

RESEARCH ARTICLE

Innovative Use of the Pointillism Technique for the Production of Scrap Metal Mural Art of Kofi Annan for Environmental Sustainability

Owusu Panin Kwame Baah^{1*}, Peggy Ama Fening², Isaac Kwabena Agyei³ Dickson Adom⁴

¹Department of Painting and Sculpture, Kwame Nkrumah University of Science and Technology;

pideckcompany@gmail.com

²Department of Industrial Art Kwame Nkrumah University of Science and Technology;

amafening@gmail.com

³Department of Industrial Art Kwame Nkrumah University of Science and Technology;

ikegyei@gmail.com

⁴Department of Educational Innovations in Science and Technology; Kwame Nkrumah University of Science and Technology; dicksonadom@knust.edu.gh / adomdick2@gmail.com

* Corresponding author: pideckcompany@gmail.com

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Abstract

Scrap metals have been an environmental nuisance blocking the pathways of water and leading to various forms of environmental pollution at Anloga in the Kumasi Metropolis of Ghana. This scrap metal art project was aimed at creatively reusing and re-purposing scrap metals from various construction, dump sites and households for the creation of a metal artwork as a step in reviving scrap metal art for environmental sustainability. Over the years, murals have been made using various techniques in painting and sculpture. The studio-based research design that employs the qualitative descriptive method was used for this project. The project adopted the concept of pointillism whereby tiny dots in various pure colours are used in creating an artwork that is appreciated when viewed from a distance. We replicated this concept by representing the dots with metal domes from scrap metals in producing an innovative

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commemorative metal mural of the former UN General Secretary, Kofi Annan. The researchers employed participant observation and used photographs to collect the data by carefully studying the various scrap metals that were available for the project and by utilizing most metal working techniques. It was very necessary to carry on this project to revive scrap metal art in Ghana which is gradually dying out. The study revealed that recycling and melting of metal scraps should be done in kilns and furnaces rather than in open hearth processes for best results. The study recommends the exploration of other methods of doming in the future for much efficiency. Also, the study recommends the exploration of other fine art techniques and media using various scrap metals for artistic production.

Introduction

Scrap metal is a combination of waste metal, metallic material and any product that contains metal capable of being recycled or reused from previous consumption or product manufacturing (Asm, 2016). In Ghana, scrap metal collectors and brokers have exploited the commercial and practical values of materials in an on-going basis. Essentially, one of the significant factors that motivate scrap metal art in a society is its provision of environmental benefits in terms of reducing volumes of solid waste and its positive transformation of the aesthetics of the environment (Yankson, 2017). Scrap metals are classified into two categories; ferrous metals and non-ferrous metals. This process of identification mostly requires the use of a common magnet which can be obtained from music speakers. This mode of identification is mostly used by scrap dealers normally called by native people in the locality as *condemn*. They are characterized by their dirty attire and their pronunciation of the word *condemn* as they go in search of scrap metals in the Kumasi locality. Construction and dumpsites are the location for most ferrous scrap metals. Ferrous metals are the most common type of recycled metals. Ferrous metal is iron or steel or based metals. Common items made of ferrous metals found at dumpsites include refrigerators, ovens, cars spoilt parts and more (Zack, 2023). Common metal scraps found at construction sites are cast iron skillets and metal tie-rods. Metal tie-rods are relevant structural elements in heritage masonry building (Calderini et. al, 2019). Zack (2023) reveals that other non-ferrous scrap metals for construction sites include screen door frames, or storm windows for aluminium, plumbing pipes as roofing material for guttering with common electric wires and even inside air conditioning units. Asm (2016) contends that households are the main source of non-ferrous scrap metals. Non-ferrous metals do not contain iron so they are not magnetic and they are typically not corrosive and are rust-resistant than ferrous metals which can be found and used at households. Non-ferrous metals at households include brass, tin, aluminium, copper and among others. Aluminium is one of the most commonly found scrap metals at households. Aluminium can be found in soda cans and food wrap foils. Copper is another highly valuable and sought after metal material. This metal is commonly found in household plumbing, living room decor, appliances, kitchen sinks, pots and electronic wiring (Zack, 2023). Metal murals have designs made in metal or on metal-on-metal surfaces because of their exterior durability, their good finishing on metal substrates (especially when they are worked on), and their resistance to water and other weather conditions. Clearly, the use of oil or lacquer on these metal surfaces is appropriate because of the possible saponification of their coatings, especially when the metal is situated for outdoor display (Bimago, 2020).

This study was aimed at the exploration of scrap metals which have been an environmental nuisance at dump sites, construction sites and households in Kumasi, Ghana for the production of metal artworks, illustrating it with the production of a commemorative metal mural of the Ghanaian icon in global politics, Kofi Annan. Kofi Annan was born into an aristocratic family in Ghana on April 8, 1938. He attended a number of schools and colleges, studying international relations in the United States and Switzerland, and became an international civil servant working for the United Nations in 1962. He went on to become the U.N. secretary-general and later a special envoy to Syria. Annan died on August 18, 2018 in Switzerland at the age of 80 (Hammarskjold, 2013). Kofi Annan who raised the flag of Ghana is commemorated in a metal mural art by using scrap metals garnered from dump sites, construction sites and households at Anloga, a suburb in Kumasi, Ghana.

Previous studies by some researchers in the Ghanaian context have similarly explored the use of scrap metals in art for environmental sustainability. For instance, Yankson et al. (2017) study was aimed at managing the scrap metal situation in the Sekondi-Takoradi Municipality in Ghana. His study revealed creative ways of dealing with the scrap metal situation in the metropolis rather than leaving them in the hands of metal traders. Nkansah (2015) also delved deep into scrap metals and its role in the circular economy in Ghana using Sunyani as a case study. He assessed the quantity and economic value of scrap metals as an essential part of resource recovery in the circular economic model. Solutions to nature conservation and environmental sustainability were the key issues for his study. This study supports the view of Adom et al. (2023) that artists in diverse fields must use their creativity as an asset in re-imagining more friendly and sustainable ways of living by innovatively using waste materials in the environment for artistic productions to achieve environmental sustainability. This study shows how scrap metals can be used in environmental conservation through the making of artworks for exhibitions and other aesthetic purposes that can be sold for economic gains and revenues in the country. This study emphasizes the use of scrap metals for the production of artworks that would in turn assist in the promotion of the art and cultural heritage of Ghana while ensuring environmental sustainability rather than leaving them to waste away or waiting on metal scavengers to salvage and trade in metal scrap recycling at very cheap and lower prices.

Scrap Metal: Types, Availability, Composition and Properties

Scrap Metal Recycling is very paramount to this research. Cohen (2012) describes scrap metal recycling as the recovery and processing of recyclable metal materials from end-of-life products and structures so they can be reintroduced as raw materials for the production of new goods.

Thematically, hard metal scrap can be divided into two groups which are soft and hard metal scraps (Naboychenko et. al, 2009). However, the two main categories of scrap metal are ferrous and non-ferrous metals (Langley, 2021). Ferrous materials as noted by Mridha (2016), are materials that contains iron and steel. Steel is the most important material of this family. Because of its importance as a result of its availability, low cost, high strength, ease of fabrication into many shapes, and a wide range of properties, steel accounts for 80% of all metallic materials (Mridha, 2016) . It is widely used in the manufacturing, building and construction industries. Ferrous metals at construction site such as iron are also part of the scrap family. In modern society iron is the most important of all metals, as it is used to craft different types of steel which is used in a diverse array of applications. Steel is used for producing paperclips, skyscrapers, and everything in between (Jefferson, 2016). Non-ferrous metals which contain no iron include aluminium, titanium, magnesium, copper, nickel, cobalt, zinc, cadmium, lead, tin, bismuth, noble metals and earth metals (Neikov et. al, 2009). Non-ferrous metals are known for their tensile strength and present characteristics that hold an advantage over ferrous metals, mainly by their malleability, lighter weight, and corrosion resistivity (Mahmoodian, 2018) . As iron content is absent in non-ferrous metals, the probability of rust and corrosion is fairly low.

Scraps can also be obtained from household and dump sites. The popular metal scrap materials found in these areas are copper, aluminium and brass. Copper can be found just about anywhere in the domestic home. From the piping in the walls, unlike PVC, the manufacturing of copper tubes is regulated and all pipes must meet quality standards (Wiley, 2023). Small electronic components in the cell phone or the microprocessors in your computer such as the copper has properties which are found and used in the home appliances are nearly endless in its usage because of its amazing properties. Copper is used in the automobile, in motors and in household appliances like washing machines and dryers, but it is even more commonly used in conjunction with other metals in numerous household products because of the abundance of copper alloys (Coppersmith, 2016). Maes et. al. (2015) mentions that local dumpsites are a hub of used forms of copper and spoilt copper drop cables.

Aluminium is used for aluminium utensils and aluminium foil in households (Gupta et.al, 2019). Aluminium can be melted and easily shaped into whatever form it needs to take for a particular project and its strength means it provides solid protection in all these applications. In line with this thought, Piping (2022) states that aluminium is light weight, yet strong properties make aluminium an invaluable resource for constructing things such as aircraft or spacecraft too. Because of its ability to resist corrosion, aluminium is even used outside, making it the popular choice for outdoor products such as garden furniture or railings. Manufacturers enjoy using brass and bronze for home hardware due to their malleability and workability. It can be bent, cast and molded into the desired shape. Due to these characteristics, intricate designs and workings can be placed into these metals. Another advantage is that solid brass and bronze can take on a finish that allows it to look like other materials or colours. It can have a smooth finish

or a brushed finish with distinct markings across the surface (Belmont, 2019). Rotax (2020) supports the view that most faucets, bidets, hose bibs, channel drains, and sinks are brass-based.

Pointillism and Mural as Techniques in Art

Pointillism as a technique in art, catches most of our attention because points vary not only in sizes, shapes, but also in colours (Yang et. al, 2008). Objects blur as they recede from the viewer in pointillism. The founder of Pointillism was Georges Seurat (1859-91), a model student at the Ecole des Beaux-Arts in Paris. As a traditional and conventional classical painter, he rejected impressionism, a style of painting and colour based on the subjective responses of the individual artist, in favour of a more scientific method which he developed around 1884 and called Chromoluminarism (Düchting, 2000). Sugita (2013) adds that Seurat's introduction of pointillism included optical mixture, complementary color contrast and halo effect.

The type of art which is the output of this research falls under mural category. A mural is a painting applied directly to a wall usually in a public space (Tate, 2013). There are other forms of murals such as frescoes and mural paintings typically an inherent .There are two primary techniques of mural paintings being portrait paintings and wall paintings (Jackson, 2008). The popularity of the mural in the Western world began in the nineteenth century, with a new, community-orientated sense of national identity. The advantage of a mural is its accessibility to a large audience, which has endeared it to many political ideologies. In the 1930s there was a worldwide trend towards making art more public in reaction to the introspective development of modern art. In Latin America, USA and Britain, mural painting became popular thanks to governmental sponsorship in the form of organizations like the Artists International Association. In 1933 Mario Sironi published his Manifesto of Mural Painting and commissioned murals by Giorgio De Chirico and Carlo Carrà. In Germany, Italy and the USSR murals reflected the totalitarian propaganda of the State. By the 1970s murals in the Western world were engineered to local politics, often revealing a sense of national, racial or civic pride in the area. Presently murals are done for its abstract and aesthetics purposes in the contemporary world (Tate, 2013).

Commemoration of Mr. Kofi Annan: An Iconic Figure in International Politics

Mr. Kofi Annan was born in Kumasi, Ghana, on 8th April 1938. He studied at the then University of Science and Technology in Kumasi currently Kwame Nkrumah University of Science and Technology and completed his undergraduate work in economics at Macalester College in St. Paul, Minnesota, U.S.A., in 1961. From 1961 to 1962, he undertook graduate studies in economics at the Institute Universitaire Des Hautes Études Internationales in Geneva. As a 1971-1972 Sloan Fellow at the Massachusetts Institute of Technology, Mr. Annan received a Master of

Science degree in management. Mr. Annan joined the United Nations system in 1962 as an administrative and budget officer with the World Health Organization (WHO) in Geneva. Since then, he has served with the UN Economic Commission for Africa (ECA) in Addis Ababa; the United Nations Emergency Force (UNEF II) in Ismailia; the Office of the United Nations High Commissioner for Refugees (UNHCR) in Geneva; and, at UN Headquarters in New York, as Assistant Secretary-General for Human Resources Management and Security Coordinator for the UN System (1987-1990) and Assistant Secretary-General for Programme Planning, Budget and Finance, and Controller (1990-1992) and UN General secretary (1997-2006). Annan passed away after a short illness in a hospital in Bern, Switzerland on August 18, 2018 (Annan, 1999). Due to his remarkable contribution to international politics, Kofi Annan is a celebrated figure in Ghana. As such, this scrap metal mural art was used for the production of his portrait as a commemorative piece.

Methodology

This study relied on the descriptive research and studio-based research designs under the qualitative research approach. The target population for the study were the people at the various dumpsites, construction sites and households in Anloga, Kumasi, Ghana. Due to the larger slum population of the Anloga community, the study was limited to the Zongo community, various households, *condemn* sites at Anloga and Lobito for their construction sites. Purposive sampling was employed for the selection of the five (5) dumpsites, construction sites and households at Anloga. There was the need to gather data on scrap metal types and the relevance of the metal mural art project from a total of 23 purposively sampled study participants consisting of five (5) construction site workers, twelve (12) household owners and six (6) metal scrap dealers. The researchers used participant observation, personal interview as well as photography as data collection tools. Their qualitative views were transcribed after their personal interviews conducted with a validated semi-structured interview guide were recorded. Member checking was used to ensure the accuracy of the views garnered. They were analysed using the qualitative thematic analysis.

On the other hand, the studio-based research that was used for the actual production of the metal mural art meticulously followed the steps outlined in Marshall's (2010) Double Helix of Praxis-Exergesis Model (Figure 1). This consisted of exploration, production, and evaluation. The exploration stage included identifying and assembling the various metal scrap materials. The production stage included the fabrication process of the metal mural of the portrait of Kofi Annan. This stage included the posterization of Kofi Annan's picture as well as the sizing, and description of the mural and domes. Finally, the work was evaluated by the study participants.

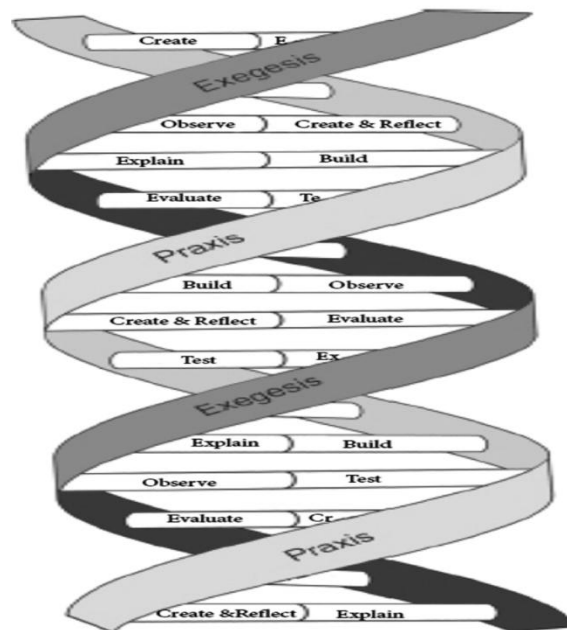


Figure 1: Double Helix of Praxis-Exegesis Model

Source: Marshall (2010)

Results and Discussion

Identification and Assemblage of the Scrap Metals

Scrap metals identified at each of the various sites included aluminium, tin steel, iron, copper and brass. These ferrous and non-ferrous metals were relevant to my study. Larger chunk of aluminium and copper were obtained from households which were aluminium from cans of soft drinks and copper from electric wires and cooking wares. These metals were later be processed to flat sheets of metal by smelting and milling them into flat sheets of metal. This is a pie chart representation in (Figure 2) shows scrap metals from different sites. Copper with a percentage of 54%, Aluminium with a percentage of 32%, Iron and Steel with a percentage of 11%. Brass is having a percentage of 2.5% and lastly Tin obtaining a percentage of 0.5%.

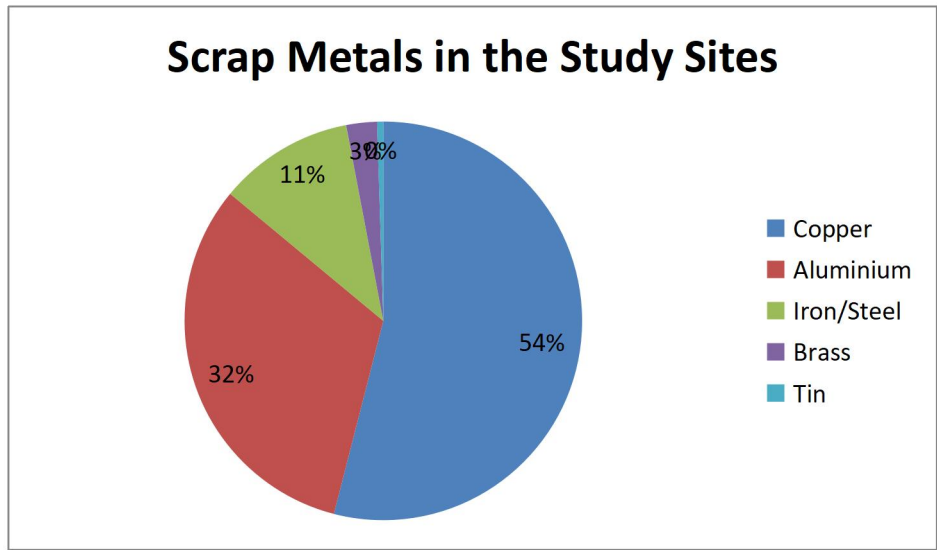


Figure 2: Pie chart of scrap metals obtained at Anloga, Kumasi, Ghana

Fabrication Process

Fabrication process started with preliminary design stages. First of all, the picture of Kofi Annan needed to be obtained; pictures of Kofi Annan were obtained from the internet. The internet search gave various pictures of Kofi Annan. Some of the pictures were in black and white and were difficult to work with because they were old. So a little editing and retouching were made onto some of them in order to make them workable. Figure 3 is the selected picture of Kofi Annan.

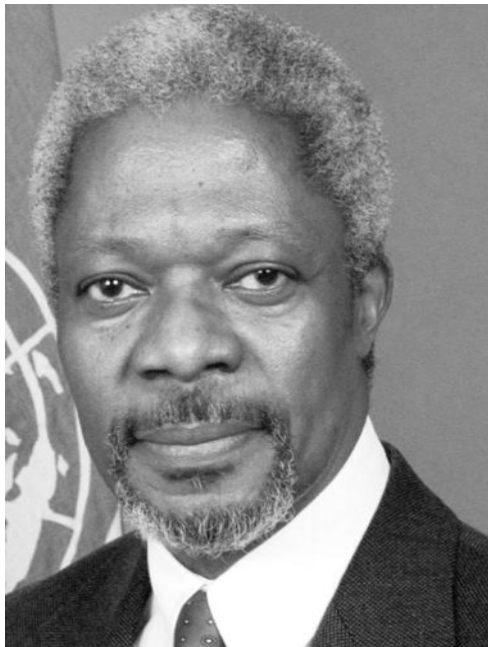


Figure 3: Selected picture

Figure 4: Posterization of picture

Copper and aluminium were well prepared for doming. The copper and aluminium were melted into ingots and annealed. This heat treatment process was done to the metals in order to reduce its hardness and make it malleable and easy to work on. In this state, the metal becomes very soft and could be milled, cut and domed perfectly without tearing or any deforming. The annealed metal ingots were left to cool and were pickled in the pickle solution and were scratched and brushed.



Figure 5: Melting and pouring of Metal ingots

The annealed metal sheets were then placed in the guillotine and were cut into required sizes. The metals were then annealed again in order to make the milling simple and easy. The annealed metals were then milled to a specific thickness using the rolling mill. The thickness of the milled metal was between 0.3 and 0.5mm. Circles were marked out on the copper and aluminium sheet before neatly pierced with jewelers saw frame and blade. The round metals were then placed onto the required space on the doming block and the punch was used on the metal to take shape of the hole in the doming block by gently hitting the punch with a hammer.

In order to get the dark tones of the mural of Kofi Annan, the steel domes were sprayed black using the graffiti spray, other copper domes were oxidized. The patination process involved mixing two parts of caustic soda, 1 part of sulphur and 10 parts of water in a metal basin. The solution was then heated for 5 to 10 minutes after a little weak acid solution (preferably a pickle solution) was gently poured into the boiling solution of caustic soda, sulphur and water. The whole solution was further boiled for 1 minute and then it is poured onto the metal domes in a plastic container. The copper domes turned black after patination process.



Figure 6: Milling of metal sheets



Figure 7: Doming of metal sheets.

The edited image was printed to size of the support and the back of the printed paper was shaded with a charcoal and 6b pencil. The black shaded paper was placed on the support and a masking tape was used to hold it in place. Tracing was done using pencil to pass through all the contours and available lines in which the lines were traced from the paper onto the support. The paper was then removed from the support and a pen was further used in retracting the pencil lines to make it visible and permanent.



Figure 8: Spraying of domes



Figure 9: Tracing Process

Some of the images that were edited had light and dark tones, with three tones being light while the others also came up with four tones. The aluminium domes were used in representing the lightest tones, normal copper domes were used for the mid tones and the sprayed steel and oxidized copper domes were used for the dark tones. The light tones of the picture were tackled first. With the traced lines as a guide, the aluminium domes were carefully arranged onto the part that had light tones. All the light tones to be arranged before moving to the next tone. This was done to prevent confusion and mistakes. The mid tones were represented with normal copper. Super glue was used as an adhesive for the work because of its strong bonding abilities. This particular type of glue is used by the people in the shoe industries because of its strong bonding and because the researcher was to glue metal domes onto a flat surface. A strong adhesive is needed in order not for the domes to fall off as time goes by.



Figure 10: Tracing Kofi Annan **Figure 11:** Arranging forehead **Figure 12:** Arranging the nose

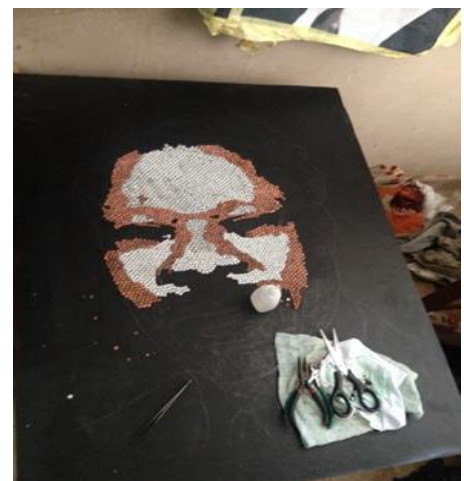


Figure 13: Filling cheeks **Figure 14:** Finishing cheeks **Figure 15:** Arranged cheeks



Figure 16: Arranged mouth



Figure 17: Arranged face



Figure 18: Arranging of hair

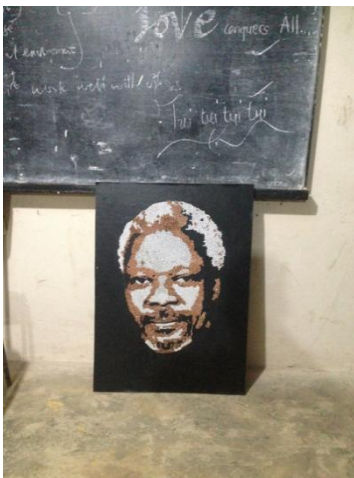


Figure 19: Arranged hair



Figure 20: Arranged suit



Figure 21: Arranged tie

Exploration of Scrap Metal for Metal Mural

The main aim of this project was to use metal domes to create murals of the former UN general secretary with copper, steel and aluminium domes using the pointillism technique. In order to achieve the above, the researchers explored various scrap metals from dump, construction and households at Anloga. Most of the metals found were mainly from households amounting to 54% of scrap metals from home appliances, spoilt cooking utensils copper pipes from air-conditioning units. Aluminium which had 32% with a chunk of them gotten from dumpsites at Anloga, households at Lobito near Anloga were most of the scrap metals were soft drinks can, spoilt aluminium utensils. Iron and steel with a percentage of 2.5% had most scrap metals from leftover and spoilt iron rods which were really hard to come by. These scrap metals obtained

were used for the metal mural using the posterization process for the edited image of the metal mural.

The posterization of the images entails the conversion of the continuous gradation of tones to several regions of fewer tones with abrupt changes from one tone to another. The result compounded further optical illusion. The visual illusion or optical illusion occurs when the posterized image become partially blur when one is closer to it but becomes very clear and vivid when it is been viewed from a distance. The purpose of posterization was to help trace the contour lines and vectorization of the images that were obtained this helped in the selection of specific tones, tint and shade, hue and saturation in relation to the natural colours of the copper and aluminium.

The main aim of this project was to use metal domes to create mural of the former UN general secretary to commemorate Kofi Annan. The size of the mural is 35 by 25 inches calculating the frame by 37 by 36 inches within the frame copper, steel and aluminium were the only metal used with copper and steel some oxidized and some sprayed. The dark tones were obtained by normal copper been oxidized whiles the mid tones were obtained by normal copper. The lighter tones were represented by aluminium.

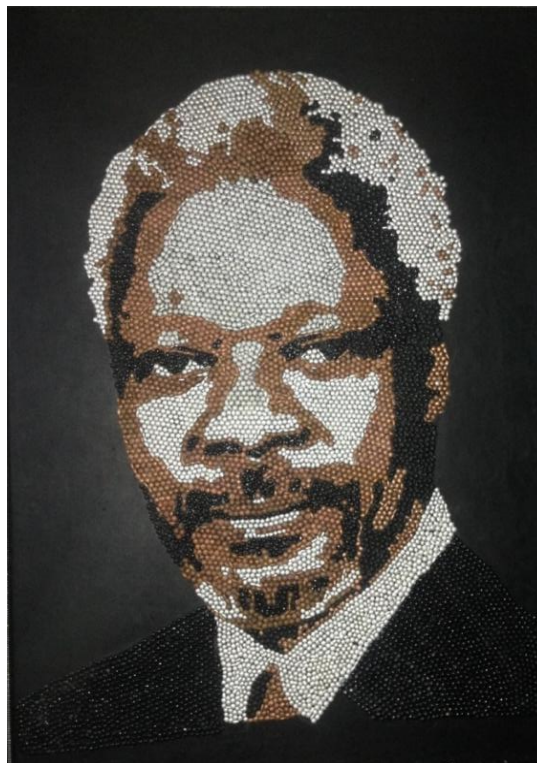


Figure 22: Metal mural of Kofi Annan

The adhesive used in bonding the metal domes to the background (leather glued to a wooden board) was super glue. Super glue was used because it bonds stronger and faster. Black synthetic was used to cover the surface of the support instead of using black velvet. In order to get perfect arrangements of domes onto the support the domes were made in various required sizes, in the sense that very small domes were applied to the areas that needed very small domes. The whole metal surface area of the domes was lacquered to prevent the metal from tarnishing. This was done by spraying the surface of the metal with hardener and clear. Approximately about 9000 domes were used in the production of the work. Below is a table of the approximately number of domes used for the mural.

Table 1: Number of domes used for the metal mural

<i>Name</i>	<i>Punches</i>	<i>Copper</i>	<i>Aluminium</i>	<i>Total</i>
Kofi Annan	5/8	2000	1500	3500
	13/11	800	300	1100

The final results show that some forms of metal fabrication can be considered or classified as fine art although the metal fabricated work is functional. Also a rough observation was made about the size of the domes. Both the small and big domes affected the outcome of the whole work respectively. The smaller the dome size the clearer and vivid the image. In order to get a perfect image, the bigger domes and the smaller domes were carefully arranged onto the support so as to prevent them falling off.

The feedback garnered from the study participants at the evaluation stage of the project revealed that the completed scrap metal mural art piece has significant relevance to environmental sustainability through the use of the scrap metal materials that would have culminated into environmental pollution in the study sites. More so, the theme selected for the project which is for the commemoration of the significant contribution of Mr. Kofi Annan to world peace and unity among countries is an important step in honoring iconic figures in the Ghanaian community who have impacted positively to sustainable societies and the well-being of the Ghanaian people.

Conclusion

Hunting for metal scraps for metal mural of Mr. Kofi Annan helps to protect the environment from pollution from waste materials. These scraps were collected from households, construction sites and dumpsites to produce metal mural of Mr. Kofi Annan. Following the scavenger hunt for metals, there was certain procedure an individual has to follow in order not to steal any metal or take any metal belonging to an individual or property. The use of artificial synthetic leather for the support was beneficial rather than using the velvet, for easy removal of adhesive (super glue) from the surface of the support based on the two experiments performed using both leathers. Domes following a particular pattern bring the pointillism effect out well. After doming by using the doming block, the jewelers saw frame was used for cutting of domes rather than the use of shears. Smaller holes in the mural were filled with domes, using smaller sizes of domes which were beneficial. Domes arranged compactly next to each other. Domes were arranged compactly next to each other brought out the metal mural very well. The aluminium was used to represent the light tones whilst the copper was used to represent the mid tones and in order to get the dark tones a surface decoration called patination and spraying were used. The spraying of the copper domes by using black graffiti showed the darkest tones while the patination darkens the copper and the various mid to dark tones were obtained. In situations where there were darker tones, metals like brass were used to represent that place in place of oxidized domes because of their natural colours they represents. Small domes were used in order to achieve a fine, clearer and vivid photo-realistic image. To avoid gradual tarnishing of the already arranged domes the surface were protected. Resemblance of the actual image was achieved by constantly checking the arrangements of the domes. Dome works should be viewed from a distance but best when viewed from higher grounds. It is recommended that the hunt for scrap metal should be done properly where scrap metal collected isn't the property of anyone from households or construction sites. Recycling of scrap metals by melting them in an open hearth or pits should be avoided but rather recycled by using kilns and furnaces. Other non-ferrous metals should be explored in the pointillism process to bring out different shades of colours. Domes making process for the portrait was a bit slow and took a lot of time to get work done since punching of metal in doming blocks were done manually. It is recommended that other finishing processes should be explored for similar projects using scrap metals in the future.

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Author Bio note

1. Owusu Panin Kwame Baah- pideckcompany@gmail.com

Kwame Baah Owusu Panin is a PhD student in African Art and Culture at the Department of Painting of Sculpture. He holds a master of fine art in Jewellery and Metalsmithing. He takes inspiration from bio mimicry and manipulates complex designs into metal products by fabricating and casting them. As a jeweler and metal product designer he works with different, precious, ferrous and scrap metals and bringing them into the light by recycling and forming an artwork out of it. Kwame believes there is nothing impossible under this sun, just find who you are and do it on purpose.

2. Peggy Ama Fening- amafening@gmail.com

Dr. Peggy Ama Fening is a senior lecturer in the Department of Industrial Art in the Faculty of Art, College of Art and Built Environment in the Kwame Nkrumah University of Science and Technology, Ghana. Her research niche has focused on the Post Independence Developmental Trends in the Gold Jewellery Industry in Ghana, Preservation and Enculturation of the Metalsmithing Industry in Kumasi-Ghana, as well as Workplace Safety Practices and Associated Health Hazards among Informal Sector Workers in the art industry.

3. Isaac Kwabena Agyei- ikegyei@gmail.com

Dr. Isaac Kwabena Agyei is a senior lecturer in the Department of Industrial Art in the Faculty of Art, College of Art and Built Environment in the Kwame Nkrumah University of Science and Technology, Ghana. His research niche is in design and fabrication of metal products, aesthetics and industrial casting methods. He has produced and is still working on producing a bank of designs for metal souvenirs for the Kwame Nkrumah University of Science and Technology in Ghana.

4. Dickson Adom - dickson.adom@knust.edu.gh/ adomdick2@gmail.com

Dr. Dickson Adom is a pluridisciplinary researcher in the Department of Educational Innovations in Science and Technology in the Faculty of Educational Studies in the College of Art and Built Environment in the Kwame Nkrumah University of Science and Technology, Ghana. His research niche focus on the use of innovations in Art and Culture for Environmental Sustainability and Nature Conservation.

Authorship and Level of Contribution

All authors contributed equally.

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