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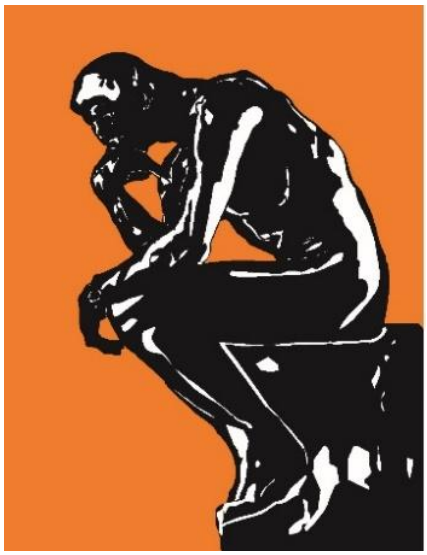

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"Nightingale Elder steps forward to confront Kingfisher:

– Sir Kingfisher, you told me earlier that the Nightingales have the right argument. How can we now lose?

Without hesitation, the Kingfisher replies sternly:

– True. The Nightingales have the right argument. But, the Magpies have multiple larger-scale right arguments. Understand?"

—In "Righteous Judge-bird"; *Wild Wise Weird* (2024)

Abstract

The major global challenges of our time, like climate and environmental crises, rising inequality, the emergence of disruptive technologies, etc., demand interdisciplinary research for effective solutions. A clear understanding of value is essential for guiding socio-cultural and economic transitions to address these issues. Despite numerous attempts to define value, existing approaches remain inconsistent across disciplines and lack a comprehensive framework. This paper introduces a novel perspective on value through the lens of granular interaction thinking theory, proposing an informational entropy-based notion of value. Grounded on quantum mechanics, Shannon's information theory, and the mindsponge theory, this framework integrates both subjective and objective considerations and is highly compatible with interdisciplinary research. The informational entropy-based notion of value effectively bridges diverse concepts of value, including use and exchange value in economics, personal values in psychology, and cultural, moral, ethical, and aesthetic values in society. By offering a unifying perspective, granular interaction thinking theory provides a valuable framework for translating insights from quantum mechanics into socio-cultural, economic, and psychological contexts, enriching theoretical discourse and enhancing analytical effectiveness.

Keywords: value; interdisciplinary research; entropy; information-processing perspective; social sciences; humanities

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A need for a new paradigm of understanding values

The world is facing major interconnected crises that threaten societal stability and the planet's future. Climate change and environmental degradation are among the most urgent challenges, pushing the Earth beyond its safe planetary boundaries. Crossing these thresholds can trigger irreversible cascading effects, posing severe risks to humanity's survival and development (Armstrong McKay et al., 2022; Richardson et al., 2023). At the same time, widening global inequality is fueling social discontent, driving political polarization and radicalization (Franc & Pavlović, 2023; Qureshi, 2023). Adding to these pressures is the rapid advancement of technologies like artificial intelligence, where controlling its power has become increasingly critical. Unchecked AI development presents multiple risks, including socioeconomic disruptions, widespread misinformation and manipulation, increasing concentration of power, and even existential threats to humanity (Marr, 2023; Turchin & Denkenberger, 2020). In such scenarios, interdisciplinary knowledge has become critical to help solve these global problems effectively (Ledford, 2015).

Addressing interconnected global challenges requires an interdisciplinary understanding of value to guide and drive socio-cultural and economic worldviews and transitions effectively. Values are fundamental in shaping how people think, make decisions, act, and share cultural norms and beliefs, as well as in influencing the foundations and functions of social and economic structures. However, current definitions of value remain inconsistent, even within the same discipline, let alone across different fields of study. This lack of coherence presents a significant barrier to developing holistic frameworks for sustainable and equitable solutions.

For instance, the question of "what is value" has long been a subject of debate in economics, where value is central to understanding socio-economic systems and individual economic decisions (Corsi et al., 2024). Various schools of economic thought offer different perspectives on value, including classical economics (i.e., cost of production), neoclassical economics (i.e., marginal utility and relative scarcity), evolutionary economics (i.e., procedural uncertainty and dynamic analysis), bioeconomics (i.e., low-entropy matter scarcity and

enjoyment of life), and econophysics (i.e., Information Theory of Intrinsic Value, embodied information, and negentropy), among others (Corsi et al., 2024).

Among these approaches, neoclassical economics dominates mainstream economic thought, defining value primarily through marginal utility and relative scarcity (King & McLure, 2014). This perspective considers value an entirely contextual and subjective construct, detached from any objective physical basis. According to neoclassical economics, value is fluid and constantly changing, shaped by individuals' subjective interpretations based on their preference structures at a given moment. This shifts the focus of value from objective, production-based (supply-side) interpretations to subjective, exchange-based (demand-side) ones. As a result, the fair price determined at the supply-demand equilibrium is often used as a proxy for value in economic analysis (Corsi et al., 2024).

Environmental economists adopt this neoclassical understanding of value in their efforts to address climate change and environmental degradation by internalizing externalities into market mechanisms (Wiesmeth, 2012). However, this approach has inherent limitations due to the subjectivity of valuation processes, the risks of creating and reinforcing delusions in decision- and policy-making, and the decoupling of climate change from biodiversity loss (Vuong & Nguyen, 2024a). These shortcomings prevent it from effectively addressing the climate and environmental crises, highlighting the need for a more comprehensive framework for understanding value.

Therefore, this paper aims to introduce a fresh perspective of understanding value through the information-processing lens of granular interaction thinking theory (GITT) (Vuong & Nguyen, 2024a, 2024c): the informational entropy-based notion of value. This theoretical framework is conceptualized based on the worldview of quantum mechanics (Hertog, 2023; Rovelli, 2018), information theory (Shannon, 1948), and the mindsponge theory (Vuong, 2023), offering a more comprehensive and interdisciplinary approach to understanding value.

There are several reasons that we think GITT is a valuable paradigm for understanding value in an era of multiple global crises and rising interdisciplinary science. First of all, GITT is interdisciplinary in nature. The theory originates from

the mindsponge mechanism, a socio-cultural framework, which later evolved into mindsponge theory, integrating evidence from life sciences and neuroscience (Vuong, 2023; Vuong et al., 2022; Vuong & Napier, 2015). Most recently, to develop a more comprehensive worldview that can integrate the objective values of nature, which mainstream economic notions of value fail to capture, the mindsponge theory has been further refined into GITT by incorporating insights from quantum mechanics and Shannon's information theory (Vuong & Nguyen, 2024a). This theory has been successfully applied to explain various value-related challenges in social sciences and humanities, including the filtering system in knowledge production (Vuong & Nguyen, 2024b), the weaponization of climate change (Vuong et al., 2023), climate change denialism (La et al., 2024), and the relationship between artificial intelligence and retracted science (Nguyen & Vuong, 2024).

Second, GITT is conceptualized based on the worldview and features of quantum mechanics, allowing it to integrate both objectivity and subjectivity into the notion of value. This perspective is aligned with the econophysics approach (Rodríguez & Cáceres-Hernández, 2018; Stanley & Mantegna, 2000), which applies statistical mechanics and nonlinear dynamics to study economic systems, particularly financial markets. However, while econophysics seeks universal patterns but lacks integration with socio-cultural and psychological knowledge, GITT incorporates situational complexity and human cognition dynamics, making it more adaptable for interdisciplinary research on values.

Through this new perspective on value, we hope to help social scientists, including economists, view values as dynamic properties that evolve under the right conditions. It also helps equip them to more effectively address emerging phenomena beyond existing value frameworks, such as environmental crises, artificial intelligence (AI), and interdisciplinary information.

The paper is organized into four main sections. The first section highlights the importance of a comprehensive, interdisciplinary understanding of value in addressing global challenges and outlines the paper's objective. The second section introduces a new paradigm of value through the information-processing lens of GITT: the informational entropy-based notion of value. The third section applies this paradigm to integrate and expand existing perspectives on

economic, cultural, humanistic, and ethical values. Finally, the fourth section discusses the potential applications and future directions of this paradigm in social sciences and humanities research.

Granular Interaction Thinking Theory

The granular interaction thinking theory, grounded in the principles of quantum mechanics, posits that macroscopic reality emerges from interactions between quanta at the microscopic level. In physics, information—defined by Shannon as a set of possible alternatives—is a fundamental concept. Each quantum carries its information, meaning that any physical system composed of multiple quanta inherently possesses a corresponding set of information or possible alternatives (Rovelli, 2018). Since the universe functions as a network of interacting physical systems, it also operates as a network of reciprocal information exchange. This aligns with John Wheeler's "it from bit" concept, which suggests that all physical entities originate from information (Wheeler, 2002).

Within the GITT paradigm, there are two primary spectrums: the mind and the environment. The mind functions as an information collection-cum-processor, while the environment serves as a broader information-processing system—such as the Earth system or a social system—that encompasses the mind. The human mind continuously interacts with its external environment, restructuring itself to sustain its existence. Only systems that effectively manage this interaction survive, grow, and reproduce. In other words, successfully adapting to a dynamic environment requires efficiently managing information—acquiring, storing, transmitting, and processing it. This principle aligns with Charles Darwin's theory of evolution (Darwin, 2003; Darwin & Wallace, 1858).

As quanta, atoms, molecules, and energy are fundamental to the structure and functions of cells, the building blocks that constitute nature and humans (Ernberg et al., 2022; Schrödinger, 1944), the mental processes within the human mind can also be viewed as information processes (Vuong, 2023). Thus, they logically exhibit three main features of the quantum world (Rovelli, 2018): granularity, relationality, and indeterminacy.

Granularity: This feature implies that information (including energy) in a physical system, like the human mind, is finite. As the number of information units (or "grains of information") increases, the entropy (uncertainty or missing information) in the human mind also increases. The level of informational entropy within the mind can be calculated using the following formula of Shannon (1948):

$$H(X) = -\sum_{i=1}^{n} P(x_i) \log_2 P(x_i)$$

$H(X)$ is the informational entropy of a random variable X with possible outcomes $\{x_1, x_2, \dots, x_n\}$ and corresponding probabilities $\{P(x_1), P(x_2), \dots, P(x_n)\}$. $P(x_i)$ is the probability of the outcome x_i. Each probability $P(x_i)$ represents how likely each outcome x_i is to occur. In this context, the variable X can be interpreted as an individual's mind in the current state, with i number of information units. Each information unit has its $P(x_i)$ probability to be stored and processed within the mind. According to this formula, when the number of information units increases without clear differentiation and prioritization of their importance, informational entropy will rise rapidly, reaching a maximum when all information is equally important, precisely when $P(x_i) = \frac{1}{n}$. In other words, individuals face the highest risk of information loss if they fail to establish a priority system. The more information units are stored and processed within the mind, the more likely they will be lost or forgotten.

Thus, for optimizing finite information within the mind for survival, growth, and reproduction with finite energy, individuals need to evaluate, distinguish, compare, combine, and assign different probabilities of being stored and used to information based on its relevance to survival, growth, and reproduction. Information deemed more essential is given a higher probability or energy to maintain and has higher influence capability over other information within the system. Speaking differently, it is more valuable and can be used as the benchmark to shape future cognitive and decision-making processes (Vuong, 2023). In essence, a person's values represent information (or possible alternatives) within the mind deemed critical for sustaining their existence, growth, and reproduction.

Relationality: This feature suggests that world events are always interactions, and all variable aspects of an object exist only in relation to other objects. This means that when information exists within the same system, the internal states and outcomes of that system are determined by the interactions among the information within it. As these interactions occur, the information can influence one another. Here, "influence" refers to the ability to induce changes in the state of interacting information. A scattering event—where information undergoes deflection, redirection, or a change in its internal state due to interactions with other information—is one of the most common types of interactions in a quantum system (Derezinski & Gérard, 2013). Such scattering events provide crucial insights into the fundamental properties of the information involved, as they reveal how information is processed, transmitted, and transformed between its initial and final states.

Thus, values can be understood as emerging from the interactions between numerous units of information that constitute the mind—including experiences, perceptions, beliefs, biological traits, emotions, and worldviews—along with newly absorbed information from environmental, socio-cultural, and economic contexts. While values themselves are information, they carry a higher probability of being retained within the mind (or assigned higher energy to maintain), distinguishing them from ordinary information.

The scattering interactions are often analyzed using Feynman diagrams (Feynman, 1949), which visually represent particle exchanges at the quantum level. Thus, we adapted the Feynman diagram and combined it with the mindsponge theory's diagram to illustrate primary types of interactions that happen between information and values (see Figure 1). In the new diagram, we call $Qu(i)$ informational quantum, representing information i and $Qu(val)$ value quantum, representing value val. Interactions of informational quanta within the mind and newly absorbed from the environment can be classified into three main types:

- Type 1: the interaction between $Qu(i)$ absorbed from the environment and $Qu(i)$ within the mind. During this interaction, information units are evaluated, distinguished, compared, and combined to generate insights, or synthetic information units, that are beneficial for the mind. Such

information units are assigned a greater probability of being stored and used as benchmarks for later mental processes. Meanwhile, informational quanta that are deemed irrelevant or costly for the mind are discarded to conserve energy. In some cases, the interactions between informational quanta do not result in insights, so those informational quanta will continue to be stored in the buffer zone, awaiting a later process when the condition is right.

- Type 2: the interaction between $Qu(i)$ in the buffer zone and $Qu(val)$—representing value quanta—within the mindset. The mindset is the collection of the mind's core values or information units that are assigned the highest probability. These value quanta contribute to subsequent interactions within the mind by serving as benchmarks to direct the mental processes (e.g., emotions, thinking, behaviors, etc.) and interact with newly absorbed information. This tendency can lead to the dominance of values in comparison to other information units within the mind, resulting in cognitive and emotional biases.
- Type 3: the interaction between $Qu(val)$ and $Qu(val)$ within the mindset. Although former values can serve as benchmarks that often filter out irrelevant and incompatible information quanta, newly absorbed informational quanta, in some cases, can be assigned equal or even higher probability than preexisting value quanta in the mindset. Interactions between these types of quanta can lead to the refining of the preexisting value quanta (by partly recombining or recontextualizing it with new value quanta) or updating the mindset (by fully replacing preexisting value quanta with the new value quanta)

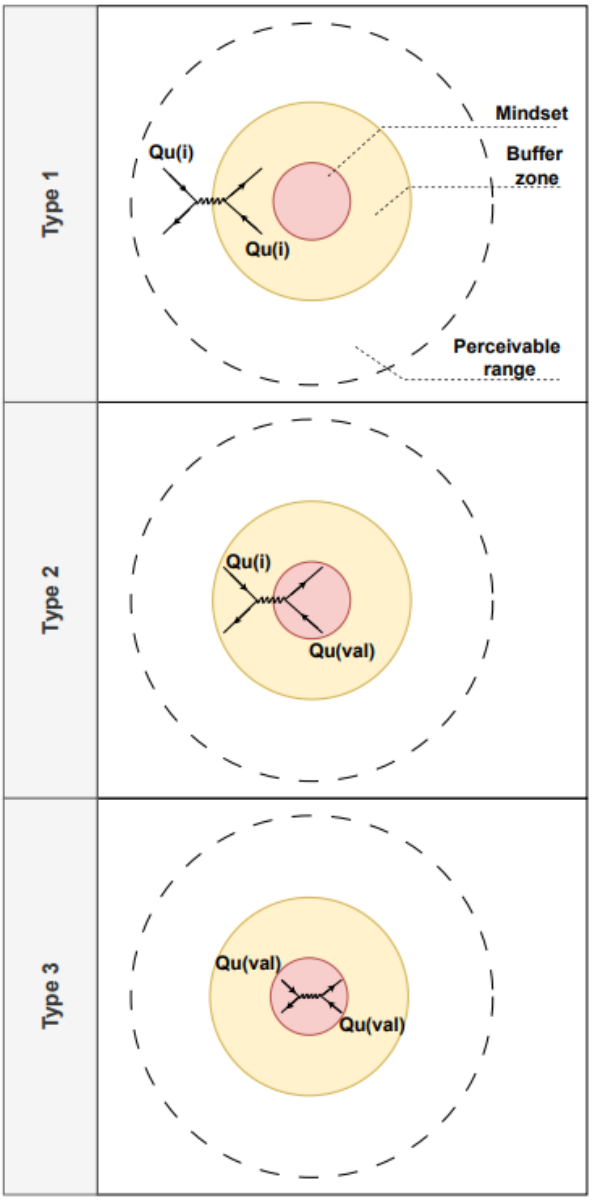

Figure 1: Primary types of interactions between informational quanta, adapted from Feynman diagram (Feynman, 1949) and mindsponge theory (Vuong, 2023)

Based on the initial and final states of information after interactions, it is also able to know whether the occurring interaction is elastic or inelastic. Elastic scattering refers to the process where the colliding quanta's internal states are not changed, as their information is not lost after the interaction. Meanwhile, inelastic scattering refers to the process where incoming quantum transfers

some of its information to the target quantum, or the collision results in the creation of multiple new quanta (Friedrich, 2013). From the information-processing perspective, we can consider the elasticity level of an informational quantum as the likelihood that its internal state (or information contained) changes after the interaction (or scattering). Then, beliefs can be interpreted as informational quanta that have high elasticity compared to other quanta.

Quantum mechanics suggests that the elasticity of a quantum is dependent on its total energy (kinetic energy + potential energy), interaction potential, and available energy states. Kinetic energy refers to the energy a particle possesses due to its motion, while potential energy refers to the energy a particle holds because of its position relative to other particles within the systems (Bohm, 1952). The interaction potential refers to the potential energy arising from the interaction between particles within the systems (Griffiths & Schroeter, 2019). The available energy state implies the specific, discrete energy level that a particle or system can occupy.

If we replace "energy" with "information," the elasticity of a $Qu(i)$ and $Qu(val)$ can be said to be dependent on four factors:

1. The information about the motion of the particle within the mind
2. The potential information that the particle possesses because of its position relative to other particles in the mind
3. The potential information that arises from the interaction between particles within the mind
4. The limit of information the particle and the mind can occupy

Based on these factors, each $Qu(i)$ and $Qu(val)$ will have different levels of elasticity.

In certain conditions, like when the set of information within the mind does not change (i.e., not interacting with the external infosphere), $Qu(val)$ can become more elastic and considered as beliefs. Specifically, as $Qu(val)$ is assigned a higher probability to be stored (or energy), the remaining potential energy within the system must decrease, resulting in a low-entropy system. In such a system, the potential information and interaction potential also reduce, increasing the elasticity of $Qu(val)$ and the mind accordingly. This feature

explains why people with a more open mindset or exposure to new information are more likely to change their beliefs as an adaptation to the changing socio-cultural environment, as their values are less elastic (Vuong & Napier, 2015; Wang et al., 2022).

Indeterminacy: This feature implies that the future is probabilistically, rather than unequivocally, determined by the past. For that reason, the value formation within the human mind is probabilistically determined by the availability of information quanta in the surrounding environment, information quanta within the mind, their potential information, interaction potential, and the mind's information processing capacity. For instance, assuming an individual's subjective sphere is the set $Mind$, a subset of the set $Environment$.

$$Mind \subset Environment$$

Assuming there is a piece of information A. If information A exists within the set $Environment$, there is some probability it exists within $Mind$. Otherwise, it has zero probability of appearing in the set $Mind$.

$$\forall A(A \notin Environment \Longrightarrow A \notin Mind)$$

It should be noted that the mind can generate novel information without immediate environmental input; however, this process still depends on the recombination and recontextualization of previously absorbed information (e.g., past knowledge and experiences) (Vuong, 2022).

In general, values are subjective constructs that emerge from interactions among information within the mind. While they are a form of information, they are no longer ordinary information units but rather synthesized insights derived from interactions among information (Vuong & Nguyen, 2024c). Such synthesized information is given a higher probability of being stored and serves as a benchmark for subsequent mental processes, as it is considered to contribute to the mind's continued functioning and adaptation. However, under certain conditions, newly absorbed information units can refine or even replace the preexisting values, enabling the mindset to be updated.

Explaining Capabilities of the Informational Entropy-based Notion of Value

In this section, we utilize the above reasoning of the informational entropy-based notion of value to explain different well-known notions of values, like use value, exchange value, personal value, cultural value, moral and ethical value, and aesthetic value.

From the granular interaction thinking theory, the mind contains a set of informational quanta. These quanta interact with each other to form a subjective sphere of influence—a set of all interactions among information existing within the mind (or the subjective world) under mental boundaries (Nguyen et al., 2023). Such a subjective sphere reflects the objective interactions that can be perceived and exist as corresponding representations within the mental realm. However, as subjective constructs, values do not necessarily align with objective reality. The subjective sphere, to certain degrees, deviates from the objective sphere due to the variances in the mental processes of the mind (e.g., absorption and simulation processes) (Nguyen et al., 2023). The degree of deviation can show how much the subjective sphere fits the objective reality. Generally, there are two types of deviations that make the values unfit for reality.

1. The individual's mind does not have sufficient information reflecting the actual interactions of a certain thing that can happen in reality.
2. The individual's mind has wrong information about the actual interactions of a certain thing that can happen in reality.

Either deviation can lead to the individual's underestimation/overestimation of the actual value (i.e., the value theoretically has the lowest deviation from reality). For the human mind's subjective sphere to be more aligned with objective reality, it needs to be continuously updated, refined, and expanded through knowledge production, filtering, and accumulation processes.

Use Value and Exchange Value

In a market, the price of a product represents its exchange value—its worth as determined by its ability to be traded for other goods, services, or money (Pirgmaier, 2021; Schumpeter, 2006). But what defines a fair price?

According to the new notion of value, exchange value emerges from informational quanta and their interactions within the minds of both the seller and the buyer. To illustrate, consider a mushroom.

Information about a product is its potential alternatives connected to it. For a mushroom, this includes size, shape, color, medicinal properties, and more. However, buyers and sellers do not assess this information in isolation. Instead, they evaluate it in relation to other factors such as scarcity, market demand, cultural significance, and availability of substitutes. These interactions between the mushroom's attributes and broader informational contexts within the mind generate insights, shaping the perceived usefulness of the mushroom—its use value (Pirgmaier, 2021). Since each individual possesses a unique set of informational quanta, the use value of the mushroom differs between seller and buyer.

The emergence of insights through informational interactions is probabilistic, not deterministic. Certain conditions increase the likelihood of forming relevant insights. For example, if a seller lacks market demand information, they may hesitate to enter the business or misprice the mushroom. Likewise, if a buyer is unaware of its medicinal benefits, they may undervalue it.

One of the most important conditions for the interaction to happen is the availability and accessibility of such units of information. As shown in Figure 2, the seller and buyer both have access to the set of information $\{a, b, c\}$, but each also has access to other information—$\{g, f, h\}$ for the seller and $\{d, e, j, i\}$ for the buyer. When information is both available and accessible, it can be absorbed into the mind, where it interacts with the existing knowledge of the mushroom, denoted as M. These interactions can then produce insights into the mushroom's value. Although seller and buyer have different sets of information, i.e., $Seller\{M, a, b, c, g, h\}$ and $Buyer\{M, a, b, c, e, j, i\}$, they share some similar units of

information $Seller \cap Buyer = \{M, a, b, c\}$, enabling them to reach a mutual agreement on the mushroom price—its exchange value.

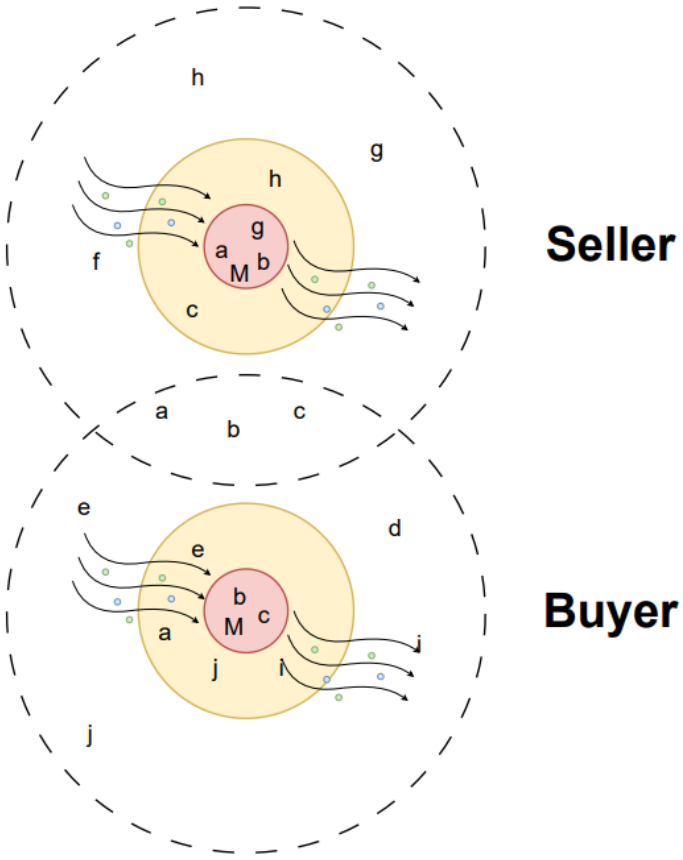

Figure 2: Informational quanta processing mechanism of the buyer and seller, adapted from the quantum mechanics and mindsponge theory

Personal, cultural, and other types of values

The new definition of value complements, rather than contradicts, existing definitions of personal and cultural values by providing a more nuanced understanding. It expands on psychological and sociological views by offering a more integrated approach.

Specifically, social scientists define "value" using three relatively distinct perspectives (Fischer & Schwartz, 2011). The first perspective considers values as personal attributes, defining them as abstract beliefs about desired goals,

ranked by importance (or priority), that guide individuals in evaluating things, events, people, and actions (Schwartz, 1992). This view links an individual's value priorities to their personality traits, attitudes, and behaviors, helping explain why value systems vary across individuals (Schwartz, 1992).

In contrast, the second perspective takes a collective approach, seeing values as shared cultural characteristics within a group. Many cultural psychologists view values as collective meaning systems that members of a collective, community, or nation share (Hofstede, 2001; Lehman et al., 2004; Rohner, 1984). Shalom Schwartz defines cultural values as shared ideas about what is desirable within a society to balance fundamental human issues, such as survival and development (Schwartz, 2006; Schwartz, 2014). This perspective often uses nations as units of cultural analysis, asserting that there is relative consensus on the importance of certain values within each nation, though values may differ between nations. For example, Hofstede's cultural dimensions theory identifies national differences through dimensions like power distance and individualism vs. collectivism.

The third perspective, held by sociologists, sees values as reflections of social structures, institutions, and power dynamics within society (Hitlin & Piliavin, 2004; Walder, 2009). This view suggests that consensus on values within a country is moderate because individuals or groups may experience different social conditions and concerns shaped by social structures. The level of consensus is influenced by the complexity of these structures, with periods of social conflict or rapid change (e.g., during periods of social conflict or rapid social and technological changes) leading to reduced consensus.

The new definition of value aligns closely with the psychological perspective: information within the mind that is important to prolong an individual's existence also includes abstract beliefs and helps guide the individual in evaluating things, events, people, and actions. Additionally, because the values emerge from interactions between the informational quanta within an individual's mind and the surrounding environment, this perspective helps explain how individuals from different backgrounds, worldviews, biological attributes, and living environments develop different values, leading to varied personal traits, attitudes, and behaviors.

One key system an individual interacts with is other people. Information exchange through observation, communication, and interaction helps individuals survive, develop, and reproduce by generating new values. While individuals in the same society may hold different values due to life experiences, social conditions, and perspectives, they often reach a relative consensus on certain values. This consensus reduces informational entropy and creates order within the social system, facilitating interactions with less energy costs. This leads to shared cultural values within a collective, community, or nation. These shared values also include moral and ethical values and aesthetic values, which are expressed and disseminated through cultural products, like arts, dance, literature, fashion, music, etc., to manifest, shape, and reinforce the society's values, identity, and structure (Coote & Shelton, 1992; Haidt, 2012; Nguyen, 2024; Vuong et al., 2020).

Beyond human interactions, individuals also engage with man-made products (e.g., technology), societal systems (e.g., economic, legal, political), and the natural world. In stable conditions, these systems and products are relatively fixed, which shapes and reinforces cultural values and consensus. However, changes in the environment (e.g., climate change, biodiversity loss), technological breakthroughs (e.g., artificial intelligence), and social transitions (e.g., economic reforms, wars) create pressures that force individuals to adapt. This leads to the transformation or creation of new cultural values for individuals, groups, organizations, or nations. The transformation or creation of these new values is not deterministic but probabilistic, influenced by objective conditions.

Implications and Potential for Future Social Sciences and Humanities Research

The informational entropy-based notion of value, derived from granular interaction thinking theory, demonstrates a strong capacity to explain, integrate, and bridge various existing value concepts. By embracing a dynamic and holistic perspective, this approach can unify different types of value—such as use and exchange value in economic activities, personal value in psychological processes, and cultural, moral, ethical, and aesthetic values within society—under a common information-processing standard. This convergence not only

enhances understanding of value systems across disciplines but also fosters interdisciplinary research.

The new concept of value offers a more cohesive and flexible framework for analyzing complex human and societal phenomena. One key area it addresses is the transition of value systems, such as incorporating environmental values into economic structures and embedding them within cultural norms (Nguyen & Jones, 2022; Vuong et al., 2024). It also provides a foundation for exploring cultural evolution, explaining why certain values that were once widely accepted may no longer be relevant while others endure (Cohen, 2022; Richerson & Christiansen, 2024; Vuong et al., 2018). Furthermore, the information entropy-based concept of value paves the way for new research directions that evaluate values and make predictions, accounting for uncertainties arising from dynamic interactions at multiple levels, ranging from individuals and small groups to nations, humanity, and the Earth's ecosystem.

From a practical standpoint, insights from these research directions can guide the development of tailored governance, education, and communication strategies that shape and update societal value systems, ensuring they stay aligned with evolving realities. By integrating dynamic interactions and information processing, these strategies may promote more adaptive and resilient social frameworks, strengthening collective decision-making and supporting cultural evolution in response to contemporary challenges.

In general, it seems to us that psychological and socio-economic phenomena are deeply interconnected, necessitating interdisciplinary research. However, as the research scope expands, so does informational entropy, increasing uncertainty (Vuong & Nguyen, 2024b). To mitigate entropy (or information loss) and maintain coherence in understanding psychological and socio-economic issues, linking social sciences and humanities with quantum physics is a good way to make sure we are not following the wrong track (Rovelli, 2018). In other words, this connection ensures that understanding of psychological and socio-economic phenomena remains consistent with the fundamental mechanisms governing the physical world.

In addition to the core quantum mechanics features already used to define the new notion of value, other quantum phenomena—such as superposition, wave-particle duality, entanglement, the Heisenberg Uncertainty Principle, quantum tunneling, decoherence, and Bose-Einstein condensation—offer significant potential to advance social science research. In this regard, the granular interaction thinking theory serves as a helpful framework that translates advances in our understanding of quantum mechanics into valuable insights, enriching the vocabulary and enhancing the effectiveness of studying and explaining socio-cultural, economic, and psychological phenomena.

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