



SHAPELESS VIDEO

Transparent and Glass Displays

Product white paper — format and encoder exist; 5th Wall app integration is still WIP. Audience: integrators, experiential designers, display OEMs, 5th Wall operators.

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1. Thesis

Shapeless video is motion that does not own a rectangle.

Fifth Wall Point Video (.5wpv) encodes a clip as a timed sequence of colored points. Empty coordinates are not stored and must not be drawn. On a transparent TV or glass LED, that empty field is the room, the product, or the street — not a black panel.

The headline use case is see-through screens: transparent OLED TVs, glass MICRO LED, storefront LED mesh, vitrines, and architectural glass. The same file also fits sparse LED façades and organic LED silhouettes. Glass is the use that makes the format's contract obvious: no point, no pixel, glass stays glass.

2. Why rectangles fail on glass

Cameras, NLEs, and generative video models (including 5th Wall's LTX path) emit $W \times H$ rasters. Containers (MP4, ProRes, HAP) assume a dense frame buffer. That is the right primitive for cinema and for opaque LED walls that are themselves rectangles. It is the wrong primitive for a display whose unused pixels should vanish.

On a transparent OLED or glass LED:

- "Black" is often the most opaque state. A 16:9 slate with a logo in the middle turns the rest of the glass into a dark curtain.
- Letterboxing, unused canvas, and motion outside a painted silhouette all become physical occlusion.
- Designers already fake the idea with keyed black, luma keys, or hand-cut alpha — then lose the key on the next transcode.

The industry already builds shapeless hardware (open LED mesh, transparent cabinets, T-OLED). The media layer is still rectangular. Shapeless video closes that gap.

Opaque TV / LED wall	Transparent / glass TV
Unused pixels = black fill	Unused pixels = nothing (see-through)

Opaque TV / LED wall	Transparent / glass TV
Content lives on a rectangle	Content is the silhouette
16:9 plate hides the room	Glass / room / product stay visible

3. What .5wpv is

A .5wpv file is a ZIP archive:

- manifest.json — fps, canvas size, point radius, provenance
- frames/NNNNNN.bin — packed records (x, y, r, g, b, a) at 8 bytes each

There is no frame buffer. A doughnut is stored as the ring. A floating 5TH WALL mark is stored as the tiles and the wordmark. Interior holes are missing data, not black RGB.

Encoding may start from MP4 + mask because that is what tools produce. The asset is the point list. Readers that only understand rasters can rasterize for debug; that is a preview path, not the identity of the file. Additive manifest keys stay at v1; record-layout changes require v2. Byte-level rules live in FORMAT.md.

Square stamps, not soft dots

Architectural LEDs and many glass cabinets are rectilinear modules. The reference renderer draws each point as an axis-aligned square (Chebyshev coverage) so neighbors with point_radius = 0.5 share edges. Circular kernels look like a phone screen. Square stamps look like tiles.

4. Primary use: transparent TVs and glass

4.1 Product classes

Class	What the viewer should see	What shapeless video supplies
Transparent OLED TV	Picture floating in a room; furniture visible through unused glass	Silhouette-only samples; unused field not encoded
Glass / transparent MICRO LED	Same, at architectural brightness	Point list mapped to the cabinet's pixel map
Storefront LED mesh	Street visible through the screen	Sparse points; no black fill in the mesh gaps
Museum / retail vitrine	Graphic on the glass, object behind	Masked encode from 5th Wall Custom / organic bounds
Scenic / broadcast glass	Lower-thirds and bugs that do not brick the set	Same file; keyed HDMI or native player

4.2 Authoring contract

1. Design the silhouette (logo, product outline, letter, organic brush).
2. Generate or edit motion inside that silhouette (5th Wall Custom / Map video already hard-masks LED bounds).
3. Encode MP4 + mask → .5wpv.
4. Play with the rule: missing sample = transparent.

Generative I2V can stay rectangular. The shapeless step is the delivery encode, the same way print PDFs are not the working Photoshop file.

4.3 Playback on today's glass TVs

Most shipping transparent TVs still ingest HDMI as a rectangle. Shapeless video does not magically change the cable. Three honest layers:

Layer	Role	Status
File	Store only lit samples; preserve silhouette	Implemented (.5wpv v1)
Key / HDMI	Composite points onto black; panel treats black as clear (or a hardware keyer does)	Integrator path; panel-dependent
Native player	Drive the glass pixel map or an RGBA overlay without a black plate	Reference player on Windows (organic HWND); OEM / processor SDK not shipped

The Windows reference player is the existence proof: an organic window cutout means a doughnut has a real hole (desktop shows through). That is the software analog of glass. A short soft feather (default 2 display pixels) keeps the rim from looking like a stair-step.

A production glass-TV take would be: encode .5wpv → either (a) rasterize with true alpha / black-as-clear onto the HDMI input the panel already accepts, or (b) a native reader on the player SoC. (a) ships with current hardware. (b) is the format's long-term home.

4.4 Why not "just use ProRes 4444"?

Alpha video still owns a rectangle. You pay for $W \times H$ every frame, including zeros. Editors fight premultiplication, color-space tags, and players that ignore alpha. .5wpv makes absence structural: there is no sample to mis-composite. For social cutdowns and review, rasterize to PNG/MP4. For the glass, keep the point file.

5. Adjacent uses (same encoder)

Shapeless video was originally drawn for sparse LED: ribbons, letters, irregular canvases, organic masks. Those remain valid.

- Custom / Map LED bounds in 5th Wall already produce masked motion. Encoding that mask to .5wpv drops the black field from disk and from a future processor feed.
- Façade mesh and media façades with large unlit regions.
- Preview windows that should not cover the desktop (current organic player).

Glass TVs are the use case that non-specialists immediately understand. LED sparsity is the use case the format was built for. They are the same geometry problem.

6. Pipeline in the 5th Wall stack

```
Comfy / LTX → Gallery MP4 (rectangle, optionally masked)
               ↓
            shapeless encode (.5wpv)
               ↓
    inspect  play  rasterize
             (organic window)
               ↓
    glass TV / LED (HDMI key now; native map later)
```

fifth_wall_pointvideo is a standalone package. It does not import Flask. Product work still open: Gallery export of .5wpv, Live Take of a point clip, mapper UV as coord_space "uv". Until that lands, encode from the CLI against a Gallery MP4 + boundary mask.

7. What works vs what is WIP

Works today

- Format v1 (ZIP + manifest + 8-byte little-endian points)
- Encode from MP4 or PIL frames, with mask or luma gate
- info, play, rasterize
- Windows organic shaped window (true holes)
- Unit tests without sample media

Open

- First-class 5th Wall Generate → .5wpv and Live Take
- HDMI presenter that keys black-as-clear for a named glass display
- OEM / LED-processor readers
- Streaming transport (files only)
- HDR, genlock, specialized point codecs beyond ZIP deflate

Do not sell those open items as shipping features.

8. Non-goals

- Replacing MP4 for YouTube, Reels, or review-on-a-laptop.
- Replacing browser mesh warp or Ghost Arcade.
- Claiming a particular TV brand's HDMI mode without on-panel verification.
- Shipping a commercial processor SDK in this paper's scope.

9. Success criteria (glass-first)

- Operator path: 5th Wall Custom/organic mask → .5wpv without leaving the app
- Documented HDMI key recipe on at least one transparent OLED or glass LED
- Native or keyed playback at show fps for a typical logo/product silhouette
- Gallery (or sibling export) recognizes .5wpv
- Stable v1 with a second independent reader (even a small one)

10. How to experiment

```
cd fifth_wall_pointvideo
pip install -r requirements.txt
python examples/make_demo.py demo.5wpv
python -m fw_pointvideo play demo.5wpv
python -m fw_pointvideo encode clip.mp4 out.5wpv --mask silhouette.png
python -m unittest discover -s tests -v
```

--no-organic forces a normal rectangle if you need to compare against the old world.

Companion summary: Shapeless-Video-Summary.pdf · Engineering paper: WHITEPAPER_POINTVIDEO.md