UNSATISFIED CURIOSITY AND ITS RELATION TO COGNITIVE CONTROL

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ABSTRACT

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Supervisor: Prof. Dr. Erol ÖZÇELİK

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The main purpose of the present study is to examine the relationship between unsatisfied curiosity and cognitive control processes. For this purpose, three different experimental studies were conducted with three different groups of participants aged between 18-26 years. In experiment 1 and experiment 3, satisfied and unsatisfied curiosity conditions were administered in separate blocks. In experiment 2, satisfied and unsatisfied curiosity conditions were randomly administered within a single block. In each experimental block, there were sub-blocks in which a curiosity condition was followed by a cognitive control task. In satisfied curiosity condition, information about the curiosity-inducing stimulus was presented; in unsatisfied curiosity condition, a repetition of the curiosity-inducing stimulus or a blank screen was presented. Each experiment included a modified Eriksen flanker task as a cognitive control task. Reaction time, percentage of correct responses, and omission rate were measured for cognitive control performance. The results revealed that, with exceptions in experiments 2 and 3, measures of cognitive control performance were not affected by satisfied/unsatisfied curiosity conditions. Overall, a congruency effect was observed in cognitive control performance. That is, participants responded faster, more accurately, and with fewer omission errors to congruent flanker stimuli compared to incongruent ones. Only in experiment 2, participants had lower reaction times in unsatisfied curiosity condition compared to satisfied curiosity condition.

Additionally, only in experiment 2, no congruency effect was observed in omission rates, regardless of the satisfied/unsatisfied curiosity condition. The relationship between unsatisfied curiosity and cognitive control processes was discussed in the perspectives of semantic memory and attention processes.

Keywords: Unsatisfied Curiosity, Cognitive Control, Semantic Memory, Attention

ÖZ

TATMİN OLMAYAN MERAKIN BİLİŞSEL KONTROL SÜRECİYLE İLİŞKİSİ

ÖZDEMİR, HÜSEYİN ARDA
PSİKOLOJİ YÜKSEK LİSANS TEZİ

Danışman: Prof. Dr. Erol ÖZÇELİK
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Mevcut araştırmanın temel amacı tatmin olmayan merakın bilişsel kontrol süreçleriyle ilişkisini incelemektir. Bu amaç doğrultusunda yaşları 18-26 arasında olan üç farklı katılımcı grubunun bulunduğu üç farklı deneysel araştırma yürütülmüştür. Deney 1 ve deney 2'de merak-oluşturucu uyaran olarak bulanık görseller, deney 3'te ise neden-soruları kullanılmıştır. Deney 1 ve deney 3'te, tatmin olan merak ve tatmin olmayan merak koşulları ayrı bloklarda uygulanmıştır. Deney 2'de tatmin olan merak ve tatmin olmayan merak koşullarının rastgele uygulandığı tek bir blok bulunmaktadır. Her bir deney bloğunda, önce bir merak koşulu ardından bir bilişsel kontrol görevinin geldiği alt-bloklar bulunmaktadır. Tatmin olan merak koşulunda, merak-oluşturucu uyarana dair bilgi sunulurken; tatmin olmayan merak koşulunda ise merak-oluşturucu uyaranın tekrarı veya boş ekran sunulmuştur. Her deneyde bilişsel kontrol görevi olarak modifiye edilmiş Eriksen flanker görevi yer almıştır. Bilişsel kontrol performansı için tepki süresi, doğru tepki yüzdesi, ve ihmal hatası oranı ölçülmüştür. Sonuçlar, deney 2 ve deney 3'deki istisnalar dışında, bilişsel kontrol performansına ilişkin ölçümlerin merakın tatmin olma/olmama koşullarından etkilenmediğini göstermektedir. Genel olarak, bilişsel kontrol performanslarında uyumluluk etkisi gözlemlenmiştir. Yani katılımcılar, uyumsuz uyaranlara kıyasla, uyumlu flanker uyaranlarına daha kısa sürede, daha doğru ve daha az hatalı tepkiler vermişlerdir. Yalnızca deney 2'de, tatmin olmayan merak

koşulunda, tatmin olan merak koşuluna kıyasla, katılımcıların tepki sürelerinin daha düşük olduğu gözlemlenmiştir. Ayrıca yine yalnızca deney 2'de, merakın tatmin olma/olmama koşulundan bağımsız olarak, katılımcıların ihmal hatası oranlarında bir uyumluluk etkisinin ortaya çıkmadığı gözlemlenmiştir. Tatmin olmayan merak ve bilişsel kontrol süreçleri arasındaki ilişki, semantik bellek ve dikkat süreçleri çerçevesinde tartışılmıştır.

Anahtar Kelimeler: Tatmin Olmayan Merak, Bilişsel Kontrol, Semantik Bellek, Dikkat

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SYMBOLS

ms:	Millisecond

ABBREVIATIONS

CEI-II:	Curiosity and Exploration Inventory - II
CLS:	Cognitive Load Scale
CO:	Condition Order
CS:	Curiosity-Satisfied
CUs:	Curiosity-Unsatisfied
CS-CUs:	Curiosity-Satisfied to Curiosity-Unsatisfied Condition Order
CUs-CS:	Curiosity-Unsatisfied to Curiosity-Satisfied Condition Order
DV:	Dependent Variable
MCI:	Melbourne Curiosity Inventory
SLO:	Stimuli List Order
SoC:	Satisfaction of Curiosity
STAI:	Spielberg's State-Trait Anxiety
State-C:	State-Curiosity Scale
Trait-C:	Trait-Curiosity Scale

CHAPTER I

INTRODUCTION

1.1 CURIOSITY

Organisms with nervous systems demonstrate the ability to generate information about their environment and act based on this environmental information (Bermek 2023: 111). Animals with the ability to move freely, such as roundworms (C. elegans) which are known to have a primitive form of the nervous system, explore their environment and based on the information gained from this exploration (e.g., the presence of food) exhibit behaviors of moving toward specific locations in their surroundings (Qin & Wheeler 2006: 186). These kinds of behaviors of free movement and environmental exploration have been observed in animal species ranging from invertebrates to primates (Byrne 2013: 469; Hughes 1997: 213). Environmental information can also play a role in animals' decision-making behavior. For instance, based on available information, they can make comparisons and prioritize fulfilling one specific need over another. For example, there are some studies in the literature on how male roundworms use environmental cues to decide between exploring for mates and exploiting food. (Barrios 2014: 11). Moreover, when earthworms (annelids) were placed in a T-maze, it was observed that they initially preferred a specific path. However, upon being placed in the maze again, they chose a different path than their previous preference (Dember & Richman 1989, as cited in Aunger & Curtis 2020: 57). The point is that the process of evolution gave rise to organisms capable of generating information about their environment and regulating their behavior accordingly. Recognizing the environment as a source of discoverable information introduced a basic understanding that the environment has discoverable aspects. This, in turn, implies the emergence of a kind of information-deficient state in organisms. When in such a state, free-moving organisms began to use exploratory behaviors to learn more about their surroundings. The evolution of biological systems that generate these behaviors, which are

associated with information and information-deficiency, serve as the basis for curiosity as a psychological phenomenon.

1.1.1 Theoretical Perspectives on the Curiosity

Before psychology established itself as an independent science, philosophers (e.g., Aristotle, Cicero, Hume) described curiosity as an intrinsic desire and love for knowledge (Loewenstein 1994: 76). During the period when psychology was emerging as an independent discipline, William James (1899/1962: 40-41), who led the field more through conceptual definitions than experimental practices, defined curiosity as an "impulse toward a better cognition." Furthermore, James introduced the terms "sensational curiosity," triggered by novel sensations, and "philosophic or scientific curiosity," driven by the desire for more complete knowledge. For the latter, he also used the term "theoretical curiosity," referring to an interest in rational relations between objects or events.

Curiosity, often defined in terms of human cognitive capacity and emotionality, was sidelined due to the behavioral paradigm's tendency to avoid mentalistic concepts. As a result, observations from studies involving rats and monkeys were described using terms such as "exploratory or orienting reflex" rather than being labeled as curiosity (Kidd & Hayden 2015: 449; Loewenstein 1994: 77). These reflexes were considered basic drives for non-human animals and were interpreted as external behaviors exhibited in response to novel stimuli. Harlow et al. (1950: 233) and Butler (1953: 98), based on observations in their studies, distanced themselves somewhat from these behaviorist terms and highlighted intrinsic rather than extrinsic motivation. A commonality in these studies is the observation that monkeys engaged in exploratory behavior even when it did not provide primary reinforcers (e.g., water, food). Harlow et al. (1950: 233) observed that monkeys showed a tendency to solve puzzles, and they referred to this as the "manipulatory motive". Butler (1953: 98) reported that monkeys confined to a closed room consistently learned to open a window and engage in watching the outside world. He called it the "visual exploration motive." However, neither researcher labeled these observations as curiosity.

Daniel E. Berlyne was among the first to use the term curiosity and to propose a comprehensive theory on the subject (Berlyne 1950: 69; Hughes 1997: 214; Kidd & Hayden 2015: 450; Loewenstein 1994: 77). Berlyne (1950: 71) initially drew

attention to “the problem of novelty”. He stated that it can be expected that organisms' behaviors are influenced by stimuli they have previously encountered and responded to, or stimuli they are genetically predisposed to react to (i.e. innate reflex). However, it seems less intuitive that entirely novel stimuli would lead to a behavioral change in organisms, as such stimuli lack any identifiable physico-chemical properties that could facilitate recognition (Berlyne 1950: 71). Based on this reasoning, Berlyne (1950: 72) concluded that for a stimulus to induce a significant behavioral change, it should not be entirely novel. Thus, a stimulus must exhibit both novelty and familiarity to influence the behavior. That stimulus’ familiar aspects elicit anticipatory responses, while its novel aspects create a conflict. Therefore, in situations where novelty is high, animals are more likely to exhibit fear, as approaching such unfamiliar objects could be dangerous (Berlyne 1950: 73). Laboratory observations were supporting this likelihood. Rats placed in experimental boxes initially remained cautious and alert, later exhibiting exploratory behaviors (e.g., sniffing) toward objects in the environment (Berlyne 1950: 77). In a similar line, Berlyne (1955: 246) observed that rats displayed more exploratory behaviors toward objects they had been briefly exposed to (i.e., short-term novelty) compared to objects they had never encountered (i.e., absolute novelty). In addition, relatively novel objects elicited more exploratory behaviors compared to objects with which familiarity had already been established. Observations derived from Berlyne’s studies, which highlighted the novelty problem in the emergence of curiosity, introduced the idea into the literature that curiosity arises as a result of a stimulus’ relative novelty rather than absolute novelty.

Later, Berlyne (1954a) proposed his first comprehensive theory on curiosity. In this theory, he introduced two types of curiosity. "Perceptual curiosity" was defined as the type of curiosity shared by humans and other animals, focusing on perceiving an external object (e.g., seeing, touching, smelling, etc.), while "epistemic curiosity" was described as the uniquely human drive toward knowledge acquisition (Berlyne 1954a: 180). Besides these two types of curiosity definition, the important aspect of Berlyne’s theory is its emphasis on the role of conflict in the emergence of (any type of) curiosity (Berlyne 1954a: 184). Berlyne explained the relationship between conflict and curiosity through a Hebbian perspective, which posits that coordinated timing among cortical cell groups is necessary for behavior formation (Berlyne 1954a: 185). Thus, from a Hebbian perspective, encountering stimuli with both novel

and familiar features leads to a conflict (i.e., a disruption in cortical organization). Drawing on Hebb's work on perceptual learning, which demonstrated that repeated exposure to conflicting stimuli enhances the organization of cortical cell groups, Berlyne (1954a: 185) interpreted exploratory behavior as serving this organizational purpose. In other words, through repeated exposure to the stimulus during exploration, the stimulus becomes familiar. A new cortical organization is established in response to the now-familiar stimulus. As a result, exploratory behavior gains reward value because it reduces conflict and causes learning of new behavior (Berlyne, 1954a: 185). Building on this line of reasoning, Berlyne (1954a: 186) defines curiosity as a drive to reduce conflict through knowledge acquisition (i.e., symbolic representations of learned responses). Then he proposes that intermediately familiar stimuli are most effective at evoking curiosity (Berlyne 1954a: 189). If a stimulus is almost entirely novel, either the absence of learned responses prevents sufficient conflict from arising, or avoidance may occur due to perceived risk. Conversely, if a stimulus is overly familiar, the resulting conflict is minimal because learned responses make the stimulus predictable.

While Berlyne generally focused on explaining how a stimulus evokes curiosity in an organism, Loewenstein concentrated on how curiosity about specific information (i.e. epistemic curiosity) arises in humans (Loewenstein 1994: 87). According to Loewenstein, individuals have an information-gap perception regarding what they know and what they wish to know. When individuals' attention focuses on this information gap and they experience deprivation because of this gap, curiosity arises. Therefore, Loewenstein (1994: 87) argues that curiosity is dependent on situational determinants. As evidence of this situational factor, he points to the fact that, although we are surrounded by many things about which we have little knowledge, we do not feel curious about most of them. He suggests that even when we possess the same level of knowledge in two situations—one where we interact with these things and one where we do not—our attention is more likely to focus on the perceived information-gap in situations involving interaction. When the awareness of information-gap combines with the feeling of deprivation in these situations, curiosity emerges.

Litman and Jimerson (2004: 156) and Litman (2008: 1585) demonstrated that epistemic curiosity in humans can arise not only from deprivation but also from interest. Interest-based curiosity has been shown to be associated with mastery-

oriented learning (i.e., the joy of better understanding), whereas deprivation-based curiosity is linked to performance-oriented learning (i.e., the discomfort of uncertainty about one's knowledge-set), (Litman 2008: 1594). However, although these studies provide insights into the emotional dimension of curiosity, they were conducted using self-report measures from participants. Thus, they do not rely on any experimental data regarding the behavioral mechanisms of these two types of curiosity, especially for interest-based curiosity (Litman 2008: 1594). Experimental studies exploring the behavioral mechanisms of interest-based curiosity began within the field of developmental robotics under the "learning progress theory" framework (Gottlieb et al. 2013: 585; Gottlieb et al. 2016: 10). More recently, findings supporting this theory have also been observed in humans (Ten et al. 2021: 1; Ten et al. 2021: 1022).

According to Gottlieb et al. (2013: 590), novelty-based curiosity theory (e.g., Berlyne, 1954) and the information-gap theory (e.g., Loewenstein 1994) may effectively explain curiosity and learning in response to temporary stimuli or situations. However, neither theory addresses how such temporary learning influences individuals (or robotic agents) in acquiring knowledge and developing skills in open and unbounded environments. In other words, the question of how individuals develop specific interests and achieve self-organization in an environment filled with diverse information and possible tasks remains unresolved (Gottlieb et al. 2013: 592; Gottlieb et al. 2016: 10-11). Therefore, Gottlieb et al. (2016: 3-4) suggested that an effective curiosity mechanism should help the agent learn and predict its environment better over time and in large areas of the learning space. They also proposed that such a curiosity system should be able to integrate two conflicting drives: "the need to reduce uncertainty" in short-term learning and "the intellectual risk taking" through searching a reducible uncertainty for long-term learning (Gottlieb et al. 2016: 11).

Basically, the learning progress theory depends on the "maximation of learning progress" and plays an important role in choosing which uncertainty to explore (i.e., intellectual risk-taking) (Gottlieb et al. 2013: 591; Gottlieb et al. 2016: 11). The environment contains tasks that can be manipulated by individuals using their existing skills. Individuals randomly identify various tasks in their surroundings, during which initial interactions occur between the individuals and the tasks. During these interactions, individuals may generate two types of predictions: what outcomes

their actions will produce for each task or how long it will take to solve the self-generated problems related to these tasks. (Gottlieb et al. 2013: 591). Based on these predictions, individuals assess their learning progress of new skills for each task and classify the tasks according to their difficulty (or complexity). Tasks with intermediate difficulty are classified as having high learning progress, while those with low or high difficulty are categorized as having low learning progress (Gottlieb et al. 2013: 592). Tasks with low difficulty are associated with predictable outcomes and limited challenges, resulting in low learning progress. Meanwhile, tasks with high difficulty involve problems that are too complex to solve, making the outcomes of the individual's actions nearly unpredictable, and thus are also classified as low in learning progress. Furthermore, individuals categorize tasks that are considered intermediately complex, taking into account which task will result in faster learning progress (Gottlieb et al. 2013: 592). The task that provides the quickest results is given priority for exploration. Thus, the theory explains curiosity as a learning progress-driven cognitive mechanism. In other words, individuals in a constantly changing open environment need to develop new skills. To fulfill this need effectively, it is not sufficient to resolve uncertainty in a specific situation alone; it also requires exploring situations with uncertainty that can foster skill acquisition.

1.1.2 Unsatisfied Curiosity

Based on the theories presented above, it can be concluded that curiosity may emerge from novelty-based conflict, awareness of an information gap, or maximization of the learning progress of one’s motor or cognitive skills (Berlyne 1954a: 189; Gottlieb et al. 2013: 593; Loewenstein, 1994: 87). However, regardless of how it emerges, the satisfaction of curiosity depends on knowledge acquisition. In this regard, knowledge acquisition can be conceptualized in different terms such as: learning how to respond to novel stimuli (Berlyne 1954a: 186), closing an information gap (Loewenstein 1994: 87), and improving the ability to predict the outcomes of one's actions or the resolution of self-generated problems (Gottlieb et al. 2013: 592). Studies have shown that relatively high curiosity (vs. low curiosity) enhances memory and learning in human subjects across different types of items: questions directed at relatively short paragraphs (Berlyne 1954b: 259), trivia questions (Gruber et al. 2014: 491; Kang et al. 2009: 963; Wade & Kidd 2019:

1377), numerical-facts (Brod & Breitweiser 2019: 1), and incidentally (or task-irrelevant) presented human faces (Gruber et al. 2013: 592).

In contrast to the satisfied curiosity, the unsatisfied curiosity is typically defined as the inability to acquire knowledge about the curiosity-inducing stimulus. According to Berlyne's theory, when curiosity remains unsatisfied (i.e., exploratory process of organisms for an object is blocked), the unresolved conflict can be more intense or stronger. This unresolved conflict may cause the unknown component of the object to become more dominant, thereby evoking a sense of danger due to its unknown nature. Thus, an unsatisfied curiosity may cause organisms to exhibit fear- or anxiety-like reactions such as avoidance (Berlyne 1950: 73; Berlyne 1954a: 187). Similarly, according to Loewenstein's theory, since curiosity arises from the feeling of deprivation accompanying the awareness of an information gap, an unsatisfied curiosity may lead to an increase in the unpleasurable sense of deprivation (Loewenstein 1994: 87).

However, in comparison to studies on the effect of satisfied curiosity on behavioral performances, the literature remains significantly lacking in addressing the relationship between unsatisfied curiosity and behavioral performance. Existing studies have focused on indulgent behavior and attitude (i.e., consumption of luxuries, hedonics, and other temptations), (Wang & Huang 2018: 1052; Wiggin et al. 2018: 1195). The results of both studies indicated that the unsatisfied curiosity brings a generalized desire for reward and this desire makes people prefer indulgent behaviors such as eating junk food (vs. healthy food) or small immediate monetary gain (vs. delayed larger monetary gain) (Wang & Huang 2018: 1061; Wiggin et al. 2018: 1206). Wang and Huang (2018: 1062) also observed that when people received a small reward after their curiosity was left unsatisfied, their preference for indulgent choices diminished. Additionally, Wiggin et al. (2018: 1206) reported that the impact of unsatisfied curiosity on the indulgent behavior is independent from the cognitive depletion (i.e., reduction in cognitive resources).

According to Noordewier and van Dijk (2020: 71), affective experience of unsatisfied curiosity may depend on several factors. One factor may be the individual differences in personality trait. People with a high openness to experience trait were found to be interested in stimuli involving ambiguity and complexity, despite the fact that they might feel confused (Noordewier & van Dijk 2020: 72). In contrast, those with a low openness to experience trait did not exhibit a sense of interest

accompanying their feelings of confusion toward such stimuli. Similarly, individuals with high stress tolerance have been found to be more motivated to learn new information compared to those with high deprivation sensitivity. Another factor could be the emotional experience people expect to have upon learning the answer what they are curious about. For example, when people anticipate experiencing positive feelings as a result of knowing something, they may delay satisfying their curiosity to savor those positive emotions (Noordewier & van Dijk 2020: 72). The final factor concerning the affective experience of unsatisfied curiosity is its relation to the temporal proximity of satisfying curiosity. For instance, if people believe their curiosity will not be satisfied in the near future, this leads to greater deprivation, heightened discomfort, and less positive affect regarding their unsatisfied curiosity (Noordewier & van Dijk 2020: 73). On the contrary, if they believe that their curiosity will be satisfied soon, then they engage more with the discovery motive and feel more positive about their unsatisfied curiosity. Lastly, Metcalfe et al. (2021: 8) found that participants preferred to request a hint (i.e., hint-seeking) and sustain their curiosity partially unsatisfied, rather than immediately satisfying it by learning the answer from another person. The researchers interpreted these results with the view that curiosity leads to a sense of competence that individuals create through their own efforts to find the answers by themselves. In other words, when given the opportunity, people may prefer to keep their curiosity unsatisfied in order to feel more competent and may continue making predictions.

1.2 COGNITIVE CONTROL

1.2.1 Brief Overview of the Cognitive Control

Cognitive control, also known as executive functions, is referred to the ability to maintain goal-oriented behavior and to adapt environmental changes (Cohen 2017: 3; Krebs & Woldorff 422). Control processes may operate more slowly compared to automatic processes such as habits or reflexes (Cohen 2017: 4). However, with practice and learning, these control processes can become faster and more automatic (e.g., “practice effect”, Cohen 2017: 7; Milham et al. 2003: 483). Additionally, motivational factors such as enjoying a task that requires control or expecting a reward upon completing such a task can also enhance control processes (Krebs & Woldorff 2017: 422).

In the unity/diversity framework, Miyake et al (2000: 49) indicated that there are co-dependent yet distinguishable three core control functions as: “inhibition”, “updating”, and “shifting”. The inhibition function provides goal-irrelevant representations or behaviors to be neglected. The updating function ensures that the goal-relevant information is updated and remains active. And lastly, the shifting function enables changes between mental or behavioral sets. In the following studies, Miyake & Friedman (2012: 11) investigated what brings the unity and what are the diversities. The results highlighted a common executive function that provides the unity dimension and two specific functions for the diversity dimension. Since the inhibition function almost perfectly correlated with the common executive function, the authors suggested that the inhibition ability could be defined as the common executive function among all the three core functions (Miyake & Friedman 2012: 11). On the other hand, the updating and the shifting functions have some independent abilities (i.e., updating-specific and shifting-specific, respectively).

Botvinick et al. (2001: 625) emphasized that the three core functions proposed by Miyake et al. (2000: 49) represent the regulatory aspect of cognitive control. Thus, Botvinick et al. (2001: 625) argued for the necessity of an evaluative component within cognitive control, which assesses cognitive demands and monitors information processing. To this end, the authors proposed “the conflict monitoring hypothesis” that describes a system in which existing conflicts are assessed and used to inform the control system in order to regulate the strength of control. According to Botvinick et al. (2001: 637), through the influence of conflict on the attentional system. Thus, the conflict monitoring model can explain three empirical findings: a) the ability to respond more quickly to a conflict situation following a previous conflict situation (an observation called the "congruency sequence effect", Egner 2007: 381); b) improved performance on conflict-related tasks when conflict occurs frequently; c) and the tendency to provide more accurate but slower responses following an error in a task (in response to error detection).

Another perspective on cognitive control considers the explore-exploit trade-off, which refers to deciding on a behaviour by comparing the costs and benefits of both the values of immediate reward (i.e., exploitation) and gaining information (i.e., exploration, a future reward through learning) (Cohen 2017: 10). Initially, the cost-benefit approach began to gain importance based on the effects of incentives, mostly extrinsic rewards (e.g., money), on the functioning of control processes (Botvinick &

Braver 2015: 92; Kool et al. 2017: 172; Shenhav et al. 2013: 234). Shenhav et al.'s (2013: 230) 'the overall expected value of control theory' proposes that because there is a cost (i.e., physical or cognitive effort) to perform control, there must be a comparison between the cost of control and the expected reward. Based on this comparison, individuals decide whether or not to act in control. Consequently, if a reward is more valuable than the cost of control to achieve that reward, then that reward may enhance control performances such as response inhibition, conflict monitoring, or attentional control (Krebs & Woldorff 2017: 424-428). Building on this, the explore-exploit framework also extends such a reward-focused cost-benefit analysis to another domain of behavioural decision making: whether to consume a known, present reward or to explore a potential new reward (Cohen 2017: 10; Wyat et al. 2024: 1).

1.2.2 Cognitive Control in Relation to Affect/Emotion

Affective states and emotions have the capacity to guide behavior through physiological signals or cognitive associations (Chiew & Braver 2011: 2; Gendron & Barrett 2009: 319). The dual competition model of Pessoa (2009: 160) puts forward two different effects ("state-dependent", "stimulus-driven") of how an emotional or affective state may influence the cognitive control processes through the changes in information processing. The state-dependent effect may emerge from reward anticipation, as mentioned above in the cost-benefit framework (e.g. Shenhav et al. 2013: 230), or from motivations like approach and avoidance (Pessoa 2009: 164-165). On the other hand, the stimulus-driven effect may work on two possible path: a) the sensory representations are enhanced for the emotional/affective stimulus, therefore the locus of control changes to that stimulus, b) control mechanisms may have a specific sensitivity for the emotional/affective stimulus itself (Pessoa 2009: 161). For the latter, Pessoa (2009: 161) emphasizes the critical value of the level of threat which results in a decreased control processes if the level is high, whereas control may increase or stay stable if the threat level is low. Most of the experimental studies reported the stimulus-driven effect of emotions/affective states, especially in a cognitive association way, by comparing distinct valenced word stimuli (Doğanay 2023: 13-15) such as: positive vs negative; negative vs neutral; threat-related vs neutral; agression-related vs positive/negative; fear-related vs neutral. These studies reported the detrimental effects of negative emotions/affective states in comparison

to neutral/positive ones. In sum, cognitive control might be effected from affective states or emotions, even if there is no occuring real-life situations. This also reflects the fundamental value of some evolutionary socio-psychological factors, as can be seen in the cognitive associative effects. (Doğanay 2023: 13-15, Pessoa 2009: 161).

1.2.3 Cognitive Control Tasks

Control tasks are typically categorized based on the three components of cognitive control proposed by Miyake et al. (2000: 86) (Diamond 2013: 135; Gratton et al. 2017: 4). This section will introduce the most commonly used task(s) for each category of cognitive control.

1.2.3.1 Inhibitory Control Tasks

As the name suggests, inhibitory control tasks are associated with the inhibition component of cognitive control. The tasks introduced here include the flanker task, the Stroop task, the Simon task, the go/no-go task, and the stop-signal task (Diamond 2013: 135; Gratton et al 2017: 5-6).

In the flanker task, a stimulus consists of a “target” at the center with two or more “flankers" arranged around the target (Diamond 2013: 139; Egner 2007: 381). Participants are asked to respond based on the target. Typically, two different symbols (e.g., the letters A and B) are used as targets. If the stimulus consists of the same symbols for both the target and flankers (e.g., AAA), it is classified as a "congruent stimulus". However, if the target and flankers consist of different symbols (e.g., ABA), it is referred to as an "incongruent stimulus (i.e., conflict situation)".

In the Stroop task, participants see color words (e.g., GREEN) displayed in various ink colors (Diamond 2013: 139; Egner 2007: 381). The task involves two dimensions: the meaning of the word and the color of the ink. Participants are asked to respond based on the ink color. If the meaning of the word matches the color of the ink (e.g., the word "GREEN" colored in green), the stimulus is considered congruent. If they do not match (e.g., the word "BLUE" colored in green), the stimulus is considered incongruent.

In the Simon task, the congruency of stimuli is determined based on the position in which they appear on the screen (Diamond 2013: 139; Egner 2007: 381). For example, suppose one stimulus is a square and the other is a triangle. Participants

are instructed to press the left response key when they see a square and the right response key when they see a triangle. If the square appears on the left side of the screen, this is a congruent condition because the spatial position of the stimulus matches the response position. However, if the square appears on the right side of the screen, this creates an incongruent condition.

The go/no-go and stop-signal tasks slightly differ from previous tasks (Diamond 2013: 140). In these tasks, instead of attempting to inhibit one of two possible responses, participants must suppress their behavioral response altogether. In go/no-go tasks, conditions in which participants are expected to respond to stimuli are referred to as "go" conditions. Conversely, conditions where participants are required not to respond are labeled as "no-go" conditions. In stop-signal tasks, a go signal is presented before each stimulus. However, for some stimuli, a stop signal is presented shortly after the go signal, and participants are expected to withhold their response when they get this stop signal.

In the flanker, the Stroop, and the Simon tasks, measurements include reaction time, percentage of correct responses, and omission rates (i.e., failing to give any response). In these tasks, the interpretation of the results is based on comparing the measurements obtained from congruent and incongruent conditions. In addition to the previously mentioned measurements, go/no-go and stop-signal tasks also measure commission errors (i.e., giving a response in no-go or stop conditions) (Yaşuk 2023: 57).

1.2.3.2 Working Memory Tasks

The working memory tasks are generally related with the updating and maintaning information components of the cognitive control (Diamond 2013: 142; Gratton et al. 2017: 5). As an example, the n-back task will be introduced. In the n-back tasks, a series of stimuli (e.g., letters, numbers, or visual images, etc.) are shown to the participants. The participants are instructed to response when the current stimulus matches the one from "n" steps earlier in the sequence. As 'n' increases, the cognitive control load increases, thus making the task more difficult (Gratton et al. 2017: 5). In this task, reaction time and response accuracy are measured. Response accuracy is examined through three concepts (Meule 2017: 2): accurately pressing a button for targets (i.e., hits), mistakenly pressing a button for

non-targets (i.e., commission errors or false alarms), and fail to press a button for targets when required (i.e., omission errors or misses).

1.2.3.3 Task-Switching Tasks

Task-switching tasks are generally associated with cognitive control mechanisms required for shifting between task sets (Diamond 2013: 149; Gratton et al. 2017: 7). These tasks are also known as tools for measuring cognitive flexibility abilities. Here, the cued-trials paradigm will be introduced (Gratton et al. 2017: 5). In the cued-trials paradigm, two or more tasks are included. Each task is associated with a separate cue. The cue determines which task the participant will perform in the current trial. If the trial following the current trial involves the same task, it is referred to as a "repeat trial". If the task is different, it is referred to as a "switch trial". The comparison of performance between repeat trials and switch trials provides insights into cognitive control processes. A decline in performance on switch trials (e.g., an increase in response time) is referred to as "switch cost" (Gratton et al. 2017: 7).

1.3 THE PRESENT STUDY

Curiosity can direct attention toward areas or objects where knowledge has previously been acquired (Gottlieb et al. 2014: 15503). This characteristic of curiosity suggests a close relationship with control mechanisms. However, the literature lack of investigation about the impact of satisfied/unsatisfied curiosity on the cognitive control tasks such as inhibitory control, working memory, or task-switching. This makes it hard to provide a directional hypothesis about the impact of satisfied/unsatisfied curiosity on such tasks. Moreover, two possible features of the unsatisfied curiosity also bring a controversy to build a directional hypothesis.

Firstly, unsatisfied curiosity may increase conflict by uncertainty (Berlyne 1957: 336). The increase in conflict may have two different consequences. One possibility is that this conflict can enhance control performance in line with the conflict monitoring hypothesis by adjusting attentional processes to detect conflict (Botvinick et al. 2001: 625). As a consequence of this, it can be expected that the control performance will be enhanced after the unsatisfied curiosity condition compared to the satisfied curiosity. Another possibility is that because the conflict itself may have an aversive effect, the conflict by unsatisfied curiosity may act as a

negative affect/emotion in line with the stimulus-driven effect of emotion hypothesis by changing locus of control to the unsatisfied curiosity stimulus (Pessoa 2009: 164-165). According to this, the control performance can be poorer after the unsatisfied curiosity condition compared to the satisfied curiosity.

Secondly, unsatisfied curiosity may increase reward anticipation (Gruber et al. 2014: 491; Kang et al. 2009: 964; Marvin & Shomamy 2016: 266). An information is considered as a reward by the brain, because it holds an adaptive value whether as a future utility or as an evaluation of current beliefs about the environment (Kang et al. 2009: 964; Liquin & Lombrozo 2020: 2; Marvin & Shomamy 2016: 266). So, although the curiosity may emerge from a conflict by uncertainty, it may also generate reward anticipation, whether for an immediate or a future reward (Gruber et al. 2014: 491). As a consequence of this, a state of unsatisfied curiosity can act like a state of reward anticipation rather than a negative affect/emotion, so it may enhance cognitive control performance as in previous studies that find the enhancing impact of extrinsic reward anticipation on control performance (Botvinick & Braver 2015: 92; Kool et al. 2017: 172; Shenhav et al. 2013: 234).

In pursue of the goal of the present study, three separate experiments have been conducted. Each experiment differs either based on the experimental flow or the type of curiosity-inducing stimuli used. Experiment-1 and experiment-2 have the same type of curiosity-inducing stimuli (visual fact-seeking), whereas they have different experimental flow (blocked or randomised presentation, respectively). Experiment-1 and experiment-3 have the same experimental flow (blocked presentation), whereas they have different types of curiosity-inducing stimuli (visual fact-seeking or verbal explanation-seeking, respectively).

The reason for using two different experimental flow is based on the idea that the uncertainty level of the experimental setting may be a factor on the results. Because in the blocked structure, there is a low uncertainty in the experimental setting in which the participants probably know whether their curiosity in the next trials will be satisfied or unsatisfied in a given block. In contrast, in the randomised structure, there is a high uncertainty in which the participants most likely do not know whether their curiosity will be satisfied or unsatisfied. Therefore, to observe whether the degree of uncertainty in the experimental setting affects the impact of the satisfaction of curiosity condition on cognitive control performance, two distinct experimental flow were used.

The basic distinction between the two types of curiosity-inducing stimuli, that were used in the present study, relies on the nature of curiosity-inducing stimuli (explanation-seeking or fact-seeking), rather than the stimulus modality (verbal or visual). Although both types of stimuli are associated with reducing uncertainty, explanation-seeking stimuli are more strongly associated with future utility compared to fact-seeking stimuli (Liquin & Lombrozo 2020: 16). In the current study, verbal questions were used as explanation-seeking curiosity-inducing stimuli, while blurred images were used as fact-seeking ones. In this way, it will be possible to observe whether the interaction between curiosity satisfaction and cognitive control performance differs based on the type of curiosity-inducing stimuli.

The present study aims to contribute to the literature by providing observations on the interaction between curiosity satisfaction and cognitive control performance. The use of experimental settings with varying levels of uncertainty and different types of curiosity-inducing stimuli may further enhance the potential contribution of the study to the field.

Although the three experiments were conducted in different experimental flow/settings and involved different types of curiosity-inducing stimuli, their research questions are common. Therefore, the hypotheses presented below encompass all the experiments included in the present study. To reiterate, since there is no direct study in the literature to guide this research and there are plausible reasons suggesting that unsatisfied curiosity could have effects in two opposite directions, the present study proposes non-directional rather than directional hypotheses.

H1. The mean reaction times will be different between the satisfied and unsatisfied curiosity conditions.

H2. The mean percentage of correct responses will be different between the satisfied and unsatisfied curiosity conditions.

H3. The mean omission rates will be different between the satisfied and unsatisfied curiosity conditions.

H4. The mean reaction times to incongruent stimuli will be different between the satisfied and unsatisfied curiosity condition.

H5. The mean percentage of correct responses to incongruent stimuli will be different between the satisfied and unsatisfied curiosity condition.

H6. The mean omission rates to incongruent stimuli will be different between the satisfied and unsatisfied curiosity condition.

H7. The mean reaction times to congruent stimuli will be different between the satisfied and unsatisfied curiosity condition.

H8. The mean percentage of correct responses to congruent stimuli will be different between the satisfied and unsatisfied curiosity condition.

H9. The mean omission rates to congruent stimuli will be different between the satisfied and unsatisfied curiosity condition.

CHAPTER II

METHOD

2.1 STUDY-1: SCALE ADAPTATION

The Turkish adaptation study of Naylor's (1981) Melbourne Curiosity Inventory was conducted prior to the experimental studies, with the objective of measuring the trait-curiosity characteristics of the participants as an individual personality trait, and their state curiosity, depending on the experimental manipulation. To ascertain divergent validity of the Melbourne Curiosity Inventory, the State-Trait Anxiety Inventory developed by Spielberg et al. (1983, as cited in Yaşuk 2023: 37) was utilised. The basis for the preference for the concept of anxiety for divergent validity is rooted in Berlyne's (1954a: 189) propositions that an inverse relationship may exist between curiosity and anxiety. To assess convergent validity, the version of the Curiosity and Exploration Inventory-II developed by Kashdan et al. (2009) and adapted into Turkish by Acun et al. (2013) was employed.

2.1.1 Method

2.1.1.1 Participants

Two-hundred and forty-four participants (n_{male} = 71, n_{female} = 173) were recruited via an online Google Forms platform. All the participants were adults whose ages ranged from 18 to 67 (M_{age} = 29.71, *SD* = 11.923). Of the participants, %54.9 were undergraduate students, %20.9 had an undergraduate degree, %7.4 had only completed high school, %6.1 had graduate degrees, and %1.6 were undergraduate students. A total of 99 participants previously applied for a psychological consultation from a professional. Twenty-eight of the participants received both drug and psychotherapy treatment, while thirty-three received psychotherapy treatment and thirty-six received drug treatment. Among the participants who had previously undergone psychological treatment, 27 remained in treatment, whereas 72 had stopped. Four were receiving both medication and psychotherapy, while the remaining eleven were receiving only psychotherapy, and

twelve were receiving only medication. Two of these ninety-nine participants did not report receiving any treatment after counseling.

2.1.1 Materials

2.1.1.2.1 Melbourne Curiosity Inventory

The inventory was developed by Naylor (1981) to make a theoretical distinction between state and trait curiosity. According to Naylor (1981: 172), the trait curiosity dimension is represented by an individual's potential to experience curiosity, while the state curiosity dimension is represented by the variation in an individual's curiosity levels based on the situation. The inventory consists of State Curiosity (C-State Form) and Trait Curiosity (C-Trait Form) scales with twenty items each. Each item was responded to using a 4-Likert type scale. Four separate samples were subjected to the C-Trait form, and the alpha coefficient for these samples ranged from .84 to .93. In two of these samples, the test-retest reliability was measured. One sample had r = .83, while the other one had r = .77. The C-State Form was applied to two separate samples, and the alpha coefficient for these samples ranged from .87 to .92. There are no reversed items in either scale. High scores indicate high levels of curiosity.

2.1.1.2.2 State-Trait Anxiety Inventory

The inventory developed by Spielberg et al. (1983, as cited in Yaşuk 2023: 37) to determine state and trait anxiety levels separately. The inventory consists of State Anxiety and Trait Anxiety scales with twenty items each. Each item was responded to using a 4-Likert type scale. Both the state-anxiety and the trait-anxiety scales contain direct and reversed items (Öner & Le Compte 1983, as cited in Yaşuk 2023: 37). In the Trait Anxiety Scale, the numbers of these items are: 21, 26, 27, 30, 33, 36 and 39, while in the State Anxiety Scale, these are items 1, 2, 5, 8, 10, 11, 15, 16 and 19. When scoring the scale (Öner & Le Compte 1983, as cited in Yaşuk 2023: 37), direct items are added, reversed items are subtracted, and a fixed score is added to the score obtained here (50 on the State Anxiety Scale, 35 on the Trait Anxiety Scale). High scores indicate high levels of anxiety. Öner and Le Compte (1983, as cited in Yaşuk 2023: 37) translated this scale into Turkish, and studies were done on its validity and reliability. These studies show that the State Anxiety Scale's Alpha

reliability coefficient ranges from .83 to .87, while the Trait Anxiety Scale's ranges from .94 to .96 (Öner and Le Compte 1983, as cited in Yaşuk 2023: 37).

2.1.1.2.3 Curiosity and Exploration Inventory-II

Kashdan et al. (2009) developed the Curiosity and Exploration Inventory-II (CEI-II) to measure trait curiosity. The CEI-II consists of 10 items and two factors (stretching and embracing). Each item was responded to using a 5-Likert type scale. In three studies, the Cronbach's alpha coefficient of the scale was found to range between .75 and .86. There are no reversed items in the scale. High scores indicate high levels of curiosity. The CEI-II was adapted to Turkish by Acun et al. (2013) with two studies. In the first study, Cronbach alpha coefficient was found to be .81 for the whole scale, .81 for the stretching factor and .68 for the embracing factor. (Acun et al. 2013: 76). In the second study, Cronbach alpha coefficient was found to be .82 for the whole scale, .81 for the stretching factor and .67 for the embracing factor. (Acun et al. 2013: 81).

2.1.1.3 Procedure

Initially, two independent English teachers from Giresun Hamdi Bozbağ Anatolian High School translated the Melbourne Curiosity Inventory (MCI) from English to Turkish. During the process of merging these two translations into a single version, it was noted that some items could carry dual meanings. For the C-Trait form, these items included: item 6, item 8, item 11, and item 19. For the C-State form, the relevant items were: item 3, item 10, item 12, and item 20. The Turkish word corresponding to one of the meanings was used explicitly in that item, while the word representing the other meaning was placed in parentheses. Consequently, due to this ambiguity, the back-translation procedure in the literature could not be applied (Güngör, 2016: 106). Instead, two additional English teachers compared the original version of the inventory with the incomplete single translation, first independently and then collaboratively. These two translators suggested modifications for several other items. For the C-Trait form, these included: item 7, item 15, item 18, and item 20. For the C-State form, the items were: item 6 and item 13. Ultimately, the translation process was completed through discussions among these four teachers and the researcher of this thesis. The Demographic Form, MCI, STAI, and the CEI-II were administered to the participants via Google Forms. After

approving the informed consent form, the participants completed the demographic form and the inventories, respectively.

2.1.1.4 Results and Discussion

All analyses were performed with the IBM SPSS Statistics v.25. For reliability of both state-curiosity and trait-curiosity scales, the Cronbach's alpha coefficent was found .94 and .93, respectively. These results indicated that both trait- and state-curiosity scales had a high reliability. There was a strong and positive correlation between trait-curiosity and scale-curiosity scales, $r = .73$, $p < .001$. The result supported that people with high trait-curiosity tend to have high state-curiosity (Naylor 1981: 173). For convergent validity of both scales, the Turkish version of CEI-II was administered. The results revealed that both the state-curiosity scale ($r = .52$, $p < .001$) and trait-curiosity scale ($r = .71$, $p < .001$) had statistically significant positive correlations with the CEI-II. For divergent validity of the state-curiosity and trait-curiosity scales, STAI was administered. The trait-curiosity scale had negative correlations with both the trait-anxiety scale ($r = -.24$, $p < .001$) and the state-anxiety scale ($r = -.15$, $p = .017$), while the state-curiosity scale had no correlations with both the trait-anxiety scale ($r = .053$, $p = .41$) and the state-anxiety scale ($r = .01$, $p = .932$) indicating that STAI is divergent from state-curiosity and trait-curiosity scales.

According to Berlyne, there should be a medium level of conflict arising from uncertainty (Berlyne 1954a: 189). If the conflict arising from uncertainty reaches very high levels, the existing symbolic representations will not be enough to resolve the conflicts generated by that uncertainty (Berlyne 1954a: 189). Even if Berlyne did not use the term anxiety for this insufficiency of conflict resolution, he drew a connection with Freudian explanation of the play activity of a child as to overcome anxiety through a tendency of discovery (Berlyne 1954a: 189). Consequently, although there was a statistically weak negative correlation between trait-curiosity and anxiety (whether trait or state), the findings of the current study align with Berlyne's reasoning. However, these findings can not provide an explanation for why there was no significant relationship (whether positive or negative) between state-curiosity and anxiety. What does this tell us about the nature of curiosity? Based on the results, it can be concluded that there could be an inverse relationship between an individual's capacity to experience curiosity and anxiety. In other words, a person who has a higher tendency for experiencing curiosity, probably has a lower tendency

for experiencing anxiety. However, we cannot suggest that in a given situation, one will feel either curiosity or anxiety. In other words, an individual can be both anxious and curious in similar situations. Data from an experiment with rats supports this notion. In a study examining the relationship between early life stress and anxious or curious-like behaviors, it was observed that the rats exposed to early life stress exhibited both types of behavior (Sharma et al. 2022: 9). Researchers have linked the findings related to curiosity-like behaviors with impulsive and addictive behaviors (Sharma et al. 2022: 11). Future studies may need to investigate the state curiosity through impulsivity and addiction. Finally, several studies (Boyle 1989: 15; Kashdan & Roberts 2004: 812; Naylor 1981: 181; Spielberg & Reheiser 2009: 293) indicated that there is a structural difference between the concepts of state and trait curiosity. Therefore, it should be considered that the findings of the current study may not be solely based on that kind of structural confound.

2.2 STUDY-2: VISUAL STIMULI SELECTION

In order to determine the stimuli in the experimental studies to be conducted using visual fact-seeking stimuli, a stimuli selection study was conducted before the experiments.

2.2.1 Method

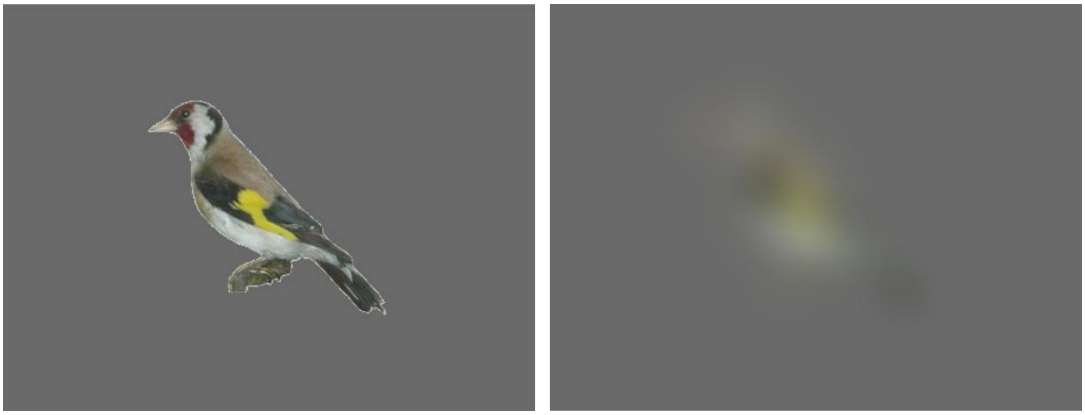
2.2.1.1 Participants

One-hundred and seven participants (n_{male} = 18, n_{female} = 89) were recruited via an online Google Forms platform. All the participants were undergraduate students, with the majority being first- or second-year psychology students from Çankaya University whose ages ranged from 19 to 28 (M_{age} = 20.80, SD = 1.428).

2.2.1.2 Materials

Forty-eight pictures in different categories (e.g. animal, plant, tool etc.) were selected from the real-life image set created by Moreno-Martinez and Montoro (2012). All of the chosen images were colourful and used in two different formats: a clear version and a blurred version. Similar to Chen et al.'s (2022: 9-10) study, the blurring process was carried out in the 20–30 degree Gaussian filter range, and the images were set to 450 x 350 pixels in size (Figure 1).

Figure 1. Examples of Clear and Blurred Images



2.2.1.3 Procedure

First, the participants completed an informed consent and a demographic form. Then, the participants were asked to make the following evaluations for each of the selected forty-eight images: 1) the uncertainty of the object in the visual (1: very uncertain, 6: very clear), 2) their level of confidence in their guesses about what the object in the visual is (1: not at all confident, 6: very confident), 3) their curiosity levels about what the object in the visual is (1: not at all curious, 6: very curious). After each blurred image, the clear version of that image was presented and they were asked to make the following evaluations: 1) the level of differentiation between the clear version of the image and the participant's guess (1: not at all different, 6: completely different), and 2) the level of curiosity satisfaction created in the participant by the removal of uncertainty (1: not at all different, 6: very much). Three criteria were taken into consideration for the images to be used in the experimental phase: 1) the level of uncertainty of the blurry image, 2) the level of curiosity about its clear version, and 3) the level of satisfaction when seeing its clear version. Stimuli that scored in the medium-high range from these three criteria were included in the further ranking. In order to determine the further ranking, the following procedure was executed in the Microsoft Office Excel program: if a participant's scores for an image met the criteria specified above, that visual was given the value of 1; otherwise, it was given the value of 0. The mean scores for each image were calculated by the sum of these 1 and 0 values per participant. Following that, the mean scores were used to rank each image. All forty-eight images' descriptive scores can be found in Appendix-13. Each image's average score and the ranking of the images, both are based on the applied formula, can be found in Appendix-14.

2.3 STUDY-3: VERBAL STIMULI SELECTION

In order to determine the stimuli in the experimental studies to be conducted using verbal explanation-seeking stimuli, a stimuli selection study was conducted before the experiments.

2.3.1 Method

2.3.1.1 Participants

Ninety-four participants (n_{male} = 41, n_{female} = 53) were recruited via an online Google Forms platform. All the participants were adults whose ages ranged from 18 to 50 (M_{age} = 28.09, SD = 7.672). Of the participants, 31 had an undergraduate degree, 30 were undergraduate students, 14 had a graduate degree, 12 were graduate students, 6 had only completed a high school degree, and 1 had a primary school degree.

2.3.1.2 Materials

Twenty verbal questions were selected from the Forty Why-Questions set created by Liquin and Lombrozo (2020). The verbal stimuli consisted of both the questions and their answers. The selected questions and their answers were translated into Turkish by both the researcher and his advisor.

2.3.1.3 Procedure

First, the participants completed an informed consent and a demographic form. Then, the participants were asked to evaluate these twenty questions in the verbal stimulus set as follows: 1) the level of comprehensibility of the questions (1: not at all comprehensible, 6: very comprehensible), 2) their level of confidence in their guesses regarding the answers to the questions (1: no guess/not at all confident, 6: very confident), and 3) their level of curiosity regarding the answers to the questions (1: not at all curious, 6: very curious). After the evaluations on each question, the answers to the questions were presented and they were asked to make the following evaluations about these answers: 1) the level of comprehensibility of the answer (1: not at all comprehensible, 6: very comprehensible), 2) the level of difference of the answer from their predictions (1: not different at all, 6: very different), and 3) the level of curiosity satisfaction created by the answer to the question for the participant

(1: not at all, 6: very much). Two criteria were taken into consideration for the Why-Questions to be used in the experimental phase: 1) the level of curiosity on learning the answer to the question and 2) the level of satisfaction which was elicited by learning the answer. Stimuli that scored in the medium-high range from these two criteria were included in the further ranking. In order to determine the further ranking, the following procedure was executed in the Microsoft Office Excel program: if a participant's scores for a Why-Question met the criteria specified above, that verbal question was given the value of 1; otherwise, it was given the value of 0. The mean scores for each Why-Question were calculated by the sum of these 1 and 0 values per participant. Following that, the mean scores were used to rank each why-question. All twenty verbal why-questions and their descriptive scores can be found in Appendix-15 and Appendix-16, respectively. Each question's average score and the ranking of the questions are based on the applied formula, which can be found in Appendix-17.

2.4 EXPERIMENT 1: BLOCKED-CONDITIONS WITH VISUAL STIMULI

Experiment 1 examined how two different curiosity conditions affected cognitive control performance when participants encountered visual fact-seeking stimuli (i.e., blurred images). Specifically, it explored the impact of satisfied and unsatisfied curiosity on cognitive control performance. Expriment 1 consisted of a blocked design, where each curiosity condition was assigned to separate blocks, ensuring that participants experienced satisfied curiosity in one block and unsatisfied curiosity in another.

2.4.1 Method

2.4.1.1 Participants

Thirty-two students (n_{male} = 16, n_{female} = 16) from Giresun University's Vocational School of Health Services were recruited for experiment 1. All the participants were young adults whose ages ranged from 18 to 25 (M_{age} = 20.28, *SD* = 1.782). Twenty-eight of the participants reported that they use their right hand dominantly, while four of them reported being dominantly left-handed. All the participants voluntarily took part in the study.

2.4.1.2 Materials

2.4.1.2.1 Melbourne Curiosity Inventory

The Turkish-translated version of the MCI was used for two purposes: 1) to control individual differences in participants' trait-curiosity (Trait-C Form), and 2) as a manipulation check between the curiosity-satisfied and curiosity-unsatisfied conditions (State-C Form). Both the Trait-C Form and the State-C Form consist of 20 items. Each item is rated on a 4-point Likert scale. In the Turkish adaptation study, the Cronbach's alpha coefficients for the reliability of the trait-curiosity and state-curiosity scales were .93 and .94, respectively.

2.4.1.2.2 Cognitive Load Scale

The original version of the scale was developed by Paas & Van Merrienboer (1993). According to Paas & Van Merrienboer (1993: 739), the scale was modified after Bratfisch et al. (1972) to measure subjective ratings of task difficulty. The Cognitive Load Scale (CLS) consist of one item which is responded by using 9-Likert scale (1: very low mental effort, 9: very high mental effort), and the Cronbach's alpha coefficient of the scale was found to be .90 (Pass & Van Merrienboer, 1993: 739). The original version was adapted into Turkish by Kılıç & Karadeniz (2004) in two different studies: one examined the scale's reliability, and the other examined its criterion validity. For reliability of the scale, participants were given four different tasks and were asked to rate (Kılıç & Karadeniz 2004: 570). The Cronbach's alpha coefficent and the Spearman Brown split-half correlation were found .78 and .79, repsectively (Kılıç & Karadeniz 2004: 570). For criterion validity of the scale, the relationship between participants' disorientation levels and cognitive overload were examined, and a positive moderate correlation was found to be .43 (Kılıç & Karadeniz 2004: 569).

2.4.1.2.3 Visual Stimuli Used in the Experiment

A total of thirty real-life images were selected from the initial pool of forty-eight images in the visual stimuli selection study (Study 2). The thirty images that scored the highest were determined as the stimuli for experiment 1 based on the criteria defined and the procedure executed in study 2. Two lists (List A and List B) were created to be used in the experimental conditions (curiosity-satisfied or curiosity-unsatisfied). The images were ranked from highest to lowest in terms of

their scores, and consecutive rows were grouped into pairs. The images within each pair were randomly assigned to one of the two lists.

2.4.1.2.4 Flanker Stimuli Used in the Experiment

Five arrow symbols were used to adjust the flanker stimuli. Congruent stimuli were represented as (<<<<< and >>>>>), while incongruent stimuli were represented as (<<><< and >><>>). The colour of the stimulus was white and the stimuli were presented on a light grey background. The font used for the stimuli was Open Sans. The size of the stimuli was set to a letter height of 0.075, which is compatible with a 15.6-inch monitor in the PsychoPy software.

2.4.1.3 Procedure

Participants first read the informed consent form and filled out the demographic form on paper. Then, they sat in an upright position in front of the computer. The distance of each participant to the computer screen was approximately 60 cm. The computer used in the experiment was an ASUS-X55LB brand with an Intel i5-5200U 2.20 GHz processor and a 15.6-inch monitor. The experiment was designed with the PsychoPy v2022.2.4 software. The experiments were conducted at the Giresun University Vocational School of Health Services' computer laboratory. Participants were told to carefully read the instructions on the screen throughout the experiment.

The study began with participants filling out the trait-curiosity scale. Then, a two-block practice session, 16 trials for each block, was held regarding the cognitive control task to be performed in the experiment. After the cognitive control task was sufficiently understood, a practice session consisting of two blocks was held. In both blocks, first the curiosity task consisting of 3 trials, then the cognitive control task consisting of 16 trials was performed. One block contained only the curiosity-satisfied condition in the curiosity task, while the other contained the curiosity-unsatisfied condition. The explanation for both the curiosity and cognitive control tasks will be provided below. The practice session differed only in the number of trials in both the curiosity task and the cognitive control task. The duration of the stimuli and the flow of the tasks were the same as in the main experiment. Also the visual stimuli in the curiosity tasks were different from the main experiment. When the experimenter confirmed that the participants had sufficiently understood both the

flow of the experiment and the tasks, the experimenter turned on the experiment room's light and left the room. The participants were told to read the instructions on the screen once more carefully and to start the experiment after the light went out. In addition, the participants said that the main experiment has a slightly longer version of the tasks so far.

Experiment 1 had a within-subjects design such that all the participants took part in both the curiosity-satisfied and the curiosity-unsatisfied conditions. The order of the conditions and the stimuli lists were counterbalanced. Specifically, half of the participants first performed the curiosity-satisfied condition (one quartile out of the total participants with List A and another quartile with List B) followed by the cognitive control task, then the curiosity-unsatisfied condition (participants who were presented List A in the first condition were presented List B and vice versa) followed by the cognitive control task, while the other half did vice versa.

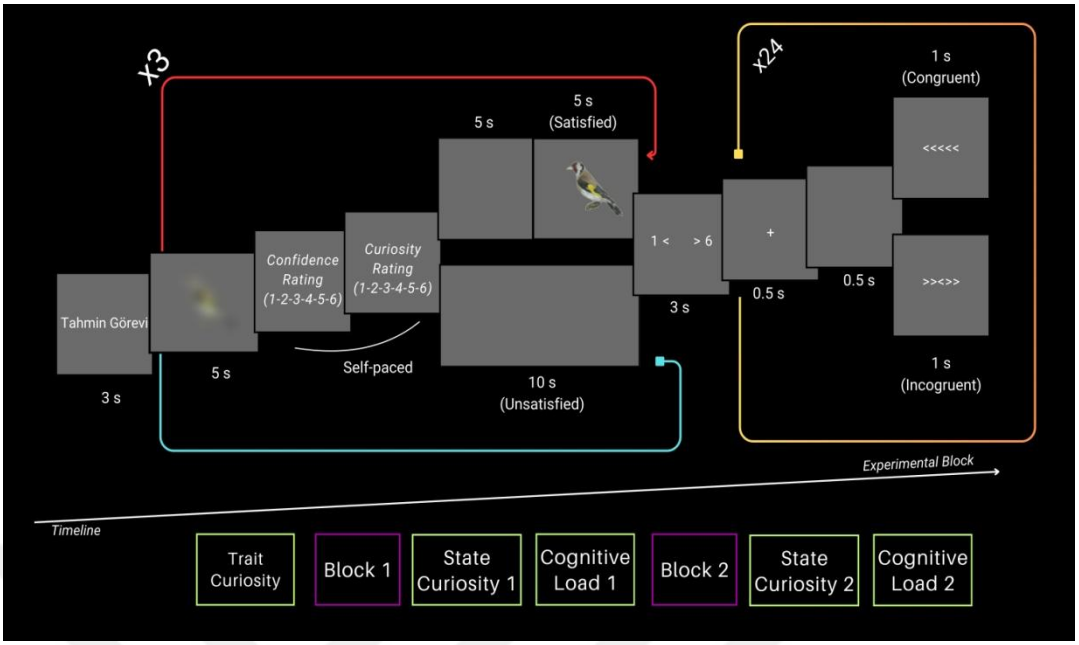
Each condition consisted of 5 blocks. Each block contained a curiosity task consisting of 3 trials followed by an Eriksen Flanker task consisting of 24 trials. During the transition from the curiosity task to the cognitive control task and from the control task to the curiosity task, a reminder screen about the new task was displayed (for the curiosity task: "Guessment Task", for the control task: "1 < > 6"). The flow of a trial in a curiosity task was as follows: 500 ms of fixation cross (*), 1000 ms of blank screen, 5000 ms of blurred image stimulus, participant's confidence level for their guesses on the clear object on a 6-Likert scale (1: not at all, 6: very much), participant's curiosity level to learn what the clear object on a 6-Likert scale (1: not at all, 6: very much), 5000 ms of blank screen (for induction of curiosity), 5000 ms of reply screen (clear version of the blurred image or a blank screen). The durations for the participants' responses for their confidence and curiosity levels were self-paced. After 3 trials of the curiosity task, the reminder screen for the cognitive control task was presented for 3000 ms and then the Eriksen flanker task was started. The flow of a trial in an Eriksen Flanker Task was as follows: 500 ms of the fixation cross (*), 500 ms of a blank screen, and 1000 ms of a flanker stimulus. Both congruent and incongruent stimuli had an equal probability of occurrence, set at 50% each. Stimuli were presented randomly. After 24 trials of the Eriksen flanker task, a reminder screen was presented for 3000 ms, and a new block was started.

Participants were instructed that the target stimulus was the arrow symbol in the center. If the target stimulus pointed to the right (>), they were instructed to respond by pressing the “6” key on the upper part of the keyboard with their right index finger; if it pointed to the left (<), they were to press the “1” key with their left index finger. Participants were also instructed to respond as quickly and accurately as possible in the cognitive control task. In the guessment task, the participants were instructed to try to figure out what is the real object in the blurry image. In the curiosity-satisfied condition, the clear version of the blurred image was presented. In the curiosity-unsatisfied condition, a blank screen was shown. The participants’ confidence and curiosity ratings for the blurred images were responded to by the keys 1, 2, 3, 4, 5, and 6 on the upper part of the keyboard.

All the visual stimuli, the flanker stimuli, the fixation cross, and the reminder screens were centered on the screen. The position of the fixation cross was the same as the location where the target stimulus would appear on the screen. The font and size of the fixation cross were the same as the flanker stimulus.

When the first five blocks were completed, participants filled out a state-curiosity scale and a CSL, respectively. Then, an instruction appeared on the screen telling the participants to take a brief break from the experiment before beginning the second part, and to press any button when they were ready. After that, the opposite curiosity manipulation, which also had a state-curiosity scale and CLS at the end, was started. After the experiment ended, the researcher informed the participants about the purpose of the study and asked for their opinions about the study. Each experiment lasted approximately 30 minutes. An illustration of the experimental flow of experiment 1 is shown in Figure 2.

Figure 2. An Illustration Of Experimental Flow In Experiment 1



2.4.1.4 Results

All analyses were performed with the IBM SPSS Statistics v.25. The following were considered to determine the normal distribution of the data: the Shapiro-Wilk test results, skewness and kurtosis scores, and visual examination of histograms and Q-Q plots (Ghasemi & Zahediasl 2012: 489). The decision was made to apply a parametric test, considering the robustness of ANOVA to normality violations (Norman 2010: 628) and its robustness in the presence of equal or nearly equal sample sizes in circumstances of homoscedasticity violations (Zimmerman 2004: 180). The statistical significance level was set at $p < .05$ for all applied analyses.

2.4.1.4.1 Results Related to Curiosity-Inducing Stimuli

A 2x2x2 mixed-design ANOVA was conducted to analyse whether there were between-subjects factors effects. The only within-subjects factor was the satisfaction of curiosity (SoC) with two levels: curiosity-satisfied (CS) and curiosity-unsatisfied (CUs). One of the between-subjects factors was the condition order (CO) with two levels: CS-CUs and CUs-CS. The other between-subjects factor was the stimuli list order (SLO) with two levels: ListA-ListB and ListB-ListA. The dependent variables (DVs) related to curiosity-inducing stimuli were the curiosity ratings and the confidence ratings. Additionally, the state-curiosity scores as a dependent variable

were analyzed for manipulation check purposes regarding the two curiosity conditions. Lastly, the cognitive load scores as a dependent variable were analyzed to determine whether there were any differences in cognitive effort between the two curiosity conditions combined with the cognitive control tasks. All ANOVAs were done separately for each DV.

For mean curiosity ratings, results showed that there was no statistically significant main effect of satisfaction of curiosity (SoC), $F(1, 28) = 0.889$, $p = .354$, $\eta_p^2 = .031$. There was no statistically significant main effect of both the stimuli list order (SLO), $F(1,28) = 0.101$, $p = .753$, $\eta_p^2 = .004$, and the condition order (CO), $F(1,28) = 2.414$, $p = .132$, $\eta_p^2 = .079$. All the interaction effects were statistically non-significant: between SoC and SLO, $F(1,28) = 0.050$, $p = .824$, $\eta_p^2 = .031$; between SoC and CO, $F(1,28) = 0.000$, $p = .993$, $\eta_p^2 = .000$; between SLO and CO, $F(1,28) = 0.071$, $p = .791$, $\eta_p^2 = .003$; between SoC, SLO, and CO, $F(1,28) = 0.126$, $p = .726$, $\eta_p^2 = .004$.

For mean confidence ratings, there was no statistically significant main effect of SoC, $F(1, 28) = 3.253$, $p = .082$, $\eta_p^2 = .104$. There was no statistically significant main effect of both the SLO, $F(1,28) = 0.124$, $p = .728$, $\eta_p^2 = .004$, and the CO, $F(1,28) = 1.576$, $p = .220$, $\eta_p^2 = .053$. All the interaction effects were statistically non-significant: between SoC and SLO, $F(1,28) = 0.921$, $p = .345$, $\eta_p^2 = .032$; between SoC and CO, $F(1,28) = 1.044$, $p = .316$, $\eta_p^2 = .036$; between SLO and CO, $F(1,28) = 0.556$, $p = .462$, $\eta_p^2 = .019$; between SoC, SLO, and CO, $F(1,28) = 0.156$, $p = .696$, $\eta_p^2 = .006$.

For state-curiosity scores, results showed that there was no statistically significant main effect of SoC, $F(1, 28) = 0.126$, $p = .725$, $\eta_p^2 = .004$. There was no statistically significant main effect of both the SLO, $F(1,28) = 0.911$, $p = .348$, $\eta_p^2 = .032$, and the CO, $F(1,28) = 0.019$, $p = .890$, $\eta_p^2 = .001$. All the interaction effects were statistically non-significant: between SoC and SLO, $F(1,28) = 1.730$, $p = .199$, $\eta_p^2 = .058$; between SoC and CO, $F(1,28) = 1.313$, $p = .262$, $\eta_p^2 = .045$; between SLO and CO, $F(1,28) = 1.646$, $p = .210$, $\eta_p^2 = .056$; between SoC, SLO, and CO, $F(1,28) = 3.419$, $p = .075$, $\eta_p^2 = .109$.

For cognitive load scores, results showed that there was no statistically significant main effect of SoC, $F(1, 28) = 3.619$, $p = .067$, $\eta_p^2 = .114$. There was no statistically significant main effect of both the SLO $F(1,28) = 0.677$, $p = .418$, $\eta_p^2 = .024$, and the CO, $F(1,28) = 0.031$, $p = .862$, $\eta_p^2 = .001$. All the interaction effects

were statistically non-significant: between SoC and SLO, $F(1,28) = 0.078$, $p = .782$, $\eta_p^2 = .003$; between SoC and CO, $F(1,28) = 0.402$, $p = .531$, $\eta_p^2 = .014$; between SLO and CO, $F(1,28) = 0.038$, $p = .847$, $\eta_p^2 = .001$; between SoC, SLO, and CO, $F(1,28) = 0.701$, $p = .410$, $\eta_p^2 = .024$.

2.4.1.4.2 Results Related to Cognitive Control Measurements

A 2x2 repeated-measures ANOVA was administered to analyse cognitive control performances since there was not any statistically significant effect of the between-subjects factors. SoC (CS, CUs) remained as one of the within-subjects factors, and the other within-subjects factor was congruency (congruent, incongruent). The DVs related to cognitive control were the reaction times, the percentage of correct responses, and the percentage of omission rates. For each DV, ANOVAs were done separately.

For mean scores of reaction times, the only statistically significant main effect was found for the congruency factor, $F(1, 31) = 94.774$, $p < .001$, $\eta_p^2 = .754$. Participants had lower mean reaction times for congruent stimuli ($M = 507$ ms, $SD = .063$) compared to incongruent ($M = 564$ ms, $SD = .052$). The main effect of SoC was statistically non-significant, $F(1, 31) = 0.339$, $p = .564$, $\eta_p^2 = .011$. There was no statistically significant interaction between SoC and congruency, $F(1, 31) = 1.978$, $p = .170$, $\eta_p^2 = .060$.

For mean scores of percentage of correct responses, the only statistically significant main effect was found for congruency factor, $F(1, 31) = 72.368$, $p < .001$, $\eta_p^2 = .700$. Participants had higher mean percentage of correct responses for congruent stimuli ($M = 98.07\%$, $SD = 1.887$) compared to incongruent ($M = 93.75\%$, $SD = 3.238$). The main effect of SoC was statistically non-significant, $F(1, 31) = 1.397$, $p = .246$, $\eta_p^2 = .043$. There was no statistically significant interaction between SoC and congruency, $F(1, 31) = 0.435$, $p = .515$, $\eta_p^2 = .014$.

For mean scores of omission rate, the only statistically significant main effect was found for the congruency factor, $F(1, 31) = 12.438$, $p = .001$, $\eta_p^2 = .286$. Participants had a lower total mean omission rate for congruent stimuli ($M = 1.33\%$, $SD = 1.495$) compared to incongruent ($M = 2.50\%$, $SD = 2.592$). The main effect of SoC was statistically non-significant, $F(1, 31) = 0.921$, $p = .345$, $\eta_p^2 = .029$. There was no statistically significant interaction between SoC and congruency, $F(1, 31) = 0.412$, $p = .526$, $\eta_p^2 = .013$.

2.5 EXPERIMENT-2: RANDOMISED-CONDITIONS WITH VISUAL STIMULI

As with experiment 1, experiment 2 also investigated the effect of conditions of satisfied and unsatisfied curiosity on the performance of cognitive control in the context of visual fact-seeking stimuli (i.e. blurred images). In experiment 2, conditions of satisfied and unsatisfied curiosity were presented randomly in a single block. In order to increase the uncertainty about whether participants would experience satisfied or unsatisfied curiosity, an experimental setting with random presentation was chosen in experiment 2.

2.5.1 Method

2.5.1.1 Participants

Twenty-eight students (n_{male} = 13, n_{female} = 15) from Giresun University's Vocational School of Health Services were recruited for Experiment-2. All the participants were young adults whose ages ranged from 18 to 26 (M_{age} = 20.11, SD = 1.548). All of the participants reported that they use their right hand dominantly. All the participants voluntarily took part in the study.

2.5.1.2 Materials

The same materials (MCI, CLS, and flanker stimuli) in Experiment-1 were used in Experiment-2 except for the changes in the visual stimuli lists and the purpose of using the state-curiosity scale of the MCI. The state-curiosity scale, which was used as a manipulation check between the satisfaction and dissatisfaction conditions in Experiment-1, was used to obtain an overall measurement depending on the sum of the satisfaction and dissatisfaction conditions in Experiment-2. Thus, it would be possible to investigate how the cognitive control performances were affected by the individual differences in the state-curiosity.

2.5.1.2.1 Visual Stimuli Used in Experiment-2

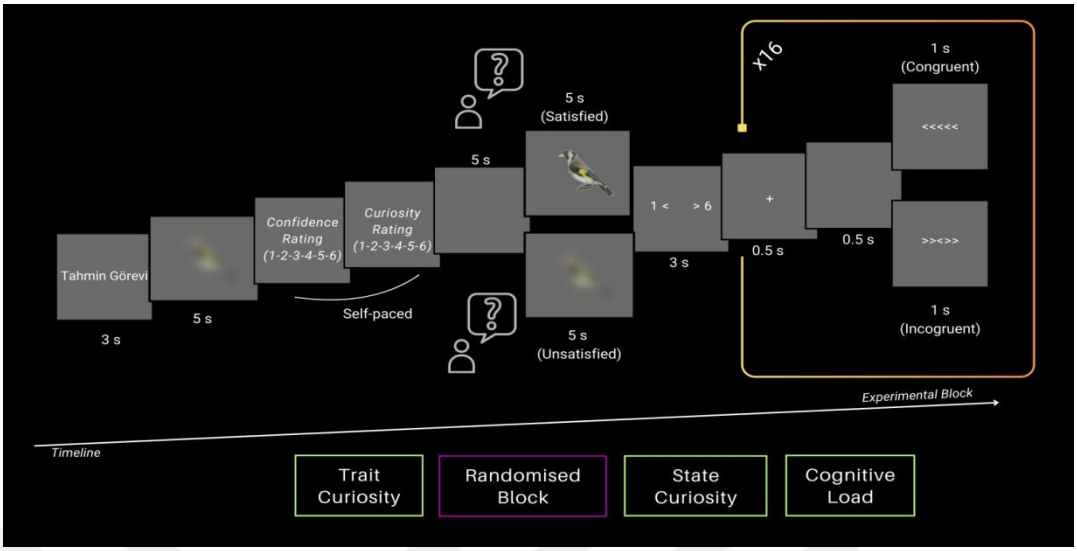
There were again two stimuli lists (List-A and List-B) but with a total of sixteen images for each. Both of the lists consisted of exactly the same images, but half of the images were used for the curiosity-satisfied condition and the other half for the curiosity-dissatisfied condition It should be noted that the lists in Experiment-1 were used for only one satisfaction/dissatisfaction condition. That is, the images

used for the satisfaction condition in List-A were used for the dissatisfaction condition in List-B, and the images used for the dissatisfaction condition in List-A were used for the satisfaction condition in List-B. The procedures for determining the images to be used and randomly assigning them to the lists were exactly the same as in Experiment- 2.

2.5.1.3 Procedure

The experiment-2 was a within design which was that all the participants took part in both the curiosity-satisfied and the curiosity-unsatisfied conditions as in the experiment-1 except for several differences in the flow of the experiment. In the experiment-1, the conditions for the satisfaction of curiosity were in separate blocks. Meaning that, the participants experienced the same conditions of satisfaction, followed by a control task, during the five sub-blocks. Then, they experienced the counter-condition throughout the new five blocks. However, in the experiment-2, the participants encountered the satisfaction conditions at random. In other words, after a condition of satisfaction, the future of satisfaction was uncertain. Either the same condition of satisfaction or a different condition of satisfaction might be experienced. There were two stimuli lists, as mentioned above, to counterbalance the stimuli list effect for curiosity manipulation. The experiment-2 consisted of 16 blocks in total. In the experiment-1, the curiosity task comprised the presentation of three consecutive blurred images, whereas in the experiment-2, only one blurred image was presented during the curiosity task. In the experiment-1, a blank screen was shown as a reply in the curiosity-unsatisfied condition, whereas in the experiment-2, the same blurred image was shown. The experiments lasted approximately 25 minutes for each participants. An illustration of the experimental flow of experiment 2 is shown in Figure 3.

Figure 3. An Illustration Of Experimental Flow In Experiment 2



2.5.1.4 Results

The same statistical analysis standards were held as in Experiment-1. As mentioned above, Experiment-2 had no condition order. Consequently, first, a 2x2 mixed-design ANOVA was administered to examine whether there were any differences in self-report between curiosity-inducing stimuli in each SoC condition. The dependent variables related to curiosity-inducing stimuli in Experiment-2 were the curiosity ratings and the confidence ratings. The within-subjects factor was the SoC condition, while the between-subjects factor was the type of the stimuli list (ListA, ListB). Because of that there was no statistically significant stimuli list effect, a 2x2 repeated-measures ANOVA was administered to analyse cognitive control performances. The within-subjects factors were SoC (CS, CUs) and congruency (congruent, incongruent). The DVs related to cognitive control were the reaction times, the percentage of correct responses, and the omission rates. For each DV, ANOVAs were done separately.

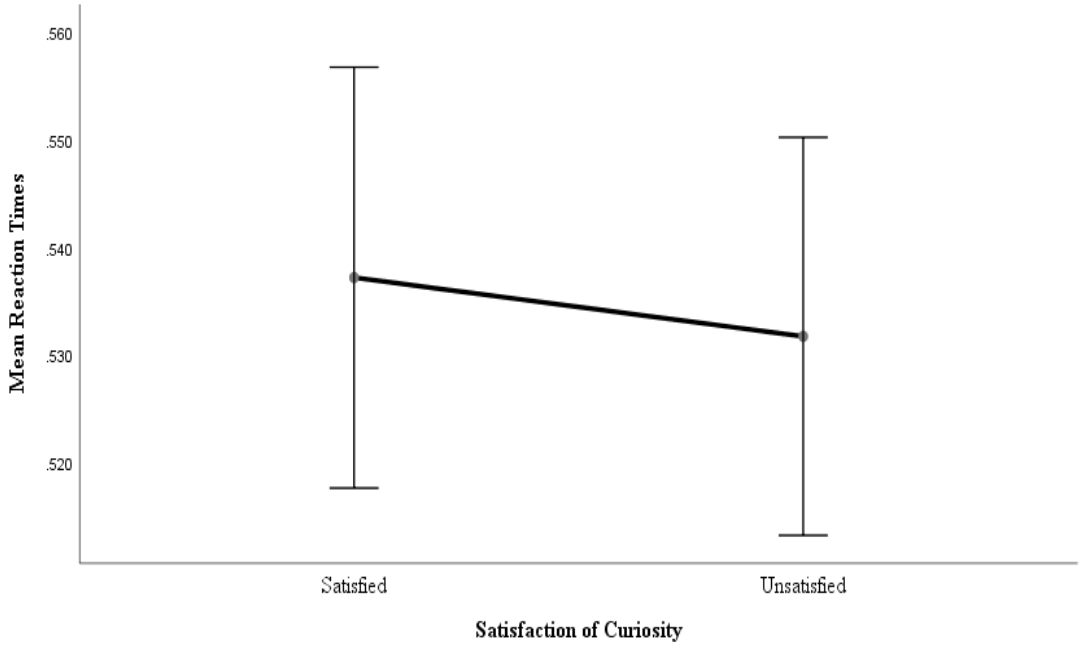
For mean curiosity ratings, results showed that there was no statistically significant main effect of SoC, $F(1, 26) = 2.406$, $p = .133$, $\eta_p^2 = .085$. The main effect of SLO was statistically non-significant, $F(1, 26) = 0.002$, $p = .961$, $\eta_p^2 = .000$. The interaction effect between SoC and SLO was also found statistically non-significant, $F(1, 26) = 1.562$, $p = .222$, $\eta_p^2 = .057$.

For mean confidence ratings, results showed that there was no statistically significant main effect of SoC, $F(1, 26) = 0.300$, $p = .588$, $\eta_p^2 = .011$. The interaction

effect between SoC and SLO was also found statistically non-significant, $F(1, 26) = 0.300$, $p = .588$, $\eta_p^2 = .011$. The main effect of SLO was statistically non-significant, $F(1, 26) = 0.534$, $p = .471$, $\eta_p^2 = .020$.

For mean scores of reaction times, there was a statistically significant main effect of SoC, $F(1, 27) = 5.336$, $p = .029$, $\eta_p^2 = .165$. Participants had higher mean reaction times in CS condition ($M = 0.537$ s, $SD = .050$) compared to CUs ($M = 0.532$ s, $SD = .048$). There was also a statistically significant main effect of congruency factor, $F(1, 27) = 123.159$, $p < .001$, $\eta_p^2 = .820$. Participants had lower mean reaction times for congruent stimuli ($M = 502$ ms, $SD = .048$) than incongruent ($M = 567$ ms, $SD = .054$). The main effect of SoC on mean reaction times is shown in Figure 4. The interaction between SoC and congruency was statistically non-significant, $F(1, 27) = 0.010$, $p = .923$, $\eta_p^2 = .000$.

Figure 4. The Main Effect of Satisfaction of Curiosity on Reaction Times in Experiment 2



** Error bars represent ±1 standard deviation*

For mean scores of percentage of correct responses, the only statistically significant main effect was found for congruency factor, $F(1, 27) = 18.129$, $p < .001$, $\eta_p^2 = .402$. Participants had higher mean percentage of correct responses for congruent stimuli ($M = 97.38\%$, $SD = 3.254$) compared to incongruent ($M = 94.06\%$, $SD = 4.426$). The main effect of SoC was statistically non-significant, $F(1, 27) =$

1.289, p = .266, η_p^2 = .046. There was no statistically significant interaction between SoC and congruency, F(1, 27) = 0.003, p = .959, η_p^2 = .000.

For mean omission rates, the main effect of SoC was found statistically non-significant, F(1, 27) = 1.743, p = .198, η_p^2 = .061. Also, there was no statistically significant main effect of congruency, F(1, 27) = 1.700, p = .203, η_p^2 = .059. The interaction between SoC and congruency was also found statistically non-significant, F(1, 27) = 0.515, p = .479, η_p^2 = .019.

2.6 EXPERIMENT-3: BLOCKED-CONDITIONS WITH VERBAL STIMULI

Experiment 3 was conducted to compare the effects of satisfied curiosity and unsatisfied curiosity conditions on cognitive control performance with verbal explanation-seeking stimuli. In experiment 3, as in experiment 1, blocked presentation was applied as the experimental setting.

2.6.1 Method

2.6.1.1 Participants

Twenty-seven students (n_{male} = 15, n_{female} = 12) from Giresun University's Vocational School of Health Services were recruited for Experiment-3. All the participants were young adults whose ages ranged from 19 to 25 (M_{age} = 20.59, SD = 1.390). Twenty-six of the participants reported that they use their right hand dominantly, while one participant was left-handed. All the participants voluntarily took part in the study.

2.6.1.2 Materials

The MCI, the CLS, and the flanker stimuli from Experiment 1 were used in the same manner in Experiment 3. The primary difference was the use of verbal questions as stimuli. Additionally, the presented stimuli were white, while the background color was black.

2.6.1.2.1 Verbal Stimuli Used in Experiment-3

Ten verbal questions that scored the highest were selected as the stimuli for Experiment-3 based on the criteria defined and the procedure executed in Study-3. Two lists (List A and List B) were created to be used in the experimental conditions

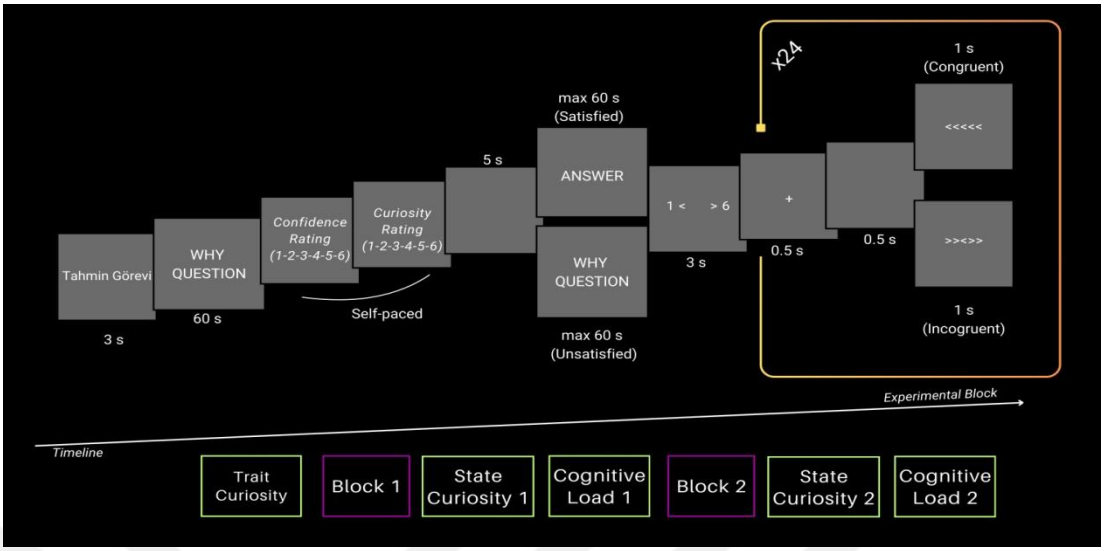
(curiosity-satisfied or curiosity-unsatisfied). The Why-Questions were ranked from highest to lowest in terms of their scores, and consecutive rows were grouped into pairs. The questions within each pair were randomly assigned to one of the two lists.

2.6.1.3 Procedure

The only difference between the procedures of experiment 3 and experiment 1 is the flow of the curiosity task. In the curiosity task of experiment 1, there were three trials, each presenting a different curiosity-inducing stimulus, while experiment 3 included only a single trial. In this trial, a verbal Why-Question was presented during the curiosity induction phase. Participants were asked to make guesses regarding the answer to this Why-Question. They were informed that the question would remain on the screen for a maximum of one minute, and that they could press any key to proceed to the evaluation questions (confidence and curiosity ratings) once they felt ready with their predictions.

After the evaluation questions, the reply screen appeared. For the curiosity-satisfied condition, the answer to the Why-Question was presented on the reply screen, and participants were instructed to try to comprehend it thoroughly. In the curiosity-unsatisfied condition, the question was repeated, and participants were informed that they could revise their first guesses. In both conditions, participants were told that the reply screen would remain on the screen for a maximum of one minute and that they could press any key to continue at their discretion. An illustration of the experimental flow of experiment 3 is shown in Figure 5.

Figure 5. An Illustration Of Experimental Flow In Experiment 3



2.6.1.4 Results

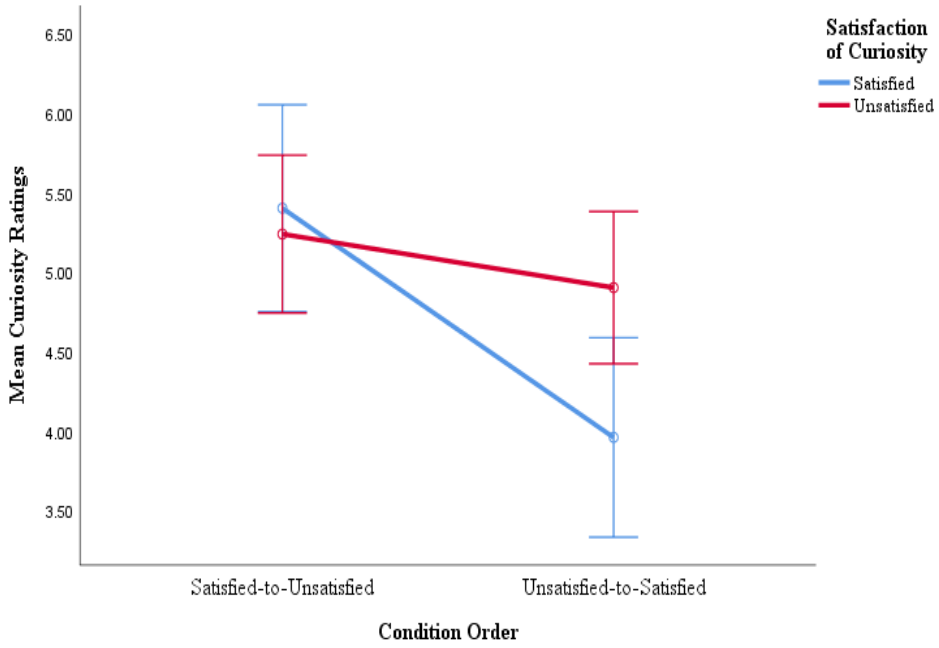
The statistical analysis standards and the procedure were the same as in experiment 1 except that since there were effects of condition order and stimuli list order in experiment 3, a 2x2x2x2 mixed-design ANOVA was applied in the analysis of cognitive control measurements. The SoC (CS, CUs) and the congruency (congruent, incongruent) were within-subjects factors, while the CO (CS-CUs, CUs-CS) and the SLO (ListA-ListB, ListB-ListA) were between-subjects factors. The DVs related to cognitive control were the same as in both of the previous experiments and for each DV, ANOVAs were done separately.

2.6.1.4.1 Results Related to Curiosity-Inducing Stimuli

For mean curiosity ratings, the main effect of SoC was statistically significant, $F(1, 23) = 5.276$, $p = .031$, $\eta_p^2 = .187$. The main effect of CO was also found statistically significant, F(1, 23) = 5.629, p = .026, ηp2 = .197. There was also a statistically significant interaction between SoC and CO, $F(1, 23) = 10.351$, $p = .004$, $\eta_p^2 = .310$. Paired-samples t-test revealed that, for CS-CUs order, there was no statistically significant difference of mean curiosity ratings between CS ($M = 5.40$, $SD = .668$) and CUs ($M = 5.24$, $SD = .831$), $t(12) = 1.820$, $p = .094$, $d = .21$. Meanwhile, for CUs-CS order, participants had a statistically significant lower mean curiosity ratings in CS ($M = 3.96$, $SD = 1.445$) compared to CUs ($M = 4.90$, $SD = .904$), $t(13) = -3.086$, $p = .009$, $d = .78$. The interaction effect of SoC and CO on

mean curiosity ratings is shown in Figure 6. There was no statistically significant main effect of SLO, $F(1, 23) = 0.235$, $p = .632$, $\eta_p^2 = .010$. All the remaining interaction effects were statistically non-significant: between SoC and SLO, $F(1, 23) = 0.001$, $p = .980$, $\eta_p^2 = .000$; between SoC, CO, and SLO, $F(1, 23) = 0.099$, $p = .756$, $\eta_p^2 = .004$.

Figure 6. The Interaction Effect of Satisfaction of Curiosity and Condition Order on Curiosity Ratings in Experiment 3



** Error bars represent ±1 standard deviation*

For mean confidence ratings, the main effect of SoC was statistically non-significant, $F(1, 23) = 0.043$, $p = .838$, $\eta_p^2 = .002$. The main effect of CO was statistically significant, $F(1, 23) = 5.149$, $p = .033$, $\eta_p^2 = .183$. Participants in CS-CUs order ($M = 3.59$, $SD = .883$) had lower mean confidence ratings than participants in CUs-CS condition ($M = 4.21$, $SD = .868$). The main effect of SLO was statistically significant, $F(1, 23) = 6.521$, $p = .018$, $\eta_p^2 = .221$. Participants in ListA-ListB order ($M = 3.58$, $SD = .899$) had lower mean confidence ratings than participants in ListB-ListA order ($M = 4.28$, $SD = .815$). All the interaction effects were statistically non-significant: between SoC and CO, $F(1, 23) = 0.001$, $p = .838$, $\eta_p^2 = .002$; between SoC and SLO, $F(1, 23) = 2.367$, $p = .978$, $\eta_p^2 = .093$; between CO and SLO, $F(1, 23)$

= 1.046, p = .317, η_p^2 = .044; between SoC, CO, and SLO, F(1, 23) = 0.011, p = .916, η_p^2 = .000.

For state-curiosity scores, all the main effects were statistically non-significant: for SoC, F(1, 23) = 0.079, p = .782, η_p^2 = .003; for CO, F(1, 23) = 0.327, p = .573, η_p^2 = .014; for SLO, F(1, 23) = 0.009, p = .924, η_p^2 = .000. All the interaction effects were statistically non-significant: between SoC and CO, F(1, 23) = 1.670, p = .209, η_p^2 = .068; between SoC and SLO, F(1, 23) = 0.735, p = .400, η_p^2 = .031; between CO and SLO, F(1, 23) = 2.688, p = .115, η_p^2 = .105; between SoC, CO, and SLO, F(1, 23) = 0.395, p = .536, η_p^2 = .017.

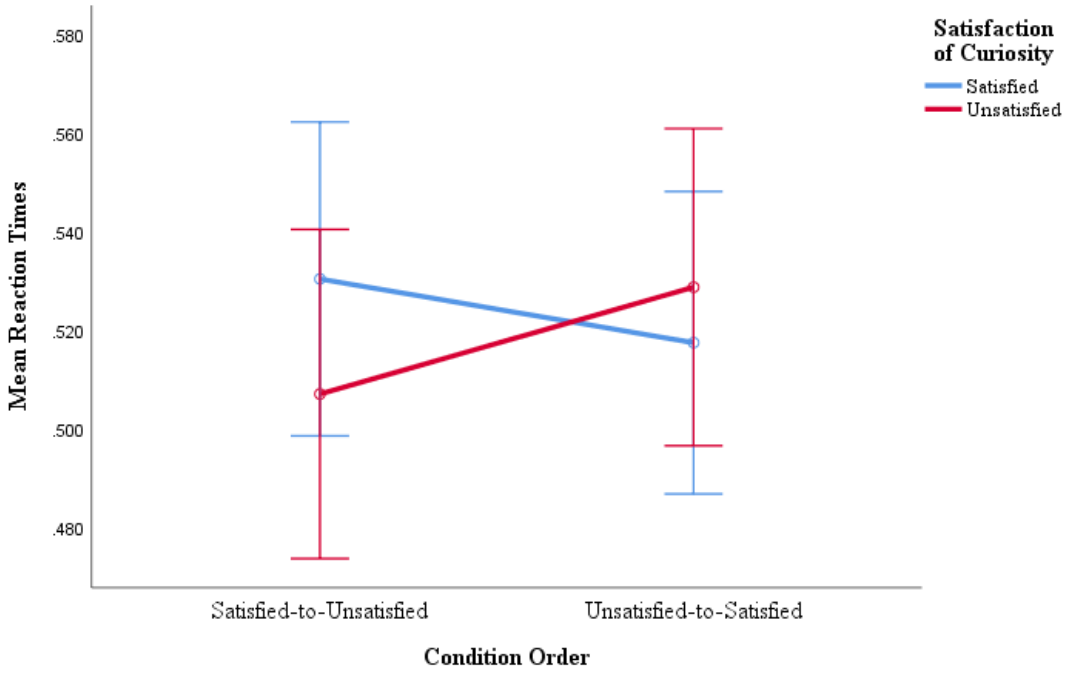
For cognitive load scores, all the main effects were statistically non-significant: for SoC, F(1, 23) = 0.860, p = .363, η_p^2 = .036; for CO, F(1, 23) = 3.820, p = .063, η_p^2 = .142; for SLO, F(1, 23) = 0.161, p = .692, η_p^2 = .007. All the interaction effects were statistically non-significant: between SoC and CO, F(1, 23) = 1.019, p = .323, η_p^2 = .042; between SoC and SLO, F(1, 23) = 1.654, p = .211, η_p^2 = .067; between CO and SLO, F(1, 23) = 3.056, p = .094, η_p^2 = .117; between SoC, CO, and SLO, F(1, 23) = 0.049, p = .828, η_p^2 = .002.

2.6.1.4.2 Results Related to Cognitive Control Measurements

For mean reaction times, the main effect of SoC was statistically non-significant, F(1, 23) = 1.815, p = .191, η_p^2 = .073. There was a statistically significant interaction between SoC and CO, F(1, 23) = 12.526, p = .002, η_p^2 = .353. Paired-samples t-test revealed that, for CS-CUs order, participants had a statistically significant higher mean reaction times in CS (M = 530 ms, SD = .058) compared to CUs (M = 507 ms, SD = .049), t(12) = 3.115, p = .009, d = .43. Meanwhile, for CUs-CS order, there was no statistically significant difference of mean reaction times between CUs (M = 529 ms, SD = .066) and CS (M = 517 ms, SD = .054), t(13) = -1.900, p = .080, d = .20. The interaction effect of SoC and CO on mean reaction times is shown in Figure 7. The main effect of congruency was statistically significant, F(1, 23) = 114.410, p < .001, η_p^2 = .833. Participants had lower mean reaction times for congruent stimuli (M = 488 ms, SD = .054) than incongruent stimuli (M = 554 ms, SD = .061). The interaction between SoC and congruency was statistically non-significant, F(1, 23) = 0.520, p = .478, η_p^2 = .022. All other interactions were statistically non-significant: between SoC and SLO, F(1, 23) = 0.053, p = .821, η_p^2 = .002; between SoC, CO, and SLO, F(1, 23) = 1.150, p = .295,

η_p^2 = .048; between congruency and CO, F(1, 23) = 0.148, p = .704, η_p^2 = .006; between congruency and SLO, F(1, 23) = 12.526, p = .002, η_p^2 = .004; between congruency, CO, and SLO, F(1, 23) = 2.393, p = .136, η_p^2 = .094; between SoC, congruency, and CO, F(1, 23) = 0.012, p = .913, η_p^2 = .001; between SoC, congruency, and SLO, F(1, 23) = 0.044, p = .836, η_p^2 = .002; between all within- and between-subjects factors, F(1, 23) = 0.161, p = .692, η_p^2 = .007; between CO and SLO, F(1, 23) = 1.182, p = .288, η_p^2 = .049. All the between-subjects effects were statistically non-significant: for CO, F(1, 23) = 0.001, p = .981, η_p^2 = .000, for SLO, F(1, 23) = 2.020, p = .169, η_p^2 = .081.

Figure 7. The Interaction Effect of Satisfaction of Curiosity and Condition Order on Reaction Times in Experiment 3



** Error bars represent ±1 standard deviation*

For mean percentages of correct response, there was only a statistically significant main effect of congruency, F(1, 23) = 33.489, p < .001, η_p^2 = .593. Participants had higher mean percentage of correct response for congruent stimuli (M = 98.49%, SD = 1.864) than incongruent stimuli (M = 93.36%, SD = 4.751). The main effect of SoC was statistically non-significant, F(1, 23) = 0.234, p = .633, η_p^2 =

.010. The interaction between SoC and congruency was statistically non-significant, $F(1, 23) = 0.016$, $p = .900$, $\eta_p^2 = .001$. All other interaction effects were statistically non-significant: between SoC and CO, $F(1, 23) = 2.178$, $p = .154$, $\eta_p^2 = .086$; between SoC and SLO, $F(1, 23) = 0.291$, $p = .594$, $\eta_p^2 = .013$; between SoC, CO, and SLO, $F(1, 23) = 2.572$, $p = .122$, $\eta_p^2 = .101$; between congruency and CO, $F(1, 23) = 1.358$, $p = .256$, $\eta_p^2 = .056$; between congruency and SLO, $F(1, 23) = 2.629$, $p = .119$, $\eta_p^2 = .103$; between congruency, CO, and SLO, $F(1, 23) = 0.558$, $p = .463$, $\eta_p^2 = .024$; between SoC, congruency, and CO, $F(1, 23) = 0.044$, $p = .836$, $\eta_p^2 = .002$; between SoC, congruency, and SLO, $F(1, 23) = 0.000$, $p = .986$, $\eta_p^2 = .000$; between all within- and all between-subjects factors, $F(1, 23) = 1.190$, $p = .287$, $\eta_p^2 = .049$; between CO and SLO, $F(1, 23) = 0.013$, $p = .911$, $\eta_p^2 = .001$. All the between-subjects effects were statistically non-significant: for CO, $F(1, 23) = 0.651$, $p = .428$, $\eta_p^2 = .023$ and for SLO, $F(1, 23) = 3.207$, $p = .086$, $\eta_p^2 = .122$.

For the mean percentage of omission rate, there was only a statistically significant main effect of congruency, $F(1, 23) = 7.570$, $p = .011$, $\eta_p^2 = .248$. Participants had a lower mean percentage of omission rate for congruent stimuli ($M = 0.99\%$, $SD = 1.329$) than incongruent stimuli ($M = 2.25\%$, $SD = 3.099$). The main effect of SoC was statistically non-significant, $F(1, 23) = 0.380$, $p = .544$, $\eta_p^2 = .016$. The interaction between SoC and congruency was statistically non-significant, $F(1, 23) = 0.004$, $p = .949$, $\eta_p^2 = .000$. All other interaction effects were statistically non-significant: between SoC and CO, $F(1, 23) = 0.226$, $p = .639$, $\eta_p^2 = .010$; between SoC and SLO, $F(1, 23) = 0.003$, $p = .958$, $\eta_p^2 = .000$; between SoC, CO, and SLO, $F(1, 23) = 0.008$, $p = .931$, $\eta_p^2 = .000$; between congruency and CO, $F(1, 23) = 0.017$, $p = .898$, $\eta_p^2 = .001$; between congruency and SLO, $F(1, 23) = 0.064$, $p = .802$, $\eta_p^2 = .003$; between congruency, CO, and SLO, $F(1, 23) = 1.400$, $p = .249$, $\eta_p^2 = .057$; between SoC, congruency, and CO, $F(1, 23) = 0.088$, $p = .769$, $\eta_p^2 = .004$; between SoC, congruency, and SLO, $F(1, 23) = 0.185$, $p = .671$, $\eta_p^2 = .008$; between all within- and all between-subjects factors, $F(1, 23) = 0.113$, $p = .740$, $\eta_p^2 = .005$; between CO and SLO, $F(1, 23) = 0.479$, $p = .496$, $\eta_p^2 = .020$. All the between-subjects effects were statistically non-significant: for CO, $F(1, 23) = 0.545$, $p = .468$, $\eta_p^2 = .023$ and for SLO, $F(1, 23) = 0.306$, $p = .586$, $\eta_p^2 = .013$.

CHAPTER III

GENERAL DISCUSSION

The present study aimed to investigate the effects of satisfied and unsatisfied curiosity on cognitive control. To achieve this, three separate experiments were conducted with distinct groups of young adult participants. Prior to the experimental studies, stimulus selection surveys were administered to determine the blurred images and the verbal why-questions stimuli to be used. These surveys were conducted online with participants who did not take part in the experiments and aimed to identify stimuli that elicited moderate-to-high levels of curiosity. Additionally, to compare participants' state-curiosity levels after satisfied and unsatisfied curiosity blocks in experiment 1 and experiment 3, as well as to control for individual differences in trait-curiosity across all experiments, the Turkish adaptation study of the Melbourne Curiosity Inventory (Naylor 1981) was administered. In experiment 1, satisfied and unsatisfied curiosity conditions were presented in separate blocks, using blurred images as curiosity-inducing stimuli. Experiment 2 also employed blurred images; however, satisfied and unsatisfied curiosity conditions were presented as randomized within a single block. Experiment 3 followed the same procedure as experiment 1 but replaced the blurred images with the verbal why-questions. In each experiment, a (satisfied/unsatisfied) curiosity condition was followed by a modified flanker task. Cognitive control performance was assessed through reaction time, percentage of correct responses, and omission rate obtained from the flanker tasks.

3.1 SUMMARY OF RESULTS

The findings of the current study showed that visual and verbal curiosity-inducing stimuli obtained from stimuli selection studies were able to generate moderate-to-high curiosity in the participants of the experiments on a 6-point Likert scale. In experiment 1 and experiment 3, participants' self-report cognitive load scores and self-report state-curiosity scores did not differ after the two condition

blocks. That is, in both experiments, participants reported similar levels of being in a curious state and cognitively challenged after two blocks.

Separate analyses of mean reaction time, mean percentage of correct responses, and mean omission rate measures of cognitive control performance revealed that, with exceptions in experiment 2 and experiment 3, these measures were generally unaffected by the satisfied/unsatisfied curiosity conditions. Only one hypothesis (H1) was supported in one of all experiments (i.e., experiment 2). This hypothesis suggested that there was a difference in the mean reaction time of the participants depending on the satisfaction of curiosity condition. Specifically, participants had significantly faster responses in the flanker task following the unsatisfied curiosity condition compared to the satisfied curiosity condition in experiment 2. When the trait-curiosity scores were controlled as a covariate, the previously significant p-value became non-significant. Additionally, only in experiment 2, the mean omission rates did not statistically differ between congruent and incongruent stimuli, regardless of the satisfied/unsatisfied curiosity conditions. In other words, the congruency effect on mean omission rates was absent only in experiment 2. Apart from this, across all experiments, a congruency effect was observed in all cognitive control measurements, regardless of the satisfied/unsatisfied curiosity conditions. That is, participants responded faster to congruent stimuli while demonstrating higher percentage of correct responses and lower omission rates.

In experiment 1, a statistically significant increase in response speed was observed in the second block across all curiosity condition orders . A similar effect was observed in experiment 3, but only in the satisfied curiosity to unsatisfied curiosity condition order (i.e., CS-CUs). However, in the unsatisfied curiosity to satisfied curiosity condition order of experiment 3 (i.e., CUs-CS), no statistically significant difference in response speed was found between the two blocks. In other words, following the unsatisfied curiosity condition for verbal why-questions, participants' response speed did not increase significantly, that is, no practice effect was observed. Additionally, in all curiosity condition orders of experiment 1 and in the CS-CUs condition order of experiment 3, the mean curiosity ratings of the participants' self-reports in both blocks did not differ statistically. However, in the CUs-CS condition order of the experiment-3, the curiosity ratings differed between the two blocks. Participants reported fewer curiosity ratings to the why-questions in the satisfied curiosity block following the unsatisfied curiosity block. When trait

curiosity scores were controlled as covariates, there was no significant change in results.

In the discussion section, the findings of experiment 3 will be evaluated first, followed by the findings of experiment 1 and experiment 2, respectively. Then, it will be questioned why there is no difference between the two curiosity conditions in the behaviors regarding congruent and incongruent stimuli. Finally, the lack of difference in state-curiosity scores between the satisfied/unsatisfied curiosity blocks in the experiment 1 and the experiment 3 will be discussed.

3.2 WHY WAS THERE A LACK OF A SIGNIFICANT PRACTICE EFFECT IN THE CUs-CS CONDITION OF EXPERIMENT 3?

Practice effect is known as the increase in task competence by repeatedly performing a task (Duff et al. 2012: 1117). Tasks that can be developed through practice, whether simple or complex, are combined under the concept of skill (Radvansky 2017: 247). Therefore, the increase in task competence with practice effect is related to the concept known as skill acquisition in the literature. For skill acquisition, some memory processes must be provided. In this case, the non-occurrence of the practice effect can be analysed in terms of memory processes. In other words, some memory-related processes during the CUs-CS condition must have had a negative effect on the memory processes required for the occurrence of the practice effect, so that sufficient skill acquisition (i.e., learning) could not occur. This negative effect on the skill acquisition process may be related to unsatisfied curiosity. Before speculating on how unsatisfied curiosity could have such an effect, it may be necessary to consider the possibility that this negative effect is related to satisfied curiosity.

Acquiring declarative knowledge before learning a skill may negatively affect skill learning processes (Radvansky 2017: 247). Therefore, it can be considered that satisfied curiosity condition instead of unsatisfied curiosity during CUs-CS condition may be effective in the non-occurrence of practice effect. However, if such a situation was the case, such a negative effect of the satisfied curiosity condition on the practice effect during the CS-CUs condition should have been observed. The findings of the present study do not indicate such a situation. Another support that satisfied curiosity may not have such a negative effect on memory comes from the study of Gruber and colleagues (2014). In this study, researchers ask participants a

series of trivia questions (e.g., where was the first musical instrument discovered?). In the interval between the questions and their answers, incidental human faces unrelated to these questions are presented. The findings of the study show that the human faces presented before the answers to the high-curiosity questions can be recognised better than the human faces presented before the answers to the low-curiosity questions. In addition, participants were also better able to recall information that they were highly curious about than information that they were lowly curious about. In other words, although it is not a case of skill acquisition, the previous finding suggests that satisfied curiosity might not negatively affect the consolidation processes of memory for irrelevant information, but on the contrary, it might consolidate the memory for this information. Therefore, it seems more plausible to think that the findings in the current study are related to unsatisfied curiosity rather than satisfied curiosity.

At this point, then, we may start reasoning about how unsatisfied curiosity might have an effect on memory processes and negatively affect skill acquisition. The curiosity-inducing questions in experiment 3 are mostly related to our general knowledge about the world in everyday life (e.g., why do we dress in layers for our upper body in extremely cold weather, but not for our lower body?) Such general knowledge about the world is referred to in the literature by the term ‘schemas’ and is associated with semantic memory (Radvansky 2017: 397). Therefore, it may be necessary to look for the effects of unsatisfied curiosity in experiment 3 in the nature of semantic memory and schema processes.

Semantic memory contains many concepts and their associations with each other (Radvansky 2017: 380). Except in cases where there is a special focus on information, semantic processes operate in a way that provides access to a partial part of the memory (Radvansky 2017: 408). In this context, curiosity about the answer to the questions may have increased the focus on information (Gottlieb et al. 2014: 15503). Therefore, participants may have started to access a larger part of the semantic memory rather than a partial part. This may have led to the awareness of an information-gap (Loewenstein 1994: 78) that there may be other guesses about the answer to the questions other than the first ones that come to mind. When curiosity is not satisfied, the awareness of information-gap may continue. According to Berlyne's (1954) theory of curiosity, this is a conflict situation related to uncertainty that needs to be resolved and the mind needs to provide a solution to this situation,

such as exploration. Here it may be necessary to reconsider the nature of the curiosity-inducing questions used in Experiment 3. These questions are related to schemas of general knowledge about the world. These schemas consist of some concepts and fragments of concepts in semantic memory. A feature of schemas is the ability to perform 'memory reconstruction' processes by using fragments in memory to fill gaps in memory (Radvansky 2017: 401). Now, suppose someone is curious about a topic and there is a book in front of them to find out about it, will they start looking through the book? Or someone wants to play with a new toy with their child and there are a lot of logo pieces in front of them, would they try to put these logo pieces together in different ways? The answer to these two questions is most likely yes. The mind may also be doing this in a state of unsatisfied curiosity where it cannot find an answer from outside. That is, the mind enters a memory reconstruction process within itself.

In order to facilitate the memory reconstruction process, it is necessary to initiate a memory search (i.e., activating of memory traces) in the relevant parts of the semantic memory associated with the information-gap to be reconstructed (Radvansky 2017: 380). To access the relevant parts of the memory, the search should be narrowed. This process is dependent on the inhibition and updating functions of cognitive control, which prevent irrelevant parts of the memory from interfering with the memory search process and ensure that the relevant parts of the memory are kept active in this search process (Dudukovic & Kuhl 2017: 370; Radvansky 2017: 380). It may be the reason why the practice effect was not observed in experiment 3. Because inhibition and updating functions of cognitive control also play a role in the encoding processes of new information (Dudukovic & Kuhl 2017: 360). While inhibition tries to prevent situations that will lead to distortion in the encoding of new information, updating ensures that this new information is kept active and reinforced. It is a widely accepted view in the literature that the resources of the mind are limited and therefore a choice should be made about where to direct the resources (Shenhav et al. 2013). According to the findings in experiment -3, it seems that the mind may prefer to direct these resources to the memory reconstruction process due to the unsatisfied curiosity condition instead of learning the cognitive control task better. Speculatively, unsatisfied curiosity may negatively affect the practice effect through such a mechanism.

In short, curiosity may have led participants to access a larger portion of semantic memory. The subsequent unsatisfied curiosity condition may have led to the initiation of the memory reconstruction process in order to fill the resulting information-gap or to reduce the conflicts related to uncertainty. For the reconstruction process, the search in memory needs to be narrowed and the inhibition and updating functions of cognitive control need to be used for this narrowing process. Since the resources related to these functions were involved in the memory reconstruction process related to unsatisfied curiosity, they may have negatively affected the learning process of the skill related to the task in the experiment. Thereby, resulting in a lack of a significant practice effect.

3.3 WHY THE MEAN CURIOSITY RATINGS DECREASED IN THE SECOND BLOCK OF THE CUs-CS CONDITION ORDER IN THE EXPERIMENT-3?

It can be deduced from daily life observations that different people may be interested in different subjects. Such a phenomenon is also likely to pose difficulties for laboratory experiments that require strict controls. Therefore, it may also be possible to explain the decrease in the curiosity ratings in the experiment-3 directly by the participants' general lack of interest in the questions. However, the counterbalancing of stimuli list order and the lack of main or interaction effects of stimuli list order on mean curiosity ratings may, at least for the time being, require interpreting the findings beyond the stimuli used.

According to the findings of Wiggin et al. (2018) and Huang and Wang (2018), it was previously mentioned that unsatisfied curiosity can bring desire for reward. Accordingly, participants should have had more desire to know the answer to the questions following the unsatisfied curiosity block. That is, they should have given more curiosity points. However, the findings of the present study point to the opposite. The decrease in curiosity scores after the unsatisfied curiosity block may again be due to the effect of unsatisfied curiosity on semantic memory processes.

It has been suggested that in the case of unsatisfied curiosity, a memory reconstruction process may start in order to fill the information-gap or resolve the conflict, and therefore memory search will be narrowed down in order to access the relevant parts of the memory. Therefore, it is possible that the drop in curiosity scores after the unsatisfied curiosity block may have been caused by this memory

search narrowing process. Since the mind tries to access certain parts of the memory and prevent the activation of other parts through this memory search narrowing process, it may not be able to allocate resources to a wide range of semantic processing for the new questions that come after the unsatisfied curiosity block. Therefore, alternatives other than the initial (general) guesses in semantic memory may not have been assumed for the answers to these new questions. This may have led to a relatively low level of curiosity about new questions in terms of all three theories of curiosity. This means that there is not enough awareness of informationgap according to Loewenstein's (1994) theory or not enough conflicts to be resolved according to Berlyne's (1954) theory, whereas according to the learning progress theory (Gottlieb et al. 2013) new questions are considered relatively more predictable. In short, the process of providing access to a certain part of the memory for the purpose of memory reconstruction due to unsatisfied curiosity may have prevented access to other parts of the memory, leading to insufficient alternative guesses for new questions, and thus, relatively less curiosity.

Such a proposed mechanism for the effect of unsatisfied curiosity about why-questions on semantic memory processes through the inhibition and updating functions of cognitive control offers some predictions that can be tested in future studies. First, if there is an inhibition process that prevents the activation of certain parts of semantic memory, unsatisfied curiosity might be expected to reduce performance in tasks involving response inhibition such as go/no-go and stop-signal. Participants may have difficulty inhibiting responses in these tasks due to the unsatisfied curiosity condition, and thus may exhibit more commission errors or slower responses. Second, if updating is used to keep relevant memory segments active for memory reconstruction, we can expect unsatisfied curiosity to degrade performance in working memory tasks where updating is required. For example, in the n-back task, participants may find it difficult to keep the stimuli in the task active in working memory due to the unsatisfied curiosity condition, and thus may exhibit fewer hits and more false alarms or misses. Third, participants' performance may be impaired in the Stroop task, in which a semantic process is attempted to be inhibited. Resources spent on inhibition of semantic processes in the unsatisfied curiosity condition may be insufficient for inhibition of the semantic process in the Stroop task, so that participants' responses in the unsatisfied curiosity condition may be slowed down or more incorrect responses may occur to incongruent stimuli. Finally,

unsatisfied curiosity may increase the formation of false memories. For example, in the DRM paradigm, participants are presented with a specific list of words and then given a recall test (Radvansky 2017: 565). During the recall test, participants are presented with new words that are not on the word list but have a high semantic association with these words. When the participants state that these new words are also in the list they read, this is an example of false memory. In other words, participants think that they have read a word that they have not actually read. The emergence of false memory may be caused by problems in the encoding process of the presented list or in the process of accessing the memory of this list (Radvansky 2017: 568). Therefore, unsatisfied curiosity may affect the encoding process of the list as well as the retrieval process, and may make it difficult to distinguish new words with high semantic connotations and cause them to be remembered incorrectly.

The lack of a sufficient practice effect after the unsatisfied curiosity condition may raise a new question about the cause of the incidental memory effect in Gruber et al. (2014). Gruber and colleagues (2014: 492) reported that the enhancement in memory performance for the incidental stimulus may be attributable to the anticipation process prior to the acquisition of information that has generated high levels of curiosity. Although the method of the present study did not include an incidental stimulus presented during the anticipation process, it seems that satisfied and unsatisfied curiosity conditions may have different effects on learning processes regarding stimuli other than the object of curiosity. In the present study, it appears that the satisfied curiosity condition may have a neutral or positive effect on the learning of curiosity-irrelevant stimuli, whereas the unsatisfied curiosity condition may have a negative effect. Therefore, the results observed in Gruber and colleagues' (2014) study may be due to another mechanism related to the satisfaction of curiosity instead of the anticipation process. Perhaps because curiosity is satisfied, these incidental stimuli may be considered worth encoding. This issue can be investigated in future studies by comparing the memory performance for incidental stimuli under satisfied and unsatisfied curiosity conditions.

3.4 WHY WERE THE RESULTS IN EXPERIMENT 1 NOT SIMILAR TO THOSE IN EXPERIMENT 3?

The reason why unsatisfied curiosity did not lead to a negative effect in the practice effect and a decrease in curiosity scores during the CUs-CS condition of Experiment 1 may be due to the use of blurred images as a curiosity-inducing stimulus. The curiosity generated by blurred images is based on perceptual uncertainty and less related to semantic memory than why-questions. When trying to identify the object in the blurred image, concepts in semantic memory (e.g., cat, car, tree) need to be activated, but ultimately perceptual (i.e., visual) information is needed to reach this recognition. However, in order to establish a cause-effect relationship in why-questions, existing schemas and other concepts and associations in semantic memory must be activated. Thus, the blurred images in experiment 1 may not have had an effect on memory processes due to the unsatisfied curiosity condition as the why-questions in experiment 3.

In order to have an effect on memory processes for unsatisfied curiosity, the stimuli may not only need to be verbal, but nonverbal stimuli may also elicit this effect. For example, the magic tricks stimuli recently developed by Ozono and colleagues (2020) can be used in future studies for this investigation. In magic tricks, a situation of uncertainty arises because some expectations about the occurrence of events are violated (Ozono et al. 2020: 189). Therefore, curiosity may arise as to why such uncertainty arises. Satisfying curiosity about how magic tricks occur may require more complex cognitive processes such as perspective taking, rethinking general knowledge of the world (i.e., schemas), and establishing cause-and-effect relationships between actions. Therefore, nonverbal stimuli like magic tricks may require more cognitive resources than blurry images and may have a similar effect to why-questions in the unsatisfied curiosity condition.

3.5 INSIGHTS FROM THE FINDINGS IN EXPERIMENT 2

Compared to experiment 1, it can be said that the random presentation manipulation in experiment 2 had a different effect on cognitive control performance. This effect appears to enhance performance in terms of control, both in general with respect to the task in which curiosity was induced and in particular with respect to the condition of being satisfied or unsatisfied. The interpretation of a general effect can be based on the fact that mean omission rates did not differ

between congruent and incongruent stimuli regardless of satisfied/unsatisfied curiosity conditions. The difference in response speed between satisfied and unsatisfied curiosity conditions can be interpreted as a particular effect of random presentation.

According to Perri et al. (2017: 9), omission errors can be caused by weaknesses in attention or behaviour preparation processes. Since there is a conflict in attention and response preparation processes, more omission errors may occur in incongruent stimuli (Egner 2007: 381). Therefore, some factors in experiment 2 may have reduced the omission rate for incongruent stimuli by causing changes in attention and/or response preparation processes. Since a statistically significant main and/or interaction effect of the satisfaction of curiosity condition was not observed in the mean omission rate findings of experiment 2, it can be considered that the task in which curiosity was tried to be generated had a decreasing effect on omission rates. That is, aside from seeing or not seeing the clear version of the blurred image, the factor enhancing attention and/or response preparation processes could be the process of guessing what the object in the blurred image is. The guessing process in experiment 2 may have led to an increase in attention to the visual field, where visual cues were used to overcome current uncertainty (Gottlieb et al. 2014: 15503). The fact that no congruency effect was observed in omission rates in the satisfied curiosity condition in which uncertainty was removed may indicate the emergence of a general preparatory attention process (Drisdelle et al. 2023: 2505). That is, the process of attentional regulation may not be an immediate response to unresolved perceptual conflicts. In the random presentation, the uncertainty about whether the current uncertainty and/or the next uncertainty would be resolved may have contributed to the increase in the attentional process, as it created a relatively high perception of uncertainty compared to the whole block presentation in experiment 1. For example, in a very recent study, Prasad and Hommel (2024:1) found that attention to stimuli in the visual field may increase under high uncertainty. Since the uncertainty based on the blurred images in experiment 1 did not produce a similar effect on the mean omission rates, the uncertainty brought about by randomised presentation may have an additional effect on attention, leading to better processing of stimuli and a reduction in omission rate. In future studies, experimental designs in which different uncertainty levels are controlled and measurements of attention and

behaviour preparation processes are included will contribute to the relationship between curiosity and cognitive control.

In the unsatisfied curiosity condition, the acceleration of response times without a speed-accuracy trade-off can be interpreted as enhancing cognitive control performance. The occurrence of this enhancement in the unsatisfied curiosity condition may be related to temporal uncertainty. Temporal uncertainty is defined as the predictability of when the stimulus will be exposed (Rolke & Hofmann 2007: 522). Low temporal uncertainty occurs if the predictability of the timing is high and high temporal uncertainty occurs if it is low. According to Denison et al. (2018: 11092), people may engage in heuristic decisions in situations of uncertainty. The generation of desire for reward by unsatisfied curiosity (Wiggin et al. 2018) may have arisen as a desire for a stimulus without perceptual conflict. In addition, because of the random presentation, there is a probability of encountering a conflict-free stimulus in the near future. Since participants may have a desire for reward after unsatisfied curiosity, they may have regulated their behaviour with the heuristic that a conflict-free stimulus would be presented in the next condition. This may have generated a perception of low temporal uncertainty. Rolke and Hofmann (2007: 525) state that low temporal uncertainty can lead to better processing of stimuli, better preparation of behaviours and thus faster responses. Therefore, in the unsatisfied curiosity condition, a heuristic judgement that a conflict-free stimulus will be seen in the next condition may have been made and low temporal uncertainty perception may have occurred. As a result, participants may have started to be more focused and to react faster. Since a conflict-free stimulus was seen in the satisfied curiosity condition, a desire for it, and thus a heuristic decision and perception of low temporal uncertainty may not have occurred.

It may be necessary to be cautious to state that the findings in experiment 2 are related to curiosity. These results may only be due to the fact that the blurred images contain perceptual uncertainty. In future studies, semantic stimuli such as trivia questions or why-questions could be used to better understand whether changes in attention processes are related to a general state of curiosity.

3.6 WHY WERE THE HYPOTHESES ABOUT THE INTERACTION BETWEEN THE SATISFACTION OF CURIOSITY CONDITION AND THE STIMULUS CONGRUENCY NOT SUPPORTED?

The answer to this question may be related to the nature of curiosity. Curiosity wants to seek knowledge. So, what is a knowledge? Where it can be found? Inside or outside? By imagination, as Albert Einstein famously said, or by experiment and experience? What is being tried to say is that the body cannot produce its own food from within, it has to get it from outside. But knowledge is both internally produced and externally acquired. Therefore, it may not be surprising that an information-seeking mechanism, i.e., curiosity, has the flexibility to pay attention to both internal and external processes. Thus, when comparing state-curiosity scores between satisfied and unsatisfied blocks, participants may be paying similar levels of attention to external stimuli in the flanker task, as they self-reported similar curiosity scores in both conditions. Therefore, responses to congruent and incongruent stimuli may not differ between satisfied and unsatisfied curiosity conditions. Thus, comparing both curiosity conditions with neutral stimuli may also provide new insights into the relationship between curiosity and attentional processes. A general state of curiosity, independent of the satisfied and unsatisfied condition, may lead to better attention to external stimuli compared to neutral stimuli. Conversely, attention to internal processes arising from curiosity may reduce performance by relatively decreasing attention to external stimuli. Most interestingly, curiosity may affect control performance in a similar way to neutral stimuli. In such a scenario, how can a system that deals with uncertainties and information processing also influence behaviour like a neutral stimulus?

It is obvious that the behavioural methods and conceptual structures of psychology alone cannot answer this question. The good news is that the neuroscience literature has made considerable steps forward in the study of curiosity, especially in the last 15 years (e.g., Blanchard et al. 2015; Gruber et al. 2014; Kang et al. 2009; Kidd & Hayden 2015; Marvin et al. 2020; van Lieshout et al. 2018). Berlyne's (1954) theory of conflict-based curiosity has been supported by studies observing activation in brain regions associated with conflict-monitoring during the induction of curiosity (Cervera et al. 2020: 51; Jepma et al. 2012: 1). In the light of these findings, researchers pointed out that curiosity may have a close relationship with cognitive control processes. However, there are still questions to be answered

and explored about how the conflict involved in curiosity affects and interacts with mental processes and neural mechanisms of these processes. The findings of the present study suggest that the effect of conflict involved in curiosity on cognitive control tasks may be different from the effect of affective conflict as in the case of social exclusion. For example, Wang and Sha (2018: 1714) found that participants exposed to social exclusion had attenuated brain activations related to conflict detection and inhibition of responses in a flanker task and responded more slowly to incongruent stimuli at the behavioural level. Since the present study did not include any neurophysiological measurements, nothing can be said about brain activations during the two curiosity conditions. However, none of the experiments in the present study yielded a result such as social affective conflict effect at the behavioural level. Since neurophysiological measurements were not included in the present study, it can only be theoretically inferred that the experimental stimuli create conflict. Therefore, there is a limitation in evaluating the significant results in experiment 2 and experiment 3 within a conflict framework. In future studies, methods in the field of neuroscience can be expected to provide enlightening contributions in this regard.

3.7 THE ISSUE OF STATE-CURIOSITY SCORES

Specific to experiment 1 and experiment 3, the lack of a difference between participants' self-reported state-curiosity scores between satisfied and unsatisfied curiosity blocks contradicts the findings of Huang and Wang (2018) and Wiggin et al. (2018). This may be due to a methodological problem related to the state-curiosity scale used in the present study or the weakness of the experimental manipulation. According to the results of the adaptation study in the present study, the scale is highly reliable. In the first place, this may indicate the weakness of the experimental manipulation. However, there was no reflection in participants' self-report state-curiosity scores during the CUs-CS condition of experiment 3, in which self-report curiosity ratings for stimuli decreased. On the other, behavioural data can be interpreted as indicating that the experimental manipulation worked in some way. One reason for the lack of difference in state-curiosity scores may be that the items in Trait-C and State-C forms are very similar to each other and the participants may have responded by rote. The fact that the participants were participating in a psychological experiment for the first time may have created a general state of curiosity about the experience itself.

3.8 CONCLUSION

Unsatisfied curiosity may have different cognitive effects depending on the type of curiosity-inducing stimulus. In experiment 3, there was evidence that the unsatisfied curiosity condition for answering why-questions about general world knowledge may weaken the acquisition of skills for another task. Moreover, another result from experiment 3 suggests that unsatisfied curiosity with why-questions may lead to relatively low curiosity about other questions. However, experiment 1 provides evidence that a similar effect does not occur in the unsatisfied curiosity condition for the clear version of objects in blurred images. These results suggest that epistemic and perceptual curiosity may exert different effects when unsatisfied. Therefore, it offers a new perspective on the distinction between epistemic and perceptual curiosity. The effect of unsatisfied epistemic curiosity on memory processes is discussed in terms of the relationship between the memory reconstruction processes of semantic memory for schemas and the inhibition and updating functions of cognitive control.

Unsatisfied curiosity may also have different cognitive effects depending on the nature of the experimental setting. In Experiment 1, the satisfied and unsatisfied curiosity conditions were presented in separate blocks, with the same curiosity conditions appearing consecutively, whereas in Experiment 2, the satisfied/unsatisfied conditions were presented within a single block in a randomised order. These two different experimental environment manipulations highlight that the level of uncertainty regarding whether the current state of curiosity and the subsequent state of curiosity will be satisfied may have different effects on the relationship between unsatisfied curiosity and cognitive control. In experiment 2, cognitive control performances may be affected both in a specific way for the satisfaction of curiosity condition and in a general way for the guessment process in the prediction task. Participants responded faster in the unsatisfied curiosity condition compared to the satisfied curiosity condition, showing no speed-accuracy trade-off. On the other hand, no congruency effect was observed in participants' mean omission rates, independent of the satisfaction of curiosity condition. However, similar findings regarding mean reaction time and mean omission rate were not found in experiment 1. The relationship between unsatisfied perceptual curiosity and cognitive control processes is discussed within the framework of uncertainty and attention.

In summary, the present study suggests that unsatisfied curiosity may have different effects on cognitive control performance depending on the nature of the curiosity-inducing stimulus and the level of uncertainty of the experimental environment.

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APPENDICES

APPENDIX 1: APPROVAL OF THE SOCIAL AND HUMANITIES ETHICS ÇANKAYA UNIVERSITY

T.C.
ÇANKAYAÜNİVERSİTESİREKTÖRLÜĞÜ

Sayı : E-31115241-050.99-153062 11.05.2024
Konu : Etik Kurul Kararı

SOSYAL BİLİMLERİ ENSTİTÜSÜ MÜDÜRLÜĞÜNE

İlgi : a) 11.03.2024 tarihli ve E-22374944-100-149768 sayılı yazı.
b) 06.05.2024 tarihli ve E-90705970-100-152853 sayılı yazı.

Enstitünüz Psikoloji Anabilim Dalı Tezli Yüksek Lisans Programı 202297006 numaralı öğrencisi Hüseyin Arda ÖZDEMİR'in "Tatmin Olmayan Merakın Bilişsel Kontrol Süreciyle İlişkisi" konulu Yüksek Lisans tezinde kullanılacak olan anketlerin Üniversitemiz Bilimsel Araştırma ve Yayın Etiği Kurulu tarafından değerlendirilmesi talebi, Çankaya Üniversitesi Sosyal ve Beşeri Bilimler Bilimsel Araştırma ve Yayın Etiği Kurulu tarafından değerlendirilmiş ve uygun görülmüştür.

Bilgilerinizi ve ilgiliye bilgi verilmesini rica ederim.

Prof. Dr. Hadi Hakan MARAŞ
Rektör

Ek: Etik Kurul Kararı (119)(8 sayfa)

APPENDIX 2: INFORMED CONSENT IN ALL EXPERIMENTS

ARAŞTIRMA GÖNÜLLÜ KATILIM FORMU

Bu çalışma; merak ve bilişsel süreçler arasındaki ilişkiyi incelemeyi amaçlamaktadır. Çalışma Hüseyin Arda Özdemir tarafından yürütülmektedir.

- Bu çalışmaya katılımınız gönüllülük esasına dayanmaktadır.
- Çalışmanın amacı doğrultusunda size birtakım görsel veya yazılı uyaranlar sunulacak ve bu uyaranlar hakkında bazı değerlendirmelerde bulunmanız istenecekir. Bunun yanı sıra bilişsel süreçlerinizi değerlendirebilmek amacıyla standardize edilmiş bir görevi yerine getirmeniz beklenmektedir. Uyaranların sunumu ve standardize görevin detayları deneyde belirtilecektir.
- Araştırmada katılımcıların isimleri gizli tutulacaktır; isminizi yazmak veya kimliğinizi açığa çıkartacak herhangi bir bilgiyi paylaşmak zorunda değilsiniz.
- Araştırma kapsamında toplanan veriler, sadece bilimsel amaçlar doğrultusunda kullanılacak, araştırmanın amacı dışında ya da bir başka araştırmada kullanılmayacak ve gerekmesi halinde, sizin (yazılı) izniniz olmadan başkalarıyla paylaşılmayacaktır.
- Talep ettiğiniz takdirde sizden toplanan verileri inceleme hakkına sahipsiniz.
- Sizden toplanan veriler araştırma boyunca korunacak ve araştırma bitiminde arşivlenecek veya imha edilecektir.
- Katılımınız süresince herhangi bir rahatsızlık duyarsanız çalışmadan istediğiniz zaman ayrılabilirsiniz. Bu durum gerçekleştiğinde, sizden toplanan veriler çalışmadan çıkartılacak ve imha edilecektir.

Gönüllü katılım formunu okumaya ve incelemeye ayırdığınız vakit için teşekkür ederim. Çalışma hakkındaki sorularınızı mail adresime (xxxx@xxxxxxxx) yöneltebilirsiniz.

Bu çalışmaya tamamen kendi rızamla, istediğim takdirde çalışmadan ayrılabileceğimi bilerek verdiğim bilgilerin bilimsel amaçlarla kullanılmasını kabul ediyorum.

Katılımcı Ad ve Soyadı:

İmza:

Tarih:

APPENDIX 3: DEMOGRAPHIC FORM IN ALL EXPERIMENTS

KATILIMCI BİLGİ FORMU

Katılımcı Numarası:

Cinsiyet:

Yaş:

1.Eğitim Durumu:

2.Baskın El Kullanımı: ☐ Sol ☐ Sağ

3. Düzeltilmemiş bir görme bozukluğunuz var mı?

☐ Evet ☐ Hayır

4. Daha önce psikiyatrik/psikolojik bir rahatsızlık tanısı aldınız mı?

☐ Evet ☐ Hayır

Eğer yanıtınız evet ise lütfen konulan tanıyı belirtiniz ……..

5. Daha önce nörolojik bir rahatsızlık tanısı aldınız mı?

☐ Evet ☐ Hayır

Eğer yanıtınız evet ise lütfen konulan tanıyı belirtiniz ……..

6. Daha önce motor kontrol becerilerine dair bir rahatsızlık tanısı aldınız mı?

☐ Evet ☐ Hayır

Eğer yanıtınız evet ise lütfen konulan tanıyı belirtiniz ……..

7. Yukarıda belirtilen hastalıklara dair herhangi bir tedavi görüyor musunuz?

☐ Evet ☐ Hayır

Eğer yanıtınız evet ise lütfen ilacın adını belirtiniz ……..

8. Daha önce kafa travması geçirdiniz mi?

☐ Evet ☐ Hayır

APPENDIX 4: COGNITIVE LOAD SCALE

Verilen görevi tamamlarken ne kadar çaba gösterdiniz?

1. Çok çok az
2. Çok az
3. Az
4. Kısmen az
5. Ne az ne fazla
6. Kısmen fazla
7. Fazla
8. Çok fazla
9. Çok çok fazla

APPENDIX 5: INFORMED CONSENT OF ONLINE SURVEY IN VISUAL STIMULI SELECTIO STUDY

Sayın Katılımcı,

Sizi, Doç. Dr. Erol Özçelik danışmanlığında Çankaya Üniversitesi Bilişsel Psikoloji Yüksek Lisans programı öğrencisi H. Arda Özdemir tarafından yürütülmekte olan tez çalışmasına davet ediyoruz. Mevcut araştırmanın amacı, deneysel çalışmada kullanılabilecek görsel uyaranları belirlemektir. Bunun için sizden görseller hakkında tahmin yürütmeniz ve bazı değerlendirmeler yapmanız istenmektedir.

Çalışmaya katılmak tamamen gönüllülük esasına dayanmaktadır. Dijital olanlar da dahil olmak üzere herhangi bir kimlik bilginize erişimimiz yoktur. E-posta hesabınızı kullanmadan araştırmaya dahil olabilirsiniz. Çalışmaya katılmama veya katıldıktan sonra herhangi bir anda herhangi bir neden belirtmeden çalışmayı bırakma hakkına sahipsiz. Çalışmayı tamamlamayıp herhangi bir aşamada bırakırsanız yanıtlarınızın hiçbiri bize ulaşmayacaktır.

Çalışmanın amacına ulaşması için sizden beklenen, bütün soruları eksiksiz ve kimsenin baskısı veya telkini altında olmadan, size en uygun gelen cevapları içtenlikle verecek şekilde cevaplamanızdır. Her sayfadaki talimatları dikkatle okumanızı rica ederiz.

Eğer araştırmanın amacı ile ilgili verilen bu bilgiler dışında daha fazla bilgiye ihtiyaç duyarsanız araştırmacıya …….. e-posta adresinden ulaşabilirsiniz.

APPENDIX 6: INFORMED CONSENT OF ONLINE SURVEY IN VERBAL SELECTION STUDY

Sayın Katılımcı,

Sizi, Doç. Dr. Erol Özçelik danışmanlığında Çankaya Üniversitesi Bilişsel Psikoloji Yüksek Lisans programı öğrencisi H. Arda Özdemir tarafından yürütülmekte olan tez çalışmasına davet ediyoruz. Mevcut araştırmanın amacı, deneysel çalışmada kullanılabilecek sözel soru uyaranlarını belirlemektir. Bunun için sizden sözel sorular hakkında tahmin yürütmeniz ve bazı değerlendirmeler yapmanız istenmektedir.

Çalışmaya katılmak tamamen gönüllülük esasına dayanmaktadır. Dijital olanlar da dahil olmak üzere herhangi bir kimlik bilginize erişimimiz yoktur**.** E-posta hesabınızı kullanmadan araştırmaya dahil olabilirsiniz. Çalışmaya katılmama veya katıldıktan sonra herhangi bir anda herhangi bir neden belirtmeden çalışmayı bırakma hakkına sahipsiz. Çalışmayı tamamlamayıp herhangi bir aşamada bırakırsanız yanıtlarınızın hiçbiri bize ulaşmayacaktır.

Çalışmanın amacına ulaşması için sizden beklenen, bütün soruları eksiksiz ve kimsenin baskısı veya telkini altında olmadan, size en uygun gelen cevapları içtenlikle verecek şekilde cevaplamanızdır. Her sayfadaki talimatları dikkatle okumanızı rica ederiz.

Eğer araştırmanın amacı ile ilgili verilen bu bilgiler dışında daha fazla bilgiye ihtiyaç duyarsanız araştırmacıya …….. e-posta adresinden ulaşabilirsiniz.

Yukarıda yer alan ve araştırmadan önce katılımcıya verilmesi gereken bilgileri okudum ve bu koşullarda söz konusu araştırmaya kendi isteğimle, hiçbir baskı ve telkin olmaksızın katılmayı **kabul ediyorum**.

APPENDIX 7: INFORMED CONSENT IN SCALE ADAPTATION STUDY

Sayın Katılımcı,

Sizi, Doç. Dr. Erol Özçelik danışmanlığında Çankaya Üniversitesi Bilişsel Psikoloji Yüksek Lisans programı öğrencisi H. Arda Özdemir tarafından yürütülmekte olan tez çalışmasına davet ediyoruz. Mevcut araştırmanın amacı, yetişkin bireylerin belirli duyguları ne ölçüde yaşadıklarını ve bu duygular arasındaki ilişkiyi anlamaya çalışmaktır.

Çalışmaya katılmak tamamen gönüllülük esasına dayanmaktadır. Dijital olanlar da dahil olmak üzere herhangi bir kimlik bilginize erişimimiz yoktur**.** E-posta hesabınızı kullanmadan araştırmaya dahil olabilirsiniz. Çalışmaya katılmama veya katıldıktan sonra herhangi bir anda herhangi bir neden belirtmeden çalışmayı bırakma hakkına sahipsiz. Çalışmayı tamamlamayıp herhangi bir aşamada bırakırsanız yanıtlarınızın hiçbiri bize ulaşmayacaktır.

Çalışmanın amacına ulaşması için sizden beklenen, bütün soruları eksiksiz ve kimsenin baskısı veya telkini altında olmadan, size en uygun gelen cevapları içtenlikle verecek şekilde cevaplamanızdır. Her sayfadaki talimatları dikkatle okumanızı rica ederiz.

Eğer araştırmanın amacı ile ilgili verilen bu bilgiler dışında daha fazla bilgiye ihtiyaç duyarsanız araştırmacıya …….. e-posta adresinden ulaşabilirsiniz.

Yukarıda yer alan ve araştırmadan önce katılımcıya verilmesi gereken bilgileri okudum ve bu koşullarda söz konusu araştırmaya kendi isteğimle, hiçbir baskı ve telkin olmaksızın katılmayı **kabul ediyorum**.

APPENDIX 8: SPIELBERG'S STATE ANXIETY INVENTORY TURKISH STANDARDIZED VERSION

Aşağıda kişilerin kendilerine ait duyguları anlatmada kullandıkları birtakım ifadeler verilmiştir. Her bir ifadeyi okuyun, sonra da ***şu anda*** nasıl hissettiğinizi ifadelerin yanındaki kutucuklarda size uygun olacak şekilde puanlamak suretiyle işaretleyin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarf etmeksizin nasıl hissettiğinizi gösteren cevabı işaretleyin.

	Hiç	**Biraz**	**Oldukça**	**Tamamıyla**
Şu anda sakinim				
Kendimi emniyette hissediyorum				
Şu anda sinirlerim gergin				
Pişmanlık duygusu içindeyim				
Şu anda huzur içindeyim				
Şu anda hiç keyfim yok				
Başıma geleceklerden endişe ediyorum				
Kendimi dinlenmiş hissediyorum				
Şu anda kaygılıyım				
Kendimi rahat hissediyorum				
Kendime güvenim var				
Şu anda asabım bozuk				
Çok sinirliyim				
Sinirlerimin çok gergin olduğunu hissediyorum				
Kendimi rahatlamış hissediyorum				
Şu anda halimden memnunum				
Şu anda endişeliyim				
Heyecandan kendimi şaşkına dönmüş hissediyorum				
Şu anda sevinçliyim				
Şu anda keyfim yerinde				

APPENDIX 9: SPIELBERG'S TRAIT ANXIETY INVENTORY TURKISH STANDARDIZED VERSION

Aşağıda kişilerin kendilerine ait duyguları anlatmada kullandıkları birtakım ifadeler verilmiştir. Her bir ifadeyi okuyun, sonra da ***genel olarak*** nasıl hissettiğinizi ifadelerin yanındaki kutucuklarda size uygun olacak şekilde puanlamak suretiyle işaretleyin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarf etmeksizin nasıl hissettiğinizi gösteren cevabı işaretleyin.

	Hiç	**Bazen**	**Çoğu Zaman**	**Hemen Her Zaman**
Genellikle keyfim yerindedir				
Genellikle çabuk yorulurum				
Genellikle kolay ağlarım				
Başkaları kadar mutlu olmak isterim				
Çabuk karar veremediğim için fırsatları kaçırırım				
Kendimi dinlenmiş hissediyorum				
Genellikle sakin, kendine hâkim ve soğukkanlıyım				
Güçlüklerin yenemeyeceğim kadar biriktiğini hissederim				
Önemsiz şeyler hakkında endişelenirim				
Genellikle mutluyum				
Her şeyi ciddiye alır ve endişelenirim				
Genellikle kendime güvenim yoktur				
Genellikle kendimi emniyette hissederim				
Sıkıntılı ve güç durumlarla karşılaşmaktan kaçınırım				
Genellikle kendimi hüzünlü hissederim				
Genellikle hayatımdan memnunum				
Olur olmaz düşünceler beni rahatsız eder				
Hayal kırıklıklarını öylesine ciddiye alırım ki hiç unutamam				
Aklı başında ve kararlı bir insanım				
Son zamanlarda kafama takılan konular beni tedirgin ediyor				

APPENDIX 10: STATE CURIOSITY INVENTORY TURKISH TRANSLATION VERSION

Aşağıda kişilerin kendilerini tanımlamak için kullandıkları birtakım ifadeler verilmiştir. Her bir ifadeyi okuyun, sonra da **şu anda** nasıl hissettiğinizi ifadelerin yanındaki kutucuklarda size uygun olacak şekilde puanlamak suretiyle işaretleyin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifade üzerinde çok fazla zaman harcamadan şu anda nasıl hissettiğinizi tarif eden cevabı veriniz.

	Hiç	**Biraz**	**Oldukça**	**Tamamıyla**
Daha fazla bilmek istiyorum				
Olan biteni merak ediyorum				
Kafam karışmış (şaşırmış) hissediyorum				
Bir şeylerin anlam ifade etmesini (mantıklı gelmesini) istiyorum				
Olan bitenler tuhaf geldiği için merakım arttı				
Bir şeyleri derinlemesine araştırmak (incelemek) istiyorum				
Olan biten üzerine tahmin yürütüyorum				
Merakım uyandı				
Bir şeylere ilgili hissediyorum				
Meraklı hissediyorum				
Olan bitenle ilgili soru sorma isteği duyuyorum				
Olan bitenler tamamlanmamış (eksiklik) hissi veriyor				
Bir şeyler araştırma isteği duyuyorum				
Cevap arama isteği duyuyorum				
Yaptığım işe kendimi kaptırmış hissediyorum				
Olabilecek şeyleri araştırmak istiyorum				
Olan bitenler ilgimi çekti				
Yaptığım işin içinde hissediyorum				
Daha fazla bilgi istiyorum				
Daha fazla araştırmak (soruşturmak) istiyorum				

APPENDIX 11: TRAIT CURIOSITY INVENTORY TURKISH TRANSLATION VERSION

Aşağıda kişilerin kendilerini tanımlamak için kullandıkları birtakım ifadeler verilmiştir. Her bir ifadeyi okuyun, sonra da **genel olarak** nasıl hissettiğinizi ifadelerin yanındaki kutucuklarda size uygun olacak şekilde puanlamak suretiyle işaretleyin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifade üzerinde çok fazla zaman harcamadan genel olarak nasıl hissettiğinizi tarif eden cevabı veriniz.

	Hiç	**Bazen**	**Çoğu Zaman**	**Hemen Her Zaman**
Bence bir şeyler öğrenmek ilginç ve heyecan vericidir				
Bir şeyleri merak ederim				
Bir şeylerin nasıl çalıştığını anlamak için parçalara ayırıp incelemekten keyif alırım				
Kendimi yaptığım işin içinde hissederim				
Boş vaktim ilginç aktivitelerle doludur				
Kafamı karıştıran (beni şaşırtan) problemleri çözmeye çalışmayı severim				
Bir şeyleri derinlemesine araştırmak (incelemek) isterim				
Yeni yerler (mekanlar) araştırmayı severim				
Aktif biriyimdir				
Yeni durumlar dikkatimi çeker				
Meraklı biriyimdir				
Olan bitenle ilgili soru sorma isteği duyarım				
Yeni şeyler öğrenme olasılığı beni heyecanlandırır				
Cevap arama isteği duyarım				
Yaptığım işe kendimi kaptırırım				
Olan bitenle ilgili tahminde bulunmayı severim				
Yeni hisler tecrübe etmeyi severim				
Kendimi bir şeylere ilgili hissederim				
Anlamadığım şeyleri araştırmayı (sorgulamayı) severim				
Yeni şeyler keşfetmeyi severim				

APPENDIX 12: CURIOSITY AND EXPLORATION INVENTORY-II TURKISH ADAPTATION VERSION

Aşağıdaki ifadeleri genel olarak nasıl hissettiğinizi ve davrandığınızı en doğru biçimde yansıtacak şekilde değerlendiriniz. Ne yapmanız gerektiğini, yapmayı arzuladığınızı, ya da artık yapmadığınız şeyleri düşünerek değerlendirmeyiniz. Lütfen mümkün olduğunca dürüst olunuz.

	Hiç	**Biraz**	**Kısmen**	**Sık Sık**	**Çok Fazla**
Yeni durumlarda aktif olarak edinebildiğim kadar bilgi ararım					
Günlük yaşamın belirsizliğinden gerçekten hoşlanan bir insanımdır					
Karmaşık ya da mücadele gerektiren şeyler yapmada çok iyiyimdir					
Gittiğim her yerde yeni şeyler ya da deneyimler ararım					
Mücadele edilmesi gereken durumları gelişme ve öğrenme fırsatı olarak görürüm					
Biraz korkutucu olan şeyleri yapmaktan hoşlanırım					
Daima kendime ve dünyaya ilişkin olabilecek (düşündüğüm) güçlüklerle (zorluklarla) ilişkili deneyimler ararım					
Kesinlikle kestirilemeyen – tahmin edilemeyen işleri tercih ederim					
Kişi olarak gelişebileceğim ve kendimle mücadele edebileceğim fırsatları sıklıkla ararım					
Aşina olmadığım kişileri, olayları ve yerleri kabul eden bir insanımdır					

APPENDIX 13: DESCRIPTIVES FROM VISUAL STIMULI SELECTION STUDY

Image Name	M_{uc}	SD	M_{con}	SD	M_{cur}	SD	M_{dif}	SD	M_{sat}	SD
accordion	2.04	1.21	1.97	1.18	3.37	1.48	5.04	1.44	4.10	1.50
barn_owl	2.34	1.52	2.63	1.57	3.56	1.54	4.64	1.87	3.86	1.62
biretta	3.33	1.44	3.73	1.44	3.76	1.51	5.08	1.41	4.11	1.56
cap	2.98	1.35	3.43	1.50	3.75	1.51	3.57	2.13	3.74	1.66
cat	2.34	1.47	2.60	1.49	3.64	1.47	4.49	1.82	4.08	1.61
chess	2.43	1.44	2.52	1.43	3.69	1.63	5.26	1.28	3.65	1.64
couch	3.21	1.43	3.30	1.47	3.80	1.48	4.86	1.58	3.55	1.68
crab	2.83	1.41	3.21	1.48	3.61	1.53	4.05	1.98	3.65	1.69
crocodile	3.37	1.46	3.80	1.52	3.81	1.53	2.49	1.86	3.77	1.63
dartboard	4.49	1.46	4.70	1.46	3.32	1.72	2.52	1.96	3.32	1.74
diadem	3.25	1.33	3.51	1.40	3.75	1.48	3.88	1.90	3.51	1.57
dice	2.80	1.51	3.02	1.54	3.46	1.57	4.22	1.96	3.71	1.65
drum	3.14	1.36	2.97	1.52	3.65	1.60	4.37	1.75	3.62	1.51
duck	2.37	1.53	2.74	1.60	3.45	1.71	3.91	2.15	3.69	1.73
glove	2.19	1.48	2.26	1.40	3.55	1.77	4.91	1.65	3.53	1.66
goldfinch	3.54	1.71	3.93	1.79	3.24	1.60	2.18	1.83	3.32	1.79
harp	3.22	1.60	3.43	1.70	3.08	1.64	3.44	2.18	3.33	1.68
hazelnut	3.65	1.63	3.95	1.62	3.42	1.61	4.08	1.61	3.37	1.51
hummingbird	3.10	1.44	3.15	1.39	3.61	1.57	3.43	1.89	3.56	1.67
jump_rope	3.51	1.47	3.20	1.50	3.44	1.74	3.5	1.95	3.37	1.61
kangaroo	3.08	1.63	3.31	1.70	3.37	1.68	4.01	1.76	3.37	1.67
ladybird	2.79	1.52	2.97	1.53	3.34	1.69	4.57	1.78	3.60	1.78
lamp	3.49	1.59	3.79	1.68	3.24	1.70	4	1.91	3.43	1.72
lettuce	3.60	1.52	3.66	1.61	3.18	1.64	3.44	1.97	3.27	1.63
lilac	2.92	1.55	2.94	1.60	3.53	1.73	4.52	1.85	3.45	1.75
olive_tree	4.20	1.72	4.25	1.75	3.14	1.80	2.75	2.12	3.23	1.79
orchid	3.94	1.67	4.08	1.52	3.26	1.60	2.35	1.81	3.35	1.75
ostrich	2.28	1.50	2.41	1.54	3.37	1.87	5	1.65	3.42	1.91
peanut	2.09	1.38	2.35	1.52	3.41	1.82	5.08	1.46	3.42	1.81
piano	2.94	1.61	3.06	1.69	3.36	1.65	4.48	1.95	3.52	1.85
ring	3.12	1.90	3.37	1.85	3.12	1.72	3.67	2.12	3.25	1.79

APPENDIX 13 (*continued*)

paragliding	2.55	1.46	2.79	1.65	3.33	1.69	5.09	1.52	3.52	1.78
saxophone	2.58	1.51	2.81	1.61	3.31	1.72	4.3	1.85	3.39	1.68
scorpion	2.56	1.53	2.86	1.61	3.06	1.73	4.42	1.81	3.14	1.79
platypus	2.55	1.62	2.62	1.60	3.15	1.62	4.7	1.74	3.38	1.77
palm_tree	3.87	1.69	3.89	1.82	3.00	1.61	3.07	1.95	3.26	1.70
stapler	2.90	1.48	2.87	1.43	3.29	1.69	5.2	1.42	3.25	1.88
rocking_chair	3.10	1.67	3.21	1.75	3.06	1.69	3.55	2.07	3.24	1.85
rubber_stamp	3.00	1.55	3.10	1.71	3.18	1.66	4.07	2.04	3.14	1.72
starfish	4.46	1.69	4.50	1.68	2.87	1.67	1.75	1.45	3.14	1.86
teapot	3.12	1.52	3.14	1.65	3.36	1.66	4.38	1.83	3.24	1.65
tiger	4.22	1.65	4.28	1.67	2.91	1.65	3.02	1.82	3.39	1.82
trumpet	2.52	1.47	2.65	1.49	3.28	1.74	4.71	1.66	3.17	1.76
train	3.13	1.54	3.06	1.73	3.32	1.71	3.94	2.11	3.37	1.82
walnut	3.40	1.83	3.24	1.76	3.01	1.67	3.98	1.73	3.14	1.72
turtle	3.03	1.71	3.15	1.79	3.21	1.69	3.21	2.05	3.33	1.72
wasp	2.19	1.35	2.39	1.45	3.24	1.83	4.78	1.60	3.37	1.74
willow	4.23	1.67	4.14	1.72	2.79	1.57	2.16	1.60	3.09	1.76

Notes. SD: Standar deviation; M_{uc}: Mean scores of uncertainty regarding the object in the visual; M_{con}: Mean scores of confidence for guessings regarding what the object in the visual is; M_{cur}: Mean scores of curiosity regarding what the object in the visual is; M_{dif}: Mean scores of differentiation between the clear version of the image and the participant's guess; M_{sat}: Mean scores of curiosity satisfaction created in the participant by the removal of uncertainty.

APPENDIX 14: RANKING OF VISUAL STMULI ACCORDING TO THE SCORES OBTAINED FROM THE FORMULA USED

Image Name	Formula	Image Name	Formula
accordion	0.42	kangaroo	0.21
barn_owl	0.40	ring	0.21
chess	0.37	rocking_chair	0.21
glove	0.37	teapot	0.21
cat	0.36	train	0.21
lilac	0.36	lamp	0.20
wasp	0.35	goldfinch	0.18
peanut	0.34	harp	0.17
cap	0.33	lettuce	0.17
duck	0.33	hazelnut	0.16
ostrich	0.33	walnut	0.14
dice	0.31	orchid	0.12
paragliding	0.30	willow	0.11
platypus	0.30	palm_tree	0.09
ladybird	0.29	tiger	0.09
saxophone	0.29	dartboard	0.08
trumpet	0.29	olive_tree	0.08
couch	0.27	starfish	0.06
diadem	0.27		
piano	0.27		
drum	0.26		
hummingbird	0.26		
stapler	0.26		
biretta	0.24		
crab	0.24		
scorpion	0.24		
rubber_stamp	0.24		
turtle	0.23		
crocodile	0.22		
jump_rope	0.22		

APPENDIX 15: TWENTY VERBAL QUESTIONS SELECTED FROM THE FORTY WHY-QUESTİONS

1.SORU: Kanımızın içinde demir elementi bulunmaktadır, ancak kanımız mıknatısları çekmez.. Neden?

Cevap: Bunun nedeni kandaki demirin ferromanyetik yapıda olmamasıdır. Yani kanda bulunan demirdeki elektronlar yeterince serbest hareket edemiyorlar. Bu da kanın mıknatısla etkileşime girmesini engelliyor.

2.SORU: Buz küpleri üzerlerine sıvı döküldüğünde neden çatırdar?

Cevap: Çoğu şey ısıtıldığında genleşir ve soğutulduğunda büzüşür. Buz zaten çok soğuk olduğu için, buzun üzerine bir sıvı döktüğünüzde, sıvının çarptığı yüzey anında genişler ve buzun geri kalanının buna yetişecek zamanı olmaz. Üst yüzey, ısıdan genleşir. Buzun geri kalanı soğuk kalır ve genleşmez. Aniden buz çatlar.

3.SORU: Aşırı soğuk havalarda, neden vücudumuzun üst kısmı için 3-4 ve bazen daha fazla kıyafeti kat kat giyerken, aynı şeyi vücudumuzun alt kısmı için yapmıyoruz?

Cevap: Üşüdüğümüzde kanımız organlarımızı ve vucudumuzun merkezini ısıtmaya odaklanır. Çünkü tüm hayati organlarımız vücudumuzun üst kısmında bulunmaktadır.

4.SORU: Bazen uyandığımızda ağzımızdaki bakterilerden dolayı kekremsi tat oluşurken neden aynı tat gün içinde genellikle oluşmaz?

Cevap: Gün içerisinde yeme, içme, ve konuşma davranışlarımız sırasında ağzımızda salgılanan tükürükler temizlik görevi görürler. Ancak uyku sırasında bu davranışlarda bulunmadığımız için uyandığımızda ağzımızda kekremsi bir tat oluşur.

5.SORU: Cep telefonları haparlör modundayken sesi neden daha kötü gelir?

Cevap: Bir ses sinyalindeki enerji, ses kaynağından uzaklaştıkça oldukça hızlı bir şekilde kaybolur. Bu durum kulaklıklar, kulakiçi kulaklıklar ve telefon hoparlörleri gibi kulağınıza çok yakın yerleştirdiğiniz küçük hoparlörler için geçerlidir. Bir telefonda "hoparlör" moduna geçtiğinizde, kullanılan hoparlörler hala çok küçüktür ve enerji oldukça hızlı tükenir, bu nedenle ses bozulur.

6.SORU: Kase neden mikrodalgada her zaman yiyecekten daha fazla ısınır?

Cevap: Çünkü kase ve yiyecek farklı özgül ısıya sahiptir. Özgül ısı, o malzemenin sıcaklığını yükseltmek için ne kadar enerji gerektiğinin bir ölçüsüdür. Metal veya seramik gibi malzemelerin özgül ısıları düşüktür. Bu nedenle sıcaklıklarını

değiştirmek için fazla enerji gerekmez. Gıdanızın çoğunlukla yapıldığı suyun özgül ısısı yüksektir ve ısıtmak için çok fazla enerji gerekir. Dolayısıyla, mikrodalgadaki yiyecek ve kasenin durumunda, her ikisine de aynı miktarda enerji verilir, ancak kasenin sıcaklığı yiyeceğe göre daha fazla artar.

7.SORU: Grip olduğumuzda neden her yerimiz ağrır?

Cevap: Grip virüsü, vücudun bağışıklık sistemini devreye sokar. Bağışıklık sisteminin mücadelesi iltihaplanmaya yol açar. Enfeksiyona karşı mücadele eden hücrelerin salgıladıkları bazı kimyasal maddelerin sinir sistemindeki ağrı devrelerini uyarması ve iltihaplanma sırasında kas ve eklemlerde oluşan sıvı birikimi (ödem) ağrıya neden olur.

8.SORU: Ağladıktan sonra göz kapaklarımız neden şişer?

Cevap: Güçlü duygulardan kaynaklanan gözyaşları, göz küremizi nemli tutan normal gözyaşlarından daha az tuzludur. Göz kapaklarımızda ise daha tuzlu gözyaşları bulunur, ağladığımızda gözyaşlarımızdan gelen su, tuz miktarını dengelemek için göz kapağı dokumuza gider ve göz kapağının şişmesine neden olur.

9.SORU: Bir şeyden ürktüğümüzde veya korktuğumuzda neden nefes nefese kalırız?

Cevap: Nefes nefese kalmak, vücudu harekete hazırlamak için adrenalin ve diğer hormonların salgılandığı "savaş ya da kaç" tepkisinin bir parçasıdır. Bu durumdayken göz bebekleri büyür, kalp atış hızı, solunum ve metabolizma hızı artar ve kaslara daha fazla yakıt sağlanır. Tüm bu değişiklikler oksijenin daha hızlı kullanılması anlamına gelir. Bu nedenle daha fazla oksijen alabilmek için nefes alıp verişimiz hızlanır.

10.SORU: Masaj yaptırmak neden zevklidir?

Cevap: Masaj, kan dolaşımını ve lenf akışını iyileştirerek, kasları gevşeterek ve ağrıyı azaltarak vücudu rahatlatır. Doğru uygulanan masaj, parasempatik sinir sisteminin uyarılmasına yardımcı olur ve bu sayede stres ve gerginlik hislerinde azalma meydana gelir. Aynı zamanda bir başkasının dokunarak bunu yerine getirmesi de psikolojik olarak olumlu ilişki hissi uyandırır. Bu da rahatlık hissimizi arttırır.

11.SORU: Stres neden baş ağrısı yapar?

Cevap: Stres, vücudun "savaş ya da kaç" tepkisini tetikler. Bu tepki, kas gerginliğine, beyin damarlarında genişlemeye ve beyin kimyasallarında değişikliklere neden olabilir. Bu değişiklikler, gerilim tipi baş ağrılarına neden olabilir.

12.SORU: Bir başkası vücudumuza hafifçe dokunduğunda hoş veya kaşıntılı şeyler hissederiz. Neden kendi kendimize dokunduğumuzda aynı hissiyatı alamayız?

Cevap: Beynimiz planlanmamış uyaranlara daha fazla tepki vermek üzere tasarlanmıştır. Kendi tenimize dokunduğumuzda, beyin bunun nerede ve ne zaman olacağını bilir. Başka biri yaptığında, beyniniz bunu bilemez ve daha güçlü tepki verir.

13.SORU: İnsanlar uykuya dalarken neden seğirir veya zıplarlar?

Cevap: Buna hipnagojik sarsıntı denir ve uyanıklık ile uyku arasındaki geçiş sırasında oluşur. Evrimsel teoriye göre bu sarsıntının kökeni ağaçlarda dinlendiğimiz ve yırtıcılardan saklandığımız zamanlara dayanıyor. Bu hipnagojik sarsıntı sayesinde, saklanma dinlenme sırasında uykuya daldığımız durumlarda aniden bir dala tutunabilir ve ağaçtan düşmemizi engelleyebilirdik.

14.SORU: Acı hissettiğimizde neden çığlık atarız?

Cevap: Bu bir alarm tepkisidir. Çok fazla acı hissettiğimizde, iki şey büyük olasılıkla doğrudur: yardıma ihtiyacımız vardır ve tehlike mevcuttur. Çığlık atmak diğer kabile üyelerini olası bir sorun konusunda uyarır ve onları yardıma çağırır.

15.SORU: Tekerlemeleri söylemek neden zordur?

Cevap: Bunun nedeni, beynin konuşma için gerekli kasları kontrol etme işleyişiyle ilişkilidir. Tekerleme söylerken benzer seslerin üretilmesi için beynin benzer bölümlerini kullanırız. Dolayısıyla benzer seslerden oluşan bir diziyi söylemek beynin işlem yapmasını zorlaştırır ve bizim zorlanmamıza neden olur.

16.SORU: Musluktan akan sıcak su neden bulanık görünür?

Cevap: Bu durum, suyun içindeki kalsiyum karbonatın haliyle alakalıdır. Kalsiyum karbonat, sıcak suda daha az çözünür, bu nedenle katı bir hal alır ve suyun içinde beyaz bir çökelti oluşturur. Bu da sıcak suyun daha bulanık görünmesine neden olur.

17.SORU: Yiyecekler yandığında neden siyaha döner?

Cevap: Yiyeceklerin içinde farklı elementlerle birlikte birbirlerine bağlı bir sürü karbon elementi bulunur. Yiyecekler uzun süre aşırı ısındığında, içlerinde bulunan bu elementler kimyasal tepkimeye girerler ve geriye sadece siyah renkli saf karbon elementleri kalana dek parçalanırlar.

18.SORU: Bebeklerin dişleri çıktığında diş etleri neden kanamıyor?

Cevap: Dişler, diş etlerinde büyük bir yırtık oluşturacak kadar hızlı hareket etmez. Bu nedenle de çok fazla kanamaya yol açmazlar. Bu esnada oluşan az miktarda kan da tükürükler tarafından yutulur.

19.SORU: Yeterince uyumadığımızda neden gözlerimizin altında torbalar oluşur?

Cevap: Vücudumuzun alışkın olduğu uyku zamanı geldiğinde, göz çevremizdeki kan damarları normalden daha fazla kan toplar. Ayrıca, bu uyku zamanında göz kaslarımızı kullanmadığımızdan dolayı bu kaslar gevşer ve kan damarlarımız genişler. Ancak alışkın olduğumuz uyku zamanında uyanık kalırsak kaslar gevşeyemez ve buraya toplanan kanlar damarlarda birikmeye başlar. Bu sıvı birikintisi, göz çevresindeki dokuların şişmesine neden olur ve göz torbaları oluşur. Cildimizin en ince derisi bu bölgede bulunduğu için, biriken kan göz torbalarımızın koyu görünmesine neden olur.

20.SORU: İnsanların neden " boşluğa dalma" alışkanlığı vardır?

Cevap: Bu, göz sağlığımızla ilişkili bir davranıştır. Bu esnada gözlerimiz dinlenmektedir. Bu nedenle uzmanlar “20-20 kuralını” önermektedirler. Bu kurala göre, 20 dakikada bir 20 saniye boyunca 5 metre uzağa (boşluğa) bakmak bilgisayar başında çalışan insanlar için göz sağlığını korumaya yardımcı olmaktadır.

APPENDIX 16: DESCRIPTIVES FOR WHY-QUESTIONS

Question No	M_{comQ}	SD	M_{con}	SD	M_{cur}	SD	M_{comA}	SD	M_{dif}	SD	M_{sat}	SD
1	5.35	1.03	3.85	1.65	4.73	1.32	5.38	1.11	3.20	1.63	4.52	1.50
2	5.70	0.75	4.67	1.44	4.54	1.51	5.86	0.75	2.54	1.49	4.17	1.54
3	5.63	0.86	4.44	1.37	4.75	1.44	5.63	0.90	3.23	1.81	4.55	1.60
4	5.63	0.76	3.70	1.71	4.92	1.25	5.73	0.61	3.36	1.85	4.75	1.49
5	5.61	0.86	3.70	1.79	4.79	1.31	5.40	1.00	3.96	1.64	4.35	1.63
6	5.59	0.91	4.05	1.78	4.51	1.52	5.61	0.82	3.20	1.84	4.19	1.69
7	5.81	0.59	4.26	1.61	4.65	1.59	5.70	0.60	3.30	1.78	4.48	1.64
8	5.81	0.55	3.32	1.69	4.82	1.34	5.47	1.02	4.34	1.51	4.89	1.40
9	5.77	0.71	4.87	1.51	4.22	1.90	5.78	0.66	2.04	1.58	3.68	1.97
10	5.81	0.59	4.60	1.51	4.64	1.59	5.69	0.70	2.64	1.64	4.34	1.60
11	5.73	0.66	4.21	1.43	4.69	1.50	5.60	0.77	2.95	1.53	4.22	1.50
12	5.67	0.71	3.65	1.63	4.67	1.51	5.69	0.72	3.20	1.81	4.51	1.59
13	5.44	1.09	3.46	1.76	4.78	1.52	5.40	1.20	4.22	1.79	4.72	1.56
14	5.71	0.88	3.87	1.54	4.89	1.32	5.69	0.59	3.37	1.77	4.51	1.52
15	5.76	0.73	4.26	1.61	4.52	1.48	5.68	0.66	3.42	1.66	4.60	1.53
16	5.62	0.88	3.52	1.87	4.36	1.63	5.53	1.00	4.45	1.46	4.72	1.39

APPENDIX 16 (*continued*)

17	5.75	0.70	4.01	1.65	4.65	1.55	5.65	0.70	3.53	1.78	4.33	1.59
18	5.67	0.80	3.20	1.81	4.65	1.57	5.65	0.79	3.89	1.83	4.39	1.69
19	5.81	0.59	3.33	1.69	4.81	1.49	5.53	0.88	4.19	1.54	4.82	1.32
20	5.52	1.07	3.26	1.56	5.06	1.23	5.49	1.03	4.49	1.50	4.90	1.35

Notes: SD: Standar deviation; M_{comQ}: Mean scores of comprehensibility of the question; M_{con}: Mean scores of confidence for guessings regarding the answers to the question; M_{cur}: Mean scores of curiosity regarding the answers to the questions; M_{comA}: Mean scores of comprehensibility of the answer; M_{dif}: Mean scores of difference of the answer from their predictions; M_{sat}: Mean scores of curiosity satisfaction created by the answer to the question for the participant.

APPENDIX 17: RANKING OF VERBAL STIMULI ACCORDING TO THE SCORES OBTAINED FROM THE FORMULA USED

Question No	Formula
8	0.75
19	0.75
4	0.74
20	0.74
1	0.72
13	0.7
3	0.66
10	0.66
14	0.66
17	0.66
5	0.65
15	0.65
7	0.64
16	0.64
18	0.64
12	0.63
2	0.62
11	0.61
6	0.58
9	0.52