Brief Report:
Efficiency as a Dynamic Range
and Distortion as Its Consequence in Complex Systems

Kai H. Kayser, MBA, MPhil
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Revised Version

Abstract
Traditional models locate efficiency at a singular point of minimal input for maximal output. This paper argues that such point-based conceptions belong to *parareality* — the human-made layer of stable semiotic representations (words, numbers, fixed categories, and single optima) that we necessarily use to navigate the world. These representations are abstractions that simplify and, to varying degrees, distort the continuous, variable nature of actual processes. Mathematics, being built upon language, inherits these structural limitations. In all real, open, complex systems, efficiency is structurally and necessarily a dynamic range shaped by constant flux and interconnected determinants. The Efficiency Range (eR) model is expressed as $eR = \{ x \mid Adapt(x, S_t) \geq \alpha \}$. While every human concept necessarily distorts reality to varying degrees, parareality does not annihilate reality; reality remains stronger, which is why evidence and observation can reveal the imperfections of our conceptual tools. The novelty of this study lies less in the observation that efficiency is realistically a range, and more in explaining why this must be the case — rooted in the semiotic nature of human concepts and representations — and in deriving the methodological implications for future research and practice: a shift from the pursuit of illusory fixed points toward evidence-based, iterative approximation within viable ranges. This approach is not nihilistic or purely relativist. It offers a constructive path forward through continuous refinement, increased observational detail, and greater computational capacity — processes that AI can significantly accelerate by variating data in a form of trial-and-error until a "good enough" state is reached, a state that can itself be improved when more data or new context appears. Illustrations from muscle hypertrophy, object transport, neural plasticity, microbiome dynamics, and corporate growth demonstrate the pattern.

Keywords
Efficiency, Distortion, Dynamic Range, Semiotic Parareality, Facetism, Neuroplasticity, Systems Theory, Complex Systems, Self-Organization, Iterative Approximation

Introduction

Efficiency is conventionally treated as a fixed optimum. This treatment works inside artificially closed systems where variables can be isolated and held constant. It becomes systematically misleading when applied to real conditions of constant flux and dense interconnection.

This paper develops the position that point-based efficiency belongs to *parareality* — the human-made layer of stable semiotic representations (words, numbers, fixed categories, and single optima) that we necessarily use to navigate the world. These representations are not neutral descriptions of reality; they are abstractions that simplify and, to varying degrees, distort the continuous, variable nature of actual processes. Mathematics, being built upon language, inherits these structural limitations.

We cannot abandon language and mathematics and start again. We are already inside this system. The realistic path forward is therefore not rejection but recognition: we can acknowledge the distorting effects of our semiotic tools and actively work to reduce them through more careful observation, greater detail, and continuous refinement — without the arrogance of assuming we have already arrived at final or precise descriptions.

Facetism provides the philosophical orientation for this analysis. It treats efficiency as an emergent property of complex, adaptive systems while remaining attentive to the limitations of the conceptual tools we use to understand them. The practical implication is methodological: in domains characterized by interconnection and change, evidence consistently favors operating with dynamic ranges and iterative approximation rather than chasing fixed points.

Linear Model versus Efficiency Range (eR) Model

Two contrasting models clarify the distinction.

The **linear model** represents efficiency as rising in a straight line toward a single point of maximum efficiency and then plateauing. In its simplest form it is expressed as:

$e = \text{Output} / \text{Input}$

This model belongs to *parareality.* It assumes conditions stable enough for a fixed optimum to be meaningful. In actual systems, however, there is no straight line of continuous efficiency increase leading to a stable point, nor is there a reliable plateau. Any supposed maximum moves within a band as conditions change. The model remains useful as a heuristic inside tightly controlled or artificial environments (e.g., algebraic equations), but it distorts understanding when treated as a description of real adaptive processes.

The **Efficiency Range (eR) model**, by contrast, treats efficiency as a fluctuating yet viable band of inputs. It is expressed as:

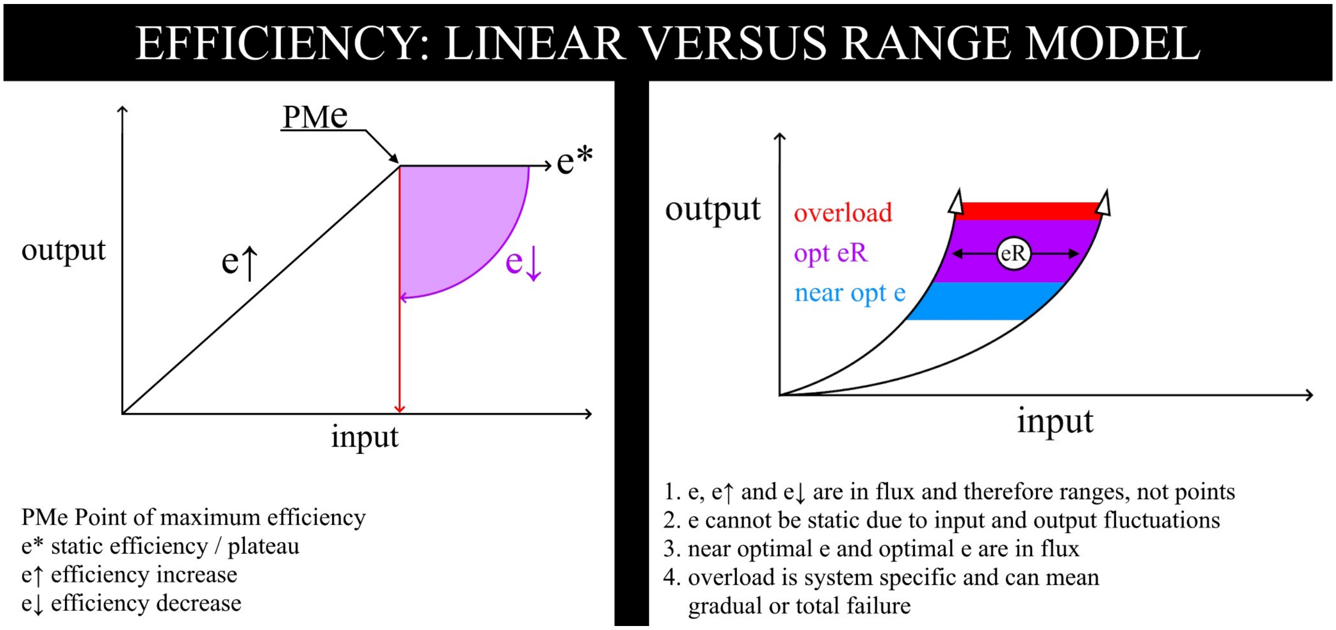
$eR = \{ x \mid \text{Adapt}(x, S_t) \geq \alpha \}$

Where:

- x = a candidate input
- S_t = the system state at time t (i.e., current conditions)
- α = the minimum acceptable level of adaptation

Within this range, efficiency increase and decrease occur continuously. The optimal zone contains safety margins rather than a precise point. Inputs that move outside the viable band produce distortion.

Figure 1: Linear versus Efficiency Range (eR) Model.



Description: *The left panel illustrates the linear model characteristic of parareality. The right panel shows the eR model, in which efficiency exists as a fluctuating range with safety margins. Overload or insufficiency relative to the moving range produces distortion.*

Results and Discussion

Muscle Hypertrophy (Physiological System)

Skeletal muscle adaptation occurs within a non-linear efficiency range. Loads in the approximate region of 60–80 % of one-repetition maximum, combined with adequate recovery and nutrition, support hypertrophy (Schoenfeld, 2010). Both insufficient stimulus and excessive load without appropriate progression produce distortion. Daily and individual variation in recovery capacity, hormonal milieu, sleep quality and timing, temperature, humidity, psychological state, and the so-called mind-muscle connection interact in ways that cannot be reduced to a single optimal ratio or fixed number of repetitions. Hypertrophy concerns maximum muscle volume rather than maximum strength, yet building volume requires strength work, and the point at which emphasis should shift is itself context-dependent. Real training outcomes show that protocols allowing flexibility within viable ranges and ongoing adjustment based on observed results consistently outperform rigid, point-based prescriptions. Even when practitioners attempt point-based calculations, they routinely introduce safety margins (“X factors”) because they know real conditions contain variability that pure point math cannot capture.

This complexity is reflected in real-world outcomes: while roughly 77 million Americans train regularly in gyms and the U.S. sports nutrition market surpasses $20 billion annually, only a small fraction — approximately 50,000 competitive amateurs and a few hundred professionals — achieve sustained high-level results (HealthandFitness, 2024).

Object Transport (Physical System)
What seems like simple and basic physics is actually extremely complex, with no way of precise calculation that holds across real conditions. Transporting objects across variable surfaces and distances requires continuous, context-sensitive calibration of force, leverage, and method. Fixed or linearly calculated force frequently either fails to move the load or damages it when surface friction, distance, or mass distribution changes. Effective practice incorporates adaptive responsiveness — adjusting leverage, using mechanized assistance, or modulating force according to real-time feedback — precisely because linear, context-free specifications break under realistic variance. Efficiency here emerges from ongoing alignment with moving physical determinants rather than from any single optimal force value.

A simple cardboard box filled with heavy books serves as an illustrating example: the force needs to be applied at the right location, in the right angle, and with adequately increasing power to move the box without damaging the cardboard — and all within ranges, not precise points. Location, angle, and utilized force are intertwined and allow for variation, making far more than one way possible.

Neural Plasticity and Multi-Scale Biological Dynamics
The nervous system demonstrates efficiency as compensatory range. When established pathways are disrupted, new functional ranges emerge through reorganization rather than restoration of a prior fixed state. Research further shows that certain compounds can enhance structural plasticity; psilocybin, for example, has been observed to rapidly increase dendritic spine density and size in the medial frontal cortex, with lasting effects on network remodeling and upregulation of BDNF and mTOR signaling (Shao et al., 2021). These changes can support recovery from stress-related deficits, illustrating that neural efficiency operates through dynamic compensatory ranges rather than fixed points.

Similar multi-scale dynamics are evident in gut microbiome–host interactions. Research by Dr. Sabine Hazan has shown that microbial composition significantly influences host energy metabolism, inflammatory tone, and overall systemic resilience. These effects have wide-ranging consequences, directly and indirectly impacting immune function, quality of life, and even life expectancy. Such processes demonstrate that organism-level efficiency emerges from complex, cross-level interactions rather than from isolated numerical targets.

Corporate Growth (Economic System)
Value creation requires ongoing calibration of investment, production, and market engagement to shifting conditions. Austrian economics has long emphasized that centrally planned or rigidly optimized systems underperform compared with decentralized, self-organizing ones. This pattern aligns with the observation that efficiency in complex economic processes appears as adaptive range rather than fixed optimum.

Cross-System Synthesis
Across physiological, physical, neural, and economic domains, a consistent pattern emerges. When efficiency is treated as a fixed point or single ratio, distortion follows under real conditions of flux and

interconnection. When it is treated as a dynamic range maintained through ongoing adjustment, systems demonstrate greater resilience.

Similar limitations appear in the modeling of complex biological processes. Didier Raoult has repeatedly shown that overly simplistic linear compartmental models often fail to capture the heterogeneity and emergent dynamics of real infectious disease spread. While such critiques remain specific to particular fields, they illustrate a recurring difficulty: linear and point-based frameworks tend to break down when applied to open, variable, and interconnected systems.

Why is it that all efficiency outside artificial isolation is range and not translatable to precise numericals? Because numerals are not identical outside of the semiotic pre-arranged agreement. Seven apples are seven individual apples, so we measure and categorize them in real life by weight, kind, color, and sweetness — or we differentiate them as organic, etc. Seven is never just seven. This is not a philosophical conundrum but a quintessential reality, forcing us to be ever more detailed and creating an ever more complex parareality. The qualitative aspects bleed into the quantitative; seemingly different measures are increasingly intertwined (weight and height, pixel and RAM, rpm and hp, etc.). The world we live in and the words we created to describe it have mutual impact. The homeostatic idea of semiotic representations needs constant adjustments, forcing engineers to add safety round-ups and argue (rightfully) for "range."

Discussion

All human concepts are products of language and are therefore necessarily partial and distorting to varying degrees. Raw phenomena exist independently of our descriptions, but the moment they are rendered as concepts they become extracts — compressed into parareality, the domain of human semiotic constructs. Arguing that physics is completely different from neuroscience or hypertrophy is myopic academism. That is why the top echelon of research is increasingly interdisciplinary. The undisputable fact is that all science utilizes language and language-derived mathematics. Mathematics inherits these linguistic, conceptual, and structural limitations, inevitably.

While parareality necessarily distorts reality, it does so to varying degrees and not completely — which means it cannot annihilate it. We therefore speak of exceptions, paradoxes, and oxymorons; reality remains stronger, which is why evidence and observation can still reveal the imperfections of our conceptual tools. These are not mere philosophical exercises but facts with real-life implications: whenever scientific measures fail, people and their lives are at risk. Failed medications, procedures, and safety features have produced countless deaths and injuries, but halfway adequate ones have saved just as many (e.g., heating, refrigeration, antibiotics).

Even where scientific progress is still lacking, we cannot take language and mathematics back and restart. We are already inside this system. The realistic path forward is therefore not rejection but recognition: we can acknowledge the distorting effects of our semiotic tools and actively work to reduce them through more careful observation, greater detail, and continuous refinement — without the arrogance of assuming we have already arrived at final or precise descriptions.

This is not a nihilistic or purely relativist stance but solution-oriented pragmatism. It offers a constructive path forward through iterative improvement. AI performs a function analogous to what nature does: it variates the given data in a form of trial-and-error procedure until a "good enough" state is reached. That state can itself be improved when more data becomes available or when context changes. In this sense, AI can accelerate the very process of refinement that Facetism advocates, even while remaining constrained by the same semiotic origins.

The methodological implication is clear. In domains characterized by dense interaction and constant change, evidence reliably favors operating with viable ranges rather than pursuing precise points. This does not mean abandoning measurement. It means using observation and results to maintain and refine ranges, accepting that any specific value within the range is provisional.

Implications

- *Theoretical:* Models that assume fixed points of efficiency require explicit justification of their closure assumptions. In open systems, range-based approaches with built-in adaptability are generally more robust.
- *Practical:* Training protocols, rehabilitation, organizational design, and policy benefit from defining viable ranges and using ongoing evidence to adjust within them.
- *Methodological:* Progress in complex domains is better served by iterative approximation within ranges than by the pursuit of mathematical precision that cannot be sustained under real conditions. Tools such as AI can significantly accelerate this iterative process.

Limitations

The analysis relies on patterns observed across domains. Linear and point-based models retain value as approximations within controlled technical contexts. More systematic empirical work comparing range-based versus point-based approaches would strengthen the argument.

Future Research

Agent-based modeling and longitudinal studies could test the relative performance of range-based protocols. Further development of methods for maintaining and refining viable ranges under high complexity remains open, including the role of AI in accelerating evidence-based refinement.

Conclusion

Efficiency in complex systems is a dynamic range maintained through ongoing adaptation, not a fixed point. The linear model belongs to parareality. The Efficiency Range model better corresponds to the flux and interconnection of real processes. While every human concept necessarily distorts reality to varying degrees, reality remains stronger than our representations. This is why evidence-based, iterative approximation within viable ranges offers a viable path forward. Facetism provides a coherent orientation for this approach by treating efficiency as an emergent property while remaining attentive to the semiotic tools we use to understand it. We cannot escape language and mathematics, but we can recognize their limitations and work to reduce their distorting effects through more science, more detail, and continuous refinement — without the illusion that we have already got it right.

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