Modular design as an approach to creating glass lighting units

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Summary

Modular design is known as an approach that divides the system into smaller parts (models, units or standards) that can be made independently for use in different systems for many functions.

Modular design has become a major focus in architectural engineering, but it has not received sufficient attention in industrial products, especially glass. Modular products are products and components that perform different functions by combining (units). Therefore, the research tended to take advantage of the Modular design and employ it in industrial products to create unconventional glass lighting units that are more effective and perform different functions of the same unit, and meet customer needs and exceed their expectations.

Hence the research problem: How to reach innovative designs for glass lighting units that perform more than one job and meet the needs of customers and exceed their expectations through the standard design.

The research also aims to: - Employment of standard design in industrial products and in the units of glass lighting.

- Take advantage of the normative design to search for visions and patterns that lead to more creative solutions in glass products.

The importance of the research lies in revealing human-centered design principles that can be used to evaluate standard design solutions.

As for the research hypothesis: The modular design helps to create multi-functional glass lighting units that are more creative and less expensive

Research methodology: The research follows descriptive analytical method - experimental.

an introduction:

Normative units were first known to the world in the 1930s, with the architectural theories of Albert Farwell Pemes, and since then they have been adopted and applied in a variety of industries, including computer programming, biology, and mathematics, due to their rapid production, low costs, and ease Assembly.

The application of the normative product during the design phase has attracted sustainability management and the management of the product life cycle continuously as it ensures the product to achieve a degree of sustainability and survival, and when technology becomes more advanced, design becomes more important and sophisticated, product design is an innovative process that combines customer needs with the strategic requirements of enterprises.

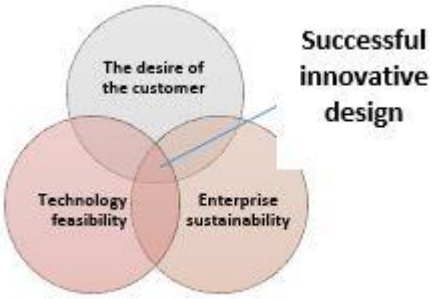

Figure No. (1) the goal of successful design

Determine customer needs

In order for the product to be successful, it does not require the presence of technological and technical

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opportunities only, but there must be a real need and desire to obtain the product, and the new products will achieve success when they meet the real and perceived needs of the customers, hence the following statements (approaching the customer, listening to the customer's voice). And normative design occupies a great importance, as it develops the sense of listening in the institutions to produce innovative products that guarantee their success in the market, because its basis is listening to the needs and desires of the customer

Modular design concept

(Modular design) is the design of units, it is an approach that divides the system into smaller parts (models, units or standards) that can be made independently for use in different systems of many functions, allowing them to separate and recycle and give a degree of flexibility in the design of the final product.

Modular products

Modular products indicate that they are products that perform different functions by combining units, as they can generate a large number of different products from the same units through the difference in their composition, and the term modularity is related to normative products in a large way, as it arises from the division of the product into separate components Modules differ in definition, depending on context and industry, however, in general, modules refer to something created from standard units - modules - that can be separated or combined to create a complete product, a simple example is a sectional sofa consisting of several individual modules. Small, sectional sofa can be rearranged in various ways, depending on space and user preferences.

Modular Product Features

There are many advantages of standard products for institutions as well as for customers, and some of them are mentioned below:

Modular product advantages for institutions:

1- Rapid manufacture of small individual units.

2- Concurrent engineering is possible (many engineers work simultaneously on multiple units where they are produced in parallel and not in succession).

3- Production licenses due to saving time.

4- Flexibility, as units can be modified / replaced easily, as it facilitates finding weaknesses in the product and changing them only without compromising the rest of the units.

5- Ease of modifying, maintaining or disposing of the product (since the product is divided into units, it is only necessary to dispose of a specific unit without the rest of the parts.

Modular product advantages for customers and users:

1- Increasing the diversity of products.

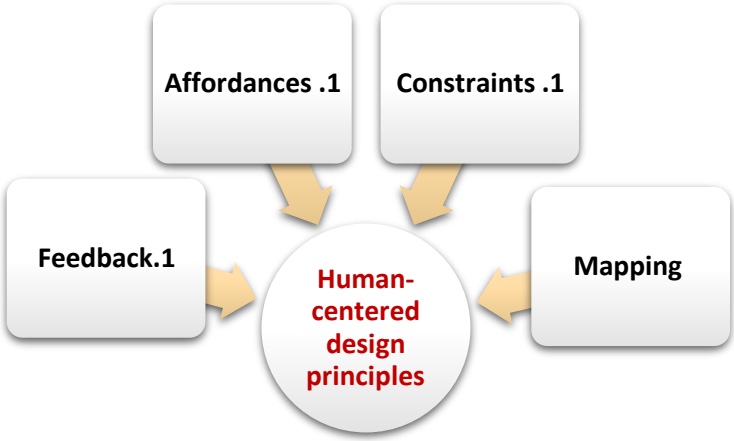
2- Cheaper price due to cheaper and faster production.

3- The materials can be reused / recycled as standard products are more sustainable.

4- Recruiting / arranging the product according to the user's preferences.

Human-centered design principles:

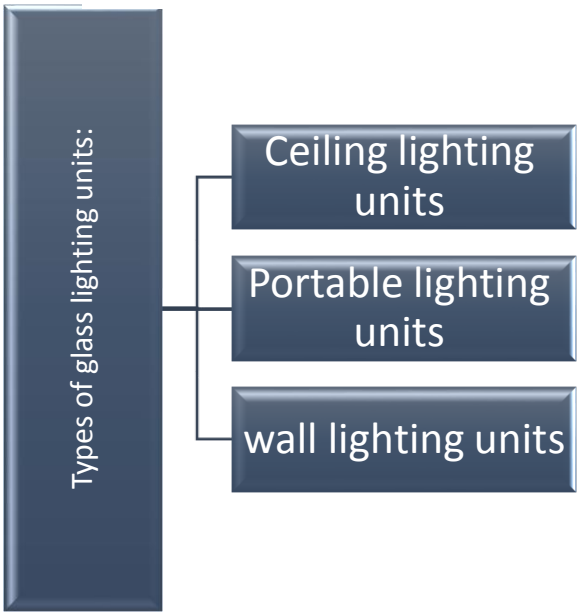
We live in a world full of natural things, and the rest are artificial. Every day we face thousands of things, many of which are new to us, many new things are similar to those we already know, but many are unique, yet we manage it well. How do we do that? Why when we face so many extraordinary natural things, we know how to interact with them? The answer lies in a number of design principles centered around the human or the client as mentioned by Don Norman)):



Glass lighting units:

Lighting is the main and most important element when establishing interior design, and with the development of technology and its ramifications, the importance of human dependence on lighting has increased in order to enhance the functional and aesthetic performance of interior architecture, so lighting has become a priority of interior design, as it works to highlight the beauty of the elements within the architectural space, as well as meet Practical and aesthetic requirements in architecture, as it plays a big role in the psychological state of a person, lighting is divided into two types, which are natural lighting, which comes from the sun, and industrial lighting, which we obtain by different lighting units, which is what we focus on in this research.

Types of glass lighting units:



Amount of illumination required:

The amount of lighting required varies depending on the use and the place in which the lighting unit is placed, it is important to have lighting appropriate for vision and not stressful to the eye, as well as homogeneity of lighting on the work surface and there are some terms related to lighting we review some of them: -

Luminous flux:
Luminous flux is defined as the amount of light coming from the light bulb in all directions, and is measured in a unit called Lumen and is important for choosing the appropriate illumination.

Luminance level:
The amount of light in a place, measured in units called lux, and one lux equals one lumen per square meter.

Optical intensity:
It is the amount of light in a specific direction and is measured in a unit called the Candela Cd. The difference between the light flux and the light intensity is that the first expresses the amount of light in all directions, while the light intensity is in one direction (a specific angle).

Methodology for designing glass lighting units through modular design:

A typical four-step process for creating standard glass lighting units is suggested:

1- Designing the lighting elements and assembling the internal components inside the units in the design. The design is done through focusing on:

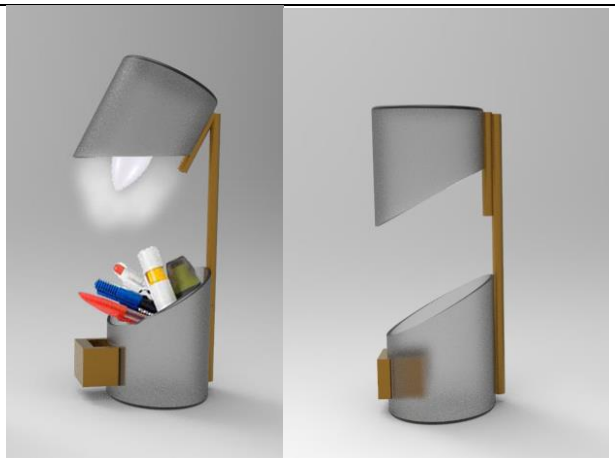
2- Development of a model for the components and functions of glass lighting units, taking into account:
Technological simplicity. - The ability to change.
Standardization. Understanding diversity.

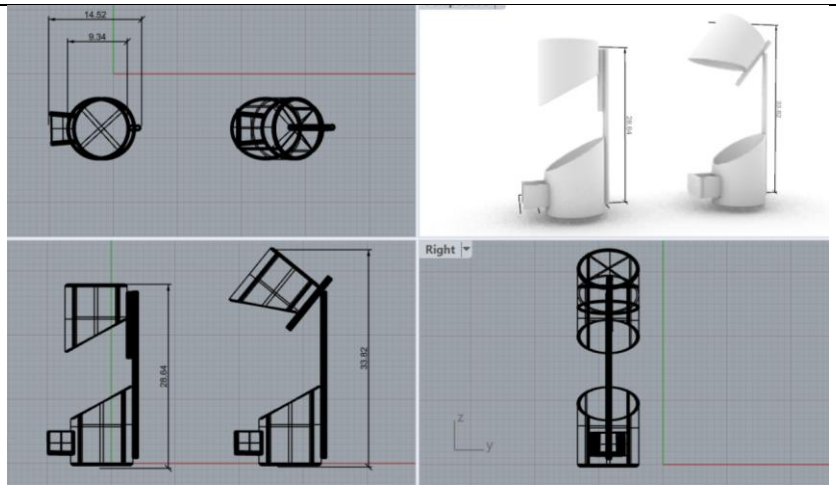
3- Create an engineering drawing for the glass lighting units to better illustrate the projections and modules.

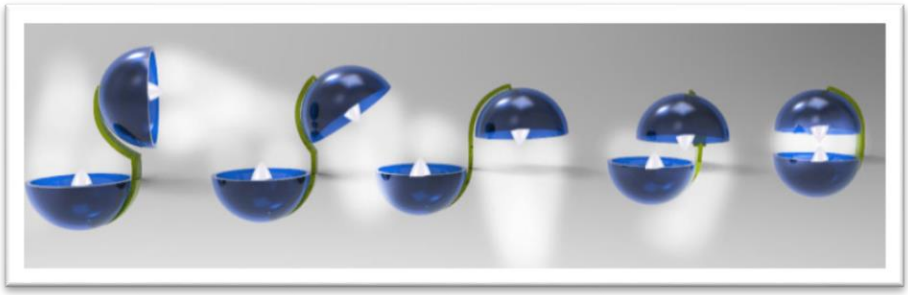
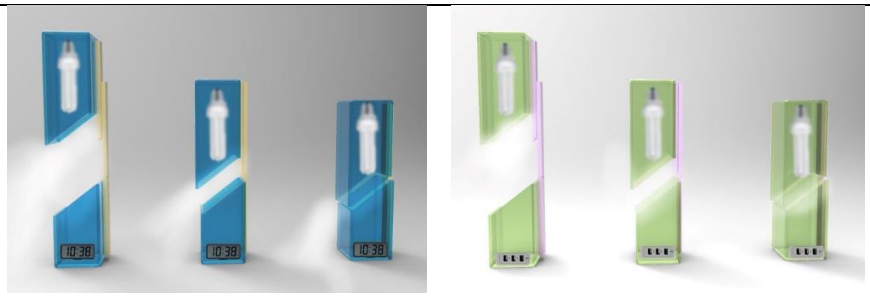
4- Knowing how the glass units are combined and the possibility of changing and switching to get more than one product.

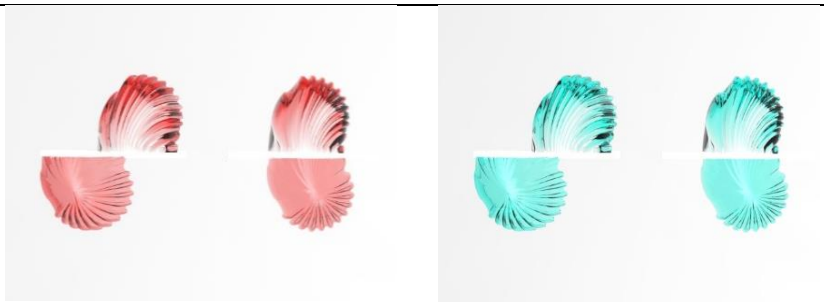
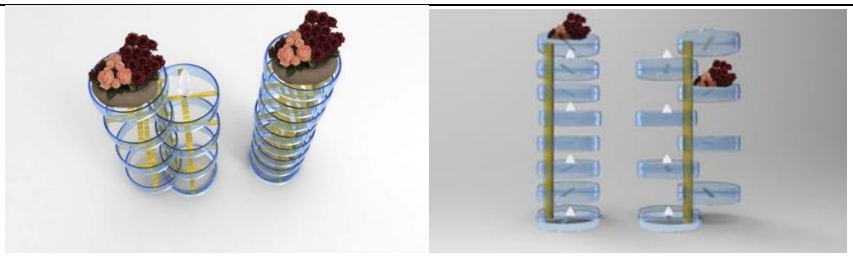
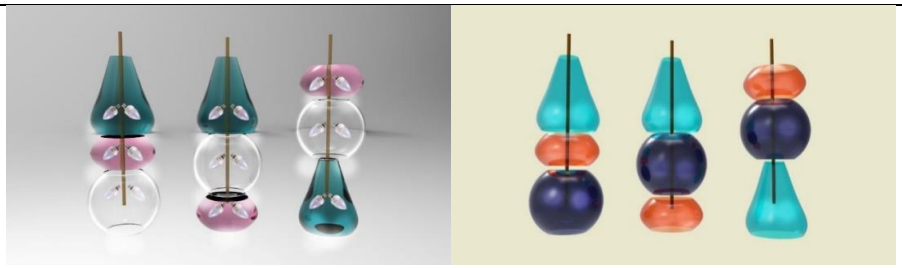
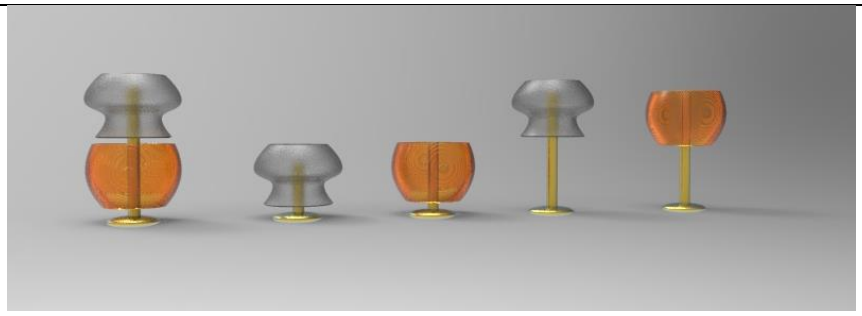
And for the success of the standard design is based on the design of the unit and its development through the application of the unit system and the development of relations between them in the form, where the excellence in product development depends mainly on the capabilities of assembly among them, taking into account the sequence of stages and relationships, and putting the needs and desires of customers in mind until reaching the product The normative,

Applications

First application (office lighting unit)	
	
Multi-function (desk lamp, pen holder, and staples)	Based design
14.5 * 30cm	Unit size
It is the glass unit and it is a cylinder and it is cut with an electric saw in a direction of 45 degrees, As well as metal pipes, which is already present in the local market, and the glass is combined with metal together with a nail, and the movement is carried out through the two metal columns.	Modular unit
Blow mold with spindle and with chainsaw 45 degrees	Production method
The design idea depends on the kinetic performance in the forward direction, and with different movement, the feeling of mass and space differs, which leads to the spread of light and its projection on the front side. As well as the use of the bottom to place tools stationed in it, and the unit contains a drawer to place small tools such as pins and other things, which makes it a multi-functional unit.	Design idea
Direction of light diffusion in the forward direction downward	Direction of light diffusion
Venus bulb sprint 11 watt white light	Lighting type
The design includes some design principles such as the properties of the external appearance Affordances where through the appearance the customer knows how to use it easily, as well as the principle of constraints through the direction of movement of the upper part as it moves in the side direction only or in the direction of stillness down. Likewise, the principle of mapping through the on and off button.	Design principles

	**Color alternatives**
	**projection**

Another Applications	
Product design based on multiple forms	
Multifunctional design	

Product design based on multiple forms	
Multifunctional design	
Product design based on multiple forms	
Product design based on multiple forms	
Multifunctional design and **Product design based on multiple forms**	

Results and recommendations

First the results:

1- Flexible products such as modular products allow institutions to respond quickly to keep pace with changes in the market.

2- Standard products achieve a great degree of sustainability for the organization, as it focuses on diversifying and improving product performance quickly and continuously.

3- Aesthetic and innovative design is a prerequisite for creating satisfaction among users.

4- Customers desire products that perform more than one job.

5- Human-centered design principles, allow the designer to evaluate solutions and is a quick way to avoid basic design flaws.
6- Unconventionally designed glass lighting units help enrich and distinguish units and add value to the product.
7- A survey study and opinion poll was done for some clients, and some results and ratios for the questionnaire were reached.
8- An applied study was done through designing nine designs for modular lighting units based on multi-functionality or polymorphism or both, and the comparison showed the added values of the design and some principles about human being, and the idea of the design work and its movement.

Second, the recommendations:

1- Glass companies and institutions adopt the standard design methodology.
2- The researcher recommends that the standard design be included in the fields of design at the Faculty of Applied Arts.
3- The necessity of paying attention to studying the standard design through the different materials, in order to use them optimally and to achieve the aesthetic and use goals

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