

CHAPTER 1:

INTRODUCTION TO FORENSIC GRAPHICS

Contributed by

Muhammad Bashir Hashim

INTRODUCTION

The origin of graphic design can be traced back to the Paleolithic period, when the first known visual communication, known as cave art, arose around 38,000 BC (De Heij, 2012). Numerous cave art images and symbols were found in various sites globally, such as Altamira cave paintings in Spain, Apollo 11 cave stones in Namibia, Lascaux caves in southern France, Binnin Kudu cave art in Jigawa State, Nigeria, Lower Pecos rock art in Texas, Mexico, and Kakadu National Park, Australia, just to mention a few. Those art pieces that are usually referred to as cave art or cave painting are the origin of graphic design because they were mainly made to communicate among themselves, protect themselves from dangerous animals, and indicate a specific task or action at that time. They remain fundamentals of graphic design to this day, even though cave art is far from what is seen as graphic design presently. The word graphics is a generic term; in other words, it's a broad field of study that encompasses many disciplines. Graphics is a part of our daily lives and is an amazingly powerful and persuasive tool for communication and transmission. Graphics can simply be defined as a process of communication through the use of text or image, or text and image combined to convey a message from a client to a specific audience utilizing posters, postcards, packages, banners, billboards, magazines, books, logos, the internet, and so on. Graphic design is a creative process that combines art and technology to inform, persuade, organize, stimulate, locate,

identify, attract, and convey not only information but also moods and emotions to the target audience.

On the other hand, the term forensics refers to the application of scientific methods, knowledge, techniques, and/or devices to identify a crime; likewise, it can seem to be scientific knowledge and/or methods of solving problems related to crime. Similarly, the term forensic refers to the application of scientific knowledge to a legal problem, especially the scientific analysis of physical evidence in court (Museum, 2022). Nevertheless, forensics is not just important in the courtroom; forensic evidence needs to be found before any scientific discussion in court can take place. This evidence can be found by forensic scientists and allies such as chemists, forensic graphic designers, biologists, psychologists, mathematicians, security printers, and artists.

Forensic graphics is a scientific aspect of graphic design that deals with the research and development of sensitive paper documents and products. The main aim of forensic graphics is to protect and safeguard valuable paper documents from forgery and counterfeiting. Similarly, forensic graphics is a segment in the printing industry that focuses on the printing and protection of sensitive paper documents such as banknotes, checks, and passports, from tamper-evident, product authentication, certificates, postage stamps, identity cards, and so on. The main goal of security printing is to prevent forgery and counterfeiting.

Document Theft

The concepts of forgery, counterfeiting, piracy, faking, alteration, fraud, corruption, and bribery are some of the global crimes that have received little or no attention from the international community and governmental and non-governmental organisations (Hashim, 2016). Document theft is one of the major societal ills in our society. This is because organized crimes aided by forgery and counterfeiting of valuable paper documents constitute a source of major societal problems in Nigeria, with

attendant consequences such as damage to all facets of Nigeria's corporate existence, enormous loss of government revenue, undermining national development efforts, economic potential and political instability, erosion of efficiency, and damage to the national image (Dakyes, 2009). Unfortunately, these menaces have not been well addressed, especially in third-world countries like Nigeria, where the problem is becoming endemic every day. Document theft is said to be an aspect of fraud that has become almost a way of life for Nigerians at home and abroad Ladan, (2008). Today, in Nigeria, it is hard to see an original product without seeing a counterfeit around it. Many Nigerians are seriously indicted for involvement in the menace. For example, a good number of politicians are forging to win elections, civil servants counterfeit to mismanage public funds, students fake to get admission or a scholarship, lecturers forge for promotion, pharmacists fabricate substandard drugs, businessmen import pirated products, contractors are also scamming tax documents, manufacturers are producing substandard products while traders are retailing counterfeited products, and so forth. These menaces have brought a great setback to national development. For this reason, there is a need for serious and urgent efforts from colour chemists, graphic designers, researchers, security printers, and law enforcement agencies to jointly tackle this ugly phenomenon.

Forgery and Counterfeit

The words forgery and counterfeit are two different names that are synonymous in usage and different in action. Forgery has to do with the unlawful altering of genuine documents, such as the name, grade, year, rank, gender, registration number, plates, passport, or signature of a genuine document, with the intent to deceive someone. While counterfeiting has to do with the complete reproduction of fake documents or products to look indistinguishable from the original, with the intent to deceive the end-users, According to the National Document Fraud Unit, United

Kingdom (NDF UK, 2014), "forgery is a form of fraud that deals with the altering of products or valuable paper documents". A forged document is an original document that is unlawfully altered with the intent to deceive, while a counterfeit is the complete reproduction of a fake version of an original document from scratch to resemble an officially issued document (NDF UK, 2014).

Pseudo-documents

Pseudo-documents are illegal documents that belong to nowhere and have no legal basis because they are not issued by a legally recognized authority under state or international law. In other words, pseudo documents are fake documents without legal basis.

Camouflage documents

A camouflage document is an unauthorized document that claims to come from a particular state or country that does not even exist or has a new name. For example, someone holding a visa issued by the Biafra nation or by the Sokoto caliphate or somebody who presented a document claiming Gongola or the Bendel state of Nigeria can be referred to as camouflage documents because the mentioned states are not legally under a state or international law.

History of Counterfeiting

The main aim of forensic design is to prevent counterfeiting; therefore, it is essential to trace the origin of counterfeiting. The crime of counterfeiting is as old as the making of the banknote itself (Giesecke & Devrient, 2015). The advent of the computer, direct imaging, desktop publishing, and computerized image systems that produce excellent colour jobs makes forgery and counterfeiting of sensitive paper documents and products easier and more rampant. Counterfeiting and forgery of sensitive paper documents such as banknotes, certificates of occupancy, chequebooks, statements of results, cash receipts, identity cards, letterhead papers, drivers' licenses, school certificates, passports, tamper-evident labels, stock

certificates, postage stamps, and so forth are on the increase in Africa. To minimize the menace of forgery and counterfeiting, security features are developed by forensic graphic designers and other experts in the field. Security features can be classified into three types: OVERT, the level one security features that can be seen by our naked eyes; COVERT, the level two security features that can be seen with the aid of tools like a magnifying glass, ultra-violet lamp, infrared viewer and so on; and lastly, FORENSICS, the level three security features that can only be identified in the laboratory with sophisticated devices, paraphernalia, and equipment.

Security Features

Anti-Scan: This is a kind of security feature that essentially prevents forgery and counterfeiting through the scanning technique of sensitive paper documents. This technique is principally achieved by integrating an Anti-Scan feature into the design background to protect a sensitive paper document against unauthorized copying. In other words, image and pattern are embedded into the background design's (hidden) information, which is invisible to the naked eye under normal inspection conditions but becomes visible, legible, or readable after photocopying or being reproduced with a scanner.



Plate 1. Anti-Scan

Background Pattern:- This is a systematic arrangement of thin lines to form a regular or irregular pattern to serve as background design as well as security features on sensitive paper documents to protect them against counterfeiting. This technique is mostly achieved by drawing a continuous intertwining line to form an attractive background that will serve as a security feature.

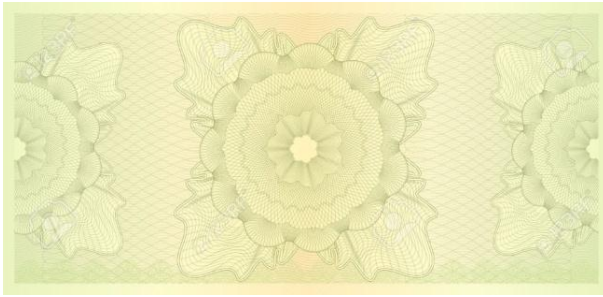


Plate 2. Background Pattern

Source: <https://regulaforensics.com/en/support/glossary-banknotes> (2018)

Bar-Code:- This is a form of digital security feature that is fundamentally achieved by the systematic arrangement of sequential parallel lines (bars) that vary in their widths and spaces between them to store data readable by special devices. A barcode is usually printed by a letterpress machine using special inks (magnetic pigments) that contain additional security properties to prevent the forgery of sensitive paper documents.



Plate 3. Bar-Code.

Clear Window: - This is transparency as a security feature that can only be found on polymer banknotes, created during the manufacturing process of the substrate.



A – N 50 note with clear window (2014) and B– 20 Brunei Dollars (2007)

Plate 4. Clear Window

Source: <https://regulaforensics.com/en/support/glossary-banknotes> (2018)

Guilloches:- This is a technique where an intricate geometrical pattern is systematically arranged by superpositioning curved lines using mathematical laws (a formula), which makes it impossible to reproduce the same guilloche pattern without these mathematical laws. Guilloche designs form rosettes, frames, borders, vignettes,

and other images, as well as the elements of background patterns. A pattern can consist of either negative or positive lines.



Plate 5. Guilloches. Source: 10 Pounds Note
Source: glossary-banknotes (2018)

Hologram

Holography, also known as hologram technology, is the next level of photography method that records the light dispersed from an item and then projects it as a three-dimensional (3D) object that can be seen without the use of any additional equipment. This feature can only be achieved by the diffraction and refraction of light on gratings, which change at different illumination angles. In other words, holography is a technique that enables a light field (which is generally the result of a light source scattered off objects) to be recorded and later reconstructed when the original light field is no longer present due to the absence of the original objects.



Plate 6. Hologram. Source: 200 Naira Note (2018)

Micro perforation:- This is a kind of security feature that is fundamentally achieved through the orderly fabrication of microholes that can be seen in transmitted light.



Plate 7 Micro perforation 200 Swiss Francs (1996)
Source: glossary-banknotes (2018)

Serial Number:- This is a unique combination of letters and/or numbers that are uniquely assigned to each banknote. It is usually printed by letterpress using UV, infrared, or magnetic inks. Vital information like the issuing year, series, and other security information are exclusively encoded to form the serial numbers of a banknote.



Plate 8. Multicoloured Serial Number 50 Pounds Sterling (2010)

Varnish Coating:- A varnish coating is one of the latest security features and consists of two varnishes: matte and glossy. The fifty-naira Nigerian note is a good example of this security feature because it is printed with glossy varnish over matte varnish and is visualized when the banknote is tilted due to the contrast of the varnishes.



a – at right angles

b – at an acute angle

Thermal Ink:- This is an invisible ink that changes its colour or optical density when the image and/or text are exposed to heat.



A – general view
after its exposure to heat

B – decolorization.

Plate 9. Thermal Ink 500 Latvian Lats (2008)

Source: glossary-banknotes (2018)

Rainbow Printing

This is a printing technique in which multiple inks are applied at the same time and on the same printing plate to overrule tints with smooth colour transitions among the main colours of the image, as well as to avoid breaks and displacements.



Plate 10: Rainbow printing in 1000 Belarusian Rubles (2000)

Source:<https://regulaforensics.com/en/support/glossary-banknotesm> (2018)

Substrate

A substrate is a special material (paper or polymer) used in the production of banknotes. Paper substrate is a thin material consisting of plant fibres (cotton, linen etc.). Polymer substrate is a thin (approximately 0.1 mm) clear plastic film covered with multiple layers of specialized coatings.



Plate 11: Banknote Substrate

Source: <https://regulaforensics.com/en/support/glossary-banknotes> (2018)

Banknote Design

A banknote is a genuine piece of art. A banknote reflects a country's culture and communicates messages millions of times faster and more directly. The banknote must be functional, payable, acceptable, and secured. Banknote designers assimilate the country's artistic heritage and cultural values, take psychological insights into design, as well as integrate security features to portray societal identity.

Banknote Production Process

The banknote production process is extensively wide. This is because banknote design and development is not a one-man show but a collective responsibility of over 250 experts, but it can be summarized into five most important stages, such as the papermaking stage, design stage, plate-making stage, printing stage, and varnishing/finishing. Every stage of the production is

strictly controlled and protected against forgery and counterfeiting. According to Manisha and Gupta (2016), "most of the modern banknote consists of the following security features: paper quality, security thread, gradient colouring, intaglio printing, UV glowing, micro text, anti-copying mark, watermarks, infrared glowing, and so forth".

Bank Note as Utility Product

Banknote is not a consumer product; rather, it refers to utility products. Equally, any utility product has to follow the principles of 'one size fits all'. Banknote designers are unlike fashion designers their designs must fit ONE not ALL. People expect trouble-free daily use of their utility products, such as handsets, vehicles, electronic appliances, and so on. Likewise, such a principle most often applies to banknotes as utility products.

Banknote Redesign

People frequently ask, 'Why do we need a new banknote?' There are many issues facing the need to redesign a banknote, such as insecurity, corruption, government policy, changes in government, and so on. But the most foremost is to upgrade the security features of the banknote; in other words, to keep up with technological developments in the banknote industry. There are several reasons for introducing a new banknote.

Standard Design Process

Banknotes have existed for over 350 years, and probably over 50,000 different designs have been created. Over time, banknote designers have developed from craftsmen to graphic designers (Haij, 2017). Today's banknote design process follows the design phases of the Standard Design Process, which are subsequently problem description, information, analysis, design requirements, exploring solutions, prototyping, and the selection of a final design.

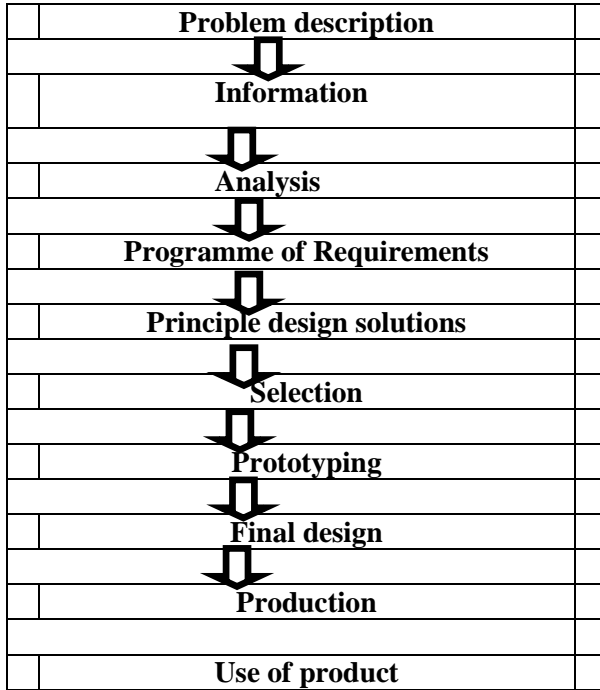


Table 2.2 Standard Design Process
Source: Heij (2017)

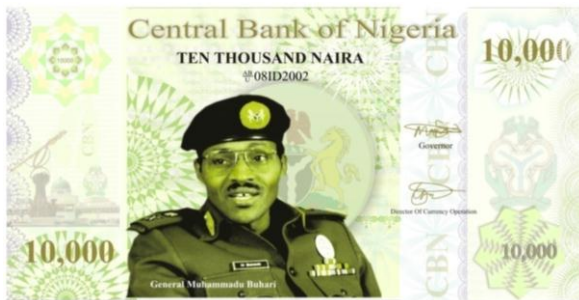


Plate: 12 Proposed 10, 000 Naira Note
Source Hashim 2020

Muhammad Bashir Hashim

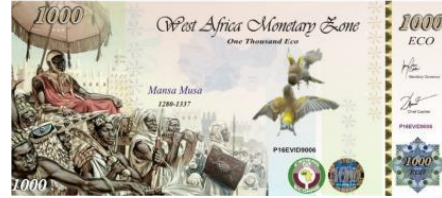


Plate: 13 Proposed 1000, ECO Note
Source: Hashim 2020

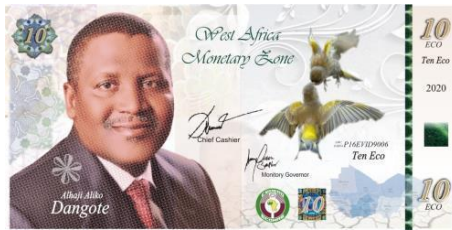


Plate: 14 Proposed 10, Eco Note
Source: Hashim 2020



Plate: 15 Proposed 2000, Eco Note
Source: Hashim 2020

Introduction to Forensic Graphics

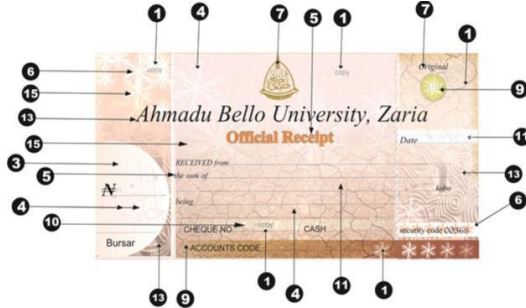


Plate 16: ABU Sensitive Document, Security Features (prototype)
Source: Hashim 2016

Below are the descriptions of the forensic features used on the above sensitive document.

1. **Anti-copying Mark:** This is an invisible mark that is hidden in the design background and becomes boldly visible after being scanned or copied.
2. **Bill paper.** Is a secured paper with a mixture of 73% rag (cotton) and 27% fibre (paper) embedded with security features during the paper-making process for protection against counterfeiting.
3. **Chemically Reactive Paper:** This is a special white paper that changes from brownish to black when bleached solvents or any erasable chemicals are used on it in an attempt to alter the text.
4. **Ghost Watermark:** This is an artificial watermark created as a background during the paper-making process.
5. **Colour Shifting Ink:** This is a special ink that changes to different rays of colours, based on the angle at which one holds the document.
6. **Invisible Ink:** This is a special ink that is only visible under ultraviolet light.

7. Penetrating Ink: This is a unique ink that contains a penetrating red dye, goes into the fibres of the paper, and shows through to the back of the document to deter forgers from trying to scrape the number off the document.
8. Micro-text: This is a technique of creating very tiny and lighter repeated text that appears blurred as a dotted line when copied or scanned.
9. Fluorescent Coating: This is an invisible ink that glows under UV light or a sensor.
1. Erasable Ink: This is a special ink that contains a solvent and chemically reactive substance that rubs off when an attempt is made to alter the text written on it.
10. High-Resolution Image: This consists of a very fine line or image that is too thin to reproduce illegally.
11. Security Thread. A security thread is an embedded security feature into the valuable paper document, the thread with the text "ABU Zaria" embedded in it, and can be seen when the document is held to a light source.
12. Raised print. Raised ink is a special technique of security printing where one feels the raised text.
13. Observe through Register: This is a special technique by which a small hole, e.g., a logo, is printed both on the front (hollow) and back (filled up) of the document.
14. Protection ornament: This is the process of integrating multifarious security features into the valuable paper document during the design process, guided by the elements and principles of design. (Hashim, 2016).

Summary

The origin of graphic design can be traced back to the Paleolithic period, when the first known visual communication, known as cave art, arose around 38,000. Conversely, forensic graphics is a segment in the printing industry that focuses on the printing and protection of sensitive paper documents such as banknotes, checks,

passports, tamper-evident, product authentication, certificates, postage stamps, identity cards, and so on, to prevent forgery and counterfeiting, piracy, faking, alteration, fraud, corruption, and bribery, which are some of the global crimes that have received little or no attention from the local and international community and governmental and non-governmental organisations. The advent of the computer, direct imaging, desktop publishing, and computerized image systems that produce excellent colour jobs makes forgery and counterfeiting of sensitive paper documents and products easier and more rampant. A banknote is a genuine piece of art. A banknote reflects a country's culture and communicates messages millions of times faster and more directly. Banknotes have existed for over 350 years, and probably over 50,000 different designs have been created. Over time, banknote designers have developed from craftsmen to graphic designers.

Questions

1. Trace the history of graphic design
2. What is forensics graphics?
3. Differentiate the differences between forgery and counterfeiting
4. Distinguish between the following terms: pseudo-documents and camouflage document.
5. Write a short note on the following security features: anti-scan, bar-code, guilloches, holography, serial number, and substrate.
6. Why do we need a new banknote?

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