Mastering, Compression & Codecs

Technology for Performers

The Music Production Process: An Over(re)view

- Pre-Production
- Recording (Production)
- Post-Production
- **Mastering**

Mastering

- Arriving at ‘final’ mixes
    - Before we send our work to be mastered, we need to be sure that it is as good as it can be
- How?
    - Export mixes from Pro Tools
    - Listen critically on different systems (car, different headphones, speakers, laptop)
    - Tweak/refine mixes if necessary
    - Repeat until satisfied

Mastering

- Once mixes are finalized, they are sent to a mastering engineer to have the finishing touches put on them for release
    - This process happens on a much shorter time-scale than mixing (typically one album per day)
- A good mastering engineer offers a few benefits to a project:
    - Fresh ears and a fresh, unbiased perspective on the project
    - A facility which is optimized for hi-quality stereo monitoring and processing

Mastering

- ‘Finishing touches’ include:
  - Pacing
  - Denoising
  - Subtle EQ
  - Dynamic Range Processing
  - Adding Metadata

Mastering

Pacing

- Determining the time between tracks on an album

Mastering

Denoising

- Removal of hum, hiss, or any other distracting noises in a recording (chair squeaks, coughs, etc.)

- May also be done during the editing phase of the production process instead of at mastering

- Common software for denoising: iZotope RX, Sonnox Restore Suite

Mastering

EQ

- For arriving at an appropriate/even spectrum for the program material

- For matching tracks that were mixed in different control rooms or compensating for uneven monitoring environments (i.e. whole album has too much low frequency emphasis)

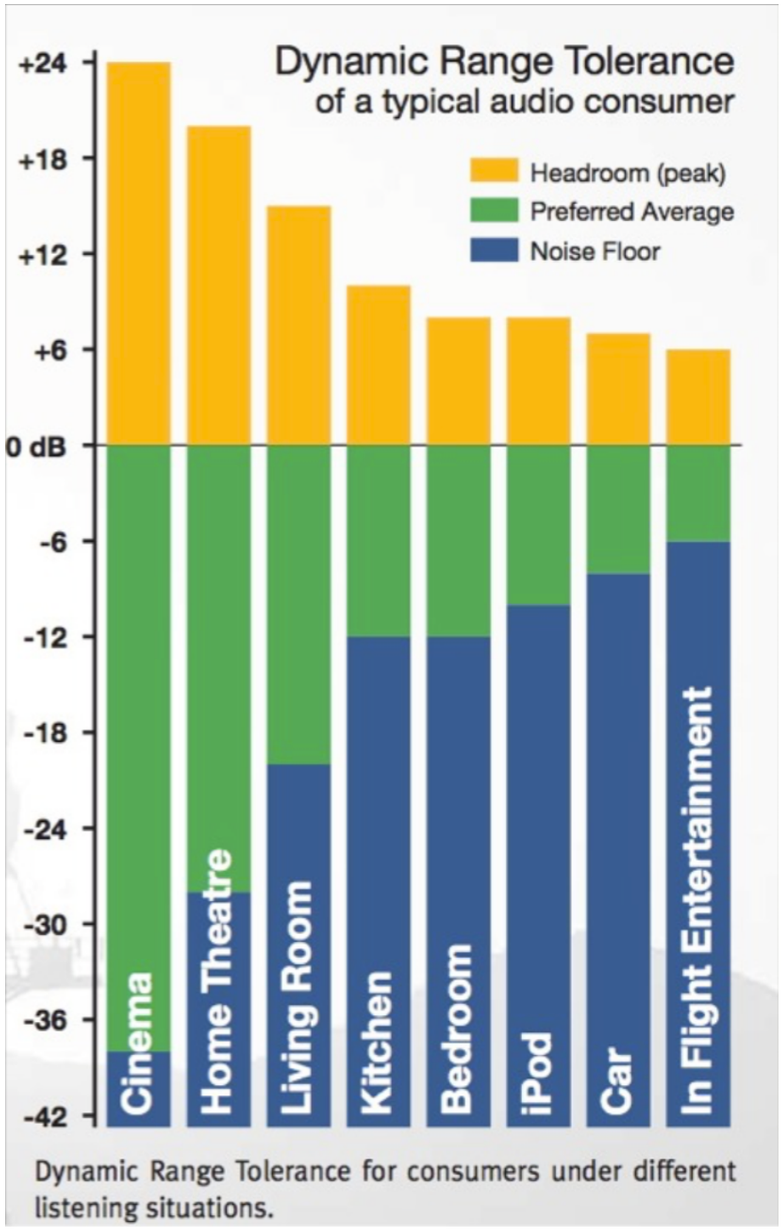
Mastering

Dynamic Range Processing

- Compression/Limiting to get the album to a reasonable loudness/ dynamic range for the intended playback medium

- Different for Digital (CD), Vinyl, and specific playback environments

- Compression & Limiting???



Dynamic Range Tolerance for consumers under different listening situations.

Compression Tangent!

Compression

- A **compressor** is a device that automatically reduces (‘compresses’) the dynamic range of an input signal

- When the input signal rises above a **threshold**, the device turns down the signal at the output

- Traditionally used to protect equipment from clipping/overloading

- Now a common effect used in both practical and creative ways

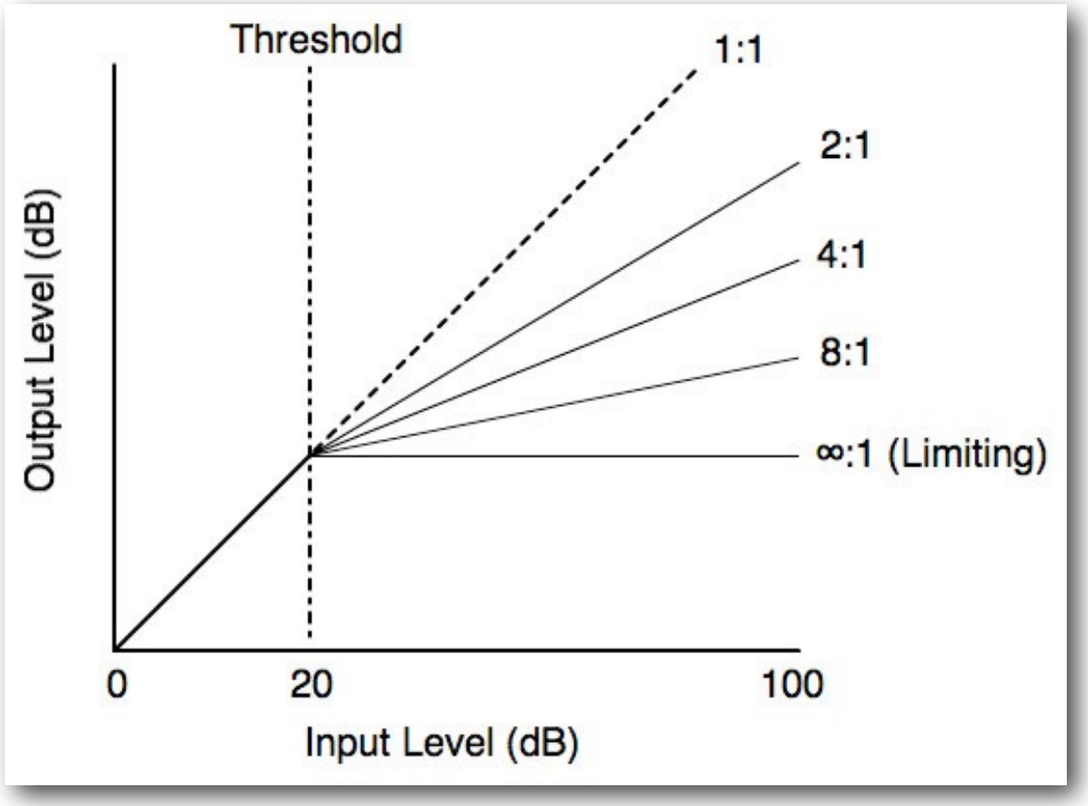
Compression

- Compressors typically share a basic feature set:
  - Threshold
  - Ratio
  - Attack
  - Release
  - Makeup Gain

Compression

Threshold

- How loud an incoming signal needs to be before the compressor engages



Ratio

- How much the output signal is turned down after the input signal exceeds the threshold
- Expressed as a ratio of input vs. output (2:1, 3:1, 4:1. 10:1)
- Anything above 10:1 is considered **limiting**

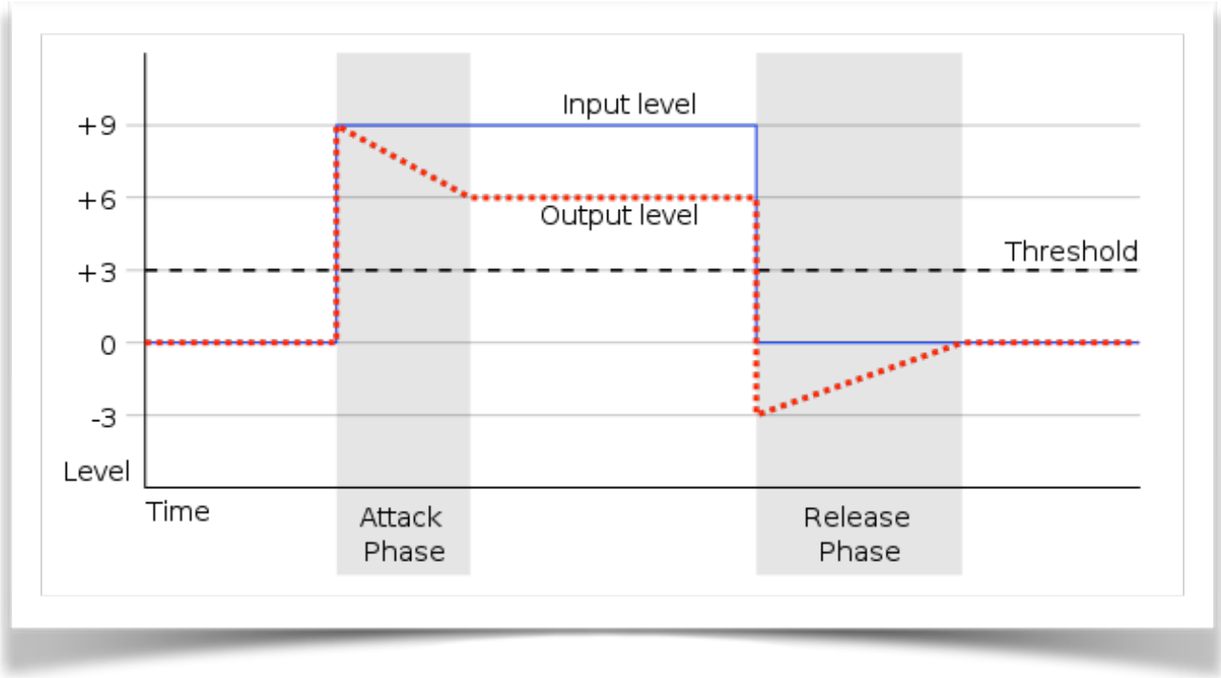
Compression

Attack

- How long it takes the compressor to fully compress the signal after it exceeds the threshold

- A ‘fast’ attack is good for attenuating transients

- A ‘slow’ attack lets transients through



Release

- How long it takes the compressor to return to unity gain after the input signal returns below the threshold

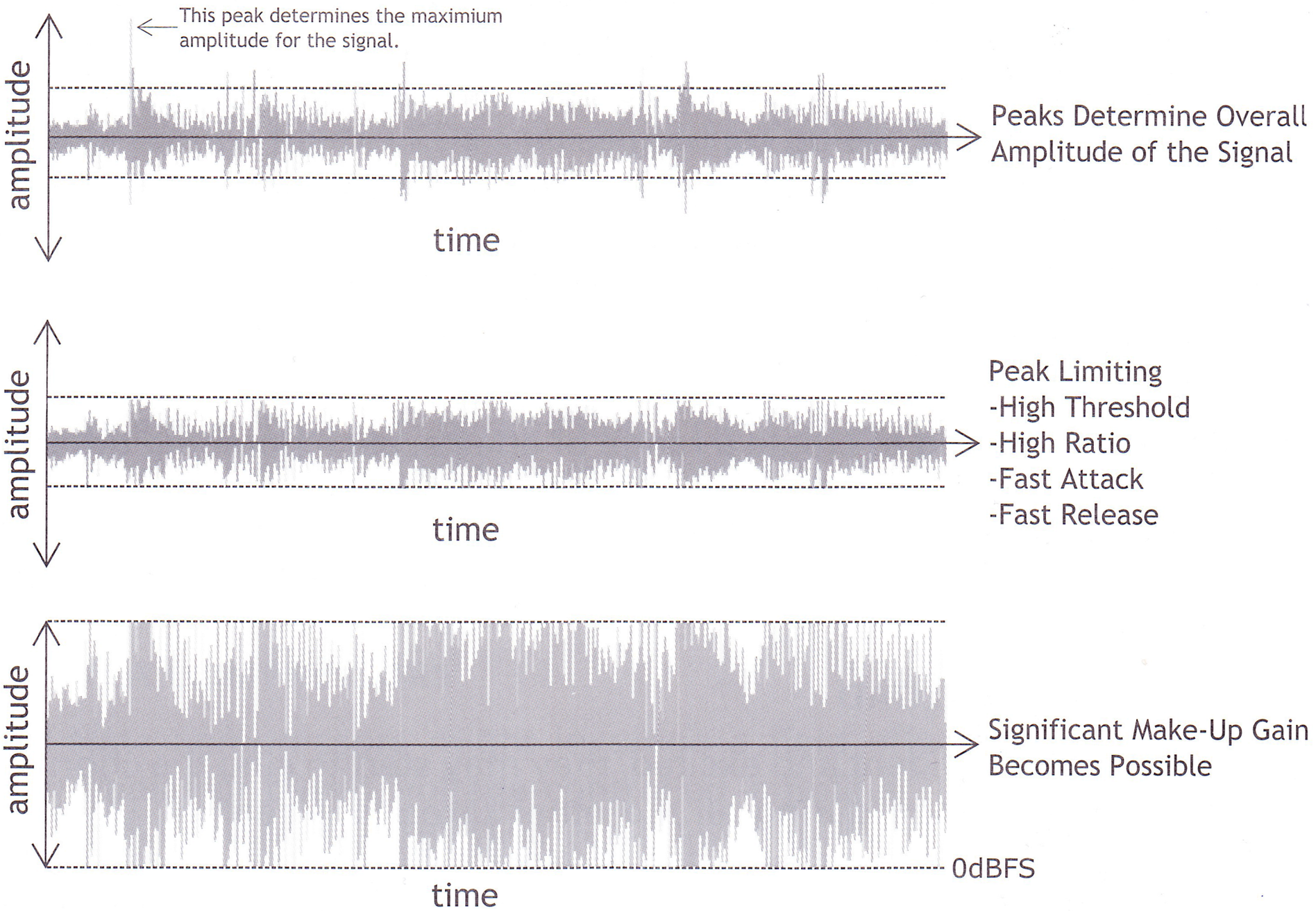
- Closely tied to tempo - release times allow for recovery between notes, phrases, etc.

Compression

Makeup Gain

- Often just labelled ‘Gain’
- Increases the output signal, post-compression
- By 'chopping-off' the loudest part of a signal, we buy ourselves ‘headroom’ to turn the remaining signal up

Peak Limiting



*From *Sound FX* by Alex Case

See it in action!

- Let’s watch Mastering Engineer Mark Wilder work on a track…

- https://www.youtube.com/watch?v=pHsRK0ln4VQ

Mastering

- ‘Finishing touches’ include:
  - Pacing
  - Denoising
  - Subtle EQ
  - Dynamic Range Processing
  - **Adding Metadata**

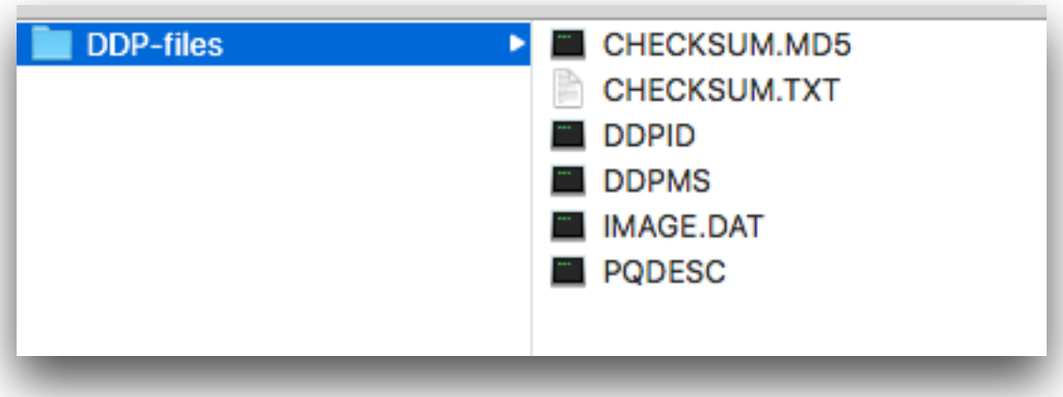
Mastering

Metadata

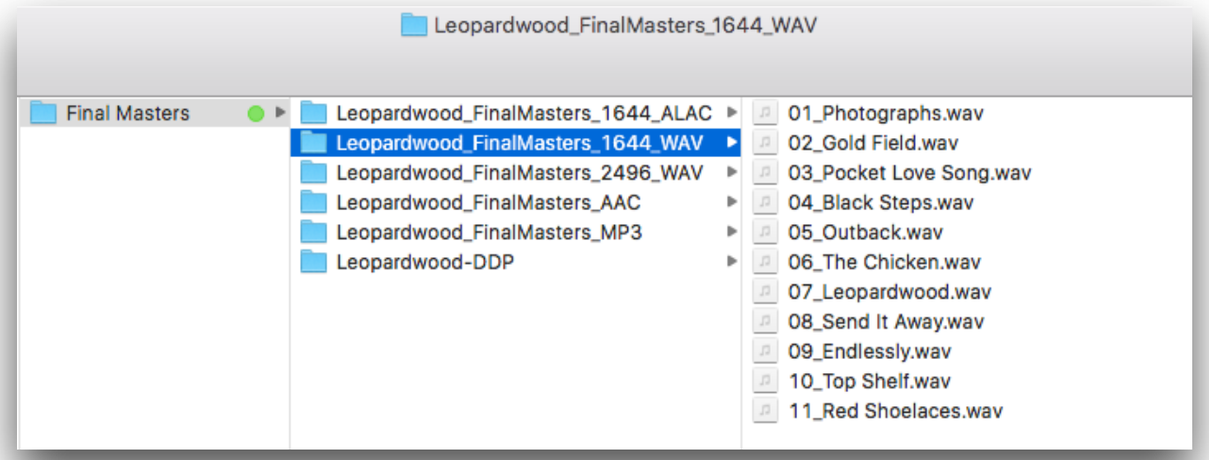
- Information about the music that is stored *in* the files for each track
- ISRC codes, Track Number, Disc Number, Artist Name(s), Album Name, Song Names, Composers, Album Artwork - anything that might be useful
    - Different audio codecs can store different metadata
        - More on audio codecs in a moment…

Mastering

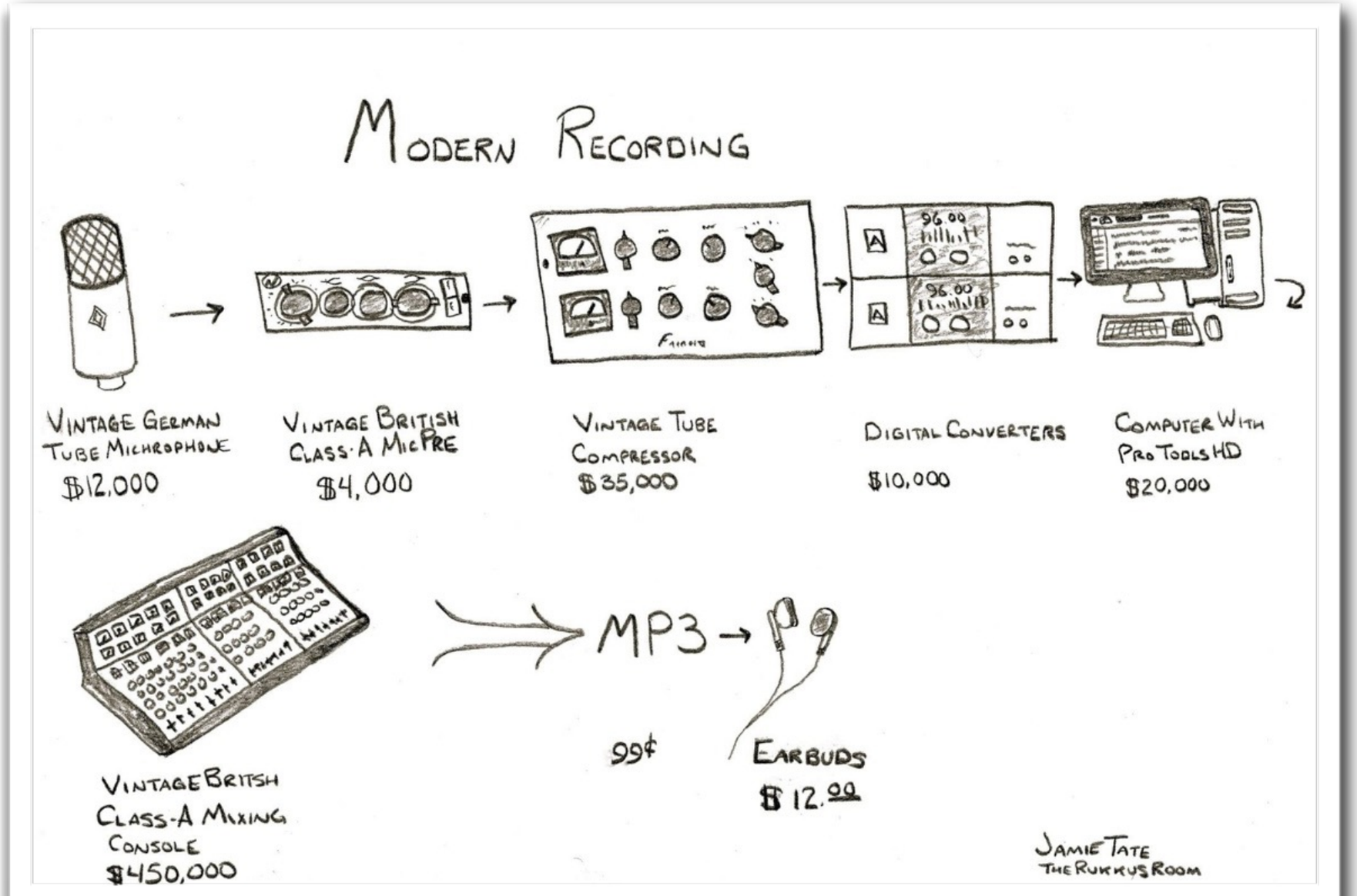
- What you get *back* from mastering:
    - **DDP** - Disc Duplication Protocol
        - Folder containing a specific set of files (see image)
        - Album can be previewed via DDP player (software) for approval
        - Can be easily verified for data-integrity
        - This what you send off to a professional CD manufacturing facility, <u>not</u> a CD-R



- Full Quality **WAV** files
- Other file types on request (ALAC, MP3, etc.)
    - Of course, all you really need is the full quality copy and you can make your own versions from that as needed



Audio Codecs



Audio Codecs

- What's a codec?
  - Stands for **Co**der + **Dec**oder
    - We encode the file to reduce (compress) its size
    - We decode it to play it back
- Consumer audio codecs:
  - MP3, AAC, OGG Vorbis, WMA, FLAC, ALAC

Consumer Audio

- Today most of the audio we hear was encoded with an audio codec
- These formats are not for audio production, only for consumer delivery.

Audio Codecs

- Why bother to encode?
- Full quality files are big. Some common concerns:
    - Internet bandwidth (downloads or streaming) - though this is becoming less of an issue
    - Storage limitations (iPods, phones, portable media players, gaming consoles, etc.)
- How big of a difference?
    - Hi resolution (WAV @ 96 kHz, 24bit) 1 hour of stereo = 2 GB
    - CD quality (WAV @ 44.1 kHz, 16 bit) 1 hour of stereo = 620 MB
    - iTunes store (AAC @ 256 kbps) 1 hour of stereo = 112 MB

Audio Codecs

- There are two types of Codecs:

Lossy

- Codecs that eliminate data to reduce file size

- MP3, WMA, AAC, OGG Vorbis

Lossless

- Codecs that reduce file size while preserving all data

- ALAC, FLAC

Lossy Codecs

- Lossy Codecs use **perceptual coding** to decide what data to throw away
    - Based on studies of *psychoacoustics* (our perception of sound)
    - Takes advantage of the limitations of human hearing, in particular the ability for one sound to ‘mask’ another from our perception (in either the time domain or the frequency domain)
- What is thrown away?
    - Generally, low level details. Less bits are assigned to elements that are more likely to be masked, and more bits are assigned to elements deemed more perceptually relevant
- Once you encode a file to a lossy format, this information is gone forever.

Lossless Codecs

- Reduce file size without throwing anything away
- This is accomplished by looking for redundancies in the code and replacing them with placeholders which take up less space
- On playback, the swap happens in reverse and the original material is presented without any loss of data
    - Grossly Simplified Example:
        - 11111111111111111111
        - 1(20)

Photography

- Images can be stored as **lossy** or **lossless** file types just like audio
    - Some typical photo file types:
        - jpg, gif
        - These are **lossy**!
- When we try to save space by making images smaller, we get subtle changes in the quality of colour and light.
- In audio this would be similar to subtle changes in high frequencies or spatial content.

High resolution (18MB)

High resolution .gif (2.9MB)

Medium resolution .gif (1.8MB)

Low resolution .gif (1.1MB)

Good Practices

- The morals of the codec story…
- When working on a project, it is important that you keep your assets at full quality as long as possible.
    - Once you go to a lossy format, you can't go back.
- Lossy copies should be made from the master copy and the master copy should be retained. Do not transcode lossy codecs. If you need a different lossy format, go back to the original to make the copy.
- Don't use lossy-encoded audio in production work
- Be conscious of audio quality
    - Consider ripping CDs to ALAC instead of MP3
    - Look for high quality music online (Pro Studio Maters, Bandcamp, HD Tracks)

Listening time!

- Let’s see if we can hear the difference…