Throw user guide

Throw is **a projector throwing your clip onto a real surface, for Resolume Arena and Avenue**: one FFGL effect, **SW Throw**. Pick a wall (crumpled paper, a brick wall, corrugated sheet, aluminium tread plate, pleated drapes, weatherboard, glazed tiles, or a height map or photo of your own), put a projector somewhere in the room, stand somewhere else, and the clip comes out the way it would on the night.

It's a projector, not a texture map. A texture map paints the picture onto the surface. Here every pixel of the clip is a ray of light leaving a lens at a real place in the room. Where the ray meets the wall it brings light: as much as the clip's pixel, times how squarely it meets the surface, over the square of how far it travelled. The wall gives that light back in its own colour. And you're watching from somewhere else, so you see each bit of the relief from your own angle, not the projector's. Everything in this guide is what that one idea does.



Rendered by `twtest`, the offline harness, rather than captured from Resolume: Resolume's bundled IntoTheGlow_02, 1.67 s in, on Drapes with everything else at the defaults, at 1280×720.

> **Before you rely on this:** it's at **v0.1.0**, the first release, and very early days. Its behaviour is measured rather than asserted, by a harness (`twtest`) that drives the plugin's own class in a headless GL context on one Apple Silicon Mac (macOS 26), at 1280×720 and 320×180 and again on Apple's software renderer. A flat wall gives the clip back to within 3e-7 from any projector and viewer position. Every pixel of a tilted plane carries the inverse-square and cosine light its closed form says (the worst is 0.47 of its bound). A recess shows the picture where the parallax formula puts it, to 0.0007 px; a step's shadow is the length the geometry says to within a pixel; the lens's highlight on zinc sits at the mirror point. Eighteen models that are wrong on purpose and 23 one-character changes to the shipped code are all caught, and all 29 controls measurably change the picture. It's **never been loaded into Resolume on macOS**. The one host it has run in on a Mac is the fleet's own test host, `oxbow` , for 120 frames, so on a Mac nobody has seen its controls in Arena's inspector or what Resolume's own clips at 4K do to the frame rate. On **Windows** it has been in Resolume. The fleet's Arena gate ran this release's own Windows build in Resolume Arena 7.27.1 on software rendering (no GPU), twice: it loads, registers as `TW01` , an effect, and all 35 controls (Arena's Opacity and the plugin's 34) match their names, order, types, ranges and defaults. It renders, 28 of the 29 controls visibly change the picture (the 29th, Surface File, took a height map that File Holds then changed), and Arena's log stays clean. Software rendering says nothing about speed on a GPU. Try it on a spare layer before you put it in a show.
>
> This codebase was created with AI assistance, directed and reviewed by a human author.

Installing

Every download carries one effect, **SW Throw** (`Throw.bundle` on macOS, `Throw.dll` on Windows). Drop it into Resolume's effects folder and restart Resolume:

```
macOS    ~/Documents/Resolume Arena/Extra Effects/
Windows  %USERPROFILE%\Documents\Resolume Arena\Extra Effects\
```

Avenue uses the same layout under its own folder name. The effect then shows up in the effects browser as **SW Throw**.

The macOS download is a universal build (Apple silicon and Intel), as a `.dmg` or a `.zip` . It's **Developer ID-signed and notarised**, so the bundle just loads. The Windows download is an x64 installer or a `.zip` . The installer asks which folder to put the plugin in: give it the one above. It isn't code-signed, so it trips SmartScreen once: **More info** → **Run anyway**. Or skip the installer, take `Throw.dll` out of the `.zip` and drop it into the folder by hand.

Start here

Put SW Throw on a layer with something in it and leave every control where it is. The defaults are a brick wall 2.5 m high in the frame, a 10 000 lumen projector a metre above its centre and 6 m back, a dim room, and you standing 2 m to the right of the projector, a little below it and 4 m from the wall. The clip comes out brick-coloured, with the brick showing through its darks.

Then, in this order:

1. **Depth** all the way up. The joints are four times their real depth now, and the picture steps where it crosses them, because you're not standing at the lens.
2. Stand at the lens: **Viewer X** 0.5, **Viewer Y** 0.66 and **Viewer Distance** 0.46, which are the projector's own X, Y and Throw. The steps go, and so do the shadows: from the lens the relief only shades the picture. Move **Viewer X** either side and they come back, leaning the other way.
3. **Surface** to **Drapes**. Pull **Viewer X** about and watch the picture slide over the folds. **Pleats** and **Sag** change the cloth.
4. **Surface** to **Corrugated** or **Plate**. There's a bright patch where the sheet throws back the lens, coloured by whatever bit of the clip is aimed there. Move the viewer and it moves.
5. **Ambient** up. The room's light washes in, and the clip's blacks turn into the wall.
6. **Aim** to **Pointed** and **Projector X** off to one side. The picture becomes a trapezoid, brighter on the near side.
7. **View** through **Height**, **Normals**, **Light**, **Shadow** and **Albedo** to see what the plugin is working with, then back to **Picture**.

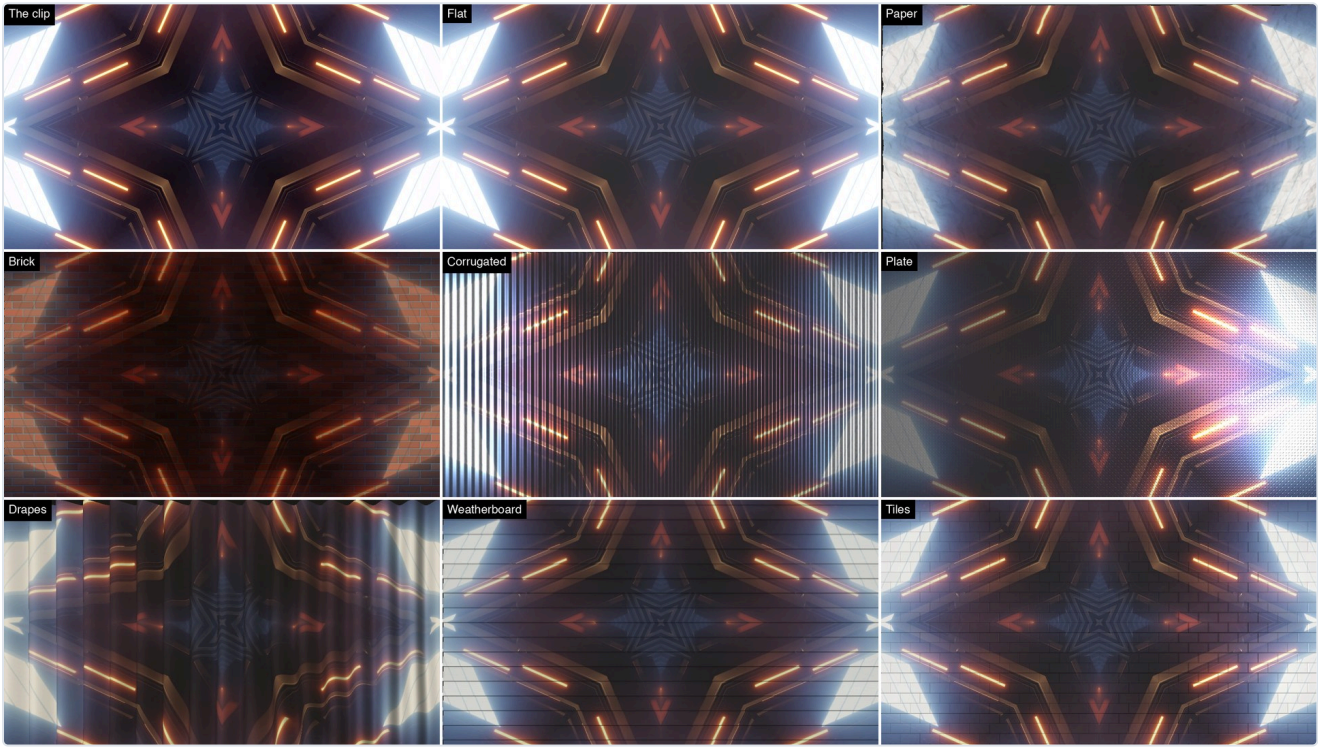
A projector, not a texture map

Everything below falls out of the one idea. None of it is drawn on.

- **The wall's colour.** Red brick eats the blue: a white clip comes back brick-red, and a blue one comes back dark. A projector adds light. It can't take away what the wall soaks up.
- **Shading by angle.** A face turned from the lens is dimmer by the cosine of the angle. One turned past 90° gets no projector light at all, only the room's.
- **Shadows.** Relief between a point and the lens shadows it: the deep side of a corrugation, the far side of a drape fold, the strip under a weatherboard's lip.
- **The picture slides over the relief.** Stand to one side and the recesses are further away than the front, so the picture lands on them where the projector put it but you see it somewhere else. Straight lines kink across mortar joints and ripple over folds. Stand at the lens and it all goes straight again, and the shadows go too: from the lens you can't see a shadow the lens casts.

- **Metal throws back the lens.** The projector is a small, bright source, so galvanised sheet, tread plate and glazed tile show its reflection where the mirror puts it. It moves as you do.
- **No black.** A projector can't project black. Its own black level and the room's light set the floor, and the wall shows through every dark part of the clip.
- **Keystone.** Point the projector at the wall from off-centre and the picture is a trapezoid, bright on the near side and dim on the far side. Lens Shift keeps it square and even, as a real shift lens does.

Everything is at its real size, in metres. A brick is 215 by 65 mm with its joints raked 8 mm deep, the corrugated sheet is 3-inch, 18 mm deep, and a drape's folds are half as deep as they are apart. That's honest, and it's subtle: at its real depth a brick joint slides about two pixels at 1080p from the default spot, which is what it really does. **Depth** is the knob for drama.



The clip, then Flat, Paper, Brick, Corrugated, Plate, Drapes, Weatherboard and Tiles, everything else at the defaults. The dark band along the top of Paper and Drapes is the room's light only: from below, you see up into recesses past the top edge of the picture, where no projector light lands.

The Surface group

Hosts show slider positions, not metres, so this guide gives each control's range and where its default sits on the slider.

Control	What it does	Range	Default
Surface	Which wall: Flat, Paper, Brick, Corrugated, Plate, Drapes, Weatherboard, Tiles or File.		Brick
Wall Height	How much wall the frame shows, top to bottom. The width follows the frame's shape.	0.25–20 m, evenly in ratio	2.5 m (0.53)
Scale	Every surface's size, bricks, folds and all.	0.25–4×	1× (the middle)
Depth	Every surface's depth, from flat to four times real.	0–4×, finer near 0	1× (the middle)
Seed	The surface's random variation: each brick's colour, tilt and set, the paper's creases, the cloth's wander, the grain.	0–99	1

Surface	What it is
Flat	A plain matte screen with a gain of 1. The reference: the clip comes back as it went in, give or take the room.
Paper	Crumpled paper: flat facets in up to four generations, each finer than the last, arriving as **Crumple** rises. 120 mm facets, ±15 mm.
Brick	UK metric brick, 215 × 65 mm, raked joints. Each brick its own colour, tilt and set.
Corrugated	Galvanised steel sheet: the light meets the zinc.
Plate	Aluminium tread plate, 30 mm cells, 1.5 mm lugs.
Drapes	Pleated ivory cotton, the folds wandering and deepening towards the floor.
Weatherboard	Painted feather-edge boards, 150 mm, each with a 15 mm lip at the bottom.
Tiles	White glazed metro tile, 200 × 100 mm, running bond, bevelled, 3 mm grout.
File	Your own **Surface File**: see *The File group*.

The surfaces' own controls

Each of these only acts on its own surface.

Group	Control	What it does	Range	Default
Paper	**Crumple**	How crumpled: the big folds first, then smaller ones inside them.	0–1	0.7
Brick	**Bond**	Stretcher, English, Flemish or Stack.		Stretcher
	Mortar	Joint width.	3–25 mm, even	10 mm (0.32)
Corrugated	**Profile**	Sine (3-inch corrugated) or Box (trapezoidal cladding).		Sine
	Pitch	The repeat; the depth goes with it.	25–300 mm, evenly in ratio	76 mm (0.45)
Plate	**Pattern**	Diamond, Five-Bar or Crosshatch.		Diamond
Drapes	**Pleats**	How many folds across the frame.	2–60	16
	Sag	How slack the cloth hangs, so the folds wander and deepen lower down.	0–1	0.3
Finish	**Roughness**	How sharp the highlight is on metal and glaze. Matte surfaces ignore it.	0.05–0.8	0.35 (0.4)

The metals' reflectance is worked out from published optical constants (zinc, Werner et al. 2009; aluminium, Rakić 1995), not picked by eye.

The File group

Control	What it does
Surface File	A picture of your own, used when **Surface** is **File**: PNG at 8 or 16 bits, JPEG, TGA or BMP.
File Holds	**Height**: the picture is a height map, grey, white at the front and black 100 mm back at Depth 1. **Photo**: the picture is a photo of a wall, its colour the wall's and its brightness the height.

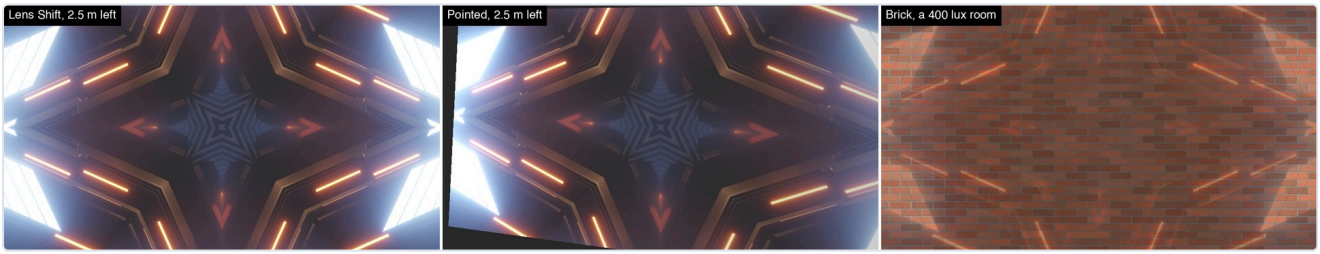
The file spans the frame at Scale 1. Below 1 it repeats, mirrored so there's no seam. A 16-bit height map keeps its precision all the way through. A missing or unreadable file gives you Flat, and the reason is in the log.

Photo is a look, not a measurement: a photo's darks aren't really its recesses. For a real wall, a height map from a scan or a depth camera is the honest input.

The Projector group

Control	What it does	Range	Default
Projector X, **Projector Y**	Where the lens is, left-right and up-down from the frame's centre.	±10 m, finer near the middle	0 m and 1 m above (0.5 and 0.66)
Throw	How far the lens is from the wall.	1–50 m, evenly in ratio	6 m (0.46)
Aim	**Lens Shift**: the lens faces the wall square on and its picture is shifted to fill the frame, as a projector with a shift lens does. **Pointed**: the projector is turned to aim at the frame's centre, so from off-centre the picture is keystoned.		Lens Shift
Lumens	How bright the projector is. Against the room, that's what decides how well the clip holds up.	500–50 000, evenly in ratio	10 000 (0.65)
Black Level	What the projector gives for black, as a fraction of its white.	0–2%, finer near 0	0.05%, 2000:1 (0.16)

The light at each point is $d^2 \cdot \cos\theta / (r^2 \cdot \cos^3\alpha)$, relative to a flat screen at the throw: the inverse-square and cosine laws for a projector built to light its design screen evenly. On a flat wall with Lens Shift that's exactly 1 everywhere, so the clip comes back as it went in. Anything nearer the lens gets more and anything turned from it gets less.



Left, Flat with the projector 2.5 m left of centre on Lens Shift. Middle, the same on Pointed. Right, Brick at the defaults with Ambient at 400 lux.

The Room group

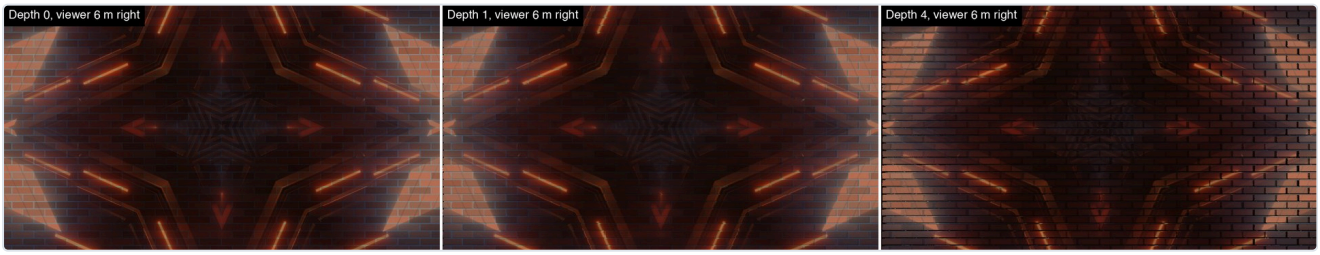
Control	What it does	Range	Default
Ambient	The room's own light on the wall, even from every direction: it reaches every face, turned from the lens or not, and less of it gets into deep recesses.	0–1000 lux, finer near 0	20 lux, a dim room (0.14)
Exposure	The whole picture up or down, as a camera would expose for it.	±4 stops	0 (the middle)

The room's light against the projector's is lux × wall width × wall height ÷ lumens, so a bigger wall or a dimmer projector shows more of the room. With the defaults, a 4.4 × 2.5 m wall at 20 lux under 10 000 lumens, the floor is a little over 2% of white. A projector at 2000 lumens in a 200 lux room loses most of its contrast, as it would.

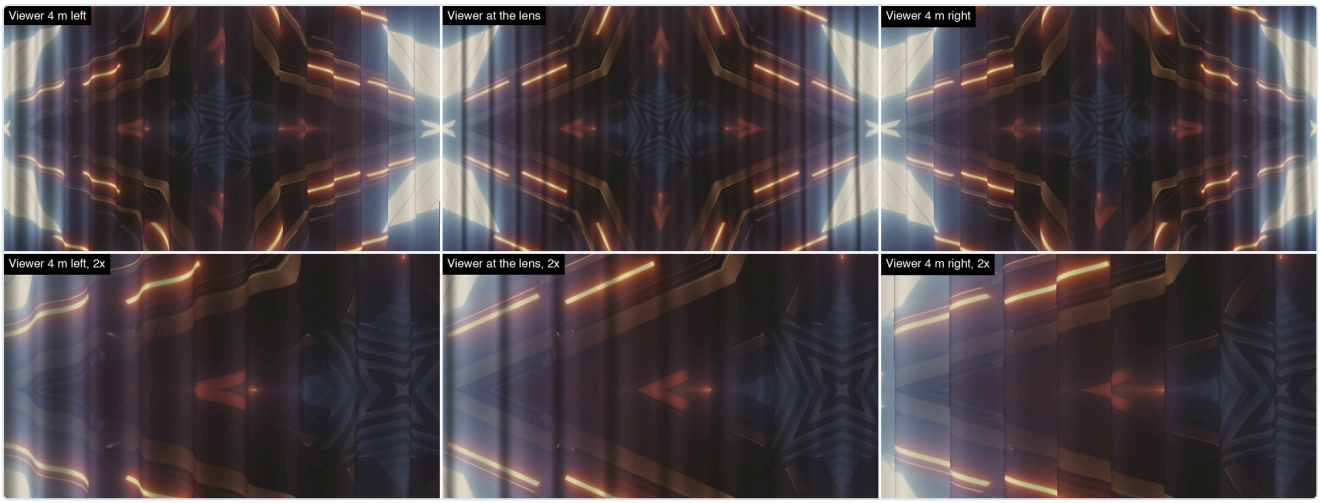
The Viewer group

Control	What it does	Range	Default
Viewer X, **Viewer Y**	Where you're standing, left-right and up-down from the frame's centre.	±10 m, finer near the middle	2 m right and 0.8 m below (0.72 and 0.36)
Viewer Distance	How far you are from the wall.	1–50 m, evenly in ratio	4 m (0.35)

The frame always shows the same rectangle of wall, wherever you stand: the viewer has a shift lens too. What changes is which bit of the relief you see each point of the picture on. Put the viewer exactly where the projector is (the same X, Y and distance as the projector's X, Y and Throw) and the picture lies on the relief with no slide and no shadow, shaded by the surface and nothing else.



Brick with the viewer 6 m right of centre, at Depth 0, 1 and 4.

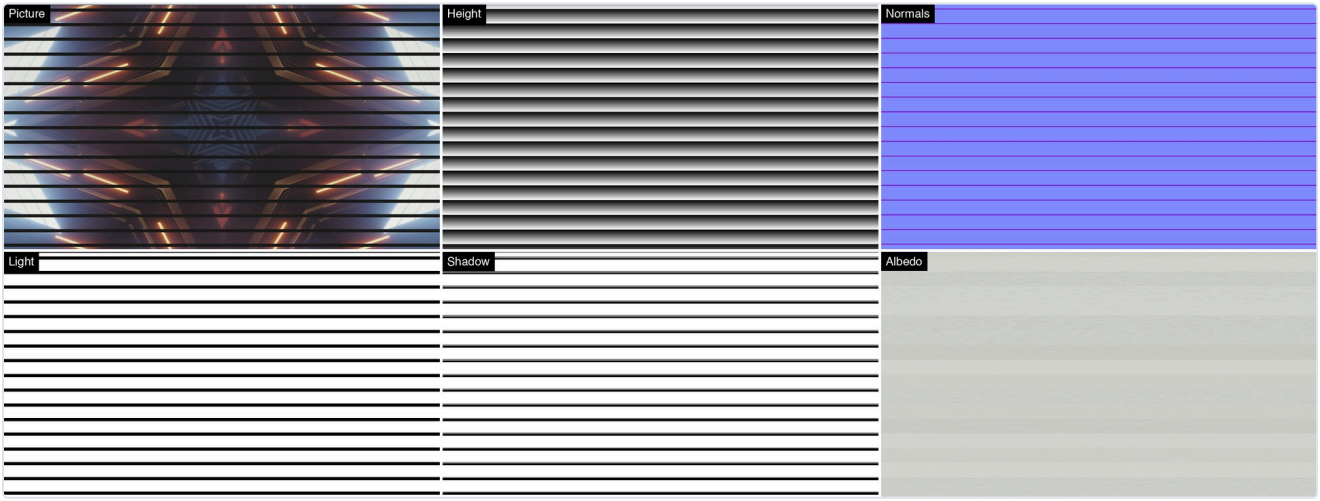


The viewer walks past the drapes, level with the lens and as far back. From the lens the picture is the clip, shaded by the folds and nothing else. Either side, it slides over them.

Viewer X is the one to animate: give it a slow LFO and the wall turns into a set you're walking past.

The Output group

Control	What it does
View	**Picture**, or what the plugin is working with: **Height** (the relief, white at the front), **Normals** (which way each bit faces), **Light** (the projector's light alone, shading and shadows, no colour), **Shadow** (white where the lens can see, black where it can't), **Albedo** (the wall's own colour).
Mix	Blends between the clip as it came in (0) and the thrown picture (1).



Weatherboard with the projector 6 m above centre and 2.5 m back, in each View.

At Mix 1 the output is opaque: the thrown picture fills the frame, wall and all, whatever the clip's alpha.

Recipes

Slider positions in brackets.

- **A gig on a warehouse wall.** Brick, Bond English, Depth 2 (0.71), Lumens 5000 (0.5), Ambient 60 lux (0.24). Viewer X slowly back and forth.
- **Theatre drapes.** Drapes, Pleats 24, Sag 0.6, the projector 3 m to the left (Projector X 0.23) so one side of every fold is lit and the other falls into shadow, and the viewer in the stalls (Viewer Y −1 m, 0.34; Viewer Distance 10 m, 0.59).
- **Shed at night.** Corrugated, Profile Box, Roughness 0.2 (0.2), Ambient 0, the viewer 3 m to the left (Viewer X 0.23): dark steel with the lens glinting off the ribs.
- **Crumpled flyer.** Paper, Crumple 1, Depth 2 (0.71), Ambient 100 lux (0.32): pale paper with the clip printed on it.
- **A projector on a stand.** Flat, Aim Pointed, Projector Y −1.5 m (0.31), Throw 3 m (0.28): the picture spreads as it climbs the wall, as a projector tilted up at it does.
- **Your own wall.** A greyscale height map of a real wall as the Surface File and File Holds on Height. At Depth 1 (0.5) black is 100 mm behind white; set Depth to the map's own range over 100 mm for its real depth.

Performance

Measured by the offline harness on an Apple Silicon Mac: GPU time by `GL_TIME_ELAPSED`, median of 120 frames after a warm-up, on a GPU shared with other work, so the small numbers wobble from run to run.

	720p	1080p	4K
the defaults (Brick)	0.27 ms	0.47 ms	2.03 ms
Drapes	0.48 ms	1.40 ms	8.77 ms
Corrugated at Depth 4	0.37 ms	1.01 ms	5.78 ms
Paper, Crumple 1, Depth 4 (the heaviest tried)	0.71 ms	2.07 ms	13.04 ms
Seed changing every frame, so the wall is rebuilt every frame	3.90 ms	8.37 ms	33.47 ms

The wall is built once and kept: everything in the Surface, Paper, Brick, Corrugated, Plate, Drapes, Finish and File groups decides the wall, and changing any of them rebuilds it. The projector, room, viewer and output controls don't, so **animate those freely and leave the surface's controls still**. Animating Seed or Crumple rebuilds the wall every frame, which at 4K is about two 60 fps frames' worth. Deep relief costs more than shallow, because each pixel looks further along its ray. These are macOS figures from the harness; nothing was timed inside Resolume.

If it looks wrong

The effect does nothing at all. That's what a shader that won't compile looks like. The actual error is in the log:

```
macOS    ~/Library/Logs/throw/throw.YYYY-MM-DD.log
Windows  %LOCALAPPDATA%\throw\logs\throw.YYYY-MM-DD.log
```

It records the build, the GL vendor, renderer and version at load, which shader failed if one did, and why a Surface File didn't load.

It isn't in the effects browser. Check the folder under *Installing*, including the one you gave the Windows installer, and that Resolume was restarted.

I can't see the relief. At its real depth it's subtle, as a real wall is from a few metres: turn up **Depth**, move the viewer away from the projector, or try Drapes.

A control does nothing. The surface's own controls only act on their own surface (Crumple on Paper, Bond on Brick, and so on), and Roughness only on metal and glaze. Surface File does nothing until Surface is File.

The clip looks washed out. That's the room: Ambient is high for the projector's Lumens or the wall's size. Lower Ambient, raise Lumens or make the wall smaller with Wall Height.

The clip's colours are wrong. That's the wall's colour, as on a real wall. Brick eats blue. Flat, Tiles or Drapes keep the clip's colours closest.

A dark band along the top or bottom. You're looking into recesses past the edge of the picture, where no projector light lands, so they get the room's light only. It goes as the viewer comes level with the projector.

Black wedges round the picture. Aim is Pointed and the projector is off-centre: that's the keystone. Lens Shift fills the frame.

The frame rate drops when I animate. You're animating a surface control: see *Performance*.

The Surface File didn't load. The log says why. The path must be one Resolume can read, and the file a PNG, JPEG, TGA or BMP.

The layer under it has gone. The output is opaque. Use a blend mode, or Mix.

Known limits

- **Never loaded into Resolume on macOS.** On Windows, Arena lists all 29 controls as declared, but only on software rendering: nobody has watched it in Resolume on a GPU.
- **The inspector shows slider positions**, not metres, lumens or lux. This guide gives the ranges, and where the defaults sit.

- **A pinhole projector and a pinhole viewer.** No depth of field: at real distances there's nothing to model (a 40 mm lens focused at 6 m blurs a 150 mm drape fold by about 1 mm, under half a pixel of a 2.5 m wall at 1080p).
- **One bounce.** Light from the projector reaches the wall and comes back to you. It doesn't bounce between the folds or off the floor.
- **The room's light is even and white**, and the projector has no colour of its own: no lamp colour and no gamut.
- **The surfaces' colours are chosen to look right**, not measured. The metals' reflectance is computed from published optical constants.
- **sRGB in, sRGB out.** The plugin takes what Resolume hands it as sRGB-encoded and turns it into light. A host handing over linear light would have it lit twice over.
- **A heightfield.** Every surface is a height at each point of the wall, so nothing overhangs: a drape can't fold back over itself.
- **One projector.**
- **No presets** (Resolume saves parameter presets itself) and no OpenFX version.

About

The last group, **About**, has the plugin's name, version, licence and maker, and buttons that open this user guide, the project page, the source on GitHub and the support page in your browser.

Reporting something

If something's wrong, shout at github.com/stoatworks-labs/throw/issues. A screenshot, the Surface and any controls you changed, and the composition's resolution and frame rate are usually enough. If the effect drew nothing, or a Surface File didn't load, attach the log.

The FFGL SDK, GLEW and stb_image it's built on, and the published measurements behind the metals, are credited in ATTRIBUTIONS.md, which travels with the plugin.
