STRETCHLEARN · WORKBOOK

Sound Design & Synthesis — Workbook

This workbook turns the course into reps at the synth. Each section maps to a course module and gives you exercises, fill-in worksheets, and checklists to run inside a real synthesizer. Work through it with Vital or Serum open (and Ableton Operator for the FM section) so every concept becomes a finished patch rather than a note.

The Building Blocks of Synthesis

Internalize oscillators, filters, envelopes, and LFOs by hearing each one change in isolation.

Exercise: Waveform and Filter Listening Lab

Load an INIT patch with a single oscillator. Cycle through sine, sawtooth, square, and triangle and play the same note on each. Then insert a low-pass filter and slowly close the cutoff on the sawtooth while listening to harmonics disappear. Add resonance until the filter nearly self-oscillates.

• Describe in your own words how each of the four waveforms sounds and what it might suit.

• At roughly what cutoff frequency did the sawtooth start to sound dark and warm?

• What did adding resonance do to the character, and at what point did it whistle or self-oscillate?

• Which waveform had nothing to filter, and why is that the case?

Worksheet: ADSR Envelope Map

Route one envelope to volume and dial in each of the four target sounds below. Log the attack, decay, sustain, and release you used and what the result sounded like, so you build an instinct for the shape.

Target sound (pluck / pad / organ / swell)

Attack time

Decay time

Sustain level (0 to 100%)

Release time

Envelope destination (volume / filter)

Resulting character in one line

Checklist: Signal-Path Fluency

[ ] Located the oscillator, filter, amplifier, and modulation sections in your synth
[ ] Heard each of sine, saw, square, and triangle on the same note
[ ] Detuned a second oscillator by about 7 cents and heard the thickening beat
[ ] Routed an envelope to filter cutoff and heard the pluck or sweep it creates
[ ] Added a slow LFO to pitch (vibrato) and to filter (movement)
[ ] Synced an LFO to tempo (1/4 or 1/8 note) and heard it lock to the beat

Subtractive and Wavetable Synthesis

Build complete patches from a blank synth using subtractive sculpting and wavetable modulation.

Exercise: Build a Bass, Lead, and Pad From One Start

Starting from INIT each time, build three patches: a classic analog bass, a moving lead, and a warm pad. Follow the course recipes (saw oscillators, low-pass filter, filter envelope) and change only what each sound needs. Save all three.

• For the bass, what cutoff and filter-envelope settings gave you a tight pluck that then closes?

• For the lead, how did raising cutoff and adding an LFO change the feel versus the bass?

• For the pad, which settings (attack, release, resonance) softened it from a bass into a pad?

• What surprised you about how few controls separated three very different sounds?

Exercise: Animate a Wavetable

Load a complex wavetable in Vital or Serum. First sweep the wavetable position by hand to hear the morph. Then route a slow bar-synced LFO to wavetable position and a second slow LFO to filter cutoff so the tone evolves on its own.

• Which region of the wavetable sweep sounded most interesting, and why did you build around it?

• How did running two modulators at different rates change the feel versus one?

• What happened to the sound when you swapped in a different wavetable with the same routing?

Worksheet: Modulation Routing Planner

Before wiring anything, plan each routing as a sentence: source controls destination by amount, in order to achieve a goal. Fill one row per routing for a patch you are building.

Modulation source (envelope / LFO / velocity / mod wheel / key)

Destination (cutoff / pitch / wavetable position / level / effect)

Depth amount and polarity (+ or -)

Synced or free-running (and rate if synced)

Musical goal this routing achieves

Checklist: Patch-Building Discipline

[ ] Started every patch from an INIT / default preset, not someone else's sound
[ ] Built the core tone with oscillators and filter before adding modulation
[ ] Used unison and detune deliberately for width without losing focus
[ ] Kept modulation depths small and complementary rather than extreme
[ ] Animated a wavetable by modulating its position, not just the filter
[ ] Saved and named each finished patch for reuse

FM Synthesis and Sampling

Make metallic and bell tones with FM, then turn real audio into playable sampled instruments.

Exercise: Two-Operator FM Exploration

In Ableton Operator or Dexed, use just two operators (one carrier, one modulator). Hold a note and change only the ratio, then only the index, listening each time. Then shape the modulator's envelope so the index decays fast for a bright attack that mellows.

• Which whole-number ratios stayed musical, and which non-integer ratios turned metallic or bell-like?

• What did raising the index do to the brightness and complexity of the tone?

• How did decaying the modulator's index over time change the realism of the sound?

• Did adding feedback give you the edge you wanted, and where would you use it?

Worksheet: Sample Mapping Sheet

Take one recorded sample (an instrument, a found sound, or your voice) and turn it into a playable instrument. Log the mapping and the synthesis processing you applied so it behaves like a designed patch, not just a clip.

Sample source and description

Root key (original pitch)

Key range mapped (lowest to highest note)

Start and end trim points

Loop points set? (yes / no, and where)

Filter and amp envelope applied

Warp mode used (Beats / Tones / Complex) if time-stretched

Checklist: FM and Sampling Review

[ ] Built a tone with two operators by changing only ratio and index
[ ] Made the modulator envelope decay so brightness fades like a real bell or electric piano
[ ] Routed velocity to modulator level so harder playing sounds brighter
[ ] Set a sample's root key so it plays in tune across the keyboard
[ ] Ran a sample through a filter and envelope like a synth oscillator
[ ] Chose the warp mode that matched the material to avoid artifacts

[ ] Layered a synthesized and a sampled element into one richer sound

Designing Sounds for Music and Media

Design a cohesive sound palette and finished effects that work in a real mix.

Exercise: Build a Tension Riser Into a Drop

Create a riser using a noise oscillator or bright wavetable. Automate rising pitch over 4 to 8 bars, automate a filter opening across the same span, add a tempo-synced volume LFO that speeds up toward the end, and cut the reverb tail off exactly at the drop.

• Over how many bars did your riser build, and did the acceleration create real tension?

• Which filter type (band-pass or low-pass) gave the most satisfying brightening sweep?

• How did cutting the reverb at the drop affect the sense of release?

• What would you change to make it fit a specific genre or scene?

Worksheet: Sound-in-the-Mix Planner

For each core sound in a track, plan its job and frequency space so the palette sits together. Fill one row per sound, referencing the bass / lead / pad / pluck guidance from the course.

Sound role (bass / lead / pad / pluck / FX)

Synthesis method used (subtractive / wavetable / FM / sampling)

Primary frequency range it occupies (Hz)

Mono or stereo, and pan position

Frequency carved out to make room for another element

Shared effect for cohesion (reverb send / saturation)

Worksheet: Finishing-Effects Chain Sheet

Document the effects you place after a patch and why, so the chain is intentional rather than piled on. Record settings for the effects that finish the sound.

Patch name

Saturation / distortion type and amount

Chorus / unison width setting

Reverb type and size

Delay time and tempo sync (1/4 / 1/8 / dotted-1/8)

Final EQ moves to fit the mix

How the patch sits in the full arrangement

Checklist: Finished, Mix-Ready Sound

[ ] Designed the patch against the full mix, not in solo
[ ] Kept the bass mono below 120 Hz and carved space for the kick
[ ] Gave the lead presence around 2 to 5 kHz without harshness
[ ] High-passed the pad so it sits above the bass and behind the focal element
[ ] Routed related sounds through a shared effect for a cohesive palette
[ ] Checked layered stacks in mono for phase cancellation
[ ] Added humanized randomness so repeated sounds do not feel robotic
[ ] Saved and named the patch in a personal library and backed it up

Your Action Plan

1. Learn the signal path: hear every waveform, then sculpt one with a low-pass filter and resonance.
2. Master the modulators: route an envelope to filter cutoff and an LFO to pitch and filter for movement.
3. Build a bass, a lead, and a pad from a blank INIT patch using subtractive synthesis.
4. Animate a wavetable by modulating its position with two slow modulators at different rates.
5. Plan every modulation as a source-controls-destination sentence before wiring it in the matrix.
6. Explore FM with two operators, changing only ratio and index, then decay the index for natural attacks.
7. Turn a recorded sample into a playable instrument: set the root key, trim, loop, and filter it.
8. Layer a synthesized and a sampled element, giving each a job and its own frequency space.
9. Design a cohesive palette of bass, lead, and pad that leave room for each other in the mix.
10. Build effects (riser, impact, atmosphere) with noise and automation, finish patches with effects, and save them to a named library.