To Be Seen and Not To Be Seen in Environmental Design

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Abstract
Perception as a general idea is related to different scientific issues that are involved in cross-disciplinary knowledge. Gestalt theory as the main concept of the research was surveyed to answer why the objects are either seen or not seen in an environment. Objects were evaluated with a visual questionnaire. The results showed the role of inherent features of objects' contribution to their backgrounds. The test was an empirical inquiry and the result of the test will be used for safety design, environmental design, and product design. The data were analyzed using a hierarchical analytical process. The human visual system is the main entrance of visual data presented in our environment. Not only does the system play the function of an active surveillance system that lets us make decisions according to our sensations, but also it has the role of the passive surveillance system for the subliminal stimulus that we cannot understand consciously. To study such a complex system of perception, it is needed to use advanced equipment. However, what we did was using the most available method to study it.

Introduction

What we either imagine or see has the same neural mechanisms in our brain (Gage & Baars, 2018), which is a complex process that commences from the eye and continues into the brain. The human visual system is the most complex system being inquired by scientists in our body – from the eyes to cortex areas related to the visual system (Chinchu, 2021; Maria & Bharath, 2012; Best, 2017). David Maar, an interdisciplinary computational neuroscientist, claimed that the human visual system is an information processing system such as a complex neural network in the brain that is more than a single neuron or a module (Warren, 2012). He was a pioneer in the field of computational modeling and tried to formulate the system of vision using knowledge of computer vision (Warren, 2012). A concept is perceived using three different levels which are local features, shape representation, and object representation, respectively (Nieslony & Gussen, 2008). The concept of representation means: what we imagine or assign in our mind as the whole of something instead of the main object has an interactive definition between object and the concept in the neural affiliation in our brain (Baker et al., 2021). The concept of Representation and Camouflage - To be seen and not to be seen - were inquired in this article from the point of view of Gestalt theory, and an empirical test to make design an outline for environmental and product design. There are two terms, liminal and subliminal consciousness, ones are the points that must be probed by cognitive scientists and neuroscientists, which is the root of attention, perception, and superior mind process (Pitts et al., 2018) because they are specialized issues; however, we have tried to make it clear for designers using an interdisciplinary approach.

1. *Visual Consciousness and Attention*

What a person sees in their environment is a phase spectrum between completely invisible to visible. The range is categorized into four nominal groups, completely invisible, subjectively invisible, unattended, and visible (Lamme, 2020), which are categorized as different terms in the Perceptual Awareness Scale (PAS) — the PAS was designed to evaluate visual consciousness, using four stepwise *No experience*, *Brief glimpse*, *Almost clear experience (ACI)*, and *Clear Experience (CE)*, respectively (Overgaard & Sandberg, 2021; Skóra et al., 2021)—. The term PAS is to be distinguished from the subjects' bias; hence, it is affected by the color of the stimulus. It is important to note that there are many differences between attention and consciousness in the human visual system. To make clear, to some extent, attention is defined and compared to this term to understand them. Attention can be defined as a conclusion of some sequences that consciousness located at the basement of the process of attention (Baars, 1999; Baars & Gage, 2010; Sternberg & Sternberg, 2017). To sum up when a stimulus attracts our attention, not only does it have related to memory and learning, but also it has been affected by what a person looks for, which can be diffracted by bias. For instance, in the attentive process, vigilance, search, selective attention, and divided attention can be distracted by internal or external distractors (Sternberg & Sternberg, 2012). Therefore, not to be confused by both concepts-attention and consciousness-these two terms must be reckoned as interchangeable and crossbreeding sequences in addition to being semi-independent.

2. *Gestalt Theory and Visual Perception*

What we perceived as a stimulus is not a subjective representation in our mind but has its own phenomenological and ontological state (Wageman et al., 2012; Ellis, 2018). In other words, gestalt or whole of something is more than details make it. In another word, according to the Gestalt theory, the perceptual of sensation is the combination of organization of some segregated objects or stimuli. To convey the exact principles of Gestalt theory is easy to compare them in our environment. For instance, in the park, swing — *A swing is a seat, often found at playgrounds for children.*— is perceived by general ontologies and phenomena, which are called laws of human perception, such as continuation, similarity, common fate, figure-ground (Ramos, 2018). Chains of the swing are perceived using continuation, the seat of the swing is bolded based on figure-ground and in general, the swing is draw-out by a common fate.

In this study, we have focussed on evaluating reasons that they cause not to be seen or visual deceived in our environment. The results of the study can be used for designers who work on product development or civil designers to make the environment more compatible with our needs.

3. *To Be Seen and Not To Be Seen*

Designing for the environment is an organized process that pays attention to the environment, health issues, emergency, safety, and sustainability before designing a product and during its uses (Fiksel, 2009). If it were reckoned that a product was designed without sufficient tendencies about vandalism, it would cause many side effects in the future that no one knows exactly the prolonged consequences on human beings and their environment. From the ecological lifestyle (eco-design) viewpoints, it can be described that a product or object in its ambient has four different aspects in its relations and interaction as following human-human, human-products, product-environment, and human-environment (Sintowoko & Hidayat, 2021). It would not have been neglected in the current era demands for social design and researchers have planned to extend knowledge about this issue (Hanusch & Birkhofer, 2010). Since that products have a direct effect on the behavior of humans; designers must encompass the interaction of this issue that is as important as other factors to make consumer's behavior (Smith, 2021). From the point of view of Gestalt theory, the whole of form in addition to shape is more than its details, as has already been mentioned. By no means, it can't be interpreted that what a person is encountered and gets inspired by is a glance of a millisecond that is perceived in a subliminal stage of perception. Indeed, it is a combination and binding of experience and cognition as well as the range of consciousness.

The main question emerges here, what factors cause not seeing an object in our environment; even though a user has had either an experience of semantic or objectional of that or user experience. Having been interested in surveying the question, we used an analog process to study the question among the students of the Islamic Art University of Tabriz.

Methodology

Having taken seventy photos from the environment of the Islamic Art University of Tabriz - the locations were chosen in the commuting path of students. Among all the photos, thirty-four images were selected as indexes. Two groups of questions were inquired from subjects to compare the images. One group was about the relation of product-product and another was the interaction of human-product. The main factors that were inquired in the questions were as follow a reflection of light, shape, size, height, shadow, silhouette, texture, material, material, and noise. Visibility and its antonyms were measured according to the norm of the human visual system, material differentiation, and disruptive camouflage patterns. The subjects were questioned whether they could see the objects, which are presented in images or not. If the objects presented were not seen (camouflaged) the answer was 1; otherwise, it was equal to 0. Thirty-five questions were asked for thirty-four images, which is equal to 1190 answers. The test was taken from 10 students who had been in the range of 23 to 24 years old and studied Industrial Design.

All the participants were girls. The students knew a general concept about Gestalt Theory. Among the ten answer sheets four were rejected because the answers were not accurate enough to process in the next step. To process the data, MATLAB was used to make clusters using the linkage method. Finally, five answer sheets were compared to each other from the correlation and distribution graph.

The summary of method sequences:
1. Test-setting – Having designed the questions and taken photos, the authors chose 35 questions and 34 photos among all the alternatives.
2. In the second step, all the subjects were presented how to participate in the test, each of them took the exam, and filled in the answer sheet, respectively.
3. In the third step, the answer sheet was transferred to an excel file to be imported into MATLAB.
4. Finally, the data were analyzed using clustering and correlation methodology.
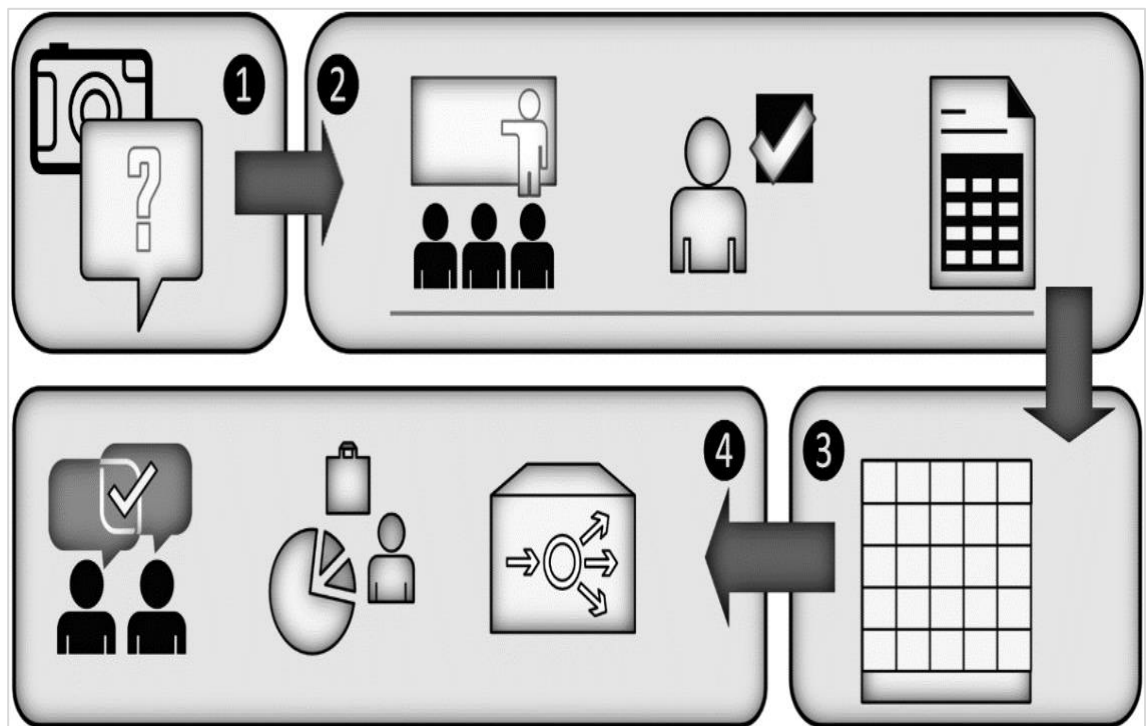
Figure 1: *The diagram of the method.*

Results and Discussion

The results made clear two main factors, similar objects in the landscapes, and the questions were either similar or contiguous for the subjects. Using the *cluster-gram* function of MATLAB, the data were processed to analyze hierarchical clustering. The data were grouped into two different clusters, the cluster of images and the cluster of questions. To be understandable the results for the readers are easy to make brief. Therefore, all the clusters that have homogeneity are set in the same group, which is shown in Figure 2. Then, the Euclidean distance weight was calculated using the function in MATLAB, that is Z = dist(W, P, FP) – FP = Struct of function parameters (optional, ignored). The clustering was defined in 5 different groups.

The summary of analysis sequences:
1. Cluster number 1, is the most subcluster among all the data; so, it is assigned under cluster number 2. Meanwhile, it is the subcluster of cluster number 5, too.
2. The second step is related to cluster 2, which is directly set sub-listed number 4.
3. The single sub-listed of all the groups is cluster number 3, which is set under cluster 4.
4. Cluster number 4 is the most interactive cluster among all clusters, which has related to all of them. Therefore, the affiliation of images and questions in cluster number 4 can be used as an outline of the design.
5. Cluster number 5 is important to control and restrict the concept of design. It means that the rule of cluster number 5 is as critical as all the factors in cluster number 4.

In the clusters, numbers 4 and 5 as well as 2 and 3 exist the most repeated number of common indicator questions. According to the asked questions it can be inferred that the main highlight of the questions was about the gestalt of images. the result is presented in Figure 3.
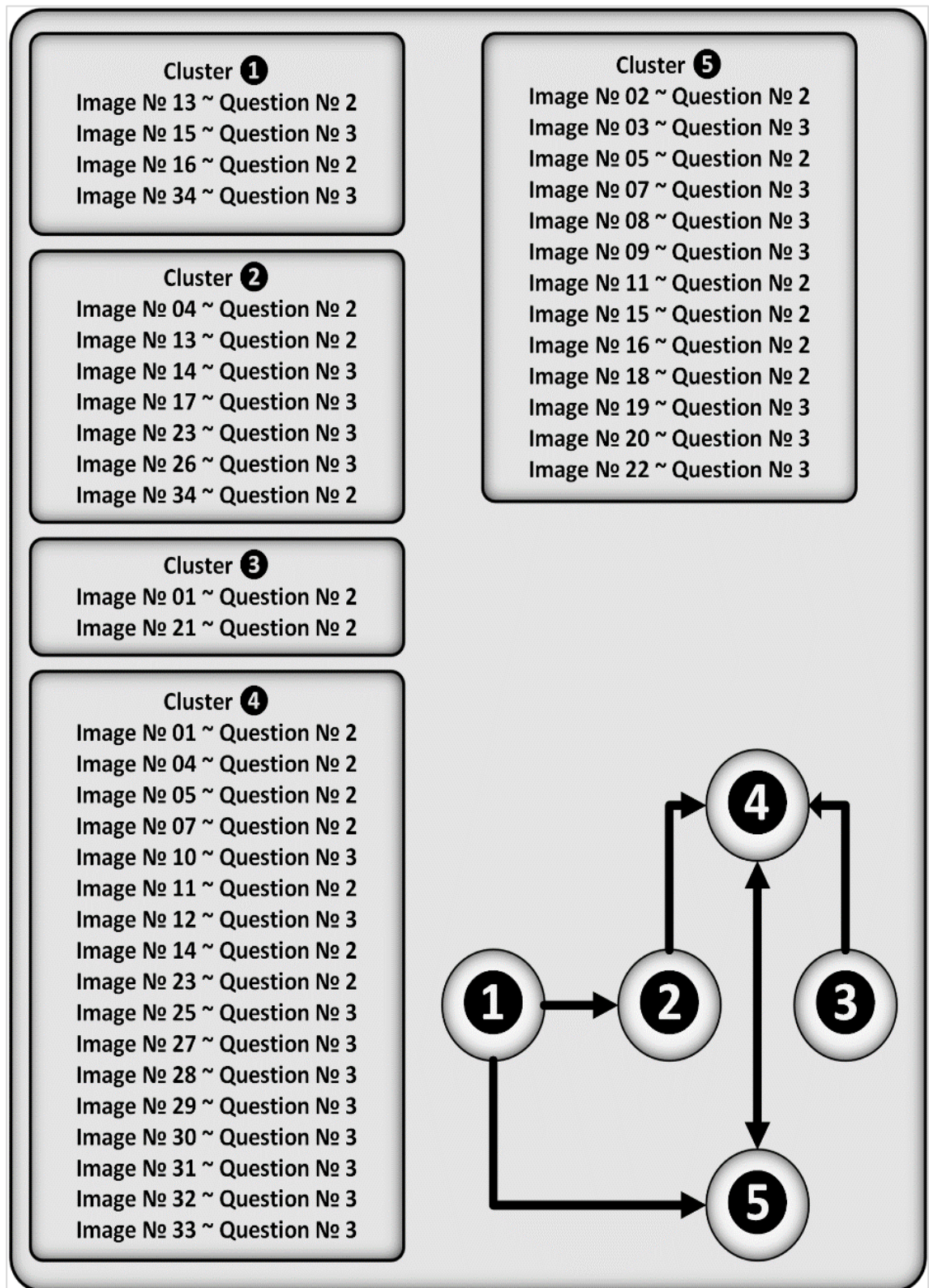
Cluster ❶
Image № 13 ~ Question № 2
Image № 15 ~ Question № 3
Image № 16 ~ Question № 2
Image № 34 ~ Question № 3

Cluster ❷
Image № 04 ~ Question № 2
Image № 13 ~ Question № 2
Image № 14 ~ Question № 3
Image № 17 ~ Question № 3
Image № 23 ~ Question № 3
Image № 26 ~ Question № 3
Image № 34 ~ Question № 2

Cluster ❸
Image № 01 ~ Question № 2
Image № 21 ~ Question № 2

Cluster ❹
Image № 01 ~ Question № 2
Image № 04 ~ Question № 2
Image № 05 ~ Question № 2
Image № 07 ~ Question № 2
Image № 10 ~ Question № 3
Image № 11 ~ Question № 2
Image № 12 ~ Question № 3
Image № 14 ~ Question № 2
Image № 23 ~ Question № 2
Image № 25 ~ Question № 3
Image № 27 ~ Question № 3
Image № 28 ~ Question № 3
Image № 29 ~ Question № 3
Image № 30 ~ Question № 3
Image № 31 ~ Question № 3
Image № 32 ~ Question № 3
Image № 33 ~ Question № 3

Cluster ❺
Image № 02 ~ Question № 2
Image № 03 ~ Question № 3
Image № 05 ~ Question № 2
Image № 07 ~ Question № 3
Image № 08 ~ Question № 3
Image № 09 ~ Question № 3
Image № 11 ~ Question № 2
Image № 15 ~ Question № 2
Image № 16 ~ Question № 2
Image № 18 ~ Question № 2
Image № 19 ~ Question № 3
Image № 20 ~ Question № 3
Image № 22 ~ Question № 3

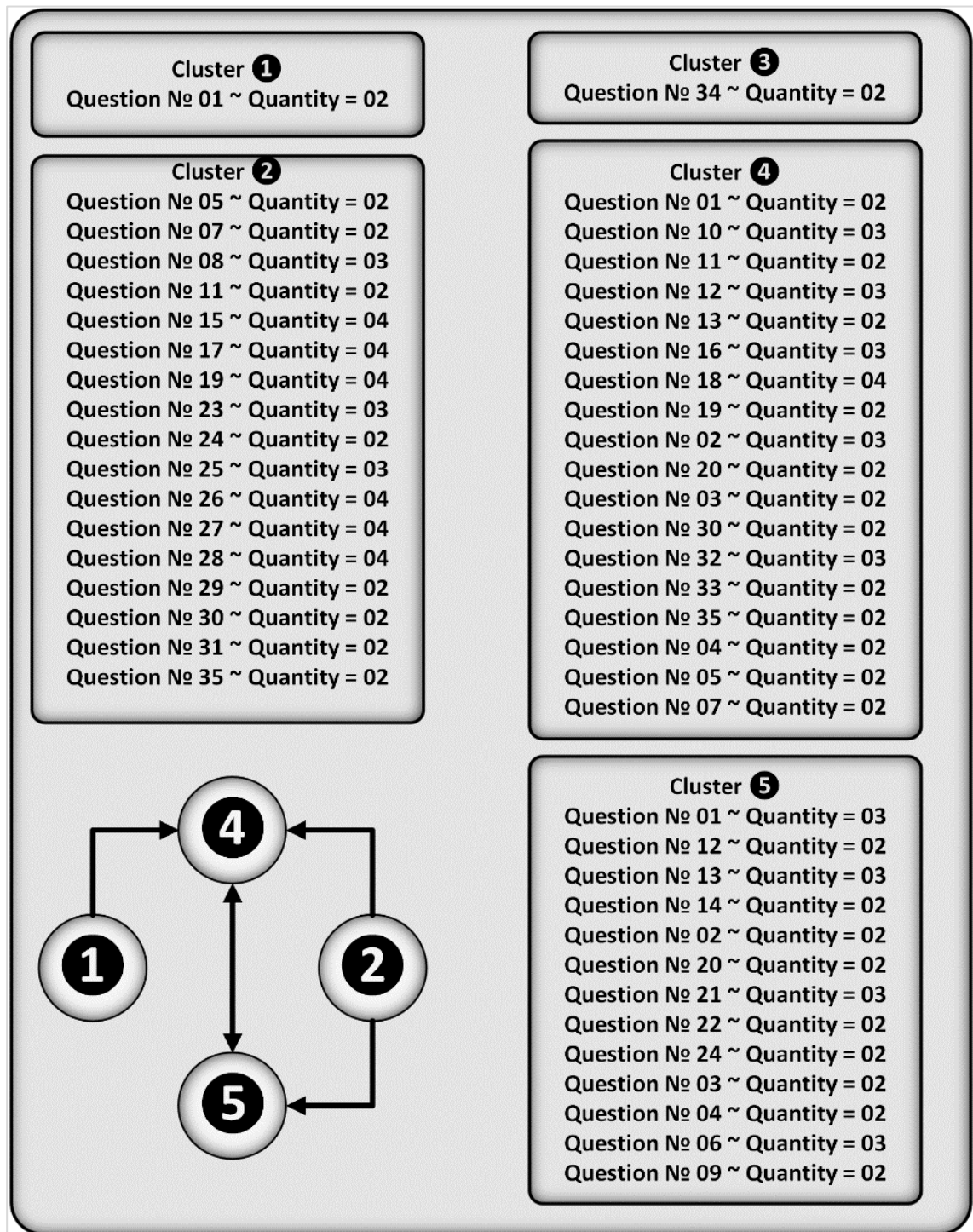**Figure 2:** *The diagram of the analysis – 34 images.*

Figure 3: *The diagram of the analysis – 35 questions.*

The summary of analysis sequences:

1. Cluster number 1, is the most subcluster among all the data; so, it is assigned under cluster number 4.

2. The second step is related to cluster 2, which is directly set sub-listed numbers 4 and 5, which means that does the role of coupling for cluster numbers 4 and 5.

3. The single sub-listed of all the groups is cluster number 3, which is set under cluster 4.

4. Cluster numbers 4 and 5 are the most interactive cluster among all the clusters, which is related to all of them. Therefore, the affiliation of questions in clusters number 4 and 5 can be used as an outline of the design, but cluster number 4 is more important.

The questions in each cluster are summarized as follow:

Cluster 1; Products in the image are mimicked as different shapes and forms as having a camouflaged appearance (Figure 4).

Cluster 2; Products in the image were merged in their background (figure-ground); therefore, they were invisible at a glance. The integrations were especially in the edge and countershading lines in addition to the texture, color, and attractors. The physical properties such as a form of product, height, and size were not tall and big enough to be seen in the case of being covered with snow, clay, or rubbishes (Figure 5).

Cluster 3; The disruptive pattern of texture in products made them nonsense or mismatch to the representation stored in our brain. so, they became invisible or non-attractive (Figure 6).

Cluster 4; The products were not shiny enough to be seen in comparison to their environments. The lines streams of the products were in continuation of the background and juxtaposition objects surrounding them (Figure 7).

Cluster 5; Products were heterogeneous in their environments; however, they were not big enough to disturb the process of dazing (Figure 8).

Figure 4: *Cluster 1.*

Figure 5: *Cluster 2.*
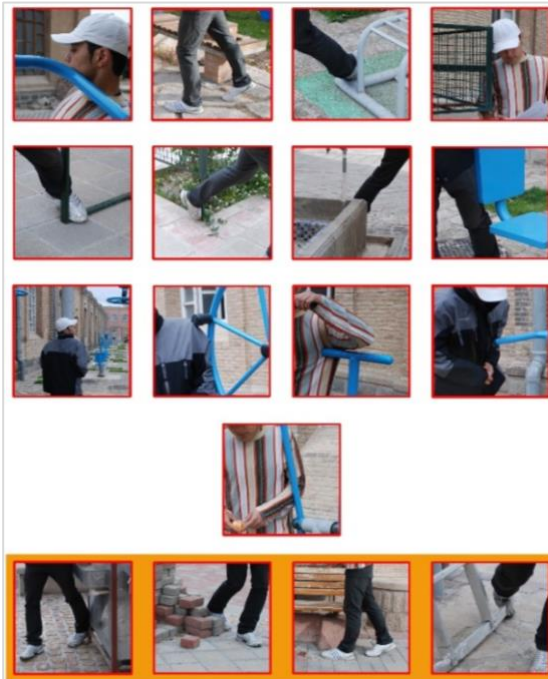

Figure 6: *Cluster 3.*

Figure 7: *Cluster 4.*

Figure 8: *Cluster 5.*

The images which have an orange border are common in all the clusters.

Conclusion

To compare the probability of the data Q–Q (quantile-quantile) plot is used to percept the result visually – to save the pages of the article, just one of them is presented (Wageman et al., 2012). For instance, in Figure 7, the scatter graph of answer sheets is shown the viewpoint of subject number 1.
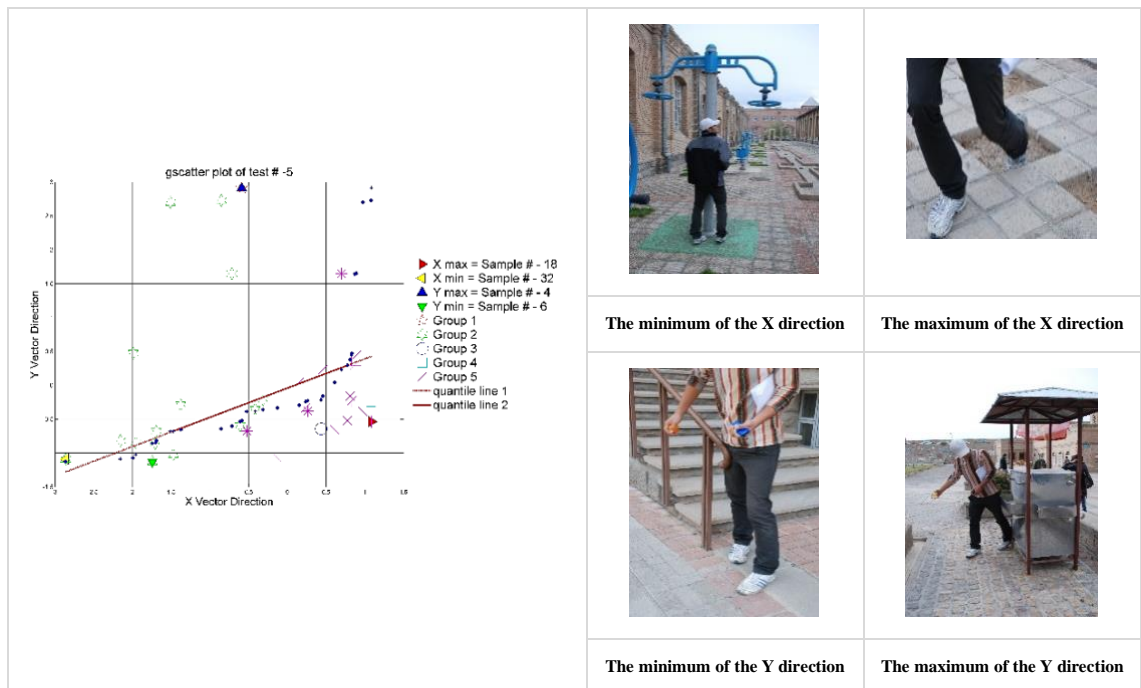

Figure 9: *Subject number 1.*

In Figure 9, it is shown that the concentration is on clusters 2 and 5. The main focus was on the minimum of the Y direction and the maximum of the X direction. According to the results, it can be inferred that inherent properties of products have a direct relationship to not to be seen in their environments, but the variation and temporary conditions are as important as their properties. Where to be the gestalt similar to their environment, it could not help neither seeing nor comparing objects in their backgrounds. Texture and color are two main factors among all the features that can disguise viewer not to be seen an object in its background. The disruptive pattern is one of the most distractor patterns in comparing other patterns, which makes objects more nonsense (Fiksel, 2009). To sum up the discussion, the boundary of objects designed for the civil environment must be shiny or counter-color, but it must not be disruptive. Meanwhile, the pattern and color of objects have to represent the exact previous experience to let the mind associate and percept objects as independent objects in comparison with a background. The role of health, safety, and emergency lead us to evaluate our product in and virtual reality software before lunching them in the market to reduce the rate of accidents.

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