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Title: Binary Cognitive Mechanics: A Framework for Understanding Cognitive Structures

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Abstract: *Binary Cognitive Mechanics (BCM) reinterprets the Jungian Cognitive Functions as informational structures independent of personality traits. BCM draws on Thermodynamics and Information theory to employ an S(3,4,8) Steiner system for analyzing the cognitive functions' setspace, revealing the fundamental informational structure underlying Jung's theory. This structure is shown to not only reconstruct Jung's Cognitive Functions but other cognitive information structures as well; many of which already exist in current literature, thereby providing a unified framework to contextualize them all. Although not explicitly discussed, BCM's potential implications extend beyond human cognition, offering insights into non-human, non-animal, and non-biological cognitive systems.*

Keywords: Binary Cognitive Mechanics, Jungian Cognitive Functions, Information theory, Thermodynamics, Steiner systems, Cognitive structures, Cognitive entropy, Cognitive diversity, Active inference, Schwartz's Theory of Basic Human Values, Implicit/explicit cognition, Embodied/detached cognition, Cognitive dissonance, Collective cognition

Binary Cognitive Mechanics

1. Introduction

Just over a century has passed since the publication of Jung's groundbreaking work, "Psychological Types" (1923). Despite Jung's status as one of the founders of modern psychology, his profound insights into cognitive functions have been largely overlooked by contemporary cognitive science. While Jung's work remains central to discussions on personality and is closely associated with systems like MBTI and Socionics, its potential to inform the study of cognition has been underexplored.

Binary Cognitive Mechanics (BCM) represents a novel approach that reinterprets the Jungian Cognitive Functions as informational structures within cognition, independent of personality traits. Drawing upon thermodynamics and information theory from classical physics and computer science, BCM employs an S(3,4,8) Steiner system to analyze the cognitive functions' setspace. This analysis not only reveals the fundamental structure underlying Jung's theory but also uncovers a more fundamental informational structure.

Furthermore, BCM demonstrates how this underlying structure can be used to reconstruct Jung's Cognitive Functions as well as other cognitive information structures, such as Schwartz's theory of universal human values. This innovative approach also has the potential to reveal previously undiscovered cognitive structures.

This work also includes a preliminary psychometric study indicating the plausible validity of this model.

The implications of BCM extend beyond the realm of human cognition, offering insights into the nature of non-human, non-animal, and non-biological cognition, although a comprehensive exploration of these domains lies beyond the (already broad) scope of this paper.

2. Terminology

2.1. **Cognitive Agents:** Cognitive Agents are a broad category of cognitive embodiments with self-contained cognition (entities). Although there are many current and possible cognitive embodiments, for the purposes of this paper this term can be interpreted as **individual human cognition**.

2.2 **Cognitive Representations:** Cognitive structures that encode information and enable their utilization by cognitive agents to perceive, interpret, and interact with their environment. Representations allow for a world of information where cognitive entities may experience a detached ruleset of their own construction.
Different parts of cognition function independently to render representations the same way that sound is represented as pitch in our representative experience. Representations are designed to be utilized at their proper level of cognition.

2.3. **Cognitive Entropy:** Based on Thermodynamics, cognitive entities exist and survive within an entropic system of reality and must therefore reflect that entropy both in the construction of their own cognition and to cognitively represent and function within this system.
As a general description, low-entropy cognition is concerned with the certainty of its cognitive representations, and high-entropy cognition is concerned with the adaptability to newer or more uncertain representations.

2.4. **Cognitive Diversity:** We evolve not just as individuals, but as interconnected societies that shape our individual cognition based on collective needs. Cognitive diversity within our population is thus a biological advantage, crucial for adaptation and survival.

Thus, by uncovering our cognitive differences, we gain deeper insights into the nature of cognition itself.

3. Literature Review

3.1 Carl Gustav Jung: A Brief Introduction

While Carl Jung's contributions to psychology remain influential, his work has also faced significant criticism within the academic community.
Some scholars, like Robert A. Segal, argue that Jung's reliance on mythology and symbolism lacks empirical validation, questioning the scientific rigor of his interpretations (Segal, 1991). Additionally, the ambiguity and subjectivity of certain Jungian concepts, such as archetypes and the collective unconscious, have been met with skepticism (Bornstein, 2001). This perceived lack of empirical grounding and reliance on subjective interpretation has contributed to the marginalization of Jungian psychology within mainstream psychology departments (Samuels, 1985; Marlan, 2005). Furthermore, Jung's interest in the occult and his controversial views on race and ethnicity have also drawn criticism, leading some to question the validity and relevance of his work within the field of psychology.

Despite this criticism, we can't discredit the fact that Carl Jung was performing psychoanalysis for decades on some of the world's most imbalanced patients who either sought him out directly or were referred to him by other psychotherapists. Over time, Jung began noticing patterns across the vast spectrum of individuals he was encountering, leading to his theory of Cognitive Functions and ultimately to his book, "Psychological Types" (1923). In this work, Jung presents a curious framework for understanding cognition. Jung not only proposes the eight cognitive functions but also describes their structure. He takes the four traditional cognitive capabilities (Sensation, Intuition, Thinking and Feeling) and demonstrates how each one can be directed introvertedly or extrovertedly.

Briefly:
Sensation (S): This function relates to how we represent and recognize sensory experience.
Intuition (N): This function involves the recognition and representation of possibilities and patterns beyond the reach of the senses, relying on hunches, insights, and associations. Jung's intuition is more focused on unconscious processes and symbolic interpretation than earlier descriptions.
Thinking (T): This function involves logical analysis, judgment, and decision-making based on logical criteria and principles.
Feeling (F): This function involves making value judgments. Jung's feeling function emphasizes valuation and relationships.

Throughout his work Jung emphasizes cognitive diversity and the unconscious aspects of the psyche. Jung's typology offers a nuanced understanding of personality, highlighting the diverse ways individuals perceive, process, and interact with the world.

3.2. Information Theory

Information theory is born of traditional thermodynamics and pioneered by Claude Shannon and Norbert Wiener (1948). It posits a method of connecting Thermodynamics and entropy to information. It is used in all of computer science and forms a foundation for many of the algorithms that manipulate information for transfer and data analysis.
By using information theory, it becomes possible to measure the entropy of information across a system.

As a general rule, we can understand low entropy as either a high density of energy, or an unlikely state of matter.

3.2.1. Shannon Entropy and Information

Shannon entropy is a measure of the uncertainty associated with a random variable. Mathematically, it's defined as:
[1. Entropy — SciPy v1.14.0 Manual]

$$H(X) = \Sigma\, p(x) * -\log_2(p(x))$$

Where:

- $H(X)$ is the entropy of the random variable X
- $p(x)$ is the probability of the outcome x
- Σ is the summation over all possible values of x

Essentially, higher entropy indicates greater uncertainty or randomness in the information source. A perfectly predictable source has zero entropy. We primarily see this in terms of our current and newly generated representations.

3.2.2 **Binary Cognitive Mechanics and Steiner Systems**

Using set theory, BCM performs a combinatorial analysis on the eight cognitive functions and their structure as proposed by Jung, revealing a hierarchical setspace.
An S(3,4,8) steiner system is used to show the 7 primary dichotomies in this setspace which combine to form Jung's Cognitive Functions.

Steiner systems are combinatorial designs characterized by specific properties of their elements and subsets. Named after Jakob Steiner, who popularized them, these systems have applications in various fields, including mathematics, computer science, and statistics.

A **Steiner system S(k, t, v)** consists of:

- **v** elements or points
- **b** subsets or blocks
- Each block contains **k** elements
- Any **t** elements are contained in exactly one block

For instance, S(3,4,8) implies a system with 8 elements, arranged into 14 blocks of 4 elements each, where any set of 3 elements appears uniquely in one block.

Since these 14 blocks can be paired into 7 dichotomies, they form the first order basis that gives rise to the third order cognitive functions.

For a more concise exploration of the full combinatorial analysis please refer to:
Binary Cognitive Mechanics

4. Theoretical Framework

Using the results of the S(3,4,8) analysis of the Cognitive Functions, the following first order dichotomies were detected:

- **Orientations:**
  1. Attention: Introverted/Extroverted (Low-Entropy/High-Entropy)
  2. Purpose: Internalizing/Externalizing
- **Approaches:**
  3. Form: Implicit/Explicit
  4. Substance: Experiential/Intellectual
- **Structurizations:**
  5. Continuity: Formulating/Generalizing
  6. Integration: Synergizing/Combining
- **Justification Mode:**
  7. Identification/ Evaluation

The following sections (4.1 to 4.6) will describe each of these first order structures in detail and how they build up to their corresponding higher order structures (second and fourth order).
Finally, section 4.7 will demonstrate how each of these 7 structures produce the Cognitive Functions (third order) as Jung initially described.

4.1. The Cognitive Orientations

The fundamental aspect of the orientations was found to directly relate to Cognitive Entropy. All of these structures emerge from the way that cognition interacts with and affects entropy, including but not limited to:
Its representations, goals and outcomes, exploration, interaction with other cognitive entities and the way that the entity differentiates and integrates itself with its surroundings.

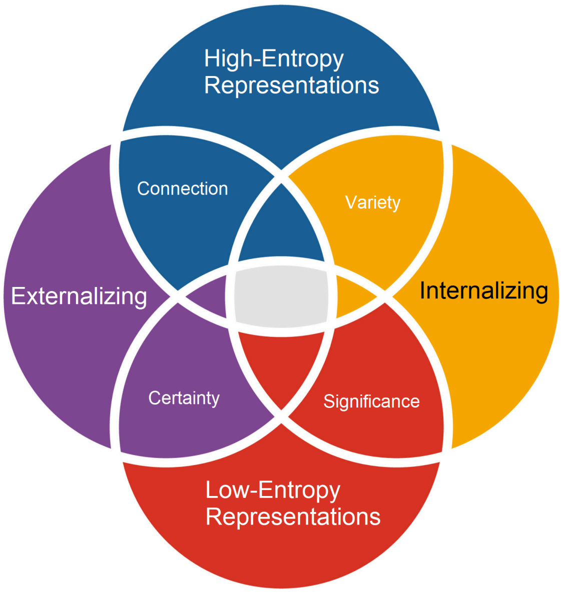
4.1.1 Cognitive Attention

Jung originally defined Introversion as: An "attitude-type characterized by orientation in life through subjective psychic contents", and Extraversion as: "an attitude-type characterized by concentration of interest on the external object".
However, based on the emergent structures, BCM has found that this parallels differentiation between high and low entropy forms of information.
It becomes easier to define high-entropy and low-entropy information based on the emergent second order structures. However, in a very general sense, **low-entropy** information represents a high degree of cognitive certainty and a delicate refinement of informational representations, whereas, **high-entropy** information represents a high degree of uncertainty and coarse comparison of the signals and noise in the broad spectrum of informational representations.

4.1.2 Cognitive Purpose

Cognitive representations are formed for one of two general purposes. When **internalizing** information, we form representations that affect the cognitive entity directly, integrating the representations together in a cohesive whole; whereas when **externalizing** information, we form representations that can be used to affect information outside of the cognitive entity. Both forms of representations exist in the psyche and are both independently utilized and combined for further cognitive processes.

4.1.3 Cognitive Needs: Second order Orientations



The Four, First Order, Entropic Orientations (High-Entropy, Low-Entropy, Internalizing and Externalizing), can be further combined to form Second Order structures (Certainty, Variety, Significance and Connection). Certainty, for example, can be seen as a combination of externalization and low-entropy. Fascinatingly enough, these Second Order Structures have been well defined across both academic and non-academic literature.

While not strictly adhering to the rigors of academic research, Tony Robbins (1991) has nevertheless identified the second order orientations correctly.

Robbins' methodology primarily relies on observational studies, case studies, and experiential learning. Through his workshops, seminars, and coaching sessions, he has collected vast amounts of anecdotal evidence to support his model. While lacking the controlled rigor of academic research, his work has had a profound impact on millions of people, suggesting the potential validity of his findings.

The first to make this connection between Robbins and Jung was "objectivepersonality.com". Although Tony Robbins describes 6 human needs, "objectivepersonality.com" has discovered that 4 of the 6 are relevant as 2nd order structures:

- **Certainty:** The need for predictability and stability.
- **Variety:** The need for novelty and stimulation.
- **Significance:** The need for importance, recognition, and value.
- **Connection:** The need for belonging and intimate relationships.

A year later, **Schwartz's Theory of Basic Human Values** (1992) termed them as: Conservation, Openness-to-Change, Self-Enhancement and Self-Transcendence. However, Shwartz labeled these according to the 4th order Orientations which are the central thesis of his theory (as will be discussed in section 4.1.4).

4.1.3.1 Certainty: Externalizing Low-Entropy Representations

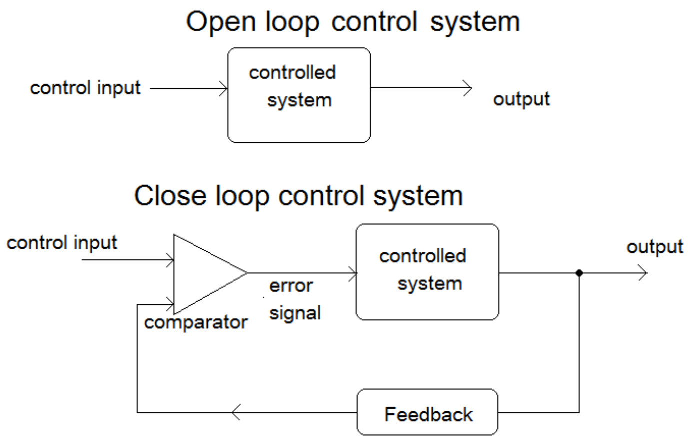
Certainty and Active Inference

Certainty, as a fundamental human need, manifests in human cognition as a drive towards predictable outcomes and stable environments. By externalizing low-entropy representations, cognitive entities can reduce the uncertainty of their external world, creating a sense of familiarity and security. The process of certainty involves the formation of cognitive representations capable of performing such tasks.

Certainty-seeking cognitive behavior is linked to the creation and maintenance of cognitive structures whose objective is to predict specific outcomes while minimizing unexpected or unpredictable ones. Overall, preprocessed outcomes reduce cognitive load and allow for certainty in their prediction and performance.

Certainty as a Predictive Model

The pursuit of certainty and its representations can be framed as an active inference process, where cognition constructs predictive models that minimize surprise. This involves generating expectations about outcomes and goals to carefully and subtly affect information outside of the cognitive entity thereby creating highly specific and detailed predictive models, reducing the probability of unexpected outcomes.



Control systems are commonly used in a wide array of engineering applications. They were once made using basic electrical components, but grew to involve microchips, more complex computational algorithms and now AI has become a valuable tool for more modern control systems.
The externalization of representations form a critical part of cognitive entities in order to exert control on the information output.
A high entropy externalization process (section 4.1.3.4) tends to more closely resemble open loop systems whereas low entropy externalization tends to more closely resemble closed loop systems.

4.1.3.2. **Variety: Internalizing High-Entropy Representations**

Variety and Active Inference

Variety, as a fundamental human need, manifests in cognitive processes as a drive towards novelty and exploration. This inclination is reflected in the construction of high-entropy cognitive representations, designed to navigate and process uncertainty. By focusing on cognitive structures that internalize high-entropy representations, cognitive entities can navigate the complexity of unexpected information to actively seek and update their representations. This cognitive process involves the processing and integrating of novel information.

Cognitive Flexibility: A Cornerstone of Adaptability

Cognitive flexibility refers to the mental ability to switch between different concepts, tasks, or mental sets. It is the cognitive process that allows individuals to adapt to changing circumstances, learn new information, and solve problems creatively (Uddin, 2021).

While the term "cognitive flexibility" itself is relatively modern, the concept has been implicitly explored by various psychologists and philosophers throughout history. Jean Piaget, a Swiss psychologist known for his work in child development (1952), is often credited with laying the groundwork for understanding cognitive flexibility as a developmental process. Piaget's theory of cognitive development emphasizes the child's ability to adapt to new information and experiences, a core component of cognitive flexibility.

Variety-seeking behavior is linked to the creation and maintenance of cognitive flexibility. It involves a willingness to challenge existing schemas and develop new perspectives. This cognitive state is often associated with increased creativity and problem-solving abilities.

Cognitive Flexibility, Active Inference, and Surprise

Cognitive flexibility is intrinsically linked to the concept of **active inference**. Both emphasize a cognitive capacity to adapt to a changing environment. Active inference posits that cognition constructs representational models which minimize surprise or prediction error.
In contrast to certainty, variety seems to be actively seeking out surprise as a reaction to boredom or curiosity. Cognitive flexibility, in this context, is the ability to rapidly update or modify representational models in response to unexpected events and new information. The relationship between cognitive flexibility and cognitive entropy can be further understood through the lens of information theory, where the concept of "surprisal" (the negative logarithm of probability, $-\log_b(P)$) captures the degree to which an event is unexpected, entropy is then the average surprisal across the system.

Surprise, the discrepancy between predictions and observations, serves as a critical catalyst for cognitive flexibility. When confronted with unexpected representations, a cognitive entity can then adjust its internal models to accommodate the new information. This process often involves challenging existing schemas and exploring alternative possibilities, which is the essence of cognitive flexibility.

4.1.3.3. Significance: Internalizing Low-Entropy Representations

Significance, as a fundamental human need, manifests in cognitive processes as a drive for optimizing low-entropy representations of self.

The pursuit of significance is not exclusive to humans but appears to be a fundamental drive across various cognitive entities. From single-celled organisms to collective entities and social systems, the need to differentiate one embodiment from the next is a pervasive force that preserves low-entropy representational structures from each other.

At its core, significance-seeking is a manifestation of the broader drive to reduce entropy and increase order within an entity's informational representations. By constructing distinctive self-referencing representations cognitive entities can evaluate self-efficacy and decision making for individual survival and responsibility thereby enhancing the significance of their representational structures and their potential influence on the collective.

Most of the differentiated representations in the collective are truly just noise as they are self-serving and their disagreements are evenly distributed, but occasionally a specific low-entropy representation is collectively required, making this a beneficial mechanism for the collective. Accurate low-entropy representations can be invaluable, making entities that succeed in this achievement more valuable to the collective.

When detached from the collective, low entropy representations are free to independently internalize themselves. By merging the randomness of these independent entities, collectives are able to access distributive cognition. However, because these low-entropy internalized processes are so fine-tuned, it is often difficult and time consuming for other cognitive entities to access this information despite the cognitive entity using it as a basis for self-representation and decision making. This can lead to self-alienation, as connection is rooted in shared representations.

Overall, Significance represents the need for individual cognitive systems to remain distinct in order to both preserve individual cognitive entities and better serve the collective.

4.1.3.4. **Connection and collective cognition: Externalizing High Entropy Representations**

Connection, as a fundamental human need, manifests in cognitive processes as a drive for belonging and affiliation.

This inclination is reflected in the construction of inter-subjective representations, designed to facilitate interaction and cooperation between collective cognitive entities. By externalizing high-entropy representations, cognitive entities can mobilize to collectively solve high entropy problems through coordinated and collective externalization. In this way, cognitive entities collectively bond together forming a collaborative organism or social structure.

The pursuit of connection allows for the application of high-entropy representations outside of the cognitive entity. Research on swarm intelligence (Bonabeau et al., 1999) supports this notion, demonstrating how simple individual behaviors can lead to complex, adaptive group-level outcomes through self-organization and distributed information sharing. Similarly, the social brain hypothesis (Dunbar, 1998) proposes that the human brain evolved to support complex social relationships, suggesting that social cognition is fundamental to human intelligence.

Collective Consensus

When high-entropy cognition gets a significant entropy increase (beyond the ground level fluctuations) it stimulates a form of stress on the individual entities in the collective (Cantril, 1940).

This disruption can originate outside the collective entity, but it can also originate from a gradient in the shared low entropy representations.
The more they polarize and coalesce, the more significant they become (Bail et al., 2018).

Consensus exists when several cognitive embodiments contain low entropy representations that are either in agreement with each other, or hidden from the collective (Erb, 2002). Whenever collective representations infringe on individual representations or when individual representations infringe on consensual representations, an entropy gradient will be observed across the collective which serves to process this dissonance (Tajfel, 1986). This fundamental mechanic is at the core of distributive cognition, collective entropy reduction and collective cognitive success.
High entropy disruptions indicate a high degree of dissonance between subjective representations. Collective barriers may form between collections of entities (Tribes) with differing subjective representations, thereby creating separate subgroups (local minima) with collective agreement (Festinger, 1954).

Assabiya (Tribalism)

Social harmony arises when group members share low-entropy representations. This alignment, as philosopher Ibn Khaldun's *Muqaddimah (1377)* elucidates, is central to *Assabiya*: a collective sense of solidarity and purpose. Divergence in representations, whether individual or collective, creates cognitive dissonance, necessitating the collective to manage the ensuing entropy gradient. These entropic separations safeguard core group values while potentially contributing to conflict if excessively rigid.

Khaldun formulates his theory based on observing the rapid rise and fall of civilizations in the midst of bedouin tribes. He introduces this concept and argues that Assabiya is essential for the formation and maintenance of states and empires. However, he also emphasizes its cyclical nature, suggesting that over time, Assabiya weakens, leading to the decline and eventual collapse of dynasties.

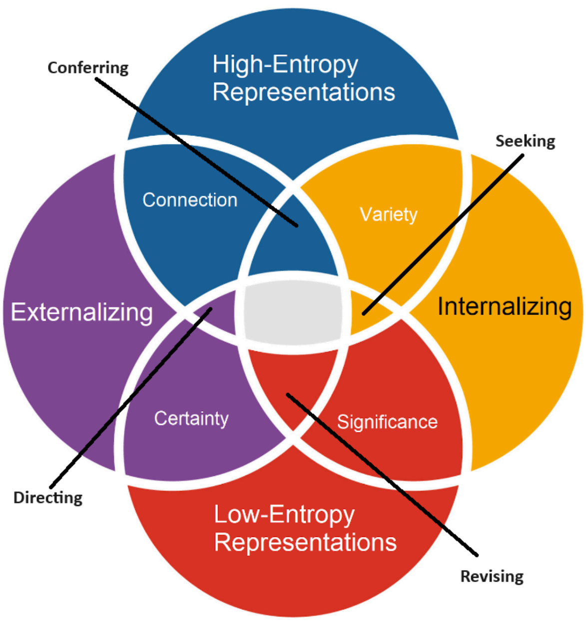
This demonstrates how social collapse is accompanied by a deteriorating collective that cannot protect the entropy of its shared representations, rather, they often form new collectives that overcome the previous ones.

Assabiya and Collective Consensus demonstrate a form of opposing tension.
According to Assabiya, shared representations unite us, but shared representations must adapt or the low-entropy representations may become stagnant. Cognitive diversity can also be seen as a form of tension, as it creates fundamental differences in the cognitive landscape of the population.

Mathematical Representation of Collective Entropy and Consensus

To formalize these concepts, let's consider a collective of N cognitive entities,
Where each entity's representation can be simulated as a D-dimensional vector. The collective consensus of a representation can then be determined as the mean vector ($\bar{X}$), calculated as the average of the individual vectors:
$\bar{X} = \Sigma(X_1 + X_2 + \ldots + X_N) / N$
The deviation of a individual representations from this consensus can be quantified using the Euclidean norm:
$\Delta X_i = ||X_i - \bar{X}||$
A higher value indicates a larger deviation, signifying greater disagreement with consensus. To estimate the collective entropy, we can consider the deviations of representations. By normalizing these deviations, we obtain a probability distribution, allowing us to calculate entropy using the standard formula:
Entropy = $- \Sigma [p_i * \log(p_i)]$, where p_i is the normalized deviation of ΔX_i, and the sum is taken over all N entities. A higher entropy value suggests greater disagreement or representational diversity, while a lower entropy implies more consensus.
Additionally, the standard deviation (σ) of these representations provides a direct measure of the spread or variability, which is closely linked to the concept of collective entropy:
$\sigma = \sqrt{[\Sigma(\Delta X_i)^2 / (N - 1)]}$

4.1.4. **Cognitive Vectors: 4th Order Orientation Structures**

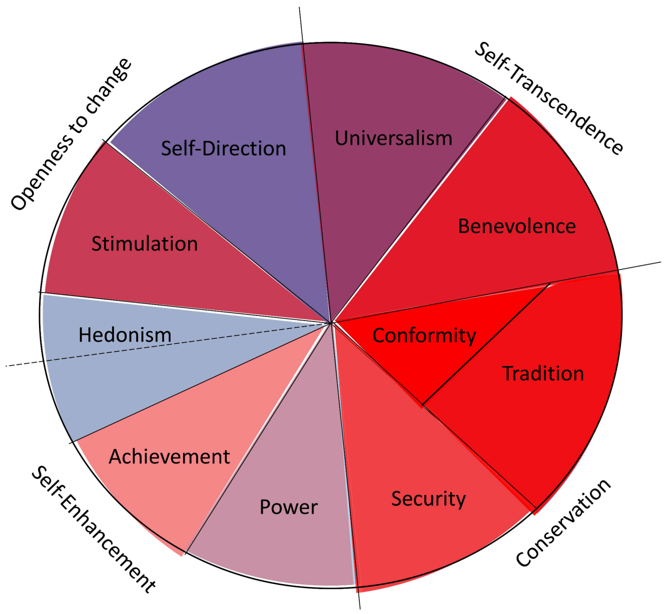


Identified by "objectivepersonality.com" as "the animals", Cognitive vectors are 4th order structures that correlate to Schwartz's Theory of Basic Human Values.
As the diagram describes, the Cognitive Vectors (Seeking, Directing, Conferring and Revising) can be viewed as a combination of two Cognitive Needs (Certainty, Variety, Significance and Connection) or the coupling of two opposing Orientations (High-Entropy, Low-Entropy, Internalizing and Externalizing) under a binding Orientation with a stronger "will to power" (Nietzsche, 1885).

Schwartz's Theory of Basic Human Values

Schwartz's Theory of Basic Human Values offers a powerful framework for understanding human motivation. Developed by Shalom H. Schwartz, this theory identifies ten core values that influence behavior across cultures: Power, Achievement, Hedonism, Stimulation, Self-direction, Universalism, Benevolence, Tradition, Conformity, and Security. As detailed in his seminal work, "Universals in the Content and Structure of Values: A Theory of Basic Human Values" (Schwartz, 1992), these values are arranged in a circle to represent their inherent tensions and compatibilities.

Schwartz employed factor analysis across diverse cultures to reveal the underlying structure of human values, supporting the theory's universality. This robust approach provides a strong foundation for exploring the relationship between motivations and cognitive processes.



Bridging the Gap: Towards a Unified Framework

The alignment between Schwartz's Theory of Basic Human Values and the 4th order Orientation structures, constructed by BCM (Cognitive Vectors), is striking. This unexpected correlation highlights the potential of how the abstraction of the seven dichotomies from the Cognitive Functions can be used to construct cognitive structures.

4.1.4.1. **Seeking: Prioritizing Internalizing Across the Entropy Spectrum**

Identified by "objectivepersonality.com" as "consume", the seeking behavior is the merging of both high and low entropy representations through the internalization process. This serves to ensure that internalized representations remain consistent across the entropy spectrum.

Since it is a fourth order cognitive structure, it also includes the combination of two second order structures, Variety and Significance, which merge into an engaging behavior that seeks to both increase significance by reducing the entropy of new representations and **increasing variety by incorporating more representations into the low entropy internalized structure**.

"Seeking" correlates to Schwartz's Theory of Basic Human Values with the 4 traits of Achievement, Hedonism, Stimulation and Self-direction.

The advantage of viewing this behavior through the lens of "Seeking", however, is that it does not limit the cognitive entity to specific actions, but broadens it to a general problem solving agent that utilizes representational structures identifiable through entropy.

4.1.4.2. **Directing: Prioritizing Externalizing Across Entropy Gradients**

Identified by "objectivepersonality.com" as "blast", the directing behavior is the merging of both high and low entropy representations through the externalization process. This serves to ensure that externalized representations remain consistent across the entropy spectrum.

Since it is a fourth order cognitive structure, it also includes the combination of two second order structures, Certainty and Connection, which merge into coordinated actions which simultaneously increase certainty by **reducing the entropy of collective cognition**, and increase connection by aligning the collective together in a common (Certain) outcome.

"Directing" correlates to Schwartz's Theory of Basic Human Values with the 3 traits of Conformity, Tradition and Benevolence.

Directing as a unifying force

The unifying force of objective goals is well-documented across various fields of psychology. Research has shown that setting specific and challenging goals can enhance both individual and group performance, as they provide direction, focus, and motivation (Locke & Latham, 1990). Furthermore, shared goals foster a sense of belonging and connection, encouraging cooperation and transcending individual differences (Oettingen et al., 2001). This unifying power extends even to intergroup relations, as working towards a common objective can reduce prejudice and promote collaboration between groups (Gaertner et al., 1993).

The impact of shared goals extends beyond conscious intention, as evidenced by the phenomenon of goal contagion (Aarts et al., 2004). Observing others pursue goals can unconsciously influence our own goal pursuit, suggesting a subtle yet powerful social influence on individual motivation. Moreover, neuroscience research has revealed the neural mechanisms underlying goal pursuit and behavior change, highlighting the complex interplay between cognitive, emotional, and motivational systems in striving towards desired outcomes (Falk & Lieberman, 2013).

4.1.4.3. **Conferring: Prioritizing High-Entropy Across Representational Purpose**

Identified by "objectivepersonality.com" as "Play", the conferring behavior is the merging of both internalizing and externalizing representations for high entropy information states. This serves to ensure that high-entropy representations are passed on, shared and universally relevant.

Since it is a fourth order cognitive structure, it also includes the combination of two second order structures, Variety and Connection, which merge into **a collective behavior facilitating the exchange and comparison of diverse perspectives and intersubjective representations**.

"Conferring" also correlates to Schwartz's Theory of Basic Human Values with the trait of Universalism.

4.1.4.4. **Revising: Prioritizing Low-Entropy Across Representational Purpose**

Identified by "objectivepersonality.com" as "Sleep", the revising behavior **seeks to reduce the entropy across both its internalizing and externalizing representations through direct comparison**.

Since it is a fourth order cognitive structure, it also includes the combination of two second order structures, Certainty and Significance, which merge into **a withdrawn behavior** that seeks to both increase certainty by utilizing significance, and increasing significance through certainty.

"Revising" correlates to Schwartz's Theory of Basic Human Values with the 2 traits of Power and Security.

4.1.5. **Summary of the Cognitive Orientations**

The Cognitive Orientations, while not entirely new concepts, have not yet been presented in a unified framework as they have been within BCM. This framework not only integrates these orientations (First, Second, and Fourth Order) with other cognitive structures (4.2 to 4.7), but more importantly links them directly to the fundamental principles of Thermodynamics and Information theory. This grounding in Physics provides a clear and concise explanation for the structures underlying cognitive processes. The success of this unification strongly suggests that BCM can be a powerful tool for deriving and constructing other cognitive structures.

4.2. The Approaches

4.2.1 **Implicit and Explicit Cognition**

Implicit and explicit cognition represent two fundamental modes of information processing. While previous research, such as the seminal work by Dougherty, Chandler, and Chaiken (2007), has explored the distinction between implicit and explicit cognition, it often conflates these processes with conscious and unconscious awareness which agrees with Jung's conclusions in "Psychological Types". However, BCM views this conflation as problematic, as it limits the applicability of these concepts to other cognitive embodiments.

BCM acknowledges that more explicit forms of cognition tend to "feel" more conscious, despite involving many unconscious processes in rendering these representations, they are actually just more unambiguous. BCM also posits the inverse, that our implicit representations may "feel" more unconscious because they are more ambiguous but they have conscious elements.
According to BCM, explicit cognition utilizes representations which are discretely precise and easily provable, whereas implicit cognition utilizes representations which are analogue inferences, implications, and contextual information that cannot be directly proven with ease.
By decoupling implicit and explicit cognition from consciousness, BCM attempts to look at this dichotomy through the lens of cognition alone, in attempts to understand the fundamental structure of cognitive representations.

4.2.2 **Experiential and Intellectual or Detached Cognition**

Embodied cognition offers a radical departure from traditional cognitive science, positing that cognition is inextricably linked to the body and its interactions with the environment.

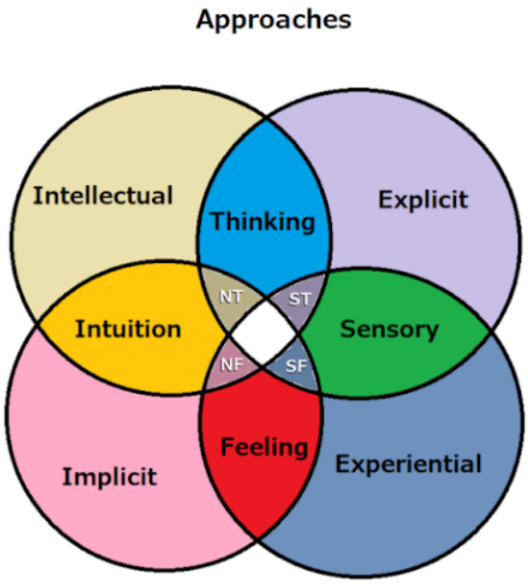
This perspective challenges the notion of the mind as a disembodied computer, emphasizing instead the role of bodily experiences and sensory-motor interactions in shaping thought and perception.
Embodied Cognition - Stanford Encyclopedia of Philosophy

In contrast to the traditional view of cognition as primarily internal, symbol-manipulating processes, embodied cognition emphasizes the role of experiential representations. These representations are grounded in bodily sensations, actions, and interactions with the world, rather than abstract symbols. This approach highlights the dynamic and context-dependent nature of cognition.

Invariant representations in abstract concept grounding – grounded cognition
Pioneers in the field, such as James Gibson (1979), Merleau-Ponty (1962), and more recently, Varela, Thompson, and Rosch (1991), have contributed significantly to the development of embodied cognition. Their work has challenged the Cartesian dualism of mind and body, emphasizing the inseparability of cognition and action.

Embodied cognition offers context to the purpose and development of cognition, especially when combining this notion with collective and distributive cognition and how individual cognitive entities are formed by their role in the collective.
However, the S(3, 4, 8) Steiner System analysis reveals a complementary form of cognition, which is termed "intellectual" or "experientially detached cognition". This mode of cognition operates independently of direct experience, relying instead on abstract reasoning and symbolic manipulation. This finding suggests that both embodied and detached cognition both have informational representations.
This is especially a vital perspective when considering digital intelligence that might be completely detached from an embodied evolution and purpose.

4.2.3 **Capabilities: Second order Approaches**



The Cognitive Capabilities are historically ancient and have been directly discussed in Vedic Traditions and by Maimonides (1168).
Jung discussed them directly in his book "Psychological Types" and used them to identify the Cognitive Functions.
In the following sections, this paper will present a few examples of scientific literature that explores these second order cognitive mechanisms.
Currently, **fourth order approaches** are softly discussed in Jungian typology and known as: (NT, ST, NF and SF)

4.2.3.1. **Sensory: Explicit Experiential Representations**

Research highlights the dynamic and multifaceted nature of sensory processing, extending beyond mere passive reception of information. Ostarek and Huettig (2016) demonstrate that sensory representations are strategically recruited based on task demands, optimizing cognitive resource allocation.

Furthermore, the concept of grounded cognition posits that abstract concepts are rooted in sensorimotor experiences (Dove, 2016). Invariant representations, capturing the essential features of these experiences, enable the formation of higher-order conceptual understanding, bridging the gap between sensory information and abstract thought.

Pautz (2015) delves into the philosophical complexities of defining sensory representation, emphasizing the need to consider both subjective experience and objective cognitive access to the world.

Multisensory integration, the process of combining information from multiple senses into a single representation, further enriches our perception and understanding of the environment (Stanford & Stein, 2007).

Meanwhile, Gazzaley and Nobre (2012) challenge the traditional view of sensory cortices as solely dedicated to perception, revealing their active involvement in higher-order cognitive functions like attention, memory, and decision-making.

4.2.3.2. **Intuition: Implicit Intellectual Representations**

Intuition, a complex and often enigmatic aspect of cognition, has been explored from various perspectives, revealing its role in judgment, decision-making, and problem-solving. It is characterized by rapid, effortless recognition that often arises from a combination of expertise and unconscious associations (Hogarth, 2001).

Neuroscience research suggests that intuition emerges from a dynamic interplay of brain regions associated with emotion, memory, and decision-making (Volz & von Cramon, 2006). It involves the swift and automatic integration of information from diverse sources, including social cues, emotional signals, and past experiences (Lieberman, 2000), highlighting the influence of collective and distributive cognition on intuitive representations.

Furthermore, intuition has proven valuable in strategic decision-making, particularly in complex and uncertain environments where quick assessments are crucial (Salas et al., 2010). Contrary to the notion of intuition as an innate or mystical ability, Kenett and Faust (2023) argue that it is a skill honed through training and experience, emphasizing its relevance in the context of human-computer interaction and artificial intelligence.

4.2.3.3. **Thinking: Explicit Intellectual Representations**

Dual-process theories of cognition highlight the distinction between fast, intuitive thinking and slow, deliberate reasoning (Evans & Stanovich, 2013). The latter, characterized by its conscious, effortful, and rule-based nature, is crucial for complex cognitive tasks like problem-solving and decision-making, especially in novel or high-stakes situations.

The capacity for explicit reasoning is not limited to humans. Hurley and Nudds (2006) challenge the traditional view by presenting evidence of rationality in non-human animals, demonstrating their ability to engage in flexible, goal-directed behavior, and solve problems. Similarly, Shumaker et al. (2011) explore tool use and tool making in animals, emphasizing the role of planning, problem-solving, and causal reasoning, further supporting the notion of explicit thinking in non-human species.

Moreover, the rapid advancements in artificial intelligence highlight the potential for explicit reasoning and decision-making in machines (Brynjolfsson & McAfee, 2014). AI systems are increasingly capable of performing tasks that were once considered exclusive to human intelligence.

These diverse perspectives underscore the importance of understanding explicit and structured reasoning across various cognitive embodiments. Whether in humans, animals, or artificial systems, this form of cognition plays a critical role in navigating complex environments, solving problems, and achieving goals.

4.2.3.4. **Feeling: Implicit Experiential Representations**

The role of "Feeling" in shaping human experience is multifaceted and deeply intertwined with value representations and emotional processing, but at the most rudimentary level, emotional experiences tend to take representational form as pleasure and pain. The orbitofrontal cortex (OFC) plays a crucial role in encoding the reward value of stimuli, impacting our emotional responses and choices (Rolls, 2017). Impairments in representing emotional values, as seen in alexithymia, can lead to suboptimal decision-making, underscoring the importance of anticipatory emotional representations for adaptive behavior (Moretti & Canessa, 2018).

Emotional states and bodily awareness also influence our perception and interaction with the environment (Andreatta et al., 2021), highlighting the interconnectedness of emotion, cognition, and the physical body. Panksepp (2004) and LeDoux (1996) shed light on the neural basis of emotions, revealing their complex interplay with cognitive processes. Damasio (2003) further emphasizes the critical role of emotions in decision-making and self-awareness, suggesting that emotions provide crucial representational information about the value and significance of **experiences**.

4.2.4. **Summary of the Cognitive Approaches**

As with the Cognitive Orientations, none of the Cognitive Approaches are new concepts, however, the unification between first, second and fourth order structures demonstrates the utility of BCM as a broader framework. In addition, the clear absence of fourth order structures from the scientific literature demonstrates potential new research areas for cognitive science.
Additionally, the fact that the Orientations and Approaches are unified into a single framework allows for the prediction of other structures (Section 4.5 The Cognitive Mannerisms) which combine these two distinct elements.

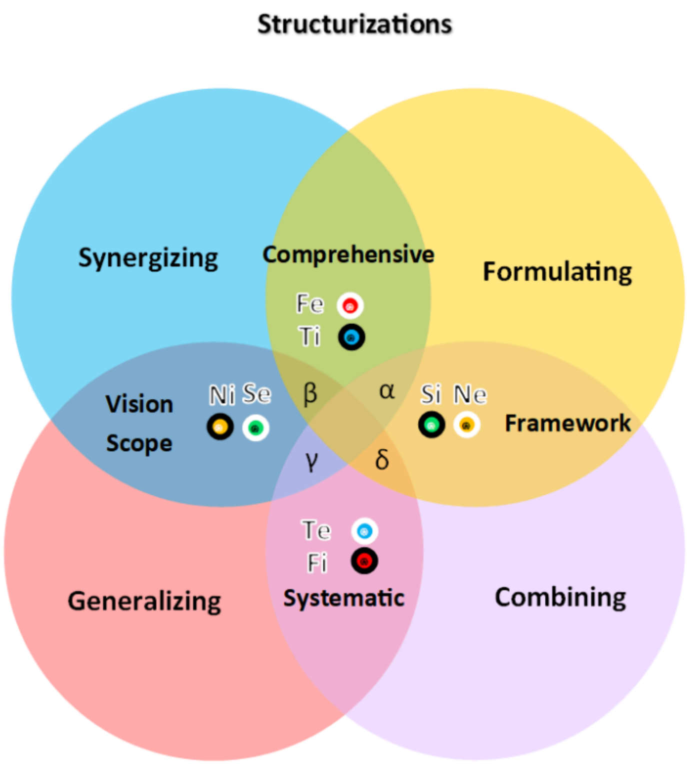
4.3 Structurizations

Cognitive structurizations refer to the potential structures that cognitive entities use to justify information. These organizational methods influence how information is processed, stored, and retrieved, ultimately shaping the entity's cognitive abilities and behavior.

While prior research has acknowledged this concept, it lacks a thorough investigation that clearly describes this phenomenon. BCM proposes a comprehensive framework, encompassing multiple levels of structurizations, from fundamental first-order categories to emergent fourth-order ones.

This hierarchical organization of cognitive structurizations is a unique prediction of BCM, offering a fresh perspective on the relationship between information processing and cognitive architecture.

Furthermore, BCM makes a unique prediction that each individual will notably lack one of the four specific categories of first-order structurizations. This absence is expected to influence the formation of the second-order structures which ultimately shape the individual's fourth-order Quadra.



Individual Differences in Brain Structure

Research consistently demonstrates that human brain anatomy and connectivity exhibit significant variability across individuals and populations. This variability is shaped by a complex interplay of genetic predispositions, life experiences, and sociocultural factors (Mueller et al., 2019; University of Zurich, 2018; Holmes et al., 2010). These unique patterns of brain structure and connectivity are reflected in diverse cognitive styles, behaviors, and even personality traits (DeYoung et al., 2010).

This variability in brain structure underscores the concept of cognitive embodiment and the individualized nature of information processing. Each brain, with its unique architecture, represents a distinct cognitive system uniquely navigating and adapting its informational representations. This diversity in cognitive embodiments likely contributes to the richness and adaptability of human cognition, enabling individuals to perceive, process, and respond to the world in unique ways.

4.4 Justification Mode

The final of the 7 base informational dichotomies relates to Jung's concept of perception vs judgment. This serves as a fundamental representational dimension, as derived from the S(3,4,8) Steiner system. This dimension is unique as it shares the same geometric direction as all of the previous second order informational structures:
4 Needs, 4 Capabilities, and 4 Structures.

Essentially, the two justification modes act as a lens through which we can independently view each of the twelve previously mentioned second-order representations and how they combine into Jung's 8 Cognitive Functions.

4.4.1 Recognition, Identification and Perception

Research across various fields highlights the active and adaptive nature of cognitive processes involved in recognition, identification, and perception. The brain utilizes prior knowledge, expectations, and specialized structures to make sense of the world (Kersten et al., 2004; Hohwy, 2013). Kersten et al. (2004) specifically propose that object recognition can be modeled as a Bayesian inference problem, where the brain combines sensory information with prior knowledge and expectations to make probabilistic inferences about the world, reducing uncertainty and optimizing information processing.

Furthermore, categorization and essentialist beliefs play a role in organizing sensory information and creating stable representations (Gelman & Wellman, 1991). The brain's distinct neural pathways for processing animate and inanimate objects suggest specialized cognitive structures for different types of information (Caramazza & Shelton, 1998).

Perception is also linked to navigating uncertainty and evaluating options, often relying on heuristics and bounded rationality (Newell & Simon, 1972). Framing effects demonstrate the influence of context and representation on choices (Tversky & Kahneman, 1981), while neuroscience research reveals the neural mechanisms underlying value representation and reward-based learning (Schultz et al., 1997; Knutson et al., 2005). Reinforcement learning provides a computational framework for understanding how agents learn to process identification and recognition through trial and error, emphasizing the role of feedback in shaping perception and action (Sutton & Barto, 2018).

4.4.2 Judgment, Evaluation and Decision Making

Decision-making under uncertainty involves navigating a "problem space" with heuristics and bounded rationality, seeking satisfactory solutions rather than optimal ones (Newell & Simon, 1972). Tversky & Kahneman (1981) demonstrate how the framing of information impacts choices, even when the underlying facts are unchanged. This highlights the influence of context and representation on decision-making.

Neuroscience research reveals how the brain encodes value and computes choices. Schultz et al. (1997) propose a model for neural encoding of reward prediction errors, crucial for learning and adapting behavior. Knutson et al. (2005) demonstrate specific brain regions correlating with expected value, further supporting the neural basis of value representation in guiding decisions.

Reinforcement learning (Sutton & Barto, 2018) provides a computational framework for understanding how agents learn through trial and error, emphasizing feedback and reward.

4.5 The Cognitive Mannerisms: Second Order - Approach ∩ Orientation

The Cognitive Mannerisms are second order cognitive processes that differ from other 2nd order structures in that they share directionality with and are predicted from the combination of a first order approach and orientation. There are 16 predicted mannerisms in all and although some of the individual mannerisms have been identified in the literature (most notably “preference” and “consensus”), they are *collectively* undefined and unlinked to scientific literature.
Based on observational inference, the interpretation of the mannerisms have been approximated.

This domain of BCM is still open to further research and progress in each of these 16 areas.

Finally, fourth order transmutations are only possible to clearly define and utilize once the research on the second order mannerisms has been more clearly fleshed out.

The following are the preliminary names for the 16 mannerisms:

Alpha Quadra:
Analyzing: Internalizing Intellectual Representations
Associating: High-Entropy Implicit Representations
Catering: Externalizing Experiential Representations
Exacting: Low-Entropy Explicit Representations

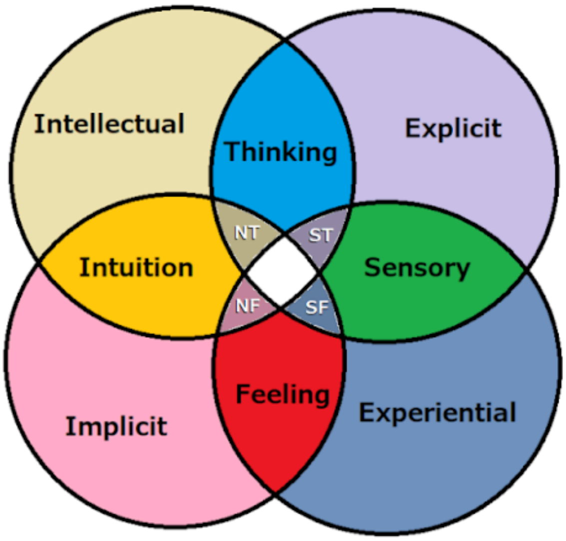
Beta Quadra:
Examining: Internalizing Explicit Representations
Circumstance: High-Entropy Experiential Representations
Uniting: Externalizing Implicit Representations
Truth: Low-Entropy Intellectual Representations

Gamma Quadra:
Acquiring: Internalizing Experiential Representations
Empirical: High-Entropy Explicit Representations
Explaining: Externalizing Intellectual Representations
Essencial: Low-Entropy Implicit Representations

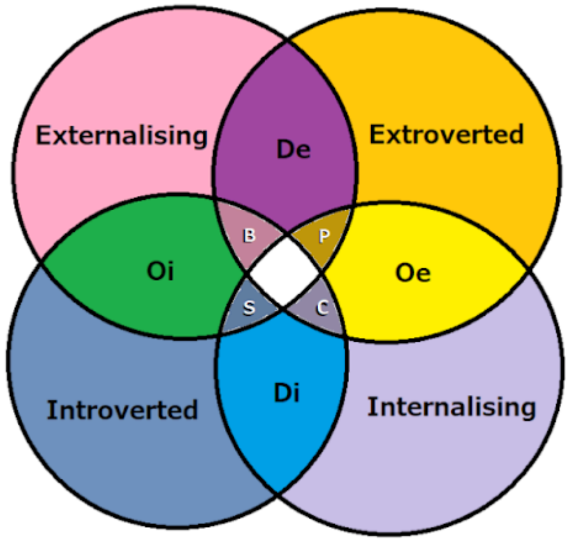
Delta Quadra:
Uncovering: Internalizing Implicit Representations
Consensus: High-Entropy Intellectual Representations
Implementation: Externalizing Explicit Representations
Preference: Low-Entropy Experiential Representations

Binary Cognitive Mechanics

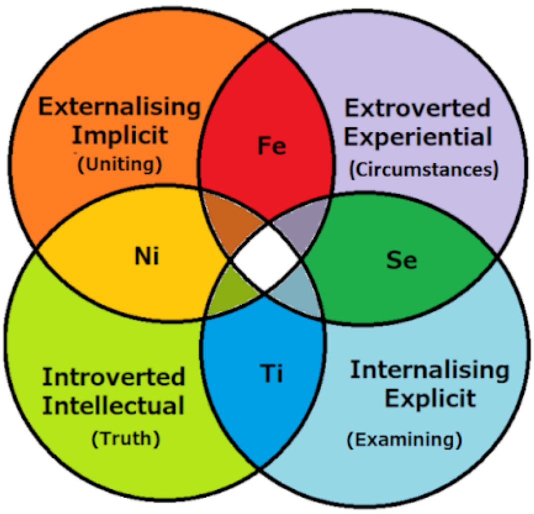
Approaches



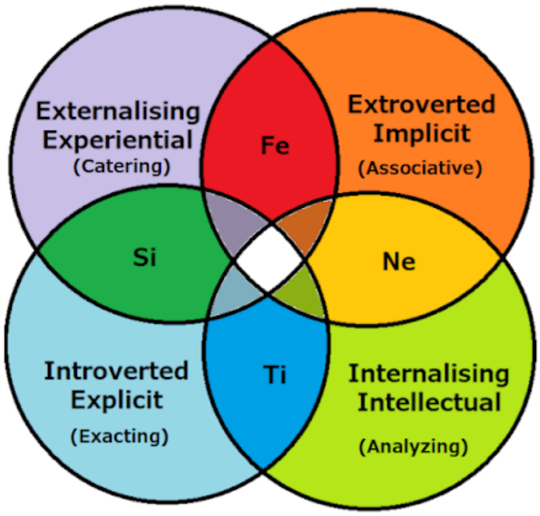
Orientations



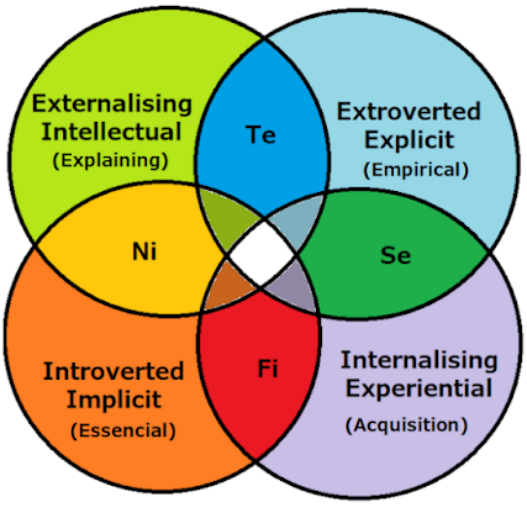
Beta Quadra



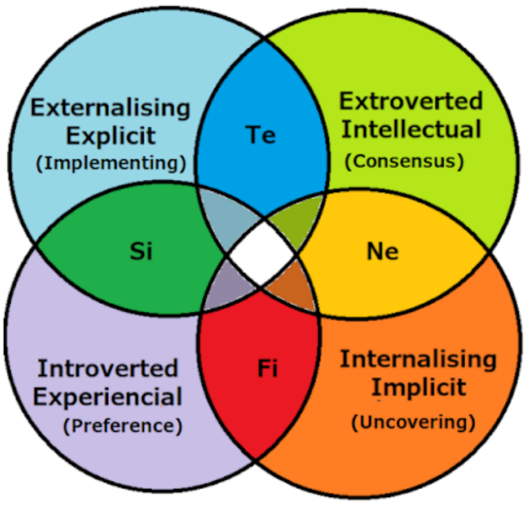
Alpha Quadra



Gamma Quadra



Delta Quadra



4.6. Obligation, Polarization, and Alignment

Due to the existence of separate and oppositional cognitive processes, a relationship between these processes naturally emerges in cognitive entities and their respective representations. This was clearly discussed by Jung as the reason why "types" emerge and as the path for personal growth and balance. The following are some examples in literature where opposing structures may be implied.

Cognitive Dissonance

Cognitive dissonance, a concept introduced by Festinger (1957), describes the psychological discomfort arising from holding conflicting cognitions. This internal conflict motivates individuals to seek resolution (principle of least energy), often by altering their beliefs or behaviors to align with each other. Cognitive dissonance can be interpreted as a state of high cognitive entropy, where inconsistencies between internal representations create a sense of disorder and instability within the cognitive system. The drive to reduce dissonance can be seen as an inherent mechanism to minimize this entropy and restore internal coherence.

Festinger and Carlsmith's (1959) classic experiment on forced compliance provides empirical evidence for the power of cognitive dissonance in shaping attitudes and beliefs. Their findings demonstrate how individuals actively manipulate their internal representations to justify their behavior, even when it contradicts their initial beliefs.

Furthermore, Van Veen et al. (2009) utilized neuroimaging to identify brain regions associated with experiencing and resolving cognitive dissonance, linking it to both emotional and cognitive processes. The brain's attempt to reconcile conflicting representations and reduce internal entropy manifests as observable changes in neural activity and, ultimately, in behavior and belief systems.

Psychological Compensation

The concept of compensation in psychology, initially proposed by Alfred Adler (1927), describes a strategic response to perceived weaknesses or limitations. It involves individuals actively developing and focusing on their strengths in other areas to maintain self-esteem and achieve personal goals. This can be seen as an attempt to balance cognitive capacity by leveraging areas of proficiency to counterbalance areas of perceived deficiency.

Over time, our understanding of compensation has deepened. Anna Freud (1936) viewed it as a defense mechanism to protect against anxiety, suggesting that compensation helps individuals maintain a sense of equilibrium in the face of perceived threats to their self-worth. Baumeister and Vohs (2004) further explored compensation as a self-regulatory strategy, highlighting its active role in goal pursuit and self-image management.

Later research has investigated compensation in various contexts, such as social comparisons (Wood et al., 2004) and child development (Elliot & Dweck, 2005). These studies underscore the dynamic interplay between individual strengths and weaknesses, environmental factors, and motivational drives in shaping compensatory behaviors.

Cognitive Polarization

Cognitive polarization, the tendency for individuals and groups to adopt increasingly extreme and opposing viewpoints, is a complex phenomenon with significant societal implications. Several studies shed light on the mechanisms that drive and sustain polarization.

Mason (2020) provides a comprehensive overview of the psychological factors contributing to political polarization, emphasizing the interplay between cognitive processes and social communication contexts. He highlights how ego-justifying, group-justifying, and system-justifying motives can reinforce existing beliefs and lead to increased polarization. Kteily, Sheehy-Skeffington, & Halperin (2021) explore "false polarization," where people overestimate intergroup disagreement, suggesting that cognitive mechanisms like assuming shared extremity drive this bias.

Jost (2022) delves into the cognitive and motivational processes behind polarization, focusing on selective information processing and motivated reasoning that confirm pre-existing beliefs. He also underscores the role of social identity and group dynamics in amplifying polarization.

Finally, Palonen (2023) examines the tension between cognitive diversity and polarization, arguing that while diversity is essential for a healthy democracy, excessive polarization can hinder the pursuit of truth and collective decision-making.

Bipolar Swings and Cognitive Oscillations

Research suggests that bipolar mood swings involve complex interactions between biological, psychological, and environmental factors. Goodwin and Jamison (2007) provide a comprehensive overview of the longitudinal patterns of mood swings, highlighting their cyclical and often unpredictable nature. Koukopoulos and Sani (2001) focus on mixed states, where symptoms of mania and depression co-occur, adding another layer of complexity to the understanding of mood fluctuations.

Neuroscience research offers insights into the neural underpinnings of mood instability. Passarotti et al. (2015) identified brain regions associated with mood instability, suggesting that specific patterns of brain activity could predict future mood swings.

BCM suggests that similar swings occur between many different cognitive structures, perhaps not as extreme and pronounced as bipolar swings, but similar in nature nonetheless.

Research suggests that neural oscillations play a crucial role in regulating attention (Buschman & Miller, 2007) and cognitive control (Voytek et al., 2015), potentially contributing to shifts in focus and information processing strategies. Similarly, oscillatory activity has been implicated in memory and learning processes (Hanslmayr & Staudigl, 2014; Buzsáki, 2002), suggesting a dynamic interplay between the encoding, consolidation, and retrieval of information.

Furthermore, fluctuations in brain activity have been observed during creative thinking and problem-solving (Beaty et al., 2014; Grabner et al., 2007), potentially reflecting shifts between divergent and convergent thinking.

4.7 The Cognitive Functions: 3rd Order Coalescence of the 7 Dichotomies

Now that all of the previous dimensions and structures have been fully fleshed out, we can see how they all amalgamate into the 8 Cognitive Functions originally described by Jung. Each function can be viewed as the combination of a set of unifying “wills to power” (Neitzche, 1885) uniting oppositional dichotomies.
The following table shows how the 7 primary dimensions combine to the higher order Cognitive Structures.

The 8 Cognitive Functions According to Binary Cognitive Mechanics and the S(3,4,8) Steiner System

Cognitive Function (3rd Order)	Justification Mode	Orientations			Approaches			Structurizations			Mannerisms (2nd Order)	
		Attention	Purpose	Need (2nd Order)	Form	Substance	Capability (2nd Order)	Continuity	Integration	Structure (2nd Order)	Navigation	Development
Ne	Identification	Extroverted	Internalizing	Variety	Implicit	Intellectual	Intuition	Formulating	Combining	Framework	Analyzing, Uncovering	Associating, Consensus
Si	Identification	Introverted	Externalizing	Certainty	Explicit	Experiential	Sensation	Formulating	Combining	Framework	Catering, Implementation	Exacting, Preferences
Ti	Evaluation	Introverted	Internalizing	Significance	Explicit	Intellectual	Thinking	Formulating	Synergizing	Comprehensive	Analyzing, Examining	Exacting, Truth
Fe	Evaluation	Extroverted	Externalizing	Connection	Implicit	Experiential	Feeling	Formulating	Synergizing	Comprehensive	Catering, Unifying	Associating, Circumstances
Se	Identification	Extroverted	Internalizing	Variety	Explicit	Experiential	Sensation	Generalizing	Synergizing	Scope/Vision	Acquiring, Examining	Empirical, Circumstances
Ni	Identification	Introverted	Externalizing	Certainty	Implicit	Intellectual	Intuition	Generalizing	Synergizing	Scope/Vision	Explaining, Unifying	Essential, Truth
Fi	Evaluation	Introverted	Internalizing	Significance	Implicit	Experiential	Feeling	Generalizing	Combining	Systematic	Acquiring, Uncovering	Essential, Preferences
Te	Evaluation	Extroverted	Externalizing	Connection	Explicit	Intellectual	Thinking	Generalizing	Combining	Systematic	Explaining, Implementing	Empirical, Consensus
4th Order	Coupled	Cognitive Vectors Directing/Seeking/Conferring/Revising			Cognitive Domains NF/ST/NT/SF			Worldviews Alpha/Beta/Gamma/Delta			Transmutations (Undefined)	

4.8 Cognitive Complexity

Tier 0 Cognition - *Pre-Component Cognition*
- Independent Cognitive Processes

Tier 1 Cognition - *Base Components*
• Orientation • Approach • Structurization • Justification Mode

Tier 2 Cognition - *Base Units and Alignments*
- Cognitive Needs = Orientation ∩ Orientation = Orientation ∩ Justification Mode
- Cognitive Capability = Approach ∩ Approach = Approach ∩ Justification Mode
- Cognitive Structure = Structurization ∩ Structurization = Structurization ∩ Justification Mode
- Cognitive Mannerism = Orientation ∩ Approach = Structurization ∩ Approach = Structurization ∩ Orientation

Tier 3 Cognition - *The Cognitive Functions*
- Cognitive Functions = Orientation ∩ Approach ∩ Structurization ∩ Justification Mode
- Cognitive Functions = Orientation ∩ Capability = Approach ∩ Needs = Justification Mode ∩ Mannerism = ∑ Mannerisms

Tier 4 Cognition - *Complex Units and Alignments*
- Cognitive Vectors = Need ∩ Need
- Cognitive Domain = Capability ∩ Capability
- Transmutations = Mannerism ∩ Mannerism
- Cognitive Worldview (Quadra) = Structure ∩ Structure

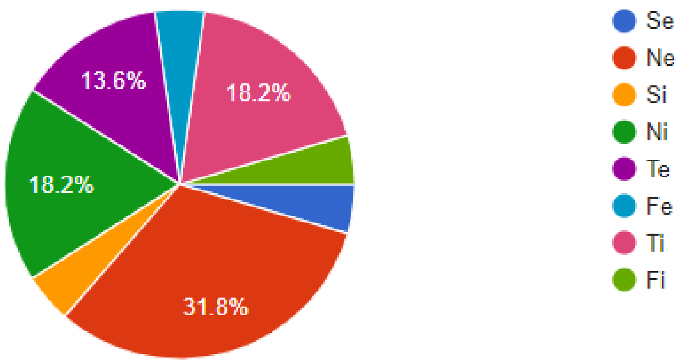
Broad Cognition - *Broad Units and Alignments*
- Full Vectors = Domain x Vector x Transmutation == Function ∩ Function
- Vector Addition

5. Preliminary Psychometric Study

A preliminary study was conducted that should be considered as an informal exploration, aiming to provide initial indications of the BCM model's validity. It's important to note that psychometric studies often rely on self-report measures like questionnaires or interviews, which can be susceptible to biases and inaccuracies in self-perception. However, even with these limitations, the findings from this study can serve as a valuable starting point for future research employing more objective measures to further validate and refine the BCM model.

The subjects of this study were selected from a population with self knowledge of their primary cognitive function as confirmed by a 3rd party source.
The sample size thus far is at 44 individuals which is quite small and will require a more extensive study in the future.

The distribution of primary cognitive functions is also asymmetric which may be of worthy note:



It should be noted that individuals were able to skip certain sections of the test that they were unable to answer with certainty.
The findings are as follows:

- **Orientations:**
  1. Attention: 90.00% correlation
  2. Purpose: 63.16% correlation
- **Approaches:**
  3. Form: 80.00% correlation
  4. Substance: 80.95% correlation
- **Structurizations:**
  5. Continuity: 65.00% correlation
  6. Integration: 60.12% correlation
- **Justification Mode:**
  7. Identification/ Evaluation: 90.48% correlation

Preliminary results indicate a potential value bias or misunderstanding with regards to the dimensions of Purpose, Continuity and Integration within the BCM framework. Another possible explanation could be that the individuals taking the test failed to self assess correctly.
However, each of these 7 dimensions did result in a correlation with the primary cognitive function therefore lending validity to the overall framework of this model.

6. Conclusion

Binary Cognitive Mechanics (BCM) presents a theoretical framework for understanding the fundamental structures of cognition. By reinterpreting Jungian Cognitive Functions as informational structures and employing an S(3,4,8) Steiner system analysis, BCM not only reconstructs Jung's original model but also reveals a deeper underlying informational architecture. This architecture successfully maps onto established theories in cognitive science, such as Schwartz's Theory of Basic Human Values, and offers a unified framework for understanding diverse cognitive processes.

Furthermore, BCM generates testable predictions, such as the existence of 16 second-order "Cognitive Mannerisms" and potential fourth-order structures. These predictions open up exciting new avenues for research in cognitive science, with potential implications for fields like artificial intelligence, psychology, and neuroscience.

While further empirical validation is needed, BCM provides a promising foundation for a more comprehensive and integrated understanding of cognition as an embodied, dynamic, and evolving system. By bridging the gap between abstract theoretical models and concrete cognitive phenomena, BCM offers a powerful tool for exploring the complex interplay of information, energy, and organization in shaping cognitive structures across diverse systems.

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