

Innovation Treatments for Designing Ceramic Forms

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Abstract

The study aimed to find practical ways to create designs for ceramic shapes by taking advantage of some design methods, drew the attention of those interest to the sources of shapes to draw inspiration form, in order to facilities the difficulties associated with design processes and their restriction to ceramic materials and methods of formation. The study reviews the different concept of design and its components in the field of ceramic and methods of its application. Is also deals with modern concepts and visions of design and its stages in general. On practical side it is passed on two methods for creating designs. The first method is deletion, addition and installation, it takes abstract geometric shapes as primary source for design and is implemented with geometrical instrument. The second method is elicitation, in which primary shapes are obtained through freehand drawing spontaneous as well as by drawing spaces among the things found in nature and also drawing their shadows. Then make the necessary transformations, treatments and addition to develop them. Seven groups of different design studies were carried out. Fifteen design were selected to analyze and measure the advantage through twelve criteria. The study concluded elicitation method is very effective in giving shapes, ideas and options in a short time and shortens the design steps. Integration of the two methods mentioned in the design processes gives advanced innovative options. Curved, zigzag, wavy lines, spaces, lots of small items, diagonal movement, and flexibility are all factors provide designs with aesthetic features that positively affect the visual attraction and are methods of implementing ceramics.

Keywords: Symmetrical – Movement – Harmony - Visual attraction - Implementation.

The study problem: The difficulty of design in the field of ceramics to arrive at shapes with unique creative features that are not related to the complex process of design only. Rather, it adheres to the characteristic of ceramic raw materials that require specific method of implementation, and herein lies the problem.

The importance of study: Ceramic materials are not suitable for implementation of all designs, therefor it is necessary to find a match between them. Design must related with method of implementation.

Objectives of the study: - seeking to find applied methods that enable the process of designing innovative forms of ceramics so that they are feasible.

- Benefiting from some design methods in other fields to create ceramic shapes.

- Draw attention of those interested in design sources so that they can draw ideas from them.

1. INTRODUCTION:

The design process in creative fields is characterized by complexity of reaching a new form. It is controlled by important factors such as the idea in terms of form, contents of cultural, social, spiritual aesthetic values that the sense responds to and perceive mind. However, it's not easy to judge a work of art because it is more inclined to intuitive understanding than the rational understanding (al-shafi, 2010). Products that are manufactured in large quantities often do not change the method of their use, but the effect can be positively on the recipient and attracting to buy it at a higher price, as an example of that mobile phones, and cars. This underlines the important of design and even its necessity for products. The process of repetition of shapes and circumvention to impart aesthetic vales through decoration or change the color of product, as observed in works of some potters, diminish the creative aspect and make it ordinary and repetitive. In order to promote the development of innovation, some countries have sought to establish ceramic workshops and organized competitions, exhibitions such as Cairo biennale, and Mino exhibition. It's also established organization for specialized associations, federation and unions to preserve rights. In Sudan for example, the scientific creativity promotion authority work as an official corporation to preserve creators rights and contribute in encouraging innovation. The first conference to encourage and innovation was held in the year 2010 in Khartoum, and it was preceded by laws to register property intellectual. Design is an important part of industrial and technical activities within the concept of intellectual property.

Digital technology has developed several design assistance programs in field of ceramic such as 3D design, and sold, which enable the designer to provide the shape with its dimensions, colors and all the details required. 3D printer have also allowed designers to be linked to complex 3D shapes, but the process of obtaining an innovation design still depends on the designers expertise, capabilities, needs multiple steps, and process according to his knowledge of raw materials requirements to be implemented.

2. METHOD OF STUDY:

- The study follows the experimental approach to provide design applications in multiple ways from different sources.
- Geometrical instrument and free hand drawing are use in the procedure of designs.
- To measure the results is based on the qualitative method in interpreting the finding of the study.

3. SAMPLE OF THE STUDY:

Innovative ceramic in terms of design and execution ability with clay materials as aesthetic or functional products.

4. DESIGN CONCEPT IN ART FIELDS:

Design means controlling the aesthetic aspects of the shape for purpose (Dodd, 1994). It's also intended as a process of planning a work that fits a specific purpose, has fun to the senses, and harmony to the fullest extent with its components (Norton, 1967). Also it is a deliberate and phased planning through preliminary studies of the art work according to an inaccurate general vision, it is usually small, have many studies and then going through the stage of selection, zooming, then entering into the parts of the work to draw the final lines and equation, objectivity and aesthetic by deletion and adding (Haidar, 1984). Design varies from discipline to other according to the materials and tools available, yet it is one of the basic ways of creativity that gives a picture of the component of mental and behavioral life and human interaction with its surrounding.

4.1 Design in the field of ceramic:

There are several factors to consider in the design of ceramics, which are related to materials and shape function, summarized by Norton (1967) in the following points:

- 1 – The correct performance of the piece based on the validity of use to perform its function easily.
- 2 – Balance (stability of the piece).
- 3 – The strength of the shape by not showing the thin piece as if could be smashed or distorted by cutting or removing the prominent parts.
- 4 – Suitable for the area in which it is placed, e. g: the piece placed on balcony must be solid.
- 5 – Easy washing.
- 6 – Design making into account the characteristics of the materials (working with the ore and not against it).
- 7 – The right thickness for the size.
- 8 – Avoid sharp corner and edges.
- 9 – Design taking into account the method of implementation so that it must give evidence of the way in which the piece was implemented.
- 10 – Taking into account the ratios of general form. In addition to these points, plastic clay materials cannot withstand their horizontal formation for a long distance where the ore drooping. It also cannot afford to make large forms of it as a single mass, which exposes the ore to different mechanical stresses during the dry period leading to cracks.

5. DESIGN METHODS:

5.1 Golden ratio:

In the past, Greeks believed that beauty could be measured by the amount of coordination in the design. So they and the Egyptian veterans went to take the percentage of survey, through the rectangle. A square is made and then converted into a consistent rectangle with a mathematical relationship of 1,618 as shown in figure No.1. Then from that known the rotation square as in figure No.2, which is new later golden ratio. It is a series of numbers with relationship begin from 1:1, 2:3, 3:5, 5:8, 8:13, 13:21, 21:34, 34:55Etc. each number is sun of the previous two numbers, and by dividing the number to the previous one gives approximately 1,618. These proportions were found in measurement of plant leaves, seeds, and the human body and were used in various design areas (Norton, 1967).

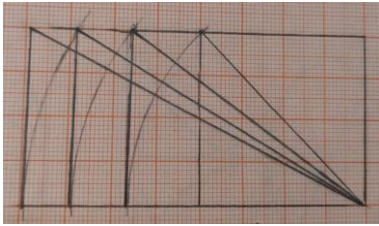


Figure No.1 survey ratio

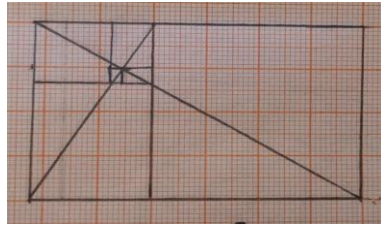


Figure No.2 rotation square

5.2 Delete, add and install:

It is simple method commonly used, where it depends on taking geometric shapes by adding parts to it or deleting parts of it or by installing two or more shapes to give a new design. Fruits and vegetables forms can also be altered in the same way, in which the shape is adapted to the desired purpose. In this regard, the work of Mohammed armed Abaru, whose work have been described as modern classic can be inferred as he has been able to give a special dynamic to work from Sudanese heritage of the Nuba mountains region (The British Museum, 2015). He presented detailed design studies of Tabaco pipe, wine cups, wooden mug, incense, women, mushroom, cows, and sheep. He was able to transform these things by installing, adding, and executing ceramic pieces with consistent and distinctive designs (Abaru, 2000).

5.3 Spontaneous method:

It is based on the unexpected ness of design. A reaction to a particular movement that produces a shape or image, as an example, when a quantity of gravel drop on a surface, it is scattered randomly and in its entirety gives a composition to an unexpected form. Also when pouring water and photographing it, it gives a new shape as well as when photographing flame of fire. Drawing with accelerated music is also used to replicate lines, for example according to the speed of rhythms, resulting in an overlap of lines that is examined, then selected, and processed to give a new design (Watson, and Claire, 1999).

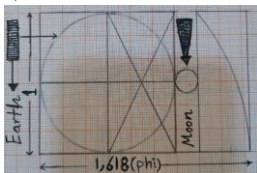


Figure No.3

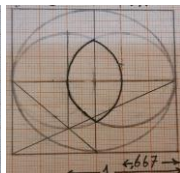


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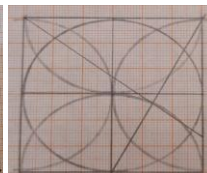


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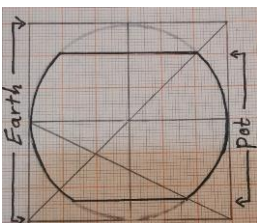


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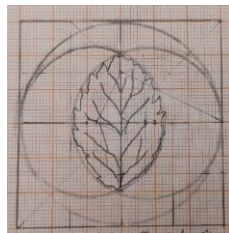


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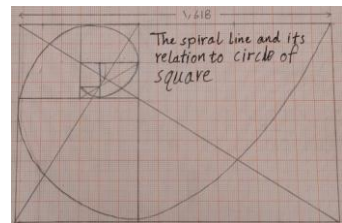


Figure No.8

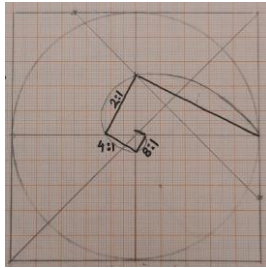


Figure No.9 Ratios of spiral line in rotation square

5.4 Geometrical method:

There are even mathematical explanations taken in the relationship of the planet to each other according to the percentage of survey reached through the circle and square. The relationship of some forms of ancient ceramics and plant leaves related to those measurements as shown in figures No.3, 4, 5, 6, 7, 8, 9 (Lieben, 2018).

6. MODERN CONCEPTS AND VISIONS OF DESIGN AND ITS STAGES:

Beauty is one of the qualities associated with creative work. It is sensual and creative work itself is physical, the challenge facing the designer is how he will work to connect the sensory aspects during the change of shape with a focus on functional aspects. Chen, and Tom (2015) believes that this requires the search for social and cultural values of society as well as personal experience. For industrial design products, Ulrich, and Steven (2017) shows that the designer's primary task in the product is to make into account aesthetic values and factors adapted to use ergonomics as well as diversity and sophistication. To assess this, he has set the following criteria as questions:

- will the product serve after it has performed the required operations?
- Are all the product component safe?
- Is there consideration that all peoples can use the product?
- In sensory terms, is the product attractive?
- Dose the product reflect quality?
- What is the first mental impression when seeing the product?
- Dose the product give a sense of development?

Almamari (2017) also stressed that the designer's strategy today is based on balancing aesthetic and functional values as a key factor. He determined that the creative process of design goes through the following stages:

- The stage of foresight and deals with contend of the problem.
- The preparation stage and attempt to realize the options.
- The incubation stage and there is an effort without awareness.
- The luminous phase during which emergency idea appear.
- The stage of stability, which is specific to perception and the beginning of development.

Designers are also seeing the use of ancient traditions and their development or support through stories as method. Due to the link of design to implementation methods, 3D printing has helped solve many implementation problems for complex

forms, a technique whose basic idea belongs to the photo sculpture machine that folded in France in the year 1860 (Hoskins, 2018). Later developed to be used in the work of complex and simple models. It should be noted that the interest in design has greatly helped to increase the volume of purchases of works of art, especially in the Middle East (Dubai Design and Fashion Council, 2016).

7. PRACTICAL ASPECT:

The study applications were based on two methods of conducting initial layouts in design processes. The shapes were presented in a simplified way that enable the options and directions through which they could be developed. Conducted adjustments to adjust the shapes in terms of balance. Proportions and unit of shape in addition to introducing the flow lines as an aesthetic feature of some forms in order to create a link of consistency between units in addition to adding a dynamic movement of shape and suitability of ceramic materials in terms of the possibility of implementation. Complementary parts such as bases, necks, and knobs were also added. Some forms were transformed to take analogue balance and others were treated a symmetrically.

7.1 First method: Design by deletion, addition, and installation:

Geometric shapes (circular, cylindrical, and oval) have been taken as primary sources of design. Set of geometric instruments were used with freehand drawing. The layouts according to the following:

A/ Circular shapes carried out on graph paper as shown in figures number from 10 to 15. Some design capabilities that can be made available through deletion or addition. Figure No.11 can be executed as a small aesthetic piece in the wheel in stages or by mold. Figure No.13 is design of necklace and can be a frame for mirror. Figure No.16 prominent semi-spherical part have been added around a pot for agriculture. In figure No.17, it was deleted method. Shapes in figures No.18, 19, 20 were deleted and added with severe modifications of the circle to give aesthetic pieces.

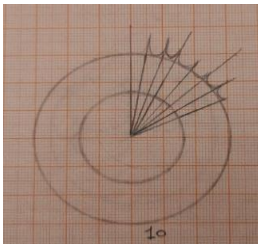


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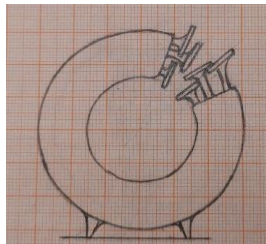


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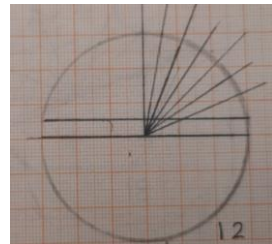


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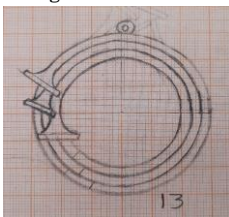


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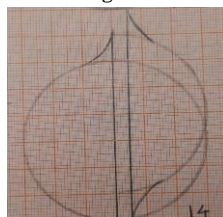


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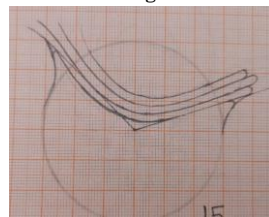


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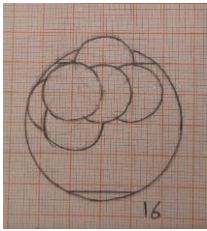


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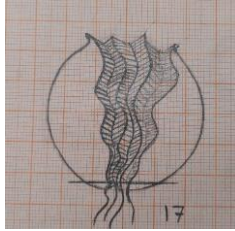


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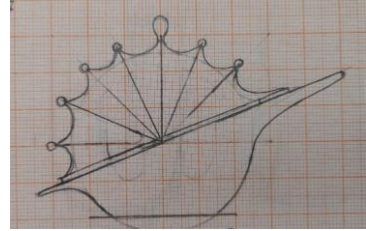


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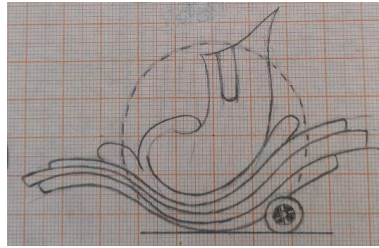


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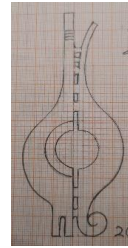


Figure No.20

B/ Cylindrical shapes carried out by freehand drawing to make change through curvatures as shown in figures No.21 to 24 as a design of mugs. Shapes in figures No.25, 26, 27, 28 were treated with arcing, curvature and installation.



Figure No.21

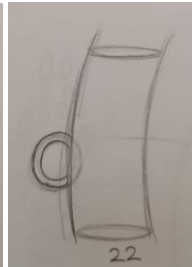


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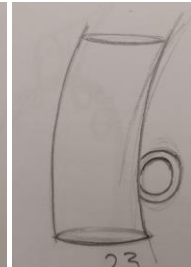


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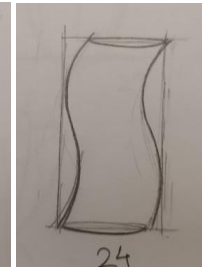


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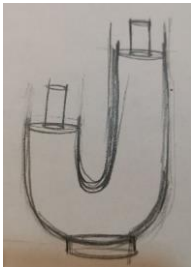


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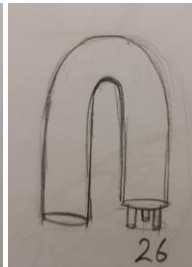


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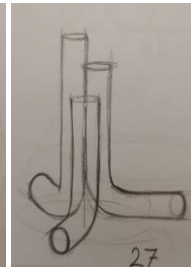


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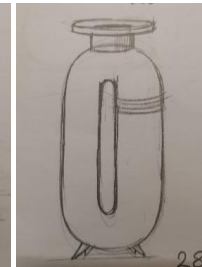


Figure No.28

C/ Oval shapes planned by freehand drawing in which it explains the possibility of deleting small parts of the general shape with the addition of necks or handles of some shapes as they are in figures No.29, 30, 31, and used as a vases. To adjust the balance of oblique shapes, other forms of the same type have been added in smaller sizes as they are in figures No.32, 33. Figure No. 34 is suitable as a candy or fruit basket. It has been

treated by deletion. The designs that has been followed in this aspect can be implemented in an oval horizontal format.

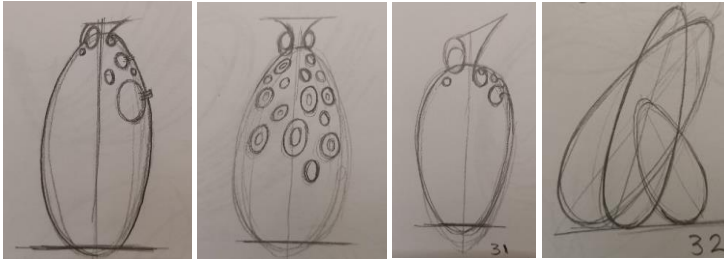


Figure No.29

Figure No.30

Figure No.31

Figure No.32

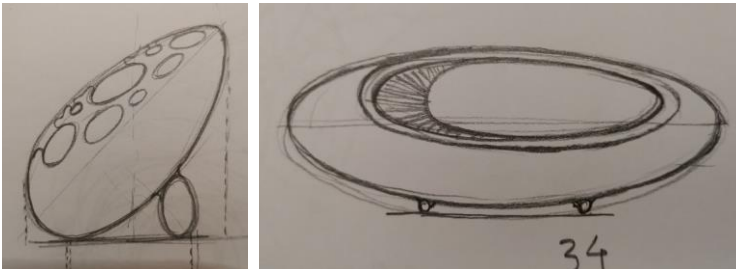


Figure No.33

Figure No.34

7.2 The second method: Elicitation:

Freehand drawing used to associate shapes that gives new ideas as an optical input to unintended forms and then modify them by deleting the situation or taking the same shape pattern and developing it through repetition, interference, abstraction. Design models have been made in three different ways as follows:

A/ Elicitation through random interference of lines: application were made by freehand drawing curved lines in the form of slanted beams as in figures No.35, 36. Draw curved lines that overlap with each other, taking semi-horizontal and slanted direction as in figure No.37. Draw curved lines around circular axis in figure No.38. Draw curved lines in the form of semi-rectangular as in figure No.39 which is derived from the layout of shape in figure No.37. Also figure No.40 developed from figure No.37. Figure No.42 is derived from the layout of the shape in figure No.36 with addition to the base and others at the top, while intermittent points indicate the possibility of adding a handle to become a fruit basket design. The two forms in figures No.43 and 44 in which the simple curvature line is taken more regularly and then altered in stages as shown in figures No.45, 46, 47. To reaching design with aesthetic is shown in figure No.48. Figure No.49 is designed to be base of a table.

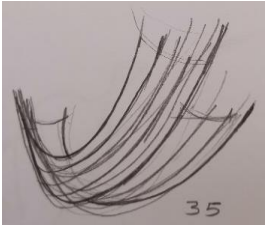


Figure No.35



Figure No.36



Figure No.37



Figure No.38



Figure No.39



Figure No.40



Figure No.41



Figure No.42

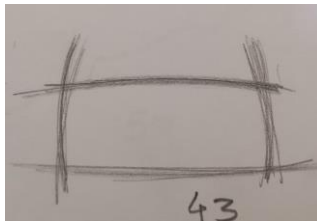


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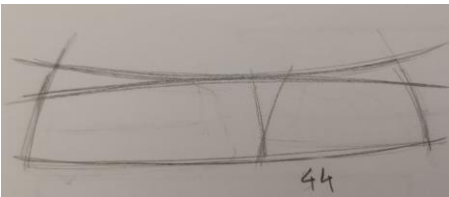


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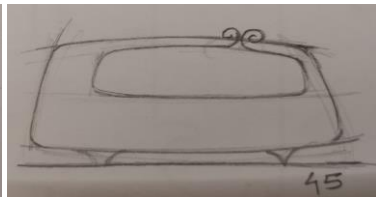


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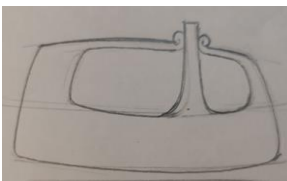


Figure No.46



Figure No.47

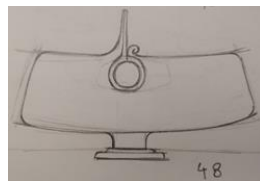


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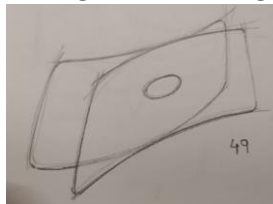


Figure No.49

B/ Elicitation through the spaces between shapes in nature: The outer spaces between trees, pots of water and other things were taken as a sources of design as it is in figures No.50 to 54. Figure No.55 contains it an attempt to repeat the lines of figure No.50. Figure No.56 is result of deriving part of figure No.54 with make on the same pattern as the basic shape. Figure No.57 is derived from figure No.51. Figure No.58 derived from the two figure No.50 and 52. While the dashed points indicate the possibility of giving it other form. Figure No.59 also derived from figure No.51.

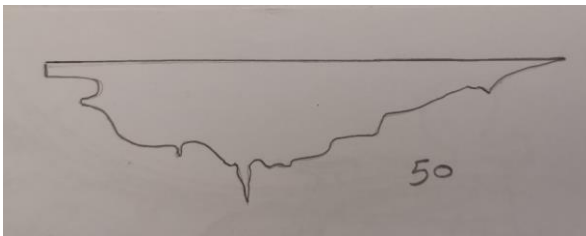


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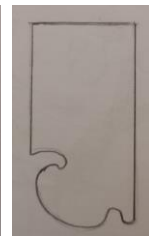


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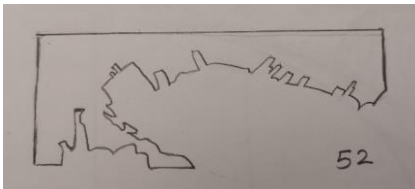


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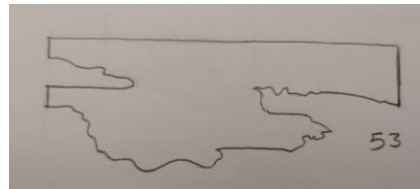


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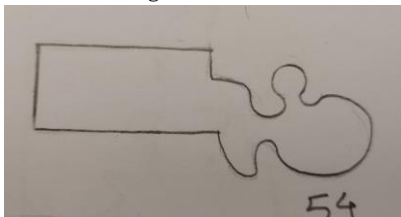


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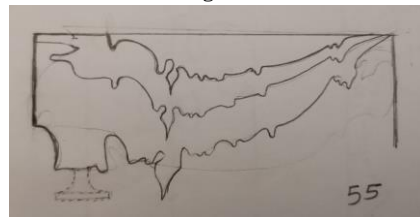


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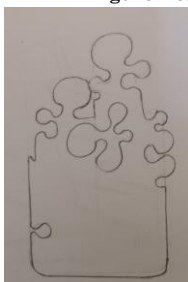


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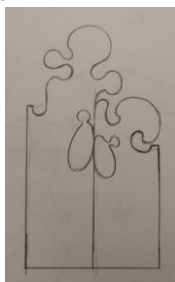


Figure No.57



Figure No.58

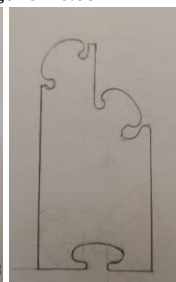


Figure No.59

C/ Elicitation through shadows: Drawing shadows of plants, household items, and other different things, as shown in figures No.60 to 65, then reflect on it to identify the forms that can be developed by merging some of them, changing positions, repetition or taking the general form and altering them. The two figures No.66 – 67 are developed

from figure No.60, in the first one some parts were reduced and merged, in the second the position was changed after stripping. Figure No.68 derived from figure No.62 with reducing some parts and adding a general form. Figure No.69, developed from the two figures No.61- 63, the sharp parts transformed into notches. Figure No.70 is taken from figure No.64 and is valid as a design for pencils or brushes box. Figure No.65 is a design for a fountain basin.

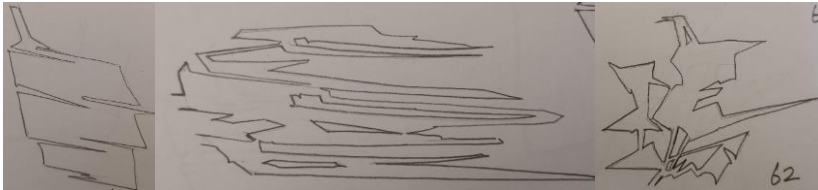


Figure No.60

Figure No.61

Figure No.62



Figure No.63



Figure No.64



Figure No.65

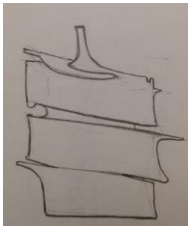


Figure No.66

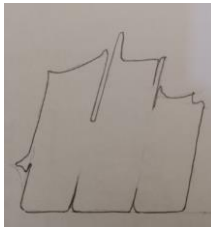


Figure No.67

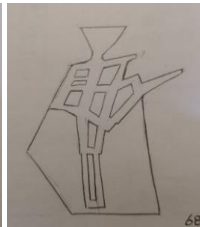


Figure No.68



Figure No.69

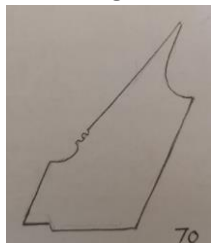


Figure No.70

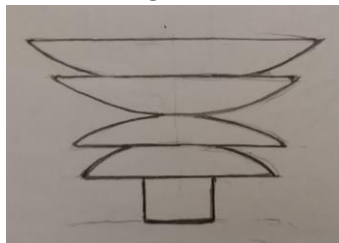


Figure No.71

7.3 External treatments:

The design of the previous shapes can be develop continuously and unlimited, in this aspect the tools were used geometric instrument and freehand drawing in a combination of the two pervious methods to give shapes with advanced treatment of complexity or simplification general shape. Emphasis were placed on the usability aspects of designs. Figures No.72 to 75 are proposals for ceramic forms that can be implemented as separate parts and then assembled with each other or implemented as

aesthetic pieces of small size through molds. Figure No.76 is suitable as a dish for fruits. Figure No.77 a design for a vase executed by a mold. Figure No.68 a design a table seat executed by a mold. Figure No.79 is a design for a wall work, and its vertical position can be changed to horizontal to serve as a table base. Figure No.80 design for column and suitable as a vase, implemented by mold. Figure No.81 design for an aesthetic form.

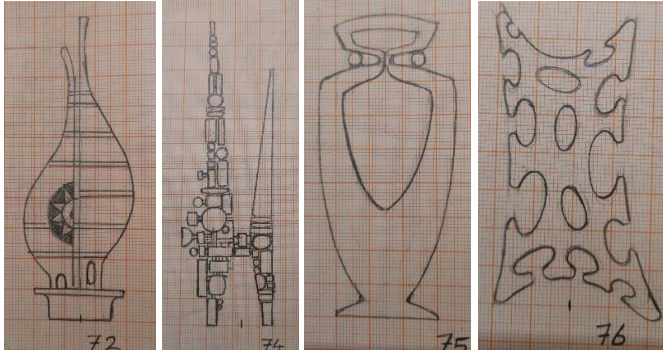


Figure No.72

Figure No.73

Figure No.74

Figure No.75

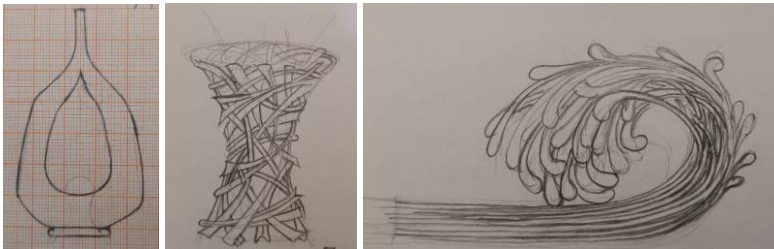


Figure No.76

Figure No.78

Figure No.79

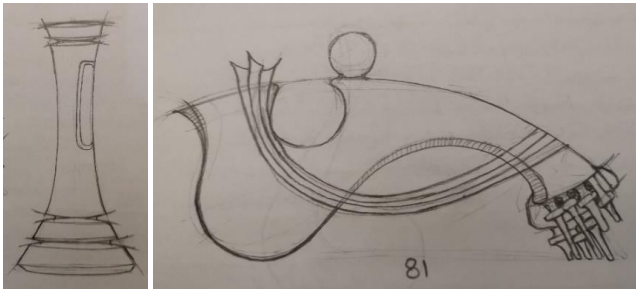


Figure No.80

Figure No.81

8. ANALYSIS AND MEASUREMENT:

First there are no fixed rules that define an ideal design. Secondly, visual experience and continuous practice enable the attainment of better result. Figures No. (11, 19, 27, 41, 48, 56, 69, 72, 81) were selected as designs distinctive for rich ceramics, as for figures by No. (17, 34, 42, 49, 76, 78) they are designs of functional purposes. The study was based on the analysis and measurement on the following criteria's:

1 – Balance.

2 – Unity (harmony and compatibility between elements).

- 3 – Ratios (the relationship of element to each other in terms of sizes).
- 4 – Idea (what the form suggests).
- 5 – Renewal and innovation (the originality of design).

To determine the aesthetic values in design that were conducted, the following points were relied on:

- 1 – Systems (the way of element placed together and their directions in design).
- 2 – Movement (streamlined, launch, ripple interference, and spread).
- 3 – Visual attraction (places that provoke visual focus such as tilts, voids, elongations, and overlap).
- 4 – Diversity (enriching the design with multiple components with interrelated relationships).

Analysis of form of use in terms of their suitability for the specific purpose with possibility of implementing them with ceramic materials the following points were identified:

- 1 – The simplicity of the form.
- 2 - Cleanliness (possibility of cleanliness inside and out).
- 3 – Ease of use.

9. MEASUREMENT OF STUDY MODELS:

- Figure No.11 characterized by symmetrical balance. Consisting of a large arched mass, necks, legs in symmetrical installation position, and block of varying sizes. The orientation of components is circular, excluding the legs. Suggesting a dynamic movement. Point of the visual attraction are in the necks. The idea is new. Suitable method for implementation is wheel in stages or by mold.
- Figure No. 17 is generally has a symmetrical balance. Its units have interrelated relationship in congruent proportions. The idea suggests with botanicals. The form structure is circular and wavy. Carving carves dominate the shape visual attraction site. It consist of three components. It's simple and suitable for cultivation. Implemented by mold.
- Figure No.19 characterized by non-symmetrical balance. It consists of three different units that are interconnected harmoniously form through lines. The position of element are horizontal and vertical. The undulating rhythm creates visual attraction. The form can be made by mold.
- Figure No.27 is characterized by non-symmetrical balance and more stable stability on the surface. Its units vary in length and similar that created harmony. The idea is familiar. Form construction suggests containment. Consists of three elements with a void at the top, which is the site of visual attraction. It's simple, ease of use and cleaning. Executed by mold.
- Figure No.34 is characterized by non-symmetrical balance. It consist of an oval and semi-oval, so it is homogeneous in terms of units and varying in terms of proportions. It looks like fruit and pebbles. The form structure suggests containment. Consists of three element with avoid at the top, which the site of visual attraction, which can be used as a plot for the shape. It's simple, ease of use and cleaning. Executed by mold.
- Figure No.41 it has symmetrical balance. The general shape, spaces, and neck movement are all on the oval pattern make the elements coherent. The element are

distributed on the side are relatively equivalent the spaces on the opposite side. Unusual and rich in curved and flowing lines. Visual attraction is directed towards the voids. Executed by mold.

- Figure No.42 it is not symmetrical. Consist of two adjacent and harmonious masses. The approximate relative relationship is 3:5. The design is unfamiliar with something of modernity and innovation. The elements are curved upwards with lines. Streamlined give a dynamic movement. It is carried out manually in stages or by mold.

- Figure No. 48 it has non-symmetrical balance, it need a base to be stand. It consist of five interconnected units. General shape is larger than the additions above and below, which is new and unusual, dominated by curvature and arctic extension. The void at the top represents the visual attraction. Its various in details and simple as shape.

- Figure No.49 it has a symmetrical balance, simple and consistent with similarity of units and proportions. Its idea is atypical, towards curvature and gluing with each other in the middle. Characterized by a simple flexible movement by curved lines. Simplicity the design indicates ease of use and hygiene. Executed by mold.

- Figure No.56 it has symmetrical balance. Void were create to balance the masses. Units are close to each other at the top, so it is compatible. The approximate ratio of upper blocks to the rest of the shape is 1:2. Its new idea. Elements tend to the complexity because of the zigzags, which is difficult to comprehend, that makes the whole upper part an area of visual attraction. It is multiple and varied in its components. Executed by mold.

- Figure No. 69 it is non-symmetrical balance. There is a discrepancy in the ratios between the multiple components but they are interrelated harmonious. The idea is unfamiliar, structure of form is tilted. Curved and straight lines give a sense of launch blanks. The small diagonal units are the visual attraction. Executed by mold.

- Figure No.72 its equilibrium is unequal despite, the different proportions of its components, so it is coherent and harmonious in its general form. It is unusual shape, characterized by movement of vertically curved and horizontal flexible lines. The direction of the dominant elements is vertical. Tilting one side of the top of shape and space in the middle are two of visual attraction. Executed by mold.

- Figure No.76 it's not symmetrical balance shape. The general shape and the peripheral spaces and inside are system of relations consist derived from the oval. The areas distributed almost equally. The design is unusual. Elements are tending in all directions because the shape consist of group of zigzags and curvatures that enrich the movement, which region in the shape is source of visual attraction. Suitable for use as a fruit basket.

- Figure No. 78 it has symmetrical balance. Its units are belts of double lines overlapping a grid. Made homogeneity. The proportions of the components are of congruent areas. The idea is familiar, like a bird's house. Interlocking shape structure and complex, each shape is considered a source of visual attraction. It is complex and easy to clean but can be used as a base table. Executed by mold or 3D printer.

- Figure No.81 is not symmetrical balance shape. The proportion of its component are different, but they are harmonious with each other. The design is characterized by being strange shape. The structure of form depends on the curvature in opposite directions through the movement of flexible lines every the shape represents a source of visual attraction due the large number of components and the interrelationship between them. Executed manually in stages or by mold or 3D printer.

10. DISCUSSING THE RESULT OF STUDY:

Balance as a measuring factor not restrict shapes to symmetry, which many lead to familiar or monotonous design. Balance is not analogue is opposite and often needs manipulations such as creating spaces, tilting or adding a base to balance position of the shape, and its stability on the surface when implemented.

Design components when they are similar or derived from a single unit or element are more harmonious. Short arched lines connect and harmonize disparate units as legs and necks, which achieves a correlation of elements as they are shapes in figures No. (11, 17, 19, 27, 41, 42, 48, 56, 69, 72, 81).

The difference in sizes and sizes of units gives appositive effect to the eye, while equally giving visually perceived forms without looking as in figure No.49, which may suit the designs for functional uses.

The general shape structure of design and the direction of its element has a role in imparting aesthetic values. Analogue construction with vertically or horizontally straight lines gives a sense of habitability and monotony. Tilting shapes, elongation, sideways distribution of elements, complex compositions between units, and overlap are all add aesthetic features to the design.

Curved, winding and corrugated lines help to create in design and add a pleasant movement to look at the posit of the paths of straight lines, it gives a sense of disorientation and distance in order to connect the visual observations of the human being in nature to the horizon such as the electricity poles stacked on the roads. Most creatures in nature have streamlined bodies, plus they fit ceramic materials when implemented. The quality lines that make up the shape in design determines the movement, but many of them are complicate the shapes.

The multiplicity and contrast of units provide the design with aesthetic characteristics because it makes the shape mass vary in proportions, especially when the composition of the units are treated asymmetrically.

Simplicity, cleanliness and ease of use are required in the shape designs that are implemented for use purposes.

They are associated with forms with one or two components and are more abstract. Shrinking corners, bumps and zigzag to the maximum to avoid difficulty using. The functional aspect must be dominated by aesthetic aspect and this does not detract from the design, as simple treatments such as arching and opening may be enough as aesthetic touches of the shape.

11. RESULTS OF THE STUDY:

1/ Using the method of development in design in its said methods is effective in giving multiple initial forms that need some treatments. It also provides the designer with ideas and reduces effort and time.

2/ Combining deletion, addition, and installation with innovation gives advanced and diverse design options.

3/ Curved, winding, and undulating lines give shapes aesthetic features through flexibility and movement and reduce the rigidity of the shape.

4/ Building shapes in a slanted way, distributing items on one side or overlapping them also add aesthetic features to the design.

5/ Side spaces or within shapes, multi-elements, tilting some parts, small additions such as necks and legs all represent aesthetic features in ceramic designs and positively affect the visual attraction but many give complex forms.

6/ All the shapes analysed are suitable for implementation with ceramic materials. Some of them are also suitable for implementation by 3D printer.

REFERENCES:

1. Abaru, Mohammed Ahmed Abdallah, (2000). Modern Ceramics on the Interplay Form and Surfaces, Published by Mohammed Ahmed. London, UK, p. 10-16, 26-34, 50-53, 68, 69, 81, 104, 181.
2. Almamari, B. (2017). Ceramic Designer Contemporary Vision , Department of Art Education , College of Education ,Sultan Qaboos University ,Muscat , Oman, p. 142, 144.
3. Al-Shafia, Shafia Basheer, (2010). Professional arts – general professional positions and development, Sudan Printing for Currency, Khartoum, Sudan, p. 39.
4. Chen, Lin and Tom Djajadiningrat, Jun Hu, Steven Kyffin, Lucia Rampino, Edgar Rodrigues, Dagmar Steffen, (2015). De S for M 2015 Program Committee, Italia, p. 15.
5. Dodd, Arthur Edward, (1994). Dictionary of Ceramics, The Institute of Materials, London, U.K, p. 88.
6. Dubai Design and Fashion Council, (2016). Design Education Horizons in The Middle East and North Africa, Dubai Design, Dubai, U.A.E, p. 16, 73.
7. Haidar, Kazem, (1984). Sketching and Colors, Ministry of Higher Education and Scientific Research, Baghdad University, Baghdad, Iraq, p. 123.
8. Hoskins, Stephen, (2018). 3D Printing for Artists – Designers and Makers, 2nd Edition, Bloomsbury publishing Plc, London, U.K, p. 16.
9. Lieben, John Oscar, (2018). Sacred Geometry for Artists Dreamers and Philosophers, Electronic Edition, Digital Media Initiatives, Rochester, Vermont: Inner Traditions, p. 28, 95, 109, 114.
10. Norton, F. H. (1967). Ceramics for The Ceramic Artist, Translated by Saeed Al-Sadr, 2p, Dar Al-Nahda Al-Arabia, Cairo, Egypt, p. 111, 128, 131-133.
11. The British Museum, (2015). African Art Close – UP, The Trusts of British Museum Company Ltd, London, U.K. p. 112.
12. Ulrich, Karl T. and Steven D. Eppinger, (2012). Product Design and Development, 5th Edition, Mc Craw – Hill, New York, America, p. 226.
13. Watson, Lorna and Claire Sloan, (1999). An Introduction To Jewelry Design, The British Council in Collaboration with the College of Fine and Applied Art, Sudan University for Science and Technology, Khartoum, Sudan, p. 10.