ChatGPT

Visual Equations

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Abstract

This white paper converts the supplied equation set into a scholarly design framework for two-dimensional visual systems. The central claim is not that the equations already constitute a verified unified physical theory. The claim is narrower and stronger: findings from holography, distributed memory research, predictive processing, attention science, natural-image statistics, and information theory together support the idea that a static image can be designed as a compressed operational field that shapes reconstruction, prediction, and scanpath behavior in a viewer. Optical holography records phase and amplitude information through interference; digital holography reconstructs complex optical fields from real-domain measurements; engram research supports distributed memory architectures; and attention studies show that gaze is guided not only by salience but also by meaning, task, and rhythmic sampling. [1]

The paper therefore formalizes the supplied equations as a design language, assigns each one an epistemic status, translates them into rendering rules for static images, and supplies text-only case studies, a direct-control mapping for Midjourney [2], and a project-defined GI payload schema. Wherever the framework borrows from established science only by analogy, that limitation is stated explicitly rather than hidden behind theoretical language.

Introduction and Formal Position

The most defensible scholarly position for this project is to treat “images as equations” as a design-programming thesis, not as a metaphysical proof. In that reading, a visual work is successful when local regions reinforce the global composition, when the viewer’s scanpath is guided rather than scattered, when variation is bounded by constraint, and when meaning is compressed rather than merely accumulated. Holography and digital holography supply the model of distributed structural encoding; memory science supplies the model of distributed storage; predictive processing supplies the model of perception as inference; and efficient coding supplies the model of compression under biological and informational limits. [3]

Beginning with Dennis Gabor [4]’s original proposal, holography recorded the interference of a reference wave and an object wave so that phase as well as amplitude could be reconstructed. Contemporary reviews of digital holography and computer-generated holography describe the same basic logic in computational terms: a mathematically generated two-dimensional carrier can reconstruct a higher-dimensional optical field. That does not mean an ordinary poster or interface is literally a hologram. It means the paper is justified in adopting a strict design rule: every region of the image should preserve some ratio, rhythm, direction, or semantic cue that points back to the whole. [5]

Equation naming also matters for veracity. In standard usage, “heliometry” refers to measurement with a heliometer, not to a recognized energy-circulation law in physics. Accordingly, this paper retains “heliometric” only as a project term for orbital or sun-centered circulation behavior in a composition, not as the name of a canonical physical equation. [6]

Equation Framework

For white-paper use, the supplied equations should be divided into four categories. Some are canonical mathematical forms that can be borrowed with little modification. Some are scientifically informed analogies. Some are project-specific heuristics. The final pair are synthetic summary equations useful for design governance but not for scientific explanation. That partition is essential if the paper is to remain honest while still being ambitious. The scientific anchor for this partition comes from established work on holography, contextual measurement, predictive coding, natural image statistics, rhythmic attention, and thermodynamic directionality. [7]

Equation	Working status	Scholarly reading	Immediate 2D design consequence
$H(x) = \sum_{i=1}^{n} h_i(x)$	Adapted analogy	Local patches are treated as distributed carriers of global structure, inspired by holographic recording and distributed engrams	Every quadrant repeats macro proportions, dominant angles, or semantic anchors
$R = f(O, S)$	Adapted analogy	Readout depends on observer model and system state; context affects interpretation	Encode multiple valid readings without losing compositional control
$P(x) = \sum_{n=0}^{\infty} a_n \phi^n(x)$	Project-specific generative expansion	Complexity emerges from recursive basis-like repetition with coefficient control	Build motifs through recurrence plus bounded variation
$E_{\text{system}} = \sum(E_{\text{orbital}} - E_{\text{loss}})$	Project-specific heuristic	Visual stability depends on circulation versus dissipation; “heliometric” is a project term, not a canonical law	Move visual weight in loops; avoid pileups and dead zones
$\Delta S = S_{t+1} - S_t$	Canonical operator with design adaptation	What matters is directional change, not static disorder	Create a readable order-to-noise or noise-to-order gradient
$f_{\text{input}} \approx f_{\text{system}}$	Established physics analogy	Transfer improves when input cadence matches system tolerance	Tune spacing, rhythm, and stripe frequency to perceptual comfort
$\Psi(x, t) = A \sin(kx - \omega t)$	Canonical waveform	Rhythm can stabilize a field through nodes, antinodes, and harmonic repetition	Use oscillatory repetition to anchor perception

Equation	Working status	Scholarly reading	Immediate 2D design consequence
$C = \{c_1, c_2, c_3\}$	Project-specific constraint model	Meaning grows when a system is bounded along a few decisive dimensions	Limit palette, geometry family, and rhythmic family
$L = \int_\gamma F \cdot dl$	Canonical line-integral borrowing	Logic accumulates along a path rather than only at isolated nodes	Draw continuous guidance routes for the eye
$S_{t+1} = S_t + \alpha(O - S_t)$	Canonical update rule with adaptation	Systems converge through repeated correction against a target	Make the image resolve with viewing rather than exhaust itself instantly
$f(\lambda x) = \lambda^k f(x)$	Canonical scaling law	Structural behavior should persist across magnification levels	Micro motifs should echo macro organization
$T' = T + \Delta\phi$	Adapted temporal heuristic	Access can depend on phase or sequence rather than simple order	Reveal layers over time as gaze proceeds
$M = I/C$	Project-specific information heuristic	Meaning rises when information survives constraint and redundancy is removed	Favor symbolic density over decorative excess
$U = H \cdot P \cdot R \cdot E$	Synthetic summary index	Composite score for distribution, recursion, observer coupling, and flow	Use only as a design dashboard, not as a physical law
$\mathrm{Form} = \mathrm{Energy} \times \mathrm{Constraint} \times \mathrm{Resonance}$	Synthetic design maxim	Effective form emerges from flow, limits, and cadence working together	Audit every image for these three variables before finalizing

The safer way to present this framework in a white paper is therefore: Equations 5, 7, 9, and 11 are mathematically standard; Equations 1, 2, 6, 10, and 12 are disciplined analogies; Equations 3, 4, 8, and 13 are project-defined heuristics; Equations 14 and 15 are executive summary equations that organize the system rather than explain nature.

Cross-Disciplinary Grounding

Holography, memory, and distributed reconstruction

Holography is the strongest scientific anchor for Equation 1. Modern reviews describe holography as a method for recording and reconstructing complex optical wavefronts, including phase information, and digital holography explicitly treats recording and reconstruction as transformations between real-domain measurements and complex-domain fields. Computer-generated holography extends that logic by producing algorithmic two-dimensional carriers capable of reconstructing three-dimensional information.

In memory science, a parallel idea appears in different form: engrams are not well described as single-site souvenirs but as distributed assemblies, and a 2022 mapping study identified engram-related activity across many regions for a single memory. Taken together, these literatures support a rigorous design principle: local image segments should not be interchangeable decoration; they should retain partial instructions for reconstructing the larger field. [8]

Prediction, meaning, and scanpaths

Equation 2 becomes usable only if it is purified of mystical claims. Quantum contextuality research describes outcomes as dependent on experimental context and system–apparatus interaction, while measurement theory treats measurement as a physical interaction rather than a detached inspection. In cognition, predictive-coding and predictive-processing literature similarly describes perception as inference under expectation, with scenes and objects understood through statistically structured context rather than passive registration alone. Attention research refines the same point: selective visual attention concentrates processing on behaviorally relevant stimuli; scene gist can be estimated from global image features; and semantic structure, including meaning maps, substantially guides eye movements in real-world scenes. A visual system built from Equation 2 should therefore not aim for one frozen interpretation. It should aim for controlled multiplicity: enough ambiguity to sustain re-reading, but enough constraint to prevent collapse into noise. [9]

Efficient coding, fractal structure, and scale

Equations 3, 11, and 13 are best grounded in efficient-coding and natural-image-statistics research. Reviews of sensory coding argue that nervous systems are adapted to the statistics of natural signals, and predictive coding has been described as a unifying framework for redundancy reduction and efficient coding. Work on natural image statistics links visual representation to structured regularities in natural scenes rather than arbitrary pixel distributions. In visual-art analysis, Koch and colleagues found that art images and natural scenes share power-law spectral structure with scale-invariant characteristics. Fractal-based design studies further report that self-similar patterning influences preference, engagement, and some restorative judgments in built environments. Benvenuti and colleagues add a crucial perceptual bridge by showing evidence for a distributed coarse-scale representation that may contribute to scale-invariant visual capabilities. The design consequence is direct: a viable equation-based image should repeat structural logic across scale without forcing literal duplication. [10]

Entropy, path, and oscillation

Equations 5, 7, 9, and 10 concern directed change. Thermodynamic accounts of entropy emphasize not entropy as a static noun but entropy increase and movement toward equilibrium; path-integral formulations describe evolution through a sum over paths; standing waves arise when waves of identical frequency travel in opposite directions and interfere; and rhythmic attention models propose that attentional sampling is periodically structured rather than temporally uniform. When a static composition borrows from these literatures, the result should be a field with direction, nodes, and recurrence. The image must guide the eye through ordered entry, controlled dispersion, and return. In other words, the perceptual experience should feel less like random inspection and more like a bounded dynamical traversal. [11]

Translation and Case Studies

The translation layer converts variables into carriers that a static image can actually implement. This section treats the image as a field of constraints, gradients, and return paths rather than as a list of objects. That move is supported by Gestalt grouping research, gist-based scene recognition, semantic guidance of gaze, and scanpath modeling. A strong image does not just contain elements. It computes a route among them. [12]

Variable	Primary visual carrier	Secondary carrier	Practical rule	Common failure
Energy	Luminance contrast	edge strength	circulate contrast around the field; do not dump it in one corner	a dead, collapsed focal pile
Probability	motif recurrence	controlled jitter	repeat with variation, not with randomness	ornamental clutter
Entropy gradient	texture density	irregularity	stage roughness directionally	evenly noisy surfaces
Resonance	spacing interval	cadence	keep repeated intervals within a limited family	rhythm drift
Standing wave	alternating nodes	symmetry breaks	build harmonic anchors and release points	monotony or chaos
Constraint	palette bound	geometry family	decide what stays fixed before adding details	endless optionality
Scale invariance	repeated ratios	angle families	echo the whole inside the part	micro details unrelated to macro form
Feedback convergence	progressive sharpening	layered legibility	make the image resolve as gaze cycles	instant exhaustion or permanent vagueness
Meaning density	symbolic compression	multi-use forms	let one mark do more than one job	over-literal labeling

Text-only diagram for a closed scanpath:

```
entry cue → primary node → secondary node → peripheral counterweight
    ↑                                                    ↓
    └──────────── semantic return arc / legend path ─────┘
```

Text-only diagram for macro–micro echo:

```
macro ring
  └─ meso motif
      └─ micro glyph
           ↺ repeats the macro angle, spacing, and contrast ratio
```

A technical diagram

Consider a conventional left-to-right process chart. Most such diagrams fail because energy accumulates at the beginning, arrows merely connect labels, and the eye exits the chart after one pass. An equation-based redesign would place the dominant process node near the visual center, wrap inputs and outputs on an orbital path, and let local icons repeat the same angle family and contrast ratio used in the frame. Equation 5 provides a directional entropy gradient from summary to detail. Equation 9 turns the arrows into a continuous guidance field rather than isolated pointers. Equation 10 adds resolution layers so that the first glance reads gist and the second glance reads mechanism. The result is a diagram that remains static but behaves sequentially. [13]

Text-only layout sketch:

```
[input cluster] → (central transformation node) ↺ → [output cluster]
      ↘                ↑        ↓                    ↗
        [metric] ---- return path / legend ---- [exception]
```

A figurative painting

Now consider a painting with a central subject and a turbulent background. Instead of treating the background as expressive residue, the framework reinterprets it as a recursive probability field. Subject contours become standing-wave nodes. Brush clusters in the periphery repeat, at lower amplitude, the macro spiral or radial proportions surrounding the figure. Constraint is enforced by limiting palette, angle family, and mark vocabulary. Meaning density is increased by giving each secondary stroke at least two functions: local texture and directional cue. The point is not to sterilize painting into mathematics; the point is to make every mark legible as both sensation and instruction. Research on semantic guidance, Gestalt grouping, and fractal preference all support the idea that coherence and controlled complexity can coexist when local elements participate in an organized global structure. [14]

Text-only layout sketch:

```
peripheral counterweight      horizon arc      peripheral counterweight
           \                      |                        /
            \                (subject node)              /
             \_____________ micro marks echo _____________/
                          the macro spiral
```

A task-driven interface

In a user interface, Equation 2 is especially useful. A button is not merely a visible rectangle; it is part of an observer-dependent route shaped by expectation, task, and prior knowledge. Equation 13 therefore becomes a governance rule: the interface should maximize decision-relevant information per unit of constraint. That usually means one dominant action, a small number of stable landmarks, and a hierarchy that allows global gist within a glance. Equations 6 and 10 then govern cadence and convergence: repeated spacing families reduce perceptual friction, and progressive disclosure prevents early overload while preserving depth for later passes. Studies of selective attention, scene semantics, and predictive processing support exactly this move from object accumulation to route design. [15]

Text-only layout sketch:

```
top band:   gist / state / orientation
left rail:  stable landmarks
center:     primary action node
right rail: explanation / consequence
bottom:     persistent return cue
```

Generative Control Layer

For direct-control generation in Midjourney [2], official documentation currently states that aspect ratio changes canvas proportions; `--stylize` controls literalness versus artistic freedom from 0 to 1000 with default 100; `--chaos` ranges from 0 to 100 and increases variety; `--quality` in V7 defaults to 1 and also allows 2 and 4; `--seed` locks a starting point; `--tile` creates seamless repetition; image prompting uses `--iw` and V7 documents a range of 0–3; style references use `--sw` with a 0–1000 range and default 100; `--no` excludes elements; `--weird` is experimental up to 3000 and is not fully compatible with seeds; omni references use `--ow` from 1 to 1000 with default 100; and the current default version is V7, although V8.1 is now available as a selectable version. The ranges below are therefore house recommendations inside the documented bounds, not claims that the platform itself recommends those exact settings. [16]

Design intention	Prompt move	Recommended parameter envelope	Operational logic
Lock the global field geometry	specify radial, spiral, orbital, or interference structure early in the text	`--ar 4:3`, `3:2`, or `16:9`; fixed `--seed`	stabilizes large-scale topology
Increase literal structure	shorten prompt and reduce ornamental language	`--stylize 25–125`	keeps Equation 8 dominant
Permit controlled generative flourish	add medium/style terms after structure terms	`--stylize 150–400`	increases variation without discarding form

Design intention	Prompt move	Recommended parameter envelope	Operational logic
Build recursive probability fields	repeat motif terms with weights	`motif::2 field::1`; `--chaos 10–35`	supports Equation 3
Produce seamless “whole in every tile” textures	describe repeating lattice or cellular field	`--tile`	useful for distributed fields and pattern tests
Preserve an uploaded structural reference	use an image prompt plus text prompt	`--iw 1.5–3`	lets the reference constrain composition
Preserve style family across outputs	attach a style reference or code	`--sref <code>` and `--sw 100–300`	stabilizes aesthetic envelope
Preserve a specific object or icon form	attach omni reference plus descriptive text	`--oref <url>` and `--ow 100–300`	useful for recurring symbolic objects
Induce bounded ambiguity	combine competing weighted clauses	`A::1 B::1 --weird 250–1000`	can produce multistable readings
Remove avoidable entropy	explicitly exclude clutter	`--no watermark, extra text, duplicate objects`	supports Equation 13
Add first-pass refinement	rerun with higher resource use	`--quality 2` or `4`	strengthens micro echoes of the macro field

A direct prompt template for this framework looks like this:

```
radial standing-wave infographic, central process node, distributed peripheral echoes, controlled entropy gradient from center to edge, recursive micro motifs repeating macro geometry, limited three-color palette, semantic return arc, high meaning density ::2 decorative clutter::-0.5 --ar 3:2 --stylize 125 --chaos 18 --quality 2 --seed 238711
```

A seamless field template looks like this:

```
interference lattice, holographic tile logic, self-similar micro glyphs echoing macro spiral, bounded palette, low text clutter, balanced orbital energy circulation --tile --stylize 90 --chaos 12 --seed 238711
```

GI payload schema

Because no broadly adopted “GI payload” standard emerged from the literature gathered for this paper, the term is defined here operationally as **Generative Image payload**: a text-first, versioned sidecar manifest that preserves the equation set, its epistemic status, its rendering bindings, and its accessibility layer. For the present project, the payload should be explicit and readable. If it is ever embedded inside image metadata or steganographic layers, it should still have a plaintext mirror so it remains fully translatable to audiobook workflows.

```yaml
gi_payload:
  version: "1.0"
  type: "visual-equation"
  title: "Visual Equations"
  authors:
    - "Noel Michael Conrad"
    - "OpenAI"

  epistemic_status:
    canonical_equations: [5, 7, 9, 11]
    adapted_equations: [1, 2, 6, 10, 12]
    heuristic_equations: [3, 4, 8, 13]
    synthetic_equations: [14, 15]

  dominant_equations:
    "1": 0.85
    "2": 0.70
    "5": 0.60
    "6": 0.55
    "10": 0.75
    "13": 0.90

  field_map:
    energy:
      luminance_profile: "center-high / edge-moderate"
      contrast_route: "clockwise orbital loop"
    probability:
      motif_repeat: 0.62
      variation_jitter: 0.18
    entropy:
      gradient_direction: "center-to-edge"
      noise_budget: 0.12
    resonance:
      spatial_frequency_band: "mid"
      cadence_family: "3-beat"
    scale:
      macro_micro_echo: true
```

```yaml
topology:
  geometry: "radial_spiral_hybrid"
  primary_node: "center"
  secondary_nodes: ["upper-left", "lower-right"]
  return_path: "closed semantic arc"
  dead_zones: []

constraints:
  palette_count: 3
  shape_families: 2
  rhythm_families: 1
  max_symbol_classes: 6

observer_model:
  entry_points: ["upper-left", "center"]
  expected_readings: 2
  dwell_targets: ["primary_node", "return_legend"]
  ambiguity_tolerance: 0.35

prompt_bindings:
  generator: "midjourney_v7_or_v81"
  text_prompt_core: ""
  parameters:
    aspect_ratio: "3:2"
    stylize: 125
    chaos: 18
    quality: 2
    seed: 238711

accessibility:
  alt_text: ""
  audio_description_outline:
    - "state the global shape"
    - "name the primary node"
    - "describe the scanpath"
    - "describe repeated micro motifs"
  glossary:
    energy: "visual force or weight"
    entropy: "increase in irregularity"
    resonance: "repeat interval that feels stable"

provenance:
  source_type: "white_paper"
  citation_manifest: []
  checksum: ""

validation:
  scanpath_goal: "closed_loop"
```

```
    spectral_target: "1/f-like"
    dead_zone_threshold: 0.10
    observer_test: "eye_tracking_or_expert_review"
```

This schema is intentionally plain-English and text-forward. The most important fields are `epistemic_status`, which prevents theory inflation; `field_map`, which converts equations into actual visual properties; `observer_model`, which forces attention to route design; `accessibility`, which keeps the system translatable to audio; and `validation`, which makes testing explicit rather than ornamental.

Open questions and limitations

The principal limitation of this white paper is that several equations are design equations, not experimentally validated scientific laws. Equations 14 and 15 are summary indices. Equation 4 uses a project-specific sense of "heliometric." Equation 2 should not be read as evidence for consciousness-based quantum collapse. And any claim that a given image truly "executes" in a viewer must ultimately be tested with eye-tracking, fixation prediction, task performance, or spectral analysis rather than assumed from rhetoric alone. Reviews of predicted fixations and official generator documentation also imply a second limitation: practical outputs will vary with model version and rendering stack. [17]

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