

Image Colouration in Adobe Photoshop: A Digital Painting Technique for Transforming Grayscale Photographs into Colour Mode

Godfred Yeboah Annum, Kwabena Afriyie Poku

Department of Painting and Sculpture, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
Email: anngodam@yahoo.co.uk, paletg@yahoo.com

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Abstract

Digital Photography as a modern trend in the photographic industry offers a wide range of software for editing and enhancing visual qualities of hue, colour saturation, vibrancy, colour balance, exposure and gamma correction among many others in images. Most of this graphic application software is also equipped with tools for transforming grayscale photographs into colour. This photographic exercise, however, requires artistic and technological expertise to accomplish. Adobe Photoshop, one of the most popular software for digital imaging among graphic artists in Ghana, offers a flexible scheme for transforming grayscale photographs into colour, even though many users of the software in Ghana are not conversant with this scheme. This paper, which is a practice-led research, is written to demonstrate the fundamental editing procedures and skills, to help equip digital photographers in Ghana with the capacity and the technical know-how for grayscale image colouration. The authors have illustratively explained the techniques using the design-based and descriptive methods to simplify the procedures for easy grasping by all categories of digital photographers.

Keywords

Digital Photography, Visual Qualities, Adobe Photoshop, Digital Imaging, Grayscale Image Colouration

1. Introduction

Photography is one of the most fascinating technologies for documenting historical events, archaeological findings and explorations. The technology has seen many developments from the camera obscura of the 11th century through the

sensitometry technology of the 19th century leading to the black-and-white monochrome photography and colour photographic technology (Wales, 2020). The technology has remained the choice of vast people of all shades of beliefs and cultures (rich and poor, young and old) for keeping memories of the past.

Even though the history of colour photography dates as far back as the 1860s, it was not until the early 1970s that James Barnor, a native of Accra whose vibrancy in photography spanned over sixty years of practice, introduced this art in Ghana (Quaye, 2010). It marked a turning point in the history of photography in Ghana because grayscale photography had dominated the industry and therefore needed a change in the printing of photographs of social and cultural significance.

A visit to various museums in Ghana will show evidence of photographic recordings of historical events and happenings in the pre and early post-colonial era captured in grayscale mode. Some of such grayscale photographs are also in family archives. Examples of such photographs with strong historical values are the narratives of the Asante War, the burning of Coomassie, the blown-up of the Asante palace and the pitched high roofed architecture which depicted the prosperity of pre-1874 Kumasi. With the advent of the colour Polaroid and coloured photography, some photographers and family members sought ways of converting copies of some of these memorable grayscale photographs into colour modes (Jenkins, 2008).

It is evidently clear that coloured photographs can easily be converted into grayscale using the camera, a computer or on smartphones. However, the reverse does not come that easy even though available computer software offers the possibilities. The digital photographic technology and all its image-manipulating graphic application software have provided vast dimensions of possibilities for achieving fascinating results in this subject area. The authors of this paper were motivated to conduct this practical-led research (Candy, 2006) using Adobe Photoshop “CS6” to simplify the skills for grayscale image colouration and impart the procedures to academia especially those in the new-media art profession. This is intended to equip digital photographers with the skill of adding aesthetic value to outmoded grayscale photographs. Inculcating the skill for this art among traditional photographers is also to enhance innovativeness and proficiency in their practice as photographers so they can impact positively on various homes in societies of Ghana.

2. Methodology of the Study

Two research methodological schemes were employed in this practical-led study; the Design-Based Research and Descriptive Research Methods.

The essence for adopting the Design-Based Research (DBR) scheme is because the various underpinning concepts (Kennedy-Clark, 2013) emphasise the use of methodological approaches in addressing problems using instructional tools that can be tested to see their positive impact on student learning (Scott et al., 2020).

In addition, DBR stresses the need for theory building and development of design principles that guide, inform and improve both practice and research in educational contexts (Anderson & Shattuck, 2012). As new-media artists in studio-art practice, these DBR concepts becomes meaningful in the application of computer technological tools for teaching and impacting digital painting skills to fine art students in higher education. DBR concepts have created the platform for art educational technologists to explore computer technology as a tool for iterative approach to resolving creative problems in Art Education.

Descriptive research is considered as the prevailing research method of the behavioural sciences used to systematically investigate, examine analyze and describe occurrences in the home, the classroom, recreational centres, the offices and many other work places. It offers researchers the strategy for accounting for the status of a phenomenon under study by obtaining appropriate information that can best describe, interpret or explain the nature of a phenomenon (Alhassan, 2007). It is undoubtedly the most appropriate method for artists in studio-art practice whose major concern is to make an impact on society with the products of their creative exposition. Artists can therefore give meaning to their practical procedures through descriptive research strategies. This is the motivation for its adoption as a research method in this practice-led research.

Adobe Photoshop Essentials for Image Colouration (Adobe Systems, 2013)

The introduction of the first handbook on “Photoshop Elements Solutions”, (Mikkel, 2001), began the popularisation of digital imaging with Adobe Photoshop. Adobe Photoshop is well known for its dual functionality in creating and editing both bitmap and vector images, which are the two major categories of computer graphics. For bitmap imaging, it uses grid of colours called pixels to create and edit graphics which are displayed in continuous-tone effects and subtle gradations of shades and colour. Photographs and digital paintings are examples of such images.

It is important to understand the essential utilities for grayscale image colouration in Photoshop in order to appreciate their application in this art. These concepts include:

- 1) Colour Mode;
- 2) Colour Adjustment Commands;
- 3) Grayscale and Bitmap Mode;
- 4) Lasso Selection Tools;
- 5) The Layer Panel;
- 6) Image Colouration Schemes;

Colour Mode

Photoshop offers users the opportunity to work in any of the editing colour modes for changing colour values in images. They are range of commands and features for adjusting the tonal quality, colour balance, brightness or contrast and hue or saturation of continuous-tone images. Photoshop uses these modes to determine the colour model used to display and print images. It bases the colour modes on established models for describing and reproducing colour. The colour

modes are located in the image menu under the modes submenu (**Figure 1**).

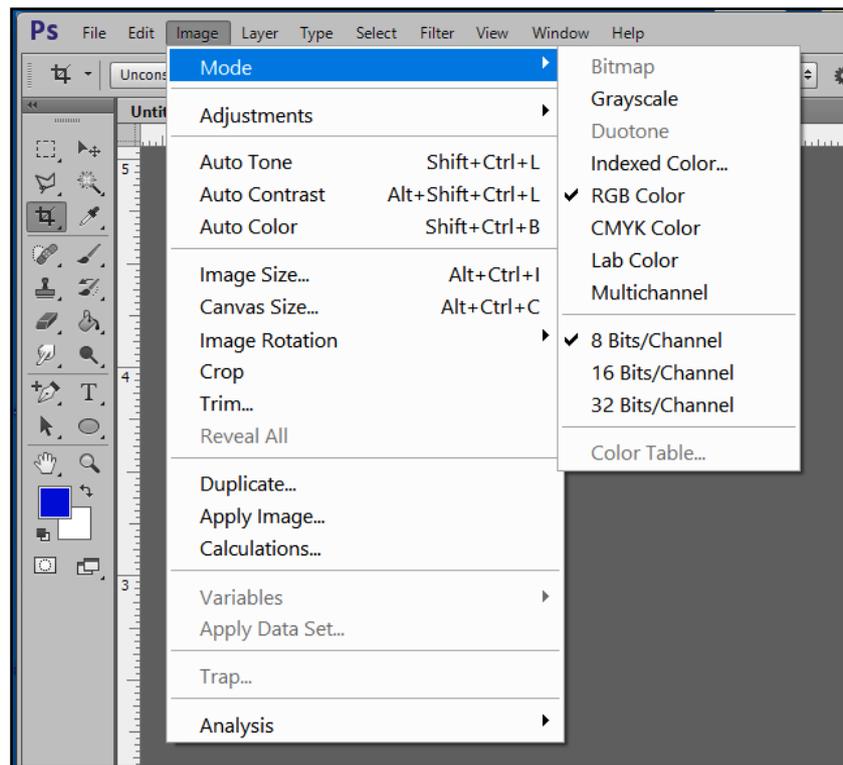


Figure 1. The colour mode submenu.

They include RGB (red, green, blue); CMYK (cyan, magenta, yellow, black); and $L^*a^*b^*$ colour (the “L” component being luminance or lightness, the “a” ranging from green to red and the “b” component from blue to yellow, as two chromatic components). It also includes modes for specialized colour output such as indexed colour and duotone as well as Multichannel mode which uses 256 levels of gray in each channel. Essentially, multichannel images are useful for specialized printing. It is important to note that Colour modes affect the number of channels and the file size of an image.

Colour Adjustment Commands

Image colouration in Photoshop employs the colour adjustment commands in the adjustment submenu under the image menu (**Figure 2**). Not all of these commands have the capability for colourizing the pixels of the grayscale values. Some only adjust and modify colours in an image. Others replace specified colours in an image with new colour values. Those that can change gray values into colour values include: photo filter command; colour balance command; hue/saturation command and channel mixer command.

- Photo filter command makes colour adjustments by simulating the effects of using a Kodak Wratten or Fuji filter in front of a camera lens.
- Colour balance command changes the overall mixture of colours in an image.

- Hue/saturation command adjusts the hue, saturation, and lightness values of the entire image or individual colour components.
- Channel mixer command modifies a colour channel and makes colour adjustments not easily done with other colour adjustment tools.

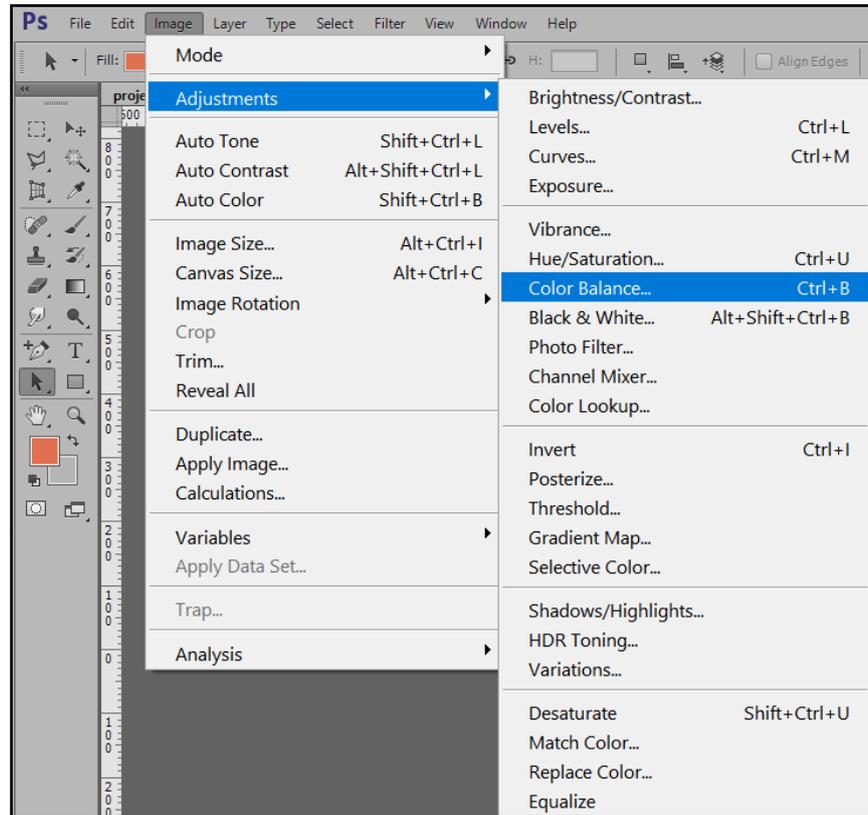


Figure 2. The adjustment submenu.

Characteristics of a Grayscale Image

Grayscale results from the discarding of all colour information in an image. The gray levels pixels represent the luminosity of the coloured pixels in a photograph or an object in nature. In its grayscale mode, it does not support “vibrance”, “colour balance” as well as “hue and saturation” adjustment commands which are the most critical commands in image colouration. This is the state of the grayscale image (**Figure 3**) that was used for this practical research.

Lasso Selection Tools

Selection tools are important in image colouration. They are used to select pixels in bitmap images like photographs so their colour information can be adjusted. The lasso selection tools are peculiarly useful for this kind of project. They are three in all; Lasso, Polygonal lasso and Magnetic lasso (**Figure 4**). The lasso and polygonal lasso tools let you draw freehand segments of the border of an image and straight-edged respectively, to select an area in an image. With the magnetic lasso tool, the border snaps to the tool as you define areas in the image. The magnetic lasso tool is especially useful for quickly selecting objects with complex edges

set against high-contrast backgrounds.

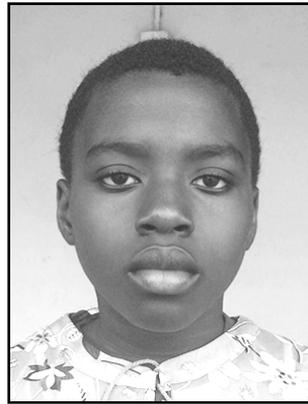


Figure 3. Grayscale image of 8-bit per channel.

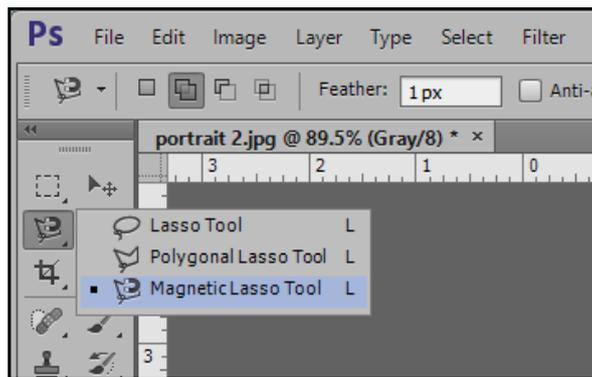


Figure 4. Lasso, polygonal lasso and magnetic lasso tool.

Configuring the Magnetic Lasso Tool

Before using the lasso tool, it was customized in the options bar to specify the selection mode and sensitivity to the edges of the image.

1) Specifying a selection mode in the options bar is based on whether to add a new selection “A”, add to an existing selection “B”, subtract from a selection “C”, or select an area intersected by other selections “D” (**Figure 5**).

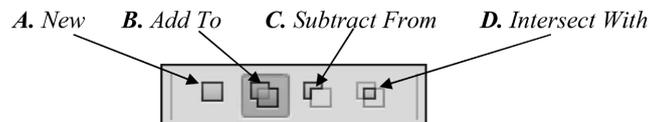


Figure 5. Selection option.

2) The other options in **Figure 6** were specified at the following values to determine; Feather and Anti-alias options, detection width, edge contrast, fastening points frequency and stylus pressure.

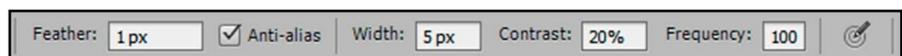


Figure 6. Magnetic lasso tool options bar.

- Feather blurs edges by building a transition boundary between the selection and its surrounding pixels. This blurring can cause some loss of detail at the edge of the selection.
- “Anti-alias” smoothens the jagged edges of a selection by softening the colour transition between edge pixels and background pixels. Because only the edge pixels change, no detail is lost. Anti-aliasing is useful when cutting, copying, and pasting selections to create composite images.

Note: you must specify this option before using the tool. After a selection is made, you cannot add anti-aliasing.

- Width specifies a detection space. When a pixel value is entered for the width, the magnetic lasso tool detects edges only within the specified distance from the pointer.

To change the lasso pointer so that it indicates the lasso width, press the Caps Lock key. You can change the pointer while the tool is selected but not in use. Press the right bracket (]) to increase the Magnetic Lasso edge width by 1 pixel; press the left bracket ([) to decrease the width by 1 pixel.

- The contrast controls the lasso’s sensitivity to edges in the image. Enter a value between 1% and 100% for Edge Contrast. A higher value detects only edges that contrast sharply with their surroundings; a lower value detects lower-contrast edges.
- The frequency controls the lasso’s sets fastening points. Enter a value between 0 and 100. A higher value anchors the selection border in place more quickly.

On an image with well-defined edges, try a higher width and higher edge contrast, and trace the border roughly. On an image with softer edges, try a lower width and lower edge contrast, and trace the border more precisely.

- Stylus pressure: if you are working with a stylus tablet, select or deselect the Stylus pressure option. When the option is selected, an increase in stylus pressure decreases the edge width.

The Layer Panel

Image colouration cannot be done without the use of layers panel. The layers panel avails to users, skills for performing tasks such as compositing multiple images, adding text to an image, adding vector graphic shapes and special visual effect such as a drop shadow or a glow. The Layers panel (**Figure 7**) lists all layers, layer sets, and layer effects in an image. In the panel, new layers can be created, hidden, displayed and deleted using the buttons in the Layers panel. You can access additional commands and options in the Layers panel menu and the Layers menu. As you add layers to an image, it’s helpful to give them names that reflect their content. Descriptive names make layers easy to identify in the panel. This is done by double-clicking the layer name in the Layers panel.

Layers allow a user to work on one element of an image without disturbing the others. In Photoshop colouration, if you want to apply a colour effect to specific elements in an image, you have to select that element only, if not the adjustment will be applied to the entire image.

Another important functionality is the visibility icon “” in the layer panel which helps to display and hide the content of a layer in the document window (clicking the eye to disable it will hide the content and clicking to enable it will redisplay the content).

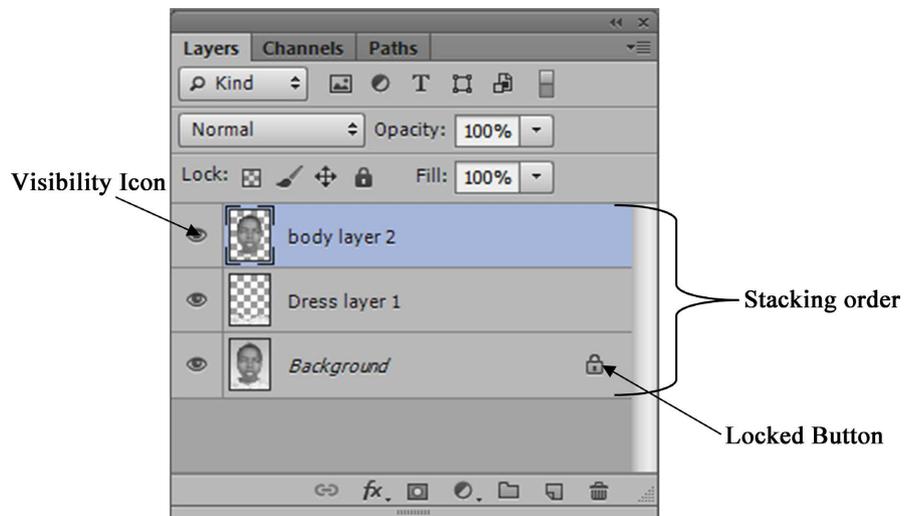


Figure 7. The layer panel.

When a new image is imported into Photoshop for editing, it is automatically locked in the layer panel as the background layer or bottommost image (**figure 7**). All other layers created from the image to display separate picture elements, will be stacked above this bottommost image. The stacking order of the bottommost image cannot be changed, neither its blending mode nor the opacity can be modified. All other layers can have their stacking order changed, and blending mode or the opacity modified without any constraint. To remove these constraints from the background layer, it has to be converted into a regular layer. This conversion will however not affect its picture elements.

To convert a background layer into a regular layer:

- Double-click Background in the Layers panel, or choose Layer > New > Layer from Background, to display the new layer dialogue box (**Figure 8**);
- Set the layer options as shown in **Figure 8**;
- Click OK.

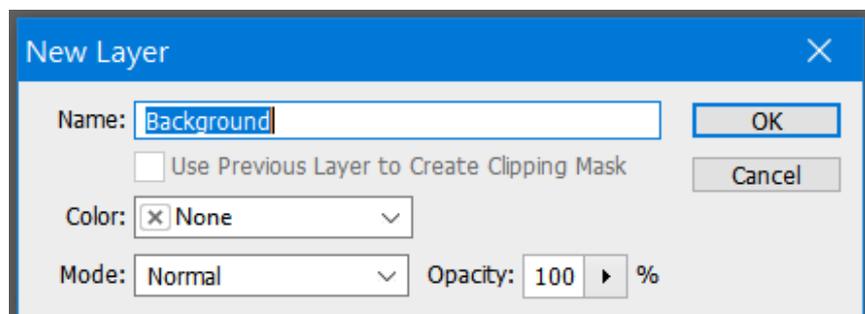


Figure 8. Converting background layer into a regular layer.

Image Colouration Schemes

For this practical research, a scanner and a 64-bit Windows Operating System Laptop Computer were the main devices used. The “Digital Image Enhancement” technique was employed. In Adobe Photoshop, this technique involves using the colour adjustment commands to manipulate, transform and enhance the chromatic effect of a digital image without introducing new picture elements. For effective image colouration the three most effective commands to use are the colour balance, hue/saturation and the brightness/contrast. These commands can be accessed from the image > adjustment menu.

Colour Balance

The Colour balance command (**Figure 9**) changes the overall mixture of colours in an image.

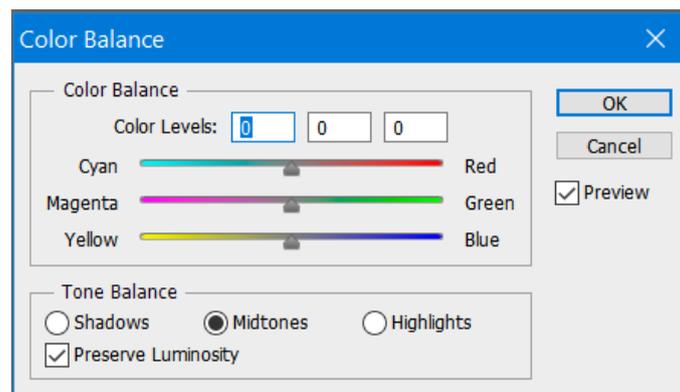


Figure 9. Colour balance.

To Use the Colour Balance Command

- Make sure the corresponding layer in the layer panel or an image element is selected.
- Open the colour balance dialog box.
- Select Shadows, Midtones, or Highlights to select the tonal range on which you want to focus the changes.
- Select preserve luminosity to prevent changing the luminosity values in the image while changing the colour. This option maintains the tonal balance in the image.
- Drag a slider toward a colour you want to increase in the image; drag a slider away from a colour you want to decrease in the image.

The values above the colour bars show the colour changes for the red, green, and blue channels. Values can range from -100 to +100.

Hue/Saturation

The hue/saturation command (**Figure 10**) has three bars, hue, saturation and lightness which helps to adjust the hue, saturation, and lightness of the entire image or individual colour components in an image.

- The “hue”, (upper colour bar) represents the colours in their order on the colour wheel.

- The “saturation”, (lower colour bar) sometimes called chroma, is for adjusting to increase or decrease the strength or purity of the Hue. It represents the amount of gray in proportion to the hue.
- The lightness is the relative lightness or darkness of the hue. It is usually measured as a percentage from left 0% (black) to the right 100% (white).

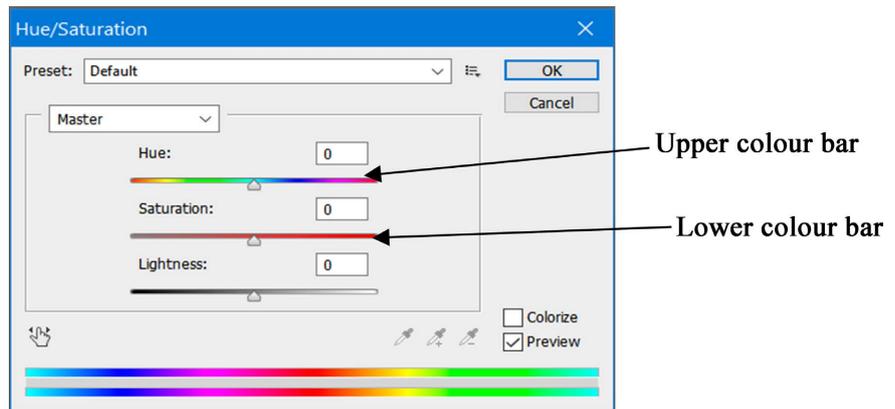


Figure 10. Hue/saturation.

To Use the Hue/Saturation Command to Colourize:

- Make sure the image mode is in RGB;
- Open the hue/saturation dialog box.
- Select the colourize option. If the foreground colour is black or white, the image is converted to a red hue (0°). If the foreground colour is not black or white, the image is converted to the hue of the current foreground colour. The lightness value of each pixel does not change.
- Use the hue slider to select a new colour. Use the saturation and lightness sliders to adjust the saturation and lightness of the pixels for Hue, enter a value or drag the slider until the colours appear as you want.

Brightness/Contrast Command

The brightness/contrast adjustment (**Figure 11**) lets you make simple adjustments to the tonal range of an image. The command makes the same adjustment to every pixel in the image. It does not work with individual channels and is not recommended for high-end output, because it can result in a loss of detail in the image.

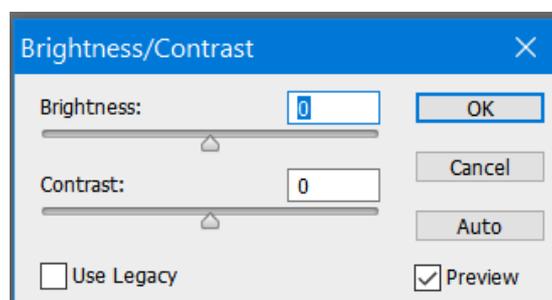


Figure 11. Brightness/contrast.

Moving the brightness slider to the right increases tonal values and expands image highlights, to the left decreases values and expands shadows. The contrast slider expands or shrinks the overall range of tonal values in the image.

When “use legacy” is selected, brightness/contrast simply shifts all pixel values higher or lower when adjusting brightness. Since this can cause clipping or loss of image detail in highlight or shadow areas, using brightness/contrast in Legacy mode is not recommended for continuous tone images like photographs (but can be useful for editing masks or scientific imageries).

To Use the Brightness/Contrast Command

- Open the brightness/contrast dialog box.
- Drag the sliders towards left or right desirably to adjust the brightness and contrast of the pixel values.

3. Results and Discussion

The image (**Figure 3**) used for this practical research was a hard copy photograph. It was first digitised by scanning, before importing it into Photoshop CS6. The first step in the colouration process was to convert the image to RGB Mode with a bit-depth of 8-bit per channel (bpc). The Bit-depth in this case, specifies how much colour information is available for each pixel in an image. This implies that the more bits of information exist in a pixel, the more available colours and more accurate colour representation that will occur. Technically, an image with a bit depth of one (1) has pixels with two possible values: black and white. Hence an image with a bit-depth of 8 will have 2^8 , or 256, possible values. Since an RGB image is made of three (3) colour channels, an 8-bit per pixel RGB image will possess 256 possible values for each channel, resulting in over 16 million possible colour values (*i.e.*, 256^3). For this reason, RGB images with 8-bpc are sometimes called 24-bit images (*i.e.*, 8 bits \times 3 channels = 24 bits of data for each pixel).

Step 1: Converting Grayscale image to RGB Mode

The image (**Figure 3**) mode was set in RGB and the bit-depth was set at 8-bpc mode by choosing image menu > mode > RGB Mode and 8-bpc (**Figure 1**). This action instantly converts an image to RGB. Converting to RGB mode is essential to activate the colour adjustment commands use in colouration.

Step 2: Selection of Picture Elements with the Magnetic Lasso tool

The character of the Magnetic Lasso tool  is to snap to the edges of defined areas in an image. It is however not available for 32-bits-per-channel images. It is useful for quickly selecting objects with complex edges set against high-contrast backgrounds. For this practical research, the option; add to an existing selection “B” (**Figure 5**) was used for each element.

To select picture elements with the magnetic lasso tool (Figure 12)

- 1) Select the magnetic lasso tool.
- 2) Carefully click the border of the image, described in the layer panel as the background image, to set the first fastening point. Fastening points anchor the

selection border in place.

3) To draw a freehand segment, move the pointer along the edge you want to trace (you can also drag with the mouse button depressed).

4) The most recent segment of the selection border remains active. As you move the pointer, the active segment snaps to the strongest edge in the image, based on the detection width set in the options bar. Periodically, the magnetic lasso tool adds fastening points to the selection border to anchor previous segments.

5) If the border doesn't snap to the desired edge, click once to add a fastening point manually. Continue to trace the edge and add fastening points as needed.

6) To switch temporarily to the other lasso tools, do one of the following:

- To activate the lasso tool, hold down Alt and drag with the mouse button depressed.
- To activate the polygonal lasso tool, hold down Alt, and click.

7) To erase recently drawn segments and fastening points, press the Delete key on the keyboard until you've erased the fastening points for the desired segment.

8) To close the selection border:

- Double-click, or press Enter or Return to close the border with a freehand magnetic segment.
- Hold down Alt and double-click to close the border with a straight segment.
- Drag back over the starting point and click to close the border.

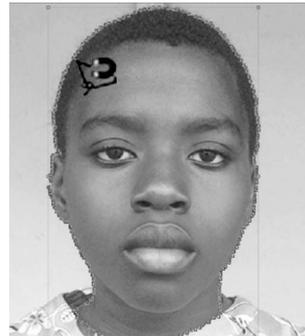


Figure 12. Selecting with the lasso tool.

The above procedures were used to select two picture elements; the body element (**Figure 13**) and the dress element (**Figure 14**). The original image was retained as the background image (**Figure 15**). These elements were used to create the layers for the colouration.

Step 3: Creating Layers from the Selected Elements

To Create a Layer from a Selected Element

- 1) After selecting the elements with the lasso tool, select the move tool .
- 2) Press Ctrl + C to copy the selected area.
- 3) Press Ctrl + V to paste a copy of the selected area. Once pasted, it will display as a layer in the layer panel.
- 4) Verify the element by selecting the layer and click the move tool. On the move tool options, make sure Auto-select and show transform controls are all



Figure 13. Body element.



Figure 14. Dress element.

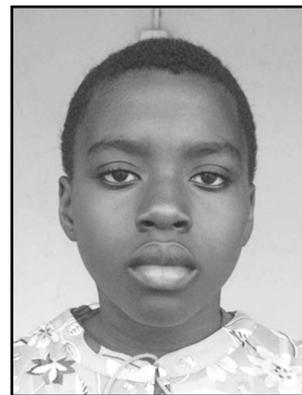


Figure 15. Background image.

checked so that any layer that will be selected in the layer panel will automatically display the transform control on the corresponding element.

Creating the layers was strategic, to constrain colouration effects to specific layers only. In all, two layers were created with the original serving as the background layer as shown in **Figure 16**.

Step 4: Colour Adjustment Scheme

The colour balance adjustment command (**Figure 9**), and the hue/saturation adjustment command (**Figure 10**), were used to transform the grayscale image

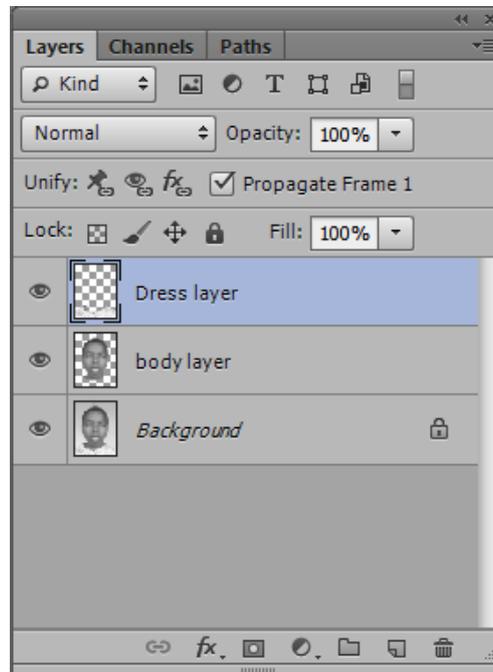


Figure 16. Layers of selected elements.

into colour mode. In this process, the stacking order was arranged by moving the dress layer to the top position above the body layer whilst the background layer remained at the bottom (**Figure 16**). The background layer was first coloured followed by the body layer and finally the dress layer.

A) Colouring the Background Layer (Figure 17)

From the layer panel, the background layer was selected whilst the visibility of the body and the dress layers were hidden by clicking the eye icon  next to the layers. With the background layer still selected, displaying only the background image in the document window, the hue/saturation command was opened and the following commands were set to transform the image.

- 1) The “colourize” and the “preview” check boxes were checked
- 2) The “hue” value was set at 36, the “saturation” at 67 and the “lightness” at -22 to produce the orange warm effect.

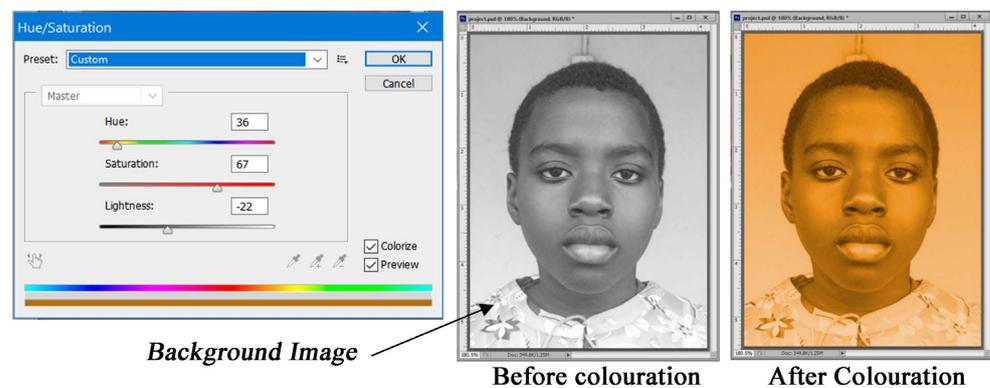


Figure 17. Background image colouration.

B) Colouring the Body Layer (Figure 18)

From the layer panel, the visibility of the body and the background layers were shown whilst the dress layer was hid. The body layer was selected in the layer panel, to display its content over the background image in the document window. The hue/saturation command was opened and the following commands were set to transform the image.

- 1) The “colourize” and the “preview” check boxes were checked
- 2) The “hue” value was set at 11, the “saturation” at 31 and the “lightness” at -24 to produce the dark brown skin colour effect.

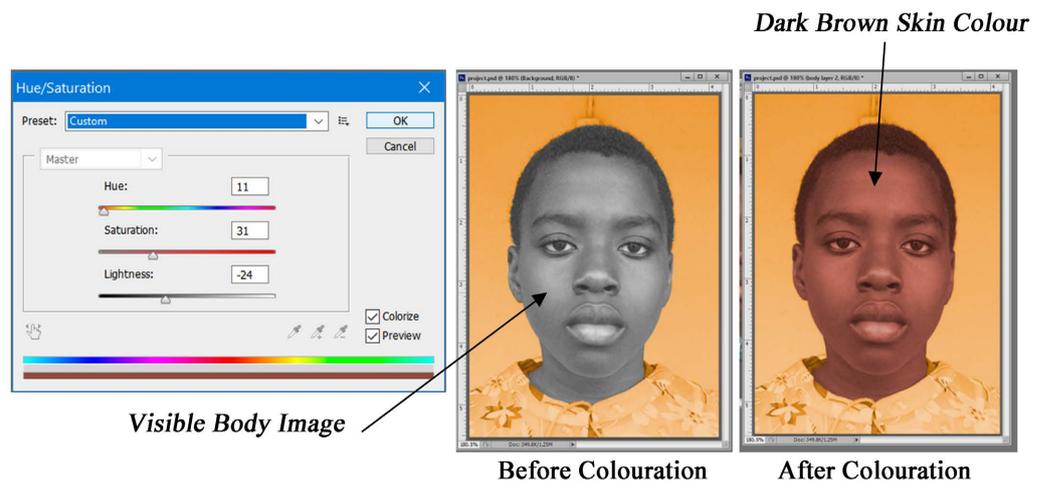


Figure 18. Body image colouration.

C) Colouring the Dress Image (Figure 19)

From the layer panel, the visibility of the dress layer was shown to add to the body and the background layers. The dress layer was selected in the layer panel, to display its content over the body and the background image in the document window. The colour balance, and hue/saturation adjustment commands were used to transform the dress colour effect. Three (3) actions were performed to obtain the desired effect.

- 1) The initial process was to use the “colour balance adjustment command” to colourize to obtain a light bluish colour in a monochromatic style. This was achieved by first selecting the preserved luminosity in the colour balance command dialog box. Then the midtone values were set at -64, 0 and +75 whilst the High-lights values were set at 0, 0, +21 to produce the desired effect. It is important to note that the luminosity of the gray scale will account for the tonal variations in the colouration.

- 2) The final process (Figure 20) was to use the magnetic lasso tool and the “hue/saturation adjustment command”, to introduce patterns of colour into the dress. The patterns were first selected with the “new selection” option of the magnetic lasso tool (Figure 5) before opening the hue/saturation dialog box. The “colourize” and the “preview” check boxes were checked in the dialog box, and

for each selected pattern, the hue slider was moved to the desired colour on the colour spectrum, the saturation was increased towards the right whilst the lightness slider was reduced towards the left to strengthen the chromatic effect of the selected colour.

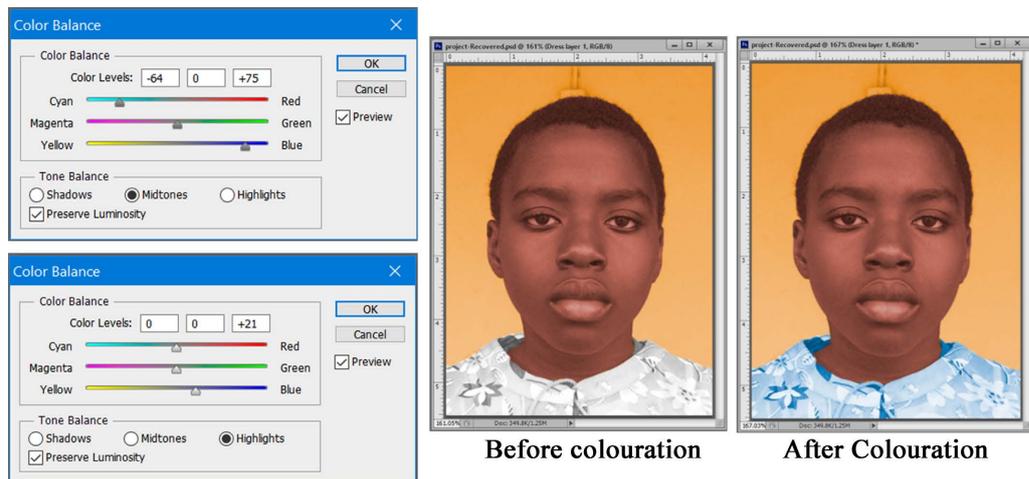


Figure 19. Dress image colouration.

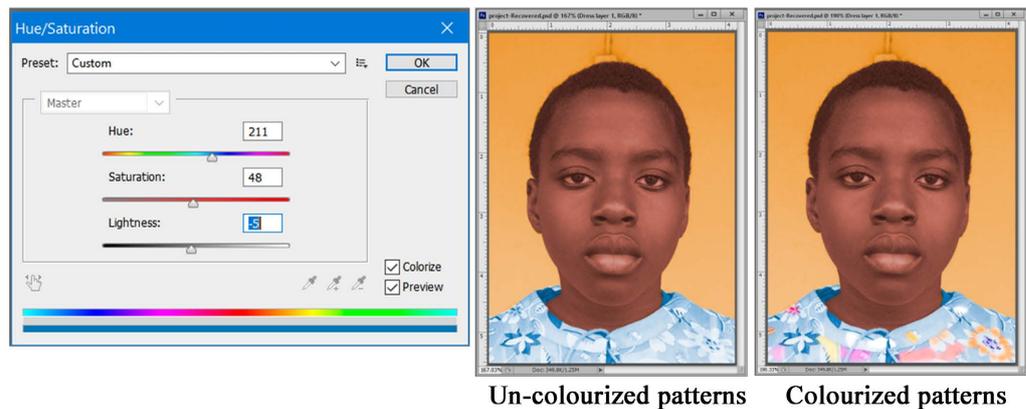


Figure 20. Dress pattern colouration.

Finishing with the Brightness/Contrast Adjustment Command

There was the need to enhance the brightness and contrast of the image with the Brightness/Contrast adjustment command. The brightness command increases tonal values and expands image highlights whilst the contrast command expands or shrinks the overall range of tonal values in the image. This was applied to bring clarity and distinctiveness to individual pixels in the entire image (Figure 21). In the Brightness/Contrast dialogue box, the brightness value was set at 40 whilst the contrast value was set at 50 (Figure 22). The “Use legacy” was kept unchecked (these values are not static but selected in relation to the degree of dullness of the coloured photograph).

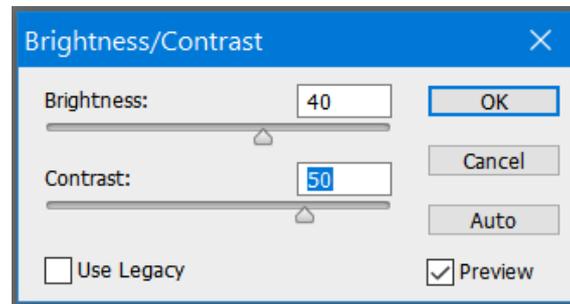


Figure 21. Brightness and contrast values.

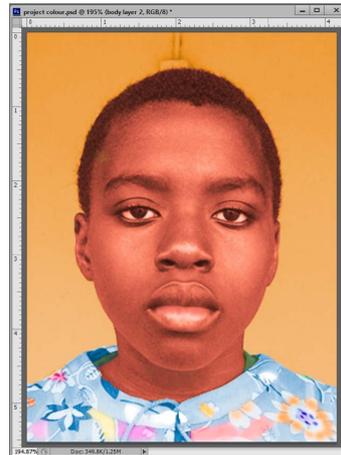


Figure 22. Finished photograph in colour.

4. Recommendations

It is important for new-media artists with speciality in digital photography who will find this paper useful for improving their image editing skills to understand that in image colouration, a grayscale photograph to be digitised for colouration should not be obsolete beyond recognition. This is because luminosity and clarity of a grayscale image is so vital for obtaining desirable results in image colouration. The authors therefore recommend the use of a good quality scanner for digitising the photograph in order not to compromise on the sharpness and clarity of the grayscale tonal values in the image. In the absence of a scanner, an ordinary smart phone with a rear camera lens resolution of not less than 8 Mega Pixels can be used to capture to digitise the grayscale photograph for equally good result.

5. Conclusion

The art of digital photography avails more creative approaches for editing and displaying great-looking images. This includes the skills for converting grayscale images into fascinating colour mode through the use of one of the most popular image editing software (Adobe Photoshop). Among the techniques for accomplishing this art is the advanced process of digital painting of picture elements. This technique is very challenging in Photoshop and should not be underestimated by any traditional photographer who is already versed in the use of the

software for image enhancement. It is aimed at popularizing this skill in the Ghanaian photographic industry, and the technical procedures for achieving this have been documented illustratively in this paper, based on the design-based research process. The essence is to serve as a basic manual for colour adjustment, colour transformation and chromatic enhancement of photographs. The Technical and Vocational Education and Training (TVET) unit of the Ghana educational service must find this paper as useful material for incorporating digital art into the vocational education syllabus to help build the capacity of art students who intend to pursue photography as a course of study at the tertiary level.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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