MUS112 Desktop Audio Production 2: week 8

Revision and self-test: sound synthesis

Dr Brian Bridges

BD.Bridges@ulster.ac.uk

Recap

- **Summarising sound design technologies** (d'Escrivan, 2012, pp.72–3 after Smith, 1991):
- **1: processed recordings** (samples, not really synthesis unless significant processing)
- **2: spectral models** (broad focus on moulding spectrum into desired 'shape' or constructing spectrum from simpler components: subtractive/additive)
- **3: physical models:** imitating the systems found in acoustic instruments
- **4: abstract algorithms (e.g. FM):** processes which have no particular direct/intuitive connection with 'acoustic behaviours' but happen to produce interesting sounds in an efficient manner (e.g. modulation techniques such as FM)

Summary of ‘uses’ of particular synthesis methods

...adapted from/developed from d’Escrivan (2012, pp.77–8)

SUBTRACTIVE
ES1, ESP, ESM, ESE, Retrosynth

Rich sound source, shaped by filter (boost/ cut freqs)

Vary cutoff by hand, with envelopes and LFOs, try other filter types (if available)

FM
EFM1
external software synthes (FM8)
Retrosynth (FM)

One oscillator (modulator) imposes its vibration pattern on another (carrier) very rapidly, bending the wave out of shape

Vary ratio between different oscillators: how does this affect the spectrum?
Vary modulation (FM) depth (also known as mod index): how does this affect the spectrum?

WAVETABLE/ HYBRID
ES2, Hybrid Morph, Retrosynth (‘Wave’)

‘Scrub’ through different stored ‘frames’ /wave shapes of a waveform&filter

Aim for dynamic effects: combine different rates of ‘scrubbing’ through wavetables with different filter automation

PHYSICAL MODEL
Sculpture

Mathematical model of an acoustic musical instrument

Subvert the physical model/ combine different components in your model (‘mutant instruments’)

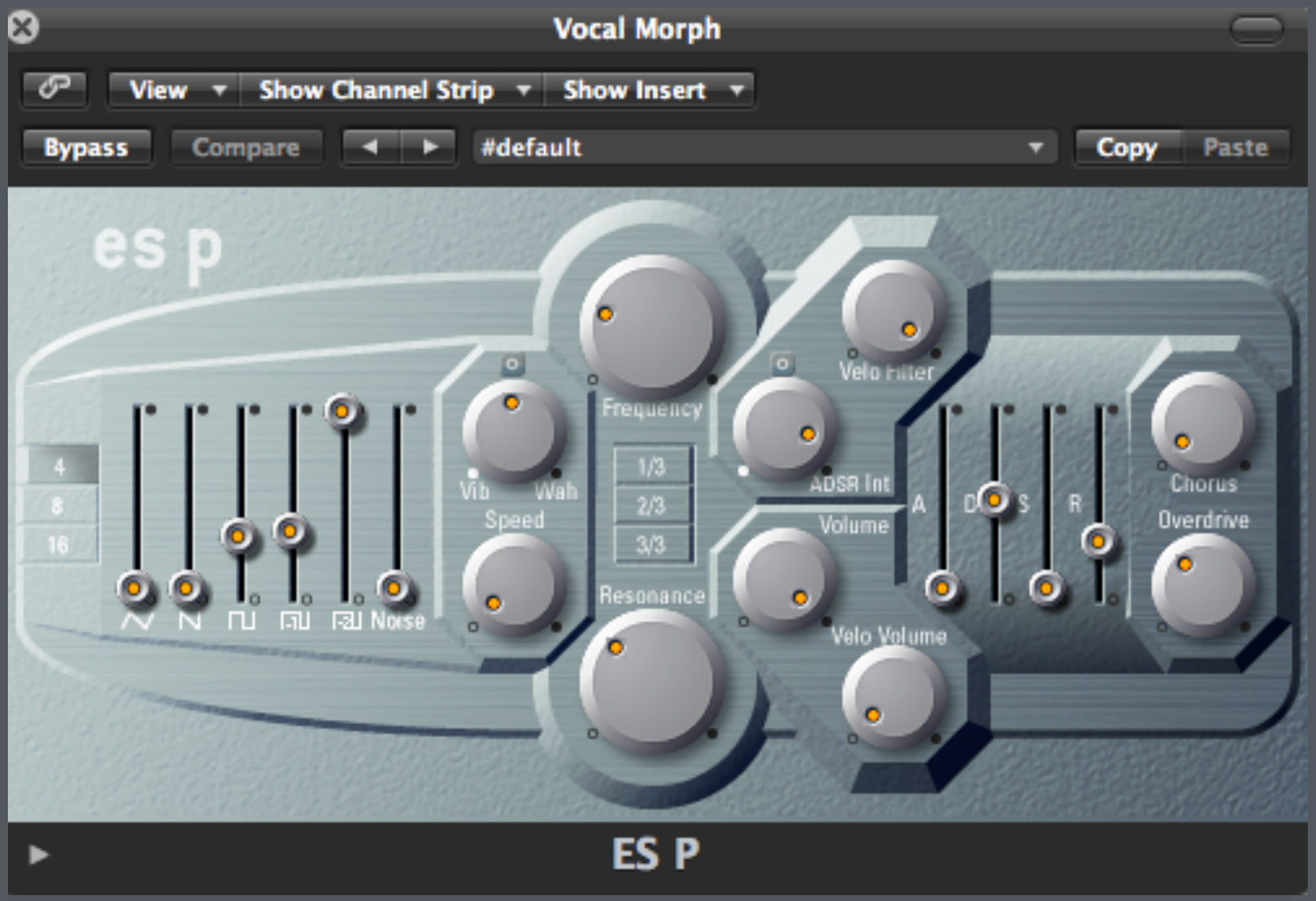
Exercises!

- Can you say what the following denote (and what their function is)?
  - LFO
  - ADSR
  - Q
  - LPF

Exercises!

- Can you say what the following denote (and what their function is)?
- LFO - Low-frequency oscillator (slow modulation oscillator)
- ADSR - Attack time, Decay time, Sustain level, Release time
- Q - Resonance (in filter)
- LPF - Low-pass filter

Can we apply what we've learned to new synths?



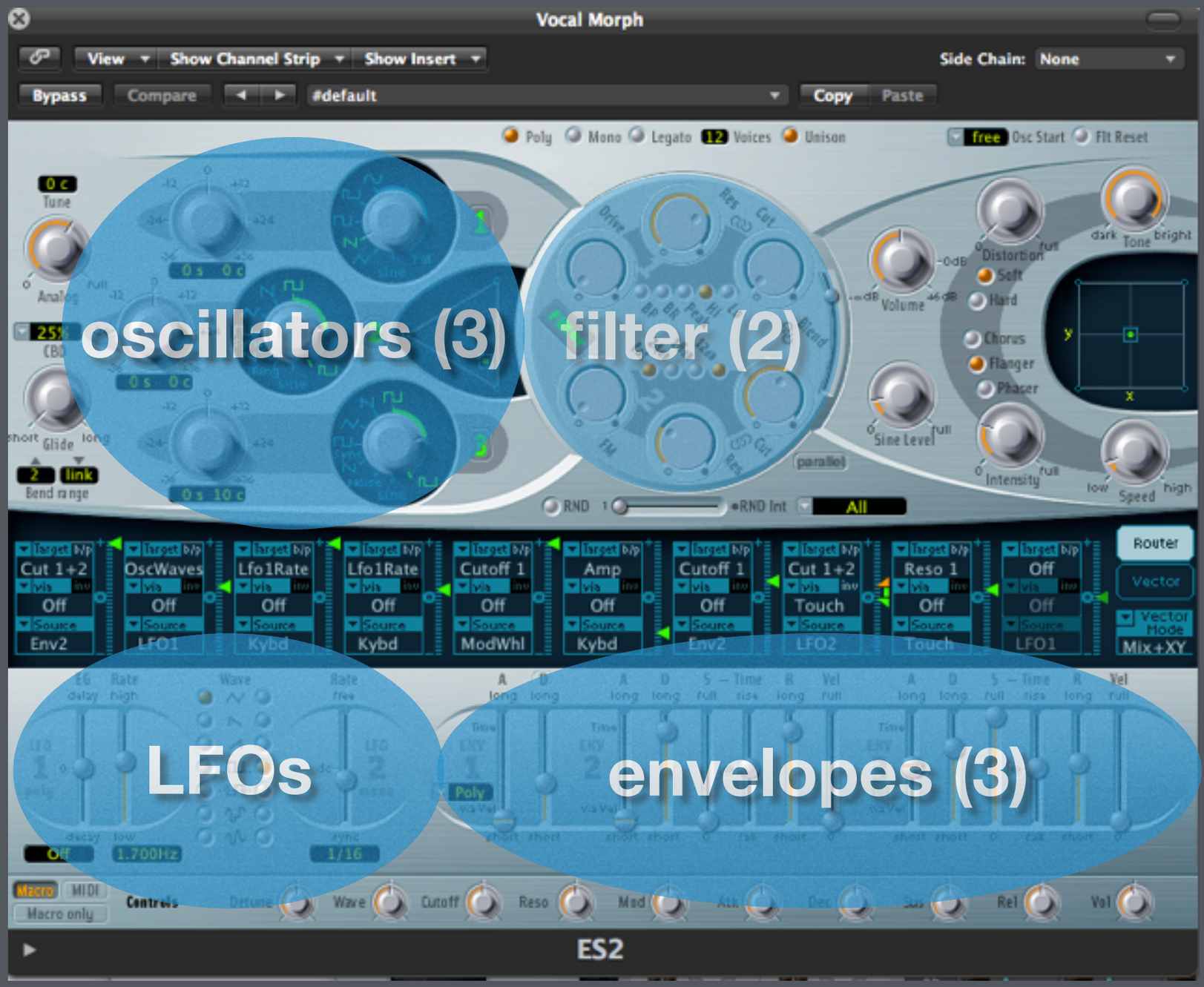
identify the key parts

which method is being used here?

Can we apply what we've learned to new synths?

identify the key parts

Can we make any sense of this?



Recap

- **Summarising sound design technologies** (d'Escrivan, 2012, pp.72–3):
- **1: processed recordings** (samples, not really synthesis unless significant processing)
- **2: spectral models** (broad focus on moulding spectrum into desired 'shape' or constructing spectrum from simpler components: subtractive/additive)
- **3: physical models:** imitating the systems found in acoustic instruments
- **4: abstract algorithms:** processes which have no particular direct/intuitive connection with 'acoustic behaviours' but happen to produce interesting sounds in an efficient manner (e.g. modulation techniques such as FM)

Sound design tests 1: intro

- Pick any synthesis type you like and make a plucked sound
- Make a bright pluck initially
- Then create a darker pluck
- Save any new sounds you create to a presets folder (save it to your local hard disk, copy to your student account)

Sound design tests 2: subtractive

- Create a sound with an amplitude swell
- Next make a sound with in which the filter also swells (opens gradually)
- Make this sound more resonant
- If using the ES1, add some filter modulation from another source...(if using another synth, move to the ES1)

Sound design tests 3: FM (EFM1)

- Can you create a swell sound (dar/k to bright) with this synth type?
- Can you create anything like a ‘brass swell’ sound? (hint, switch carrier off ‘fixed’ and have both waves set to 1st harmonic)
- Can you create anything like an ‘overblown woodwind? (hint, set the modulator to 2nd harmonic)
- Examine the ‘FM bells’ groups of presets (FM is ideal for this type of sound) What happens when you alter the key controls (i.e. the tuning of modulator and carrier, the FM depth, fine tuning, stereo detune). Can you see how this type of sound is made?
- Remember, bell sounds have some frequency components which are tuned slightly ‘off’ from where they would occur in a harmonic series, so change the fine tuning and/or the stereo detune settings

Summary

- Although a very wide range of sounds is possible with modern sound synthesis methods, we can still often group them on the basis of some of their components
- Examples would be plucked articulations vs. gradual swells (which may come from the amplitude envelope imposed on the sound, coupled with the filter articulation and, perhaps, characteristics of any digital samples used to create the sound)
- As some self-directed homework, go back to the sounds you have created and analyse them using the terms from the synthesis method which created them (e.g. LFO-modulated filter swell on a sawtooth wave/rapid ‘plucked’ envelope on a square wave, also applying its contour to a filter sweep etc.)

Summary (2)

- Think about the potential roles of some of your new sounds for a full mix/arrangement
- E.g. swell sounds might contribute to chordal ‘pads’ which accompany key melodic activity
- E.g. plucked sounds might articulate arpeggiated melodies or be used to denote/augment certain rhythmic accents

Further reference/reading

- d'Escrivan, J. 2012. *Cambridge Introduction to Music Technology*. Cambridge: Cambridge UP. [in library as e-book - log in via portal to view/download temporary copy]