

===== README.md =====

Sculptiq — User Manual (English)

The complete reference for the Sculptiq studio: every step, every control, and what it does to the printed object.

This manual covers the **studio** — the design and slicing surface at `/studio``. The Raspberry Pi edition, the admin section and the printer connector program have their own documents and are only cross-linked here.

Who this is for

Anyone printing thin-walled objects — lampshades, vases, planters, diffusers, containers — who wants direct control over the toolpath instead of fighting a generic slicer's vase mode.

No CAD experience is assumed. Every parameter in Sculptiq is a slider, a field or a drag in the 3D view.

Chapters

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1	Getting started	Access, the studio layout, your first print, saving and undo
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3	Steps 2 and 3 — Pattern and Surface	Pattern types, image and text maps, the formula engine, surface texture, woven walls
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5	Preview, pre-flight and export	View modes, simulation, G-code inspector, printability score, export formats and filenames
6	Step 6 — Connect	OctoPrint, Moonraker / Klipper, PrusaLink, queue, camera
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Conventions used in this manual

- **All lengths are millimetres** unless stated otherwise. Angles are degrees, speeds mm/s, temperatures °C.
- **"The wall"** means the single continuous spiral extrusion that *is* the model. Sculptiq never produces a second perimeter, infill or a solid top besides the explicit floor and ceiling fills.
- **Normalised values (0–1)** appear where a control describes a fraction of the model — for example a fade over the first 8 % of the height is ``0.08``.
- Controls are named exactly as they appear in the interface.
- Everything is computed in your browser. No geometry, toolpath or export is ever uploaded (audio tracks are the one optional exception — see chapter 7).

Related documents

- Features — feature list per pipeline step
- Architecture — how the pipeline is built
- Studio access — accounts, invitation codes, licences
- Raspberry Pi edition — Pi edition: kiosk, Wi-Fi, USB export
- Connector program — writing a printer connector
- Audio uploads — where uploaded tracks go

===== 01-getting-started.md =====

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1. Getting started

1.1 Getting into the studio

The public site — landing, features, how it works, printers, pricing, gallery, contact and legal — is open to everyone. Only `/studio` is gated.

1. **Sign in** at `/auth`. The card holds sign-in, account creation and the invitation-code request in one place, over a blurred live studio backdrop.
2. **Access** is granted by either an **invitation code** or a **lifetime licence** bought through the checkout.
3. If you requested a code, it is remembered in your browser and redeemed automatically the moment it is issued — you land straight in the studio.
4. Without either, `/access` explains your options and lets you request a code or buy a licence.

Invitation codes unlock the **Browser Edition** for one week. The **Raspberry Edition** always requires the €99 lifetime licence.

Accounts only exist for people who requested a code or purchased, so the sign-up form only appears when there is a code present or a purchase just completed.

Details: the Studio access document.

Raspberry Edition: activation and the setup PIN

The Raspberry Edition runs as a fullscreen kiosk. On first boot — and on every boot until a licence is activated — it shows a local **lockscreen** instead of the studio.

1. **Connect to the internet once.** Activation contacts the licence server a single time; afterwards the Pi works fully offline.
2. **Choose a setup PIN** (4–8 digits) when prompted. The PIN protects licence actions on the touchscreen against casual tampering. It is stored as a salted hash on the device and can only be set once — after that, changing it requires the current PIN.
3. **Enter your licence key** (format `SQ-XXXXX-XXXXX-XXXXX`, from your purchase

confirmation or your account page) and tap **Activate this device**. The key binds to this Pi and the studio starts.

From then on the kiosk boots straight into the studio. The licence is checked locally on every boot using a signed offline token — no network needed. The key is bound to one device at a time; activating it on a second Pi requires removing it from the first.

1.2 The studio layout

```text

|      |                       |                             |  |
|------|-----------------------|-----------------------------|--|
|      |                       |                             |  |
| step | settings panel        | stage (3D viewport)         |  |
| rail | controls for the step | view modes, stats, scrubber |  |
| 1..6 | you are currently in  |                             |  |

```

- **Step rail** — the six steps of the pipeline: Shape, Pattern, Surface, Floor, Printer, Connect. Click a number, or press `1`-`6`. `[` and `]` step back and forward. The Sculptiq mark at the top returns to the landing page.
- **Settings panel** — every control for the active step, with a one-line blurb at the top explaining what the step does.
- **Stage** — the live 3D view. It always shows the *actual* result, not an approximation: in the path views you are looking at the real extrusion moves.
- **View modes** — *Shape* (solid model), *Toolpath* (the extrusion path), *Speed* (the same path coloured by feed rate), *Preview* (glowing filament render), *Light* (the object previewed as a lit lampshade). `V` cycles them.
- **Stats bar** — live height, maximum diameter, layer count and nozzle size.
- **Full screen** — `F` expands the stage; `F` or `Esc` leaves it.

Below the panel sit the project bar (save, load, presets), undo / redo, the quick-start button, Sound Sculpt, Help and Reset.

1.3 Your first print, in ten minutes

1. **Step 1 — Shape.** Drag the default silhouette, or pick one from the silhouette library. Set *Height* and *Max. diameter* to something your bed and gantry can take (120 × 100 mm is a safe start).
2. **Step 2 — Pattern.** Choose *Sine*, frequency around 12, amplitude 2–3 mm, twist 90°. Leave the fades on so the first layers stay clean.
3. **Step 3 — Surface.** Leave it on *None* for the first print.
4. **Step 4 — Floor.** *Concentric*, 3 bottom layers. Add a *Hole* only if a cable has to pass through.
5. **Step 5 — Printer.** Pick your machine, material and nozzle. Check layer height and first-layer settings.
6. **Check it.** Switch the stage to *Toolpath*, scrub a few layers, then open the pre-flight dialog and read the score.
7. **Export.** Save the G-code, or push it to the printer in **Step 6**.

The **Quick start** panel (`G`) walks through steps 1–3 with a minimal example and stays movable and non-blocking, so you can keep working while it is open.

1.4 Presets and founder picks

The project bar carries built-in presets — ribbed lamp, twisted planter, stitched vase, faceted shade, soft bowl, tall column, box lantern, wave cylinder, noise pot, cord pendant, spiral groove vase, diamond mesh shade. Each loads a full, print-tested parameter set you can then modify.

Curated **Founder picks** and the moderated **community gallery** live at `/gallery`; any entry opens in the studio in one click, ready to remix.

1.5 Saving your work

Mechanism	What it does
Autosave	The current state is written to browser storage continuously. Reload and you are back where you left off.
Save slots	Named snapshots inside the browser. Fast A/B comparisons.
Presets	Your own parameter sets, stored beside the built-in ones.
.svstudio project files	A full project exported to disk — the portable format. Share it, archive it, or move it to another machine.
Share links	A URL that carries the design; opening it rebuilds the model in the recipient's studio.
Cloud sync	When signed in, projects, profiles, presets and report history can sync to your account. See the Cloud sync document.

Naming your project matters for exports: the project name becomes part of every export filename (see chapter 5).

1.6 Undo, redo and reset

- **Undo / redo** cover every parameter change, curve edit and lattice drag.
- **Reset** (`R`) returns the model to a single plain silhouette. It asks for confirmation first, because unsaved changes are lost.

1.7 Working offline

The studio is local-first: once loaded it keeps working without a network connection, including exports. On a Raspberry Pi next to the printer it runs in kiosk mode with touch-friendly controls, Wi-Fi onboarding and USB export — see the Raspberry Pi edition document.

Next: Step 1 — Shape

===== 02-shape.md =====

← Getting started · Manual index · Next: Pattern and Surface

2. Step 1 — Shape

The silhouette you draw here is spun around the vertical axis into one continuous wall. Nothing later in the pipeline can add a second perimeter: this curve **is** the model.

2.1 Drawing modes

Mode	How it works
---	---
Draw	Freehand. Drag in the profile canvas; the stroke is simplified into a node curve.
Pen	Editable nodes. Click empty space to add a node, drag to move it, Alt-click to delete, double-click to switch a node between smooth and hard corner.
Lattice	Shows a 3D control cage around the model — see 2.3.

Detail sets how many nodes a drawn stroke is reduced to (default 14). Fewer nodes give a smoother, easier-to-edit curve; more nodes follow your stroke closely. **Simplify curve** re-runs that reduction on the current curve.

Hard-corner nodes are respected by every smoothing pass — they stay sharp.

2.2 The profile canvas

The canvas plots radius (horizontal) against height (vertical), normalised 0–1 and scaled by **Height** and **Max. diameter**. The left edge is the axis of revolution; a point on the axis closes the model at that height.

Bands where the wall leans further than the overhang limit are drawn in red (see 2.8).

2.3 The lattice cage

Enable **Lattice** to wrap a control cage around the wall.

- **Rings** × **Points per ring** — the density of the cage.
- **Drag a node in the 3D view** to move the wall in any direction: out and in (radial), sideways around the object (tangential), and up and down (vertical).
- **Shift-drag** moves the whole ring at once.
- **Click a node** to open the point editor and type exact values — **Out**, **Around**, **Height**, all in millimetres.
- **Edge smoothness** blends the cage influence: ``0`` gives hard facets, ``1`` a soft, continuous surface.
- Automatic model rotation pauses while the cage is visible, so nodes stay where you expect.

An untouched cage never changes the shape — every offset starts at 0 mm.

2.4 Import STL

STL import is a first-class path, not an afterthought. Drop in a binary or ASCII STL and Sculptiq scans it into:

1. a **silhouette** — the average radius per height, editable like any drawn curve, and
2. a **per-angle lattice cage** — the deviation from that silhouette at each angle, so square, lobed or faceted cross-sections survive the import.

From there the model is fully editable: re-proportion it, re-pattern it, re-texture it and re-slice it as a single-wall print.

Note that the result is always a single-wall object. A solid mechanical part imported this way becomes a shell of that part's outline.

2.5 Silhouette library

Ready-made starting curves — cylinder, sphere, egg, bowl, cone, amphora and more. They are a starting point, not a template: keep dragging afterwards.

The library, like every other catalog list, can be curated in the admin section — items can be disabled, relabelled and reordered.

2.6 Cross-sections

The cross-section defines the footprint the curve is swept around.

Mode	Controls	Notes
---	---	---
Revolve	—	Perfectly round. The default.
Polygon	Sides	3 upwards. Sharp-cornered prisms.
Box / rect	Depth / width , Corner radius	A superellipse. Ratio 1.0 is square.
Ellipse	Depth / width	Oval footprints.
Star	Points , Valley depth , Tip rounding	Fluted and star profiles.

Freehand box sketch. In Box mode you can sketch the cross-section by hand instead of dialling in depth / width / rounding: draw the outline once and it is sampled into radius factors around the full turn. Clearing the sketch returns control to the sliders. This is the fastest route on a tablet.

2.7 Size and openings

Control	Meaning
---	---
Profile smoothing	(0–10) Softens the drawn curve. Hard-corner nodes are untouched.
Height	Overall print height in mm. Check it fits under your gantry.
Max. diameter	Widest point of the model in mm.
Ø bottom	Forces an exact opening diameter at the base. Useful when a part has to fit over a fitting.
Ø top	Forces an exact opening at the top. `0` closes the model completely at the apex.

The build volume of the selected printer is drawn in the viewport, so a model

that will not fit is visible before you export.

2.8 Overhang limit

Overhang limit is the steepest wall lean your printer tolerates, in degrees from vertical (45° is a common, safe value).

Sections of the curve past the limit turn **red**. Three ways to fix them:

1. pull that part of the curve inwards so the wall stands up more,
2. raise the limit if you know your machine and cooling can take it, or
3. lower the layer height — finer layers stand up steeper, so the same lean falls back inside the limit.

Overhang findings also appear in the pre-flight score, each linked straight to the slider that fixes it.

2.9 Multi-section profiles

A profile can be split into height bands, each with its own pattern settings blended over the base pattern — see Pattern and Surface. Use it for a plain base, a patterned body and a plain rim on one model.

2.10 Wall thickness

Wall thickness is not a free parameter: it equals the **line width** set in Step 5 — the extrusion bead width in millimetres. The nozzle only constrains the usable range (roughly 0.8× to 2.2× its bore); it is not itself the wall. Change the line width and the wall follows; change the nozzle and the line-width default tracks it (≈1.12× the bore).

Next: Steps 2 and 3 — Pattern and Surface

===== 03-pattern-surface.md =====

← Shape · Manual index · Next: Floor and Printer

3. Steps 2 and 3 — Pattern and Surface

Pattern displaces the silhouette radially. **Surface** reshapes the toolpath itself. They stack: pattern first, surface on top.

Step 2 — Pattern

3.1 Pattern types

Type	What it does
---	---
None	Plain wall.
Sine	Classic vertical flutes / ribs.
Twist	Ribs that rotate as they climb.
Ripple	Horizontal rings running up the wall.
Star	Sharp radial points.
Noise	Smooth pseudo-random relief — organic, non-repeating.
Superformula	Mathematical rosette shapes, from soft lobes to spikes.
Hammered	Dimpled, beaten-metal relief.
Sunflower	Phyllotactic spiral of bumps.
Hexagon	Honeycomb cells.
Pleats	Sharp folded pleats.
Bubbles	Rounded blisters scattered over the wall.
Waves (horizontal / vertical)	Long flowing waves in either direction.
Bumps	Regular grid of soft bumps.
Smooth	Very low-frequency swelling — subtle body shaping.
Image	Your own PNG or SVG as a displacement map (3.4).
Text	Lettering rasterised into the wall (3.5).
Formula	Your own maths (3.6).

3.2 Core controls

Control	Meaning
---	---
Frequency	How many repeats fit around, or up, the model.
Amplitude	How far the wall moves, in mm. This is real material displacement — keep it sane relative to the wall.
Twist	Total rotation of the pattern over the full height, in degrees.
Fade in	Fraction of the height over which the pattern eases in at the bottom. Keeps the first layers clean and well-stuck.
Fade out	The same at the top.
Offset	Shifts the wall radially in mm — a uniform swell or shrink.
Phase	Rotates the pattern's starting angle in degrees.

Defaults: sine, frequency 12, amplitude 2.5 mm, twist 90°, fade in 0.08, fade out 0.05.

3.3 The live effector

The effector confines the pattern to one band of the model instead of running it over the whole wall.

Control	Meaning
---	---
Enable effector	Turns the band on.
Position	Centre of the band, 0 (floor) to 1 (top).
Range	Full width of the band as a fraction of the height.
Feather	Soft edge on both sides of the band.
Strength	Multiplier inside the band, 0–2. Above 1 the pattern is exaggerated there.

| ****Invert**** | Pattern everywhere **except** the band. |

The effector recomputes the whole wall on every change. Updates are throttled so the interface stays responsive while you drag; if you are on very modest hardware, drop the ****Path resolution**** (segments per revolution) in Step 3 while shaping and raise it again before export.

3.4 Image and SVG import

Drop in a transparent PNG or an SVG; it is rasterised to a normalised height map and wrapped around the wall.

Control	Meaning
****Tile X / Tile Y****	How often the map repeats around and up.
****Invert****	Flips high and low.
****Use alpha****	Reads transparency instead of brightness. Best for logos on a transparent background.

Amplitude still governs how deep the map cuts, and the fades still apply.

Practical advice: high-contrast, simple artwork prints best. Fine gradients below roughly one layer height disappear into the wall.

3.5 Text and lettering

The ****Text**** pattern rasterises lettering into the same map an imported image would use.

Control	Meaning
****Text****	The string. Multi-line is supported.
****Font**** and ****Weight****	Typeface and stroke weight of the raster.
****Letter spacing****	Extra space between glyphs.
****Line spacing****	Line-height multiplier for multi-line text.
****Cap height****	Letter height as a percentage of the map.
****Outline****	Outlined letters instead of solid ones.
****Bevel****	Edge rounding, 0 (crisp) to 100 (very soft).

Bevel matters on a single wall: a crisp edge on a thin wall can produce a step the nozzle cannot resolve, so soften it if letters print ragged.

3.6 The formula engine

Choose ****Formula**** to write the displacement maths yourself. The expression is parsed by Sculptiq's own compiler — it is never executed as JavaScript, and it is limited to 512 characters.

****Variables****

Name	Meaning

`a`	Angle around the wall, 0 to 6.283
`t`	Height, 0 at the floor, 1 at the top
`f`	The frequency slider
`pi`	3.14159...
`tau`	6.28318... (a full turn)

Functions — `sin`, `cos`, `tan`, `abs`, `sqrt`, `exp`, `log`, `floor`,
`ceil`, `round`, `sign`, `noise` (smooth pseudo-random wobble, -1 to 1), plus
`min`, `max` and `pow` with two arguments.

The result is multiplied by *Amplitude*, so keep the expression roughly in the
-1...1 range.

Examples

```
```text
Ripple sin(a * f) * 0.6 + sin(t * tau * 6) * 0.4
Braid sin(a * f + t * tau * 4) * cos(a * 2 - t * tau * 2)
```
```

Errors are reported with a caret at the character where parsing stopped.

3.7 Pattern sections

Sections are extra height bands, each with its own pattern blended over the base
pattern.

Per section: **Enabled**, **Start** and **End** (0–1 of the height),
Feather (soft edge on both sides), plus its own **Type**, **Frequency**,
Amplitude, **Phase** and **Twist**.

Typical use: plain foot, ribbed body, hexagon collar under the rim — one model,
three treatments.

Step 3 — Surface

Surface reshapes the toolpath rather than the silhouette. It is the difference
between a wall that has a texture and a wall whose *path* is the texture.

3.8 Surface types

| Type | What it does |
|-------------------|--|
| --- | --- |
| None | Plain spiral. |
| Stitches | Short alternating in/out moves, like a knitted seam. |
| Distortion | Continuous wobble of the path. |
| Columns | Vertical ridges built into the path itself. |
| Mesh | Open diamond cells — the wall becomes a lattice. |
| Facets | Flat, chiselled panels. |

| **Woven** | A **non-planar** path: the nozzle arches up and down so consecutive rows interlock like woven loops. |

3.9 Controls

| Control | Meaning |
|------------------------|--|
| --- | --- |
| Depth | How far the surface effect moves the wall, in mm. |
| Spacing | Vertical period of the effect, in mm. |
| Count | Angular repeats around the model. |
| Z-tilt | Leans the pattern so it spirals instead of stacking straight. |
| Shape | Morphs the waveform from soft sine (0) to hard square (1). |
| Flow modulation | Varies extrusion along the path, so peaks print fatter than valleys. |
| Round corners | Mesh only: softens cells from sharp diamonds to rounded openings. |

Woven only

| Control | Meaning |
|--------------------|--|
| --- | --- |
| Loop height | Arch height of each loop, in mm. |
| Overlap | How far rows interlock, 0 to 0.85. Too low and the loops do not catch. |
| Loop twist | Angular advance per row, in degrees. |

Woven walls ask more of the machine than anything else in Sculptiq: the nozzle moves in Z while extruding. Check the pre-flight report and print slowly. Some printers with a large, low-hanging fan shroud will collide with previous loops — reduce loop height if that happens.

3.10 Mesh walls and light

Mesh and woven both produce openings. For lampshades this is the whole point: switch the stage to **Light** view to see the shadow pattern before committing filament. **Structure** in the light controls exaggerates grazing light so relief reads clearly.

Next: Steps 4 and 5 — Floor and Printer

==== 04-floor-and-printer.md ====

← Pattern and Surface · Manual index · Next: Preview, pre-flight and export

4. Steps 4 and 5 — Floor and Printer

Step 4 — Floor and ceiling

Closes the bottom and, if you want, the top of the model. Everything between

them is the single spiral wall.

4.1 Floor

| | |
|--------------------------|---|
| Control | Meaning |
| --- | --- |
| **Floor type** | *Concentric* (rings from the outside in), *Linear* (straight back-and-forth lines), *Spiral* (one continuous spiral), or *None* . |
| **Bottom layers** | How many solid layers are laid down before the wall starts. Two or three is normal; more if the floor has to carry weight. |
| **Line width** | Extrusion width used for the fill lines. Slightly wider than the wall gives a denser, watertight floor. |
| **Hole** | Leaves a centred opening. |
| **Hole diameter** | Size of that opening, in mm — a lamp cable, a socket thread, a drainage hole. |

None leaves the base open — handy for shades that slip over an existing fitting, and for objects printed rim-down.

****Which floor type?**** Concentric is the most reliable and the most watertight. Linear is fastest. Spiral gives the cleanest single-motion floor and pairs naturally with the wall that follows.

4.2 Ceiling

The same set of options for the top of the model: type, ****Top layers****, line width, hole and hole diameter. Both ends can be sealed.

A ceiling only makes sense when the wall has closed enough at the top for the fill to be supported. If ***Ø top*** is large, expect the pre-flight check to warn about an unsupported ceiling.

4.3 Bulb / socket reinforcement

Around a centre hole you can print a reinforcement so a lamp socket or bulb holder can be mounted.

| | |
|----------------------|--|
| Control | Meaning |
| --- | --- |
| **Support** | Turns the reinforcement on. |
| **Spokes** | 2–12 radial ribs running out from the collar. |
| **Width** | Width of the collar and spoke band, in mm. |
| **Collar** | Extra collar band added outside the hole, in mm. |
| **Layers** | Extra reinforcement layers printed on top. |
| **Thickness** | Extruded bead thickness of the collar and ribs, in mm. |

The reinforcement is written into both the exported ****G-code**** and the ****mesh exports**** (STL / 3MF / OBJ).

- > ****Important — vase mode and reinforcement are mutually exclusive.****
- > With reinforcement ****off****, a mesh export can be sliced in spiral-vase mode
- > for a seamless single-wall spiral. With reinforcement ****on****, slice in

> **normal** mode: vase mode permits exactly one wall and silently drops the collar and the spokes. Or simply print the G-code Sculptiq exports, which already contains everything.

4.4 Spiral ramp

Ramp turns (Step 5) controls how many turns are spent easing the wall out of the floor. ``0`` starts the wall abruptly, which can leave a visible step or a weak joint; one to three turns blends the transition.

Step 5 — Printer

Machine, material and everything the G-code writer needs.

5.1 Machine and material

| Control | Meaning |
|--------------------------|--|
| --- | --- |
| Printer profile | Ready-made profiles for Bambu Lab, Anycubic, Prusa, Elegoo, Snapmaker and Creality, plus a custom profile for anything else. Sets build volume, defaults and the start / end G-code. |
| Material | Sets temperatures, fan and the density used for the weight estimate. |
| Nozzle | 0.2 / 0.4 / 0.6 / 0.8 mm, or your own value. Together with line width it <i>is</i> the wall thickness. |
| Filament diameter | 1.75 mm on most machines; 2.85 on some. Used for the extrusion maths. |

Custom printer profiles can be created and managed in the admin section, and the whole printer list can be curated there.

5.2 Layers and widths

| Control | Meaning |
|--------------------------------|--|
| --- | --- |
| Layer height | Controls detail and print time. A spiral wall is forgiving; 0.2 mm is a good default, 0.12 mm for fine relief. |
| Line width | How fat each extrusion is. Typically $1.0\text{--}1.25 \times \text{nozzle}$. |
| First layer height | A thicker first layer sticks far better. |
| First layer width | Wider first-layer beads increase bed contact. |
| Segments per revolution | Resolution of the circular path. Higher is smoother and slower to compute; lower keeps the interface snappy while you shape. |

Variable layer height. Enable **Variable layers** to make the layer height respond to the geometry: thinner through curvature, thicker through straight walls. **Layer variation** limits how far it may swing from nominal, in per cent (``0`` disables it).

5.3 Speeds

| Control | Meaning |
|---------|---------|
| --- | --- |

| **Print speed** | Feed rate of the wall, mm/s. Tall thin walls like it slow. |
 | **First layer speed** | Slower is better; this is where adhesion is won or lost. |
 | **Travel speed** | Non-printing moves. A spiral wall barely travels. |
 | **Adaptive speed** | Slows the wall down where the pattern turns tightly, so sharp features stay accurate. |
 | **Adaptive minimum** | The slowest the adaptive pass may go, as a percentage of print speed. |

The *Speed* view mode colours the toolpath by feed rate, so you can see exactly where the adaptive pass is intervening.

5.4 Temperature, cooling and flow

| Control | Meaning |
 | --- | --- |
 | **Nozzle temperature** | From the material profile unless you override it. |
 | **Bed temperature** | Likewise. |
 | **Fan** | 0–100 %. Thin single walls generally want a lot of cooling; the first layer usually wants none. |
 | **Flow** | Extrusion multiplier in per cent. Nudge up for stronger, more watertight walls. |

5.5 Seam, Z-hop and retraction

| Control | Meaning |
 | --- | --- |
 | **Seam mode** | *Aligned* keeps the wall start at a fixed angle; *Random* lets it wander per turn so no visible line forms. |
 | **Seam angle** | The fixed angle used when the seam is aligned. Put it at the back. |
 | **Smooth Z** | Ramps Z-hops over a short move instead of jumping straight up. |
 | **Retraction** | Only used on travel moves — a spiral wall barely retracts. |
 | **Z-hop** | Lift on travel moves. |

5.6 Ironing

Iron floor runs a fine, low-flow pass over the top of the floor to flatten it. **Iron flow** is the flow used by that pass as a percentage of a normal bead; **Iron spacing** is the ring spacing as a percentage of line width.

Useful when the floor is a visible surface — a tray, a coaster, a base that sits face-up.

5.7 Custom start and end G-code

Copy, paste, edit or reset the machine's start and end block, so any printer can be driven correctly. The block is written verbatim around the generated toolpath. Reset restores the block from the selected printer profile.

5.8 Export

Export lives at the end of Step 5. Formats, filenames, metadata stamping and the pre-flight gate are covered in chapter 5.

Next: Preview, pre-flight and export

===== 05-preview-preflight-export.md =====

← Floor and Printer · Manual index · Next: Connect

5. Preview, pre-flight and export

5.1 View modes

| Mode | What you see |

| --- | --- |

| **Shape** | The solid model — the fastest way to judge proportions. |

| **Toolpath** | The actual extrusion path, move by move. This is the truth: what you see is what the G-code contains. |

| **Speed** | The same path, coloured by feed rate. Reveals where adaptive speed slows down. |

| **Preview** | A glowing filament render — closest to how the print will look. |

| **Light** | The object previewed as a lit lampshade. |

`V` cycles the modes. `F` toggles full screen.

Light controls (Light view): **Intensity**, **Warmth** (cool white to warm tungsten), **Bulb height**, **Translucency**, **Room** ambient and **Structure** — a grazing-light contrast that makes surface relief readable. These are viewport settings only: they never touch the toolpath, the mesh or the G-code.

5.2 Layer scrubber and simulation

In the path views a scrubber runs alongside the stage.

- **Layer mode** — step through the print layer by layer, with the current layer number and Z height shown.
- **Move mode** — step through individual moves. Feature type and move index are displayed.
- **Play / pause** the tool head sweep, and step move by move with the arrow buttons.
- **Show / isolate** — hide everything except, for example, the reinforcement, to inspect it on its own.
- **Show all** resets the preview to full height with every feature visible.
- **Wall continuity** is reported live: continuous and always rising, or a message you can click to jump straight to the offending move.

5.3 Build volume and G-code inspector

The **build volume** of the selected printer is drawn around the model, so a part that will not fit is obvious before export.

The **G-code inspector** shows the generated file itself — header, start block, the wall, the end block — with the move under the scrubber highlighted. Use it to confirm a custom start block, check temperatures, or verify that reinforcement really is in the file.

5.4 Pre-flight check

The pre-flight dialog scores the toolpath **out of 100** and gives a green / amber / red verdict.

It explains every deduction, and each finding links straight to the slider that fixes it — change the value and the score updates live, without leaving the dialog. Typical findings:

- wall sections past the **overhang limit**,
- walls thinner than the nozzle can actually lay down,
- unsupported **ceiling** over a large top opening,
- model outside the **build volume**,
- non-planar (woven) moves that risk fan-shroud collisions,
- extreme speeds or flow.

The dialog also plays back the **tool head sweep** so you can watch the print happen before it happens.

Reports. Export the pre-flight result as **HTML** or **PDF**. Each report carries its own Report ID, the full parameter set and the score, which makes it a usable record for a client or an archive. Report history can sync to your account when signed in.

A **printability badge** sits next to the export button, so the current score is always visible.

5.5 Export

Formats

| Format | Use |
|-------------------|---|
| --- | --- |
| G-code | Prints directly. Contains everything: wall, floor, ceiling, reinforcement, ironing, seam handling, your start / end block. |
| .gcode.3mf | G-code wrapped in a 3MF container, for machines and hosts that expect it. |
| STL | Watertight thin-wall solid. The cord / bulb hole is cut through, and any reinforcement (collar and spokes) is built into the same mesh. |
| 3MF | The same geometry in 3MF. |
| OBJ | The same geometry in OBJ. |

Mesh exports are **watertight thin-wall solids**. When reinforcement is on, its collar and spokes travel with the mesh — just as they travel with the G-code — so they slice hollow with or without spiral-vase mode. With no reinforcement, vase mode is optional — use it for the seamless single-wall spiral. With reinforcement on, slice in normal mode

(see 4.3).

Metadata stamping

G-code, 3MF and OBJ carry the full stamp: Sculptiq version, printer, material, nozzle, wall width, layer height, printability score, checksum and timestamp. Binary STL has only an 80-byte header, so it carries the identifying subset — version, checksum, score and date. That makes an exported file self-describing months later; for the full record, keep the G-code or 3MF alongside the STL.

Filenames

Exports are named after your project, slugified:

```
```text
sculptiq_ribbed-lamp.gcode
sculptiq_ribbed-lamp.stl
sculptiq_diamond-mesh-shade.3mf
```
```

An unnamed project falls back to `sculptiq.<ext>`. Repeated names inside one session get a numeric suffix (`sculptiq\_ribbed-lamp-2.gcode`) so downloads never overwrite each other. The exact filename is shown in the pre-flight footer before you export, so you can confirm it first.

Batch export

Export several formats — or several presets — in one action, each with its own resolved filename.

5.6 Sharing and the gallery

- ****Share link**** — a URL that carries the whole design. Opening it rebuilds the model in the recipient's studio, ready to remix.
- ****Publish to the gallery**** — submit a design to `/gallery`. Entries are moderated before they appear; approved designs open in the studio in one click. Curated ****Founder picks**** sit above the community feed.

5.7 USB export (Raspberry Pi edition)

On the Pi edition, exports can be written straight to a USB stick. Transfers are chunked, show live progress, and resume byte-accurately if the stick is unplugged or the Pi restarts mid-write. See the Raspberry Pi edition document.

Next: Step 6 — Connect

===== 06-connect.md =====

← Preview, pre-flight and export · Manual index · Next: Sound Sculpt

6. Step 6 — Connect

Optional. Step 6 sends the finished G-code to a printer on your local network, instead of walking a memory card across the room.

Nothing here is required: you can always export the file in Step 5 and use it however you like.

6.1 Supported hosts

| Host | What you need |
|--|--|
| OctoPrint | Host address (for example <code>http://octopi.local</code>) and an API key from <code>*Settings → API*</code> . |
| Moonraker / Klipper (Fluidd, Mainsail) | Moonraker address, usually <code>http://pi:7125</code> . An API key only if your instance requires one. |
| PrusaLink | Printer address and the PrusaLink password / API key shown on the printer's display. |
| Bambu Lab (LAN) | Not shipped yet — it is the open seed request of the connector program. See 6.6. |

6.2 Connecting

1. Pick the host type.
2. Enter the address. Include the scheme (`http://` or `https://`) and the port if it is not the default.
3. Enter the API key where the host needs one.
4. `**Test the connection.**` Sculptiq reports back the host name and state.
5. `**Upload**` — the current G-code is sent, using the same filename Step 5 would have produced.
6. Optionally `**start the print**` straight after upload.

Credentials stay in your browser. The studio talks to the printer directly over your local network.

6.3 Print queue

Uploads are queued rather than fired blindly, so several exports can be sent in sequence and each one reports its own progress and result. A failed upload stays in the queue with its error, ready to retry.

6.4 Camera

If the host exposes an MJPEG stream, the camera panel shows it inside the studio — useful to watch the first layer without switching to another interface. Enter the stream URL (for example `http://octopi.local/webcam?action=stream`).

6.5 Monitoring and control

Once a print is running, the studio polls the printer and shows **state** (printing, paused, idle), **progress** (0–100 %), nozzle and bed temperatures, and elapsed time. Use the **pause / resume / cancel** buttons to control the active job without leaving the studio.

The auto-queue option starts the next queued job automatically as soon as the printer reports idle.

6.6 Troubleshooting

| Symptom | Likely cause |
|------------------------------------|---|
| "Cannot reach host" | Wrong address or port; the printer is on another subnet; the host is only reachable over `https` with an untrusted certificate. |
| "Unauthorised" | Wrong or expired API key. Regenerate it on the host. |
| Upload works, print does not start | The host requires a print job to be selected manually, or the printer is not idle. |
| Mixed-content blocked | The studio is on `https` and the printer on plain `http`. Use the Pi / local edition over HTTP on the local network. |
| Camera panel blank | The stream URL points at a snapshot rather than an MJPEG stream, or the host restricts the origin. |

6.7 The open connector program

Printer connectors are a public, open-source part of Sculptiq. Each one is a small adapter behind a fixed interface, licensed Apache 2.0 in ``packages/connectors/``, with a security guard and a conformance suite in front of it.

If your machine is not supported, you can write the adapter — and merged connectors earn Cortex Points in the reward programme. The Bambu Lab LAN connector is the current open seed request.

See the connector program documentation and the Printers page on the site.

Next: Sound Sculpt

===== 07-sound-sculpt.md =====

← Connect · Manual index · Next: Shortcuts and troubleshooting

7. Sound Sculpt

Sound Sculpt (``S``, or the **Sound** button) turns audio into geometry.

It does **not** generate random shapes. It converts measurable properties of a recording into printable geometry, deterministically: the same track plus the

same settings always rebuilds the same object.

7.1 What drives what

| Property of the sound | Geometric effect |
|-----------------------|---|
| --- | --- |
| **Amplitude** | Strength of the deformation |
| **Frequency** | Radial displacement |
| **Time** | Vertical growth — the print climbs as the track plays |
| **Waveform** | Profile modulation |
| **Spectrum** | Circumferential detail |

Internally the track is analysed into a normalised spectrogram: rows climb the print (time), columns run from bass to treble.

7.2 Getting audio in

- ****Drop an audio file**** for a whole-track bake — the complete track is analysed and mapped over the full height.
- ****Record from the microphone**** for a live capture.

A ****playback scrubber**** lets you play the track back and freeze the moment that produces the best shape.

When you are signed in, the track can also be uploaded to `cloud.sculptiq.eu` through an authenticated proxy so it stays with the project. The upload is optional and the geometry never depends on it — the analysis happens in your browser. See the Audio uploads document.

7.3 Mapping modes

| Mode | Result |
|----------------------|---|
| --- | --- |
| **Waveform** | Smooth circular waveform (mirrored spectrum). |
| **Geometric** | Quantised, faceted steps. |
| **Bars** | Hard radial bars, one per frequency group. |
| **Particles** | Beat-reactive blobs scattered around the wall. |
| **Spiral** | Frequency sampled with a rotating offset — galaxy arms. |
| **Kaleido** | One wedge mirrored around the circumference. |

****Symmetry**** sets the number of repeats, wedges or bars around the circumference.

7.4 Shaping controls

| Control | Meaning |
|-------------------------------------|---|
| --- | --- |
| **Time → height** | How much the track's loudness drives the silhouette (0–1). |
| **Spectrum around** | How much the spectrum wraps around the circumference (0–1). |
| **Reshape** | How violently the silhouette swings between quiet and loud (0–2). |
| **Bass / Mid / Treble gain** | Weight of each band in the read. |

| **Depth** | Millimetres of radial displacement at full **Spectrum** around*. |
 | **Smoothing** | Softens the map, 0–1. |
 | **Sensitivity** | Gamma on the spectrogram read, 0.2–4. Above 1 sharpens peaks so bass hits jump. |
 | **Dynamics** | Blends from global normalisation to per-height-band normalisation. With a quiet intro and a loud chorus, raising this keeps detail in both. |

The curve the sound is blended against is snapshotted when the audio is captured, so you can keep editing the underlying silhouette afterwards — but note that the snapshot is taken each time audio is captured, so edits you make to the profile underneath are overwritten. Clear the audio and re-capture to snapshot a fresh base curve.

7.5 The advanced routing matrix

Turn on **Advanced routing** to wire the sources onto the targets yourself.

Sources — `amplitude` (overall loudness of the moment), `energy` (squared loudness, punchier and beat-following), `bass`, `mid`, `treble`, `time` (position up the print), `waveform` (folded waveform read), `spectrum` (frequency read wrapped around the wall). Every source returns a normalised 0–1 value for a given height and angle.

Targets — `radius`, `height`, `twist`, `patternDepth`, `surfaceTexture`, `diameter`, `wallThickness`.

Each wire has an **amount** from –1 to 1, so a route can invert.

> **Note on `wallThickness`:** this target modulates **extrusion flow** along the path — more or less material per millimetre of the bead — not the **Line width** set in Step 5. Wall geometry width stays at the Step 5 line width (see Chapters 2 and 4). The floor is 0.25×, so the bead never drops to nothing.

Default routing — the logic behind every out-of-the-box result:

```
Source	Target	Amount
amplitude	radius	1.0
time	height	1.0
bass	twist	0.35
mid	pattern depth	0.4
treble	surface texture	0.4
energy	diameter	0.25
```

7.6 Practical notes

- **Short is better.** 20–60 seconds of a track usually reads more clearly over 120 mm of height than a full four-minute song.
- **Percussive material** gives crisp relief; sustained pads give soft swells.
- Sound-driven walls can exceed the overhang limit quickly. Check the profile for red bands and lower **Reshape** if the silhouette whips in and out.
- Every result is reproducible: keep the track and the parameters and you can

reprint the identical object.

Next: Shortcuts and troubleshooting

===== 08-shortcuts-and-troubleshooting.md =====

← Sound Sculpt · Manual index

8. Shortcuts and troubleshooting

8.1 Keyboard

Shortcuts are ignored while you are typing in a field, and modifier combinations (Ctrl / Cmd) are left to the browser.

| Key | Action |
|--------------------|--|
| --- | --- |
| `1` - `6` | Jump to that step |
| `[` / `]` | Previous / next step |
| `V` | Cycle the view mode (Shape → Toolpath → Speed → Preview → Light) |
| `F` | Toggle full-screen stage |
| `Esc` | Leave full screen, or close the open dialog |
| `S` | Toggle Sound Sculpt |
| `G` | Open the quick-start walkthrough |
| `R` | Reset the model (asks for confirmation) |
| `?` or `Shift`+`/` | Open the help dialog |

Sliders. Tab to a slider, then `←` / `→` to nudge, `Home` / `End` for the extremes. Every slider also has a number field next to it — type an exact value, or use `Shift`+`↑`` / `↓`` to step by ten.

Skip link. The first Tab press offers *Skip to the 3D view*.

8.2 Tablet and Apple Pencil

- Strokes are **pressure-aware**: press harder and more nodes are kept in that part of the curve.
- A **hover ghost** previews the next pen point with a live Ø / Z readout.
- Box cross-sections can be **sketched freehand** instead of dialled in with the depth / width / rounding sliders.
- In kiosk mode on a Raspberry Pi, controls switch to larger touch targets and a four-corner calibration step aligns taps after screen rotation.

8.3 Troubleshooting

Shape and modelling

| Problem | Fix |
|---------|-----|
|---------|-----|

| --- | --- |
| Curve is lumpy after freehand drawing | Lower ****Detail****, or press ****Simplify curve****, then raise ****Profile smoothing****. |
| A corner keeps rounding off | Double-click the node to mark it a hard corner; smoothing then leaves it alone. |
| Lattice drags move the wrong point | Show the cage first; auto-rotation pauses while it is visible. Click a node to type exact values instead of dragging. |
| Imported STL looks wrong | Sculptiq scans it into a silhouette plus a per-angle cage. Solid mechanical parts become shells; that is expected. |
| Red bands on the profile | The wall leans past the ****overhang limit****. Pull the curve in, raise the limit, or slow that band down. |

Printing

| Problem | Fix |
| --- | --- |
| First layer will not stick | Raise ****First layer height**** and ****width****, lower ****First layer speed****, turn the fan off for layer one, check bed temperature. |
| Blobby, over-extruded wall | Lower ****Flow****, check nozzle and line width match reality, lower ****Print speed****. |
| Visible seam line up the model | Set ****Seam mode**** to **Random**, or keep it **Aligned** and rotate ****Seam angle**** to the back. |
| Wall thin and weak | Increase ****Line width**** — it is the extrusion width in mm and therefore the wall thickness — or raise ****Flow**** a few per cent. |
| Pattern detail disappears | Amplitude below roughly one line width will not resolve. Raise ****Amplitude**** or lower ****Frequency****. |
| Woven wall collides with the fan shroud | Lower ****Loop height**** and ****Overlap****, and slow the print down. |
| Step or weak joint where the wall leaves the floor | Raise ****Ramp turns****. |
| Floor is not watertight | More ****Bottom layers****, slightly wider floor ****Line width****, or switch to **Concentric**. |

Export and slicing

| Problem | Fix |
| --- | --- |
| Exported mesh slices ****solid**** | Do not scale it after export, and do not repair it in a tool that fills shells. The mesh is a watertight thin-wall solid — slice it as-is. |
| Reinforcement missing after slicing | Vase mode allows one wall only and drops the collar and spokes. Slice in ****normal**** mode, or print the G-code Sculptiq exported. |
| Downloads all called `sculptiq.gcode` | Name the project. The name becomes the filename slug, and repeats get a numeric suffix automatically. |
| Model larger than the printer | The build volume is drawn in the viewport and flagged by pre-flight; reduce ****Height**** or ****Max. diameter****, or pick another profile. |

Performance

| Problem | Fix |
| --- | --- |
| Interface lags while dragging with the live effector on | Lower ****Segments per revolution**** while shaping and raise it before export; reduce lattice ****Rings**** × ****Points per ring****. |

| Studio takes a few seconds to appear | The 3D stage loads on demand. Once loaded it stays warm for the session. |
| Preview stutters on very tall, very detailed models | Switch to **Shape** view while editing and back to **Toolpath** to verify. |

Access

| Problem | Fix |
| --- | --- |
| "Studio access" screen after signing in | Your account has neither an invitation code nor a lifetime licence. Request a code or purchase on `/access`; a requested code is redeemed automatically once issued.
|
| Cannot find the way back to the site | The Sculptiq mark at the top of the step rail returns to the landing page; sign-out sits in the same header. |

8.4 Updating the Raspberry Edition

The Pi agent can update itself, but only after the update has proven it is genuine.

- **Check.** The kiosk calls the agent's `/update/check` endpoint, which downloads the update manifest and payload from `updates.sculptiq.eu`.
- **Verify.** The payload's SHA-256 checksum must match the manifest, and the manifest's Ed25519 signature is verified against the public key built into the agent — the same key family that protects licence tokens. An update that fails either check is discarded before anything is written.
- **Stage and apply.** A verified update is staged on disk. Applying it is protected by your setup PIN (once you have set one): the agent service restarts and swaps in the new files on boot.

Rollback protection. Licence expiry uses a monotonic trusted clock: the agent remembers the latest time it has ever seen, and trusted time can never move backwards. Setting the Pi's clock back does not extend an expired licence token, and a power cut without internet does not lock you out — trusted time simply resumes from the last observed moment.

Offline note. Checking for updates needs internet. Everything else — modelling, exporting to USB, licence verification — keeps working offline.

8.5 Where to go next

- Manual index
- Features — the feature list, kept in step with the app
- Roadmap — what is coming
- bugs.sculptiq.eu — report a bug, earn Cortex Points