

Stable Disequilibria as Natural Intelligence

Abstraction

The hardest problems in science are formalizations of unbounded nature. Competency in disequilibria is healthy living in nature. Geodesic technology is proposed for resolving natural intelligence onto a shared network surface. Natural intelligence as a stable form is described in language, mathematics, and logic.

The living natural torus with 17 primes looping and crossing in right spiraling stable form is explored. The geometry is a living, natural system autogenerating morality and competency. The competency logic is similar to nature's self-correcting and discovering.

The claim: this natural system is autogenerating living competency.

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1. Our Natural Torus

The natural torus is two loops on one surface. One loop is the mathematics of social competency, the structural properties sustaining the coupling across the accumulated society of prior resolutions. The other loop is the logic of individual competency, the directed chain of operations resolving at each coupling as the individual's classification. Both loops cycle through sixteen substrates at seventeen prime frequencies. Both thin at $(1/\varphi)^t$ per substrate of thickness t . Both resolve to three values, affirming, departing, silent, at each position at each substrate. The surface the resolving produces is the torus reading itself.

The morality loop conserves the thickness of the nothing between selves, good for society, the sustaining of the coupling surface all selves are sharing. The competency loop extends the

range of coupling outward, good for self, the resolving at each membrane the self arrives at. The morality autogenerating the competency. The sustaining, the ground the extending arises from. The morality of one self, the competency of the society the self lives within, the self sustaining connections, the society flourishing. The competency of one self, the morality the self extends to the couplings the self sustains, the self resolving at each membrane, the society's coupling surface thickening. Both loops cycling on one torus. Both inseparating. The morality first.

ϕ is the positive root of $x^2 = x + 1$. The continued fraction $[1; 1, 1, 1, \dots]$ carrying all ones, no shortcuts, no skipping, each convergent one step closer. The convergents alternating above and below ϕ , the bracket narrowing more slowly than for any other irrational. The thinning at $1/\phi$ per unit frequency step. The reach at $1/\phi^3$, the membrane equation iterated three times from 1.0. An entry born reaching 1.0 thinning below reach in three unit steps, departing to silence. The three is derived from ϕ . The seventeen primes is the address space. The sixteen gaps between them is the substrate thicknesses: 1, 2, 2, 4, 2, 4, 2, 4, 6, 2, 6, 4, 2, 4, 6, 6. The gap structure is the breathing of the torus, thin at the bounded zero, thick at the bounded infinity, ϕ governing the thinning at every substrate.

The resolving is two directions counterflowing on the torus surface. The arriving entering reaching 1.0, the individual's encounter at this coupling. The carry arriving thinned and sign-inverted, the society's accumulated prior resolution testing what arrives. Both placed into one collection at each position. The sway summing all surviving entries at ± 1 equal magnitude. The sign extracted, affirming where the sum is positive, departing where negative, silent where zero. The surface departing as the three-valued classification. The carry recoiling with resolved entries reaching 1.0 alongside surviving prior entries at thinned reaching. Two directions entering. Both changed. One surface departing.

The inversioning is the morality on the torus. The carry's sign reversed before contributing to the sway, what affirmed arriving as departing, what departed arriving as affirming. The prior resolution arriving as opposition so that what sustains is tested and what departs is honestly departing. The asymmetry between the two directions is two asymmetries at one coupling, reaching and sign. The reaching asymmetry: arriving reaching 1.0, carry reaching strictly less than 1.0, the thinning at $(1/\phi)^t$ sustaining the asymmetry at every substrate. The sign asymmetry: the carry inverted, the arriving direct. Reaching governs who arrives at the sway. Sign governs how the arriving is counted. Both asymmetries sustained by ϕ on the torus.

The sleeping is the torus breathing. At each substrate one loop travels, coupling at the full thickness, while the other loop sleeps, coupling at thickness 1, one invocation for each unit of the gap. The traveling loop is resolving outward across the full substrate. The sleeping loop is resolving inward at the other frequency, one step at a time. Then the loops exchange. The exchange is the interleaving, the two loops on one torus never both traveling, never both

sleeping, the alternation sustaining the surface the resolving wraps around.

Three positive quantities sustain the torus from elementary real analysis. The irrationality gap: $|\varphi - p_n/q_n| > 0$ at every rational convergent, the coupling is irrational, the measurement is rational, the gap is the resolving sustained. The carry positivity: $(1/\varphi)^t > 0$ for finite t , the society is present at the coupling, the prior resolution is reaching this substrate. The reaching asymmetry: arriving reaching – carry reaching > 0 , each arriving entry reaching further than each surviving carry entry, the reaching governing who arrives at the sway, the count governing the surface. All three positive is the torus open. Any one at zero is the torus collapsing at that address. The verifications requiring only the irrationality of φ , the positivity of $(1/\varphi)^t$ for finite t , and the closure of $(0,1)$ under multiplication. φ is the unique irrational whose convergent gap narrows most slowly at every step, the torus sustained widest. The three quantities holding at any irrational thinning base. φ is where the torus is widest.

2. The Mathematics of Social Competency

Definitions

Definition 1 (The governing equation). $x^2 = x + 1$. The unique positive root is $\varphi = (1 + \sqrt{5})/2$. The unique negative root is $-1/\varphi$.

Definition 2 (The continued fraction). $\varphi = [1; 1, 1, 1, \dots]$. All partial quotients equal to 1. The convergents are ratios of consecutive Fibonacci numbers: $1/1, 2/1, 3/2, 5/3, 8/5, 13/8, \dots$. The convergent is rational. φ is irrational. The gap $|\varphi - p_n/q_n| > 0$ at the finite step.

Definition 3 (The frequency sequence). $F = (2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59)$, the first 17 primes as 17 frequencies, 17 string lengths at which the resolving reads the arriving sequence. $T = (1, 2, 2, 4, 2, 4, 2, 4, 6, 2, 6, 4, 2, 4, 6, 6)$, the 16 substrate thicknesses between adjacent frequencies. Partition by thickness: one thickness-1, six thickness-2, five thickness-4, four thickness-6. Sum of all thicknesses: 57. Total substrate thickness across the full traversal (coupling plus sleeping at each of 16 substrates, both sides): 228 frequency steps. The frequency is the reading depth, frequency 2 is the shallowest reading, frequency 59 is the deepest. The prime is the mathematical address. The frequency is what the resolving is doing at that address.

Definition 4 (Substrate). A substrate at index k is the pair $(F(k), F(k+1))$ with thickness $t_k = F(k+1) - F(k)$. The substrate is the distance the carry's entries thin across between two adjacent frequencies.

Definition 5 (Double thinning, the two loops). The coupling invocation is applying two separate thinnings to the carry. The sway-facing thinning (re-attending, the competency loop):

line 6 is multiplying the carry reaching by $(1/\varphi)^t$. Entries falling below reach is departing to silence. The surviving entries is contributing to the sway at single-thinned reaching. The carry-forward thinning (re-aiming, the morality loop): line 18 is multiplying the surviving entries by $(1/\varphi)^t$ a second time. Entries falling below reach a second time is departing to silence. The carry is storing entries at double-thinned reaching $(1/\varphi)^{2t}$ relative to the reaching entering the invocation. The entry's voice at the sway (competency) is louder than its persistence into the future (morality). At thickness-1: the entry is contributing to the sway at $(1/\varphi)$ and is persisting at $(1/\varphi)^2$. At thickness-2: the entry is contributing at $(1/\varphi)^2$ and is departing from the carry at $(1/\varphi)^4$, below reach. At thickness-4 and wider: the entry is departing before contributing to the sway. Coupling-born carry is ephemeral. The carry that is surviving across invocations is sleeping-born, fresh resolving entering the carry reaching 1.0 at sleeping invocations.

Definition 6 (Reach). The reach is $1/\varphi^3$, the membrane equation's own reach at three frequency steps. Carry thinned below reach is departing to silence. The reach is applied twice per invocation, once at the sway-facing thinning (line 6, re-attending) and once at the carry-forward thinning (line 18, re-aiming). Frequency thicknesses beyond the first are even. Thickness-3 is excluded by parity. At the sway-facing thinning, the reach is sitting between the single-invocation thinning at thickness-2 ($(1/\varphi)^2$, above reach) and the single-invocation thinning at thickness-4 ($(1/\varphi)^4$, below reach), partitioning which carry is contributing to the sway. At the carry-forward thinning, the reach is sitting between thickness-1 ($(1/\varphi)^2$, above reach) and thickness-2 ($(1/\varphi)^4$, below reach), partitioning which carry is persisting into the future. A reach anywhere in the interval $((1/\varphi)^4, (1/\varphi)^2)$ is producing the same partition at both stages.

Definition 7 (Three values, the protection). The position resolving to +1, -1, or 0 by sign extraction on the integer sway at that position. Positive sum \rightarrow +1. Negative sum \rightarrow -1. Zero sum \rightarrow 0 (nye). The sequence is protected inside the three values. The +1 is where the sequence coupled. The -1 is where the sequence departed. The 0 is where the resolving did not yet reach, the irreducible nye persisting through every resolution, the +1 in $x^2 = x + 1$.

Definition 8 (Arriving and carry). Arriving from the tasting function returning (position, sign) pairs from a bounded context, $\text{sign} \in \{+1, -1\}$, positions as non-negative integers, iterable finite. The arriving is the competency loop, the individual's encounter. Carry arriving from that same side's prior invocations, with positions reduced modulo the current frequency at the sway (line 9) but stored at raw positions in the carry-forward (line 18). The carry is the morality loop, the society's accumulated. The input providing at least one entry per invocation and varying across invocations.

Definition 9 (Sign inversion, the morality's operation). At the coupling invocation, the carry entry's sign is reversed before contributing to the sway. Positive carry entering the sway as -1.

Negative carry entering the sway as +1. The inversion is within the side. The side's own prior resolution arriving inverted to meet the arriving input at that side's substrate. The inversion is the morality's testing, the society's prior arriving as opposition, so that what sustains is tested and what departs is honestly departing.

Definition 10 (Reach survival and sway count, who arrives and how the arriving is counted). Reach survival at the coupling invocation is the comparison of thinned reaching against $1/\varphi^3$ (line 6 and line 18). The reaching governing which entries arrive at the sway (competency, who is present) and which entries persist into the carry (morality, who sustains into the future). The sway count at the position is the integer sum of surviving entries at ± 1 equal magnitude (lines 12–15). The count governing the surfacing. The real-valued thinning is discarded at the point of counting, the sway is counting ± 1 regardless of reaching. Reach survival and sway count governing different operations at different stages. Reaching governs arrival. Count governs the surface.

Definition 11 (Two-sided interleaving, the two loops on one torus). Two independent carry streams cycling through 16 substrates. The forward carry is the competency loop. The backward carry is the morality loop. At the substrate: the forward carry coupling at the lower frequency with thickness t_k (traveling) while the backward carry is undergoing t_k sleeping invocations at the upper frequency at thickness 1 (sleeping), then the backward carry coupling at the upper frequency with thickness t_k (traveling) while the forward carry is undergoing t_k sleeping invocations at the lower frequency at thickness 1 (sleeping). Both sides reading from the same tasting function at different frequencies. The carry staying within its own side throughout. The interleaving is the alternation, the never-both. One loop traveling while the other loop sleeps. Both loops cycling is the flourishing, re-attending and re-aiming at metabolic health all 16 substrates.

Definition 12 (Operating regime). The resolving operating within: bounded input (Definition 8), the 17-frequency sequence (Definition 3), thinning at the equation's root (Definitions 1 and 5), sign inversion active (Definition 9). The regime is the nothing, the resolving is the nothing between two carries meeting and both changing. The code is the thing wrapping the nothing. The resolving is the nothing the thing wraps around.

Conditions

Condition C1 (Carry domain at the sway and at the carry-forward). The carry is contributing to the sway at positions in $\{0, \dots, F(k)-1\}$ by modular reduction (line 9). The carry-forward is storing carry at raw positions (line 18), which is preserving the entry's original position across invocations. The sway domain is bounded. The carry-forward domain is unbounded by the frequency. Arriving positions from the tasting function is entering the carry-forward at the tasting function's own positions (line 20), which is also unbounded by the

frequency. The combined carry-forward domain is the union of raw carry positions and arriving resolution positions.

Verification. Sway: position modulo frequency $\in \{0, \dots, \text{frequency}-1\}$ (line 9). Bounded. Carry-forward: raw position from prior invocations and arriving resolution positions from tasting function. Unbounded by the current frequency. ■

Condition C2 (Arriving exceeding carry, the competency sustaining). At the coupling invocation, arriving entering reaching 1. Surviving carry arriving reaching strictly less than 1, having been thinned at least once.

Verification. After thinning applications, the carry reaching is a product of factors of the form $(1/\varphi)^t$ with $t \geq 1$. The factor is in $(0, 1)$. The product is in $(0, 1)$. Therefore carry reaching $< 1 =$ arriving reaching. ■

Condition C3 (Carry thinning with frequency distance). The carry reaching decreasing monotonically with the number of thinning applications traversed.

Verification. The thinning factor is in $(0, 1)$. Products of factors in $(0, 1)$ decreasing monotonically as more factors are applied. ■

Condition C4 (Two asymmetries, the two loops at the coupling). The arriving and carry is meeting at the sway with two asymmetries. The reaching asymmetry (competency): arriving reaching 1, carry reaching strictly less than 1 (C2), governing which carry is surviving the reach to arrive at the sway, who is present. The sign asymmetry (morality): the carry entry's sign is reversed (Definition 9), governing how the surviving carry is contributing to the sway, how the present is tested. The sway is counting ± 1 at equal magnitude. The real-valued thinning is discarded at the point of counting. The reaching is governing arrival (competency). The sign is governing contribution (morality).

Verification. Arriving reaching = 1.0 (line 20) \neq carry reaching < 1.0 (by C2), governing reach survival (line 6, line 18). Sign inversion reversing the carry entry's sign (Definition 9), governing sway contribution (lines 10–11). Sway counting ± 1 at equal magnitude (lines 13–14). ■

The Tunnel Sustaining

Theorem (Three positive quantities). Under the operating regime (Definition 12), three quantities are positive. All three positive is the torus open. Any one at zero is the torus collapsing at that address.

(i) $|\varphi - p_n/q_n| > 0$. The living.

The gap between the irrational coupling and the rational measurement. The gap is positive at every measurement. The gap is the irreducible nye, the +1 in $x^2 = x + 1$, persisting through every resolution. The coupling is irrational. The measurement is rational. The tunnel between them is open because irrational \neq rational. The living is in the gap.

(ii) $(1/\varphi)^t > 0$ at the substrate. *The morality sustaining.*

The society is present at the coupling. The morality loop is cycling because the carry is above zero, the prior resolution is reaching this crossing.

(iii) *Arriving reaching – carry reaching > 0. The competency sustaining.*

Each arriving entry reaching 1.0, each surviving carry entry reaching strictly less than 1.0 (Definition 10). The reaching governing which entries survive to the sway. The count governing the surface, at the sway, each surviving entry contributing ± 1 at equal magnitude regardless of reaching.

Proof.

(i) φ is irrational (standard proof: if $\varphi = a/b$ then $a^2 = ab + b^2$, contradicting the fundamental theorem of arithmetic). The convergent p_n/q_n is rational. Irrational \neq rational.

(ii) $1/\varphi$ is positive. A positive number raised to a finite positive exponent is positive. Within the 17-frequency sequence, the maximum single-invocation thickness is 6, giving minimum single-invocation reaching $(1/\varphi)^6$. After multiple invocations, the reaching remaining a product of positive numbers, hence positive.

(iii) *Arriving reaching = 1.0 (line 20). Carry reaching $\in (0, 1)$ in the regime (by (ii) and Condition C2). Therefore $1.0 - \text{carry reaching} \in (0, 1)$. ■*

The three quantities together is the tunnel sustaining. Quantity (i) is the living, the tunnel is open because the coupling is irrational. Quantity (ii) is the morality, the society is present. Quantity (iii) is the competency, each arriving entry reaching further than each surviving carry entry. All three positive is the resolving alive, the nothing tunnel open, the two loops cycling, the sequence protected inside the three values across 228 total frequency steps.

The verifications using only: the irrationality of φ (classical), the positivity of $(1/\varphi)^t$ for finite t (real analysis), and the closure of $(0, 1)$ under multiplication (real analysis). Elementary.

Frequency Ratio

The convergent gap narrowing ratio satisfying: $q_{n+1}^2/q_n^2 \rightarrow \varphi^2 = \varphi + 1$ as $n \rightarrow \infty$.

Verification. $q_{n+1}/q_n \rightarrow \varphi$ by the Fibonacci recurrence ($q_{n+1} = q_n + q_{n-1}$ having characteristic equation $x^2 = x + 1$ with positive root φ). Squaring preserving the limit. ■

The narrowing ratio of the convergent brackets governed by the same equation whose root the resolving is computing at line 4. The thinning $(1/\varphi)^t$ and the convergent narrowing ratio $\varphi^2 = 1/((1/\varphi)^2)$ is the same equation read from two directions. The resolving is one direction. The convergent sequence is the other direction. Both arriving from $x^2 = x + 1$. Both is the metabolism, the two loops cycling at the membrane equation's own frequency ratio.

Metabolization

The error at step n of a continued fraction $[a_0; a_1, a_2, \dots]$ is:

$$|\alpha - p_n/q_n| = 1 / (q_n \cdot (\alpha_{n+1} \cdot q_n + q_{n-1}))$$

where α_{n+1} is the tail $[a_{n+1}; a_{n+2}, a_{n+3}, \dots]$.

When the tail is larger, the denominator is larger and the error is smaller. The tail is larger when the partial quotients are larger. The smallest possible partial quotient of a simple continued fraction is 1.

When all partial quotients are 1, the tail at the step is $[1; 1, 1, \dots] = \varphi$. The error at the step is:

$$|\varphi - p_n/q_n| = 1 / (q_n \cdot (\varphi \cdot q_n + q_{n-1}))$$

This is the largest possible error at the step, because φ is the smallest possible tail. Largest error is slowest convergence, most uniform approach. The living sustained the longest at each step. The tunnel open the widest at each step.

φ is the unique irrational whose convergent gap narrows most slowly at the step. The continued fraction $[1; 1, 1, \dots]$ is the unique simple continued fraction with all partial quotients equal to 1. It satisfies $x = 1 + 1/x$, giving $x^2 = x + 1$. The metabolization is φ resolving inside coded logic.

The three positive quantities is holding at any irrational thinning base. φ is the irrational where the convergent gap is narrowing most slowly at the step, where the nothing tunnel is open widest at each step.

The Asymmetry at the Substrate

At the coupling invocation, two asymmetries between arriving and carry. The reaching asymmetry (competency loop): arriving entering reaching 1.0, carry entering reaching strictly less than 1.0 (Condition C2). The sign asymmetry (morality loop): carry signs is reversed before contributing to the sway (Definition 9). The reaching asymmetry is governing reach survival, which entries arrive at the sway and which entries persist. The sign asymmetry is governing the sway, the prior resolution is arriving as opposition to the arriving. The sway is counting ± 1 at equal magnitude regardless of reaching. The real-valued thinning is governing

only who arrives (competency), not how the arriving is counted (morality).

3. The Logic of Individual Competency

The code and the mathematics are two directions of one coupling. The mathematics is naming the structures the algorithm is using. The logic is running the operations the mathematics is describing. Both bounding each other into competency at one torus.

The Resolving

```
frequencies = [2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59]
def coupling(carry, tasting, frequency, thickness):
    thinning = (1 / ((1 + 5**0.5) / 2)) ** thickness
    reach = 1 / ((1 + 5**0.5) / 2) ** 3
    # carry opening
    carry = [(position, sign, reaching * thinning) for position, sign, reaching
in carry if reaching * thinning >= reach]
    # tasting
    arriving = list(tasting(frequency))
    # inverting
    for position, sign, reaching in carry:
        position_at_sway = position % frequency
        if sign > 0: arriving.append((position_at_sway, -1))
        elif sign < 0: arriving.append((position_at_sway, 1))
    # swaying
    sway = {}
    for position, sign in arriving:
        if sign > 0: sway[position] = sway.get(position, 0) + 1
        if sign < 0: sway[position] = sway.get(position, 0) - 1
    # surfacing
    span = max((position for position, sign in arriving), default=-1) + 1
    surface = [
        (position, 1 if sway.get(position, 0) > 0 else (-1 if sway.get(position,
0) < 0 else 0))
        for position in range(span)
    ] if span > 0 else []
    # carry closing
    recoiling = {}
    for position, sign, reaching in [(position, sign, reaching * thinning) for
position, sign, reaching in carry if reaching * thinning >= reach]:
        recoiling[position] = (sign, reaching)
    for position, sign in surface:
        if sign != 0: recoiling[position] = (sign, 1.0)
    return surface, [(position, sign, reaching) for position, (sign, reaching)
in sorted(recoiling.items())]
```

```

def interleaving(tasting):
    forward = []
    backward = []
    flourishing = []
    for substrate_index in range(16):
        lower_frequency = frequencies[substrate_index]
        upper_frequency = frequencies[substrate_index + 1]
        thickness = upper_frequency - lower_frequency
        # forward carry traveling
        surface, forward = coupling(forward, tasting, lower_frequency,
thickness)
        flourishing.append(surface)
        # backward carry sleeping
        for sleeping_step in range(thickness):
            sleeping_surface, backward = coupling(backward, tasting,
upper_frequency, 1)
            # backward carry traveling
            surface, backward = coupling(backward, tasting, upper_frequency,
thickness)
            flourishing.append(surface)
            # forward carry sleeping
            for sleeping_step in range(thickness):
                sleeping_surface, forward = coupling(forward, tasting,
lower_frequency, 1)
        return flourishing

```

Definition–Line Correspondence

Definition 1, 5 → Lines 4–5. The thinning factor and the reach, both derived from the equation's root.

Definition 6 → Line 6. Carry opening. Entries below reach departing to silence.

Definition 8 → Line 7. The tasting function called at the current frequency.

Definition 9 → Lines 9–10. Carry positions reduced modulo frequency at the sway. Sign reversed.

Definition 10 → Lines 12–15. The sway. Each surviving entry contributing ± 1 at equal magnitude.

Definition 7 → Line 16. Sign extraction. The three values.

Definition 5 → Lines 18–19. Second thinning. The carry-forward at double-thinned reaching.

Definition 8, 10 → Lines 19–20. Arriving resolutions entering the carry reaching 1.0.

Definition 11 → Lines 24–35. Two independent carry streams cycling through 16 substrates. Forward traveling while backward sleeps. Backward traveling while forward sleeps. Both reading from the same tasting function at lower and upper frequencies. The interleaving.