Proceedings of the 3rd International Conference on Social Psychology and Humanity Studies
DOI: 10.54254/2753-7048/91/2025.22780

How Anxiety Impacts the Economic Decision-Making: Insights from Neuroscience and Cognitive Psychology

Shan Huang

London School of Economics and Political Science, London, United Kingdom
huangshan_sd@163.com

Abstract: Anxiety is a mental disorder that not only impacts the physical and mental well-being of individuals but also affects cognitive functions, including decision-making processes. Does anxiety, as a trait instead of a state, disrupt the normal decision-making process? This paper explores the impact of anxiety as a trait on the normative decision-making framework, focusing specifically on economic choices that necessitate a balance between potential losses and gains. A review and discussion of how anxiety affects decision-making will be discussed in detail from cognitive psychology and neuroscience perspective. The first section examines key cognitive differences between anxious and non-anxious individuals, highlighting cognitive biases that hinder decision-making in those with anxiety. Subsequently, we analyze the neural mechanisms underlying these processes, emphasizing the roles of critical brain regions such as the amygdala and prefrontal cortex, along with relevant functional connectivity, to elucidate how cognitive biases affect individuals with anxiety during economic decision-making. Lastly, the practical implication of the paper will be discussed.

Keywords: anxiety, cognitive bias, economic decision making, neuroeconomics, decision neuroscience

1. Introduction

Anxiety, characterized by excessive worry, fear, and heightened sensitivity to potential threats, is one of the pervasive mental disorders affecting the various aspects of people's daily lives, including emotional well-being, physical health, social interactions, work performance and so on [1]. Apart from that, it also influences the executive function and cognitive processes, including the decision-making process. Many previous studies using behavioural, cognitive and neurobiological methods have indicated that anxiety impacts the decision-making process [2-4]. Individuals with generalized anxiety disorder (GAD) show heightened risk aversion and emotional hyper-vigilance. [5,6]. Building on evidence that anxiety disrupts the ability to balance risk and reward during decision-making [7], economic decision-making, which requires substantial cognitive effort and involves considerations of profit, may also be adversely affected by anxiety. This paper aims to explore the cognitive biases and neural mechanisms that underlie impaired decision-making in anxious individuals, particularly in economic contexts involving risk and reward.

Economic decision-making, as an intersection between behavioural economics and decision psychology, has been widely investigated using financial and psychology tools since it is highly relevant to everyday life. Incorporating neuroscience into economic decision research is useful for uncovering the underlying rules since even decision behaviours may be identical but associated with

DOI: 10.54254/2753-7048/91/2025.22780

different underlying neural circuitry [8]. Besides, economic decision-making involves a blend of emotional regulation, reward processing, and risk evaluation, which are key areas that anxiety to exert significant influence.

Nowadays, some neuroscience techniques, such as electroencephalogram (EEG), positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), have been applied to economics constructing a new view of economic decision-making mechanism, which is the area called neuroeconomics [9]. In Camerer's paper, the key brain regions related to economics have been marked clearly as shown in the figure1. Noticeably, the "prefrontal cortex" related to cognitive control and "amygdala" related to automatic affect is included, which is also related to anxiety disorder. Previous researches point out that neuroeconomics can work as a bridge to apply in psychiatry [10,11] since many mental disorders involve deficient cognitive function and result in an abnormal decision-making process. Hence, the neuroeconomics framework provides new insights about analyzing the decision-making process, and with better understanding to the decision-making process related to mental disorder is helpful to relative intervention and treatment.

Previous studies usually explore the abnormal decision-making process from the behavioural and cognitive perspective, such as decisions under uncertainty, biased attention, and loss aversion. Few of them explore the neural mechanism underlying the decision-making of anxious people. Besides, the scope of many papers focuses on nonclinical or mood anxiety, but few of them focus on clinical anxiety. This paper will narrow down the focus to how anxiety influences the economic decision-making process through the cognitive and neuroscience lens. Firstly, cognitive differences in decision-making between anxious and non-anxious people will be reviewed. Three core areas related to anxiety cognitive bias: adverse events perception and evaluation, increased emotional interference, and difficulty in decision-making under uncertainty, will be discussed below. Then, the brain region associated with anxiety-induced abnormal decision-making processes will be discussed to show how anxiety influences the neural mechanism of decision-making.

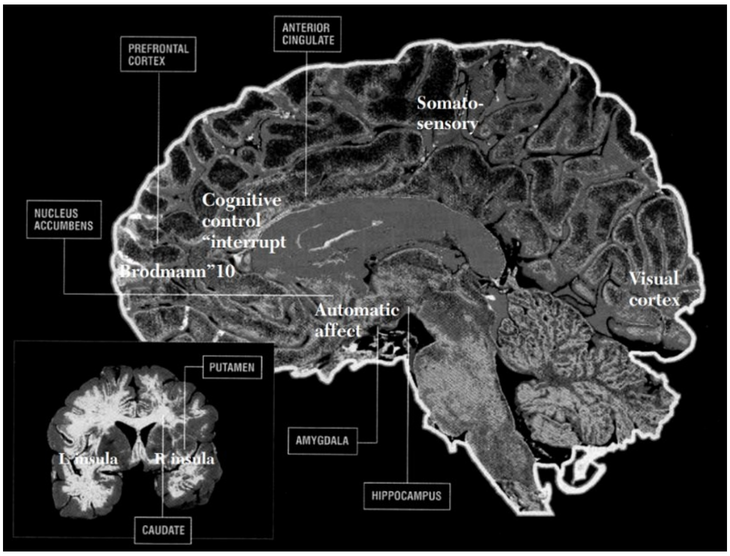

Figure 1: The human brain with some economically relevant areas marked

2. Cognitive bias of anxiety

Various studies have explored the behavioural and cognitive differences between anxious people and non-anxious ones. Here, three key cognitive biases influencing the decision-making of anxious people will be illustrated below. Some of them overlap and work together, resulting in making the more conservative and less rational choices for anxiety population.

DOI: 10.54254/2753-7048/91/2025.22780

2.1. Adverse events perception and evaluation

People with anxiety tend to exhibit abnormal perceptions and evaluations of adverse events, such as threat, loss and risk. Characterized by enhanced processing of potential future losses, anxiety leads to attentional biases toward threat-related stimuli [4, 12-14]. Attentional bias specifically refers to 'the difficulty in disengaging attention from negative stimuli, relative to neutral or positive stimuli' [15]. A study employing the Risk-Taking Behaviors Scale to assess individuals' propensity for engaging in risky decision-making found that trait anxiety correlates with pessimistic risk appraisals. This indicates that individuals with anxiety are more likely to perceive the likelihood and severity of adverse outcomes as heightened [16]. Furthermore, the gambling task, emphasizing the decision-making under an economic context that involves monetary loss and gains, is useful for inferring how anxiety potentially impacts the decision-making processes. An experiment utilizing it to compare the risk aversion tendencies between anxious individuals and healthy controls revealed that risk aversion is significantly greater in those with pathological anxiety compared to control subjects (mean risk preference parameter ρ: anxious = 0.564 ± 0.313; control subjects = 0.875 ± 0.537) [17]. Additionally, evidenced research using the Iowa Gambling Task to test the exaggerated processing of uncertain negative events among people with GAD reveals that GAD is characterized by enhanced perception of potential future losses.

Apart from the behavioural evidence, the pessimistic negative outcome perception also can be explained from the cognitive perspective. According to the Attentional Control Theory (ACT), anxiety impacts the attentional processes and overall cognitive performance because of the increased attention to threat-related stimuli [18], which interfere with the normal evaluation of threat and risk. Besides, unbalanced risk perception can be explained by the prospect theory [19], a neuroeconomic model explaining risk aversion behaviours under uncertainty. Currently, Attention Bias Modification (ABM), a cognitive intervention designed to mitigate threat avoidance in anxious individuals, is being increasingly implemented in therapeutic settings [20].

Anxiety not only influences the perception of negative outcomes but also affects the processing of positive ones. Individuals with anxiety often exhibit deficient reward processing, characterized by a diminished response to positive outcomes. We suggest that this reduced sensitivity to rewards may lead to more conservative economic choices. Consequently, anxiety tends to increase the preference for low-risk, low-reward options in decision-making [21].

2.2. Increased emotional interference

Emotional interference refers to intense emotional stimuli that can impair cognitive performance [22]. Given that anxiety is a mood disorder [23], the disproportionate influence of emotions on decision-making is particularly pronounced in individuals with anxiety. The heightened salience of emotions—especially exaggerated fear and worry—disrupts rational cognitive processes, making it difficult for individuals to objectively weigh the pros and cons of decisions. Instead, they are more likely to make biased, emotion-driven choices.

Research indicates that anxiety is associated with a biased evaluation of emotional information during decision-making, with neural evidence pointing to a hyperactive emotional system, particularly the amygdala [24]. The Emotional Stroop task, widely used in cognitive psychology and neuroscience, assesses how emotional interference affects cognitive performance, particularly in anxious individuals [25,26]. These studies consistently conclude that emotional interference is heightened in individuals with high levels of state anxiety. Notably, findings from a study [27] suggest that attention biased towards emotionally salient stimuli exacerbates emotional interference with normal cognitive processes. This interference is especially relevant in consumer behavior, where anxiety can lead to impulsive purchasing decisions [28].

DOI: 10.54254/2753-7048/91/2025.22780

The dual-system model, proposed by Evans [29], also sheds light on how anxiety interferes with decision-making through emotional pathways. This model divides the process of decision making into contributions from system 1 (autonomous and emotional) and system 2 (analytical and deliberate). Since anxiety is characterised by heightened sensitivity to emotional information [30], individuals with anxiety are more likely to rely on System 1 (fast, automatic, emotional thinking) when confronted with intense emotional stimuli. This emotional interference diminishes their ability to engage in deliberate, rational thinking. Studies utilizing EEG and fMRI techniques have shown that anxious individuals have impaired working memory compared to those with low anxiety [31,32]. These findings align with previous research [24], which used a dual-system framework to explain decision-making in anxiety with greater activity in the amygdala-based emotional system and less activity in the analytic one.

2.3. Difficulty in decision-making under uncertainty

Decision-making under uncertainty is a pervasive topic investigated in neuroeconomics [9,33] since it is associated with how people balance the distribution of possible outcomes. Key brain regions implicated in this process include the insular cortex (INS) and the prefrontal cortex (PFC) [34,35]. Individuals with anxiety often find decision-making under uncertainty and ambiguity particularly challenging due to their heightened sensitivity to potential errors or conflicts. This increased sensitivity can lead to indecision. Additionally, for anxious individuals, uncertainty can negatively impact decision-making by diminishing the perceived value of future rewards, leading them to prefer options with shorter delays in payoff [36].

Other theorists have developed frameworks to explain how anxiety influences decision-making in uncertain situations. One research [37] propose the Intolerance of Uncertainty theory to explore the relationship between intolerance of uncertainty and emotional problems. This model posits that individuals with anxiety have a lower tolerance for uncertainty, making them more prone to distress in uncertain situations. Taking investment as an example, anxious individuals are likely to forego greater profits with small uncertainty of risk to obtain smaller gains portfolios. The later similar research focus on clinical anxiety further illustrates how intolerance of uncertainty contributes to excessive worry among GAD patients [38]. Another model, the 'uncertainty and anticipation model of anxiety' (UAMA), proposed by Grupe [39], identifies five processes explaining why uncertainty about future threats is so disruptive in anxiety. As shown in Figure 2, this model emphasizes that individuals with anxiety exhibit exaggerated anticipatory responses to uncertainty, driven by the hyperactivity of the brain's threat detection systems, particularly the amygdala. Specifically, during the stage of heightened threat attention and hypervigilance (stage b in Figure 2), individuals experience increased emotional sensitivity to uncertain situations, leading to intensified reactions to perceived threats. Collectively, these five processes culminate in heightened threat expectancy among those with anxiety.

DOI: 10.54254/2753-7048/91/2025.22780

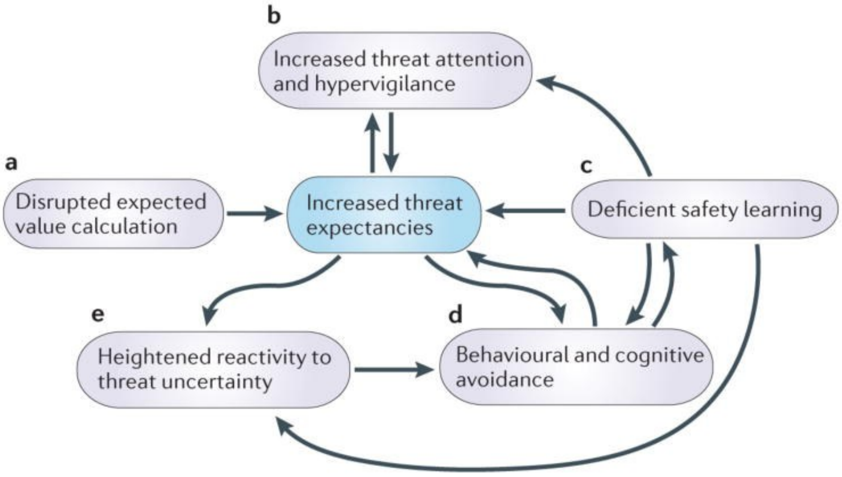

Figure 2: The five stages of altered anticipatory processes in response to uncertainty in anxiety

3. Neural mechanism of decision-making among anxiety

Next, it will analyze from the neuroscience perspective based on the cognitive difference mentioned above. The studies based on microeconomics have highlighted a network of brain regions including the striatum, amygdala, vmPFC, insula, and dlPFC are associated with the cognition function for decision-making, which also the region involves emotion processing [2]. Below, we will analyze and discuss two key brain regions, the amygdala and prefrontal cortex, as well as their functional connectivity implicating anxiety, to uncover the neural mechanism related to abnormal decision-making processes.

3.1. Amygdala: heightened emotional processing

The amygdala, an almond-shaped structure in the temporal lobe, is central to processing emotions [40], particularly automatic affective responses such as fear and anxiety. In anxious individuals, the amygdala tends to be hyperactive [41, 42], leading to heightened sensitivity to potential threats. Also, “amygdala damage is associated with impairment in decision-making” [43] suggests the amygdala did play a role in the decision-making process [44, 45]. In short, the heightened emotional processing of the amygdala related to anxiety disorder generates a potential influence on the decision-making process [2].

The abnormal amygdala activity can account for the salience-averse event perception and evaluation among anxious people. The heightened activity of the amygdala can result in an exaggerated perception of risk, making anxious individuals more likely to avoid negative outcomes, such as risk and loss during economic decisions. It has been supported by some fMRI studies. For instance, a study by [46] examined whether the amygdala is involved in the computational processes underlying loss aversion in a monetary gambling context. Participants with amygdala lesions exhibited a marked absence of loss aversion during the task. The findings reveal that the amygdala plays a necessary role in shaping everyday financial decisions by contributing to monetary loss aversion, as it inhibits actions that may lead to harmful outcomes. Another fMRI study focuses on the functional dissociation within the human amygdala with aversive information processing indicating a similar result [47]. Investigating the sub-regions of the amygdala suggests that highly anxious individuals show increased activity in the basolateral amygdala (BLA) for aversive cues, which may explain why people with high anxiety tend to be risk aversion or threat avoidance.

Furthermore, the emotional interference affected by abnormal activity in amygdala influences the economic decision-making among anxious individuals. Generally, the heightened activation of the

DOI: 10.54254/2753-7048/91/2025.22780

amygdala and reduced regulatory control from the PFC can lead to decisions that are more emotionally driven rather than rational. Etkin team's research [41] using fMRI have demonstrated that individuals with anxiety show increased amygdala activation when exposed to emotional stimuli, such as images of fearful faces. This hyperactive activity leads to an exaggerated response to emotionally salient information and interferes with decision-making further step by prioritizing emotional responses over logical or rational considerations. Also, the bed nucleus of the stria-terminalis, located in the ventral basal forebrain and often considered part of the "extended amygdala," seems to contribute to the emotional distress (such as a prolonged state of arousal and heightened vigilance) typically seen in individuals with anxiety [48]. The sustained hyperarousal state causes individuals to be very cautious and deliberate when deciding on economic or financial choices that involve deep considerations. Hence, the emotional interference caused by anxiety distorts rational thinking during the economic decision-making process.

Apart from the influence on risk perception and emotional interference, difficulty in making decisions under anxiety is also associated with elevated amygdala activity. Researchers proposed the UMMA model also explains from the neuro perspective, they found that maladaptive responses to uncertainty in anxiety involved the amygdala [39]. They suggest that amygdala responses under conditions of uncertainty are elevated. Besides, another study draws a similar conclusion, it shows that even without any adverse outcome following, the unpredictability or uncertainty itself can elicit increased amygdala activity and induce anxious behaviour among human subjects [49]

In sum, anxious people experience difficulty in making decisions under uncertainty due to the hyperactive activity in the amygdala, resulting in risk-aversion bias and less rational decision-making. For the economic decision context which involves the monetary gains and loss, I propose that the elevated amygdala activity plays a crucial role in distorting the normal decision-making processing.

3.2. Prefrontal cortex: impaired executive function

The PFC is primarily responsible for cognitive control and higher-order executive functions [50], including planning, impulse regulation, and evaluating long-term consequences. Same as the amygdala, the prefrontal cortex (PFC) is a key brain region affecting both anxiety [51] and decision-making [43, 52]. It facilitates the balance between immediate rewards and future benefits. Specifically, the ventromedial prefrontal cortex (vmPFC) is involved in reward evaluation, while the dorsolateral prefrontal cortex (dlPFC) exerts control, enabling individuals to prioritize long-term gains over immediate temptations in decision-making [53].

Firstly, the PFC's reduced cognitive control is evident in its less efficient regulation of emotional responses from the amygdala [2]. Since economic decision-making usually involves the considered balancing loss and gains, the reduced regulatory control can lead to heightened emotional reactivity and an exaggerated tendency to make impulse choices, which finally leads to poorer decision-making. Consequently, the impaired impulse control of the PFC prevents it from properly regulating the emotional interference aroused by anxiety.

Besides, a previous paper review of the relationship between anxiety and decision-making concludes that anxiety impairs part of the prefrontal cortex-dependent cognitive function and reduces its ability to modulate these prepotent tendencies [2]. The impairment of the PFC may shape or influence cognitive processes since it is related to various cognitive executive functions. For instance, attention control involves the lateral PFC circuitry, and evidence suggests there is reduced lateral PFC activity among people with heightened anxiety [30]. Hence, anxious individuals find it hard to remove their attention from threat-related stimuli, which drives their cognition to make risk-aversion decisions. Also, anxiety not only attention control but also working memory. During a visuospatial task that requires memory, people with anxiety display reduced PFC activation during tasks since anxiety taxes cognitive resources by loading emotional processing circuits [54]. Thus, it can be

DOI: 10.54254/2753-7048/91/2025.22780

inferred here that emotional distractions impact the executive cognitive functions that require mental effort. And people with high anxiety may be lost in indecision.

Furthermore, the papers using fMRI and transcranial magnetic stimulation (TMS) respectively demonstrate dlPFC related to risk aversion, the increased dlPFC activity decreases the risky preference [55], while disruption of it increases the tendency to make risky choices [56]. The paper suggests that dlPFC of the anxiety population inhibits their risk-seeking predisposition mediated by the orbitofrontal cortex. It emphasizes the risk aversion tendency during the decision-making process mediated by dlPFC among anxious people.

3.3. Alter functional connectivity

A singular brain region cannot adequately explain the complexity of anxiety-related processes, as abnormal brain activity involves interactions among multiple key structures. For example, as discussed earlier, trait and clinical anxiety are associated with reduced prefrontal engagement. Expanding on this,Sehlmeyer et al. [57] explored how anxiety affects the interplay between various brain regions from a fear control perspective. Given that both the amygdala and PFC are involved in the fear response or control of fear, their study demonstrated that elevated levels of trait anxiety are linked to increased amygdala activation and decreased recruitment of the dorsal anterior cingulate cortex (dACC) during fear extinction. The influence of both the hyper-responsitivity of the amygdala and the deficient cognitive control in anxious subjects reflect an increased resistance to extinct fear responses and may potentially reinforce the vulnerability of anxiety disorders.

Functional connectivity studies capture the complexity of brain interactions, providing a more comprehensive, dynamic, and network-based understanding of how anxiety affects decision-making. As shown in figure 3, a ROI analysis based on the fMRI experiment explores how the amygdala and vmPFC functional connectivity are impacted by anxiety. The result indicates the functional connectivity between the amygdala and vmPFC was significantly positively correlated with trait anxiety ($r = 0.61$, $p < 0.01$) [24]. Also, Bishop's study [51] highlights that anxiety alters the balance of activity within the amygdala-prefrontal circuitry, leading to a bias toward threat-related responses. The findings suggest that anxiety plays a central role in influencing both the representation of a stimulus's emotional salience and the top-down control of attentional processes. Therefore, it can be inferred that when the anxious population face economic or financial decisions, such as investment or gambling, their impulse or less rational choices are driven by a distorted top-down cognitive process.

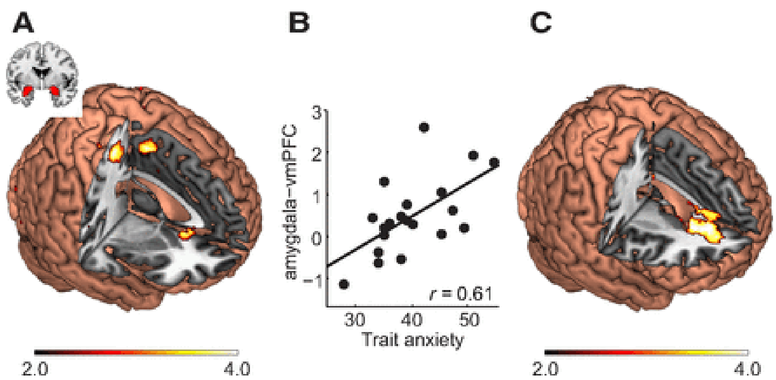

Figure 3: The amydala-prefrontal circuitry on trait anxiety

Figure 4 depict the abnormalities in the neural circuitry associated with decision bias among anxious people, based on the UAMA model proposed by Grupe[36]. It emphasize the dynamic process of how amygdala, dorsomedial prefrontal cortex (dmPFC), orbitofrontal cortex (OFC),

DOI: 10.54254/2753-7048/91/2025.22780

ventral striatum (VS) and anterior insula (AI) work together result of the heightened reactivity to uncertainty for anxiety people. Specifically, as shown in the figure 4. step (b), hyper-vigilance and heightened threat perception in anxiety are the result of interactions between the amygdala, OFC), and VS. And as indicates in step (e)the responses to uncertainty are linked to dysfunction in the anterior insula, which is associated with an elevated intolerance of uncertainty and further contributes to amygdala hyperactivity. Together, these findings illustrate the complex processes by which various brain circuits and cognitive functions are impacted by anxiety.

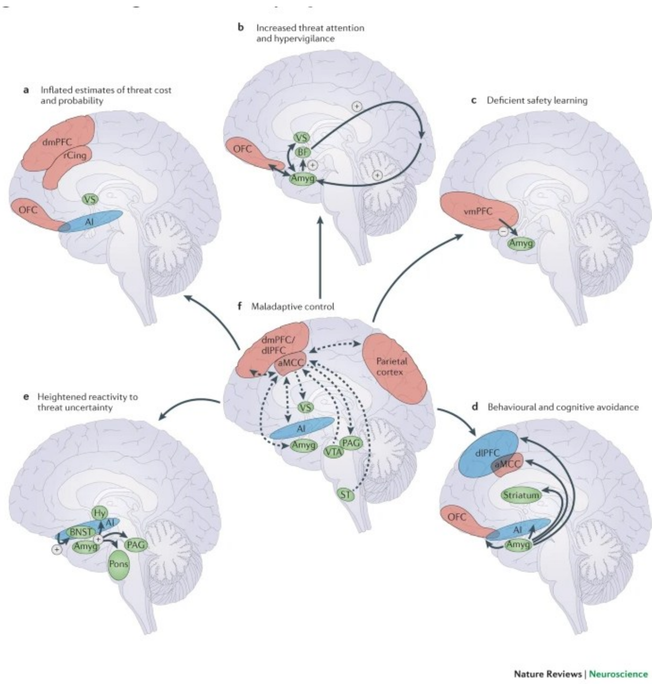

Figure 4: Neural regions and circuitry implicated in the UAMA

4. Discussion and conclusion

Grupe [36] notes that anxiety and its associated disorders have not traditionally been examined through the lens of decision-making. As a result, much of the evidence discussed in this paper addresses through the lens of decision-making or anxiety independently to infer how anxiety impact decision-making processing, due to the scarcity of explicit research connecting the two.

This paper firstly explores the cognitive biases that individuals with anxiety may exhibit during the decision-making process, particularly within an economic context. It presents three key biases closely associated with anxiety, supported by both behavioral and cognitive evidence. The cognitive biases discussed here pertain to value, risk, and uncertainty—key components that must be considered in economic decision-making. First, anxious individuals often exhibit heightened attention to potential negative outcomes, leading them to avoid risk. As a result, they may be more inclined to purchase insurance or select less risky options to ensure security in their decisions. Additionally, due to increased emotional interference, individuals with anxiety are more prone to making less rational decisions, such as engaging in impulsive buying. Lastly, anxiety can exacerbate indecision, particularly when faced with uncertainty, making it difficult for them to arrive at clear decisions.

The following section examines how anxiety shapes the decision-making process from a neuroscience perspective. Generally, anxiety is associated with heightened amygdala activity and reduced PFC activity, alongside increased functional connectivity with heightened trait anxiety. The

DOI: 10.54254/2753-7048/91/2025.22780

impaired cognitive control and heightened emotional responses help explain the cognitive biases observed in individuals with anxiety.

Therefore, the paper implies the cognitive characteristics and neural mechanisms underlying the economic decision-making processes with anxiety. Understanding these mechanisms has significant practical implications for decision-making, especially for economic decisions which involve putting into cognitive efforts. Some tailored suggestions and interventions can be provided for anxious people to help them make rational decisions. For example, recognizing that anxious individuals may be more risk-averse in high-stress financial contexts, emotional regulation and more balanced choices should be provided to anxious individuals. Or, giving them a second chance to double-check their choices before making the payment to mitigate the impulsive consumption.

Some limitations are admitted here, firstly, the investigations of the amygdala and PFC are not covered in detail, and even though some sub-regions of PFC are mentioned in the paper, the analysis is not deep and comprehensive. And the potential impact from neurotransmitters is not mentioned here. Secondly, instead of attention and memory, some other cognitive functions that are relevant to decision-making are understudies. In addition, there is a lack of contextual variability in economic decisions. Therefore, future research should delve deeper into the interplay between anxiety and decision-making across different economic and cognitive contexts, such as long-term financial planning or high-risk investment environments. Additionally, further investigation into the role of specific subregions within the prefrontal cortex, such as the mlPFC and dACC, in regulating decision-making under anxiety could provide more nuanced insights. Lastly, even though the paper stand from a neuroeconomics perspective, other areas, for example computational psychiatry, can be integrated to provide insights about mental disorder impact the decision-making process. For example, calculate the probability of how likely people will choose the preference for risk in an economic decision based on the prediction errors in ventral stratum related to gains and loss will be interesting and meaningful.

References

[1] *Wittchen HU. DSM-III-R Generalized Anxiety Disorder in the National Comorbidity Survey. Archives of General Psychiatry. 1994 May 1;51(5):355.*

[2] *Hartley CA, Phelps EA. Anxiety and decision-making. Biological Psychiatry. 2012 Jul;72(2):113–8. doi:10.1016/j.biopsych.2011.12.027*

[3] *Paulus MP, Yu AJ. Emotion and decision-making: affect-driven belief systems in anxiety and depression. Trends in Cognitive Sciences. 2012 Sep;16(9):476–83.*

[4] *Wu T, Luo Y, Broster LS, Gu R, Luo Y. The impact of anxiety on social decision-making: Behavioral and electrodermal findings. Social Neuroscience. 2013 Jan;8(1):11–21. doi:10.1080/17470919.2012.694372*

[5] *Teng C, Otero M, Geraci M, Blair RJ, Pine DS, Grillon C, Blair KS. Abnormal decision-making in generalized anxiety disorder: Aversion of risk or stimulus-reinforcement impairment?. Psychiatry Res. 2016;237:351-6.*

[6] *Weinberg A, Hajcak G. Electrocortical evidence for vigilance ‐ avoidance in Generalized Anxiety Disorder. Psychophysiology. 2011;48(6):842-51.*

[7] *Miu AC, Heilman RM, Houser D. Anxiety impairs decision-making: psychophysiological evidence from an Iowa Gambling Task. Biol Psychol. 2008;77(3):353-8.*

[8] *Yoon C, Gonzalez R, Bechara A, Berns GS, Dagher AA, Dubé L, et al. Decision neuroscience and consumer decision making. Mark Lett. 2012;23:473-85.*

[9] *Camerer C, Loewenstein G, Prelec D. Neuroeconomics: how neuroscience can inform economics. J Econ Lit. 2005;43(1):9-64.*

[10] *Hasler G. Can the neuroeconomics revolution revolutionize psychiatry? Neurosci Biobehav Rev. 2012;36(1):64-78.*

[11] *Sharp C, Monterosso J, Montague PR. Neuroeconomics: a bridge for translational research. Biol Psychiatry. 2012;72(2):87-92.*

[12] *Mogg K, Bradley BP. Anxiety and attention to threat: cognitive mechanisms and treatment with attention bias modification. Behav Res Ther. 2016;87:76-108.*

[13] *Mitte K. Anxiety and risky decision-making: the role of subjective probability and subjective costs of negative events. Pers Individ Differ. 2007;43(2):243-53.*

[14] Wilson E, MacLeod C. Contrasting two accounts of anxiety-linked attentional bias: selective attention to varying levels of stimulus threat intensity. J Abnorm Psychol. 2003;112(2):212-8.
[15] Cisler JM, Koster EH. Mechanisms of attentional biases towards threat in anxiety disorders: an integrative review. Clin Psychol Rev. 2010;30(2):203-16.
[16] Maner JK, Schmidt NB. The role of risk avoidance in anxiety. Behav Ther. 2006;37(2):181-9.
[17] Charpentier CJ, Aylward J, Roiser JP, Robinson OJ. Enhanced risk aversion, but not loss aversion, in unmedicated pathological anxiety. Biol Psychiatry. 2017;81(12):1014-22.
[18] Eysenck MW, Derakshan N, Santos R, Calvo MG. Anxiety and cognitive performance: attentional control theory. Emotion. 2007;7(2):336-53.
[19] Kahneman D, Tversky A. Prospect theory: an analysis of decision under risk. In: Handbook of the Fundamentals of Financial Decision Making: Part I. 2013. p. 99-127.
[20] 20.MacLeod C, Clarke PJ. The attentional bias modification approach to anxiety intervention. Clin Psychol Sci. 2015;3(1):58-78.
[21] Raghunathan R, Pham MT. All negative moods are not equal: motivational influences of anxiety and sadness on decision making. Organ Behav Hum Decis Process. 1999;79:56-77.
[22] Song S, Zilverstand A, Song H, d'Oleire Uquillas F, Wang Y, Xie C, et al. The influence of emotional interference on cognitive control: a meta-analysis of neuroimaging studies using the emotional Stroop task. Sci Rep. 2017;7:1-9. doi: 10.1038/s41598-017-02266-2.
[23] Barlow DH. Disorders of emotion. In: The Neurotic Paradox. Vol 2. Routledge; 2018. p. 201-26.
[24] Xu P, Gu R, Broster LS, Wu R, Van Dam NT, Jiang Y, et al. Neural basis of emotional decision making in trait anxiety. J Neurosci. 2013;33(47):18641-53.
[25] Boehme S, Ritter V, Tefikow S, Stangier U, Strauss B, Miltner WH, et al. Neural correlates of emotional interference in social anxiety disorder. PLoS One. 2015;10(6).
[26] Egloff B, Hock M. Interactive effects of state anxiety and trait anxiety on emotional Stroop interference. Pers Individ Differ. 2001;31(6):875-82.
[27] 27.Dresler T, Mériau K, Heekeren HR, van der Meer E. Emotional Stroop task: effect of word arousal and subject anxiety on emotional interference. Psychol Res. 2009;73:364-71.
[28] Rook DW, Gardner MP. In the mood: impulse buying's affective antecedents. Res Consum Behav. 1993;6(7):1-28.
[29] Evans JSB. In two minds: dual-process accounts of reasoning. Trends Cogn Sci. 2003;7(10):454-9.
[30] Bishop S, Duncan J, Brett M, Lawrence AD. Prefrontal cortical function and anxiety: controlling attention to threat-related stimuli. Nat Neurosci. 2004;7(2):184-8.
[31] Basten U, Stelzel C, Fiebach CJ. Trait anxiety and the neural efficiency of manipulation in working memory. Cogn Affect Behav Neurosci. 2012;12:571-88.
[32] Yang H, Li J, Zheng X. Different influences of negative and neutral emotional interference on working memory in trait anxiety. Front Psychol. 2021;12:570552.
[33] Weber EU, Johnson EJ. Decisions under uncertainty: Psychological, economic, and neuroeconomic explanations of risk preference. In: Neuroeconomics. Academic Press; 2009. p. 127-44.
[34] Platt ML, Huettel SA. Risky business: the neuroeconomics of decision making under uncertainty. Nat Neurosci. 2008;11(4):398-403.
[35] Glimcher PW. Decisions, uncertainty, and the brain: the science of neuroeconomics. MIT Press; 2004.
[36] Grupe DW. Decision-making in anxiety and its disorders. In: Decision Neuroscience. Academic Press; 2017. p. 327-38.
[37] Dugas MJ, Freeston MH, Ladouceur R. Intolerance of uncertainty and problem orientation in worry. Cognit Ther Res. 1997;21:593-606.
[38] Carleton RN. The intolerance of uncertainty construct in the context of anxiety disorders: theoretical and practical perspectives. Expert Rev Neurother. 2012;12(8):937-47.
[39] Grupe DW, Nitschke JB. Uncertainty and anticipation in anxiety: an integrated neurobiological and psychological perspective. Nat Rev Neurosci. 2013;14(7):488-501.
[40] LeDoux J. The emotional brain, fear, and the amygdala. Cell Mol Neurobiol. 2003;23:727-38.
[41] Etkin A, Wager TD. Functional neuroimaging of anxiety: a meta-analysis of emotional processing in PTSD, social anxiety disorder, and specific phobia. Am J Psychiatry. 2007;164(10):1476-88.
[42] Shackman AJ, Fox AS. Contributions of the central extended amygdala to fear and anxiety. J Neurosci. 2016;36(31):8050-63.
[43] Bechara A, Damasio H, Damasio AR, Lee GP. Different contributions of the human amygdala and ventromedial prefrontal cortex to decision-making. J Neurosci. 1999;19(13):5473-81.
[44] Seymour B, Dolan R. Emotion, decision making, and the amygdala. Neuron. 2008;58(5):662-71.
[45] Gupta R, Koscik TR, Bechara A, Tranel D. The amygdala and decision-making. Neuropsychologia. 2011;49(4):760-6.

DOI: 10.54254/2753-7048/91/2025.22780

[46] De Martino B, Camerer CF, Adolphs R. Amygdala damage eliminates monetary loss aversion. Proc Natl Acad Sci USA. 2010;107(8):3788-92.

[47] Michely J, Rigoli F, Rutledge RB, Hauser TU, Dolan RJ. Distinct processing of aversive experience in amygdala subregions. Biol Psychiatry Cogn Neurosci Neuroimaging. 2020;5(3):291-300.

[48] Somerville LH, Whalen PJ, Kelley WM. Human bed nucleus of the stria terminalis indexes hypervigilant threat monitoring. Biol Psychiatry. 2010;68(5):416-24.

[49] Herry C, Bach DR, Esposito F, Di Salle F, Perrig WJ, Scheffler K, et al. Processing of temporal unpredictability in human and animal amygdala. J Neurosci. 2007;27(22):5958-66.

[50] Miller EK, Cohen JD. An integrative theory of prefrontal cortex function. Annu Rev Neurosci. 2001;24(1): 167-202.

[51] Bishop SJ. Neurocognitive mechanisms of anxiety: an integrative account. Trends Cogn Sci. 2007;11(7):307-16.

[52] Barraclough DJ, Conroy ML, Lee D. Prefrontal cortex and decision making in a mixed-strategy game. Nat Neurosci. 2004;7(4):404-10.

[53] Hare TA, Camerer CF, Rangel A. Self-control in decision-making involves modulation of the vmPFC valuation system. Science. 2009;324(5927):646-8.

[54] Shackman AJ, Sarinopoulos I, Maxwell JS, Pizzagalli DA, Lavric A, Davidson RJ. Anxiety selectively disrupts visuospatial working memory. Emotion. 2006;6(1):40-61.

[55] Christopoulos GI, Tobler PN, Bossaerts P, Dolan RJ, Schultz W. Neural correlates of value, risk, and risk aversion contributing to decision making under risk. J Neurosci. 2009;29(40):12574-83.

[56] Knoch D, Gianotti LR, Pascual-Leone A, Treyer V, Regard M, Hohmann M, et al. Disruption of right prefrontal cortex by low-frequency repetitive transcranial magnetic stimulation induces risk-taking behavior. J Neurosci. 2006;26(24):6469-72.

[57] Sehlmeyer C, Schöning S, Zwitserlood P, Pfleiderer B, Kircher T, Arolt V, et al. Human fear conditioning and extinction in neuroimaging: a systematic review. PLoS One. 2009;4(6).