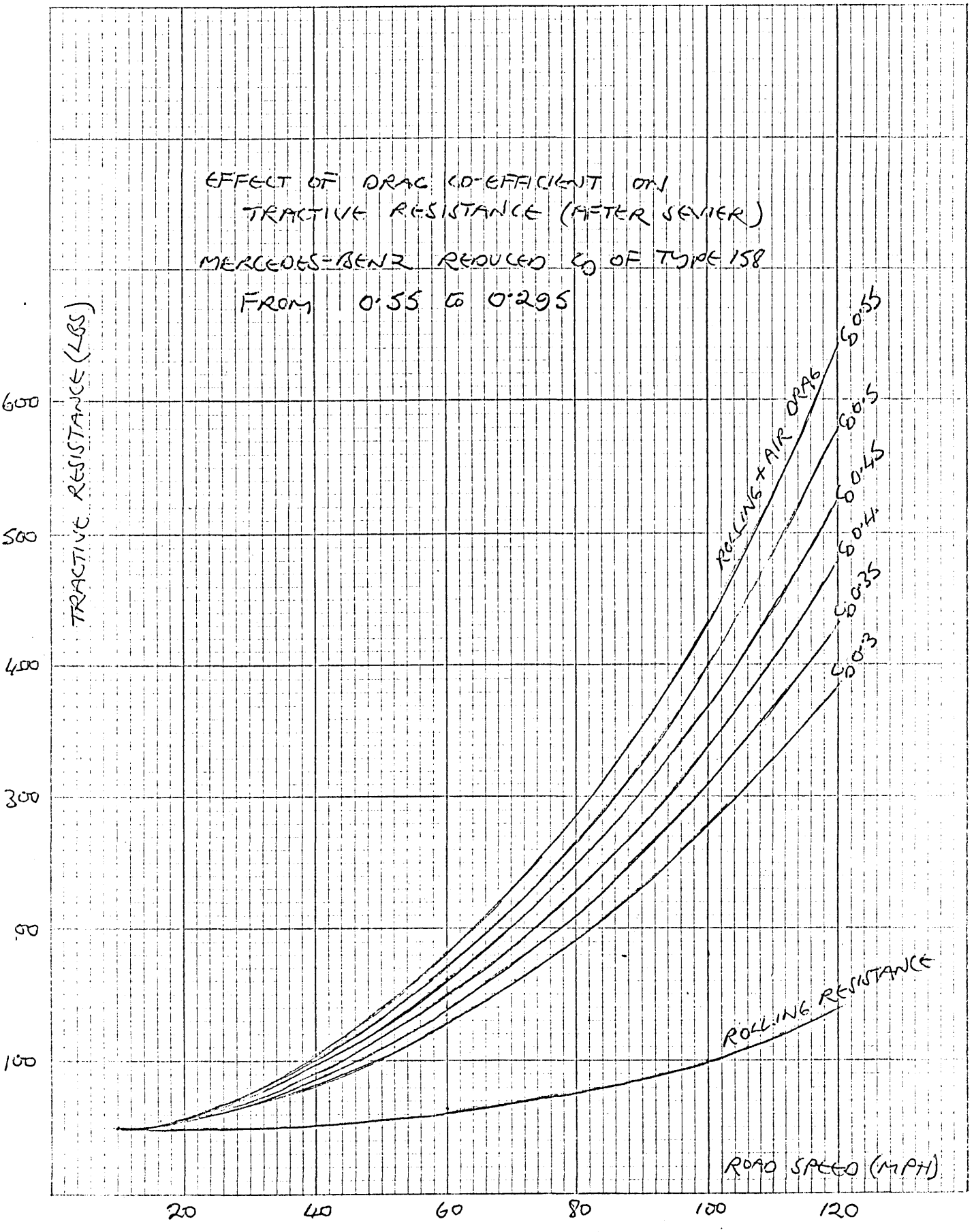
It was postulated that design revolutions occurred as a result of a dialectical relationship between two opposing modes of thought. These modes were characterised respectively as classic and romantic. This terminology is open to criticism, as was any other that could be devised, but is defined at some length in the text.

The main body of the text is concerned to demonstrate that changes in car body shape may be best understood in terms of this opposition between classic and romantic, in conjunction with a separate but related opposition between organic and inorganic form.

Appendix I considers the political implications of the explanatory model and argues that future developments may be predicted in the light of these.

Appendix 2 considers the problem of meaning and explains that it is not yet possible to devise a coherent theory; it does however indicate the importance of certain factors that such a theory should embrace.

Appendix 3 presents the results of an experiment designed to test the explanatory model used.


EFFECT OF DRAG CO-EFFICIENT ON
TRACTIVE RESISTANCE (AFTER SEVIER)
MERCEDES-BENZ REDUCED C_D OF TYPE 158
FROM 0.55 TO 0.295
TRACTIVE RESISTANCE (LBS)
600
500
400
300
90
100
ROLLING + AIR DRAG
C_D 0.55
C_D 0.5
C_D 0.45
C_D 0.4
C_D 0.35
C_D 0.3
ROLLING RESISTANCE
ROAD SPEED (MPH)
20
40
60
80
100
120

Chapter 1

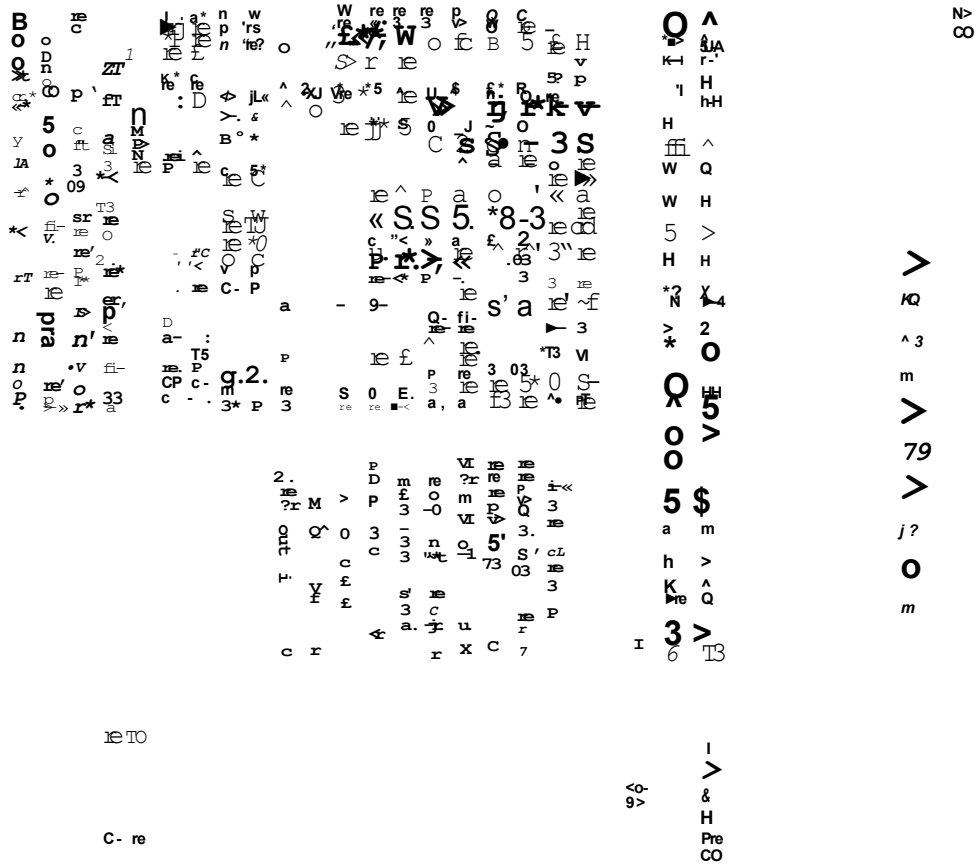
Because the car is so obviously a product of technology, it has often been assumed that the history of technology can account for its morphology. Yet this, in several crucial respects, it has failed to do. In particular, it has failed to account for changes in body shape, most of which have occurred without reference to technological development. Even when this fact has been admitted its significance has usually been underestimated. The technical bias of most critics leads them into two major errors. The first of these is to assume that those elements of the car which fit their explanatory model, namely the assemblage of material components, somehow constitute the *real* car, in relation to which the body is a literally superficial addition. The second, which stems from this, is to assume that body changes which the model cannot explain are either inexplicable, or can be subsumed within a notion of *fashion*. Underlying this strategy appears to be a linguistic confusion: even if *fashion* be not a very satisfactory explanation, the phenomena with which it deals are held to be *superficial*, that is trivial, that is unworthy of serious investigation anyway.

The first step in reappraising this situation must be a re-examination of the status of car body shape.

The shape of a car is in fact of paramount importance for reasons both commercial and technical. The commercial importance is clear in that the potential customer*s first contact with the car is visual - either directly or through the photographic image - and the nature of this experience will influence his willingness to seek further contact. First impressions count, but not digitally.

The technical importance is just as great, but perhaps less generally recognised. The shape of the car body largely determines the resistance to motion offered by the car. It therefore takes logical priority over the design of the engine, the function of which is to provide tractive effort in excess of this pre-existing resistance.

> MIt can be shown that maximum speed, power required, therefore engine size and weight, cooling system, optimum rear axle ratio and intermediate gear ratios, fuel consumption and tank size, braking and wind noise, ventilation, ride and steering characteristics, and finally safety, are all determined by a motor car*s proportions and style.*
>
> D. W. Sevier, 195^ (i)



APPEARANCE Ba *ck *off* the items fhct or* most important from your standpoint

1] FRONT END VIEW
Co.nsid-if radicrtor d»»lgn, he«(J tamps, bumpers, fenders and mud guards—not os separof® items but in tb*ir relation ?© on© another.

HARDWARE (Interiorr & tExterior)
ruij be *cf* high sjuality—styled in ; -any with the overoii interior treat* Rent *or* streamlined in keeping with *tKt%ri©r.

□ **FENDER5**
Must not only be in harmony with the gensrol motif cf the design, b&t must (sroside protection cgcinrf mud end water splashing and prevent grave! striking body. Mon-rplash fenders also hide unsightly chassis parts.

J **&1ETAL TRIMfKINGS**
Distributed its harmony wiih ©vetall dii.gn.

□ **CRAFTSMANSHIP**
PKwaine feinting of isdal port*—tesh os rwrmmg board aprons to body—OS to eccvtocy of ftf snd gsselity of finish. Greek details of upholstery.

[*] *COUin* .*
There siiould be artistic hermeny inside csnd cut- Neo-fading.

□ **TOP VIEW**
Consider smooth-flowing lines made pop sibie by all steel top construction.

□ **SIDE VIEW**
Consider ewpraif appearattca of car—blending of streamlines, otV> height, winddsioSd slops, fondnts, rstining boards, wheels end *rant* end treatment.

□ **REAR END VSEW**
Consider body contour and blending of body lines with gas tank, fenders, bumpers and trunk.

□ FINISH *
Should b-t of high quality and f?<jj3of-vloui to weather.

Sevier wrote this over twenty years ago, and based his observations on research that was, in part, even then over twenty years old. Information has been available, but generally ignored for over forty years.* Why should this be?

There are, in fact, a number of difficulties involved in an analysis of car body shape, and these may account for the scant attention it has received, compared to, say, engine design. Essentially, these difficulties consist in the fact that statements commonly made on the topic may fall into different areas of discourse and therefore be difficult to inter-relate. For example, the same car may be variously described as *beautiful*, *aerodynamically efficient1, and lmasculine*. •Beautiful* is an aesthetic term (by definition) and may be taken, on a Kantian view as a statement with two points of reference: the subject (or observer) and the object (or car). It is a judgement that may vary through time or space. *Aerodynamically efficient* however has two quite different points of reference: the car and the measure of aerodynamic efficiency. Aerodynamics shares —with other sciences the concern to remove the observer from the discussion. Scientific objectivity attempts to isolate object from subject. *Masculine* involves a third order of relationships. In using this term, the observer makes a connection between the object (car) and some external point of reference (masculinity). Thus, we have to consider three points of reference: subject (observer), object (car), and referent (masculinity). The object is seen to mediate between subject and referent: it 1signifies* the referent and to that extent operates as language, and is therefore subject to the same temporal and spatial constraints as language. Our three epithets then come within the respective domains of aesthetics, science, and linguistics. I shall attempt to effect some kind of synthesis between these three and this operation may be considered philosophy.

* During the 1930s Mercedes-Benz carried out a series of experiments on body form and succeeded in reducing by 46% the power necessary to provide a given performance for a car of a certain size. Yet all their subsequent designs, including the present range, bear a greater resemblance to the unmodified 1930s models than to the more efficient shapes determined by experiment. Aerodynamics are used not to halve the size of the engine, but to keep the rear lights clean. Technological explanations lead us to expect •progress1; clearly some other explanation is necessary for this example of regression.

There is considerable evidence that any explanatory model which is devised to account for the morphology of design must be able to accommodate irrational decisions. Mercedes-Benz*s decision not to use the aerodynamically more efficient shapes they had developed appears to be of this nature, as does the pointed refusal by most designers to heed Sevier*s conclusions. Rationalisations of these decisions, such as Reid*s (2) attempt to shift the source of irrationality from designer to consumer. Thus it was for many years considered a truism that Aerodynamics don*t sell*.

Without modification this truism is clearly untrue, and more accurate would be the statement that for long periods design conventions have produced shapes far removed from those dictated by considerations of aerodynamics, and I suggest that it is the departure from convention rather than the aerodynamic shape per se which encounters hostility. Lanchester departed from conventional form, not for aerodynamic reasons, but in the interests of weight distribution and suspension, and encountered similar hostility.

> "But the Lanchester not only was unconventional in almost every respect, but looked so, with the result that the inevitable dislike of the unusual innate in the British, resulted in the car failing to have the success it deserved."
>
> S. C. H. Davis (3)

"The success it deserved" refers to the operational superiority of the Lanchester, which can be apprehended rationally. Davis clearly considers the hostility of the public irrational, but his conclusion that it is "innate in the British" seems problematic. The same conservatism can be observed in other countries (notably the U.S.A.), while the notion that it is "innate" is even more contentious. Conventions exist at various times, but design nevertheless changes. The tendency to conventionality may be innate but the conventions themselves certainly are not. To attribute a car*s success (or failure) to its adherence to convention is clearly unsatisfactory, since some designs have departed from convention in a way which was seen as desirable, and have established a new convention. These designs we may call paradigms*, and the question we need to answer is howr are we to determine whether a departure from convention will establish a new paradigm or meet with an apparently irrational hostility?

* See Kuhn, T. Structure of Scientific Revolutions

"One of the least rewarding occupations for any student of the history of the automobile is lengthy contemplation of designs that should have been of epochal importance but somehow caused only a tiny ripple of interest before they disappeared."

McLellan, John (4)

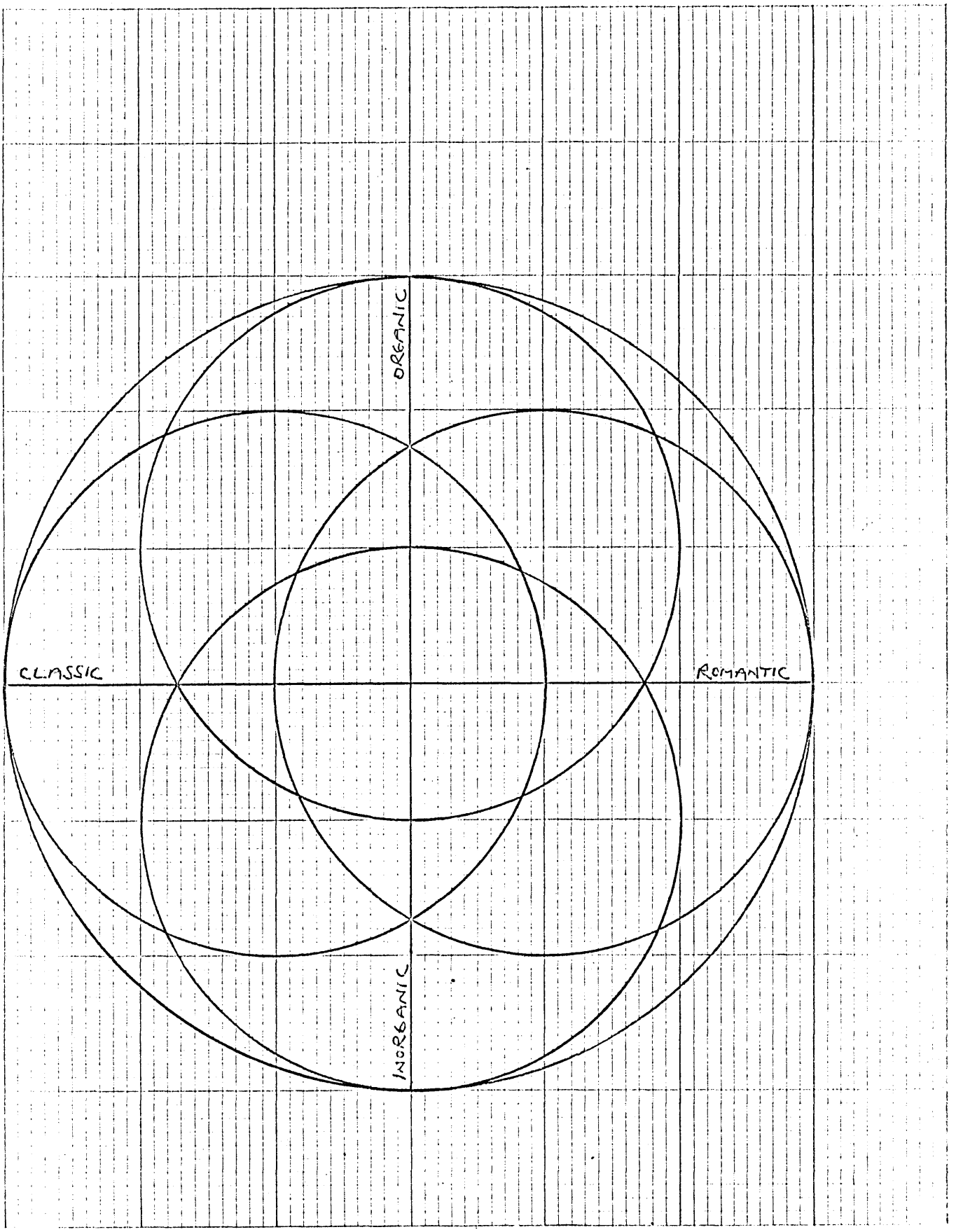
MtoLellan*s "should have been", like Davis* "deserved" indicates designs which offered tangible benefits: their failure was a result of some inscrutable ("least rewarding") perversity "innate" like original sin. Both admit the inadequacy of their technological explanations, yet McLellan*s "somehow7" must be confronted. He is talking about designs "of epochal importance" whose superiority is obvious to the intelligent observer, and to which hostility is irrational.

The notion of *convention* entails a consensus, the boundaries of which are ill-defined, but which clearly extend further than the rational judgement of performance. The *coming together*, •like-mindedness*, *feeling together* wliich unites a group of people at a certain time operates at many levels, of which the rational is, I would suggest, by no means the most important.

•Irrational* is, in a technological society, often held to be a pejorative term: *imagination*, *intuition* are more favourable synonyms. All these terms indicate a mode of thought which is often opposed to rationality, but which defines, I suggest, one end of a continuum which may be envisaged between the two. In constructing a model for understanding design, including convention and its irrational components, I postulate such a continuum as one axis.

One extreme of this axis I shall call classic, the other romantic. The difference is essentially in the attitude to nature. The classic embraces logic, mathematics, scientific method; all of which attempt to understand the world by reduction, simplification, categorisation: by the intellect. The romantic embraces intuition, imagination, myth, and attempts to understand the world by identification, expansion, empathy: by the emotions. This definition is close to that of Pirsig.

The second axis of the model concerns the kind of shapes generated by design. It is perhaps methodologically contentious, but empirically justifiable, to observe that some designs have used shapes which are closely related to those found in nature, and best described as organic


ORGANIC
CLASSIC
ROMANTIC
INORGANIC

others have used geometrical shapes such as the plane, the cube, the sphere which are not commonly found in nature. Further, organic designs, by the subtlety or complexity of their shape and their disposition of masses often appear animated: inorganic designs typically appear static. In postulating the organic/inorganic as a continuum I admit the possibility that some shapes may be allocated to the mid-point because they are not clearly one or the other, while others may effect a synthesis between the two extremes.

The experimental evidence for the model is contained in Appendix 3*

The explanatory model, then, consists of one dimension of organic/inorganic form, and one of classic/romantic modes of expression. These may be represented diagrammatically; the Keplerian circles being added to clarify the areas of overlap.

Thus a design may constitute a classic or a romantic approach to organic, or to inorganic form, or it may effect a compromise between any combination of these. The model is most useful when designs are plotted on it chronologically, when its necessarily subjective nature is, I believe, justified.

Because the notion of irrational processes defeats the technological explanation (as when it appears in a definition of 'convention*) and because it forms a major axis of the present explanation, it is necessary to examine it more closely. It will be found that a usual, but not a necessary connection exists between romantic modes of thought and organic form and conversely between the classic and inorganic form.

Chapter 2

The book which first popularised the notion that the buying public was often motivated by non-rational factors was Vance Packard's "The Hidden Persuaders" (Longman 1957)* The fact that the book was popular, together with Packard's rather sensationalist style tended to discredit it in academic circles. Furthermore, the practitioners to whom he drew attention - the 'motivational researchers* and 'depth analysists1 - could also be shown to have no academic credability, their methods being characterised by pragmatic eclecticism. On the shaky foundation of behaviourist psychology they erected a ramshackle methodological structure of techniques from Freud,Jung, Rorschach, T.A.T., and hypnotism. For these reasons the subject wasnot accordedthe attention which Packard evidently thought it merited. Nevertheless, some of his terminology, such as 'status symbol' and sex symbol* (which derived ultimately from Freud) passed into popular usage.

On Packard's view, the problem faced by manufacturers in a highly industr-ialised society was not production, but sales. Mass production ensures that the majority of the population are soon provided with durable goods: the problem then is how to encourage them to replace these while they are still serviceable. As the market nears saturation, this is the only way in which production may be continued and the economic system perpetuated.

> "As a nation we are already so rich that consumers are under no pressure of immediate necessity to buy a very large share - perhaps as much as 40% of what isproduced, and the pressure will get progressively less in the years ahead. But if consumers exercise their option not to buy a large share of what is produced, a great depression is not far behind."
>
> 'Advertising Age* Oct. 24 1955} quoted by Packard, p.20.

The solution to this problem was considered to be in 'psychological obsolescence*, that is in regularly replacing consumer goods with visually distinct 'new models' which could be presented as more desirable. This was where the 'motivational researchers' made their contribution, their rationale being that since the consumer was in any case buying for largely non-rational reasons, the way to increase sales was by manipula-tion of these reasons. It should be noted however that these eonculsions had been drawn before. Voisin had remarked in 1927 that 'The purchaser of a motor car has always reminded us of a child wanting

forms rear edge of roof. Bumpers front and rear are plain and wrap-around. Note how the sweeping styling line along body sides gives a lowering effect.

Buick Electra 2-door Hardtop: Number of cylinders \ S. Cubic capacity 401 cu. in. Compression ratio 10-5: i- B H.P. 125. Overall length 18 ft. 4?- in. Overall width 6 ft. 8fo in. Height 4 ft. 9ro in- Turning circle 45 7 ft. Wheel-base 10 ft. in. Max. track 5 ft. 2§ in. Fuel tank capacity 20 I'.S. gals.

Appearance: Generally similar to Le Sabre but note naim " Electra " just forward of front wheel arch, insignia on air-intake grille, framing either side of front number plate mounting, and bright trim along lower edge of body. Windscreen is well raked and carried into roof line, long side windows and wrap-around rear windows. Note low ness of car.

Buick Electra 225 Convertible Coupe: Mostly as for 2-door Hardtop. Overall length 18 ft. </^ in.

Mostly the same as the other Buick models but note abric convertible top. Name " Electra 22s" appears just forward of front wheel arch, and hub-caps bear four-spoked mo 1. right trim on lower edge of body is broader between Ifont wheel arches and doors on Electra 225's.

I

to buy a toy.1 t1/, and General Motors* policy ever since Alfred Sloan had been one of *planned obsolescence*. What was newx was the attempt to justify this policy on both economic and psychological grounds.

It was on the basis of this ideology that the great *consumer boom* of the 50s took place in the U.S.A., and the *depth men* were instrumental in devising the model changes which fuelled it.

In a study carried out for Chrysler, Ernest Dichter attempted to explain why more male customers apparently entered a showroom if a convertible were on display, yet almost invariably bought not the convertible but a saloon. He concluded that the customer unconsciously perceived the convertible as a *mistress symbol* and the saloon as a *wife symbol*. Seduced into the showroom in a reverie of languid torpor, he would suddenly be smitten with feelings of guilt and purchase a solid down-to-earth (and cheaper) saloon. Dichter*s recipe for increased sales was "If we get a union between the wife and the mistress - all we sought in a wife, plus the romance, youth and adventure we want in a mistress - we would have .... lo and behold, the hardtop!" (o) Dichter claimed that his *mistress versus wife* study was directly responsible for the introduction of the *hardtop* style which enjoyed considerable success in the 50s, and which may be considered the prototype of the current *GT* idiom.

While it is easy to attack the methodology and the crass notions of sex roles exhibited by Dichter, it is less easy to offer an alternative explanation for observed styling changes. Similarly, when Chrysler decided in 1953 that there were rational reasons for producing smaller cars, and immediately saw their market share drop by 50^, it was Motivational research* which informed them that size was symbolic of status. Chrysler heeded this advice, elongated their cars, and re-covered their market share.

What disturbed Packard was not over-production, nor advertising, per se, but the idea that, in the process of acquiring their information, the depth researchers were invading the privacy of consumers. Later critiques have focussed on the social and economic consequences of continuous production rather than on the mechanics of selling. The problem of signification has thereby been bypassed by most commentators.*

* For a discussion of this problem, see Appendix 2

- ***\ppearan€*e:*** Large, low car, the appearance of which is dominated by the large rear fins. Full-width radiator air-intake with central bar and grille, consisting of six rows of small projections. Paired headlamps under heavy hoods. Massive, wrap-around bumper feature^ side and indicator lamps in over-riders. \\ ing line tapers down at rear to circular

Galbraith, for example, sees the increase of capital and of technology as leading inevitably to planned control of the market.

> "All such planning is dealt with only by highly-qualified men - men who can forsee need and ensure the supply of production requirements, relate costs to an appropriate price strategy, see that customers are suitably persuaded to buy what is available..... "
>
> J. K. Galbraith (3)

Implicit in this view appears to be the assumption that since the process is inevitable (and therefore amoral), and since the men involved (no women, of course) are ^highly-qualified* (responsible, above reproach), it is therefore socially incumbent upon the customers to be persuaded. In fact, since the economic structure depends upon his compliance, recalcitrance appears tantamount to treason. The mechanism whereby the customer is actually persuaded need not be scrutinised. Note the further assumption that the customer must be persuaded: there is admitted no possibility that the product will be so self-evidently beneficial and desirable that he will voluntarily contemplate purchase. Galbraith agrees with Packard that there is no rational reason why the customer should actually require most of the commodities on sale or the values implicit in them. His purchase is therefore either irrational or coerced.

But whereas Dichter exhorted manufacturers to exploit the fantasies of their customers, it appears that some designers found this unnecessary: they exploited their own fantasies. Harley Earl clearly brought forth the monsters of his own imagination, as did his successor Bill Mitchell.

> "His little round body clad in bright scarlet or mylar-chrome-coated leathers, astride one of his adolescent-fantasy motor-cycles, is enough to force a guffaw from Samuel Beckett ...."
>
> Hiram J. Askmor, tCar* June 1976

Several designers have stated that rational requirements play only a part (if that) in their designs. Definitions of what else is involved vary. For some, acceptance of fantasy is implied in the notion of the *dream car1, while others see aesthetics itself as opposed to rationality. Tom Tjaada of Ghia sees himself as a sculptor, concerned only with aesthetics. Some of his designs have been too low to accommodate an engine, on others the windows cannot be opened. Like several other designers, he does not drive the cars he designs: use plays no part in process.

1***ppearance:*** Small car of graceful, well-balanced appearance. Tiny, vertical, pointed radiator air-intake with large horizontal flanking intakes, all having mesh grilles. Large aeadlamps, straight-through wings to high-set, vertical tail-amp clusters. Plain bumpers, wrap-around at rear, have no >verriders. Curved windscreen and large wrap-around rear vindow. Perforated disc wheels have large hub-caps.

1959 Alfa Romeo Riulietta Sprint

Zagato also sees aesthetics as opposed to rationality ' ' and sees the designer's job as mediating between the two. This opposition between aesthetics and use, art and technology, intuition and rationality, appears to be deep-seated and subscribed to by many designers. Some such as Tjaada and Fiore see aesthetics as concerned with the manipulation of 'pure form', that is the control of flat versus curved panels, mass and void, hard and soft. Others are concerned with external as well as internal relations, that is with the connotations of shape. Bertone describes his Giulietta Sprint as "a lively, cheeky car that attracted equally young people and men of a certain age" (Style Auto No. 3).

Such anthorpomorphism clearly approximates to the notions of Dichter. The sexual implications are clear, and are related to Dichter*s "romance, youth and adventure". But whereas Harley Earl's creations of the 50s employed quite overt sexual icons (breasts, eyes, penis), Bertone's did not. What he, and others like him are concerned with is the emotional potential of non-iconic shapes, that is with the relation between the abstract and the connotive. One of the clearest expositions of this concern was by Roy Brown of Ford styling, concerning the Corsair. In this design, he attempted to unite the male and female principles. The pointed nose was considered masculine, the curve of the doors feminine. (Style Auto No. 3)«

This process of signification is not susceptible of logical manipulation (see Appendix l) and this is one of the factors which militates against the use of totally logical (e.g. computer-aided search) techniques in body design. Such analysis may be carried out on a proposed design and may indicate the desirability of modification in the interests of structural stiffness, ease of production, aerodynamic efficiency, or some other parameter; but it cannot predict the effect upon the signification of the shape. It remains the designer's decision whether or not to incorporate such modifications.

Logical analysis presupposes a scientific paradigm, and Popper, Kuhn, and Koestler have indicated its limitations even here. Every major scientific discovery has involved the destruction of the paradigm on which such logical analysis depended. Those scientists who have thus managed to lift themselves up by their own bootlaces owe their success

to imagination, intuition, the non-rational. Kekule solved his problems in his sleep. (5)

Even those (few) designers who see car design as a scientific activity must admit the limitations of rationality; most make no pretence to science. Those who see it as an art implicitly accord prime importance to imagination.

Chapter 5

It would appear that in the processes of design, advertising and buying of a car, non-rational thought processes which we may collectively term romantic, may occur. These may indicate the designer*s hunch, inspiration, fantasy, or imagination; the salesman1s psychological sell; the customer*s daydreams or response to sensuous appeal. One problem is that in any given transaction, any, all, or none of these factors may be involved. A second problem is that no statement made by any of the protagonists can be relied upon to clarify the situation: all may have motives for presenting the situation differently. Since the whole transaction also clearly involves logical, rational thought, it is necessary to examine the relationship between these two modes of mental operation.

Logical thought, at least, is clearly understood, since it is rule-based, deductive. Liam Hudson (i) uses the term 1convergent* thinking; opposed to this he sees *divergent* thinking as a mode which is used by most of the people some of the time, and by some of the people most of the time.

Convergent thinking is characterised as proceeding logically from the commonly-accepted or given general to the particular. This is the process involved in employing a scientific paradigm, and not surprisingly is institutionalised in technological societies by such means as standard I.Q. tests. Divergent thinking is, by contrast, non-linear, non-rational, working intuitively outward from one particular to another. The test of convergent thinking lies in determining the *correct* answer, but the test of divergent thinking is the number of alternative answers postulated. Divergent thinking is therefore one manifestation of imagination.

Hudson*s research indicates that children at an early age not only perceive their own position on this continuum between convergent and divergent dominance, but also perceive jobs and professions in the same way. He discusses *stereotypes* of *scientist*. *engineer*, *artist*, and so on, and finds that job selection is usually determined by the process of self and job description he describes. So that if the job of *car designer* (not one of his examples) is sometimes defined as •engineer*, and sometimes as *artist*, one would expect different types of people to be attracted to it. Since the nature of the job does in

fact change through time and space, one would expect such changes to be re-inforced by recruitment and successive change to be consequently inhibited. General Motors1 change of nomenclature from 'Styling/Art and Color Section1 to 'Design1 is clearly an attempt to make such a change.

Hudson's psychological theory has considerable consequences for theorists of method such as Koestler and Ford. They stress the importance of the imagination, the non-rational, in arriving at new theories, in trans-cending the paradigm:

> "To transcend a paradigm is to move beyond it and engage in an imaginative encounter with the ^unthinkable?"
>
> Julienne Ford (2)

Yei, according to Hudson, in children's perception of many jobs there is no place for the imaginative, the non-rational. Their stereotype of 'engineer* is at least better in this respect than mathematician and physicist:

> "The engineer is seen as less intelligent, cold and dull than the other two, but as more manly and dependable and imaginative." (3)

Clearly these stereotypes are inaccurate: scientists and engineers, if they are to be other than mediocre, must have imagination. Yet it is the convergers, the logical thinkers, who seek out science and engineering.

Car design has been variously perceived as an engineering, a scientific, or an artistic activity. The immediate implication of Hudson is clear in terms of individual recruitment, but at the organisational level the situation becomes more complex.

A Voisin or an Issigonis is virtually autonomous since he has control over every element in the car. So is an Earl or a Mitchell, since the mechanical design is virtually static over long periods. Both groups are free to design, after their own manner. However, in the production hierarchy as frequently defined the definition of body design as 'artistic' or as 'scientific1 can have various implications for the decision-making process. For example, throughout the long period of 'psychological obsolescence', every major decision affecting the appearance of the car was taken by 'stylists'. Engineers concentrated on the mechanics and economics of production.

At the other extreme, a firm like W with a very long production run, depended entirely on engineers. When it became necessary to design new models, the firm found itself (despite the takeover of Audi-NSU) short of suitably qualified (imaginative?) personnel. Outside consultants (ital Design) were drawn into the decision-making process.

If body design is handled within the firm, there is still the problem of reconciling a range of viewpoints the extent of which will vary according to design definitions. Stylists at General Motors have considerable autonomy, yet can still see their ideas rejected by unsympathetic management. Citroen alone has an aesthetician on the board of directors.

Whether the pragmatic solution adopted is autonomy or committee decision, the relation between decisions taken and non-rational components of the design will vary. For example, the flash of inspiration which illuminates the midnight hours must still withstand the cold scrutiny of analysis: non-linear methods may have been employed to solve a problem, yet it is still possible to assess whether the problem has in fact been solved. By contrast, decisions as to whether a proposed design does or does not look like a spaceship/shark/dogfs breakfast and whether this is/is not what the public wants are of a different order. They cannot be validated logically: therefore various measures involving consensus, market surveys, evaluation clinics, previews, are employed. All must however be impirical, and since most can be carried out only at a fairly advanced stage of model design, considerable investment is as risk. Furthermore, such empirical measures are inconclusive, and designs so assessed can still be commercial failures. In fact most commercial failures can be attributed not to the technical or functional shortcomings which are subject to logical validation, but precisely to their non-rational characteristics.

The process of perceiving- meaning
1968 Chevrolet Corvette

Chapter 4

The process of perceiving meaning in a car*s diape is qualitatively different from that of judging the fitness for use of that shape. Extreme examples of this have been provided by a number of *show cars* which have created great excitement, but, which have been found on subsequent inspection to be incapable of accommodating an engine, or to be of such structural frailty that the opening of their doors would lead to their premature collapse.

The psychological and organisational bifurcation of which this is a symptom did not obtain in a craft-based technology. Increasing industrialisation has progressively divorced reason from intuition, scientist from artist, engineer from designer.

The earliest car bodies can hardly be said to have been designed at all, in that this term distinguishes the function of envisaging or planning the final product from the one of actually making it, and therefore assumes a range of options not available to the craftsman. The early bodies were formed by craft processes generations old according to which the final shape is determined by the processes and materials used. Craft processes have been characterised as *unselfconscious*: within the particular craft paradigm, there is a *best way* to do the job, and the information necessary to accomplish this is embodied in tradition and transmitted by example and word of mouth. The method is the sum of all the retained knowledge within the paradigm, and the purpose of apprenticeship is to perpetuate this fund of retained knowledge. In such a craft paradigm leaning* is inherent in the product: thus a vehicle may be solidly constructed from costly materials, from which it may be inferred that the owner can afford not only the material and labour embodied in the vehicle, but also the team of horses or large engine necessary to propel it. As machines replaced human labour and materials became standardised (to suit the requirements of these machines) this area of inherent meaning became progressively circumscribed: one vehicle might be constructed in a manner and of materials identical to those embodied in another vehicle costing several times as much. Vestiges of this *inherent meaning* of the craft product survive however in such notions as the equation of size with status. Also craft processes per se, when in danger of extinction, came to be valued. Customers became willing to pay more for a car assembled by hand rather than by

machine, irrespective of whether the standard of assembly was superior. Similarly, materials such as wood and leather, which had previously been taken for granted, acquired symbolic value as the craft of coach-building declined. The manufacturers of the plastics which replaced the craft materials adopted these values and sought to reproduce their colour, texture, and even smell, by machine.

The buyer of the hand-made car was announcing that he could afford the product of the more expensive labour-intensive process. However, since the actual product was usually indistinguishable from that madeby machine it wasnecessary to disseminate by other means, such as advertising the fact that the product was hand built (or as the Americans have it *hand-craftedI).

Nevertheless, the craftsman cannot manipulate the meaning of the product: it means what it is. Further, because of his unselfconscious relation to the process he is in no position to do so: manipulation implies detachment, self-consciousness.

Also, although the retained knowledge of the craft paradigm may have a rational basis, the particular craftsman may be unaware of this: it may only be when he tries to do something a different way that he discovers the reason forthe accepted method. The paradigm is the result of trial and error, butthe errors may not be recorded. The craftsman who attempts a new shape is therefore in the position of intuitively enlarging the boundaries of the paradigm: he will essay what he feels should be compatible with what is established. This is rather different from the operation of a scientific paradigm which includes logical checks that what is proposed will be compatible. The empirical rationality which underlies the craft paradigm is not logically structured in this way, and in any case may not be accessible to the individual practioner. He must therefore intuit what he feels to be reasonable.

The designer who is consciously attempting to manipulate the meaning of a shape is in a similar case. Although constrained by materials and processes, production costs and other requirements, he has available a far greater range of options than the craftsman, and will be aware that different meanings will attach to different options. However, he cannox make his choice of meaning under the guidance of logic. The semiotics of shape follow neither the strict rules of language nor the rigid re-

quirements of the scientific paradigm. For example, if his concern is to exploit the potential of science-fiction iconograjdiy (thereby to imply the modernity of the product), there is no logical check on whether the proposed shape will in fact be meaningful in these terms - as the Edsel demonstrated. The designer can only intuitively attempt to enlarge the boundaries of the paradigm.

Designers such as Voisin, Lanchester, Issigonis, and Costin, who have employed scientific, or quasi-scientific, paradigms justify their designs on rational grounds. In fact, justification per se presupposes rationality, being a logical deduction from a commonly-held *truth* to the particular case. Earl, Mitchell, Michelotti, and Bertone cannot employ this process, though they may try. For any *justification* they may offer for their designs can be based, not upon logical deduction, but only upon empiricism: *people like it*, *it sells*.

Any design exercise exists in a tension between the logical and the intuitive, and it is the dialectic between these two modes which has characterised the history of car design.

Chapter *5*

> "I have yet to see any problem, however complicated, which when you looked at it in the right way did not become still more complicated."
>
> Poul Anderson

Hudson*s main contribution was to demonstrate that convergers and divergers were attracted to different academic disciplines and so to different professions. In 1966 he predicted the trend away from ,engineering and science and towards the humanities and social sciences which has recently been observed. One of the factors involved he considered to be the attitude to authority, and this may also be considered important in the similar distinctions between modes of mental operation determined by others. For underlying the convergent/divergent dichotomy is a philosophical one which has been widely recognised.

Freud distinguished conscious/unconscious, ego and id, and saw the super-ego as the source of authority(^)Jung considered the personality to be structured around a number of axes, among which was intuition/intellect.^)

The terms of reference of the intuition are internal, those of the intellect external. The intellect operates by following logical rules from a commonly-accepted generalisation to a particular. It therefore acknowledges three kinds of *authority*: i) that of the rules of logic; ii) that of the generalisation: theory or paradigm; iii) that which underpins the whole system. That is the authority which claims that phenomena are explicable, and that this is the way in which they are to be explained. The fact that this mode of thinking has been the dominant one in European culture for several centuries should not obscure the fact that it is not the only mode of thinking.

Ornstein v[4], tabulates

The two modes of consciousness

A tentative dichotomy

Who proposed it?	Day	Night
Many sources	Day	Night
Blackburn	Intellectual	Sensuous
Oppenheimer	Time, History	Eternity, Timelessness
Deikman	Active	Receptive
Polanyi	Explicit	Tacit
Levy, Sperry	Analytic	Gestalt

Domhoff	Right (side of the hody)	Left (side of the body
Many sources	Left hemisphere	Right hemisphere
Bogen	Propositional	Appositional
Lee	Lineal	Non-lineal
Luria	Sequential	Simultaneous
Semmes	Focal	Diffuse
I. Ching	The Creative: Heaven Masculine, Yang	The Receptive: Earth Feminine, Yin
I. Ching	Light	Dark
I. Ching	Time	Space
Many sources	Verbal	Spatial
Many sources	Intellectual	Intuitive
Vedanta	Buddhi	Manas
Jung	Causal	Acausal
Bacon	Argument	Experience

Western culture is based almost exclusively on the intellectual, the left-hand column, often to the extent of denigrating or even denying the existence of the right-hand column. Eastern culture, by contrast, incorporates the existence of both but often favours the development of the functions in the right-hand column. Ornstein seeks a physiological explanation of the dichotomy, and follows Bogen in finding it in the division of functions between the left-hand and right-hand hemispheres of the brain. This hypothesis has yielded much that is interesting and valuable. It suffers, however, from one inherent deficiency: it operates at a sub-individual level of the hierarchy. That is, in order to account for interaction and mediation between the two hemispheres, it is necessary to invoke a 'higher* level of the hierarchy, which is not included in the model. Predictably, therefore, it cannot help with supra-individual, that is social or cultural levels. That is to say even if the phenomena be satisfactorily explained at the psychological level, the sociological and philosophical problems remain.

The existence of two modes of thought has long been recognised, as is evident from the sources quoted by Ornstein. Technology, however, influences the operation of these modes, as demonstrated by Galbraith, Marcuse, and others. Thus the Japanese have comparatively recently been forced by technological development into a 'western* mode of relationship to the world.

Classic and Romantic

1954 Bristol 450
1950 Studebaker Commander

The motor car is intimately bound up in such developments, being both cause and effect of not only technological but also of social change. It should not therefore be surprising that it has been the repository of visual symbols of society*s attitudes to technology. These attitudes are at present in a state of extreme tension, and this tension exists at several levels. Reactions against technological culture, such as Roszak*s (5) are not primarily against the nuts and bolts, nor even the pollution, but against the narrow definition of consciousness implied by a Technological ideology; against the flattening of response which leads to Marcuse*s *One Dimensional Man*. Contemporary car design at least in Europe is reflecting this ideological tension, if only symbolically; it is however, as I shall argue, incapable of resolving the tension.

To understand why this should be so, it is necessary to examine further the two modes of thought involved as manifest incar design. In preference to any of the formulations reviewed above, I will use the terms classic and romantic, as employed by Pirsig.

The romantic responds immediately to the world. This is a phenomenological approach, stressing the primacy of sense experiences. The classic approach, however, involves a two-stage process of dislocation: of observer from observed, and of observed from *underlying* reality. The scientific search for *causes* is in this sense identical to the Platonic distinction between substance and form: both regard phenomena as superficial, symptomatic of some *deeper reality* in relation to which they must be understood. The classic always entails this (Platonic) distinction between underlying reality and surface form, and addresses itself to the former. The romantic either does not admit the distinction, or, if it does, addresses itself to the latter. One is idealistic, the other phenomenological.

There are a number of reasons why this characterisation is to be preferred. Most important is the fact that the car body is a social transaction. It is almost invariably constructed for sale, which implies the involvement of at least two people, constructor/designer and customer. Usually, considerably more people than this are involved. Now while such notions as convergence/divergence may help to illuminate the design process, they can say little about the transaction. For example, the design of the Burney can be shown to be an exercise of the intellect,

1928 Burney Streamline

ew in c v it at th<' 'Ring again, in litre HKi7 Auto L'nion

While the Germans were setting a new and matchless pa were also setting new fashions which appeared sufficiently stated for other manufacturers to follow. The configuratio Auto Union was popularly dismissed, the car heing con

imaginative in the sense of proposing a radically different alternative. But why do people laugh at it? The problem here is that the shape has meaning, even though no meaning was intended. Society is full of convergers and divergers, and our culture is supposedly intellectually based, but here is an example of discordant sets of values operating about the transaction.

This example is complicated by time; an analogous one which is not, was the contemporary reaction to the Auto-Union. All racing car designers were exercising similar mental faculties to an identical end, yet the Auto-Union was perceived as totally alien, grotesque: the manifestation of an entirely different philosophy. A convention is a nexus not only of technological solutions, but also of cultural, mythic values. Auto-Union and W125 rejected, to a more or less immediately obvious extent, such mythic values, and it is this fact which underlies such epithets as 1grotesque*.

Other designs have similarly rejected mythic values and have thus either destroyed or radically enlarged the current convention: DS 19 and Mini are clear examples. But what is important is that they not only change engineering conventions but also because they embody a nexus of values, such designs have a resonance far beyond their immediate engineering context. Any change in mythic values is applicable not only to the car, but also to society at large.

Since most designs have, necessarily, achieved a certain minimum acceptable level of performance, I believe that it is on this relation to such mythic values that their success or failure depends. Those designs which Msomehow(!) caused only a tiny ripple of interest" were judged against a mythos which simultaneously ensured the success of their competitors.

It is for the purpose of clarifying the nature of this mythos that the explanatory model, described earlier, has been devised, and it is in the light of this that I now wish to examine the 1evolution* of motor

The Machine Aesthetic

1912 Mercer $5 T

c. 1920 Stutz

n

Chapter 6 The Machine Aesthetic

The machine may be defined as an assemblage of separate components which, by virtue of their peculiar spatial relationship achieve a purposive integrity. Further it may be noted that the mode of relationship obtaining is a hierarchical one. That is to say, the machine as a whole is conceived to fulfil a specific function, while the subsystems or components of the machine have their functions defined as necessary contributions to this end. Thus it may be seen that the car as a whole has a specific function(transport) and that this is achieved by the contribution of a number of subsystems (power system, transmission system, steering system). These subsystems may in turn be seen to comprise lower levels of subsystem (induction system, ignition system, lubrication system) which in turn comprise still lower levels of subsystem (battery, coil, distributor).

If this seems self-evident, it is because such a hierarchical structuring is, in a number of senses, natural. Koestler maintains that all living organisms, for example, are so structured: " .... wherever there is life, it must be hierarchically organised."

Further, Aristotle*s system of biological classification, which provides the model for all subsequent scientific endeavour, may be seen to be hierarchically structured. The *correct* definition of hierarchies has been the main concern of Western thought ever since. The recognition that electricity and magnetism, for example, may be more profitably considered as belonging to the same, rather than to different branches of the hierarchy is of this nature, while the search for a *unified field theory* represents an attempt to clarify the highest levels of the hierarchy.

Western concern with hierarchical structure has extended into philosophy. Kant*s [2] concern was to demonstrate that man*s mental capacities are themselves so structured: that is, that man perceives hierarchies in a hierarchical manner. In these senses, then, the machine may be considered as an isomorph of man, and of life itself. And while the activity of car design may or may not be considered to be a scientific activity, it parallels exactly such activity. *Convention* in design is the equivalent of the *paradigm* of science, and both represent the common definition of hierarchies which provides the intellectual and social cohesion within comimmities.

But although Koestler presents hierarchies as having independent existence, as being really real, it is important to realise that they are in fact inventions, intellectual constructs. They are the product of the classic mode of thought, which is not the only way of apprehending the world. While the classic observer is outside the phenomena, ordering them hierarchically, the romantic is 'into* them, 'with* them, *grooving* intuitively on them.

The reaction was to occur later, but for the early car designers the problem was one of hierarchical definition. If they disagreed about definitions, this was a result of their previous experience in other industries, and to that extent a measure of their departure from pure classic thought. If a designer is swayed by previous experience with bicycles or steam locomotives, then he is seduced by the particular, rather than recognising the general.

The use of different size wheels at front and rear is an example of such a process. Even if it can be demonstrated that practical advantages accrue from such a configuration, such demonstration depends upon seeing the two pairs of wheels as components of two different subsystems (steering/transmission or steering/suspension). This hierarchical definition is at odds with the visual experience (romantic) and while appropriate for a horse-drawn vehicle was incongruous in the automobile. The desire to equalise front and rear wheel sizes was primarily an effort after conceptual congruity. That such a move facilitated the introduction of the pneumatic tyre (owing to the possibility of interchangeability) was a welcome result, since it increased the ramifications of the hierarchy by introducing yet a lower level of subsystem.

Most early designs, however, acknowledged no hierarchy 'bodywork*. What panelling there was, was usually restricted to a cover for the engine and bucket seats for the passengers. 'Bodywork*, that is, was conceptually diffused throughout the mechanical hierarchy. This was actually a perfectly satisfactory arrangement and a number of designs achieved an economical authority. Perhaps the most minimal was the Oldsmobile Curved Dash, which with underfloor engine attained an elegance and economy never surpassed. What was at issue vas the creation of a visual image of *the machine*, to which this minimal approach was far better fitted than the alternative: the grafting on of coach bodies.

Revolution and Evolution: Paradigms and Possibilities

Revolutions have occurred in car body design to disrupt an apparently 'evolutionary' development. Cars which accomplish such revolutions may be termed paradigms: they represent a nexus of technical, aesthetic and mythic values. Revolution in only one of these areas is insufficient qualification, as the right hand column of alternative possibilities below indicates. Sometimes paradigmatic status is not immediately recognised: the fate of a successor may decide the issue. Thus the Mini might have remained an interesting alternative had not the 1100 demonstrated the universal applicability of its philosophy: The Post-War Cisitalia was accorded the status denied to its Pre-War predecessors.

The cars in the list below, which are all discussed in the text, exemplify rather than exhaust such developments.

The Machine Aesthetic

1901 Mercedes

1905 Renault

1909 Ford Model T

1909 Roland-Pilain

The Organic Aesthetic

1912 Hispano-Suiza

1913 Ricotti Torpedo

1919 Dodge

1922 Rumpler

1923 Voisin

1928 Burney

The Technological Aesthetic

1934 Citroen

1935 Cord

1935 VW

1946 Studebaker

1948 Citroen 2CV

1950 Ford

1953 Studebaker

1955 Citroen DS19

1958 Austin A40

1959 Mini

1960 Corvair

1965 Renault 16

1969 Scimitar GTE

Unfortunately, -with rising speeds the minimal approach revealed its limitations, as passengers became increasingly aware of wind, dust, and mud. The nature of the protective bodywork to be supplied thus became of crucial aesthetic importance, and instrumental in determining the form it should take was the almost universal adoption of the front engine.

History is necessarily written in hindsight, but this can make it unfortunately prone to what I shall call the Darwinian fallacy. Thus, since most cars have had their engine at the front, and have been demonstrably superior to their predecessors, it is inferred that it is the engine position per se which is superior, and credit is given to those of the early manufacturers, such as Panhard, who adopted this layout for having the forsight to initiate a successful mutation. This irrespective of whether alternative layouts such as Lanchester*s were perceived as superior at the time.

The basis of my argument is somewhat different. I suggest that the front engine layout was successful (that is, widely adopted) for reasons not primarily technical at all. The most important feature of the front engine is its conspicuousness. In terms of the hierarchies I have been discussing this entails a two-fold advantage: not only is the hierarchy *power system1 made manifest, but it also appears in a position where it can fill the vacuum left by the departure of the horse. This endows it with considerable mythological importance.

The central focus of the mythos of Europe and America for decades had been the machine, and of machines possibly the most significant was the steam train. Now while there may be good practical reasons for placing the engine at the front of the train, this position is largely responsible for its image of power, and therefore its grip on the imagination. A train pushed by its engine lacks this iconic power, as indeed does any car which does not display the source of its motive power in pride of place.

This is not to suggest that man can live by myth alone. The early long distance races engendered cars whose engines were clearly too large to be located anywhere other than at the front, given the current state of dynamic theory. Where the mythos is evident is in the attitude to these cars: were they to be emulated or repressed? There was, of course, some

Man1s domination?

1802 Trevithick Steam Carriage
'Motor Accident in Naples!
A. Beltrame c. 1908

doubt about this, reflected in the suspension of races and in legislation, but the outcome was clear: man's domination over nature through the agency of the machine was soon accorded virtually teleological status. This was nowhere better expressed than in Marinetti's Futurist Manifesto:

> "4. We say that the world's magnificence has been enriched by a new beauty: the beauty of speed. A racing car whose hood is adorned with great pipes, like serpents of explosive breath - a roaring car that seems to ride on grapeshot - is more beautiful than the Victory of Samothrace.
>
> 5. We want to hymn the man at the wheel, who hurls the lance of his spirit across the Earth, along the circle of its orbit .....
>
> 11..... we will sing of the vibrant nightly fervour of arsenals and shipyards blazing with violent electric moons; greedy railway stations that devour smoke-plumed serpents; factories hung on clouds by the crooked lines of their smoke ..... deep-chested locomotives whose wheels paw the tracks like the hooves of enormous steel horses bridled by tubing " (3)

The institutionalisation of the front engine with passengers seated behind, and at the rear, petrol tank, luggage or spare wheel (of size equal to that of the four on which the car ran) can together be said to constitute the arrangement which distinguishes the automobile from the horseless carriage. What this arrangement in fact does is to create an image of the machine and of hierarchical thought. It was the power of this image which ensured the perpetuation of the design in preference to alternative arrangements, which have usually been distinguished by their ingenuity, superiority and economic failure. In 1911> Autocar considered the Lanchester to be the definitive solution for the motor car. S. C. H. Davis* autopsy has already been noted.

The orthodoxy was established by the turn of the century, and by 1910 there were few manufacturers who dared deviate from it. It had been arrived at somewhat piecemeal, the process conforming to Kuhn's characterisation of scientific revolutionary. That is, after an initial period of bewildering, almost random diversification, a paradigm was found: the 1901 Mercedes. I follow Kuhn's definition:

> "Their achievement was sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity. Simultaneously, it was sufficiently open-ended to leave all sorts of problems for the re-defined group of practitioners to resolve.

> Achievements that share these two characteristics I shall henceforth refer to as 'paradigms'." (4)

There followed a period of refinement which was to lead inevitably, but in easy stages, to a complete reversal of the mythos.

The task of the body designer before about 1914 was constrained by a number of factors beyond his control, the most important of these being the spot heights determined by the pre-existing chassis. This constraint applied not only to the autonomous coachbuilder to whom the car manufacturer supplied only a rolling chassis, but also to the *in-house' designer, since the chassis m s almost exclusively regarded not only literally as the foundation for the body, but as the essence of the car. This is a natural consequence of the hierarchical approach: the higher level (that which gives the car its autonomy) having precedence over the lower (that which shelters the occupants of car, coach, train alike).

There existed a number of constructional techniques which, potentially, could have reversed these priorities. The most notable of these was . employed on the Gordon Bennett Renault of 1905> with its semi-monocoque construction, but the tubular chassis of Stanley, Lanchester and others was also capable of altering the chassis/body relationship perceived at the time, in that it could have been developed into a semi space-frame structure, with all that this would have implied for body design. If it was not, this was for a number of powerful reasons concerning the deployment of the available technology and expertise. The coachbuilder, in the original sense, had been responsible for the entire vehicle. But the automobile implied, by its conjunction of mechanical and inert components, a division of responsibilities. The body might be constructed by the firm which also assembled the mechanical components, or it might be supplied by an outside firm of coachbuilders, but in any event there was a lesser or greater spatial dislocation between the two, and a use o different personnel and technologies. The hierarchical thought pattern of which the machine is the image leads inevitably to the division of labour and ultimately to mass production. In this way, technology engenders its own contradiction: ultimately, the process of increased fragmentation led to the integral body. But at first it necessarily worked against the unifying practices implicit in the space-frame or the monocoque.

Paradigm and possibility

1901 Mercedes
1905 GP Renault

"And if you make a transition by small steps from anything to its opposite you are more likely to escape detection than if you proceed by leaps and bounds."

Plato Phaedrus 262

Meanwhile, the greatest constraints upon the design of the body were not those of the body-building technology, but those inherent in the Platonic notion that the machinery constituted the substance of the car. Thus the body designer was confronted by a large number of spot heights determined by the machinery, and by the pre-existence of the radiator, and often of the running boards. It is important to note that a number of these constraints were in fact arbitrary, particularly the rake of the steering column, the height of the scuttle, and the shape of the radiator. Although there m s no mechanical justification for these, they were accorded the same deference as any other Engineering1 specification. Far from altering them in the interests of the body design, the body builders seemed to accept without question 'mechanical* authority and to allow its relationships to permeate their own contribution.

The shape of the radiator was indeed a special case. From the beginning it seems to have been considered a heraldic device. The running chassis, from a distance as anonymous as the mechanistic knight in armour, proclaimed its identity with this shield, and this identity was understood to remain intact whichever body-builder later cloaked it. As a totem, the radiator alone was placed above engineering influence. Thus, although the water pump was available by 1909 few manufacturers fitted it: the radiator they had already adopted m s large enough to cool by thermosyphon action alone. The refusal to fit the smaller radiator made possible by forced cooling wrould later be reiterated in the resistance to the diminution made possible by aerodynamic ducting. Making obstinacy a virtue, Mercedes-Benz and Rolls-Royce would suggest that their competence to meet the future be assessed by the size of their historic totem.

But although the shape of the radiator might be arbitrary, the use to which it was put wBs not. Whether circular, square, or octagonal, the radiator generated the section of the bonnet, and since the section of the passenger space was rectangular, the relationship between the two acquired a quasi-mechanical character. The bonnet became a length of tube, of whatever section, abutting the dashboard: the emphasis was thus on the integrity of the components, the cogs of the body machine.

The Renault/Panhard arrangement, on the other hand, by locating the radiator behind the bonnet allowed the latter to be formed by other

considerations, such as aerodynamic efficiency. By eliminating all vertical surfaces forward of the windscreen, the increase in section up to that point might be smoothly made. Insofar as this configuration was informed by the notion of the car as an indivisible entity and its concern was with the interface between that entity and the environment, it militated against the logical reductionism of the mythos. It lasted quite well, considering.

It is the emphasis on internal relations which distinguishes the products of the mechanistic mythos. Every level of the functional hierarchy is visually discrete. Parts are colour or texture-coded: the chassis, whether of wood or metal, distinguished from the suspension, and from the body; the cooling system made discrete; the wheels defined. But whereas this level of coding is susceptible of a more or less satisfactory rationalisation based on a notion of suitability of materials, the level of separation of individual panels is not.

McLellan (5) attempts such a technicist rationalisation, citing especially the difficulty, within the prevailing technology, of generating shapes of more than simple curvature. This argument, however, fails to explain why, given separate panels, it was felt necessary to emphasise their discreteness by painting their borders. Nor does it account for the common practice of ensuring the visual identity of 'special' panels, such as the bonnet, by the use of different materials or textures.

My point is that the mechanistic ideology which informed the design of the 'mechanical' branch of the hierarchy was carried over into the body shape, irrespective of constructional methods. Any possibility of ambiguity or homogeneity of shape was eliminated and every part securely located within the structural hierarchy.

The resemblance of orthodox body design to the machine was, then, a resemblance of organisation. But there are different forms of organisation, and by 1914 a few designers had begun to explore these.

Chapter 7

The mechanistic aesthetic which had informed practically all car design until around 1912 was replaced when production restarted in Post-War Europe by an aesthetic based on the smooth, flowing lines of organic shapes. This represented not 'merely* a change in 'fashion*, but a complete revolution in ideology. Unashamedly romantic, the European 'vintage* car embodied an appeal to the senses, to intuition, which today still evokes a passionate response in many people.

Most commentators agreee in finding the cause of all Post-War changes to car design in the War itself. S. C. H. Davis, for example:

> "After the First World War had ended, we entered a new era and everything in Europe seemed radically changed. All car manufacturers had learned a great deal about production from the intense supplying of war material. Time and motion study had ceased to be a theory and had become a necessity."

While it is true that war experience did have an effect, particularly on production methods, what I wish to show is that the actual shapes produced in large quantities after the War had in fact been designed before the War and depended upon a slow revolution in mythology that had begun as early as 1903 and was complete by 1913* The values generally adopted after the War were those essayed by classic designers six years earlier.

The problem with the mechanistic aesthetic was that, being concerned with internal relations, it was static, introspective. The geometry of the cylinder, the semi-circle, the ogee produced many designs of mathematical elegance, very shapely machines, but machines which bore no relation to forward movement. Marinetti writes of his car in terms which, in 1909> can refer only to its perceived function, not to its appearance:

> "They thought it was dead, my beautiful shark, but a caress from me was enough to revive it; and there it was, alive again, running on its powerful fins! "

It is not known to what make of car Marinetti refers; but is is extremely unlikely that it would embody, at that date, the marine imagery he uses here. The paradigm of the car was at that period a visual symbol of classic thought. Marinetti's response is romantic, and indicates alternative definitions of the relation between substance and form. It is a measure of the extent of the conceptual revolution which subsequently

occurred that car designers came to accept Marinetti's formulation.

The precipitating factor was wind resistance, and its manifestation two-fold. First, the problem of protecting the occupants of an open car from dust, mud and rain was, literally, a pressing one; secondly, measures typically taken to alleviate this problem (such as the provision of an enormous, vertical 'windscreen*) themselves gave rise to additional wind resistance which impeded the motion of the whole vehicle. The higher the speed, the more acute became this second problem.

There were three major approaches to the problem of protecting the occupants of the open car. One was to ignore it, leaving them totally exposed upon the chassis. The second was to provide an engine whose cross-sectional area approximated to that of the passengers and therefore provided shelter in its wake. The third, and most common, since the projected frontal area of the passengers usually exceeded that of the engine, was to provide a vertical windscreen. It is significant that windscreens remained vertical long after the recognition that a sloping one would in fact reduce wind resistance. The explanation lies in the mechanistic aesthetic which, being concerned with internal relationships and the shapes of classical geometry, considered the relation of bonnet section to vertical plane and vertical line to circular wheel of greater importance than the external relationship to the environment, In their concern with the appearance rather than the reality of classic design, such designers were unable to tackle the more fundamental problem of the wind resistance of the total vehicle.

Designers in search of higher speeds, however, were forced by pressure of aerodynamic necessity to attempt a solution, and in this they followed two main strategies. The first may be termed the common-sense approach: reduce wind resistance by reducing frontal area. Clearly, other things being equal, the smaller the car the less resistance it offers. This approach generated a number of ingenious designs. In the Prince Henry Trials, for example, the regulations were clearly formulated on the assumption of the mechanistic aesthetic. Thus the r.ear seat was to be four inches higher than the front seat; and minimum restrictions were placed upon body width. Nevertheless, once it was realised that body width was measured at the top of the body, the possibility occurred of reducing the width lower down. The subsequent 'tulip body* was as narrow as possible at the base, then flared out to regulation width.

'Other things being equal'

1909 Vauxhall KN
1913 Ricotti Torpedo

to

Porsche*s design for the -winning Austro-Daimler of 1910 was of this configuration.

V/here restrictive regulations did not apply, body width could he reduced by staggering the seats; but the reduction in frontal area approach would obviously reach its ultimate in the design of the single-seater. The existence of the Brooklands track led to a whole school of British single-seater designs based on this strategy, but once these designers had reduced the width of the body to that of the driver, further reduction was impossible.

The alternative method of reducing frontal area, that of reducing the height of the car, was never generally adopted for a number of reasons. Firstly, the long-stroke engine dictated by contemporary metallurgy was of such a height, in a car of any power, that it often reached to the shoulders of a driver sitting upright. There was thus no point in adopting a reclining driving position; also steering geometry demanded that the driver be in a position to exert maximum leverage. The state of the roads and even of the tracks, prevented the floor of the car being brought too near the ground, for fear of bottoming; though even when surfaces improved the use of the underslung chassis was a rarity. But another reason for adopting a generous ground clearance was ignorance of the behaviour of the airflow under the car, which ignorance has persisted until the present.

The common-sense reduction of frontal area approach accepted the proviso of *other things being equal*. The alternative, aerodynamic approach sought to investigate the reason why other things rarely were equal. The former approach was concerned simply with scale, the latter with efficiency.

The primary tool in the search for aerodynamic efficiency is the wind tunnel, and by 1910 these had been constructed in almost every country in Europe, the best-known being those of Eiffel, Parseval, and Zeppelin. The last two were concerned particularly with the behaviour of airships and since this is the simplest case (the symmetrical body totally immersed in the medium) they were the first to produce results. Zeppelin established the ideal form for the airship as being of circular cross-section and lenticular profile, having a length: diameter ratio of 6:1 with maximum diameter occurring at 1/3 length. Or, as C.C. Turner put it, rather more succinctly;

"Pure streamlined form is, roughly speaking, pearshaped, the blunt end foremost." wJ

This form represented the optimum compromise between two different considerations: form, or profile, drag and skin friction. Profile drag is the resistance which results from the disturbance of the airflow as it follows, more or less easily, the contours of the body. It is mitigated if the body be of infinite length, when pressure changes may be infinitely graduated. However, the actual surface area of the body, and its texture, exposed to the airflow also present resistance to the air in immediate contact (the boundary layer), and this militates against the infinite length approach. The 6:1 ratio was a useful compromise since it also met another requirement, that of directional controllability. This is influenced by the sectional density of the body $\left(\frac{\text{length}}{\text{projected frontal area}}\right)$, for which 6:1 answered satisfactorily.

Now airship research was invested by a number of governments in their naval services. This may seem paradoxical, but in fact hydro-dynamics was an established branch of naval research. More paradoxical was the fact that this science was based on the 18th century theories of the land-locked Swiss, Bernoulli. Anyway what was good for the airship was also good for the torpedo, and this conjunction of the aerial and the marine was to have far-reaching effects on motor car design.

Aerodynamics had less relevance, paradoxically, to aircraft design. This m s because the requirement for controllability in all directions was at least as important as maximum speed, and posed problems far more difficult to resolve. Thus, although Nieuport demonstrated in 1910 that a monoplane needed only 50 b.h.p. to achieve 80 m.p.h., the biplane remained the most popular configuration throughout the War. Its lower efficiency (80 b.h.p. for 85 m.p.h. for the 1914 Bristol Baby Scout, for example: similar to Porsche*s 1910 Austro-Daimler) was more than compensated by its agility and rate of climb. Indeed, the most successful design of the War was the triplane, initiated by Sopwith and copied by Fokker, which traded off even greater skin friction against increased lifting area. Empiricism rather than science seems to have guided the design of aircraft of the period - though some, such as the HE8, showed evidence of neither.

The car, similarly, posed problems far more difficult of solution than those associated with the airship. The first to be recognised, and the

last to be solved, derived from the fact that the car is simultaneously in contact with both air and ground; air movements between car and ground could not be created in the wind tunnel. A second problem flow'ed from this, which was that the car was in fact propelled by wheels which, when in motion, created their own airflow: this too could not be re-created in the wind tunnel. The pragmatic solution adopted was to keep both wheels and ground well away from the body and hope for the best.

There remained the upper surfaces of the body, and it was in the design of these that the nautical influence was first felt, for here aerodynamics confirmed what intuition already recognised: the efficiency of organic form. Whatever they might pretend above the water-line, boat builders knew that shapes which move through water must be shaped like fish. At high speeds the resistance of air approaches that of water; from which it follows that fast cars too should be pisciform.

Curiously, marine and automobile architecture had passed, like ships in the night. The motive power that had made possible the automobile had also freed ship designers from their ancient constraints. Relieved at a stroke, as it were, of the necessity to see which way the wind blew, they raised up in the form of their colossal vertical superstruetures, an altar to the machine. D. H. Lawrence confessed to the fish "Your god is other than my god." But the builders of the steam-ships served two masters: one above and one below the water-line. They thus lost claim to that organic integrity which has always been the prerogative of the small boat; and it was to the skiff and barchetta rather than to the Dreadnought or Ironside that car designers turned for inspiration.

To see the substitution of organic for mechanistic models as *1*fashion* is to miss the importance of the ideological change. To see the car as an entity, an organism, rather than a collection of mechanical components is to achieve a shift in perspective similar to that now painfully occurring in western medecine. This discipline has retained a mechanistic model longer than any other (except experimental psychology) and. because it concerns itself with separate branches of the hierarchy and their internal relations, has been unable to comprehend the higher reaches of the hierarchy necessary to explain, for example, psychosomatic* illness - the coining of which term recognises the involvement of two 1separate* branches of the hierarch}^. The organic paradigm accepts that the whole is more than the sum of its parts.

La Jamais Contente'

The car designers who found it easiest to reject the mechanistic model were those to whom it was in any case peripheral: the designers of electric cars. Both McLuhan [4] and Koestler , jn their different ways, have indicated the difference in the thought processes necessary for dealing with, respectively, machinery and electricity. Machinery confirms a belief in causality: it is the model of logical, rational, classic thought. But electricity reveals the limitations of this perspective, demanding a grasp of simultaneity, of totality, of a universe where causes may be preceded by their effects.

At 60 m.p.h., according to the mechanistic mythology, a driver*s lungs would explode, or maybe, implode. Anyway, it would be very nasty. Perhaps Jenatzy*s lungs were sustained by his faith in electricity; certainly the body of ,Jamais Contente* gave little credence to the mechanistic mythology. At 5*5*1 its length/diameter ratio intuitively approximated the ideal soon to be scientifically established. It was a torpedo on wheels. The torpedo body stood, however, in curious relation to the clearly mechanical chassis and suspension.

McLellan considers that:

> Mthe disregard of such *substructure* as the exposed driver and undercarriage is reminiscent of the marine architect*s willingness to accept much additional drag above the waterline through ignorance of the properties of air.”

Any marine architect ignorant of the properties of air should have been made to drive *Jamais Contente*. What this design states, more strikingly than any other, is the curious multi-media nature of the car. The paradox of the flightless bird or the fish with feet, which has underlain designers* glosses ever since, is here starkly evident in 1899*

%

The Baker Electric Torpedo 999 of 1903 also enjoyed the privilege, common to all electric cars, of not having to admit the airflow to the interior of the body. The hermetic nature of the electric car both suggests and facilitates the adoption of organic models, and may usefully be contrasted with Henry Ford*s 999 of 1902. This, a stripped chassis, was devoid of all panelling and was a statement of faith in the naked power of the machine. In the ideological struggle, Ford was of course on the winning side; and domination rather than identification was to mark America*s relation to nature thenceforth.

That the adoption of machine iconography was a matter of myth rather than

of performance is clear from the policies of the Stanley Steam Company. Following the lead of Baker, they adopted the marine model for their record car of 1906, and established a record speed of 121 m.p.h. Yet the design of their cars for private sale was conservative even by American standards. The White Steam car went even further, however, in adopting the inappropriate iconography of the internal combustion engine: its boiler masqueraded as a petrol tank while its condenser mimicked the conventional radiator. Both makes achieved respectability by apeing the forms of an arguably inferior technology. But customers expected a car to look like a car, not like a fish.

What the record cars had demonstrated was that the smoothness of organic form, whether derived first-hand from the fish or second-hand from the boat, bestowed greater aerodynamic efficiency, and because efficiency applies regardless of scale, this suggested possibilities in those cases where reduction of frontal area was either impossible or insufficient. The change was, however, made gradually, and since most designers were besotted by the mechanistic aesthetic, the piece-meal adoption of organic form gave rise to several problems.

Not that the mechanistic aesthetic was without its own problems. These centred on the section change from bonnet to passenger space. The more conceptually clear this was, the worse it seemed to be aerodynamically. This therefore was the area where designers first tried to achieve the smooth transition characteristic of organic form. The 1908 GP Mercedes illustrates the uneasy compromise achieved by such a collision of aesthetics, and the term *scuttle* coined to describe the resultant shape indicates its incongruity. The idea of the scuttle was that a shape of smaller frontal area than the passengers might deflect the airflow round them, if it were of appropriate shape. However, two requirements of the 'appropriate* shape militated against a mechanistic form. One was that, if maximum benefit were to be derived from it, the scuttle should wrap round the sides of the passengers; that is, should present a smooth, homogeneous contour from all elevations. The other was that any shape which deflected the airstream drew attention to the relationship between what was internal to the car and what was external. In the period 1908-1914 the design of the scuttle was to exercise the same compulsive hold over designers as that of the male torso had over Greek sculptors of the fourth century B.C. For what was apparently a fairly simple geometrical problem became the testing ground for a whole ideology.

1908 GP Mercedes

This is a sports version of the production 25 hp SPA, fitted with a special two-seater body. A large clock stands out on the dashboard, and the spark and carburation controls are on the steering wheel. The car belongs to the director of Le Meats museum, Bernard de Lassee.

their front and rear sections almost a replica of each other, are divided by a tiny running board.

The big main headlamps are acetylene, with the gas generator on the right hand running board, and there are also two small oil lamps. Bernard de Lassee has

The machine was the icon of classical thought, and the machine aesthetic enshrined this concept of the machine as the repository of social values. But now classical thought had produced a range of shapes which bore no relation whatever to the machine. How could they be incorporated into the existing iconography?

The answer was, that they could not. By 1912 Austro-Daimler and Hispano-Suiza had abandoned the machine aesthetic, as did Peugeot, Spa and Zust the following year. Their solution was the *torpedo1, which title makes clear the cutaneous nature of the model employed, and its form was deceptively simple. The radiator was raised, thus allowing an un-broken bonnet line straight back to the windscreen. The change in width of the body was accomplished as gradually as possible by means of a tapering bonnet. The essential thing was the sense of continuity of the car as an entity, a holon, rather than an assemblage. In this sense, a number of so-called torpedoes, such as the Fisher (ironically enough), are dis-qualified since they retained visual boundaries between bonnet and scuxtle. Yet the alacrity with which the name, if not the subtlety of form, was adopted is a measure of the frustration felt at the internal contradictions of the ,old* machine aesthetic. From the speed with which the organic aesthetic took hold during 1912 and 1913 it is clear that, but for the intervention of the War, it would have been general earlier than 1919 and that it can in no way be explained by the War.

There is one curious aspect to the problem of section-change over which designers agonised for so long; which is that a simple and elegant solution had been devised in 1909 hy Rolland-Pilain and universally ignored. The Rolland-Pilain was not itself a torpedo, since it retained a pro-nounced scuttle and visual boundaries to the bonnet, but its chassis tapered in plan, thus allowing the section change to be accomplished more gradually. Other advantages were that the chassis was narrow at the front, to the advantage of engine mounting and steering lock, and widest when the sides of the passenger compartment could be bolted directly to it. The parallel chassis involves compromise between these conflicting requirements. It is difficult to understand why the Pilain should have been thus ignored. Pressed steel side-members had been introduced by Mercedes and Darracq in 1901 and were almost universal within five years, so there was no technical obstacle. The tapered frame might have been marginally more expensive, but this would be offset by the reduction in the number of mounting plates and lugs necessary. One can appreciate

that subscribers to the machine aesthetic would be more resistant to its attractions, but it is strange that designers of torpedoes did not embrace it more enthusiastically.

Although the straight, tapered bonnet of these torpedoes represented a breaking of the machine aesthetic, it did not constitute the complete revolution. This was not fully accomplished until the entire car acknowledged organic form: when the back of the car became the tail and the mudguards became the wings. Duck- and boat-tail solutions, such as Spa's of 1913> continued the horizontal line of the bonnet straight through the body sides then gently curved it, either in or down, or both, to reach either a point or a vertical arris at the extreme tail. In either case the entire profile of the car was now bounded by a smooth, continuous line, of which William Blake would have approved.

Popular, however, was an alternative arrangement which, for pragmatic reasons, retained the machine aesthetic in rear elevation and which was saved from incongruity only by the mediation of the wing. In this arrangement the body was abruptly terminated by a flat panel immediately behind the seats. This served as a convenient mounting point for hood, spare wheel, petrol tank or luggage carrier. It was the designers* equivalent of the attic, where anything could be stored, and did overcome the practical disadvantages associated with the more organic tails.

Crucial to all, however, was the wing. Under the machine aesthetic, the mudguards, like all other components, had been treated as visually discrete. Therefore, even if they were formed with regard to their environmental function (which often they were not, their mere presence being deemed sufficient) they were isolated. On the Darracq Type N of 1901, for example, the front mudguards are clearly intended to deflect mud or dust sideways, yet the valences which support them are as unobtrusive as possible, giving them the appearance of being free-floating. Front and rear mudguards, together with running board were often visually continuous, a sub-system; but their relations were internal, being based on geometrical notions such as symmetry, rather than external. As fitted to the Hispano and Spa, such mudguards are clearly alien to the aesthetic which has tried to integrate all other parts of the car.

The solution, adopted by Peugeot, Zust and Austro-Daimler, was to relate the flowing curves of the wings to the horizontal of the bonnet in such

V 'The nature of the divine'?

a way as to maximise the implication of forward movement implicit in both. The torpedo was incomplete without the wave, which rolled over the rear wheel, swept down beneath the doors, then rose still higher to break over and in front of the front wlieels.

This truly was the new paradigm: the subtle, assymmetric curve was also capable of suggesting swelling musculature; balanced against the arrow-straight line of the bonnet, supple curves could suggest a whole range of organic imagery. Perhaps most important was that the swelling, muscular curve could finally exorcise the ghost of the missing horse. A whole new mythology became possible. As Plato put it:

> "The natural function of the wing is to soar upwards and carry that which is heavy up to the place where dwells the race of the gods. More than any other thing which pertains to the body it partakes of the nature of the divine." w)

The power of the cutaneous model, first proposed by the classic procedure of the record-breakers, was to sweep European designers along on a tide of romanticism that subsided only in the mid-Atlantic of the 1950s.

It was all, of course, a beautiful lie, but the hard-headed would-be iconoclasts, like Voisin in the 1920s and the Germans in the 1930s, would find that like every myth it was soon surrounded by taboos, regulations, and formulae erected for its protection. Also like every myth it incorporated resilient intuitive truths which proved immune to scientific attack.

By 1919 the machine aesthetic had virtually disappeared from Europe. The whole ideology of domination over nature through the agency of the machine had been too painfully experienced by too many people for it to be revived to challenge the more benign iconography of organic form.

In America, however, faith in the machine vas undaunted. More than any other country, the U.S.A. owed its prosperity and its mythology to the machine systems which it had created. Mass production is commonly supposed to have originated in the American armaments industry, and certainly the interchangeability of parts made the Colt more useful than it would otherwise have been. But mass production had been started even earlier than that: in the Connecticut clock-making industry. Although these clocks were made of wood, all the processes later to be so profitably employed in steel-based industries were in evidence, and the same benefits

- scale of production, low unit costs, interchangeability of parts, use of semi-skilled labour - were enjoyed by the manufacturers. Undoubtedly, however, the application of these processes to weaponry represented a major technological advance, and demonstrated the possibility of almost unlimited expansion of the steel-based industries.

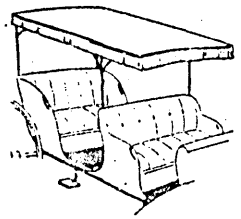
Ford*s Model T therefore had dual significance: not only was it the machine that gave Americans mobility, but it was itself the product of a machine system, and it looked it. It was clearly an assemblage of interchangeable parts. But if the Model T itself became a figure of mythology, it in no way countermanded the major figure in the American pantheon, the railroad engine. Between them these two machines offered a mobility, and a demonstration that culture resides in technology, that consigned the horse to the leisure role.

Therefore, although American steam and electric cars revealed the aerodynamic superiority of organic form, they were iconographically related to the very nature-in-the-raw which Americans were busy subjugating. Even the model T and Oldsmobile Curved Dash because they were physically and visually light, were too insect-like, too animated for the developed machine aesthetic. American designs grew progressively heavier, always emphasising mass rather than void. Even the sports cars such as the Stutz and Mercer emphasised heavy, static internal relations, rather than suggesting fluent forward motion. Individual items such as wheels tended to visually be heavy, using wooden rather than wire spokes; and even when wire was used heavy hubcaps destroyed any sense of insect lightness.

The emphasis on mass extended to the terminology. While European designers were soaring on wings of fancy, the Americans were building fenders: big, solid bulwarks. Everybody could grow up to be an engine driver.

This mechanistic ideal survived the introduction of the pressed steel body. Although in theory one of the major advantages of pressing technology was the ability to handle larger sheets and thus create continuity of shape, Dodge retained forms such as the discrete, rising scuttle well into the 1920s. Budd was pressed into the service of the machine aesthetic. Even when apparently organic details were employed, such as the concavely-faired headlights of the 1915 Pierce-Arrow 48 Roadster, they were mechanistically related to the other volumes. Pierce-Arrow in fact retained what was virtually a carriage body.

TURRET TOP
Body by Fisher

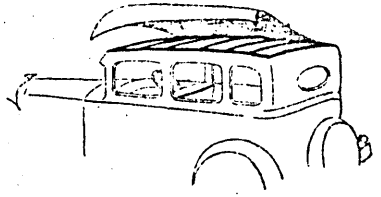


The motor car industry in America grew out of the old-time carriage business—and up until 1935 the construction of the tops on motor car bodies bore a general family resemblance to the old time horse drawn surrey.

The tops on these old-time surreys, as some of you may recall, were canopies of fabric stretched over slats, light in weight and lightly supported. Then to protect the passengers from side winds, carrying rain and snow, the spaces between the slender top supports were filled in with detachable weather-proof curtains.

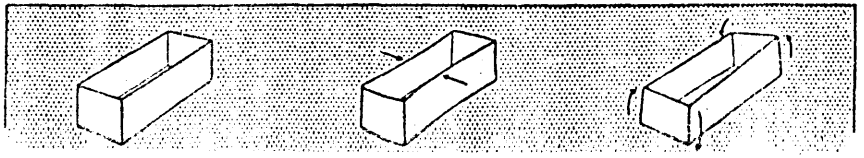
In spite of the fact that a long road has been traveled from the old fashioned surrey to the modern motor car, the tops of closed bodies have, up until this year, remained fabric supported by slats or wire mesh screen, the front, sides and back forming what might be described as a fence-like structure similar to a box without a top and without any bottom either for that matter, because the loose floor added little or no strength and rigidity.

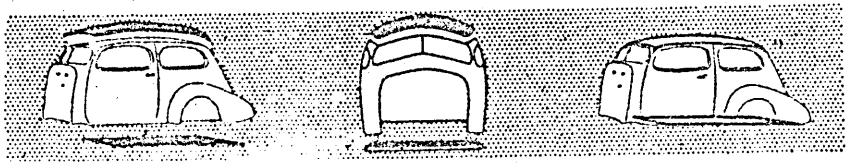
Now if we take a box—just any kind of ordinary box—and remove the top and the bottom, it doesn't take much force to twist or bend it



out of shape—no matter how carefully the ends and sides are fastened together.

So in the usual type of body construction with fabric top and loose floor boards it has always been a problem to get the body sufficiently strong to resist the weaving and





twisting action which tended to cause annoying squeaks -also bad fitting doors—too tight or too loose and rattly, due to distortions in the door frames.

Now the advantages of covering the top with solid steel have long been recognized, not only by body engineers but by the motoring public. There was really nothing new in the idea but such an innovation demanded important revisions in manufacturing processes and equipment.

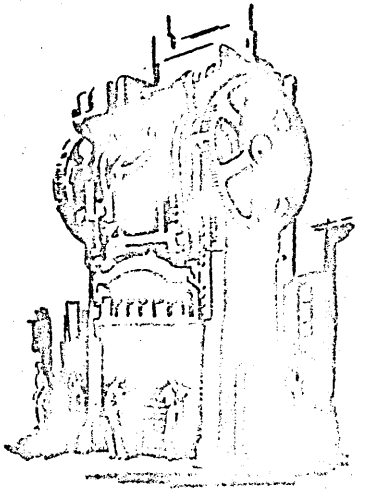
This involved, among other things, the building of special presses designed for this specific purpose and which are probably the largest and most powerful presses in the whole world today.

So in these new "Turret Top" bodies by Fisher, a dome shaped lid accurately formed by these giant presses is electrically welded into place.

To complete the armored structure, a steel sub-floor is welded to the bottom edge of the body. This might be called a "Double Bottom".

Thus, the topless and bottomless box which was little more than just a "fence" around the passengers has now been transformed into a rigid, one piece unit, shaped and reinforced to provide maximum strength, durability, safety and beauty in your new car.

These new "Turret Top" bodies by Fisher are scientifically insulated. The inside ceiling is lined with heavy corrugated felt. The flooring is covered with a layer of heavy jute. This not only provides added protection against heat and cold but reduces rumble, drum and rattle to the minimum. To seal out the noise and heat of the engine, the dash is insulated with felt and lined with fiber board deadener.



Where pressing did assist the furthering of the American ideal was when used for the roof and fenders. The 'turret top' made possible a rigid structure on a larger scale than hitherto; the car could become a mobile Fortress America. The fenders too could become even more deeply flanged, more clearly three-dimensional. America thus arrived at the bulky envelope body of the 1930s by a process of steady development: Europe required another revolution.

Although American and European reactions to the shapes postulated by the aerodynamicists were in one sense so different, in another they were identical. Organic form was the outcome of classic procedures which concentrated on aspects of substance rather than of surface appearance, yet the reaction to it in both continents was purely romantic. Thus the Americans rejected it in favour of their mechanical mythos, while European designers seized on the symbolic possibilities of organic form at the expense of the aerodynamic performance which had motivated it. This clash between classic and romantic reactions to organic form became most evident in the European Grands Prix of 1922-24.

Chapter 8

> "What you've got here, really, are two realities, one of immediate artistic appearance, and one of underlying scientific explanation, and they don't match and they don't fit and they don't really have much of anything to do with each other. That's quite a situation. You might say there's a little problem there."
>
> Robert M. Pirsig

> "For sight is the sharpest of the physical senses, though wisdom is not seen by it ....."
>
> Plato

By 1922 organic form had become the focus of the European mythos, and it was for this reason that body design was not dramatically affected by the events on the race tracks in that and the following two years. Organic form offered the possibility of a synthesis between rationality and intuition and it was faith in this possibility which motivated the rejection of superior alternatives postulated by the aerodynamicists.

The 1922 Grand Prix at Strasbourg was important as the testing ground of a number of aerodynamic approaches. Bugatti and Ballot both ran cars of circular cross-section and more or less lenticular longitudinal section which were clearly based on the early Zeppelin studies. They satisfied the requirements neither of any conceivable aesthetic nor of rationality, being designed in ignorance of the later work at Freidrichshafen and, in the case of the Bugatti, cobbled up the day before the race. Both treated the body as an entity separate from the chassis and wheels, after the manner of Jenatzy, thus making explicit the discrepancy between airship and car. The Rolland-Pilain used a long tapering tail similar to that introduced by Duesenberg the previous year; this was clearly intended to maintain attached airflow for as long as possible.

But nothing succeeds like success, and it was the configuration of the winning Fiat 804 which confirmed the faith in the conjunction of classic and romantic made possible by the use of organic form. It was however essentially a compromise, albeit a convincing one, between the various requirements of streamline form, minimal frontal area (neglected somewhat by Bugatti and totally by Ballot) and conformity to the chassis. The solution was to achieve 'streamline* form in plan view only. Vertical bonnet and body sides, which rose more or less directly from the chassis, kept the frontal area down, after the manner of The Brooklands cars. It was because it so nearly met the conflicting requirements of reason

1925 Voisin

Fiats 804 and 805

and of intuition that it appeared to effect a synthesis, and success was proof.

Running in the production car category, however, were the cars of Voisin, which owed nothing to romanticism. Voisin was one of the first aerodynamicists. He had made the first flight officially observed to be under full control, and the theory which informed this was also able to demonstrate that the first *flight* by the Wright brothers, using their small engine, could only have been an assisted glide. He was a theoretician, a classic thinker, and addressed the three problems of ground effect, wheel effect, and lift in a straightforward manner. Ground effect he reduced by designing the cars to skim as closely as possible to the ground, in contrast to the conventional approach, and thereby also reduced effective frontal area. Wheel effect was reduced by a body which, wedge-shaped in plan, enveloped the rear wheels. Lift was reduced again by the inorganic wedge profile; from the cockpit back the car followed a simple arc down to meet the flat floor.

So effective was this classic, inorganic configuration that not only did Voisins take the first three places in their category, but the organisers prohibited the use of *streamlining* in this category in future as it conferred fan unfair advantage*. The terminology reflects the confusion: Voisin*s were among the few cars which did not intuitively adopt the organic form to which *streamlining* refers.

But he knew what they meant. The following year, undeterred, he entered his cars in the racing car category where they were hopelessly underpowered. Nevertheless, the winning Sunbeam, which enjoyed a 57% advantage in power, managed only a 19% superiority in speed over the leading Voisin. Voisin*s cars were comparatively underpowered owing to his espousal of sleeve valves: a decision taken on two grounds not normally considered in racing car design - silence and economy. "Of all the sensations experienced by the human organism, noise is by far the most upsetting", he said, revealing a sensibility rare amongst car designers. Economy he achieved not only through thermal and aerodynamic efficiency, but also by low weight: the monocoque body of the Tours cars weighed only 84 lbs. For what Voisin sought was efficiency, and efficiency is concerned with relationships rather than absolutes, a fact from which the higher absolute speed of the winning Sunbeam (and the even higher speed of the Fiat 805, which retired) distracted attention. Nevertheless Voisin*s offer of

1923 Grand Prix .Bugatti

1921 Rumpler Tropfenwagen

500,000 francs for any design of greater efficiency was never claimed.

Also in search of aerodynamic efficiency at least was Bugatti. Radically different from his design of the previous year the 1923 Tours 'Tank* revealed a greater familiarity with the more recent, if not the current work of Jaray, chief aerodynamicist for Zeppelin from 1914-1925* Ground effect was reduced by the use of an underslung chassis, while the airflow was directed over rather than round the aerofoil-section, flat-sided body. 'The Motor1 described these cars as 'nightmarish 'monsters1, and the drivers must have agreed, for they suffered from handling peculiarities which were then attributed to their very short wheelbase, but which were more probably caused by excessive lift over the body. In 1922, Jaray had written an article in *Der Motorwagen* entitled 'The streamlined car, a new form of automobile body* which had advocated this body shape, but with the crucial difference that it was applied to a saloon car. Fitted with a roof the Bugatti would certainly have behaved differently.

More directly involved in racing car design was the aerodynamicist Prandtl. He had worked before the War for Parseval, and after at Gottingen University. He assisted Rumpler, himself an aircraft designer, on his 'Tropfenwagen* saloon car of 1921 and on his racing car of the same name of the following year. The design for the latter was bought by Benz and raced under their name in 1923* For the saloon, they adopted the opposite approach to that of Jaray, directing the air round the sides of the car, while the racing car was of almost circular cross-section. Both owed their configuration to Prandtl*s belief in the superiority of the rear engine. Thus the saloon employed forward control, behind a curved windscreen; while the racing car, similarly hermetic at the front, mounted its heat-exchanger neatly on the tail of the body. The main difference between the two was the use of an underslung chassis for the racing car which thereby achieved full expression of the aerodynamic form towards which Bugatti and Ballot had groped the previous year. The Rumpler-Benz in fact, by virtue of its rear engine, defined exactly the configuration adopted a decade later by Auto-Union. If the Benz engine had performed better at Monza in 1923 the history of car design might have been different.

But it did not; and the Fiat 805 which had promised so well at Tours won convincingly. This it did by virtue of the superiority of its supercharged engine, which superiority was extended by association to its bodyshape.

1924 Bugatti Type 35

1922/23 Benz Tropfenwagen GP

For not only was this engine deservedly emulated, for good rational reasons, for a decade; but so also, for more dubious reasons, was its shape. By 1924 the aerodynamic shapes of Voisin, Rumpler and Bugatti had disappeared from the race tracks. Bugatti, always just out of touch with scientific aerodynamics, put his faith instead in intuition: drawing on his love and knowledge of horses, he adopted the motif of the *horse-shoe* radiator and created his *utterly beautiful* Type 35* This car has exerted an unparalleled influence on subsequent body designers; it followed, but refined, the model provided by the Fiat and in so doing achieved "a level of aesthetic sublimity which has seldom been equalled and perhaps never surpassed". Since any aesthetic presupposes an ideology, such a judgement seems to imply either that one ideology is superior to others, or that Bugatti achieved some kind of transcendental synthesis.

I have tried to indicate the recent history of two rival ideologies, and to show that Bugatti!s conceptual shift was occasioned by failure, not of the ideology, but of his own knowledge. What Voisin and Rumpler succeeded in doing was presenting a redefinition of the car which, as it transpired, was socially unacceptable and which could not be authenti-cated by victory. At the centre of their redefinition of the car was a redefinition of human values.

By a process of classic thought, Rumpler defined the car as comprising only two hierarchical strands: body and wheels. The driver was embedded within technology, the source of motive power behind him. Voisin too identified two branches: body and front wheels, while Chenard-Walker in 1925 followed Bugatti*s 1923 postulation of a single projectile. In each case the driver was subordinate, an unwelcome source of aero-dynamic drag. Even the car itself was a drag, a physical encumbrance in the pursuit of an aerodynamic nirvana.

In the T35> as in the Fiat 805, and the succeeding Alfa Romeo P2, the driver was clearly visible, exercising by muscular effort of arms and shoulders control over his lithe, graceful mount. Rumpler*s was a cerebral vision: only the top of the driver*s head was visible. For the Americans (except Duesenberg), the driver dominated nature through the agency of the machine which he controlled. But for Bugatti both man and car were visibly organic: the driver a centaur, a little lower than the angels. Beside such a vision, the superior aerodynamics of Voisin and Rumpler cut no ice at all.

Although Bugatti followed the general model of the Fiat he departed from it in a number of subtle respects; and it is on these subtleties that he demands aesthetic respect.

The Fiat, in profile, consisted essentially of a rectangle, to which were related the front wheel (centred at the bottom front corner) and the rear wheel (centred inside the bottom rear corner). The driver was clearly visible above. Bugatti, however, while retaining the vertical boundaries and even the bottom horizontal within the wheelbase, curved the top contour gently up to the scuttle, then down again behind the driver; the bottom of the tail followed a similar curve. This shape connotes two things which the Fiat does not. First, the car rather than being a box for the driver becomes a supple beam with the driver mounted at the thickest point: that is, it has structural connotations. Secondly, the curves suggest a more organic shape and this is borne out bythe curves in front elevation and by the location of thefront wheels. These are centred above and in front of the front bottomarris of the body; the car therefore appears to be crouched between them, like a cat ready to spring. The relation between tyre and cat*s paw is one often exploited by tyre advertisements, and depends upon similarities of colour, texture and function. By emphasising this the Bugatti implicitly acquires the grace, agility and aggressiveness of the cat. Its shape has therefore, by its identification with nature, a romantic validity. By comparison, the Fiat is boxy and awkward - graceful only in plan.

But the suggestion of aesthetic sublimity requires more than this, suggest a synthesis of romantic and classic.

> "The classic style is straightforward, unadorned, unemotional and carefully proportioned. Its purpose is notto inspire emotionally but to bring order out of chaos andto make the unknown known."

This is an excellent characterisation of Voisin*s designs, and even of Bugatti*s mechanical design. Such details as the brake drums cast integrally with the eight-spoked wheels, or the proportions of the chassis beam depend exactly upon a redefinition of the hierarchies in such a way that the world becomes more elegantly comprehensible. It appears at first sight however to have little to do with his body design.

The crutial phrase is *carefully proportioned*. While Rumpler and Voisin carefully determined the proportions of their cars for a specific, aerodynamic, purpose Bugatti*s T35 is carefully proportioned for no reason

other than a faith in the aesthetic justification of proportion.

Thus, the top contour is determined by a 33° arc which describes the curve of the tail and passes through the highest points of both scuttle and radiator. A 33° arc of a similar circle describes the bottom curve of the tail and passes through the front wheel centres. The relationship of the overall length of the car to the radius of these describing circles closely approximates to the Golden Section. The Golden Section also determines, in side elevation, the proportion of bonnet side to overall height and of depth of louvre to bonnet side. The distance from the leading edge of the front tyre to the highest point of the scuttle is the same as from the front of the bonnet to the driver1s head and the same as from the scuttle to the extreme tail. The highest point of the car, the top of the scuttle, thus occurs exactly at half length, while the driver sits in a *rocking couple* of similar and crucial dimensions. That is, by including the driver in the mathematical scheme Bugatti aligns himself with the architects not of the Renaissance but of the Baroque. Without the driver, the car is incomplete. This may be one reason why it is considered so inviting to drive.

It is because it combines an internal system of mathematical proportions with an exciting iconography of external references that the T35 represents a synthesis of classic and romantic thought. Yet in other respects the relation between the two modes becomes schizophrenic. For example, the carefully proportioned side-members are concealed behind a skirt perforated with non-functional louvres. Derived from the gill3 of a fish, the louvre attains what validity it may from an intuitive perception of the likely airflow through the engine cooling system. As a totem to decorate superfluous metal it not only loses its own romantic validity, but also prevents appreciation of the classic shape of the chassis. It must have worried Bugatti too, for he dispensed with it for the T59*

It is for this reason that the 59 represents an even clearer, and simpler, synthesis between the two modes. Everything is pared down, most of the references stripped away. The classic shape of the chassis can be clearly seen, and the body follows it exactly. The wdiole car appears an immensly strong yet breathing beam, its suppleness measured against the strong horizontal of the exhaust pipe. Simpler, more straightforward, that is more classic than the 35, it nevertheless connotes even greater animal

power and speed.

The influence which racing car aesthetics have had on production aesthetics has varied according to a number of factors. One of these is relevance: the notions which inform the purpose built monoposto grand prix car may be quite inapplicable to the current market. The Bugatti 35 was a two seater designed for quantity production. But perhaps the most important factor is success. The Fiat 804 and 805 established, by their success, the relevance of organic form; the Bugatti 35 refined this form and went on to achieve unprecedented racing success. It must have been seen by more people than any other racing car, and if its mathematical subtleties of form were only dimly perceived and rarely emulated, its clear vision of man in harmony with nature, its theme of subtle, supple, organic curves formed a paradigm for car designers for decades. And although the 59 attained an even greater aesthetic coherence, it would not be so well remembered, for it was soon to be overtaken by a tide of events which paid little heed to the humanist values it embodied.

If the Bugatti represented the quintessence of the vintage car, a status enhanced by its racing success, the Auto-Union encapsulated the technocratic revolution which displaced the romantic organic paradigm, first on the race track and, later, in the market place.

Although Mercedes-Benz were generally more successful in the period 1934 - 39 it was Auto-Union who most offensively challenged the identification of the intuitive and the rational. Compared to the Bugatti 59 the Auto-Union was an affront to the sensibilities. Mercedes-Benz did at least have the grace (1) to put the engine where it belonged and thereby escaped some of the odium which they otherwise deserved as much as Auto-Union. For both were an expression of the power of the will, of a ruthless rationality which acknowledged none of the common decencies. Whereas the cars of Bugatti, Maserati and the rest took humanity as their point of reference, both economically and aesthetically, the Germans were determined to win at any price. Economically, with Hitler1s backing, they mocked not only the private owner but even the independent factory, and theirs were the aesthetics of contempt. The continued success of the traditionalists throughout 193^> and even occasionally in 1935? seemed like the rearguard action of liberal, humanist values against an alien invasion.

To take the least alien first: the W25 Mercedes-Benz owed its success to a sophistication which was largely concealed, to the skills of the engine designer, metallurgist, fuel chemist. The engine, although of overwhelming power, was traditionally located, and the configuration of the whole car therefore familiar. There were, nevertheless, certain differences which when developed in the W125, revealed its totally different ideology. That the W25 was conceived of as a projectile should have been clear from the fairings behind the driver, and around the suspension, indeed from the cutaneous nature of the whole body, representing as it did, the interface between internal structure and external pressures. This was nowhere clearer than in the treatment of the nose. Gone was the flat radiator, whether vertical or inclined, set well back between the wheels; gone the feline imagery, instead, the nose curved down, well before the wheel centres, the double curvature grill admitting air to the concealed heat-exchanger. In the W125 this curvature was compounded as the nose broadened to enclose the front suspension. In fact, by 1939 the frontal area of the W125 had been increased by 45% and, contrary to all reasonable expectations and all intuition, its wind resistance was thereby reduced.

It is important to understand not only why wind resistance was reduced, but also why this should be surprising (virtually every published reference uses eixher italics or exclamation marks). There are two ways of reducing the wind resistance of a vehicle: one by reducing its projected frontal area, the other by increasing its aerodymanic efficiency. The first of these is immediately apprehensible: it is virtually self-evident. That is to say, it is immediately accessible to both reason and intuition. Efficiency, however, is an entirely different matter and is often misunderstood. It is concerned with principle rather than appearance, and therefore inaccessible to romantic intuition. Logically, it is clear that an efficient shape will generate less resistance than a smaller, but less efficient, shape; but this size discrepancy can become so great that the intuition can no longer apprehend the situation. It looks wrong. To designers who had for years been assiduously reducing the frontal area of their cars, the Mercedes-Benz decision to drastically increase theirs must have seemed like madness. The success of the move must have confirmed the growing conviction that there is no justice.

Even in the matter of reducing frontal area, intuition can be offended. A long tradition of racing and record cars had pursued the ideas of minimal frontal area, but invariably predicated upon the front engine. The Auto-Union decision to place the engine behind the driver immediately, by removing the propshaft, made possible a lower vehicle. Most designers had accepted the essential virticality of the body; now it could once more approach the Zeppelin ideal attained by Rumpler and more was at issue than mere record breaking. Although the synthesis of romantic and classic in the later work of Bugatti seemed to have established humanism beyond attack, the German designers were engaged in an exercise of rationality and willpower, which was shortly to stage a global confrontation. For theirs was the technology of war, and their achievement was to raise to mythological status an ideology of design which had never before attained this level.

The only thing that was radically new about the classic grand prix designs of Porsche and Niebel was their success, and this success was due to the fact that, unlike Bumpier and Voisin, they applied to the engine (and eventually to the suspension) the same iconoclastic logic which informed the body design. Theirs were, purely in a grand prix context, more essentially, because more completely, classic. But if their influence on production aesthetics was greater, this was due not only to their success, but also, paradoxically, to their greater relevance.

On one level, these 200 m.p.h. single seaters had nothing whatever to do with production cars. Their significance was that the iconography of power which both (but particularly the Mercedes) displayed was as easily adaptable to the saloon car as was that of Bugatti or Alfa Romeo to the tourer. Also the aerodynamic principles on which they were based were even more applicable to the saloon, as Bugatti*s Tank had indicated.

McLellan indicates the increasing popularity of the saloon:

> "The touring body accounted for 97^ of the total production of cars in Britain in 1912, 38Øo in 1928, and only *yjc* in 1930." (1)

Underlying this apparently exponential curve of saloon production was a self-stoking cycle. To increase car production meant selling family transport rather than rich men*s toys; and steel saloon bodies facilitated mass-production, which in turn led to lower unit costs and wider sales. America was the biggest potential market, and it was there that mass-production was introduced. In 1919 Dodge introduced all-steel bodies produced under Budd patents.

The saloon body posed problems both structural and aesthetic: Dodge resolved only the former. The structural problem was two-fold in the sense that traditional methods weakened the structure of both production organisation and vehicle. Using traditional coach-building techniques the body was not only slow and expensive to build, in terms of skilled man-hours, but also, once built it contributed nothing to the structural stiffness of the vehicle. Either increased size or increased speed accentuated the latter problem. The pressed steel body with its stressed roof answered both problems simultaneously, and was for this reason being used by many manufacturers by 1927* It was, however, not the only

solution proposed. Best known of the alternative approaches was Weymann*s which accepted the flexibility of the chassis and strove to make the body equally flexible, by means of jointed, fabric-covered frames. Although this method was quicker and cheaper than the traditional, and also far lighter (such that a saloon could wreigh less than a conventional tourer) and did not involve the capital outlay of presses, it was nevertheless unable to compete on unit costs with the press.

The steel body was not, of course, essential to mass-production, as •Austin like Ford before him demonstrated. It was however the logical outcome of the analytic approach implied in mass-production, since there is no logical reason why the body should be made of wood, while there are good organisational reasons why it should employ the same materials and technology as the rest of the vehicle. If this analysis also produced a stiffer structure, so much the better.

But while the Dodge was cheaper and stiffer than its coach-built contemporaries, it looked exactly the same. If art lies in concealing art, Dodge were rivalled in sublimity only by Lancia, who achieved a similar invisibility of advanced structure. The technicist approach can never explain why new materials and techniques, be they stone, metal or plastics have always first been used to ape conventional form. For the explanation resides not in the technology but in the modes of thought which inform its use, and though technologies may come to influence those modes of thought, they cannot determine them.

Hence the aesthetic problem of the saloon. The problem of providing weather protection is a perfectly straightforward, practical one, but whether designers embraceda mechanistic or an organic aesthetic, and however carefullythey shaped their mudguards, wings or fenders, they could not encompass the addition of a sensible, rain-proof box.

The nearest approach to aesthetic coherence in the saloon followed the adoption of the organic aesthetic, and even here it was attained only in profile. The idea was that the horizontal of the bonnet (against which was contrasted the flow of the wings) be continued along the sills of the windows, and echoed by the horizontal of the roof. The longer the car, the more effective this proved. The aim was ^elegance1, and its highest achievement the six-light saloons of the 1920s. The reason why it succeeded only in profile was that fundamental to the organic

Top-. **A Chrysler of 1926. The normal saloon car of this period was not startlingly original, nor were the different makes easily distinguishable. But the body was both commodious and comfortable, and this was particularly noticeable with American cars, for at last they were starting to give as much thought to the body as the chassis.**

Bottom: **The six-cylinder Napier. The appearance of this car prompted other British manufacturers to think hard about six-cylinder units, when they were only making four-cylinder cars. Due to the persuasive drive of Selwyn Edge of Napiers, the Napier soon came to the forefront of the range of luxury cars.**

The aim was 'elegance'

aesthetic were two basic curves:

> "The basics for any builder planning a body were the sidesweep - the convex outer contour of the body in plan view, and the turnunder - the shallow curve of the body side from the cant rail through the waist to the bottom side."

The former is familiar, but the latter is an extension upwards, in the saloon, of that avoidance of the vertical so powerfully used by Bugatti. Its effect, in front or rear elevation, was to make the car appear top-heavy - the very antithesis of all that the organic ideal represented. Emphasis was therefore placed on the profile, and the best of these saloons were so graphically convincing that one tended to overlook the fact that the aesthetic made no provision for luggage accommodation.

The introduction of the steel roof raised a problem. If maximum benefit were to be derived from it, it should be domed; and this would destroy the horizontal on which the saloon aesthetic rested. The ultimate solution to this problem was that the whole body should become a convex, dome-like envelope; but designers in Europe and America arrived at this solution by very different routes.

Dodge indicated the American solution verbally, if not visually, when they christened their saloon the *Turret Top*. The Americans had always favoured mass rather than void, and the notion of the turret (impregnable defense, Fortress America) appealed. Ford was unique in keeping so light a design as the Model T in production for so long; and when he replaced it with the Model A in 1927» he adopted the mass/void ratio that Chevrolet had used since 1912. The development was evident as mudguards became fenders; and the notions which were to inform the whole body were first evident here.

The simplest form of mudguard had been the cycle type, which being attached to the stub axle moved directly with it. Like the cycle wheel with which it was associated, it espoused an ideology of minimalism for which the insect is the paradigm. It was more widely adopted in Europe than in America.

As soon as a mudguard is attached to the body, however, the wheel moves in relation to it, both in steering lock and suspension travel. Its internal dimensions are thus contingent upon the somewhat complex geometry of the moving wheel; and not until 011ey*s work in the early 1939s was this fully understood. There was therefore good reason to keep the mudguard well clear of the wheel, but there were different ways of ensuring

1945 Tasco
1935 Auburn 851 Speedster

that it still fulfilled its function. One was to make it a wing which spread wide above the wheel; another was to flange it deeply so that it capped the wheel. The first created a dark shadow, a visual void, beneath it; the second added to the mass of the wheel that of the mudguard. The first created a dark ground against which the figure of the moving wheel was animated; the second did not, relying for coherence on a stationary wheel. The first strove for animal grace and lightness; the second remained a heavy, somewhat lumpen alternative until it was developed into the *helmet* or *spatted1 wing.

Whereas the Americans arrived at the spatted wing by a process of gradually increasing the curvature of their already typically deeply flanged mudguards, for the Europeans it represented a totally new and exciting icon.

Among aircraft manugacturers who sought to reduce the drag of their undercarriages without resorting to the expense and complication of retraction mechanisms were Hawker, Gloster and Macchi. Their solution was a faired spat or helmet which fitted closely over the wheel and was attached to the axle. This method of mounting was the simplest, since unsprung weight was unimportant and the wheels were not steerable. Neither of these conditions obtained, however, on the car; and designer who sought to adopt this iconography of the air therefore faced considerable problems.

Buehrig was perhaps unique in adopting it unmodified on his Tasco, and that was not until 1948, when he should have known better. He blames the original idea on Claim Hodgman, and regrets it:

> "Someone once said, *Show me a man who never made a mistake and 1*11 show you a man who never did anything.* When I think of the Tasco I repeat this to myself. It helps a little." (3)

The problem was not so much the additional unsprung weight as the aerodynamic anomolies engendered by the changing angles at which the steerable front wheels met the airflow. The Tasco was pure fantasy; in his more lucid moments Buehrig had realised, like everyone else, that the problem was to attain visual identity between wheel and spat while maintaining physical separation. On his Auburn Speedster he had achieved this. Several Alfa Romeo bodies of 1933-37 also accomplished this visual redefinition of the hierarchies. The body thus became a streamlined projectile visually suspended between the four similar

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1933 Cord 810
1938 Buick Y

shapes of the wheels: a modular aesthetic coherence informed the whole, and could he picked up with 1torpedo* head and side lights. Buehrig*s achievement was to show how this iconography could he used to unify the saloon car, and in so doing to create a new paradigm.

The Cord 810 of 1935 was paradigmatic because it was clearly produced by machine. It was - like the refrigerator, the washing machine, the radio receiver - a domestic appliance, one of the blessings of technology, and as a statement of faith in the continuing blessings of technology it was a wonderful antidote to the depression. It represented faith in the future.

This it achieved by three formal means, of which one created a furore but was never emulated, and two passed without comment but have been adopted by virtually every car designer ever since. The disappearing headlights were the work of a master conjuror, for suddenly revealed was the relationship of bonnet to wings which had, in America, been for so long obscured. European designers had typically set their wheel centres level with, or in front of, the radiator, thus allowing the headlights to be tucked down between them. But the Americans, in their search for greater frontal mass, had in fact defeated their own object. By adopting a more forward radiator, they had thrust the headlights up into a position where they were distracting and therefore incongruous in both front and side elevations, as on Buehrig*s own regular Auburn. On the Cord, Buehrig used helmet front wings which were visually separate from the body, and into these set his pop-up headlamps. The wings now needed to extend even further forward, in order to accommodate within them the lights, and to join up "with the pressing which covered the gearbox. At a stroke, Buehrig increased the apparent frontal mass by reducing the number of its component parts, and made possible the treatment of the bonnet in any one of a thousand ways.

The pop-up headlights were not emulated, because the Cord contained the clue to its own redundancy. Reducing the apparently irreducible number of frontal masses from 5 to 3 revealed the possibility of even further reduction. Harley Earl and C. A. Chayne took the ultimate step with their Buick Y oT 1938, when they adopted the single frontal mass body envelope which has been de rigeur ever since.

Hu Citroen II CV' was produced in varying versions for nearly 20 years from the 1930s. It followed the famed Citroen "7 CV vitn h was the first car with front-wheel drive to go into mass production. The ”7 CV” incorporated a vast range of other technic innovations Above the Citroen B 14

The two formal devices introduced on the Cord and emulated by virtually all others both involved the use of convex curves. Perhaps the less important was the way the body sill curved under. The bottom edges of helmet wings had often been radiused, to emphasise their three-dimensional nature, but the sills had usually been either right-angled or even flaired out like embryo running boards. On the Cord, all bottom edges curved under, giving the design a unity, a self containment.

More significant however was the rear roof, which now became the point of greatest cross-sectional area and also of greatest radius. In plan, the body widened towards the rear - 1streamline form* in reverse - but in side elevation too the rear was emphasised. This Buehrig did by adopting a back that had not a reverse curve, but instead sloped out, creating between roof and back an obtuse angle which was gently radiused. The whole car was thus domed: helmet wings, bonnet, roof, back. The domed roof that had threatened to destroy the saloon aesthetic was here used as the basis for a new convex, obviously pressed aesthetic. The luggage boot now provided within the structure was an incidental bonus.

It is instructive to compare the Cord 810 with the Citroen 7CV of a year earlier which had initiated some of these forms, and which shared its front wheel drive configuration. Both exploited the low body height made possible by this layout, and emphasised this by smooth, unobstructed body sides, but there the similarities contingent upon FWD end. The Cord set its *radiator* further back than was customary, but the Citroen*s was further forward. The Cord in standard form had an integral boot though in Berlina form used the larger, additional boot adopted by Citroen. The similarities stem rather from an aesthetic attitude to the presses whence the bodies emerged. Thus both abandoned the louvre, the Cord adopting an idiosyncratic grill system, the Citroen hinged flaps. Both emphasised convex curves, though the Citroen retained ogival wings, albethey clipped. Both repudiated the romantic organic aesthetic (compare either with the 1936 SS100 Jaguar) and also the romanticism of the machine. Both were examples of that truly rare phenomenon; industrial design.

Citroen had been the first European manufacturers to adept Budd*s system, in 1923» If it had taken them a decade to evolve a production aesthetic,

it had taken the Americans even longer. In each case, FWD seems to have acted not as a determinant of design, but as a catalyst in the search for this aesthetic. Evidence for this is that of all the designers who adopted their body forms, very few emulated their mechanical arrangements.

If the Cord was visually even more revolutionary than the Citroen, this was probably due to Buehrig?s invention of *the bridge1: a device which enabled him to measure accurately a clay model and which therefore freed him from the constraints of two-dimensional graphic design, and it was this aid to three-dimensional manipulation rather than FWD, which accounts for the influence of the Cord. Clay modelling and concern with rounded plastic forms so suited to the press, replaced flowing graphic elevations.

Significant was the way in which the Cord in particular was not emulated. Not only its FWD configuration but also its physical smallness inspired no followers. In spite of its physical size, the Cord was a statement of three-dimensional, plastic mass; and it was this, expressed in terms of Cord convexity which stimulated American designers for over 30 years. Both Citroen and Cord were classic designs, but the Cord served as a paradigm not of classicism but of massive, Promethean, romantic iconography. Buehrig, who for once in his life had adopted a classic mode of thought:

”.....as La Corbusier (sic) says, form follows function" (^)

provided the iconography by which subsequent designers were todemonstrate that, rather, form follows myth.

Chanter 10

By the end of the Second World War design was in a state of chaos, and nowhere more so than in England. The problem was that the old paradigm had been destroyed, but what should have superceded it was by no means universally acceptable. The situation was thus rather different from that at the end of the First World War, which had seen the adoption of the organic paradigm which had been firmly established before hostilities started.

The Americans had, by 1947> developed the pontoon body as a theme of mass capable of an almost infinite number of permutations, each of which had references both to mythology and to the production process. Their romanticism of technology had widened in scope to include mass production. For the English, this issue re-opened a bitter ideological argument that dated back to Ruskin and Morris.

The argument was entitled *Art and Industry1, and the start of the latest round was signalled by the Eoyal Society of Arts exhibition !British Art in Industry1 in 1935* This occasion stimulated the production of a large literature among which perhaps the most important was Herbert Read!s *Art and Industry1 Read*s plea was for recognition of the status of the industrial designer1, and this was answered in 1944 with the establishment of the National Council of Industrial Design. Read further envisaged a programme of design education modelled on the Bauhaus, but recognised that this would involve an educational, if not a social revolution. A seductively easy alternative was suggested in 1941 when John Gloag read to the Royal Society of Arts a paper entitled 1Selling Through Design* and written by the American 1industrial designer1 Raymond Loewy. (2) Loewy was to prove probably the most influential Post-War ^designer* both in the U.S.A. and in England, and the last thing he wanted was a social revolution.

Read claimed that the concept of the industrial designer had originated in England, citing as evidence Peel*s commercial motives in establishing the National Gallery in 18j2. The rather touching notion behind this was that Englishmen would gaze at Old Masters then go away and design better steam engines. *Art* and 1industry* remain separate concepts, but some unspecified mechanism was envisaged, mediating between the two. *Art* could be *applied* to the products of industry.

Morris* achievement was to break down this distinction between *fine* and *applied* art, and to demonstrate that what was important was not the medium but the attitude of the designer, which could inform any product from easel painting to wallpaper. He was in pursuit of what Pirsig calls Equality*, that is, moving the levd of discussion away from the product (medium, technology) to the designer (aesthetic, moral).

Predictably, Morris was misunderstood, the significance of his work being seen rather in terms of hand-work versus machine-work. When the discussion was hammered back into the conceptual framework of *art* and *industry*, it appeared that Morris was relevant only to the former, and opposed to the latter, an aesthetic Luddite. Quite what the alternative might be was not clear until the establishment of the Banhans. The concepts informing the Bauhaus were in fact essentially similar to those of Morris: that the designer should be neither artist, scientist, engineer, nor philosopher (conceived as specialisms) but a grand synthesis of all these. To this end, teaching staff were assembled representing all these specialisms, the intention being that the student would emerge greater than the sum of the parts. Again, the search was for *quality*, which would inform any product from a dance to a teapot.

The distinction between on the one hand Morris and the Bauhaus, and on the other, proponents of *applied art* from Peel to Loewy is the distinction between designer and stylist. The designer is concerned with the whole product from its inception, the stylist *applies* his je ne sais quois to some pre-existing entity. That is, the designer is concerned with underlying form, the stylist with surface appearance. This distinction I have termed classic/romantic.

Loewy*s achievement was to so thoroughly confuse these issues that few designers of the next quarter-century could disentangle them, while simultaneously offering a simplistic by-pass to the problem so seductive that few would wish to. His notion of designer as *silent salesman* amounted to *never mind the philosophy, look at the profits*.

> "In 1941 it is estimated that approximately $ 850,000,000 worth of manufactured goods and operations will appear according to design specifications marked *Raymond Loewy* ..... the royalty basis for agreement with certain manufacturers is a welcome form of contract in my office." (3)

Raymond Loewy
1946 Studebaker

On this basis, the designer can provide any philosophy the client requires. One moment he can embrace the tenets of classic design:

> "Four principles have guided the designer early and late - efficiency, simplicity, economy, and ease of maintenance. I do not mention beauty, since it is a direct result of the combination of simplicity and efficiency." (4)

The next moment he is providing romantic, symbolic shrouds:

> "The tractors and trucks are designed to dramatise their ruggedness, power and durability." (5)

This contradiction appears not to have been noticed at the time. Loewy, like Read, seemed to argue for a future in which life would be enhanced by technological revolutions guided and mediated by the civilising hand of the industrial designer. Also, he appeared to have impeccable credentials: he had designed a whole rail system and become a millionaire into the bargain. He urged designers to prepare for peace by planning how they would use the materials, techniques and form of war technology for the subsequent betterment of mankind. When the National Council of Industrial Design was established in 1944 it seemed to rest on a firm ideological base buttressed by Read, Loewy and the Bauhaus.

The buttresses crumbled in reverse order. The Bauhaus had already, of course, physically disbanded, but Read appeared not to have noticed thai, before doing so it had weakened his own position. Gropius had worked -with Adler and was associated with the group which included the aerodynamicists Kamm, Everling, Von Fachsenfeld; and cars such as the Adler, Auto-Union, the racing and experimental Mercedes-Benz and the K-Wagen had achieved their efficiency at the expense of intuition. That is, they had demonstrated the fallacy of *if it looks right it is right* on which Read took his stand.

Then, in 1946, Loewy designed the *going both ways* Studebaker. This used not the materials and techniques of advanced technology, but only their image. And as a romanticisation of advanced technology it was the direct model for the science fiction monsters of Harley Earl which were to give Read nightmares. His reaction was to retrench into a support for *quiet good taste* which formed one side of a critical argument which proceeded in England throughout the 50s. Its aesthetic base was in architecture and pottery, and it disapproved of American cars because they could not have been designed by Bernard Leach. The avant garde loved them because they looked like Batmobiles.

1955 Alvis
1955 Citroen DS 19

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The establishment position, as represented by Read, purported to encourage classic design, but insofar as it had not evolved an aesthetic of mass-production, of pressed steel, it reduced to a support for forms which symbolised restraint. Of the illustrations in the latest edition of *Art & Industry1 only one is of a car. It is a 1955 Alvis 1styled by Carosserie Graber*. In that year Citroen had announced the DS19, which not only rendered all other cars obsolete, but simultaneously provided a measure of the extent by which other designers departed from the classic mode of design. To select the Alvis (clearly because of its lack of chromework) and ignore the Citroen is also to reveal Readss own departure from classic aesthetics. His advocacy of restrained surface is thus as superficial as the enthusiasm of the Batophiles. Little wonder that most subsequent English cars were designed by either Americans or Italians.

Clearly, at a very fundamental level, something had gone wrong.

Bristol 401
Jowett Javelin

Chapter 11

The confusion in theory revealed itself as confusion in practice. Important in this was the image of Germans as bogeymen. SS exchanged their runic name for Jaguar and continued the romanticism of organic form which they had perfected before the War. The later German (and Czech) designs had as a consequence of their classic approach abandoned all such referents. Their cars were images of nothing but their own efficiency, and the last thing Post-War Europe wanted was the image of German efficiency. The *technical experts1 from Humber advised the government that the Volkswagen would not be a commercially viable proposition.

Bristol and Jowett alone succeeded in separating reality from image, for a time at least. Bristol*s 400 was the Pre-War BMW, though it was soon to be replaced by the 401, which not only eradicated the Teutonic image but was even more efficient. Jowett*s Javelin used the envelope body with flat back which had been approved by both German and American designers, and it achieved an efficiency of internal space relative to external aerodynamic disturbance rarely surpassed in car design. Its commercial failure has been variously ascribed to different components of a technicist model, but is I believe rather to be understood as a failure of mythology.

The only way in which the Javelin may be said to have external referents was in the angle of its sloping back: which angle approximates to that of the human figure in flight or combat and is familiar from the Elgin marbles. As is clear from the rest of the design, Jaray*s aerodynamic theories, and not those of Phidias were the immediate source of this angle, and this may be made clearer by comparison with the 1948 Cadillac.

The Cadillac exploited the angle of the flat back against the new-found horizontal of the fender-tops but superimposed on this basic shape several stylised icons: airships (rear fenders), jet blasts(chrome strips), bombs (overriders). Clearly the basic shape was not considered in itself suggestive enough of forward motion without these additional clues. Both Jowett and Cadillac can of course be traced to their most immediate model, the Lincoln Zephyr which, in original form, is open to the same objection as the Jowett, that it lacked mythological referents.

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1933 Ford Prefect

But the mythological confusion in England spread further. Triumph, with their 1800 roadster, tried to advance a synthesis of Jaguar organic and Buehrig/Alfa-Romeo helmet wings. Riley too adopted a similar approach, eventually abandoning the flowing wing in favour of the helmet. Considered in isolation, any of these designs may be deemed more or less satisfactory/coherent/worthwhile/beautiful. What is at issue here is their ability to offer an image of mythological validity.

The coachbuilders, of course, tried images of status. These were perpetuated unchanged in their lovingly-crafted carriages for the rich. But when they tried to adopt this iconography to the smaller car, they failed utterly. Their two main contributions were the *razor-edge* and the so-called fEnglish line*. Both, in their original form, depended upon separate front wings and a generous wheelbase. When applied respectively to the Triumph Mayflower and the Austin A40, where space was at a premium, their incongruity was evident. This did not, however, prevent the name and ideology of Vanden Plas from disfiguring small English cars for the next 30 years.

If the coachbuilders were living in the past, other designers found their stimulus in the new forms of American modernity. Issigonis* sketches for the Morris Minor reveal such a fascination, and the Minor was certainly more coherent than most such scaled-down imitations. Far more so than the Standard Vanguard, for example.

The chaos in English design immediately after the War was exactly that characterised by Kuhn as following the breakdown of a scientific paradigm. But it is clear that what is required of a paradigm in design is not only operational, but also mythological validity. Ideally it should answer the requirements of both classic and romantic modes of thought. Such a new paradigm was provided by the new Ford range, redesigned in 1950-53* which presented a clear and convincing image of what the Post-War car might look like. As an almost symmetrical 3-b°x shape the new Ford clearly derived from Loewy*s epochal 1946 Studebaker; but whereas this configuration formed the basis of the unbridled romanticism of General Motors, for Ford it revealed the possibility of a new classic approach to design. To understand how this could be so, it is necessary to examine the Studebaker more closely.

Although Loewy had urged designers to assess the advanced technologies o'f war, these technologies were judged irrelevant to motor car design.

Before the War the Cord had achieved a level of technological sophistication that was not to be surpassed for decades. More importantly, it looked the part, and it was the image not the reality of advanced technology that manufacturers sought. Loewy*s contribution was to graft on to the Studebaker*s archaic mechanical underpinnings the image of the Jet Age.

The major formal means by which he achieved this was the rearward extension of the luggage trunk. This gave, simultaneously, an almost symmetrical profile, and an unprecedented rear overhang. Visually the effect of overhang is to dissociate the car from the ground. If either front or rear be cantilevered, suspended in the air, the car appears to float above the ground. This is in marked contrast to the purposeful (steering, traction) down-to-earth implications of the wheel-at-each-corner configuration. Insofar as the car appears to float above the ground, it approximates to the aeroplane, and if the overhang be at the rear, it resembles the jet aeroplane. As jet-powered aircraft proliferated throughout the late 40s and 50s, rear overhang on American cars increased.

The most important symbolic change contingent upon the adoption of the jet engine was the relocation of the pilot relative to the airframe. Whereas the F-51 Mustang and AV-1 Corsair of 1940 disposed respectively 34.8% and 59,7% of their length in front of the pilot, the F4D-1 Skyray and F100A Super Sabre jets of 1951-53 deployed only 16.25/6 and 18.9^6 respectively in this way. Both of these planes claimed considerable public attention, each raising the World Air Speed record. The pilot sat very much in the nose of the plane with the bulk and power of the engine behind him. Neither plane was extreme in this respect: the Gloster Meteor F-8, for example, displayed only 10.8^6 of its total length before the cockpit, compared to the 33•8^6 by the Spitfire. On the ground this redisposition was emphasised by the adoption of the nose-wheel tricycle undercarriage facilitated by the relocation of the engine. Instead of squatting tail-down, the plane was poised horizontally ready to go, with typically 55/6 of its total length cantilevered rear of the main landing wheels. This was the Post-War geometry of power; beside it, the panther, the greyhound, the racehorse were obsolete.

Not content with emulating the general configuration, Loewy also adopted various details, of which the most important was the wraparound screen. Although the perspex bubble canopy had been used on piston-engined planes its use became mandatory on jets and its future assured by the

introduction of the ejector seat. Its effect was to reinforce the symbolic relocation of the pilot. Instead of being buried in the air-frame, peering out as best he could round wings and engine, he was now sitting in what was virtually the transparent nose of the projectile. Visually in a position of extreme control (and extreme vulnerability) he sat literally at the forefront of technological progress.

Loewy*s pilots were in a rather different case. The wraparound screen incorporated the symbolism but not the optical accuracy of the flighty model. The jet pilot sat beneath a perspex bubble, but the glass windscreen before him was flat; Loewy*s screens might be good to look at, but were not so good to look through. Similarly the chromed *jet* intakes and exhausts might look fast, but after the accident they were far more expensive to repair than the old spring bumpers. So much for "efficiency, simplicity, economy and ease of maintenance".

But who would want the neighbours to think he could not afford repairs? Not only the jet plane, but also the ever-rising standard of living which it symbolised informed the rear overhang. The size of the trunk was unprecedented, but what successful consumer would not be able to fill it? So the trunks of American cars grew throughout the 50s and none could gainsay them; for to deny their necessity would be to deny the possibility of an ever-increasing standard of living, and that would be unthinkable.

There were, however, contradictions within the 1946 Studebaker which were adopted by subsequent designers and which led to an impasse over which only Harley Earl could leap.

Every line on the Studebaker was either vertical or horizontal, except for the leading edge of the rear fender which, contrary to all precedent, sloped forward from the bottom. Embellished by a chrome *stoneguard*, its effect was to emphasise the rear cantilever, but its position was not dictated by any functional necessity. This fender was adopted by Lincoln, but by 1956 it had migrated as far forward as the front door. Why not? It was no. more functional than any of the other streaks, spears, or lightning flashes which adorned the sides of contemporary models. But if these features were without function, they were not without purpose; and their purpose was to emphasise the symbolism of jet flight. Always the emphasis was on the horizontal, and this theme was extended to bumpers, overriders, grilles. However, this horizontal was

always negated by the verticality of the front, the pillars, and the shut lines. The contradiction was evident in designs such as the Oldsmobile Dynamic, Hudson Jet Liner and particularly the Cadillac 62 series. Here the horizontal emphasis of hard-top, rubbing strip and overriders was countermanded by the verticality of the bonnet (above the grille), the raised tail lights and most of all by the chrome dummy air intake, which was made even more incongruous by its location (on the 4-door sedan) in the middle of the rear door.

Clearly the iconography of the Jet Age sat uneasily upon the basically boxy body. The horizontals and verticals had to go if any coherence were to be established. Loewy tried with his 1953 Studebaker to stop the process he had started in 1946, and this time he completely misjudged it.

His aim was to remove all verticals and horizontals and his method was to employ subtley curved surfaces. There was a wraparound rear window7 (to give an oblique C-pillar), but no wrap on the windscreen (which would have given a vertical A-pillar). Hood, roof, trunk and sill surfaces were all subtly curved, just avoiding the horizontal; but the grille and hood front represented the most dramatic departure. Instead of presenting a vertical, ornate cliff, these now sloped forward from a point behind the headlights down to the bumpers. The plane was emphasised by the large simple chrome shapes of the intake surround and of the bumper. The front of the car was a wedge, while the rear deck sloped gently away towards the tail. The B-pillars were the only straight lines. Now this design received critical acclaim in Europe, ostensibly because of its *restra.int*; although the area of chrome exceeded the European norm, its use (to emphasise rather than to distract from the basic body form) was approved: there was a notable absence of 1fussy* detail. But behind this reason for approval lay another. In abandoning the straight line Loewy had also abandoned the machine: the length of the bonnet, extended by the slope of bumper and of windscreen, gave visual proportions nearer to the organic than anything else in contemporary America. Deep side windows (the door tops curved down below the horizontal) and slimmer front wings (larger wheel arches, protruding bumper) combined with the simple slot intake gave a void/mass ratio higher than any other contemporary design. .The whole car was visually lighter. In 1954 the company merged with Packard and by 1959 Loewy*s design had been replaced with a flat-fronted rocket-lorry.

Cadillac 62 Series Coupe: Number of cylinders VS. Cubic capacity 390 cu. in. Compression ratio 10-5 : 1. **B.II.R.** 32^. Overall length iS ft. 9 in. Overall width 6 ft. 8 „j, in. Height 4 tt. 6 „0 in. Turning circle 47 ft. Wheel-base 10 ft. 10 in. Max. track 5 ft. 1 in. Fuel tank capacity 21 U.S. gals. Dry weight 4690 lb.

Appearance: Frontal details as for Sixty Special Sedan. Note that body lines are smoother than Sedan. Long, pillarless windows, wrap-around windscreen extends into roof line, rear window slopes gently and is of large area. Note large fins, a feature of Cadillacs, also dummy rear " grille." Rear wheels almost concealed.

Cadillac 62 Series Convertible: Number of cylinders VS. Cubic capacity 390 cu. in. Compression ratio 10*5 : 1. B.H.P. 325. Overall length 18 ft. 9 in. Overall width 6 ft. 8 „1, in. Height 4 ft. 5i<y in. Turning circle 47 ft. Wheel-base 10 ft. 10 in. Max. track 5 ft. 1 in. Fuel tank capacity 21 I .S. gals. Dry weight 4855 lb.

Loewy, for once, had mis-timed it. 1953 saw not the extreme of science-fantasy, but only the beginning. Harley Earl, to his undying credit (or notoriety, depending on one*s standpoint) realised that the inherent contradiction in contemporary body design could be resolved not only by Loewy*s 1sensible* retrenchment, but also by abandoning the horizontal for an outrageous upsweep towards the rear. Such lateral thinking is possible only for one who has relinquished any notion of function: his imagination is then quite unbridled. Oblique angles could be generated by fins, hardtops, cut-away wheel arches - the rear quarter forming a nexus of totally unexpected and inexplicable angles. Only in zero-gravity did Earl*s designs make sense. The 1959 Buick Electra used a reverse-angle A-pillar as the nexus of upsweep and downsweep lines to the rear. The Cadillac 62 series used the same A-pillar, but placed the nexus at the rear quarters, emphasising the massive rear overhang (21^ of total length) with dart fins which generated not only an enormous side area, but also a profusion of oblique angles. The Chevrolet Impala used the same A-pillar and cut-away front arches as the Buick, plus cut-away rear arches. The common problem was how to generate the dart rear quarters without creating a broken-back effect. Concentration on the formal problem of transforming the American car into a space-ship also made it possible to side-step another contradiction that had been built into the previous models. In 195^ much of the chrome-work had stylised organic shapes (breasts, eyes, eye-lids, lips) and these had borne no relation to the already disjointed basic body form. Once attention focussed on the rocket, these organic details were suppressed in the interest of the overall effect.

Now the only aspect of this development which could be rationalised as being in any way functional (other than the *tremendous trunk space*) was the fin - on aerodynamic grounds. As Mercedes-Benz, Bristol and Porsche had discovered, a vertical fin at the rear could move back the centre of pressure and so add directional stability to a low-drag car (which suffers from the fact that its centre of pressure is in front of the centre of gravity, or even in front of the car). However, since this problem besets only low-drag cars, and since the American cars of the 50s clearly had very high drag coefficients, such a rationalisation is spurious. Moreover it points to the discrepancy between appearance (rocket speed) and actuality (high drag). This concentration on surface appearance rather than (or even at the expense of) reality is the

major manifestation of what I have called the romantic approach. American design during the 50s is a record of romanticism in pursuit of an object. Given, was the requirement that such an object must represent expansion, novelty, extravagance, power - (all, incidentally, anathema to the classic approach). Although Loewy*s 1946 design had pointed the way, it was to be 10 years before other designers realised its full potential. The contradictions that arose along the way resulted from attempts to graft together existing and new romantic objects None of this development had anything to do with function. What was resolved in 1956 was romantic object, powerful enough to command the proper pride of the richest nation on earth.

Beside such designs Loewy*s 1953 Studebaker appears a model of classicism, but it is important to understand why this is not strictly so. Loewy, like everyone else, spent the late 40s and early 50s trying to make his *46 design look more like a jet. The 1951 Skylark, for example featured a rear window that wrapped right round to the rear quarter-lights, and a central circular nose-cone. It was as inefficient a wind-jammer as the rest, adorned with the iconography of speed. His 1953 design was certainly cleaner, both aerodynamically and visually, but the changes which accomplished this were almost certainly not done for this reason. More likely is that departure from the vertical and horizontal was made in order to achieve a smoother transition between the steeply raked A and C pillars and the rest of the car, upon which they had previously perched uneasily. Loewy was committed to these oblique pillars for two reasons: firstly, they gave the jet age wraparound rear window; secondly, they looked windswept - the flat back in reverse. How well the bonnet and boot lid fitted in can be judged by the disruption that occurred when a cautious management insisted on following convention by grafting on rear fins in 1959* Certainly, Loewy shied away from excesses such as Earl*s, but his 1953 design seems to be no more than a first step towards classicism; one that was unwelcome in the U.S.A. but which found favour in post-Ford England.

The Ford range of Consul, Prefect, Anglia introduced in 1950-53 adopted the basic shape of Loewy*s 1946 Studebaker, but stripped it of all connoiations. This was achieved by not only omitting the extraneous chrome motifs, but also by reducing the rear overhang and carefully controlling the relationships between volumes. The result was functionalism mediated by formalism. The basic tenet was still symmetry

stated in identical front and rear doors. Variations on this theme (bonnet slightly longer than boot, front wheelarch slightly larger than rear, C-pillar slightly thicker than A) were to be understood precisely as variations: all related back to the basic symmetry. The car comprised three approximate cubes, and appeared to be hardly 1styled* at all. It was so eminently *sensible* that it provided a paradigm for nearly all subsequent *family* cars. For it was in this sensible, reasonable, moderate, Restrained* use of technology that its novelty resided. Being itself new it did not ape any other novelty. This was what Loewy had preached, if not what he had practised.

The Ford Popular which the Anglia superceded had also been an outstanding example of classic design, though superficially it appeared the complete antithesis of the Anglia. The thought processes which generated each were identical; only priorities had changed.

Based on essentially the same parameters as the Model T, the Popular represented a ruthless sacrifice of roadholding, handling and luggage accommodation to cheapness, simplicity, and an enormous volume of passenger space per £. The Anglia was altogether more moderate, attempting to reconcile parameters intrinsic and extrinsic to the Popular. That the luggage boot was of Reasonable* rather than enormous size was due partly to this conciliatory approach and partly to the fact that in England the jet place could not symbolise social values.

Not for decades had the machine been romanticised in England. Even when Armstrong-Siddeley produced a range of cars named after warplanes, the relationship to the model was never isomorphic. When sports cars were referred to as *fighter pilot*s delights*, the reference was to the instrumentation, speed and controllability, and the referent was never the jet plane, but the Spitfire, as Triumph made explicit as late as 1963.

There were some, and not only in England, who never achieved any kind of emotional rapport with the jet plane. To them it represented dehumanisation, speed and power beyond the human scale: power which was measured not in animated horse-power but in thousands of pounds thrust. This appears to be Buehrig*s position. Although probably the most influential Pre-War American designer, having created Duesenberg, Auburn and Cord, he seems quite unable to comprehend the basis of Post-War

design. Refusing to discriminate between Post-War designs (fthey all look the same*) he uses a 1972 8slab-sided* design to represent all, and quantifies design changes as follows:

Package Evolution: Trend Analysis (l)

(	Wheel base	Body Space Dash to Rear Axle	Engine Space Dash to Front Axle	Overall Length
1935 Auburn	127	88.5	38.5	204.7
1936 Cord	125	91.5	33.5	195.2
J-Duesenberg SWB	142.5	91.2	51.3	207.5
J-Duesenberg LWB	153.5	102.2	51.3	218.5
1972 Luxury 4-Door Sedan (USA)	127	104.8	22.2	225

The status of the *package* is unclear: at times it appears to be decided by the designer, at others to be a pre-existing requirement (made by engineering, marketing, etc.). The most dramatic change in the *package*, Post-War, - increased overall length accompanied by decreased engine room - he does not explain. At least, his acceptance of *the American*s demand for a tremendous trunk space within the body* as a *given* does not constitute an explanation. He appears to disapprove of this requirement (1tremendous*) but accepts it as intractable. Similarly he disapproves of the reduced engine room as entailing an unfavourable weight destribution, and also as complicating servicing operations, yet offers no reason for its popularity. By contrast, he approves the Duesenberg, in spite of its unfavourable weight distribution, in terms of its *striking proportions*, and of the Cord for its rational weight distribution and equally striking appearance.

That is, Buehrig is unable to account for the Post-War car in terms either of logical requirements (rather the reverse) or of style (*they all look alike*). This in spite of designing the Continental Mk II (1953-56).

To return to Buehrig*s table. First, it is difficult to see why, since it is entitled *Package Evolution*, it is not arranged chronologically. Perhaps it is not really about *evolution* at all; certainly the inclusion of both wheelbase versions of Duesenberg (produced simultaneously) is difficult to justify in evolutionary terms, placing them last instead of first is impossible.

There is also the problem of the dimensions chosen, which conceal almost as much as they reveal. For example, why is engine room defined by the front axle? - the Cord*s transmission extends further forward. In fact these particular figures are not very useful for investigating the changes. However, they are useful for investigating Buehrig*s attitude. Taking the cars in the order given and expressing wheelbase as a percentage of overall length, we find 61.9> 64, 68.5 > 70.5 > 56.5. This appears to be the only *evolution* derivable from the figures, and reveals Buehrig*s implicit preference for as high a percentage as possible, amd a source of his dissatisfaction with contemporary models. Had the cars been arranged chronologically this would not have emerged, and this, I believe, is his reason for arranging them as he does. The only explicit disapproval he shows for overhang is in citing the increased cost of body repairs after minor accidents, but the real reason appears to lie deeper. The dimensions he gives are engineering dimensions; insofar as overall length exceeds these parameters it does so for non-engineering (non-functional) reasons. The extent by which overall length exceeds wheelbase is the measure of the hegemony of the stylist over the engineer, and by his ordering of the data Buehrig reveals his affiliations. Not that Buehrig was above a spot of *styling* himself. But while Loewy was ransacking the inconography of the aviation revolution, Buehrig was recreating, in his Tasco, the *Spirit of St. Louis*. His failure to understand Post-War design is primarily a failure of mythic communication.

Even Loewy seemed to be horrified by the progress of the Frankenstein*s monster he had created in 1946 and had failed to quell in 1953» In 1955 he redesigned the Rootes range, using the 1953 forms. Hillman had introduced the pontoon body in 1950, like Ford. But whereas the Ford was crisp, clear, and obviously new, the Hillman was rounder, vaguer Loewy*s redesign, while clearly in the Ford idiom, gave Rootes a crisp new look, aided by the reverse-angle C-pillar and two-tone colour schemes

The basic format of the European family car had been established, and of the numerous variations on it perhaps the most interesting vas Ford*s realisation that the wraparound rear window existed primarily to give a reverse-angle C-pillar and was in fact dispensible. Such novelties apart, European design became locked into a mode which at its best exceeded Read*s requirements and at its worst approached them. What Read seemed not to realise was that the design of the car, unlike that of

the teapot, is subject to continually changing constraints and so what is classic in concept may be imitated in changed circumstances simply out of reverence for its surface appearance. Classic design produces new shapes by redefining the parameters; good taste merely 'civilises' existing and perhaps inappropriate shapes. Such a notion of 'civilisation' rests on a number of mystical premises of varied authenticity. 'Rules' such as the Golden Section have historic and, at least arguably, biological validity, and appeal to the Protestant ethic in that they necessitate quite difficult sums. But notions such as 'truth to materials' are impotent when Harley Earl demonstrates that mild steel can be pressed into any shape you can imagine, and 'truth to imagination' is even more problematic.

In the 15 years after the end of the War three cars indicated, with varying degrees of influence, just how notions of design might be expanded.

1955 Citroen DS 19

1948 Cisitalia

Chapter 12

The three cars which revelaed the limitations of European Post-War design were the Citroen DS19, Farina's 1948 Cisitalia, and the Mini.

To deal with the least influential first; the DS19 was an utterly logical extrapolation from the 15CV, and the dumb amazement with which it was received was an indication of how far designers had ignored the lessons of the 1930s* Its total lack of influence was a measure of their illogicality.

Citroen had been the first European firm to manufacture bodies under Budd's patents, and although it had taken a long time, they had been the first to evolve an aesthetic of the pressed steel body. Although it had retained separate wings, the lpCV had looked new; and what was new was the fact that it was clearly machine-made. Like the Cord, with which it shared its front wheel drive configuration, it was remarkably free from nostalgia or romanticism. Similarly the 7CV of 1948 respected none of the conventions or even secondary characteristics of the car. Its failure to influence other designers appears to be a result of their reclassification process: 7CV not as car, but as agricultural implement. This strategy was not possible with regard to the DS19.

The DS19 was technologically more advanced, and looked it. If it was a spaceship it was one designed by rational beings; if it was a shark, it was simply because it was as efficient in its own medium as the shark in its. It was "without nostalgia, and without fear of the future". It was an efficient machine, produced by other efficient machines, and if it looked like no other car the blame was not its own. It obeyed no laws of taste or of proportion but was shaped, it seemed, by logical necessity: it vindicated exactly what Herbert Read should have said.

The Cisitalia was less important intrinsically, but had far greater influence. It established for Pinin Farina a quite unwarranted reputation, as he repeatedly demonstrated before audiences bemused by this reputation. But more importantly, it established the Post-War Italian coach-building industry at a time when it could have preceded even the English into oblivion.

The Cisitalia was the Pre-War Adler Autobahn stripped of many of its virtues but amazingly prettified. Farina alone, it seemed, had the sagacity to realise that for the customer thermal and aerodynamic efficiency count for almost nothing. Efficiency is a cold, heartless, abstract concept, and people buy cars with which they can persuade themselves they have emotional rapport. Thus was the spirit of the Bauhaus romanticised as a fairytale ghost, and thus did it seep into European design under the back door.

•The Cisitalia was quite efficient, achieving a respectable performance on only 1100 cc, and thus prepared the way for a multitude of special bodies on quite humble mechanical foundations. It was also extremely stylish. The basis of the style was the pontoon body with straight-through wings with a back that was a compromise between the aerodynamic theories of Jaray and Kamm. This back neither pointed to infinity nor bore traces of the guillotine; instead it curved gently in upon itself, echoing the curves of the wheelarches, roof, and vestigial rear wings and imparted an organic wholeness to the design. Implicit was a conflict between aerodynamic and aesthetic requirements which was made explicit by Zagato. Of his Lancia Flaminia Supersport he said:

> "For this car we set off with a functional aerodynamic line, and have tamed it, taking care of the aesthetic appearance and renouncing, naturally, something of the aerodynamics." v.1/

Aesthetic appearance1 further reduces to two components: organic form and the classical mathematics of symmetry, harmony and proportion; that is, to external and internal relations. The subsequent history of 'style in Italian coach-building has been that of the changing relationships postulated between these three basic components. British coach-builders by contrast, managed to devise a style that had relevance only to royalty and to corpses.

Not surprisingly, Italy has also been the main forum for aesthetic debate. As an organ of this debate 'Style Auto* has been, since 19^3j important, and it is unfortunate that translational aberrations have done little to alleviate the opacity which seems endemic to the topic. Also, 'function* in the wider sense has not featured largely in this debate, which is why Italian coach-builders who have excelled at sports and coupe bodies have rarely managed to organise four doors and luggage space. Yet as the coach-builders* prestige increased, due to the sophistication of their work on increasingly exotic and esoteric chassis, sr did the number of commissions they obtained to design for mass manu-

facturers, whose products bore an ever-dwindling relationship to those chassis.

Predictably, the results of these commissions have varied widely in their relevance, significance and success. One extreme was achieved by Touring who applied their motto "Weight is the enemy and air resistance the obstacle" (2) to their body for the Bristol 401 - though they seem to have forgotten it for the Hillman Super Minx. The other must have been reached in Farina*s redesign of the BMC range when he succeeded in increasing weight, lethargy and thirst, but provided a boot of Harley Earl dimensions which seemed to be filled only when the cars were used as taxis.

But if the Cisitalia was concerned with *style*, the Mini was concerned with the absence of style; it was an even more naked statement of ideology than the DS19, and may usefully be compared with Ford*s New Anglia of the same year, whose main claim to fame was its reverse angle rear window.

The contrast between these two cars is normally presented as one of *advanced* versus *conventional * engineering, yet this formulation obscures two crucial points. Firstly, *engineering* is a means to an end, and numerous examples show that *advanced* engineering, if it is to sell, is usually submerged within a conventionally acceptable end *package*. Secondly, the Mini was not that *advanced*. Every single idea embodied in it had been used before. Voisin, that despair of the would-be innovator, had installed the gearbox in the sump of his Micron in 1925» and had used a transverse engine in his 1945 design that became the Biscooter. What was new about the Mini was the 'advanced* philosophy that engineering means should be devised to make possible a pre-established, and hitherto unthinkable end. The contrast with the Anglia was a contrast not of technique but of philosophy. The former is always dependent upon the latter.

Issigonis* philosophy, as embodied in the Mini, was classic to an almost pathological degree. The whole design flows logically from one inflixible requirement: that the car be not more than 10 feet long. There are several noteworthy attributes of this requirement: first, it is self-imposed; second, it is arbitrary; third, it is incompatible with several other requirements conventionally held to be important.

It presents a logical puzzle bearing no relation whatever to demand, to precedent, or to manufacturing processes. The Anglia was a skillful compromise between these three.

fThe Mini Story* by Issigonis*s friend Lawrence Pomeroy is a eulogy which nevertheless makes clear the obsessive nature of the Mini design:

> "Briefly, he had in mind a box measuring 10ft. x 4 ft. x 4 ft. of which, looking at it lengthwise, about 6 ft. 6 ins. would be available for passengers and about 1 ft. 6 ins. for a luggage locker, leaving not more than 2 ft. in which to mount the only possible engine. This was the A Series which measured 3 ft. 2 ins. from the radiator to the back face of the gearbox." (3)

What is less clear is Issigonis* reason for adopting this rigid parameter of 10 feet. Pomeroy quotes Dante Giacosa*s 1957 James Clayton Lecture to the Institute of Mechanical Engineers:

> "Coming to the critical point Giacosa was able to show that selling prices per pound weight of car rise sharply as the mass of the vehicle is reduced." (4)

This clearly militates against the very small car, yet seems to have been welcomed as one more obstacle to be overcome. Similarly, Issigonis* rejection of the obvious solution (rear engine) was based on philosophic/moral rather than engineering grounds. Pomeroy enumarates the virtues of the rear engine (cheapness, better traction, better braking, better accessibility) but continues:

> "Against these formidable, and by no means exhaustive, objections to front drive were some basic advantages, which Alec thought were vastly more important.
>
> The foremost of these was the fact that a transverse engine with the gears beneath it would fit between the front wheel arches in space which was little used for any other purpose. Thus the front engine mounting fitted perfectly with Alec*s philosophy that not a single inch of space could, or should, be given away." (5)

This *could or should be given away* conveys an ethical attitude to space as a commodity, which may be contrasted with other ideological approaches. Functionalism, for example, as expounded by Corbusier, and adopted in various degrees by several designers, would hold that the space occupied by the car should be the minimum capable of containing the required functions (*form follows function* rather than *function must be fitted into form*) and is compatible with an economy-based production engineering view (as expounded by Giacosa, above) which v'ould relate the mass of the car to production costs. Also compatible with the latter v7ould be the aerodynamicists concern with the space outside the car as well as inside, noting that extra mass may give

superior aerodynamic performance, at little extra production cost. It is Issigonis1 refusal to consider such matters, subordinating everything to one passionately-held conviction that makes him a classic thinker par excellence. Compromise is a fall from grace. That Issigonis motivation was ethics rather than engineering is clear from his first design for the Mini, which used an A Series engine sawn in half - at first the only apparent way of fitting it into the space available. The fact that he even contemplated such an engineering monstrosity indicates the order of his priorities. Such a concern with ends rather than means is rare in car design, and it is significant that the reasons Pomeroy gives for Issigonis* persistence in the face of all odds amount only to his encouragement by

> " .... the good report he had of the experimental Morris Minor (which he designed but never drove), by his respect for Citroen engineering sagacity, and by his own conclusions and intuitions." (6)

The nature of all these factors is revealing. It issignificant that Issigonis never drove his experimental front-drive Minor, his assessment of it being based on reports and, more important, on theory. Theory again is the foundation of his respect for Citroen. The car he says he most wishes he had designed is the 2CV, and it is evident again that this admiration is based not on driving experience but on theoretica ideological grounds. The *conclusions* of which Pomeroy writes are similarly not experimental, but theoretical, and clearly secondary to the 1intuitions *.

The subsequent history of the Mini bears out its ideological rather than its practical importance. Ford production engineers reportedly dismantled one of the first Minis and pronounced "It will never make a profit." This assessment was not far from the mark: the Mini has never been very profitable for its producers, despite its extremely long production run. Its importance lies not in its success or otherwise in commercial terms, nor even in its fulfilment of customers* requirements: the compactness which is a source of delight in city driving is viewed rather differently by the owner trying to change a bottom hose. Its importance lies rather in its revelation of other possibilities, demonstrated by a designer who refused to accept the conventional wisdom of what a car should be; whose passion compels the customer to assess his own ideology and to react vigorously either for or against the product.

Other manufacturers have subsequently exp]oited these possibilities, but the manner in which they have done so has been influenced in perhaps unexpected ways by certain contradictions in Issigonis* attitude to space. For him space was an entity, an autonomous concept quite removed from any reference to context. Thus the engine compartment could be so packed as to render maintenance a nightmare while minor driving controls could be placed beyond the driver*s reach. For most designers, space is ergonomic space, for Issigonis it is an absolute. The interior of the Mini is styled to emphasise its spaciousness and is as devoid of reference to external criteria as is the arbitrary 10 feet overall length. The essential problem faced by imitators was how to reconcile the overall dimensions now shown to be possible with the actual physical requirements of users. This was indeed a problem that might not have been solved had not Issigonis followed the Mini with the BMC 1100 in 1962. The essential thing about the 1100 was that it scaled up the 2-box front wheel drive configuration to a point where other designers could adopt its advantages without having to accept the monomania inherent in the Mini. The flexibility of strategy it afforded led directly to flexibility in the treatment of space and thus to a conclusion which was the very antithesis of Issigonis* starting point. But before considering the spatial revolution of the hatch-back, we must examine the effect of the Mini on existing design wisdom.

To return to Pomeroy*s point: the major pre-Mini European designs (W, Fiat 500, Dauphine) were all rear-engined. This configuration bestows not only the advantages cited by Pomeroy, but also the possibility of low aerodynamic drag. This may not be particularly evident from the examples quoted, but is nevertheless a consideration of some historical importance. Against all these advantages, the rear engine reveals one inherent deficiency: oversteer. Issigonis has always been more familiar with problems of handling than of aerodynamics (of which he appears to be oblivious), yet even on this his approach is simplistic. The Mini, like the Minor was designed, in Issigonis* own words, *nose-heavy* - this being the simplest way of achieving directional stability. In fact the Mini is directionally stable not only because its centre of gravity is so far forward (by design), but also because its centre of pressure is so far back (by accident). The lower the drag co-efficient, the further forward the centre of pressure. While low-speed oversteer is an engineering phenomenon, high-speed oversteer is an aerodynamic one, and is capable of aerodynamic solution. The Mini thus represented only

one possible solution (and an expensive one) to this problem. That the alternative was not attempted was due largely to the influence of the Mini: an influence which was enhanced by the superficially unrelated debate on car safety.

The Roman poet Horace once grumpily observed that nothing is beautiful from every point of view. That ma\ have been true in Horace's day, but a fine example of why it isn't am more is Cheviolets exquisite little Corvair two-door coupe. From any angle the Corvair is faultless, including the view above which is normally one of the most unflattering angles from which a car can be photographed. Nothing on this car ever appears too long, too short or in any way out of proportion. It is a styling *lour d< force*. An i igenious finishing touch is the gentle crease that courses around the cars middle, impaiting a lightness and crispness to the whole that is altogether masterful.

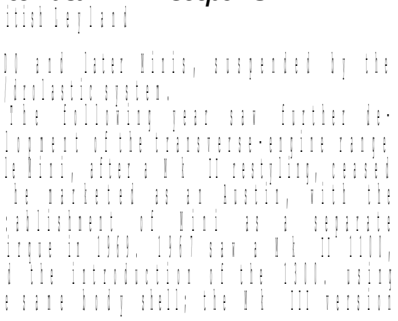
Chapter 13

The issue of car safety in general, and the rear engine configuration in particular was raised by Ralph Nader in his book 'Unsafe at any Speed*, which was an attack on the dynamic instability of the Corvair. The Corvair was introduced in i960, a year after the Mini, and represented, in an American context, almost as radical a redesign. Market research had shown that more intelligent Americans (i.e. college graduates) were more likely to buy imported cars. The Corvair was an attempt at 'European* design. It was in fact viewed in Europe as a return to sanity by American design after the romantic *excesses* of The Fin. The Corvair returned to the near-symmentrical profile widely adopted in Europe since its introduction in 1950 by Ford. Moreover, it represented a return to classicism, not only in its symmetry but also in its size and in its adoption of the rear engine. It was a rare attempt by General Motors to design a car of 1sensible* size, 'civilised* proportions and economic construction. For these reasons it sold well in Europe as well as in the U.S.A. Unfortunately it inherited the dynamic instability of the under-developed rear engine layout. Worse, General Motors realised this, but chose to ignore it. Nader obtained a copy of the internal memo concerning this decision and launched an attack on the cynicism of the company. Further, he accused the VW Beetle, at that time the best-selling import, of possessing the same instability.

There seems little doubt that Nader*s criticisms were justified. The VW does oversteer to a degree which may be deemed unacceptable; it was, after all, designed in 1936 when not even Porsche knew how to solve the problem; neither did Ledwinka, whose patents he infringed. There was less excuse for General Motors. They may have been ignorant of aerodynamic solutions to the problem, but they were certainly aware of engineering palliatives, which they refused to apply on grounds of cost.

What was unfortunate about the episode was that the stigma of instability came to be attached, by association, to all rear engined cars. For General Motors it meant only a change in marketing strategy. Their response to Nader*s criticism was characteristic. Making a virtue of necessity, they admitted that the Corvair*s handling was tricky but implied that this made it driver*s car*. Modifications were made not to the suspension, but to the engine, to increase power output. Remaining in production for 9 years it was sold as a sporting saloon, technically

65 Austin Mini Cooper 'S'.



56 Austin A40 Farina saloon.

Model	Cooper S970	Cooper S 1275	Mini Mk II 850	Mini Mk II 1000	Mini Mk II 1000
Types	Sal	Sal	Sal	Sal	Esi
Years	1964-65	1964-69	1967-69	1967-69	1967-69
/Vo Cyls	4	4	4	4	4
Bore	70.62	70.6	62.9	64.6	64.6
Stroke	61.91	81.3	68.3	76.2	76.2
Capacity	970	1275	848	998	998
Valves	ohv	ohv	ohv	ohv	ohv
CR	10.0	9.5	8.3	8.3	8.3
BMP at	64	75	34	38	38
... rpm	6500	5800	5500	5200	5200
Coolant	W	W	W	W	W
Carburation	2SU	2SU	su	SU	SU
Wheelbase	6'8 V	6'8%"	6'8%"	6'8%"	7'0"
Track	4'0Vi"	4'0⅞i"	3'n% "	3'11%''	3'11Vi"
F Suspen	1Rub	I'Rub	I Hyd	1Hyd	I Rub
R Suspen	1Rub	I Rub	I Hyd	1Hyd	I Rub
Length	10**m "**	1O'OVi"	**10'0''**	10'0"	10'10"
Width	4'7"	4'7"	4'7%"	4'7%"	4'7%"
Weight	12%	12%	12%	12%	13
Top Gear R	3.765	3.77	3.77	3.44	3.44
Tyre Size	5.20x10	5.20x10	5.20x10	5.20x10	5.20x10
0-50		8.2		17.2	17.2
Standing Q-m		18.4		22.7	22.7
Fuel Consum		28		34	2
Max Speed		96.2		75	75

too advanced for the masses, but of interest to the sporty intellectual. Nevertheless, they did not repeat the experiment. For VW however the effect was traumatic. Clearly the Beetle was obsolete, but if it was also to be considered unsafe in its largest market, the future would be grim. Several attempts were made to widen the VW range. All involved rear-mounted air-cooled engines, and none was particularly successful. Not until the take-over of Audi-NSU made available a very different design expertise did VW*s future seem assured. It was this expertise which was to lead to the adoption of the front wheel drive hatchback concept which had become established as the predominant design mode in Europe.

Nader*s attack was thus partly responsible for the sudden undesirability of the rear engined car (except of course for the Porsche, which was accorded exemption by re-classification: not car, but supercar) but does not account for the consequent vogue for the front wheel drive hatchback. The design revolution which this represents was brought about by a process of creative synthesis, pragmatism, cynicism, and irony.

Pinin Farina has been falsely credited with the invention of the fastback envelope body (Cisitalia 1948) and has not demurred. More strangely he has not been credited with the 2-box hatchback, and perhaps out of a sense of justice, has not protested. His 1958 Austin A40 was a synthesis of estate car and saloon. However, it was perceived not as synthesis but as compromise (a distinction I shall explore later) and was therefore rather underestimated. Several extraneous factors were partly responsible including the introduction the following year of the Mini. Not only was the Mini clearly a far more radical redesign than the A40, and therefore overshadowed it, but since both were intended to replace the A35> they were really competitive designs. BMC failed to capitalise on the fact that they represented opposite approaches to space: contrasted to the absolutism of the Mini was the flexibility of the A40. But whereas the Mini pursued the absolutist ideology to an extreme, the A40 only tentatively explored the notion of flexibility. The hatchback was in fact offered only as an option; that is, it was presented as a secondary rather than a primary characteristic of the design. The Mini could not be emulated; the A40 was not considered worth emulating.

At the opposite end of the spectrum from the A40 the Jaguar E-type coupe, MGB GT, Rochdale Olympic, and GT6 established a few years later a tradition

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even at tick over speed. The headlights have a simple beam adjustment that allows you to alter the angle when a heavy load is carried, ensuring a well lit road ahead and preventing dazzle. So there it is;

an ample 25 cu. ft. simply py toiaing trie DUCK seats. m m me seats iuny reclined you can even sleep in it without having to remove your luggage What other car in the world offers as much versatility as the Renault 16

of hatchback coupes. In these examples, the hatchback was the most elegant solution to a very real problem of access. Accepting the notion of the coupe, as opposed to the open sports car, the roof line which swept down from the driver's head to the rear bumper represented a reasonable compromise between external aerodynamic form and internal enclosed space. This space was limited, and difficult of access, as anyone who has tried to remove the spare wheel of a TVR will testify. The hatchback rendered this limited space immediately accessible, and was largely responsible for the popularity of the MGB GT. Apparently no connection was seen between the utilitarian hatch of the 2CY, A40 and R4 and the aperture employed on these coupes. Both were seen as specialised applications.

The car which synthesised the two approaches was the Renault 16, which utilised the hatchback, together with a multitude of seat positions, to combine the commodiousness of the estate car with the sophistication of the saloon and performance approaching that of the sports cars. Front wheel drive and torsion bar suspension provided good handling and a low platform height at the rear. These advantages, together with performance and prestige far above those of the A40, firmly established the hatchback concept in the middle range market. It provided a new paradigm, in the Kuhnian sense, of what the car might be, and this has been consolidated by many other manufacturers in recent years.

The irony is that while one of Issigonis1 motives in opting for front wheel drive was the ease with which a variety of body styles could be, and were added aft of the driver's seat, the one style never offered (except by Innocenti) was the hatchback. Issigonis thus missed the opportunity of providing the complete model for the current car. Yet this was no accident, for the R16 was to the Mini the total antithesis which the A40 was not.

The antithesis lies in the treatment of space. That of Issigonis I have called absolutist. In architectural terms it is the ideology of the tower block which deals with abstract notions of density rather than the pragmatics of life. That the Mini is more popular than the tower block is due to the differing efficiency with which the abstractions -work rather than to differences on the level of abstraction. In the R16, by contrast, space is conceived not as finite, but as malleable, flowing through the car, round its permutations of seat arrangements, and out of the hatch-back. That space was in no way considered to flow either round or through

the hermetic concept of the Mini was evident from its Cd of 0.64 and its total lack of ducted ventilation. In the hatchback, by contrast, the emphasis is not on the volume but on the malleability of space. As Vauxhall's copywriters have it: "it's anything you want it to beM, "it's as versatile as you are". Many current hatchbacks are in fact quite tiny, and it should be noted that the volume of luggage space varies inversely with the number of passengers carried.

The Rl6 conception is as revolutionary as its corollary, the aerodynamicist's notion of volume preceding the vehicle. Such a treatment of space had long been the architectural concern of Frank Lloyd Wright, but the vision he could offer only to the elite, the Rl6 brought to the middle classes. The hatchback of the Rl6 is a direct equivalent of the 'patio door* by means of which interior and exterior of the house may interpenetrate. The architectural precedent, the French window, did not have the same automotive parallel, even if some of the wooden-bodied estate cars of the 40s look somewhat incomplete without leaded lights. Though the synthesis of estate and saloon achieved by the Rl6 was remarkable, that of estate and sports car was more so. Koestler, in his useful analysis of creativity, defines the act of creation as the realisation that two previously disparate frames of reference may suddenly be seen to intersect. Any point on this axis of intersection, or 'bisociation* may be seen in the context of either frame, while its existence alters the whole gestalt.

The first thing to notice about this synthesis is that it would be impossible for the greater part of the world's car industry. Most major manufacturers are administratively divided according to established frames of reference: 'specialist car division*, 'sports car division', 'commercial vehicle division', etc. Synthesis or bisociation is organisationally impossible. Many new cars are hailed by eulogistic copywriters as being 'a new concept*; but while it is clear that few are, without the concept of bisociation it is not evident that few can be, nor is it clear why innovation has been the almost exclusive preserve of the small, or integrated, organisation. Awarding the title 'car of the year' to the Jaguar XJ6 (not an example of bisociation) the editor of 'Car' wrote:

> "The 1969 car of the year was conceived and executed by a relatively small team with a very clear idea of what they wanted to achieve. They were little influenced by the approach of the vast corporation of which they now form

> part. Their very success throws into focus the difficulty which the larger British groups are having in producing truly significant new cars - as opposed to the carefully market-researched, automotive-bromide models of which we are seeing a great deal." (1)

This difficulty was not exclusive to British groups. The Autobianchi Primula was produced by a subsidiary of Fiat, and was a development of Issigonis* 1100 concept not only in engineering terms (it avoided the need for the dreaded sub-frames to which Issigonis had resorted, with disastrous effects on production costs) but also in body design. The Primula featured a hatchback, but Fiat insisted on perceiving their subsidiary in an 'experimental* role, with the result that the Primula was not publicised, neither was its hatchback adopted in the Fiat range. The Fiat 128 which was otherwise based on the Primula retained the conventional saloon or estate option, and even the 127 appeared first as a fastback saloon, the hatchback being offered as an extra cost option. The organisational structure of Fiat thus delayed their adoption of the hatchback on the small car for so long that Renault were able to capitalise on it and claim the idea as their own.

Such organisational impediments did not beset Reliant. Their first 4-wheel car, the Sabre, appeared as late as 1962; and the first Scimitar GT of 1966 was basically a superior Ford sepcial. Similarly, Karen, designer for Ogle, whose show car of 1968 became the GTE, was better known for his work in public rather than in private transport. Both designer and manufacturer were thus comparatively free from the conceptual constraints of the car industry at large.

The second point about any creative act is that, once it has been done, it appears so obvious. Why did no-one think of it before? It is a measure both of the originality of the GTE and of the conceptual rigidity of the car industry that no-one thought of the GTE even after it had been done. As 'Car* said:

> "It will be interesting to see the extent to which it is in fact accepted; there is always an element of risk in trying to introduce a new concept. But it deserves to succeed, if only because it really offers something new."

This slowness to recognise and adopt new thinking has marked the reaction to all real innovation: cars such as most Citroens, the Mini, Lanchesters, the Model T Ford have all revealed to the industry a new approach, and in every case the reaction has come late, or never. By these standards

Volvo's response to the GTE, made in 1972, was instantaneous.

The third important point about creativity, highlighted by the fate of the Volvo, is its relation to notions of development. Historians of technology tend to use a Darwinian model in which the evocative vocabulary of 'evolution* or 'progress* looms large. However, this model is incapable of embracing the notion of revolution in either mechanical or biological terms. Fundamental to it are the two notions of random mutation and natural selection. The first may be disqualified as a causal explanation by a process of simple calculation, while the second rests upon a tautology: "survival of the fittest" means no more and no less than "survival of the fittest to survive", that is "survival of the survivors".

If biologists are able to use this model to their own satisfaction, it is because they are rarely confronted by the problem of revolution. In the history of ideas, however, it is clear that several sudden changes of direction have occurred which can in no way be extrapolated from preceding events. Quasi-biological development may take place between revolutions but the future cannot be predicted from this. One of the original ideas of the present study, for example, was to quantify the proportions of cars, with the aim of predicting future developments. Yet it quickly became apparent that a graph of any ratio (e.g. height: length) was subject to sudden changes of direction, the causes of which must be sought elsewhere.

The notion of scientific development by revolution as expounded by Kuhn and enlarged by Koestler seems more appropriate, yet even this is not quite accurate. Koestler distinguishes five progressive phases in the history of ideas: Revolution, Consolidation, Saturation, Crisis, New Departure. Yet as far as the hatchback is concerned, the phase of consolidation hardly occurred: saturation seems to have followed revolution, separated by a period not of consolidation but of inertia. Furthermore, crisis certainly occurred, but externally to the idea itself, and preceded saturation.

The crisis occurred on the mythic level. The effect of 'the safety scare*, was to focus attention on function, which had been the last thing in the minds of most designers. The increase in oil prices in 1973 and the concommitant public awareness of the finiteness of resources ^e-emphasised this consideration. Harsh reality intruded into the

romantic universe of symbolic freedom. The consumer who had stoutly maintained, against all the evidence, that his car was "simply a means of transport from A to B" was suddenly confronted with the reality to which he pretended. It seemed that the car, as a repository of mythic values, was dead.

The designers rediscovered the hatchback. The 7CV, A40, R16 and GTE had been good ideas virtually in vacuuo, but once that vacuum was filled with growing doubts about the future viability of the car, the hatchback was seized upon as a symbol of function. For the effect of the hatchback, like that of the exposed wheelnuts, flared wheelarches and airdams which have accompanied it, is to impart to the private car an air of purposiveness. It matters little if actual space for luggage be less than in a 3"k°x saloon (as it almost certainly will be if passengers be carried); what is important is that the yawning tailgate is so obviously useful. Even if you cannot think of a use for it at the moment. It extends an invitation to carry articles far too bulky to be taken on public transport and since you never know when you might need it, it implicitly presents a powerful symbolic argument for the private car. Carping realists have pointed out the many practical disadvantages of the hatchback: some cannot be opened if the car be in a garage or parked close to a wall; all entail problems of noise, heating and structural rigidity.

This last consideration is of considerable importance for proponents of the evolutionist model. Changes in context (environment) press for body rigidity (safety legislation) and simplicity (resource usage, ease of maintenance, economy). Yet the front wheel drive hatchback not only uses the most expensive transmission system yet devised (apart from 4-wheel drive) but also compromises its structural integrity in order to make a gratuitous offer of only apparently additional space. The product of classical thought in the 1960s has been seized upon by the romanticisers of the 1970s 'functionalism1.

Since the crisis which brought about this transformation is still in force (despite the concerted efforts of the car industry to ignore it) it seems fairly certain that until such time as the private car is priced beyond general reach (when its symbolic value will obviously change) the hatchback will be retained despite its limitations. For symbolic power always takes precedence over boring practicality.

The argument most commonly advanced in support of the current vogue for front wheel drive is the safety one, which claims advantages in terms of both primary and secondary safety. These claims, however, should be viewed with some suspicion.

Primary safety is concerned with accident avoidance, and it can be shown that the roadholding and handling of current front wheel drive designs are superior to those of their immediate predecessors (e.g. Fiat 127 v Fiat 850, R12 v R8). The rear engine has been almost universally abandoned, and several manufacturers, including Renault and Simca have adduced the safety argument. The problem is that comparisons with earlier designs, however valid, represent only a partial truth, since they obscure the existence of alternative possibilities. The trend in so-called 'supercar1 design, for example, has been to the mid-engine location revealing that the superiority of front wheel drive is relative rather than absolute. Further, 'conventional* design, as developed by Opel for example, has also proved superior in terms of primary safety to the rear engine, and at lower cost than front wheel drive. But even this comparison is with relatively underdeveloped rear engine designs: Porsche have demonstrated that the rear engine lay-out can be developed to exceed the requirements of most drivers. What in fact has happened is that manufacturers have abandoned the cheapest method of construction in favour of the most expensive on very tenuous grounds, drawing partial comparisons to support their move. One crucial aspect of primary safety, for example, is braking performance, which is rarely referred to. This is because the 'inferior* rear engine configuration inevitably provides superior performance in this respect. The phenomenon of weight transfer under braking which accounts for this superiority means that a front wheel drive design may have to transmit *80%* of its braking force through the front wheels. This may in fact represent a greater effort than the driver can provide without servo assistance (which entails further expense, weight and complication) even though his unaided efforts will more than suffice to lock the rear wheels.

It is when we consider seondary safety, however, that the weakness of the front wheel drive argument is really revealed. All manufacturers define secondary safety as the provision of a 'safety cell* or 'safety cage* for the passengers, surrounded by progressively deformable sections. Several manufacturers stress this in their advertising, providing dia-

Repository **of** myth

1973 Tyre11

1974 Pontiac Transam

grammatic illustrations. These illustrations, however, never show the engine, for the very good reason that the engine block is not progressively deformable1. Crushable zones must be provided around the engine thereby sacrificing the major inherent advantage of front wheel drive, minimal length. If the obstinately undeformable engine block be placed behind the passengers, the front may be made as deformable as may be wished. One of the best performances in British crash testing was in fact by a rear engined car, the Clan Crusader; a car which was noted by road-testers to possess in addition exemplary roadholding, handling, and braking. Clearly the rear engine configuration is capable of providing performance in terms of both primary and secondary safety that is at least the equal of the front wheel drive configuration, and at considerably lower cost. It might also be noted that the provision of a smooth underside, and therefore greater aerodynamic efficiency, with all that this entails, is also far easier given a rear engine.

It would appear, therefore, that the safety argument adduced in favour of front wheel drive is at best doubtful and possibly completely spurious. It is rationalisation, rather than rationality: a pseudo-scientific justification for the myth of symbolic utility.

One of the early conclusions of this study - that the car, as a repository of myth, is dead - is now seen to have been premature. However, its corollary - that the car, as an object of design, is dead - still stands.

The distinction I have drawn between classic and romantic modes of design approximates to that between 'design' and 'styling'. That 'styling* is now almost universally considered a dirty word is evident from the change of nomenclature exemplified by General Motors. The assumption behind this strategy is two-fold: that 'design* of the car is still feasible; and that 'styling' is still acceptable if disguised as 'design* - that is, if it romanticises 'function*. The latter activity is widely evident but I consider the former to be no longer feasible.

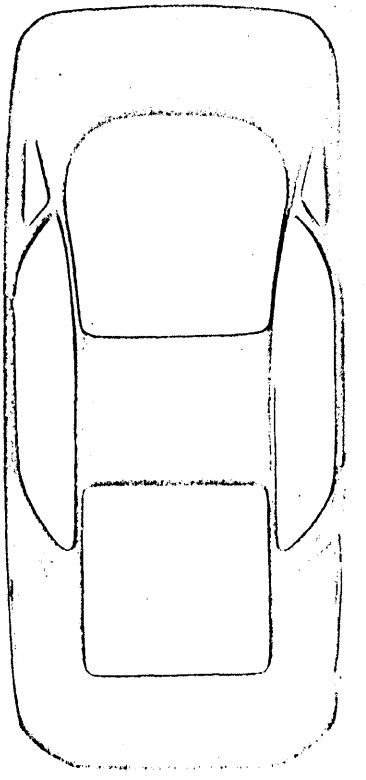
Historically, the form of the private car has changed little, and has been predicated on two assumptions: the supposed transport needs of the nuclear family (whose existence it has encouraged); and the availability, of the means to fulfil those supposed needs. Its probable historical failure to meet the first has been masked, in the producing countries, by the surplus capacity of the latter to provide alternatives. Today,

resource shortage focuses attention on the extent to which the car does in fact meet transport needs.

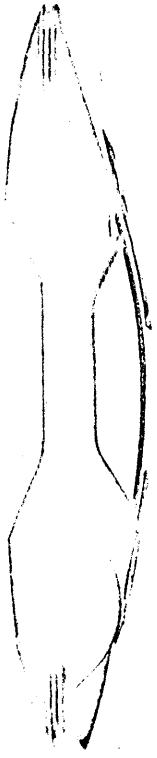
The average car typically carries fractionally more than one person. Now simply in terms of mass, irrespective of technologies employed, the private car represents an inordinate outlay to transport one or two people. Something on the scale of the motor cycle would he far more appropriate. If larger numbers must be transported something like the minibus is far more economic than the car in mass/capacity terms. The bus or train is even better. The car can be quite efficient if all seats are always occupied, as the communal taxis of Israel, Turkey and elsewhere demonstrate. But this raises the question of ownership; and in property-owning capitalist democracies in which the car is acknowledged as the second-largest capital expenditure made by an individual consumer, this question is fundamental. Furthermore, since the manufacture of the private car forms a vital component in the economies of these countries, the crisis in car design is ultimately that of capitalism itself.

Governments inject public money into car industries not because demand for the product exists, but because survival of the economic system depends upon the employment created by manufacture. Failure to buy is tantamount to treason. Meanwhile public transport is crippled; accounting procedures are adopted which insist that capital expenditure in public transport must be amortised, but assume that that in private transport is invested by God. British Leyland plans expenditure of £48m to produce a 'new1 Mini with an engine designed in 1948 while bus fleets are immobilised waiting for spare parts. Over the past three years bus companies have had, typically had, at any one time, 30% of their fleet immobilised because of unavailability of spares. The waiting time for some parts is over 2 years.

There is little doubt that the 'new* Mini will feature a hatchback, and so assert its claim to have been 'designed* with 'function* in mind. The conclusion that the car as an object of design is dead rests on the conviction that romantic design, which has enriched the visual experience of many people, is now irrelevant and that classic design can no longer legitimately consider the private car as any kind of 'solution* to the actual needs of users.



ONE SAYS THAT THE FUNCTION CREATES THE SHAPE, BUT THE FORMAL INTERPRETATION OF A SAME FUNCTION, IN OUR CASE OF THE AUTOMOBILE, ARE NUMBERLESS (AND NOT VERIFIED). TODAY ALL CARS MEET VERY WELL THE REQUESTED PERFORMANCES, BUT PERHAPS DON'T SOME SO WELL NOT TO THE REQUIREMENTS THAT MAKE ALSO CARS BECOME EXPRESSIONS OF CULTURE.
AND IT IS CHARMING TO LOOK INTO THE REQUIREMENTS OF THIS CULTURAL PROMOTION, BECAUSE OF THEIR GREATER AND GREATER IMPORTANCE IN HISTORY.



Appendix I

The Politics of Design Aesthetics

The contrast between classic and romantic design is usually seen exclusively in aesthetic terms: the possibility of political implications was first generally recognised in the six years preceding the last War. The political significance of German domination of Grand Prix racing in 1939, echoing that of 1914, was lost on no-one, and the reason for their domination was evident. By addressing themselves directly to the logical problems of the formula, at the expense of notions of beauty and of visual as opposed to actual lightness, the German designers dissociated themselves from, and by their success discredited, the romantic aesthetic which had underpinned European design since 1918.

The obvious immediate association was of romantic design with liberalism, classic with fascism, and there was much to support this view. Classic design, whether practised by Voisin, Burney, Porsche or Issigonis is authorative, if not authoritarian. Its reference is to objective criteria, rather than to the vaguer, almost mystical notions which underlie romanticism. In Grand Prix racing objective assessment is provided, but on the open market the allegedly objective virtues may not be appreciated. Certainly to Voisin, the buying public appeared an ill-educated, fickle mob often incapable of appreciating such virtues: failure to sell indicated deficiency in the judges rather than in the product. Implicit is a notion of superiority, whether intellectual or moral.

Romantic design, however, insofar as it concerns itself rath fantasy, nostalgia, anthropomorphism or myth, takes as its point of reference individual consciousness and its appeal may range from the universal to the individual. At one extreme it may invoke Freudian or Jungian validation of its universality, at the other it may lapse into a mindless position of ”it's all a matter of taste anyway”. This contrast has led to a number of paradoxes from which it is clear that the right/left political association of classic/romantic is misleading.

For example, it might be expected that a mode of design rooted in individual consciousness would be the preserve of the individual designer or small firm, while one appealing to objective criteria would inform the work of the team or huge impersonal corporation. Yet this has not been the case. Almost all classic design has been produced by individuals,

Synthesis

1949 Bristol 409
1994 Jaguar I) Type
1968 RSU RO 80

or small integrated teams, while the larger the corporation, the more likely it is to produce romantic designs.

The solution to this apparent paradox lies in the relationship of the hierarchy which is the car to the hierarchy which is the producing organisation. In terms of production, endemic to the car industry is a dislocation of the hierarchy at the mechanical/non-mechanical level. This has become synonymous with a concealed/visible distinction, implicit in which is the assumption that two different production methods/sets of rules/modes of thought are involved. Increasing size of production organisation invariably entails further sub-division, departmentalisation; and since the primary function of any department is to justify and perpetuate its own existence, divisions become concretised, and relationships between different levels of the hierarchy more difficult to regulate. Requisite for classic design, by which is implied regulation of the hierarchy of subsystems which comprise the car, is regulation of the hierarchy of the production organisation. This is easiest in a concern small enough to be non-departmentalised, non-fragmented. It is of course possible, but unusual, for the sub-systems of the large corporation to be so regulated as to allow of classic design. More common, however, is a situation in which one department, be it styling, production engineering, or accounts has a disproportionate determining influence on the product. !Disproportionate* is of course difficult to define; but taking Koestler*s notion of the *holon*, empirical definition by exclusion becomes possible. Implied is a notion of balance which is often cited in relation to the product; thus a car may be described as too fast for its chassis, or conversely, deserving a more powerful engine. In both applications, the notion of balance appears to imply a biological homeostatic model.

Also perhaps biologically based is the distinction between romantic and classic as previously discussed. Thus, using Piaget*s (2) development model, animism, which lies at the roots of romanticism, is structurally different from, and occurs earlier than the capacity for formal logic, on which classicism is based. In this sense, of course, both romantic and classic modes in their extreme form are pathological, indicating fixation at one or other developmental level. Synthesis, siich as maturity should make possible, has only rarely been attained in car design. However the location of classic design in an objective and of romantic in a subjective universe have favoured the adoption of the latter by an industry to whose survival it has since become essential.

When Buirk introduced their first Riviera in late 1962 it was an immediate success. A neat and ordered blend of rounded and razor edge fonns, it was refreshingly different and was a very popular seller. But with the introduction of the 1966 model the Riviera became a stunningly beautiful car. Although it shares its E-body structure with the Toronado, the outward effect is entirely different — and equally effective. Enough has already been written about the styling treatment of this latest Riviera to fill several volumes. All of it has been praise, and all of it is well deserved. The design is absolutely flawless. *397*

Oldsmobile's Toronado is the most distinctively styled American automobile since Gordon Buchrig's 810 Cord. A radically different look has been achieved with a minimum of fuss. There are no loose ends, no unresolved lines. Starting from the car's center-line, the angle of the roof gradually increases as it nears the window edge, falls in an unbroken curve almost to floor level and then swiftly curls underneath in a pronounced roll-under. The most striking features of the Toronado, the bold wheel arches, arc thus left standing free of the rest of the car. The result is logical, imaginative and totally unique.

An impressive testament to the ingenuity of GM stylists, the 1967 Cadillac Eldorado is bast'd on the E-body structure which it shares with both the Toronado and the Riviera, but it is strikingly different from either. It possesses an aggressively angular look which demands instant attention without resorting to bombast, and there are few cars that can stand next to it without disappearing altogether. The lines are concise, sure and unlike anything else on the road. Though the Eldorado name has been used by Cadillac for-some years now, it has never been applied to a more distinctive car. *399*

What price 'Progress'?

The functional superiority of classic German design in the 1930s was over both romantic design and even over the synthesis of Bugatti. Since then, however, both classic and synthetic have been largely submerged in the overwhelming romantic output of the world1s car industry. The most important single cause of this has been the increasing size of producing organisations.

Mass production, and the ever-accelerating growth of both investment and output which it entails, militate against both classic design and *universal* or archetypal romantic design and favour instead a trivialisation of the romantic, which in turn serves the ends of production. Production runs of pressed steel bodies are determined by the life of the producing dies, and the higher the volume the shorter this life. It is therefore in the interest of the high volume manufacturer if the customer can be persuaded of the desirability of a new model in a cycle which corresponds with that of his dies rather than with the longer one of a low-volume competitor, whose product can thus be made to appear 1outmoded1.

By objective criteria the actual needs of consumers may be long-term; but as this is not in the interest of the high-volume producer, he may go to extraordinary lengths to ensure that the *real* needs of the consumer are replaced by other, perceived needs which are more favourable to his interests. American marketing methods have been well documented, and they dominate by reason of ownership or example, those of most of the industry. Their success in modifying the perceived needs of consumers is evident from Buckminster Fuller*s Inventory of World Resources, quoted by Papanek

	Primary Useful Product Life in Years	Actual Time Used in U.S. in Years	Actual Time Used in Underdeveloped Countries in Years
Automobiles	11	2.2	40+

The rationalisation, where one is offered, for planned obsolescence is technological progress; yet it is clear that consumers are urged to replace their cars in a period so short that any *progress* is imperceptible, Furthermore, while some models may be functionally superior to those they replace, others are inferior; and any technological progress which may or may not occur is secondary to the principle of change for profit*s sake. Also, the notion of *progress* implies that consumers* needs are

being consulted, and are being met with ever-greater efficiency. Yet this, despite the existence of considerable 'market research* is clearly not the case. Almost exclusively, the *improved* new model turns out to be bigger than its predecessor. This is not in the interest of the consumer (even if it be his expressed desire) but of the manufacturer, whose profit may be expressed as a percentage of mass. By any objective criterion (resources, pollution, congestion, declining birth-rate) real needs are best met by reduced mass; but manufacturers by their model policy and price structure invariably equate bigger with better. *Market research* thus always operates with loaded questions and within the manufacturer*s own parameters: if Ford, for example, decree that price and *status* vary with size, then the respondent has little option in defining how to *improve* the model he drives. Such *research* is directed not towards any real needs the consumer may have, but towards those which it is in the manufacturer's interest to fulfill; he after all is paying the 'research* bill.

The Ford Capri Mk 1 like the Mustang before it, was the product of intensive *market research*. What was unusual about it was the advertising, which in claiming it to be "the car you always promised yourself" made explicit what usually remains tacit: the manufacturer*s familiarity not with objective needs, but with innermost dreams and aspirations. The common solution was the masking of stock mechanical components with visual symbolism concocted from Freud and Jung. If the Mustang was crudely phallic and the line of its bonnet dictated more by suggestions of erection than aerodynamic dictates, the Capri with its curved windows was a more slippery hermaphrodite. But the common effect was to direct attention away from function and towards superficial appearance: into a universe where the curved panel is more desirable than the flat (or vice versa) and the masculine more valued than the feminine (or vice versa).

Of considerable importance in focusing attention on this symbolic universe have been the Italian Carrosserie. Their interests, like those of the mass producers, are best served by frequent model changes, since their designs are either made in very small numbers with low capital investment, or sold to major manufacturers: the more often the latter are in the market for designs, the better for them. Their model is the clothing industry and their desire is to shorten production runs to correspond with the showing of their 'collections' at the international motor shows.

Pinin Farina's

> "fundamental assumption is that a body design should always conform with the principles of a constantly updated and evolving aesthetic." (^0

Naturally whether the designer should lead or follow this aesthetic evolution is a matter of some debate. Vignale considers that "style is bound to public taste" (5), while Sergio Rogna believes that the designer should lead 'public taste'; this unfortunately can lead to a car "so advanced in taste that few appreciate it". (6) The car in question was the Maserati 3500 Spider designed by Vignale - which may cast some doubts on the latter's accuracy of self-perception. Ideally, of course, designer and public march confidently together along the road of aesthetic evolution.

Their progress has been obstructed in recent years by intrusions from the real world, but the ideological footwork round these obstacles has been commendably nimble.

Perceiving that planned obsolescence and a rapidly evolving surface aesthetic presuppose an exponential growth curve which looks increasingly improbable, some commentators have suggested that 'industrial design' may take over the evolutionary baton, albeit at a slower pace. Thus Pio Manzu and Michael Conrad suggest (") that a proliferation of fashion leads to subjective taste and the loss of logic; "styling" therefore becomes a dirty word to be abandoned in favour of logical "design" (and an objective taste?). L. Savoia develops this notion:

> "The 'stylist* was an aesthete - an individual creator of objects - but now the 'industrial designer* is mediator between man and machine (automation and cybernetics) in the system of the automobile." (8)

Manzu confirms that

> "Now changed social and economic conditions made the car simply 'an object for use' - that is, a problem of industrial design. Romanticism is against the modern trend to automation." (9)

Tomas Maldano completes the evolutionist argument:

> "Until 1930, the designer was an inventor, manufacturer, planner (e.g. Henry Ford). From 1930 until the present the designer was an artist, whether popular or purist. But from now on the designer will be co-ordinator between the means of production and the requirements of the product." (10J

Still nothing about the requirements of the customer... In fact it is clear that the car industry, whatever its model policy and whatever its aesthetics, has saturated society's ability to absorb its products and

is therefore unable to meet the needs of the travelling public. Perhaps recognising this, all the Italian designers, with the exception of Giugiaro, while paying lip service to the 'industrial design1 argument, have continued to practice romantic design. They have no choice. For there cannot be room for many design consultancies such as Ital Design, particularly if the longer model cycle implicit in the industrial design argument be adopted. The coachbuilders' economic future depends upon the perpetuation of 'styling1, of the 'fashion' approach. They have recently been encouraged by the emergence of a new clientele in the Middle East whose aesthetic they may help evolve, while rumour suggests that the fashionable paint finish for 1980 will be tartan.

Inevitably, therefore, the Italian trendsetters perpetuate a design mode upon which their economic survival depends. The major manufacturers, whose own economic situation is little more secure, also persist in their attempts to distract the customer from real to imagined needs. Marcuse, in his pessimism, believes that society is willingly and irretrievably locked into a universe of values dictated by the manufacturers:

> "The people recognise themselves in their commodities; they find their soul in their automobile, hi-fi, split-level home, kitchen equipment. The very mechanism which ties the individual to his society has changed, and social control is anchored in the new needs which it has produced." VA*/

But the mechanism through which this social control is exerted is romantic design. For only by diverting the customer from real to perceived needs can manufacturers hope to satisfy him. The iconography of myth is rich and powerful but the recent switch from the myth of freedom to that of function leaves the structure exposed to the winds of reality. The air-dam may prove inadequate to deflect the wind of change. Consumers may still be persuaded that bigger is better but it is doubtful if they will be persuaded that on the other hand the best things come in small parcels before petrol is sold by the pint. The present crisis reveals the discrepancy between real needs and the solutions proposed by decades of corporate 'progress*. The latest Cortina is "a car that's built to last". After all, "Ford have the knack of producing the right car at the right time". (13) Taken together these t/wo claims seem to commend the car as one in which to ride out the crisis of capitalism. At "around 25 m.p.g." the driver should have an interesting time during his car's "long reliable life". (x5)

Elsewhere 'ESV* noses and 'safety' bumpers outside, and soft cloth up-

holstery inside lull drivers into an illusion of inviolable, womb-like security. Meanwhile manufacturers intervene in an increasingly overt manner in the domestic and foreign policies of governments in their attempts to safeguard supplies of cheap labour with which to deliver the next fantasy. And fantasy it must be, for only by romantic design can the manufacturer prolong the consumer's symbiotic slumber.

But if classic design, with the threat which it implies to the existing production organisation, appears unlikely, synthesis 'such as maturity should make possible' is out of the question. Whether one adopts the developmental model of Piaget or the neurophysiological one of Ornstein, it is evident that existing structures rely on dislocation, fragmentation, alienation of form from content, artist from engineer, imagination from intelligence, conscious from subconscious; that the consumer of its products can only be one-dimensional man. Integration of personality, of society, of real and perceived needs is impossible within the existing structure. It can only be hoped that the very real wind of change which blows through the cracks in the consumer's brain will awaken the realisation that his slumber is in fact not symbiotic but hypnotic and that the design and manufacturing expertise at present squandered in nightmarish fashion will be applied to the solution of the real problems of an increasingly evident real world.

Appendix 2

The Problem of Meaning

The problem of meaning has long exercised the minds of philosophers, psychologists and linguists, and has recently given rise to yet another discipline, semiology, whose special object it is. Springing from linguistics, semiology has as its aim the construction of a 'science of signs* which will ultimately encompass linguistics itself. That this aim seems unlikely to be rapidly attained may be explained by the recalcitrance of a factor which has already emerged as central to the present study: that of the relation of iconic to non-iconic signs.

Linguistics is concerned with a non-iconic sign system, onomatopoeia being the exception which proves the rule but which can also be accommodated within the rules. Spoken language is a rule-based activity, and much of the discussion has centred on whether its rules are innate or learned. One of the major contributions of Naom Chomsky has been to indicate the existence of different 'levels* of rules: at the level of 'deep structure* the apparent diversity of different languages is so reduced that the existence of a \miversal grammar* is indicated. Innate to all human beings, that is, is such a mental structure that they can intuitively apprehend the rules of any language which does not violate this structure - as no known language does.

The power of language is two-fold. On one hand the native speaker is enabled by his intuition of a finite set of rules to generate and understand an infinite number of utterances; on the other hand the relation of signifier to signified is arbitrary. That is, no relation whatever exists between any particular signifier and signified other than that conventionally agreed. Language depends upon social cohesion and also ensures, by its non-iconic relation to the world, that in the interests of communication this cohesion occur : it thus operates as both cause and effect of social groupings.

It would appear that music operates in an analogous manner. Its signs, like those of spoken language, are largely non-iconic: 'realism* in music is almost as rare as onomatopoeia in speech. Also, musical like grammatical structure seems to be intuitively perceived. Pythagorus demonstrated its mathematical basis and deduced that it is mathematical structure per se which is intuitively perceived. The extrapolation from

this - that not only music but the whole cosmos is structured upon mathematical relationships and so may be intuitively perceived - constituted an article of faith which underpinned centuries of intellectual endeavour. It was Kepler's misfortune to discover that the harmony of the spheres is merely a five-finger exercise. (2) However, the notion that music is somehow the key to an understanding of the world - that its signifieds are not specific but universal - survived even this apparently catastrophic reassessment. Its most recent manifestation has been in plant biology, where research has indicated that plants respond both to music and to the planets and therefore provide a possible cosmic link, based this time upon notions of 'wave length*. (3)

Visual communication differs from both language and music in several ways. Most important is that most visual images are iconic. The comparatively recent emergence in western culture of 'abstract art* has been countermanded by the simultaneous proliferation of iconic images by means of photography, film, and television. Societies which do not employ iconic imagery, on religious grounds, share a fear of iconic power: the abstract is 'safer*. Certainly the notion that possession of a likeness grants power over the signified is ancient and found in both established and folk religions. This identity of signifer and signified has no parallel in music and is approached in speech only by the proper noun. Further, it is immediately accessible to all men, cutting across social and linguistic barriers. Although the division between iconic and non-iconic is not immutable (the main concern of the visual arts for the past 100 years having been to explore and redefine the boundary) it does appear that the allocation of an image to one category or the other does involve a qualitative conceptual switch.

This fact is central to a number of psychological tests, notably the Rorschach inkblot test, which has been widely used by 'motivational researchers* since the 1950s. In this test the subject is shown a number of carefully selected 'ambiguous*, non-iconic shapes and asked to describe what he sees. The shapes are ambiguous in that while they are in fact non-iconic, it is possible, with a little imagination, to see them as representations of various objects and scenes. The rationale underlying this test is two-fold. Firstly, it is held that it is an innate tendency of the human mind to attempt to derive meaning: therefore the failure to exercise *a little imagination* is itself pathological. Secondly, it is held that in such cases of ambiguity the actual signified perceived is indicative of the 'psychological set* of the subject - this being the actual

object of investigation.

Now the tacit assumption of the Rorschach test is that the perception of meaning is contingent upon the perception of similarity: that is, that any visual language that may exist must be iconic. Nevertheless, others have attempted to formulate an 'abstract visual language'. The painter Mondrian, for example, drew an explicit parallel between his abstract compositions and those of music. It does appear however that some form of contextual clue, such as a title, is necessary before the correspondence can be perceived.

B. F. Skinner has succeeded in training rats and pigeons to respond to abstract visual shapes by the use of food as a reward or 'reinforcement': the square button 'means* food, the round does not. (4) Such 'meaning' is of course dependent upon total contextual control: in any other context it is unlikely that any relationship whatever will obtain between square buttons and food.

Although both animals and people may learn to perceive meaning in abstract visual shapes, it is clear that they have no innate propensity to do so, as Chomsky claims people have with regard to language. There is some evidence of innate propensity to perceive the meaning of iconic shapes, but even this is tenuous. Harlow's monkeys, for example, would respond to mother-images up to a certain level of abstraction, when response ceased, yet offered no response to images of similar survival value - those of snakes. One response appeared innate, the other learned. (3) Human infants, similarly, will respond to images of the human face, but only up to a certain level of abstraction. (^) The newly-hatched chicks of the grey-legged goose however are apparently less fussy and will accept as a mother-icon anything that moves: Lorenz established an alarm clock on wheels as such for one lucky brood. (^) Whether or not they were early birds is not recorded.

The only thing which emerges clearly from this is that there seems no innate tendency to perceive meaning in 'abstract* shapes, while there may be to do so with iconic shapes. The difference in where the demarkation between the two is drawn appears to be a question of 'sophistication*, whatever that may be. It may well be that the meaning of an abstract shape can be perceived only if the iconic derivation of that shape is detectable. If this is the case then the assumption behind the Rorschach test; is sound, and we are left with the not very edifying conclusion that

Bertone's customers are more 'sophisticated* than Harley Earl's.

If however we turn from the 'meaning' of isolated images to the relation between them, it becomes clear that no structure resembling that which underlies language or music informs visual imagery. Iconic images are not themselves related, but depend upon the relation of their signifieds, while abstract shapes - in the absence of a coherent mathematical theory such as once explained their relationship to the cosmos - share nothing but their abstraction. It is in this sense that we must examine such expressions as 'vocabulary of form*, 'a powerful statement', *a new idiom* sometimes applied to motor cars. If such expressions are to be more than analogies, we must define the scope and structure of the 'language* whose existence they imply.

While the number of possible utterances in any natural language, and probably in music, is infinite, the number of forms which a car body may take, and still be immediately recognisable as an automotive statement, is obviously finite. The scope of any possible car language thus approximates to that of such restricted codes as traffic signs rather than to that of a 'language* in the Cliomskean sense. Also, although it includes elements which are quasi-iconic the presence of non-iconic elements entails its comprehensibility only within a context of conventional approval, which is subject to modification through time and space. The shapes which signify social status for example are subject to such change. Any notion of innate comprehension would be difficult to validate.

It is however in terms of structure that the attempt to postulate a 'language* becomes most problematic. The level at which a generative grammar may be deemed to exist is comparatively simple in the cases of language, music or traffic signs. In the case of the car, distinctions between grammar, syntax, vocabulary, sense and nonsense seem intractable. For example, it might be maintained that the switch to a rear engine configuration entails not merely an enlargement of the 'vocabulary of form* but an actual change in grammatical structure. If this were the case, forms contingent upon the front engine would cease to be meaningful; yet if they did not where would we seek the level of grammar? If not in mechanical configuration, perhaps in materials (when the fibreglass car inevitably entails different sets of meanings from the steel car) or in flat panel versus curved, mass versus void (but is this not vocabulary?).

Another difficulty if that certain elements majr or may not he significant, dependent on context. For example, it is unlikely that many people know, or care, whether a Cortina is longer or shorter than a Renault 12; hut most will know that a Cortina is longer than an Escort. Length per se may or may not he significant, and the same is true of height, track, wheelbase, angularity. Wliat the designer does is to assemble from a set of elements which in themselves may not be significant, a statement whose overall meaning is, within the society, quite clear. This operation seems to he without parallel and perhaps explains why no-one has so far presented a coherent analysis of the car*s *body language1.

The fragmentary efforts of the semiologist Roland Barthes are noteworthy; and in spite - or perhaps because - of the methodological difficulties his essay on the DS19 represents, on a phenomenological level, an illuminating insight. (®) However, when he attempts a systematic analysis the difficulties become clear. Adopting a Saussurean linguistic model, to which the langue/parole (language/speech) distinction is central, he is forced to admit that

> "In the car system .... the scope of *speech1 is very narrow, because, for a given status of buyer, freedom in choosing a model is very restricted." (9)

He attempts to overcome this problem by widening definitions:

> "But perhaps we should exchange the notion of cars as objects for that of cars as sociological facts; we would then find in ihp r1r*ivin(T nf par's +.Tip vflriaiinns in nsanrp of the object which usually make up

But even after admitting the impossibility of alanguage of *car as object* he still finds that

> "The fact remains that if it is true that there are languages without speech, or with a very limited speech, we shall have to revise the Saussurean theory ...." (ll)

That is, the theory on whichhis whole approach is based. In fact, which-ever linguistic model they adopt, semiologists have encountered analogous problems in various fields, such that the whole emergent discipline now* looks in danger of being redigested by the linguistics whence it emerged.

In a way, this is sad, for there is much to encourage it. Clearly, the driving of a Rolls signifies something different from the driving of a Mini; a sports car means something different from a saloon car; a red car from a black one. But if it is to attain a level deeper than the anecdotal it must resolve these structural difficulties.

Anecdotally, two further examples. Consider the signification of the W to the pre-War Germans who paid their deposits; to the *technical advisors* from Humber cars who reported, after the War, that it was not a commercial proposition; to the countries whose markets it subsequently swamped; to those same countries when they devised a superior product. Clearly all -were contingent upon context: the cold, efficient Volks-wagen became the small, vulnerable, animated Beetle when it lost its technical superiority and when the Germans lost their image as bogeymen. Yet the devising of a coherent theory of signification even without such considerations of context defeated Barthes.

A final example. During the research described in Appendix 3> subjects were convulsed vuth mirth at the sight of the Burney; some were still laughing as they saw it for the eleventh time. How is this to be ex-plained in linguistic terms? Is the Burney no longer an automotive state-ment at all, but stigmatised by some crippling semiological ineptitude, to the amusement of the *normal*? Is it nonsensical, a tale told by an idiot, devoid even of sound and fury? Is it a really good joke? Or was it designed by Walt Disney?

It would be gratifying to be able to answer such questions. Meanwhile, however, the present study may further future investigations by indicating the importance of two factors perhaps previously overlooked:

1) iconic or quasi-iconic shapes - that is, those whose derivation is more or less easily detectable have relatively constant meaning; completely non-iconic shapes are (like Skinner*s buttons) totally dependent on context for any (temporary) significance they may acquire. The first problem, then, is to devise a theory which can deal with equal facility with both.
2) designers whom I have called romantic are specifically concerned with appearance, and with meaning; classic designers are not. The problem of intention thus arises as forms devised by one are adopted by the other. For example, wings and air dams were first devised by designers whose concern was all for function, nothing for *meaning*, yet as used on production cars many air dams are devoid of function: their presence is purely symbolic. How then can one divorce the *significance* of the air dam (for example) from the intention of the designer? And by what non-telepathic means may one determine such intentions?

It may be that such considerations will deter the discussion of car body shape from emerging from the empirical and anecdotal morass where it normally resides; it can only be hoped that this will not be the case.

Appendix 3

Factor Analysis and the Perception of Car Design

1. The Research Problem

Historical research had led to the hypothesis that differences in car designs can best be accounted for in terms of two dimensions: 1) organic versus inorganic, and 2) classic versus romantic. Organic is defined as bearing an iconic resemblance to certain natural forms (e.g. musculature wave forms) and is characterised by the illusion of forward movement even when stationary; inorganic, by contrast, is defined as using simple geometrical form (e.g. the flat plane, the hemisphere) not associated with natural formations.

Classic is defined as logical, rational, concerned with function rather than appearance; romantic, on the other hand, is essentially concerned with appearance, stressing by symbolic means the relationship between the car and other things or ideas held to be of value. These two dimensions were seen to be often, but not necessarily, related. For example, romantic design has often, but not always, been characterised by the utilisation of organic form. The evidence for this hypothesis has been given earlier.

As it stands, this hypothesis is, perhaps, one among several that might account for the facts. It was felt that weight would be added to it if it could be shown that contemporary persons can, as a matter of routine, categorise cars according to these dimensions. Personally, I considered the dimensions useful and valid, but it may have transpired, for example, that there was disagreement as to what shapes were or were not organic. I wished to discover whether these concepts had general validity.

2. Testing the Hypothesis

I a) A set of cars was selected which would:

i) cover the full range of both dimensions

ii) cover as fully as possible known historical developments

iii) represent both European and American interests

It was felt that 30 cars would be the minimum number to meet these criteria. The cars selected were

CAR	SCALE									
	LOOKS FAST / LOOKS SLOW	LIFELESS / ALIVE	ARTISTIC / SCIENTIFIC	FLOWING / GEOMETRICAL	ROBUST / DAINTY	UNINHIBITED / RESTRAINED	ORGANIC / INORGANIC	FEMININE / MASCULINE	UGLY / BEAUTIFUL	FUNCTIONAL / FANCIFUL
1	4	4	3	3	6	6	1	7	6	2
2	1	6	6	6	4	3	2	4	7	5
3	7	7	1	6	7	4	4	1	1	4
4	2	5	3	2	1	6	5	7	3	2
5	7	6	1	7	7	7	6	7	5	4
6	6	5	5	4	2	3	3	4	2	3
7	2	3	4	4	4	4	2	4	7	6
8	6	5	2	6	7	2	5	1	5	1
9	3	5	3	3	3	6	6	7	3	2
10	2	6	2	2	3	1	1	3	5	1
11	5	7	6	5	2	3	4	4	2	6
12	4	2	5	5	1	4	3	5	4	3
13	5	5	2	3	2	2	2	3	2	5
14	2	5	6	6	5	4	3	2	4	6
15	1	7	7	7	2	3	3	1	7	1
16	2	6	6	3	1	1	2	3	6	5
17	4	5	5	5	2	3	7	2	3	7
18	2	5	3	4	3	2	6	4	7	6
19	3	7	2	2	3	4	5	3	4	2
20	3	7	3	6	6	7	2	5	3	6
21	3	6	5	2	2	6	3	6	7	6
22	3	7	6	5	5	1	3	4	4	3
23	1	5	7	6	2	4	1	3	6	3
24	7	1	1	4	1	1	5	7	7	5
25	4	3	5	5	3	2	6	1	4	4
26	7	2	4	5	1	6	2	5	5	3
27	4	4	5	2	3	5	4	4	3	4
28	2	5	5	2	5	2	2	6	2	5
29	6	4	3	2	2	3	3	7	3	6
30	3	4	2	3	6	5	1	1	2	1

1. 1938 Alvis
2. 1968 Imperial
3. 1913 Mercer
4. 1947 Triumph
5. 1901 De Dion Bouton
6. 1947 Jowett
7. 1920 Lancia
8. 1912 Hispano-Suiza
9. 1939 Hudson
10. 1948 Tucker
11. 1937 Austin
12. 1941 Lincoln
13. 1925 Mercedes-Benz
14. 1968 Pontiac
15. 1970 Modulo
16. 1934 Airflow
17. 1970 Citroen
18. 1955 Imperial
19. 1933 Alfa-Romeo
20. 1958 Edsel
21. 1949 Talbot
22. 1923 Voisin
23. 1971 Lamborghini
24. 1928 Burney
25. 1965 Renault
26. 1937 Tatra
27. 1948 Cisitalia
28. 1965 Abarth
29. 1937 Cord
30. 1934 Hispano-Suiza

b) 35 m.m. slides were prepared on these cars. Unfortunately it was not possible to obtain standardised photographs, thus some were colour, some black and white; the cars were photographed from a variety of angles; some cars were empty, others included driver and/or passengers the cars occupied varying proportions of the frame; some slides incorporated two views of the car; the cars were photographed in various locations. It is of course impossible to say exactly what effect these variables may have had; however only one photograph was felt to be obtrusively different from the rest, and this was of the Voisin: the car was much smaller in frame than any of the others, and was the only one of a car in motion - it was obviously racing. For both these reasons I regard the responses to this photograph as unreliable,

c) Subjects were asked to rate each car (photograph) on ten seven-point rating scales (see Table 1). The scales were:

looks fast/looks slow	uninhibited/restrained
lifeless/alive	organic/inorganic
artistic/scientific	feminine/masculine
flowing/geometrical	ugly/beautiful
robust/dainty	functional/fanciful

These scales were held to relate to the two dimensions thus: lifeless/alive, flowing/geometrical, organic/inorganic related to the organic/inorganic dimension, with robust/dainty, feminine/masculine as further tests of this (it being presumed that sexual characteristics would apply only to organic forms) while artistic/scientific, uninhibited/

Car	A (1)	B (2)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	J (10)		
1	20 4·27	3·90	3·26	3·72	1 2·59	3·95	3·76	27 4·98	17 3·82	3·28	1938	ALVIS
2	11 3·21	3·56	4·42	27 5·07	2·95	4·73	4·85	26 4·90	7 2·53	2·92	1968	IMPERIAL
3	22 5·42	5·00	3 2·31	4·35	30 5·29	4 2·95	3·54	4 3·86	29 4·14	30 5·30	1913	MERCER
4	16 3·89	4·42	3·40	3·38	3·14	3·76	3·51	4·76	18 3·89	4·14	1947	TRIUMPH
5	39 6·87	4·45	4 2·55	30 5·62	3·88	3·61	3·22	1 3·29	25 4·75	28 4·17	1901	D-D BOUTON
6	23 4·89	3 2·46	4·39	3·51	4 2·81	27 5·12	4·62	4·30	2 2·31	6 2·69	1947	JOWETT
7	18 4·15	4·18	3·68	4·36	3·40	3·56	4·06	29 5·12	20 4·16	4·24	1920	LANCIA
8	24 4·80	5 5·25	1 2·16	4·65	29 4·85	29 3·19	3·58	5 3·88	30 5·60	28 5·17	1912	HISPANO
9	26 5·28	4 2·50	4·21	3·91	3·01	29 5·19	4·71	4·22	8 2·35	2·89	1939	HUDSON
10	12 3·41	3·36	4·15	3·19	3 2·69	3·99	4·18	4·64	9 2·63	3·20	1948	TUCKER
11	28 5·57	3·07	4·14	29 5·24	3·68	30 5·52	24 4·86	3·83	10 3·12	1 2·57	1937	AUSTIN
12	19 4·19	3·26	3·92	4·56	3·20	4·65	4·54	4·01	11 3·15	3·57	1941	LINCOLN
13	22 4·82	5·09	2 2·30	26 5·03	3·44	3·86	3·84	28 5·03	28 5·12	4·57	1925	M-BENZ
14	14 2·25	5·05	26 4·66	3·46	3·73	3·17	3·60	4·59	22 4·55	3·56	1968	PONTIAC
15	1 1·20	29 5·39	32 5·72	3·91	27 4·05	1 2·12	5 3·35	4·69	21 4·33	29 5·21	1970	MODULO
16	24 5·24	5 2·64	4·32	4·03	5 2·86	28 5·18	4·67	4·59	6 3·47	2 2·65	1934	AIRFLOW
17	7 2·69	4·18	27 4·77	4·61	3·50	4·29	4·10	3 3·70	16 3·72	5 2·87	1970	CITROEN GS
18	13 3·29	3·32	4·20	5·02	3·80	4·45	31 4·65	6·77	3 2·46	5 2·32	1955	IMPERIAL
19	6 2·62	25 5·37	5 3·20	2 2·71	3·50	2 2·81	3 3·19	4·07	24 4·66	21 4·53	1933	ALFA
20	17 3·92	27 3·22	4·00	28 5·11	3·06	4·21	30 4·00	4·73	8 2·55	3·19	1958	EDSEL
21	8 2·75	4·68	4·07	1 2·25	3·32	3·05	3·50	4·24	13 3·62	4·43	1949	TALBOT
22	4 2·29	5·06	28 5·52	4·59	3·96	3·30	3·55	30 5·46	12 3·27	3·62	1923	MORRISON
23	2 1·33	30 5·74	29 5·70	4·03	31 4·09	3 2·88	4 3·29	4·16	27 4·85	26 4·77	1971	COUNTACH
24	29 6·34	11 2·25	3·99	4·23	2·99	4·38	29 4·93	4·39	1 2·20	3·50	1928	BURNEY
25	10 3·16	3·81	4·58	4·91	3·51	24 4·70	4·29	3·92	18 3·96	4 2·77	1965	RENAULT
26	24 5·24	2 2·36	4·19	4·19	2 2·64	4·49	28 4·59	4·52	2 2·24	3·03	1937	TATRA
27	9 2·96	4·94	3·85	5 3·09	3·80	3·83	2 3·02	2 3·65	23 4·66	4·46	1948	CISITAU
28	3 1·67	17 3·85	4·66	4 2·97	24 3·92	5 3·02	1 3·03	4·51	26 4·81	4·46	1965	ABARTH
29	14 3·55	3·93	3·61	3·64	2·92	3·75	3·99	4·19	16 3·78	4·15	1937	CORD
30	15 3·65	4·11	4·43	3 2·84	3·32	3·56	3·84	4·22	15 3·76	4·20	1934	[illegible]

TABLE 2

Table 3 Table of Standard Deviations of Ratings of Cars on Scales

Car	1	2	3	4	5	6	7	8	9	10
1	1.176	1.478	1.070	1.376	1.085	1.477	1.404	1.365	1.433	1.340
2	0.982	1.694	1.196	1.490	1.303	1.470	1.630	1.580	1.407	1.356
3	1.512	1.545	1.601	1.512	1.275	1.573	1.811	1.798	1.631	1.630
4	1.256	1.252	1.235	1.256	1.255	1.573	1.262	1.468	1.481	1.510
5	0.654	2.062	1.955	1.443	1.680	2.124	2.180	1.653	1.772	1.953
6	1.042	1.551	1.177	1.106	1.191	1.423	1.679	1.253	1.253	1.262
7	1.268	1.677	1.603	1.746	1.425	1.677	1.654	1.645	1.735	1.549
8	1.560	1.499	1.442	1.647	1.499	1.589	1.715	1.904	1.498	1.628
9	1.194	1.455	1.002	1.098	1.170	1.293	1.623	1.277	1.205	1.453
10	1.067	1.513	1.237	0.986	1.285	1.652	1.728	1.379	1.449	1.516
11	1.104	1.781	1.071	1.281	1.457	1.351	1.698	1.416	1.635	1.453
12	1.115	1.379	1.031	1.197	1.186	1.156	1.343	1.355	1.237	1.313
13	1.260	1.577	1.253	1.529	1.399	1.735	1.696	1.704	1.443	1.612
14	0.939	1.542	1.670	1.407	1.271	1.417	1.727	1.485	1.467	1.544
15	0.840	2.231	2.205	2.551	1.792	1.819	2.446	2.199	2.201	2.293
16	1.019	1.532	0.945	1.144	1.242	1.328	1.669	1.446	1.570	1.642
17	0.925	1.711	1.522	1.497	1.166	1.327	1.536	1.400	1.497	1.480
18	1.040	1.343	1.135	1.344	1.166	1.576	1.537	1.367	1.468	1.480
19	1.100	1.262	1.554	1.419	1.165	1.323	1.401	1.572	1.530	1.695
20	0.942	1.428	0.824	1.372	1.261	1.518	1.369	1.423	1.588	1.501
21	1.155	1.423	1.691	1.164	1.388	1.451	1.393	1.634	1.713	1.593
22	1.218	1.619	1.269	1.537	1.526	1.789	1.970	1.427	1.656	2.151
23	1.074	1.768	2.052	2.548	1.673	1.912	2.189	2.025	1.879	2.200
24	1.103	1.963	1.407	1.374	1.745	2.138	2.197	1.663	1.866	1.995
25	0.956	1.595	1.196	1.415	1.199	1.434	1.641	1.356	1.278	1.483
26	1.145	1.469	0.871	1.308	1.278	1.790	1.753	1.455	1.404	1.536
27	1.174	1.371	1.364	1.158	1.347	1.371	1.405	1.550	1.326	1.421
28	1.028	1.739	1.918	1.861	1.525	1.637	1.616	1.718	1.583	1.694
29	1.222	1.402	1.194	1.123	1.356	1.356	1.423	1.405	1.570	1.371
30	1.245	1.576	1.221	1.247	1.367	1.467	1.352	1.494	1.485	1.361

restrained, functional/fanciful related to classic/romantic. Since the classic/romantic dimension itself related to Hudson's artistic/ scientific dimension, it was anticipated that feminine/masculine would relate to this dimension too. (-0 Looks fast/looks slow was not considered to relate to either dimension: it was included as 'warm-up' for subjects, and framed to direct their attention to the appearance of the car, rather than to any other attributes of which they may have been aware. Ugly/beautiful was not considered to relate to either dimension, but it was felt that, being a qualitatively different judgement it might shed some light on the subjects* perception both of the cars and of the dimensions.

d) The subjects were 104 polytechnic students. They represented a number of different courses, but no attempt was made to control the ratio of, for example, 'arts* students to 'science* students, or of male to female students. The possible effects of this are discussed below.

e) The subjects were shown all 30 slides, to familiarise them, before they were asked to respond. Then they were asked to rate each car in turn on the first scale. They were shown each slide for approximately five seconds. When all the cars had been rated they proceeded to the second scale, now* viewing the cars in reverse order, and so on.

a) This data has been derived of this form: 104 ratings of 30 cars on 10 scales of judgement. The mean rating of each car on each scale was calculated, and this score was used as a basis for further calculations. These means are given in Table 2, and the standard deviations in Table 3 (approx. 64% of the ratings of a car on a scale will fall within ilstandard deviation of the mean: thus the 'representativeness' of the mean can be judged.)

b) Since the hypothesis leads us to expect that people, though using 10 scales to rate the cars, will be perceiving them and judging them especially in terms of two dimensions, we are further led to expect that certain particular scales will be used in a similar way: they relate to the same basic dimensions of judgement. Our hypothesis is therefore tested by observing whether cars are in fact rated similarly on scales which are, we expect, related to the same dimension.

Using the table of mean ratings (Table 2), correlation coefficients are computed between all pairs of scales. If all 30 cars are rated in exactly the same way on two scales, this perfect correlation appears as a value of +1.00. If one scale is the reverse of the

FACTORS OF MOTOR CAR JUDGEMENT 01/07/76

FILE NONAME (CREATION DATE = 01/07/76)

VARIABLE	MEAN	STANDARD DEV	CASES
FAST	3.8313	1.4311	30
XLIVE	4.0610	1.0442	30
ART	4.0067	0.9038	30
FLOW	4.0727	0.8483	30
ROBST	3.4363	0.6245	30
XINHIB	3.8810	0.8213	30
ORGAN	4.0333	0.6268	30
FEM	4.3967	0.4946	30
UGLY	3.6763	1.0281	30
FUNCTION	3.7933	0.8799	30

NAME (CREATION DATE = 01/07/76)

TABLE 5

ON COEFFICIENTS..

	FAST	XLIVE	ART	FLOW	ROBST	XINHIB	ORGAN	FEM	UGLY
	1.00000	-0.58799	-0.63130	0.41080	-0.14936	0.56436	0.54122	-0.25197	-0.263
	-0.58799	1.00000	-0.05042	-0.22258	0.71417	-0.87494	-0.91210	-0.06011	0.895
	-0.63130	-0.05042	1.00000	-0.15541	-0.18150	0.00206	0.06175	0.23383	-0.360
	0.41080	-0.22258	-0.15541	1.00000	0.12589	0.38089	0.51927	-0.03616	-0.102
	-0.14936	0.71417	-0.18150	0.12589	1.00000	-0.58325	-0.58564	-0.39061	0.763
	0.56436	-0.87494	0.00206	0.38089	-0.58325	1.00000	0.84173	-0.04913	-0.727
	0.54122	-0.91210	0.06175	0.51927	-0.58564	0.84173	1.00000	0.10297	-0.835
	-0.25197	-0.06011	0.23383	-0.03616	-0.39061	-0.04913	0.10297	1.00000	-0.280
	-0.26344	0.89578	-0.36035	-0.10276	0.76322	-0.72717	-0.83596	-0.28015	1.000
	-0.15660	0.78420	-0.34955	-0.20481	0.68976	-0.84668	-0.76738	-0.20109	0.822

other, the correlation is -1.00. If the two scales bear no relationship, the correlation is zero. Table 5 lists the correlations. (Table 4 lists the means and standard deviations of mean-ratings on each scale, and indicates how much Spread1 in car ratings there was on each scale.)

From Table 5 it can be seen that there are several close correlations between scales. The organic/inorganic dimension is clearly validated, if not quite in the manner predicted. Organic correlates closely with alive, uninhibited, beautiful, and fanciful. Flowing/geometrical does not correlate with these, or any other scales.

Several things are evident;

i) the organic/inorganic dimension is important, with four close correlations, but is being used somewhat differently than predicted.

ii) the classic/romantic dimension appears to have broken down. This will be discussed further below, but it is clear that correlations predicated earlier, following Hudson, have been dismantled thus; artistic/scientific has been separated out to correlate only with looks fast/looks slow; uninhibited/restrained has been absorbed into the organic/inorganic dimension, and so has functional/fanciful; feminine/masculine correlates with nothing,

iii) ugly/beautiful is more important (that is, more consistent) than expected, and may explain the above phenomena, as was hoped.

c) A more refined test of the hypothesis is this; we expect scales a, b, c, to relate to each other, being measures of the same dimension (organic) and we expect these scales not to relate to scale x, y, z, which are measures of a different dimension (classic). This means that we predict that two specified factors underlie the table of correlations.

Factor analysis is a mathematical procedure that has as its aim the derivation of a set of 'underlying variables' that can account for a much larger set of observed relationships. So the purpose is to economise in the number of factors required to 'explain the existence' of a table of correlations (see Child 1970).

TABLE 6

FACTORS OF MOTOR CAR JUDGEMENT

FILE NONAME (CREATION DATE = 01/07/76)

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2
FAST	-0.40298	0.91420
XLIVE	0.95483	-0.19045
ART	-0.19980	-0.69243
FLOW	-0.24605	0.38367
ROBST	0.73995	0.23245
XINHIB	-0.87685	0.27261
ORGAN	-0.91530	0.23623
FEM	-0.18806	-0.37029
UGLY	0.94245	0.19392
FUNCTION	0.89274	0.17907

The model is that the score (i.e. mean rating from Table 2) of a certain car on a certain scale can be analysed into a number of values of that car on a set of factors which are common to that scale and one or more other scales, plus a value for that car on whatever factor is unique to that scale:

Xy. — A-^F^ + + ... + Z j (^j)

where Xy isthe score of car i on scale j
Ai isthe score of car i on underlying factor F^
B-^ isthe score of car i on underlying factor Fg etc.
and is that car*s score on the factor unique to scale
J (sj)

And factor analysis enables a calculation to be made of how many underlying factors are minimally required in order to account for the observed scores of cars, given the observed relationships between scales (relationships between scales being due to common factors) and also enables the nature of these factors to be specified.

Now although the minimum number of common factors can be derived with accuracy (i.e. it is clear from the analysis that only so many factors are important enough to consider), their nature cannot be uniquely specified. There are always several possible solutions. However, the unique solution can be arrived at if certain constraints are placed upon the analysis. For instance, a Varimax analysis calls for the factor structure to be calculated that most clearly differentiates between the factors: scales a, b, c, (or whatever) will relate clearly to one factor, and will not relate to the others.

To return to the research hypothesis: we hypothesise that a factor analysis of mean ratings will produce factors of which two are predicted. One of these will draw together scales supposed to be related to the organic dimension, the other ivill represent the classic dimension. A Varimax solution is specified. Table 6 gives the result of this analysis.

It will be seen from Table 6 that 2 factors are sufficient to embrace all *underlying1 commonality between scales, and that together they encompass all the scales except flowing and feminine, which have no significant commonality either with each other or with any other scale (Calculation by SPSS).

	Cues										
Car	1	2	3	4	5	6	7	8	9	10	
corr I	.193	.538	.110	−.033	−.062	−.139	−.055	−.042	.314	.149	
$\bar{x}$	3.531	4.061	4.007	4.073	3.436	3.551	4.033	4.397	3.676	3.773	Scale
σ	1.431	1.044	0.904	0.548	0.624	0.521	0.627	0.495	1.028	0.550	value
1	.059	−.083	−.091	.016	.054	−.021	.024	−.050	.044	−.087	−105
2	−.084	−.258	−.050	−.043	.048	−.059	−.072	−.043	−.350	−.148	−961
3	.214	.484	−.207	−.012	−.184	.157	.043	.043	.447	.255	1240
4	.008	.185	−.074	.031	.029	.020	.046	−.029	.065	.059	340
5	.210	.200	−.178	−.070	−.044	.046	.010	.094	.328	.233	1029
6	.143	−.525	.047	.025	.062	−.209	−.052	.006	−.439	−.186	−1425
7	.043	.061	−.040	−.013	.004	.054	−.002	−.061	.148	.076	270
8	.131	.612	−.225	−.026	−.140	.117	.047	.044	.587	.233	1380
9	.195	−.504	.025	.007	.043	−.221	−.060	.015	−.350	−.154	−1305
10	−.057	−.361	.017	.040	.074	−.018	−.013	−.021	−.319	−.100	−758
11	.235	−.510	.016	−.053	−.024	−.277	−.073	.040	−.170	−.207	−1023
12	.048	−.413	−.011	−.022	.023	−.130	−.045	.033	−.160	−.038	−715
13	.133	.530	−.205	−.043	.000	.004	.017	−.054	.440	.131	950
14	−.209	.509	.080	.028	−.027	.120	.038	−.016	.267	−.038	749
15	−.355	.684	.209	.007	−.061	.275	.057	−.045	.309	.239	1339
16	.190	−.732	.026	.002	.057	−.220	−.057	−.016	−.369	−.193	−1311
17	−.154	.061	.093	−.024	−.006	−.069	.004	.059	.013	−.164	−185
18	−.073	−.433	.024	−.043	.043	−.096	−.075	−.032	−.371	−.164	−1220
19	−.163	.674	−.095	.061	−.010	.181	.074	.028	.300	.125	1172
20	.012	−.433	−.001	−.047	.037	−.056	−.052	−.028	−.343	−.110	−1151
21	−.146	.319	.008	.052	.011	.140	.047	.013	−.017	.108	565
22	−.209	.504	.185	−.023	−.052	.088	.043	−.090	−.124	−.027	293
23	−.357	.865	.207	.002	−.005	.169	.065	.020	.358	.165	1449
24	.338	−.917	−.003	−.007	.049	−.084	−.079	.001	−.450	−.050	−1202
25	−.090	−.129	.070	−.035	−.007	−.135	−.023	.041	.056	−.173	−431
26	.190	−.868	.022	−.005	.077	−.101	−.075	−.010	−.439	−.129	−1333
27	−.117	.453	−.019	.048	−.036	.076	.084	.063	.300	.113	965
28	−.291	.664	.074	.050	−.043	.146	.055	−.010	.346	.109	1128
29	−.035	−.067	−.048	.019	.051	.022	.013	−.037	.032	.060	11
30	−.024	.025	.052	.055	.011	.054	.017	.015	.028	.069	300

Scaling of cars

d) Factor 1 clearly represents the organic dimension of judgement and - although some scales were so highly loaded on this factor (e.g. ^ 0.9) that it could he said that these are nearly pure measures of this dimension - a further computation allows us to score cars on that factor. The calculation depends on the formula already stated, and uses scores of cars on the scale (Xy) to arrive at their score on the factor we are interested in (Ai). Table 7 gives scores of cars on that dimension, the main contributory factors being alive, organic, beautiful, uninhibited, fanciful and dainty.

5. Discussion

I Table 2 If the cars are ranked in order on each of the scales shown, it becomes clear that some cars appear more often at extreme positions than do others. Any car appearing at or near an extreme of a scale (i.e. ranking highest or lowest on that scale) is in a sense defining that scale. Thus the extremes of the organic/inorganic scale are defined, respectively, by the Abarth and the Edsel. If we consider the top 5 cars and bottom 5 cars to define the extremes of a given scale, we find that the Lamborghini appears in such a position for 8 of the 10 scales, whereas the Cord appears at none. Another expression of this would be that the Lamborghini was seen as outstanding, or significant, in 8 respects, the Cord in none. Other significant cars, in this sense, include the Mercer, De Dion Bouton, Jowett, Hispano, Austin, Modulo, Airflow, Burney, Tatra, Abarth. All these appear at or near the extremes of several scales and are therefore important in defining the limits of scales.

II It is evident from Tables 5 and 6 that the organic dimension is clearly validated. That is, not only was the organic scale readily understood and operated by the subjects, it also correlated closely with several other scales, indicating the existence of an ,underlying dimension* (Factor l).

III The classic dimension did not emerge in the factor analysis. There are a number of possible reasons for this:

a) The cars were not perceived in those terms.

b) The scales were not clearly related to that dimension; other scales might have produced the factor. Arguing in favour of this is the fact that neither the artistic nor the feminine scales correlated as supposed; against it is the fact that the other

Table 8

Factor 1: Alive, Organic, Beautiful, Uninhibited, Fanciful, Dainty

		difference		
1.	1449		Countach	1971
2.	1380	69	Hispano-Suiza	1912
3.	1339	41	Modulo	1970
4.	1240	99	Mercer	1913
5.	1172	68	Alfa	1933
6.	1128	44	Abarth	1965
7.	1029	99	De Dion Bouton	1901
8.	965	64	Cisitalia	1948
9.	950	15	Mercedes-Benz	1925
10.	749	101	Pontiac	1968
11.	565	184	Talbot	1949
12.	340	215	Triumph	1948
13.	300	40	Hispano-Suiza	1934
14.	293	7	Voisin	1923
15.	270	17	Lancia	1920
16.	11	259	Cord	1937
17.	-105	116	Alvis	1938
18.	-185	80	G.S.	1970
19.	-431	246	R16	1965
20.	-715	284	Lincoln	1941
21.	-758	43	Tucker	1948
22.	-961	203	Imperial	1968
23.	-1023	62	Austin	1937
24.	-1151	132	Edsel	1958
25.	-1202	51	Burney	1928
26.	-1220	18	Imperial	1955
27.	-1305	85	Hudson	1939
28.	-1311	6	Airflow	1934
29.	-1333	22	Tatra	1937
30.	-1425	92	Jowett	1947

two scales, uninhibited and functional did correlate closely with each other (- 0.84668). Confusing the issue is the fact that they also correlated closely with the organic dimension.

c) The classic dimension was in fact absorbed into Factor 1, as indicated above. There are precedents for this, the best known being the absorption, in psychological testing, of creativity into intelligence. The elimination of any of these three possible reasons would necessitate redesign of the test.

d) The classic dimension was subsumed into an evaluative factor. The importance of evaluative factors in all judgements has been shown by Osgood et al (1957)» A number of considerations suggest that this did in fact happen:

i) The judgement of the beautiful is, as writers on aesthetics have tirelessly pointed out, qualitatively different from other judgements. Significant is the way in which it relates to other judgements. For these subjects, beautiful correlated closely with alive, organic, fanciful, dainty, and uninhibited. Now this is a clear statement of the romantic aesthetic: Wordsworth could not have defined it better. It appears therefore that these subjects did not perceive the classic/romantic dimension because it existed for them at a different level: at the level of assumption which underlies evaluative judgements and which is not readily accessible to inspection. In Hudson*s terms, they were giving the *artistic* response; it is possible that a sample of engineers or scientists would respond differently. Certainly, people at other times would have done so. The correlation, for example, of functional with restrained, ugly, lifeless, inorganic, robust, has certainly been disputed in the past, and may so be by other contemporary subjects.

Table 7 indicates the scores of cars on Factor 1; Table 8 presents these scores in rank order. From Table 8 it will be seen that the scores were not equally spaced: the cars fell into groups. The nature of the grouping indicates the presence of an evaluative factor:

a) the top group consists of open or coupe cars; the bottom group are all saloons

b) at the top are the oldest and the newest models; neither are in the bottom group

c) cars which embody the classic approach to aerodynamics (e.g. Burney, Tatra, Jowett) are at the bottom; those which represent romantic aerodynamics at the top. This is not a function of time: a modern example of classic aerodynamics (Citroen) ranks low

d) the scale appears to be one of desirability, and to that extent parallels that other scale of desirability; market value, from which it differs only in excluding any consideration of historical importance1

e) the scale differs in several ways from my own characterisation of the cars. For example, I considered the Mercer and De Dion Bouton as romanticisations of the machine; these subjects consider them to be organic. My interpretation of this is that they are perceiving, and responding to the romanticism rather than to the organic/inorganic dimension - i.e. that this judgement is subsumed under an evaluative one.

V The temporal ranking of the cars merits further consideration (Table 8). All the subjects were approximately 20 years old; it may be that older subjects would perceive older cars differently, that is, that nostalgia may be a factor in the underlying evaluative judgement.

VI Related to the temporal context is the geographical. In general, the American cars were accorded less significance, in terms of defining scales, than expected. The Cord, for example, was seen as in no way significant - though the oldest, the Mercer, was. It would appear that three contexts are relevant to the evaluative judgement: temporal, geographical, and ideological. Further testing of specific groups would be necessary to establish the exact significance of these factors.

VII It may be however, that the organic/inorganic dimension is the only thing that can be perceived between different contexts.

.4. Conclusion

The test, as it stands, raises almost as many questions as it answers. Most of these centre on the ages of the cars in the test, in relation to the age of the subjects, and on the classic/romantic dimension.

It seems likely that further useful information could be obtained, and existing information clarified, if the test were given to:

a) engineering and science students of the same age as this sample
b) depending on the results of this, older subjects of *artistic* and 1scientific* background, either separately or together
c) American subjects.

Alternatively, the test might be altered, to comprise a range of both dimensions from cars of similar age. It would then be difficult, however, to compare existing results with future ones.

I wish to acknowledge my indebtedness to Dr. Pecer Ashworth for his assistance in designing this experiment and for carrying out the computations.

PLATES

1. 1959 Buick Electra Hardtop
   1959 Buick Electra Convertible
2. 1959 Cadillac Fleetwood 60 Special Sedan
   1959 Chevrolet Impala Sport Coupe
3. 1959 Alfa Romeo Giulietta Sprint
4. 1968 Chevrolet Corvette
5. 1954 Bristol 450
   1950 Studebaker Commander
6. 1928 Burney Streamline
   1937 Auto-Union G.P.
7. 1912 Mercer 35T
   c.1920 Stutz
8. 1802 Trevithick Steam Carriage
   c.1908 'Motor Accident in Naples' by A. Beltrame
9. 1901 Mercedes
   1905 Renault G.P.
10. 1909 Vauxhall KN
    1913 Ricotti Torpedo (Alfa Romeo, Body by Castagna)
11. 1899 Jamais Contente
12. 1908 Mercedes G.P.
    1912/13 Spa
13. 1920 Salmson
    1922 Bentley
    1934 Riley MPH
14. 1923 Voisin
    1922/23 Fiats G.P.
15. 1923 Bugatti G.P.
    1921 Rumpler Tropfenwagen
16. 1924 Bugatti Type 35
    1922/23 Benz Tropfenwagen G.P.
17. 1933 Bugatti Type 59 G.P.
    1937 Mercedes Benz W125 G.P.
18. 1926 Chrysler
    1926 Napier
19. 1948 Tasco
    1935 Auburn 851 Speedster

20. 1935 Cord 810
1938 Buick Y

21. 1934 Citroen 11CV
1936 SS 100

22. Raymond Loewy
1946 Studebaker

23. 1955 Alvis
1955 Citroen DS19

24. 1949 Bristol 401
1947 Jowett Javelin

25. 1953 Ford Prefect

26. 1959 Cadillac 62 Series Coupe
1959 Cadillac 62 Series Convertible

27. 1955 Citroen DS19
1948 Cisitalia

28. 1960 Chevrolet Corvair

29. 1959 Mini
1958 A40

30. 1965 Renault R16

31. 1973 Tyrell G.P.
1974 Pontiac Transam

32. 1949 Bristol 401
1954 Jaguar D-Type
1968 NSU RO 80

33. 1966 Buick Riviera
1966 Oldsmobile Tornado
1967 Cadillac Eldorado

References

Chapter 1

1. SEVIER, D. W. (1954) 'The Influence of Aerodynamics on Automobile Design1, Paper to the Institute of Mechanical Engineers, March 24 1954.
2. REID, John, 'The Aerodynamics of Motoring2, Autocar (N.D.).
3. DAVIS, S. C. H. (1967), 2Cars, Hamlyn, p.49.
4. MeT/ETiAN, John (1975)? 2Bodies Beautiful2, David & Charles, p.53*
5. PIRSIG, Robert M. (1974), 2Zen and the Art of Motorcycle Maintenance2, Bodley Head.

Chapter 2

1. KRONSBROEK, H. R., 'Gabriel Voisin1, in BAREER, Ronald and HARDIN, Anthony (1970)> 2Automobile Design - Great Designers and their Work2, David & Charles.
2. PACKARD, Vance (1957)» fThe Hidden Persuaders2, Longman, p.87.
3. GALBRAITH, J. K. (1969), 'Technology, Planning and Organisation2, in BALER, K. and RESCHNER, N. (eds), 'Values and the Future: the impact of technological change on American Values2, Free Press.
4. See Style Auto No. 5*

Chapter 3

1. HUDSON, Liam (1966), 'Contrary Imaginations2, Methuen, and (1968) 'Frames of Mind2, Methuen.
2. FORD, Julienne (1975)> 'Paradigms and Fairy Tales2, Routledge & Kegan Paul.
3. HUDSON, (1968), p.47.

Chapter 4

1. JONES, J. Christopher (1970), 'Design Methods2 John Wiley especially quotes from STURT (1923) 'The Wheelwright2s Shop1, Cambridge.

Chapter 5

1. Quoted by KOESTLER, Arthur (1967), 'The Ghost in the Machine2, Hutchinson, p.59» Picador edn.
2. FREUD, Sigmund (1933)> 'New Introductory Lectures on Psychoanalysis2, Allen & Unwin (1971) edn.

3. JUNG, C. J. (1971), 'Psychological Types2, Routleclge & Kegan Paul.
4. ORNSTEIN, Robert E. (1972), 'The Psychology of Consciousness1, W. H. Freeman, Pelican edn. p.83.
5. ROSZAK, T. (l97U), 'The Making of a Counter-Culture2, Faber.
6. PIRSIG (1974), op cit.

Chapter 6

1. KOESTLER (1967).
2. KANT, I., 'Critique of Judgement2, GREENE, Theodore, M. (ed), (1957) Charles Scribner's sons.
3. MARINETTI, 'Selected Writings1, FLINT (ed), (l97l), Seeker & Warburg.
4. KUHN, Thomas, S. (1962), 'The Structure of Scientific Revolutions2, University of Chicago Press, p.10.
5. McEELLAN (1975), op cit.

Chapter 7

1. DAVIS, S. C. H. (1967), p.78.
2. MARINETTI, (l97l), p.41.
3. TURNER, C. C. (l909)j 'Aerial Navigation Today1, quoted Encyclopedia Britaimica (l9?0).
4. McLUHN, Marshall (1964), 'Understanding Media2, Routiedge & Kegan Paul.
5. KOESTLER, A. (i960), 'The Lotus and the Robot2, Hutchinson.
6. McLELLAN (1975), p.37.
7. PLATO, 'Phaedrus2, 246E (1972), CambridgeU.P.

Chapter 8

1. PIRSIG (1974), p.61.
2. PLATO, 'Phaedrus2, 250D.
3. SETRIGHT, L. J. K. (1973), *The GrandPrix2,Nelson, p.84.
4. PIRSIG (1974), p.74.

Chapter 9

1. McLELLAN (1975), p.69.
2. op cit. p.70.
3. BUEHRIG, G. M. and JACKSON, W. S. (1975), tolling Sculpture2, Haessner Publishing Inc., p.120.
4. op cit. p.99*

Chapter 10

1. READ, Herbert (1934), 'Art andIndustry1, Faber.
2. Reprinted in GLOAG, John, 'Industrial Art Explained1, Allen & Unwin edns. after 1941.
3. op cit. Appendix.
4. loc. cit.
5. loc. cit.

Chapter 11

1. BUEHRIG, (1975), p.158.

Chapter 12

1. Style Auto No. 5«
2. Style Auto No. 1.
3. POMEROY, Lawrence (1964), 'The Mini Story*, Temple Press, p.30*
4. op cit. p.24.
5. op cit. p.34.
6. op cit. p.33.

Chapter 13

1. 'Car1, March 1969*
2. 'Car1, January 19^9*

Appendix 1

1. KOESTLER, Arthur (1964), 'The Art of Creation*, Hutchinson.
2. PIAGET, Jean (1926), 'Language and Thought of the Child1, Routledge & Kegan Paul.
3. PAPANEK, Victor (1971), 'Design for the Real World*, Thames & Hudson.
4. Style Auto No. 1.
5. loc. cit.
6. Style Auto No. 3»
7. MANZU, Pio, and CONRAD, Michael, 'Industrial Design and Coachbuilding* Style Auto No. 2.
8. Style Auto No. 3»
9. Style Auto No. 3*
10. Style Auto No. 3«
11. MARCUSE, Herbert (1964), 'One Dimensional Man*, Routledge & Kegan Paul
12. Ford advertisement 'Car1, November 1976.

13. loc cit.
14. op cit.
15. loc cit.

Appendix 2

1. CHOMSKY, Naom (1968), 'Language and Mind', Harcourt, Brace & World.
2. KOESTLER, Arthur (1964), 'The Sleepwalkers', Penguin.
3. WATSON, Lyall (1973), 'Supernature', Hodder & Stoughton.
4. SKINNER, B. F. (1938), 'The Behaviour of Organisms', Appleton - Century - Crofts.
5. HARLOW, H. F. (1959), 'Love in Infant Monkeys', Sci. Amer. Vol. 200.
6. FANTZ, R. L. (1961), 'The Origin of Form Perception', Sci. Amer. Vol. 204.
7. LORENZ, K. 'The Companion in the Bird's World', AWK, Vol. 54, nos. 245-273.
8. BARTHES, Roland (1972), 'Mythologies', Cape.
9. BARTHES, Roland (1967), 'Elements of Semiology', Jonathan Cape, p.29.
10. loc cit.
11. op cit, p.33.

Appendix 3

1. See HUDSON (1968).
2. D. CHILD (1976), 'The Essentials of Factor Analysis', Holt, Reinhart & Winston.
3. OSGOOD, C. E., SUCI, G. J. & TANNENBAUM, P. H. (1957), 'The Measurement of Meaning', Illinois U.P.
4. Manual: Statistical Package for the Social Sciences (Program Factor).

Additional Biography

AUTOCAR (1932 to date) courtesy Fiat Centro Storico, Turin.

BANHAM, Rejmer (i960), 'Theory and Design in the First Machine Age1, The Architectural Press.

CASSIRER, Ernst (1955), 'The Philosophy of Symbolic Forms1, Yale U.P.

CLARK, Kenneth (1956), 'The Nude1, Pelican i960.

CULSHAW, D., and HOEROBIN, P. (1974), 'The Complete Catalogue of British Cars1, Macmillan.

ELIADE, Mircea (1957), 'Myths, Dreams and Mysteries1, Galimard Fontana (1968).

FLETCHER, W. (189l)> 'Steam 011 Common Roads1 reprinted David & Charles 1972.

FULLER, Buckminster (1969), 'Utopia or Oblivion1, Penguin.

FULLER, Buckminster (1969)5 'Operating Manual for Spaceship Earth1, Southern Illinois U.P.

GEORGANO, G. N. (1973), 'The Complete Encyclopedia of Motorcars1, George Rainbird.

GRAVES, Robert (ed) (1959), 'Larousse Encyclopedia of Mythology1, Harnlyn.

HAYWOOD, Paul (1975), 'Streamlining1 On Four Wheels No.Ill, Orbis.

HOUGH, Richard (1966), 'Racing Cars1, Harnlyn.

LEACH, Edmund (1970), 'Levi-Strauss1, Fontana.

LYONS, John (ed) (1970), 'New Horizons in Linguistics1, Pelican.

LYONS, John (1970), 'Chomskey1, Fontana.

MOTOR (1919 to date) courtesy Fiat.

OBSERVER'S BOOK OF AIRCRAFT (1952 to date), Warne.

OBSERVER'S BOOK OF AUTOMOBILES (1955 to date), Warne.

OLIVER, George A. and POMEROY, Lawrence (1963)5 'Historic Racing Cars 1907 - I9601, Evelyn.

ROGLIATTI, Gianni (1973), 'Period Cars1, Harnlyn.

ROTH, Gabriel (1967)5 'Paying for Roads1, Penguin.

SCIBOR-RYLSKI, A. J. (1975), 'Road Vehicle Aerodynamics1, Pentech.

SETRIGHT, L. J. K. (1973) with material by HAYWWOD, Paul 'Aerodynamics1 Car, April, May, June 1973*

SETRIGHT, L. J. K. (1976), 'The Designers1, Weidenfeld & Nicholson.

WRIGHT, D. A. and TAYLOR, A. (1970), 'Introducing Psychology1, Penguin.