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The aesthetic and technical dimensions of metal casting and benefiting from it in the field of relief sculpture for tourist souvenir coins

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Abstract:

Coins, with their aesthetics, are one of the elements of heritage, as they carry in their form and form previous heritage and civilizations, which constitute an important aspect of human culture. Where heritage is one of the most important sources that are taken in most fields of art education as a balance of artistic and technical expertise, which carries many connotations and intellectual premises that can be studied through the study of plastic solutions useful in the field of tourism souvenir production, especially in the field of sculpture.

The coin carries artistic values derived from the fragrance of history and is characterized by multiplicity and variation in terms of material, shape, shape, size, and tactile richness, as evidenced by prominent historical drawings and inscriptions. The use of these coins, with all their previous characteristics, requires a great deal of experimentation, know-how and awareness to work with them, whether on the part of the learner or the teacher, leading to creativity.

In the current research, coins are used as a key element in the formation of some experimental practices using many manual techniques of prominent sculpture and metal casting technique in line with the thought and philosophy of art education, which calls for the importance of manual formation, handicrafts compete with automated manufactures because they are characterized by creativity and art, so that they have become competitive with modern manufactures from several aspects, the most important aspects of workmanship, and the thought and foundations of those works are based on plastic and aesthetic in plastic formulations characterized by aesthetic values. The research is experimented on third-year students in the Department of Art Education, Faculty of Specific Education, Alexandria University, in order to encourage and motivate young graduates to establish small projects.

Craft industries are closely related to tourism, as the tourist demand is a fundamental and important factor in activating crafts, as the tourist benefits through his dealings with the centers of production of handicrafts to identify the cultural and social situation of society and transfer this to his country, and through that the tourist movement increases and the return from it to the homeland increases in improving the economic situation and advancing it to the required levels. Handicrafts compete with machine manufactures because they are characterized by creativity and art.

The field of sculpture is one of the most attractive artistic fields for small handicraft projects, as sculpture is a handmade product made with local or imported raw materials produced by local craftsmen to create a work of art that bears the character of the country that produced it and is linked to the environment, customs and traditions or heritage and reflects the culture of society. It is also a beautiful and exciting art, and a science in its own right, with its own theories and scientific applications.

Keywords:
Metal casting, bas-relieving, commemorative coins

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Search problem:

Coins are considered one of the important entrances that express the heritage because of the values and decorative and color artistic treatments that can be studied through plastic solutions that are useful in the field of tourist souvenir production, especially sculpture. The research problem revolves around how to benefit from the aesthetic values of coins because of their decorative elements and apply them with sculptural materials and metal casting technique as tourist souvenirs characterized by originality and contemporary vision.

Tourist memorial sculptures are considered one of the sources that must be paid attention to and studied scientifically and artistically for many reasons, including that it is one of the small Egyptian industries that express the Egyptian civilization and heritage, as it is considered an ambassador for Egypt across the countries of the East and West, and it also affects tourism development, which in turn affects economic development, which is one of the pillars of the country's national income.

One of the most important problems facing tourism products of all kinds in general, and in the field of sculpture in particular, is that they lack good design of high artistic value, which reflects the features and authentic character of our ancient and contemporary arts, or expressing the environment.

The research identifies the basic considerations for the design and implementation of Egyptian tourist souvenir coins, and provides some design solutions implemented on a tourism product associated with heritage in a new form, using one of the manual techniques of metal casting forming.

The research problem lies in the following questions:

1. To what extent can the coin achieve aesthetic and artistic dimensions derived from the artistic and technical features of tourist souvenirs?
2. How can cultural traditions be analyzed in the design of coins to reach the foundations and good technical aspects of the design and implementation of tourist commemorative coins?

Research hypotheses:

1. Coins and their decorative elements can be inspired in sculptural tourist souvenir applications with metal casting.
2. Cultural traditions can be analyzed in the design of coins to reach the foundations and good technical aspects of the design and implementation of the tourist commemorative coin.

Research Objectives:

The research aims to:

1. Achieving harmonization and integration between form and content in terms of designing the tourist commemorative coin as an aesthetic work of art and the documentary and expressive content of the event or character.
2. Shedding light on the commemorative coin and medal From the beginning of its inception and development, it participated in recording major events and national and personal occasions that revealed to us important periods in history.
3. Training students on the scientific system to benefit from the heritage environment to make small projects for handmade sculptural tourism products.
4. Finding features of the tourist commemorative coin that carry the characteristics of authenticity and modernity.
5. Shed light on metal casting techniques by which surfaces can be treated for plastic solutions in the field of bas-relief sculpture as tourist souvenir coins.

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6. Seeking to find specifications, steps and technical foundations that the sculptor must pay attention to to implement the metal tourist commemorative coin.

The importance of research:

- Shedding light on the importance of heritage as an important entry point for inspiration and strengthening the distinctive features of heritage sculptural memorabilia.
- Enriching the field of creativity in the production of memorial sculptural forms and the interaction between the sculptor and the successive historical events of the homeland.
- Work to enrich the technical experiences of students on how to benefit from the plastic potential of coins and the technical of plumbing forming.
- Opening new horizons to reveal the aesthetic values in coins and medals and the decorative and symbolic elements they contain associated with customs and traditions and employing them in sculptural tourist souvenir coins.

Search terms:

1- Clone:

The concept of plastic reproduction in the field of sculpture is the process of reproduction intended to achieve the characteristic of repetition, similarity and correspondence between the original model and the copy taken through a template.

"The idea of artistic reproduction is summarized in (complete / blind imitation) where multiple copies of the same artwork are made, and reproduction is an advanced stage of influences and imitation, it is a complete transfer of the artwork without increase or decrease" (Rehab Bayoumi Abdel Hafez, 2009, p. 579), we find the cloned artist takes from the original masterpiece (reproduced from it) the raw material, processing methods and industry, decorative methods, decorative theme, elements and artistic formations in full, as well as the color plan, that is. The literal meaning of total reproduction, and there are many words indicating artistic reproduction, including: artistic imitation, artistic congruence, artistic similarity, artistic symmetry, simulation and quotation, and complete transfer of artistic correspondence.

Reproduction by traditional methods means manual cloning known since ancient times and is being worked on until now, despite the existence of the terrible technical development provided by modern technology, but it is indispensable for traditional manual methods in the art of reproduction and molding and manual reproduction depends on the preparation of a model of work of gypsum taken from the origin of clay and this model is the real guide to raise the real sizes in the required version, which will be implemented with the same size or for the purpose of zooming in or out.(Daniel Rhodes, 1959, p189)

The materials used in the formation of models of sculptural works are limited to clay and gypsum materials, especially Parisian gypsum, while in the reproduction materials for the manufacture of molds, they are also confined between gypsum ores and in certain cases silicon material is used in the event of work under cut .

2- **Relief Sculpture :**

Beynon defines bas-relief as "the protrusion of forms on the floor and forming an inseparable part of the floor" or low protrusion high (Beneon, 1968, p. 128). There are those who know it "that sculpture is surface sculpture where it is formed by carving the surface of the material, and it takes its vitality as a result of the reflection of light" (Robert Scott, 1980, p. 3).

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Bernard Mayes says of bas-relieving: "It is a sculpture that is raised or raised above the space on which the protrusion can be seen. (Bernard Mayes, 1966, p. 131) for new concepts for the practice of bas-sculpture" (Iyad Hussein Abdullah Al-Husseini, 2002, p. 11)

3- **Commemorative coins:**

They are the coins or paper coins issued to register a national event, national occasion or commemoration of a person, body or institution, these coins are minted and printed with a distinctive design that indicates the occasion or event, some of which are traded at the value of the minted currency, and some of them are issued at a metal value higher than their minted value, such as gold and silver, acquired by amateurs and currency lovers at a value higher than their original value . "The commemorative coin has historical significance and documentation of important events, giant projects, treaties and victories, and has an effective role in the lives of peoples and societies in terms of cultural, national and also artistic because of its high design taste. (Victor Morgan, 1993, p. 3).

4- Coin :

It is a circular metal disc mostly of various sizes, diameters and denominations implemented in the style of minting or casting and represents a logo or image of a character, landmark or nature of the state, "and its purpose is to distinguish between the original and counterfeit and estimate the value of each currency in relation to other currencies.(Atef Mansour Mohamed Ramadan, 2008, p. 13)

5- Medal Art:

One of the definitions of the medal is that it is a sculptural work of art carried out in one of the metals, metal alloys or polymers, by the artist adopting the style of relief or sunken sculpture sometimes, and in the past it was often of a circular shape.

When searching for the origin of the name, we find that the word medalea in Latin medalea or medalia or medalla had a synonymous word in the Middle Ages called (Opol), but the French in the fourteenth century called it the ring, and the real equivalent of this name means Mezalba or Medaglia) and did not work with this name as stated in the volumes of Italian historical documents.

In the current era, the word (Medaille) in the French language means medal, and the word (Medaillo) means a large medal or a large medal, and that the medal, coins, medals and medals are all subject as a study to a science in history called numismatics (la numismatiqu) (JEAN Babelon 1927-p11,12,13)

Research Limitations:

1. **Human limits:** conducting research applications on 55 undergraduate students - third level - in the Department of Art Education
2. **Spatial boundaries:** Faculty of Specific Education - Alexandria University
3. **Time limits:** Academic year 2023/2024

- The research is limited to the production of souvenir coins for the purpose of acquisition as a tourist souvenir.
- The research focuses on the analysis of the technical and plastic aspects in the design of the coin in terms of shape, symbols and writings used and the artistic relationships associated with them.
- The application period lasted five meetings, four hours per meeting per week.
- Study the methods and means used in the production of coins and medals
- A study of the history of coins and their relationship to the art of medals.
- The practical application depends on the use of sand foundry forming techniques (aluminum - copper) to produce tourist souvenirs enlarged from the coin.

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Research Methodology:

In the theoretical framework, the researcher follows the descriptive analytical approach.
In the applied framework, the researcher follows the semi-experimental approach through a set of practical applications.

First : Theoretical Framework:

It is related to the theoretical study that has been highlighted before, which is also related to the test of research hypotheses, which included the study of the plastic potential of coins and the art of medals, which carry artistic features and plastic methods, which can contribute to enriching the educational process in the field of sculpture as tourist souvenirs.

- A brief history of coins and commemorative coins.
- The plastic potential of coins, which carry technical features and plastic styles.
- The symbol and its artistic connotations in the design of the commemorative coin.
- Metals used in minting coins
- Production of metal clones with plumbing technology.
- The most important processes for the formation of sand mold for castings.
- Elements of sculptural formation and its relationship to the art of medallion.
- Techniques and the most important technical methods used in the production of coins.

• The emergence of commemorative coins:

The overlap that occurred between the definition of the medal and the currency came as a result of the similarity in the nature of the currency and the medal in terms of artistic form and literary content and is Philippe de Cummins the first to launch in French literature the word medal on coins that have only historical or archaeological significance and which keep them as artistic effects and outside the circle of monetary dealing, and the relationship between the medal and the currency was the emergence of the currency earlier than the medal currency is used for the purposes of trading and trade while the medal is used In commemorating a character or recording an important historical event, and thus the medal was associated with the idea of immortalizing tournaments, battles and kings, and we find that the most important requirements for currency circulation are that each copy is identical to the other in terms of shape, size and weight. (Ahmad Mohamed Omar Badawi, 1982, p. 63). The relationship of the medal and the currency with stereoscopic sculpture The medal and the coin represent a form of memorial sculpture as it has the freedom of movement and actual spread and ease of acquisition and the possibility of viewing it as a work of art under different lighting conditions, whether natural or industrial, and the commemorative aspect of the medal and the coin is to highlight the symbols recognized by society and derived from its history to express the meanings of power, justice and peace and the relationship of the medal and currency with bas-relief sculpture The medal and the coin belong mainly to the art of prominent sculpture and share the medal and the coin in the same Plastic characteristics of the style of relief relief sculpture.(Mohamed Ahmad Mohamed Rahuma, 1987, p. 31)

In the beginning, the religious character prevailed over those slogans and symbols multiplied on the coins in Egypt and Greece, and it remained prevalent until the advent of Alexander of Macedon, so he was the first ruler in history whose human image appears on coins in Figure (1), and the Memphis Mint produced these coins, in addition to issuing some bronze coins bearing the image of Alexander.

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Figure (1) is a silver coin of Alexander the Great, a house mint Memphis representing Alexander in the form of Hercules wearing the scalp of the lion's face and on the other side Zios holding the scepter and carrying the eagle with the Egyptian lotus flower in front of him .

Alexander succeeded Ptolemy I, and has a major role in the development of currency, he is the first to make the Egyptians deal with metal currency instead of barter, he is the first to mint the coin in Egypt, "and varied gold and silver coins were minted during the reign of the king, whose image bears the figure of No. (2) and appeared another type of coins commemorating some former kings and many carry the ordinary silver coin on the face image of Ptolemy I, the founder of the family, and the name of Ptolemy, which carried all Kings of this family" (Nahed Abd al-Raziq, 1988, p. 47).

Figure (2) is a coin of Ptolemy I Octadrachma, with the king's head on its face, and on the back a warrior on top of a chariot pulled by four elephants

- **Commemorative currency in Egypt :**

A royal decree was issued by Law No. 178 of 1950 establishing the Egyptian Mint and was inaugurated with mid-1954, and the mint witnessed a growing production of Egyptian currencies and met all the needs of the state as well as the minting of some Arab countries' coins .

The Egyptian Mint, like other international mints, has issued commemorative coins to record historical events and national national occasions, as well as commemorate many leaders, leaders, scholars and prominent and influential figures in Egyptian society, "Initially, Egypt issued a set of commemorative coins negotiable, as the return did not represent a difference between cost and nominal value, but with the rise in the prices of precious metals, the value of the ore of the currency increased its nominal value. It became non-negotiable, which used to be minted from gold and silver, but without that of metals such as bronze, nickel and copper, it remained in circulation until the eighties" (Ministry of Finance, Cairo, p. 5).

The Council of Ministers approved the issuance of the first silver commemorative coin after the July 1952 revolution negotiable of the fifty piasters on the occasion of the evacuation of the English from Egypt on June 18, 1956 AD and the exit of the last English soldier from Egypt, "This date coincided with the proclamation of the Egyptian Republic and an inscription on the coin A girl in Pharaonic costume symbolizes Egypt has broken the chains and shackles holding her right hand The flame of freedom Figure No. (3), This coin was designed by the designer Abdel Fattah Wahba, and the coin weighs 28 grams of silver 900 carat and diameter 40 millimeters" ((https://ar.wikipedia.org)

Figure (3) The first silver commemorative coin after the July 1952 revolution negotiable in the denomination of fifty piasters on the occasion of the evacuation of the English occupation from Egypt on June 18, 1956

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- **The symbol and its technical implications in the design of the Egyptian commemorative coin :**

The Egyptian commemorative coins have passed with the beginning of the July revolution in the design of the currency to a qualitative change in symbolic connotations according to the new political vision of republican rule wishing for the independence of the country and the evacuation of foreign forces to form a new society that carries its societal characteristics according to the goals of the revolution, hence the new symbols developed in the design as symbols of industry, agriculture and sustainable development according to global plastic symbols used by designers worldwide, such as the gear symbol of industry, and wheat the symbol of goodness Agriculture and development, the dove is the symbol of peace, and other symbols that have become a tangible reality in the field of formation (Islam Abdul Hamid Zaki Diab, 2013, p. 5) Figure (4)

Figure (4) A group of commemorative coins after the 1952 revolution during the rule of Abdel Nasser, the emergence of symbols of industry and agriculture, and the implementation of mega projects

Figure (5) Commemorative coins representing the symbols of the agricultural renaissance

Figure (6) Commemorative coins representing the symbols of the industrial renaissance

Figure (7) Commemorative coins representing the symbol of the Egyptian lotus flower

Figure (8) Commemorative coins representing the symbols and forms of ancient Egyptian civilization

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- **History of ancient coins:**

In the primitive era, some goods of popular use performed the task of cash: animal skins, stone axes, dried fish, shells and pearls, and when the ways of civilization advanced, metals were preferred as a monetary commodity, so iron, bronze, copper, silver and gold were used. Metals were used, first of all, in the form of ingots and their weight and value were arranged on the occasion of each commercial transaction, and then the public authorities intervened and set the weights and standards and approved them with official marks. After this stage, plumbing turned into pieces We lead a process similar to the cash used today. (Ahmad 'Abd al-'Aziz al-Sharqawi, p. 40).

- **What is money:**

It is indisputable that "every independent and sovereign state is the one that creates its monetary units, i.e. its own currencies, determines its value, chooses names for it, and gives it its characteristics the advantage and the image in which it is issued." (Hossein Omar, 1965, p. 28)

Money can be functionally defined as "the power that enables its owner to obtain the goods and services of others". (Zakaria Nasr, 1965, p. 20) It can also be said that the greatest invention invented by man after writing is money, which has many forms such as (coins - paper money - bank money - credit card - electronic money). Coins will be briefly explained only because of their great importance in the current research.

- **Coins:**

Coins appeared after commodity money was deficient (Ahmad Abdul Aziz Al-Sharqawi, p. 45). To keep pace with the requirements of that era, as it began to be used initially in the form of ingots weighed in each process, and coins are those coins minted from metal such as gold, silver or bronze.

Coins have two forms: full coins, in which their value is equivalent to their legal value with their value as metal, and auxiliary coins (modern money), in which their legal value exceeds the value of the metal they contain, so that their cost is not higher than their value.

In fact, it is rare in today's world to find the first type of money with full material, as it was replaced by the second type, which is used in all countries of the world today, and therefore with the passage of time, the money of the second type becomes useless and has no material value and therefore has no metal value. (Zaki Mohamed Hassan, 1950, p. 16)

The coins have developed remarkably, as the materials varied and the methods of minting and formation varied as a result of the diversity of dimensions and design elements of texture, color and technology. "Precious metals such as gold and silver took the lead among ancient metals, followed by other metals such as iron, copper, zinc and tin." (Mohamed Zaki Shafi'i, 1962, p. 21)

- **Classification of coins:**

A- Coins in circulation: as they are "coined and sealed with a weight, caliber and known value determined by the government that ordered their issuance" (Saleh, 2002, p. 13), and their actual value is less than their nominal value such as silver, nickel and bronze coins, and these coins are used in transactions and daily circulation.

B- Non-negotiable commemorative coins: This type of commemorative coins is not negotiable, as the coins are minted for commemorative purposes only, and the state determines the official price for selling them to the public at much more expensive than their nominal value, which is money whose monetary value is equivalent to its metal value.

C- Commemorative coins in circulation: Commemorative coins in circulation are similar in description to commemorative coins that are not in circulation, except that the commemorative coins in circulation have a commercial value equal to the nominal value written on them.

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- **Anatomy of the coin:**

: The currency consists of:

1. **Currency face**: It is usually the upper side of the coin, which contains the subject and is often a symbol or personal image of one of the presidents or famous personalities or the registration subject as well as the date of issuance of the currency.

2. **Currency back :** It is the back of the coin, which contains the emblem of the state, the mint mark, the nominal value of the coin, and sometimes the date and issuance .

3.**Currency floor:** It is the flat area on which there is no design or engraving in the coin and can be considered the floor of the formation.

4- **Frame :** It is a part that surrounds the entire currency and is at a slightly higher level than the floor and protects the currency from repeated friction during the circulation process, and it is easy to collect coins on top of each other and their shapes and designs vary from one currency to another, but the goal of them is one and it is preferable not to take up a large space of the surrounding space around the formation.

5- **History**: It is one of the most important elements contained in the currency as a document of the year in which this currency was minted, which is the period of circulation.

6- **The edge** (the existing perimeter): It is what is sometimes called the third side of the coin, as it surrounds the coin in a circular manner from all sides and can be smooth or with specific writings or inscriptions and help in the process of preventing counterfeiting.

7- **The emblem of the state :** It is the slogan taken by the state and varies from one country to another, some write freedom or there is no god except Allah Mohamed the Messenger of Allah, and other slogans raised by each country according to its culture and sometimes its religion, and some countries are satisfied with writing the name of the head of state, king or republic, and thus conclude that the metal currency is the official means through which payment can be made for the value of goods or services, whatever the actual value of the currency, and the currency is made of different bullion of metals It is produced according to the size, weight, images and engraving (writing) determined by the decision-makers in the country or region, so the coin has special specifications, components and standards that make the designer of coins committed to them and must take them into account when developing the design.

One of the most important characteristics of the currency that distinguishes it from the medal is that it is implemented on the scale of low sculpture, any sculpture that does not rise above the surface of the coin much, for well-known reasons such as the regularity of stacking currencies on top of each other and the ease of circulation between dealers and their small size, as for the medal, the designer artist gave her freedom and unleashed her in design, and did not specify her limits, but made her take many steps in all directions, relying on freedom of thought And the opinion and expression of the subject, the occasion and the situation for which the medal is implemented, which made this accurate art has pauses with free formation that is not associated with temporary solutions, but rather exceeded to rely on the mental and intellectual ability in the design and implementation process, and because the medal takes a high-level position among people because it is a real and realistic guide to honor, appreciation and homage to the distinguished who have done useful work in the lives of peoples and societies and this made it a valuable art Impressive and high.

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- **The medal bears the characteristics of bas-relief:**

And because the medal is implemented in a prominent and sunken sculpture method, it carries the characteristics of the relief sculpture and the different methods of implementation with various materials, the rise or decrease in the relief sculpture represents the height of the relief sculpture on the surface of the medal and within the framework designated for this purpose , the medal is more symbolic and a brief expression of the subject with the use of some phrases that confirm the meaning and symbolize it, and also the use of numbers to indicate the year of manufacture and the occasion for which the medal was implemented and one of the characteristics of the relief sculpture is that the forms that It is implemented to show as many pictures of people or other auxiliary images as possible such as birds, animals, trees, and the following elements of the subject of relief sculpture, as well as in the design of the medal is taken into account that the constituent elements of the subject of the medal are formed easily and easily, during the implementation on the surface of the medal is not adhered to the rise or fall of the relief sculpture, and the opposite is done during the implementation of the relief sculpture on the surface of the coin, and the most appropriate way to follow is the method used in the implementation of Ancient Egyptian bas-relief sculpture on the walls of temples, prayers, obelisks, scarabs and utensils, they are very suitable for the implementation on the surface of the medal and the coin, it is done by removal around the outer lines of the shape or design and reaches the gradation of the removal of the original surface level and real removal inside the shape can be easily and accurately unloaded levels and put touches and clarify the required details, and this method is closer to the reality in seeing light projections on the shape and diversifying the intensity of shadows by distributing shadow and light on the coin and medal surfaces (El-Shazly Abdel Allah El-Sayed, 2005, p. 473)

- **Elements of sculptural formation and its relationship to the art of medallion:**

1. **Calligraphy:** What is meant by the line in the sculptural formation of the medal is the limit of the confluence of the different levels above the surface and therefore the line does not exist by itself, and the line in the art of the medal has a role in the design construction of the medal All lines on the surface of the medal must be subject to an integrated structural law.

2. **Surface :** What is meant by the surface in the medal is that space formed by the outer boundary and how the artist treats it in terms of the heights of the shapes and levels through which he performs his artwork and the relationship of those levels to the rhythms of light that confirm him.

3. **Mass and void:** The art of the medal in particular belongs to the art of prominent sculpture and to the art of stereoscopic sculpture in general, so we find in the works of modern art the art of the medal is evolving at the hands of contemporary medal artists to become an art that achieves the mass and the actual space, as we find in a medal for the English artist Jones Elizabeth, a medal for the exhibition of late photography, sculpture and engraving artists, so the medal achieves the actual void.

4. **Texture :** It is the addition of effects to the work surface ranging from gravity to roughness and can be confirmed by color oxidation and thus contributes to the texture in achieving the mutual relationship between the nature of the material and the extent of its acceptance of light and shade, and is also used to give the sculptural work a certain visual effect that corresponds to the intellectual and emotional content sought by the artist and the texture in the medal constitutes an artistic value associated with the plastic practice itself.
5. **The outer limit of the medal between the geometric shape and the free:** The first forms of the coin were variable and different, and the circular shape continued in the Greek, Roman, Byzantine and Islamic coins, and from this circular shape, the medals that emerged from these civilizations derived their first forms, as the medal and the currency participated in various artistic and technical methods since ancient times, but the medal retained its independent personality.

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6. **Writing as a plastic element in the medal**: The formation on the surface of the medal represents one indivisible unit and there should be no separation between art forms and forms of writing, they together represent an integral whole is the composition in the medal, and one of the most important medals that depend in their design on the compatibility between forms and writings is New Year's medals. (Samir Shoshan, 2003, p. 27)

- **Production of metal clones with molding technique:**

Most of the products produced every day around the world through mechanical forming processes use only about 20% in the foundry operations directly and these products are formed in the form of metal plates produced through the hardening of alloys and the final product depends a lot and strongly on the quality of the cast metal.

- **Definition of plumbing:**

Casting (plumbing) of metals is meant as a method of forming materials, especially casting metals by melting metal or alloy and converting it from its rigid state to liquid and pouring it into the cavity of a mold in the required form so that the molten is formed in the form of a mold cavity depending on the fact that the liquids are formed in the form of the vacuum that contains them and then leave the mold to freeze by cooling its content and then the cast comes out of the mold. (Ahmed Salem Al-Sabbagh, 2012, p. 35), Metal casting is one of the basic plastic techniques used by ancient civilizations and moved to us through a series of artworks such as antiques, utensils and jewelry that abound in the world's museums, and religious belief was the main factor and the main engine for human creativity through ancient civilizations and because of that metals were used in the production of what he needs from the requirements of his life, Fayman of the ancient Egyptian man with an immortal life after death is a leg to use metals in the work of jewelry and some Other daily tools that were buried with the deceased to be used in the life of death, so the ancient Egyptians excelled in the casting technique and have dealt with the method of beeswax, so plumbing has become the most important method in the production of metals at all and is used today in industry and plastic arts, it has been active interest in that search for mentioning some types of plumbing techniques and how to take advantage of the possibilities of casting in the field of research.

- **Required properties in plumbing:**

The metal alloys used for the production of castings must have certain technological properties and be given castings with certain mechanical properties and the most important qualities that characterize the alloys are:

A. Fluidity: It is the ability of the metal to fill the plumbing mold well The process of metal flow The fluidity of the metal depends not only on its chemical composition, but also on the temperature of the casting (John A. Schey, 2000, p 190)

B Shrinkage, which is the property of shrinkage of the longitudinal and volumetric scales of metals and alloys when frozen and cooled, and expresses the longitudinal shrinkage by the percentage of length of the cold casting. (Mohamed early Mustafa, 2010, p. 134)

c. Surface effects: "When the metal melts it must flow through small channels (typically, below 5 mm), so the surface tension becomes large and the high surface tension makes it impossible to fill the sharp corners and when exposed to the atmosphere, many molten surfaces are quickly coated with a layer of oxide and naturally this layer of oxide greatly affects the performance of the plumbing process. (John A. Schey, 2000, p 191)

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D. Isolation: Isolation occurs when the outer part of the alloy freezes faster than its center, which cools slowly, so the center is richer in atoms and impurities than the outer part that froze first, and isolation depends largely on the nature of the alloy and plumbing technology, and the greater the range between the two degrees of crystallization, the greater the risk of isolation. (Mohamed early Mustafa, 2010, p. 315)

- Casting processes:

A. Plumbing in permanent molds is suitable for many times used in mass production.

B. Plumbing in a semi-permanent mold, i.e. used for a limited number of estuaries and then demolished and not recycled.

C Plumbing in consumable molds, i.e. used for one time and re-demolished.

Types of plumbing:

- **Sand plumbing:**

It is a casting or casting of metals in molds container on sand represents the body or shape of the piece to be founded, and it is one of the oldest plumbing methods and the most used and the most important of all and this method is used to produce most of the castings almost and in sizes ranging from a few grams to hundreds of tons, and this method is used when it is required to produce a certain number of repeated castings or one piece complex shape or large size, but in the case of cases it is necessary to prepare a new mold For each piece it is required to be cast and this process is to pour the molten metal into the vacuum of the mold and leave to fill the void.

- Sand plumbing steps:

1- sand.
2- model.
3- pulp.
4- metals.

1- Plumbing sands:

Casting sand represents the main element in the plumbing process, but it is the sand mold that contains the space formed for the desired purpose, and therefore certain characteristics must be available in the sand to be suitable for use as plumbing sand, **and the most important of these characteristics are:**

- The property of cohesion and shape retention.
- Permeability property, which is intended to enforce gases when casting molten metal into the mold.
- Heat melting resistance property.

The most important source of casting sand is river basins and shores and the sand consists mainly of granules irregular silica (silicon dioxide) linked to each other by clay and water and the size of the grains ranges from 3339-33 micro.

The sand used in plumbing can be generally divided into:

A -wet sand: It contains a high percentage of silt and water vapor, which is used in the vast majority of sand molds and is suitable for casting cast iron, aluminum and copper, and this type is characterized by ease of processing the sand mold and low cost, but the mold is easy to crush, especially when transported, and the mold cannot be stored after working for a long time.

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B -dry sand: It consists mainly of silica grains linked to each other by colloidal materials or cement and sometimes some oils are used for this linkage and usually dried this sand with heat after forming the mold and is mainly used in the work of the pulp and also used to make molds for casting cast steel, and this type of sand is characterized by being very coherent and does not break easily with the transfer of the mold and can store its molds for a long time, but it is more difficult to form and more expensive than wet sand.

- **Testing the properties of casting sands:**

Before using sand in plumbing, several tests must be conducted on it to ensure its suitability for this purpose, and to know the quantitative value of each of its properties, the tests performed on plumbing sand to determine the cohesion of the sand and the permeability of gases can be divided into the following tests:

- Humidity test: This test is conducted for the purpose of knowing the percentage of moisture in wet sand (wet) and there are several ways to conduct this test, including:
  - A- Drying method
  - B- Chemical reaction method
  - C- Electrical method
  - Clay Percentage, Granule Size and Distribution Test
  - Resistance Test
  - Sand Permeability Test

2- Models:

Models are made in forms similar to the required product and by which voids can be made inside the sand and models may be made of wood or metals or plaster or plastics and depends on the type chosen from the material models on the design of the foundry and the number of castings to be produced and production methods and usually wood is used in the models used to produce small numbers of castings and when it requires the work of a large number of castings, this justifies the use of equipment models elaborately made because of its impact on increasing the efficiency of production and models Metal in this case meets the purpose in terms of cost and quality in production and cast iron, brass and aluminum are used to make these models using a main wooden model "https://ar.wikipedia.org/wiki))

- **Models Styles :**

Model styles can be divided in terms of shape and product size.

A - models of one piece form (9 - a) B - slotted models as in the form of (9 - b)

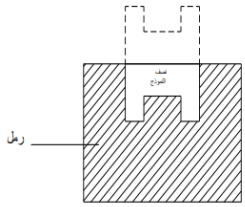

Figure (9-b)

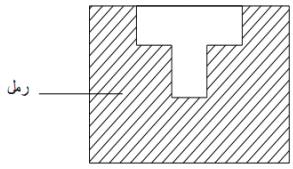

Figure (9-a)

- **Precautions to be taken into account when making models:**

When making wooden models, the ease of use of the model must be taken into account, including the ease of removing it from the sand mold after its work, as well as the accuracy of the dimensions of the required foundry, and to ensure this, the model maker must take into account some basic considerations, the most important of which are:

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A- Negative:

For easy withdrawal of the model outside the sand mold, the models must be made so that their surfaces parallel to the withdrawal of the model are of light robbery and the amount of the negative ranges from 1/4 to 1 degree, depending on the method of formation and the design of the cast.

B- Allow shrinkage:

When the molten metal is poured into the sand mold, it fills its void, but it shrinks when it cools, so the dimensions of the foundry become smaller than the dimensions of the sand mold by the amount of this shrinkage, and to obtain the required dimensions of the casting, the mold must be made taking into account the amount of shrinkage.

C. Operating Permit (Termination):

Castings need after being taken out of the sand mold to finish the refinement of the shape of the resulting surfaces and give them the smoothness and freedom of impurities required and this is done by removing a certain layer from the surface of the casting with different operations and the thickness of this removed layer depends on:

- Mode of operation
- Metal qualities
- Size and shape of the foundry
- Casting method

3-- For the door:

The word pulp usually expresses a pre-formed block of sand placed inside the vacuum of the sand mold to help form the foundry so that it contains a required internal space and in this case the model used is provided with appendages called pulp substrates that prepare a place in the mold on which the pulp can rest.

- **Pulp patterns**

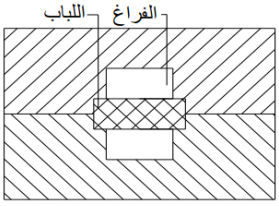
The pulp can be divided in terms of the quality of the sand used in its manufacture into:

1- Green sand pulp This is made of green soft sand with relatively low resistance. 2- Dry sand pulp made of sand added to it special binder materials give the pulp high resistance. The pulp can also be divided in terms of its description within the mold into:

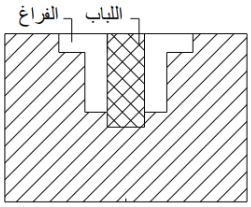
Horizontal door shape (10-A)

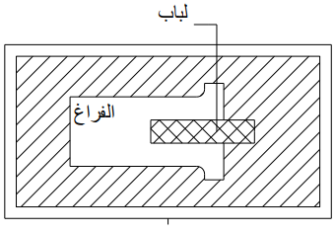
Vertical Pulp (10-B)

Cantilever pulp shape (10-C)



Horizontal door shape (10-C)





Usually the pulp is placed inside special boxes called pulp boxes made of wood or metal and the box is designed so that it is easy to take out the pulp from it and the pulp is manufactured manually or using special machines, and is used to make the pulp a mixture of sand and binder materials such as sand oils and pine gum and roast the pulp after manufacturing it in roasting ovens for several hours to dry and store it after that until it is used.

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- **The most important processes for the formation of sand mold for castings:**

- Preparation of plumbing sand (mixture).
- Prepare the wooden or metal model and then divided into two symmetrical halves and be completely solid and do not contain cavities even in the cylindrical shape and for ease of installation of the halves digs in one of the surfaces one of the halves holes and in the other side regions and protrusions settle in these holes.
- Half of the model containing the holes is placed upside down on the wooden prank board and the lower half of the dump box is placed around it.
- Comes with pre-prepared sand and placed around half of the model in the box of pranks and your hand Balmadak light Dhaka around half of the model

Usually, the newly prepared sand, which was not previously used, is used around the model directly and is called (confrontation sand) in order to reproduce all the details of the model such as (symbols, logos, writings) and then put the rest of the sand, which is called (filler sand) and then your hand is a light Dhaka . After the box is filled with sand, its surface is leveled and excess sand is removed with a leveling ruler.

- After that, turn half of the model upside down with the pranks board and raise the first wooden panel, then clean the surface of the second model and then sprinkle it with charcoal powder or a quantity of fine sand in order to prevent it from sticking to the upper half of the mold, then the second half of the model is placed so that the first half applies to it by installing a semi-cylindrical wooden column and another conical shape open from the top and these columns are called the feeding hole or elevator and then your hand sand as we did previously .

Separate the two halves of the box from each other by lifting the upper half and turning it on the wooden prank board after pulling the two wooden columns, then separating the half of the model from the half of the mold very carefully without deforming the mold, then digging a stream between the lower end of the casting channel and the space formed by the model. **(** https://ar.wikipedia.org/wiki**))**

3- Metals used in minting:

The coin is usually made of ingots (gold and silver), (silver and copper), (nickel and copper), (bronze and copper), (aluminum and copper), (copper and tin) and added to it in modern times zinc and nickel mix the last three in certain proportions 79% red copper 1%, nickel 2%, zinc, so we get a bronze alloy from which money is minted for the internal circulation of the state. (Bahij Skaik, 2008, p. 86)

The coin is less expensive than paper currency if compared to the life span of the currency, the life of the paper currency ranges from six months to three years, while the coin has a life span ranging from ten to twenty years, meaning that the consumption of one coin corresponds to the consumption of between 7 to 40 paper currencies. (Jamal al-Kurdi, 2007, p. 29)

- **Metal smelting for plumbing:**
- **Casting Furnaces:**

The process of smelting metals is known as the process of converting them from a solid state to a liquid state by heat and the plumbing process depends on the ability of the metal to flow in the liquid state and there are several ways to melt metals, each of which needs equipment (special furnaces) and depends on the method of smelting and therefore the equipment required on the deification factors:

- The temperature required for smelting the required metal or alloy.
- Costs of establishing and operating smelting equipment.
- The amount of molten metal required at each time.

The most important melting furnaces are:

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1 - Rast oven
2 - Hazka furnace

- Centrifugal Casting Centrifugal Plumbing:

Centrifugal castings are characterized by their homogeneity, free of impurities and bubbles, and the regularity of their thickness, moreover, characterized by high density, fine granule composition, good mechanical properties and high productivity, and the cast is able to capture the smallest details and the rotation speed can be controlled according to the size of the cylinder, the relative degree of complexity of the model and the type of metal used. (Mohamed Salah al-Din Abbas Ibrahim Musa, 2008, p. 248)

The centrifugal casting method is used to produce pipes with large diameters in this case is not considered suitable from an economic point of view, and for this I invented the continuous casting method, which is considered in this regard more fulfilling the purpose as well as used in the production of rectangular castings in which the metal is poured through a vertical passage and cools quickly without interruption, if the casting freezes, it is fed and it is still hot to the point of redness, and the parts produced in this way are characterized by its high mechanical resistance and can obtain thin castings, and from Then the metal used in casting can be economized.

This method is used in the production of relatively simple shapes, which are usually cylindrical, or of symmetrical shape, or semi-symmetrical axis , and it uses molds for casting rotates at a certain speed around its axis and expels the molten metal to the outside to adhere to the wall of the mold under the influence of centrifugal forces

- **Vacuum plumbing:**

Fine sand is mixed with urethane foam poured onto metal forming molds and treated with amino vapor. Then the mold is attached to the robot arm and then the placed mold is submerged inversely compared to the normal casting method partially in the molten metal in the induction furnace) The metal may be melted in air or in vacuum (CLV Process)

The vacuum reduces the air pressure inside the die to about two-thirds of the atmospheric pressure and pulls the molten metal into the mold cavities through the lower gate of the mold. The molten metal in the furnace is usually at a temperature of 55 degrees Celsius above the melting point of the liquid. Thus, the metal begins to freeze within a fraction of a second and after filling the mold is drawn from the molten metal.

- **Plumbing models by evaporation) Missing foam: (**

" In the evaporative casting process uses models of polystyrene (missing foam) that evaporates upon contact with molten metal to form a molding cavity. As this process is known under its trade name (mold process) it was officially known as the expanded polystyrene process and became one of the most important casting process for ferrous and non-ferrous metals, especially for the automated industries in modifying the evaporation model process where polystyrene models are surrounded by a ceramic shell (CS Replicast process). Forms are burned when molten metal is filled into the mold. The main advantage of this process over precision plumbing processes (with its wax models) is that the presence of carbon in the metal is avoided (Serope Kalpakjian, Steven R. Schmid, 2003, P 224).

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- **Plumbing with lost wax**:

Plumbing with lost wax is one of the most accurate plumbing methods, through which metals (gold, silver, copper) are formed, and at the beginning of this process, the artist begins to develop a design for the piece and then carves the design on wax and this piece can be made of other materials such as clay or even metal, and this process is known in the industrial field as micro-plumbing and depends on special patterns in the formation, There are a number of names for this method, such as wax casting, precision plumbing or molten model plumbing, and this method is used in the quantitative production of castings, and in this way castings can be obtained with a high degree of surface quality in terms of smoothness and finishing without using any mechanical operation after that. (Mohamed Salah al-Din Abbas, 2008, p. 292)

- **Plumbing in sucker molds:**

A mold is formed from prominent and sunken clay and is well finished, then pouring plaster on the mold with a large thickness so as not to be exposed to breakage during pouring and left to dry completely from the water, after that the metal is poured and then the piece of molten metal is finished, and this method is one of the simplified methods in the work of the mold, through which expressive dimensions are achieved in the human face, after obtaining the metal cast, the surface will be treated with several different techniques such as bending, knocking, cutting, addition and raw materials Metallic such as red copper, yellow and aluminum and the connection process is done in many ways and must pay attention to cheap and fast melting raw materials and easy to obtain from them on technical castings such as tin metal melts at 230 degrees, lead melts at 330 degrees zinc melts at 450 degrees, 412 nitmony melts at 450 degrees.

- **Production method with semi-permanent casting molds:**

In this method, the casting mold is formed in a semi-permanent building for the purpose of casting it many times, and this method is similar to the casting process in the permanent molds used in the production of castings now, but the difference between them is due to the material for forming the molds, while we find permanent molds made of cast iron or steel and sometimes of bronze, we find semi-permanent molds were formed in clay, and this method was invented by some German medalists in the Renaissance to produce their medals and coins, so they tended to dig Their designs are in a solid material such as wood or plaster... etc) and then take negative copies (reverse design) of this template by pressing a piece of clay material on the prominent formation of the mold printed in this piece design medal by placing the reverse and then burned until it turns into solid material (pottery) and used as a mold for casting and in the case of the production of large numbers of medals or coins produces from the prominent mold a large number of inverted molds and collects a number of them after burning in a control portfolio with the work of corridors between each mold and another so that take these The corridors form a tree-like shape or rosary, and then the metal casting process is carried out, a method that is still used today in the Far East. (Hasan Abd al-Rahman, 1949, p. 50)

- **Method of plumbing in the style of payment from the back:**

The method of payment from the back can be used in the work of medals, and the medal formed in this method is a stereoscopic shape consisting of two halves and each of the halves formed separately and this method is on the approach of the method of casting by pressure and is still used in modern times, and metal foil can be formed by the method of payment from the back, but it differs from medals in that it is formed first for a decorative purpose and not a memorial, which is usually from one face and the most widespread rectangular shape resembles a medal. (Hassan Abd al-Rahman, 1949, p. 55)

- Minting method :

The minting is one of the processes of cold metal formation, and the minting is summarized in the formation of a cavity and protrusions on the surface of the preparatory block by another metal (Astamba) with more hardness than the metal required to be minted and was done in two ways ways and pressure,

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which is very similar to the effect of seals on wax by means of pressure and this process is intended to give a final shape to a piece of metal as this piece of metal is pressed between two surfaces formed in the mold and is formed in the form of a cavity surface mold, and this method was followed abundantly in Production of coins and medals in ancient times in the Greek, Roman and Renaissance (Fathi Mahmoud Tawfik, 1971, p. 21)

- **Castings cleaning:**

Castings come out after freezing from the sand mold by cleaning operations for the mold and the casting in this case consists of the form to be produced adhered to it unwanted appendages, which are the estuaries and sewers necessary for the casting process as well as the surface of the castings is not suitable for direct use because of its roughness and the adhesion of some of the burned sand and on that the castings must go through a cleaning process so that they can be used for the required purposes and the cleaning operations vary according to the purpose for which the foundry is used and usually precedes the operations Cleaning This is the process of removing estuaries and sewers and these are usually broken in gray cast iron castings with a light or heavy hammer, although some estuaries may break from steel castings in this way, but there are other methods usually used such as cutting or sawing with a metal cutting saw as well as spreading the estuaries of non-ferrous metal castings and loose sand is removed by hitting the castings with a light or heavy hammer.

- **Castings Inspection:**

Castings are examined during and after the cleaning process in order to know the parts with defects and the degree of defect in them, so that castings with defects can be excluded from production lines, saving time and effort, and the inspection processes can be divided into two types:

1- Destructive test: by taking samples from castings to analyze their substance chemically or conducting tests of mechanical properties on them.

2- Non-destructive examination: by examining all castings or samples of them without destroying them, and there are several ways to conduct this examination, including:

- Visual inspection
- Examination to estimate dimensions
- Sound and method examination
-Ultrasonic oscilloscope
- Pressure examination
- Inspection with ports
-Magnetic wave examination
- X-ray examination

- **Advantages and disadvantages of productive castings**
  - **Advantages of castings:**

1. The plumbing process can be used to produce complex shapes that contain many details or thin castings.
2. The sand casting process can be used to produce relatively large shapes.
3. The plumbing process can be used on any metal, i.e. it can be heated to the melting point and then benefit from the plumbing process in its production.
4. The plumbing process is suitable for producing in relatively reasonable quantities.
5. The possibility of controlling the maqamat of the casting to some extent.
6. The perfect casting can be obtained after surface finishes of the foundry.

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- Disadvantages of castings:

Castings containing visible or invisible defects are considered an undesirable product and the presence of these defects is not allowed when using and the defects vary in terms of size, shape and damage caused to the pieces and there are repairable defects and irreparable defects.

(https://www.academia.edu)

Among the most important disadvantages of castings:

1- Lack of metal or incompleteness
2- Cracks
3- Casting ripples
4- Gas bubbles
5 - Freeze gaps (shrinkage gaps)
6 - slag lobes
7- sand lobes

The following table shows the defects of sand castings, the causes of their occurrence and the method of treatment of each of them :

	taint	The cause of the defect	Treatment
1	Bubble holes (Bubbles)	The use of sand with low permeability grade sand Its humidity is high or lack venting for the mold	Use sand with lower humidity and Higher In permeability with the action of air jets in the mold
2	Sand gaps	Use a poorly compacted template (Loose sand)	Increase sand tamping and use fine sand Face
3	Lifting and shifting	Movement of the upper half of the mold to the top as a result Putting weights on it and the movement of the mold as a result of its poor anchor	Hold the mold well with weights place on top of it And fix the massage in place well
4	Peels	Combustion of sand adherent to metal as a result of the use of Suitable sand	Using inappropriate sand
5	Cold closures	Molten metal goes in opposite directions Their meeting with the metal relatively cold due to Poor design of the sand mold or the length of the distance Driven by metal	Redesign of the template taking into account that The metal travels short distances inside The different wers in the mold
6	Shrink cracks	Wrong foundry design results in design improvement concentration of met in certain places or presence of pillars Sharp	

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- **Craft projects and their link to tourism and heritage**

- The importance of craft industries:

The craft industries are of great importance, whether in preserving the cultural and historical heritage or the economic aspect, and the state's interest in young graduates and encouraging the establishment of small projects is one of its top priorities at the present time, and determining the priorities of future plans and programs, festivals and some training activities constitute a basic base for the advancement of the craft industry, reviving the economic movement, improving the standard of living of young graduates and creating job opportunities for them through training them on handicrafts in centers and institutions teaching crafts and applied arts. Craft industries with tourism are closely related as the tourist requirement is a key and important factor in activating crafts as the tourist benefits through his dealings with the centers of production of handicrafts to identify the cultural and social situation of society and transfer it to his country and through that the tourism movement increases and the return on the homeland increases in improving the economic situation and advancing it to the required levels.

- Craft products and identity preservation:

The identity is the nature, origin and place of birth surrounding its inhabitants, which earns the bearer features of that place and its geographical and climatic gains, and from them breeds an existing civilization from the product of this place be based on the requirements imposed by its environment and nature and linked to each other in a reciprocal relationship interconnected with each other between the benefit and the emergence of religious tendency followed by the existence of a production process consisting of civilized vocabulary linked to the character of this place and from all these highlights the personality of nations with its components and successive cultural and religious variables And humanity becomes an old heritage, which is the basis that consists of the personality of nations.", and the preservation of historical and archaeological identity is essential for the development of craft industries, especially as we live in the era of development and progress, as some craftsmen seek to develop craft manufactures, which loses their aesthetic, archaeological and historical splendor, and they can introduce some aesthetic touches such as inscriptions and decorations, which increases their artistic and aesthetic value, so it is necessary to educate craftsmen about these matters and find courses and training programs for young people, and this is the competence of the authorities with The relationship, including technical colleges, as these courses contribute to ensuring the continuity and development of craft work, and these courses and training programs will maintain its survival instead of its extinction. (Aref Shamma, 2008, p. 14)

The importance of craft industries, especially in developed countries, lies in the fact that some tend to protect the product and privacy, which adds value to the consumer by his uniqueness in those products or handicrafts, as their prices exceed the prices of products manufactured by modern machinery, and there are groups in society that tend to environmentally friendly products, all these factors combined positively affect the importance of craft industries economically, which pushes to practice them and benefit from their characteristics.

The employment of traditional crafts creates new tourist patterns and the establishment of tourist souvenirs that meet the need of these patterns need tools and professionals who can be a key factor in establishing this style and encouraging its establishment, for example: Sculptural souvenirs can achieve a distinctive boom in the tourism movement, which has great importance in increasing tourism income, and the development of many traditional industries attached to it, such as the sand metal casting industry, a crafts that technicians are good at, in addition to many Of other job

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opportunities, which combines the cultural characteristics and creative artistic values of the community, it is worth noting that statistics indicate that the number of workshops that manufacture tourist goods reaches more than 17 thousand workshops employing 150 thousand workers, which calls for the need for the state to pay attention to this activity by providing and granting important facilities provided to craftsmen, in meeting the necessities that enable them to develop themselves, their crafts, maintain and preserve their artisanal heritage and encourage craftsmen and that By acquiring vocabulary from their products that have many benefits (Majed Mohamed Fahmy Negm, 2010.)

- Tourist souvenirs: -

Tourist souvenir is small works and artistic products that the tourist buys to express the country or place that he visited and carries with him to his country to gift it to his friends and relatives or to keep it throughout the days, and the tourist souvenir carries with it what expresses the countries that produced it and reflects its culture or heritage and its popular and aesthetic symbols that distinguished it from other countries of the world, and the distinctive popular raw materials of these countries are used in its manufacture and expressed by folk makers and artists in an aesthetic and artistic expression that makes Among them are worthy artifacts, and these gifts are sold at varying prices and are affordable for all different categories of tourists. (Suniya Khamis Sobhi, p. 77)

Souvenirs are a means of perennial propaganda that gives a great impact for a long time, so they are considered a silent ambassador and are the best ambassador if they are carried out with a degree of quality and proficiency (Sahar Ahmed Massad ElBaradei, p. 112.)

Tourism propaganda of all kinds is the first pillar to stimulate the tourist movement, as for tourism products such as gifts, antiques and tourist souvenirs, tourist countries pay great attention to them, as the tourist souvenir expresses the country's civilization on the one hand and is one of the means to increase the state's sources of foreign currency income on the other hand. Tourist and memorial sculpture is one of the areas of productive creativity in the art of ceramics as multiple artifacts of various shapes and sizes, based in their design and surface treatment on the cultural and civilizational heritage of the country, to emphasize Its identity on the one hand, and derives its uniqueness and distinctiveness on the other hand, and this is an important element of attractiveness that helps in its ease of marketing. (Taha Yusuf Taha, 2006, p. 18)

Second: Applied Framework:

The practical applied aspect includes a sample of students of the third level of the Faculty of Specific Education, Department of Art Education, Alexandria University, in light of the results reached by the researcher during the theoretical framework of the research study, which aims to shed light on metal casting techniques that can be reproduced by sculptural models to obtain plastic solutions in the field of relief sculpture as tourist souvenirs.

The researcher found in the use of coins an essential element in the formation of some experimental practices using many manual techniques of prominent sculpture and metal casting technique in line with the thought and philosophy of art education, which calls for the importance of manual formation, handicrafts compete with automated manufactures because they are characterized by creativity and art, so that they have become competitive with modern manufactures from several aspects, the most important aspects of workmanship, and the thought and foundations of these works are based on plastic and aesthetic in plastic formulations characterized by aesthetic values. The experiment is being done Research on third-level students in the Department of Art Education, Faculty of Specific Education, Alexandria University, in order to encourage and motivate young graduates to establish small projects.

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Objectives of the experiment:

The applied side of the research aims to achieve the following:

1. Training students on the practical system to benefit from the heritage environment to make small projects for sculptural tourism products.
2. Studying some contemporary plastic solutions for a manual sculptural tourism product.
3. Revealing the plastic potential of coins and medals among third-level students in the Department of Art Education

The importance of the experience:

1. Studying the methods of implementing metal clones by forming by plumbing.
2. Directing and preparing skills to accommodate manual methods of plumbing and benefit from them in the production of models of tourist commemorative coins.

Limitations of the experiment:

The researcher applies a practical experiment to the students, in which he deals with the results of the analytical study of commemorative coins models based on the style of relief sculpture and resulting from the theoretical framework for research in the implementation of metal sculptural clones enlarged as tourist souvenir models implemented by the students of the third level of the Faculty of Specific Education, Department of Art Education, Alexandria University, and the number of 55 students by work for each student and work to form a sculpture on a gypsum mold that was implemented and reproduced with metal material implemented in the style of sand plumbing and the technique of relief sculpture (relief).

Timeline of the experiment:

- The researcher designed his experiment to be applied over a month and a half in the form of a study unit consisting of six lessons, i.e. six interviews, one interview per week and a duration of four hours.
- The experiment in the application of the work takes six interviews, during which a commemorative sculptural work is produced magnified for the currency circulating in the markets, implemented with the technique of bas-relief sculpture and sand plumbing style, by a work for each student in an area of 25 cm ×25 cm.
- The experiment takes place in the first and second half months of the first semester of the academic year 2023-2024 to benefit from the accumulation of cognitive and skill experiences in achieving the results of the experiment.
- The experiment takes place in the classroom designated for teaching the third-level curriculum of the selected division as a sample for research, as the place is appropriately prepared in terms of the availability of lighting, tables and seats.
- The metal casting stage is carried out in Alexandria City Beautification Center.

Plastic limits of experience:

- The experiment is carried out using gypsum material and carving it in the direct sculpture method as a methodological basis in the study of the third level, then the mold is converted into a bronze or aluminum metal version in the style of sand plumbing, then the stages of finishing, polishing and polishing the surface are completed.
- The practical application is based on the use of techniques (drilling and removal of gypsum - metal casting (sand casting).

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Place preparation:

- The researcher conducted his experiment in a laboratory equipped with the necessary capabilities for direct formation on gypsum and it is possible to be available in the halls and laboratories of stereoscopic expression at the Faculty of Specific Education and the stage of metal casting is carried out in the Alexandria Center for beautification of the city.

Tools used in forming:

- The researcher used simple hand tools, namely direct drill rudders.
- Hand saw for cutting in a flat manner to implement the required design and with a leg with a round shape to determine the areas of circles.
- The researcher used tools represented in the rocket cutting device and the metal saw to remove outfalls and appendages.
- Haddadi files of different sizes to level the dents from the impact of casting.
- Sanding to polish countertops.

Experience:

Theme: Making a sculptural formation as a tourist souvenir with direct formation techniques on gypsum (relief) and reproducing it in the style of sand plumbing.

View the topic of the experiment:

The current research is concerned with the study of plumbing, which is one of the most important and oldest manufacturing processes, in which the material to be cast is melted into the mold until it reaches a certain temperature and then the molten metal is poured into the mold and this mold represents the shape of the desired product.

Then we got acquainted with the elements of the plumbing process, which is sand, and we explained its characteristics and the features of the sand used, as well as the test of casting sands, then we talked about the models and their patterns and the precautions that must be available when making models, different pores, pulp and patterns, then we talked about the necessary processes for the formation of the sand mold, then we touched on the smelting of metals for plumbing, melting furnaces and cleaning castings, all in order to reach an examination of castings through which we can identify the defects of castings and how to avoid them or at least reduce them to Minimum Then we learned about the advantages of sand plumbing operations, and from here the researcher began to present and present to the sample of the experiment that the sculptural work is carried out in the style of medium protruding sculpture, as the height of the prominent sculpture in the work does not exceed 1 cm, due to the relationship of the emergence of the sculpture to the area on which the work is executed, which ranges between 25× 25 cm with a circular frame according to the implemented design.

After the presentation and explanation provided by the researcher, however, it remained an open dialogue throughout the period and time of the experiment between the students and the researcher through which they address some obstacles such as the problems they encounter in the practical and executive procedures of sculptural formations and methods of casting .

- **Characteristics and features that distinguish tourist sculptural souvenirs**

Sculptural souvenir tourism products must have some characteristics and features, the most important of which are:

- To express the historical heritage of coins and their distinctive characteristics.
- Be of the right size and be rigid to make it easier to carry.
- Its price should be appropriate.
- To be characterized by the quality of implementation and finishing.

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- Good design reconciles aesthetic values with functionality.

- Innovative, distinctive and attractive in terms of colors and packaging.
- Diverse in forms and functions.

Technical specifications for the search experience Tourist souvenir coins for the third level to achieve the details and plastic features:

- The formation should be linked to technical standards and the principles of plastic, aesthetic and structural values.
- The technical, engineering and plastic details should be accurate and quality.
- To perform the function for which it was carried out efficiently (a memorial tourist sculpture).
- The ratio and proportion between the details of the formation should be consistent and balanced.
- The study of the details of the plastic should be interrelated (writing and memorial history, drawing and emoji, decorations and floor touches, the general form form) and be linked to assets that have a natural scientific or anatomical significance.
- To be valuable, expressive, sophisticated and luxurious, and have a rewarding economic return.
- To be finished, refined details, lined and directed at a good skill level.

The researcher reviews the most important artistic experiments carried out by the sample of the experiment and through these works the researcher shows the multiple methods of formation of bas-relief sculpture in addition to identifying the means of safety that are followed during the implementation of experiments and what is the educational benefit of each experiment so that it can be used in the field of stereoscopic formation.

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Research Experience
For students of the third level - Department of Art Education, Faculty of Specific Education - Alexandria University.

- Below will be presented and analyzed some of the students' work as a result of the research experience to find out some of the plastic and aesthetic artistic values achieved by the proposed educational unit for research

Models for direct sculpture on gypsum shapes (12-31)

Figure (12)

Figure (13)

Figure (14)

Figure (15)

Figure (16)

Figure (17)

Figure (18)

Figure (19)

Figure (20)

Figure (21)

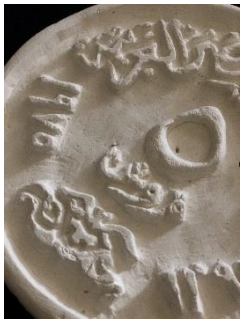

Figure (22)

Figure (23)

Figure (24)

Figure (25)

Figure (26)

Figure (27)

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Figure (28) **Figure (29)** **Figure (30)** **Figure (31)**

Models of some coins after the stage of metal plumbing shapes from (32 - 56)

First work: Figure (32) – Material: Bronze





Different viewing angles for the fourth action **Back of the currency** **Coin face**





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Second work: Figure (33) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

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Third work: Figure (34) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Fourth work: Figure (35) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Fifth work: Figure (36) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Sixth work: Figure (37) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

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Seventh work: Figure (38) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Eighth work: Figure (39) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Ninth work: Figure (40) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work X: Figure (41) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

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Eleventh work: Figure (42) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Twelfth work : Figure (43) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Thirteenth work : Figure (44) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Fourteenth work: Figure (45) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

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Fifteenth work: Figure (46) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work Sixteen: Figure (47) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Seventeenth work: Figure (48) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work Eighteen: Figure (49) – Material: Aluminum

Different viewing angles for the fourth action **Back of the currency** **Coin face**

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WorkXIX : Figure (50) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work 20: Figure (51) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work Twenty-One: Figure (52) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work Twenty-two: Figure (53) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

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Work Twenty-Three: Figure (54) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work Twenty-four: Figure (55) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**

Work Twenty-Five: Figure (56) – Material: Aluminum





Different viewing angles for the fourth action **Back of the currency** **Coin face**






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Search results:

1.The researcher concluded that the historical event is an important source and fertile material for the production of the artwork, which is represented in the commemorative coin using various design methods and foundations of various shapes and formulations.

2.Tourist sculptural souvenirs are one of the important areas that are useful in the work of small industries projects and provide job opportunities for graduates of technical colleges.

3.Students were taught the importance of quality and intonation in the stages of artistic and plastic performance.

4.Students were trained on the importance of linking academic and educational fields of art when studying fine artwork, especially the medal and commemorative coin.

5. The students' cognitive aspect of the importance and value of their work and the extent of their economic return and the possibility of benefiting from them financially have been developed.

Research recommendations:

1. The tendency to pay attention to the study of numismatics, especially commemorative coins, and to expand the circle of study in our societies due to the scarcity of written sources in this regard.
2. The need to link the graduate, especially graduates of art education, to the local and global labor market, contribute to solving the problem of unemployment and work to provide new concepts of art.
3. Consideration of the design aspect as an important and essential part in the modernization of the plastic formulations and symbolic composition of the commemorative coin.
4. The importance of the positive impact of the plastic artwork on the behavior of the receiving and connoisseur of art through tourist sculptural souvenirs.
5. The need to take advantage of the diverse cultural heritage in the production of sculptural and tourist souvenirs.

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