

Session 2

Oscillator, Signal Layers

VA309 Modular Sound Synthesis @ EKA
Aubery Lis

Informational / Organisational

- **9 sessions left** – please, don't miss out!
- **First coursework handed today** – deadline in 2 weeks

Recap of previous sessions

- What does a modular synth operate with? (as in, what is in the wires?)
- What is similar and different about a modular synthesizer and a hard-wired synthesizer (e.g. doepfer A-100 vs moog prodigy)?
- What does this mean: CV, VCO, VCF?

Today

- **First half:** in-depth oscillator lore. More theoretical and lecture-ish.
- **Second half:** signal layers in modular. Some practice, too!

Oscillator and oscillations

- Basic tone generator inside a modular system
- A voltage-controlled circuit is used to produce some wave (usually triangle or sawtooth)
- Other waveshapes derived from it
 - a handful of waveshapes all share the same **frequency**



Oscillator and oscillations

- Frequency: how **frequently** something happens
- For oscillators: how frequently a wave completes a cycle
- Measured in **Hertz** (Hz) = times (cycles) per second
- Human hearing range: ~ 20hz to 20000hz
 - producing an oscillation at a frequency inside hearing range = possibly hearing it



A-110-2 controls

- **Tune** knob manually changes the oscillator's frequency
- **Sawtooth, Pulse** and **Triangle** wave outputs are where the sound comes from!



A-110-2 controls

- **Octave** musically: a note (say, A#3) played 12 semitones up (→ A#4)
- **Octave** technically: when the tone frequency doubles (440Hz → 880Hz)
- The octave switch allows to quickly jump an octave up or an octave down
→ a melody played in a lower register can be easily brought to a higher register



A-110-2 controls

- “**Modulation**” in synths = “changing of something over time by means of an external signal”
- Linear Frequency Modulation (Lin. FM) – good for using other audio as modulator
- Exponential Frequency Modulation (Exp. FM) – good for sequencers, envelopes, LFOs etc. **Comes with an attenuator!**



A-110-2 controls: linear vs exponential

- “**Linear**” or “**Exponential**” refers to oscillator’s response to incoming control voltage
- Imagine the VCO initially runs at 100hz, and 0v, then 1v, 2v and 3v of CV is provided.
- Linear: for every volt of CV, go up 100 hertz
→ *100hz, 200hz, 300hz, 400hz..*
- Exponential: for every volt of CV, double the frequency
→ *100hz, 200hz, 400hz, 800hz..*
- **Which response is better for playing octaves?**

A-110-2 controls

- **1 Volt per Octave input (1V/Oct)** – a special exponential input calibrated so that the VCO goes up exactly 1 octave for each 1 volt of CV
- **Soft and Hard sync inputs** force the VCO core to change direction or restart in the middle of its cycle, making it “sync” to external audio



A-110-2 controls

- **Pulse Width (PW) knob** sets the high/low part ration of the pulse output
- **Pulse Width Modulation** input can be used to add external control to PW. It has an attenuator!





Signals? Voltage? Information?

What exactly flows in the wires that you patch?

- Physically – there is electricity in the wires, that have different properties (current, voltage, power, ...) - the most representative, useful and meaningful of which are **voltage**. Everything else does not mean much to the end user! (that's you)
- The voltage change is the **signal** that is useful to a musician – a sound, a voltage sequence, an envelope, and so on. The signals come in and out of modules.

Signals? Voltage? Information?

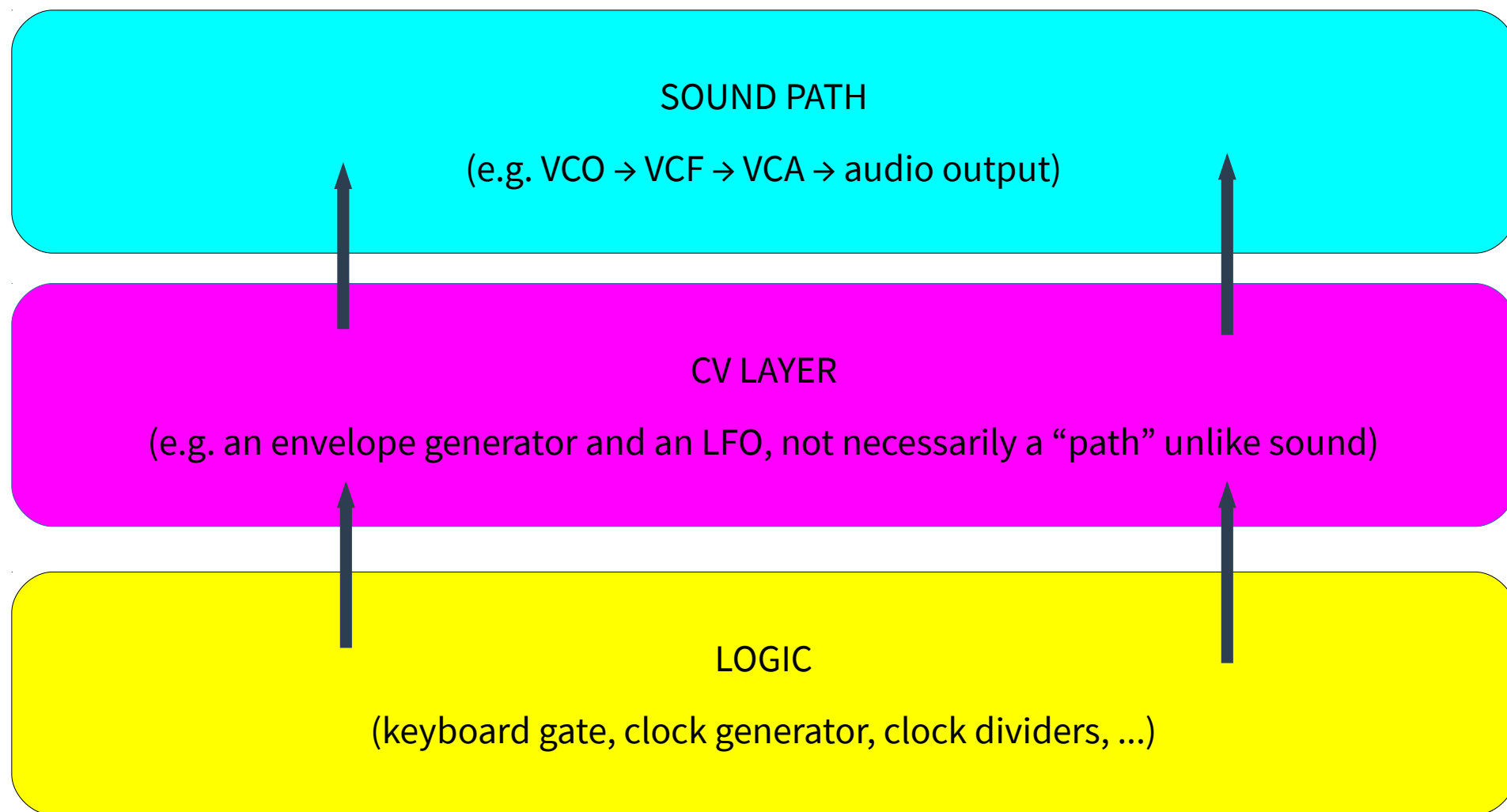
- The signals represent **information** in many ways, and what exactly it means depends on you and the modules in question. For example, a clock signal may represent tempo information for your sequencer, but patched to an oscillator, it now represents an information about two frequencies played back and forth

Which means, voltage \sim signal \sim information in modular!

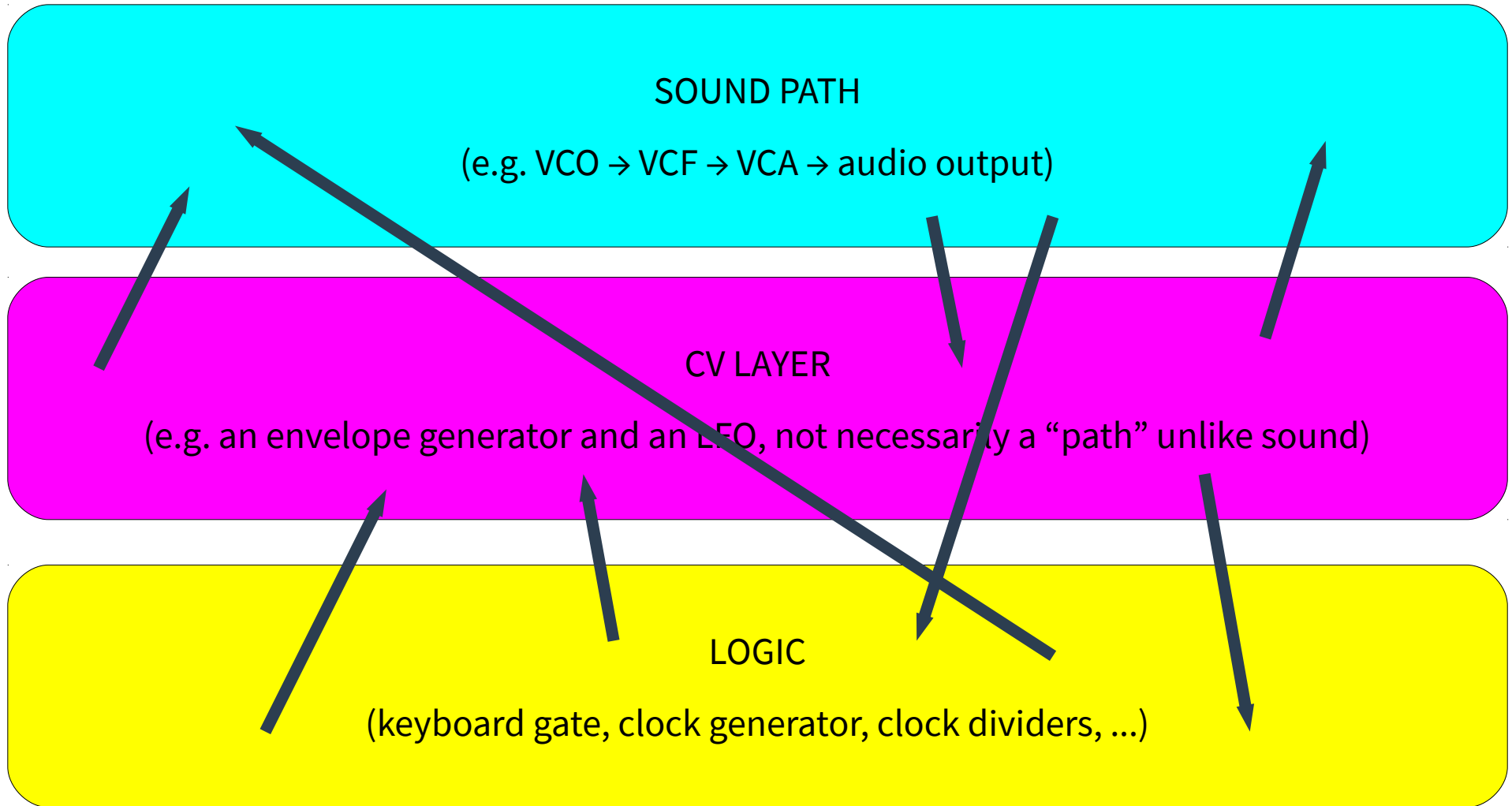
Ok, everything is anything, now what?

- **True:** any signal in modular is just some voltage, or some electric signal, or some information, that can be interpreted pretty arbitrarily and used in whichever way
- **Also true:** humans like structuring and order, it is easier to study and understand ordered things
- **Hence,** humans decided to create a little fundamental system of treating signals inside a modular as three main layers...

Signal layering (the “supposed” way)



Signal layering (the way it ends up)



Which way is better?

- A modular synth gives you abilities and freedoms hard-wired and digital synths don't, so, using them makes full sense

however,

- Before breaking rules, it makes sense to learn to handle them to break them with class

Signal layering – example patch

