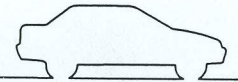
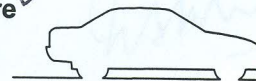


Psychological perception of product form: elements - Automobiles

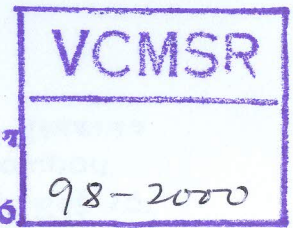


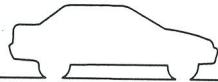
Guide:
DR. Prof. G. G. Ray

Submitted by:
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Special

The project ■ entitled,
'Psychological perception of product form: elements - Automobiles'
is approved for the partial fulfillment of the
requirements for the postgraduate degree in
Visual Communication.

Guide:

Chairperson:

Internal
examiner:

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Introduction

Globalisation and liberalisation started in India around the early 90's, with the automotive industry in the forefront amongst various other industries.

Until then there were only a few players in the automotive industry who provided very few options for the Indian customer.

But with the globalisation process, major automotive players from all over the world like Honda, Suzuki, to name a few, were already setting up their roots in India. Owing to the success of this initial liberalisation policy, many other automotive giants around the world started looking towards India to exploit the potential market.

Companies like Hyundai, Ford, Volvo, setup their manufacturing facilities in India. Looking at the potential market in India, they contemplated a step further of setting up R&D facilities in India, which would help them to study the needs of the Indian market and accordingly develop products, right from the concept to the manufacturing stage. Owing to this potential a large scope is envisaged for the styling and design industry in India.

Considering this potential and the competition faced due to foreign manufacturers, the automotive styling industry in the country started gearing up, and a few vehicles in the country rolled out with improved styling.

But though with all the sincere efforts, the industry has failed to attract, or rather distract the Indian consumer from opting for foreign vehicles.

The major factor for this phenomenon seems to be the design itself. It usually happens so that the designer conceives his designs with some predeterminations, which most probably fails when it comes to the customer purchasing the car. This happens due to improper or misjudged communication between the designer and his immediate audience.

This project hence, is an effort to develop a methodology for the designer which would yield expected and not misleading results.



Objective

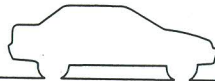
To develop such sort of a methodology for the designer, a thorough study of the user group had to be made, as in order to perceive his/her communication abilities.

Most of the styling is usually based on certain attributes that the designer tries to imply in the design. For e.g. sporty, rugged, safe, strong, elegant etc. But it happens so that it is easy to define these attributes (words) verbally, but when it comes to defining them in the real world in 3d format, different people have different definitions. For e.g. 'sporty'. Now every body knows what 'sporty' means verbally, but every body would have a different visual in mind about the word being represented in 3d format.

The solution for this problem is to generate a database of examples (in this case, vehicles) and compare them together, then rate them accordingly and decide as to which attribute they belong to. Basically the aim of this exercise is to develop a relationship between such fuzzy words (attributes) and the actual product form.

Hence the objective of this project is to create a databank of such attributes and images of related images, which would help the designer to consolidate his/her concepts and visuals.

To achieve this objective, certain experiments had to be carried out; experiments that would reveal how a person perceives an image and identifies it; within how much time and stages he identifies it and represents it in what ever form.



Methodology

To get to know how a person perceives an object, it was necessary to track his vision and study how he would scan the image.

The best way to do this was to conduct an experiment where in the subject was presented with a set of silhouettes/contours of vehicles and asked to recognize them. In this process the eye-movement recorder was utilised due to which the subjects eye movements were recorded. With the help of this experiment it was possible for us to record as to which area of the silhouette/contour, the subject was stressing to identify the vehicle.

Eye movement and tracking:

Till date there have been many methods to study and record eye movements, out of which some are,

- 1) Eye movements by means of after images.
- 2) Study of eye movements by visual observation.
- 3) Mechanical recording of eye movements.
- 4) Recording by a reflected beam of light.
- 5) Recording by still motion photography.
- 6) Recording the corneal bright spot.
- 7) Electro-oculography.
- 8) Photo-electric method for recording.
- 9) Creation of a stabilized image with contact lens.
- 10) Use of suction devices.(caps)

Out of all these, the corneal bright spot recorder is the oldest type. It has a basic principle on which photographic recorders of eye movements are based. A small spot of light is reflected from the eye onto a photographic plate or a moving film. As the eye moves in exploring a visual display, the surface of the cornea acts as a mirror and reflects the light onto corresponding locations on the light sensitive surface. Fixations record as spots and movements record as fainter thin lines between fixation points.

Eye movements are as essential to vision as photochemical process in the retinal receptors is. Eye movements may be voluntary or involuntary. Voluntary eye movements are scanning movements which occur as visual targets of any size explored. These movements occur at the rate of approximately one to three times per second. Their excursions cover the entire range of displacements possible for an eye. Involuntary movements occur as the eye fixates at a point. Eye movements are response to a visual stimulation. The identical and simultaneous rapid rotation of the eyes, conventionally termed as saccades, is of high velocity (the duration of a saccade is measured in hundredth of a second) and uniform amplitude, when both eyes move simultaneously.



When the object of perception is stationary relative to the observer's head, the process of perception taking place between any two adjacent saccades conventionally called the fixation process has been shown experimentally that during the perception of stationary objects, in the interval between rotations of the head and blinking movements, the human eye can be only in one of the two states i.e. in a state of fixation or in a state of changing the points of fixation. Fixation is associated with three types of movements : drifts, tremor and involuntary saccades.

A drift is an irregular and relatively slow movement of the axes of the eyes, in which the image of the fixation point for each eye remains within the fovea. The drift is always accompanied by a tremor, which is the oscillatory movement of the axes of the eyes of high frequency but very low amplitude. Small involuntary saccades usually arise when the duration of fixation on a particular point of stationary object exceeds a certain length of time (0.3-0.5 sec) or when because of drifts, the image of point of fixation becomes too far removed from the center of the fovea. Not all fixations are accompanied by involuntary saccades, for instance, during a relatively cursory examination of an object, most fixations are accompanied by two types of movement drift and tremor. Many records have shown that during the free examination of stationary objects, the overwhelming majority of fixations on elements of the object take place without saccades (involuntary). For such fixations the duration of the independent drift and the duration of the fixation are identical. It is important during perception of a stationary object that the duration of the independent drift (of fixation) is nearly always adequate to enable the eye to see the fixated element. However this time may sometimes be insufficient for the thought process evoked by the perceived element to be completed.

In a human eye, the retinal image under natural conditions is never stationary relative to the retina and if a strictly stationary and unchanging retinal image is created artificially, the eye ceases to see. In other words, within any object of perception remaining strictly stationary relative to the retina and unchanging in time, after 1-3 secs. all visual contours disappear (the resolving power of the eye rapidly falls to zero).

A contour is the one-dimensional interface between figure and ground.

An object's edge has the same nature. It is a sudden change in colour, texture, or the direction of lines, except that an edge here signifies the end of a surface, hence a passage to another surface or simply the end of the object. An edge stands out against another surface of some other colour, texture et c., or simply in the air. There is no difference between the contours or outlines of a two-dimensional form and the edges of an object when both are projected through a lens onto the surface of the retina.

Once a contour is perceived, it becomes possible for the organism to perform additional operations on it e.g., to compare two contours present in the visual field (to discriminate between them) or a contour and its memory trace (to recognize it). Discrimination and recognition, shift the emphasis to the experiencing organism, the organism that learns, compares and makes decisions.



Experiments

To attain the objectives defined through the mentioned methodology, the following experiments were carried out:

- 1) Eye movement tracking.
- 2) Relationship of attributes and images.

1) Eye movement tracking:

This experiment was focused at the study of various car profiles of the mid-size segment and to experiment on the perception and identification of the cars, based on eye movement tracking and recording. The regions of the projected image scanned by the subject of experimentation, and the components stressed by the subject which would aid him to identify a particular car formed the basic data for analysis.

The exercise was conducted with the mid-size cars as the products for perception, because a lot of mid-size cars are appearing in the Indian markets. They also pose a versatility in the designs. Some are very similar, whereas the rest are very unique. They pose a certain amount of confusion for identification, hence a good example for the exercise.

The car was broken down to elemental levels. The exercise was constrained to side profiles only. The car in the side profile was broken down to three parts: the front extending to the leading edge of the front door, the mid section up to the rear windscreen and the rear portion comprising the rear booth. Each car had one full profile and three in bits (front, mid, rear). These three bits were further arranged to form combinations of front+middle, middle+rear, front+rear. The test projections were in form of black silhouettes on white background. All in all, each car had seven silhouettes of different combinations.

Six cars in the mid-size segment:

Maruti Esteem

Daewoo Cielo

Honda City

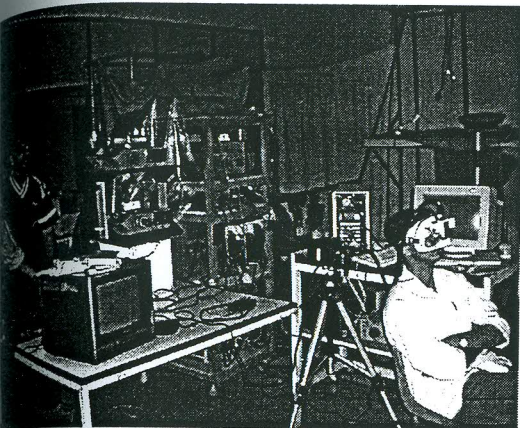
Mitsubishi Lancer

Opel Astra and

Ford Escort.

All these six cars had a slide of the side profile image and silhouettes of the above combinations.





Five subjects, all male, age group ranging from twenty one years to twenty eight years, and belonging to the design field were chosen for the task. They were also supposed to have elementary knowledge about cars such as distinguishing between them. Additionally the constraint was that all these subjects had to have clear vision (without spectacles) as they had to wear the eye movement recorder on their head, and secondly they had to view the profiles of various cars, hence their vision had to be sharp.

The subject was supposed to wear the eye movement recorder on the head and sit at a distance formed by the 30 degree cone based on the width of the slide projection. This was in order that the image was adequately covered within the scope of vision of the subject. The randomly arranged slides comprised of silhouettes of Full profile, bits (front, middle and rear) and combination (front+middle, middle+rear and front+rear) of all the six cars.

Initially the subjects were shown the slides(photo of side profile) of all the six cars for them to identify, differentiate study and retain the images in their mind.

The tasks were:

- 1) Randomly arranged order (of silhouettes) were projected.
- 2) Timing of 15 seconds per slide was allotted.

- 3) The possible responses from the subject would be --

Correct identity
Wrong identity
Unable to identify

- 4) Upon the subjects response, next slide would be projected even if its less than fifteen seconds.
- 5) Every slide was followed by a blank slide with a pin hole in the center of the slide. The objective being that subject's vision be directed to this spot light, i.e. the scanning should always begin from the center for every slide.

The experimental setup comprised of the eye-mark tracker unit, a fibre optic connector to the video camera, CCTV, VCR and a slide projector.

Eye mark tracker:

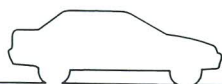
Its a portable device which is head mounted, and takes about fifteen minutes setup time before it can start tracking. It detects and records a viewing point of the movement of the eye. This optical device focuses an illuminated rectile reflected by the movement of the eyeball so that it always coincides with the eye viewing point. This is superimposed on a primary image and is recorded by the VCR and as well as displayed on the CCTV.





Two basic models are available one 30 degrees and other 60 degrees, which are field angles (total view area) of the camera lens. The spot travel or eye point of viewing track is approximately 20 degrees around the camera lens in the 30 degrees and 40 degrees in 60 degrees type. Its approximate, because in some cases, depending on the individual's eyeball rectile travel may be full field (see appendix).

Through the use of fibre optics, the recording camera is remote which allows freedom of head movement and reduces the amount of weight on the subject's head. During the setup, provision is made for monitoring through the optical system. The recording camera feeds the data to the VCR as well as CCTV which displays the slide and the eye movement of the subject.



2) Relationship of attributes and images:

This was the second part of the project.

Very surprisingly, in the previous experiment, it was found out that a greater percentage identified the cars correctly only by the front profile rather than the whole profile, which tended some confusion.

To solve this problem it was decided to conduct a similar sort of experiment, but this time with photographic side profiles of the vehicles.

5 subjects were selected and were presented the front section (side profile) and the whole car (side profile), and were asked to identify the vehicle. However, this time the results varied drastically.

The responses for each of the above elements were recorded as:

Yes - meaning correctly identified

No - meaning wrongly identified

Nil - meaning no decision

The percentages for each of these responses for every element was calculated e.g. :

Element: Front,

Yes = 26

No = 4

Nil = 0

Total= 30

Total responses per element was 30.

Hence percentage

Yes = $26/30 \times 100 = 86.66\%$

No = 13.33%

Nil= 0%

Hence it was found out that 86.66% of the subjects identified the vehicle positively if shown in photographic profile.

The same procedure was carried out for the full photographic side profile where the results showed that 93.33% of the subjects identified the vehicle positively where as 6.66% did not.

Then comes the second part of the experiment.

This part of the experiment involved five subjects who were provided eight attributes and were presented different sets of combinations of cars. Three cars were selected for this experiment viz:

- 1) Honda City
- 2) Ford Escort and
- 3) Opel Astra.

These cars were digitally manipulated and a set of combinations of these cars were developed. For e.g. the front section of Honda City with the middle and rear section of Ford Escort and Opel Astra. The subjects were then asked to assign these images, the attributes provided. The eight attributes were:

- 1) Sporty
- 2) Aggressive
- 3) Speedy
- 4) Sleek
- 5) Bulky
- 6) Dynamic
- 7) Rugged
- 8) Elegant

This experiment was carried out with three cars, eight attributes and five subjects only, which provided quite a healthy result for this project. Done on a larger scale, it would certainly yield better results.



Subject Sachin	City front with		Ford M & R	Opel M & R	City mid with	Ford F & R	Astra F & R
			soft	Sleek ✓		soft ✓	Sporty ✓
	Ford front with		City M & R	Astra M & R	Ford mid with	City F & R	Astra F & R
			Elegant ✓	Bulky ✓		Sleek ✓	Sporty ✓
	Astra front with		City M & R	Ford M & R	Astra mid with	City F & R	Ford F & R
			dynamic ✓	smooth soft ✓		fold ✓	Sleek ✓

Experiment form.

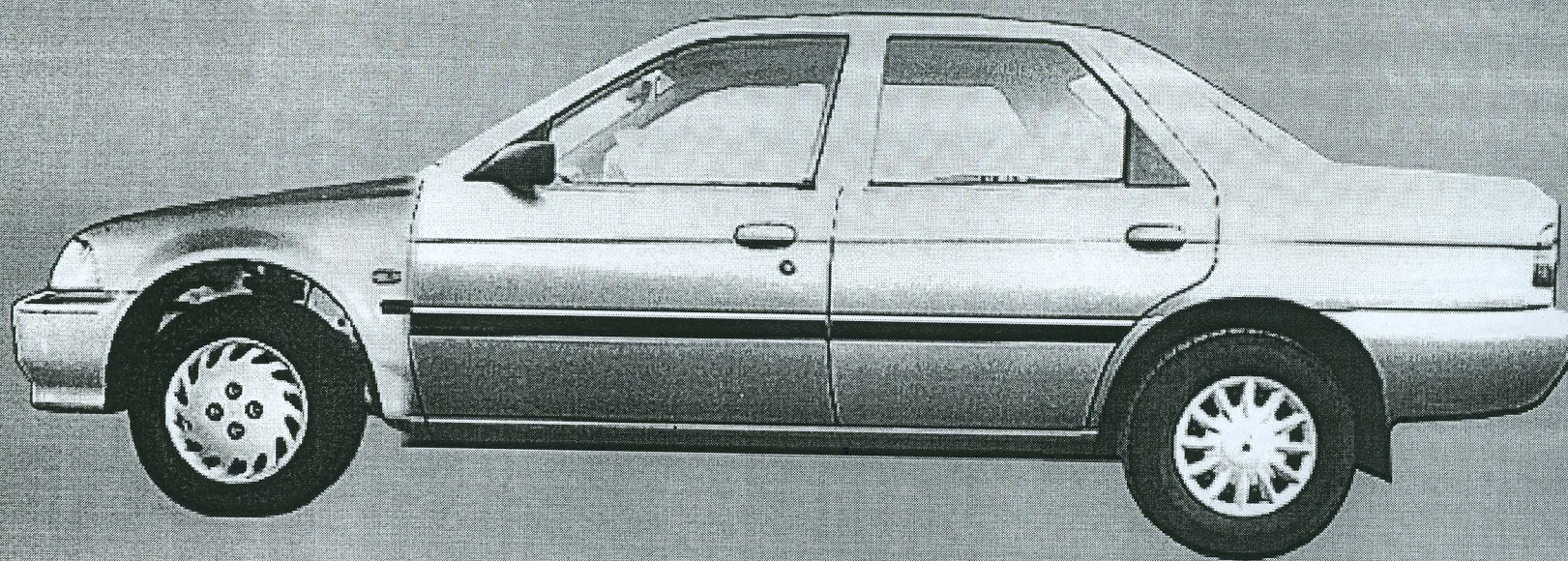
Subject Anuraj Raywade	City front with		Ford M & R	Opel M & R	City mid with	Ford F & R	Astra F & R
			Elegant ✓	Bulky ✓		dynamic ✓	dynamic etc. ✓
	Ford front with		City M & R	Astra M & R	Ford mid with	City F & R	Astra F & R
			Speedy ✓	Bulky ✓		dynamic Elegant ✓	Speedy ✓
	Astra front with		City M & R	Ford M & R	Astra mid with	City F & R	Ford F & R
			dyna ✓	Elegant dyna ✓		Bulky ✓	Bulky ✓

Subject Ritesh.	City front with		Ford M & R	Opel M & R	City mid with	Ford F & R	Astra F & R
			steek. ✓	Speedy & dynamic ✓		aggressive ✓	steek ✓
	Ford front with		City M & R	Astra M & R	Ford mid with	City F & R	Astra F & R
			N-A ✓	dynamic ✓		speedy. ✓	sporty. ✓
	Astra front with		City M & R	Ford M & R	Astra mid with	City F & R	Ford F & R
			steek. ✓	Bulky ✓		steek. ✓	dynamic ✓

Subject Ajay	City front with		Ford M & R	Opel M & R	City mid with	Ford F & R	Astra F & R
			N-A ✓	aggressive & Bulky ✓		Bulky ✓	N-A
	Ford front with		City M & R	Astra M & R	Ford mid with	City F & R	Astra F & R
			speedy ✓	Bulky ✓		sporty ✓	speedy ✓
	Astra front with		City M & R	Ford M & R	Astra mid with	City F & R	Ford F & R
			N-A ✓	Bulky ✓		sporty ✓	Bulky ✓

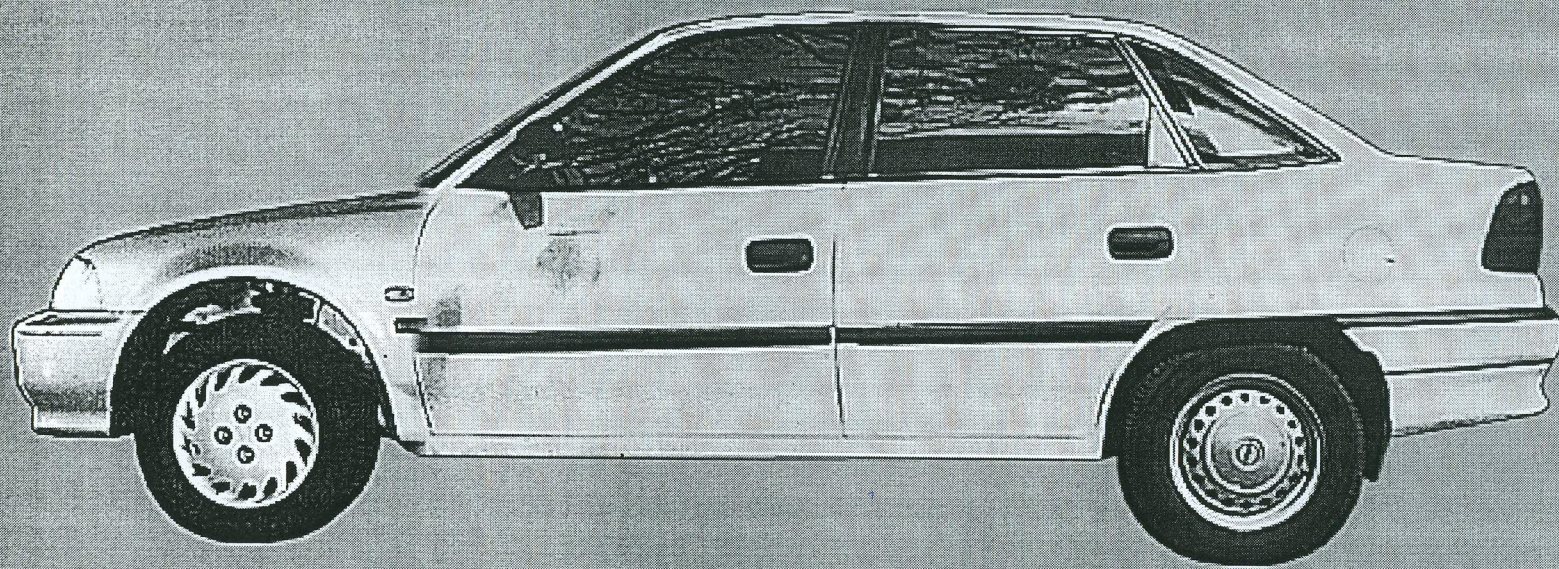
Subject <i>Puneet</i>	City front with	Ford M & R	Opel M & R	City mid with	Ford F & R	Astra F & R
		<i>Elegant & sporty.</i> ✓	<i>Sleek.</i> ✓		<i>N-A.</i> ✓	<i>M-A.</i> ✓
	Ford front with	City M & R	Astra M & R	Ford mid with	City F & R	Astra F & R
		<i>dyna & sporty</i> ✓	<i>Bulky</i> ✓		<i>dyna & sporty</i> ✓	<i>dyna & sporty</i> ✓
	Astra front with	City M & R	Ford M & R	Astra mid with	City F & R	Ford F & R
		<i>dynamic</i> ✓	<i>Sleek.</i> ✓		<i>dynamic</i> ✓	<i>Bulky</i> ✓

Subject	City front with	Ford M & R	Opel M & R	City mid with	Ford F & R	Astra F & R
	Ford front with	City M & R	Astra M & R	Ford mid with	City F & R	Astra F & R
	Astra front with	City M & R	Ford M & R	Astra mid with	City F & R	Ford F & R



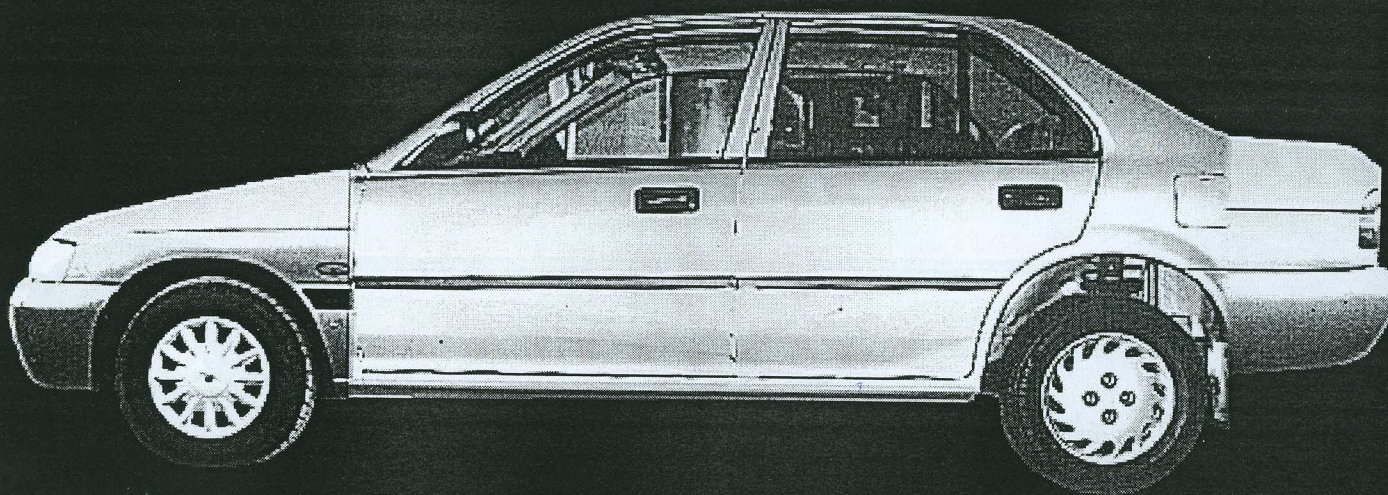
City front with Ford mid & rear.
attribute - Elegant 40%



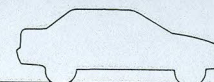


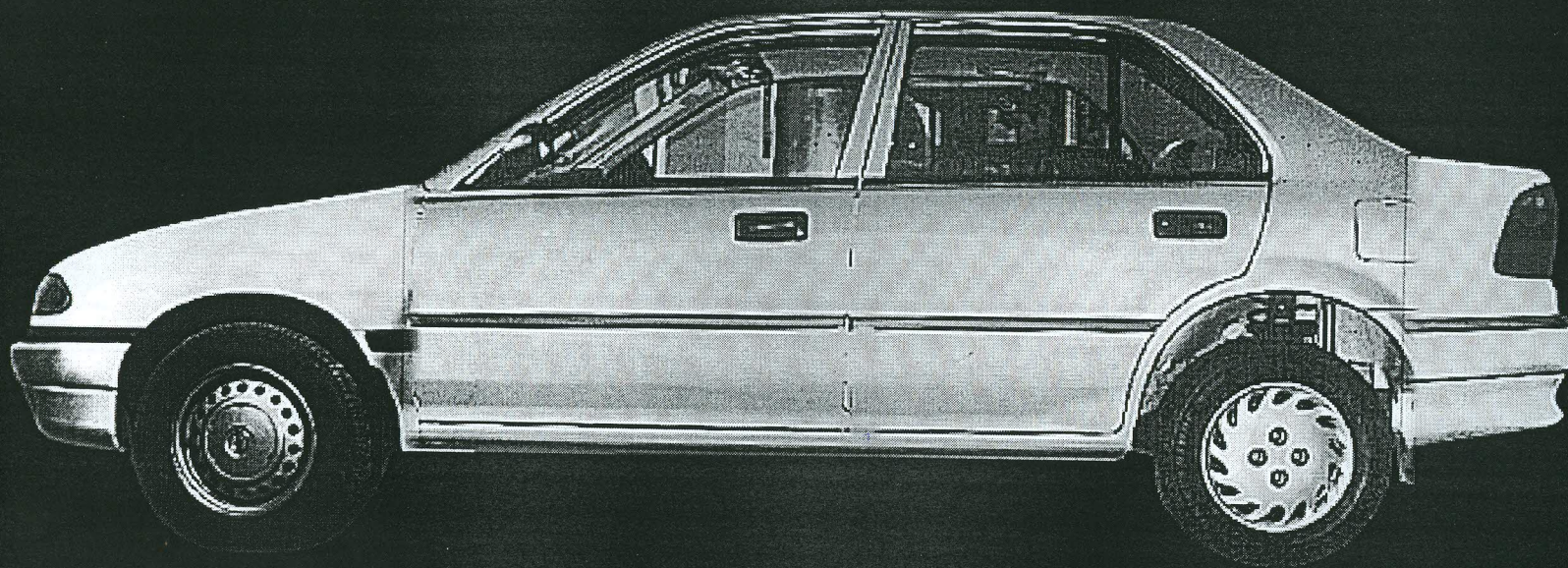
City front with Astra mid & rear.
attribute - (in determinant)



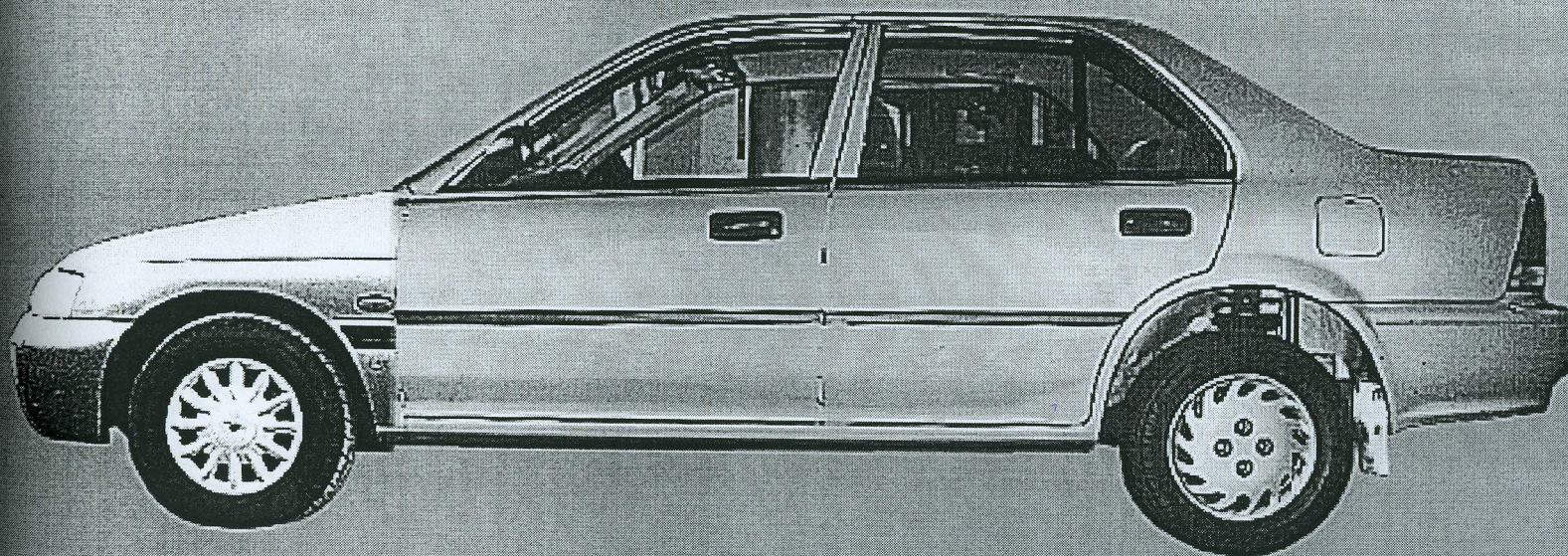


City mid with Ford front & rear.
attribute - (in determinant)



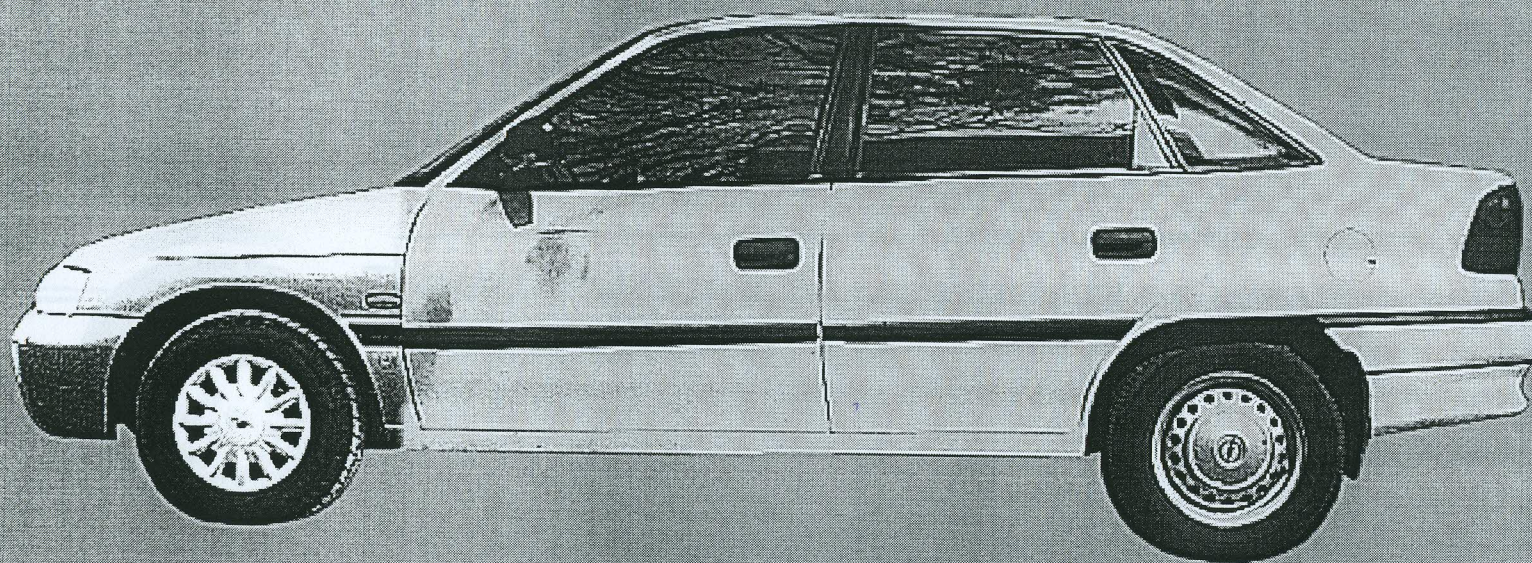


City mid with Astra front & rear.
attribute - (in determinant)



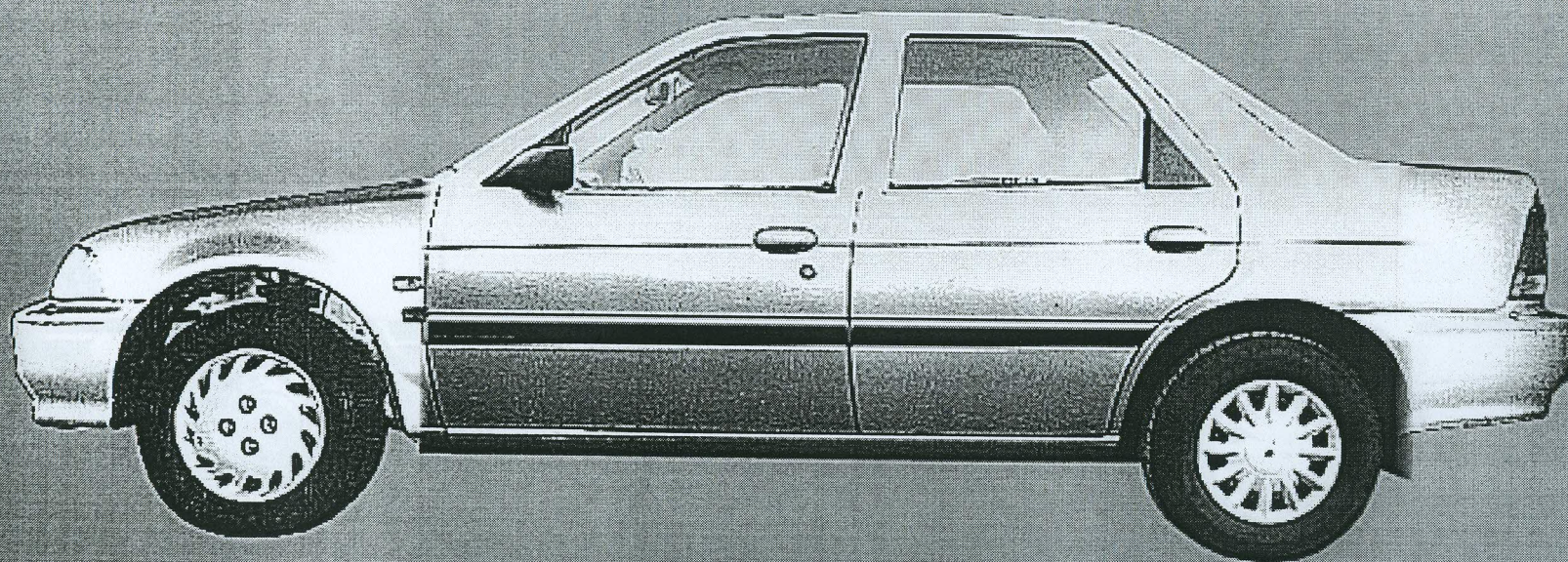
Ford front with City mid & rear
Attribute - speedy 40%





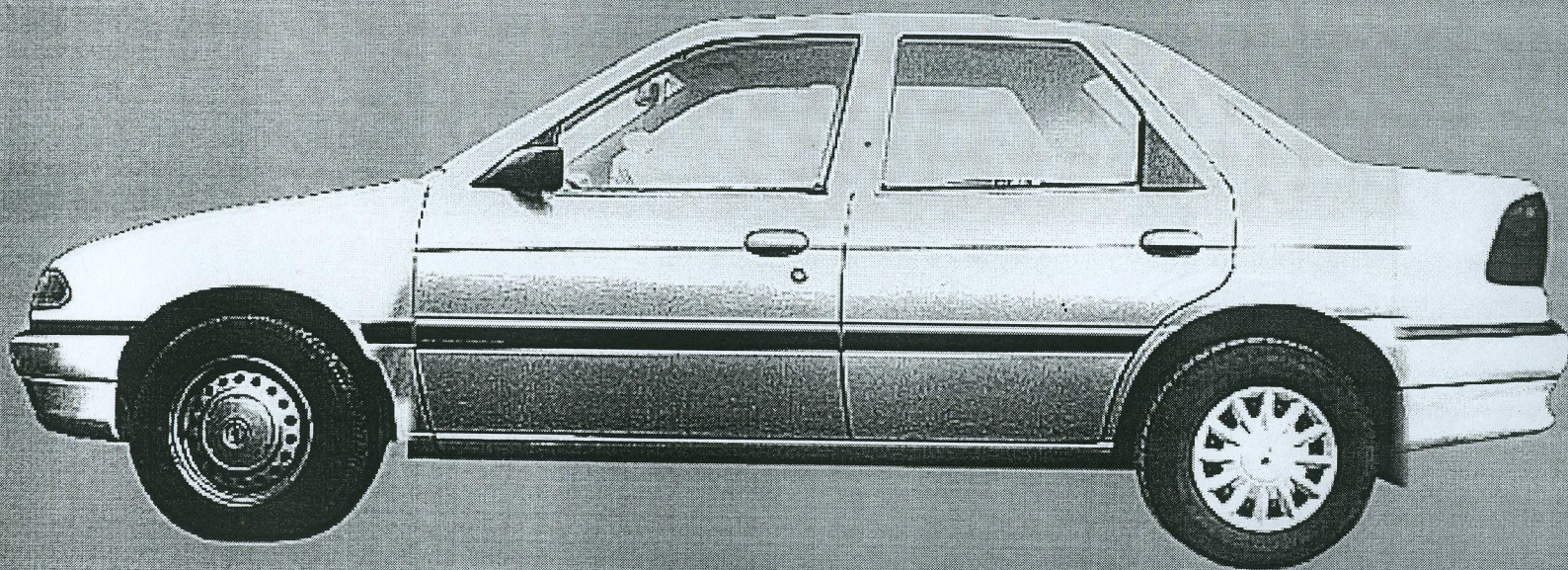
Ford front with Astra mid & rear.
attribute - Bulky 80%





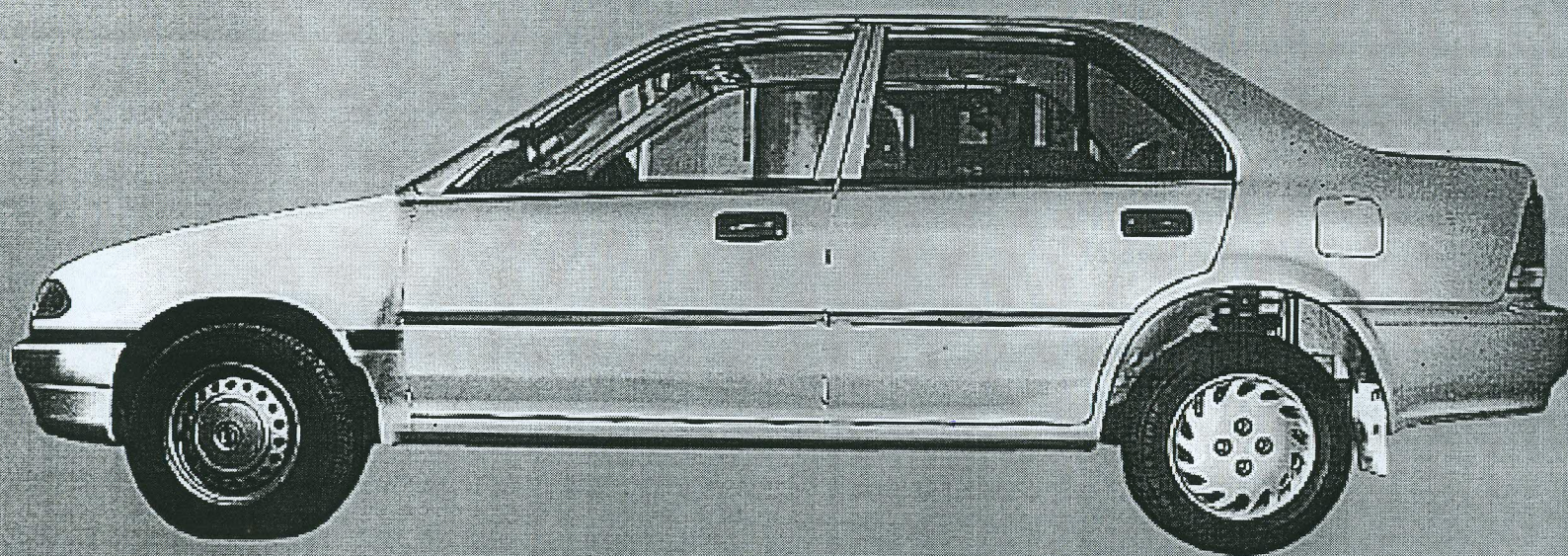
Ford mid with City front & rear.
attribute - Dynamic 40%





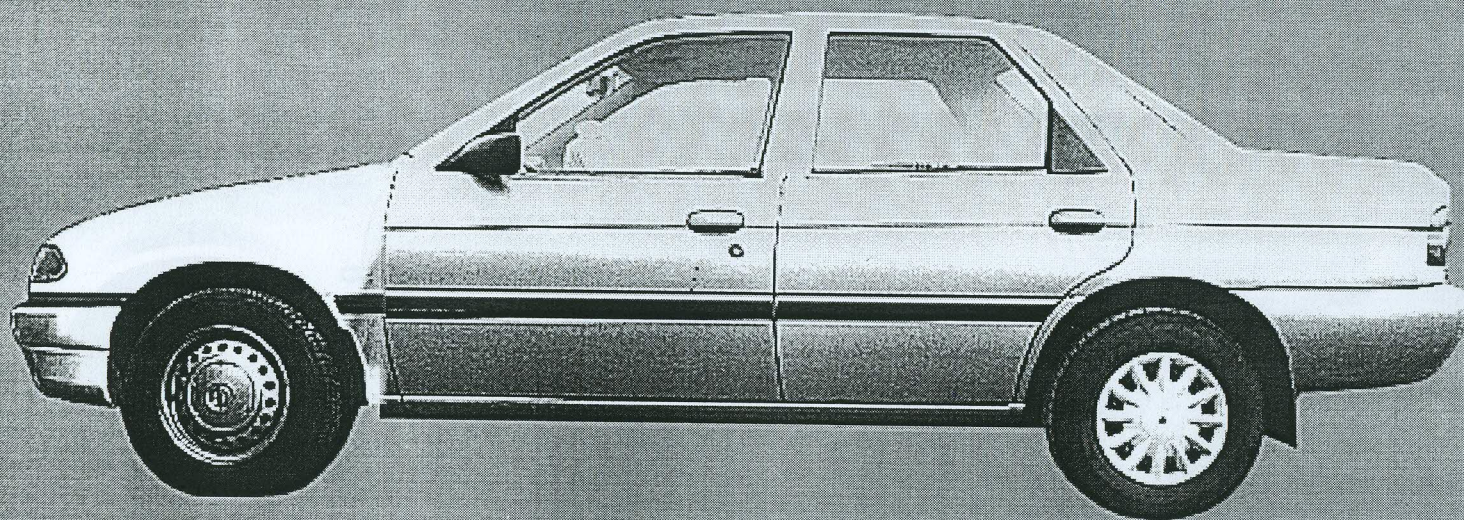
Ford mid with Astra front & rear.
attribute - Speedy 40%
Sporty 40%
Dynamic 20%



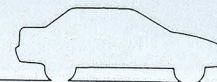


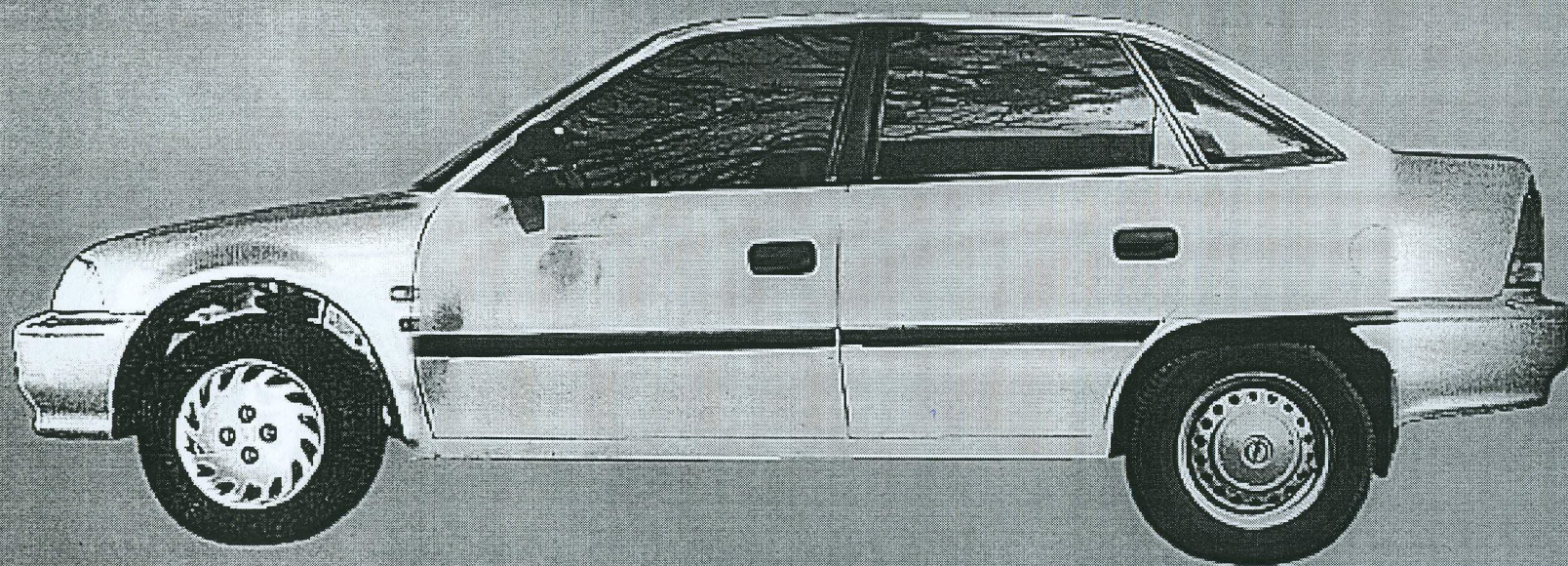
Astra front with City mid & rear.
attribute - Dynamic 60%





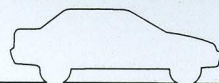
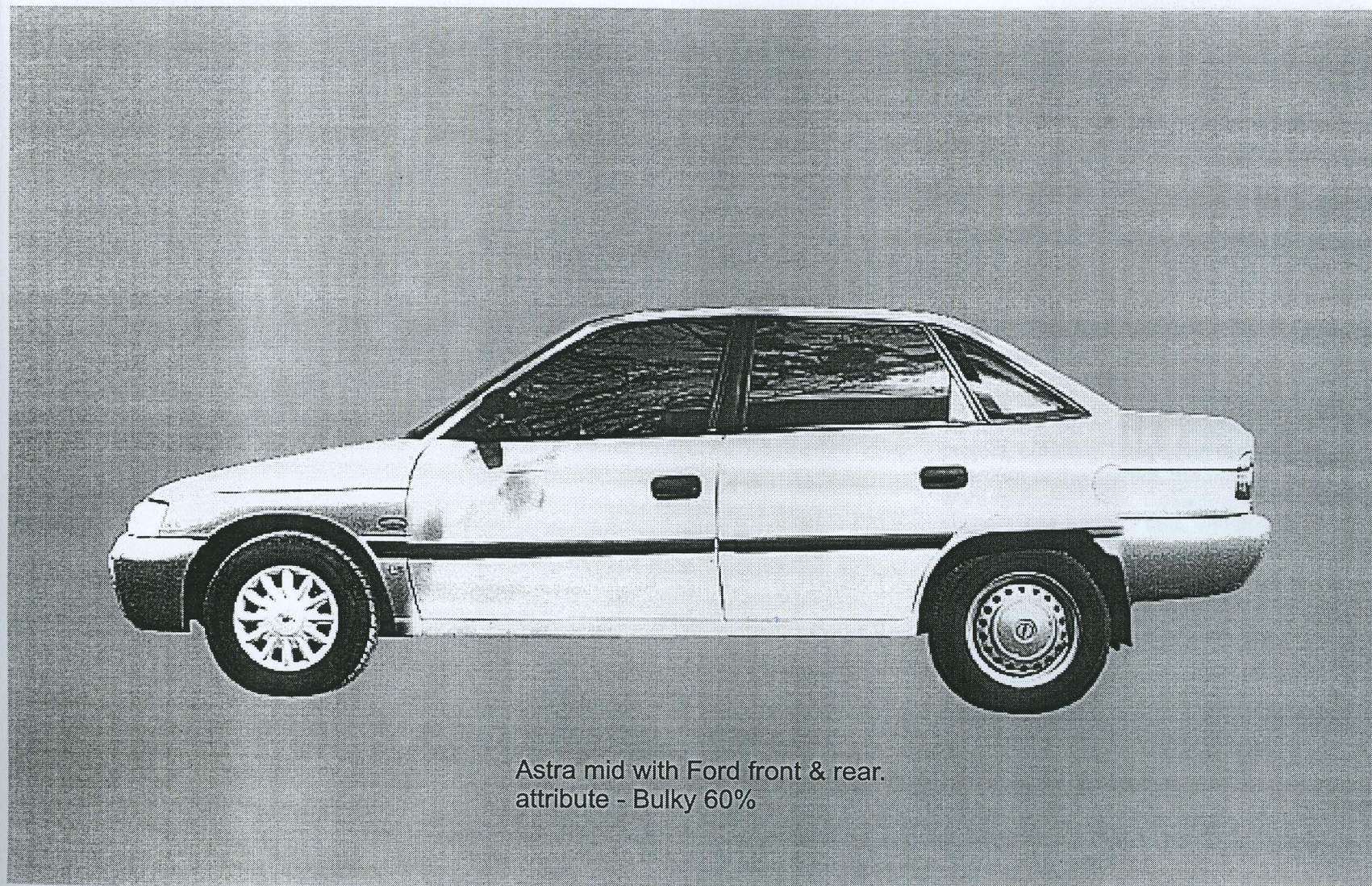
Astra front with Ford mid & rear.
attribute - Bulky 40%





Astra mid with City front & rear.
attribute - (in determinant)





Limitations

While carrying this project ahead, there were certain constraints and limitations to be considered.

The very first factor was time. For a project of this scale, it demanded to be carried out in far more than the allotted time, i.e. three months.

To start off, we had estimated ten cars for this project, but then later when realised the quantum of the project, the number of cars were reduced to six. Collecting data for these six cars was a major task, which was underestimated. The photographs of these cars were supposed to be shot at authorised dealers, where the job would be done according to the availability of the cars and authorised personnel only.

In the later part of the project, time was a major constraint. Specially when we had to conduct the experiments with the eye-movement recorder.

Hence this project was carried out under such limitations.



Conclusion

In the previous experiment we saw that we did not get marginally clear results, except for a few examples (80% bulky).

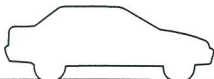
This happened due to the selection of attributes. The selection of attributes was done by asking subjects to contribute towards as to what they would think would be potential attributes. Finally this list of attributes was generated:

Delightful
Young
Sporty
Aggressive
Agile
Speedy
city featured
Hi-tech
Sleek
Bulky
Rugged
Dynamic
Feline
Friendly
Safe
Road hugging

Muscular
Strong
Box type
Elegant
Executive
Luxurious

Out of these many, the ones that were repeated mostly, were selected. Hence the selection was done by rating a few attributes, due to which quite a few attributes happened to be similar to each other. For e.g. Sporty and Speedy.

This was the major cause of results that were so similar. One thing we can conclude in this experiment is that, certain amount of polarity has to be maintained amongst the attributes to achieve varied and interesting results.



Acknowledgments

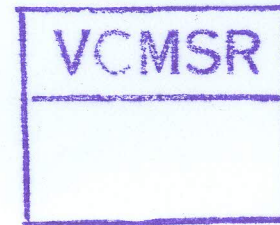
I would take this opportunity to thank my guide DR.G.G.Ray. Without his watchful guidance and cooperation, this project would have been an impossible task.

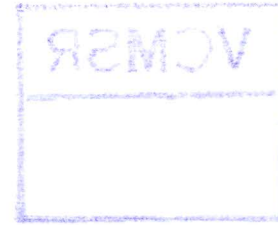
Many thanks to Ms. Rina of Ergonomics lab for sparing the F-10 camera for a week for our experiments.

I would also like to thank the auto dealers Linkway Honda, Orix Motors, Krishna Motors, Wasan Automobiles and Pilot Automobiles for permitting us to take photographs.

We would like to thank our colleagues Rahul, Ritesh, Sachin, Nikhil and Hemsingh for their cooperation. *also Puneet, Ajay & Ameet.*

And lastly I would personally like to thank Vinod for helping me in this project and making it a success.





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