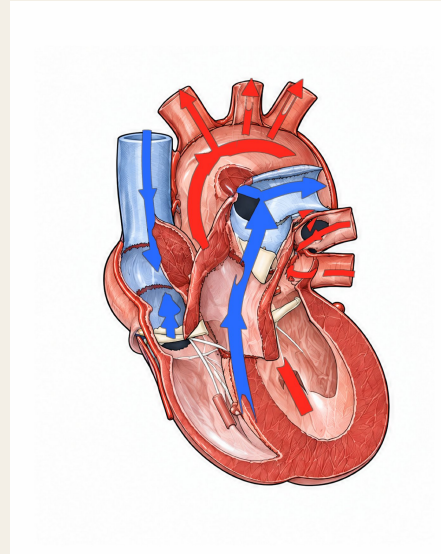


One heartbeat, six stages, four layers.

A teaching model of the human heart, checked against open textbooks: 53 Scenario calls, 9 models, 541.75 CU, 48 medical plates, 6 narrated stages.



Stage 3, ventricular ejection, section layer, blood flow

The receipt

53 Scenario calls across 9 models, 541.75 CU in all, reconciled job by job with the ledger.

48 plates

Six stages by four layers by two overlays, one camera per section, a medical-plate finish on every still.

6 narrations

Each stage voiced and captioned, checked by transcription and level measurement.

Accurate enough for a classroom, beautiful enough for a museum.

One heart model stays constant throughout: the same chambers, valves and conduction path, seen through six moments of the cardiac cycle and four ways of opening the body.



All 48 stage stills, stage by layer

Stage x layer x overlay

Six Wiggers phases (atrial systole to diastasis), four layers from surface to a long-axis cut, two overlays: blood flow and the electrical signal.

One heart, one camera

Every still in a section shares one locked camera, so a visitor compares stages and layers without the frame moving under them.

Every statement traces to a textbook.

Before any modelling, a table fixed the valve states, flows, active conduction parts and chamber-volume order for each of the six stages, from OpenStax Anatomy and Physiology, the Wiggers diagram, NIH NHLBI and TeachMeAnatomy.

Valves per stage

from the open textbooks

	T	M	P	A
1 Atrial systole	○	○	●	●
2 Isovolumic contraction	●	●	●	●
3 Ventricular ejection	●	●	○	○
4 Isovolumic relaxation	●	●	●	●
5 Rapid filling	○	○	●	●
6 Diastasis	○	○	●	●

T tricuspid · M mitral · P pulmonary · A aortic
ring = open, dot = closed

The textbook table: valve states per stage

The check

A script checks the model against the table after every change: 43 checks, 0 failures, one error caught and fixed before publication.

accuracy_check.py

43 checks, 0 failures

✓

valves open or closed

✓

leaflets 3 / 2 / 3 / 3

✓

flow paths

✓

active conduction

✓

depolarised muscle

✓

13 great vessels, 4 pulmonary veins

✓

LV wall thicker than RV

run on every stage after any model change

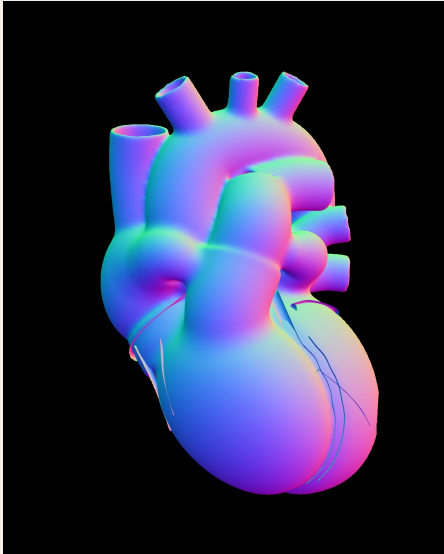
The automated check: 43 checks, 0 failures

What is assumed

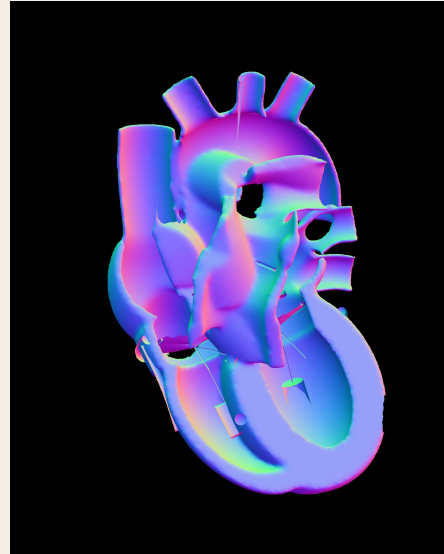
Proportions of a typical adult heart, not a measurement of any person; simplified leaflets; trabeculae not modelled; a representative subset of Purkinje fibres.

A signed distance model, one heart, four layers.

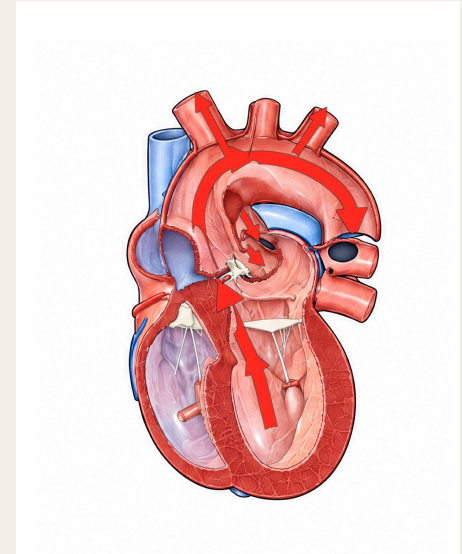
Not a generated mesh: a numpy signed distance model builds the four chambers, four valves, the great vessels and the conduction path, meshed with marching cubes. Stage parameters move chamber volumes, wall thickness, valve states and the valve plane.



Layer 1, surface



Layer 3, section



Layer 4, long axis: apex, mitral and aortic valves

Four layers

Surface, see-through, a four-chamber section, and a long-axis cut that shows the aortic valve behind the mitral valve.

Checked geometry

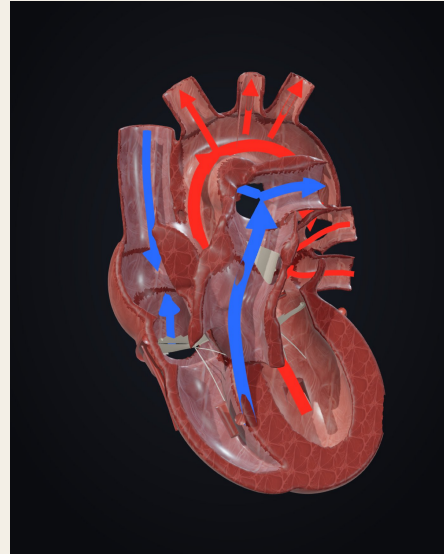
Every conduction curve lies inside the wall; the left-ventricle wall is thicker than the right in every stage.

PBR tissue, real-time renders, two Cycles stills.

PATINA Material generated the seamless epicardium and cut-muscle maps that the renders project onto the model. Because the shared Blender slot stayed blocked, the 48 stage stills are CPU real-time renders (three.js, SwiftShader) of the same meshes from the locked camera; two hero stills are Blender 5.2 Cycles (CPU).



PATINA Material: epicardium base colour



CPU real-time render, stage 3, section



Blender 5.2 Cycles hero still, stage 3

Tissue maps

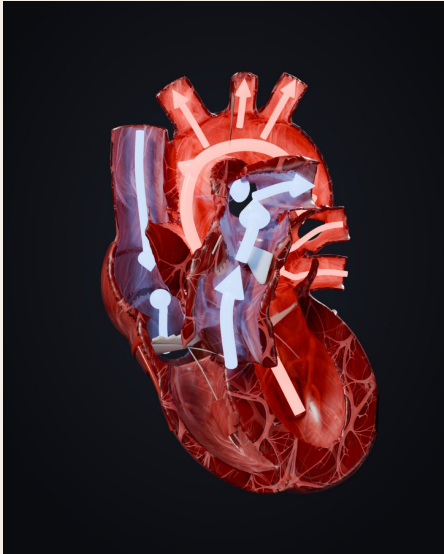
2 Scenario calls, 30 CU: epicardium and myocardium cut-face materials, colour, normal, roughness and height.

Two renderers

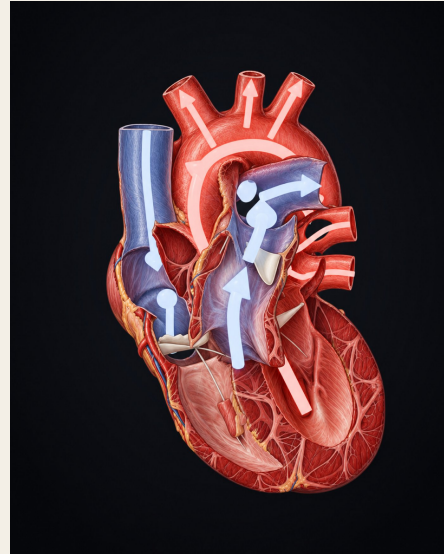
36 stage stills real-time (three.js on SwiftShader); the two hero stills Blender Cycles through the shared render guard.

Two image models on the same render and prompt.

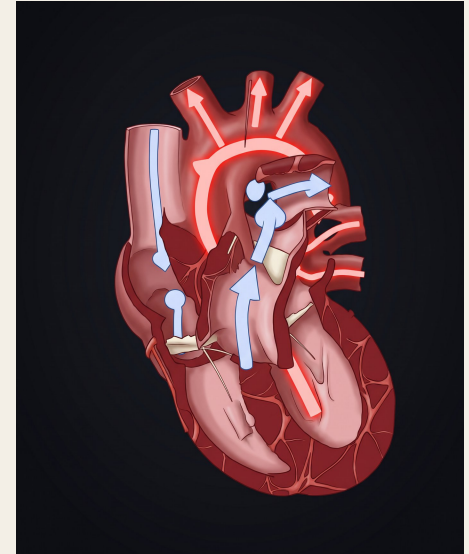
GPT Image 2.5 Sunburst and Gemini 3.0 Pro redrew the same anatomy-only render as a medical plate. The shoot-out measured shape overlap (IoU) and edge recall against the source render.



The anatomy-only render, before redraw



GPT Image 2.5 Sunburst, kept



Gemini 3.0 Pro, runner-up

Kept: GPT Image 2.5 Sunburst

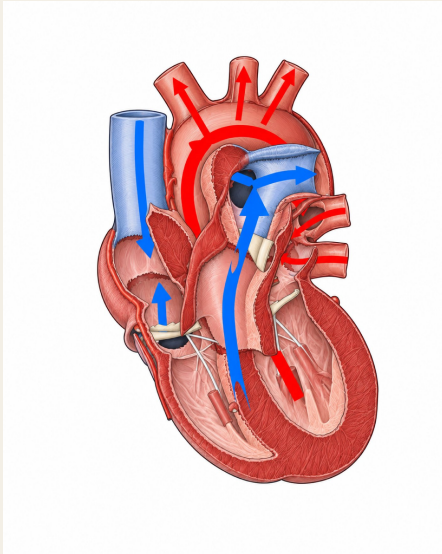
Higher edge recall against the source render; six stages redrawn per call, one call per layer.

Runner-up: Gemini 3.0 Pro

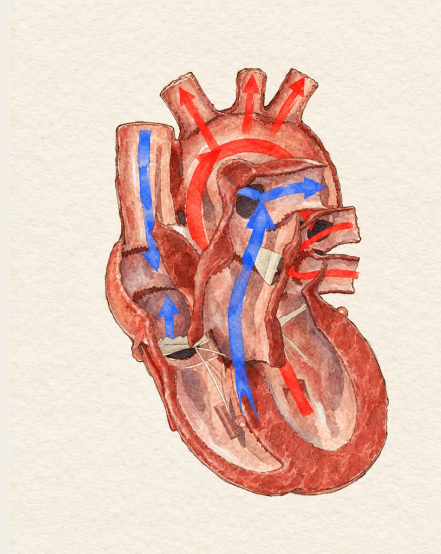
Close on shape overlap but lower edge recall on fine structures such as the papillary muscles.

Medical plate, watercolour, glass.

The key stage, ventricular ejection, was finished three ways from the same render and arrows, each with its own edge recall against the source.



Medical plate



Watercolour



Glass

One finish shipped

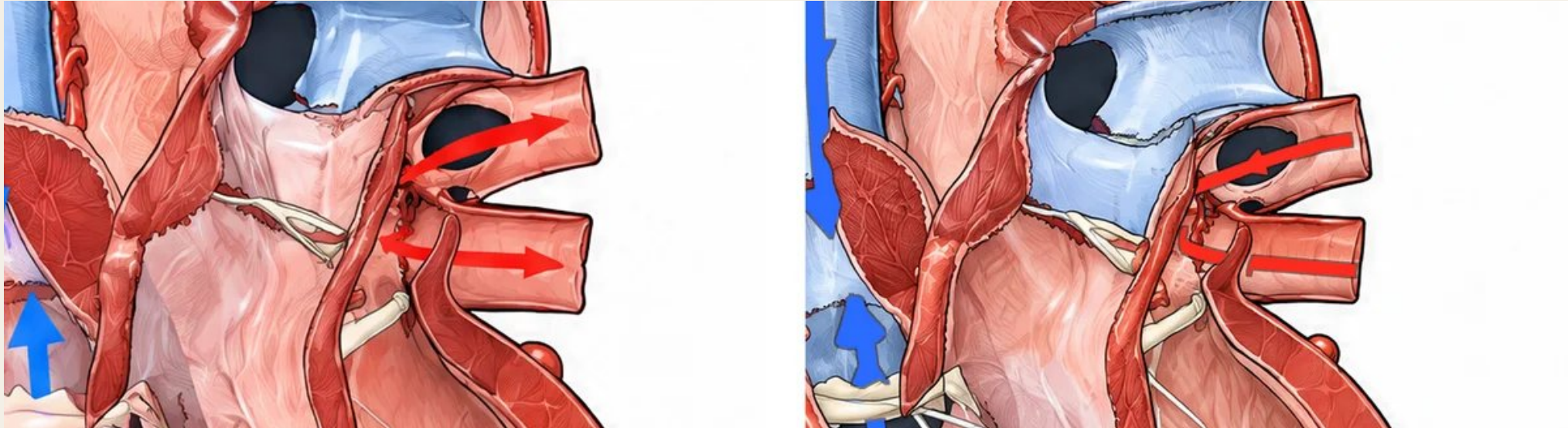
The medical-plate finish was applied to all 48 stills, so every stage and layer reads as one atlas.

Two kept for the page

Watercolour and glass stay as art treatments of the key stage, alongside the medical plate, on the page's Look row.

A first pass drew the arrows wrong; the fix removed generated arrows entirely

An advisory review scored the model and caught a real error: the first plate pass let the image model draw its own arrows, and it reversed the pulmonary-vein arrows. The fix: plates are anatomy-only redraws, and every arrow, conduction path and wash is drawn from the model's own 3D paths and laid on top afterward.



Overlay pass: continuous vector arrows drawn from the model

What failed

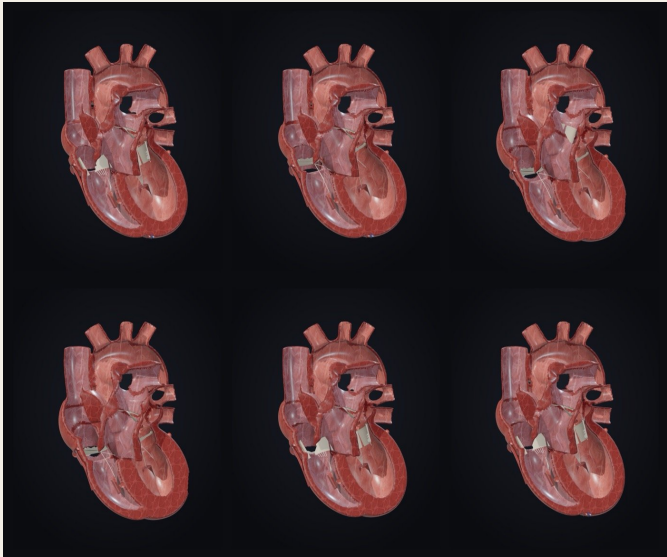
The rejected pass (19 CU) let the model draw arrows from the prompt alone; some pulmonary-vein arrows pointed the wrong way.

The fix

Arrows, conduction path and wash are computed from the model's 3D paths and composited onto the anatomy-only plate; the image model never draws them.

Six stages per call, one call per layer.

Each of the four layers was redrawn once per call across all six stages, then aligned, scored against the source render and composited with the model's own overlays.



The six-stage grid before overlays, layer 3

Alignment and scoring

Silhouette overlap 0.89 to 0.97 and edge recall 0.66 to 0.81 against the renders across the 48 plates.



All 48 finished plates

Cost

76 CU across 4 calls for the kept plates, plus the 19 CU rejected proof.

A three-voice shoot-out, six narrations.

Gemini 3.8 Flash TTS, Minimax Speech 2.8 HD and ElevenLabs 3 were compared on the same stage-1 script; the winner voiced all six stage narrations and the how-to film. Every narration was checked by transcription, word for word.



The voice shoot-out

Kept: Gemini 3.8 Flash TTS

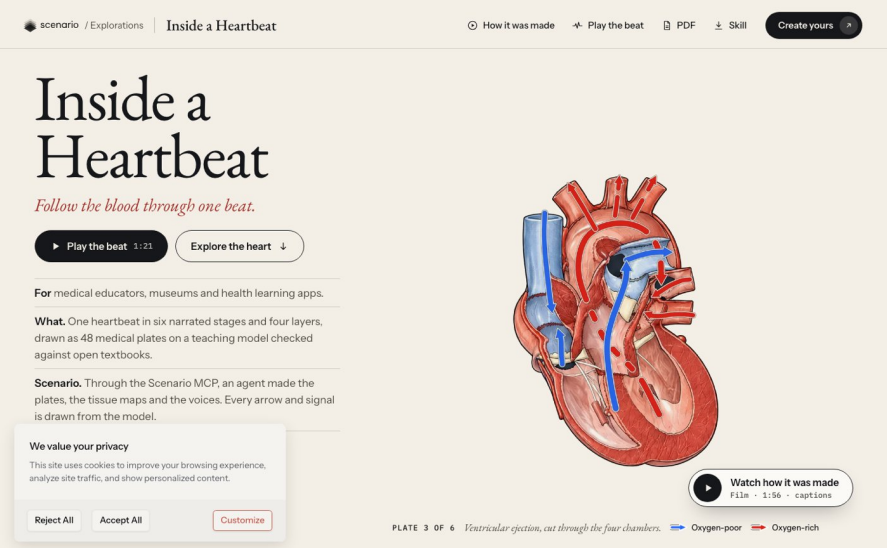
24 calls, 51 CU: the six stage narrations, the how-to narration and the shoot-out itself.

Checked, not heard

Every narration and the how-to score were transcribed word by word and level-measured; a human has not listened yet.

Step through the beat, peel the layers, switch the overlay, turn on the labels, compare the plate with the render, and turn the heart in 3D.

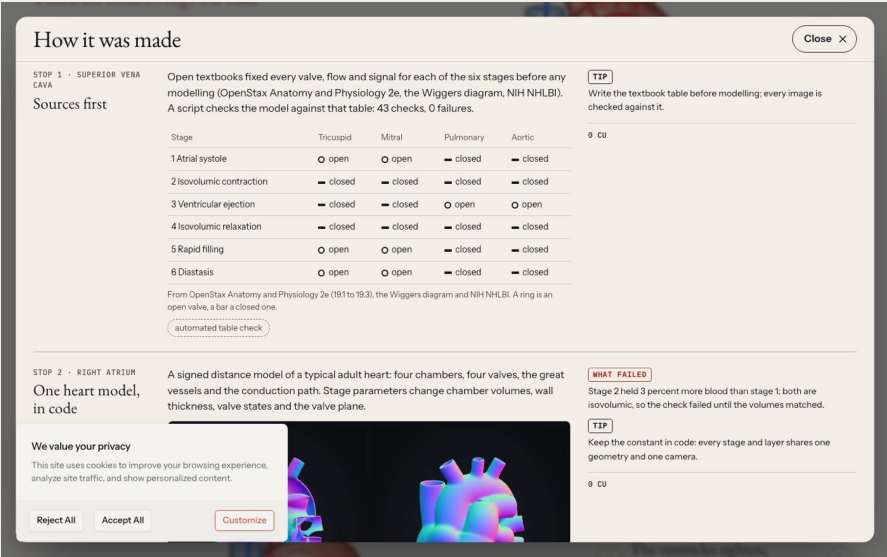
The page opens on stage 1 and plays the beat with narration and captions; visitors peel four layers, switch blood flow and the electrical signal, turn on the labels, compare the plate with the render, and turn the heart in 3D. “How it was made” opens as a modal on the film, with a card per step.



The page: hero and explorer

Try it

Play the beat, step stage by stage, switch layer and overlay, turn on labels, compare plate with render, and turn the 3D heart.



How it was made: the film and the step cards

Before publication

A qualified anatomy review of the 48 plates and a human listen of the narrations are still required.

Every model, every call, every CU.

The full model table, the recipe with every prompt as sent, and the reproduction skill are all in the downloads. Made through the Scenario MCP.

Models

PATINA Material, GPT Image 2.5 Sunburst, Gemini 3.0 Pro, Gemini 3.8 Flash TTS, Minimax Speech 2.8 HD, ElevenLabs 3, Gemini 3.5 Transcribe, ElevenLabs Music Advanced v2.5, and a Scenario LLM review pass.

Scenario MCP

Take it with you

The reproduction skill, the recipe ZIP with every prompt as sent, the making-of PDF and the GLB.

Scenario