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The Role of Consciousness and Emotion in Decision-making: A NeuroPhilosophical Perspective

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Abstract

Humans engage in a complex array of metacognitive activities in their daily lives. These mainly involve being aware consciously or unconsciously while deciding on a particular action, which is fundamental to human existence. Humans acquire a unique skill of observing societal nuances, expressing their opinions, feeling a range of emotions, and choosing the actions that reflect their identity. The paper aims to comprehend the fundamental aspects of consciousness and human emotional decision-making, which are influenced by socio-economic factors. This will be presented in three ways: first, it will explain the intricacies involved in decision-making science and behavioural outcomes. Second, the theoretical models and themes will explain the socio-economic factors influencing the emotional components of humans. Thus, this compromises an individual's decision-making skills. Third, an experimental representation of consciousness and decision-making models by scientists- Antonio Damasio and Stanislas Dehaene. This will hold the essentiality of modern outlook, tools, and methods adopted in Psychology and Neuroscience to perceive consciousness and decision science differently. Lastly, the paper highlights a comprehensive theoretical and empirical investigation of factors compounding the consciousness, socio-economic and emotional decision-making of humans.

Key Words: consciousness, decision-making, socio-economic, emotion, behavioural response

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Introduction

One of the crucial aspects of human conditioning is the experience of conscious self, where we are inherently made aware of control and responsibility towards our actions and choices. The term consciousness hereby is woven with an understanding of awareness,

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attention, and subjective aspects of perception and volition. Even though consciousness is one of the defining features of human life and a course of experience in which we engage, it remains a perennial challenge to explain. The paper acknowledges the assumptions and inherent responsibilities associated with using this term. Therefore, it strives to explicitly define and present it, thus improving its access to specific scientific content. Consciousness encompasses both-attention and awareness. Awareness is the background radar of consciousness while attention is the process of focusing conscious awareness (Brown and Ryan, 2003). Simultaneously, our choice of action is determined by an active engagement of decision-making in our societal roles. It can be debated whether they are consciously or unconsciously involved. Humans are additionally characterized by decision-making skills, which are observed in different facets of our lives. These facets involve social, economic, and emotional factors. We are entitled to these factors while dealing with property negotiations, home or land investments, taking closer routes to our workplace, and having difficult conversations with our family or friends. Each one of them requires an intricate decision skill, which is supported by an awareness of a choice.

Often, the assumption that conscious thought is an epiphenomenon has lately been overlooked with a sharp rise in evidence of unconscious or automatic processes, which prompts the question- Does unconscious thought have any influence on our decision-making? It is evident that humans indulge in a wide variety of cognitive interactions and behavioural processes with socio-economic and emotional factors; however, in the end, everything stands out in the form of behavioural action.

The aim here is to understand the principal role of consciousness in human emotional decision-making. It is also with an agenda to gather a cumulative perspective related to the varied forms and models of consciousness and decision-making theories that supports this aim. The paper, thereby, intends to answer two primary questions- To determine the role of consciousness in decision-making and second, does emotional decision-making influence our actions? This will be supported by theoretical contents which will build an overview and in depth understanding of functions related to emotional and conscious decision-making. Second, it will attempt to indulge in scientific explanation presented by Antonio Damasio and Stanislas Dehaene, who approach their model of research with empirical investigation, thus encouraging a visionary platform for Neuro-Philosophy. Lastly, it will indicate a few shortcomings in Damasio's approach, accentuating the fundamental need to place evident tools when incorporating conversation on the role of consciousness and emotional quotient in human decision-making.

The vast literature on consciousness and decision-making helps us adopt imperative techniques that are available in the modern age

of technology. The theories posed in philosophy have the potential to be transformed into the empirical data. Primarily, Psychology and Neuroscience have taken this as a challenge to learn and evolve these theories into a broad spectrum of cognitive science experiments. We can, hence, see that the neurobiology of decision-making provides detailed insight into how the brain deliberates and reasons ranging from evidence to choices. One of the key insights from this content is allowing the idea of exploring science, especially the one which puts forth evidence on brain's reaction to minute differences and has enabled the skill to consciously and unconsciously decide.

The upcoming sections will primarily discuss the means of monitoring and understanding decision-making from multivariate theoretical perspectives, which will involve the interconnectedness and relevance of emotion and behavioural responses. Further, accompanied by factors affecting emotional decision-making, its impact on socio-economic regions of society, and age playing a pivotal role in decision-making science.

Decision-making: A source of behavioural outcome

Decision-making is viewed as a stage of human information processing because individuals must gather, organize, and combine information from various sources to affirm their decision. People frequently make decisions based on what they believe they ought to do, rather than what truly resonates with their preferences (Kahneman, 2011). Here, Kahneman presents a different perspective by noting that humans do not always make choices consistent with their preferences. This aspect gives rise to a room full of theories that have been modulated and adapted in a wide range of cognitive science studies—for instance: utility, subjective theories, normative and behavioural models. To start with, Kahneman introduces the famous analogy of system analysis.

The system analysis (Kahneman, 2011) states that one is fast (unconscious) and two is slow thinking (conscious) when a situation is presented before an individual. He states his theory in understanding choice and preference as systems 1 and 2. It is often implied that humans make decisions and judgments through automatic or reflective processes (Quadt *et al.*, 2022) which works well for us. For instance- in a daily scenario, how are we capable of remembering routes to our workplace from home and vice versa? Or if asked for a mathematical expression of 18*15, can we answer it quickly? It is here where we acknowledge the training or muscle memory that humans adopt in their everyday lives; hence, they can internalize, execute a series of complex inferences, and make quick affirmative judgments (Brust-Renck *et al.*, 2021). The attributes of System 1 include automatic and quick operation with little or no effort, and it lacks voluntary control. Meanwhile, System 2 directs its attention toward handling the challenging mental tasks that involve

complex computations. It is also associated with the experience of agency, choice, and concentration (Kahneman, 2011). Kahneman's decision-making model portrays the idea of human brain uniquely processing the information. Human beings tend to use both systems in problem-solving and decision-making, nevertheless seeking a solution. With respect to the above-posed question, system one is immediately activated on remembering the route to our workplace or switching car's indicator to turn left or right. On the other hand, for the mathematical questions, system 2 takes the lead. In the end, it is a collaborative effort to conclude with learning and experiences of an event.

In our daily lives, we can find relevance in system analysis since we can always operationalize and observe the intuition, attention, and effort required to initiate an action. For instance, if I feel thirsty and immediately reach out for water, it is system 1 urging an action. On the other hand, if I have the temptation to drink a cocktail which has alcohol content in the morning but decide that it is quite early to have it; and then switch to drinking orange juice, this urges system 2 in action. Interpreting Kahneman's ideology, this example can be understood as- when I had an immediate need; it could be satisfied by an action based on intuition alone. While, initially it was intuitive for me to have a nice, refreshing cocktail. However, considering the time of the day, cocktail was not a favourable option. Essentially, this can also be comprehended from the emotional quotient, wherein the influence of emotions can alter an individual decision into an inaccurate or less favourable rational one. In such situations, human decision-making is conducted by the emotionally influenced System 1, which passes the careless and permissive review of System 2. Furthermore, System 1 often creates correlation where there is none.

The progress in the neurobiology of decision-making stems from experimental paradigms. Many studies have emphasized tasks in which decision-making reduces to choose among actions. Primarily, it states that the formation of decisions affects the neurons in the higher-level association areas of the brain i.e. motor planning. Information flow in the brain is effectively channelled into structures that are organized in terms of behaviour (Shadlen *et al.*, 2008). It is understood that perception like decision-making, stems from asking and answering questions that can bear specific propositions. Further, the techniques of evidence gathering must be organized in the brain, which is in association with a structure that controls the body.

Often, when considering the decision as an origin of behaviour, we tend to think about its source. The brain stands out as an integral part of human functioning. However, usually, our eye movements make decisions about the stimulus and then communicate the outcome of the intended decision. For example, if we decide that motion is rightward, we communicate this by making an eye movement, pushing a button, or making a verbal response. In many

occasions, decisions are determined by external sources, i.e., evidence from the environment- a noisy source. If different effector systems examine the same evidence, they will naturally reach the same conclusion (Shadlen *et al.*, 2008). This statement adheres to an assumption about the source of variability in the decision process i.e. a decision made by eye movement or hand gesture is a source but they will not prevent a human to reach their decision. This assumption holds precedence when accuracy is valued. Amidst multiple challenging scenarios that require perceptual decisions, each of our choices is processed in the brain with a signal-and-noise ratio, ultimately leading to a decision. In the end, it summarizes an analysis of the noise contributions in brain regions that represent momentary evidence and areas of decision variables.

In our day-to-day living, every significant decision entails some uncertainty and evokes a range of emotions. Emotion becomes dominant in our course of work; humans are risk averse, i.e., the potential of losing something can dissuade us from engaging in a particular behaviour. We can address inconsistencies between one's intuitive impressions about how to decide and evaluate different conflicting situations. This is where System 2 becomes vigilant and resolves the issue. Primarily, whenever we encounter a particular situation, it is often accompanied by fear (which can involve overwhelming anxiety and obsessive thoughts), and from fear, we feel risk. It is common for us to feel scared at the primordial level. However, the matter of concern is how we process it internally. Does it initiate conflict in us? Or, does it cloud our judgment of action? Kahneman affirms both the above questions, the answer being that we perceive more risk than there actually is, and we react with more aversion than is necessary. For instance, an individual may be more scared of flying on a plane than riding in a car. One study found that between 33% to 40% of people experience anxiety when it comes to flying – a huge proportion of the population – but there is minimal risk in plane travel (Risk as feelings theory. The Decision Lab, 2021). In the years 2012-2016, the chances of dying on a plane were one in 3.37 billion. If we compare plane statistics to the one with car crashes, a report by Esurance, an auto insurance company (Thomas, 2022), found that the odds of getting into a car crash during a 1000-mile trip is 1 in 366. This accounts for being more dangerous than flying.

The example here sets us with an opening remark that the decision to avoid the perceived risk of flying instead of a road trip is not rational. Emotions like anxiety and fear are powerful enough to diminish our rational decision-making ability, thus compelling us to choose a more dangerous mode of transportation. Emotions can flood consciousness because the wiring of the brain at this point in our evolutionary history is such that connections from the emotional systems to the cognitive systems are stronger than connections vice versa (LeDoux, 1996).

Decision skills and choices run in congruency when the external stimulus dictates them. The conditions prevalent in our society are presented in the sublet of social, political, economic, and emotional factors. The upcoming sections will thereby, highlight the influence of socio-economic conditions on our emotional human decision-making. The socio-economic factors discussed below comprise income, education, employment, housing, safety conditions prevalent in a community.

Does emotion influence our decision-making ability?

Humans are embedded with a plethora of responsibilities and choices. These choices are widely involved in our daily activities and revolve around our social choices. A few simple ones in addition to the one mentioned above involve- moving to another city for work, having a tough time in marriage, dietary preferences, choosing to prioritize family over work, taking a career break, financial crunch etc. Each of the instances mentioned here stirs emotional quotient in humans, even though these are materialized from economic and social situations. When engaging in socio-economic scenario, the incidental emotional state of a person influences the decision one will make, and this gives rise to the integral emotional state of the person (Ahmed *et al.*, 2023). There are plenty of components and themes to understand how emotions are processed within varied scenarios. For instance- the economic status of an individual in society tends to have a substantial impact on their emotional and physical well-being. It ignites feelings of inferiority, class differences, anger, jealousy, and low confidence.

Researchers in this field have proposed that emotions often serve an adaptive coordination role, which triggers distinct responses that are comprehended in different sets. Amidst many such scholars Jennifer Lerner's work (Lerner *et al.*, 2015) highlights key themes that will help us comprehend human behaviour. This has been elaborated by considering how external conditions dictate emotional responses in our body and brain. A few questions that we might stumble upon when discussing emotional decision-making are: Which socio-economic factors influence our actions? How can we determine the influence of these in our daily lives? Are we aware of these influences, and are they detrimental to our well-being? The answer to each one of them lays in financial paradigm and the emotional inclination of humans- depending on their age and influential means which impacts our well-being. The well-documented contributions on cognition, emotion, and related metacognition, i.e., the onset of emerging cognitive deficits, depict higher range of socio-economic disadvantage. This confers risks to emotional processes and psychopathology (Elsayed *et al.*, 2023).

Emotion knowledge and regulation reflect an understanding of the causes and consequences. Emotion regulation refers to strategies that influence the intensity, timing, and expression of emotions. These

involve a set of factors such as integral, incidental and immediate emotions; each one of them will be unfolded in the coming section. In continuum these factors help us track the response of an external situation (socio-economic), how they are processed in brain and thereby affiliating each emotion. Often, the triggering part of our vulnerability is financial constraints. It provokes a massive change in older and younger adults. The dissimilarity in economic and class conditions has been prevalent in society for ages. Social norms and conformity in financial choices have profound influence and power in our financial decision-making. The reasons being shaped are- our deep desire to belong, fear of deviation, information asymmetry, reinforcement through social validation, and peer pressure. Each one of them are associated with psychological settings. Starting with our deep desire to belong (Baumeister *et al.*, 2017) we see that humans tend to make financial choices based on their desire to fit within social groups. This inherently leads to spending on items that we cannot afford. Second, fear of deviation- this involves our legitimate fear of being different. It involves our social circle and self-judgment of carrying oneself. Further, this fear raises the concern of discouraging us from making unconventional financial decisions, even when they are more financially responsible. Third, information asymmetry states the importance of a lack of financial knowledge, which may lead to reliance on social networks, hence being misled without proper research. This ignites the feeling of helplessness and ego. Lastly, reinforcement through social validation- sometimes, we may get positive feedback for certain financial behaviours, which motivates us to move ahead, even if that step isn't wise (Mannion, 2024). This raises doubt and apprehension about taking a leap of faith in financial investment. In addition to the previous point, individuals often have the desire to keep up with their peers or social circle, which results in excessive spending on investments or housing, hence leading to financial instability and emotional stress.

Age is another essential factor in the field of emotional financial decision-making. Individuals above 50 are observed to have different decision styles as compared to younger adults. For instance, older adults have financial choices that appear to be optimal due to age-related cognition, selection, and cohort effects. The link of older age and financial literacy; concludes that a robust relationship exists between age and financial sophistication (Lusardi, 2012). Neuropsychology helps us access this question by delving deep into how aging impacts our cognitive abilities, which influences our emotional decisions. The statistics indicates cognitive decline in an individual ranging 60 years and above. The pressing reasons are memory; specifically episodic memory and old age, both of them are well established grounds in scientific studies. Essentially, older individuals perform poorly in domains of literacy, health and financial literacy, which are critical for the many complex, influential health and financial decisions. Financial fraud, exploitation, and

inconsistency in valuing the asset, which majorly involves money, are a few prime causal outcomes of emotional decision-making. They also increase the susceptibility to cognitive decline. Age differences in capacities (e.g., financial literacy and cognitive ability) and outlooks (e.g., motivations, emotional states, and confidence) can combine to affect both deliberative and intuitive decision-making processes (Chomik et al., 2022). Additionally, cognitive impairment inequity is detrimental to overall social welfare. The higher socioeconomic groups have more advantage with means to healthcare, living conditions and access to worldly knowledge as compared to lower economic groups. Irrespective of age and circumstance, financial decision-making makes a massive difference in the life of an individual. Those experiencing cognitive impairment are also at greater risk of financial exploitation and fraud, consistent with higher levels of credulity (Smith and Budd 2009; Purser et al. 2018). About 2% of the population aged 65+ is estimated to have experienced financial abuse in 2020 (AIFS 2022).

These propositions encourage us to acquire a clear understanding on the aftermath of emotional decision-making, especially when encountered in a vulnerable situation where our judgment and decision skills are questioned and compromised. This weaves an added explanation of age and financial decision being correlated with significant relevance of intuitive thinking. It is essential to acknowledge themes in decision-making, which develops a link to behavioural change thereby, bridging gap in understanding socio-economic and emotional decision-making.

An emotion, be it happiness or sadness, embarrassment or pride, is a patterned collection of chemical and neural responses produced by the brain when it detects the presence of an emotionally competent stimulus (Le Coz and Tasy 2007). The factors of emotional quotient can be respectively understood in three streams- integral, incidental, and immediate emotions. When we make a particular decision, it entails these streams in our system. For instance- integral emotions are the ones arising from our judgments and strongly influence our decision skill. It is a state in which a decision is constructed and delivered in an appropriate scenario. Consider an individual who feels anxious about a risky choice that they are considering. The emotion of anxiety may drive the decision maker to opt for a safer option rather than a possibly profitable one. It is substantial that integral emotion occur at conscious and non-conscious level. In the series of subsequent events, an individual is expected to decide on the task before them. Incidental emotion are typically sub conscious and aren't much aware of impact in our surroundings. Hence, every decision made by an individual has a significant influence on the decisions that follow, i.e., changes in the emotional states. For instance- The incidental emotion has a track of anger, fear, jealousy, resentment and happiness. I am frustrated with my lifestyle and choose to do better, by joining gym and eating healthy. However, if I see my friends

enjoying fast food it may generate resentment and anger which will affect my decision to continue with healthy lifestyle choices. Emotions that arise from the decisions at hand are known as integral emotions (e.g., anxiety and stress elicited by difficult decisions), whereas irrelevant emotions are called incidental emotions (Keltner and Lerner, 2010). Lastly, immediate emotion as name suggests is an imperative technique of quickly responding to a situation.

This section delivered extensive range of theoretical factors which contributed in understanding emotional and behavioural decision-making. They were primarily engaged in answering the ideation ranging from socio-economic factors, money being a central piece of decision-making, and how it alters an individual decision emotionally. Thus, highlighting the root of emotional and behavioural contents in an individual.

In the next section, we will observe an empirical perspective i.e. experiments which take measures to understand the emotional conscious and unconscious decision-making. Fundamentally, it will be assessing Damasio and Dehaene's conceptual model of consciousness and emotional decision-making by analysing their implications and scientific problems.

Experimental approach in the Neuro-philosophy

In light of the evident theoretical factors and themes mentioned above, the goal is to go beyond the postulated theoretical evidence, which will unify the principles of complex decisions. These decisions involve an array of possibilities for understanding emotional decisions affecting humans.

Antonio Damasio introduces us to one of the theoretical hypotheses of consciousness within the arena of Neuroscience, which has inspired fields such as philosophy, cognitive science, and psychology. Damasio, in his theory states that consciousness is not a unitary experience but rather something that emerges from the dynamic interplay between different brain regions and corresponding bodily states (Damasio, 1999). Damasio's theory posits three layered stages, where each stage builds upon the preceding one. The primary representation of the organism is referred to as the Proto-self, Core consciousness, and Extended consciousness. Damasio's theory of consciousness revolves around three concepts- emotion, feelings, and 'feeling a feeling'. Emotions are a collection of unconscious neural responses that give rise to feelings. They are complex reactions to stimuli that cause observable external changes in the organism. A feeling arises when the organism becomes aware of the changes it is experiencing as a result of external or internal stimuli.

According to him, our experiences are shaped by emotional responses originating from our body's interaction with the

environment. Thus, it emphasises the vital role of these responses in shaping our conscious experiences. Additionally, emotions are a largely automated program of action carried out in our bodies, modulating our facial expressions, body posture, and physiological functioning. On the other hand, feelings are perceptions of what happens during an emotional state (Damasio, 1999). Hence, it emphasizes the importance of the body and its physiological processes in the emergence of consciousness. In other words, we need perceptual processing to be a stimulus (sensory information). Thus, when we are aware of an object, it happens because the perceptual processing of the object (sensory information) interacts with the perceptual processing of the body through mechanisms of the brain stem, insular cortex, and somatosensory cortex. Thereby, giving rise to sensory neural information which is processed by perceptual mechanisms giving rise to a second type of perceptual processing, i.e. is the second-order map (Munévar, 2014).

In Damasio's hierarchical model of consciousness the proto-self is the first stage. Many organisms share the proto-self, which is the most basic representation. It arises from the brain's constant interaction with the body. The proto-self is an unconscious process that creates a map of the body's physiological state, which is used by the brain to generate conscious experience (Anderson, 2019). This map is updated whenever the brain receives new stimuli from the body, thereby forms the foundation for developing more complex forms of consciousness. The emergence of core consciousness in the second stage occurs when an organism becomes consciously aware of the feelings associated with changes in its bodily state. At this stage, the organism gains the ability to recognize its thoughts and formulate them from its own perspective. The brain continuously constructs representative images based on communications received from the Proto-self, leading to the development of self-awareness. Nonetheless, this level of consciousness is not limited to humans and remains unwavering throughout the organism's lifespan. Finally, extended consciousness signifies the third stage. This level advances from its earlier stages and is essential for memory. Therefore, an injury to a person's memory can cause damage to their extended consciousness without hurting the other regions. The autobiographical self draws on the memory of past experiences, which involves the use of higher thought. This autobiographical layer of self is developed gradually over time. Working memory is necessary for an extensive display of items to be recalled and referenced.

Damasio, in one of his collaborated study designs, observes the behavioural actions and decisions of patients and non-patients. Patients suffering from damage in the prefrontal cortex and non–brain damaged individuals played a game in which the objective was to win/gain as much money as possible (Bechara *et al.*, 1997). Hypothetical players earned money by turning over cards that were labelled as monetary gains or losses. On any given turn, individuals

could draw from any of four decks, two of which included high payments ($100) and two of which contained lower payments ($50). The high-paying deck, however, also included occasional substantial losses, to the point where these decks had a net negative expected value. It was found that both non-patients and those with prefrontal damage began by sampling from all four decks, and both groups avoided high-paying decks immediately after penalty cards were encountered. 'If compared to non-patients, those with prefrontal damage returned to the high-paying decks more quickly after suffering a loss' (Damasio, 1999). Due to this tendency, they went bankrupt despite having a strong desire to win and acquiring a thorough understanding of the game. Here, we can anticipate one possible interpretation of the patient's behaviour, i.e., they were aware of the risk factors attached to the high-paying deck. However, their inability to experience fear when contemplating a draw from one of the decks created risky draws more satisfactory moves. It is here where Damasio reiterates the statement that a lack of emotional response does not give enough assurance of an individual's poor decisions. This study design explains the expected value of the high-risk deck; the one that contains significant losses is higher than that of the low-risk deck. Further, it serves as a valuable resource for gaining a deeper understanding of brain regions and that which empowers our cognitive ability. Emotions are, per se, an integral element which, as a situation emerges, is accompanied by fear and anxiety, thus limiting an independent and accessible course of decision-making.

In his work, Damasio walks us through his concepts, explaining the connection between emotion and consciousness and, essentially, how consciousness has comprehensive connectivity with organisms and humans. The argument put forward is that in the study of consciousness, complex problem theorists overlook processes that occur outside the brain. It is proposed that to understand consciousness truly one must consider the processes which takes place in the body and the way in which mind interprets bodily sensations and feelings. This involves everything from the sensations experienced by plants to the social cooperation observed in bacteria, leading to the development of animal minds, feelings, and ultimately, the evolution of consciousness.

On the other hand, Stanislas Dehaene sets up the bar higher with his work on consciousness and further publishes book, 'Consciousness and Brain: Deciphering how the brain encodes our thoughts'. His work predominantly focuses on critical elements - what consciousness is, how it operates, and why we have it. Essentially, all these topics have been discussed, debated, and published widely by scholars over the decades. His work reinvigorates findings of the neuroscientific and psychological studies of consciousness; and provides an update with a large set of findings published over the past decade. Importantly, Dehaene puts the extensive data set into a coherent framework known as 'Neural Global Workspace'. The Neural

global workspace represents a significant advancement, effectively building upon and expanding current notions of consciousness. This model is built from the global workspace, initially proposed by Bernard Baars. Dehaene and colleagues add the 'neuronal' component from recent Neuroscientific studies using techniques, including EEG, fMRI, single-cell recordings, and magnetic stimulation.

Fundamentally, the consciousness process is ignited when 'preconscious' sensory data combines into an integrated percept. Although the preconscious data may be incomplete, ambiguous, and self-contradictory, but the conscious percept appears as singular, coherent, and unambiguous. According to the model, raw data is mainly unfiltered and sent to an 'igniter' zone (Kubie, 2014). The igniter inputs the raw data along with memory and expectancy to build candidate percepts. When one of the candidate percepts reaches the threshold, ignition occurs, causing widespread activation and conscious perception. The initial stages of processing are identical for stimuli that may or may not become conscious. In both cases, the igniter takes in raw data, along with memory and expectations, to form potential perceptions. When one of these potential perceptions reaches a certain level, it triggers widespread conscious activation. In both cases, the stimuli stimulate retinal receptors, which then send signals to the thalamus and the primary visual cortex. After this point, the process splits into two. If there is substantial interference from previous or subsequent stimuli, the response to the stimulus weakens as it gets processed in other areas of the brain. The stimuli excites retinal receptors, sending messages to the thalamus and then to the primary visual cortex. Thereon, the process bifurcates in an all-or-none manner. If interference from previous and subsequent stimuli is substantial, the response to the stimulus weakens as it passes to other cortical areas. Here, we may observe subtle bias in behaviour also known as 'subliminal perception'. However, the person will have no conscious perception and cannot report the stimulus verbally (Dehaene, 2014). When there is a lack of effective inhibition, the prefrontal and parietal cortices communicate with the primary visual cortex, resulting in the amplification and reverberation of the message across other brain areas (Dehaene and Changeux 2011). He introduces varied means of measuring neural correlates of consciousness using paradigms like minimal contrasts of images, masking subliminal stimuli, binocular rivalry, and attentional blink. Further, masking has been equipped with understanding conscious percepts in Neuroscientific studies. It can also be measured with skin, i.e., when we start to sweat and the body tenses—it is a marker of unconscious perception. Hence, they measure how it affects our performance in a subsequent conscious task. Seeing the word ATM unconsciously will make you react faster to a related word like money or bank an effect known as priming.

A few functional roles of consciousness described by Dehaene are to subside many lower-level probability assessments into one

conscious perception, which is sampled from the Bayesian distribution model, hence allowing us to make a single decision. Second, it helps in creating long-lasting thoughts that can be stored in working memory. Finally, reasoning through multi-step strategies and performing serial computations (Dehaene and Changeux 2004), such as the steps in figuring out mathematical setup 12*13 = 156. Consciousness seems to collect the information from various processors, synthesize it, and then broadcast the result – a conscious symbol – to other, arbitrarily selected processors (Dehaene, 2014). It is understood that consciousness has a coordination effect; for instance, if we observe a line moving diagonally over the screen, we are aware of its incidence at lower-level visual areas. The neurons present there cannot see the entire picture, and therefore, for them, it is ambiguous. It is tricky for neurons to decide their direction. If the image remains unconscious, then these mismatches are not resolved. On the other hand, if the image enters consciousness, then after 120-140 ms, all neurons in lower layers will encode diagonally.

Dehaene compares the unconscious state or perception with that of a wave that runs out of a shore, while a conscious perception is more like an avalanche that gains momentum (Roberto, 2022). He explains this in technical terms; after 400 ms, conscious avalanche tends to activate large regions of the brain, which he terms as global ignition. After this state, the entire brain region synchronizes, and information flows from various parts into each other. In the end, he nudges on a possible conviction that Granger causality- known as the flow of information happens in the conscious moment wherein the P3 wave is ignited, hence giving accurate evidence of the conscious state of a human. Hence, his model gives a coherent worldview that, with the help of scientific differentiation of neurons, sampling, and an inherent understanding of P waves, we can point out which perception of consciousness is ignited in a human at any given moment. Dehaene's work has highlighted essential elements involving not only consciousness, but also how a human brain reacts to the external elements. When we encounter any social or economic situation, the emotional section of our brain is simultaneously activated. This is seen in the form of sweat, irregular heartbeats or mood changes which is noted as unconscious processes. Thus, giving us insight that humans do get influenced by socio-economic and emotional factors affecting our daily decisions and actions.

The above sections interpret logical expressions, mediums, and models which corroborates consciousness studies. It is exhilarating to find these experimental studies being situated in a time where the urge to learn, evolve, and publish more about consciousness and decision-making is encouraged. The fundamentals are age-old theories that have rendered potential and can be looked beyond the primary level.

In relation to the initial inquiry presented in the paper about determining the role of consciousness in decision-making, an

experiment carried out by the prominent decision scientist Michael Shadlen highlights its significance. Michael Shadlen is a neuroscientist and neurologist whose research concerns neural mechanisms of decision-making. Shadlen, in his work, explains two figures with respective neural data, each one enhancing features of awareness and attention, which he comprehends as features of consciousness configuring decision aspects in a human. The experiments were conducted on animals in two sections. Starting with first, monkeys were asked to view a movie consisting of dynamic random dots wherein they had to decide whether the direction of the dot was to left or right. Random dot motion is a process that explains the speed and accuracy of choice in human and non-human primate subjects.

The majority of decisions are difficult because the stimulus consists of dots appearing at random locations within the displayed passage. Within this aspect, a small fraction of dots change, and then they tend to disappear. This fraction, termed 'percent coherence', controls the difficulty of discrimination. Ideally, the decision-maker must bear in mind the respective hypothesis and must strive to accumulate momentary evidence. This task helps us understand cognitive decisions with problems in perception, which involves the collection of momentary evidence. (Shadlen and Kiani, 2011). In the 2nd task, the monkey must decide between a red and green target. One or the other will lead to a reward for a random half of the trials. Simultaneously, in one trial, the probability of 'reward at red' is governed by a set of four shapes; the other half is supported by 'reward at green' by varying degrees. The experiment tests whether the monkey can reason from probabilistic values and make better choices based on the four random shapes shown on any one trial. This section implores a satisfactory idea of not only venturing into the awareness states- i.e., conscious and unconscious states but also about the auditory and visual cortex, which are supporting components in this field. Here, the core relevance is the role played by LIP neurons; this neuron implies that it responds more when motion is in one direction than when it is in the opposite direction, hence highlighting our initial reference points on awareness and consciousness.

The terms awareness, attention and consciousness develops a link in understanding human cognitive function. This points rightly into the debate on the definition of consciousness presented by literature. If consciousness is intrinsically related to attention, then its functional role and evolutionary advantage should pertain to executive functions. With respect to any given task at hand, the role of attention is to prioritize incoming sensory processing to enable an optimized behavioural response. The main neural mechanisms associated to the attentional modulation of sensory processing are target amplification and distractor suppression. The combination of these two mechanisms and sensory regions would be able to selectively amplify target-related neural signals to facilitate the transmission of target-

related and the information processing chain (Desimone and Duncan, 1995). The decision to engage is the first building block of subjective conscious experience, not the entirety of it (Shadlen and Kiani, 2011). Here, the notion of consciousness as a decision to engage is that it offers an additional glance of neural mechanism that can be studied in varied context and model systems. Hence, Shadlen's agenda in this experiment was to highlight a possible outcome of the brain contributing to the idea of consciousness and decision-making.

The functional hallmark of consciousness is control over the behavioural influence of information, and the ability to integrate the information in a flexible manner with changing contextual demands and executive goals (Price and Norman, 2008). The ability to integrate information with flexibility and preprocessing data in our brain is set within contexts of demand in language and activity. Some debates involve how we can determine systems 1 and 2 with intuitive or non-conscious thinking- it is here where Shadlen's experiments can be brought into the picture. The random dot motion is an exciting setup of interpreting system 2, which is activated at first, and later on, system 1 affirms the same.

Essentially, if we break down the theoretical understanding from the broad scope of Mind and Philosophy, the question of defining and interpreting 'consciousness' always keeps arising. Consciousness has been featured in wide range of behavioural and cognitive science studies. It ventures into arena of not only theoretical debates comprising of ancient and modern philosophical interpretation but also engaging in the fascinating human and animal studies in current era. It is well understood that human-level consciousness includes an introspective sight of self-awareness, intuition, and a heightened level of symbolic thought systems such as language, emotion, feelings, empathy, and rationality. This varies in parameters to each individual, but on average, the functioning is similar. Humans are entitled to unique characteristics of agility and decision-making, which are comprised of rationality and skills that embody the same. It serves the essential purpose of connecting the notion of consciousness used in clinical neurology with the experiences associated with the mind's most valuable activities. It may guide future experiments, and if correct, it would render broad areas of systems, such as cellular and molecular neuroscience, relevant to the study of consciousness.

Our society is engulfed with constant curiosity entailing the topics of mind, phenomenology, subjectivity, cognition, and how they act as a powerful aid in developing societal pillars such as human resources, public policy, political judgment, and rational power engagements. Our human emotions act as an underlined feeling in these factors. At the surface level, it is always the enactment of physical features, i.e., an individual requires vigilance, knowledge, opinions, and the ability to envision and lead society. The socio-political endeavour is engaged with economic decisions; thereby,

finance taking a key position. Numerous examples related to consciousness and emotional decision-making mentioned above give a universal understanding of how an individual tends to process a thought, its accompaniment of awareness (consciousness) (Shadlen and Kiani, 2011), and the possibility of getting derailed with emotional context.

Discussion

All the experimental studies discussed in this paper have a common ground of examining contents in decision-making; and a wide range of learning and collaborating consciousness and decision science into one forum. Even though the medium here is varied, it encourages us to delve further into the lines of intersections.

Michael Shadlen exhibits the nature of his work by wholeheartedly referring to the characterization of consciousness from the perspective of philosophy of mind and neuroscience. From a philosophical perspective, he identifies it as a collection of mental phenomena that share subjective and personal features. Along these features, there are perceptual and self-awareness, volition with awareness, a capacity to report narrative, and so on. Hereby, it is implicit that Shadlen urges to comprehend the terms specified and elaborated in philosophy; and is motivated to measure the same. In one of his experiments mentioned above, the goal was to portray that similar neural mechanisms, computations, and structures underlie varied components to show forms of consciousness. Thereby, proposing the medium in which neural mechanisms responsible for conscious states share standard features with those that underlie simpler forms of decision-making. Amidst the methodological contents, there were a few sections of his experimental study that were unclear and difficult to understand in relation to the intent of his study.

Although the mechanism mentioned in his study indicates LIP neurons as a possibly prime indicator of consciousness, it was unclear if the recording showed the probability of non-conscious proceedings as well. Second, the time accuracy was not precise enough to indicate the actions of the monkey since the movement of dots were a continuous process, leading us to question their awareness state. Lastly, the mechanism does not explicitly clear the subjective aspects of consciousness- this is to be followed along the characterization of P-consciousness, which he relates to philosophical grounds. Shadlen acknowledges that the subjective aspects of conscious experience are multi-faceted and complex and, hence, unlikely to be explained by a single process (Shadlen and Kiani, 2011). Thus, he reflects upon the shortcomings and willingness to work along the lines of qualia and neurobiology of decision-making. According to him, qualia might arise when we engage in ways that involve social and communicative

components with attributes such as (before, after, where, what else is present, etc.) However, it would have been helpful to see these characteristics enabled in his mechanism; nevertheless, the future definitely holds a lot of exciting research and scientific data. In the end, this experiment instils hope and adequate means for the principal aspects of consciousness, i.e., experience and awareness, which can be located in the human brain since science finds resemblance between the animal and human brains.

In response to Damasio's experiment, the concerned paper acknowledges his intent of highlighting a novel cause and distinctive features that can be considered groundbreaking for science. Primarily, it is easy to set up a design and weigh the statistics of the expected value of the high-risk deck, which also contains some significant losses that are higher than that of the low-risk deck. It is observed that patients with prefrontal damage perform better in the long run than non-patients because the fear in the latter group would hinder them from choosing risky options (an indication of emotion or feelings) but with a higher expected value deck. This can be seen differently in real-world experience, i.e., through the lens of an industrialist or stock investor.

Fundamentally, if compared to the current lifestyle, the fear and myopic loss aversion (Benartzi and Thaler, 1995) in any established industry or business forum has led employees to gain financially by investing more in forums such as safe bonds or money market funds rather than equities. Statistically, it shows that the long-term return of equities is comparatively higher than other mediums (Thaler *et al*, 1997). Second, with respect to the experimental design mentioned above, a few things were unclear and, therefore, it was difficult to interpret the outcome of his work. The total count of participants was not mentioned explicitly; further, while the task was in process it was not apparent whether the participants, i.e., patients and non-patients, were placed in the same room or not. This is with an understanding to remove bias and to avoid imitating one another's actions or decisions. Therefore, it is challenging to undertake a cumulative understanding of emotional decision-making amidst this group and whether it influences their action or behavioural responses.

Thirdly, Damasio, in his work Emotions and Feelings: A Neurobiological Perspective (Damasio, 2004) mentions that feelings are mental experiences of body state; this arises as the brain interprets emotions, of which physical states arise from the body's responses to external stimuli. Since the concept of consciousness is linked to the concept of emotion, then consciousness occurs exclusively through an emotional reaction to any experience. This statement is difficult to comprehend in reality. For instance, I may fear constantly that new tax policy or inflation rate will rise in my country, but this fear does not involve any bodily changes or somatic changes, as Damasio mentions. Alternatively, if my friend shares that her close relative has

passed away. Ideally, there must be a cognitive appraisal of the statement, which involves a series of cognitive processes, such as awareness, attention, memory, language processing, etc. However, according to Damasio's theory, none of these processes becomes conscious before the changes in the body, i.e., there is no direct cognitive trigger. The body must react to this information before we become aware of both what was said and the emotion it caused.

With reference to an earlier experimental study, Damasio's statement seems to contradict when he states, feelings are experiences of changes in body state (Damasio, 1999) however, it was not specifically indicated which feelings or experiences were observed in patients. It was merely shown that the fear of losing high stakes was similar in both groups (patient and non-patient). Second, some feelings do not involve changes in body state, and even if some feelings do involve them, the body changes are insufficient to identify the character of the feeling. Thirdly, it was difficult to understand how the brain gives rise to the 'feeling of a feeling', the one which he claims to be related to consciousness, and how it is linked with neural circuits of producing emotion and consciousness.

Lastly, it would have been exciting to see if the experiment also included an exploratory analysis, i.e., evaluating the awareness or consciousness index, emotional responses, and whether age played a role in the response of patients and non-patients. Additionally, there was an absence of a tool for prediction, especially when Damasio promotes his model of consciousness. Given the determined neural activity in patients, this particular model has an absence of neural activity or tool that can access the consciousness quotient in an individual. For instance- Dehane's model of the global neuronal workspace (Dehaene, 2014) provides an eclectic explanation of how the brain creates consciousness, wherein he links the contents with Baars to empirical concepts such as cortical connections, amplified brain activity found in prefrontal and parietal areas, stronger gamma waves and brain-wide synchronization, i.e., hoping for exploratory analysis highlighting additional information apart from region of interest.

Primarily, Dehane outright took responsibility for converting Baars's model of consciousness into a neurobiological model of consciousness. He proposed a model that linked the high-order, i.e., computational concepts proposed by Baars, to empirical concepts that arose from empirical investigation, i.e., data. For instance- associating the concept of 'increased system activity' with 'stronger gamma waves and brain wide-synchronization' (Dehaene, 2014), thus forming an integrated whole through which we are able to decipher conscious activity through its neural correlates. In the end, this model presents a tool that shows conscious activity can be predicted; it explains both the regular and pathological functioning of consciousness, i.e., blindsight and any conscious impairment due to brain lesions.

Conclusion

The field of consciousness and decision science is today spurting with a range of possibilities in psychology, economics, philosophy, and a new dimension of neuro-philosophy. This paper has equipped us with varied discussions, inputs, and contradicting statements, which allows us to foresee the limitations present before us and, thereby, curate a better theory into an empirical data acquisition. The interplay of cognition and emotion, moreover, has shown much potential in explaining the behaviour, attitude, and power imbibed when brain activity is compromised. Each of the research findings mentioned in the paper has undoubtedly led to an inclination to develop and aspire more to the wide range of possibilities in our scientific community.

Scientists such as Antonio Damasio, Michael Shadlen and Stanislas Dehaene have made consciousness and decision-making science an even more exciting area of research. Moreover, they have operationalized the definition of consciousness and curated the pathways, tools, and empirical implications. At every step, they evolve by creating and diffusing the scripts necessary for understanding the brain's signature of consciousness. Further, we can see their curiosity about new methods of fMRI and EEG, which localize brain activity in people, thereby finding pathways of conscious and non-conscious access. Similarly, Daniel Kahneman’s exceptional approach to system analysis has revolutionized our comprehension of decision-making and its gradual advancement and interaction with consciousness. It is with this innovative theory that Shadlen and Dehaene urged us to perceive it from neurobiological and neuroscientific experiments.

In the end, the paper transpires on developing interest in behavioural science by including theoretical concepts and signifying its potential of being converted into empirical evidence. It offers a unique perspective by advocating a shift away from traditional methods. This would certainly encourage young students and scholars to engage more in scientific inquiry especially in widening the horizons of consciousness and decision-making science. Lastly, it has endeavoured to address the questions with substantial evidence and theoretical implications, showing a strong desire to explore the realm of Neurophilosophy.

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