

# SEMANTICS COMMUNICATED BY THE GRAPHICAL SYMBOLS USED IN VEHICLE CONTROL SYSTEMS

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For a successful ‘user-centred design’ (UCD), it is mandatory to understand the customer’s overall experience of a product beyond the intended usage and acceptance measures. Users’ perceptions are closely related to the pleasure transferred by the products and are dictated by emotional and practical benefits associated with the products. The three components or levels of product experiences are: aesthetic experience, experience of meaning, and emotional experience. Hence it is necessary to study the role of ‘semantic interpretation’ and ‘symbolic association’ of the graphical symbols used in controls of the Low Priced Vehicles (LPVs). Consequently this research study aspires to look into the study of human perception of these symbols in the context of the emerging Indian middle class.

*Keywords:* Graphical symbols, semantics, controls, comprehensibility, evaluation, automotive control.

## 1. INTRODUCTION

Livelihood in India has become increasingly linked with wider economy resulting in an ascending socioeconomic mobility. The country is going to undergo a major transformation over the next decade through sustained growth which would lead to the formation of half a billion strong middleclass and a downsizing of poverty. This in turn would result in a huge purchase ready segment being born. As this society is undergoing such transformation changes like, blending of cultures, increasingly demanding and improved educational conditions are also taking place.

At the same time the purchasing power of the middle class, their demands and aspirations might increase. Hence, the emerging Indian middle class becomes the future prospect for purchasing Low Priced Vehicles (LPVs). With a view to catering to these possible demands and taking into account the technological advancements in future, this study will focus on understanding the aspects that influence, affect and dictate the tastes and the perceptions of these people related to LPVs. The focus area would be on understanding the perception of the graphical symbols used in the controls of the vehicles by the emerging middle class. The controls would include Forward & Signal Lighting, Interior Lighting, Central Locking and Power window controls.

In India, the middle class consists of varying cultures and languages. Culture is defined as “the total pattern of human behaviour and its products embodied in thought, speech, action, and artefacts, and dependent upon man’s capacity for learning and transmitting knowledge to succeeding generations through the use of tools, language, and systems of abstract thought.” (Y.Y. Choong, 2006) They are different in perception, cognition, and style of thinking. They may hold different cultural assumptions and values. When a product like a vehicle or a machine is said to be ‘successful’ in a culture; the product should match with user’s cognitive model together with no loss of information, which the designer of the product tries to convey. Also, at the same time it should enhance the effectiveness & efficiency of human work conditions and counteract possible adverse effects on human health, safety

and performance (ISO, 1999). To design such a successful product, it is very important to understand the cultural traits of the target user group and not just the language or symbol translation.

### 1.1. Emerging Middle Class

There exists no clear definition for the Indian middle class officially. Certain economic research Institutes like National Council of Applied Economic Research (NCAER) define the middle class as the people with annual household income between Rs. 2 Lakhs and Rs. 10 Lakhs. In terms of occupations, shopkeepers, salesman, brokers, government and non-government office-workers, writers, teachers, and self-employed professionals, such as engineers, pleaders, physicians, etc. constitute the middle class. Statistics data estimates that the total population of India will increase almost 30% between 2005 and 2025, together with this rise the middle class population will increase approximately 10 times or almost 1000% during this period as a result of social mobility (McKinsey Global Institute, 2007). The strata of people, who are going to be a major part of this transformation, are the ones currently part of the lower boundary of the middle class of the socio economic pyramid, *the emerging middle class of the future*. This study is primarily focussed on this emerging middle class, with the annual income band of Rs. 0.7 Lakhs to 5 Lakhs. The age group is set within the range of 25–40 years. Given the tremendous socioeconomic growth, this emerging middle class will be the consumer of LPVs like Tata Nano, Piaggio Ape etc.

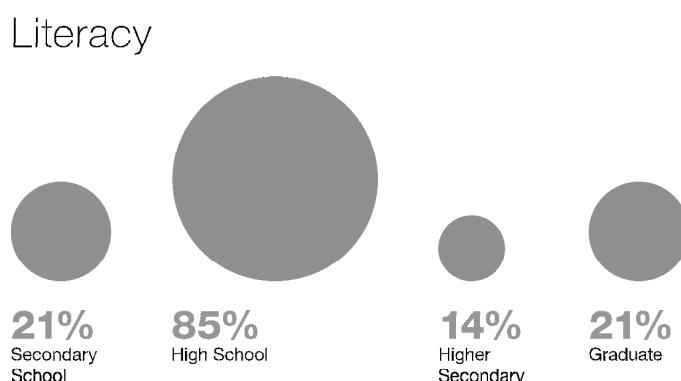
Before starting the evaluation of comprehensibility, a pilot study consisting of personal interviews was conducted with 23 people from the above middle class strata, consisting of shopkeepers, salesman, Rickshaw drivers, and others. These interviews gave an overall understanding of the literacy, life style etc.

From the study, we can see that 43% of subjects current average household income is above Rs. 15000/month and together with the high savings practice. This shows that the low middle class will be the customer of a car in the near future.

85% of the candidates own a TV and a mobile, and 29% of them own electronic appliances like Music/DVD Player, washing machine. Also 75% of the people learned use these gadgets of their own. This information together with high percentage of people having good education background (Fig. 1), we can judge that the comprehension ability of the maximum number of people would also be good.

### 1.2. Graphical Symbols

Graphical symbols are visually perceptible figures with particular meaning that are used to transmit information independently of language. They provide information in a compact form that occupies less space. These graphical symbols should be effective in communication. There are situations where they fail to attract sufficient attention or sometimes unintentionally convey a message different from



**Figure 1.** Literacy among the interviewed candidates. Source: Data collected from the interviews.

or opposite to what was intended. To avoid such failure, these symbols should be evaluated for effectiveness before usage. They can be evaluated for symbol perception — where the noticeability and legibility of a symbol is evaluated; and also for symbol comprehension — where the comprehensibility and suitability for learning of symbols is measured.

The study of signs (Semiotics) has three branches: syntactics or syntax, semantics, and pragmatics. Even though this study is regarding the semantics of the symbols, it is also important to look at the symbols from other perspectives and understand how other parameters affects the interpretation of the meaning from the signs.

The sign itself is not the only one responsible for the sender's intended message being correctly understood by the receiver. The context in which the symbol is placed and the way it is perceived are also major factors which contribute in its comprehension. Same symbol can be interpreted in a different way in a different context. The conditions that influence the meaning of a symbol are: surroundings (context), knowledge of the receiver, culture, social circumstances and combination of signs. The degree of correspondence between the sender and receiver's repertoire of signs is an important factor in correct interpretation. The initial interviews helped us to understand the receiver's repertoire and context.

Sigmatics of the graphical symbols explains the relation between the sign and the signified; based on which the symbols are classified as ideograms (representation of a concept), pictograms (iconic representation of an object) and synonymous signs. Pragmatics deals with the manner in which the receiver interprets the symbol. The decisive factors here, are the intention of the sign and the complete interpretation within the system of controls. The symbols on the controls especially in vehicle controls are suggestive in nature, i.e. merely to inform the user; and the user is left to make his or her own decision about how to act.

Few symbols can be instantly effective in use. Most of the symbols need to be learnt, so that they are understood. Majority of symbols under study come under this category. Because of this, the suitability for learning, or the ease to be learned (learnability) and remembered (recallability) by target users, should be an important criterion to determine the symbol's effectiveness.

### 1.2.1. Graphical Symbols in Automotive Controls

Each element of the automotive controls should be present only to enhance the driving, not to distract or visually entertain the driver. Studies suggest that the interactions with some of the fixed vehicle controls may have significantly adverse effects on driving performance. Manipulating vehicle system controls which are not integral to the driving task (e.g. climate controls, sun visors) results in an 8.55% increase in the amount of time spent driving with both hands off the steering wheel. Also such vehicle controls cause a 13.20% increase in the amount of time driving while looking inside the vehicle (Stutts *et al.*, 2003). Graphical symbols are crucial constituents of automotive controls. This study is focused on the comprehensibility and suitability for learning of the graphical symbols in the controls of the Indian Cars for the emerging middle class.

## 2. EVALUATION OF COMPREHENSION

For the study of evaluation of comprehension, 59 participants were asked to complete questionnaires. The participants included people from emerging middle class currently not owning a car (45 out of 59) and people with exposure to the controls of a car. People who own and drive regularly (14 out of 59) were included in the questionnaire to bring in the 'Recallability' factor of the symbols during evaluation. Since the contextual enquiry was not feasible, visual questionnaire (with instructions written both in English and the local language Kannada) was designed to bring in maximum level of context. The questionnaire design and the evaluation method were based on ISO 9186–2001: Graphical Symbols — Test Methods for Judged Comprehensibility and for Comprehension.

The questionnaire is divided into two parts. In the first part, the symbols are presented to the participants with a global context of a car and the participants are asked to freely express their opinions of the meaning of the symbols. Then the symbols within a particular type of control (say

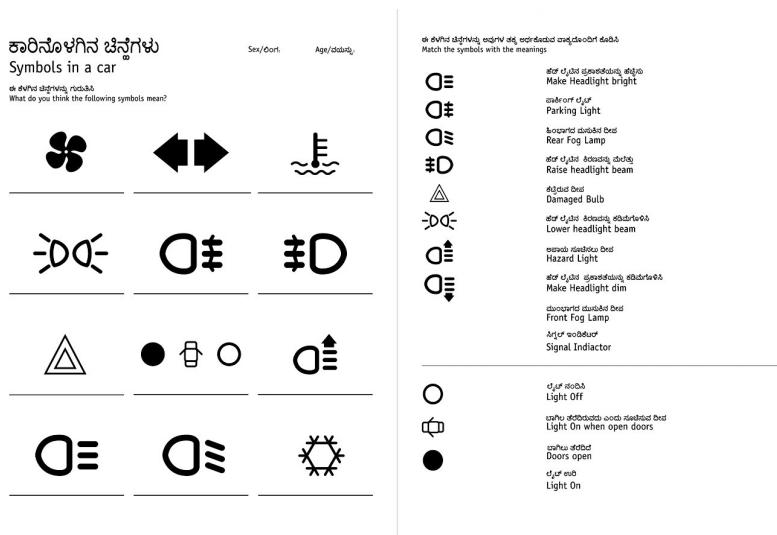


Figure 2. Pages from the visual questionnaire.

Climate controls) are shown to the participants together with the set of intended meanings, to bring fine context to the test. The purpose of this particular ordering of the questionnaire was to avoid influencing of the comprehension of the symbols by providing meaning to the users. The open-ended test has the advantage of producing more participant responses on symbol comprehension, including the incorrect and opposite responses, which provide additional insights on possible confusions or critical misunderstanding.

## 2.1. Evaluation Method

The responses of all participants are classified into the following four categories, according to specific criteria:

Category 1: Correct understanding of the symbol is certain.

Category 2: Correct understanding of the symbol is very probable.

Category 3: Correct understanding of the symbol is probable.

Category 4: The meaning stated is the opposite of that intended.

For example, consider the icon for rear fog lamp (Fig. 3). The responses for this icon were broken bulb, left signal indicator, lamp, fog lamp, front fog lamp etc. From these responses ‘front fog lamp’ shows the correct understanding of the symbol and was taken as Category 1 response. The ‘fog lamp’ was taken into Category 2 and ‘lamp’ was put in Category 3. Whereas responses like ‘broken bulb’, ‘left signal indicator’ were far away from intended and were put in Category 4.

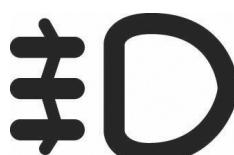


Figure 3. Graphical symbol for rear fog lamp.

The final score of comprehensibility was calculated as follows:

- |   |      |   |
|---|------|---|
|   | 100% | of category 1 (correct understanding certain)       |
| + | 75%  | of category 2 (correct understanding very probable) |
| + | 50%  | of category 3 (correct understanding probable)      |
| - | 100% | of category 4 (stated meaning opposite)             |
| = |      | Comprehensibility Sum                               |

Comprehensibility Score =

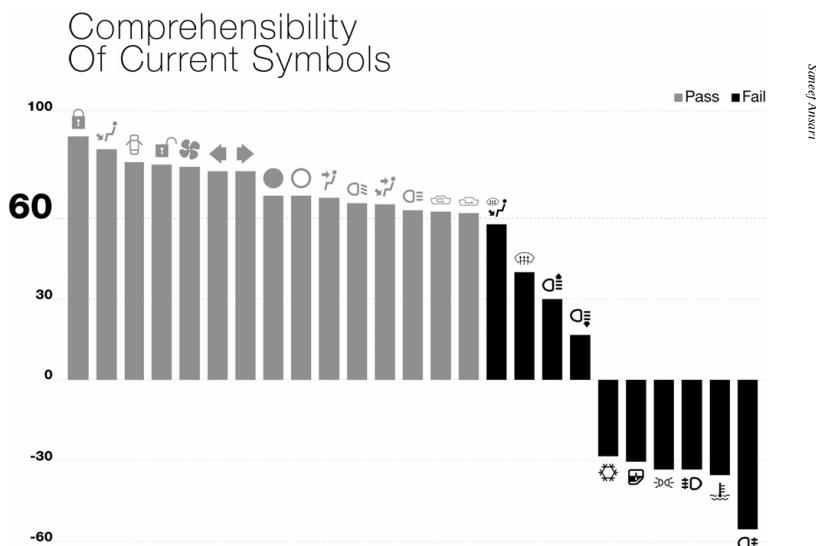
(Comprehensibility Sum  $\times$  100)/Total Number of Answers for the symbol

This final score reflects the comprehension rate of the symbol. If the final score is higher than the criterion of acceptability, for example 85 for symbols used as warning signs, the symbol is recommended to be standard. For the study here, the symbols that scored below 60 are considered, because those are not warning symbols and are also exposed to the users on daily basis, which they will learn eventually.

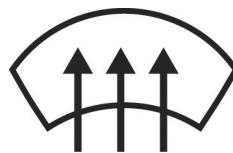
### **3. ANALYSIS**

From the comprehensibility test of the symbols, 15 out of the 25 tested scored above 60 in the Comprehensibility Score (Fig. 4). These symbols proved that, the subjects could successfully comprehend them either by recognition or through their recallability. Meanwhile, the failed icons are analysed further to understand the causes of the failure in the comprehension test.

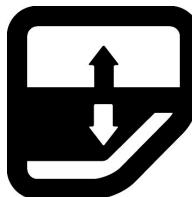
Abstraction is one of the ways in which humans express and receives visual messages, where the kinesthetic quality of a visual event is reduced to the basic elemental visual components, emphasizing the more direct, emotional, even primitive message-making means. The symbols right now in use have been simplified to a large extent. In the process of simplification the symbols reached a high degree of abstraction loosing the kinesthetic quality of the actual subject. The existing iconogram for defrost (Fig. 5) failed to relate to the windshield in the process of abstraction, thus misleading the user away from the intended idea.



**Figure 4.** Comprehensibility scores of each of the tested symbols are plotted in bar graph. Symbols, which are marked in black have comprehensibility score below 60 and considered for analysis. *Source:* Commonly used graphical icons in the Indian automotives



**Figure 5.** Existing symbol for windshield defrost.



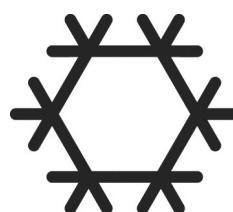
**Figure 6.** Icon for Power Window.

At the same time abstraction to a high degree results in ineffectiveness of a symbol, and lack of adequate abstraction also results in the same. The interpretation of the symbol becomes ambiguous. The icon to signify power window control currently (Fig. 6) used in some of the mid-sized cars in India is an example. In the icon, the designer tried to abstract a vehicle door and with a pair of arrow to show the up and down movement of glass pane; but rather it conveyed ideas like sliding switch, on/off switch to many.

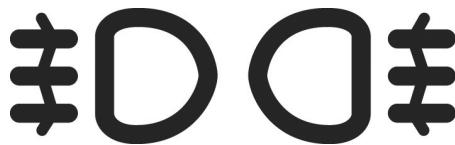
The Swiss linguist Ferdinand de Saussure (1857–1913) who is considered to be the father of 20<sup>th</sup> century semiotics, indicated that the connection between the signifier (the symbols, sounds, letters, gestures, etc.) and the signified is an arbitrary one that human beings and/or societies have established at will; based on their knowledge-making ability and capacity to make and understand signs. Since representational activities vary from culture to culture, the people of one society or culture may not comprehend a symbol that came into existence from another society. This is the reason for which the snowflake symbolic icon (Fig. 7), which is used to indicate ‘Air Conditioner’ in the cars, failed in the comprehension tests.

As humans, we interact with the dynamic world around us in our every day life. We judge the location of objects relative to ourselves in order to maintain the spatial constancy. This factor has to be taken into account when we design symbols involving direction or any spatial references. If we look at the icons used in the cars to indicate the two sets of fog lamps (Front & Rear) (Fig. 8), it is evident that this attribute of humans creating spatial reference model relative to him/her have been ignored.

The symbols that belong to a single control set should achieve a sense of unity. If the style of the symbolic language in each element drastically varies, this unity among the symbols is lost together with their aesthetic quality. We can see this kind of lack of unity in the icon on air conditioning controls (Fig. 9) of some of the low-end cars in the Indian market. An icon is one of the many graphic elements



**Figure 7.** The snowflake icon used in some cars to indicate Air Conditioner.



**Figure 8.** Symbols for front fog lamp (Left) and rear fog lamp (left).



**Figure 9.** Symbols of air conditioning controls.

that need to work together harmoniously. This aspect should be kept while designing a set of icons that should work as a system. While attempting to achieve this visual unity, it is very necessary to make sure that the symbols still hold on to the thread to the signified.

#### 4. CONCLUSION

The graphical symbols are prime contributors towards the successful translation of the designer's concept model to a user's mental model through the product. Hence, the evaluation of the graphical symbols is unavoidable for effective communication. Through the evaluation of the symbols for comprehensibility the hitches in the system image that hinders the proper translation can be discovered.

With help of the above comprehensibility evaluation of symbols, the graphical symbols on controls can be improved for the effective use for the future customers of Indian LPVs. Also, similar methods can be utilized for improving symbols in other areas like public signage, localization of software, electronic gadgets etc for the people of India.

#### ACKNOWLEDGMENTS

This work came to fulfilment as part of an industry-academia research project I did on In-Vehicle HMI, under the guidance of Dr. Bibhudatta Baral, Research Head — R & D, National Institute of Design, Bangalore. I would like to express my sincere gratitude towards him for his invaluable support throughout the project. I would also like to appreciate Manoj Neelakantan, National Institute of Design, R & D Campus Bangalore for his beneficial suggestions during the course of the project. Thanks to my friends: Sangeeta Balasubramani & Jonathan D'Mello, for their timely and constructive discussions. I also extend my thanks to Vikram Managoli for his invaluable help with Kannada translations.

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