DIGITAL IMAGING

Introduction to Digital Imaging

Diploma in Multimedia and Animation (DMA)
Digital Imaging

Block – I: Introduction to Digital Imaging

Odisha State Open University
Introduction to Multimedia

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## Contents

### Course Overview
- Welcome to Introduction to Digital Imaging ......................................................... 5
- Introduction to Graphic Design ............................................................................... 5
- Understanding Digital Images ............................................................................... 6
- Understanding Colour .......................................................................................... 6
- Visual concept and Graphic Preparation ............................................................... 6
- Course outcomes .................................................................................................... 7
- Timeframe .............................................................................................................. 7
- Study skills ............................................................................................................. 8
- Need help? .............................................................................................................. 8
- Assignments ........................................................................................................... 9
- Assessments ........................................................................................................... 9
- Video Resources .................................................................................................... 9

### Getting around this Course material
- Margin icons .......................................................................................................... 10

### Unit 1
- Introduction to Graphics Design ........................................................................... 11
  - Introduction ......................................................................................................... 11
  - Outcomes ............................................................................................................. 12
  - Terminology ........................................................................................................ 12
  - Graphics .............................................................................................................. 12
  - Historical Background of Broadcast Graphics .................................................. 17
  - Principles of Design ........................................................................................... 20
  - Design Elements ................................................................................................. 24
  - Fundamentals of Computer Graphics ................................................................ 26
  - Print Graphics and TV Graphics ....................................................................... 33
  - Unit summary ....................................................................................................... 35
  - Assignments ....................................................................................................... 35
  - Resources ............................................................................................................. 36

### Unit 2
- Understanding Digital Images ............................................................................... 37
  - Introduction ......................................................................................................... 37
  - Outcomes ............................................................................................................. 37
  - Terminology ........................................................................................................ 37
  - A Brief History of Designing ................................................................................ 38
<table>
<thead>
<tr>
<th>Unit 3</th>
<th>64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Colour .......................................................... 64</td>
<td></td>
</tr>
<tr>
<td>Introduction ................................................................. 64</td>
<td></td>
</tr>
<tr>
<td>Outcomes ................................................................. 64</td>
<td></td>
</tr>
<tr>
<td>Terminology ................................................................. 65</td>
<td></td>
</tr>
<tr>
<td>Introduction to Color ....................................................... 65</td>
<td></td>
</tr>
<tr>
<td>Color Theory ................................................................. 66</td>
<td></td>
</tr>
<tr>
<td>Color Harmony ................................................................. 73</td>
<td></td>
</tr>
<tr>
<td>Color Contrast ................................................................. 76</td>
<td></td>
</tr>
<tr>
<td>Cool and Warm Colors ........................................................ 78</td>
<td></td>
</tr>
<tr>
<td>Additive And Subtractive Colors Modes .................................... 79</td>
<td></td>
</tr>
<tr>
<td>Color And Graphics .......................................................... 82</td>
<td></td>
</tr>
<tr>
<td>Colors For The Web ............................................................ 84</td>
<td></td>
</tr>
<tr>
<td>Converting Image Between Color Modes .................................... 86</td>
<td></td>
</tr>
<tr>
<td>Unit Summary ................................................................. 88</td>
<td></td>
</tr>
<tr>
<td>Assessment ................................................................. 89</td>
<td></td>
</tr>
<tr>
<td>Resources ............................................................... 90</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 4</th>
<th>91</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual concepts and Graphics preparation ................................. 91</td>
<td></td>
</tr>
<tr>
<td>Introduction ................................................................. 91</td>
<td></td>
</tr>
<tr>
<td>Outcomes ................................................................. 91</td>
<td></td>
</tr>
<tr>
<td>Terminology ................................................................. 92</td>
<td></td>
</tr>
<tr>
<td>Origin Of Broadcast Graphics .................................................. 93</td>
<td></td>
</tr>
<tr>
<td>Graphic Designing ............................................................ 95</td>
<td></td>
</tr>
<tr>
<td>Implications for Design ....................................................... 98</td>
<td></td>
</tr>
<tr>
<td>Graphic Requirement for TV Program ......................................... 98</td>
<td></td>
</tr>
<tr>
<td>Preparing TV Graphics ........................................................ 99</td>
<td></td>
</tr>
<tr>
<td>Title Safe And Action Safe Margin ............................................. 101</td>
<td></td>
</tr>
<tr>
<td>Vector Graphics .............................................................. 103</td>
<td></td>
</tr>
<tr>
<td>Raster Graphics .............................................................. 104</td>
<td></td>
</tr>
<tr>
<td>Visual Effects (VFX) Design .................................................. 104</td>
<td></td>
</tr>
<tr>
<td>Illustrations and their Use In Graphic Designing ......................... 107</td>
<td></td>
</tr>
</tbody>
</table>
Course Overview

Welcome to Introduction to Digital Imaging

In this Block 01: ‘Introduction to Digital Imaging’ which begins with overview on Graphics, Use of Digital technologies in graphics and desktop publishing. You will learn History of Digital Imaging and Television Graphics, along with various digital techniques that were used in creating and editing digital images. This block will provide you handful information about fundamentals of computer and web designing, Aesthetics, Colour harmony, Design elements and Principles of design. You will also learn Digital imaging file formats; their uses and editing/conversion of various types of digital images into different modes and study about Pixel and Resolution of digital images.

Here you will also brush up on colour theory; Additive and Subtractive colour modes and use of colours in different graphics composition as per the mood and requirement of design. You will also study how colour tones will be changed during the mode conversion. The fourth unit of this block will provide the information about Vector and Raster Images, Preparation of TV graphics in different video formats and you will get an overview of 2D and 3D animation techniques and virtual world.

Introduction to Graphic Design

This course is intended for the learners and people who wish to create innovative designs and impressive animations, like to do photo finishing of images, love to generate stunning graphics and multimedia presentations.

Basic knowledge of Computers and related software, good visualising power and a flare for creativity are the primary requirement for this course.
Understanding Digital Images

This course is intended for the learners, who wish to create innovative designs and impressive designs, like to do photo finishing of images, love to generate fantastic graphics and multimedia presentations.

Creative attitude and good visualisation is the primary requirement for this course.

Understanding Colour

This course is planned for people who want to play with color. Color is the basic element of any art form. It helps in translating the image grasped by humans through their eyes. Since the civilisation of humans, colors have attracted the human beings. Artist plays with colors to form different artistic form and compositions, which were accepted to eyes of patron like the poetry to ears.

Visual concept and Graphic Preparation

This course is meant for individuals who mean to make creation outlines for visual medium. As the visual information is most important content of any production; graphic plays the key role in making any video program more interesting and informative. Since major development happens in technology by the invention of computer; graphics too had also developed with the same pace.
This video will provide a brief overview of this course.

<table>
<thead>
<tr>
<th>Topic</th>
<th>YouTube link</th>
<th>QR Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Video 1 – Digital Graphics Technology</strong></td>
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<td><img src="https://youtu.be/4qPIDiiM6GM" alt="QR Code" /></td>
</tr>
<tr>
<td><strong>Video 2 – Colour Theory</strong></td>
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<td><img src="https://youtu.be/d0B-Y6ig9I8" alt="QR Code" /></td>
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</tbody>
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**Course outcomes**

Upon completion of Introduction to digital Imaging you will be able to:

- Explain the Fundamentals of Computer Graphics and
- Prepare Print Graphics and TV Graphics
- Describe Pixel, Resolution and Bitmaps;
- Differentiate Square and non-square pixel and Pixel dimension;
- Describe Color;
- Differentiate between primary, secondary and tertiary colors;
- Prepare VFX (Visual Effects)
- Illustrate Info graphics and use them as Visuals in Multimedia Production

---

**Timeframe**

This course will be completed within “1” classes.

This course is of “1” credits.

2 Hours of study time is required for this unit.
Study skills

Learning about the software options and tools are a part of Multimedia Coaching. But, when it comes to creation of an output, there is no specific ABC formula for doing so. It is just like a painting in which the artists choose the colour and proportion according to the need, not as per a written plan.

In creating outputs for TV, Films etc. we have to utilize the software tools from one corner to another randomly. So for every project, the formula is different. There is no fixed recipe for all kind of output. So, the more and more you learn about the tools and options, you will get variety while creating an output. Each and every options are explained step by step in the course material.

Apart from this course material, the learner has to adopt the tendency of learning from multiple sources i.e.,

- Internet tutorials
- Video tutorials on youtube
- Collaboration with people working in the industry etc.

Only classroom study will not make you a professional. You have to be active to grab the opportunity of learning wherever you get a chance.

Need help?

In case of any help needed you can browse the internet sites like youtube.com for video tutorials about the subject.

Apart from that, you can contact the writer of this course material at arif.naqvi@ignou.ac.in
Assignments

There will be some assignments at the end of each unit. These assignments are mostly practical-based and should be submitted in CD or DVD. Theoretical assignments are to be submitted neatly written on A4 size sheet.

All assignments will be submitted to respective study centre of Odisha State Open University or as directed by Co-ordinator.

All assignment should be unit-wise on separate CD/DVDs clearly mentioning course title and unit on the top. Theoretical Assignment will be neatly filed or spiral bind with cover clearly mentioning necessary information of course, student detail on top.

Assessments

There will be “1” assessments for each unit.

All practical assessment will be submitted to OSOU.

Assessment will take place once at the end of each unit.

Learner will be allowed to complete the assessment within stipulated time frame given by the university.

Video Resources

This study material comes with additional online resources in the form of videos. As videos put in human element to e-learning at the same time demonstrating the concepts visually also improves the overall learning experience.

You can download any QR code reader from Google Play to view the videos embedded in the course or type the URL on a web browser.
Getting around this Course material

Margin icons

While working through this Course material you will notice the frequent use of margin icons. These icons serve to “signpost” a particular piece of text, a new task or change in activity; they have been included to help you to find your way around this Course material.

A complete icon set is shown below. We suggest that you familiarize yourself with the icons and their meaning before starting your study.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Assessment</th>
<th>Assignment</th>
<th>Case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td>Group activity</td>
<td>Help</td>
<td>Note it!</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Reading</td>
<td>Reflection</td>
<td>Study skills</td>
</tr>
<tr>
<td>Summary</td>
<td>Terminology</td>
<td>Time</td>
<td>Tip</td>
</tr>
</tbody>
</table>
Unit-1

Introduction to Graphics Design

Introduction

Today due to technological advancement and improved tools in computer software programs almost every computer and Smartphone is equipped with capability to perform some effects of graphics. Now even common people can perform some creative tasks easily on their devices, in many cases so good that they look to have been done by professionals.

Creating meaningful and effective graphic visuals for television requires very simple but specific design that communicates the message to the audience / viewer straight as the diverse audience has different understanding levels. Sometime, what you are viewing neatly and easily readable on your computer or laptop, may look clumsy and difficult to be read on television screen. So one has to careful, while producing any graphics that will be viewed properly on a TV screen too besides a Smartphone. In short, graphics shall be prepared in such a manner so they can be easily readable and understood by TV viewing audiences within short time. People are easily discouraged by reading rapid graphics. Hence we can say that the key for all appealing visuals lies in their simplicity and boldness.
Outcomes

Upon completion of this unit you will be able to:

- Describe Evolution of Computer Graphics;
- Use Digital technology in Graphics;
- State the Principles of Graphic Design;
- Explain the Fundamentals of Computer Graphics and
- Prepare Print Graphics and TV Graphics.

Terminology

Broadcast: Program transmitted from Radio or Television

Computer Graphics: Designs, Art or Illustrations created through computer

Chroma Key: A technique used in removing a particular colour (blue or green) from video image and replaced by another image or colour.

Clipart: Readymade simple icons, pictures, logos etc. available for use in computer designs

CGI: Computer Generated Imagery

Graphics

What does the term “Graphics” stands for?

A graphics is an image or visual representation of any object. It can be a Map, Sketch or Picture that was produced using various techniques of paintings, i.e. etchings, engravings and lithographs. Later on as the technology developed, drawing and painting techniques gradually transformed into new avatars and this fusion came to be known as ‘Computer Graphics’ later. It is the stage
when imagery based graphics are created without pigment colours and paper. It is not only an interesting method but also a more convenient way to create art works. Even on this media one can work like a traditional artist and with much more precision and possibility of corrections.

It would have been interesting to see whether the old great masters in the history of world art, like Salvador Dali or Van Gogh were alive today, would they still paint canvas using pigment colours and use charcoal or pencil to draw on a sketchpad or sit on their PC holding a mouse or a Graphics Tablet instead to draw their masterpieces on screen on a virtual canvas using virtual colours.

Digital Painting is now growing popular among next-gen who creatively uses modern tools for making digital art or digital imagery in the computer. Computer software that help in creating virtual canvas and virtual colours and many tools that have replaced traditional painting mediums and woven canvas-cloth / paper now seem to be the first choice of digital artists. Here more accurate drawings of any form of geometrical designs, symmetry, repetition of motifs can be created very easily those are less possible in traditional painting. The option of undo without leaving trace adds more finishing and freshness to any digital graphics. Thus use of technology in creating graphics proves to be more accurate than that by human hands and traditional methods. It is now possible to generate more complex shapes and figures using computer programs by an artist for their visuals. Taking an example of ‘Fractal Art’ (Fig. 01) which was rarely drawn or painted by hand can now easily be created on computer, which is capable in creating any type of complex nature of patterns just by its calculations resulting to a mesmerizing fractal in form of still images or animated sequences.

![Fig 01: Computer Generated Fractal Art](image)

Created by Author
Overview of Evolution of Computer Graphics

If you look back into the history of computer and technology you’ll find a guy from mid twentieth century a scientist named Ben Laposky (1950) who invented first ever Graphic Images, he was a mathematician and artist in Cherokee, Lowa, he used electronic machine (which was an analog vector devise) named Oscilloscope. By utilizing it as a medium for creating abstract images he produced most of the images. It was achieved by manipulating the electronic beams on the device and later on recording those on photographic films. He named these images as “Oscillons”. Laposky created electronic vibrations on the screen of his Oscilloscope which produced a number of abstract images which were named as “electronic compositions” by the artist and by using photographic stills he captured those images, which he displayed too in an exhibition at Sanford Museum in Cherokee.

Later on, as technology advanced many inventions happened in this field. Invention of light pen (1955) as input device is one of them. By using this device (Light pen) earlier graphics designers were able to create basic shapes on computer screen by using Ivan Sutherland’s software “Sketchpad” for sketching. Light pen has small photoelectric cell on its tip. When placed near a screen, with the help of cursor, one can easily draw any shape and fill desired colours to it. Sutherland’s software has lots of self-programmed features like basic primitive shapes, which can help in easy drawing, hence one can choose from them and the shape is automatically created; only operator has to modify or reposition it in his composition.

In 1965 Jack Bresenham invented “Line drawing algorithm”. By the early 70’s Raster displays were introduced so the magnification of images became more clear and crisp. In 1977 Apple II design was presented to this world of computing which became the first ever Personal Graphic Computer. In the 80’s various technologies were invented for creating and producing digital images on computer. Star Wars like programs used optimum graphic effects by using ‘chroma key’ (blue screening). We find the same revolutionary techniques of imagery introduced in printing technology too where the use of Computer Aided designs starts replacing conventional techniques. Many tools were
developed to visualize data. In later stage this was bifurcated into 2D and 3D computer graphics. Over the past few decades we saw the growth in visualization, be it informative or scientific visualization.

Further advances in computing technology led to greater advancements in Post Script Page descriptions when “John Warnock” and pioneers founded Adobe Systems and made revolutionary entry into Photo editing and Movie editing software’s “Adobe® Photoshop®” and “Adobe® After Effects®” respectively. By this time in early 1980s we see commercialization and modernization of computer graphics at steady rate. Computer was now adopted by many sectors of society. Software Developers are increasing now significantly. Artists and animators have started using computers as a design tool on which they can design more accurately and saves lots of time. Macintosh computers are highly popular among artists and design studios.

During the 1990s’ use of 3D modeling grows on mass. As the CGI quality improved, more users are now able to use their home or personal computers for 3D modeling and rendering. Earlier it was limited to heavy ‘Silicon Graphic workstations’ only. Growing demand of cost effective machines leads to popularity of Microsoft Windows and Apple Macintosh which are now capable of running 3D studio and Autodesk products. 3D graphics became far more popular among multimedia artists and animators.

Later in 2000s’ video games and CGI cinema’s accelerated pace leads digital revolution to new highs. Increase in digital processing and 3D rendering capabilities improved the efficiency of computer in texturing, shading, bump mapping allowing the simulation of details in imagery. Computer graphic imagery that was used in film and animation gradually increased the realism due to these advance GPUs. Animated 3D films like ‘Ice Age’, ‘Finding Nemo’ and ‘Madagascar’ are some examples where one can witness the close to reality and their photorealistic CGI characters that can be possible only with motion capture technique.

**Use of Digital Technology in Graphics**

As technology progressed we saw more advancement in 3D computer graphic use. It emerged as a new tool for generating
virtual images, complex 3D models having vast number of polygon which were used in almost all major streams, like Architecture, Films, Medical science, Astrophysics, Advertising and promotional videos. Now graphics are nearly scientifically photorealistic, having texture mapping in matured stage we see that designers/modelers can create more complex objects, shapes and anatomy figures quite easily and that too with realistic ambience.

Here are some common terms that are used as technological tools in graphic context.

**Desktop Publishing**: Vast number of software are developed for integrating graphics and texts in layout so that it may be arranged in desired order for production of various images, magazine, catalogs, newspaper and other media in printed form. This form of technology allows users to create and print their data in magazine, book or paper formats. It is also used for Digital Typography where large number of fonts, symbols and icons can be used for composition. There are two types of pages that can be created on Desktop Publishing -

1. **Electronic pages**: These pages are published only in electronic form. e.g., Web newspaper, magazines etc.

2. **Virtual pages**: These pages are digitally designed page layouts to be printed on physical paper of varied size. e.g., News Paper, Books, catalogs etc.

**Graphics Programs**: Any software that is used for generating, modifying, or editing the digital images. Scribus, Krita®, Inkscape®, Microsoft Word®, Adobe® Indesign®, Adobe® Photoshop®, CorelDraw®, Blender®, Maya® etc. are some examples of Graphic programs.

**Internet and Web**: It is a worldwide network of computers interconnected with each other by internet protocol suite (TCP/IP) sharing extensive data of information resources and services among group of computers through graphical interface. Internet service providers made the connectivity available to the users who then share or obtain the information on network. This is a vital tool that was helpful for artist for gathering or sharing graphic data. Graphic artist can access various and enormous information
from web uses it in their composition or can share his creative output to the outer world also.

You can find in later units of this course how effectively digital technology can be used as designing tool and helps artist in creating its artwork more easily and accurately.

**Historical Background of Broadcast Graphics**

In television technology ‘Broadcast Graphics’ were adapted as like they are used in films. Since the invention of Television in 1936, there were constant experiments were done for the enhancement of its potential visual communication by creating attractive graphics. During this period all graphics were created by hand on celluloid, paper and card board. Some studios use embossing machines to give the feel of 3D. Usually Program Title, Maps, Illustrative charts, Credits and weather report featuring temperature were common graphics prepared by artists. Whole process was extremely time consuming and due to limited resources and technical limitations in resolution of only 405 lines restrict the professional painters in achieving desired results. Most of the areas around borders and corners of screen was not fully utilized as it remains out of focus as the resolution of cameras was very low.

Letters and text that was written on black paper sheets are bold and larger in size. For credit rolls lettering was done on paper roll and then manually or with the help of electric motor it was physically rolled. All illustrative work would also be created with bold outlines. Sometime limited animation gimmick were done by designers. They make cut holes a window like shape on black paper sheet then write lengthier text matter on little bigger size of black paper strip which was placed behind that cut window opening. *(Fig 02)* Then a path was made by sticking little thick paper so when this text written strip was dragged or pulled from one side only some part of text appears on screen and gives crawl like effect.
It was the time during 1920’s when Graphic designer, Saul Bass made Graphics for Films and Television. He was the earlier artist before computer generated graphics invaded the industry. He had designed many opening titles for number of films. *The Man with the Golden Arm* (1955), *Vertigo* (1958), and *Psycho* (1960) etc. are few famous films for which he made title sequences. He was a creative and talented designer, and a pioneer of motion graphics. Comparing from today’s standards, Bass’ designs seem very simple and amateur, but they were effective and considered state-of-the-art visuals at the time when all graphics were created by hand, without the aid of any computer.

Later Rostrum camera was invented and frequently used in Graphic designing. By the help of this vertically mounted Rostrum camera Graphics and cell animation sequences become
automated to some extent. This camera has the function to move up and down and any artwork which was placed in front of it was exposed on film and later on after processing like any other film these exposed negatives were edited manually and pasted so as to give the motion effect to that artwork. With the help of Rostrum camera ‘Still images’ like Photographs, Paintings or hand drawn artwork was exposed on film. This also helps in shooting lots of cell frames for 2D animations. Later on as the technology advances further these Rostrum cameras were attached with motorized units which helps in taking more variety of camera moves such as ‘Slit-scan’ and ‘Streak-timing’.

The 1980’s more development happened in Graphic technology, resulted to the evolution digital paint systems like ‘Quantel Paintbox’. This gadget strengthens the creativity of Graphic designers and enabling them to assemble collages and montages as well as to adapt more images into their compositions. Graphic Designers are now able to type on Quantel Paintbox by choosing varied Fonts, though limited, but this text typing saves a lot of time and also the finishing in artwork was improved. Earlier these compositional Lettering or typography were drawn either by hand or by using stencils, later on Letterset transfer sheets and character generators came to help designers in formatting, composing text matter with vide range of fonts, borders and corners readymade designs. By the help of Quantel machines text captions could now be composed in few seconds. The computer systems are become so functional, that it was used in varied form of designing with numerous ranges of fonts and symbols.

After computers were introduced to graphic industries, companies in association with BBC develop Character Generator, an initial device for creating onscreen graphics named ‘Aston’ and ‘Chyron’. These hefty and bulky machines are very popular in that era as the graphic generated on these machines are quite crispy and fast as compared to the traditional manual graphic making process. It consumes less time, paper & pigment colours were replaced by electronic generated imagery.
In 1990s 3D Character Generators were introduced to electronic media, they are improved versions of their ancestor CG machines, Quantel Paintbox was one of them which were very costly and bulky also. It was generally used for generating backgrounds and small animated sequences. It takes frame by frame rendering process which was very tedious and time consuming. Later Silicon Graphic computers invaded the industry, though they also had memory like issues but become the first choice of designers and 3D animators as they can operate various dedicated programs on it. This era of Silicon Graphic® and Qantel Paintbox® was not as lengthy because Windows based Computer machines stepped into the market and programs like Adobe® Photoshop®, Adobe® After Effects®, Adobe® Premier®, Digital Fusion®, were equipped with lots of Tools and Effects. Windows-driven software is easy to operate and was programmed by keeping in mind the artistic sense of Visual art.

**Principles of Design**

Before starting any artwork or painting or any digital layout it is good to follow some rules and principles that will enhance the composition’s aesthetic value and appears more effective, balanced and meaningful. Some aesthetic principles are drawn which guides for a good and balanced composition. These principles are – Unity, Harmony, Contrast, Repetition, Variety, Emphasis, Balance and Proportion (Fig 03). According to the author of ‘The Elements of Graphic Design’, Alex White: “To achieve visual unity is the key concept and main aim of any graphic design. If all elements are in linear arrangement, a graphics design is treated as unified”. The expert designers sometime break these rules of designing. They usually compensate this by some unusual composition for viewer’s attraction or achieving something different. But it is always recommended that unless you are not sure or be certain of doing something miraculous, it is better to abide by these principles.
- **Unity**: It refers to a sense that all elements in your composition or in a piece of work will be in proper order i.e. having some sort of relation in between them. If proper unity is achieved it will bind all forms into a single piece of work that is an ‘artwork’ in proper sense. Unity can be achieved by proper use of balance in composition, repetition of graphic forms.

- **Harmony**: Always remember that Harmony is a very important element in composition and it is created by the balance of unity and variety. It can also be achieved by Colours, using complementary colours. It appears visually pleasing and makes any composition more lively and balanced.
- **Contrast**: Separating and making the subject prominent is the main use of contrast. It can be achieved by choosing variation of great difference in colour, value, size, etc. It creates significance in layout and attracts the viewer’s attention close to the important area in the subject.

- **Repetition**: Repeating some elements within a composition, be it in the forms of colours, lines, shapes, values, etc. with some variations to generate interest in design.

- **Variety**: The use of various elements in composition, which creates interest in the mind of viewer with variation of forms and colours in order to make design more dynamic and not have monotony, is called variety, another important principle in design.
• **Emphasis**: It specifies the prominent area of interest where the designer wants to pull more attention of the spectator. It is the main point of interest in any composition. It also gives direction and specific pattern to a design. Emphasis or ascendancy of an object can also be achieved by increasing the object size, by placing it in the prominent area or foreground, and making it visually emerge more compared to other objects in a painting or artwork.

• **Balance**: There are two types of Balance, symmetrical or asymmetrical. It depends on artist’s visual sense how to use it. Sometimes this balance can be gained by arranging its objects according to their figure or sizes and sometimes it can be according to its colour also. Symmetrical colour scheme can also help in making the composition more Balanced.
• **Proportion:** It involves directly with the relationship of size of different objects. Sometime Proportion is also relative to size of areas of different colours. Proportion also depends on purpose of used object in composition.

![Fig. 11: proportion](image)

**Design Elements**

E. Graves (1902-1978) in his book *The Art of Colour Design* mentions that any composition can be created by using these elements of design. *(Fig 03).* These design elements are Line, Shape, Size, Space, Colour, Texture and Value. Hence these are the components which are used in creating any painting or digital layout.

- **Line:** Line is treated in two ways. The linear marks made by any writing/painting tool or the boundary created when two shapes meet. While making any composition be careful in adding Line shape horizontally, it should be more than 4 points thick otherwise it flickers like crazy on screen due to interlacing.

- **Shape:** A shape is a geometric form, drawn to create objects, figures and visual components in any layout. A shape may be round, square, triangular or oval etc. Try using similar shape throughout your Compositions.

- **Size:** It is an important element as it makes your artwork attractive and organized. Choosing the right size for selective layout is very important. If you are creating Graphics for Television your layout must be in horizontal shape and usually be either a 4:3 or 16:9 displays. Hence it is better to know what your target output size is. In television broadcast system there are various display sizes. Some of them are listed as below:
- **Display Size – 4:3 format**
  a) VGA: 640 x 480
  b) PAL: 768 x 576
  c) SVGA: 800 x 600
  d) XGA: 1024 x 768
  e) 1280: 960
  f) SXGA+: 1400 x 1050
  g) UXGA: 1600 x 1200

- **Display Size – 16 : 9 format**
  a) WVGA: 854 x 480
  b) HD 720: 1280 x 720
  c) 1366 x 768
  d) HD 1080: 1920 x 1080

Some other Display Sizes are as below:
  a) Cineon Half: 1828 x 1332
  b) Cineon full: 3656 x 2664
  c) Film 2K: 2048 x 1556
  d) Film 4K: 4096 x 3112

- **Space**: It is the area that contains any visual image or shape in the given picture. It is referred in design element as an aesthetical element also as it gives some meaning and aesthetic value to any composition. There are two types of
space in any composition ‘Positive’ and ‘Negative’ space. Positive space is referred as the ‘Brimming’ space or you may say it is any form, object or element that is occupying space in any design layout. While Negative space is the empty space leftover in design.

- **Colour:** In technical terms colour is referred to as ‘Hue’. It is the most important element of composition hence its use is very crucial. In any composition choosing right colour is very important as artist should know the properties and their combinations of colour schemes for effective and meaningful output or composition. Colour schemes or colour harmonies are made to help artists choose the colour that suit their composition or layout. For the help of designers and artists in choosing proper colour; having certain properties and meaning, colour wheel was invented. This colour wheel is a visual representation of all Basic colours specifically known as Primary, Secondary and Tertiary colours.

- **Texture:** Texture is like material coated on the surface. It reflects the quality of a shape – means viewer can assume the surface after looking the drawing, that gives the feel of smooth, soft, hard, rough, glossy etc. Texture can be created by two methods, Physical (tactile) or Visual. Physical Texture is that texture which you can actually feel by your hand. Visual Texture is only an illusion. It just gives the feel of physical texture to the viewer. Use of Digital Paint in artwork gives the effect of texture to it.

- **Value or Tone:** Value is referred here as the lightness or darkness of a colour. It is also termed as Tone sometime. Difference between the light and dark areas in a graphic composition is known as Tonal contrast.

**Fundamentals of Computer Graphics**

In the field of Information & Technology Computer Graphics is an emerging trend. Almost any venture now days make some use of Computer Graphics. Some major areas are - creating Cartoon Films, Animations, Architecture, Fashion Designing, Photography, Special effects for films and Ads, and for visualising Print publicity for which we use Computer as a tool.

In addition computer graphics are massively used in the Film and Video industry, exclusively to develop special effects in
movies and animations. Video games are now very much popular among all generation groups. In the field of Animation there are graphic artists, who efficiently blend different techniques by using or exploring different media effects to enhance the creative aspect.

Now the question arise how we perceive any information in a computer? Answer to it is obviously by seeing Images, Texts and Through Videos, while sound support us in understanding the visuals. These visual are created by the computer using various input devices. These are:

- **Keyboard and Mouse**
  
  ![Keyboard and Mouse](Created by Author)

  Fig. 13- Keyboard and Mouse [Created by Author]

- **Wacom Tablet**
  
  ![Wacom Tablet](Created by Author)

  Fig. 14-Wacom Tablet[Created by Author]

- **Scanners**
  
  ![Scanners](Created by Author)

  Fig. 15-Scanners [Created by Author]
• Digital Camera

![Digital Camera](image16.png)  
**Fig. 16-Digital Camera [Created by Author]**

We have output devices on computer through which we can obtain the information are:

• Monitor

![Monitor](image17.png)  
**Fig. 17: Monitor [Created by Author]**

• Screen

![Screen](image18.png)  
**Fig. 18-Screen [Created by Author]**

• Printers

![Printers](image19.png)  
**Fig. 19-Printers [Created by Author]**
• **Speakers**

In computer we have CD/DVD ROMs, Hard drives and Tapes as storage devices. These all devices are connected with various cables, wires and fibre optics through which the information was carried to different devices and transmitted to different places for e.g. transmission using computer networks and through different broadcasting mediums.

Multimedia production for presentation, films requires Graphics, some moving images, such as animation and sound. It also requires effective approach of utilising the data consisting of text, voice, audio components, video components and image animation. Here in integrated multimedia applications user can modify this data by cutting partial sections of all or any of these components and pasting them in their project for making their presentation.

While working on computer graphics we use some media elements for creating our projects, these are as follows

- **Images**: These can be imported from digital cameras or scanned through scanners using a hand scanner, sheet fed scanner, flatbed & drum scanner. After scanning these photographs or other various images save them in any desired format (JPEG, TIFF, GIF etc.). You can use any other program to generate your own graphics/image like Paint®, Inkscape®, Krita® etc. If one has good hand in drawing and painting then they can create sketches, painting on paper and then after scanning that artwork you can use them as digital images.

- **Text**: Using variety of fonts and symbols.

- **Video**: This can be recorded by camcorder or digital camera, now even smart phones comes with high quality recording facilities in it and animated sequence.
• **Audio**: Adding music to compositions is very important; it can be created or recorded from any source.

Note, however, if you won’t be able to create drawings/sketches through pen and paper or in any computer program, need not to worry, you can pick up existing images for a wide range of purposes. Collections of clip art are available on web and in many commercial and shareware software packages.

Term Clip art is used for image files (sometimes for other media files like animations or sound tracks) that you get readymade and not created by you but which are made available to you for use in your graphic compositions. Clip art libraries can be found on Web, it comes along with some software packages, and on CD-ROM/DVD disk from different vendors like “Getty Images” or any local software store. These Clip art as a rule are offered copyright-free, and you can use them any way you like. Some Clip art collections are copyright protected for some uses; be sure to read any copyright notice accompanying any clip art before using them into your artwork.

**Downloading Clipart from web**

1. Using Internet browser, go to web page of Clip art/Image site.

![](fig_21.png)

**Fig. 21 Screenshot**

2. Browse your desired picture and select it.
3. Right click your mouse button and choose Save Picture As from the pop-up menu.

4. Save this file on your computer using the path and filename desired. All image files have a name by default, but you can rename them to suit your identification. Do not change the extension, which informs browsers of the image's type.

5. Now switch to your Program and import/insert this image.
6. Select the image from the location it was saved on computer and click the open button.

7. Now this image is placed or imported to working software/program.
Using Images from CD-ROM/DVD

1. You can insert/import a picture directly from your disk (CD/DVD) into your program or

2. You can copy Clip art/ Images from CD-ROM or DVD to your project folder on your Local drive by creating a new folder and renaming it ‘Clip art’ or whatever you like.

3. Use ‘My computer’ to navigate to the CD/DVD drive where it is stored, locate the exact image (can preview by increasing the Icon size) you need.

Important Stuff about using Images

Before inserting any image into your composition check the quality and resolution of chosen image. Resolution of image may differ from medium to medium, for Print medium, image should be not less than ‘300 Pixels per inch’ but in video it will be of ‘72 Pixel per inch’. Images used for printing purpose require more colour depth in image and higher resolution. Higher resolution means bigger file size.

Print Graphics and TV Graphics

Computer screen has relatively low-resolution as compared to printed surface. Computer screen has 72 dots per inch resolution display while most four colour printing of magazines is done on 300 dpi at least. It means the resolution of printing is higher hence more fine details were produced on paper as compared to television screen.

Four colour print reproduction is separated into four colours also known as ‘Subtractive Colours’ These colours also known as CMYK colour scheme where ‘C’ is ‘CYAN’, ‘M’ is ‘MAGENTA’, ‘Y’ is ‘YELLOW’ and ‘K’ is referred to ‘BLACK’. (Fig 28)After mixing these combinations with different tonal values we get the image printed on paper. These four colours give the illusion of full range of colour on any printed surface but only 4 primary colours are printed through separate plates of each colour.
Trans illuminated Images on Television or Computer monitors are generated by three colours RED, BLUE and GREEN commonly known as RGB colour where each initial represent each colour. This scheme is also known as ‘Additive Colours’ also. These illuminated images have greater range of contrast and colour intensity as compared to subtractive colours printed on paper. One reason may be that what is printed on surface was received by human eye as a reflected light, but RGB colours system appears to be much broader and subtler range of colour.
Unit summary

In this unit you learned the Basic of Graphic Design and Use of Digital technology; ‘Historical Background’ of Graphics since the beginning of Television and stages of development of Television. You were able to understand about the ‘Elements of Designs’ and ‘Principles of Design’. How to add aesthetics to any composition? Why these elements are important for any layout.

We also addressed about ‘Fundamental of Computer Graphics’ and able to distinguish Additive and subtractive colours. How their properties are different from each other? While working on TV graphics or Print Graphics you may be able to select the appropriate colour mode. You also learn the difference of pixel size between Screen Graphic and Print Graphic along with CMYK and RGB colour.

We also discussed importing and cropping the clipart, images from internet or CD-ROM/DVD.

Assignments

1. Name the person who invented Computer Graphics?
2. List the elements of design? Briefly explain their use in multimedia designing.
3. Describe the term “Fractal Art”
5. Explain the need to use Principles of Design.
6. What is Chroma key and how it is beneficial in making videos.
7. Describe the use of Desktop Publishing.
8. Write the role of Scanners and Cameras.
9. Differentiate between additive and subtractive colour mode.
10. Identify the primary colours for Print medium and Colour Monitor? How do they differ in properties?
11. Write the difference between 4:3 and 16:9 display size of video frame?
Resources


Unit 2

Understanding Digital Images

Introduction

Pixel and resolution are the primary source of the video which displays any image on the screen or monitor. Clarity of any image depends upon its resolution which is calculated by the amount of pixels having in it under standard and universal measurement unit i.e. “Per Square Inch.” It means that the more the pixel per inch present in an image, more colour information and details is present in it. Increasing the quality of image is possible by increasing the PPI.

Secondly, every digital image must be saved in desired format or which will suit to your requirement. As now there are lot of common formats like “JPEG”, “TIFF”, “PNG”, “GIF”, and “TARGA”, “BMP” etc.

Outcomes

Upon completion of this unit you will be able to:

- Describe Pixel, Resolution and Bitmaps;
- Differentiate Square and non-square pixel and Pixel dimension;
- Recognize different file formats;
- Practice optimizing Digital Images;
- Modify colour by reduction algorithm;

Terminology

Alpha Channel: It represents the degree of transparency present in any colour.

Algorithm: A procedure to solve any complex problem.

Bitmap: It is a type of memory organization that stores the image format
Mega Pixel: Unit used for One Million Pixel.

Optimization: Process of reducing the Image file size without any change in quality, sharpness or tonal value for faster download from web.

Pixel: Single rectangular shape dot that contains blend of RGB colour information.

Resolution: Amount of Pixels presents in Display monitor on ‘x’ and ‘y’ co-ordinates.

A Brief History of Designing

Since the inception of civilisation humans were fond of making images. During those ages humans communicated through signals, symbols and sounds. Sometimes they used to create images of their daily life on cave wall where they dwelled. They were very much intrigued by the majestic nature and hence they used to draw to express their thoughts and reverence towards the unknown power. That was the only way of communication in prehistoric era as the knowledge of languages had not come to humans till then. Mostly hunting, animals, motifs, and images related to nature were common subjects whom they engraved by rough tools generally stones, charcoal and chalk. Initially colours were not used, only outline of figures were engraved without any details. These images were drawn either for their memories or to show the strengths of their habitation.

As the times passed, prehistoric humans started inventing more means of communication. By the ancient time around 1000 – 500 BC humans had developed the alphabets; their drawings were now little more advance and had greater details like paintings of later period. Use of pigment colours was introduced to wall paintings. Later after the invention of paper and inks these groups started making paintings on paper. Engraving techniques like Lithography and Etching were developed. Artists were now well equipped with different tools, brushes and colours which they used in creating their artworks.

During 400 & 1000 AD books were the storage medium of information. Decorated illustrations were given place as visual
communication; the contents of books were hand written initially. Much later, after invention of printing press Typographic fonts, blocks and screens were used for printing on paper surface. This period is known as Renaissance era of human civilisation; the period approximately from 1300 to 1800 AD. A lot of inventions were made during this period in all fields. Various Printing techniques were developed; Books, newspapers and magazines now became the main storage medium of information.

In the modern world when film and magnetic tapes were invented, they brought a revolution in the field of information and communication. Now it was very easy to document anything by photograph with a new invention, ‘camera’, now everybody’s most popular machine. The photographs taken from a camera produce images that are more realistic, more authentic and accurate than those produced by paintings or illustrations or any other traditional method of creating images. Films and magnetic tapes are the storage devices that store all these artworks and information. After it came the electronic era (1950 – 1980) what we call Telecommunications. Television and Computers were invented as tools of information and now all information is stored on these electronic tools like Electronic memory cassette, L.P. records etc.

After the invention of digital techniques there were drastic changes in information and communication mediums. It also helps other varied sectors in their functioning, for example in Medical science, Astrology, Space missions, Banking and Insurance sector. These are just a few examples that have been benefited and are now using newer techniques in their functioning.

CD-ROMS, DVD, Blu-ray Hard disks became the storing devices for any information. Digital cameras and computers had given a new meaning to the digital art. Higher details in photography are now possible through advance cameras. They have processor to generate stunning results. Digital images produced by these cameras are very much clear, sharp, and instant. Variety of mesmerising effects of virtual world can be generated by these tools. Film and television industry, Printing and Gaming industry are main gainers of this digital revolution. Pictures are now displayed through “Pixel”.
Pixel and Bitmaps

A Pixel is a tiny dot which contains RGB information of any picture. Computer monitor reflects colours through this information. Millions of pixels are connected in lines and columns and attached together to form an image on display monitor. Each pixel has RGB (Red, Green and Blue) information which was calculated in bits. It is binary and only has two possible values, 0 or 1. Colours or shades of gray present in any displayed image are determined by bits which are used to represent each pixel. If we take an example of 8-bit colour mode, it means that our colour monitor is using 8 bits for each pixel, hence the monitor is capable of displaying \(2^8 = (256)\) of different shades of gray.

Here you may note that aspect of any display monitor depends on its resolution. VGA system displays 640 x 480 resolutions; it means about 3,000,000 pixels. While SVGA monitors can display 800 x 600, or 4,800,000 pixels. 24 bits per pixel were used by True colour system monitors that are capable of displaying 16 million different colours. One more important point you may note that Pixels of any image don’t have a definite / fixed size. They are relative to the screen’s resolution.

Every pixel stores its own value or colour information, or intensity. If all the pixels in any image have the same value or colour information, then it is a uniform colour image. Intensity in a Black and white image is from 100% white to 100% black. While on the other hand, intensity of each Red, Green and Blue value in all colour images are from their brightest to darkest value.

Fig 01-Pixel [Created by Author]
By mixing these primary or basic colours, in varying proportions, another colour is produced that is called ‘secondary colour’. Image generated in such way will contain varied range of tonal values. Since one more thing is added, all RGB images consist of 3 x 8-bit intensities; that’s why, they are also called as 24-bit colour images. It is important to mention here that in theory, an 8-bit range stores values from “0” to “1” using $1/256$th increments, while in real term, 8-bit images appear only in whole number; that is from 0 to 255.

All digital images consists Pixels that stores 24-bit colour information. These digital images are also called as Raster images. Bitmap is a file that indicates a colour of each pixel along its horizontal and vertical axis i.e. “x co-ordinates” and “y co-ordinates” respectively. A ‘JPEG’, ‘BMP’ or ‘TIFF’ for example contains a bitmap of an image. In some images transparency value is also stored. Those images having transparency channel also are of 32-bit. Image files like - Targa, PNG and GIF are capable of storing this transparency value.

Resolution and Pixel Dimension

Any image appears on screen can be displayed high and low quality due to screen resolution. This screen image is expressed as “dpi” (Dots per inch), here Dot is represented as pixel or “ppi”(pixel per inch). This resolution is determined by both physical screen display size or by resolution settings. Pixel Dimension is the horizontal and vertical measurements of a digital image. Dimensions of any image can be calculated by multiplying the width and the height by the dpi. All digital cameras work on this pixel based technique; dimensions of their output images are calculated as the number of pixels in horizontal and vertical co-ordinates which also specify its resolution.

Image size exactly specifies the number of “Pixels” within a digital image, while “Resolution” is the pixels occupying the image or can say groups of pixel carrying colour information. For resolution we use following terms “ppi” as pixels per inch and “dpi” is dots per inch. “ppi” refers to ‘pixel arrays’, while “dpi” refers to ‘Printer resolution’. There is one more resolution term that you may encounter is “Lpi”, which is known as
‘lines per inch’. It is generally used in printing technology. By default resolution of images captured by camera or video is 72 ppi.

Depending on each monitor specification, its screen can display maximum amount of pixels, but their resolution can be increased or decreased by adjusting the settings of any display monitor screen. By reducing the number of pixels of display monitor we can increase the size of image and therefore increase or expand the image size. See below two examples of screens.

![Screen comparison](image)

This can be understood by above illustration more easily. There are two images one has 16 x 12 pixels (Fig 2) and 8 x 6 (Fig 3). Let’s assume each square as 1 pixel and the whole area as screen. Observe that when resolution was lowered to half (Fig 3) the image appears double in size, but if image was scale down as shown in smaller images of both figure we observe that their resolution is twice and have more pixel per square inch of monitor.

Hence, we can say that the higher is the pixel resolution, the higher is the quality of the image. Higher pixel may also increase the file size of image also.

**Aspect ratio**

It is an important concept with the pixel resolution of output device of computer. Every monitor or screen is quite different from one another. We can easily understand size of any screen without physically seeing it or can assume it. Aspect ratio is helpful in making digital images where the exact size is not known, only ratio is known. Just by ratio one can easily able to design his
composition which can be scaled up or down later to fit in desired size. Aspect ratio is the ratio between “X” and “Y” co-ordinates of an image. It can be differ in separate image sizes and in separate screens.

The common aspect ratios of video screen resolutions are - 3 : 4 and 16 : 9 in video format. There are some other few ratios also like 5 : 3, 16 : 10 (WXGA), 5 : 4 (SXGA).

While creating any graphics these ratios must be kept in mind and follows as a thumbs rule otherwise created image may get distorted or become non-impressive.

Square and Non-square Pixel

It is very important to learn the properties of “Square” and “Non-Square” pixel as both have certain differences. If we design any composition of graphic in Square Pixel (as most of graphic software generate image in this format) on computer display or computer based software like Adobe®Photoshop®, Flash etc. it will be fine but if we display the same image on conventional Standard-definition Television (PAL or NTSC) that uses rectangular pixels our image will get horizontally distorted and unnaturally stretched.

Digital camera images, web videos is always ‘Square Pixel’ based but videos shot on PAL D1/DV or NTSC D1 video, a digital electrical video signal (SDI) are rectangular or non-square pixels. So if you are using this format into your project do changes to get even output. Similarly, consider it also before making any graphics on these formats. A Circular shape will appear horizontally stretched while in PAL video it is squeezed. Following illustration will make it clearer. Here are three monitors, ‘A’ is ‘Square Pixel’ based computer screen on which circular object is perfect round.
But if it is not corrected it will appear distorted in ‘B’ (PAL) and ‘C’ (NTSC) non-square monitors.

While doing editing on Standard Definition software Pixel Aspect Ratio must be taken into consideration. Graphics or video footages generated on Square Pixel ratios must be used very with cautiously. Adobe®Photoshop® software had reduced this size related puzzle with its default file sizes for various frame size. Hence need not to worry distortion of image the only care one has to take is just choose the right size for output. Adobe After effect software will also be helpful in handling or making correction to this type of complexity. See below when creating new file in Adobe® Photoshop® following options are suggested by software when we choose our preset size as ‘Film & Video’.

![Size templates for different video formats in Adobe® Photoshop®](screenshot)
When your project is ready for outputting, Adobe Media Encoder is software that can take care of your size with properly scaling it for any format.

**Pixel Dimensions**

As we know that an “inch” is a standard unit of measurement, which cannot be change and remains same and equal. But Pixels may vary in different photographs; say one picture of 10 inches x 8 inches may be of 300 PPI and can be of 72 PPI. Size doesn’t matter but the resolution of image that is holding more pixels in one inch appears to be more sharp and clear. Here size of a pixel in one inch is much smaller as compared to the 72 PPI’s pixel size, for example, you can accommodate more tennis balls as compared to footballs in the same area.

![Fig 07-Pixel dimensions](Created by Author)

You need not to worry about it as Image editing software including “Adobe®Photoshop®” do resizing of pixels for us. Here I just want to brief “image resolution” has two things – size of a pixel and number of pixel per inch (PPI) that will be printed on surface. Hence you have to be very conscious of using correct “PPI”.

Here’s one photograph which is clicked by 10 MP camera, having resolution of 3648 x 2736 to illustrate how re-sizing of images works.
This picture obviously appears smaller as to fit in the screen window of “Adobe® Photoshop® Software” to see the actual size of image you have to open “Image menu” and scroll to “Image size”.

After clicking on “image size” a dialogue box will appear on the screen, which provides the information about the size, resolution and pixel dimensions of this picture. On top you can see “Pixel Dimension: 28.6M” which is the file size of this Image on disc. Here you saw two types of Sizes, “Pixel Dimensions” and “Document Size”. Adobe® Photoshop® is giving measurement of this image in “Pixels” as well as in Centimeter or Inches, as per Width and Height of above image which is 3648 and 2736 respectively. It means that 3648 pixels are in “x” co-ordinate and
2736 in “y” co-ordinate. If we multiply ‘x’ co-ordinate times ‘y’ co-ordinates we get total number of pixels in image. If we calculate for this picture, 3648 x 2736 we get total 9,980,928 pixels.

If you remember, it is mentioned above that this picture was taken by 10 Mega Pixel Camera. Here Mega stands for “Million” hence “10 MP” means 10 Million Pixels. Our total pixels (9,980,928) come near to it. Similarly if 16MP or 24MP camera, we get 16 Million or 24 Million pixel images from it.

**Document Size**

Now, let’s discuss the “Document size” which is 12.16 inches in width and 9.12 inches in height with 300 Resolution. It means above image having 3648 pixel x 2736 pixel on 300 resolution when get printed on paper will cover area of 12.16 “x 9.12”. Let’s do some maths here if we divide pixel width by resolution, we gets the printable width.

\[
3648 \div 300 = 12.16 \text{ (width)}
\]
\[
2736 \div 300 = 9.12 \text{ (height)}
\]
Now, if we reduce the resolution from 300 to say 72 pixels/inch, our width and height’s size increased to 50.667” and 38” respectively. It means this document is oversize for A4 size print.

One important thing you may notice here that even after reducing the resolution 300 pixel/inch to 72 pixels/inch width and height of pixels remains same and even it size also i.e. 28.6M

You can also use GIMP (GNU Image Manipulation Program) as it is open source (free) editing software very much similar to Adobe® Photoshop® for changing the size and
resolution of image. Krita® is also a similar image editing program where you can manipulate the digital images.

Re-sizing of image

We know any picture can be used in different means of communication, like – Newspaper, books, magazines, HD videos and on Web pages. Each format has its own limitation and pixel requirements. Magazine and Newspaper require higher resolution, say more than 300 DPI.

Re-sizing of image for webpages save lot of bandwidth and page loading time. Determining the right size for web image is only its “Pixel” size not resolution. Let’s say if the web page is 960 pixels wide, your image cannot be more than 960 pixels.

You can find the size of an image on the web.

1. First right-click the image in Firefox viewer.

   ![Fig 13 Screen shot](image)

2. Select “view image info”

3. In the dialogue box you will see the file name, size, Dimensions of the image and all web page information.
Understanding image File Formats

In this digital era, when you take a photograph or acquire any image from scanners what is essentially happens is the data was generated in form of Digital Image. This data requires to be saved for further use. Now there are several file formats into which this data was saved and retrieved, edited and transferred using several image editing software available today. Be it open source (free) or commercial ones. Digital artist / photographers generally use JPG, GIF, TIFF, PNG, DNG, BMP, PSD & RAW formats commonly for creating or capturing digital images.
Some Digital Image files can be quite bigger in file size, which means they consume more disk space and slower to transfer or download. To reduce this, Compression technique is used to scale down the size of any file. Compression can sometimes reduce the image details leading to a hazy picture.

**BMP (Bitmap Graphics):** This is a Microsoft’s® uncompressed proprietary format. It is now universal format that saves each pixel data of image without any compression; which results to heavy file size and qualitative image resolution simultaneously. BMP images are assumed good and suitable for use in printing but due to bulky size these are not ideal for Web.

*Advantages:* These images have higher quality of pixels.

*Disadvantages:* Bigger size of image needs more storage space.

**TIFF (Tagged Image File Format)**

It is in principle most commonly and frequently used industry standard file format, it is preferred in printing industry due to its uncompressed and lossless feature. Due to this feature images saved under this format are bulky and much bigger in size. These files also take more memory and disk space. Sometime you may find ‘LZW’ term in software while converting to TIFF format. It’s Lossless compression algorithm’, This “LZW” is not universally supported by some software. Most digital cameras now days have TIFF as the highest image quality level.

*Advantages:* It has ability to manipulate images extensively in editing software. Printing larger size and highest quality without any loss is also strength of Tiff.

*Disadvantages:* More loading/transfer time is required due to fat size of image that again leads to more storage or disc space requirement.

**JPEG (Joint Photographic Experts Group)**

This format is especially optimized for digital photographs and other identical rich tone digital images that contain wide range of colours. These files have ability to store compressed information in much smaller size. Most of the cameras stores digital images in JPEG format. A JPEG file can store pixel colour information as 24 bit colour. Its compression levels is so much balanced that photographs saved in this format are next to uncompressed quality, it is very difficult for the human eye to find any difference
in quality. Sometimes even at large enlargements these files produced spectacular results without any blur or haziness. JPEG files help users to upload their pictures on web portals easily, as smaller size gets quickly uploaded on web. JPEG are not good for Line drawings or fine illustrations as these images, after compression, look jagged or broken.

**Advantages:** Smaller file size results in quick upload/download and more storage in small size discs.

**Disadvantages:** Loss in quality due to compression leads to limited image manipulation in any photo editing software.

**PSD (Photoshop)**

This file format is a proprietary formats used by Adobe®Photoshop® programs. It is by default saving format of Adobe®Photoshop® and allows user to save his document in layers. This feature makes it unique and easy to manipulate each layer separately without affecting other layer data. Layers are used for making complex images while editing and saving them as it is, while in other non-proprietary programs this feature is not available.

**Advantages:** Separate layers and accurate colour information are main USP’s of this format.

**Disadvantages:** Due to more information the file size grows larger and larger by addition of Layers.

**PNG (Portable Network Graphics)**

It is also a lossless storage format. However, in comparison to TIFF format (indexed or RGB, 1 to 48-bits), it reviews the arrangement of pixels in the image that it can use to shrink file size. Transparency is also retained in these types of 24 bit RGB images. Normally PNG files are much smaller than LZW compressed TIFF or GIF format. In this format the compression is volatile; hence the image is recovered exactly. PNGs are much slower to read and write but these are good option for lossless quality with transparency work for saving photographs, PNG is considered as not so good format as compared to JPEG, the reason is it creates larger size.
**Advantages**: Lossless compression feature is its strength. It means during and after editing quality of image is not changed and its transparency feature remains as it is.

**Disadvantages**: PNG images are not good for high quality printing.

**GIF (Graphics Interchange Formats)**

This format is able to create up to 256 colours from available bandwidth of 16 million colours. If there are less than 256 colours in the image, GIF can render the image exactly. It was designed by ‘Compuserve’ in the starting days of computing era when computers functions on 8-bit video. This format is fine for computer and video screen images. GIF is not recommended for printing related designing due to less colours storing capacity. GIF format is "lossless" only for images with 256 colours or lesser and good for transparency in animated images.

**Advantages**: Animation and small file size is its uniqueness, it is ideal for web graphics.

**Disadvantages**: Due to limited colour use it is not good choice for photographs. It also not supports partial transparency.

**RAW**

These file formats are generally used on DSLR cameras while taking high quality images. Mostly RAW files are compressed using a process which stores all of information which was originally captured, like white balance, exposure, contrast, saturation, etc. The major drawback of RAW is that all manufacturers coded their RAW individually and according to their standards, which means you may have to use their indigenous software to view these images. Photographing in this format is very expensive in the manner of storage. This format requires lot of processing time and user must be capable of handling graphic editing software as after finishing some editing one has to share these images perfectly on internet or export them into various file formats.

**Advantages**: Images captured in this format are best in quality, Extensive options of editing and post production remains open due to best quality and details in pictures.

**Disadvantages**: Bigger file size and conversion from RAW to another format after editing is very longer process and time consuming activity.
Optimising Digital Images

It is the process of adjusting the display quality and lowering the file size of any digital image you are preparing for the webpage use or on other online media. You can also term it as ‘Conversion of Digital image file to a type that can be affectively displayed on web page’. It is a process to reduce the file size of an image so it can be quickly sent or received electronically across the World Wide Web. There are several programs available now in which you can optimize your images. Among those “Adobe® Photoshop®” and “Adobe ImageReady®” gives you more effective and wide range of controls for compressing the file size.

Now the question arise, why it is necessary to reduce the file size? Answer is, as you know that all web pages are downloaded into web browser window, it is good for user experience that all information on visiting page immediately opens up and all images on that HTML page appears without any wait. For this optimization of images is required. Without sufficient optimization, digital images file can increase the file size of web page which will slow down the download process. This leads to the increase in waiting time for users, sometime their patience lost and user become irritated and frustrated due to wastage of his time.

How the files are optimized?

It is very simple, if we reduce the visual information, i.e. colour or tones of an image we can reduce its size, but this also reduces the quality of an image. When displaying image resolution is lowered it is not taken as big issue, since the image is only for viewing purpose and not for printing. As you know the computer monitor’s display resolution is lower than that resolution required for printing.

There are two approaches for optimizing digital images:

- Basic image optimization can be done in Adobe®Photoshop® software by using “Save As” command. This lets you save any image as a GIF, JPEG, PNG, or WBMP file. Here as per your requirement, you can define quality, select transparency or matting, choose the colour display, and also determine the downloading method.

- For actual optimization, you have to use the given features of optimization in software like “Adobe®Photoshop®” or “Adobe ImageReady®”. There only you can preview optimized images in different formats and attributes. In
this software you can see different views of your image results after assigning required parameters you may get the desired result. Out of these best required image can be chosen. In these software you can also add and specify transparency, dithering can also be adjusted, and can resize the image to the required size.

**Types of Image that can be optimized for web:**
- JPEG
- PNG-8
- PNG-24
- GIF
- WBMP

Below here is step by step optimization process for PNG-8 and GIF format is described-

Solid colour areas are compressed in PNG-8 format along with retaining the sharper details. GIF is also a good format for compressing images. This format also retains flat colour and crisp details. Here also by reducing the number of colours you can decrease the size of your GIF images. PNG-8 is very similar to the GIF format in terms of file settings. Below is the image of Optimization Panel *(Fig 16)* which controls the conversion of optimization in Adobe®Photoshop®.
Colour Reduction Algorithm and Colours

For optimizing a JPEG image to GIF in Adobe ImageReady® first choose algorithm for generating a colour table from the Colour Reduction Algorithm menu. There you find some options like – Perpetual, Selective, Adaptive, Web, and Custom, Black and White, Grey Scale, Mac OS and Windows options. After choosing desired option, say ‘Perpetual’ or ‘Selective’ then choose the maximum number of colours from the Colour text box, For Perpetual, Selective, and Adaptive selection from colour reduction algorithm menu, you can choose 2 to 256 colours, while for others like - Web, Custom, Black and White, Grey Scale, Mac OS and Windows options you have option either to select ‘Auto’ or any number of given colours.

Dithering

Dithering is technique of simulating colours that are not available in your computer colour system. Solid colour images are good without dithering but those having continuous gradation type tone of colour must need this process (Dithering) because if it
is not processed or dithered it may shows colour banding in image.

![GIF image with 0% dither, and with 100% dither](image)

**Fig 17 [Screenshot]**

- If ‘No Dither’ is selected from the menu box then it won’t be applied to the image.
- Diffusion control can only be applied to the random pattern which is very much less noticeable.
- Pattern option only applies like a halftone pattern.
- Noise option gives a grainy random like pattern which is very much similar to the Diffusion dither option.

Apart from above Dithering and Colour control algorithm there are some more controls, like ‘Transparency’, ‘Matte’, ‘Interlaced’ and ‘Web snap’ which you can try yourself and enjoy the results. You can use transparent image also by checking the Transparency box and then choose from drop menu; ‘Diffusion Transparency Dither’, ‘Pattern Transparency Dither’ and ‘Noise Transparency Dither’. Try and use Matte option also for more dramatic results.

Let’s optimize given below JPEG picture (Dimensions: Width 3648 Pixels x Height 2736 Pixels) and see how it appears after optimization in GIF and PNG-8 formats.
Go to ‘File’ menu bar, select Save for Web

Then another window open up. In this window there are several options for adjustments. Choose 4-Up in top left corner. It gives you 4 displays of same image. You can assign different values to 3 displays, I suggest you to leave first one (Top Left) as original one for comparison.
Here in different windows (Except first one) notice that some information was given, i.e. file format, image size and Data transfer speed and time was displayed at bottom left of the window. In the right side Colour reduction algorithm menu, Dither algorithm menu and total number of colours presents in file are displayed.

Change the settings in colour reduction algorithm menu to ‘Perceptual’ and Dither algorithm to “No Dither’ with 256 Colours. See the result of New Size i.e. 2.44M and transfer rate 101 sec @ 256 kbps. It means this image is now reduced to 2.44Mega Pixel and will take 101 seconds @ the speed of 256kbps.
Now let’s try more options.

Fig 22 Screenshot

This time I choose GIF File format and ‘Web’ in colour reduction algorithm menu and choosing ‘Diffusion’ with Dither as ‘0%’. Now image again reduced to 754.5K having transfer rate 35 sec @ 256kbps. See the colours chosen are web palette having only 55 colours in the image. Now I wish it to convert image in WBMP. Let’s see the result below.

Fig 23 Screenshot

Wow, here I get nice stippling B/w result of my image. See its transfer rate is 50 sec @ 256kbps and the file size is 1.19M
Output results shown in the above example of optimisation of JPEG image may vary from picture to picture due to their resolution, document size, colours and pixel dimensions. Illustrative example is only for demonstration purpose. You may get different results with different images.
Unit Summary

In this unit you learned about **Pixel and Bitmaps**. Based on prior learning you can practice importing the images and changing it size and resolution for different usages. You also learn the names of different image file types and their properties, Importing and exporting those files into different formats. You are able to reproduce the images by using various outputting techniques. In this unit you were able to recognise Square and non-square Pixels. Here you learn about x and y co-ordinates of pixel. We have also learnt step by step optimisation process of images for web usable images.

Assessment

1. What is a Pixel?
2. Differentiate between square and non-square pixels.
3. Describe the common aspect ratios used in video.
4. What is Resolution and Pixel Dimensions?
5. Write different types of file formats, and how do you choose these formats?
6. Write the advantages of JPEG file format. What makes this format more popular?
7. What is dithering?
8. Why Optimisation of image for web is needed?
9. Write the full forms of following:
   (a) BMP
   (b) PNG
   (c) TIFF
   (d) JPEG
   (e) GIF
Unit 3

Understanding Colour

Introduction

Colour is the basic element for any Art. It spreads the essence of composition to the viewer’s eyes and brain or makes the viewer to feel the given composition. It helps in translating the image grasped by humans through their eyes. Since the civilisation of humans, colours have attracted the human beings. They had the passion for them. Later it transformed every part of their lives. Artist plays with colours to form different artistic form and compositions, which were accepted to eyes of patron like the poetry to ears. Putting right colours to any composition is highly skilled job and has some aesthetics behind them. In this unit we will learn the development process of colours since start and nature of colours, their use in compositions and making variety of colour harmonies from the hues and shade.

Outcomes

Upon completion of this unit you will be able to:

- Describe Color;
- Differentiate between primary, secondary and tertiary colors;
- Explain Hue, Value and Chroma;
- Practice using the proper color harmony;
- Explain Additive and Subtractive color modes;
- Practice optimizing Digital images;
- Practice converting images color modes;
- Use the Hexadecimal representation code for web colors
Terminology

**Color Wheel:** It is a circular shape consisting basic Hues with their values around a circle for creating different color schemes.

**Electromagnetic Waves:** Waves used in transmitting Long / Short / FM wavelength TV / Telephone / Wireless signals.

**Infrared:** Thermal in nature these rays extends from the edge of visible spectrum at 700 nanometers (nm).

**Ultraviolet:** These are also an electromagnetic ray shorter than visible spectrum.

**Wavelength:** Distance measured between the two high and low points in a wave.

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Introduction to Color

What is Color? How do we see them? How colors affect our composition? These are some questions which come to our mind as a digital imaging learner. We will be going to address all such queries in this unit which will not only broaden the learner’s knowledge about color but also make him better understand color schemes and their use in their digital compositions / animation scenes.

Color is not only very important element of composition but it also helps us in many ways in our day to day life. Our eyes see visible subject in the presence of light, which was processed by brain and then we recognize it. Hence we can say that Color is only a perception. We see what our eyes and brain tells us. When light was reflected from any object it was in different combinations of wavelengths. Our brain processed this wavelength combination and tells us about the image we are viewing or in other words we were able to identify the colors in that image.

Digital Images has vast numbers of colors in them. The least number in any image is only two colors, Black or White; only 1 bit for each pixel is needed for these types of images. It is also known as bitmapped 1-bit image, as it has a bit depth of 1. During the early stage PC’s video cards support only 16 colors. Later on
these were developed to display 256 colors and gradually, 16 million colors can be shown up in monitors. Now new display cards are capable of displaying 24 bits to each pixel, therefore more than 16 million colors can be displayed now.

In this unit we will learn the different color models, their usages, color mixing and visual effects of color combination, Color wheel, Hue, shade, tint and tone. We will also study history of color theory and color harmony schemes.

**Color Theory**

**A Brief History**

Humans have always had a passion for colors. Since early ages people had been using color as a mode of expression. Many civilizations, from early era to modern days attached symbolic meaning to color. They used to paint and decorate their bodies, masks, totems, dwellings, clothing and items used in everyday life as well as in the ritualistic life with their favorite colors. In many cases the colors represented their society, culture, identity etc. and were used in specific manner choosing specific colours only. Many archeological excavations discovered colored Pottery shreds, funerary remains; rock art which gives visual testimony that the colors, dyes and pigments were integral part of ancient human lifestyle. We see this trend all over the world. Ancient and prehistoric multi-colored rock art that early humans had created using pigment colors for aesthetic pleasure and to convey their beliefs symbolically.

Over the centuries, artists and scientists have studied this affection for color by humans. There are numerous volumes of findings and research on color was done by scientists and artistic color theorists during the last three centuries. We can now enjoy the benefits of those findings as now we are using more scientifically developed tools like digital mediums for creating artistic compositions in which we can implement those golden principles for aesthetically sound designs.

Why do some people respond to some color schemes more favorably than others? Why some designs attracts us while some not appeals us and looks dull and unimpressive? It can be a subject to personal choice. After years of studies of color properties artists and scientists came to a conclusion and developed an organized way of displaying colors more scientifically which lead to the creation of “Color Wheel”. Several theories evolved during these decades to explain the relations and significance of color patterns, Hues and contrasts. Scientist like Newton, Holze, Wilhelm von Bezold, Johann Wolfgang Goethe and
Albers derived their color theories on their experiments and measurable color attributes called ‘colorimetry’ in technical language. ‘Colorimetry’ or ‘colourimetry’ as it is called is a technique "used to determine the concentration of colored compounds in solution."

Title- Fig 01: Newton’s asymmetric color wheel relates colors with musical notes and planetary symbols from 1704
Attribution- Isaak Newton - Opticks. 1704, from Book I, Part II, Proposition VI, Problem 2.
Source- Wikipedia
Link- https://en.wikipedia.org/wiki/Color_wheel#/media/File:Newton%27s_colour_circle.png

Title- Fig 02: Goethe’s symmetric color wheel with ‘reciprocally evoked colours’
Attribution- Luestling at German Wikipedia, Transferred from de.wikipedia to Commons by Andrei Stroe using CommonsHelper.
Source- Wikipedia
Link- https://en.wikipedia.org/wiki/Color_wheel#/media/File:Newton%27s_colour_circle.png
Title: Fig 03: Boute’s 7-color and 12-color color circles from 1708
Attribution: Luestling at German Wikipedia. Transferred from de.wikipedia to Commons by Andrei Stroe using CommonsHelper.
Link: https://en.wikipedia.org/wiki/Color_wheel#/media/File:Newton%27s_colour_circle.png

Title: Wilhelm von Bezold’s 1874 Farbentafel
Attribution: Wilhelm von Bezhold
Source: Die Farbenlehre im Hinblick auf Kunst und Kunstgewerbe
Link: https://commons.wikimedia.org/wiki/File:Bezold_Farbentafel_1874.jpg
Basic of any theory is to distinguish color and give them precise name. For example if you choose Yellow, it can be bright sunshine yellow or a deep mustard yellow.

Albert Henry Munsell, (1898) an American painter and art professor in Boston, Massachusetts Normal Art school, developed a color-modeling system which is more scientific for literally naming the colors. In his study, Munsell attained a meaningful documentation of colors which is more organized and specific. He separated Saturation into ‘Value’ and ‘Chroma’. Munsell interpreted Chroma as difference between a pure ‘Hue’ and a ‘pure grey.’ Munsell identified following three independent components of color –

1. **Hue**—It is the quality through which we distinguish one color from another. He mentioned that wavelength of light differs according to different Hues.

2. **Value**—Munsell described value as “The quality by which we distinguish a dark color from a light one.” Value is a range between brightness and darkness of a color. Any color at full brightness appears “White” and when it is full dark it looks Black.

3. **Chroma**—Affluence of hue can be termed as color saturation. For example it differentiates between Deep Yellow and Pale
Yellow. If you add white color to Yellow, this will reduce its saturation or chroma, leading to the paler yellow.

Chroma specifies the difference between pure hue and pure grey. Here it is important to note that the ultimate chroma of any color is represented by the hue of color. Let’s take an example; color with hue of yellow has lower chroma values as compare to color with purple hue.

**How do we see colors?**

When the light was reflected or emitted from any object to our eyes it contains color element. To see the color you have to have light. This reflected light consist color information that our brain reads and process for identifying the objects or images. When light shines on any surface it bounce off some colors and other colors were absorbed. Our eye only sees those reflected or bounced off colors.

Sir Isaac Newton (1642-1726) was the first scientist who introduced the rainbow spectrum from the ray of light *(Fig 06)*. He placed a prism near his window and saw 7 colors were projected out in form of ‘Violet, Indigo, Blue, Green, Yellow, Orange and Red’, also termed as “VIBGYOR”. Newton also proved that Light alone was responsible for color.

![Fig 06: Newton’s Prism Experiment](image)

**Title-** Fig 06: Newton’s Prism Experiment  
**Attribution-**  
**Source-** wikimedia  
**Link-**

As we know that sun is a primary source of light which contains all colors, this rainbow when mixed all together forms pure white light. When this light falls on a white surface none of the colors are absorbed or in other words we can say when all colors are reflected back we see the surface as white. Similarly
when this light falls on black surface it absorbs all colors and none of the colors is reflected back, then the surface appears as black.

When an artist paints something black, they use black pigment as a color but in light spectrum black is not a color. It is only absence of light or of all colors.

Light is a form of electromagnetic energy emitted from any source in the form of varying degree of waves (wavelengths). Every color has a certain wavelengths (Fig 07). Human eye can perceive only a small portion of these wavelengths that is known is ‘Visible Spectrum’; the range of wavelength that is visible to naked human eye without the help of any special device. This range of ‘Visible Spectrum’ is from 380nm to 780 nm (referred to as 400nm to 700 nm approx in most references) where ‘nm’ stands for ‘nanometre’ (a unit of length in the metric system, equal to one billionth of a metre (0.000000001 m)).

At the each extreme ends of the ‘Visible Spectrum’ are violet and red color wavelengths and only up to this length humans can see. Red has the longest wavelength while Violet colour has the shortest wavelength that is visible to human eye. There is another “Ultraviolet” color which is also a shorter wavelength but it is not visible to us. Only some birds and insects can see ultraviolet light. Likewise “Infrared” has a longer wavelength than that of Red color but human eyes cannot see this light too. This can be easily understood by this given below Figure (Fig 07).

Color Wheel

The color wheel is a representative circle for all color Hues. It contains combination of colors of different values in purest form. It is designed in such a way that when any color is virtually...
chosen from it, it has interrelationship all together in a circular pattern. First color wheel was created by famous scientist, Sir Isaac Newton in 1666. Since then over the years, traditional color wheel has been changed several times with different shapes. Most of the color wheels express only primary and secondary color hues, and then show a vibrant relationship between analogous colors.

Traditionally there are 12 colors in a color wheel based on RYB (Subtractive Theory) color model (Fig 08). These colors are considered as pleasing colors and have harmony between them.

Besides RYB (Subtractive) theory there is another theory RGB (Additive). ‘Subtractive Colour Theory’ is applied for pigment colours (the colours we normally paint with) whereas ‘Additive Colour Theory’ is applied for light.

Numerous computer based programs are now available that function on the color wheel with interactive colour wheel and is available for desktop applications and Internet as well.
Color Harmony

Color harmony is a type of balance or unity of colors schemes in any art composition or photograph. Color that is used in any composition must be soothing and pleasing to our eye. Our brain can easily distinguish the visual interest in composition and the sense of order that was created by the harmony of forms and color. Just keep in your mind that what you learned above in ‘color wheel’ that those color combination that are aesthetically appealing and pleasant can create more harmonious art composition. Once you are clear about color harmony you’ll be able to choose good color from thousands of colors for a balanced harmonious composition.

Creating Color Harmony

Successful color schemes can be obtained when you have good knowledge of Hue, Value and Chroma.

1. Monochromatic: This type of harmony use variety of tonal values (tints, tones and shades) within the same color family. (Fig 10)

![Fig 10: Monochromatic Color Harmony](Created by author)

2. Analogous: These harmony use colors that are neighbors on color wheel (Fig 11) or can say next to each other. These schemes are serene and pleasing to eye and harmonious. In this color scheme three or more colors that sit side by side are used.
3. **Complementary:** Directly opposite to each other colors on color wheel *(Fig 12)* are known as complementary colors.

4. **Split Complementary:** Three colors out of which two on either side direct complementary from another single color arrangement results in this scheme. *(Fig 13)* This scheme has the same visual appearance in terms of color contrast as complimentary scheme has. This is good choice for artists as the colors used in this scheme are difficult to mess up.
5. **Double Complementary:** Under this harmony two neighbor colors those are directly opposite to each other on color wheel (*Fig 14*).

![Double Complementary Color Harmony](image)

*Fig 14: Double Complementary Color Harmony [Created by author]*

6. **Tetrad:** Four hues or four colors having equal distance from each other is known as Tetrad harmony scheme. (*Fig 15*) Under this square or rectangle shape is formed virtually.

![Tetrad Color Harmony](image)

*Fig 15: Tetrad Color Harmony [Created by author]*

7. **Diad:** When two colors that sit two steps apart one other under this adjacent color is skipped are selected then formation of this color scheme is known as Diad. (*Fig 16*)

![Diad Color Harmony](image)

*Fig 16: Diad Color Harmony [Created by author]*
8. **Triad**: On color wheel when chosen colors are equally far away and form equilateral triangle. *(Fig 17)* To use triad harmony efficiently the colors you choose should be balanced.

![Triad Color Harmony](Created by author)

*Fig 17: Triad Color Harmony [Created by author]*

Selecting right color harmony in art composition creates more appealing message and impressive artistic look.

**Color Contrast**

Adding contrast in any art composition enhances the visual appeal. As it is clear itself by word contrast, that there should be some color difference between your visual subject and its background or surrounding area. The more you add color contrast between subject and background the more it appears visible and focused.

Contrast of color can be added to any composition in two basic variations, ‘**Value contrast**’ (light vs. dark color) and ‘**Hue contrast**’ (difference in color hue).

On color wheel complementary colors are just opposite to each other like Red and Green, Orange and Blue. This color combination when used together in design creates good contrast in design composition. However you must be very careful by using complimentary colors Red and Green directly, these colors influence and pulsate when used next to each other in design. It is not advisable to use both colors directly in layouts, especially when you are using both color in text composition directly as Red in foreground and green as background or vice a versa *(Fig 18)*. If we print it on a black and white printer tonal variation will be very low, which means that our text is not clearly readable. Using high
Digital Imaging

contrast, complementary colors are good in producing more contrast and readable look on screen as well as on paper (Fig 19). Lack of contrast between text and background can irritates the user, he may get confused which color to focus, this leads to the strain on the eyes of a viewer.

(Fig 18) [Created by author]

Important point after seeing above figure we observe that it is not necessary that complimentary color give desired contrast value. It is because this combination has maximum “Hue” contrast. For getting better results from this type of complimentary color scheme we need to adjust the value.

(Fig 19) [Created by author]

Itten’s Theory on color contrast

Title- Fig 20: Farbkreis by Johannes Itten (1961)
Attribution- Zeichner: Malte Ahrens
Source- de.wikipedia

Johannes Itten, Swiss painter and theorist was one of the early people who had defined and identify approach for good and effective combinations of color by his vast and deep subjective research. Itten had defined seven types of contrast plans.
1. **Contrast of Saturation**: This contrast is between pure intensive color and neutral or grayed color. Dull color appears duller when they are placed near pure intense color.

2. **Contrast of Hue**: When contrast creates difference between Hues or by juxtaposition of Hues is known as contrast of hue. Wider distance between hues on color wheel creates more contrast.

3. **Contrast of extension**: when we need different amount of one color to balance other or the contrast of extension is used to indicate contrast between the proportions of color area of any shape.

4. **Light Dark contrast**: This is contrast between light values and dark values. Like Night and Day. This type of contrast is effective in monochromatic compositions.

5. **Complementary contrast**: Complimentary contrast refers to opposite (complimentary) colors on placed on color wheel which creates maximum contrast. For example, Yellow, violet, blue, orange, red and green.

6. **Simultaneous contrast**: Two or more colors which were not exactly opposite to each other from this type of contrast. Or in other words contrast between a color which is located on right or left of its compliment.

7. **Cool and warm contrast**: It refers to the contrast between cool and warm colors. For example, Blue, green and brown (Cool) contrast with Red, orange, Yellow (Warm).

**Cool and Warm Colors**

Warm colors are bright and fiery like sunlight, whereas cool colors are pleasant and soothing like water and moonlight.
When we develop our designs it is a golden rule to first choose your background and foreground colors according to the aesthetic sense. Firstly think about the color requirement of your subject. Choose color scheme from cool or warm colors. For example suppose, if we are designing a layout for ‘Soft drink’ it would be better to choose ‘Cool’ color scheme (Fig 22). As water, ice and chilled environment will give the freshness feel of the product i.e. chilled soft drink. This hidden message was communicated to the viewer more effectively. In this way viewer can assume or feel the chillness of the product. If we replace the composition’s background color to Yellow which is considered as warm color (Fig 23), it completely changes the mood and appearance of the product as well as design.

Feel the difference of both color schemes in the given below samples. (Fig 22) and (Fig 23) are showing Cool and Warm color schemes respectively.

(Fig 22) Cool color scheme
(Fig 23) Warm color scheme

Here another important point may be noted, in visual creativity “Thumb rules” can be changed, if they appeals more effectively.

**Additive And Subtractive Colors Modes**

These are two types of color modes which differentiate the mode or usage, be it for printing or viewing. We see colors in light waves, means mixing light in different combinations to form a certain color. This is also known as “Additive Color model” (Fig 24) as these RGB colors combines to create white. If you add all these
colors together white color is created, as all visible wavelengths are reflected to our eye.

**Fig 24: Additive Primary Colors**

In this color model we see “RED”, “GREEN” and “BLUE” are the primary colors. This is also known as “RGB” color model. By mixing these light sources in various values or intensities we get other secondary colors. Here it is to be notice that if more light we add, the brighter mix colors we get. When all these three colors lights i.e. RED, GREEN and BLUE we get “White” light. Our TV monitor screens and projectors use ‘Additive Color Model’ for producing colors. This RGB model produces intensity value from “0” to “255” to its each pixel for each channel. Here “0” is pure Black & “255” is pure White.

For example, if R=255, G=120, B=0 we see Orange color is formed (Fig 25) where red is maximum, green is medium, and color blue is absent.

(Fig 25) [Created by author]

Following table (Fig 26) shows how we can get RGB colors by assigning these values for creating some important colors.
Second color model is known as “Subtractive Color model”. This is primarily used for printing technology; where colors inks are processed, mixed and printed on physical surface i.e. Paper, Board etc. In this color model “CYAN” (C), “MAGENTA” (M), “YELLOW” (Y) and “BLACK” (K) are the primary colors (Fig 27) for this model (“K” is used for Black instead of ‘B’ just to avoid the confusion with Blue) It is also known as “CMYK” color model.

It is called “Subtractive” because it subtracts the light being reflected from the paper. Earlier RED, YELLOW and BLUE were the traditional primary colors for paintings that artists use as primary colors. Later, due to development in printing press technology, Cyan subsequently replaced Blue and Red was replaced by Magenta (Fig 28). Here it is important to note that this CMYK model is universal and more scientific to generate wider variety of colors by mixing this basic Colors (CMYK) on paper.

The additive (RGB) and subtractive (CMY) colors are complementary colors. Each pair of additive colors makes a subtractive color, and vice versa.
Printing CMYK image on paper through subtractive color mixing method produce more accurate results. If you have RGB image for printing, it is better to convert it to CMYK in any image editing software before sending it for print.

Color And Graphics

Graphic display whether it is of any type first attracts attention of the viewer and then holds the viewer to read the details. Here color plays an important role for communicating message to the viewer in short and quick time. In certain mediums of publicity, visual engagement in advertisement must be very rapid, and we have to communicate the viewer within the fraction of a second. Say, in Television ads, Highway side hoardings, Packaging of products, Display on multimedia kiosks and web site banner pages are some mediums where we have time limitations. We have to communicate and register the message on the viewer’s memory within given time. Here ‘bright colors’ clamor for attention, as they are loud. ‘Subject’ on darker background
attracts the viewer as it looks like neon signs with lighting effect. Artists can achieve this type of effect by using direct hues on a black background.

*Fig 29: Sample Web page layout [Created by author]*

Here one has to take care about the usage of bright colors as these colors should not remain for long. However, because it loses its effect quickly, one of the main reasons is our eye briskly becomes lethargic to this harmony. Hence it would be better to use more balanced color scheme. Colors themselves have certain emotional qualities, which derive from natural situations and traditional usage. Artists should use color psychology in extensive manner so as to achieve the desired results by choosing suitable color schemes in their compositions. Your design will achieve success when the viewer should retain something memorable. Human memory usually stores colors as brighter as and purer than they actually are.

Colors have psychological and emotional power which can be effectively used by choosing appropriate color schemes. For example, if you want to say some mellow or soothing information through your design, use ‘cool colors’ but when communicating some hot and fiery energetic visual it is better to use ‘warm colors’.

If there is any doubt in selection of right color scheme, the best method is usually to choose a light color for the background, and a dark color for the foreground or text matter. When you
want to draw attention of viewer to a specific portion of your composition, make its surrounding area different then the text try to keep it simple and legible.

Using color effectively in graphic layout is not very complicated subject if visualizer has taken care of certain rules. Though there is no guaranteed formula to work in all cases, but still try the following influencing factors.

1. First confirm the color need of your layout.
2. Try color harmony as per requirement of subject.
3. Be consistent in using color throughout your composition or layout.
4. Use color considering visual variable.
5. Never use those colors that are not required, use them sparingly.
6. Use color to improve object recognition and establishing identity.
7. Colors have some symbolic communication also. Hence, use them according to cultural and psychological feelings.

**Colors For The Web**

Designs created for web pages have some color restrictions. If you desire that your web pages appear on all monitors with the same quality result, you must choose among the 216 colors. Much software like Adobe® Photoshop® etc. now have the option to convert colors to web safe palette, or use browser safe palette as your default, like Dreamweaver® software where HTML picker is also available.

![Fig 30: Photoshop® color picker when only web color is selected](screenshot)
Colors for web are coded either by names or by “Hexadecimal representation code” (Fig 31) of RGBs color component. 16 colors that are recognized by all browsers are as below.

<table>
<thead>
<tr>
<th>Color Name</th>
<th>#RGB Triplet</th>
<th>Hexadecimal Code</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>255, 0, 0</td>
<td>#FF0000</td>
<td>Red</td>
</tr>
<tr>
<td>Lime</td>
<td>0, 255, 0</td>
<td>#00FF00</td>
<td>Lime</td>
</tr>
<tr>
<td>Blue</td>
<td>0, 0, 255</td>
<td>#0000FF</td>
<td>Blue</td>
</tr>
<tr>
<td>White</td>
<td>255, 255, 255</td>
<td>#FFFFFF</td>
<td>White</td>
</tr>
<tr>
<td>Black</td>
<td>0, 0, 0</td>
<td>#000000</td>
<td>Black</td>
</tr>
<tr>
<td>Aqua</td>
<td>0, 255, 255</td>
<td>#00FFFF</td>
<td>Aqua</td>
</tr>
<tr>
<td>Fuschia</td>
<td>255, 0, 255</td>
<td>#FF00FF</td>
<td>Fuschia</td>
</tr>
<tr>
<td>Yellow</td>
<td>255, 255, 0</td>
<td>#FFFF00</td>
<td>Yellow</td>
</tr>
<tr>
<td>Grey</td>
<td>128, 128, 128</td>
<td>#808080</td>
<td>Grey</td>
</tr>
<tr>
<td>Green</td>
<td>0, 128, 0</td>
<td>#008000</td>
<td>Green</td>
</tr>
<tr>
<td>Maroon</td>
<td>128, 0, 0</td>
<td>#800000</td>
<td>Maroon</td>
</tr>
<tr>
<td>Navy</td>
<td>0, 0, 128</td>
<td>#000080</td>
<td>Navy</td>
</tr>
<tr>
<td>Purple</td>
<td>128, 0, 128</td>
<td>#800080</td>
<td>Purple</td>
</tr>
<tr>
<td>Olive</td>
<td>128, 128, 0</td>
<td>#808000</td>
<td>Olive</td>
</tr>
<tr>
<td>Teal</td>
<td>0, 128, 128</td>
<td>#008080</td>
<td>Teal</td>
</tr>
<tr>
<td>Silver</td>
<td>192, 192, 192</td>
<td>#C0C0C0</td>
<td>Silver</td>
</tr>
</tbody>
</table>

*Fig 31: Hexadecimal code chart [Created by author]*

The differences in color vision of the viewer’s and monitor settings and operating system are some factors that can destroy any possibility of color accuracy. It is possible that color or tone of your photograph used in your design may not appear as it is. Another factor is “Gamma” that is responsible for the lightness and darkness of any image. Since different systems have separate
Gamma standards, many doesn’t have sufficient gamma correction feature.

This short coming of image format was addressed in “PNG” image format which is capable of holding extra detail of color information. Most of the browsers now support PNG format. However this format cannot compensate for flawed gamma correction and other computer display limitations.

Converting Image Between Color Modes

Sometime we need to convert our image mode considering their output result, especially when we go for offset printing. As we have already studied in detail about ‘Subtractive’ and ‘Additive’ color modes. You are aware that images are captured by digital cameras in RGB or additive mode. These images need conversion to CMYK or subtractive mode for printing. This conversion can be done through any image editing software like Inkscape®, Krita®, Adobe® Photoshop®, Coreldraw® etc. Although on computer display you may not be able to notice the difference between CMYK and RGB image, but they are quite different. Their output result appears after printing. Visual spectrum of RGB color mode is wider than the CMYK mode. While image having same dimensions, a CMYK image has a larger file size as compared to RGB image. This is due to different channels that are necessary for printing technology standard for inks.

When color mode is changed it also results change in its value simultaneously. For example, if you want to convert an RGB image to CMYK mode some values of RGB that are outward to CMYK color gamut are adjusted according to CMYK gamut. Here some color information is lost as CMYK has different gamut than RGB. Hence it is good that you may do all adjustments or editing in image’s original mode before conversion. Always save a backup copy of original image, including all layers.
Each time when image is converted, it may lose some color information. Therefore do all necessary editing and flatten the file before converting it so the necessary details may not vanished. Interaction of color between each layer will also change along with conversion of mode. Image conversion can be done in other modes like RGB to Grayscale, Index color, Labcolor, Duotone, and CMYK etc. and vice-versa (Fig 32).

**Note it!**

It is Important to note that if an RGB image is converted to Grey scale or Monochrome Bitmap and was saved it is not possible to revert it. So it would be better to make another copy of it and do whatever changes you want.
Unit Summary

In this unit we learnt history of color, color theories of different scientists and painters like Albert Henry Munsell and Swiss painter and theorist, Johannes Itten’s theory on color contrast. We also learn the color harmony and discussed eight different color schemes. After it we discussed warm and cool color combination scheme and their correct usage and selection for our color compositions.

We also discussed Additive and subtractive modes of colors, their properties and areas of usage. Under color for graphics you learn how to choose relevant color for different means of communications i.e. for Hoarding, TV commercials and web page. We also discussed web colors, how they appear on screen when used properly or suitable color scheme. We learnt the prominent 16 color names their RGB tonal values and hexadecimal code that were mainly used in web graphics or web pages. Contrast in tonal value, as well as Hues have important role in any design. We also cover the conversion between RGB and CMYK color modes.

Trusting your intuition, as well as theoretic knowledge is major important aspect in your design. Giving some meaning to you design through color also we had covered in this unit. By adopting these certain rules you can assign the mood, give cultural and aesthetical meaning to you designs and connect psychologically with your viewers.

Final words, try to use various image editing tools, such as: Inkscape®, Krita®, Adobe® Photoshop® for creating different compositions. Study pattern of websites, their color scheme and take note of the color combinations used. This will give you confidence and aesthetically you’ll be able to communicate the message of your artwork more effectively.
Assessment

1. Describe a color wheel and explain its purpose?
2. Define primary colors?
3. List secondary colors? How are they created?
4. Differentiate between complementary and analogous colors?
   Where do you find these one on the color wheel?
5. Colors that are next to each other on color wheel are known as ________________.
6. If you add some black to a color, that is called __________
7. If you add white to a color that is called ________________.
8. What are color contrasts and why are they important?
9. Describe color dominance in graphic design.
10. What is color contrast and how would you use it in Web design?
11. Differentiate between warm and cool colors? Site examples of each.
12. What is saturation of color? How can it be achieved in a tool such as Adobe® Photoshop®?
13. Describe color models? What is the difference between print and computer screen color models?
14. Explain the use of Hexadecimal code in making web layouts.
15. Describe the Itten’s Theory on color contrast. How it is useful in designing.
Resources

Unit 4

Visual concepts and Graphics preparation

Introduction

In this unit we will describe the development and use of computer graphics in the multimedia production. As the visual information is most important content of any production; graphic plays the key role in making any video program more interesting and informative. Since major development happens in technology by the invention of computer; graphics too had also developed with the same pace. In this unit we will discuss the components that were used in making computer graphics, like fonts, images, Illustrations etc. Making and composing graphics in tune to the display resolution, content related and easily understood by the viewer are some points that we will learn in this unit. What cares and measures can be taken for creating a good visual that would be informative, attractive and simple.

Outcomes

Upon completion of this unit you will be able to:

- Define Graphic Designing;
- Design TV Graphics in Standard and High Definition Formats;
- Practice the use of Illustrations in Graphics;
- Practice making all types of Graphics like Titles, Tickers, Credits etc.;
- Explain Title safe and Action safe Margins;
- Differentiate Vector and Raster Graphics;
- Generate Graphics for Virtual World;
- Prepare VFX (Visual Effects)
- Illustrate Info graphics and use them as Visuals in Multimedia Production
Terminology

2D & 3D: 2D images have only 2 axis ‘X’ and ‘Y’. Which means the image is flat like any drawing on paper. However in 3D space search image has a third dimension i.e. ‘Z’ which means the sense of depth.

Adjustment layers: This is a type of layer that's used to apply effects to multiple layers at once. Whenever any effect is applied to a layer it affects only that particular layer to which it was applied. With an adjustment layer the effect created on the adjustment layer can exist independently of the other layers.

Alpha Channel: Alpha channel is reserved for transparency data, and are mostly represented as a black and white image. If there are gray areas this will show a semi-transparent area.

Anti-aliasing: It is a process of smoothening broken edges on graphics. Shaded pixels were created in between the areas of high contrast when this option is selected.

Composition: A composition is the basic building block of the video. A typical composition will contain multiple layers of information like video, images and audio.

Frames: Frames are the individual images; when played at a certain speed make up a moving sequence.

HSB: It is used for color settings. Hue, Saturation and Brightness are its form.

Kerning: It is the space between individual letters. For example if you’d want to kern a small case letter “o” to fit underneath the capital letter “T”.

Leading: Leading is known as the spacing between the lines.
Tracking:
Tracking is used for adjusting the space between letters used in captions.

Typography:
Typography is the technique for arranging type. Sometimes typography is well done and easy to read which the success in terms of good composition is.

Origin Of Broadcast Graphics

It is well known that the origin of broadcast graphics, in television technologies, came from film. Since all the graphics from Opening Title to end Credit rolls were designed as like for Films. Saul Bass (1920-1996) was the very first motion graphic designer during the initial days of invention of Television, who had an expertise in generating Graphics for Film as well as Television. Prior to the invention of computer generated graphics technology he designed various opening title sequences for popular films such as: The Man with the Golden Arm (1955), Vertigo (1958) and Psycho (1960). Bass, who was also known as pioneer of motion graphics was an extremely talented and productive designer. If we judge his work by today’s standards, Bass’ contemporary graphics designs seem comparatively very simple and uninterested, but they were much attractive, effective and considered as best state-of-the-art at that time. At that time all television or film graphics were created manually by hand on paper or directly on film without the assistance of any technical equipment, like computers, Character Generator etc. Designing Handmade illustrative Graphics were extremely time consuming and expensive affair at that time.

Later on by using some initial devices like Rostrum camera, Graphic design starts to become little bit automated. This camera can produce several types of shots, hence lots of effects were achieved by early art directors and designer who starts experimenting and using different techniques of making graphics. It leads to invention of cell animation process. This is a vertically mounted camera and have fixed path for the upward and downward movement. Any artwork was placed in front of its bench which is also pressed by glass to so that cut outs may not
fold. This bench has markers and scales also called ‘Pegs’. When any artwork is placed above this bench several effects and movements can be achieved which were shot or exposed on 16mm film. This Rostrum camera is used for filming 2D animated captions, animated scenes for cartoon films etc. frame by frame. Once these films are exposing by taking series of shot, next step is to develop and process these films. After processing, editing was carried out by cutting and pasting the exposed shots in linear way so it will match with audio track also. After this long process and wait animation or graphic was ready for use. Later on computers comes to the help of designers in by automated control of rostrum camera. This adds to capture some more complicated moves and motions of Rostrum camera, such as ‘slit-scan’ and ‘streak-timing’.

Graphics preparations for Television are very costly and time consuming affair. It was generally used in film and high budget television productions. After the arrival of computers in 1960s render able computer graphics came into existence when Charles Csuri and John Whitney become the early users of computer aided animations. Later from 1980-90 several graphic systems like, Quantel workstations, ‘Paintbox’ become the standard graphic machine. Several other brands like Ampex, ADO, Abekas and K-scope were also used for creating motion graphics. Those computers have many limitations and since their processing was too slow it is very much time consuming to transfer the output on Tape media. But any how these old beasts rule the world of graphics.

When desktop based Adobe®Photoshop® entered the market in 1990s it drastically reduced the price of producing Graphics. As it is a cheaper solution for computer designers, and also easily operated due to user friendly software programming. It also has lots of filters and controls on digital image editing. Afterwards some other programs like Adobe®After effects®, Discreet Combustion®, Apple Motion® comes as a tool for computer designers. Later on Aston Broadcast system and Chyron Corporation’s invented character generators which were more suitable to incorporate motion graphics.

Autodesk’s Maya® and 3D Studio Max then steps in, as they are pure 3D modeling and rendering programs which are very useful in creating virtual environment and models. There are some
other open source programs widely used for creating 3D animations like ‘Blender®’ and for 2D image editing ‘Inkscape®’ and ‘Krita®’. Blender® integrates several 3D functions like their counterparts Maya® and 3D Max®.

**Future of Computer Graphics**

Looking the rapid pace of day by day improvement in computer graphics, it can be seen that confluence of television, computers and mobile devices when connected on internet helps in creating more interactive forms of television graphics. Here the Internet will almost certainly play an important role in telecast of new media where graphics are utilized for the enhancement of viewer’s grasping and accepting the complex information power. Edsall (2008) states that combination of television and computer creates “tele-puter” which can enable viewers to interact more effectively with their devise. There are some devices already exists that helps the viewer to interact with streaming of programs across on web and can watch their favorite shows when they want them on even multiple devices. Logically now interactive graphics are becoming more realistic and becoming the integral parts of our life which is allowing the users to connect with new media techniques and technology.

**Graphic Designing**

Graphic design is a pictorial language composed of different signs, symbols, logos, pictures and Texts. It is a designer’s role to arrange the visual elements in best effective manner so as it appears artistic and communicable. Composition is one of the most essential features of graphic design especially when designers use diverse elements and materials in their compositions. For creating any graphic visual designer creates and combines symbols, images, texts in given size (page layout or screen size) as per the subject and requirement. Graphics are commonly used in Television graphics, Magazines, Newspaper, Webpage, Product packaging and several other outdoor/indoor publicity. For example for any consumer product publicity it all starts from Logo of that product. This logo helps in registering the brand image of product in consumers mind. Then other layout like
Label, advertisement layouts, danglers, broachers, hoardings, TV commercials and web advertisements all are created in harmonious way by using organized text and pure design elements which we have learnt in “Unit 1 – Introduction to Digital Imaging” under the aesthetics and principles of designing.

Along with the role in visual designing, graphic designers today lend their visual skill expertise in various disciplines like branding and broadcast design, design consultancy, signage and other modern ways of outdoor publicity as the designers have aesthetically visualizing power in drawing, photography, composition and typography.

Earlier graphic designers have limited fields in which they work. Some are expertise in coloring, some loves to sketch and some has passion for photography. Now after the introduction of various digital tools and techniques graphic designers has a bigger territory now. Desktop graphic design, web designing, animation, special effects are some new arenas where creative visual engineers can prove their capabilities.

Designing multimedia graphics is one of the very specialized field where creative designers can do most of the effective use of digital technology. When designing multimedia graphics, one should take care of the size and ratio of the output display size which we had already discussed in unit-1.

Usually our display size of Television will be either 4:3 or 16:9. After selecting the size select square pixels or non-square pixel format as some editing systems cannot support square pixel dimension.

For creating graphics in 4:3 (standard definition) television

Select the size of your document in Krita® software. Go to File → New, Here you may find some pre-defined templates with aspect ratio under ‘Design Template’ menu. (Fig 01) You had already learnt about different sizes of video and film in Unit 01 of Block 01. Krita® similarly helps us in choosing appropriate size from 4:3, 16:9 & Web Design for making standard TV or web graphics.
Choose ‘Design screen 4:3’ select ‘Use this template button.’ New Canvas was created in Krita® afterwards Import pictures; create backgrounds using gradient tool or do what was the demand of subject. Use contrast color for fonts. If needed give some shadow or outline to separate it from background. Below is a sample TV graphic (Fig 02).

(Fig 02): Standard Definition (4:3) caption
Standard Definition (4:3) Caption [Created by author]

For creating graphics in 16:9 (High definition) televisions
Similarly you have to select from default ‘Design Templates’ or from ‘Custom document’ assign the size: 1920 x 1080 for making High definition TV graphics. Following is the example of HD size (Fig 03). Observe the difference in the space
and composition. In HD format we have more space horizontally as compared to SD format.

(Fig 03): High Definition (16:9) Caption [Created by author]

You can find some preset sizes in Adobe® Photoshop® specifically for TV graphics.

**Implications for Design**

Before composing any Television graphic, we need to think and observe what are we trying to communicate? What is the informational requirement of our graphic or a design? With the answer we can concentrate only on those elements or visual that is useful for design. If the purpose is to enhance recognition then you need to focus on those elements by using things like contrast, scale, and dominance. To extend knowledge and reasoning, make visuals clear and informative that are easy to interpret. First think about your overall outcome, how it appears after completion and also the individual design elements. Question yourself, what is the purpose of using such elements in your composition. You probably want your Graphics to be recognized and leave impact on viewer’s memory. Your efficiency and visual content can be understood by mass audience. In order to create successful designs it is must to observe the cognitive tasks of our visitors.

**Graphic Requirement for TV Program**

T.V. Graphic adds clarity to a show’s presentation. They are used to announce about the content of program through Illustrations, Texts, and Animation etc. Graphics can make a
valuable contribution to all type of Television programs, Statistical Graphics in the form of bar graphs and charts enable the viewer to understand the complex data in simplified. Likewise illustrations can be used in children’s story, to set the scene in a drama, to explain scientific principles, to provide an atmospheric background to titling and so on.

There are different types of graphics used for Television production.

(Fig 04): Opening Title Caption (16:9) Screenshot

- **Opening titles** announce and introduces the Show.
- **Subtitles** identify people and places.
- **Illustration, Maps, Animated info graphics** are some visual inputs that can be used in lieu of live visuals or to communicate the complex nature of information in simplified form of graphics.
- **Tickers** are Crawling text matter that continuously runs down bottom of the screen with various info and advertisements also.
- **Credits** names will be given to those who were the part of any production.

**Preparing TV Graphics**

It is the golden rule that first understand, and then be understood. It is very clear if you understand the concept of program for which graphics are to be prepared, you can create more effective. For example, if the script is about natural disaster, using subject related visuals in your composition and try to even
give create or choose your fonts that give the feel of disaster. It is simply by adding cracks/fire/distortion in your text. This will give the impression and feel of subject and supports your visual in communicating to the viewer more effectively.

Think clearly about the purpose of your graphic. Choose what information is useful for putting on screen in graphic. It is very important that information on screen has some message and visually understandable to the viewer. It is more important how clearly the viewer would understand what you are trying to show and what viewer will learn from this graphic?

Generally solid colors are the better options for Graphs, Pie and Charts. Using two color gradients can also enhance the backgrounds. Texture can also be over layered on this gradient background.

(Fig 05): Font Anatomy [Created by author]

Coming to the text/font part; chose proper fonts size that is readable. There are two types of fonts used in typography. “Serif fonts” and “Sans-serif fonts” it is advisable to use sans-serif fonts like ‘Aerial’, ‘Helveticca’, ‘Futura’ etc. type of fonts as they have uniform thickness. Finer line and Serifs are not present so their appearance on screen is loud and visible even for less duration these fonts are readable. While ‘Times Roman’, ‘New Century’ and ‘Zapf Chancery’ type fancy fonts have serifs and their body and shoulder have fine lines which can become unreadable at less than 72 point in size. Script type fonts can be used for Headings if required. It is advisable to avoid these fonts for body text.

While making info based text captions or slides, where there is lot of information given in textual form, try to give only 6 to 8 lines per slide or caption. Break up the text and use bullets in formatting to highlight important points. Caption on screen will
remain for 10 seconds, so try to accommodate only that much text which was readable in given duration. Long duration caption on screen make viewer uncomfortable and uneasy. Try to split the information in two or more captions by giving some transition effects such as dissolves, wipes etc.

Here you must think in terms of brightness and contrast. Right color scheme having good contrast which separates the foreground and background elements. Use either light letters on a dark background or vice versa. This harmony we have already learnt in Unit-3 “Color” of Digital Imaging.

![Example of Separate and Overlapped compositions](Created by author)

Delicate text or foreground elements need not to be used until very much required. Complicated backgrounds whether still or animated need bold foreground elements especially ‘Text’. Try to add depth into your artwork if possible. Overlapping Pictures, creating shadows, are some techniques to show depth (Fig 06).

**Title Safe And Action Safe Margin**

The title/action safe area is that area which is left around on each side of the frame as a safety of our visuals and Text matter. It is easily visualized by gridlines demarcating areas of a screen. Earlier on certain types of televisions some areas may be cut off so to make sure that the text and graphics information remains intact it is advisable to keep your objects/elements within the safe region. Readable parts need to be inside of the “Title Safe Area”, while the “Action Safe area” is a larger area which acts as
more of a margin for the television. Here within this area objects or models in picture/videos should be composed.

Since now we are generally using two types of video formats for multimedia or TV productions i.e. Standard Definition (SD) and High Definition (HD). Sizes of both formats are quite different; where SD format or generally termed as PAL D1/DV has 720 pixels x 576 pixels on width and height co-ordinates respectively (Fig 06). While HD format has display size of 1920 pixels x 1080 pixels on its width and height co-ordinates respectively (Fig 07).

10% Area is left for Action / Video safe zone and another 20% is left as Title safe zone for SD video display. Hence it is recommended to just compose the titles or written graphics within this portion and not exceeding any longer line of text more than 576 pixels in width. Illustration or any picture having some important information or details on its corner will be placed in a way so that it will fits within the video safe area zone.

Whereas, for HD videos safer area for Titles or text matter is 5% of the display size i.e. 1728 pixels in width. Similarly the Action safe margin in HD video display is recommended 3.5% of the display size. It means that important content of photos, illustrations, maps or drawing etc. will be placed in this area so the
information of video will remain in safer zone which is calculated about 1786 pixels in width

(Fig 08)
Action Safe and Title Safe Margins in High Definition (16:9) Display
[Created by author]

Vector Graphics

A vector graphic is the most common type of graphic that is used in making compositions. It is based on paths or stokes which lead to different control points which make up the graphic. Each one of these points has handle arms for adjustments and definitive position on the work plane. Vector graphics can be scale up or down to any size it never loses quality.

(Fig 09) [Created by author]
Raster Graphics

Pixel-based raster graphics will typically come from a bitmap image. These graphics are made up of individual colored squares (pixels) which are all assigned a specific location and color value. We have discussed Bitmap images in Unit-2 ‘Understanding Digital Images’. The amount of pixels that make up a graphic is determined by the resolution of image. It means if a bitmap graphic is scaled up or down it can lose quality.

![Raster Image](image)

(Fig 10) [Created by author]

Visual Effects (VFX) Design

Television industry has travelled over years. There are lots of experiments taken place since then. Now in this era when computer imagery is standing next to reality where virtual world has its own fantasy, lots of imaginary works, scientific atomic experiments, astronomical missions, space wonders, kids fairy tales and super human imagery is now can be generated in few hours. It does all can happen on your PC or workstation. During 80s when Star wars program mesmerizes us with its special effects and chroma scenes, now those effects looks dwarf sized if we measure them with contemporary technology. We are standing on the verge of virtual world where any idea/dream can be transformed into digital imagery even it can even be printed in 3D also. Visual effect artist has the tools which can dramatically
create any environment and live image of camera can be composite so perfectly that it is beyond the human eye to find the difference between virtual and real image.

Virtual World

(Fig 11): A Virtual Scene created in 3D Maya® (High Definition, 16:9) [Created by author]

Virtual world has illusionist environment, where the user can merged with 3D animated characters, or interplay with other users by using 3D characters. In sport coverage’s Broadcasters are using this technology, where one can see that anchor or commentator is standing in field and taking interview of sportsman’s. While in reality that anchors is standing in studio against Blue or Green Screen and performing live actions which appears that he is standing close to the player in ground.

(Fig 12- virtual Studio) [Created by author]
It is now very common to use graphics, animation, and special effects in television programs. Now a day’s computer artist have tools to composite many informative sports score details, data charts, with live video signals. You may have seen these effects in cricket coverage, or any other sports coverage where lots of 3D information was composite with video feed for creating the visuals more dramatic and creative. Likewise in weather reports on several news channels you can observe this virtual world environment where anchor is standing against the blue/green screen and after compositing with 3D animated imagery it appears like he is standing on physical earth or somewhere in assigned unnatural space. Weather broadcasts are now more illustrative and real-time updated. Images of earth received from satellites, helps TV broadcasters to show the accurate weather conditions and estimate precipitation or any thunderous storm-forecast with its tracking visuals.

Here is a list of some digital compositing software which was used by television industry. These packages can generate images or video sequence with alpha channel, which stores the transparency information of image.

- Adobe After Effects®
- Adobe Flash®
Digital Imaging

- Apple Motion®
- Autodesk Combustion®
- Eyeon Fusion®
- Max/MSP®
- Natron®
- Nuke®

3D softwares that are used in creating 3D graphics are:

- Autodesk 3d studio max®
- Autodesk Maya®
- e-on Vue Infinite®
- Maxon Cinema 4D®
- NewTek Lightwave®
- The Blender Foundation Blender software®

Illustrations and their Use in Graphic Designing

An Illustration is an artist’s visual language for explanation of a text, process or idea. Illustrations were frequently used as a visual since the time human learn to write and compose books. In ancient manuscripts, books or on stone carvings you can mostly see some illustrative figures were created to translate the content through visuals. ‘Illustration’ word was evolved from the word “Illumination” which means intellectual enlightenment in spiritual sense. Contemporary Illustrations can be made by using different techniques like, drawings, painting, collage, print making etc. it is depended on the requirement of subject how it can be made (Hand drawn or Computer generated)?
In the television industry illustrative information is also known as “Infographics”. Graphical visual representations of informative data have quality to communicate the information quickly and clearly. Infographics are now much popular among mass communication for broadcasting statistical graphics and info data with richness of visual elements. Similarly ‘Isotypes’ are an early example of infographics for conveying information speedily to the viewers. Maps of metro, Railways, and roads, Weather statistics, stock exchange statistics, election results index charts and bars, Stacked graphs, Hierarchal charts, communication Networks layouts are some examples of infographics that are now most popular as these graphical features can communicate position, shape and color effectively. Maps are natural ways of representing geographical image and data. Using flow maps one can depict time and space. It can be good visual for weather reports, any incident happening can also be depicted initially on map till the live visual are not available for news.
Technical and scientific illustration communicates scientific nature information. Instructional Images made for scientific components, Instructional diagrams generates more effectively and convey the information via visually generated channel to your viewers. These are generally designed to explain subjects to mass audience that is not familiar to it. Or you can say non-technical viewer can easily understood the information of scientific nature. The contemporary 2D and 3D software can be used to create these illustrations in accurate form. Similarly a Medical illustration also helps the audience to learn medical anatomical and related information. Medical illustrators can visualize medical anatomy through illustrations for bio-communication by using the same tools of designing.
Narrative visual art is another important pictorial graphic form to tell the story through graphic visual. Here sequences of images or illustration are prepared for conveying the information to audience. Comic stories and comic strips are the example of this sequential narrative graphic literature. Here series of illustrations with expressions and gestures are drawn or created in 3D models and dialogue text was written in speech balloons. Story board can also be put in this category for pre-production of 2D or 3D animation films. Here artists and directors makes some pre-visualizing images with a series of illustrations or pictures which are helpful in communicating the shot division, sequence, costume, location and camera angles. This whole exercise bridges any communication gap.
Unit summary

In this Unit we have discussed Origin of Broadcast Graphics that issued in television production. We discussed use of Designing Elements and principles of designs for balanced composition for TV graphics. We learnt how to prepare graphics for Television and dos and don’ts regarding composing TV graphics in Title safe area and Video in Action safe margin which we left while producing computer graphics. Further we described Raster and Vector form of graphics along with compositing graphics in virtual world with the help of different compositing software.

To sum up it can be said that Graphic and Animation add interest and beauty in TV production; hence there is a need to be creative and innovative. An effective graphic has the capacity to draws the attention of viewer and generates his interest in program in other words viewer was bound to watch the program if it has interesting Materials in form of Graphics and Animated Clip. Use of latest digital tools effectively can create wonders as the graphic software is more powerful and easy to operate. The more creative you are the amazing results can come out with these tools.

Assignment

1. Create opening Title for Hindi Play ‘Godaan’ written by Munshi Premchand with suitable Illustration.
2. Create weather report background of 4 Indian metro cities, with minimum and maximum temperature column.
3. Compose a ticker giving 4 headlines as breaking news.
Assessment

1. What are Television Graphics?
2. Differentiate between Serif and Sans-Serif fonts.
3. Write the difference between Raster and Vector graphic image.
4. Explain the term virtual studio.
5. How VFX helps in creating virtual background?
6. Explain meaning of info graphics. How they are helpful in communication?
7. What is onion skinning?
8. Describe the usage of typography in TV production.
9. Write the frame rate for PAL video.
10. Explain the term rendering.
11. What is the use of layers in creating graphics?

Resources


Suggested video links

(1) https://www.youtube.com/watch?v=cNCEFZLRY0k

(2) https://www.youtube.com/watch?v=xlyUEAsI3NY