DAVP1

- Prof. Mr. Aman Samuel
- This hands-on project-based course will introduce students to the world of Digital Audio and Video Production Workflow. Topics include Studio Mixing techniques, Audio mixing using various DAW, Foley Sounds & Designing, Multitrack Mixing, Video Production Workflow, Hands on Multicam setup and lighting techniques, Chroma Keying, Video Editing with DaVinci Resolve. Students will learn to record and mix audio using industry standard practice and also learn about the video production workflow, multicam shoots using various equipment (gimbal crane, sliders, etc). In this course the students will conduct their own audio-video projects inspired by the current work being done in the field of computer music & video production. Weekly assignments will be given. Students will be evaluated on both technical and creative ability in this course.
- Classes to be held in:
    - Classroom: 102 R&D Block,
    - Lab: 102 Audio Studio & 104 Video Studio R&D Block
    - Lab: 407 Gaming Animation Lab Old Academic Block

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DES 514 Digital Audio Video Production Workflow

Assessment Plan (MD Notes – Detailed, Simple Language)

Course Overview

- **Course Name:** Digital Audio Video Production Workflow
- **Goal:** Learn how to create and manage audio/video projects from idea to final output.

Evaluation Breakdown

Type of Assessment	Marks
Attendance	5
Assignments	20
Quiz	15
Midterm Exam	15
End Term Exam	20
Project	20
Class Participation	5

Assessment Details

1. Attendance (5 marks)

- Try to attend every class.
- Consistent attendance shows commitment and helps you understand lessons better.

2. Assignments (20 marks)

- Regular homework, often practical.
- You'll get practice tasks like writing scripts, shooting short videos, or editing audio clips.

3. Quiz (15 marks)

- Short tests during the term.

- Covers topics discussed up to that point.
- Helps you check your understanding and revise important concepts.

4. Midterm Exam (15 marks)

- Usually in the middle of the term.
- Includes both theory and practical questions.
- Tests your knowledge so far.

5. End Term Exam (20 marks)

- At the end of the course.
- Comprehensive—covers the whole syllabus.
- Mix of theory (concepts, processes) and practice (workflows, short tasks).

6. Project (20 marks)

- Major practical task.
- Example: Plan, shoot, and edit a short video or audio production.
- Tests your understanding of the entire workflow from planning to production.

7. Class Participation (5 marks)

- Involvement in class activities, discussions, group work.
- Asking questions and sharing ideas boosts your score.

Key Concepts to Understand

- **Workflow:** Steps involved in creating digital audio/video, from idea to final edit.
- **Production Stages:** Pre-production (planning, scripting), Production (recording), Post-production (editing).
- **Practical Skills:** Basic camera work, audio/video editing, teamwork, project management.
- **Theory:** Understanding of tools, roles, and processes in digital media production.

Tips for Success

- Submit assignments on time.
- Revise regularly using quiz questions.
- Actively participate in class for full marks.
- Practice using tools/software taught in class.
- Work steadily on your project throughout the term.

Digital Audio : Introduction

What is Sound?

- **Sound** is a pressure wave created by a vibrating object.

- These vibrations move particles (like in air), which carry energy as sound.
- Example:
  - Pleasant: Speech, music.
  - Unpleasant: Machinery, traffic noise.

How Does the Ear Work?

- The ear has three main parts: **Outer Ear, Middle Ear, Inner Ear**
  - **Outer Ear:** Collects sound and pushes it into the ear canal.
  - **Ear Drum:** Vibrates when sound waves hit it.
  - **Middle Ear:** Three small bones (Malleus, Incus, Stapes) pass along these vibrations.
  - **Inner Ear:** Vibrations reach the cochlea, which turns them into electrical signals for the brain via the auditory nerve.
- Other important parts: Semicircular canals (balance), Eustachian tube (pressure balance), facial and vestibular nerves.

Brief History of Sound Recording

1. **First Recording (1857)**
   - Invented by Édouard-Léon Scott de Martinville, France.
2. **Phonograph (1877)**
   - Invented by Thomas Edison in the USA.
   - Recorded and played sound using a tin-foil cylinder.
   - Purely mechanical process.
3. **Gramophone/Turntable (1887)**
   - Invented by Emile Berliner.
   - Used flat discs (records), not cylinders.
4. **Vacuum Tube Amplifier (1906)**
   - Invented by Lee De Forest.
   - Boosted audio signals electronically.
5. **Optical Film Recording (1922)**
   - Sound was captured on film as optical signals.
6. **Tape Recording (1930s)**
   - Developed in Germany.
   - Used tape coated with magnetic material ("Magnetophons").
   - **Analog:** The tape waveform resembled the original sound.

From Analog to Digital

- **Analog**: Records a continuous sound wave (like the original).
- **Digital Sound Recording**: Turns the audio signal into numbers using a method called **Sampling**.

Digital Audio: Sampling Concept

- **Sampling** means measuring (sampling) the height of a sound wave at very rapid time intervals.
- Converts a smooth, continuous wave into lots of tiny dots or numbers.

Nyquist (Sampling) Theorem

- To capture a sound accurately:
  - The **sampling rate** (how fast we sample) must be at least **twice** the highest frequency present in the sound.
  - If sampling is less, parts of the sound will be missed or distorted (**aliasing**).
- Formula:
  $$ F_s \geq 2 \times f_{max} $$
  Where $$F_s$$ = sampling rate (in Hz), $$f_{max}$$ = highest frequency in the audio.

Standards in Digital Audio

- **Audio Engineering Society (AES):**
  - Sets professional standards for digital audio.
- **Common Sampling Frequencies:**
  - **44.1 kHz (CD quality)**
  - **48 kHz (used in video production)**
  - **32 kHz (radio broadcasting)**
- **Bit Depth:** Indicates how many numbers are used per sample (e.g., 16 bits for CD, 24 bits for high-res audio).

Growth of Digital Audio

- **Public Release:** Digital audio reached the public in 1982 with Compact Discs (CDs), created by Sony & Philips.
- **Modern Standards:** We now have very high-quality sound files:
  - Example: 96kHz sampling rate, 24 bits per sample (used for "hi-res" audio).

Comparing Audio Outputs

- **Devices through History:**
  - Gramophone
  - Vacuum Tube Radio
  - Spool Machine (reel-to-reel tape)
  - Cassette Player
  - Modern High-Res Audio File

Main Points of Comparison

- **Audio Output:** How the final sound comes out.
- **Fidelity:** Clarity and accuracy of the sound compared to the original.
- **Amplitude/Dynamics:** Range from soft to loud sounds.

Key Takeaways

- Audio technology started from simple mechanical devices and now uses complex digital methods.

- **Digital audio** relies on sampling and bit depth for sound quality.
- Good audio depends on *how* it's recorded and *how many details* (frequency and dynamic range) are captured.

Digital Audio : Depth

Digital Representation of Analog Sound

- **Digital Audio** means converting a smooth (analog) sound wave into numbers.
- This is done by *sampling* the waveform at regular time intervals.
- The number of samples taken per second is the **sampling rate** (measured in Hertz, Hz).

Sampling, Reconstruction & Aliasing

Sampling:

- When you record sound digitally, you "capture" the signal at fixed time intervals.
- Each capture is called a **sample**.
- The higher the sampling rate, the more detail you capture.

Reconstruction:

- To play back the sound, these samples are converted back to an analog signal.
- If samples don't match the original wave (due to low sampling rate), reconstruction won't be accurate.

Aliasing (Foldover):

- **Aliasing** is a form of distortion.
- It happens when the sampling rate is too low to accurately capture the original wave.
- Result: You get a *false* or *incorrect* sound frequency when played back.
- *Example:*
    - Sampling a fast (high-frequency) wave too slowly might make it sound like a completely different, slower (lower-frequency) wave.

Nyquist Theorem / Sampling Theorem

- To capture all details of a sound:
    - The sampling rate must be **at least twice** the highest frequency in the audio.
    - Formula:
      $$ Fs \geq 2 \times f_{max} $$
    - $$Fs$$ = Sampling rate
      $$f_{max}$$ = Highest frequency present
- **Why?**

- If you sample too slowly (< 2fmax), some sound details are lost or recorded incorrectly (aliasing).

Analog-to-Digital Converter (ADC):

- Uses a clock or pulse generator to decide when to sample the signal.

Sampling Examples:

- **Sampling 1 time per cycle** (too slow): The sine wave may appear as a straight line—a constant!
- **Sampling 1.5 times per cycle**: The wave looks like a lower-frequency signal—not what was really there.
- **Sampling 2 times per cycle (Nyquist Rate)**: You get the wave correctly; no important information is lost.

Dynamic Range in Digital Audio

What is **Dynamic Range**?

- The *range* between the loudest and softest sounds a system can handle.
- Measured in **decibels (dB)**.

What is a Decibel (dB)?

- Not a direct unit of volume, but a ratio (comparison) of two levels.
- Uses a **logarithmic scale**: Each increase means a much bigger actual change.
- 0 dB = softest sound a person can hear (reference level)

Examples of Sound Intensity in dB:

Description	Approximate dB Level
Rocket launch	180 dB
Jet engine (take-off)	140 dB
Rock band	120 dB
Loud thunder	110 dB
City traffic	90 dB
Loud radio	80 dB
Ordinary conversation	60 dB
Soft whisper	30 dB
Softest human hearing	0 dB

Note: Each increase of 10 dB means the sound is about 10 times more powerful!

Key Points to Remember

- **Proper sampling** (at least twice the highest frequency) is needed to record audio accurately.
- **Aliasing** is bad: happens if you don't sample fast enough.
- **Dynamic range** tells you how loud and how soft sounds the system can capture or play.
- **Decibels** help us compare loudness, but are a relative measure, not absolute "volume."

Tip: You can experiment with different frequencies using a mobile frequency generator.

Microphones and Equalization: An Essential Guide

The provided text offers an overview of microphones and audio equalization, two fundamental concepts in sound engineering. It begins by describing microphones as the initial interface for converting acoustic sound into electronic signals, highlighting that while different types exist, they don't drastically alter the final product for listeners. The text then categorizes microphones by construction, detailing dynamic, capacitor (condenser), and ribbon types, explaining their operational principles and unique sonic characteristics. Following this, the document transitions to audio equalization (EQ), defining it as the process of adjusting frequency levels in a signal. It outlines various EQ types, including shelving, bell, graphic, and parametric EQs, detailing their functions and applications, as well as introducing filters as a simpler form of equalizer that exclusively removes frequency bands. Here are comprehensive notes on microphones, equalization, and filters, drawing from the provided sources, designed to give a full-depth understanding for beginners:

Introduction to Sound Engineering Fundamentals

At the heart of almost all sound engineering activities is the **microphone**. It serves as the crucial **interface between real acoustic sound traveling in the air and the electronic medium** used in sound engineering. While different microphones sound distinct from each other, these differences generally do not "make or break" the final product for the listener. We can understand microphones primarily in two ways: by their **construction** and by their **directional properties** (though the sources focus mainly on construction).

Microphones: Construction and Characteristics

Microphones are designed to convert sound waves into electrical signals. The sources detail three main types based on their construction: Dynamic, Capacitor (Condenser), and Ribbon, with Lapel Mics also listed as a basic type.

- **1. Dynamic Microphone (Moving Coil Mic)**
    - **Principle**: The term 'dynamic' here refers to a 'dynamo'. A dynamo converts rotational motion into an electric current using a coil rotating within a magnet's field.
    - **Construction**: In a dynamic mic, this concept is reconfigured: a **coil of wire is attached to a thin, lightweight diaphragm**.
    - **Operation**: When sound waves hit the diaphragm, it vibrates. This vibration causes the attached coil to move within the field of a magnet. This movement generates an **electrical signal directly proportional to the acoustic vibration** the microphone receives.

    - **Alternative Name**: Dynamic microphones are also commonly known as **moving coil microphones**.

- **2. Capacitor or Condenser Microphone**

    - **Key Advantage**: The primary benefit of a capacitor mic is that its **diaphragm is not burdened by a coil**. This makes the diaphragm exceptionally light.
    - **Responsiveness & Accuracy**: Due to its lightweight diaphragm, the capacitor mic is **very responsive to even the most delicate sounds**. Consequently, it is much more **accurate and faithful to the original sound** compared to a dynamic microphone.

- **3. Ribbon Microphone**

    - **History**: Ribbon technology has a long history, dating back to the earliest days of microphones, prominently featured in photos from the "golden age of broadcasting".
    - **Construction**: Ribbon mics generate their signal using an **ultra-thin ribbon of electro-conductive material suspended between the poles of a magnet**.
    - **Early Durability**: Earlier ribbon designs were known for being **incredibly fragile**. Mishandling them or exposing them to high Sound Pressure Levels (SPL) could easily cause the ribbon to break.
    - **Sound Quality**: Despite their fragility, their unique **warm, vintage tone** was highly prized and considered worth the trade-off in durability.

- **Lapel Mics:** Mentioned as one of the "Basic 3 types of Microphones" alongside Dynamic, Capacitor, and Ribbon, although no further detail on their construction or characteristics is provided in the sources.

Audio Equalization (EQ): Shaping Sound Frequencies

Equalization, or **EQ** for short, is a fundamental sound engineering technique that involves **boosting or reducing (attenuating) the levels of different frequencies within an audio signal**.

- **Basic EQ (Home Audio)**: Simple home audio systems typically offer two basic EQ controls: **Treble** and **Bass**. These controls adjust the entire high (treble) and low (bass) frequency spectrums respectively.
- **Advanced EQ**: More advanced equalization systems provide a **much finer level of frequency control**. The key benefit of these systems is the ability to **adjust a narrower range of frequencies without significantly affecting neighboring frequencies**.
- **Applications of EQ**:
    - **Corrective EQ**: It can be used to **reduce unwanted frequencies**, such as attenuating accentuated high frequencies if a sound was recorded in a room that naturally boosted them.
    - **Enhancement & Clarity**: EQ can make sounds **more intelligible**.
    - **Problem Solving**: It is also useful for **reducing feedback**.

Types of EQ

Advanced EQ systems come in various forms, each offering different methods of frequency manipulation:

- **1. Shelving EQ**

    - **Operation**: In shelving equalization, **all frequencies above a certain point (high shelf) or below a certain point (low shelf) are boosted or attenuated by the same amount**. This action creates a distinctive "shelf" shape in the frequency spectrum.
    - **Types of Shelves**:
        - **High Shelf**: Applied to the "trembly high end" of the sound frequency spectrum. High shelf boosts can add **crispness to hats, cymbals, shakes, and vocals**.
        - **Low Shelf**: Applied to the "bass bottoms". Low shelf is effective for **cuts and boosts on bass, solo acoustic guitar, strings, piano**, and anything that needs more **low-end taming or power**.

- **2. Bell EQ**

    - **Operation**: Bell equalization **boosts or attenuates a specific range of frequencies centered around a particular point**.
    - **Effect Distribution**: The **specified center point is affected the most**, while frequencies further away from this center point are affected progressively less.

- **3. Graphic EQ**

    - **Interface**: Graphic equalizers provide a very **intuitive way to work**. They feature **separate slider controls for different, fixed frequency bands**, which are laid out visually to represent the frequency spectrum.
    - **Control Level**: The more sliders a graphic EQ has, the more precise control you have over the frequency spectrum.

- **4. Parametric EQ**

    - **Foundation**: Parametric equalizers utilize **bell equalization**.
    - **Interface**: They typically feature **knobs for different frequencies**.
    - **Key Advantage**: The significant advantage of parametric EQs is their ability to **select *which specific frequency* is being adjusted**. This offers much greater precision than graphic EQs which have fixed frequency bands.
    - **Common Locations**: Parametric EQs are frequently found on **sound mixing consoles** and various **amplifier units** (such as guitar amps and small PA amps).
    - **Basic Controls**: A parametric EQ typically has **three basic controls**:
        - **Level**: Adjusts the amount of boost or cut (attenuation).
        - **Frequency**: Selects the specific center frequency that will be adjusted.
        - **"Q" (Quality Factor)**: Determines the **width or narrowness of the section of the frequency spectrum** that is being adjusted. A higher "Q" means a narrower band, while a lower "Q" means a wider band.

Audio Spectrum: Frequency Ranges

Understanding the different frequency ranges helps in precisely applying EQ and filters. The audio spectrum is commonly divided into the following categories:

- **Sub-bass**: **20 to 60 Hz**
- **Bass**: **60 to 250 Hz**
- **Low midrange**: **250 to 500 Hz**

- **Midrange**: 500 Hz to 2 kHz
- **Upper midrange**: 2 to 4 kHz
- **Presence**: 4 to 6 kHz
- **Brilliance**: 6 to 20 kHz

Filters: The Simplest Form of Equalizer

Filters are considered the **simplest form of equalizer**. Their primary function is to **remove bands of frequencies**. Crucially, a filter **never boosts** frequencies; it only attenuates them.

There are five principal types of filters:

- **1. Low Pass Filter (LPF)**
    - **Operation**: A low pass filter allows **low frequencies to pass through** while **reducing (attenuating) high frequencies** in level. Imagine a gate that lets all the low sounds pass by, but blocks or quiets the high sounds.
- **2. High Pass Filter (HPF)**
    - **Operation**: A high pass filter allows **high frequencies to pass through** while **reducing (attenuating) low frequencies** in level. This is the opposite of an LPF, letting high sounds through and blocking or quieting the low sounds.
- **3. Band Pass Filter**
    - **Operation**: A band pass filter **attenuates (reduces) both low and high frequencies**. It specifically **allows mid frequencies to pass through**. This creates a "window" for a specific range of sounds.
- **4. Band Stop Filter (Notch Filter)**
    - **Operation**: A band stop filter (also known as a notch filter) allows **both low and high frequencies to pass**. However, it specifically **attenuates (reduces) a region in the mid-band**. This creates a "hole" in the middle of the frequency spectrum, often used to remove very specific unwanted frequencies like hums or feedback.

Visual Composition and Lighting Techniques

The provided text outlines fundamental principles of framing and composition in visual media, defining terms like frame and composition and illustrating how centering can impact audience perception. It elaborates on screen direction, explaining how the apparent facing of subjects influences the shot, and introduces the concept of head room, providing a practical rule for eye placement within the frame. The document then categorizes different fields of view—from extreme long shot (ELS) to extreme close-up (ECU)—and concludes by detailing the purpose of lighting, specifically explaining the three-point lighting technique with its distinct key, fill, and back lights and their intensity ratios.

I. Framing and Composition: Establishing the Visual Canvas

For beginners, understanding the fundamental concepts of **Frame** and **Composition** is essential, as they define what the audience sees and how it's presented.

- **Frame (Prerequisite Term):** The **screen space used for your presentation**. This boundary is determined during production by the viewfinder and encompasses everything within those limits. It's your visual canvas.
- **Composition (Prerequisite Term):** Refers to the **placement of various objects, settings, and characters within the boundaries of the frame**. The primary goal of composition is to make the arrangement pleasing or at least acceptable to the audience.

A. Centering and Off-Centering for Impact

- **Centering:**
  - Often, for a single, main subject without a specific left/right orientation, **centering it horizontally in the frame is considered correct**.
  - Vertically, objects are typically placed slightly lower than true center, accounting for gravity and **head room** (a concept discussed below).
  - **Example:** A cereal box centered horizontally and almost vertically is considered correctly composed when it's the only element.
- **Off-Centering:**
  - Composing a shot with the main subject off-center without other elements can be considered "wrong," as it **draws too much attention to the empty space**.
  - **However, this technique can be used intentionally to create curiosity**. If the audience is led to question the empty space, their curiosity can be rewarded by the **introduction of another character** into that space.
  - **Extreme Example:** An off-center cereal box might initially seem unbalanced, but it effectively sets up the dramatic appearance of a "CEREAL KILLER" in the previously empty space. This demonstrates how off-centering can build anticipation and reveal narrative elements.

II. Screen Direction: Guiding the Gaze

- **Screen Direction (Prerequisite Term):** This term describes the **direction that objects, animals, or people appear to be facing** when stationary or moving on the screen. It's crucial to note that this has **no relation to the role of the film director**.
- **Application in Dialogue:**
  - When depicting a conversation, characters are typically **placed slightly off-center to one side**, facing each other in profile to the camera.
  - This deliberate placement creates **"lead room"**, which is the empty space in the direction the character is facing. This space implies their gaze or potential movement, making the interaction feel natural and balanced.

III. Head Room: Balancing Vertical Space

- **Head Room (Prerequisite Term):** Literally refers to the **amount of space between the top of a person's head and the top of the frame**.
- **Flexibility:** The ideal amount of head room can **vary depending on the field of view** (how wide or tight the shot is).
- **The Golden Rule for Correct Head Room:**

    - To consistently achieve correct head room, **divide the screen into horizontal thirds**.
    - Then, **try to place the person's eyes on or very near the top third line**.
    - This rule ensures that head room is always appropriate, regardless of whether it's a wide-angle or a close-up shot.

IV. Fields of View: Defining Shot Types

Fields of View (often abbreviated as FOV) are essential for conveying the appropriate meaning and intimacy of a shot. Understanding these shot types is a core prerequisite for visual storytelling.

- **Purpose:** To **express how wide or close a shot should be**.
- **Key Shot Types (from widest to tightest):**
    - **Extreme Long Shot (ELS): Much more than the subject matter is seen in the frame**. This shot emphasizes the environment or setting.
    - **Long Shot (LS):** The **subject matter comfortably fills the frame**, with appropriate head room and a little space beneath the subject. This provides a fuller view of the subject and immediate surroundings.
    - **Medium Shot (MS):** Approximately **half the subject matter is seen in the frame**. Also known as a "mid-shot," this is often used for dialogue and shows the subject from the waist up.
    - **Close-up (CU):** About **one third of the subject matter is framed**. This is typically a classic "head and shoulders" shot, focusing on emotion and detail.
    - **Extreme Close-up (ECU): One quarter or less of the subject is seen in the frame**. This shot emphasizes a very specific detail, like an eye or a hand, for dramatic effect.
- **Focal Lengths:** Different **focal lengths** (like **Telephoto** and **Normal**) are used to achieve these various fields of view, altering the perspective and magnification within the frame.

V. Lighting: Sculpting the Scene

Lighting is a critical component for both technical visibility and artistic expression.

A. Why Light? (Prerequisite Reasons):

- To **illuminate the scene** sufficiently so that imaging is even possible.
- To **bring out proper contrast ratios** between the lightest and darkest areas, creating depth and definition.
- To **bring out proper color shades and intensities**, ensuring accurate and desired mood.
- To **model the subject pleasingly**, enhancing their features and form.

B. Three-Point Lighting (Prerequisite Technique):

The **three-point lighting formula** is considered the **first level of professional lighting**. It involves a specific arrangement of three light sources relative to the camera and subject.

- **Setup:** The camera and subject positions are predetermined, and then the three light sources are strategically placed around them.
- **Intensity Ratio:** The lights operate on a **2 to 1 intensity ratio**.
- **The Three Light Sources:**

1. **Key Light (Prerequisite Term):**
    - This fixture **plays the part of the sun**. It is the brightest and primary light source.
    - **Intensity:** A ratio of **2** (e.g., 300 foot candles).
2. **Fill Light (Prerequisite Term):**
    - Used to **soften shadows** created by the key light on the side of the subject it affects.
    - It is typically softened using a frosted bulb or diffusion material.
    - **Intensity:** Provides **approximately half the intensity of the key light**, with a ratio of **1** (e.g., 150 foot candles).
3. **Back Light (Prerequisite Term):**
    - Its purpose is to **cast a rim of light on the top of the head and the tops of the shoulders**. This separates the subject from the background, creating depth.
    - **Intensity:** Usually the **same intensity as the key light**, with a ratio of **2** (e.g., 300 foot candles).

Understanding these concepts provides a robust foundation for anyone beginning to explore the technical and artistic aspects of visual media production.

The Craft of Visual Storytelling

The provided document outlines the fundamental principles of visual storytelling, defining a story as a progression involving change, even if minimal. It breaks down story structure into hierarchical components: acts, sequences, scenes, shots, and beats, further segmenting beats into actions and gestures. The text also identifies key narrative elements such as protagonist, motivation, conflict, antagonist, inciting incident, plot, climax, and resolution. Finally, it offers a detailed shooting script and editing guide for a specific project, including shot descriptions, timings, music cues, talent, and locations, suggesting a narrative focused on a pandemic situation and the efforts to manage it within a campus setting. For anyone new to the intricate art of visual storytelling, understanding its fundamental components is crucial. A story, in its essence, is not just a sequence of events but a carefully constructed journey designed to evoke emotion and convey meaning. The sources provide a comprehensive framework for deconstructing this journey, from its broadest strokes down to the minutest details, offering a "hardcore" look at how stories are built for the screen.

Part 1: Defining a Story for Visual Storytelling

At its most fundamental level, for the purposes of visual storytelling, **a story is defined as a progression from point A to point B**. This progression is the core requirement, meaning that some form of **change** must occur.

- **The Significance of Change**: The sources emphasize that **the difference or change from A to B doesn't necessarily have to be grand or extensive**. Even a small, subtle shift is sufficient. However, **the complete absence of any change signifies no action, and therefore, nothing to document visually with images**.
- **The Journey Back to A**: Interestingly, a story isn't always about moving forward to a completely new destination. **A story can even begin at point A and conclude by returning to point A**, provided there is significant change experienced **during the journey** itself. This journey of change is what allows for documentation and makes the story compelling.
- **The Emotional Core**: Beyond just external events, a story also encompasses **the emotional journey of a character** as they pursue their objective of moving from point A to point B. This highlights that

visual stories are deeply rooted in character experience and internal transformation.

Part 2: The Hierarchical Structure of a Story

Visual stories are constructed in a hierarchical manner, moving from the overarching narrative down to individual gestures. Understanding this structure is key to organizing your thoughts and the visual execution. The progression is as follows: **Gestures create actions, actions create beats, beats create shots, shots create scenes, scenes create sequences, sequences create acts, and acts collectively create the story**.

Let's break down each level:

A. Acts

Acts represent the **broadest division of a story**. Typically, a story is structured into **three distinct acts**.

- **Act One: The Set-Up and Problem Identification**
  - This initial act is dedicated to **introducing the world of the story and its key characters**.
  - Crucially, it **identifies the central problem** that the protagonist will face. It establishes the "point A" from which the journey will begin.
- **Act Two: The Process of Dealing with the Problem**
  - This is the **longest act** and focuses on **the protagonist's efforts to confront and resolve the problem** introduced in Act One.
  - It is filled with rising action, complications, and escalating stakes as the character navigates the challenges.
- **Act Three: The Resolution**
  - The final act brings the story to its conclusion, detailing **how the problem is ultimately resolved**.
  - It shows the aftermath of the protagonist's journey and brings them to "point B," which may or may not be the same as "point A" but always reflects a significant change.

B. Sequences

Each act is further subdivided into **sequences**.

- **Definition**: A sequence is a **collection of closely related scenes**.
- **Purpose**: These scenes are grouped together because they **form a unified whole**, typically serving to **drive home a particular story point within the act**. Think of them as mini-arcs within the larger act.

C. Scenes

Each sequence is then broken down into **scenes**. Scenes are a critical unit for detailed storytelling.

- **Definition**: A scene is a **collection of dramatic beats**.
- **Unifying Elements**: Scenes are unified by one or more of the following: **character, location, time, or theme**. This means a scene typically takes place with the same characters, in the same place, at the same time, or revolves around a single thematic idea.
- **Objective**: Every single scene **needs a clear objective**. This objective is not arbitrary; it **must relate to the overall objective for the arc of the entire story**. This ensures that every scene contributes

meaningfully to the larger narrative.

- **The Imperative of Change**: Just like the overall story, **each scene must cause change to occur**. If a scene doesn't advance the story or change a character's state, it risks being extraneous.
- **Four Ways Scenes Cause Change or Turning Points**: Scenes drive the narrative forward through specific mechanisms:
    1. **Surprise**: They can **"wow the audience with unexpected reversal information"**. This keeps the audience engaged and can drastically alter their perception of events or characters.
    2. **Increase Curiosity**: Scenes should make the audience wonder, **"what's going to happen next?"**. This builds suspense and anticipation for future events.
    3. **Insight**: They can **"fill the gap of the set-up from previous scenes"**. This means providing crucial information that explains earlier events or character motivations, enhancing understanding.
    4. **New Direction**: A scene can **"change the course in the film after an established event"**. This often involves a turning point where the narrative trajectory shifts significantly.

D. Shots

Once the story begins to be expressed through the visual medium, **each moment is conveyed through a series of camera set-ups, known as shots**. For a story artist, each shot is a deliberate decision.

- **Key Decisions for Each Shot**: As a story artist, you make several critical decisions that define a shot:
    - **Subject**: **Which subjects is the camera looking at?** (e.g., a character, an object, a group).
    - **Camera Height**: **How high off the ground is the camera?** (e.g., eye-level, low angle, high angle).
    - **Camera Direction**: **Which direction is the camera pointed?**.
    - **Lens Choice**: **Is it a wide-angle or long-lens shot?** (affecting perspective and depth of field).
    - **Framing/Cropping**: **How is the image cropped?** (determining what is included and excluded from the frame).
    - **Action Timing**: **What part of the action is being shown at this moment, and when does it start and stop?**.
- **Guiding Questions for Shot Decisions**: To make these decisions effectively, story artists should ask themselves:
    - **"What does my character want and why should we care?"** This ensures the shot serves character and emotional needs.
    - **"What do the audience need to see right now?"** This focuses on conveying necessary information and maintaining audience engagement.

E. Beats

Each shot is composed of a **collection of beats**.

- **Definition**: Beats are **collections of actions that describe a single thought**.
- **Smallest Unit of Action**: A beat is considered **the smallest unit of action within a visual story**.
- **Example**: The source provides a clear example: a character taking a sip of water and then looking to the right. This action can be broken down into three distinct beats:
    1. **Grabbing a cup** (as beat 1).
    2. **Drinking** (as beat 2).
    3. **Looking to the right** (as beat 3).

F. Actions

Each shot is usually expressed as a **series of several actions performed by characters** within that shot.

- **Purpose**: **Each action a character takes begins somewhere and ends somewhere else**, and in doing so, it **relays a pertinent piece of information**.
- **Storyboarding Levels**:
  - **Live-action storyboards** are typically drawn down to the level of **shots or actions**.
  - **Animation storyboards** often take this a step further, down to the level of **gestures**.

G. Gestures

Each action can be further divided into a number of **gestures**.

- **Definition**: **Gestures are about how an action is taken**. They describe the nuance and style of movement.
- **Connection to Acting**: **Gestures are essentially acting**.
- **Character Revelation**: Crucially, **character decisions are revealed through acting and the gestures** they perform. A hesitant gesture, a confident stride, or a subtle facial movement all convey information about a character's internal state.

Part 3: Essential Elements of Story Structure

Beyond the hierarchical breakdown, specific narrative elements are crucial for constructing a compelling story.

- **Protagonist**:
  - **Definition**: The **protagonist is the central subject of the story**. They are the character through whose eyes the audience primarily experiences the narrative.
- **Motivation**:
  - **Definition**: This is the **driving force inside the protagonist**, which **motivates their decisions to act**.
  - **Origin**: The protagonist conceives of an **"object of desire,"** and it is the pursuit of this object that **creates their motivation to act**. This object could be tangible (a treasure) or intangible (love, justice).
- **Conflict**:
  - **Definition**: These are the **forces working against the protagonist**. Without conflict, there is no struggle, and therefore, no compelling story.
  - **Three Levels of Conflict**:
    1. **Inner conflict—self**: Internal struggles, moral dilemmas, personal weaknesses, or psychological battles within the protagonist.
    2. **Personal conflict—friends, family, acquaintances**: Conflicts arising from relationships with those close to the protagonist. This is often described as **Outer/extra-personal conflict** in the source, but more specifically focuses on interpersonal relationships.
    3. **Outer/extra-personal conflict—society at large, etc.**: Conflicts stemming from external forces such as societal norms, political systems, natural disasters, or other broad external challenges.
- **Antagonist**:

    - **Definition**: The **antagonist is the personification of the major force working against the protagonist**.
    - **Forms**: This can manifest as a human **villain**, a personal **nemesis**, or even an impersonal force like **the weather** or a natural disaster.
- **Inciting Incident**:
    - **Definition**: The **inciting incident is an event that propels the protagonist into an active pursuit of the "object of desire"**. It's the spark that ignites the main plot.
    - **Impact**: This event **radically upsets the balance of forces in the protagonist's life**.
    - **Origin**: The inciting incident can either **happen directly to the protagonist or be caused by the protagonist** themselves.
    - **Consequence**: It **throws the protagonist out of balance**, which in turn **arouses the desire to restore that balance**. This desire becomes the primary motivation for their journey.
- **Plot**:
    - **Definition**: A **plot is the action of the story**, typically focusing on **external conflict**. It's the sequence of events driven by the conflict and the protagonist's actions.
    - **Subplots**: A main story can also contain **many subplots**, which are smaller, often related, narratives that run parallel to the main plot.
- **Climax**:
    - **Definition**: The **climax is the point of maximum emotional intensity or conflict** in the story. It is the peak of the narrative tension, where the protagonist confronts the antagonist or the central problem head-on.
    - **Necessity**: The sources state unequivocally: **"Without the climax you have no story"**. This highlights its indispensable role in providing resolution and emotional release.
- **Resolution**:
    - **Definition**: This is the **final winding down of the story**. It occurs after the climax, showing the immediate aftermath and the new status quo.
    - **Audience Function**: The resolution serves as a **"beat for the audience to gather their thoughts and ponder their emotional journey in the film"**. It provides closure and allows for reflection on the themes and character transformations.

Part 4: Practical Application - Storyboard/Shooting Script Example

The provided sources also offer a practical, detailed example of a shooting script, likely for a short film or documentary, focused on a "panic situation" during a "second wave" (implicitly, a pandemic). This section demonstrates how the theoretical elements of story structure translate into concrete visual and audio instructions.

The story appears to be about a pandemic situation, focusing on the chaos and struggle, but also the support provided by an institution (IIITD) and the eventual recovery and focus on mental health.

Here's a breakdown of the proposed footage, score, talent, and location details:

- **Opening Scene - Setting the Crisis (40 seconds)**:
    - **Initial Shock (10 seconds)**:
        - **Visuals**: **Stock footage with a panic situation video in the city**, showing chaos. Graphics with text displaying words like "Struggle, Pain, death, no Oxygen" to emphasize the

severity. Random footage of people walking in crowds with masks, potentially at Govind Puri metro station.
        - **Audio**: **Suttle music with anticipation**. Then, **tension & panic music** as narration about the second wave begins.
        - **Narration**: Starts with **Dr. Paro's narration** describing **"how the situation started to get bad during the second wave"**.
    - **Institutional Response (30 seconds)**:
        - **Visuals**: As Dr. Paro's voice continues in the background, the video transitions to **B-rolls showing facilities and services arranged in the campus** (IIITD campus wide & mid shot establishing the logo). This includes advisories issued. Specific B-rolls of **isolation zones, docking station, and a health centre**.
        - **Audio**: The background music shifts to **Rhythmic music with calm notes** to reflect the organized response.
        - **Talent/Narration**: Dr. Paro's narration continues.

- **Middle Section - Life Under Crisis and Support (1 minute, 30 seconds)**:

    - **Doctor's Interview & Supporting Visuals (30 seconds)**:
        - **Visuals**: A **doctor's interview shot** (30 seconds). While the doctor speaks, **B-rolls will show visuals of things he is talking about**. This could be a mid-shot of a doctor describing the situation during the 2nd wave.
        - **Talent/Location**: Doctor or Nurse in an Infirmary.
        - **Audio**: Suttle music with anticipation.
    - **Daily Life & Support Services (30 seconds)**:
        - **Visuals**: **Mess canteen – narrations with B-rolls**. Video showing **food being delivered to hostel rooms** and **students talking to caretakers**. **Nurse taking chart of students' health**. Some B-rolls of doctor and nurse helping students and canteen staff providing provisions for infected students.
        - **Location**: Rooms of students or cafeteria, canteen.
        - **Audio**: No music specified here; likely relying on natural sound or quiet ambient.
    - **Student Perspectives (1 minute)**:
        - **Visuals**: **Students' interview to cover anything left**. These are **"Bytes by students"** (1 minute). Interview shots (Closeup/Mid and Wide).
        - **Location**: In their hostel rooms or campus. Rooms of students or cafeteria, canteen.
        - **Audio**: No music.

- **Closing Scene - Hope and Mental Health (10 seconds)**:

    - **Visuals**: **Closeup and wide shots of smiling and happy faces of students and staff**. Some stock footage or B-rolls supporting this theme.
    - **Narration**: Narration on **Mental health**.
    - **Audio**: **Happy and energetic music**.
    - **Location**: Random location.

This structured approach, from the broad narrative acts down to specific camera angles and emotional beats, exemplifies how a story is meticulously planned for visual consumption. The "Editing Script" further references **"1917 Movie shots," "Interview," and "Commercial Advertisements"**, suggesting different

stylistic approaches or influences to be considered during the post-production phase, drawing on established cinematic techniques to enhance the storytelling.

Camera Optics: Lenses, Focus, and Exposure

The provided text offers a comprehensive overview of camera functionality, drawing parallels between a camera and the human eye. It details how a camera's lens focuses light onto an image sensor (CCD or CMOS) to capture images. The document thoroughly explains the optics of a camera, specifically focusing on the three main characteristics of a lens: focal length, which dictates subject magnification and depth of field; focus, defining the lens's ability to create a sharp image; and aperture settings (f-stops), which control the amount of light entering the lens. Finally, it elaborates on exposure, the total light hitting the sensor, and shutter speed, which determines the duration of light exposure for each frame. Here are comprehensive and in-depth notes on the camera and its optical components, suitable for beginners, drawing from the provided sources:

1. The Camera: An Imitation of the Human Eye

The **camera** is fundamentally an imperfect imitation of the human eye. Its primary function is to direct patterns of light onto sensitive surfaces.

In **digital cameras**, which include both still and video cameras, a lens focuses these light patterns onto an **image sensor**. There are two main types of image sensors:

- **CCD** (charge-coupled device)
- **CMOS** (complementary metal oxide semiconductor)

The image, formed by all the individual **pixels** together, is collected electronically from the sensor at a rate of either twenty-five or thirty complete images per second. These collected images can then be recorded or broadcast. When viewed on a viewfinder or TV set, this process is reversed to recreate the original image. Due to **persistence of vision**, the viewer perceives these separate pictures, or **frames**, as continuous movement.

2. Optics: The Lens

For a camera to operate, it must be able to **concentrate light** reflected from subjects onto its light-sensitive sensor. This crucial task is performed by the **lens**.

A lens is composed of a series of **optical glass or plastic elements** that are cemented together and mounted in a way that allows them to focus light onto the surface of the light-conversion chips (sensors).

The three basic characteristics of a lens that determine its performance are:

- **Focal length**
- **Focus range**
- **Aperture settings**

3. Focal Length

Focal length is a fundamental characteristic of a lens. It is measured as the ratio between the diameter of the lens and the distance from its optical center to the focal plane, specifically when the subject is in focus.

Focal length is represented in **millimeters (mm)**.

Understanding focal length is key because:

- The **longer the focal length measurement**, the greater the **enlargement of your subject**.
- Conversely, the **shorter the focal length measurement**, the **smaller your subject will appear**.
- A **longer focal length** allows space for **fewer subjects** within your frame.
- A **shorter focal length** allows **more subjects** to be included in your frame.

The focal length of a lens also determines its ability to focus over a range from close to farther away from the camera, a characteristic known as **depth of field (DOF)**.

Types of Focal Lengths and Lenses:

- **Standard Focal Length for Film**: 50 mm lenses are generally regarded as the standard.
- **Fisheye and Ultra Wide Lens**: Typically range from **8mm to 24mm** and are used for landscapes or architecture, providing a wide-angle view.
- **Wide Angle Lens**: Ranges from **24mm to 35mm** and generally produces images with no distortion.
- **Standard Lens**: Ranges from **35mm to 70mm** and is designed to reproduce images that closely resemble what our eyes see.
- **Telephoto Lens**: Ranges from **70mm to 300mm** and includes lenses often used for portraiture.

Lenses can also be classified by their focal length adjustability:

- **Prime Lenses**: Have a **fixed focal length**.
- **Zoom Lenses**: Have **variable focal lengths**.

4. Focus

Focus refers to the ability of the lens to concentrate light reflected from a subject to create the **sharpest possible image**.

The most common method to achieve focus is called **front focus**. This is typically done by adjusting (often by turning the barrel of the lens) until the image appears sharply focused at a specific point behind the lens, known as the **focal point**.

5. Aperture (Iris) and F-Stops

The **aperture**, also known as the **iris**, is a variable opening built into the lens. Its purpose is to control the **amount of light that strikes the surface of the sensor chips**.

The carefully calibrated sizes of this opening are labeled with numbers called **f-stops**. An f-stop is essentially a measure of how big or small the aperture is.

Key aspects of aperture and f-stops:

- Each **full f-stop** either **doubles** (if opening) or **halves** (if closing) the amount of light allowed to pass through the lens.
- The f-stop number itself is the **ratio of the focal length to the diameter of the aperture opening**.
- Common full f-stops used in videography include **f/1.4, 2, 2.8, 4, 5.6, 8, 11, 16, and 22**.

- The progression of f-stops means that as you go from a lower number (like f/1) to a higher number (like f/22), each subsequent stop admits **half as much light** as the one before it. For example, f/1.4 admits half as much light as f/1, and f/4 admits half as much light as f/2.8.
- **"Stop down"** means to **close the aperture** or **increase the f-stop number**.
- **"Open up"** means to **increase the size of the aperture opening** but **lower the f-stop number**.
- The size of the aperture is adjusted by the **f-stop ring** on the outside of the lens.

6. Exposure

Exposure is defined as the **amount of light that passes through the lens and hits the film or the CCD chip**.

As mentioned above, the size of the aperture directly influences exposure:

- If the **aperture is big**, it allows **lots of light** to enter.
- If it's **small**, it allows **very little light** to enter.

7. Depth of Field (DOF)

Depth of Field (DOF) is the **range from the camera where subjects appear in acceptable focus**. It describes how much of the scene, from foreground to background, is sharp.

DOF is dependent on the three primary characteristics of a lens:

- **Focus**
- **Focal Length**
- **Aperture**

How these characteristics affect DOF:

- The **longer the focal length**, the **closer the focus point**, which can affect DOF.
- The **more wide open the aperture setting** (meaning a lower f-stop number), the **shallower the depth of field**. This means less of the scene will be in focus.

8. Shutter Speed and Shutter Angle

Shutter speed is the term used to describe the **amount of time that each frame is exposed to light**.

For filmmaking, a general rule of thumb is that the **shutter speed should be double your Frames per second (FPS)**.

Here are some standard FPS and corresponding shutter speeds:

- 23.98 FPS -> 48 shutter speed
- 24 FPS -> 48 shutter speed
- 25 FPS -> 50 shutter speed
- 30 FPS -> 60 shutter speed
- 60 FPS -> 120 shutter speed
- 120 FPS -> 200 shutter speed

The **most commonly used shutter speed for filmmaking** is **1/48 or 1/50**.

Shutter angle is a useful way to describe the shutter speed relative to the frame rate. This concept originates from older rotary shutters, where a disc with an angled opening would spin, letting in light once per revolution to expose each frame.

- The **larger the shutter angle**, the **slower the shutter speed**. This can go up to the limit of 360°, where the shutter speed can become as slow as the frame rate.
- At the other extreme, the shutter speed can be made **arbitrarily fast by decreasing the angle**.