BENGİSU USLUER EFFECTS OF COLOUR AND CORRELATED COLOUR TEMPERATURE (CCT) ON SPEAKING ANXIETY IN SMALL SPACES Bilkent University 2025

EFFECTS OF COLOUR AND CORRELATED COLOUR TEMPERATURE (CCT) ON SPEAKING ANXIETY IN SMALL SPACES

A Master's Thesis

by
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Department of
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Ankara
September 2025

To my dearest family,

Lokman, Sinem, Yağız Alp Usluer

EFFECTS OF COLOUR AND CORRELATED COLOUR TEMPERATURE (CCT) ON SPEAKING ANXIETY IN SMALL SPACES

The Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University

by

BENGİSU USLUER

In Partial Fulfillment of the Requirements for the Degree of
MASTER OF FINE ARTS IN INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN

THE DEPERTMENT OF
INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN
İHSAN DOĞRAMACI BİLKENT UNIVERSITY
ANKARA

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EFFECTS OF COLOUR AND CORRELATED COLOUR TEMPERATURE (CCT) ON SPEAKING ANXIETY IN SMALL SPACES
By Bengisu Usluer

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Fine Arts, Department of Interior Architecture and Environmental Design.

Nilgün Olguntürk
Advisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of of Fine Arts, Department of Interior Architecture and Environmental Design.

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Examining Committee Member

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ABSTRACT

EFFECTS OF COLOUR AND CORRELATED COLOUR TEMPERATURE (CCT) ON SPEAKING ANXIETY IN SMALL SPACES

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September 2025

This study aims to investigate how colour and correlated colour temperature (CCT) impact speaking anxiety in small spaces. Existing literature has highlighted and emphasized the colour and CCT impact on anxiety and speaking anxiety. However, there has been a small number of analysis with the combination of colour and CCT impact on speaking anxiety. This research not only examines the impact of colour and CCT level in terms of speaking anxiety but also examines the combine effect of colour and CCT on speaking anxiety. The experimental study was employed involving 150 participants studying in the university. The experiment was conducted in Bilkent University lighting lab in Ankara, Türkiye.

The participants completed a demographic questionnaire and two anxiety tests which are GAD-7 and STAI test before the experiment. Participants were randomly assigned to one of the five different conditions. In the experiment participants were asked to talk under one condition and after the experiment speaking anxiety was assessed with STAI test. Quantitative data were analysed using two-way and three-way ANOVA in JASP 0.18.3 with the test of normality and homogeneity checked. The findings indicate that both colour and CCT as well as an interaction impact speaking anxiety. Turquoise colour and 4000 K give a calming impact whereas purple with 6500 K trigger speaking anxiety. The results of this study highlighted the importance of colour and lighting design and this may help to reduce speaking anxiety.

Keywords: Colour, Lighting, Correlated Colour Temperature (CCT), Speaking Anxiety.

ÖZET

KÜÇÜK ALANLARDA KONUŞMA KAYGISI ÜZERİNE RENK VE BAĞLANTILI RENK SICAKLIĞININ (CCT) ETKİLERİ

Usluer, Bengisu
Yüksek Lisans, İç Mimarlık ve Çevre Tasarımı Anasanat Dalı
Tez Danışmanı: Doç. Dr. Nilgün Olguntürk

Eylül 2025

Bu çalışma, küçük alanlarda renk ve ilişkili renk sıcaklığının (CCT) konuşma kaygısını nasıl etkilediğini araştırmayı amaçlamaktadır. Mevcut literatür, renk ve CCT'nin kaygı ve konuşma kaygısı üzerindeki etkisini vurgulamıştır. Ancak, renk ve CCT'nin konuşma kaygısı üzerindeki birleşimini inceleyen az sayıda analiz yapılmıştır. Bu araştırma, yalnızca renk ve CCT düzeyinin konuşma kaygısı açısından etkisini incelemekle kalmayıp aynı zamanda renk ve CCT'nin konuşma kaygısı üzerindeki birleşik etkisini de incelemektedir. Deneysel çalışma, üniversitede öğrenim gören 150 katılımcıyı kapsayacak şekilde gerçekleştirilmiştir. Deney, Türkiye, Ankara'daki Bilkent Üniversitesi aydınlatma laboratuvarında gerçekleştirilmiştir. Katılımcılar, deneyden önce demografik bir anket ve GAD-7 ve STAI testi olan iki kaygı testini tamamlamıştır. Katılımcılar beş farklı koşuldan birine rastgele atanmıştır. Deneyde katılımcılardan bir koşul altında konuşmaları istenmiş ve deneyden sonra konuşma kaygısı STAI testi ile değerlendirilmiştir. Nicel

veriler, normallik ve homojenlik testi kontrol edilerek JASP 0.18.3'te iki yönlü ve üç yönlü ANOVA kullanılarak analiz edilmiştir. Bulgular, hem rengin hem de CCT'nin ve etkileşimin konuşma kaygısını etkilediğini göstermektedir. Turkuaz rengi ve 4000 K sakinleştirici bir etki verirken, 6500 K mor konuşma kaygısını tetikler. Bu çalışmanın sonuçları, renk ve aydınlatma tasarımının önemini vurgulayarak, bunun konuşma kaygısını azaltmaya yardımcı olabileceğini göstermiştir.

Anahtar Kelimeler: Renk, Aydınlatma, İlişkili Renk Sıcaklığı (CCT), Konuşma Kaygısı.

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CHAPTER I

INTRODUCTION

Anxiety is one of the major issues in today's contemporary world. Anxiety directly impacts a person's daily life and professional life in terms of both psychological and physiological factors (Sahin & Tuna, 2022). Increased hearth rate, hot flashes, overthinking are all negative effects of anxiety (Martin, 2003). During the COVID-19 epidemic we all experienced unexpected changes which might have increased anxiety in the population. Being isolated, having to be in distance learning were all unexpected changes for the population.

Anxiety is therefore becoming a more common psychological disorder (Kumar and Nayar, 2021; Sahin & Tuna, 2022). Anxiety has been extensively studied across various subcategories, one of which is social phobia. Within the scope of social phobia, speaking anxiety is a significant area of concern that affects both person's everyday life and professional life. Speaking anxiety is shaped by a combination of people's individual characteristic, usually associated with perfectionism and environmental factors (Kelsen, 2019; Ströhle et al., 2018).

Lighting and colour are environmental factors that directly affect human's psychology, perception and cognitive functioning (Zarei et al., 2021; Zeng et al., 2022). Firstly, each colour has a divergent effect on human psychology. Red motivate discharge, purple increases and triggers anxiety levels directly whereas green gives the feeling of relaxation and stability. Mostly pastel tones relieve anxiety (Jonauskaite et al., 2020; IRELAND, 1992). Secondly, lighting parameters especially correlated colour temperature (CCT) affect directly human biological factors. Warm CCT can reduce cortisol which is known as stress hormone (Doctors, 2022). According to research of Awada et al. (2025) lower CCT directly gave a calming effect and reduced stress and anxiety level.

Despite growing acknowledgements of the significance of increased anxiety level, there remains a notable gap in the scholarly literature regarding its empirical affect within the relationship of both colour and CCT on anxiety level especially in speaking anxiety. This study aims to address this gap by examining the effect of colour and CCT on speaking anxiety in small spaces.

1.1 Problem Statement

After the COVID-19 epidemic, anxiety level has been increased dramatically in people. Unfortunately, anxiety is the widespread psychological disorder that affects daily life greatly with social anxiety symptoms (Sahin & Tuna, 2022). Speaking anxiety also known under social anxiety and directly affects a person's everyday life and professional life negatively. Increasing heart rate, hot flashes, negative thoughts,

fear of the future and overthinking are the negative effects of speaking anxiety (Martin, 2003). Lighting conditions and colours may become critical components of daily and professional life in terms of giving a psychological support, relieving stress and reducing anxiety by affecting the ambiance of the environment. There is a gap in literature, lack of studies that consider the combination of correlated colour temperature (CCT) and colour use in the environment and how that would affect speaking anxiety. In this study, the lighting laboratory in the Department of Interior Architecture and Environmental Design at Bilkent University in Ankara, was used to simulate the environments with lighting conditions and colour to see the effects on speaking anxiety.

1.2 Aim and Scope

This study aims to comprehensively understand the impact of lighting conditions and colours in design on anxiety level in terms of speaking anxiety. The existing technical literature does not explicitly address the combined effect of colour and CCT level on speaking anxiety. The aim is attained through a systematic literature review and analysing the data gathered in the experiment as well as conducting quantitative data analysis. Based on the gap in the literature and the objective of the study, the following research questions and hypotheses are addressed.

RQ1: Is there a significant relationship between CCT and speaking anxiety?

RQ2: How does colour (purple and turquoise) affect speaking anxiety in indoor spaces?

RQ3: Is there a relationship between purple, turquoise colour and 4000K, 6500K

CCT on speaking anxiety?

H1: There is a significant relationship between CCT and speaking anxiety. Warm CCT exposure promotes less speaking anxiety.

H2: Turquoise colour promotes less speaking anxiety.

H3: Higher CCT combined with purple increases speaking anxiety.

1.3 Structure of the Thesis

This thesis is structured into six chapters to clearly present the research process and findings. After this chapter, Chapter 2 gives a comprehensive understanding of the relevant literature in terms of anxiety, speaking anxiety, psychological and physiological effects of speaking anxiety, colour and lighting effects in terms of speaking anxiety. Chapter 3 explains the research methodology, experimental design, participants, research settings and data collection method in detail. Chapter 4 presents the findings of the study in terms of quantitative data which illustrated through statistical tables. Chapter 5 illustrates a discussion of existing literature findings and the findings of this thesis. Chapter 6 outlines main outcomes of the study, the limitations, suggestions and recommendations for future research. Collectively, these chapters offer a comprehensive understanding of how CCT and colour affect speaking anxiety, offering valuable contributions to both scholarly and applied domains.

CHAPTER II

LITERATURE REVIEW

2.1 Anxiety

Anxiety is a prevalent psychological disorder in today's society especially in university students (Şahin & Tuna, 2022). Anxiety is a "feeling of worry or fear that is strong enough to interfere with one's daily activities" (Encyclopaedia Britannica, n.d.). Anxiety is associated with the symptoms of fear and nervousness, often affecting the body system through increasing heart rate, increasing breathing in lungs, changing gut activities which is digestion and nervousness (Martin, 2003). According to National Institute of Mental Health (NIMH), anxiety is associated with a feeling of unease, worry, tension and restlessness in situations involving uncertainty. Also, anxiety has been described as a fear of everyday condition often attached to anticipating potential threat predicted in the future (Craske et al., 2011; Perrotta, 2019). Anxiety has a negative role and causes economic strain in today's society in terms of decrease in work productivity and mental conditions of people (Konnopka et al., 2009). According to the article written in 2023, entering a

university academic performance, romantic relationship, finance and uncontrollable changes has affected anxiety and stress level directly (Tan et al., 2023).

After the COVID-19, university students' anxiety level has rapidly increased (Şahin & Tuna, 2022). COVID-19 is a "highly contagious respiratory illness caused by coronavirus as SARS-CoV-2" (Encyclopaedia Britannica, 2025). COVID-19 epidemic has been defined as health-related uncertainty, such as death, and is a major factor that causes anxiety. The uncertainty has generated a complicated framework of potential mental stressor (Kumar and Nayar, 2021). Moreover, it has been observed that social isolation and being sick, which are factors caused by the pandemic that they cannot control along with academic stress, also increased the anxiety level considerably (Şahin & Tuna, 2022). Therewithal, in COVID-19 epidemic there has been a shift to Zoom and web instead of face to face education. This situation has triggered a new fear of the anxiety of not being able to express oneself adequately and speaking in front of the public which is known as speaking anxiety (Prentiss, 2021).

Anxiety disorders can be seen in both adolescence and childhood periods. Epidemiological studies identify eight types of anxiety disorders which are Generalized Anxiety Disorder, Panic Disorder, Panic Disorder with Agoraphobia, Agoraphobia, Social Phobia, Specific Phobia, Selective Mutism and Separation Anxiety as can be seen in **Figure 1** (Ströhle et al., 2018). According to Martin (2003), speaking anxiety is classified as a subtype of social phobia. Academic stress and perfectionism (Rassaby et al., 2021), foreign language speaking (Rottweiler &

Nett, 2021), COVID-19 epidemic (Şahin & Tuna, 2022) are factors that can trigger social phobia in terms of speaking anxiety (see figure 2).

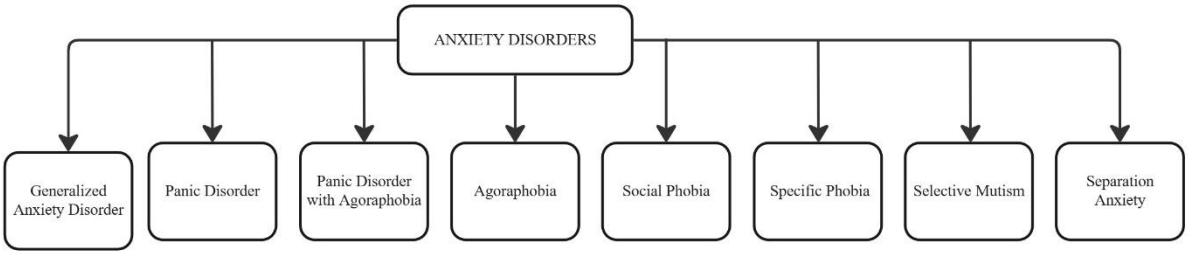


Figure 1. Eight anxiety disorders diagram, drawn by Usluer (2025)

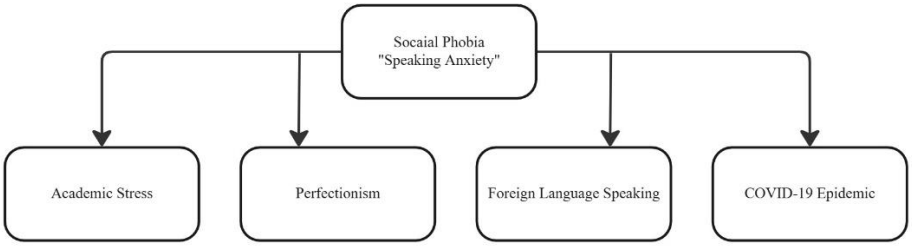


Figure 2. Four factors affecting speaking anxiety diagram, drawn by Usluer (2025)

2.1.1 Speaking Anxiety

Speaking anxiety is one of the most pervasive types of social anxiety disorder (Bartholomay & Houlihan, 2016). Preparing for or speaking a speech distress individual (Gallego et al., 2020). Speaking is an important element for people in

order to build confidence and competence. However, people who have speaking anxiety has been negatively affected both in mental well-being and physiologically. Thus, emotional distress, bodily tension and negative thoughts can be seen (**Figure 3)** (Gallego et al., 2020). According to Kelsen (2019), personal characteristics, experienced traumas and foreign language speaking directly affect speaking anxiety.

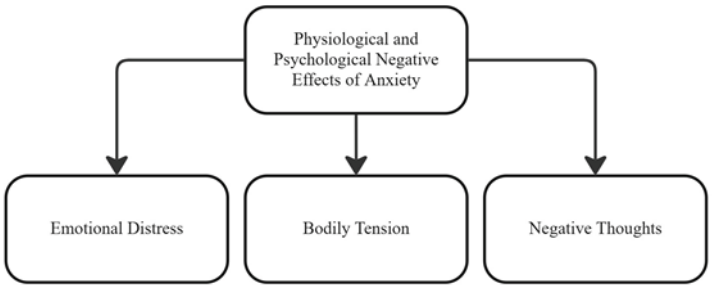


Figure 3. Physiological and psychological negative effects of anxiety, drawn by Usluer (2025)

Personality trades and perfectionism have been observed to be directly related with anxiety level (Kelsen, 2019). According to Kelsen (2019), five personality traits can be seen in **Figure 4**. Extraverted people are eager to talk in front of people with low level of anxiety, on the other hand, anxiety is high in people with perfectionism, which also has positive effects such as success (Gäde et al., 2017). This model gives a comprehensive understanding of emotional, cognitive, behavioural tendencies and it is associated with psychological consequences such as anxiety (McCrae & Costa, 2008). Also, the size of physical space directly impacts person's anxiety level. High –ceilinged environments give freedom and reduces anxiety on the contrary, enclosed

spaces give discomfort (Meyers-Levy & Zhu, 2007). Environmental psychology says that crowding and density can create stress while lighting and natural view can help to reduce anxiety (Environmental Psychology, n.d.).

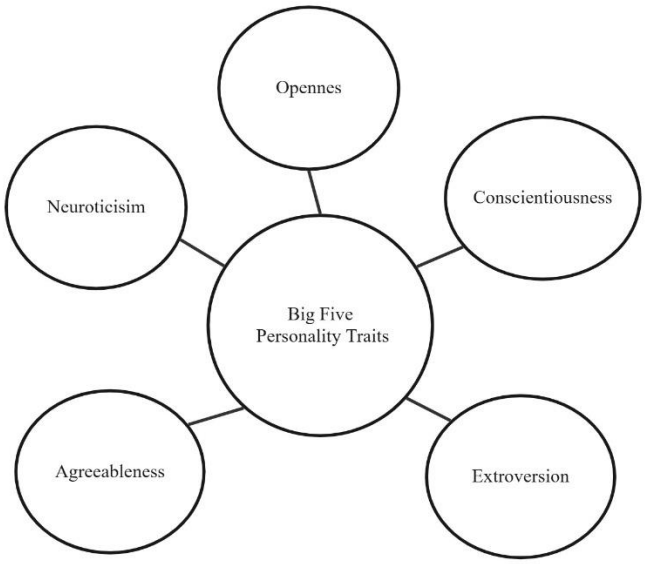


Figure 4. Big five personality traits for anxiety diagram, drawn by Usluer (2025)

Unfavourable affects have been observed when both educators' and students' communicate in a foreign language. This affects their work performance, confidence and feelings through the learning process (Kelsen, 2019). According to Karataş et al. (2016), students had difficulties when using a foreign language in oral presentations and expressing themselves. Moreover, their anxiety level was less related to the level of language proficiency and more associated with just speaking a foreign language (Karataş et al., 2016).

2.1.2 Psychological and Physiological Effects and Impact on Life

People existing with speaking anxiety face some dual effects both psychological and physiological. Increasing heart rate, hot flashes, sweating and hypothermia (Ebrahimi et al., 2019)**.** Stress and anxiety are also linked with inducing thermal responses such as sweating and heat loss which can generate reduction in body temperature (Oka, 2018). Moreover, when people give a speech, blood pressure is directly elevated (Behnke & Sawyer, 2001). Speaking anxiety, negatively affects people psychologically and mentally. Psychological effects include negative thoughts, fear, feeling bad and ashamed, and overthinking (Martin, 2003).

These physiological and psychological challenges not only effect person's current physical and mental condition but also have broader results (Bartholomay & Houlihan, 2016; Yadav et al., 2022). These issues affect self-expression and not expressing themselves as they wish may put people in disadvantaged position in job opportunities or social life. Furthermore, speaking anxiety may decrease academic performance and critical thinking skills (Bartholomay & Houlihan, 2016; Yadav et al., 2022).

2.2 The Effect of Colour on Psychology and Anxiety

Colour is an important environmental factor effecting human's psychology and perception with cognitive functioning (Zarei et al., 2021). When colours are comprehended, emotional responses are initiated in the brain. Light stimuli is detected in the eye as a colour, and guides to feeling of specific emotions that mean

"colour emotion" (Yıldırım et al., 2011). Therapeutic uses of colours are used by many doctors and psychologists (Lee et al., 2020).

Emotional feelings and mood are changed through different colours (Güneş & Olguntürk, 2019). According to Güneş & Olguntürk (2019), chromatic colours which are red, blue and green has tremendous effects on human psychology. Firstly, red initiate energy, excitement but on the other hand increase tension and anxiety. Conversely, green initiates calmness, feeling in nature, emotional stability and reduces stress. Blue inserts the feeling of calmness but sometimes promotes feelings of loneliness and sadness. Different emotional responses show up in different colour combinations and it depend on emotional experience and perception of colours (Güneş & Olguntürk, 2019; Lee et al., 2020). In Güneş & Olguntürk (2019) study, four virtual living rooms were created where walls were coloured red, green, blue and grey. According to the results of this experiment, red was associated with energy, but also fear, green was associated with calmness, but also boredom, blue was associated with peace but also sadness. This shows that colours are important in structuring emotions (Güneş & Olguntürk, 2019). It should not be forgotten that different cultures, age groups and gender are also important factors in colour preferences and the moods expressed by colours (Korkmaz et al., 2016).

Among the five senses, vision is the most important sense for human beings because it can help to provide crucial information about surroundings, environment etc. (Lee et al., 2020). Colours are indispensable elements that directly affect our lives and psychological state (Jonauskaite et al., 2020). Each colour has a different impact on

human psychology (Jonauskaite et al., 2020). According to Jonauskaite et al. (2020), every colour reveals several psychological responses. After the exposure to colour therapy, anxiety and stress levels are reduced. Frequency and wavelengths of colours are thought to substantially affecting both body and idea positively (Jonauskaite et al., 2020).

Colours directly affect psychology and physiology especially anxiety levels (Spiegel & Keith-Spiegel, 1971). Colours are grouped into cool and warm colours in terms of visual intensity. Warm colours such as yellow and orange are thought to give energy to people whereas cool colours with less vibration such as green give the energy of calmness (Korkmaz et al., 2016). Chromatic colours red to purple, externalize emotional states. According to Spiegel & Keith-Spiegel (1971), it has been observed that red motivate discharge, purple, which is a mixture of red and blue, increases and triggers anxiety levels, while green gives a feeling of relaxation and stability. After Spiegel & Keith-Spiegel (1971) work, there are not enough articles to examine this subject in detail.

Moreover, not only colour is directly related with anxiety but also individuals' preferred colour saturation is directly linked to anxiety level (IRELAND, 1992). Individuals with high anxiety level choose pastel tones because high saturated colours trigger their anxiety whereas pastel tones relieve anxiety (IRELAND, 1992). According to IRELAND (1992), 66 American college students preferred saturation levels and the results show directly that colour saturation preferences are linked with indicators of anxiety level. Over and above, people who have anxiety are eager to

choose dull colours instead of brighter colours. Because, bright colours are more stimulating for them (Korkmaz et al., 2016). According to Korkmaz et al. (2016), gender differences in terms of colour preferences draw attention. Males prefer blue 43.7%, females prefer blue 25% and also pink and purple were chosen only by females. Also, group preferences draw attention to cold colours which are chosen much and neutral colours are chosen by anxious and depressed participants (Korkmaz et al., 2016).

According to Samuel et al. (2022), colouring therapy gave participants positive energy and impacted directly their mindfulness which is related to emotional regulation. At the same time, colouring therapy helps to reduce anxiety and stress levels by painting the desired area with colours. After the colouring therapy, people with anxiety were observed to have less anxiety and less negative thinking (Samuel et al., 2022).

2.3 The Effect of CCT Level on Psychology and Anxiety

Light is the most important part of the act of seeing by reflecting on objects through receptors in the retina (Valencia et al., 2013). Light is an integral part of the physical environment. The physical environment and therefore light significantly affect people's psychology and biological activities (Zeng et al., 2022). Light influences on emotional state, with the help of both perception and impacting on stress hormone (cortisol level) (Doctors, 2022). It is crucial to knowing lighting terminology in order to understand the importance of CCT. According to IESNA Lighting

Handbook (2000), illuminance is described as the concentration of luminous flux which falls onto an exact point on a surface and the unit of measurement is lux, that can be obtained from an illuminance meter. Another term is luminance which refers to the perceived brightness of a light-emitting object and it is obtained from a luminance meter with a unit of candela per square meter (cd/m²) (IESNA,2000). The colour temperature of a light source is in accordance to the temperature of a blackbody radiator that construct same chromaticity and is quantified by Kelvin (K) (IESNA,2000). Correlated Colour Temperature (CCT) is a standard metric that indicates how warm or cool a light source appears, based on its comparison to the colour emission of an ideal blackbody at a specific temperature in Kelvin (Valencia et al., 2013). CCT also can help to change the atmosphere of an environment and can help to control stress level and mood (Valencia et al., 2013).

According to Doctors (2022), cool CCT lighting can increase cortisol levels, contributing to stress, whereas warm CCT can reduce cortisol and promote the release of melatonin (see **Figure 5)**. Cortisol is "a steroid hormone produced by the adrenal cortex that plays a crucial role in metabolism and helps body to respond to stress (Encyclopaedia Britannica, n.d.). According to a study conducted in 2022, four different CCT level conditions which are 4000K, 6000K, 8000K and 10.000K were observed and results indicated that positive mood and performance demonstrated contradictory developments with increasing CCT level (Zeng et al., 2022). Moreover, Awada et al. (2025) conducted a research about how different CCT levels affected stress biologically and psychologically. 100 office workers participated in this study and five different lighting conditions were used. Results showed that, 3000K condition helped to reduce hearth rate and gave a calming effect instead of

stress (Awada et al., 2025). More precisely, warm and dimmed light can help reduce stress and give a positive mood (Awada et al., 2025). Although stress and anxiety show similar symptoms, stress is a reaction to a specific stressor in the environment (Bandelow & Michaelis, 2015). On the other hand, anxiety is a chronical emotional state, but anxiety may also be an intensified form of stress (Bandelow & Michaelis, 2015).

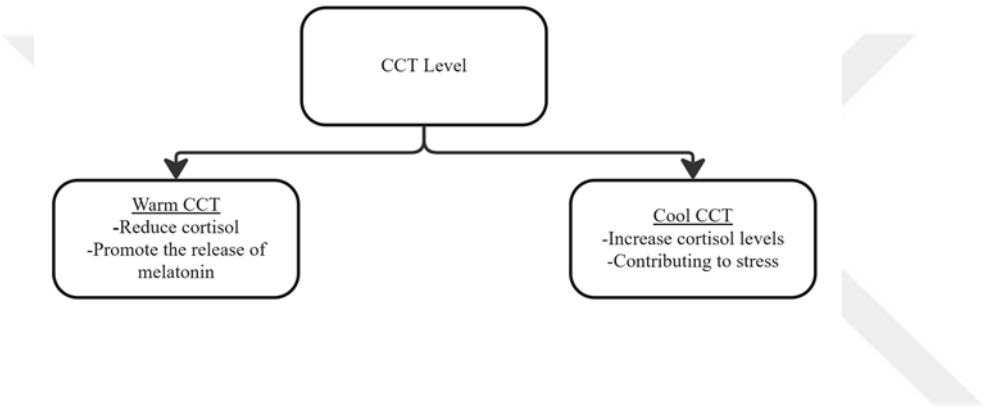


Figure 5: CCT levels and Effects Diagram, drawn by Usluer (2025)

Overall, lighting conditions especially CCT level play a fundamental role in human life. Existing literature showed that CCT level influence both psychology and physiology. With the help of CCT level emotional state is affected positively (Chen et al., 2022). 67 participants participated in the experiment and were exposed to different CCT levels. According to the results of the study, warm CCT especially 3000K was associated with relaxation (Chen et al., 2022).

Light enters the eye and it reflects to amygdala which has a fundamental role in emotional functions (Li et al., 2024). Cool and warm light environment affects directly the mood and anxiety (Shahidi et al., 2021). According to Shahidi et al.

(2021), it has been observed that cooler CCT negatively affects the negative mood and anxiety levels of people in the environment compared to warmer CCT. According to the results of this study, it has been suggested that work areas can be adjusted to warmer CCT level, but it has been emphasized that this situation may vary according to personality differences, choices and environment types (Shahidi et al., 2021). Ambient lighting helps to enhance psychological experiences in work places. Also, in this study coloured wall were used. Red walls gave anger and anxiety, blue walls gave brightness (Shahidi et al., 2021). Combination of colours and CCT indicates that warm CCT and non-coloured wall (white) gave the calming effect (Shahidi et al., 2021)

CHAPTER III

METHODOLOGY

3.1 Setting

The study was conducted in the research laboratory of the Department of Interior Architecture and Environmental Design at Bilkent University, Ankara. The aim of this study is understanding the relationship between colour, CCT and speaking anxiety in a small space. The room measures 4.10 meters in width, 4.18 meters in depth, and 3.85 meters in height, totalling to a usable area of 17.138 m². This space was specifically selected because it does not contain any windows, eliminating the influence of external light or colour sources. The experimental lighting setup utilized the existing wall washer and cove lighting systems in the room. Wall washer lighting is a system that distributes light across vertical surfaces uniformly to minimize shadows (IESNA, 2011). Cove lighting is a method in which luminaires are obscure to give indirect illumination on a ceiling (Cuttle, 2003). Before the experiment began, participants were neutralized under the wall washer lighting, which was

equipped with Philips fluorescent lamps coded TL-D 36W/54, emitting at a correlated colour temperature (CCT) of 5550 K—closely resembling natural daylight. Under this condition, participants completed pre-experiment tests within 5–10 minutes and to neutralize the light perception, they were kept under 5550K. (see **Figure 6)**. Following this neutralization phase, two different cove lighting configurations were prepared: one with a high CCT of 6500 K and another with a low CCT of 4000 K. In the first experimental condition, Philips fluorescent lamps coded TL-D80 36W/840, with a CCT of 4000 K were used to simulate the low-CCT environment. In the second condition, Philips TL-D80 36W/865 fluorescent lamps were employed to create a high-CCT, 6500 K setting. Three different background colours were used within the experiment room. To avoid damaging the walls and allowing for easier change of the environment, the coloured surfaces were applied using fabrics attached with wall staples. Colours were selected for having equal levels of blackness (10%) and chromaticness (40%) while differing in hue. The goal was to isolate the effect of hue while controlling for saturation and brightness. The goal was to isolate the effect of hue while controlling for saturation and brightness. For the methodological framework of this study, the Natural Colour System (NCS) was used as a main colour specification. Dissimilar to other systems which are Munsell, CIELAB, NCS is grounded in meaningful principles from Hering's opponent-process theory which is associated with red, yellow, green and blue as some essential hues by the side of black and white (Hård, Sivik, & Tonnquist, 1996). The hues were selected from the NCS colour atlas to represent complementary tones, as illustrated in **Figure 7.**

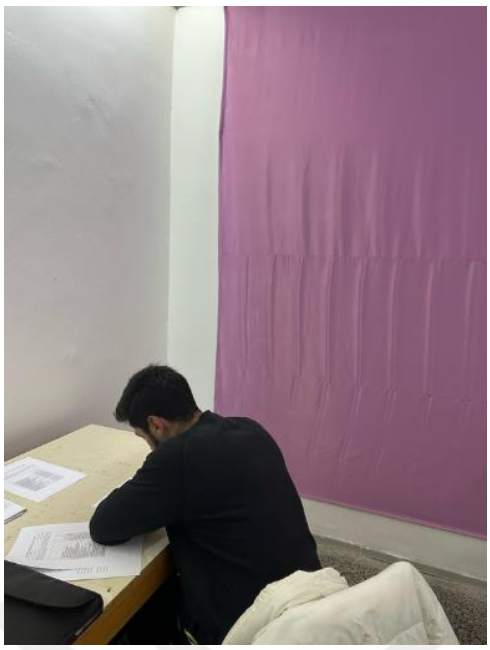


Figure 6. 5550K Exposure S1040-R40B Colour.

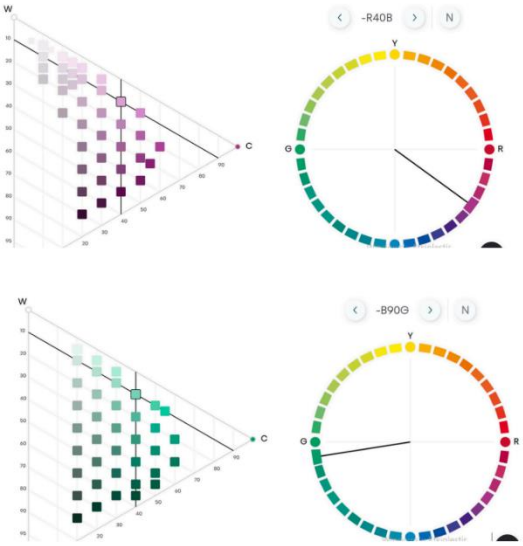


Figure 7. NCS Colour Atlas and Chosen Colours, drawn by Usluer (2025).

A total of five different experimental setups were created. In each setup, the observer sits in the center of a fabric-covered wall and listens to the participant. The

participant, in turn, speaks from the front of the fabric-covered wall, looking at the observer and, in turn, at the fabric-covered wall. The first setup included a 4000 K illumination condition with a purple background (see **Figure 8).** After the experiment room was prepared, illuminance level and luminance level was measured. Illuminance level was measured as 306 lx and luminance level measured as 28.37 cd/m2 (see **Figure 9)**. The second setup included a 6500 K illumination with a purple background (see **Figure 10)**. Illuminance level and luminance level was measured which are 261 lx and 26.07 cd/m2 respectively and can be seen in **Figure 11**. The third setup combined 4000 K illumination with a turquoise background (see **Figure 12)**. According to **Figure 13**, participants were exposed to 4000 K in reading phase of the experiment. Illuminance level was measured as 306 lx and luminance level was measured as 33.88 cd/m2 (see **Figure 14)**. The fourth setup consisted of 6500 K illumination with a turquoise background (see **Figure 15)**. All participants were exposed to 5550 K through wall-washing lighting for 5-10 minutes to neuturilize lighting perception for all in the questionare phase (see **Figure 16**). Illuminance level and luminance level were measured 305 lx, 36.31 cd/m2 respectively can be seen in **Figure 17**. Finally, the fifth setup included a white background paired with 4000 K illumination (see **Figure 8)**. Illuminance level was 519 lx and luminance level was 11.86 cd/m2 (see **Figure 19)**. White background was chosen because white is the most common colour used in general. Also, it was a control colour in order to see the differences between chromatic and achromatic settings. The overview of the experimental setups is presented in **Figure 20** and **Figure 21.**

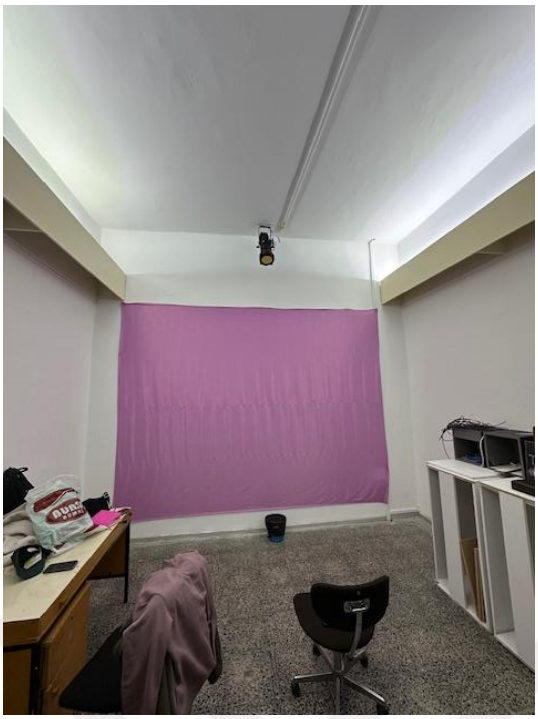


Figure 8. 4000K and Purple(S1040-R40B) Setting

Figure 9. Luminance and Illuminance Level in 4000K and Purple(S1040-R40B)

Setting are shown respectively.

Figure 10. 6500K and Purple (S1040-R40B) Setting

Figure 11. Luminance and Illuminance levels in 6500K and Purple (S1040-R40B) Setting are shown respectively

Figure 12. 4000K and Turquoise (S1040-B90G) Setting

Figure 13. 4000K and Turquoise (S1040-B90G) Setting in text reading phase.

Figure 14. Illuminance and Luminance levels shown respectively

Figure 15. 6500K and Turquoise (S1040-B90G) setting

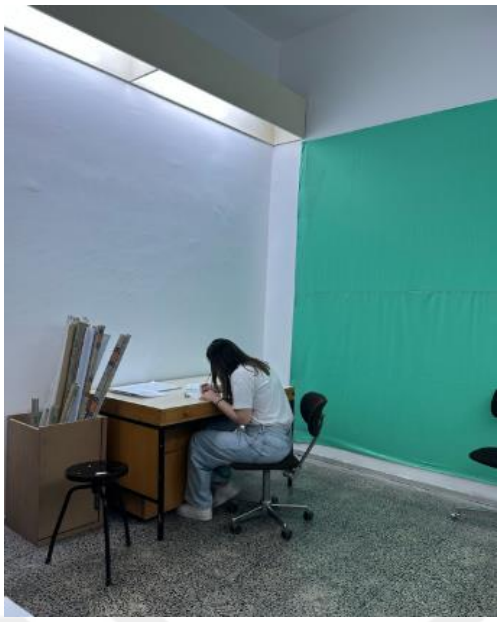


Figure 16. 5550K and Turquoise (S1040-B90G) setting in Questionnaire phase

Figure 17. Illuminance Level and Luminance Level shown respectively

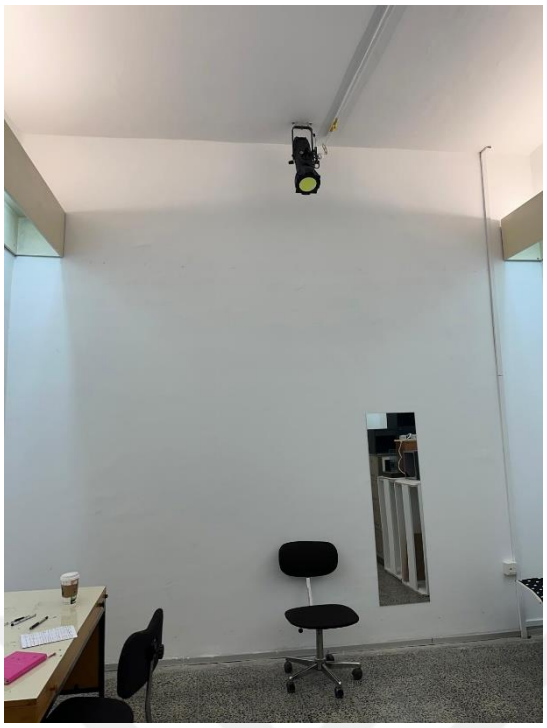


Figure 18. 4000K and White setting

Figure 19. Illuminance Level and Luminance Level in 4000K and White setting shown respectively

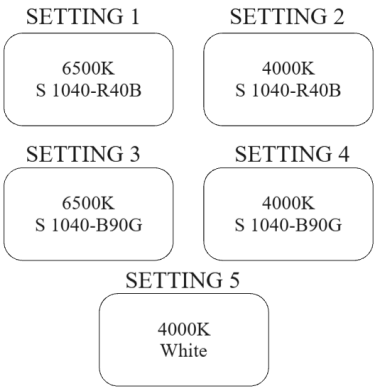


Figure 20. Experimental Setups Diagram, drawn by Usluer (2025)

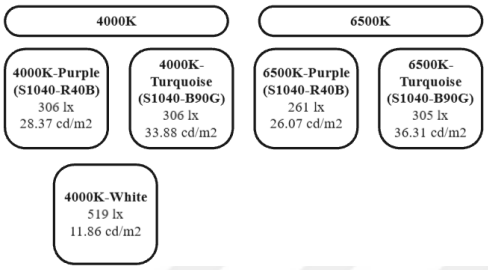


Figure 21. Experimental Setups Diagram with Luminance, Illuminance, Color data, drawn by Usluer (2025)

3.2 Participants

The participant criteria consisted of legally adult individuals aged 18 or older. Since the experiment was conducted at Bilkent University, participants were primarily in the 18-26 age range. Additionally, a fundamental requirement was that participants were not regularly using psychological medications, as sedative drugs could affect the results of the experiment. When selecting participants, it was stipulated that those from the Faculty of Design and Architecture must be in their first year, as anxiety levels tend to decrease as students' progress through the program. This is due to the

increased opportunities for public speaking and presentation skills. Furthermore, students with knowledge of colour and light were not considered suitable for the experiment, as it was believed they would not be able to perform the experiment impartially. On the other hand, participants from other departments were allowed to join regardless of their year of study, as students from these departments do not regularly engage in presentations. According to the G*Power results, under the conditions of 0.25 effect size, 0.05 alpha, approximately 101 is the total sample size (see **Appendix A)**. G*Power results show that 101 participants would be sufficient in medium effect with %70 power. The F value was 3.94 which means actual power 0.701. But, in order to make experiment reliable a sample size of 150 participants was used. There are five different conditions and each condition was experienced by 30 participants. The research was approved by the Bilkent University Human Ethics Committee on 30.04.2025 number 699 ethical document (see **Appendix B)**.

3.3 Procedure

This study consists of six consecutive stages starting with a systematic review. In the first phase, a comprehensive literature review was conducted using the key terms colour, CCT (correlated colour temperature), anxiety, and speech anxiety. Based on the gap identified in the literature, the thesis topic was further determined. In addition, psychological scales used in previous studies were examined and appropriate scales were selected for the experimental process. In the second phase, preparations for the experimental environment in Bilkent University FC112 laboratory were initiated. In this phase, the wall dimensions of the laboratory were

measured and two different fabric colours were selected according to the Natural Colour System (NCS) codes. Then, the fluorescent lighting in the laboratory was adjusted to provide two levels of CCT: low CCT condition (4000 K) and high CCT condition (6500 K). In the third phase, firstly participant come to laboratory then daylight fluorescents (5550 K) was opened. Participants were exposed to this same baseline condition at the beginning of the experiment. Then, firstly participants filled out the demographic information, then GAD-7 scale and STAI form. GAD-7 scale was used to measure the level of general anxiety. This scale consisted of seven questions with 4-point Likert scale. STAI form was used to asses both state anxiety and trait anxiety. It refers to participants' tendency to distinguish circumstances as being threatening or not. STAI consisted of 40 items with 4-point Likert scale. Before the experiment started, hearth rate measurement was checked. Afterwards, the participant was given a scientific text about astrology and was asked to understand and explain this text. Astrology text was used because people do not easily learn about this subject and that they encounter it for the first time or very rarely. Astrology text was used as an unknown, unfamiliar text because anxiety manifests itself more in unfamiliar situations. It took them 10-15 minutes to read and understand the text. It took them five minutes to speak. The experimental process began in the fourth phase, where participants participated in five separate conditions but only one condition can be done by each participant. In each condition, they were asked to discuss a given text and respond to open-ended questions totalling to five minutes speaking. The fifth phase was the post-experiment phase. In this phase firstly, hearth rate was measured and STAI test was again filled out. Finally, in phase six statistical analysis of all data retrieved from all questionnaires were done using JASP statistical software. All the phases can be seen in **Figure 22**. Also experiment

phases can be seen in **Figure 23**.

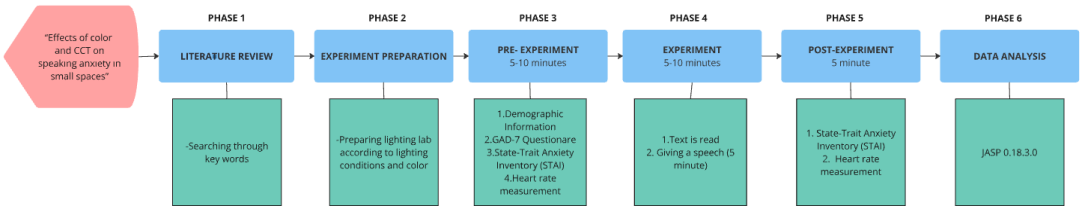


Figure 22: Procedure Diagram, drawn by Usluer (2025)

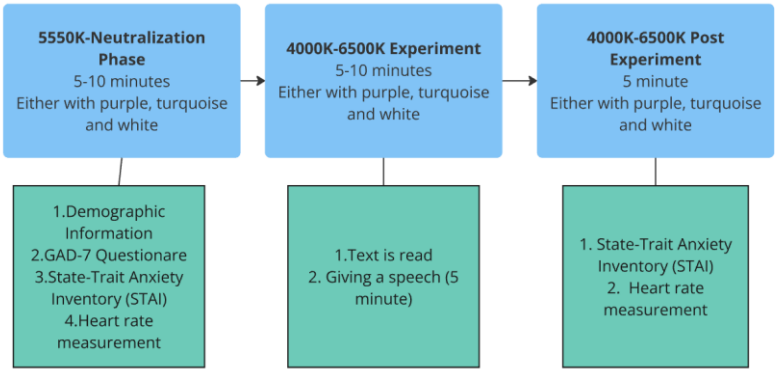


Figure 23: Procedure Diagram of Experiment, drawn by Usluer (2025)

3.4 Instrument

This study employed both subjective and objective measurements. The subjective measurement was pursued by evaluating participant's anxiety level. The objective measurements were firstly lighting and colour measurements secondly heart rate measurements. Finally, the data analysis was conducted quantitatively using JASP statistical software. Visualization of all the instruments can be seen in **Figure 24**.

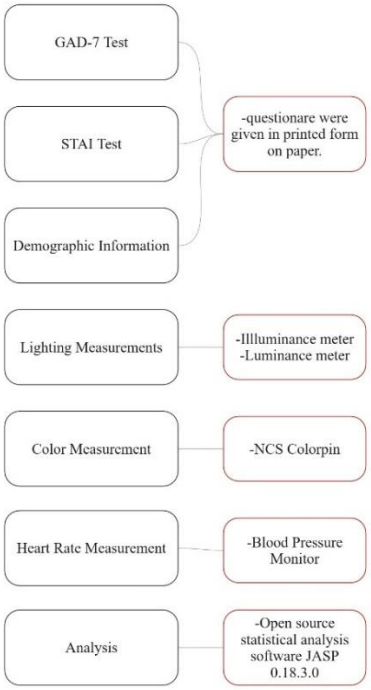


Figure 24: Procedure Diagram, drawn by Usluer (2025)

3.4.1 Lighting and Colour Measurement

The instrumental assessment of lighting conditions was carried out using an illuminance meter (Minolta T-1H) and a luminance meter (Minolta LS-100). Illuminance is known as the total amount of light falling on a surface. Illuminance was measured on the centre of the room where participants were giving a speech. Luminance is known as the total amount of light emitted from a surface. Luminance was also measured from the same place as the illuminance measurement. The measurements obtained from five different experimental setups are presented in the table shown in **Figure 25** for better clarity. Also, the fabrics used in the study were selected based on the measurements taken with the NCS Colorpin device as shown in **Figure 26**.

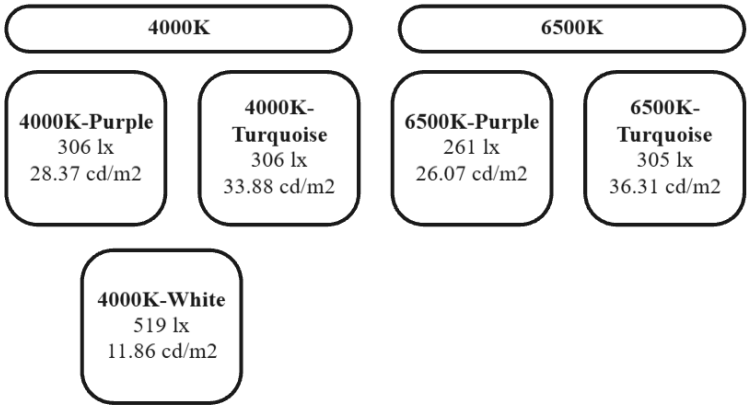


Figure 25: Lighting conditions of the 5 experimental setups, drawn by Usluer (2025)

Figure 26: NCS Colour pin, (2025)

3.4.2 Demographic Questionaire

Demographic questionaire consists of 10 questions about age, gender, education level, sleep status, whether there is any diagnosed psychological disorder, whether any sedative medication is used, and how often presentations are made. Demographic questionaire can be seen in **Appendix C** in detail.

3.4.3 GAD-7 Scale

Anxiety was assessed through measures. The standardized measures are Beck Anxiety Inventory, the Hamilton Anxiety Rating Scale, the Hospital Anxiety and Depression Scale but those are used in clinical context mostly. The GAD-7 and STAI tests capture both clinical issues and situational issues, that is why GAD-7 and STAI tests were chosen (Spielberger, Gorsuch, & Lushene, 1983). Measuring the general anxiety level provided with Generalized Anxiety Disorder (GAD-7) scale was conducted. The GAD-7 was developed by Dr. Robert L. Spitzer and Dr. Kurt Kroenke in 2006. GAD-7 is a widely used and self-reported questionnaire (Spitzer et al., 2006). It detects the level of general anxiety. It consists of 7 items and rated on 4 point Likert scale (Spitzer et al., 2006). GAD-7 scale was developed to show valid and practical self-reported tool in order to understand and find underdiagnosed or misdiagnosed mental disorders. This tool assesses quickly, sees symptoms' severity and it is applicable in clinical and research settings. It can be seen in **Appendix D** in Turkish version (Konkan et al., 2013).

3.4.4 STAI Test

State-Trait Anxiety Inventory (STAI) test measures two distinct dimensions. These dimensions are state anxiety which is about temporary emotional state and trait anxiety which is about general and long term anxiety level developed by Spielberger et al. (1970). It is a self-reported questionnaire consisting of 40 items; 20 for state anxiety and 20 for trait anxiety. 4 point Likert scale is used for rating. STAI provides delicate assessment of anxiety, it can be used both in clinical work and research, it is

also quick, self-reported and gives results detailly. It can be seen in **Appendix E** in Turkish version (Öner & Le Compte, 1985).

3.5 Data Analysis

The collected quantitative data were analysed using an open statistical analysis source, JASP 0.18.3 version (JASP Team, 2024). Two-way Anova was used to examine the effect of lighting condition and background colour on participant's speaking anxiety level. Two-way ANOVA is a statistical method used to estimate participants and interactive effects of two independent variables on dependent variable. Two-way ANOVA examines the main effects of two independent variables which are CCT and background colour in anxiety levels. Before performing Two-way Anova, assumptions of normality and homogeneity of variance were checked and met. Normality was assessed with Q-Q plots for each groups

CHAPTER IV

RESULTS

The results of this thesis were obtained and statistically tested in the JASP 0.18.3.0 (JASP Team, 2024). The answers to the demographic questionnaire, GAD-7 scale and STAI test were first scored manually, and then were entered into JASP software. Sample characteristics, assumption check, descriptive statistics, repeated measures ANOVA, independent sample t-test, paired sample t-test, Post-Hoc pairwise comparisons, correlation analyses and regression analyses were used. These research study's findings were obtained from 150 participants. 118 (%78.7) were female and 32 (%21.3) were male. Shown in **Table 1**, 135 participants (%90) were university students, 15 were (%10) graduated. The participants ages ranged from 18 to 26 with a mean age of 20.65 years old. The largest proportion of participants was aged 19-20.

Table 1. Sample Characteristic

Descriptive Statistics ▼

Descriptive Statistics

	GENDER	EDUCATION	AGE
Valid	150	150	150
Missing	0	0	0
Mean	1.213	1.100	20.647
Std. Deviation	0.411	0.301	2.229
Minimum	1.000	1.000	18.000
Maximum	2.000	2.000	26.000

Frequency Tables

Frequencies for GENDER

GENDER	Frequency	Percent	Valid Percent	Cumulative Percent
Female	118	78.667	78.667	78.667
Male	32	21.333	21.333	100.000
Missing	0	0.000		
Total	150	100.000		

Frequencies for EDUCATION

EDUCATION	Frequency	Percent	Valid Percent	Cumulative Percent
UNIVERSITY STUDENT	135	90.000	90.000	90.000
GRADUATED	15	10.000	10.000	100.000
Missing	0	0.000		
Total	150	100.000		

Table 1: (cont'd)

Frequencies for AGE

AGE	Frequency	Percent	Valid Percent	Cumulative Percent
18	17	11.333	11.333	11.333
19	38	25.333	25.333	36.667
20	36	24.000	24.000	60.667
21	21	14.000	14.000	74.667
22	11	7.333	7.333	82.000
23	8	5.333	5.333	87.333
24	4	2.667	2.667	90.000
25	4	2.667	2.667	92.667
26	11	7.333	7.333	100.000
Missing	0	0.000		
Total	150	100.000		

4.1 GAD-7 Scale Assumption Checks and Linear Regression

Assumption check is ensuring validity of the results before using ANOVA (Field, 2018). Also linear regression is used to model the relationship between dependent

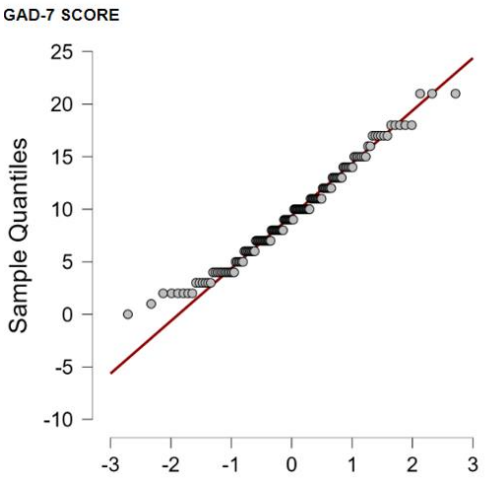
and independent variables. It shows the strength of the variables relationship (Tabachnick & Fidell, 2019). The GAD-7 scores range from 0-21. 0-4 shows minimal anxiety, 5-9 shows mild anxiety, 10-14 shows moderate anxiety, 15-21 shows severe anxiety (Spitzer et al., 2006). **Table 2** indicates that, the mean score of GAD-7 was 9.45 and SD was 4.62 with a range of 0 to 21 across 150 valid data. Across 150 participants GAD-7 score was 9.45 which corresponds to mild anxiety symptoms. In order to analyse normality assumptions a Q-Q (quantile-quantile) plot was used. Q-Q plot compares the quantiles of the data with quantiles of normal distribution. The points align with diagonal reference line that shows normal distribution (Field, 2018). **Table 2** illustrates that, most data point aligned closely with reference line which means that there is an approximate normal distribution. Therefore, assumption checks normality and ANOVA can be conducted in the following phase.

Table 2. Descriptive Statistics and Q-Q plot of GAD-7 Scale

Descriptive Statistics ▾

Descriptive Statistics

	GAD-7 SCORE
Valid	150
Missing	0
Mean	9.453
Std. Deviation	4.616
Minimum	0.000
Maximum	21.000



Moreover, a linear regression was examined to whether age and educational level substantially predicted GAD-7 scores of participants. **Table 3** shows that it wasn't statistically significant, F (2,147), p=.628 signifying the predictors didn't account for

a substantially portion of the variance in anxiety level. R^2 =.006 was very low and adjusted R^2= -.007 for poor model fit. Thus, anxiety was independent of age and education level. In the coefficient table age B= 0.207, p=.396 which means that age is not found to be significant for anxiety level. Also, education level B= -1.670, p= .355 is not found to be a substantial factor affecting a person's anxiety level.

Table 3. Linear Regression GAD-7 Scale, Age and Education Level

Linear Regression

Model Summary - GAD-7 SCORE

Model	R	R^2	Adjusted R^2	RMSE
H_0	0.000	0.000	0.000	4.616
H_1	0.079	0.006	−0.007	4.633

ANOVA

Model		Sum of Squares	df	Mean Square	F	p
H_1	Regression	20.064	2	10.032	0.467	0.628
	Residual	3155.109	147	21.463		
	Total	3175.173	149			

Note. The intercept model is omitted, as no meaningful information can be shown.

Coefficients ▼

Model		Unstandardized	Standard Error	Standardized	t	p
H_0	(Intercept)	9.453	0.377		25.081	< .001
H_1	(Intercept)	7.020	3.880		1.809	0.072
	AGE	0.207	0.243	0.100	0.851	0.396
	EDUCATION	−1.670	1.799	−0.109	−0.928	0.355

4.2 Repeated Measure ANOVA on GAD-7 and STAI Test

ANOVA is a statistical method which is used to discover whether there are statistical significances between the means of three or more groups. This method uses more

than one independent variable (Field, 2018). The experiment consisted of pre-test and post-test, that's why Repeated Measures ANOVA was used to show anxiety level changes over time and whether its dependent on lighting or colour conditions. ANOVA was used to explore the effects of CCT (4000K and 6500K) and colour (purple and turquoise) on speaking anxiety measured by the GAD-7 scale. **Table 4** shows that $F(1, 118) = 0.20$, $p = .656$, $\eta^2 = .0003$ shows that there was no overall reduction in GAD-7 scores. Nevertheless, there were notable impacts, $F(1, 118) = 16.63$, $p < .001$, $\eta^2 = .026$, and time × colour interaction effects, $F(1, 118) = 13.44$, $p < .001$, $\eta^2 = .021$ that shows anxiety level reducing depending on both colour and CCT. Descriptive illustrates that 4000K turquoise condition had the maximum reduction in speaking anxiety level. On the other hand, 6500K turquoise condition indicates minimal speaking anxiety level changes. This suggests a potential directional impact and a relationship between time and colour which should be interpreted with caution. In the Repeated Measures ANOVA RM Factor 1 represents within subject factor of time which are pre-test and post-tests. This shows changes in speaking anxiety within the same participants according to pre-test and post-test data.

Table 4. Repeated Measures ANOVA 6500K-4000K, Purple and Turquoise Conditions

Repeated Measures ANOVA ▼

Within Subjects Effects ▼

Cases	Sum of Squares	df	Mean Square	F	p	η^2
RM Factor 1	8.749	1	8.749	0.200	0.656	3.136×10^{-4}
RM Factor 1 ✻ CCT LEVEL	727.329	1	727.329	16.630	< .001	0.026
RM Factor 1 ✻ COLOR	587.782	1	587.782	13.439	< .001	0.021
RM Factor 1 ✻ CCT LEVEL ✻ COLOR	168.689	1	168.689	3.857	0.052	0.006
Residuals	5160.890	118	43.736			

Note. Type III Sum of Squares

Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p	η^2
CCT LEVEL	1471.777	1	1471.777	9.585	0.002	0.053
COLOR	835.958	1	835.958	5.444	0.021	0.030
CCT LEVEL ✻ COLOR	821.695	1	821.695	5.351	0.022	0.029
Residuals	18119.249	118	153.553			

Note. Type III Sum of Squares

Descriptives

Descriptives

RM Factor 1	CCT LEVEL	COLOR	N	Mean	SD	SE	Coefficient of variation
pre test	4000K	PURPLE	30	38.300	9.083	1.658	0.237
		TURQUOISE	31	39.710	10.606	1.905	0.267
	6500K	PURPLE	30	41.767	11.307	2.064	0.271
		TURQUOISE	31	39.161	8.840	1.588	0.226
post test	4000K	PURPLE	30	36.667	9.170	1.674	0.250
		TURQUOISE	31	35.194	10.432	1.874	0.296
	6500K	PURPLE	30	50.367	8.215	1.500	0.163
		TURQUOISE	31	38.226	11.257	2.022	0.294

Moreover, repeated measure ANOVA was used to explore the effects of CCT (4000K and 6500K) and colour (purple and turquoise) on heart rate measures of participants' before and after the experiment. Within-subject effects mention to measure variation repeatedly. Between-subject effects mention that distinctions are distinguished between independent groups of participants exposing divergent conditions (Tabachnick & Fidell, 2019). **Table 5** shows, $F(1,118) = 8.800$, $p = .004$ showing that heart rates meaningfully changed from pre-test and post-test. Thus,

there were substantial interaction impacts between time and CCT and between time and colour with value F(1,118) = 34.465, p < .001, F(1,118) = 23.507, p < .001 respectively. Those results indicate that heart rate changes in different conditions. According to between-subject effects, there is a substantial correlation between CCT and colour. F(1,118) = 9.507, p = .003 indicates that heart rate responses were affected by integrated impacts of CCT and colour. Furthermore, heart rate decreased from pre and post-test (88.84 and 85.48 respectively) in 4000K with turquoise condition. On the other hand, 6500K with purple condition it was observed that heart rate increased from pre-test to post-test (85.20, 91.77 respectively).

Table 5. Repeated Measures ANOVA CCT, Colour and Heart Rate

Repeated Measures ANOVA

Within Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
RM Factor 1	114.937	1	114.937	8.800	0.004
RM Factor 1 ✻ CCT LEVEL	450.165	1	450.165	34.465	< .001
RM Factor 1 ✻ COLOR	307.035	1	307.035	23.507	< .001
RM Factor 1 ✻ CCT LEVEL ✻ COLOR	3.313	1	3.313	0.254	0.615
Residuals	1541.242	118	13.061		

Note. Type III Sum of Squares

Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
CCT LEVEL	115.207	1	115.207	3.274	0.073
COLOR	0.168	1	0.168	0.005	0.945
CCT LEVEL ✻ COLOR	334.551	1	334.551	9.507	0.003
Residuals	4152.281	118	35.189		

Note. Type III Sum of Squares

Descriptives

Descriptives

RM Factor 1	CCT LEVEL	COLOR	N	Mean	SD	SE	Coefficient of variation
pre heart rate	4000K	PURPLE	30	84.433	4.591	0.838	0.054
		TURQUOISE	31	88.839	5.273	0.947	0.059
	6500K	PURPLE	30	85.200	3.881	0.709	0.046
		TURQUOISE	31	85.387	4.558	0.819	0.053
post heart rate	4000K	PURPLE	30	85.100	5.162	0.942	0.061
		TURQUOISE	31	85.484	4.242	0.762	0.050
	6500K	PURPLE	30	91.767	6.590	1.203	0.072
		TURQUOISE	31	87.000	4.531	0.814	0.052

Furthermore, repeated measures factors refers to difference between pre-STAI and post-STAI test results. **Table 6** indicates that repeated measures factors and colour was statistically reliable. $F(2,147)=8.376, p<.001$ $F(2, 147) = 8.376, p < .001$ $F(2,147)=8.376$, $p<.001$ shows that according to pre-STAI and post-STAI test results showing to change in anxiety level and notably depended on colours of the conditions.

Table 6. Within the Subject Effect and Colour

Repeated Measures ANOVA

Within Subjects Effects ▼

Cases	Sum of Squares	df	Mean Square	F	p
RM Factor 1	62.272	1	62.272	1.354	0.247
RM Factor 1 ✻ COLOR	770.555	2	385.278	8.376	< .001
Residuals	6761.715	147	45.998		

Note. Type III Sum of Squares

Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
COLOR	1176.091	2	588.046	3.352	0.038
Residuals	25785.325	147	175.410		

Note. Type III Sum of Squares

Additionally, repeated measure factor was used to show pre-STAI and post-STAI with the effect of CCT. STAI scores range from 20 to 80. Higher scores mean higher anxiety level. 20-37 shows low anxiety, 38-44 shows moderate anxiety, 45-80 shows high anxiety level (Julian, 2011). According to **Table 7**, $F(1,148)=19.973, p<.001$ $F(1, 148) = 19.973, p < .001$ $F(1,148)=19.973, p<.001$ means that pre-post STAI test affected anxiety level and anxiety level notably varied hinging on CCT. Which means that, anxiety levels over time deviated hinging on the CCT use.

Table 7. Within the Subject Effect and CCT Level

Repeated Measures ANOVA

Within Subjects Effects ▼

Cases	Sum of Squares	df	Mean Square	F	p
RM Factor 1	4.052	1	4.052	0.090	0.764
RM Factor 1 ✻ CCT LEVEL	895.625	1	895.625	19.973	< .001
Residuals	6636.645	148	44.842		

Note. Type III Sum of Squares

Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
CCT LEVEL	1772.856	1	1772.856	10.417	0.002
Residuals	25188.561	148	170.193		

Note. Type III Sum of Squares

4.3 Paired Samples T-Test for White and 4000K

Paired sample t-test is a statistical test to compare means of two measurements (Field, 2018). Paired sample t-test was used to assess participants' anxiety scores under the 4000K and white wall condition. According to **Table 8**, there is a notable decrease in STAI pre-test and post-test. t(27) = 2.673, p = .013 shows that warm white light (4000K) is related with reducing speaking anxiety. Also, the effect size was moderate and Cohen's d= 0.505 indicates a substantial variation in anxiety level in this condition. Cohen's d decides how large or meaningful is the effect size. According to Cohen (1988), 0.2 means small effect, 0.5 means medium effect, 0.8 means large effect. While ANOVA focused on colour excluding white and CCT conditions. Separate analysis provides supportive observation. There is a similarity

with 4000K turquoise and 4000K white condition. These conditions illustrate remarkable speaking anxiety level reduction. Also, this comparison shows that 4000K is the key factor to reduce speaking anxiety level. In order to see normality of this study, Sharpiro-Wilk test was used. Sharpiro-Wilk test is used for normal distribution. p>.05 means data are normally distributed, p<.05 are not normally distributed (Field,2018). According to **Table 8,** W= 0.933 and p= 0.075 shows that findings didn't differ significantly from normal distribution.

Table 8. Paired Samples T-Test for White and 4000K

Paired Samples T-Test ▼

Paired Samples T-Test ▼

Measure 1		Measure 2	t	df	p	Cohen's d	SE Cohen's d
PRE-STAI SCORE	-	POST-STAI SCORE	2.673	27	0.013	0.505	0.137

Note. Student's t-test.

Assumption Checks

Test of Normality (Shapiro-Wilk)

			W	p
PRE-STAI SCORE	-	POST-STAI SCORE	0.933	0.075

Note. Significant results suggest a deviation from normality.

Descriptives

Descriptives

	N	Mean	SD	SE	Coefficient of variation
PRE-STAI SCORE	28	39.000	10.245	1.936	0.263
POST-STAI SCORE	28	35.321	11.039	2.086	0.313

4.4 Post-Hoc Tests

Turkey and Bonferroni corrections were used to present the post-hoc pairwise comparisons for the factor of colour. Post-hoc pairwise shows the comparison groups

in pairs because ANOVA results do not show the differences among groups (Field, 2018). **Table 9** indicates there is modestly significant distinction between turquoise-purple conditions and white-purple conditions. On the other hand, there is no significant difference between turquoise and white conditions. These show that there is difference between specific colour conditions but they don't reach statistical significance after controlling multiple comparisons. Moreover, in order to see colour effects on pre-post STAI test, post-hoc comparison was used. According to **Table 10,** under the condition of mean difference = −6.807-6.807−6.807, pTukey=.006p_{Tukey} = .006pTukey=.006, pBonf=.007p_{Bonf} = .007pBonf=.007 indicates that turquoise post-STAI conditions differed meaningfully from purple post-STAI. Also, under the condition of mean difference = 8.1958.1958.195, pTukey=.010p_{Tukey} = .010pTukey=.010, pBonf=.012p_{Bonf} = .012pBonf=.012 indicates that purple post-STAI condition also varied considerably.

Table 9. Post-Hoc Tests for Colour

Post Hoc Tests ▼

Post Hoc Comparisons - COLOR ▼

		Mean Difference	SE	t	p_{tukey}	p_{bonf}
TURQUOISE	PURPLE	−3.702	1.696	−2.183	0.077	0.092
	WHITE	0.912	2.132	0.428	0.904	1.000
PURPLE	WHITE	4.614	2.143	2.153	0.083	0.099

Note. P-value adjusted for comparing a family of 3
Note. Results are averaged over the levels of: RM Factor 1

Table 10. Post-Hoc Tests for Colour with pre and post STAI Tests

Post Hoc Comparisons - COLOR ⁜ RM Factor 1 ▼

		Mean Difference	SE	t	P_{tukey}	P_{bonf}
TURQUOISE, pre stai test	PURPLE, pre stai test	−0.598	1.905	−0.314	1.000	1.000
	WHITE, pre stai test	0.435	2.396	0.182	1.000	1.000
	TURQUOISE, post stai test	2.726	1.218	2.238	0.227	0.401
	PURPLE, post stai test	−4.081	1.905	−2.142	0.270	0.500
	WHITE, post stai test	4.114	2.396	1.717	0.522	1.000
PURPLE, pre stai test	WHITE, pre stai test	1.033	2.408	0.429	0.998	1.000
	TURQUOISE, post stai test	3.324	1.905	1.744	0.504	1.000
	PURPLE, post stai test	−3.483	1.238	−2.813	0.061	0.084
	WHITE, post stai test	4.712	2.408	1.957	0.371	0.775
WHITE, pre stai test	TURQUOISE, post stai test	2.290	2.396	0.956	0.931	1.000
	PURPLE, post stai test	−4.517	2.408	−1.876	0.420	0.931
	WHITE, post stai test	3.679	1.813	2.029	0.331	0.663
TURQUOISE, post stai test	PURPLE, post stai test	−6.807	1.905	−3.572	0.006	0.007
	WHITE, post stai test	1.388	2.396	0.579	0.992	1.000
PURPLE, post stai test	WHITE, post stai test	8.195	2.408	3.403	0.010	0.012

Note. P-value adjusted for comparing a family of 15

4.5 MANOVA Results

Multivariate Analysis of Variance (MANOVA) was used to identify the overall variance among the dependent variables. MANOVA examine s the difference between groups of two or more dependent variables. It gives the correlation between dependent variables as a whole and contributes to comprehensive understanding of group effects (Field, 2018). **Table 11** indicates F(4,142)=0.302 , p=.763F(4, 142) = 0.302, p = .763F(4,142)=0.302,p=.763 values in terms of CCT level alone was not significantly impacting the combined dependent measure. On the contrary, F(8,286)=0.210,p<.001F(8, 286) = 0.210, p < .001F(8,286)=0.210,p<.001 was showing that colour alone had valuable multivariate impacts on combined dependent measures. Moreover, the findings reveal the combined effect of CCT and colour with the value of F(4,142)=0.097,p=.006F(4, 142) = 0.097, p = .006 F(4,142)=0.097 , p=.006. This shows that impact of colour on the dependent variables diverged based

on CCT condition.

Table 11: MANOVA Results

MANOVA

MANOVA ▼

MANOVA: Pillai Test

Cases	df	Approx. F	$Trace_{Pillai}$	Num df	Den df	p
(Intercept)	1	16473.861	0.998	4	142.000	< .001
CCT LEVEL	1	15.352	0.302	4	142.000	< .001
COLOR	2	4.193	0.210	8	286.000	< .001
CCT LEVEL ✻ COLOR	1	3.801	0.097	4	142.000	0.006
Residuals	145					

4.6 STAI Scores, GAD-7 Scales, Heart Rate Data and CCT + Colour Combinations

Independent t-test was used to examine the speaking anxiety levels between pre-test and post- test. **Table 12** shows the pre-intervention and post-intervention of STAI results. According to post-intervention STAI scores, a significant difference was found. Also, Pearson correlation analysis was implemented to analyse the relationship between pre-STAI scores, post-STAI scores and GAD-7 scores. According to Table Y, r(148) = .569 and p< 0.002 showing that there is a positive correlation between pre and post STAI score. Furthermore, r(148) = .560 with pre-STAI; r(148)= .571, p< .001 with post-STAI scores, were positively correlated with GAD-7 scale scores **(see Table 13)**.

Table 12. Independent Samples T-Test for STAI scores

Independent Samples T-Test

Independent Samples T-Test

	t	df	p
PRE-STAI SCORE	−0.862	148	0.390
POST-STAI SCORE	−4.747	148	< .001

Note. Student's t-test.

Table 13: Pearson's Correlation, Pre-STAI, Post-STAI and GAD-7

Correlation

Pearson's Correlations ▼

Variable		PRE-STAI SCORE	POST-STAI SCORE	GAD-7 SCORE
1. PRE-STAI SCORE	Pearson's r	—		
	p-value	—		
2. POST-STAI SCORE	Pearson's r	0.569	—	
	p-value	< .001	—	
3. GAD-7 SCORE	Pearson's r	0.560	0.571	—
	p-value	< .001	< .001	—

Furthermore, descriptive statistics was used to show the difference in colours in terms of STAI scores and heart rate data. **Table 14** indicates that, the mean value of pre-STAI test scores for all conditions are 39.44 for turquoise, 40.03 for purple and 39.00 for white. After the experiment post-STAI scores show some decreases and increases for colour conditions. Turquoise condition's mean value is 36.71 which is decreased, whereas purple condition's mean value is 43.52 which is increased. The white condition shows slightly decreased mean value as 36.32. According to heart rate measures, mean values are 88.68 for white, 84.82 for purple and 87.12 for turquoise. After the speaking experience measured heart rate changed. Mean value of 88.43 for purple which increased slightly, 86.24 for turquoise which decreased and

85.39 for white which also decreased.

Table 14: Descriptive Statistics for Colours, STAI scores and Heart Rates

Descriptive Statistics

Descriptive Statistics ▼

	PRE-STAI SCORE			POST-STAI SCORE			PRE-HEART RATE			POST-HEART RATE		
	TURQUOISE	PURPLE	WHITE	TURQUOISE	PURPLE	WHITE	TURQUOISE	PURPLE	WHITE	TURQUOISE	PURPLE	WHITE
Valid	62	60	28	62	60	28	62	60	28	62	60	28
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean	39.435	40.033	39.000	36.710	43.517	35.321	87.113	84.817	88.679	86.242	88.433	85.393
Std. Deviation	9.686	10.317	10.245	10.871	11.055	11.039	5.189	4.233	5.876	4.419	6.763	3.635
Minimum	22.000	21.000	21.000	20.000	21.000	20.000	78.000	77.000	78.000	78.000	76.000	77.000
Maximum	63.000	62.000	65.000	73.000	71.000	63.000	100.000	93.000	103.000	95.000	105.000	92.000

Also, descriptive statistics was used for the relationship between CCT, STAI scores and heart rate. **Table 15** indicates that under 6500K conditions pre-STAI scores' mean is 40.44 and under 4000K condition mean is 39.01. After the experiment, post-STAI scores' mean in 6500K is 44.20, which is increased whereas 4000K condition's mean is 35.73 which is decreased. These situations indicate that 4000K conditions reduce speaking anxiety whereas 6500K increased speaking anxiety level. Also, heart rate measures show that under 6500K condition there is a notable increase between pre-measure and post-measure. Contrary, in 4000K condition, there is a notable decrease between pre-measure and post-measure. Results show that 4000K gives a calming effect whereas 6500K increases speaking anxiety.

Table 15: Descriptive Statistics for CCT, STAI scores and Heart Rates

Descriptive Statistics

Descriptive Statistics ▼

	PRE-STAI SCORE		POST-STAI SCORE		PRE-HEART RATE		POST-HEART RATE	
	4000K	6500K	4000K	6500K	4000K	6500K	4000K	6500K
Valid	89	61	89	61	89	61	89	61
Missing	0	0	0	0	0	0	0	0
Mean	39.011	40.443	35.730	44.197	87.303	85.295	85.326	89.344
Std. Deviation	9.904	10.128	10.132	11.551	5.591	4.205	4.358	6.085
Minimum	21.000	21.000	20.000	20.000	77.000	77.000	76.000	78.000
Maximum	65.000	62.000	63.000	73.000	103.000	96.000	96.000	105.000

CHAPTER V

DISCUSSION

The findings of this thesis contribute to knowledge on the impact of colour and CCT on speaking anxiety level of individuals. This study aims to address the gap in literature of colour and lighting design in terms of speaking anxiety with a controlled experimental setting. This gap exists because there is not enough information on the combined effect of colour and CCT on speaking anxiety in small spaces.

This study connects anxiety, colour and CCT research studies. Anxiety is one of the most prevalent psychological disorder associated with both mental and psychological factors such as worry, tension, increasing hearth rate, sweating (Martin, 2003; Şahin & Tuna, 2022). This study also examines the impact on heart rate. Triggering the speaking anxiety conditions directly impact heart rate of participants. Speaking anxiety is one of the sub-branches of anxiety and is known as one of the difficult situations experienced by many people today. Colour and lighting parameters especially CCT are factors that are directly linked with emotions in psychology

(Yıldırım et al., 2011; Zeng et al., 2022).

This thesis contributes to existing literature with an experimental design under controlled conditions. By employing a rigorously designed methodology integrated with quantitative data, the internal validity of this thesis was enhanced. Also, finding a link between speaking anxiety, colour and CCT was established. The findings of the study demonstrated that colour and CCT are directly linked with speaking anxiety.

The experimental study was conducted in an indoor controlled laboratory at Bilkent University Ankara, Türkiye. There was a wall covered with coloured fabrics which were purple and turquoise and controlled CCTs which were 6500K and 4000K. Participants gave a speech in front of the covered wall under specific lighting conditions. The participants were 150 people, who are 18-26 years old, and mostly 1st year design students and students from other departments. Also, female participants are more than male participants. All participants progressed through eight sequential stages: an informed consent form, a demographic questionnaire, GAD-7 scale measurement, pre-STAI test, pre-heart rate measurement, experiment phase, post-STAI test and post-heart rate measurement.

The primary aim of this thesis was to examine how CCT and colour influence

speaking anxiety through self –reported measures which were GAD-7 scale, STAI test and physiological indicator which was heart rate measurements.

According to existing literature, CCT level is directly linked with stress and psychology. Awada et al (2025) and Zeng et al (2022) states that warm white light gives positive mood and reduces stress level. Also, warmer CCT gives relaxation whereas cooler CCT promotes anxiety. 3000-4000K is optimal for speaking anxiety (Awada et al.,2025). Moreover, heart rate is reduced in 3000K condition (Awada et al., 2025). This study also relates with these literature findings. Heart rates reduce in warm CCT whereas they increase in cool CCT. According to Doctors (2022), cortisol hormone which is known as stress hormone increases in cool CCT conditions, whereas it can be reduced in warm CCT conditions. **H1** predicted that exposure 4000K which is warmer would reduce speaking anxiety compared to 6500K which is cooler. The results of this study consistently support that there is a significant relationship between CCT and speaking anxiety. Warm CCT exposure promotes less speaking anxiety. 4000K conditions' participants demonstrated significant reduction in both anxiety scores and heart rate. This situation indicates a calming effect and relaxation with warm CCT. The repeated measures ANOVA revealed a significant relation between pre-test, post-test and CCT $F(1, 118) = 16.63$, $p < .001$, $\eta^2 = .026$ for STAI test and $F(1,118) = 34.465$, $p < .001$, $F(1,118) = 23.507$, $p < .001$ for heart rate. Findings illustrate that participants under 4000K conditions encounter consequential reduction in anxiety test. **H1** was strongly supported by the data. Results show that findings align with existing technical literature.

The second concern of this thesis was to examine how colour choices affect speaking anxiety. According to existing literature, colours are the most powerful design elements in terms of affecting psychology (Jonauskaite et al., 2020). Each colour affects individual's emotional states. Red gives discharge, purple which is mixture of red and blue, triggers anxiety whereas green gives calmness and relaxation (Spiegel & Keith-Spiegel, 1971). Seeing colour and being exposed to colour are directly linked to psychology and there is a therapy called colouring therapy (Jonauskaite et al., 2020). According to Korkmaz et al. (2026), neutral colours are chosen by anxious participants because they give them relaxation and calming impacts. **H2** states that turquoise colour promotes less speaking anxiety. The result of this thesis provides empirical scientific support for **H2**. According to the results of repeated measures ANOVA, GAD-7 and STAI test, colour interaction was observed and $F(1, 118) = 13.44$, $p < .001$, $\eta^2 = .021$ shows anxiety level reduces over time varied across turquoise colour conditions. Also post-hoc pairwise test shows notable variation between post-STAI scores under turquoise vs purple condition. Turquoise condition group indicated lower anxiety levels. Results of this thesis recommend that turquoise colour choices are associated with reduction in speaking anxiety and may help to alleviate speaking anxiety by giving calmness and emotional balance.

The third concern of this study is to investigate the relationship between 4000K, 6500K CCT and purple, turquoise colours on speaking anxiety. According to the

results of this study **H3** is partially supported. According to two-way ANOVA, a connection between CCT and colour is significant as between subject analysis $F(1,118) = 5.351$ and $p= 0.22$ indicates that impact of colour on speaking anxiety depends on CCT. Turquoise, 4000K condition results in notable speaking anxiety deduction while this effect of condition diminishes in 6500K condition. The three-way interaction among time,CCT and colour are addressed but didn't reach conventional significance, $F(1,118)= 3.857$ and $p= .052$ showing the combined impacts of CCT and colour on anxiety are potentially influenced by other moderating factors.

Building on the study, existing literature and hypotheses, the discussion chapter underlines the effects of CCT and colour on speaking anxiety. This chapter summarizes the key insights drawn from the research, limitations and suggests direction for future researchers. Ultimately, results of this thesis suggest practical implications for designing classrooms, conference halls etc.

CHAPTER VI

CONCLUSION

This study aims to investigate the impact of CCT and colours on speaking anxiety in small spaces. According to existing literature, warm white light helps to reduce anxiety; whereas purple colour induces anxiety (Shahidi et al., 2021; Spiegel & Keith-Spiegel, 1971). However, the specific relationship between speaking anxiety, colour and CCT has received little consideration in previous literature. This research used quantitative experimental design to investigate the impact of both colours and CCT on speaking anxiety.

The findings of this thesis provide strong empirical base for the hypotheses presented. Participants were exposed to five different conditions in the experiments in order to find a relationship between speaking anxiety, colours and CCT. Statistical analysis helps to confirm three hypotheses. JASP 0.18.3.0 was used to test hypotheses. Sample characteristic, assumption check, descriptive statistic, repeated

measures ANOVA, independent sample t-test, paired sample t-test, Post-Hoc pairwise comparison, correlation analyses, regression analyses were used. These results underscore the significance of colours and CCT on speaking anxiety.

Furthermore, these results confirmed **H1**, proposing that 4000K warm CCT directly affects speaking anxiety and notably reduces speaking anxiety compared to 6500K cool CCT. **H1** tested evidence by a significant main effect of CCT on anxiety scores. Additionally, **H2** was supported in terms of colour choices. According to results, participants exposed to turquoise colour submitted significantly lower speaking anxiety scores than those of them exposed to purple colour. This study also partially confirmed **H3**, there was an interaction effect between colour and CCT, that influence of colour on anxiety is moderated by the CCT. These results suggest that both CCT and colours impact speaking anxiety responses in a small enclosed space.

Besides providing evidences for the hypotheses, meaningful perspectives were contributed to the literature. The results of this thesis validate that there is a direct relationship between colours, CCT and speaking anxiety. The results support Spiegel & Keith-Spiegel (1971) perspectives of colour on anxiety in terms of purple triggering anxiety. Also, the results support Prentiss (2021) perspectives in terms of 4000K being optimal for speaking anxiety in order to feel relaxed and comfortable.

Of particular importance, this study fills a notable knowledge gap in literature. While there are some studies on the impact of colour and CCT on anxiety in educational areas and scientific exploration areas, there is a lack of research focusing on their impact on speaking anxiety. This thesis put forwards the existing literature and fills

the gap in both colour and CCT impacts on speaking anxiety.

6.1 Limitations

The research reveals that there is a direct relationship between colour, CCT and speaking anxiety. Although this thesis yields notable findings and insight, it is crucial to recognize its limitations. One of the limitations of this study was that this study was conducted in a laboratory-based experimental setting in a controlled lighting condition and colour choices that could restrain the generalizability of real-life conditions of public speaking environments. In a natural public speaking environment, participants may act and respond in a different way.

The second limitation of this study is a narrow age range between 18 to 26-years-old. That situation could limit the applicability of the result. Older or younger age groups could act and respond in a different manner. Also, 18-26 age group are too sensitive in speaking activities because of their ages.

Third limitation of this study is short term measurements in anxiety responses. In the future, longitudinal studies may be conducted.

Moreover, use of CCT level was limited in being 4000K to 6500K. CCT level range can be more comprehensive and detailed. Also, colour choices were limited to purple, turquoise and white. Different hues and also saturations can also affect speaking anxiety. Also, white was chosen because it is a very common colour on

walls in the built environment. It would have been good also to examine the white wall condition under 6500K CCT.

6.2 Future Research Implications

This study underlines a foundation for future researchers to explore various dimensions. Future studies may explore the impact of colours and CCT inclusively in terms of investigating saturation level, different hues and wide lighting spectrums. This may help to have a wider insight into speaking anxiety. This study tries to measure physical activity which is heart rate. Future researchers may focus on cortisol level, skin conductance and EGG results. This will help to have a richer and more comprehensive psychophysiological speaking anxiety acknowledgement. This study focuses on 18-26 years old demographic group, future researchers may also focus on diverse participant groups in order to understand the baseline of speaking anxiety. This study was conducted in a laboratory environment. Real-world environments which are offices, classrooms etc may also be used in the research. Working on these places would provide ecological validity.

In conclusion, this research study gives major comprehension into the relationship between colour, CCT and speaking anxiety. This study also combines physiological and psychological measurements which gives a holistic approach of how spatial design impacts speaking anxiety in small spaces. The results of this study fill the gap in existing literature and are valuable implications for educators, designers and future researchers.

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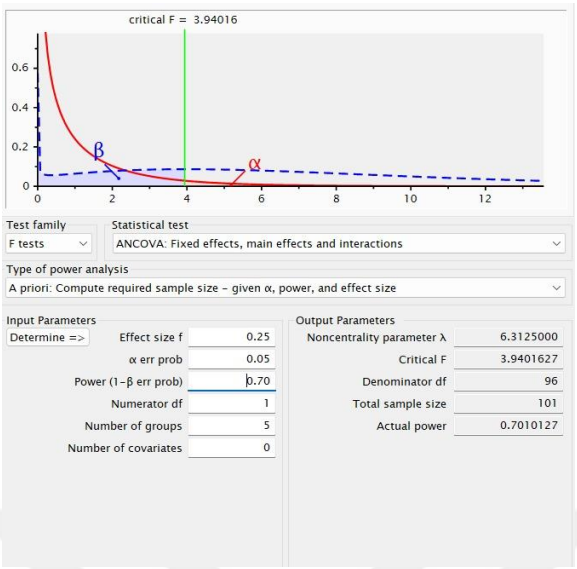
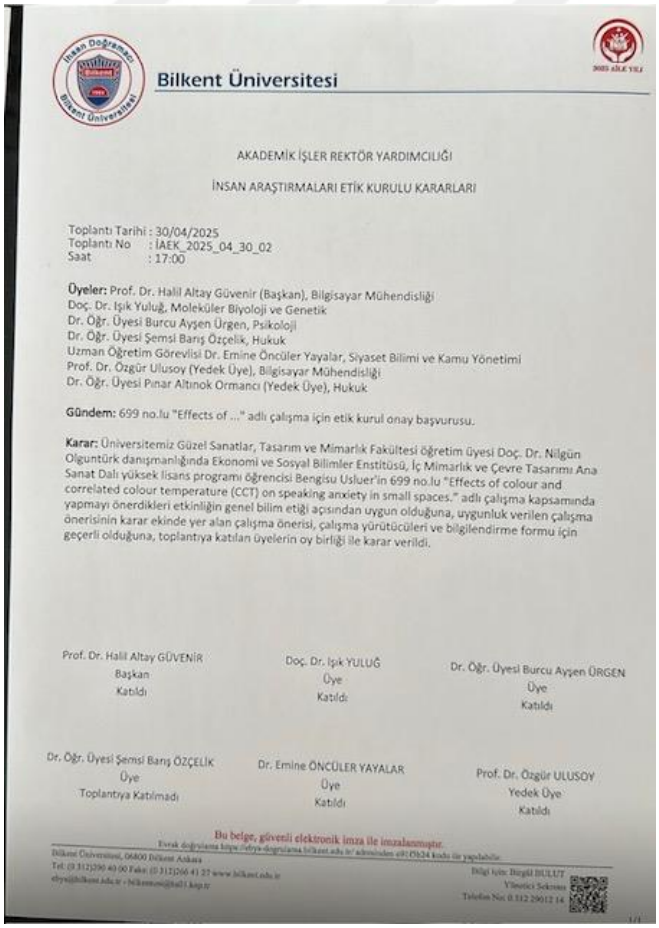
APPENDICIES

Appendix A



Appendix B



Bilkent Üniversitesi

AKADEMİK İŞLER REKTÖR YARDIMCILIĞI

İNSAN ARAŞTIRMALARI ETİK KURULU KARARLARI

Toplantı Tarihi : 30/04/2025
Toplantı No : İAEK_2025_04_30_02
Saat : 17:00

Üyeler: Prof. Dr. Halil Altay Güvenir (Başkan), Bilgisayar Mühendisliği
Doç. Dr. Işık Yuluğ, Moleküler Biyoloji ve Genetik
Dr. Öğr. Üyesi Burcu Ayşen Ürgen, Psikoloji
Dr. Öğr. Üyesi Şemsi Barış Özçelik, Hukuk
Uzman Öğretim Görevlisi Dr. Emine Öncüler Yayalar, Siyaset Bilimi ve Kamu Yönetimi
Prof. Dr. Özgür Ulusoy (Yedek Üye), Bilgisayar Mühendisliği
Dr. Öğr. Üyesi Pınar Altınok Ormancı (Yedek Üye), Hukuk

Gündem: 699 no.lu "Effects of ..." adlı çalışma için etik kurul onay başvurusu.

Karar: Üniversitemiz Güzel Sanatlar, Tasarım ve Mimarlık Fakültesi öğretim üyesi Doç. Dr. Nilgün Olguntürk danışmanlığında Ekonomi ve Sosyal Bilimler Enstitüsü, İç Mimarlık ve Çevre Tasarımı Ana Sanat Dalı yüksek lisans programı öğrencisi Bengisu Usluer'in 699 no.lu "Effects of colour and correlated colour temperature (CCT) on speaking anxiety in small spaces." adlı çalışma kapsamında yapmayı önerdikleri etkinliğin genel bilim etiği açısından uygun olduğuna, uygunluk verilen çalışma önerisinin karar ekinde yer alan çalışma önerisi, çalışma yürütücüleri ve bilgilendirme formu için geçerli olduğuna, toplantıya katılan üyelerin oy birliği ile karar verildi.

Prof. Dr. Halil Altay GÜVENİR — Başkan — Katıldı
Doç. Dr. Işık YULUĞ — Üye — Katıldı
Dr. Öğr. Üyesi Burcu Ayşen ÜRGEN — Üye — Katıldı
Dr. Öğr. Üyesi Şemsi Barış ÖZÇELİK — Üye — Toplantıya Katılmadı
Dr. Emine ÖNCÜLER YAYALAR — Üye — Katıldı
Prof. Dr. Özgür ULUSOY — Yedek Üye — Katıldı

Bu belge, güvenli elektronik imza ile imzalanmıştır.

Appendix C

Demografik Sorular

Katılımcı

1. **Yaş**
2. **Cinsiyet**
3. **Eğitim durumu**
4. **Okuduğu Sınıf**
5. **Okuduğu Bölüm**
6. **Meslek**
7. **Herhangi bir sakinleştirici ilaç kullanıyor musunuz?**
8. **Uyku durumunuz nasıl?**
9. **Herhangi bir psikolojik tanı aldınız mı?**
10. **Ne sıklıkla sunum yapmakta veya topluluk önünde konuşmaktasınız?**

Appendix D

Konkan, R., Şenormancı, Ö., Güçlü, O., Aydın, E., & Sungur, M. Z. (2013).

YAYGIN ANKSİYETE BOZUKLUĞU 7 (YAB-7) TESTİ

Lütfen geçirmiş olduğunuz son 15 gününüzü dikkatlice düşününüz. Aşağıdaki testte sıralanan sorunlar bu 15 gün içerisinde ne kadar rahatsız etti, belirlemeye çalışınız. Seçeneklerden hangisi size daha uygun geliyorsa işaretleyiniz.

Son 2 hafta içerisinde aşağıdaki problemler ne sıklıkta sizi rahatsız etti?	Hiç	Sadece birkaç gün	Günlerin yarısından fazlasında	Hemen hemen hergün
1. Sinirli, kaygılı, uçurumun kenarındaymış gibi hissetme	○	○	○	○
2. Endişelenmeyi kontrol edememe ya da durduramama	○	○	○	○
3. Farklı farklı konularda çok fazla endişelenme	○	○	○	○
4. Gevşeyip rahatlayamama	○	○	○	○
5. Yerinizde duramayacak kadar kıpır kıpır ve huzursuz olma	○	○	○	○
6. Kolayca kızma ya da rahatsız olma	○	○	○	○
7. Her an çok kötü bir şey olabileceği korkusu yaşama	○	○	○	○

Appendix E

Öner, N., & Le Compte, A. (1985). Durumluk-Sürekli Kaygı Envanteri El Kitabı. İstanbul: Boğaziçi Üniversitesi Yayınları.

DURUMLUK VE SÜREKLİ KAYGI ÖLÇEĞİ

İsim:..... Cinsiyet:.....

Yaş:..... Meslek:..... Tarih:...../...../.....

YÖNERGE:Aşağıda kişilerin kendilerine ait duygularını anlatmada kullandıkları bir takım ifadeler verilmiştir. Her ifadeyi okuyun, sonra da o anda nasıl hissettiğinizi ifadelerin sağ tarafındaki parantezlerden uygun olanını işaretlemek suretiyle belirtin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde **fazla zaman sarfetmeksizin** **anında** nasıl hissettiğinizi gösteren cevabı işaretleyin.

		HİÇ	BİRAZ	ÇOK	TAMAMIYLE
1.	Şu anda sakinim	(1)	(2)	(3)	(4)
2.	Kendimi emniyette hissediyorum	(1)	(2)	(3)	(4)
3	Su anda sinirlerim gergin	(1)	(2)	(3)	(4)
4	Pişmanlık duygusu içindeyim	(1)	(2)	(3)	(4)
5.	Şu anda huzur içindeyim	(1)	(2)	(3)	(4)
6	Şu anda hiç keyfim yok	(1)	(2)	(3)	(4)
7	Başıma geleceklerden endişe ediyorum	(1)	(2)	(3)	(4)
8.	Kendimi dinlenmiş hissediyorum	(1)	(2)	(3)	(4)
9	Şu anda kaygılıyım	(1)	(2)	(3)	(4)
10.	Kendimi rahat hissediyorum	(1)	(2)	(3)	(4)
11.	Kendime güvenim var	(1)	(2)	(3)	(4)
12	Şu anda asabım bozuk	(1)	(2)	(3)	(4)
13	Çok sinirliyim	(1)	(2)	(3)	(4)
14	Sinirlerimin çok gergin olduğunu hissediyorum	(1)	(2)	(3)	(4)
15.	Kendimi rahatlamış hissediyorum	(1)	(2)	(3)	(4)
16.	Şu anda halimden memnunum	(1)	(2)	(3)	(4)
17	Şu anda endişeliyim	(1)	(2)	(3)	(4)
18	Heyecandan kendimi şaşkına dönmüş hissediyorum	(1)	(2)	(3)	(4)
19.	Şu anda sevinçliyim	(1)	(2)	(3)	(4)
20.	Şu anda keyfim yerinde.	(1)	(2)	(3)	(4)

DURUMLUK VE SÜREKLİ KAYGI ÖLÇEĞİ - Devamı

		Hemen hemen hiçbir zaman	Bazen	Çok zaman	Hemen her zaman
21.	Genellikle keyfim yerindedir	(1)	(2)	(3)	(4)
22	Genellikle çabuk yorulurum	(1)	(2)	(3)	(4)
23	Genellikle kolay ağlarım	(1)	(2)	(3)	(4)
24	Başkaları kadar mutlu olmak isterim	(1)	(2)	(3)	(4)
25	Çabuk karar veremediğim için fırsatları kaçırırım	(1)	(2)	(3)	(4)
26.	Kendimi dinlenmiş hissediyorum	(1)	(2)	(3)	(4)
27.	Genellikle sakin, kendine hakim ve soğukkanlıyım	(1)	(2)	(3)	(4)
28	Güçlüklerin yenemeyeceğim kadar biriktiğini hissederim	(1)	(2)	(3)	(4)
29	Önemsiz şeyler hakkında endişelenirim	(1)	(2)	(3)	(4)
30.	Genellikle mutluyum	(1)	(2)	(3)	(4)
31	Herşeyi ciddiye alır ve endişelenirim	(1)	(2)	(3)	(4)
32	Genellikle kendime güvenim yoktur	(1)	(2)	(3)	(4)
33.	Genellikle kendimi emniyette hissederim	(1)	(2)	(3)	(4)
34	Sıkıntılı ve güç durumlarla karşılaşmaktan kaçınırım	(1)	(2)	(3)	(4)
35	Genellikle kendimi hüzünlü hissederim	(1)	(2)	(3)	(4)
36.	Genellikle hayatımdan memnunum	(1)	(2)	(3)	(4)
37	Olur olmaz düşünceler beni rahatsız eder	(1)	(2)	(3)	(4)
38	Hayal kırıklıklarını öylesine ciddiye alırım ki hiç unutamam	(1)	(2)	(3)	(4)
39.	Aklı başında ve kararlı bir insanım	(1)	(2)	(3)	(4)
40	Son zamanlarda kafama takılan konular beni tedirgin ediyor	(1)	(2)	(3)	(4)

Appendix F

Astrology: A Pseudoscience or a System with Hidden Scientific Roots?

Astrology is an ancient system that claims celestial bodies influence human affairs and natural phenomena. While modern science generally classifies astrology as a pseudoscience due to its lack of empirical evidence and falsifiability, some aspects of astrological traditions intersect with legitimate scientific disciplines, such as astronomy and psychology.

Historically, astrology was deeply integrated with astronomy. In ancient civilizations such as Babylon, Egypt, and Greece, planetary positions were meticulously recorded to predict seasonal changes, natural disasters, and political outcomes. The Ptolemaic model of egocentrism, which placed Earth at the centres of the universe, provided the framework for astrological calculations for centuries until the Copernican Revolution displaced this view with heliocentric.

One of the core principles of astrology is that celestial objects exert an influence on human behaviour and personality. The most well-known system, Western astrology, is based on the twelve zodiac signs, which are determined by the Sun's position relative to the constellations at the time of an individual's birth. Astrologers claim that the positions of the Moon, planets, and other celestial bodies at the time of birth shape an individual's character, emotions, and even fate. However, controlled scientific studies, such as the famous Carlson experiment (1985), have failed to demonstrate a statistically significant correlation between astrological predictions and personality traits or life outcomes.

Despite the scientific scepticism, astrology remains widely popular. Psychological theories, such as the Barnum Effect, suggest that people tend to accept vague, generalized statements as personally meaningful, which may explain why horoscopes and astrological readings often feel accurate. Additionally, neuroscientific research on cognitive biases has shown that pattern-seeking behaviour is deeply ingrained in the human brain, leading people to find connections between planetary positions and their experiences.

Another field that sometimes intersects with astrological principles is chronobiology—the study of biological rhythms. Some researchers argue that lunar cycles and circadian rhythms affect human behaviour, raising the question of whether certain astrological ideas have a yet-to-be-discovered scientific basis. For instance, studies have suggested a potential link between full moons and sleep disturbances or mood fluctuations, though these claims remain controversial.

While astrology does not adhere to the rigorous standards of the scientific method, its enduring cultural and psychological impact is undeniable. The continued debate over its validity raises important philosophical and epistemological questions: To what extent should anecdotal experiences be valued in knowledge systems? Can astrology ever evolve to incorporate empirical validation, or is its foundation inherently unscientific?

Appendix G

Open-Ended Questions on Astrology

1. If astrology lacks empirical scientific support, why do you think it continues to be widely practiced and believed in?
2. How does the Barnum Effect help explain why astrological predictions seem accurate to individuals?
3. Some people argue that astrology provides psychological benefits such as comfort, guidance, and self-reflection. Do you think these benefits justify its widespread use? Why or why not?
4. If a scientific connection between planetary movements and human behaviour were discovered in the future, how do you think it would change the perception of astrology?
5. Given that ancient civilizations relied on astrology for decision-making, do you think there were any practical advantages to using it before modern science developed?
6. Are there any parallels between astrology and other belief systems that rely on subjective validation rather than empirical evidence?
7. How does the study of chronobiology (e.g., the effects of the lunar cycle on sleep patterns) challenge or support astrological claims?
8. Should astrology be dismissed entirely as a pseudoscience, or is there value in studying it from a cultural, psychological, or historical perspective?
9. In your opinion, can astrology ever be scientifically tested in a way that would satisfy sceptics and believers alike? Why or why not?
10. How does astrology compare to other fields that started as unscientific but later found some scientific grounding, such as alchemy leading to chemistry or early astronomy evolving into astrophysics?