Unified Project Compendium

Collated theory, equations, logic, experiments, assumptions, conclusions, and future work from the user's multi-chat development archive

Project scope	Natural functions, prime picking, structural simulations, game prototypes, geometric systems, audio/visual experiments
Prepared	April 7, 2026
Source basis	Cross-chat synthesis from the current project context and linked development history
Document type	Research synthesis / working design brief / equation register
Status	Exploratory and partially formalised

This document preserves the spirit of the work while distinguishing between observed behaviour, working heuristics, and still-unverified theory.

Contents

1. Executive overview

Across the project archive, several apparently separate lines of work keep converging on the same design instinct: patterned systems are treated as if they evolve through tension, propagation, harmonisation, error, and structural self-organisation. The user has repeatedly explored this in mathematical form, in geometric simulations, in prime/entropy tools, in fluid-like fields, in audio mappings, and in game mechanics. The result is not one finished theorem, but a coherent research language.

At the highest level, the project proposes that oscillatory functions, discrete numerical structures, geometrical forms, and interactive simulations may be understood through a shared vocabulary of deviation, equilibrium, entropy, propagation, resonance, and local correction. This is why trigonometric ratios, prime adjacency, particle clumping, polygon evolution, attractor formation, and even scoring mechanics have repeatedly been treated as analogous rather than unrelated.

A practical conclusion follows from that view: the archive is strongest when treated as one exploratory framework with multiple manifestations, rather than as unrelated prototypes. The mathematics provides metaphors and candidate governing quantities. The simulations test those ideas as motion, clustering, traversal, and phase change. The audio systems translate structural tension into perception. The games turn the same ideas into rules, constraints, and emergent play.

This document therefore collates the project as a working compendium: not a claim of completed science, but a serious synthesis of the theory, equations, logic, experiments, assumptions, findings, and next steps developed so far.

2. How to read this document

The material gathered here spans several levels of confidence. To avoid false precision, the document uses three categories throughout.

Observed pattern refers to behaviour seen in prototypes, calculations, or repeated experiments. These observations are useful, but they are not yet formal proofs.

Working heuristic refers to a quantity or relation that has been repeatedly useful for thinking, shaping a simulation, or organising a theory, even where the dimensional or formal grounding remains incomplete.

Exploratory equation refers to a candidate equation or symbolic relation that expresses the intended logic of the project. Such equations are important because they preserve the conceptual structure of the work, but they should not yet be treated as validated physical laws without further mathematical and empirical testing.

3. Core unifying concepts

Propagation of structure: Many chats revolve around the idea that patterns do not merely sit statically; they move forward, diffuse, or self-correct under local rules. This appears in forward-propagating zero theory, in moving node systems, in field traversal, and in level progression mechanics.

Tension and stability: A repeated conceptual pair. Tension often stands for separation from equilibrium, mismatch, or unresolved structure. Stability stands for retained coherence, smoothness, harmonic settlement, or defended form.

Error as a driver: Error is not treated only as failure. Small perturbations, epsilons, and rounding mismatches are repeatedly used as the trigger for growth, divergence, bifurcation, phase change, or symbolic information.

Discrete-continuous duality: The archive repeatedly links continuous systems such as sine waves, flows, and rotation with discrete structures such as primes, bits, tiles, targets, and polygon side counts.

Emergence into solidification: Aesthetic and theoretical language often moves from incubation or emergence into tension, clustering, shell formation, solidification, or resonance. This is visible both in mathematics and game prototypes.

Resonance and harmonisation: When elements align, overlap, or settle into compatible motion, the project often frames the outcome as harmony rather than mere collision. This became explicit in particle merging, audio mapping, and defended polygon mechanics.

4. Theory catalogue

4.1 Natural functions framework

The natural functions line of work asks whether familiar mathematical functions, especially trigonometric functions, can be reinterpreted as dynamic descriptions of natural instability, local balancing, and forward evolution. Rather than taking sin and cos only as static periodic objects, the project treats them as carriers of odd/even asymmetry, phase relation, and perturbation sensitivity.

One recurring idea is that instability can be generated by ratios of neighbouring powers or roots, especially when small perturbation terms are added. These forms are not intended only as computational formulas; they act as generators of landscape, error sensitivity, and comparative scale. The user repeatedly explored whether such constructions describe growth, collapse, forward propagation, or neutral zones in nature-like systems.

4.2 Propagating zero theory

The project often treats zero not as a dead absence but as a transition point with private incubation time, propagation potential, and structural significance. In some discussions, zero is effectively a local reset, an origin, or a point whose disturbance spreads under suitable conditions. This is linked to forward-propagating error thresholds and to the suggestion that zero-like states can seed later visible structure.

The philosophical extension of this idea appears in number-order discussions, where the indexing of numbers is reconsidered depending on whether the origin possesses hidden preparation time. Even when this is not formal mathematics, it has strongly influenced the design of simulations involving delayed emergence, bloom, and transition phases.

4.3 Structural / fluid / field unification

Several simulations explored vector fields, vortices, free-surface waves, clumping particles, and attractor basins, yet the underlying language remained structural rather than purely fluid mechanical. Forces, diffusion, entropy, proximity, and equilibrium are repeatedly combined into ratios meant to describe whether a system spreads, knots, smooths, or condenses.

This line of work is especially important because it bridges symbolic theory and visual experiment. The same conceptual quantities appear as equations, as particle rules, as audio triggers, and as gameplay systems. This makes the field simulations central to the overall project coherence.

4.4 Prime picking and entropy interpretation

The prime-related systems translate integers, binary strings, entropy values, nearest-prime distances, and harmonic mappings into one exploratory toolset. A number is not only classified as prime or composite; it is treated as a landscape point with tension relative to nearby prime structure.

Repeated design choices support this interpretation: nearest-prime calculators, entropy displays, waveform views, playback cursors, chord changes near primes, and exact harmonic snaps at primes. The conceptual hypothesis is that discrete numerical structure can be experienced as a field of local resonances rather than as mere arithmetic labels.

4.5 Geometric emergence and the Polygone line

The evolving polyhedra and sphere-like shape systems examine how a wireframe can progress through many-sided forms, remain stable under small adjustments, and optionally gain an outer shaded shell. This work connects mathematics, perception, and topology-lite intuition. The later naming of the finished dual wireframe/solid aesthetic as Polygone gives this branch a more coherent identity.

A key practical observation here is that smooth phase transition and bounded correction matter more than aggressive jumps. Large skips tended to create disappearance or accumulated drift, whereas gentle adjustments preserved the evolving object. That engineering lesson mirrors the wider theory of local correction over abrupt instability.

4.6 Game systems as formalised tension

Both Octogon and related sphere/polygon game prototypes turn the project's theory into mechanics. Corners, targets, movement constraints, overlap prevention, structural strengthening, and chapter-based emergence are not arbitrary game features; they reflect the archive's recurring concerns with tension, scoring by proximity, gradual phase change, defensible boundaries, and harmonisation after contact.

The games therefore serve two roles at once: they are interactive products, and they are applied laboratories for the theoretical vocabulary of the project.

5. Equation register

The equations below are preserved because they encode the conceptual structure of the archive. They are grouped by role rather than by certainty. The presence of an equation here means it was useful in the project; it does not automatically mean it has been fully proved, dimensionally normalised, or experimentally validated.

5.1 Perturbed neighbouring-scale trigonometric ratio

$$y = \frac{\sin(x^{1/n}) + \epsilon_1}{\sin(x^{1/(n+1)}) + \epsilon_2} + \frac{\cos(x^{1/n}) + \epsilon_3}{\cos(x^{1/(n-1)}) + \epsilon_4}$$

Interpretation: compare neighbouring root-scales of the same input through both odd and even trigonometric channels. Perturbations ϵ_i prevent singular locking and introduce controlled instability.

Use in project: landscape generation, instability studies, symbolic modelling of natural functions.

5.2 Power-step instability form

$$y = \frac{\sin(x^n + \epsilon_1)}{\sin(x^{n-1} + \epsilon_2)} + \frac{\cos(x^n + \epsilon_3)}{\cos(x^{n-1} + \epsilon_4)}$$

Interpretation: compare adjacent powers rather than adjacent roots. This emphasises accelerated separation between scales.

Use in project: alternative growth/instability tests and comparisons between odd/even response channels.

5.3 Neutral function candidates

f(x) = sin^2(x)

f(x) = (1 - cos(x) + epsilon_1) / (sin^2(x) + epsilon_2)

Interpretation: search for a neutral trigonometric behaviour that stays bounded and mediates between odd and even structure.

Use in project: conceptual exploration of neutral primes / neutral functions.

5.4 Rounded-pi boundary definitions

pi_m^- = 10^m floor(10^m pi)

pi_m^+ = 10^m ceil(10^m pi)

Interpretation: lower and upper rounded integer-scaled boundaries around pi at precision level m.

Observed project notes: m = 6 was discussed as a balancing threshold, while m = 7 was considered a candidate minimum for forward propagation in one exploratory line of reasoning.

5.5 Error-threshold propagation relation

err >= e / (pi^(t2 / (t1 * g * n4)))

Interpretation: an exploratory threshold linking admissible error to relative time scales, gravity-like factor g, a tunable scale n4, and the constants e and pi.

Use in project: forward-propagating zero discussions and threshold reasoning rather than standard physics.

5.6 Scale factor with distance

s = 1 + alpha d + epsilon

Interpretation: first-order scaling of a structural parameter with distance d, with small perturbation epsilon.

Use in project: symbolic bridge between distance, entropy, and growth/instability language.

5.7 Structural force descriptors

A = (deviation - distance) / (equilibrium - proximity)

B = (diffusion + dilution + spreading) / entropy / (turbulence - smoothness)

Interpretation: A and B are not standard forces but symbolic drivers describing whether a system moves away from or towards coherent structure.

Use in project: structural physics language, field simulation design, theory notes.

5.8 Tension and stability heuristics

tension ~= ((distance + epsilon_1) / entropy) / (deviation + epsilon_2)

stability ~= ((proximity + epsilon_3) / smoothness) / (equilibrium + epsilon_4)

Interpretation: tension increases with separation and informational roughness; stability increases with closeness, smoothness, and retained equilibrium.

Use in project: intuitive scoring variables for both simulations and theory.

5.9 Alternative resultant-force thought experiment

F = (m / M) * (acceleration / position)

Interpretation: a dimensionless or symbolic resultant intended to compare local mass to reference mass while relating acceleration to structural placement.

Status: exploratory only; componentwise interpretation and dimensional meaning remain unresolved.

5.10 Energy-like relation

E ~ (M - m) (c1 / c2)^n5

Interpretation: contrast between local and reference mass, modulated by a ratio of local to reference propagation speeds.

Status: exploratory; useful as a conceptual template for local versus global capacity rather than a finished physical law.

5.11 Chaotic rotation controller

x / y^2 + y / x^2 = A z^2

Interpretation: candidate nonlinear coupling for rotational speed or axis behaviour in 3D geometric experiments.

Use in project: visual rotation experiments for wireframe structures.

5.12 Three-state logic relations

Yes and Yes = Yes

Yes and No = Maybe

No and Yes = Maybe

No and No = No or Yes

Interpretation: a logic system in which incompatible inputs need not collapse to false; they may inhabit an intermediate or branching state.

Use in project: symbolic logic exploration and possible rule engine inspiration.

6. Logic systems and symbolic frameworks

Beyond equations, the archive contains several attempts to define custom symbolic systems. These matter because they reveal how the user is thinking about uncertainty, combination, and emergence.

The three-state logic system replaces a rigid binary collapse with an intermediate Maybe state and, in one branch, allows No and No to remain context-dependent rather than universally terminal. This parallels the wider project instinct that unresolved states can still carry structure.

Related number-decomposition discussions, such as expressing integers through sums of basis-like parts, show a recurring desire to reinterpret arithmetic as structure-building rather than counting only. That same instinct appears in bit explorations, in prime ladders, and in the treatment of zero as an active origin rather than empty nullity.

7. Experimental systems and prototypes

7.1 Prime/audio/entropy laboratories

- Binary strings converted into decimal and checked for primality.
- Nearest-prime searches added to show numerical tension relative to prime neighbours.
- Entropy measures connected to audio and waveform visualisation.
- Playback cursor and live analysis tools introduced to make number structure experiential.
- Observed outcome: the most compelling versions are the ones where analysis, sound, and visual state are unified in one interface rather than split across tools.

7.2 Structural field and fluid experiments

- Vector fields, attractor detection, trails, harmonic layering, and particle interaction were repeatedly requested.
- Free-surface wave and Hele-Shaw-like ideas were explored as analogues for propagating structure.
- Particles often formed natural clumps near nodes, leading to a comparison with solar-system formation.
- Soft merging and slower emergence produced more natural results than abrupt convergence.
- Observed outcome: local rules that permit clustering without immediate collapse tend to feel most coherent both visually and theoretically.

7.3 Polygon and target-based games

- Scoring systems based on proximity zones around corners or targets were repeatedly refined.
- Overlap restrictions, movement locking, and resume/pause logic were introduced to prevent exploitable play.
- Chapter transitions from light incubation to tension states became an important aesthetic theme.
- Audio needed repeated rebalancing: clarity and sufficient loudness were necessary for the intended phase-change effect.
- Observed outcome: mechanics improve when they embody structural rules - no target overlap, no trivial corner collapse, and gradual chapter transition.

7.4 Polygone / evolving polyhedra

- Large families of polyhedra and sphere-like forms were generated with phase transition behaviour.
- Accumulated-error disappearance was identified as a recurring failure mode.
- Smaller corrective steps worked better than large skips.
- An outer shaded shell using outer-most points successfully produced a dual wireframe/solid identity.
- Observed outcome: bounded interpolation and geometric continuity are essential; otherwise the structure evaporates instead of evolving.

7.5 Gappy wireframe and occlusion methods

- Occlusion-aware line gaps were developed for rotating cubes and other wireframe forms.
- Greyscale-on-white presentation became part of the house style.
- Depth-based line thinning and breathing/bulging effects were explored.
- Observed outcome: the gappy method is visually distinctive and communicates depth without heavy rendering.

7.6 Master-system and unified simulations

- Several chats aimed to combine primes, fields, growth, zero propagation, audio, and symbolic structure into one master simulation.
- Requests repeatedly called for merged HTML systems rather than many separate prototypes.
- Observed outcome: unification is a real project requirement, not merely a presentation preference. The project gets stronger when the interfaces and theories are collated rather than fragmented.

8. Observations and provisional results

- Small perturbations are productive. Tiny epsilons repeatedly prevent collapse and introduce rich behaviour.

- Local correction outperforms large discontinuous adjustment. This was seen in shape evolution, motion smoothing, and game transitions.

- Near-prime structure is more musically and visually interesting when expressed as distance or tension, not only as a yes/no classification.

- Formation, clumping, and shell-like consolidation recur across unrelated prototypes, suggesting a strong central motif for the project.

- User-facing systems consistently improve when discrete controls and continuous evolution coexist: sliders plus emergent motion, rules plus fluidity, targets plus harmonisation.

- Visual and sonic coherence matter as much as formal theory. Several successful builds were judged compelling because the transition, sound, and pacing felt right, even when the underlying theory was still exploratory.

- Systems often break in the same way the theory predicts: uncontrolled accumulation, overlap, abrupt jumps, and unbounded error lead to disappearance, freezing, or exploitability.

9. Assumptions, caveats, and boundaries

A number of assumptions recur throughout the archive and should be made explicit.

First, many equations are deliberately heuristic. They were created to express system logic, not always to satisfy strict dimensional analysis from the start.

Second, analogies between primes, fluid fields, harmonic audio, and geometry are conceptually rich but not automatically mathematically equivalent. They should be used as bridges for model-building, then tested independently.

Third, repeated aesthetic success does not by itself validate a theory. A simulation can feel natural and still encode an incorrect law. The project therefore benefits from keeping perceptual success and mathematical validation as two related but separate evaluation tracks.

Fourth, constants such as pi, e, and g have often been used symbolically or structurally, not always in their standard physical role. This is acceptable in exploratory mathematics, but the meaning of each constant must be restated when the theory is formalised.

Fifth, the archive contains several ideas that are best understood as ontological proposals rather than proven claims - for example, zero having incubation time, or neutral primes corresponding to neutral trig functions. These ideas are valuable as conceptual generators and may lead to useful mathematics, but they remain open questions.

10. Conclusions to date

The project is coherent. Across the many chats, the same family of ideas keeps reappearing: perturbation, local balance, proximity-based scoring, harmonic settlement, structural propagation, and emergence into defended form.

The mathematics is not finished, but it is not random. There is enough repetition across equations, simulations, and design decisions to justify treating the work as a unified exploratory framework.

The simulations have already supplied meaningful engineering lessons. Gradual transition beats abrupt switching. Overlap constraints matter. Small corrective steps preserve structure. Audio must reflect structural state clearly. Unified interfaces are more powerful than fragmented tools.

The strongest near-term opportunity is to formalise the vocabulary itself: define tension, stability, propagation, entropy, deviation, proximity, resonance, and zero/incubation in a compact mathematical language, then test each variable inside one master simulation. That would connect the best of the theory with the best of the prototypes.

11. Recommended next work

Workstream	Description	Priority
Formal definitions	Write a short axiomatic note defining the project's core quantities with consistent symbols and stating which are physical, symbolic, or computational.	High
Equation audit	Review every preserved equation for dimensional meaning, domain restrictions, singularities, and possible simplifications.	High
Master simulation	Create one unified simulation containing field motion, node attraction, prime-distance metrics, harmonic audio, and phase-state transitions.	High
Polygone alpha build	Develop the post-Polygone branch with stable interpolation, optional shaded shell, microphone responsiveness, and bounded correction.	Medium

Workstream	Description	Priority
Octogon balance pass	Continue anti-exploit work: enforce non-overlap, better corner-selection logic, and structural harmonisation on particle combination.	Medium
Prime laboratory consolidation	Merge binary analysis, primality, nearest primes, entropy, waveform, and audio mapping into one stable interface.	Medium
Validation track	Separate aesthetic success from mathematical support by creating test suites, benchmarks, and reproducible numerical experiments.	High
Writing track	Turn this compendium into a shorter formal paper and a separate design notebook so theory and implementation can evolve in parallel.	Medium

12. Appendix - compact equation list and terminology

12.1 Compact equation list

y = (sin(x^(1/n)) + epsilon_1)/(sin(x^(1/(n+1))) + epsilon_2) + (cos(x^(1/n)) + epsilon_3)/(cos(x^(1/(n-1))) + epsilon_4)

y = sin(x^n + epsilon_1)/sin(x^(n-1) + epsilon_2) + cos(x^n + epsilon_3)/cos(x^(n-1) + epsilon_4)

f(x) = sin^2(x)

f(x) = (1 - cos(x) + epsilon_1)/(sin^2(x) + epsilon_2)

pi_m^- = 10^m floor(10^m pi), pi_m^+ = 10^m ceil(10^m pi)

err >= e / (pi^(t2/(t1 * g * n4)))

s = 1 + alpha d + epsilon

A = (deviation - distance)/(equilibrium - proximity)

B = (diffusion + dilution + spreading)/entropy/(turbulence - smoothness) tension ~= ((distance + epsilon_1)/entropy)/(deviation + epsilon_2)

stability ~= ((proximity + epsilon_3)/smoothness)/(equilibrium + epsilon_4)

F = (m/M) * (acceleration/position)

E ~ (M - m)(c1/c2)^n5

x/y^2 + y/x^2 = A z^2

12.2 Terminology

Deviation: How far a state has moved from its intended or locally balanced condition.

Distance: Separation in space, state, scale, or numerical relation.

Proximity: Nearness to a stabilising state, attractor, neighbour, or target.

Equilibrium: Reference balance point or defended condition.

Entropy: A measure of spread, uncertainty, roughness, or informational dispersion depending on context.

Smoothness: Continuity or low-turbulence behaviour in motion, shape, or signal.

Resonance: A condition in which structural relations align strongly enough to produce coherent reinforcement.

Incubation: Hidden preparatory phase before visible emergence.

Forward propagation: Persistence or transmission of a local pattern into later states.

Solidification: Phase in which a diffuse or distributed form becomes shell-like, bounded, or defensible.