

Web3D 2026

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Technē

A Deterministic Craft Layer for Model Context Protocol Servers, Grounded in LLM-Authored X3D

The schema passes; the pixels fail.

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Paper Session 4 · DOI 10.1145/3822516.3834883

Generative AI (Claude) was used as a tool under the author's direction; it is not an author.



LOA5 Anatomy Explorer · X_ITE

Web3D 2026

The schema says PASS. Here is the render.

XSD PASS · containerField='skeleton'

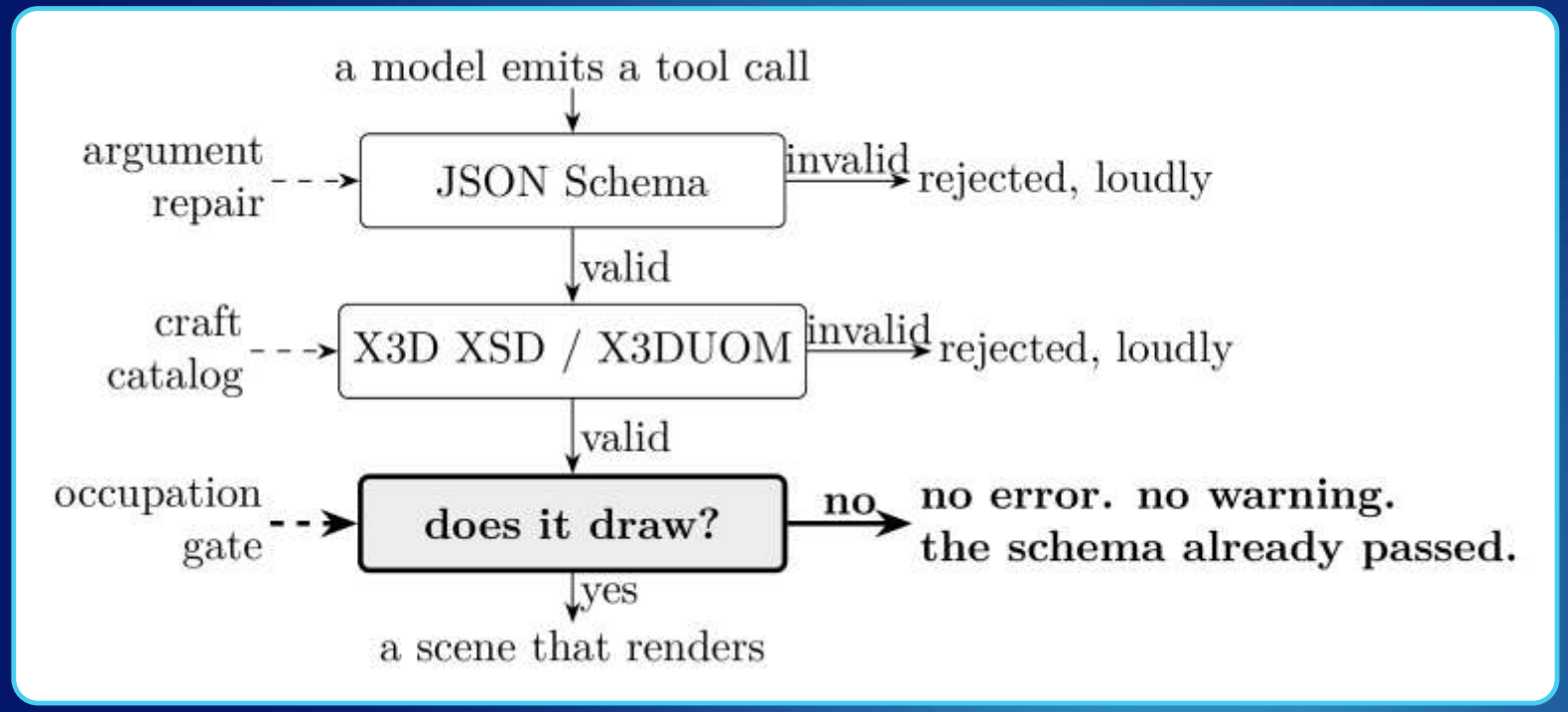
XSD PASS · containerField='children'



Both documents pass validate_x3d. One attribute differs: the skeleton root filed in `children` instead of `skeleton`.

demo/receipts/beat_a (2026-09-30), rendered by X_ITE

Why the failure is silent



Paper Fig. 2, re-set larger · dashed: where Technē inserts

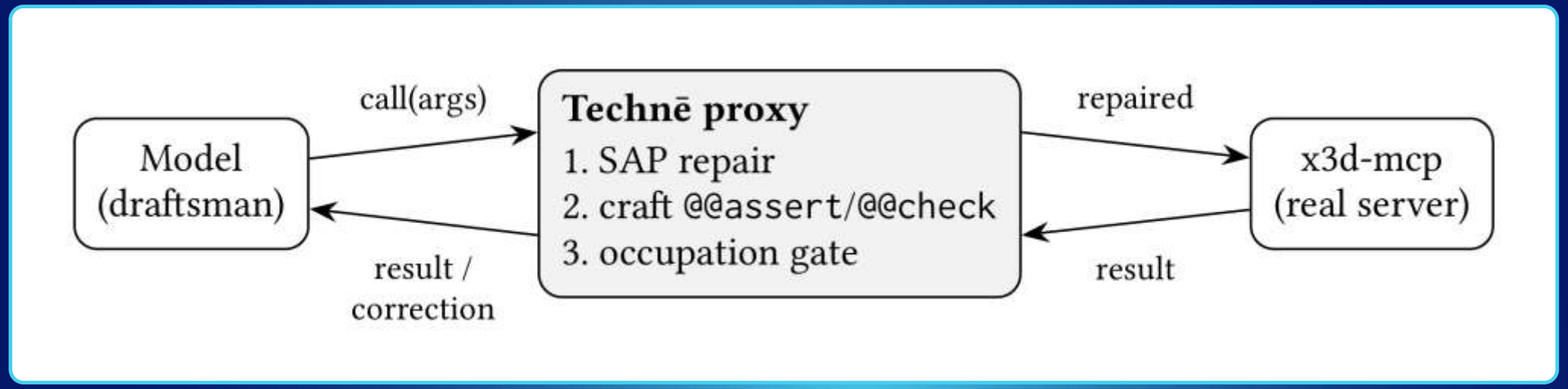
Epistēmē

what the schema knows: names, types, legal values.

Technē

the tool's craft: which slot, which default, which order.

A proxy on the MCP transport



Paper Fig. 1 · the model connects to Technē; Technē launches the real x3d_mcp as a subprocess

Same tools, same args

On accepted input: no behavioral change, at most an advisory note.

No LLM in the loop

A deterministic Python mirror of the BAML declarations.

Companion to x3d_mcp

Every forwarded call is still validated by x3d_mcp's own inputSchema.

Move 1 — repair in transit

the model's request (line breaks added)

```
{"tool": "create_node",
 "arguments": {
  "node_type": "Viewpoint",
  "fields": "```json\n{\"description\":
     \"SAP repair demo\", \"position\":
     [0, 1.6, 3.0]}\n```"}}
```

fields is an object, sent as a JSON string inside a markdown fence.

Raw server

`isError=True`

“Input should be a valid dictionary”. The model must try again.

Through Technē

`isError=False`

“Created Viewpoint”. The model never sees an error.

demo/receipts/beat_b · same bytes, two servers · Fig. 4: same class

Schema-aligned parsing, inverted: applied to the arguments a model emits into a tool.

Shape only. Nothing invented.



Move 2 — the error message is the fix

Multi-slot → BLOCK and correct

```
add_child(parent_id=m, child_id=t)
m: PhysicalMaterial   t: ImageTexture
verdict BLOCKED
rule    container_field_required
```

“… it would default to 'texture', which 'PhysicalMaterial' does not define as a field, so the child is silently dropped. Specify containerField as one of: **baseTexture, emissiveTexture, normalTexture, occlusionTexture, metallicRoughnessTexture***.”*

Single slot → REPAIR and forward

```
add_child(parent_id=h, child_id=s)
h: HAnimHumanoid   s: HAnimSegment
verdict FORWARDED
rule    container_field_required
out     "container_field": "segments"
```

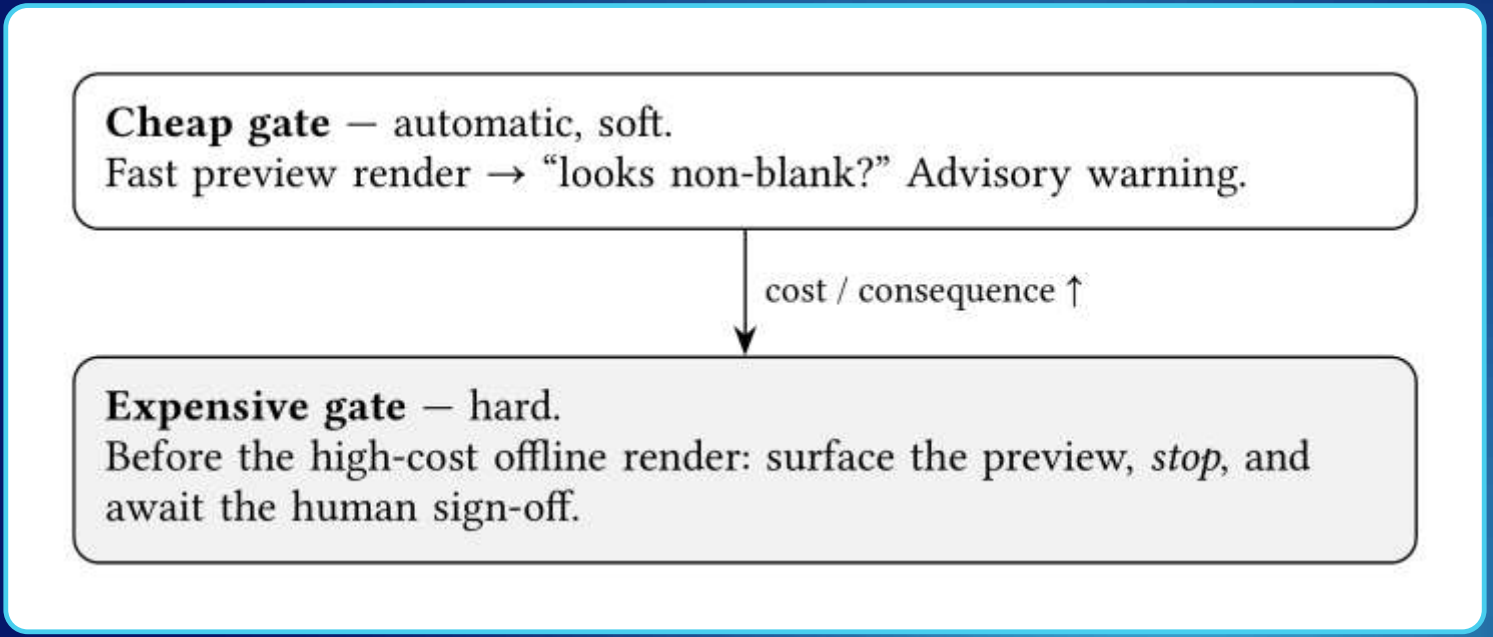
“Techne set containerField='segments'.” Same explanation, as an advisory.

Repair when the fix is unique. Block when it would need a choice.

Placement, not detection: the rule fires on the call that introduces the defect.

Verbatim proxy transcript, paper Fig. 7 (abridged; the slot names are exact)

Move 3 — the occupation gate



Paper Fig. 5 · cheap gate: runs in transport · hard gate: built as a library, no upstream offline-render verb yet

< 3.0

grey levels of luminance std-dev = blank

Fired live on the render (App A.2):
"the render looks BLANK … no geometry visible."

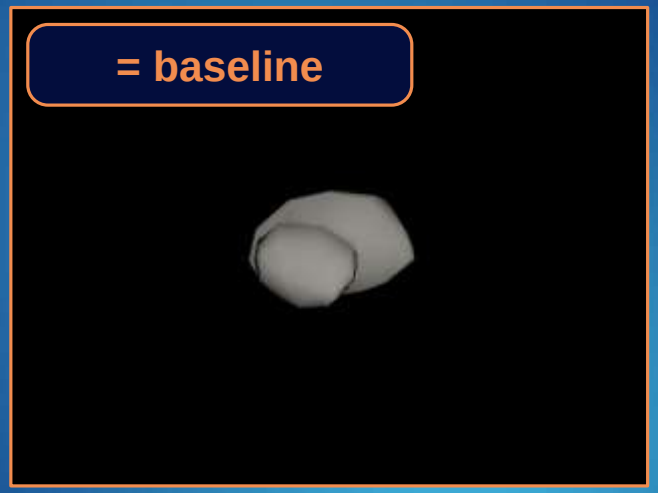
Fail-safe: undecodable = blank. A false block costs a retry; a false pass ships a blank artifact.

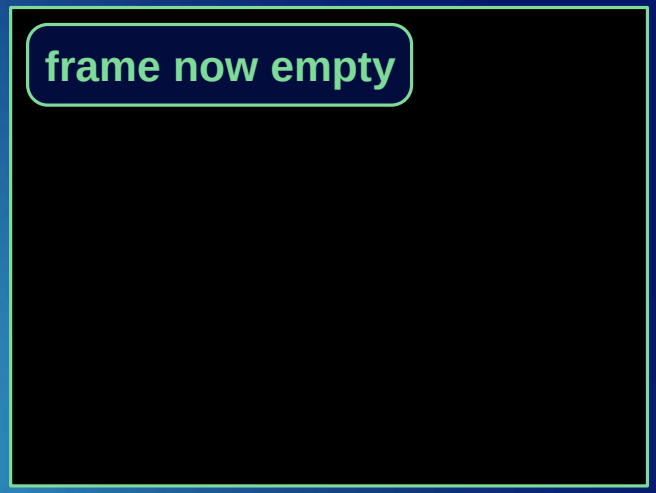
The opening slide is non-blank: semantic validation flags it a stage earlier, and Technē's add_child rule blocks it: **"Use one of: skeleton, joints."**

Did this node put pixels on screen?

Render with it, render without it, count the changed pixels.







baseline

both little-toe subtrees; not blank (σ 26.45)

0 px

change without the LEFT distal phalanx 5: ABSENT

9,243 px

change without its RIGHT twin: CONTRIBUTES

Why: `hanim_l_tarsal_distal_phalanx_5` was missing upstream (the download saved the 404 page). Added by Brutzman & Williams on 7 Oct 2026.

Noise floor 0 px, threshold 98 px: paper App A.6 · toe result: demo/receipts/beat_c · opt-in

The explorer, and whose bones they are

Bone meshes

and the prose inside them

Don Brutzman · Joe Williams
John Carlson · Damon Hernandez

Web3D HAnim AllBonesLOA5Skeletons

Teaching layer and studio

Alexander Hoffman

Authored through the proxy: 48 calls, 0 blocked, 0 repaired (31 Aug 2026)



Detail of slide 30: Brutzman & Williams, “Building LOA5 Animated Humanoids using HAnim and X3D,” HAnim WG tutorial

Measured against the bare server

6 scripted sequences, raw vs behind Technē, isolated processes: 5 carry a documented mode, 1 is a correct control

2 / 5

raw: passed silently into the scene

3 / 5

raw: rejected loudly, no remedy named

5 / 5

behind Technē: caught, each with the fix named

Control: no false positives · **234** unit tests, no LLM in the loop

Mechanism fires on documented modes; frequency in the wild not measured



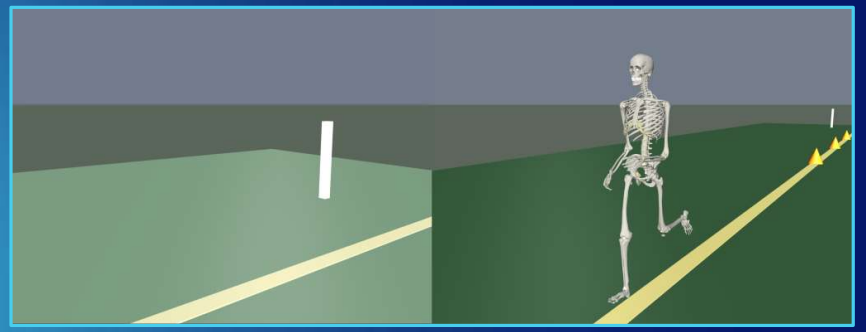
What it does not do

One question. The shipped gate asks: is the frame blank? Object presence is opt-in, one render per node.

Coverage is the catalogue. An undocumented mode passes silently.

Only as honest as its eyes. Qualified against X_ITE for HAnim and X3D 4.0 PhysicalMaterial.

Not yet: a user study or corpus benchmark; repairs written to an audit log.



X3DOM
no humanoid drawn

X_ITE
skeleton mid-stride

Paper Fig. 6 · one runner scene, two players: harness qualification, not a verdict on any player

Verify by render.

“Wherever a model authors through a tool surface, the craft that surface assumes can be compiled out of documentation and into the transport, where it holds whether or not the model understood it.”

the abstract's closing sentence

Keep the human the one who holds intent and signs off.



L. Patella, picked in the explorer (X_ITE)



Thank You!

Web3D 2026

euphememe.github.io/x3d_mcp/anatomy_explorer.html
github.com/EUPHEMEME/x3d_mcp/tree/techne/techne

x3d_mcp: Nikhil Narra, Rick Lentz, Nicholas Polys, Don Brutzman
Bones: Don Brutzman, Joe Williams & the HAnim WG
X_ITE: Holger Seelig

Doha, Qatar

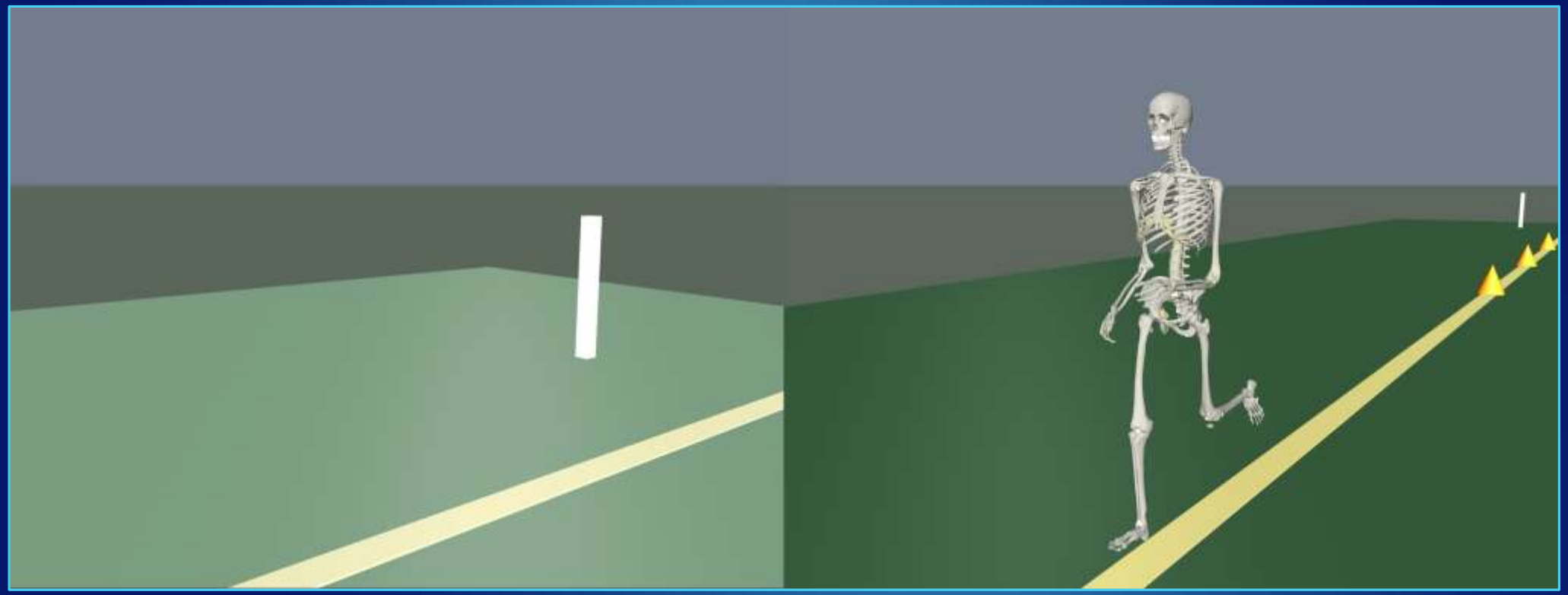


Backup: ordering ablation (Table 1)

Verdict	Meaning	n
SILENT	passes the XSD, renders wrong or blank	**0**
LOUD	the server already refuses	2
DATAFLOW	inexpressible: *B* needs an unminted id	5
FREE	renders identically; the edge is folklore	7

14 candidate ordering edges from 3 programs: none fails silently.

Backup: the renderer is a correctness property



Left X3DOM: no humanoid drawn. Right X_ITE: skeleton mid-stride. Same file, same pipeline; harness qualification, not criticism.

Backup: provenance gate (opt-in)

`catalogId='SLOP-1'`

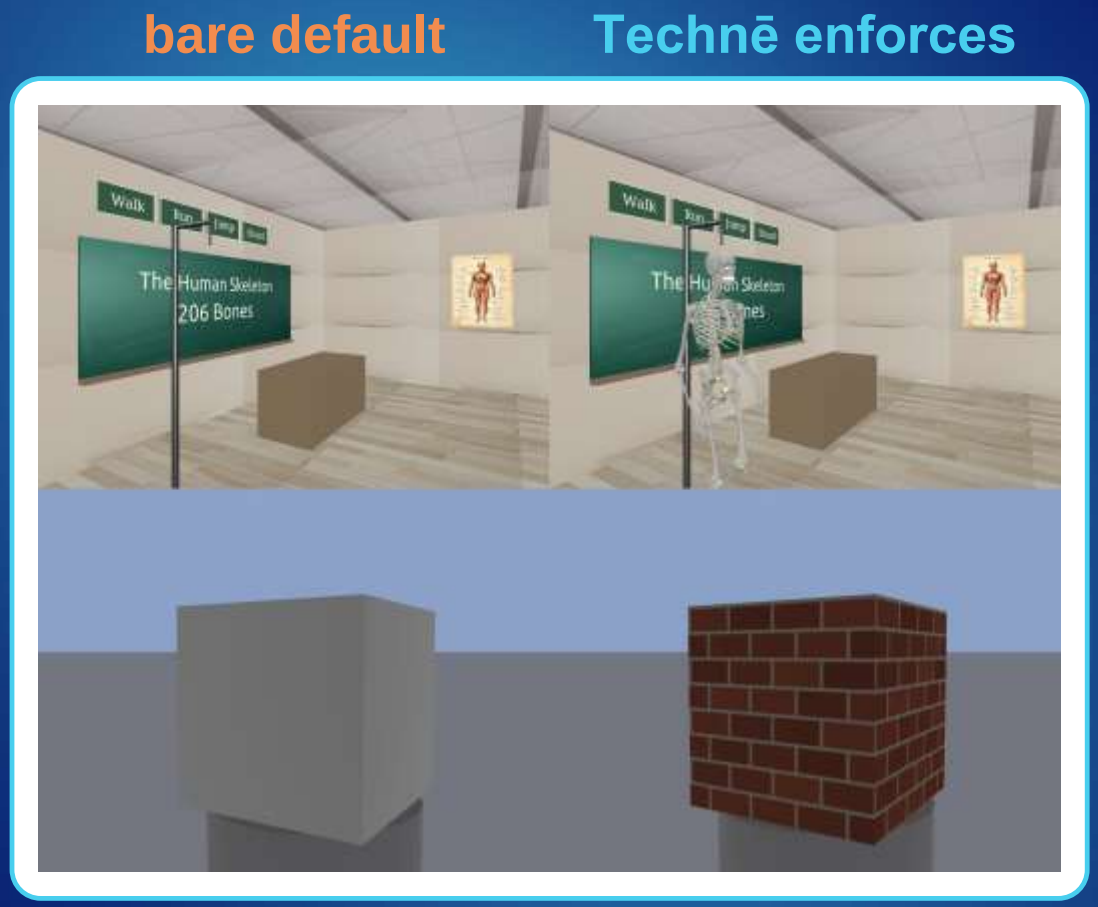
claims provenance='documented'; not in the ledger. **BLOCKED in 0.7 s, before Chromium ever launched:**
“catalogId='SLOP-1' does not resolve to any asset-ledger entry (have: BONE-R5). Register the asset with its citation/source/public-domain status, or correct the id.”

`catalogId='BONE-R5'`

the real Web3D bone mesh; attribution from the asset's own header: Brutzman · Williams · Carlson · Hernandez.
Rendered clean, provenance silent. Same strict profile.

Provenance is policy, not vibes · demo/receipts/beat_e (transcript re-set) · off by default; TECHNE_PROVENANCE_LEVEL / profile (paper App A.7)

Backup: two silent failures (Fig. 3)



Each pair: one scene, one containerField. Both defective scenes pass validate_x3d.

Backup: why not just prose instructions?

Prose instructions are advisory

The model probably follows them, and the dice reset when a fresh session connects. A correction discovered once becomes mechanism the next model cannot bypass.

The BAML trap

Only block-level @@assert / @@check fire at runtime. Field-level single-@ assertions are silently ignored: the very class of silent failure the layer exists to catch.

