

universal flow theory  
david friml

WIP. First draft. collection of ideas

### QUICK INTRODUCTION

tying together how structures (atoms, molecules, cells, organisms, minds) form as a way for energy efficiency maximization. that structures emerge to more efficiently transform and "fully use up" the available energy. and that over time the most effective ones stabilize and form the foundation for emerging complexity, which opens up new ways to fully use available energy.... and that the most effective structures are the ones allowing for most energy flowthrough and least resistance. as the whole universe is one huge energy flow and energy transformations. and the notion that emergence life isn't different from emergence of atoms. and how principles and laws that guide those simple structures (like principle of least action) are the same that guide the more complex structures like life... well wrapping my mind around it now and finding ways to formulate it

kind of a vision of a more seamless energy flow universe. also how interconnected and "gentles" transformations (like smelling a flower) are actually the most efficient ways of energy utilization. (compared to for example destruction or burning stuff - which is a suboptimal, one-time energy transformation)

Hopefully making a scientific case for "seamlessness", harmony, flow... properly formulating this has a potential to "objectify" ethics and morality also.

### NOTES

rough notes. collection of ideas and speculations

It's looking at those energy transformations through the lens of entropy, because that's a well established concept. However, entropy can be thought of as an "exhaust gas" of energy transformations. directly correlated more entropy = more efficient/"thorough" energy transformation

Life is a natural extension of the second law of thermodynamics. It emerged (and increases in complexity) to more effectively transform energy and increase entropy (compared to simple systems). It does so by creating ever more complex and diverse pathways for energy transformations (and dissipation), producing more entropy along the way (relative to non-complex systems (rock)).

Second law of thermodynamics says that in a closed system entropy always increases. Entropy is a measure of disorder. For example, a coffee mug has lower entropy compared to a broken coffee mug. Or before you mix milk and coffee it's lower entropy compared to when you mix them up

together. Life actually fastens and optimizes this inevitable process. Using low entropy energy source (Sun) and converts it to high entropy waste. Ultimately second law suggest the heat death of the universe trillions of years into the future. big bang start = max low entropy, heat death end = max high entropy

## Life as an "Entropy Engine" / maximal energy transformations efficiency engine

Life consumes low-entropy energy (e.g., sunlight or chemical gradients) and reorganizes it into localized, low-entropy structures (like cells, organisms, and ecosystems). However, this reorganization is accompanied by a net increase in entropy in the surroundings:

1. Energy Dissipation: Life systems radiate heat and convert high-quality energy into lower-quality forms.
2. Biological Processes: Processes like metabolism, respiration, and trophic interactions accelerate entropy production.
3. Ecosystem Dynamics: Complex ecosystems amplify entropy production by fostering interdependencies and increasing energy flows.

This table illustrates how complex system is more effective in producing entropy compared to simple system

### Comparing Entropy Production in Non-Living and Living Systems

Process	Bare Rock (Entropy Production)	Complex Ecosystem (Entropy Production)
Energy Input	Solar Radiation: 1000 W/m <sup>2</sup>	Solar Radiation: 1000 W/m <sup>2</sup>
Heat Dissipation	Heat Radiation: 10 – 20 J/K/year	Heat Dissipation: 1000 – 10,000 J/K/year
Weathering/Erosion	Physical Weathering: 1 – 5 J/K/year	Decomposition: 100 – 1000 J/K/year
Chemical Reactions	Minimal (e.g., oxidation): 0.1 J/K/year	Metabolism: 1000 – 10,000 J/K/year
Biological Interactions	None	Trophic Interactions: 1000 – 10,000 J/K/year
Waste Heat from Respiration	None	Respiration: 1000 – 10,000 J/K/year
Total Estimated Entropy Production	10 – 30 J/K/year	10,000 – 100,000 J/K/year

Homeostasis as a key feature of this process

A Natural Law Connecting Biology and Physics

- Life as an Extension of Universal Dynamics:
  - Life's drive to increase entropy ties it directly to the second law of thermodynamics. It's not separate from the processes governing the movement of planets or the formation of galaxies but is an emergent, complex layer within the same framework.

- If this process is universal, it seems inevitable that other intelligent systems (e.g., aliens) would arise to fulfill the same role. They too would act as entropy amplifiers, leveraging computation, creativity, and civilization-building to dissipate energy at ever-larger scales.
- Homeostasis and the Middle Way:
  - Complex systems balance between extremes (e.g., chaos and order, expansion and optimization). This balancing act is itself a way to maximize dissipation without destabilizing the system prematurely.
  - For example:
    - Too much chaos (e.g., unchecked passion or unregulated growth) leads to system collapse.
    - Too much order (e.g., rigid optimization) stifles exploration and adaptability.
- Homeostasis is the dynamic equilibrium that allows systems to persist while maximizing entropy production over the long term.

Another key feature being the expansion / optimization dynamics where life both explores new ways to dissipate energy and produce entropy, while optimizing the current pathways to do so. Basically squeezing as much "entropy production" juice as much as possible

complementary "phases" of a universal energy dissipation process:

1. Expansion Phase:
  - Systems probe their environments, explore possibilities, and generate new pathways for energy dissipation.
  - Analogous to the "creative" side of entropy production, this phase involves high variance and unpredictability.
2. Optimization Phase:
  - Systems stabilize, refine, and optimize the pathways discovered in the expansion phase.
  - Analogous to the "stabilizing" side of entropy production, this phase involves reducing variance and increasing efficiency.
3. Cyclic or Spiral Progression:
  - Life doesn't move linearly but oscillates between expansion and optimization, creating an upward spiral of increasing complexity and dissipation capacity.

Taoist Yin-Yang as a Model:

- Chaos and order mirror the yin-yang duality:
  - Chaos (yin) is the fertile ground for new possibilities.
  - Order (yang) provides structure to harness and sustain those possibilities.
- Together, they enable life to "follow the Tao" of maximizing entropy while preserving itself.

Collaboration (not destruction) increases entropy more than destruction in the long run what I find fascinating is that one would assume that destruction would increase the entropy the most, but in fact collaboration and creation increase it the most, as those take diverse and various paths to fully use the low entropy energy.

It's potentially a fascinating idea in relation to potential encounter with other advanced alien civilizations in the future.

## Scenario A: Annihilating the Other Civilization by Nukes

- **Immediate Entropy Production:** The use of nuclear weapons would result in a massive and immediate increase in entropy due to the violent release of energy. The explosion would convert organized matter (buildings, infrastructure, living beings) into disordered forms (heat, radiation, debris), leading to a significant increase in entropy in the affected area.
- **Long-Term Effects:** However, the long-term effects would likely lead to a decrease in entropy production. The destruction of a civilization would eliminate its complex systems, interactions, and energy transformations. The remaining environment would be less dynamic, leading to lower overall entropy production over time as the area may become desolate and less active.
- **Overall Entropy Impact:** While the immediate entropy increase would be substantial, the long-term impact on entropy production would likely be negative, as the complexity and interactions that contribute to entropy would be lost.

## Scenario B: Cultural Exchange, Trade, Collaboration, and Technological Exchange

- **Immediate Entropy Production:** Initially, cultural exchange and collaboration may not produce as dramatic an increase in entropy as a nuclear explosion. However, the processes involved in trade, technological exchange, and collaboration can lead to increased complexity and energy transformations.
- **Long-Term Effects:** Over time, the merging of civilizations would likely lead to greater overall entropy production. The interactions between the two civilizations would create new systems, ideas, and technologies, leading to increased energy consumption, innovation, and complexity. This would result in more dynamic processes, greater resource utilization, and higher entropy production.
- **Overall Entropy Impact:** The long-term effects of collaboration and exchange would likely lead to a sustained increase in entropy due to the ongoing interactions, innovations, and energy transformations that arise from a more complex and interconnected society.

## Harmonious Systems as Optimal Entropy Producers

1. **Integration Over Fragmentation:**
  - Harmonious systems—whether ecological, social, or psychological—dissipate energy more effectively because they integrate diverse elements into a coherent whole.
  - For example:
    - A forest generates more entropy through the interconnected activity of plants, animals, and microorganisms than through a wildfire that temporarily releases stored energy but destroys complexity.
2. **Gentle and Nuanced Dissipation:**
  - Harmony enables energy to be dissipated in ways that are sustainable and iterative, fostering growth and further complexity. This aligns with life's gradual evolution toward more intricate pathways of energy transformation.

This perspective could inspire a new worldview where humanity sees its aggressive and destructive tendencies as part of a larger journey—one where we're transitioning from crude, chaotic dissipation to intricate, harmonious energy transformations. By embracing this shift,

humanity could align with the deeper laws of the universe, fostering a future rich in complexity, diversity, and sustainable joy.

How this ties to personal psychology

I see many parallels between this fundamental nature of living systems and how this stuff like flow, non-resistance, curiosity and creativity (exploring new and more nuanced entropy creation pathways), value of diversity,.. etc

How it is what Taoism describes. Entropy as the Tao and Flow

1. The Tao as Universal Flow:

- Taoist philosophy emphasizes the natural flow of life, the harmonious balance of opposites (yin and yang), and alignment with the way of the universe.
- If life fundamentally channels entropy increase, this "flow" could indeed reflect the Tao: the continuous process of energy transformation and dissipation.
- The Tao also suggests a balance between doing and non-doing (wu wei), reminiscent of the interplay between expansion (curiosity, passion) and optimization (efficiency, refinement) in life's energy dissipation.

2. Flow States in Psychology:

- At a personal level, "flow states" occur when a person's actions align effortlessly with their environment and purpose, minimizing resistance. This is akin to the principle of least action in behavior and cognition—a microcosmic reflection of universal energy dynamics.

3. Religious and Mystical Echoes:

- Many religious traditions speak of surrendering to a higher order or "divine will." Perhaps, this resonates with the idea of aligning with the natural process of entropy production—working with, rather than against, the universe's underlying flow.

Not sure how you find it, but to me it feels like grounded perspective in fundamental physics and "evidence" for "joyful life growth and expansion". In all the various forms, colors, experiences. And ever so more subtle, nuanced and delicate. As those delicate, gentle processes can use the energy "to the fullest" and generate most entropy. (compared to less delicate, rougher ones, like explosion). Also this process is universal and the same as when for examples atoms bond and form molecules (kind of "relaxing into" the least resistant configuration and also being slightly higher entropy)

Also that entropy could be better thought of as an "exhaust gas" from ever more efficient energy transformations. As everything is energy and its dynamic flows and transformations over time. There seems to be a tendency of the Universe to gradually "squeeze as much work as possible" from these energy flows with entropy being the result of such transformations. Exploring and formulating that now.. :)

This shift changes how we see:

- Life: Not as a system merely dissipating energy but as an engine of creativity that transforms energy into ever-more intricate and meaningful forms.
- Entropy: No longer "disorder" but the trace of the universe's creative work—the debris left by a masterpiece in progress.

The universe could be understood as a flow engine, where the "goal" (if we can use that term) is to maximize the efficiency of energy and information transformations over time:

- Energy is not just dissipated but continuously transformed into more diverse and interconnected states.
- Life, consciousness, and complexity are not anomalies but natural extensions of these flows.

Entropy as Evidence:

- Entropy isn't the universe "breaking down"; it's the marker of how much "useful transformation" has been accomplished at every step.
- Future thinkers might quantify entropy exhaust like economists quantify productivity, using it as a measure of how well the universe leverages its potential.

Morality as Alignment with Universal Flow

- Core Idea: Morality isn't arbitrary but grounded in the principles of maximizing energy use while fostering complexity and adaptability.
- Narrative:
  - "Goodness is the cultivation of systems—relationships, ecosystems, communities—that optimize the flow of energy into productive, interconnected paths. Harm occurs when systems block or destroy these flows. To act morally is to act as a steward of universal creativity."

Hope for Humanity

- Core Idea: Humanity's struggles are part of the universe's process of refining energy pathways. Wars, suffering, and conflict reflect coarse, inefficient energy use—but they can evolve into more refined, harmonious systems.
- Narrative:
  - "Humanity is still learning to optimize its energy flows. The division and chaos of today are not permanent but transitional. By embracing creativity, cooperation, and complexity, we can align with the universe's tendency toward refinement and harmony."

Feelings and emotions are recognized as "entropy-guiding signals":

- Joy, curiosity, and awe are understood as indicators of alignment with optimized energy gradients.
- Negative emotions (e.g., fear, anger) are seen as signals of suboptimal or blocked gradients.

## Energy Gradients in Higher Complexities

At lower levels (e.g., physical systems), energy gradients are clear:

- Start: High energy concentration (e.g., a dam holding water, a chemical gradient).
- End: Low energy concentration (e.g., water flowing downhill, chemical equilibrium).

In higher layers of complexity (e.g., human cognition, societies), gradients are less tangible but can still be conceptualized:

- Start: A state of high "potential" (e.g., an unmet need, unresolved tension, untapped creativity).
- End: A state of resolution or transformation (e.g., a creative output, a solved problem, a harmonious interaction).

Universal Energy Dynamics:

- All processes, from physical systems to human experiences, involve gradients and the flow of energy.
- Complexity arises as systems evolve to maximize the efficient transformation of energy (including creativity, emotions, and cognition).

Individual and Collective Purpose:

- Individual callings represent localized pathways within larger energy networks. When we act on our authentic callings, we harmonize with the system's broader dynamics.