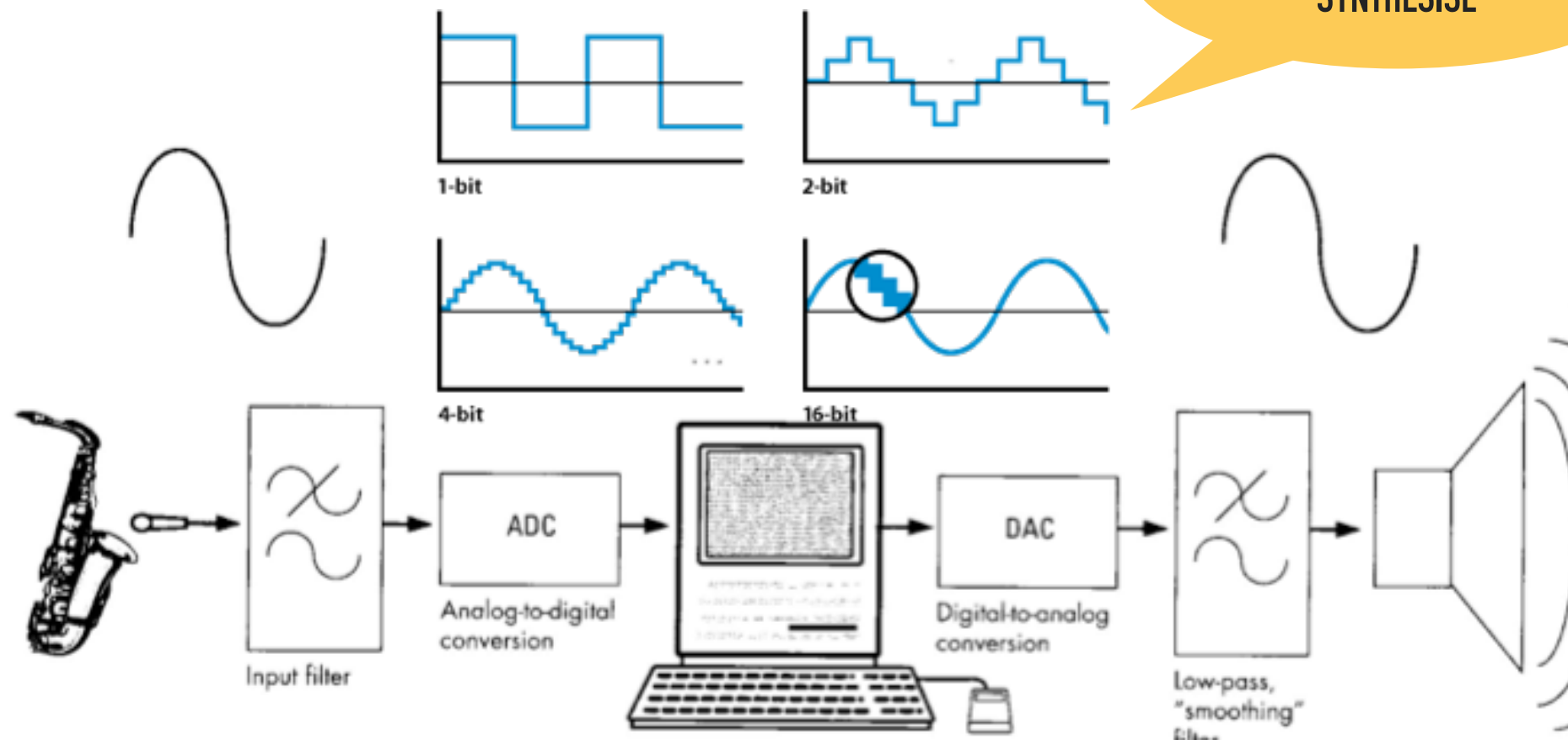MUS112 WEEK 10

MIXING AND EFFECTS

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RECAP: SAMPLING

WHY SAMPLE? BECAUSE MANY TYPES OF SOUND ARE HARD TO SYNTHESISE

1-bit 2-bit 4-bit 16-bit

Input filter ADC Analog-to-digital conversion DAC Digital-to-analog conversion Low-pass, "smoothing" filter

▸ Digital sampling is the use of digitally recorded or encoded audio data for playback of instrument sounds or other sound sources on demand

▸ Logic's main sampler instrument is the EXS24 though we can also sample in Drum Machine Designer/Ultrabeat.

▸ Logic has extensive sample-based instruments within EXS24 by default (strings, pianos, orchestal instruments, etc…sampling is often a good option for recreating fairly realistic acoustic instrument sounds), but you can also add your own by importing audio files

RECAP: USING YOUR OWN SAMPLES: EXS24

PRESS EDIT

INSTRUMENT VIEW

DRAG+DROP SAMPLE MAPS IT TO ENTIRE KEYBOARD

YOU CAN THEN TAILOR THINGS LIKE ROOT KEY OF SAMPLE, FINE-TUNING, KEYBOARD RANGE

RECAP: USING YOUR OWN SAMPLES: EXS24

Zones																

Zones		Zone	Audio File		Pitch			Mixer				Key Range		Playback			
		Name	Name		Key ▲	Coarse	Fine	Vol	Pan	Scale	Output	Lo	Hi	Pitch	1Shot	Reverse	Anchor
All Zones		Zone #1	ee.aiff	▼	F2	0	0	0	0	0	Main ⏿	C-2	G8	✔	☐	☐	1549
Ungrouped																	

key: set root key (note) of sample (if it is pitched) so that the keys are pressed, they make the note you expect!

coarse and fine tuning of sample

volume (+12/ - 96) and pan (0=centre, R= + 100, L = -100)

scale: scales level of sample across key range; root key is loudest, followed by fade-out

output: only useful for surround/multichannel: output numberings beyond stereo

key range: which notes on the keyboard play the sample

playback: pitch (off for percussion) 1 shot (play entire sample, regardless of env), reverse

anchor: set start point of sample

https://documentation.apple.com/en/logicexpress/instruments/index.html#chapter=9%26section=14%26tasks=true

RECAP: USING YOUR OWN SAMPLES: EXS24 MULTISAMPLES

EXS24 Instrument Editor: Instrument #991

| Zones | Groups | Instrument ▾ | Edit ▾ | Zone ▾ | Group ▾ | View ▾ | Show Velocity |

| Zones			Zone	Audio File		Pitch			Mixer					Key Range		Playba
	All Zones		Name	Name		Key	Coarse	Fine	Vol	Pan	Scale	Output		Lo	Hi	Pitch
	Ungrouped		Zone #1	ch.aiff	▾	E3	0	0	0	0	0	Main ↕		C-2	C♯3	☑
			Zone #2	ee.aiff	▾	F2	0	0	0	0	0	Main ↕		C-2	B7	☑

NOTE KEY RANGES

VISUALISED KEY RANGES

MULTISAMPLING IS WHEN YOU APPLY MULTIPLE SAMPLES TO A SINGLE SAMPLER INSTRUMENT
IT IS OFTEN USED EITHER TO SAMPLE DIFFERENT PITCH RANGES OF A MUSICAL INSTRUMENT
OR TO SAMPLE DIFFERENT DYNAMICS OF A MUSICAL INSTRUMENT

HERE'S A SIMPLE EXAMPLE WITH A 'CH' SOUND AND AN 'EE' SOUND LAYERED
TOGETHER OVER PART OF THE KEYBOARD

THIS IS A MORE ADVANCED TOPIC; WE'VE ONLY SCRATCHED THE SURFACE OF SAMPLING (SIMPLE
SAMPLING OF SINGLE SOUNDS FOR A KEYBOARD INSTRUMENT OR DRUM MACHINE)...
BUT HOPEFULLY YOU CAN APPRECIATE ITS POWER

FILE MANAGEMENT

▸ Remember, if using external sampled audio, save your audio files and sampler instruments and samples within the project folder: choose File: 'Save As' for these options
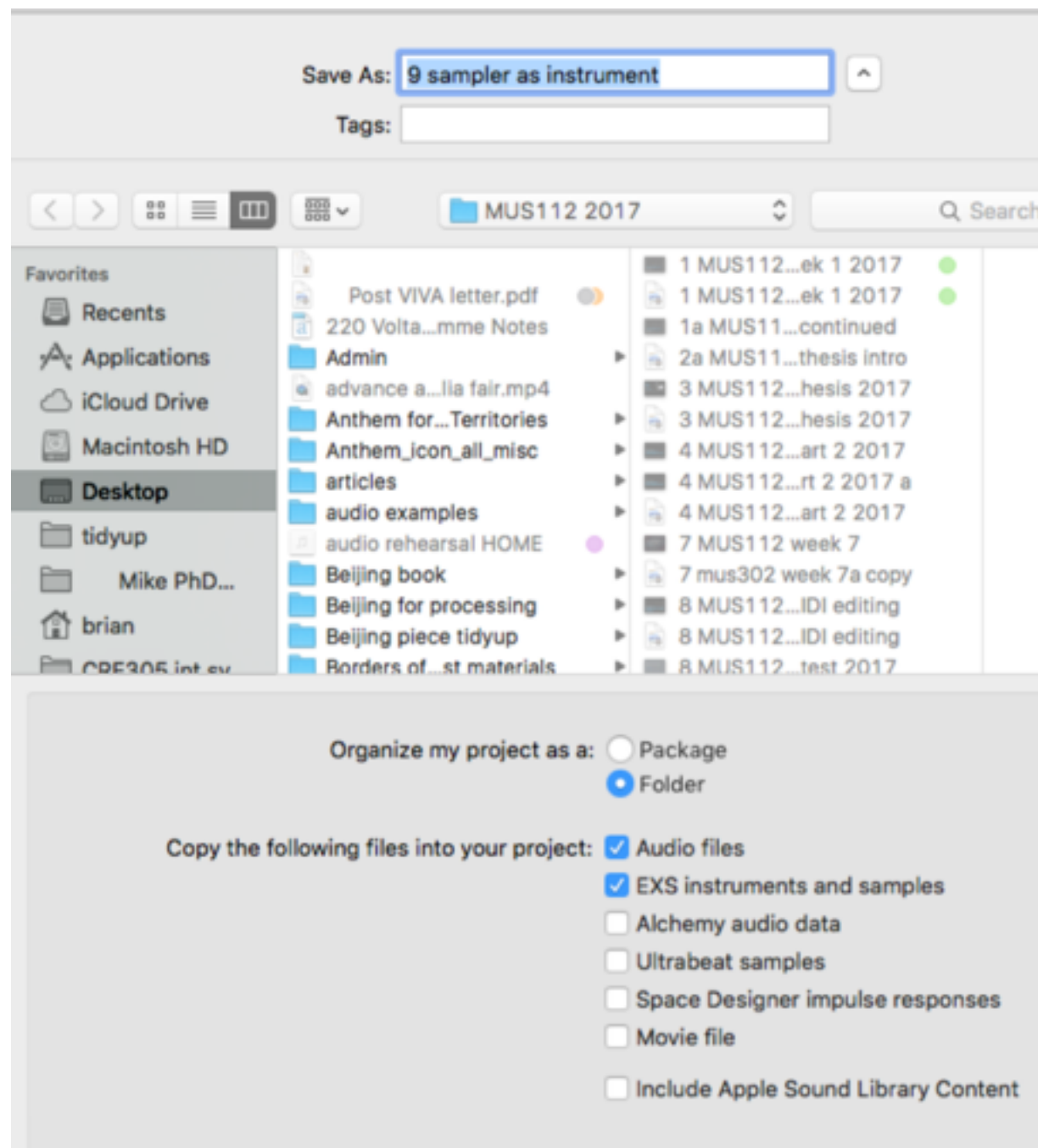
OTHER SAMPLING-RELATED FEATURES: SAMPLE EDITOR

click on arrow: select 'load in sample editor'

edit your sample, including fade functions
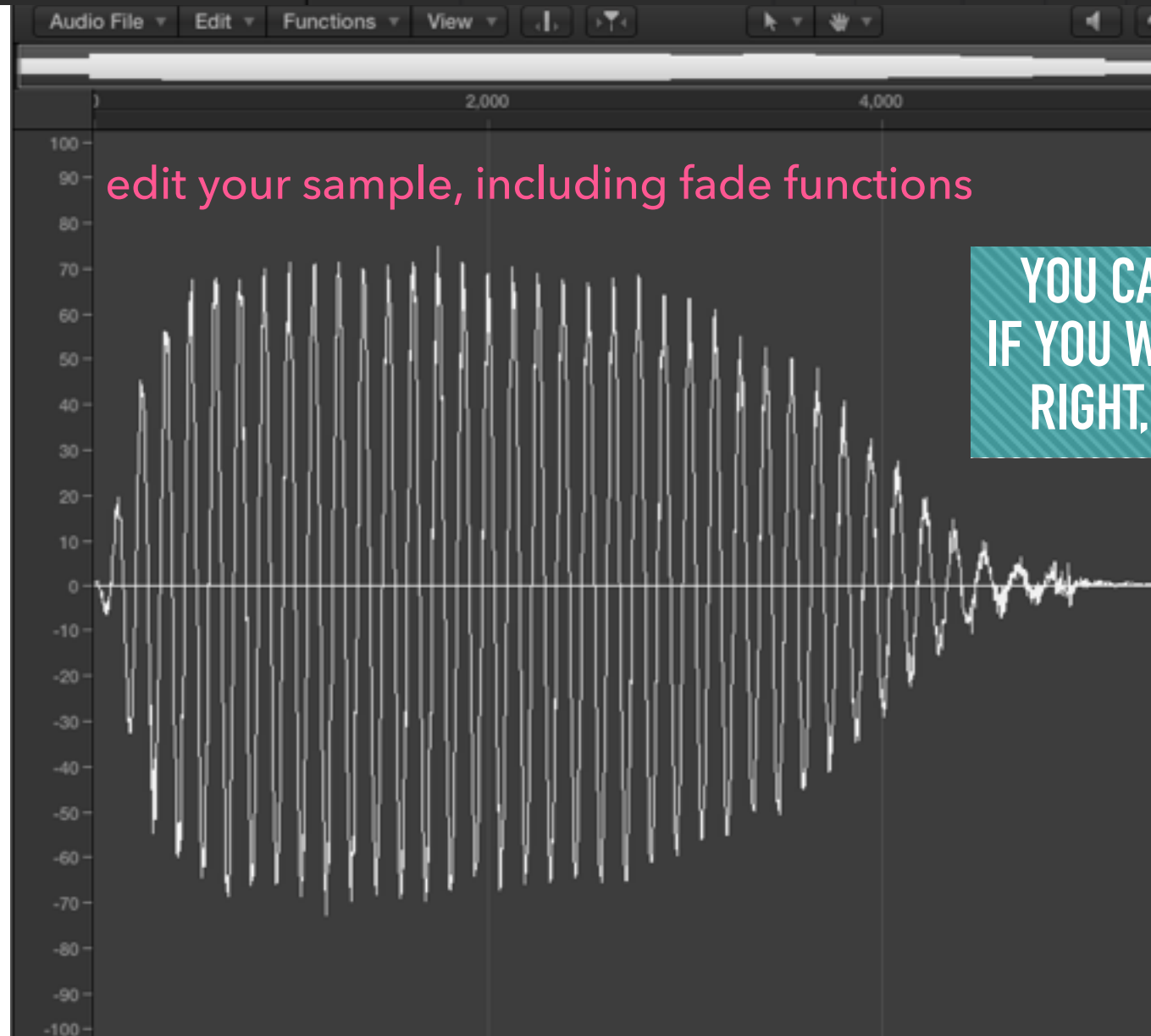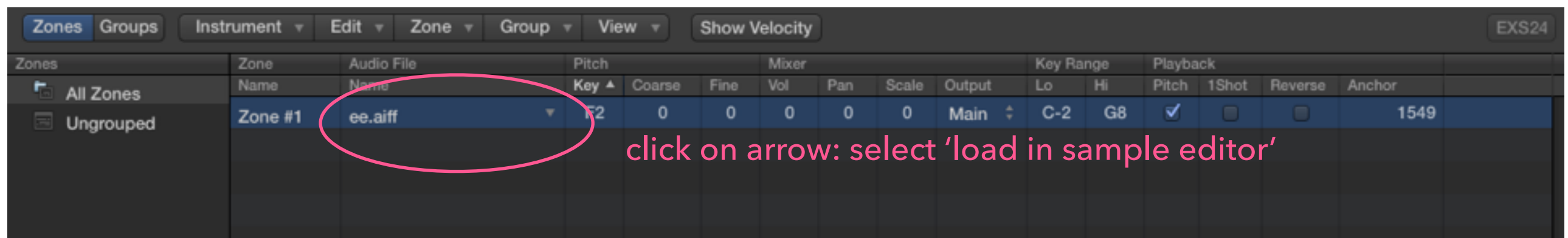
YOU CAN ALSO SET LOOP POINTS ON SAMPLES IF YOU WANT THEM TO SUSTAIN (DIFFICULT TO GET RIGHT, BUT WORTH A TRY ON SOME SOURCES)

MORE ADVANCED SAMPLING: MULTISAMPLING

▸ In many cases, if sampling an instrument (acoustic or electronic), we will want to take samples for a number of different pitches

▸ Why? Well, if we play a sound sample too far from its original pitch, it might begin to sound distorted; human voices may begin to sound like small animals if pitched up, or super-sized trolls if pitched down (search for the 'chipmunk voice effect')

▸ So, we often take multiple samples and combine them within the same sample set to avoid this. Here's one I made earlier! What do you notice about the intervals between the samples? What do you notice about the key range parameter?
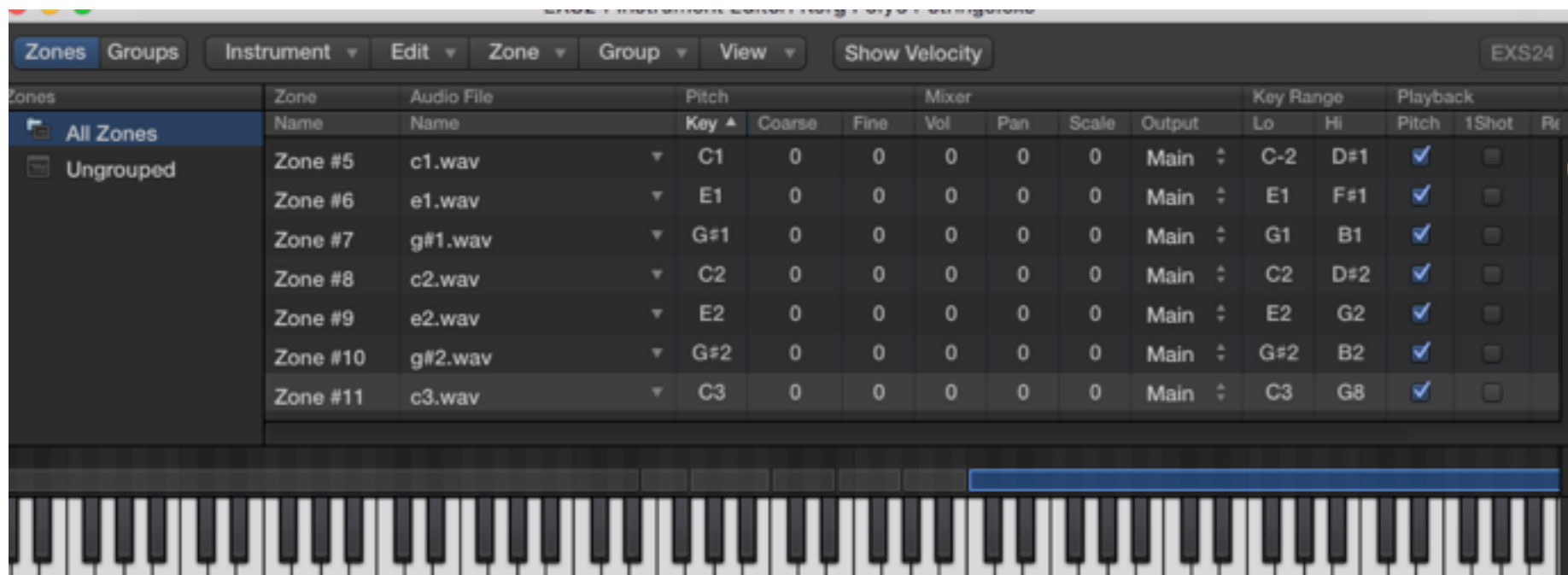

I'VE PROVIDED LINKS TO SOME FREE SAMPLE SETS ON MY WEBSITE, SO YOU CAN TRY THIS AT HOOME

MIXING AND EFFECTS

MIXING

▸ At some point, we'll need to start looking at the audio levels (amplitude, aka 'volume') of our different tracks/instrument channels within Logic and see if they're right

▸ We might need to make changes if clipping (distortion) is occurring due to levels being too high

▸ Or it might be that some sounds mask (block) certain other sounds if they overlap in frequency range (we're somewhat familiar with this concept from arranging)

▸ Beyond this, we're also trying to create a sense of musical perspective within our track; certain sounds blending, certain sounds clearly delineated

▸ This process is called mixing, and is based on changing levels, apparent direction of sources (panning) and effects processes (e.g. distortion, echo effects, etc.)

MIXING: LOGIC'S MIXER
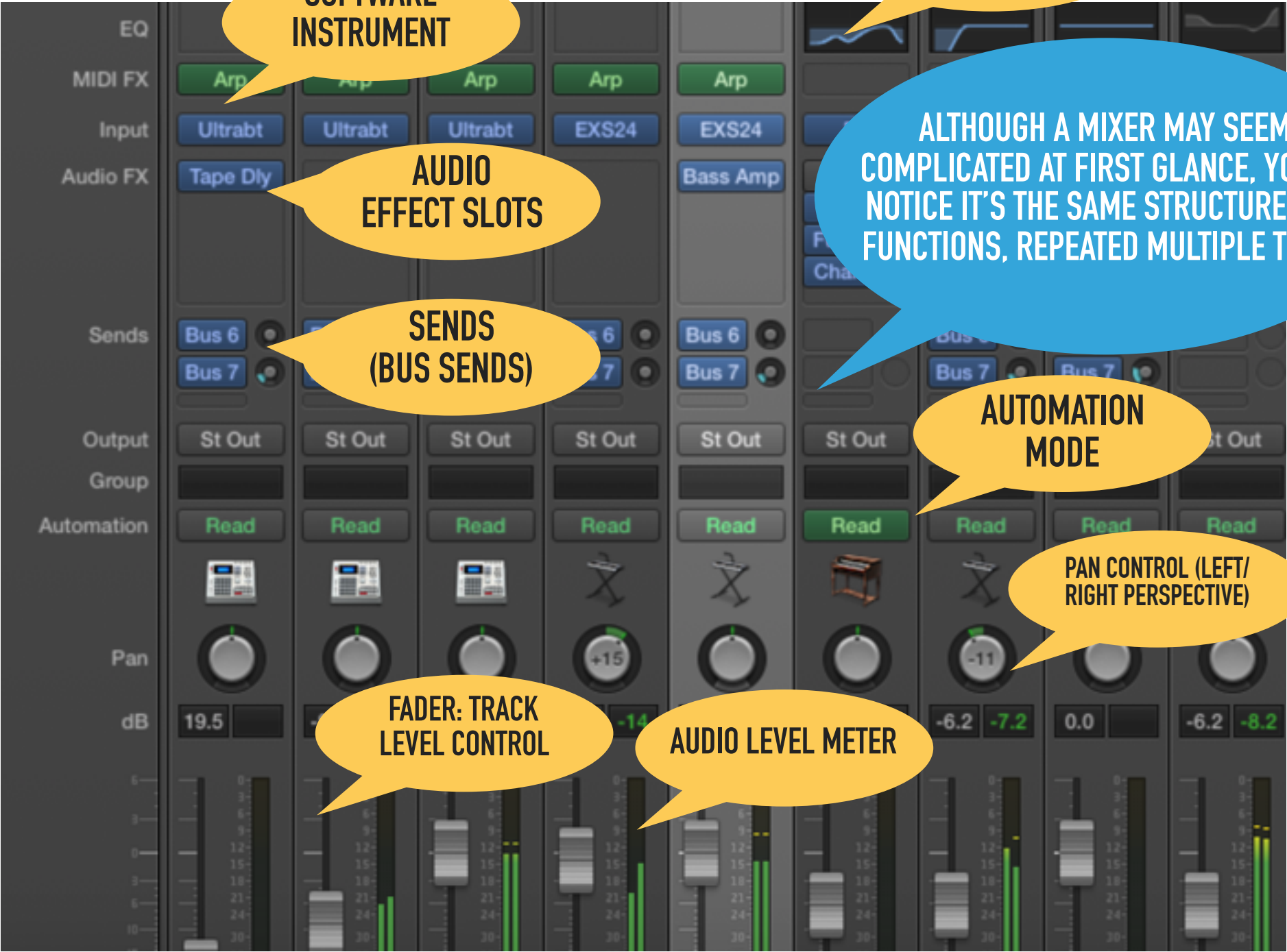
MIXING

▸ Mixing is an exercise that is part art, part science

▸ There are certain technical principles to understand, but you also need to use your ears and judgement

▸ It's advisable not too listen at levels that are too loud over extended periods as your ears will become fatigued

▸ It's important that you use over-ear headphones rather than in-ear (earbud) types as the latter will not reproduce the bass range clearly, leading you to misjudge it

▸ As well as listening to your track, listen to music that you like/that has influenced you. Do you notice anything about the mixes of songs/albums that you admire?

MIXING: FIRST PRINCIPLES: TWEAKING LEVELS

▸ 1. Check for tracks which are clipping, i.e. 'going into the red' (look for red numbers above the audio level indicator); turn these tracks down a little (perhaps turning other tracks up to compensate if this unbalances your mix) and then check if the red numbers still appear when you play the passage again

▸ 2. Start thinking about overall balance of your music. Are any instruments too loud or too quiet? Adjust instruments accordingly, bearing in mind that you might need to turn everything down a bit to avoid clipping

▸ 3. Listen carefully to the tonal range (frequency range) of your materials; do you notice any instruments which sound like they occupy the same range? Do you notice the sound being a little muddy when they play at the same time? (We may need to fix this later)!

SOUND MIXING AND MASKING

▸ Sound mixing should be straightforward, right? Place two sounds together at the same point on a timeline!

▸ But some sounds mix more easily than other sounds; some sounds will actually block [mask] certain other sounds!

▸ Masking is based on the frequencies of the sounds (e.g. high and low components in the sound's texture or timbre) and the way in which they are encoded by our ears

▸ All of the sounds we hear are filtered through a band of muscle-like substance inside the ear called the basilar membrane

▸ Overlapping frequency components from a sound wave will interfere with each other; frequencies from the quieter sound source will be masked (thus *not heard*)
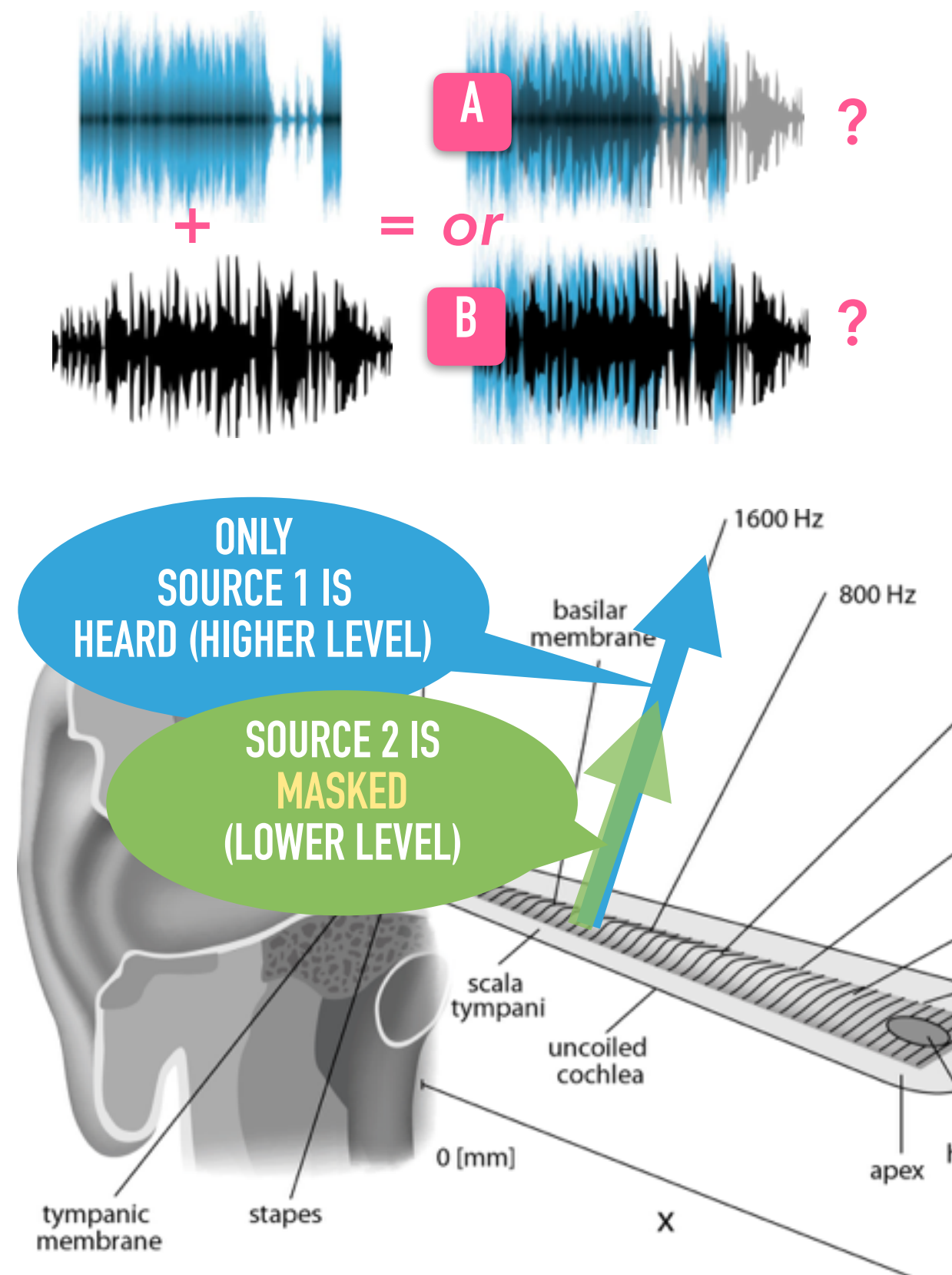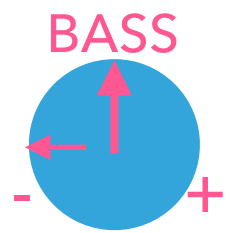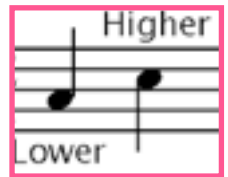
MASKING: DEMONSTRATION
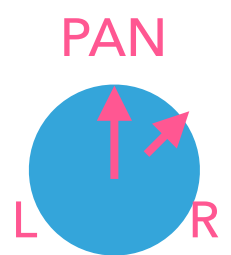
MASKING: POTENTIAL SOLUTIONS

Solutions to masking in mixing:

BASS EQ/Tone Control (more on this shortly): filter overlapping freq. components in lower-level source; boost non-overlapping components

Synthetic source/experimental sound design: change pitch of source (move all freq. components 'out of the way')

PAN Panning: change apparent direction of source (make louder in one speaker than another)…we are better at 'filtering out' sources with overlapping freqs that come from different directions (due to different signals at two ears)

Applications of masking: MP3 compression (& MP3 as bad archival format)

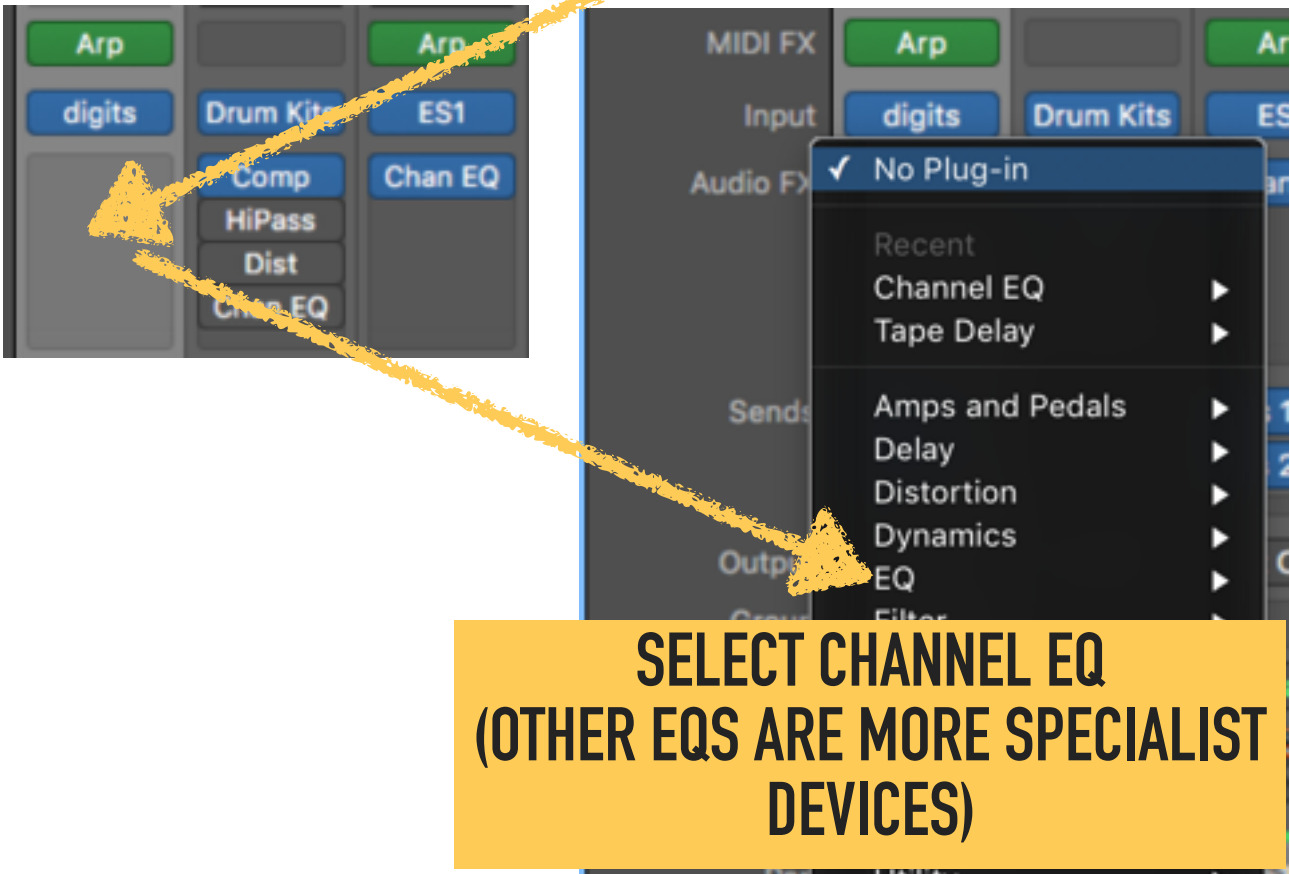Phenomenon related to masking: demonstration 'picket fence effect' with speech (and how it may be useful in mixing)

KEY TECHNIQUE: VIEWING FREQUENCY CONTENT IN LOGIC

TURN ON CHANNEL EQ

DOUBLE-CLICK HERE

OR CLICK WITHIN AN EMPTY PLUGIN SLOT

SELECT CHANNEL EQ (OTHER EQS ARE MORE SPECIALIST DEVICES)

TURN ANALYSER ON

MASKING AND ARRANGING OR TONE CONTROL

BASS AND LEAD SYNTH

DRUMS

BASS GUITAR

SOME OVERLAP BETWEEN ALL SOURES

MAY MAKE MIX LESS DISTINCT!!!!

SOLUTION: EITHER MOVE
SOME MATERIALS OUT OF THE WAY
(BY ARRANGING DIFFERENTLY)
OR APPLY TONE CONTROL TO EACH
(TO REDUCE DEGREE OF OVERLAP; MAKE
NON-OVERLAPPING REGIONS CLEARER)

MASKING AND ARRANGING, TONE CONTROL, PANNING

▸ Notice the overlap between the bass and kick drum

▸ As they both take up the same frequency space, in the same pan position, frequencies from one sound will tend to block those in another sound

▸ The result is an indistinct mix that isn't pleasurable to listen to!

▸ Solutions: (1) change arrangement/composition (both sounds happen at different times), panning overlapping sources to L or R (but we don't tend to pan bass sounds significantly) or tone control/equalisation (cut some of the common frequencies in one source and apply small boost ones which are distinct)
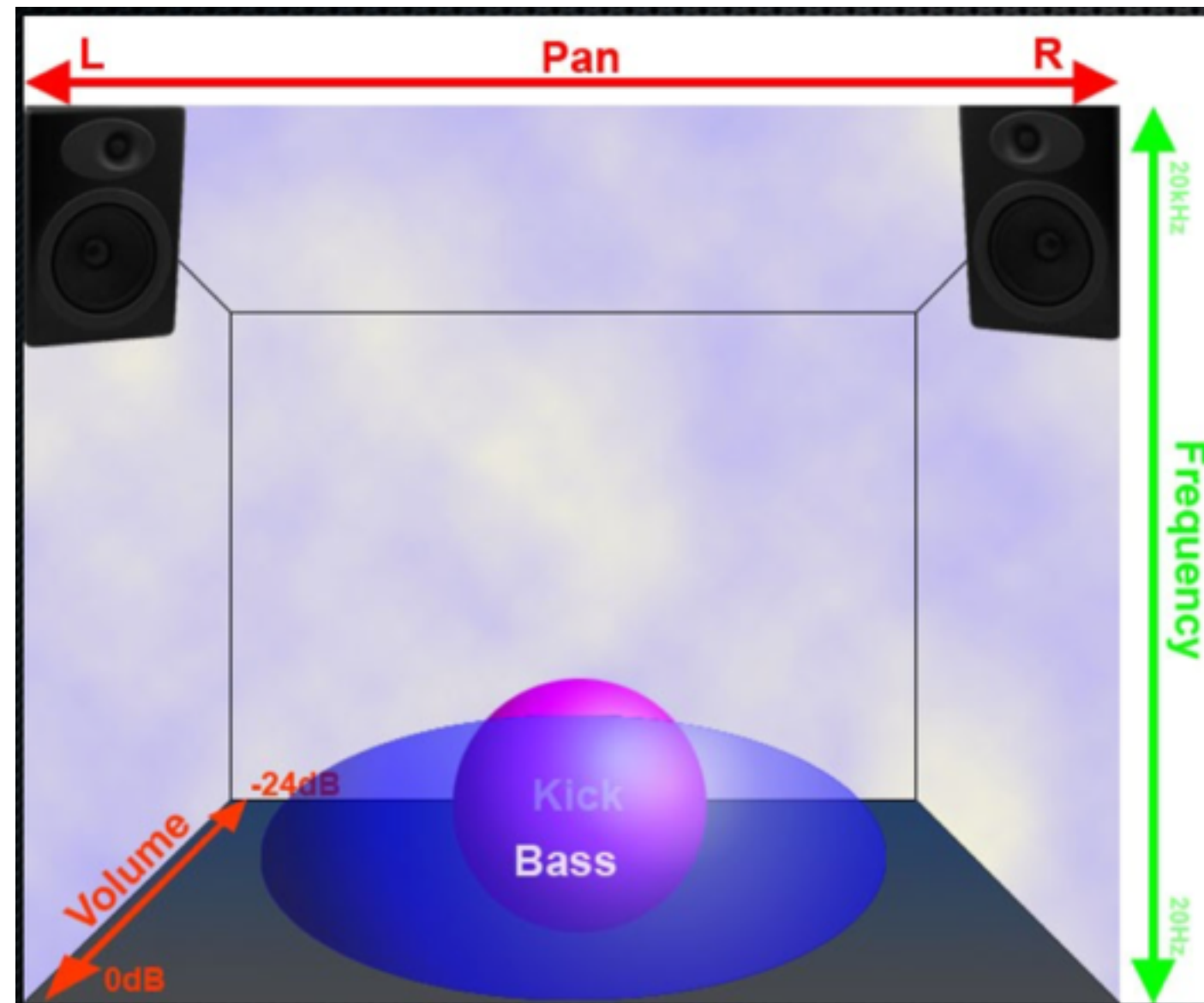

Image source: John Harding
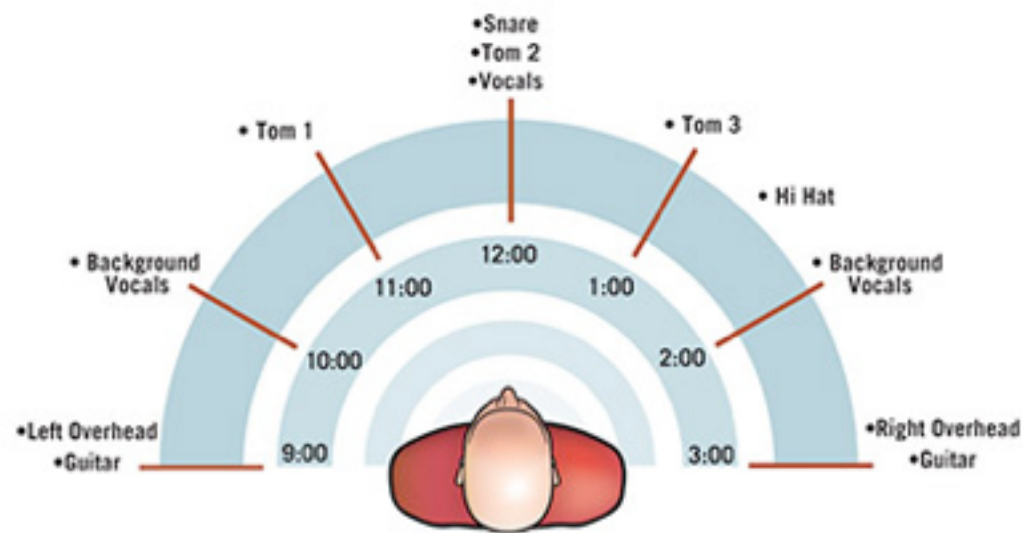
MIX PERSPECTIVE: PANNING 1
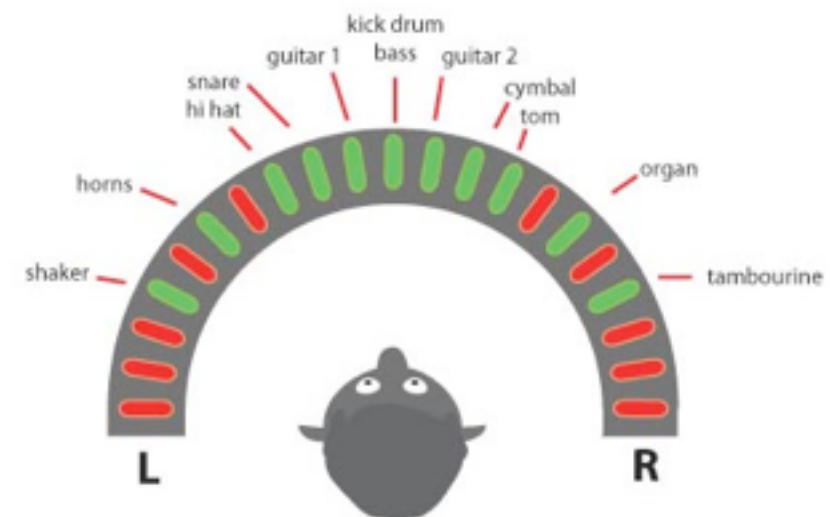

Image source: Universal audio

http://www.uaudio.com/blog/studio-basics-mixing-stereo/

Image source: Propellerhead

https://www.propellerheads.se/blog/tools-for-mixing-levels-panning

TRY EXPERIMENTING WITH PANNING FOR MIX PERSPECTIVE; THESE ARE EXAMPLES OF SOME 'DEFAULT' APPROACHES TO PANNING, BUT THE MAIN THING IS TO PAN BASS PARTS AND KEY ELEMENTS (VOCALS, MUCH OF RHYTHM TRACK) TO THE CENTRE AND APPLY COMPLEMENTARY PANNING FOR INSTRUMENTS WITH SIMILAR FREQ RANGES

(WE HAVEN'T MET RECORDED VOCALS YET, OF COURSE; JUST TREAT SOME OF YOUR MELODIC LEAD LINES LIKE VOCALS!)
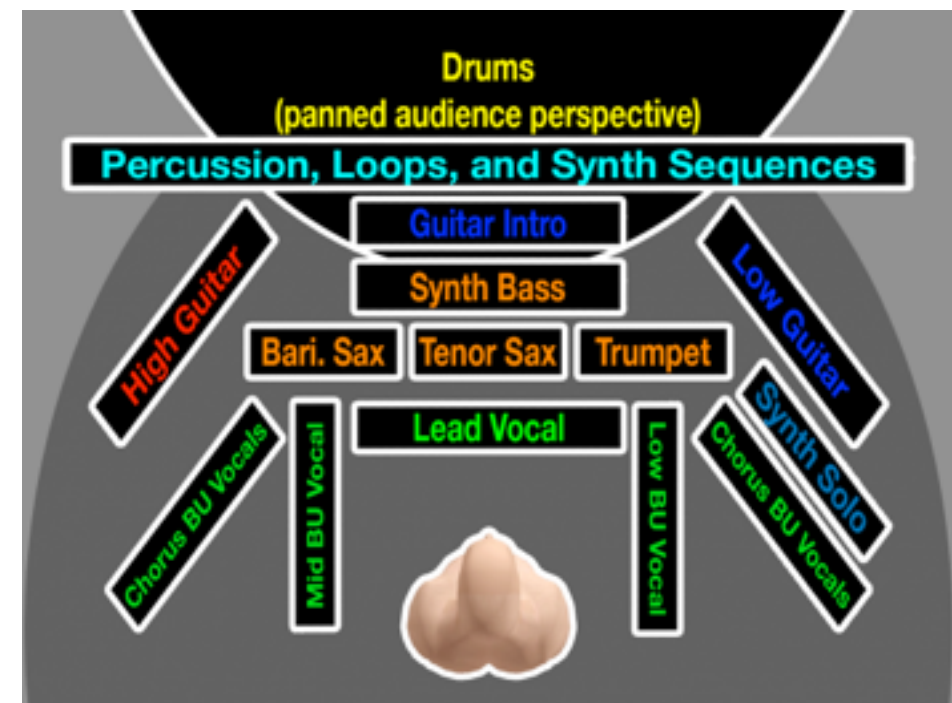

Image source: M. Hepworth, ask.audio

https://ask.audio/articles/mixing-tips-the-importance-of-panning

FREQUENCY RANGES AND EQ

Frequency Range	Frequency Values
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

Table source: teachmeaudio.com

http://www.teachmeaudio.com/mixing/techniques/audio-spectrum
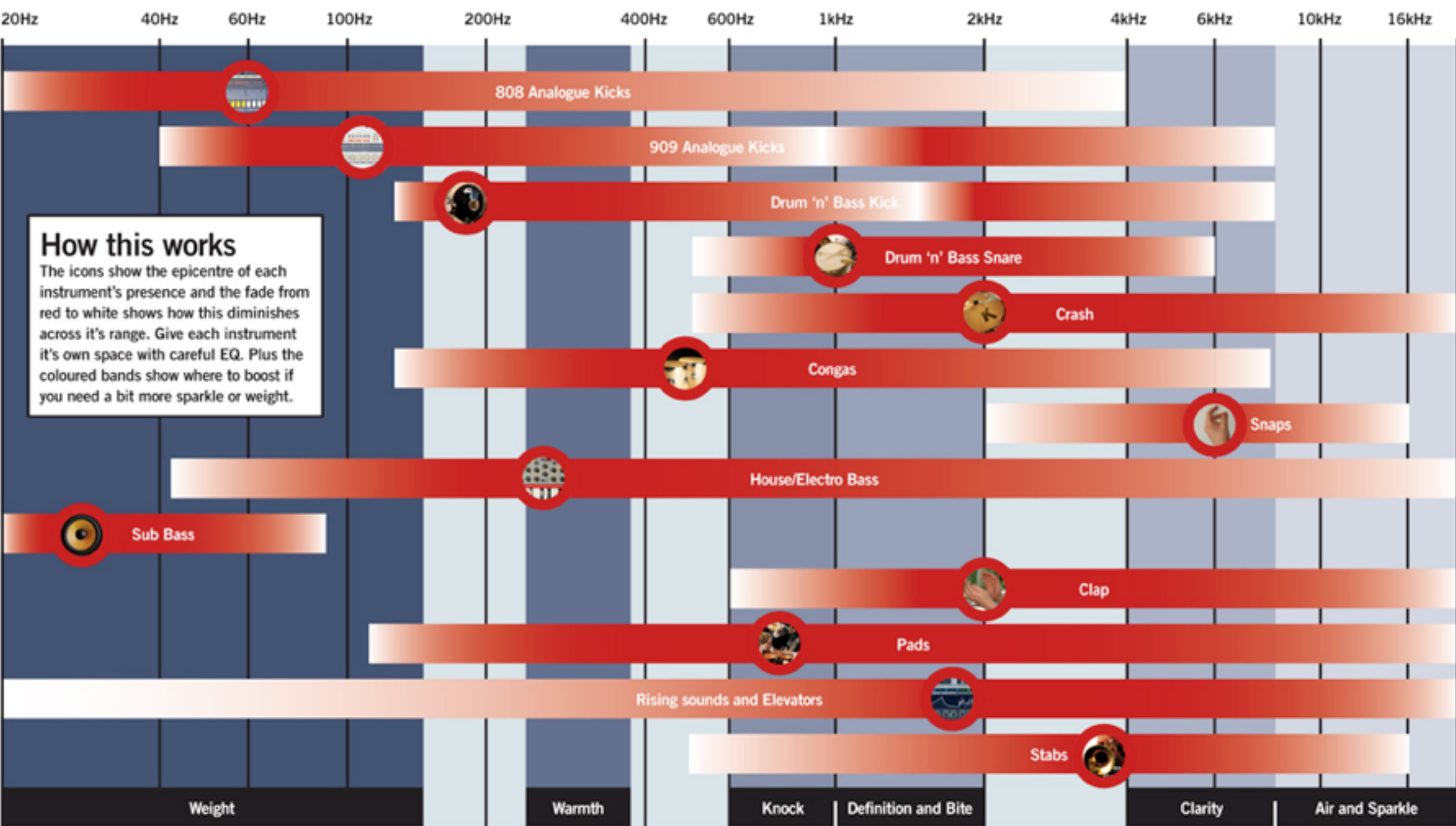
A Club Track's Frequency Map

Fit your mix together and give your tracks room to breathe with our simple guide to frequency ranges
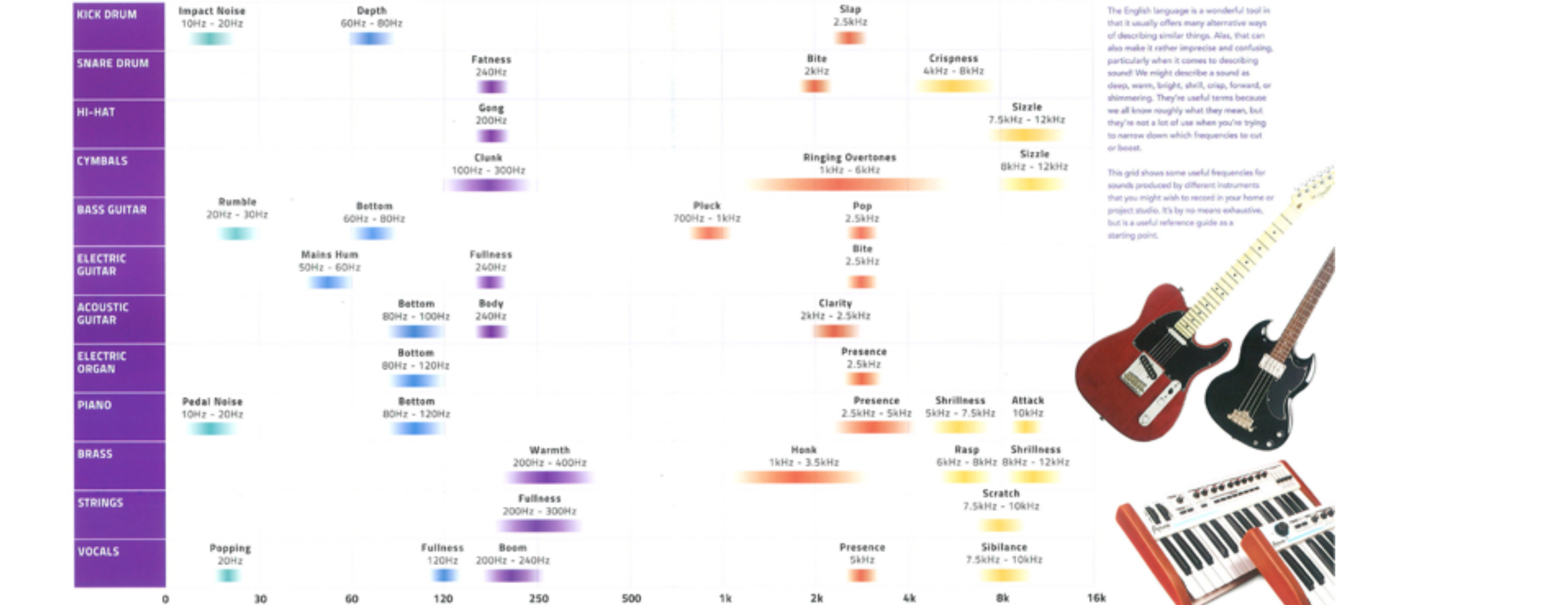
FutureMusic
Technique and technology for making music

How this works
The icons show the epicentre of each instrument's presence and the fade from red to white shows how this diminishes across it's range. Give each instrument it's own space with careful EQ. Plus the coloured bands show where to boost if you need a bit more sparkle or weight.

20Hz · 40Hz · 60Hz · 100Hz · 200Hz · 400Hz · 600Hz · 1kHz · 2kHz · 4kHz · 6kHz · 10kHz · 16kHz

808 Analogue Kicks
909 Analogue Kicks
Drum 'n' Bass Kick
Drum 'n' Bass Snare
Crash
Congas
Snaps
House/Electro Bass
Sub Bass
Clap
Pads
Rising sounds and Elevators
Stabs

Weight · Warmth · Knock · Definition and Bite · Clarity · Air and Sparkle

FREQUENCY RANGES AND EQ

Image source:
Sound on Sound
and SAE

MIX PERSPECTIVE: LOUDNESS PERCEPTION

▸ One of the key things we do in mixing is change the amplitude levels of our tracks/channels to change their relative loudness

▸ Loudness is measured in decibels (dB). Decibels are a relative, logarithmic measurement (i.e. they represent level values which scale up/down in a way which would be hard to represent with linear (e.g. 1, 2, 3, 4) steps.

▸ To put this in more concrete terms, a 10 dB increase or decrease in audio level would be a ten-fold increase or decrease in a signal's amplitude (e.g. 1 to 10, 10 to 100, 100 to 1000); the use of decibels gets around this large range.

▸ Common larger changes in audio level in mixing are in multiples of 3 dB (e.g. 6, 12 dB for dramatic changes); common smaller changes in audio level are around 1 dB (the smallest dB change we are conscious of hearing; we'll hear this in a moment).

THE DECIBEL SCALE (AUDIO EXAMPLE)
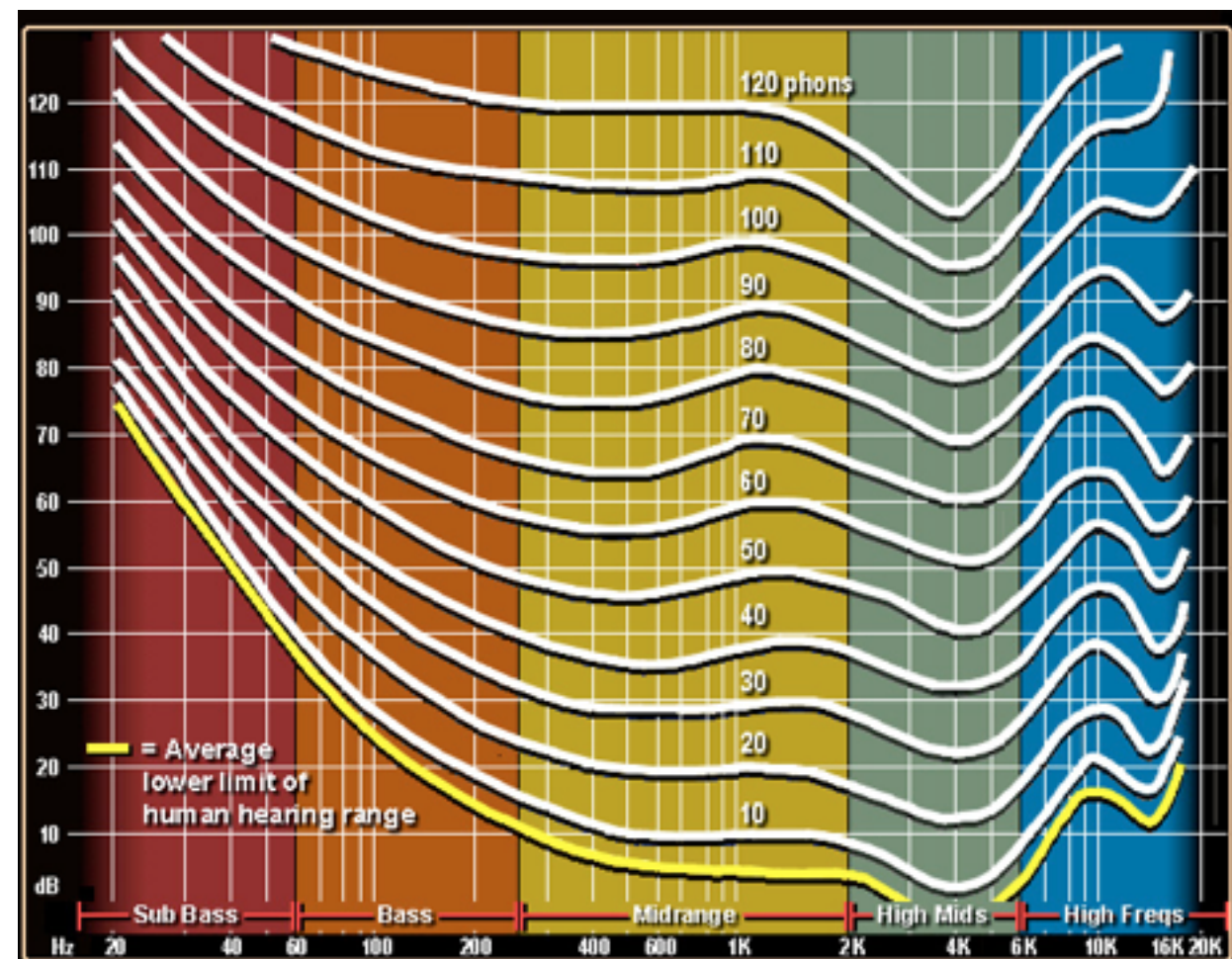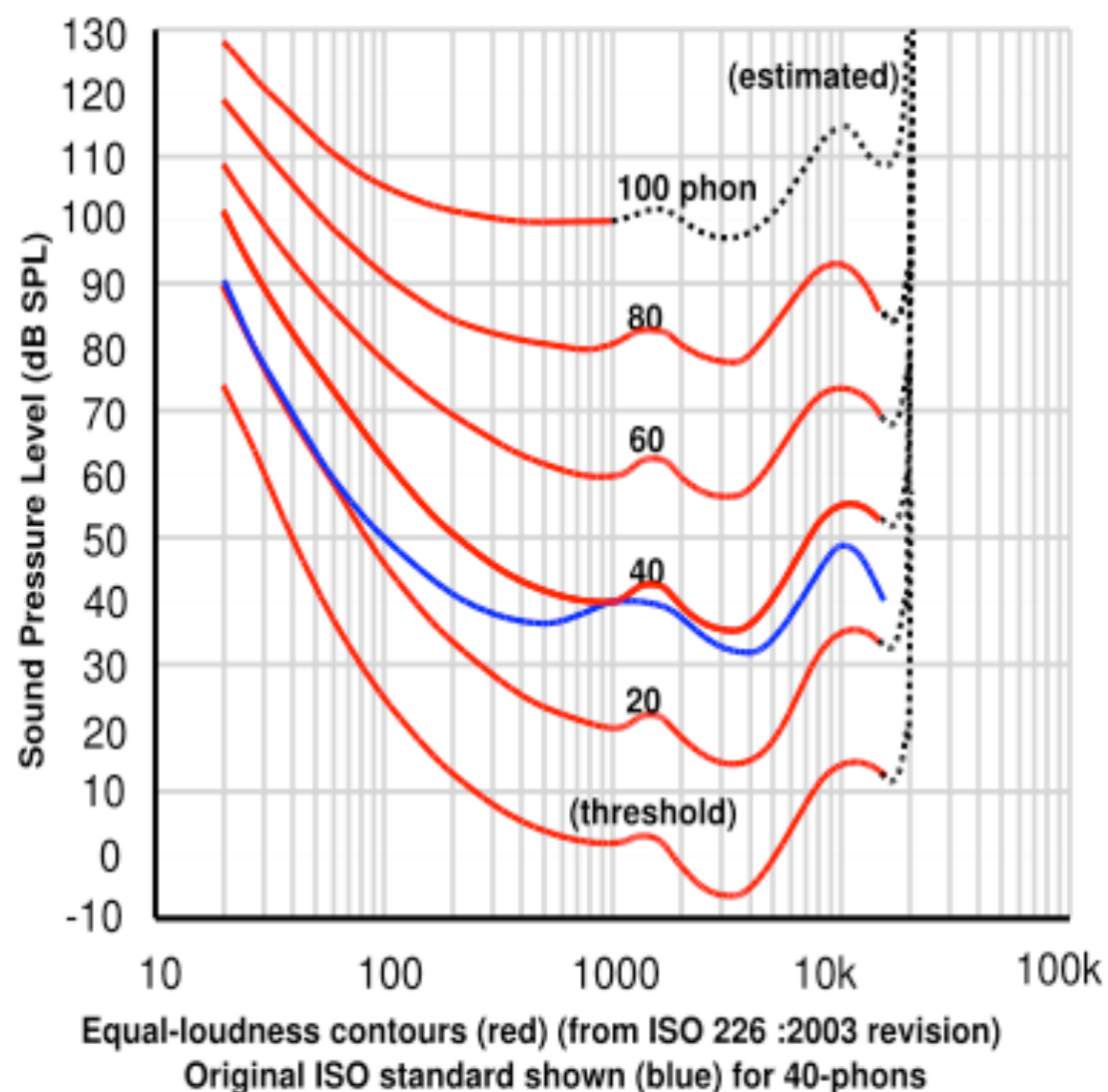
▸ 6 decibel steps

THE DECIBEL SCALE (AUDIO EXAMPLE)

▸ 3 decibel steps

▸ 1 decibel steps

MIX PERSPECTIVE: LOUDNESS PERCEPTION

Equal-loudness contours (red) (from ISO 226 :2003 revision)
Original ISO standard shown (blue) for 40-phons

EQUAL LOUDNESS CONTOURS: OUR SENSITIVITY TO SOUND LEVEL VARIES SIGNIFICANTLY WITH FREQUENCY

AT LOW LISTENING LEVELS THE EAR IS MORE SENSITIVE TO AMPLITUDE CHANGES AT MID FREQUENCY REGIONS THAN EXTREMES – REF. 'LOUDNESS'/'BASS BOOST' FUNCTIONS ON LISTENING DEVICES; I.E. BASS (AND SOME HIGH FREQUENCIES) NEED TO BE LOUDER TO PROVIDE AN IMPRESSION OF A FULL MIX AT LOW LEVELS

AUDIO EFFECTS PLUGINS: INTRODUCTION

▸ **Why use?**

▸ For mix balance and sense of space (e.g. some effects change frequency content)

▸ For sound design

▸ Where? Mixer (insert or effect send via bus)

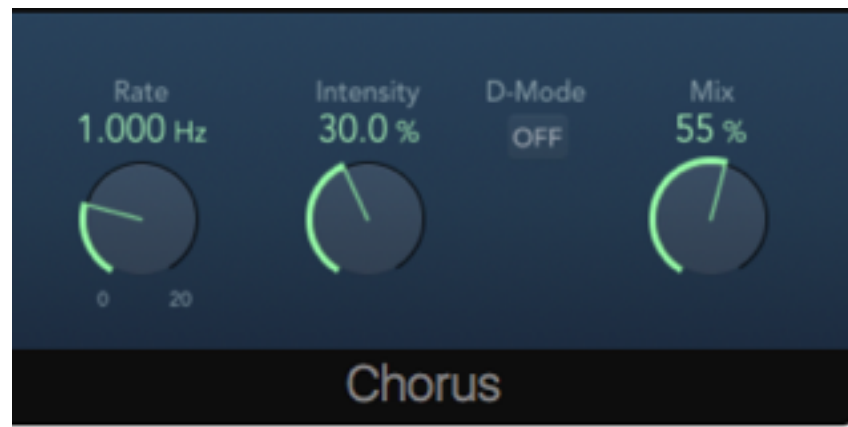▸ Can you name any audio effects types? What are their common musical functions?
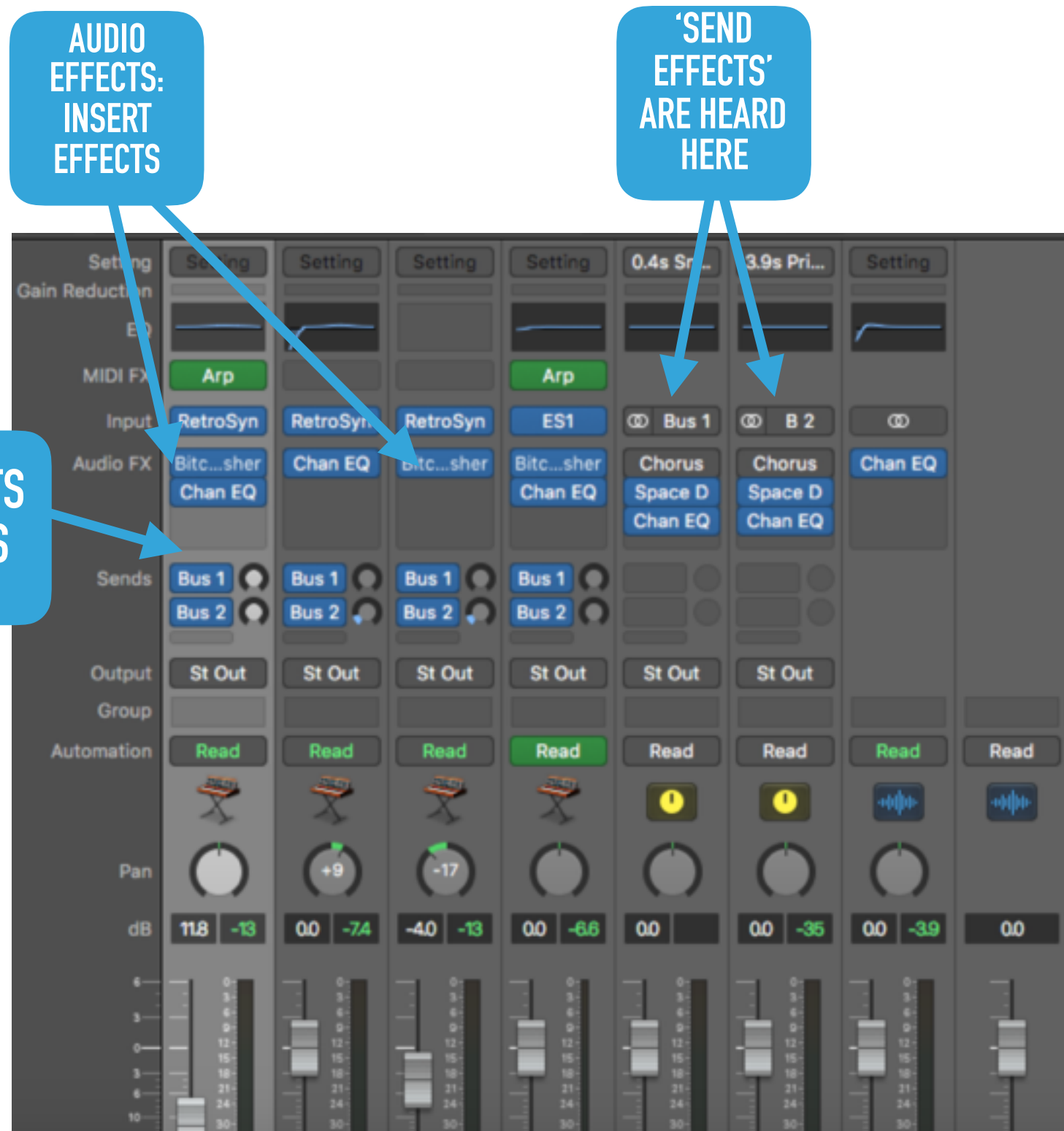
COMMON EFFECTS FAMILIES

‣ Distortion/amp modelling/lo-fi effects

‣ Delay effects

‣ Modulation effects (chorus, phaser, flanger)

‣ Reverb (acoustic space)

‣ EQ

‣ Dynamics processing - compression

http://www.soundonsound.com/techniques/effects-all-you-need-know-and-little-bit-more
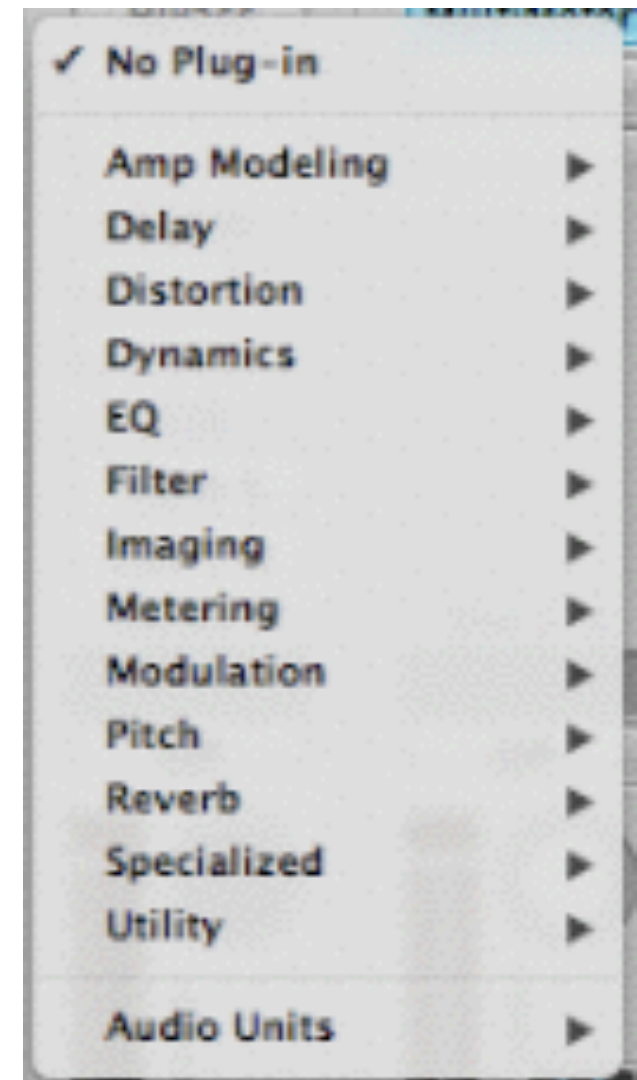
SOME COMMON INSERT EFFECTS

Chorus: 'thickening' effect (like chorus of voices)

Distortion: analogue-style or digital (bitcrusher)

SOME COMMON EFFECTS

Delay: echo effect with feedback and tone controls

INSERT EFFECTS: WET–DRY BALANCE

▸ Insert effects by default process the entire sound as they interrup the signal path

▸ E.g. with a distortion effect, you don't hear a clean signal alongside the distorted one

▸ However, some effects (e.g. chorus, delay, reverb) allow you to set a wet/dry balance

▸ Wet, in this case, is the effected signal; dry is the original signal, without proccessing

▸ Where it is available, it is important to try tweaking the wet/dry balance to see what effect it has on your sound

SEND EFFECTS: REVERB

▸ In some cases, you will want to send multiple tracks/channels to a particular effects process

▸ One common example is reverb

▸ Reverb provides a simulation of a virtual room…an acoustic environment which has reflective w
   creating a 'wash' of blended echoes, giving us a sense of space (think of churches, cathedrals, s
   gyms, swimming pools)

▸ Any room of sufficiently large size and hard surfaces will create a reverberation effect

▸ We use bus sends to send multiple tracks to a single reverb effect

SEND EFFECTS (AKA AUX EFFECTS): REVERB

▸ Spaces vary by reverb time (a key parameter) and the frequency content of the reverberated signal; pop/rock/jazz/ electronic will often have a shorter reverb time for rhythmic sections (e.g. less than a second); more ambient music or classical/choral music may have significantly longer reverb times

▸ e.g. concert halls have 2-3 second reverb times; big cathedrals have 4 second + reverb times

▸ Wet/dry balance is crucial; the more 'wet' signal, the more reverberation will be heard (and the more distant a sound will appear)

▸ The reverb time itself (the amount of time a sound takes to decay by 60 dB of its original level) is divided into an initial delay time, early reflections (sparse) and the main reverberation

▸ Logic's space designer plugin provides a range of presets for different acoustic spaces, from small chambers to concert halls and cathedrals

NB: AS SEND EFFECT, NO DRY SIGNAL BY DEFAULT
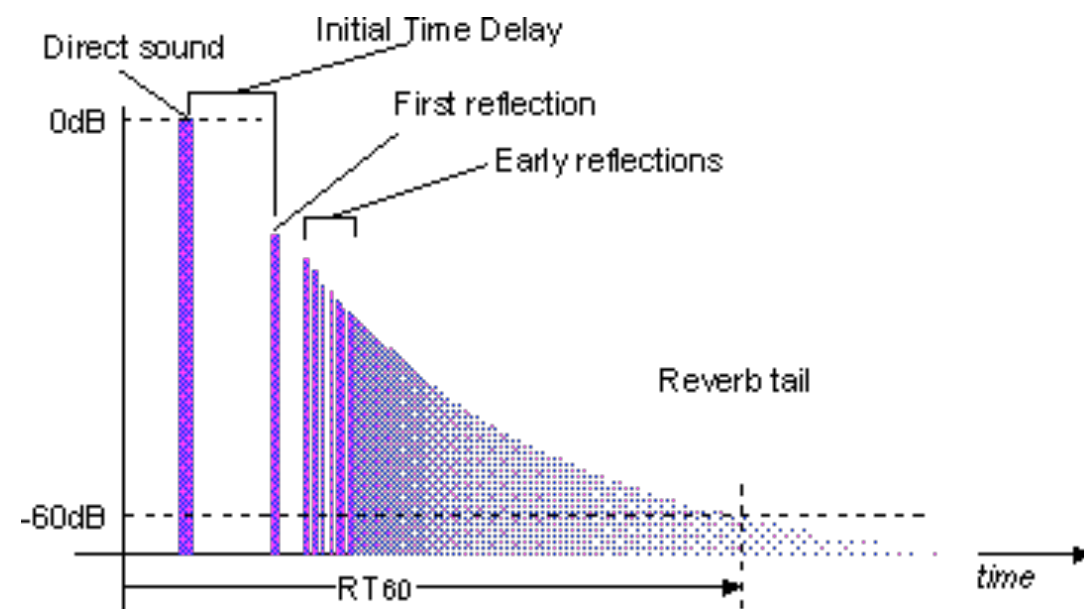
MIXING: CONCLUSION

▸ Check for frequency overlap between materials

▸ Try tweaking levels for clarity and blend

▸ Do certain effects help definition or help to blend materials?

▸ When EQing, try cutting rather than boosting in the first instance

▸ Don't be afraid to apply automation (use touch mode if you want your changes to be temporary)

▸ Try listening at different levels and on different systems (headphones, speakers); mixing takes time!

▸ Take regular breaks and protect your hearing (don't listen at high levels for long periods)

▸ Use proper over-ear headphones; not earphones

▸ There are many good mixing resources in the library and on the web, e.g.

▸ www.soundonsound.com/techniques/mixing-essentials