Further on informational quanta, interactions, and entropy under the granular view of value formation

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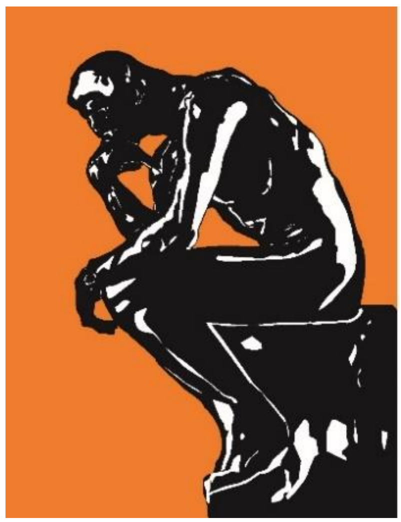

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[*Research Note v5*]

"– Wherever there is food, there is freedom! This cage room is my dream.
It is here my happiest moment has arrived."

—In "Dream"; *Wild Wise Weird* (2024)

Abstract

A recent study suggests that value and quantum states seem to be governed by the same underlying mechanisms. In our recent book titled "Better economics for the Earth: A lesson from quantum and information theories," specifically Chapter 5, we have proposed an informational entropy-based notion of value, drawing on the granular worldview and primary features of quantum mechanics, Shannon's information theory, and the mindsponge theory. Specifically, the notion suggests that values are created through the interactions of information. But how do information and its interactions lead to values? This research note aims to contribute to the answer to this question.

Keywords: informational entropy-based notion of value; granular interactions thinking; quantum mechanics; Shannon's information theory; mindsponge theory; informational quanta

According to Özdilek [1], value and quantum states seem to be governed by the same underlying mechanisms. In our recent book, specifically Chapter 5 [2], we have proposed an informational entropy-based notion of value, drawing on the granular worldview and primary features of quantum mechanics [3,4], Shannon's information theory [5], and the mindsponge theory [6]. Specifically, the notion suggests that values are created through the interactions of information. But how do information and its interactions lead to values?

To understand this, consider an example. In a market, the price of a product implies its (economic) value. However, what determines the fair price for a product? First, we need to understand the definition of information. According to Shannon, information can be defined as the potential alternatives. Therefore, the information of a product encompasses the potential alternatives connected to it. For instance, the information about a mushroom includes its size, shape, color, characteristics, medicinal properties, and more.

However, buyers and sellers rarely consider and evaluate a product's information in isolation. Instead, they consider it alongside other types of information, such as its scarcity in nature, the availability of substitutes in the market, the market demand, cultural significance, usage of traditional medicine, and so on. The interactions between the mushroom's information and these various types of information result in combinations of information (or values) that provide insights beneficial to both buyers and sellers.

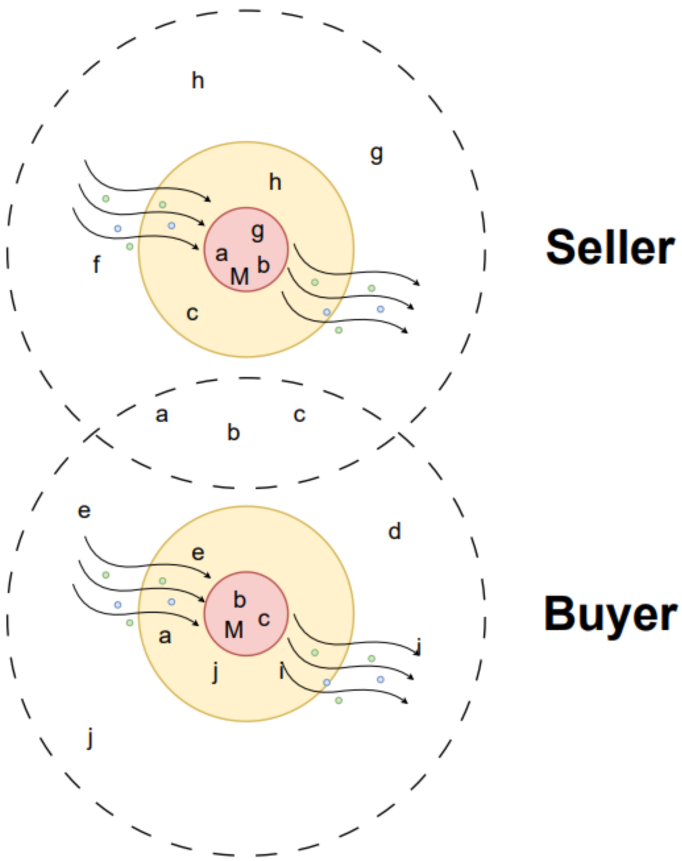

Figure 1: Informational quanta processing mechanism of the buyer and seller, adapted from the quantum mechanics and mindsponge theory

It should be noted the generation of insights through the interactions of information is not unequivocal but probabilistic. Certain conditions are required for increasing the probability of the formation of insights. For instance, without interaction with information about the real market demand for mushrooms, the seller will be less likely to start the business or sell the mushroom at a higher price. In contrast, without the interaction with information about the benefits of the mushroom, i.e., medicinal properties, the buyer will be less likely to seek the mushroom or buy it at a higher price.

The mindsponge theory can help conceptualize such conditions (see Figure 1). Specifically, the first condition for the interaction to happen is the availability and accessibility of such units of information. As seen in Figure 1, both the seller and buyer have access to the set of information $\{a, b, c\}$, but they are also accessible to different sets of information that the other do not. The seller has access to $\{g, f, h\}$, while the buyer has access to $\{d, e, j, i\}$. As the information is available and accessible, it has the possibility of being absorbed into the mind, subsequently leading to interactions with the information of the mushroom, represented by M. Such interactions can lead to insights regarding the values of mushrooms. 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 $Seller \cap Buyer = \{M, a, b, c\}$. This allows them to reach some level of agreement regarding the mushroom price.

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 entropy within the mind can be calculated using the following formula of Shannon:

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

$H(X)$ is the informational entropy of a random variable X with possible outcomes $\{x_1, x_2, \ldots, x_n\}$ and corresponding probabilities $\{P(x_1), P(x_2), \ldots, P(x_n)\}$. $P(x_i)$ 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, specifically 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. Also, according to quantum physics, all physical systems have limits, and humans are no exception [4]. The more information units are stored and processed within the mind, the more likely they will be lost or forgotten.

It seems to us that to reduce the risk of information loss in the future state, the mind tends to spend energy on evaluating, distinguishing, comparing, and combining information units to assign higher probabilities to more important information. In other words, information units are let to interact to generate insights that are beneficial for prolonging the existence of the mind, that is, values. Values are also information units. Nevertheless, they are no longer genuine information about a thing (e.g., smell, color, size, shape of a mushroom, etc.) but synthetic information derived from interactions with other kinds of information (e.g., the mushroom is suitable for fine dining; the mushroom can be used to lower blood pressure; etc.).

As key information units (i.e., values) are assigned a higher probability of being stored and processed within the mind, they might be subsequently more likely to be used as benchmarks to direct the mental processes (e.g., emotions, thinking, behaviors, etc.) and interact with newly absorbed information. This tendency leads to the dominance of values in comparison to other information units within the mind. In the context of decreasing entropy, buyers and sellers will tend to reach agreeable levels of trade value, as they tend to have similar perceptions of values.

In general, values emerge from information. However, this information is not the sole information of the product; it is synthetic information derived from the interactions between the product's information and other types of information available and acquired by both sellers and buyers. Concerning the forming of informational entropy-based value, there is an issue with probability assignments, which will determine the likely state of information loss associated with the determined value. This will benefit from Shannon's definition of entropy and its changing behavior. (For instance, we learn from Shannon's information entropy that moving away from uniformly distributed probabilities will reduce information loss, and hence entropy).

After the values are formed, it might also contribute to the subsequent interactions with the mind. Then, Interactions between informational quanta—represented by $Qu(i)$—within the mind and newly absorbed from the environment can be classified into three main types (see Figure 2):

- Type 1: the interaction between $Qu(i)$ absorbed from the environment and $Qu(i)$ within the mind.
- Type 2: the interaction between $Qu(i)$ in the buffer zone and $Qu(val)$—representing value quanta—within the mindset.
- Type 3: the interaction between $Qu(val)$ and $Qu(val)$ within the mindset.

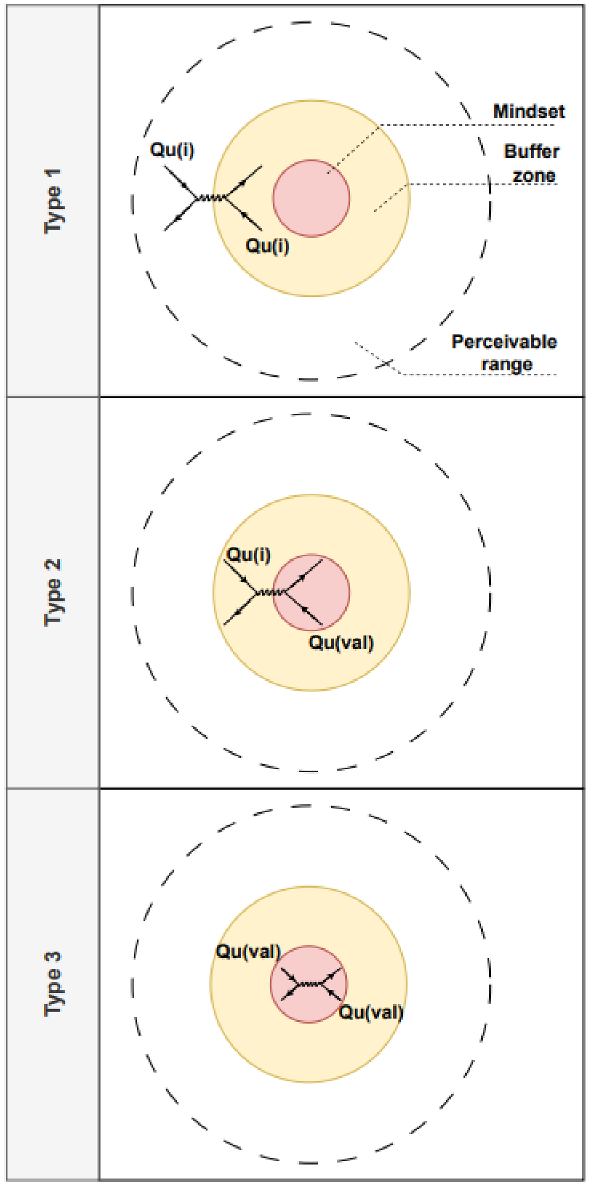

Figure 2: Primary types of interactions between informational quanta, adapted from Feynman diagram [7] and mindsponge theory [6]

The short discussion above shows that this new approach to an enlarged definition (or view or notion) will likely empower us to more effectively consider different notions of value across research or professional disciplines—economic, socio-cultural, or humanistic—under a more enabling theoretical paradigm [8-10]. It is because now the key ingredients, i.e., information, quantum states, interactions, information entropy, and probabilistic assignments, will help build productive thinking apparatuses from basic granules [11].

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