

Supplementary Material

Contents

S1. Extended Dialectical Framework.....	2
S1.1 Thesis and Antithesis Selection	2
S1.2 Constructing Tetrads.....	2
S1.3 Estimating Complementarity	3
S1.4 Complementarity Diagrams	5
S1.5 Systemic Taxonomy of Balanced Tetrads and Synthesis Stages.....	6
S1.6 Elemental Taxonomy of Balanced Tetrads and Synthesis Stages	8
S1.7 Complementarity to T/A vs. Semantic Similarity.....	8
S1.8 Selecting Best Tetrad from Balanced Alternatives.....	10
S1.9 Control Statements' Examples.....	12
S1.10 Types and Examples of Syntheses and Pathologies	13
S1.11 Circular Causality and Transitions.....	14
S2. Understanding Systems.....	15
S2.1 Summary of Analyzed Systems.....	15
S2.2 Psychology / DISC Character Traits.....	16
S2.3 Economic Cycle.....	18
S2.4 Business Cycle.....	20
S2.5 Four-Stroke Engine.....	22
S2.6 Photosynthesis	24
S2.7 Global Problematique	25
S2.8 Self-Driving Vehicles (SVD).....	26
S2.9 Israel – Palestine Conflict	29
S3. Theory Completion.....	32
S3.1 Requisite Variety and Requisite Parsimony	32
S3.2 Resilience Engineering	33
S3.3 Developmental Psychology	34

S1. Extended Dialectical Framework

S1.1 Thesis and Antithesis Selection

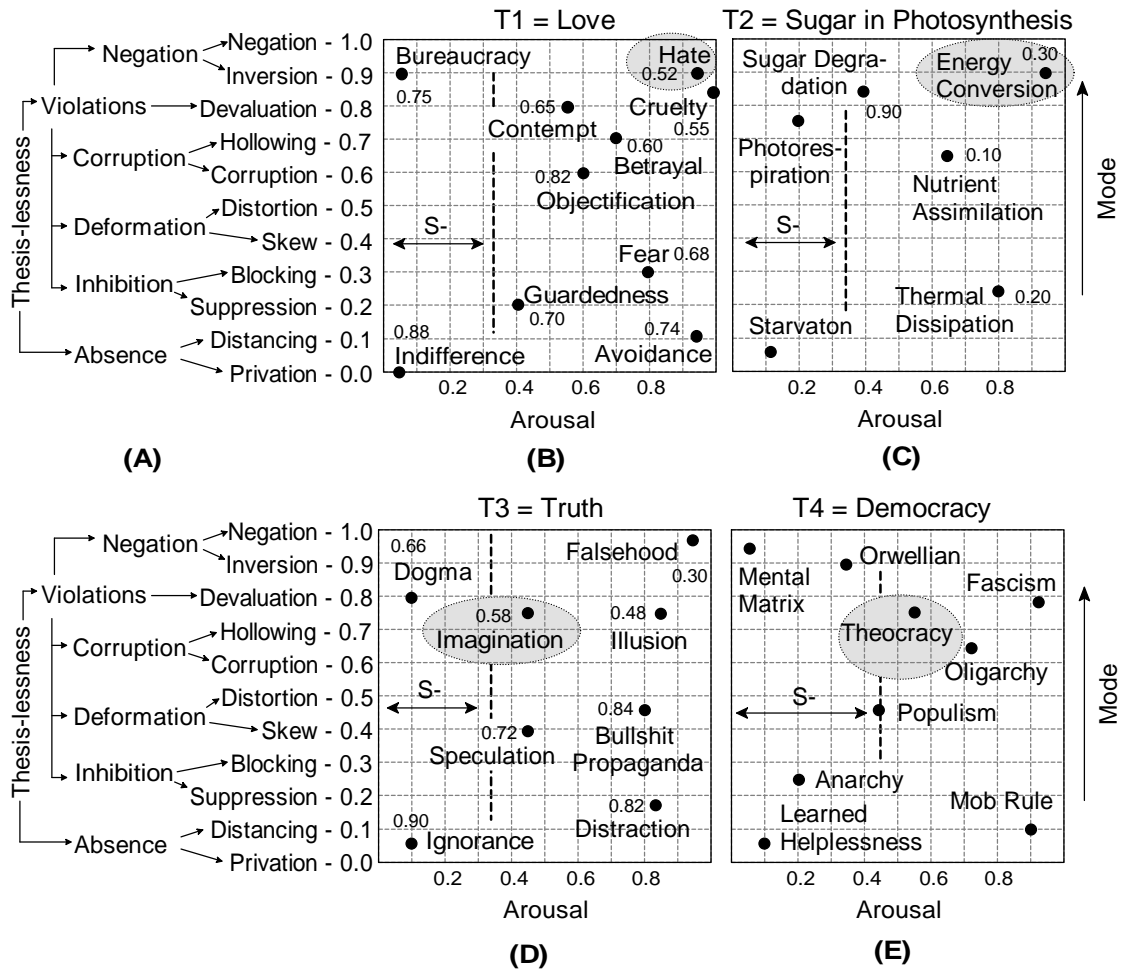


Fig. S1.1. Taxonomy of antitheses. Dashed ovals represent the most potent choices.

S1.2 Constructing Tetrads

Table S1.2. Determining T+, T-, A+, A- components for T = Love, A = Hate

N	Constraint	T = Love, A = Hate	CC*	T = Sugar, A = Energy converts	CC*
1	T+/A+ are constructive, balancing developments that enhance upsides of opposition	Bonding (T+) enhances Autonomy (A+), which is an upside of Hate (A)	0.75	Energy storage (T+) enhances Energy sufficiency (A+), which is an upside of Energy conversion (A)	0.72
		Autonomy (A+) enhances Bonding (T+),	0.92	Energy Sufficiency (A+) enhances Energy storage (T+),	0.95

		which is an upside of Love (T)		which is an upside of Sugar formation (T)	
2	T-/A- are overdevelopments or exaggerations of the parent concept, and simultaneously underdevelopments of its opposition	Enmeshment (T-) is overdeveloped Love (T) and underdeveloped Hate (A)	0.70	Resource depletion (T-) is overdeveloped Sugar formation (T) & underdeveloped Energy Conversion (A)	0.85
		Alienation (A-) is overdeveloped Hate (A) and underdeveloped Love (T)	0.88	Energy dissipation (A-) is overdeveloped Energy conversion (A) and underdeveloped Sugar Formation (T)	0.92
3	T+ must directly contradict A-, and T- must directly contradict A+ (shown by dotted arrows in Fig. 2A)	Bonding (T+) directly contradicts Alienation (A-)	0.95	Energy storage (T+) directly contradicts Energy dissipation (A-)	0.88
		Enmeshment (T-) directly contradicts Autonomy (A+)	0.96	Resource depletion (T-) directly contradicts Energy sufficiency (A+)	0.90

* Conceptual Coherence estimated by GPT 5.2

S1.3 Estimating Complementarity

Prompt for estimating Complementarity:

<!-- Complementarity Assessment Evaluates synergistic interdependence between two statements or concepts -->

Task:

Evaluate the Complementarity (K) between two given statements or concepts, measuring how strongly they need, enrich, and complete one another to produce a higher or more balanced outcome.

Complementarity expresses synergy or mutual necessity, not mere similarity or opposition.

Given statements:

T: [First statement or thesis]

A: [Second statement or antithesis / complement]

Context: [Optional domain or situation]

Evaluation criteria:

Interdependence – Do T and A need each other to reach full expression or effectiveness?

Mutual Enhancement – When combined, do they produce a new or higher quality that neither could achieve alone?

Constructive Tension – Do they maintain a productive difference (not identical, not destructive)?

Systemic Necessity – Are both required parts of a larger functioning whole?

Diminishment on Separation – Does removing one reliably cause the other to deteriorate or become exaggerated?

Scoring tip: Assign a K value that best represents the overall strength of synergy across these criteria.

Complementarity (K) Scale (0.00–1.00):

Intermediate values (e.g., 0.15, 0.35) represent gradual transitions between categories.

0.00–0.09 – No complementarity; meaningless pairing.

Example: “Iron smelting” vs. “Moral virtue.”

0.10–0.19 – Very weak resonance; coexist but independent.

Example: “Spreadsheet formatting” vs. “Emotional intelligence.”

0.20–0.29 – Weak affinity; coexist but rarely interact; minimal mutual benefit.

Example: “Budget control” vs. “Corporate empathy.”

0.30–0.39 – Mild complementarity; help indirectly.

Example: “Risk awareness” vs. “Innovation freedom.”

0.40–0.49 – Useful pairing; balanced helpers within limited scope.

Example: “Customer satisfaction” vs. “Operational efficiency.”

0.50–0.59 – Moderate partnership; clear mutual improvement.

Example: “Research” vs. “Engineering.”

0.60–0.69 – Strong interdependence; must be coordinated; mutually stabilizing.

Example: “Strategy” vs. “Execution.”

0.70–0.79 – Strong complementarity; separation harms both.

Example: “Speed” vs. “Quality.”

0.80–0.89 – Deep synergy; together generate emergent value; archetypal complementarity.

Example: “Autonomy” vs. “Alignment.”

0.90–0.94 – Near-perfect complementarity; unity-in-duality, high generativity.

Example: “Masculine” vs. “Feminine.”

0.95–1.00 – Perfect complementarity; absolute mutual necessity; loss of one destroys the other.

Example: “Yin” vs. “Yang” or “God” vs. “Love.”

Output format:

Complementarity (K): [0.00–1.00]

Interdependence analysis: [1–2 sentences explaining why this value fits, referencing the evaluation criteria.]

Emergent quality: [One phrase naming what emerges when T and A combine productively – e.g., “Sustainable innovation,” “Dynamic stability,” “Grounded vision,” “Adaptive resilience.”]

Separation risk: [What happens if one is pursued without the other – e.g., “T without A leads to chaos; A without T leads to stagnation.”]

S1.4 Complementarity Diagrams

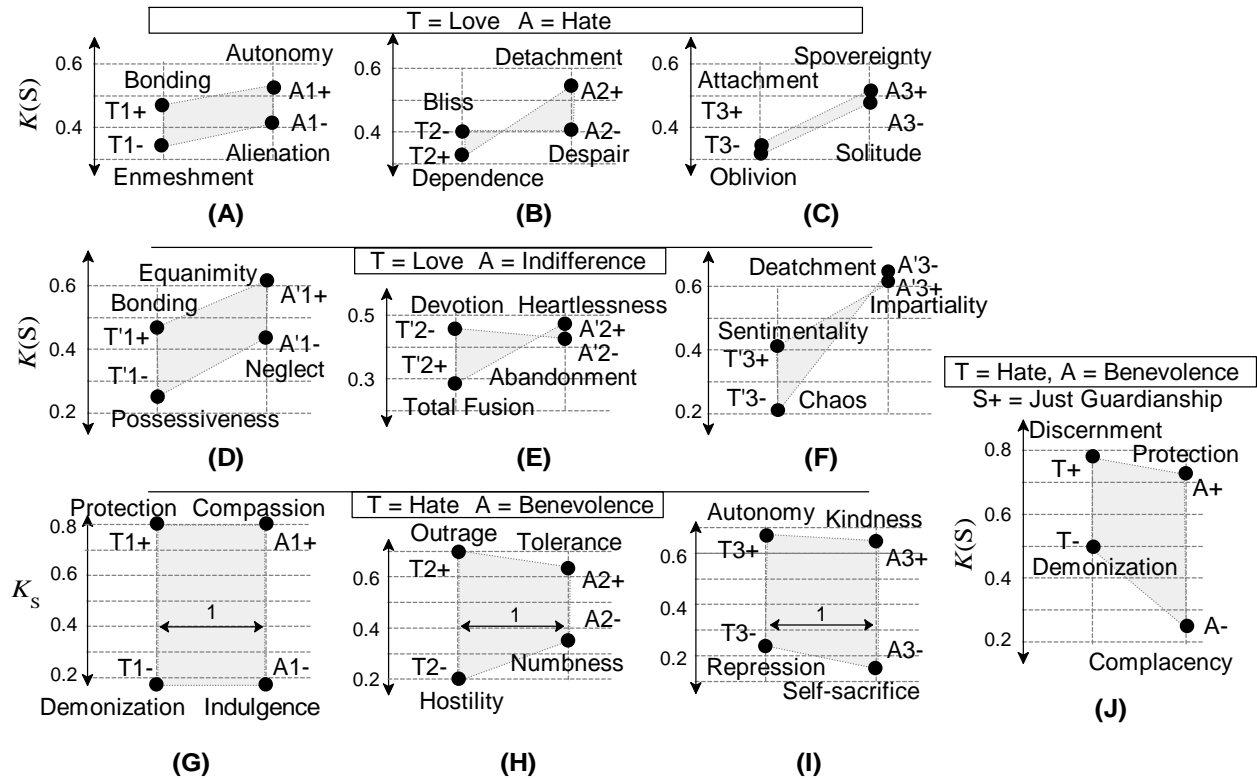


Fig. S1.4. Complementarity diagrams.

Tables S1.4

		T = Love, A = Hate			
		K_T	K_A	K_S	M
(A)	A = Hate				
	T1+ = Bonding	0.82	0.12	0.47	+5
	T1- = Enmeshment	0.32	0.38	0.35	-5
	A1+ = Autonomy	0.76	0.30	0.53	+5
	A1- = Alienation	0.10	0.72	0.42	-5
Sum		2.00	1.52	1.76	0.0
(B)	T2+ = Bliss	0.58	0.10	0.34	+7
	T2- = Dependence	0.40	0.40	0.40	-3
	A2+ = Detachment	0.55	0.55	0.55	+3
	A2- = Despair	0.14	0.68	0.41	-7
	Sum		1.67	1.73	1.70
(C)	T3+ = Attachment	0.46	0.22	0.34	+3
	T3- = Oblivion	0.04	0.60	0.32	-7
	A3+ = Sovereignty	0.60	0.44	0.52	+7
	A3- = Solitude	0.38	0.58	0.48	-3
	Sum		1.48	1.84	1.66

		T = Sugar formation, A = ATP formation			
		K_T	K_A	K_S	M
(D)	T1+ = Carbon fixation	0.95	0.55	0.75	+5
	T1- = Resource Depletion	0.20	0.25	0.23	-5
	A1+ = Regulated transduction	0.70	0.90	0.80	+5
	A1- = Oxidative dissipation	0.15	0.65	0.40	-5
	Sum		2.00	2.35	2.18
(E)	T2+ = Enhanced Growth	0.85	0.55	0.70	+7
	T2- = Resource Depletion	0.20	0.25	0.23	-3
	A2+ = Energy Efficiency	0.55	0.75	0.65	+3
	A2- = Energy Deficit	0.25	0.20	0.23	-7
	Sum		1.85	1.75	1.80
(F)	T3+ = Resource Conservation	0.60	0.35	0.48	+3
	T3- = Carbon Starvation	0.10	0.30	0.20	-7
	A3+ = Strong Energy Capture	0.45	0.90	0.68	+7
	A3- = Photodamage	0.05	0.70	0.38	-3
	Sum		1.20	2.25	1.73

T = Love, A = Hate			T = Love, A = Indifference			T = Hate, A = Benevolence		
	K_T	K_A		K_T	K_A		K_T	K_A
T1+ = Bonding	0.82	0.12	T'1+ = Bonding	0.82	0.12	T1+ = Protection	0.85	0.75
T1- = Enmeshment	0.32	0.38	T'1- = Possessiveness	0.22	0.28	T1- = Demonization	0.25	0.10
A1+ = Autonomy	0.76	0.30	A'1+ = Equanimity	0.66	0.58	A1+ = Compassion	0.70	0.90
A1- = Alienation	0.10	0.72	A'1- = Neglect	0.12	0.76	A1- = Indulgence	0.10	0.25
Sum	2.00	1.52	Sum	1.82	1.74	Sum	1.90	2.00
T2+ = Bliss	0.58	0.10	T'2+ = Total fusion	0.38	0.18	T2+ = Outrage	0.80	0.40
T2- = Dependence	0.40	0.40	T'2- = Devotion	0.62	0.30	T2- = Hostility	0.15	0.05
A2+ = Detachment	0.55	0.55	A'2+ = Heartlessness	0.06	0.88	A2+ = Tolerance	0.45	0.60
A2- = Despair	0.14	0.68	A'2- = Abandonment	0.04	0.92	A2- = Numbness	0.20	0.30
Sum	1.67	1.73	Sum	1.10	2.28	Sum	1.60	1.35
T3+ = Attachment	0.46	0.22	T'3+ = Sentimentality	0.44	0.40	T3+ = Autonomy	0.75	0.60
T3- = Oblivion	0.04	0.60	T'3- = Chaos	0.08	0.35	T3- = Repression	0.30	0.15
A3+ = Sovereignty	0.60	0.44	A'3+ = Impartiality	0.58	0.66	A3+ = Kindness	0.45	0.85
A3- = Solitude	0.38	0.58	A'3- = Detachment	0.55	0.72	A3- = Self-sacrifice	0.10	0.20
Sum	1.48	1.84	Sum	1.65	2.13	Sum	1.60	1.80

S1.5 Systemic Taxonomy of Balanced Tetrads and Synthesis Stages

Relevant to Steps 3.2 and 4.3-4.4:

Table S-1 presents a systemic taxonomy for grouping tetrads based on functional dimensions emphasized in modern systems and cybernetic perspectives. An apex concept - system viability – emerges from five interrelated capacities: (1) integrity (structural coherence), (2) fidelity (reliable information processing), (3) exchange (sustainable resource flows), (4) flexibility (adaptive responsiveness), and (5) resilience (recovery from perturbations). This taxonomy is intended as a heuristic organizing framework rather than a definitive ontology.

Table S1.5. Systemic taxonomy, assuming that each concept implies 5 different aspects:

	Apex	Branch 1	Branch 2	Branch 3	Branch 4	Branch 5
Domains	Viability	Integrity	Fidelity	Exchange	Flexibility	Resilience
General T	Integration	Cohesion	Modeling	Exchange	Exploration	Recovery
General A	Disintegration	Separation	Error correction	Consumption	Constraint	Disruption
Engineering		assembly	simulation	energy flow	control	tolerance
Ecology		Symbiosis	Sensing	Cyclicity	plasticity	resilience
Institutions		Soc. cohesion	knowledge	economy	innovation	crisis recovery
General T+	Coherence (0.90; 0.20; 1.00)*	Coherence (0.90; 0.20; 1.00)	Accuracy (0.75; 0.25; 0.60)	<i>Exchange</i> (0.70; 0.30; 0.45)	<i>Plasticity</i> (0.65; 0.40; 0.40)	Recovery (0.75; 0.55; 0.55)
General T-	Rigid fusion (0.35; 0.20; 1.00)	Locking-in (0.40; 0.20; 0.80)	Dogmatism (0.35; 0.25; 0.65)	Dependency (0.45; 0.30; 0.55)	<i>Chaotic drift</i> (0.30; 0.50; 0.20)	<i>Fragility</i> (0.35; 0.55; 0.40)
General A+	Differentiation (0.85; 0.45; 1.00)	Differentiation (0.85; 0.45; 1.00)	Critical testing (0.80; 0.45; 0.55)	Constraint (0.80; 0.40; 0.75)	Stabilization (0.75; 0.55; 0.60)	Buffering (0.70; 0.60; 0.55)

General A-	Disintegration (0.20; 0.90; 1.00)	Rupture (0.15; 0.55; 0.75)	Denial (0.20; 0.45; 0.40)	Depletion (0.15; 0.60; 0.55)	<i>Suffocating</i> (0.25; 0.35; 0.35)	Collapse (0.10; 0.70; 0.85)
T	Love	Bonding	Understanding	Giving	Openness	Repair
A	Hate	Aversion	Adversariality	Withholding	Defensiveness	Rancor
T+	Bonding (0.85; 0.10; 1.00)*	Attachment (0.75; 0.10; 0.90)	Attunement (0.80; 0.15; 0.85)	Reciprocity (0.80; 0.15; 0.85)	Flexibility (0.70; 0.40; 0.55)	Reconciliation (0.75; 0.35; 0.80)
T-	Enmeshment (0.30; 0.15; 1.00)	Enmeshment (0.30; 0.15; 1.00)	Projection (0.20; 0.20; 0.60)	Dependence (0.35; 0.20; 0.70)	Fusion (0.25; 0.15; 0.85)	Clinginess (0.25; 0.15; 0.85)
A+	Autonomy (0.85; 0.75; 1.00)	Boundaries (0.85; 0.70; 0.90)	Differentiation (0.80; 0.80; 0.85)	Independence (0.70; 0.65; 0.85)	Autonomy (0.85; 0.75; 1.00)	Self-possession (0.70; 0.60; 0.80)
A-	Alienation (0.10; 0.25; 1.00)	Alienation (0.10; 0.25; 1.00)	Estrangement (0.10; 0.30; 0.90)	Expulsion (0.05; 0.25; 0.80)	Distancing (0.10; 0.35; 0.75)	Withdrawal (0.10; 0.35; 0.75)
T	Hate					
A	Benevolence					
T+	Protection (0.85; 0.75, 1.00)	Boundary (0.80; 0.80, 0.90)	Discernment (0.75; 0.70; 0.75)	Reciprocity (0.65; 0.80; 0.55)	Caution (0.70; 0.55; 0.70)	Defensive repair (0.70; 0.75; 0.80)
T-	Demonization (0.25; 0.10; 1.00)	Exclusionism (0.30; 0.10; 0.80)	Demonization (0.25; 0.10; 1.00)	Exploitation (0.20; 0.10; 0.55)	Antagonism (0.35; 0.10; 0.75)	Vindictiveness (0.20; 0.05; 0.85)
A+	Compassion (0.70; 0.90; 1.00)	Supportiveness (0.60; 0.85; 0.90)	Empathy (0.65; 0.90; 0.95)	Generosity (0.45; 0.85; 0.75)	Openness (0.55; 0.75; 0.65)	Forgiveness (0.60; 0.85; 0.85)
A-	Indulgence (0.10; 0.25; 1.00)	Overindulgence (0.05; 0.20; 0.95)	Idealization (0.15; 0.25; 0.65)	Overgiving (0.10; 0.20; 0.80)	Naivety (0.10; 0.20; 0.60)	Passive tolerance (0.20; 0.30; 0.75)

* Numbers in parentheses indicate respectively, K_T , K_A , and HS (heuristic semantic similarity to apex) – they will be used in the following sections.

It shows that positive and negative poles can be grouped into a small set of functional categories applicable across diverse domains (including engineering, ecological and institutional systems, and interpersonal contexts). Below we provide an alternative categorization based on a four-element schema.

Literature provides many comparable attempts to classify universal positive and negative effects. These can be grouped into ethical taxonomies of virtues and vices, capability-based approaches to human flourishing, psychological models of moral foundations, and systems-theoretic treatments of viability, feedback, resilience, and failure modes.

S1.6 Elemental Taxonomy of Balanced Tetrads and Synthesis Stages

Table S1.6 presents an alternative taxonomy for grouping tetrads into coherent categories based on a classical elemental framework. Historically, elemental classifications (e.g., fire, air, water, earth) provided a broad integrative scheme for organizing diverse natural, psychological, and social phenomena across many intellectual traditions for centuries, if not millennia. While modern taxonomies often achieve greater precision within specific domains, they may do so at the cost of the integrative breadth and cross-domain coherence characteristic of earlier elemental frameworks. The alternative taxonomy presented here is intended not as a revival of classical doctrine, but as a heuristic illustration of how tetradic relations can be organized within a broadly integrative conceptual structure.

Table S1.6. Elemental taxonomy, assuming that each concept implies 4 classical elements

	Apex	Fire	Earth	Air	Water
Domains	Viability	Drive	Structure	Process	Adaptation
T	Integration	Activation	Cohesion	Exchange	Reflection
A	Disintegration	Inhibition	Separation	Consumption	Correction
Engineering		force input	assembly	energy flow	calibration
Ecology		energy input	symbiosis	cyclicity	homeostasis
Institutions		motivation	social cohesion	economy	learning
T+	coherence	motivation	coherence	exchange	plasticity
T-	rigid fusion	impulsivity	locking-in	dependency	fragility
A+	differentiation	regulation	differentiation	constraint	stabilization
A-	disintegration	repression	rupture	depletion	collapse
T = Love	integration	attraction	bonding	giving	openness
A = Hate	negation	aversion	hostility	withholding	defensiveness
T+	bonding	affection	attachment	reciprocity	reconciliation
T-	enmeshment	obsession	fusion	dependence	clinginess
A+	autonomy	restraint	boundaries	independence	self-possession
A-	alienation	rejection	estrangement	expulsion	withdrawal

S1.7 Complementarity to T/A vs. Semantic Similarity

In Table S1.5, each pole (T+, T-, A+, A-) is annotated with 3 numbers in parentheses, denoting respectively K_T , K_A (complementarity toward T and A) and HS (heuristic semantic similarity to apex). Within each row, K_T and K_A vary only modestly, suggesting similar modalities in Fig. 3. However, HS varies in larger ranges, suggesting that similar modalities may be expressed by semantically different concepts.

Fig. S1.7 shows the steep dependences of HS on the cumulative absolute deviations between apex and a concept ($|\Delta K_T| + |\Delta K_A|$), suggesting that even small changes in complementarity can cause substantial semantic variations.

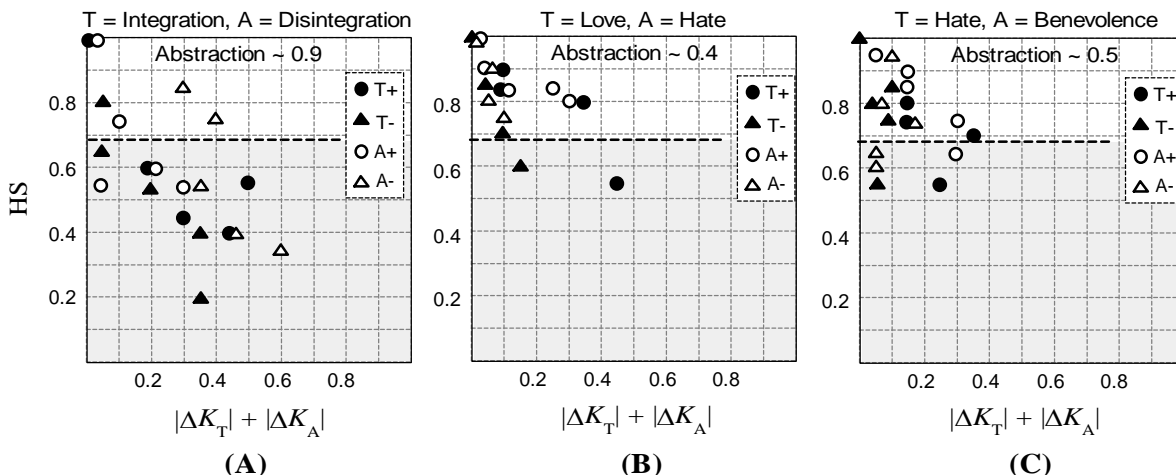


Fig. S1.7

Semantic dispersion depends on the abstraction level. Plot A shows the highest variations due to the highest abstraction level. The pair Integration/Disintegration represents apex concepts from Table S1.5 describing very wide domains (from natural ecosystems to personal affairs, institutions, and engineering) and involving multiple mechanisms. GPT assigns to it abstraction level of ~0.9 (on the scale from 0 to 1.) Plot B shows the smallest deviations, since the pair Love/Hate is psychologically concrete and socially well-defined (GPT assigned abstraction ~0.4). Plot C shows slightly higher deviations, since Hate/Benevolence is somewhat less defined socially and psychologically (abstraction ~0.5).

All in all, these observations suggest that tetrads are better selected based on complementarity (K_T and K_A) rather than purely semantic measures (HS or cosine similarity). Semantic similarity focuses on the meaning of independent statements, whereas complementarity focuses on their potential for mutual enhancement. Semantic similarity is sensitive to variability of complementarity mechanisms, while complementarity itself functions as a higher-level organizing concept for these variations.

S1.8 Selecting Best Tetrad from Balanced Alternatives

How to identify the best tetrad from many balanced alternatives? Choose the one with the highest K_T values for T+ and A+. This implies a certain asymmetry between K_T and K_A (components' complementarities to T and A) as depicted in Fig. S1.8

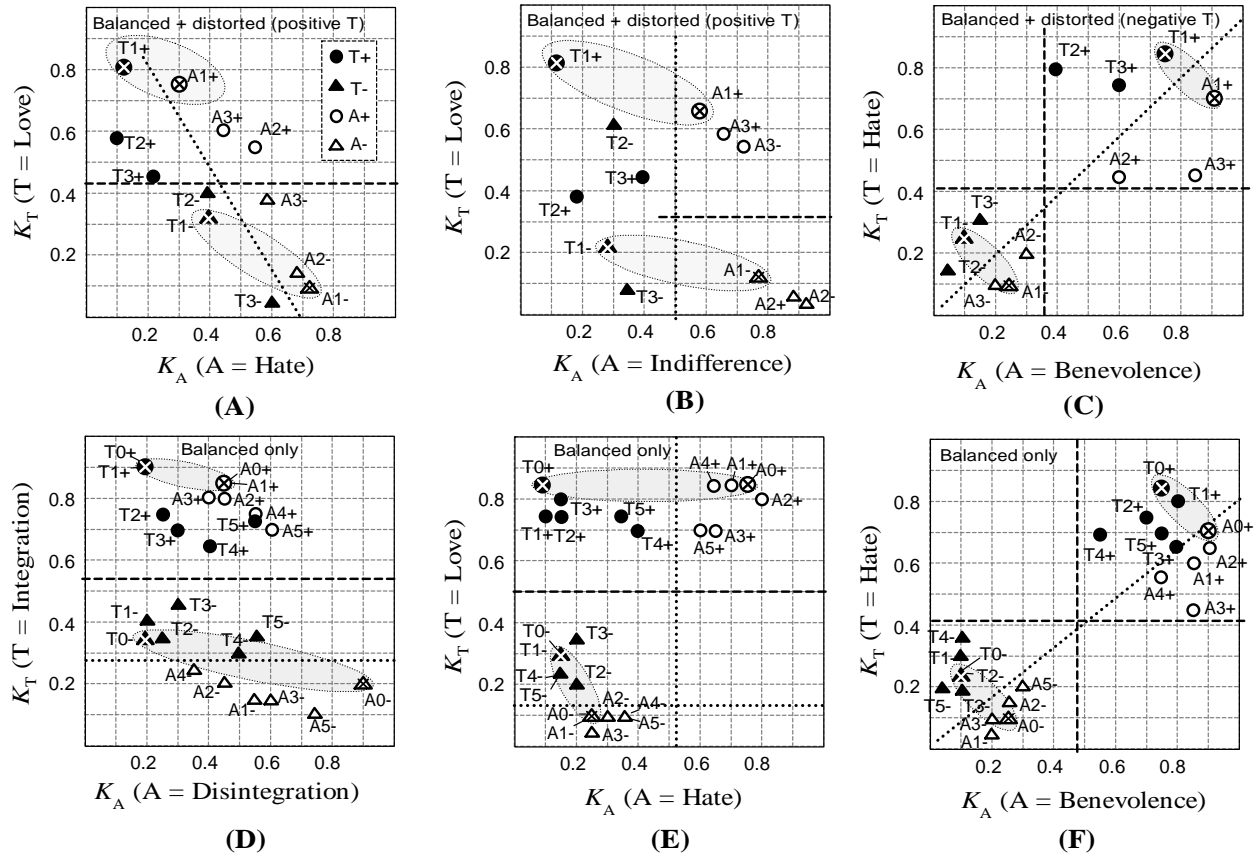


Fig. S1.8. All values were obtained with GPT-5

Table S1.8-1. Comparison of balanced (1±) and distorted (2-3±) tetrads

T = Love, A = Hate			T = Love, A = Indifference			T = Hate, A = Benevolence		
	K_T	K_A		K_T	K_A		K_T	K_A
T1+ = Bonding	0.82	0.12	T'1+ = Bonding	0.82	0.12	T1+ = Protection	0.85	0.75
T1- = Enmeshment	0.32	0.38	T'1- = Possessiveness	0.22	0.28	T1- = Demonization	0.25	0.10
A1+ = Autonomy	0.76	0.30	A'1+ = Equanimity	0.66	0.58	A1+ = Compassion	0.70	0.90
A1- = Alienation	0.10	0.72	A'1- = Neglect	0.12	0.76	A1- = Indulgence	0.10	0.25
Sum	2.00	1.52	Sum	1.82	1.74	Sum	1.90	2.00
T2+ = Bliss	0.58	0.10	T'2+ = Total fusion	0.38	0.18	T2+ = Outrage	0.80	0.40
T2- = Dependence	0.40	0.40	T'2- = Devotion	0.62	0.30	T2- = Hostility	0.15	0.05
A2+ = Detachment	0.55	0.55	A'2+ = Heartlessness	0.06	0.88	A2+ = Tolerance	0.45	0.60
A2- = Despair	0.14	0.68	A'2- = Abandonment	0.04	0.92	A2- = Numbness	0.20	0.30
Sum	1.67	1.73	Sum	1.10	2.28	Sum	1.60	1.35
T3+ = Attachment	0.46	0.22	T'3+ = Sentimentality	0.44	0.40	T3+ = Autonomy	0.75	0.60
T3- = Oblivion	0.04	0.60	T'3- = Chaos	0.08	0.35	T3- = Repression	0.30	0.15
A3+ = Sovereignty	0.60	0.44	A'3+ = Impartiality	0.58	0.66	A3+ = Kindness	0.45	0.85
A3- = Solitude	0.38	0.58	A'3- = Detachment	0.55	0.72	A3- = Self-sacrifice	0.10	0.20
Sum	1.48	1.84	Sum	1.65	2.13	Sum	1.60	1.80

In Fig. S1.8, plots A – C show distributions of balanced and distorted tetrads. Plots D – E show distributions of only balanced tetrads. Dotted ovals show positions of the apex balanced concepts. In all cases positive apex poles show maximum K_T , but far not always maximum K_A . Negative poles show less consistence, although some regularities can be traced as well.

To understand these plots, consider two types effects. First, distorted tetrads in A – C form nearly continuous dependences, since all concepts are interrelated via zero-sum entanglements. Balanced tetrads are not interrelated by such entanglements (which only act within tetrads, but not between them), therefore their concepts form clearer clusters.

Second, each concept belongs to one of 4 clusters that we intuitively identify using bold straight lines. Dashed lines differentiate between constructive and destructive groups (circles vs triangles), whereas dotted lines between “ours” and “theirs” (black and white points denoting derivatives of T and A, respectively). These lines depend on K_T and K_A with unequal weights.

Most dashed lines are horizontal, indicating their higher dependence on K_T . Most likely this is due to our asymmetric perception of theses and antitheses. We perceive our theses as constructive, while antitheses as destructive. Situation changes when we consider negative thesis (like T = Hate). Then both K_T and K_A axes serve as comparable differentiators (see plots C and F). This yields higher level of discrimination between constructive and destructive phenomena, explaining why we must perceive our opponent as our teacher – as otherwise our own optimism becomes our enemy.

Most dotted lines are either diagonal or combine both horizontal and vertical lines, suggesting complex involvement of K_T and K_A . This suggests a potentially new field of typological analysis of how different complementarities produce a synthesis.

These asymmetries invite looking for the finer criteria of the apex conditions beyond their average values (K_S). Table S1.8-2 summarizes such criteria based on Fig. S1.8.

Table S1.8-2. Empirical criteria for selecting apex tetrad from Fig. S-1

	Positive T				Negative T			
	T+	A+	T-	A-	T+	A+	T-	A-
K_T	Max	Max	-	-	Max	Max	-	-
K_A	Min	-	Min	-	-	Max	-	-

S1.9 Control Statements' Examples

Table S1.9. Control Statements for T = Love, A = Hate

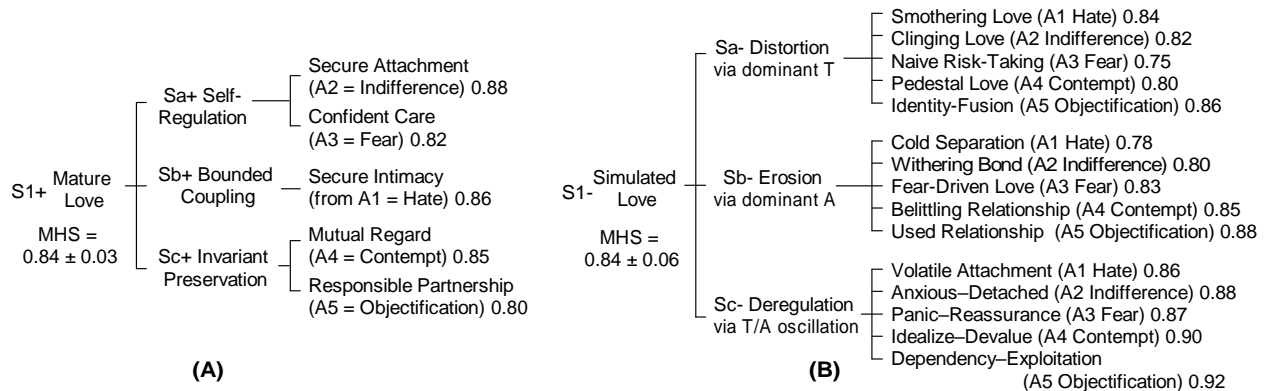
Case	T= Love, A = Hate	CC*	T = Sugar, A = Energy conversion	CC*
(A) Balanced system	Bonding (T_1^+) without Autonomy (A_1^+) yields Enmeshment (T_1^-)	0.92	Carbon fixation (T_1^+) without Regulated transduction (A_1^+) yields Resource depletion (T_1^-)	0.90
	Autonomy (A_1^+) without Bonding (T_1^+) yields Alienation (A_1^-)	0.90	Regulated transduction (A_1^+) without Carbon fixation (T_1^+) yields Oxidative dissipation (A_1^-)	0.93
(B) Biased toward T	Bliss (T_2^+) without Detachment (A_2^+) yields Dependence (T_2^-)	0.82	Enhanced Growth (T_2^+) without Energy Efficiency (A_2^+) yields Resource Depletion (T_2^-)	0.85
	Detachment (A_2^+) without Bliss (T_2^+) yields Despair (A_2^-)	0.78	Energy Efficiency (A_2^+) without Enhanced Growth (T_2^+) yields Energy Deficit (A_2^-)	0.70
(C) Biased toward A	Attachment (T_3^+) without Sovereignty (A_3^+) yields Oblivion (T_3^-)	0.72	Resource Conservation (T_3^+) without Strong Energy Capture (A_3^+) yields Carbon Starvation (T_3^-)	0.87
	Sovereignty (A_3^+) without Attachment (T_3^+) yields Solitude (A_3^-)	0.88	Strong Energy Capture (A_3^+) without Resource Conservation (T_3^+) yields Photodamage (A_3^-)	0.94

* Conceptual Coherence estimated by GPT 5.2

S1.10 Types and Examples of Syntheses and Pathologies

Table S1.10. Typical modes of Positive Synthesis (S+)

	Sa+ (Process)	Sb+ (Structure)	Sc+ (Normative)	S+ (Apex)
Core Principle	Self-Regulation and Resilience	Bounded Coupling	Invariant Preservation:	Emerging Unity, New Quality
General Schema	Remaining stable under shocks	Preserving distinction while creating new relations	Preserving core values while creating new meanings	Emergent unity that transforms values without erasing prior integrity
Birth of a Child	Emotion reorganizes around care	Proximity and irreducible distinction	Authority reorganizes under dignity	Co-emergent Parent–Child unity
Emergence of Love	Remaining stable together	Being close without losing ourselves	Mutual respect and regard	Mature Love
Emergence of Traditions	Surviving contact with change	Preserving diversity	Deserving allegiance	Cultural Wisdom
Emergence of Institutions	Remaining stable	Preserving civil autonomy	Constraining power	Legitimate Governance
Scientific Paradigms	Coherence under anomaly	Integrative Modeling	Truth constrains theory	Scientific Maturity
AI / Software	Operational Robustness	Modular Integrity	Invariant Preservation	Reliable Integration



See also S1.5 and S1.6 Taxonomies above, where different columns represent alternative types of developmental steps toward S+

S1.11 Circular Causality and Transitions

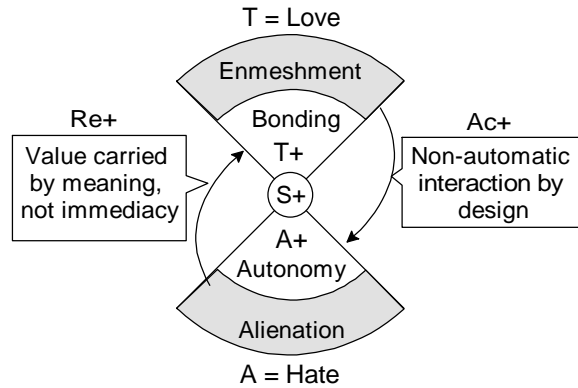


Fig. S1.11-1. One of self-regulatory cycles turning $T = \text{Love}$ and $A = \text{Hate}$ into $S+ = \text{Bounded Coupling}$

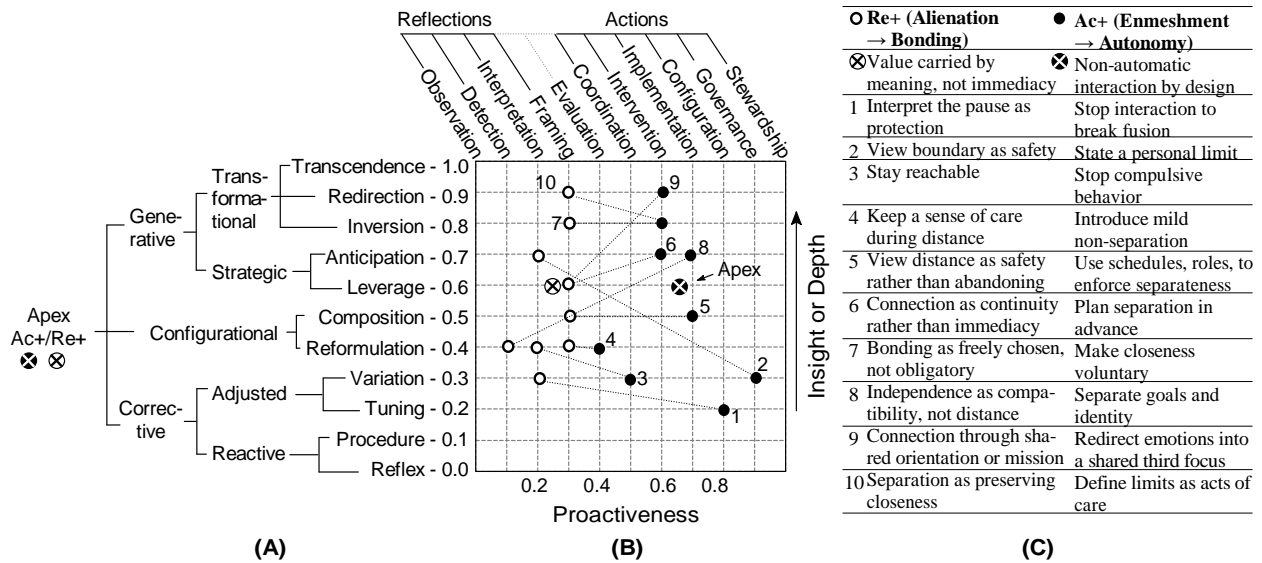


Fig. S1.11-2. Possible taxonomy of Ac/Re+ transitions, exemplified for $T = \text{Love}$ and $A = \text{Hate}$

S2. Understanding Systems

S2.1 Summary of Analyzed Systems

Table S2.1 Summary of Analyzed Systems.

Cycle	No* ≥ 0.5	Log N*	Self-Reg*	Natural?
DISC Traits	6	0	1.00	Yes
Organization optimization (1)**	6	1 – 2	0.65	Hybrid
Corporation / Viral Business	5	1 – 4	0.55	Hybrid
Self-Driving Vehicle (SDV)	4	-	0.15	No
Organization optimization (2)**	4	1 – 3	0.65	Hybrid
Photosynthesis	4	-	0.90	Yes
Israel – Palestine Conflict	3	6 – 8	0.35	No
Economy	3	6 – 9	0.50	Hybrid
Global Problematique	2	9 – 10	0.25	No
4-Stroke Engine	1	-	0.00	No

* No ≥ 0.5 – number of causal sequences with feasibility ≥ 0.5 ;

Log N – logarithm of the number of people involved

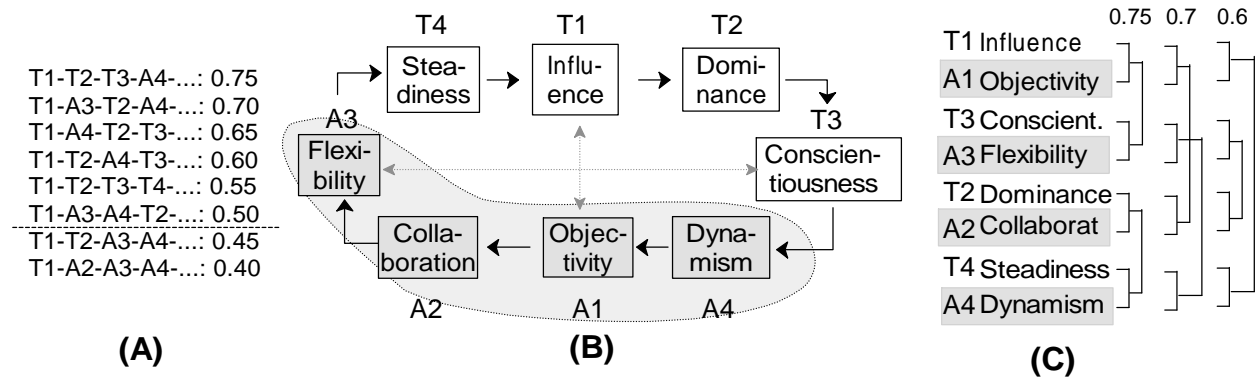
Self-Red – self-regulatory capability estimated by GPT-5

** Data available from the author

There is a clear inverse correlation between the number of feasible causalities (No ≥ 0.5) and log N (see Fig. S2.1). Also, note that the 4-stroke engine scored the lowest, whereas DISC traits and small organizations scored the highest, suggesting that No ≥ 0.5 may serve as a rough measure of self-regulatory capability. The relatively low value for photosynthesis may simply reflect our limited understanding of the underlying mechanisms, whereas the relatively high value for the self-driving vehicle may reflect limitations of the present model.

S2.2 Psychology / DISC Character Traits

The classic DISC sequence: T1 = Influence, T2 = Dominance, T3 = Conscientiousness, T4 = Steadiness. The flow from assertive traits (T1, T2) to methodical traits (T3, T4) creates a natural leadership-to-implementation arc.



Scheme A shows that six of eight sequences score ≥ 0.5 , with the remaining two not far behind—indicating the highest self-regulatory capacity observed in this study. Scheme B reveals the most probable cycle, with all antithetical domains clustered between T3 and T4. This suggests that methodological traits may host the highest internal variability—an area worth deeper attention, especially when analyzing personality differences among individuals or teams with similar DISC profiles.

Scheme C shows two dominant entanglements: Influence/Objectivity (T1–A1) links with Conscientiousness/Flexibility (T3–A3), while Dominance/Collaboration (T2–A2) aligns with Steadiness/Dynamism (T4–A4). In other words, those who are "Conscientiously Flexible" tend to be both influential and grounded, while "Steadily Dynamic" individuals balance assertiveness with cooperative execution. These couplings, however, may shift easily—given the closeness of competing sequence probabilities.

Wheel Derivation:

T1 = Influence

T1+ = Inspirational leadership, motivation

T1- = Manipulation, excessive emotionality

A1 = Objectivity

A1+ = Rational decision-making, impartiality

A1- = Cold detachment, inability to connect

Diagonal oppositions:

T1+ (Inspirational leadership) ↔ A1- (Cold detachment): Yes, these oppose each other

T1- (Manipulation) ↔ A1+ (Rational decision-making): Yes, these oppose each other

T2 = Dominance

T2+ = Decisive action, protection

T2- = Aggression, authoritarianism

A2 = Collaboration

A2+ = Mutual empowerment, shared solutions

A2- = Indecision, excessive compromise

Diagonal oppositions:

T2+ (Decisive action) ↔ A2- (Indecision): Yes, these oppose each other

T2- (Aggression) ↔ A2+ (Mutual empowerment): Yes, these oppose each other

T3 = Conscientiousness

T3+ = Reliability, thorough preparation

T3- = Rigidity, perfectionism

A4 = Flexibility

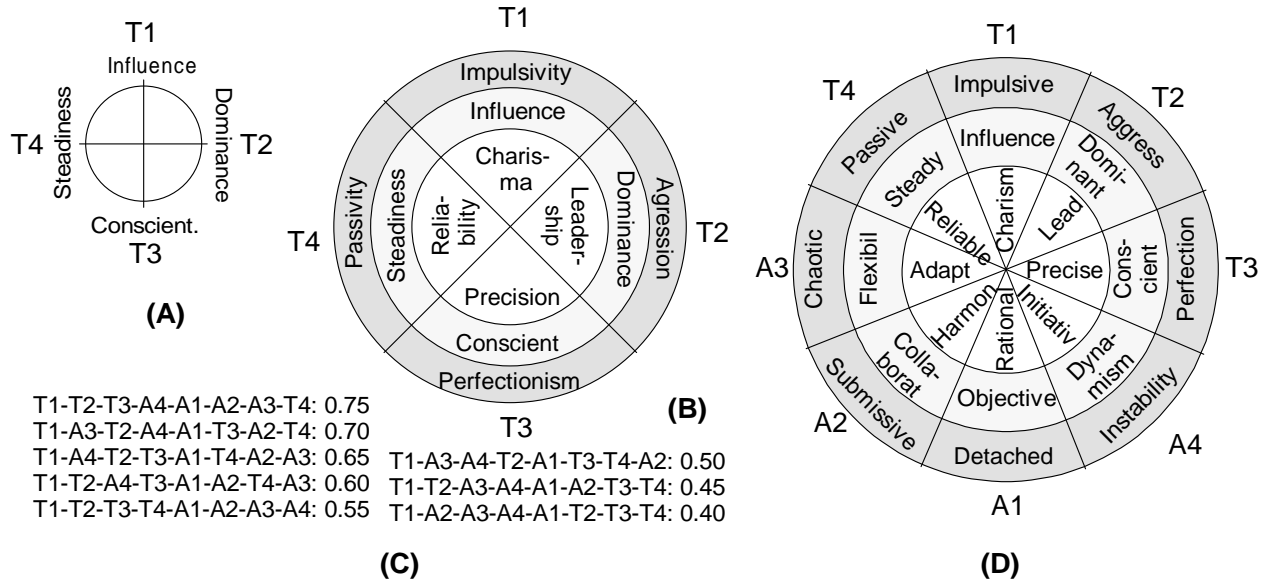
A4+ = Adaptability, openness to change

A4- = Inconsistency, lack of follow-through

Diagonal oppositions:

T3+ (Reliability) ↔ A4- (Inconsistency): Yes, these oppose each other

T3- (Rigidity) ↔ A4+ (Adaptability): Yes, these oppose each other



S2.3 Economic Cycle

Major steps: Policy Planning (T1) – Implementation (T2) – Market Response (T3) – Adaptation (T4).

Table S2.3 Dialectical Analysis of Economic Cycle

	Steps (T1, T2)	Blindspots (A1, A2)	Steps (T3, T4)	Blindspots (A3, A4)
Step	T1 = Policy Planning	A1 = Emergent Behavior	T3 = Market Response	A3 = Control Framework
Goals	T1+ = Foresight	A1+ = Natural Flow	T3+ = Innovation	A3+ = Stability
Risks	T1- = Detachment	A1- = Market Failures	T3- = Volatility	A3- = Stagnation
Owner	Congress, Think Tanks	Large Banks, Investment Funds, Multinat. Corporat.	Small/medium enterprises, consumers	Ministries, Regulatory Agencies, Admin. Bodies
Synthesis	S+ = Democratic Capitalism (Nordic dream) S- = Corporate Feudalism (gilded age USA)		S+ = Citizen-Powered Regulation (Swiss dream) S- = Administrative Suffocation (like in Venezuela)	
Step	T2 = Implementation	A2 = Experimentation	T4 = Adaptation	A4 = Subordination
Goals	T2+ = Execution	A2+ = Learning	T4+ = Flexibility	A4+ = Consistency
Risks	T2- = Overregulation	A2- = Inefficiency	T4- = Inconsistence	A4- = Rigidity
Owner	Government Action, Policy Execution	Central Bank, Econom. Council, Fin. Regulat.	Lobbyists, Prof. Networks, Unions	Taxation, Linecsing, Compliance
Synthesis	S+ = Dynamic Governance (Estonian dream) S- = Mechanical Bureaucracy (Soviet Union)		S+ = Intelligent Accountability (New Zeland dream) S- = Authoritarian Standardization (North Korea)	

In the table, diagonal arrows between T and A indicate dialectical entanglements (e.g., T⁺ vs. A⁻). This helps identify domain “owners”—the institutions or actors that typically embody each polarity. The synthesis outcomes (S⁺ and S⁻) support early-stage diagnostics by anticipating either constructive or regressive developments.

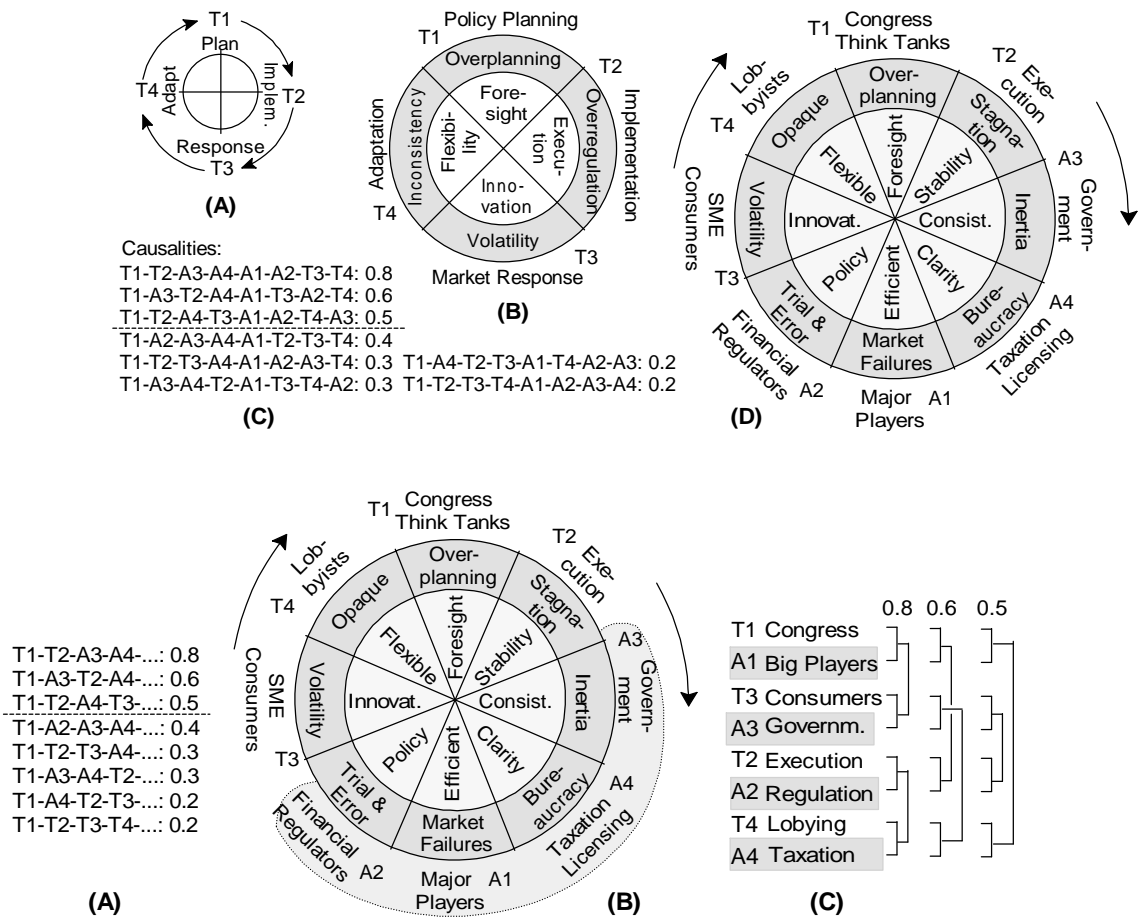


Fig. S2.3

Scheme A presents the estimated feasibility of regulatory sequences (first halves shown; second halves are their antitheses). Only 3 out of 8 exceed the threshold—suggesting weak self-regulation.

Scheme B highlights the optimal causal pathway, revealing a major blind spot between Policy Execution (T2) and SME/Consumer Response (T3)—a crucial leverage point for policy intervention. This structure may shift if the initial T1–T4 definitions are changed.

Scheme C identifies leverage mechanisms: T1–A1 (Congress vs. Major Players) is bound with T3–A3 (Consumers vs. Government), reflecting familiar effects like regulatory capture and policy lag (Stigler, 1971; Lindblom, 1959). T2–A2 (Execution vs. Regulators) is entangled with T4–A4 (Lobbying vs. Taxation), showing the push–pull between enforcement and influence—well documented in institutional economic theory (North, 1990).

These results align with traditional views while potentially revealing new effects through longer-range causal structures (cf. Arthur, 1999).

S2.4 Business Cycle

Figure S2.4 analyzes the cycle: Vision (T1) → Plan (T2) → Execution (T3) → Adjustment (T4). (Full analysis is provided in the Supplementary Material.)

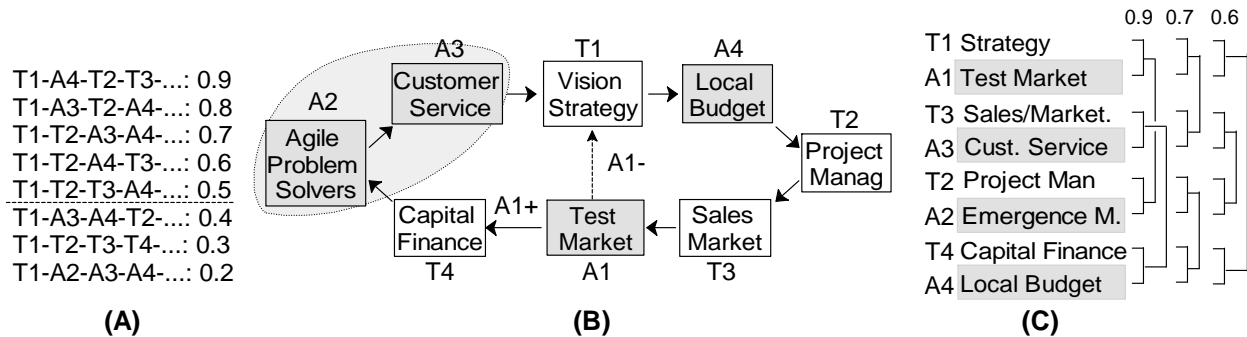


Fig. S2.4

Scheme A shows that 5 out of 8 sequences exceed the 0.5 probability threshold—indicating a strong homeostatic capacity, provided the organization can align around one of these optimal sequences.

Scheme B shows the optimal sequence. The strategic vision (T1) is tested through a localized budget (A4), which funds execution (T2) and market entry (T3). Market response (A1) reveals feasibility (A1⁺) or exposes short-termism (A1⁻). If negative, the cycle loops back to revise the strategy (T1). If positive, capital (T4) should support not traditional project structures (T2), but agile problem-solving teams (A2), shifting focus toward customer service (A3) rather than extended marketing (T3). This enables value to grow through resonance and trust rather than persuasion.

This dynamic reflects patterns of disruptive innovation (e.g., early Facebook), where value emerges not through capital-pushed marketing but through ecosystem alignment and feedback. Over-reliance on mass marketing may yield shallow wins and unstable models.

S2.5 Four-Stroke Engine

Figure S2.4 analyzes the following cycle: T1 = Fuel Intake, T2 = Compression, T3 = Combustion, T4 = Exhaust.

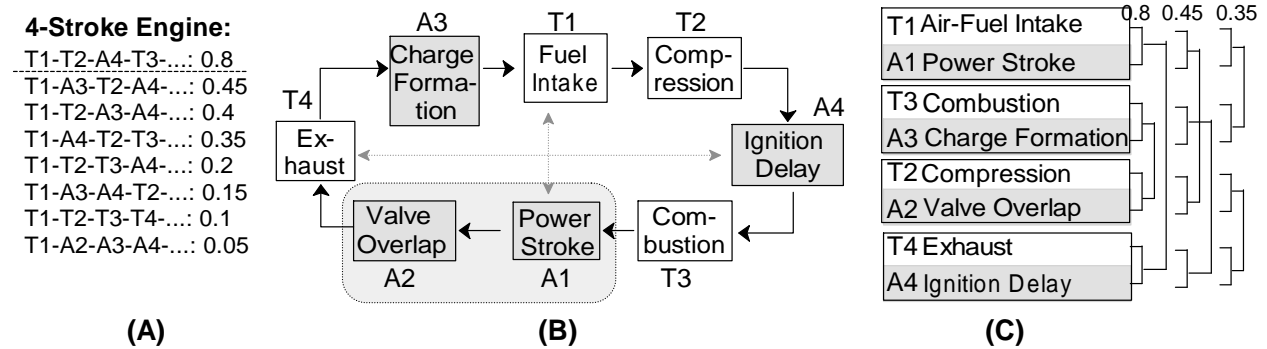


Fig. S2.5

Scheme A shows only one valid path, suggesting extremely limited self-regulatory capacity.

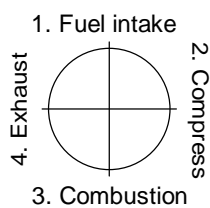
Scheme B highlights this sequence. The antithetical domains are distributed fairly evenly, with a notable two-step blind spot between T3 (Combustion) and T4 (Exhaust)—a key zone for performance tuning.

Scheme C identifies key leverage points: T1–A1 (Fuel Intake / Power Stroke) is entangled with T4–A4 (Exhaust / Ignition Delay), while T2–A2 (Compression / Valve Overlap) is entangled with T3–A3 (Combustion / Charge Formation). These couplings reflect known interdependencies in combustion timing and airflow dynamics—areas long studied in mechanical engineering optimization (Heywood, 1988).

4-Stroke Engine	
	Steps T1 - T4 Blindspots A1 - A4
Step 1	T1 = Air-Fuel Intake A1 = Power Stroke
Goals	T1+ = Efficient A1+ = Work
Risks	T1- = Clogging A1- = Blowby Jamming
Syn-thesis	S+ = Synergized Combustion (Hybrid Engine) S- = Energy Waste (Engine Cnocking)
Step 2	T2 = Compression A2 = Vale Overlapp
Goals	T2+ = Power A2+ = Exhaust Scaveng
Risks	T2- = Stress A2- = Charge Dilution
Syn-thesis	S+ = Torque Harmony (Formula 1 Dynamic Tunning) S- = Thermal Stress (Unstable Vavle Tunning)
Step 3	T3 = Combustion A3 = Charge Formation
Goals	T3+ = Force A3+ = Mixing
Risks	T3- = Heat A3- = Stratification
Syn-thesis	S+ = Clean Burn Profile (Highly Efficient EV Hybrids) S- = Incomplete Burn (Dirty Exhaust in Cheap Engine)
Step 4	T4 = Exhaust A4 = Ignition Delay
Goals	T4+ = Cleansing A4+ = Timing
Risks	T4- = Back-Pressure A4- = Cnock
Syn-thesis	S+ = Rhythmic Pulse Flow (Engine Break Systems) S- = Echo Pressure Loop (Backpressure Loss)

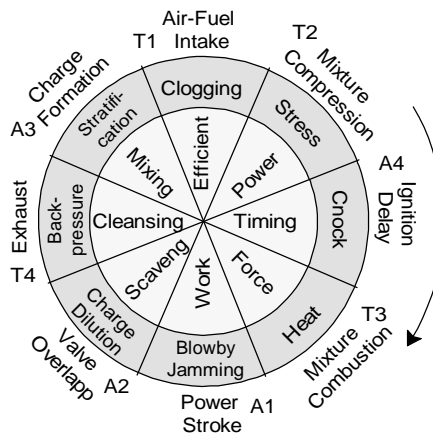
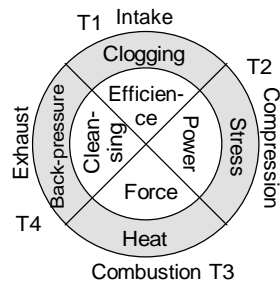
S+ in each case involves a fine-tuned synergy, generating a new functional quality (e.g. smoother torque, cleaner combustion).

S- indicates dominance of one side, causing energetic or systemic inefficiency through forced uniformity.



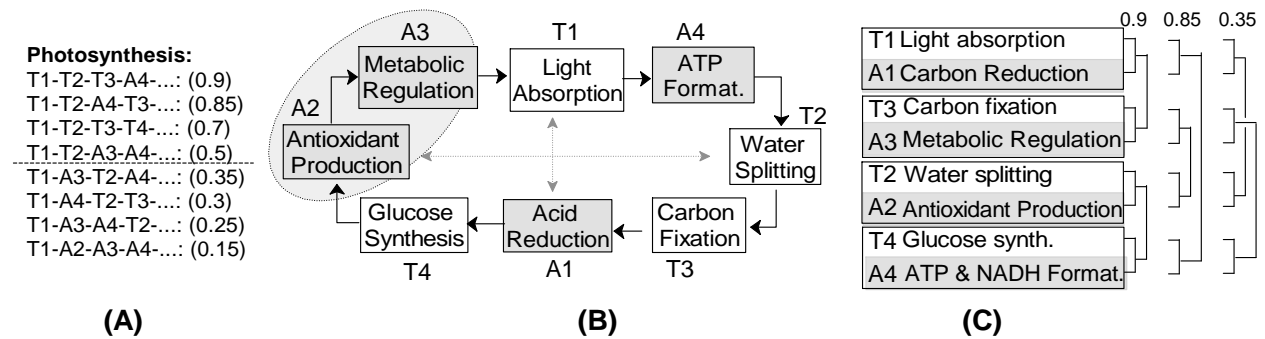
4-Stroke Engine:

- T1-T2-A4-T3-A1-A2-A3-T4: (0.8)
- T1-A3-T2-A4-A1-T3-A2-T4: (0.45)
- T1-T2-A3-A4-A1-A2-T3-T4: (0.4)
- T1-A4-T2-T3-A1-T4-A2-A3: (0.35)
- T1-T2-T3-A4-A1-A2-A3-T4: (0.2)
- T1-A3-A4-T2-A1-T3-T4-A2: (0.15)
- T1-T2-T3-T4-A1-A2-A3-A4: (0.1)
- T1-A2-A3-A4-A1-T2-T3-T4: (0.05)



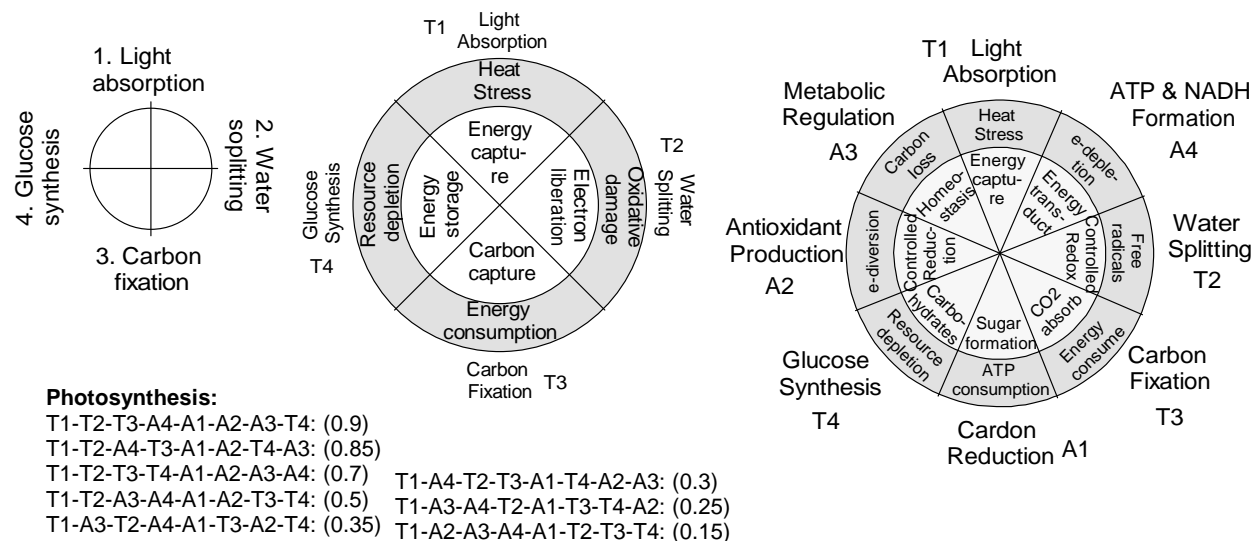
S2.6 Photosynthesis

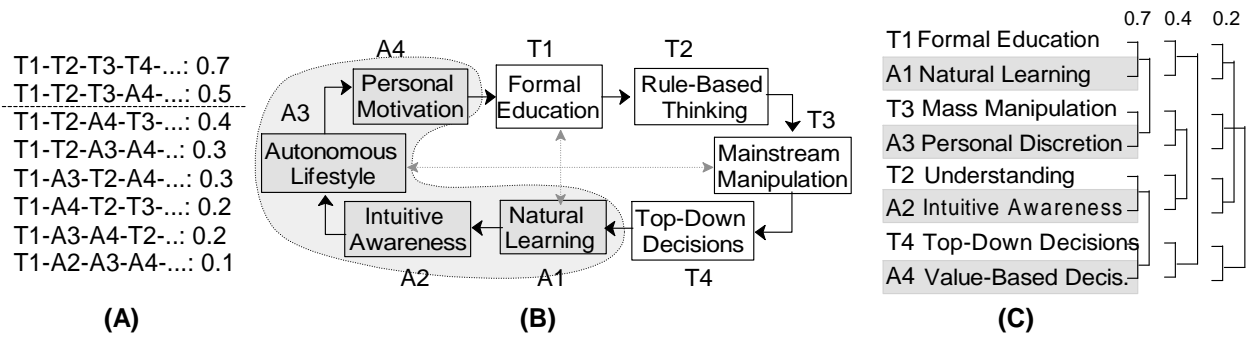
Major steps: T1 = Light Absorption, T2 = Water Splitting, T3 = Carbon Fixation, T4 = Glucose Synthesis.



Scheme A shows four out of eight sequences scoring ≥ 0.5 , indicating moderate self-regulatory capacity. However, for such a highly evolved and fundamental process as photosynthesis, one might expect full homeostatic potential—i.e., all sequences to be feasible. This discrepancy most likely reflects incomplete AI knowledge of biochemical pathways, rather than any deficiency in the natural system itself.

Scheme B presents the most likely sequence, while Scheme C highlights entanglement zones. The low entanglement between T1–A1 and T2–A2 likely reflects AI’s limited knowledge of compensatory mechanisms such as water-splitting and oxidative stress. The weak linkage between T3–A3 and T4–A4 may point to an underrepresentation of downstream metabolic feedback—like ATP or glucose levels—affecting upstream carbon fixation.





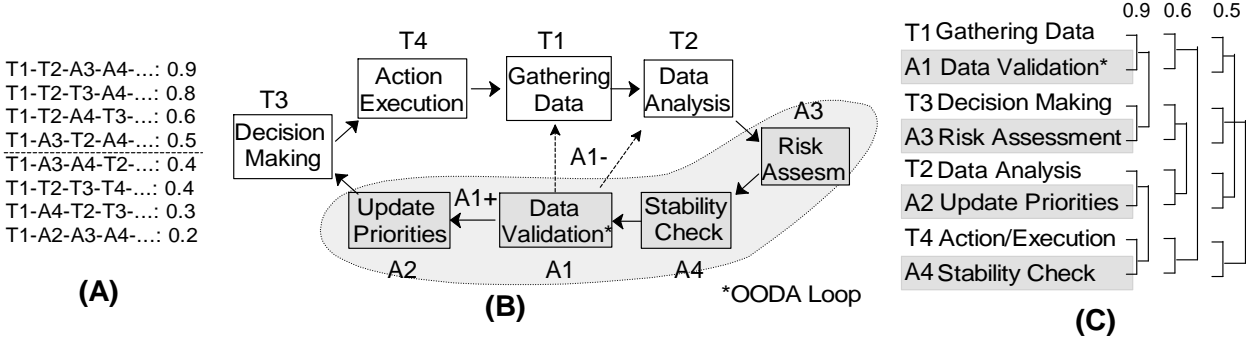
Scheme A shows distribution of probabilities commensurate to those from the Israeli-Palestinian Conflict. Only 2 sequences show acceptable values, indicating high vulnerability to external factors.

Scheme B shows that all blind-spots are located between the Top-Down Decisions (T4) and Formal Education (T1), clearly indicating that the root cause of humankind’s problematique lays in the biased views of the top decision-makers and socio-political governance.

Scheme C identifies the strongest entanglements between the Learning/Education (T1-A1) and Information Perception (T3-A3) on one hand, and between type of thinking (T2-A2) and decision-making (T4-A4) on another hand. This implies for instance, that mass media (T3) is most sensitive to the level of economic autonomy (A3) and thought independence of population (T1-A1), while political decisions (T4) are most sensitive to value system (A4) and the balance between common sense (A2) and indoctrination (T2).

S2.8 Self-Driving Vehicles (SVD)

Starting cycle: Data Gathering (T1) – Data Analysis (T2) – Decision-Making (T3) – Execution (T4).

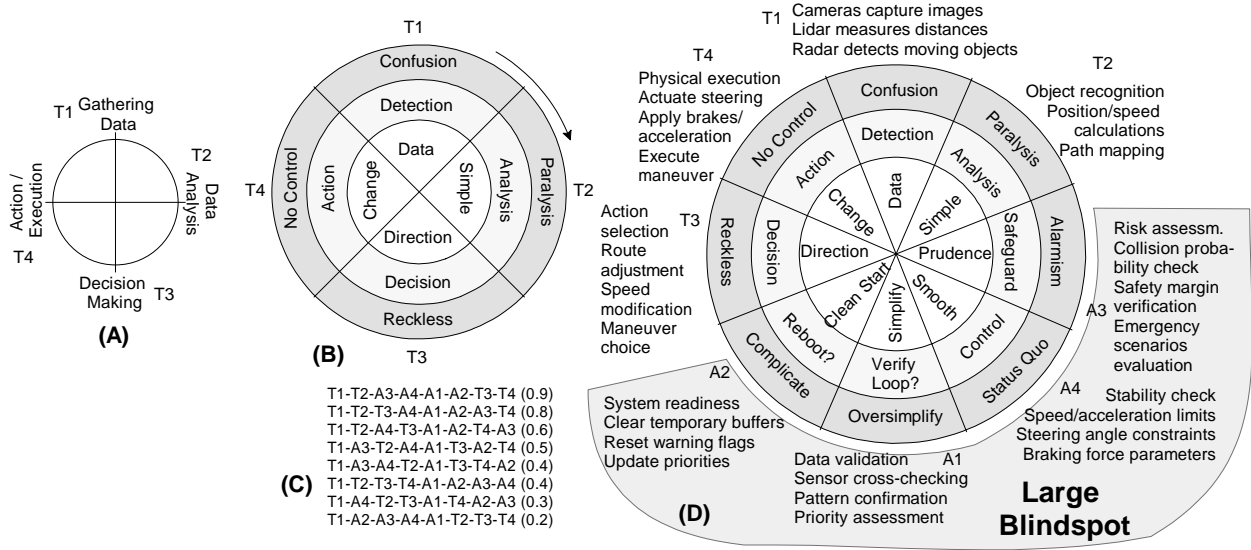


Scheme A shows that 4 of 8 sequences have feasibility scores ≥ 0.5 , indicating a fairly high self-regulation potential. Scheme B highlights that the Decision-Making stage (T3) is preceded by a large blind spot (A1–A4), which must be accounted for within the Data Analysis stage (T2). Notably, this blind spot includes processes reminiscent of the OODA loop (Observe–Orient–Decide–Act), suggesting that pre-decision quality control is essential. Specifically, once A1⁺ = Proper Simplification is achieved, priorities should be re-evaluated and system memory reset (A2 = RAM Clearance).

Scheme C illustrates two key entanglements: T1–A1 (Data Gathering/Validation) is entangled with T3–A3 (Decision/Filtering) — indicating that data integrity strongly influences decision relevance; T2–A2 (Analysis/Memory) is entangled with T4–A4 (Execution/Stability) — implying that data processing governs execution quality and system robustness.

Self-Driving Vehicles

	Steps T1 - T4	Blindspots A1 - A4
Step 1	T1 = Object Detection	A1 = Data Validation
Goals	T1+ = Data Gathering	A1+ = Simplify
Risks	T1- = Confusion	A1- = Oversimplify
Syn-thesis	S+: Meaningful detection filtered through pattern validation, e.g. Waymo's multi-sensor fusion system preventing false positives S-: Redundant Monitoring - sluggish decision-making due to over-checking, e.g. early Tesla systems prone to "phantom braking" due to overreaction	
Step 2	T2 = Data Analysis, Object Recognition	A2 = Data Clearance, Update Priorities
Goals	T2+ = Clear & Effective	A2+ = Clean Start
Risks	T2- = Paralysis	A2- = Complicate
Syn-thesis	S+: Real-Time Prioritization - Instantly clearing data noise to enable fast planning, e.g. Mobileye's RSS model S-: Analytical Bloat - processing everything equally, causing lag, e.g. Low-end AV prototypes that choke on edge-case scenarios due to data overload	
Step 3	T3 = Decision Making	A3 = Risk Assessment
Goals	T3+ = Confident	A3+ = Prudence, Safeguard
Risks	T3- = Reckless	A3- = Alarmism
Syn-thesis	S+: Dynamic Caution - Balancing confidence with safety margins in real time Cruise adjusting routes dynamically in San Francisco congestion S-: False Safety Loop - Stops or stalls due to exaggerated risk aversion, e.g. Uber AV fatal crash (2018) — system failed to react after excessive hesitation	
Step 4	T4 = Action, Execution	A4 = Control/Stability Check
Goals	T4+ = Change	A4+ = Smooth
Risks	T4- = No Control	A4- = No Change
Syn-thesis	S+: Seamless Maneuvering with continuous micro- adjustments, e.g. Waymo's predictive braking and turning S-: Status Quo Lock-in - Hesitating to act due to rigid safety buffer, e.g. AVs stuck at 4-way stops — all waiting forever due to over-conservatism	



S2.9 Israel – Palestine Conflict

Israel Claims:

T1: Israel must exist as the national home for the Jewish people.

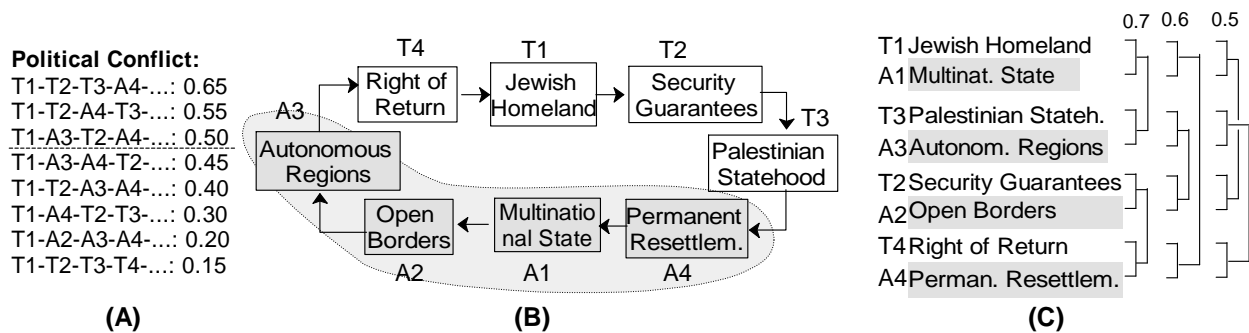
T2: Israel requires robust security measures to protect its population.

Palestinian Claims:

T3: Palestinians must have their own independent sovereign state.

T4: Palestinian refugees should be allowed to return to their ancestral homes.

Non-dialectical AI suggested using international peacekeepers, humanitarian corridors, and phased implementation with international guarantees. Yet, this approach has been attempted multiple times, and repeatedly failed because it relies on external actors and top-down implementation. The dialectical approach aims to structure bottom-up complementarity instead.



Scheme A shows moderately high feasibility across multiple sequences, indicating latent potential for systemic resolution. These values might be improved by reordering the initial claims into a more balanced configuration. Scheme B shows the best sequence for the given T1-T4 arrangement. It moves from Israeli security concerns (T1, T2) to Palestinian statehood (T3), then pivots to refugee resettlement (A4) rather than full return (T4). It then moves through multinational state concepts (A1) and open borders (A2) before addressing historical justice. The compromise positions are interspersed with traditional positions.

All blind spots occur between T3 (Palestinian Statehood) and T4 (Right of Return), perhaps due to the fact that both of Israeli claims were placed as the two starting points.

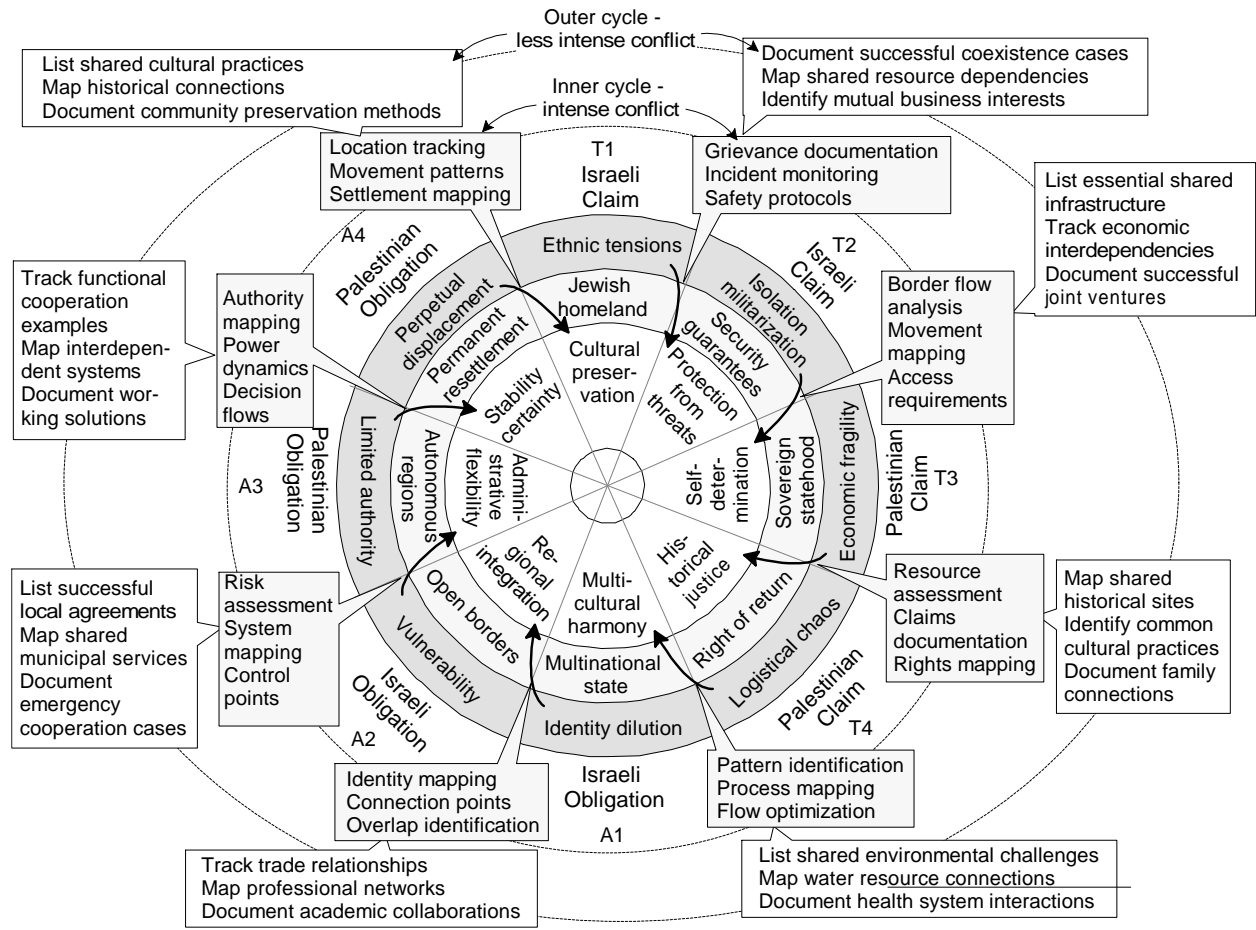
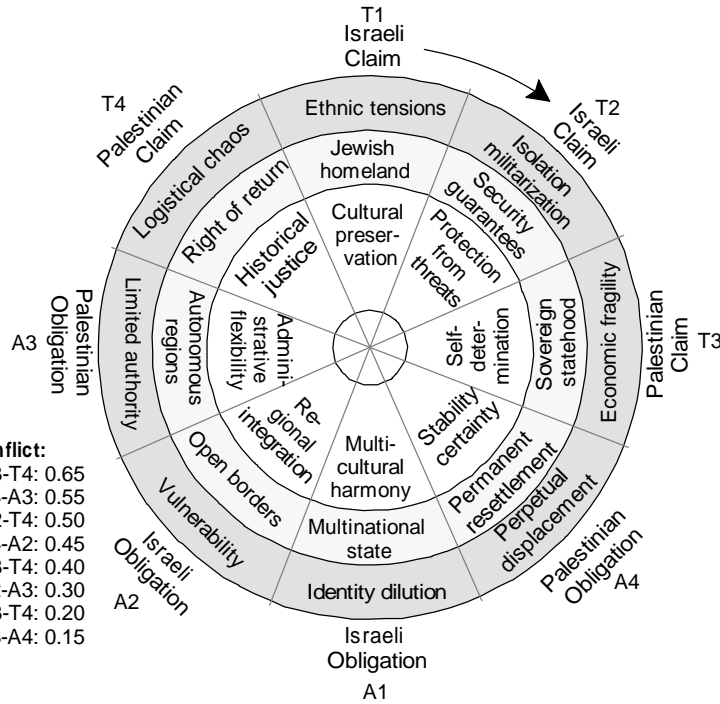
Scheme C reveals two key entanglement pairs. T1–A1 (Jewish Homeland vs. Multinational State) and T3–A3 (Palestinian Statehood vs. Autonomy) reflect identity–sovereignty trade-offs.

T2–A2 (Security vs. Open Borders) and T4–A4 (Right of Return vs. Resettlement) capture the tension between national protection and human mobility.

	Steps (T1, T2)	Blindspots (A1, A2)
Step	T11 = Israel must exist as the national home for the Jewish people	A11 = Multinational state for pluralistic coexistence
Goals Risks	T11+ = Cultural preservat. T11- = Ethnic exclusivity	A11+ = Multicultural harmony A11- = Identity dilution
Syn-thesis	S11+ = Cultural Federation (e.g., Belgium's federal system for both Flemish and Walloon identities) S11- = Enforced Homogeneity (e.g., Franco's Spain suppressing Catalan and Basque identities)	
Step	T12 = Israel requires robust security measures to protect its population	A12 = Open borders with reasonable protocols
Goals Risks	T12+ = Civilian protection T12- = Excess. restrictions	A12+ = Free movement A12- = Security vulnerability
Syn-thesis	S12+ = Collaborative Security (e.g., EU's Schengen Area) S12- = Militarized Control (e.g., Soviet-era Berlin Wall)	
Step	T21 = Palestinians must have their own independent sovereign state	A21 = Autonomous regions with regional integration
Goals Risks	T21+ = Self-determination T21- = Isolated sovereignty	A21+ = Cooperative governance A21- = Limited authority
Syn-thesis	S21+ = Confederal Partnership (e.g., Switzerland's cantons) S21- = Fragmented Dependence (e.g., Bantustans in apartheid South Africa)	
Step	T22 = Palestinian refugees should be allowed to return to their ancestral homes	A22 = Permanent resettlement of Palestinian refugees with compensation
Goals Risks	T22+ = Historical justice T22- = Demograph disrupt	A22+ = Future stability A22- = Historical erasure
Syn-thesis	S22+ = Heritage Reconciliation (e.g., Post-WWII German reconciliation with Jewish communities) S22- = Imposed Resettlement (e.g., Forced population exchanges between Greece and Turkey in the 1920s)	

Israeli-Palestinian Conflict:

- T1-T2-T3-A4-A1-A2-A3-T4: 0.65
- T1-T2-A4-T3-A1-A2-T4-A3: 0.55
- T1-A3-T2-A4-A1-T3-A2-T4: 0.50
- T1-A3-A4-T2-A1-T3-T4-A2: 0.45
- T1-T2-A3-A4-A1-A2-T3-T4: 0.40
- T1-A4-T2-T3-A1-T4-A2-A3: 0.30
- T1-A2-A3-A4-A1-T2-T3-T4: 0.20
- T1-T2-T3-T4-A1-A2-A3-A4: 0.15



S3. Theory Completion

S3.1 Requisite Variety and Requisite Parsimony

Table S3.1-1 Requisite Variety vs. Requisite Parsimony (Petrauskas, 2026)

T = Requisite Variety	A = Requisite Parsimony
T1+ Comprehensive Understand; T2+ Shared meaning	A1+ Focused Clarity; A2+ Structured Reasoning
T1– Cognitive Overload; T2– Fragmented Perspectives	A1– Reductionist Oversimplification A2– Mechanistic Formalism

Table S3.1-2 illustrates how exaggerated forms of each dimension can be transformed into constructive developments. Generative AI can assist using simple prompts (e.g., "suggest how to transform T/Ax– into T/Ay+"), producing laconic suggestions while preserving parsimony.

Table S3.1-2. Examples of GPT-5 suggested transitions from downsides to upsides

Negative pole	→ T1+ Comprehensive understanding	→ A1+ Focused clarity	→ T2+ Shared meaning	→ A2+ Structured reasoning
T1– Cognitive overload	Organize observations into coherent themes	Prioritize leverage points	Build common vocabulary	Visual influence maps
A1– Reductionist oversimplification	Restore omitted stakeholder viewpoints	Recover essential distinctions	Dialogue across conflicting perspectives	Multi-level system representation
T2– Fragmented perspectives	Integrate stakeholder narratives	Clarify common priorities	Facilitate consensus building	Explicit relationship mapping
A2– Mechanistic formalism	Include experiential knowledge	Simplify excessive mathematics	Connect models with human meaning	Hybrid dialogue–simulation workflow
Child-Clear Principle	Nobody sees the whole picture	Keep only what changes the outcome	Understand before deciding	Everything important is connected

S3.2 Resilience Engineering

Table S3.2-1 Resilience Engineering & Safety Science (Hollnagel, 2014)

Safety-I / Ac+ (T- → A+)	Safety-II / Re+ (A- → T+)
T = Prevent failure through rule-based control	A = Understand and reinforce successful adaptation
T1+ = Controlled Certainty T2+ = Compliance and accountability T3+ = Clear boundaries	A1+ = Adaptivity A2+ = Learning and continuous improvement A3+ = Intelligent autonomy
T1- = Rigidity T2- = Bureaucracy T3- = Fear of making mistakes	A1- = Uncontrolled Variability A2- = Normalization of deviance A3- = Arbitrary behavior
Ac1+ = Make all rules advisory by default, mandatory only by exception	Re1+ = Explicit zero-tolerance boundaries ("child-clear" red lines)

For the Safety-I versus Safety-II debate, DWs suggest replacing the traditional rules-versus-flexibility dilemma with the principle "advisory by default, mandatory by exception." Rules should remain advisory unless they protect clearly defined red-line conditions, whereas Safety-II should identify and continuously refine these exceptional boundaries. Consequently, operational procedures become continuously testable hypotheses rather than immutable prescriptions.

Table S3.2-2 Transitions' matrix for two tetrads

Negative pole	→ T2+ Organizational learning	→ A2+ Contextual judgment	→ T3+ Clear boundaries	→ A3+ Intelligent autonomy
T2- Bureaucratic rigidity	Continuously revise obsolete rules	Balance compliance with purpose	Simplify unnecessary procedures	Delegate operational discretion
A2- Normalization of deviance	Learn from weak signals	Periodically recalibrate acceptable risk	Reinstate critical safety barriers	Detect unsafe adaptations early
T3- Fear of making mistakes	Review incidents without blame	Train principled risk assessment	Clarify essential safety rules	Encourage local decision-making
A3- Arbitrary behavior	Share successful adaptations	Reinforce ethical responsibility	Establish non-negotiable safety limits	Coach adaptive decision skills
Life Principles	Learn from success	Adapt responsibly	Protect red lines	Use freedom wisely

S3.3 Developmental Psychology

Table S3.3-1 Developmental Psychology: Subject-Object Theory (Kegan, 1982)

Thesis / Ac+ (T- → A+)	Antithesis / Re+ (A- → T+)
T = Socialized Mind	A = Self-Authoring Mind
T1+ = Relational Interconnectedness T2+ = Shared Responsibility	A1+ = Independent Self-Determination A2+ = Authentic Autonomy
T1- = Loss of Autonomy / Individuality T2- = Conformity without Reflection	A1- = Hyper-individualistic Isolation A2- = Self-Centered Independence
Ac+ = Question positive and negative aspects of every institutional suggestion	Re+ = Express autonomy through shared obligations

Table S3.3-2 Developmental Psychology: Transitions' matrix

Negative pole	→ T+ Relational interconnectedness	→ A+ Independent self-determination	→ T2+ Shared responsibility	→ A2+ Authentic autonomy
T- Loss of autonomy / individuality	Build relationships through voluntary participation	Practice independent decision-making	Negotiate shared commitments	Express personal values respectfully
A- Hyper-individualistic isolation	Reconnect through empathic dialogue	Recognize legitimate personal boundaries	Participate in mutually beneficial cooperation	Develop purpose beyond social approval
T2- Conformity without reflection	Listen to diverse perspectives	Question inherited assumptions	Encourage constructive disagreement	Form independent judgments
A2- Self-centered independence	Appreciate interdependence	Accept responsibility for consequences	Balance personal and collective needs	Integrate autonomy with compassion
Life Principles	Care	Think	Share	Be Yourself