Özet:

Rosch'un sınıflandırma kuramına dayanarak Atavankar'ın geliştirdiği ürün sınıflandırma yöntemi, ürün anlam profilinin belirlenmesinde kullanılabilecek bir araç olarak tasarım çevrelerinde ilgiyle karşılandı. Bu kuram insanın kavrama ve sınıflandırma yetenekleri araştırmalarından elde edilen verilere dayanarak zihinsel dünya yapısının kullanıcı algılarını nasıl etkilediğini keşfetmeye çabalayarak kullanıcının zihinsel dünyasını anlamanın ürün tasarımına yaklaşımı köktenci olarak değiştirebileceği inancına dayanır. Örneğin, pazara yeni bir ürün olarak takdim edilmiş bir telefon söz konusu olduğunda, bu sadece zihnimizde telefon olarak etiketlenmiş bir kavrama sahip olduğumuzda ve yeni ürünle bu kavram arasında bir bağlantı görebildiğimizde mümkündür. Yeni üründe görünen özel görsel ipuçları zihinsel araştırmayı başlatır. Bu ise daha önce kodlanmış, yapılmış ve etiketlenmiş benzer bir örnekler sınıfını kaçınılmaz bir şekilde harekete geçirir. Görsel ipuçları temsil ettikleri anlam bilim ile zihinsel olarak doğrudan ilişkilendirilir. Bu nedenle, görsel ipuçları anlam bilimsel bir işlev gördüklerinden, anlam bilimsel araçlar olarak gönderme yapılabilirler. Dolayısıyla ürün anlam profilinin belirlenmesinde, tasarım süreçleri içinde dolaysız olarak yorumlanabilirler. Ürün biçimi betimlemelerinde kendilerini yansıtabilirler. İşte sınıflandırmanın tasarım süreçleri açısından gözardı edilmemesi gereken özelliği budur. Tasarım süreçleri açısından, görsel ipuçlarının inşa edilmesiyle oluşmuş biçimsel bir yaklaşımı görselleştirmek mümkündür. Bu yaklaşım ürünlerin göstergesellik işlevlerine bağlı görsel ipuçlarının ve zihinsel kavramlarının karakterize edilerek bunları ürünün tek bir yapısı olarak anlama üzerine temellenebilir.

Üretici bir tasarım aracı olarak kullanılabilen bu çerçeve, kuramsal açıdan irdelenip bir grup öğrenci denek tarafından tasarlanmış ürün bütüncesi üzerine örneklenecektir.

Summary

This theory lies on the belief that to understand the mental world of the user by attempting to discover how the structure of the mental world influences user's perceptions on the basis of the data obtained in the research on human being's understanding and categorization talents may trigger a radical change in the approaches to product design. The special visual clues of the new product give start to the mental research. And this research activates inevitably the category of similar examples coded, structured and labelled previously. The visual clues are connected directly with the sememe they represent in the minds. Therefore, the visual clues can have references as semantic instruments due to their semantic function. They can be, thus, interpreted directly in design processes aiming to determine product

The Theory of Categorization in the Determination of Product Semantic Profile and an example on its use in Product Design*

Doç. Dr. Oğuz Bayrakçı
MSÜ Mimarlık Fakültesi, Endüstri Ürünleri Tasarımı Bölümü

Introduction:

The design act is a process of creation directed to the future as a consequence of its general structure. The designer takes part in a cognitive communication beginning with his/her mental activities. At the very beginning of the design process she/he has a mental scheme in concordance with the design problem. This mental scheme gradually turns into projects. At the same time it proceeds towards new constructions via cognitive communication with the previously obtained drafts. This cognitive control and communicative comings and goings formulate the design; each realization stage from the previous one and produces new decisions which will be communicated to the following stage. These steps shedding light on the general structure of the design put forth that the design act, as the creation of a product which will exist in the future and as a progress process before handling three-dimensional works is related to a great extent to the mental milieu and world of the designer. Product designers, in concordance with the structure of design act, have the tendency to behave according to visual decisions related to the development of the product form. These decisions are determined to a wide extent under the influence of the images and image categories of their own mental world. "How can we formulate a model which will be appropriate to the natural structure of the design and provide the necessary basis to the decisions of the designer?" is the question to be asked in the framework of product semantics. The factors which are seen as fundamental sources of product semantics are the form realizations related to the product function and their potential possibilities, designer-user behaviours, social relations and social and cultural essences. Product form is an appearance of the designer's mental activities as an expressed affordance of these factors. This view, which puts into the foreground product form, has to suggest methods by focusing on a product definition and limits which will meet the design problem. Product definition meeting design problem in the light of the approaches of product semantics is the meaning profile which determines the

semantic limits of the product. The meaning profile is the product form obtained from the related contexts of the product and consisting of the interpretation of the visual signs related to the semiotic function of the product. While a consistent frame of the outer appearances-concerned with its physiognomy and physical geography-of the product is formulated, the limits of a semantic approach, providing clues about the mental worlds of the use and designer and based on the views on the perception-understanding appearances of the human being's getting information and communication processes, are determined *(Bayrakçı 1994)*.

In order to determine the product meaning profile, the characteristics of the product category to which the product belongs and the characteristics of the other product categories to which the product can be related should be determined. The description of the product form, obtained via the selection and interpretation of the visual clues characterizing the given product category provides the product meaning profile. The meaning fields to which the visual clues refer to should be appropriate to the goals of the design.

The key concepts, "product meaning profile" and "categorization/taxonomy" play an important role in this approach. Neither the characteristics of the product category to which the product belongs, nor the visual clues defining these characteristics can be determined without carrying on a categorization act.

1. *Categorization in the Determination of Meaning Profile:*

The method of product categorization developed by Atavankar (1990) on the basis of Rosch's categorization theory (1976, 1978) has enjoyed great acclaim in the works of the designers as an

instrument which can be used in the determination of product meaning profile *(Krippendorf 1992).* This theory aims to illustrate how the structure of the mental world influences user's perceptions on the basis of the data obtained from the research on human being's understanding and categorization talents. It is based on the belief that the discovery of the user's mental world will radically change the approach to product design.

"The fact that each human-made new product becomes easily a part of our mental world is widely disregarded. However, it is known that a new product will become a new datum in human being's mental world. The development of the mental representation is an active intellectual process which influences intensively our reactions, choices and decisions" *(Atavankar 1990).* For instance; when a telephone is launch in the market as a new product, we can perceive it if we have a concept labelled as 'telephone' in our minds and if we can establish a connection between the concept and this new product. The clues, especially visual ones, which are perceived when the new product is analyzed, give start to the mental research. And this research activates inevitably the category of similar examples coded, structured and labelled previously. "In this process, termed 'categorization', the entrance to the meaning of the new product is the first significant step. In a more generalized definition, 'categorization' is the process of synchronizing experiences. The process of mental categorization is a way to learning. The key process lying on the basis of human being's process of getting informed is learning and communication realized via categorization" *(Wittgenstein 1979).* The first encounter with many of the products entering human-made world is

meaning profile. They can reflect themselves in the descriptions of product form. This is the characteristic of categorization which should not be disregarded in design processes. From the point of view of design processes, it is possible to visualize a form approach consisting of the building up of visual clues. This approach can be based on the understanding of visual clues and mental concepts as the single structure of the product by characterizing the visual clues and the mental concepts related to the semiotic function of the products. This frame which can be used as a productive design instrument will be theoretically analyzed and examplified on a corpus of products designed by a group of subject students.

mostly visual. In order to define and find out the meaning of the new product, we perceive the visual clues related to its taxonomic identity during this encounter. The visual clues play a vital role in the establishment of a connection with gathered experience and information, the association with categorization and thus the entrance to the meaning. The most important phenomenon that should not be disregarded is the direct mental connection of the visual clues with the sememes they represent, meet or afford. Therefore, visual clues can make references as semantic instruments due to the fact that they have a semantic function. They can be interpreted directly in the determination of the product meaning profile and design processes. They can reflect themselves in the descriptions of product form. And this characteristic of categorization should not be disregarded during design processes. In the perspective of design processes, it is possible to visualize a form approach consisting of the building up of visual signs. This approach can be based on the understanding of visual signs and mental concepts as the single structure of the product by characterizing the visual signs and the mental concepts related to the semiotic function of the products. This defined frame can be applied as a productive design instrument. A design strategy can be formulated to carry out a form innovation. Therefore, categorization is an important alternative to the intuitive design approach thanks to all these characteristics.

2. *The Basis of Categorization and the Importance of Mental Strategies in Design:*

Human beings can discern objects which are similar to the determined example object among many objects without spending much effort at a very early age. "The uniqueness of the strategies of categorization developed by human mind lies on human talents for confidently discerning and evaluating irrelevant items" *(Atavankar 1990).* Categorization is previously seen as a strategy related to only "understanding economy". Then, Rosch (1978) put forth principles governing this process. For instance;

1. In many objects, the group of characteristics display very obvious relations which facilitate categorization.

2. Human mind opts for economic choices which ignore infinite differences between objects.

This kind of categorization strategies of mental processes can reinforce the principles of form innovation and manufacturing new product types related to design in conscious design processes. "We use categorization as conscious processes in our real world activities, too. The most illustrative example can be the behaviours of designers and design itself as a profession" *(Bayrakçı 1994).* Interestingly enough, designers classify real world objects under certain categories and mention them in accordance with the characteristics of these categories disregarding the differences among objects. For instance; "sitting furniture, household equipments, kitchen equipments, motor vehicles, manufacturing equipments, hand tools, office equipments" and many other similar terms are used by designers. Some of these categories are determined on the basis of the form and functional similarities of the objects and others are determined on the basis of the use-product family objects formulate in a common place.

A very important phenomenon is disregarded in the categories determined by designers. For instance; "sitting

elements" refer to all objects or positions which can have 'sitting function' or can meet this need without exceptions. Consciously or unconsciously, the limits of the categories are too flexible or limits are surpassed continuously. Each kind of object relations or positions meeting sitting function or affording this function is included in the main definition of 'sitting" and this offers at the very beginning an infinite series of interpretation and possibility to the form variety of design as it is explained in Gibson's "affordance theory" (1966, 1979). In design, this fact means a net of potential forms, concepts and relations. "These categories, which seem to be for-mulated at first look only for the sake of communication in design discourse, offer in fact a strategy for design. What we would like to emphasize at this point is the fact that the designers have the possibility of using the performance and flexibility they enjoy during categorization activities in conscious design processes. Undoubtedly, this use will be focused on the predetermination of 'product meaning profile', backward reading of the designed product or attempts of analysis." *(Bayrakçı 1995)*.

3. *The Identical Use of Natural Categorization Process in Product Design:*

"The members are gathered in a natural category because of their similar product family rather than their widespread comprehensive characteristics" *(Wittgenstein 1979).* This is the only rule which makes it possible to gather members in a certain category or to establish common memberships and class identities with other classes. However, these connections that should be established do not require each member to have one of the similar

characteristics of that category. Most of the categories which are naturally and intuitively developed do not have well-defined limits. These natural categories are not circled by defined limits but they are gathered around a good example which can be called a 'typical member'. The example member is treated as a central member. Other members do not occupy a central place but they are placed in the development field. They share certain similarities with the central member.

For instance; when we talk or think about the category of 'lighting elements', a wide variety of products-lighting products, giving messages with light or lighting with fire works-is covered. A very flexible limit here includes all kinds of elements which can originate or reflect light. Thus, what defines the category is not these vague limits but the image of the typical product which represents the central member. This image may change idiosyncratically-according to the individual-. The selection of this image, which is referred to as the representative of the category, is carried out according to the semiotic function of the product sign. The flexibility of the limits of taxonomic identity provides the formulation of double taxonomic identities by establishing associations with other categories. Thus, designer's mind creates original outcomes by being open to every phenomenon at the very beginning.

4. *The Representation of the Taxonomic Identity and Graded Membership:*
One strategy is used in categorization processes. A concept is not defined with its limits but with its essence. This essence is generally the most appropriate example or the typical member which represents the category and occupies the centre.

The typical member or the most appropriate example of the category is used to define and to refer to that category. For instance; "chair" for sitting elements, "Adidas" for training shoes, "jeep" or "Land Rover" for offroad vehicles are used as perception references to refer to the categories. The positions of the other members in the category are analyzed by comparing them with these typical and central members. However, these central members may vary according to the social and cultural status of the individual. "The comparison of central members with other members creates example objects or prototypes. This kind of members are given a percentage of perfection or a grade of reasonability" *(Atavankar 1990).* The designer aims to meet the special expectations of the real world. For instance; the designer designs the physical
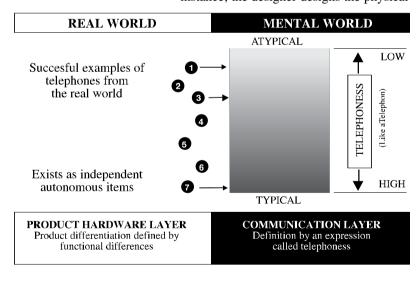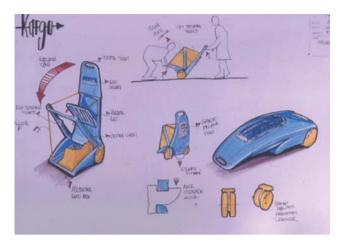
meeting limits of the real world guide this abstract "like a telephone" expression. Thus, the second layer related to the communicative function gains importance. For instance; in a design work during the fabrication of the draft models of the product called "mock-up", the function of the use does not enjoy its real practicability. The product looks like the real one but it is not ready for use. The designer imagines mentally the existence of the function. At this point the form research is carried out in communication layer by making the real world conditions smoother. What the designer is really interested in this step is the development of the visual expression of the given category. The designer walks around the communication layer called mental world by establishing new relations between the typical member of the category of telephone product and potential members which bear "like a telephone" characteristics.
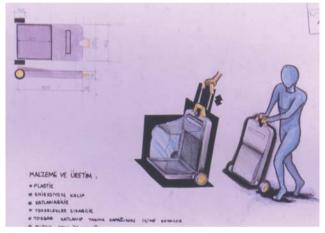
5. *The Use of Mental Categorization in Product Design:*

The use of mental categorization in product design can be examplified by an analysis. The aim of the analysis is to consider the validity of the views put forth in accordance with the categorization theory. These views are used as natural mental categorization and unconscious processes in design processes. The semantic profile of the new product is formulated according to the visual clues interpreted after being selected among and taken out of the concept and product categories determined in concordance with this new approach. The ultimate aim of the analysis is to make it possible to use systematically the categorization strategies in design by displaying the existence of these operations.

REAL WORLD	MENTAL WORLD

Succesful examples of telephones from the real world

Exists as independent autonomous items

ATYPICAL

TELEPHONESS (Like aTelephon)

LOW

HIGH

TYPICAL

PRODUCT HARDWARE LAYER Product differentiation defined by functional differences	COMMUNICATION LAYER Definition by an expression called telephoness

Figure: 1
Mental world is structured around a graded expression.

appearance of a product based on a hardware like a telephone. A categorization about the telephone product *(fig. 1)* consists of two layers representing mentally different existence fields. The second layer is a part of the mental world and it is related to an abstract "like a telephone" characteristic which exists in real world telephones in different appearances. The

The corpus of the study consists of the "shopping cart" designs given to the students of Industrial Design Department in the form of workshop questions *(Pic. 1)*. The students taking the test are not informed about the fact that the results will be used in an analysis.

The students are not given any lecture concerning product semantics.

A corpus consisting of twenty-eight successful "shopping cart" designs is formulated and then analyzed.

In the first step, "the typical shopping cart" in the market is determined and accepted as "central member" and "core meaning". Twenty-eight shopping cart designs are compared with this central member. They have been installed in four rings deviating from the central member according to the typical-atypical grade based on the form similarity relationships they establish with the central member. Thus, the distance between the shopping cart members of the corpus and the core meaning of the central member is determined *(fig. 2)*. It is observed that the designs installed in the nearest ring to the central member use the visual clues which are the most associated ones in the class. Therefore, these designs may be seen as the candidates which are installed in the nearest point to the central member and which try to influence it as the closest rivals and to replace it. They make the greatest number of references to the shopping cart due to the fact that they use the most associated visual clues and by doing so, they take part in the traditional design approach.
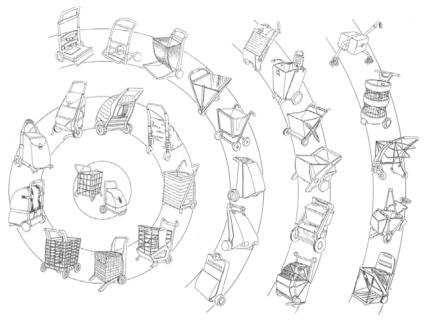
be said to be avant-garde solutions as a result of their distance to the central member.

5.1. *The Expression of Shopping Cart Product as a Compound Concept:*

In the test question about the designs consisting in the corpus design problem is defined with the compound concept "shopping cart". "Shopping" is a concept which makes references to our society's shopping culture and conditions. "Cart" concept refers to various transportation items used in the context of shopping, different types of cart appropriate for this task, traditional transportation and storing items used in old shopping tradition, the existing product category of shopping cart and establishes connections with various visual images and concept fields related to this product.

The compound concept "shopping cart" makes references first to the identity of primary expression category, the concepts of "shopping" and "cart" define together in an interrelated way. It creates associations for the visual clues of this category.

Figure: 2
Typical-atypical grade in the categorization based on the typical item ("shopping cart").

Figure: 3
The typical-atypical grade according to the cart and bag concept fields in shopping cart categorization.

The designs installed in the farthest ring display a meaning profile consisting of the least associated visual clues and the potential visual clues. It is possible to claim that a recognition problem may arise at the first visual encounter with these designs as a consequence of the fact that the used visual clues are potential ones and some of them are borrowed from the related concept fields and categories. The designs installed in the farthest may

CART AND CARTNESS CONSEPT FİELD

BAG AND BAGNESS CONCEPT FIELD

Interestingly enough, it is observed that some of the designs meet "shopping bag" concept in spite of the fact that there was no explanation about this concept in the test question *(fig. 3)*. "Shopping bag", as a compound concept, makes similar references to the ones the compound concept "shopping cart" does and it also refers to the relations prior to the presentation of "shopping cart" product to our society.

It is observed that the designs in the corpus are designed on the basis of two concept fields *(fig.3)*:
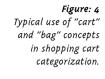
1) Cart and cartness concept field

2) Bag and bagness concept field

The designs of the first group makes references first to the bagness expression and concept field as the primary taxonomic identity and it gives priority to the use of the visual clues of this category. The visual clues pertinent to cartness taxonomic identity are secondarily used. Therefore, the designs formulate "shopping cart" semantic profile by producing a figure like a bag with wheels. The design question creates an association in the students' minds for two main structured schemes.
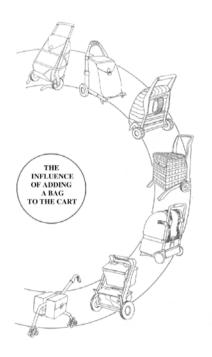
First scheme: The concepts establishing the identity of the "shopping cart" product category listed according to their influence degree: "shopping cart", "cart", "bag", bagness concept fields.
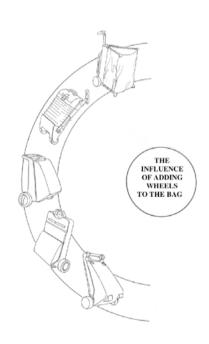
Second scheme: The listed concepts establishing the identity of the "shopping bag" product: "shopping bag", "bag", "bagness", "cart", "cartness" concept fields.

It is observed that in the framework of the first scheme, a meaning profile which leads to the presentation of expressions of "adding a bag to the cart" by choosing the visual clues which prioritize "cartness" taxonomic identity is adopted.

In the designs faithful to the second scheme, a semantic profile which leads to

the presentation of expressions of "adding wheels to the cart" by choosing the visual clues which prioritize "bagness" taxonomic identity is adopted *(fig. 4)*.

The lingual expression of the design problem or the product to be designed is defined first with the primary taxonomic identity. However, this expression gains a plurality of meaning by referring to various fields and contexts due to the fact that the expression is a compound concept. Although the design question of the example product is the expression of

"shopping cart", the concept of "shopping bag" and other related concept fields are included in design field as a consequence of the connections of the concept. The fact that the product category has a plurality of concepts and various connections provides the formulation of a plural semantic profile in the expression of the product.
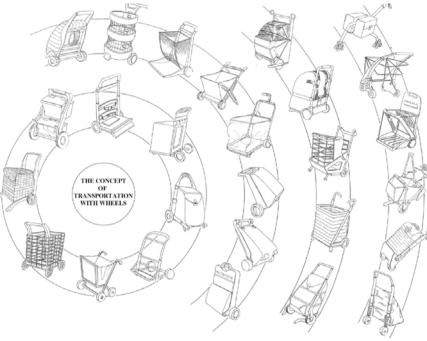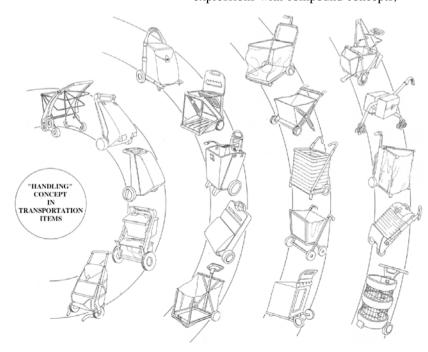
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Figure: 5
Typical-atypical grade according to the concept "transportation item with wheels" in shopping cart categorization.

Figure: 6
Typical-atypical grade according to "handling" concept.

5.2. *The Influence of the Contexts and Related Concept Fields on the Example Product:*

It is previously noticed that in the design of example products included in the corpus two categories, "shopping cart" and "shopping bag", are determined as the primary expression identity. In both expressions with compound concepts,

the solutions primarily refer to the concept "shopping activity" in communicative field and then reflect respectively the information on cartness a cart and bagness a bag. The meaning profile enriches with new types as the number of plural meanings of the product and the connections of the product increase and the designer borrows semantic items from various concept fields after proving the connections of the product with other fields. "Transportation with wheels" and handling in transportation items" are the related concept fields determined in the example product "shopping cart". The typical-atypical grade according to these two concept fields has been determined, too. In typical-atypical grade according to "transportation with wheels" concept field it is observed that in designs which are close to the core meaning, "cart" and "cartness" expressions are given priority (*fig. 5*). In designs installed in the farthest rings to the core meaning, the expressions display a semantic profile which deviates from traditional cart image by giving priority to "handling and transportation". In typical-atypical grade according to "handling in transportation items" concept field, "bagness" expression is given priority in designs which are close to the core meaning. In designs installed in farther rings to the core meaning, while "bagness" expression loses its importance, "cartness" expression enjoys only a weak influence on the designs.

5.3. *Concept Fields Influencing Alternative Visual Expressions:*

The designs of "shopping cart" included in the corpus offer a series of alternative visual expressions. The manes of the concept fields which influence these alternative visual expressions can be determined. Although the visual clues
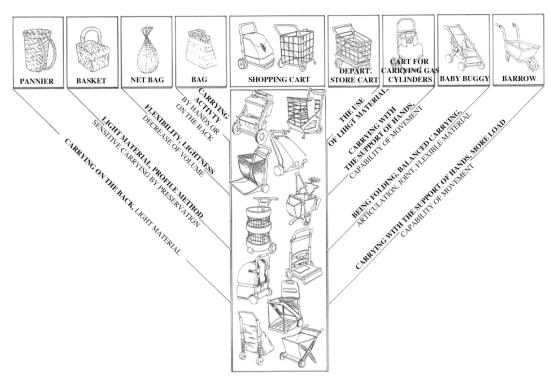
borrowed from concept fields are interpreted in a parallel way with "shopping cart" concept, they reflect themselves via the references they make. The visual clues, which are borrowed by establishing relationships of form resemblance, association, metaphorical expression, changeable expression and analogy, refer to the concept fields to which they belong thanks to the same relationships.

The visual clues borrowed from concept fields transform new functional characteristics encouraging expectations about shopping cart product into visual equivalences. Any visual clue fulfilling the mentioned prerequisite creates associations with the concept field to which it belongs via its realization form. For instance; a shopping cart which contract when it is empty refers to hood concept field. The name of the concept fields influencing the designs of "shopping cart" can be determined in a detailed way with similar analyses. In the analysis, first the concept fields which draw attention are

determined. It is observed that some of the concept fields influencing the visual expressions belong to the category of fields which make the designs look like them in form and structure *(fig. 7)*. Typical shopping carts, department store carts, carts for carrying gas cylinders, barrows, baby buggies can be seen as concept fields influencing the identity of taxonomic expression of "cart" and " cartness". Bags, suitcases, net bags, baskets, panniers, gulf bags, climber bags can be seen as concept fields influencing the identity of taxonomic expression of "bag" and " bagness".

6. *Semantic Profile of Products and Taxonomic Identity:*

The most frequently used visual clues determine semantic profile of product and taxonomic identity. To put it in other words, the selection of visual clues depend on the field to which the designer will refer to as semantic profile. When the most frequently used visual clues are selected by the designer, the new product
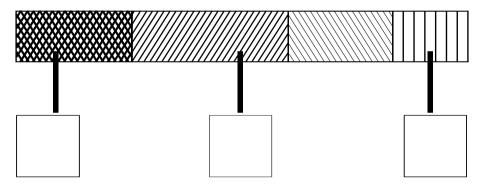
will be rather close to the central member. As the new product will be a reflection of the repetition of the existing form language of the product, it will be faithful to the product tradition and display the traditional semantic profile.

When the least used visual clues or potential visual clues are selected by the designer, the new product will be rather installed in the farthest point to the central member. Then it will be possible to speak of an avant-garde product. The visual clues of the category do not only display taxonomic membership but also determine the semantic profile of product.

The third group: The least frequently used potential visual clues associating people with images to a small extent. The appearance of the semantic profile which includes the most frequently used visual clues installs the product in the closest point to the central member. On the other hand, the form of an avant-garde product displays less frequently used visual clues or only potential visual clues. Due to the fact that these semantic visual instruments are not obtained from the central member according to a rule based on a certain deviation and interpretation, they should be studied independently one

Figure: 8
The changes in the semantic profile of the product along grading depend on the selection of the visual clues.

Most Frequently associated visual clues

Less Frequently associated visual clues

Potential visual clues

Semantic profile consists of three groups of visual clues. These are the visual clues determined according to their frequency of use in the category.
The first group: The most frequently used visual clues associating people with the core meaning in the centre.
The second group: Less frequently used visual clues associating people with images to a small extent.

by one. This kind of product includes potential visual clues, indications and signs which do not resemble each other adequately. Therefore, this kind triggers a problem of recognition at the first encounter as it is installed in the indeterminate limit fields of the category and it does not bear the visual clues placed in the core of the category. It may also undergo the risk of not being adopted by the society.
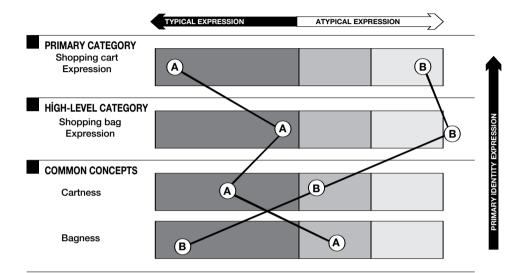
7. *The Expression of Semantic Profile of Product*

The visual clues are mostly shaped by the designer's interpretations and metaphors. Thus, the expression of semantic profile does not consist only of the visual clues

frequencies of association influenced semantic profile as it is examplified in figure 9 for "shopping cart". The selection of A-A profile, makes it possible to have a usual, easily perceived and accepted product due to the fact that this profile

reflected by primary taxonomic ownership but it comprises the combination of the visual clues reflected by compound expressions and related metaphors. Mental world structures the concepts as graded items. It is possible to control product meaning profile by selecting and collecting the visual clues installed in the grade. As it is schematized in figure 9, the control of visual expression naturally requires a change in the semantic profile of the products.

The expression displayed by the product form depends mostly on the product semantic profile. It is easier to explain this view with the help of figure 9.
The selection order of the visual clues having different frequencies of association, influences semantic profile. According to this rule, the selection order of the visual clues having different

includes the visual clues having the highest frequency of association. As to B-B profile, it makes it possible to perceive the product as something to be carried as a consequence of the fact that this profile primarily refers to "bagness" concept. However, it may trigger a problem of recognition in this field as it includes visual clues which are not comprised in the repertory of the "shopping cart" concept.

Conclusion

As a conclusion, it is understood that the categorization activity, which is a natural and unconscious process of the human being's mind, is experienced as unconscious mental processes by the designers. It may be also claimed that these unconscious categorization processes can be used as conscious processes in design activity. Thus, it is observed that the

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semantic profile of the product to be designed can be formulated in the very beginning of the design activity. This conclusion puts forth the fact that semantic approaches may be significant alternatives to the intuitive approaches of the designers [1]

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