PAIRINGS OF COLORS WITH EMOTIONS IN TURKISH

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ABSTRACT

PARINGS OF COLORS WITH EMOTIONS IN TURKISH

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Metaphorical expressions can imply the associations between colors and emotions within a specific language. For instance, tying black (karalar bağlamak) (Bas & Buyukkantarcıoglu, 2019) or withering away (sararıp solmak) are used for sadness in Turkish. The study aims to see the relationship between colors and emotions. Eleven basic color terms in Turkish which were red, blue, green, yellow, black, white, purple, pink, orange, and grey and six basic emotions which were anger, sadness, happiness, surprise, disgust, and fear used to see associations between colors and emotions. In the first set of experiments (1/A and 1/B), participants performed *the matching emotion words with colors task*. In the second set of studies (2/A and 2/B), participants were required to perform *matching emoji–like faces with colors tasks*. Initially, 780 individuals were recruited through snowball sampling. However, 389 of the participants left the study. Therefore, 391 individuals were investigated for primary analyses. According to the results, seven found associations were aligned with the previous literature. These were anger with red and black, sadness with black and white, surprise with yellow and white, and fear with black. However, the level of agreement among raters was low. In addition, results were significant in conditions where the emotion has presented in either word or emoji-like formats in the initial phase. Lastly, experiments that included emoji faces showed slightly better results on which emotion and color were most associated. Future studies should re-run this experimental procedure with a larger sample size to establish a firm conclusion.

Keywords: Figurative Language, Embodied Cognition, Conceptual Metaphor, Colors, Emotions

ÖZ

PARINGS OF COLORS WITH EMOTIONS IN TURKISH

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Bilişsel Nöropsikoloji Master Programı

Supervizör: Doç. Dr. Hale Ogel Balaban

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Metaforik ifadeler, belirli bir dildeki renkler ve duygular arasındaki ilişkileri ifade edebilir. Örneğin Türkçede hüzün için karalar bağlamak (Bas & Buyukkantarcıoglu, 2019) veya sararıp solmak kullanılmaktadır. Çalışmanın amacı, renkler ve duygular arasındaki ilişkiyi görmektir. Türkçe 'de on temel renk terimi olan kırmızı, mavi, yeşil, sarı, siyah, beyaz, mor, pembe, turuncu ve gri renkleri ile altı temel duygu olarak öfke, üzüntü, mutluluk, şaşkınlık, tiksinme ve korku kullanılarak renkler ve duygular arasında ilişki incelenmek istenmiştir. Amaç, hangi renk ve duygunun yüksek bir korelasyonu paylaştığını görmektir. İlk deney setinde (1/A ve 1/B), katılımcılardan duygu sözcüklerini renklerle eşleştirme görevini gerçekleştirmeleri istenmiştir. İkinci deney setinde (2/A ve 2/B), katılımcılardan emoji benzeri yüzleri renklerle eşleştirme görevi yapmaları istenmiştir. Çalışmaya ilk etapta 780 kişi kar topu örneklem metodu ile dahil edilmiştir. Ancak, 389 kişi çalışmayı sonuna kadar tamamlamadan yarıda bırakmıştır. Bu yüzden ana analizler için 391 kişinin cevapları değerlendirilmiştir. Sonuçlara göre, bulunan yedi ilişkilendirme, renk ve duygu ilişkilendirmesine odaklanan önceki literatürle uyumludur. Bunlar öfke ile kırmızı ve siyah, üzüntü ile siyah ve beyaz, şaşkınlık ile sarı ve beyaz ve korku ile siyah şeklindedir. Ancak, puanlayıcılar arasındaki anlaşma düzeyi düşük bulunmuştur. Ek olarak, duygunun ilk aşamada kelime veya emoji benzeri formatlarda sunulduğu durumlarda sonuçlar anlamlı olarak bulunmuştur. Son olarak, emoji yüzlerini içeren deneyler, hangi duygu ve rengin en çok ilişkilendirildiği konusunda görece daha iyi sonuçlar vermiştir. Gelecekteki çalışmalar, kesin bir sonuca varmak için bu deneysel prosedürü daha büyük bir örneklem boyutuyla yeniden çalışmalıdır.

Anahtar Kelimeler: Mecazi Dil, Somutlaşmış Biliş, Kavramsal Metafor, Renkler, Duygular

To mom & dad and my dear husband

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Chapter 1

Pairings of Colors with Emotions in Turkish

Metaphorical expressions can imply the associations between colors and emotions within a specific language. For instance, “karalar bağlamak” (*tying black*) (Bas & Buyukkantarcıoglu, 2019) or “sararıp solmak” (*withering away*) are used for sadness in Turkish. These types of metaphorical use of colors frequently occur in Turkish. The thesis focused on the relationship between basic color terms (*red, blue, green, yellow, black, white, purple, pink, orange, and grey*) and six basic emotions (*anger, sadness, happiness, surprise, disgust, and fear*) in Turkish.

1.1 Embodied Cognition

Embodied cognition refers to how the body and bodily actions shape cognition (Rowlands, 2011; Wilson, 2002). Embodied phenomena include processes based on bodily states and in the brain as modality-specific systems (Barsalou et al., 2003; Smith & Semin, 2004). Moreover, embodied cognition can branch into two subtypes (Wilson, 2002). The first type is called online editing. It emphasizes that regulation is due to actual external stimuli. The other type is offline editing, which refers to experiencing an adjustment without external stimuli (Wilson, 2002). For example, imitating another person's happy face can be explained as an online embodied cognitive experience, whereas remembering a happy moment represents offline embodied cognition. These two examples are based on modality-specific experiences (Niedenthal et al., 2005).

Stereotypes are getting activated automatically because of embodied cognition. Stereotypes are mental constructs that include automatic thoughts about specific topics. For example, they might be related to being a member of one group, like being African American or Caucasian, or related to a set of behaviors such as rudeness or kindness, or it might refer to phases of life such as being old or young. They lead to alterations in people's behavior (Bargh et al., 1996). Niedenthal et al. (2005) claimed that stereotypes are examples of social embodiment. Based on the embodied experiences of stereotypes, Bargh et al. (1996) conducted three consecutive studies. In the first study, researchers used a

scrambled–sentence test in which participants were asked to use four words out of five. They constructed grammatically meaningful sentences as fast as they could.

The test consisted of three-word priming conditions: politeness, rudeness, and neutral. Participants were encouraged to go into a hallway and approach two people when conversing after finishing the priming task. Before participants interrupted the conversation, the amount of time that took was measured. As a result, individuals were faster to interrupt two people's conversation after priming of rudeness stereotype. For the second experiment, the same scrambled-sentence test was used. The purpose was to prime elderly stereotypes (e.g., adjectives; wrinkle, obedient, dependent, and like). The amount of time was measured before participants walked down the hall and gave a paper to the pseudo-experimenter. It was found that it took a long time for people to walk down to the hall after priming elderly stereotypes. For the third experiment, participants saw odd or even numbers of circles among African American or young Caucasian male faces on the slide. They were required to decide whether the number of circles was odd or even. After this phase, the warning sign showed up on the computer screen. The warning showed that something had gone wrong, and the collected data had been lost. Participants reached out to the experimenter to handle the problem. The experimenter confirmed that the computer crashed and all the procedures needed to be redone. The signs of hostility on the participant's face were video-recorded. According to the results, individuals showed greater hostility towards the immediate problem after priming stereotypes of African Americans. Reading a word or seeing an image related to intended primed stereotypes leads to behavioral changes. All in all, environmental changes and priming certain stereotypes could impact individuals' cognition and behavior.

Comprehension of stereotypes was considered an example of offline embodied cognition. Markman and Brendl (2005) studied the automatic connection between how people perceive themselves in space and how their motor actions' speed is affected by embodied cognition. There were two types of body concepts. One referred to the body as an actual physical substance of the self, whereas the other one considered the body an illustrated form of self. Participants saw their names on the computer screen as an illustration of themselves in the corridor-like setup. They were required to pull or push the presented words away or toward their names. Participants were instructed to move the

positive word toward their names and push away the negative word from them. In the inversely worded instruction, participants were required to push positive words away and pull the negative words toward their names. Researchers claimed that the critical point was congruence between the body and the representative self. The expectation was that response times would be faster when participants were instructed to pull the positive words toward their body and push negative words away from their body if their evolution of self was based on their physical entity, not on illustrated self (the names on the screen).

On the other hand, if the representation of self were necessary, then pulling positive words toward the name and pushing negative words away from the name would be easier. Results showed that participants' responses were faster in pulling positive words toward their name (representative self) and pushing negative words away from their name.

There was a complex interplay between perceptual and motor actions when the representation of self was considered. It was suggested that not mere physical entity affects the perceptual and motor systems but also how people construct themselves in their

mind is very important. This suggestion showed the complex nature of embodied cognition.

A study on mental time travel will be another example of offline embodied cognition. Miles et al. (2010) wanted to see motor actions during mental imagery about either for future or the past. Participants were required to vividly imagine events within the previous four years or possible events that might occur within the upcoming four years. In this scope, the postural movements of the participants were tracked down with a magnetic motion-tracking system while they were blindfolded. Results showed that people move as if they are moving forward when they prospectively think about something in the future. In contrast, participants moved backward if they were thinking retrospectively during mental time travel. Briefly, the results showed the embodied experiences of time perception.

Within the embodied cognition perspective, metaphors are the concepts that we live by. According to Lakoff and Johnsen (2003), metaphors are the tools for shaping our embodied experiences. Furthermore, according to embodied language comprehension perspective, individuals understand and give meaning to language through information

coming from their sensorimotor systems (Fugate et al., 2018; Hoedemaker & Gordon, 2014).

1.2 Metaphors

Figurative language is an overarching term consisting of written or spoken language subcomponents. Idioms, metaphors, metonymy, sarcasm, indirect requests, or clichés are stereotypical utterances under the umbrella of figurative language (Parpalea, 2010; Vulchanova et al., 2019). The embedded structure of figurative language should be understood to understand how it affects people's thoughts(Lakoff, 2014). Within figurative language, metaphors shape perceptions and give meaning to everyday activities (Chew & Laubichler, 2003; Gibbs, 1992).

According to Barchard et al.'s (2017) description, a metaphor, one of the figurative language, refers to something for some other entity (e.g., happiness is a sunbeam). Another component is a simile, used when we say that something is very much alike to another thing (e.g., happiness is like a light). The last component is metonymy. It refers to a resemblance of some other thing that is closely related. Also, it usually gives meaning to a sentence distinct from what literal meaning refers to (e.g., "Kindred heart"- heart stands for emotion).

As an example of how metaphors shape cognition, Waggoner (2010) investigated the developmental trajectory of the association between temperatures based on metonymic expressions and emotional concepts. There were two aims of the study. The first aim was to see how children grasp the relationship between figurative expression and emotional concepts. The second aim was to see children's comprehension of temperature-based metonymies in the emotional language. For these purposes, both young children and adults were included. Thirty students were taken from the first (7-year-olds) and third grades (9-year-olds). Eight emotions (happiness, sorrow (sad), anger, fear, love, hate, shame, and embarrassment) and six temperature choices (very cold, cold, cool, warm, hot, and very hot) were given. Researchers used hand-drawn thermometer images and the emotional faces of the child participants. Adults were merely given the questionnaire. They were asked to fill in the space next to each emotion regarding the temperature most associated with it. Previous literature showed that there are several associations present between figurative expressions and temperature. For instance, heat was associated with anger, and

fear was associated with a cold or a drop in body temperature (Kovecses, 2003; Kovecses, 2005; Waggoner & Palermo, 1989).

Depending on Kovecses's extensive works (2003), hot, warm, and cold temperatures were found to map emotions consistently. However, cool was not considered as one of the options. Furthermore, some studies should have included it as an option (e.g., Breugelmans et al., 2005). According to the results of Waggoner (2010), adults mapped anger with hot, fear with cold, happiness with warmth, and love with hot or warm. Also, there was a mapping between cold and shame, contrary to Kovecses's (2003) work. Additionally, adults did not map any emotion with the cool temperature. As adults, children did not map any emotion with the cool temperature. However, there were mixed results for the other seven emotions. Children were not able to differentiate anger and sorrow from each other. Furthermore, younger children made different mappings from older children and adults for love and happiness. Youngest children mapped love onto hot, whereas older children and adults mapped love onto warm and hot temperature options. For happiness, adults and older children mapped onto warm, but youngest children put hot forward. The exception was that all children associated cold with fear as adults did.
In conclusion, children acquire some emotional associations earlier than others ones. Gaining an adult-like association between the physiological bases of figurative language and emotion requires early exposure to the language structure. Likewise, understanding that the underlying metonymy for anger is heat, as in the expression *"That really burns me up"* (Waggoner, 2010, p. 234), or the metonym for fear is cold, as in the sentence *"It sent a shiver down my spine*" (Waggoner, 2010, p. 234) requires an adequate level of environmental input such as language construction or direct experience. Likewise, the increase in the frequency of exposure to adult speech will lead children to make a conceptualization of the abstract connection between emotion and underlying figurative language. For example, adult expressions that include anger and hot metonymic associations such as "It burned me up" lead children to grasp the connection between emotional anger and the underlying language construction (Waggoner, 2010).

Furthermore, metaphoric expressions can explain abstract concepts (Fugate et al., 2018) as they are derived from concrete experiences (Lakoff & Johnson, 2003). Metaphorically based concepts can be altered via changes in the physical world. Based on

this assumption, Ijzerman and Semin (2009) studied the relationship between metaphoric expressions and the perception of social proximity. As there are several metaphorical expressions of warmth and social closeness, as sayings like "holding warm feelings toward someone" or "warm welcome" versus "giving someone the cold shoulder" or "giving someone a cold fish," researchers took temperature-based metaphors as their independent variable. They manipulated the warmth variable to observe the changes in the perception of social proximity. The aim was to see how the slightest changes in temperature influence social proximity concepts, language use, and perception. For their purpose, researchers conducted three consecutive experiments. In the first experiment, participants either held warm or cold beverages. They rated their social proximity to the person they selected in their mind on a 1 to 7-point scale while handling the liquids. The second experiment was designed to see the effect of ambient temperature on language use. Participants were assigned to either cold (15-18 0c) or warm (22-24 0c) conditions. This time, the experimenter was assigned as a target person to evaluate social proximity. A thirty-nine-second film clip was used to investigate language construction. The video clip included an animated chess character who made unrelated movements to the chess game. Afterward, participants were encouraged to explain what they previously saw in their own words. Then, they evaluated their level of social proximity to the experimenter. The hypotheses were that participants would use more concrete language and indicate a greater level of proximity towards the experimenter in warmer conditions. The final experiment was on why concrete language use did indicate not only the level of social proximity but also implied a detail-oriented processing style. The temperature manipulation was similar to the second experiment. Participants performed a perceptual-focus task. They were required to evaluate alternative objects relative to the target item. They focused on the relational aspects of the alternative objects and target item or the property-based analysis between alternatives and the target. After this task, the video clip (from Experiment 2) was administered to see the level of abstraction. According to the results, temperature-based changes were effective for perception, language use, and social proximity judgments. Participants in the warmth condition showed greater social proximity rating scores, more concrete language structure, and greater emphasis on relational aspects in their descriptions. The reverse pattern was valid for individuals who stood in colder

conditions (Ijzerman & Semin, 2009). Therefore, it was found that there is a close match between the social cognitive process (social proximity) and embodied cognitive experience of metaphors (warmth metaphor for closeness) (Lakoff & Johnson, 2003).

Related to the embodied experience of the metaphoric expression, Landau et al. (2009) worked on self-concept. In this study, metaphoric expressions were taken as a mediator factor to alter self-concept. Researchers took two social topics, which were attitude toward a political issue and binge drinking. They investigated how people's attitudes change toward these topics based on changes in metaphorical expressions. In the first study, a self-inflicted body contamination scenario was created either in literal language or in metaphoric expression. After that, participants were required to evaluate the content, which was either in metaphoric or literal language, in which the country (the USA) 's immigrant policies were constructed. In the metaphoric condition, the USA was represented as "a body." Furthermore, scenarios were constructed in either threat or no-threat conditions. In the contamination-threat scenario, an article described the detrimental airborne bacteria on health. In the no-threat condition, airborne bacteria were represented as widespread but harmless. According to the results, individuals who were in the threat condition and received a metaphoric expression of "the country as a body" became harsher in their attitude towards immigration policies compared to individuals who were in no-threat conditions as well as faced literal language. Also, individuals who were under threat conditions and exposed to metaphoric expression increased their conservative political attitudes.

The second study by Landau et al. (2009) was conducted to see the association between self-awareness and binge drinking in terms of metaphoric expression. Phrases like "I got hammered, destroyed, etc." metaphorically imply an obliteration of self-awareness after heavy drinking.

Researchers assumed that metaphoric expressions might reflect the inner desire for the obliteration of self-awareness, which might be why individuals perform excessive binge drinking behavior. Based on this assumption, researchers conducted three distinct experimental conditions for metaphoric expressions. Scenarios included a binge drinker into self-destructive behavior with metaphorical language, someone inflicting harm to another person, or "binge drinking" behavior expressed with literal language. Participants

were required to write a paragraph about their recent failure (threat condition) or their success (no-threat condition) for the self-esteem variable. Researchers also measured participants' dispositional alcohol use to determine heavy and light drinkers. In the final phase, participants were investigated for their attitudes toward binge drinkers. They rated how much they find binge drinkers likable. Results showed that heavy drinkers had high scores in ratings towards the binge drinker regardless of threat or no-threat conditions. In the metaphorically framed condition, binge drinking behavior was depicted as a self-destructive action, which elevated the scores. Also, heavy drinkers showed increased attraction to binge drinkers in metaphorically framed conditions. As a result, metaphoric expressions can mediate the relationship between attitudes toward a social issue and cognition of self (Landau et al., 2009).

Metaphors are crucial factors for conceptual thought (Lakoff & Johnson, 2003). Based on that, Meier et al. (2004) investigated changes in cognition due to metaphoric expressions. The starting point was that people usually associate brightness with goodness and darkness with badness. Likewise, in most religions, things like angels or good deeds are portrayed with bright colors, whereas wicked things like sins are portrayed with darker colors. For example, truth and immortality are associated with light in Hindu scripts. Also, Allah is depicted as a light, while his messenger is represented as a lamp and a star in Koran, which is religiously accounted holy by the Muslim community (Meier et al., 2004). Accordingly, Meier et al. (2004) conducted five different studies. They investigated whether metaphorically expressed brightness is an obligatory factor or provides peripheral details for emotion perception. Participants were required to categorize presented words as negative or positive in all studies. Two colors (white and black) were used as brightness dimensions. The valance of the words and brightness (letters were presented either in black or white color) varied systematically. From the first study to the third study, positiveor negative words were presented in random order with black or white letters on a gray background. Also, speed and accuracy were emphasized in these studies. Participants had to respond as fast as possible. As a result of Study 1, Study 2, and Study 3, participants were faster to categorize positive words in white and negative words in black font. Accuracy increased when positive words were presented in white font and negative words in black font.

In Study 4, participants were instructed to classify the words according to their font color. In this way, the researchers wanted to investigate the directionality of the brightness and affect judgments. Study 5 constituted a lexical decision task. They had to decide whether a verbal stimulus presented in black or white color was a word or non- word. According to the results of Study 4 and Study 5, valence and color had no significant interaction effect on latency and accuracy rates. When accuracy was emphasized (Study 1), the interaction effect between valance and color was found in latency ratings. When speed was emphasized (Study 2 and 3), the relationship between valence judgment and color was found to be effective on accuracy ratings.

Furthermore, affective judgments are expected not to be affected by physical cues. In fact, affective judgments were found to be an influential factor in the comprehension of physical cues. Lastly, font color was found to be effective on the speed of affective judgments, but this effect was absent when participants had to perform lexical decision tasks, as in Study 5. In conclusion, the automatic associations between brightness and good and between darkness and bad were demonstrated. Also, the results emphasized embodied nature between emotion and conceptual thought procedures.

A study conducted by Gokce (2016) on the conceptualization of happiness, sadness, and anger was based on the analyses of the novel titled 'Please Look After Mom' by the famous Korean author Kyung-sook Shin. Considering Lakoff and Johnson's (2003) Conceptual Metaphor Theory, Gokce (2016) investigated the roles of metonymy and metaphoric expression in the emotional language of Korean. From the analysis of source domains, a set of expressions was determined for sadness, happiness, and anger. The emotional metaphors in Korean were similar to the conceptualization of emotions in English. Examples of metaphorical conceptualization of emotions were "Happiness is a vitality," "Sadness is heat," and "The body is the container for anger." Gokce (2016) claimed that these associations emphasized the basic assumption of embodied cognition. That is the close relationship between emotion conceptualization and bodily or physiological experiences of emotions.

Before concluding the part on conceptual metaphors, several critics of embodied theories are going to be discussed to explain why conceptual metaphor and embodied cognition have been taken as separate sections in this manuscript.

Initially, theories of embodied cognition refer to the ways cognitive processes are derived from sensory-motor systems (Barsalou et al., 2003; Rowlands, 2011; Smith & Semin, 2004; Wilson, 2002). Based on this fact, theories of embodied cognition require a demonstration of each cognitive process by mere bodily states. Another question related to physical dependency is how bodily feedback is adequate, fast serving, and detailed oriented for each cognitive experience. Also, the claim of cognitive process derived from a physical, modality-specific system refers to a causal relationship. However, the same bodily states may be closely matched with various cognitive or emotional experiences. Therefore, the relationship should be more correlational. Furthermore, none of the theories considered individual differences to account for the embodied cognitive state (Niedenthal et al., 2005).

While embodied cognition theories emphasize sensory-motor dependency in cognitive processes, conceptual metaphors refer to one of the components for individuals to understand and use abstract concepts in their communications (Landau et al., 2010). Gaining knowledge about the limitation of embodied cognition is a must to understand little nuances between conceptual metaphors and embodied cognition phenomena.

Conceptual metaphors are tools used by people through source and domainanalysis when they perceive abstract concepts. Source concepts represent schematic knowledge, which is acquired through systematic and repetitive interaction with the physical and social world (Lakoff & Johnson, 2003).

On the other hand, target concepts are complex topics to grasp. Therefore, metaphors appear to be different when the literal framing of the language is elaborated. However, they provide a consistent structure to understand superficially different concepts (Lakoff & Johnson, 2003). For example, love is metaphorically constructed as "love is a journey." While 'love' is the source domain, 'journey' is a superficially dissimilar target concept (Kovecses, 2000; 2010; Lakoff & Johnson, 2003;). When partners talk about their love life, "I think we need to slow down" or "Where do you see us ten years down the road?" are statements that are frequently used (Lakoff & Johnson, 2003).

Consequently, conceptual metaphors are concepts mainly derived from embodied cognition phenomena. However, they exceed the limits of the embodiment concept. In this way, individuals grasp fundamental concepts as merely physical experiences (Landau et

al., 2010). It was seen that metaphoric expressions affect the various forms of cognitive processes. Likewise, they were found to be effective in social proximity judgments (Ijzerman & Semin, 2009), attitude changes toward social topics (Landau et al., 2009), authority, and power perception (Moeller et al., 2008). Also, these perceptual differences were effective even in sexual desirability judgments (Meier & Dionne, 2009). Lastly, metaphoric expressions were also essential factors in affect judgments (Gokce, 2016; Meier et al., 2004; Waggoner, 2010). From this onward, the manuscript focuses on the relationship between emotions and colors as metaphoric expressions.

1.3 Emotion

Emotion is a concept that scientists still need to come up with a consensus on. Some accepted emotions as bodily reactions to a survival situation (LeDoux, 1998). According to Zajonc's (1984) perspective, individuals do not require to apprehend the situations to experience the emotion. However, some other scientists claim the way of comprehension and apprehension of the situation create emotions (Lazarus, 1984). The dilemma of what is a suitable definition for emotion leads to a question of whether we can accept emotions as a particular set of emotion groups that is universal or language- or culture-specific. According to Ekman (1999), basic emotions are valid for everyone and universal. This universal set consists of six basic emotions: anger, sadness, happiness, surprise, disgust, and fear (Ekman & Friesen, 1976).

Several researchers worked on emotion perception or emotion in general. Some of them worked on this issue using objective measurement tools such as measuring physiological changes in the people's facial muscles with electromyography (EMG) measurements (e.g., Halberstadt et al., 2009). Some others investigated emotions with the help of functional magnetic resonance imaging to see which specific brain regions are activated during certain emotional experiences (e.g., Lieberman et al., 2007). Several other physiological studies were conducted to establish an objective procedure to work on emotion (Feldman Barrett, 2017). However, Feldman Barrett (2017) stated that there has yet to be an established consensus about the most objective method that can be used to study emotion so far. The physiological measurements are inadequate to distinguish between different emotions in terms of valence clearly. Feldman Barrett (2017) claimed that studies on emotions could help us to evaluate an emotion as either positive or

negative. However, they are not providing distinctions to categorize emotions like anger, happiness, or sadness.

As Kovecses (2000) emphasized, human emotions are constructed through individuals' embodied experiences within a specific culture. The conceptual metaphors within the language structure can provide ground for experimenting with emotion comprehension. This idea was grounded in previous literature findings about changes in cognitive processes due to manipulating metaphoric expressions (Lakoff & Johnsen, 2003; Landau et al., 2010; Niedenthal et al., 2005).

1.4 Color and Emotion Studies

Kovecses (2010) stated, "we cannot expect the same metaphors to occur in all languages, but we cannot expect metaphors that contradict universal human experience, either" (p. 88) in his book *Metaphor A Practical Introduction*. Emotion and metaphoric expression connections were evaluated through either universal connections or language or culture-dependent relationships. Based on Kovecses' (2010) statement, no universal metaphoric expressions can explain emotions in all languages. However, we can find a set of expressions strongly matched with emotions in one specific language. In this way, emotions can be studied more objectively with the help of language constructions.

Accordingly, Sandford (2014) concentrated on the relationship between colors and emotions. The researcher assumed that color and emotion associations are coherent with embodied experience; therefore, the associations take place in language structure. The corpus analysis on the Corpus of American English and the Corpus of Historical American English and three questionnaires were used to assess how the color and emotions are entrenched. Entrenchment is considered a physical and psychological experience. Eleven (six primaries: black, white, red, yellow, green, blue; and five secondary: brown, grey, purple, orange, pink) basic color terms from English were studied. Sandford (2014) aimed to analyze the "X (become) Y with Z" metaphorical construction. For instance, the metaphorical construction is considered as a "state of being" or "change of being," as in the "He is white with fear" and "He turned white with fear," respectively. Therefore, X refers to a person or subject, Y stands for the color term, and Z is for emotional experiences. In Corpus, Sandford (2014) looked at certain verbs within the associations between color and emotions. These were; 'be,' 'go,' 'turn,' 'grow,' and 'become .'Results

showed that 'be' was the leading verb. Other verbs like "go," "turn," "grow," and "become" were frequent in the historical corpus. However, the percentages for each verb varied. The percentage range for the verb "be" was between 11.3 % to 7 %, the range was between 2.6 % to 1.2% for "go," 6.5 % to 1.8% for "turn," 0.6 % to 7.0 % for "grow," but there was no occurrence of the verb "become ."As an example, "red" was found in the construction with "be" at 40%, whereas it was used with "go" at 50%. The percentage went down for the rest of the verbs. For the second part of the research, questionnaires were administered. Participants were instructed to create an association between emotion and the given color in the first two tests. The third test required participants to select a color from fourteen options for a given emotion. Participants were required to follow these instructions; in the first test, "What emotion comes to mind with colors? –Black with…" in the second, "What emotion would you insert in this expression? They turned black with…" and the third test included "I went/turned….. with rage/fear". According to the results, the highly ranked associations between colors and emotions and their correspondence level of agreement percentages were like this; black with anger at 23 % level of agreement, brown with boredom at 22 % level of agreement, purple with rage at 22 % level of agreement, and orange with happiness at 11% level of agreement. However, the strongly associated pairs were different. Anger with red at 74 % agreement, rage with red at 53 % agreement, and happiness with yellow at 63 % agreement. Ekman's basic emotion category of surprise was not found to be related to any color in the corpus analysis or the responses on the questionnaires. Also, calmness, cowardice, and boredom had not been found in any emotion-color constructions in the corpus analysis (Sandford, 2014). In the previous literature, positive and negative emotions were associated with a color's brightness and saturation dimensions. Intense emotions were depicted in dark or saturated colors. For example, happiness was associated with light and saturated colors, fear with lightest and desaturated colors, anger and disgust with darkest colors, sadness with intermediate lightness and desaturated color, and at last, boredom and exhaustion with desaturated colors (Da Pos & Green- Armytage, 2007; Simmons, 2011; Steinvall, 2007). The associations found in this study were similar to the previous findings in the English language (Da Pos & Green- Armytage, 2007; Simmons, 2011; Steinvall, 2007). Based on these findings, Sandford (2014) claimed that "X (become) Color with Emotion" is an

appropriate metaphorical structure to consider when the association between color and emotion is investigated for native English speakers.

Barchard et al. (2017) conducted another study to see the relationship between figurative language and emotional perception. They aimed to see whether the figurative language used in psychological measurements means the same as emotions. They took fourteen associations into account based on several metaphoric expressions. For instance, the "the anger is red" association was based on conceptual metaphoric expressions like "his face turned red" and "she was scarlet with rage"; the "fear is dark" association was based on expressions like "the blood freezes in the veins" and "I was filled with icy fear"; and for "happiness is warm" association metaphoric expressions like "she brightened up" or "he has a sunny personality" were taken as the basis. They investigated whether these metaphors are strongly associated with four primary emotions: happiness, sadness, fear, and anger. The expected associations were happiness with up, bright, and warm; sadness with down, dark, blue, and empty; fear with white, cold, dark, and paralyzed; anger with hot, red, and dark. To see the relationship between these pairs, researchers conducted two studies on groups of American and Indian participants. Participants had to select a choice in a closed-ended question about which metaphoric expressions they strongly associate with presented emotions.

According to the results, ten of the fourteen associations were endorsed by both cultural groups. Happiness was related to brightness, and negative emotions (anger, sadness, and fear) were related to darkness. The percentage of individuals who endorsed this association was 87 % in the two groups. At least 66 % of individuals associated anger with red and hot. Happiness was associated with

up, whereas sadness with down at around 96 % in the two cultural groups. Sadness was associated with empty at 91 %. Also, fear was associated with paralysis at around 86 % in the two groups.

In contrast to these ten associations, four presumed ones were culture-specific. Sadness and blue were associated among the American group at 65 %, whereas the percentage was 15 for Indian participants. The American participants predominately associated happiness with warmth and fear with cold, whereas Indian participants did not endorse these two associations. The last contradictory finding to the presumptions was

"fear is white ."Neither group endorsed this association. Fear is associated with 'looking white' in general, as was seen in the expression, "his face was white from fright ."(Barchard et al., 2017).

Another corpus study investigated the relationship between 50 colors and 135 emotion terms in English (Steinvall, 2007). Steinvall (2007) investigated the degree of salience between emotion-color collocations in the corpus named Bank of English (BoE). Accordingly, in the first task researcher investigated the most salient color matching the emotions (selection of color). In the second task, the researcher investigated the selection of the most salient emotion for the colors (selection of emotion). Fifty color terms were taken from Steinvall's study (2002). The color terms were grouped according to 11 basic color terms in English (Berlin & Kay, 1969). The same procedure applied to 135 emotional terms as they were grouped into six basic emotional categories (anger, sadness, fear, love, joy, and surprise, according to Shaver et al., 1987). Also, emotions included subcategories. For instance, love comprises affection, lust, and longing. In the first task, where the most salient color categories for each emotion were asked, positive emotions like joy and love were found to be matched with bright and warm colors. The aspect of light was shown as one of the influential factors while giving meaning to the associations. Emotion and color associations were not coherent between the two tasks. For example, anger was associated chiefly with red and green when emotion was the reference point. However, whenever the question was inversely worded, anger was found to be associated with white, brown, and purple beside the red and green combination. According to the findings, in both question types, there was no associated color with the emotion "surprise."

All the associations found in this study were based on bodily experiences of emotions. Therefore, three metaphorical models were proposed that explain emotion-color associations. The first metaphorical model referred to as "emotion is heat ."The model is based on the association between anger and red. The second one was "emotion is an illness," as green and envy matched together. The last metaphorical model was "emotion is a weather phenomenon," based on several associations. For example, blue, related to the color of the sky, was associated with joy. Yellow, derived from the sun as the light source, was found to be associated with happiness. Lastly, sadness was associated with grey and black (colors of the dark clouds) (Steinvall, 2007).

Takahashi and Kawabata (2018) studied how emotions can evoke colors. Researchers recruited forty Japanese students and randomly assigned them to two conditions. The first condition was the emotional words condition, which consisted of presenting emotional words. Participants were required to imagine colors to associate with emotions and then pick one of the colors. Also, participants were asked to write down an object if they thought about it when coming up with a color. Participants were asked to imagine facial colors for emotions in the second condition, the schematic face condition. As emotion variables, six basic emotions (anger, sadness, joy, disgust, surprise, and fear) and neutral status stimuli were selected. Emotional faces and non-emotional schematic faces were received from Ekman and Friesen's (1969) work.

For the color stimuli, 130 colors were varied in hue, saturation, and brightness. Results showed that negative emotions were associated with darker colors, whereas positive ones were with brighter colors. In the emotional words condition, it was found that the word itself triggered the imagination of various objects. However, natural facial colors became the focal point in the schematic face condition. This finding showed that the schematic face condition provides a contextual cue for the participants. It led them to choose a specific color that could be aligned with facial expressions.

Furthermore, it was found that some emotional stimuli were loaded on a specific color. For example, the association between anger and red was strong. "A face red with anger" was thought to be the trigger for this association in both face and word conditions. The light was recalled most for joy. Therefore, saturated yellow was associated with joy. Furthermore, the surprise was associated with saturated yellow and white. Achromatic colors like white were also related to no emotion schematic face stimuli. Sadness was found to be associated with bluish colors. Also, low-brightness colors (such as white and the color given as facial color in the study) were chosen for fear and disgust. The found associations became more elaborate using the color palette (Takahashi & Kawabata, 2018).

Jonauskaite et al. (2019) conducted a study to see the associations between colors and emotions based on the assumption that our physical environment affects our perception. Based on this, researchers examined whether "yellow," which implies life-sustaining sunshine and pleasant weather, is associated with the emotion "joy ."The

assumption was that if there is such an association between 'yellow' and 'joy,' countries with rare sunny days and pleasant weather due to their geographic locations should make a stronger association between yellow and joy. The second aim of Jonauskaite et al.'s (2019) study was to examine whether there are similarities and differences among 55 countries, such as Algeria, Finland, Norway, Thailand, and Turkey. Jonauskaite et al. (2019) used data collected in the ongoing study of Mohr, Jonauskaite, et al. (2018) using the International Colour-Emotion Survey. The amount of sunshine, distance to the equator, the level of precipitation in a year, and daytime hours were measured. The Geneva Emotion Wheel (GEW version 3.0; (Scherer et al., 2013) was used for the emotion presentation. GEW is a self-report scale consisting of 20 different emotions organized circularly like a wheel.

For rating, there are different sizes of circles (small to big) and a square in the GEW. The square indicates no association. To demonstrate, if participants selected the square for the association between disgust and purple, it indicated that they were no association. On the other hand, if participants selected the biggest circle for the color purple, it indicated a strong association between purple and disgust. Thus, the GEW scale consists of 6 points of ordinal rating (0-zero association to 5-strong association). Color terms are used instead of the presentation of color patches due to their easy application. According to the results, the yellow-joy association rating was 5.7 % for Egypt and 87.7% for Finland. Globally, the average association percentage was 48.26%. The effects of geographical, climatological, and seasonal factors on the yellow-joy association were seen in the results. For example, yellow was counted as more joyful in colder and rainier countries such as Finland. It had been evident that the physical environment could alter the perception of colors and their potential relationships with emotional concepts (Jonauskaite et al., 2019).

Studies mentioned above differentiated between each other depending on the usage of colors in verbal format or as color patches or palettes. Therefore, the difference between the two presentation styles in which colors are mere colors or verbal terms becomes an essential distinction. Jonauskaite et al. (2020) focused on the compatibility of the findings when different presentation styles are used. They assumed that experimenters had less control over what participants thought when colors were used. Therefore, there

might be differences between the presentations of colors as patches versus terms. For this purpose, 20 emotions and 12 colors in French were presented either in a patch or verbal format. The results showed a high similarity between the patch and verbal conditions (except for purple and black colors) regarding the association between emotion and color. Some associations, such as red anger, red love, and yellow joy, frequently appeared. Other associations occasionally occurred, such as blue-sadness. There were rare associations as well, like blue love. Some colors were found to be associated with one specific emotion, such as brown with disgust or white with relief.

In contrast, some colors had several associated emotions, such as red with love and anger or yellow with joy and amusement. The similarity coefficient score between color terms and patches were .82 point. This score implies similarity analyses based on the Pearson correlation matrix (Kriegeskorte, 2008). It ranges between 0 to 1. The score 1 indicates perfect pattern similarity between the two datasets, whereas 0 means absolute pattern dissimilarity. The higher scores refer to the high similarity between the two datasets. The differences between the two presentation styles were in valence, power, and arousal dimensions. Thus, it is claimed that findings from studies with color patches and studies with color terms provided comparable results to a large extent.

Another research on emotion-color pairing was conducted on native English speakers from North America (Fugate & Franco, 2019). Fugate and Franco (2019) wanted to investigate the consistency and specificity of color-emotion associations in English. The term consistency refers to which emotion reliably matches a color or colors. On the other hand, specificity refers to the presence of color or a set of colors associated with an emotion. Based on the definitions, researchers conducted two consecutive online surveys. In both studies, participants were instructed to choose up to three colors to match with emotions from a list. Also, they rated the pairings on a ten-point Likert scale. In the first study, participants selected three colors at most from the 23 colored swatches for ten emotions which were sadness, surprise, anger, calmness, contempt, disgust, fear, happiness, jealousy, and envy. Besides, participants were required to pick only one color for each emotion, while this forced-choice question type was administered only in the first study. In this way, researchers wanted to investigate whether there was any difference between forced-choice questioning and open-ended question types. The second study

included additional colors and emotion terms which were alertness, awe, boredom, disappointment, empathy, guilt, joy, love, pride, and shame. According to the results, four emotions out of ten showed consistency. One-third of the colors showed specificity. The pairs, which were associated frequently, were; anger with red, fear with black, happiness with yellow, and sadness with gray. However, conditions showed moderate to the low agreement. The only exception was the pair of anger and red which was relatively high. When researchers analyzed the specificity aspect of the color-emotion association, nine colors out of twenty-three were highly specified for certain emotions (e.g., the pair of red and anger).

On the other hand, associations like gray with sadness; yellow with happiness; green with envy; indigo with sadness; and lastly, chocolate, dark yellow, and light green with disgust had a moderate association strength and low level of agreement. Besides, when open-ended versus forced-choice question types were investigated, green was associated with jealousy in only one-color choice conditions. This indicated how the formatting of the questions affected the findings. In the second study, three colors showed specificity, and two colors showed consistency to a specific emotion. The associations between disappointment with gray and love with red were the ones that showed high consistency. In terms of specificity, dark red with anger, light red with love, and green with envy was the highly specified associations. The findings of the first and second studies could have been more coherent. Several associations in the first study were not found in the second study (Fugate & Franco, 2019). Therefore, the results showed the importance of how experimental setup influences the decisions for color-emotion associations.

Studies summarised above (e.g., English; Barchard et al., 2017; Fugate & Franco, 2019; Sandford, 2014 or 55 different cultures; Jonauskaite et al., 2019) mainly focused on the relationship between color and emotion in the English language. The present study aimed to explore the pairings of emotions with colors in Turkish.

There are several metaphorical expressions that imply color-emotion associations in Turkish. For instance, there were metaphorical expressions like tying black (karalar bağlamak) (Bas & Buyukkantarcıoglu, 2019), or wither away (sararıp solmak) for sadness, one’s face becomes red (öfkeden kızarmak) or becomes scarlet red (öfkeden kıpkırmızı

kesilmek) or one’s face to become black/ purple by anger (öfkeden yüzü simsiyah olmak, öfkeden mosmor kesilmek) or changes of one’s face's color (öfkeden yüzünün renginin değişmesi) for anger (Akkok, 2017). For the happiness lightness aspect of the color is used as in “his face lightens up” (yüzü aydınlanmak).

1.5 Aim of the Current Research

Presented studies from the literature have different results based on which color terms or emotions were used. Most studies used Basic Color Terms (BCT) within the targeted language. Some researchers have been investigating the validity of the assumed BCTs.

Rätsep (2011) conducted a study to see whether dark blue "lacivert" can be accounted as one of the primary color terms (BCT) in the Turkish language. To see the position of dark blue, Rätsep (2011) conducted an oral list task in which participants were required to name as many colors as possible. Also, a naming task was used in which subjects were instructed to name eighty-two color tiles. Each tile was shown in random order on a neutral grey background. Fluent Turkish speakers interviewed sixty native Turkish speakers. Participants were screened with City University Colour Vision Test (Fletcher, 1976) to ensure they had normal color vision. The results were investigated according to the cognitive salience index (Sutrop, 2001). There were 60 different color terms. Therefore, frequency distribution was evaluated out of a possible 60 colors. Several colors went beyond the chance level, which was 30. Green, yellow, black (equal), white, red, blue, purple, brown, pink, and orange were ordered as the most widely used colors. The next color term was grey which had an equal frequency with a dark blue (lacivert). The remaining colors went below 30, below the cut-off point for accepting the color as Basic Color Term in the language. According to the cognitive salience index, the most salient terms were red, blue, green, yellow, black, white, purple, pink, orange, brown, dark blue, and grey. In this respect, dark blue was in the eleventh position in the ranking. However, according to the color-naming task, dark blue (lacivert) did not enter the rating scale. Therefore, Turkish's dark blue (lacivert) cannot be considered under the basic color term even though it appeared to be highly frequent in listing tasks (Rätsep, 2011).

The Turkish language has yet to be investigated coherently for emotion-color associations. Therefore, the present exploratory study would contribute to the literature by

demonstrating whether emotion-color associations are specific to particular languages or universal concepts.

Eleven basic colors (based on Rätsep's 2011 study) were used for metaphoric expressions. For emotional stimuli, six basic emotions (Ekman & Friesen, 1976) were included in the present study. These were anger (öfke), sadness (üzüntü), happiness (mutluluk), surprise (şaşkınlık), disgust (tiksinme), and fear(korku). The reason behind using basic color terms and emotions relied on the fact that this study was the first one conducted in Turkish. These are red (kırmızı), blue (mavi), green (yeşil), yellow (sarı), black (siyah), white (beyaz), purple (mor), pink (pembe), orange (turuncu), and grey (gri). Linguistic color terms were used to eliminate the interference of technology, as individuals might use different technological devices for the study. The second reason was that controlling colorimetric coordinates was complex in online data collection. The literature has already mentioned that lightness, saturation level, and hue aspects of the color are influential factors in studies' results (Da Pos & Armytage, 2007; Sandford, 2014). Therefore, it was aimed to use stimuli as controlled as possible as technology and online experimental conditions can provide.

A set of emotional faces, in addition to emotional words, were used. There were two tasks. The first one is called *the matching emotion words with colors task*. In this task, participants had to associate emotional terms and colors. There were two conditions. Condition 1*(presentation of emotion term was initial)* in which participants had to give a rating for presented emotion terms with randomly presented 11 colors on a 0 (not at all relevant) to 5 (strongly related) point scale. In condition 2 *(presentation of color was initial)*, participants had to rate the strength of the association between emotion words and given color terms on a 0 (not at all relevant) to 5 (strongly related) point scale.

Furthermore, in experiment 1/A, participants received condition one first, then had to perform condition 2. In experiment 1/B, participants had to perform condition two first and then participate in condition 1. Between conditions, participants had to take a filler task. The filler task consisted of 10 intermediate-level mathematical equations in which participants had to evaluate the solutions as right or wrong. The other task was named *the matching emoji-like faces with colors task*. The task included emoji-like faces as emotional stimuli. Six emotional and one neutral emoji faces were presented to make an

association with 11 basic color terms. Similar to the first task, there were two conditions. In *condition 1(presentation of emoji-face was initial),* a participant had to rate the strength of the association between colors and a given emoji face on a 0 (not at all relevant) to a 5 (strongly related) point scale. In *condition 2 (presentation of color was initial),* participants had to rate the strength of the association between emoji faces and given color term on a 0 (not at all relevant) to 5 (strongly related) point scale. Participantsperformed the same filler task between conditions in which intermediate-level mathematical equations were evaluated as either right or wrong. Again, the order of conditions was changed among Experiments 2/A and 2/B. Participants who took part in Experiment 2/A performed condition one first and then condition two, whereas participants in Experiment 2/B performed condition two first and then took condition 1. Overall, we used either emotion to color matching scenario or color to emotion category-matching scenario. The aim of using these two different matching conditions was to see possible asymmetrical findings depending on the matching condition.

Chapter 2

Method

2.1 Participants

Seven hundred and eighty (780) individuals were recruited through snowball sampling. Participants were native Turkish speakers. From the whole sample, 389 individuals left the study before the end of the experiments. Only 391 participants proceed to the end. In this group, the number of female participants was 237 (60.6 %), and there were 154 (39.4 %) male participants. The age range for participants was between 20 and 55 years (M = 32.9, SD = 9.73). The average age for female participants was 31 (M= 31.41, SD = 9.73), and for male participants, 35 (M = 35.14, SD = 9.33). The informed consent (see *Appendix A*) was taken from each participant. Ethical approval for the studywas taken from the Ethical Board of Bahcesehir University.

2.2 Materials

2.2.1 Matching emotion words with colors task. The matching emotion words with colors task included two conditions. Both conditions consisted of randomly presented 6 emotion words (anger (*öfke*), sadness (*üzüntü*), happiness (*mutluluk*), surprise (*şaşkınlık*), disgust (*tiksinme*), and fear (*korku*)) and one neutral word (*Taban*); and randomly presented eleven basic Turkish color words (red (*kırmızı*), blue (*mavi*), green (*yeşil*), yellow (*sarı*), black (*siyah*), white (*beyaz*), purple (*mor*), pink (*pembe*), orange (*turuncu*), and grey (*gri*)). In condition 1, participants were required to rate the strength of the association between colors and given emotion words with the instruction, "Please indicate how much you think the emotion given below is related to the colors listed. Please indicate your assessment with options from 0 (not at all relevant) to 5 (strongly related). If there is another color that you think is related to this emotion, please specify it in the Other option." (*Aşağıda verilmiş olan duygunun sıralanmış olan renkler ile ne kadar ilişkili olduğunu düşündüğünüzü belirtiniz. Lütfen değerlendirmenizi 0 (hiç ilişkili değil) ile 5(güçlü bir şekilde ilişkili) seçenekleriyle belirtiniz. Bu duyguyla ilişkili olduğunu düşündüğünüz başka bir renk varsa Diğer seçeneğinde belirtiniz.*) In condition 2, participants were required to rate the strength of the association between emotion words

and given color terms with the instruction, “Please indicate how much you think the color given below is related to the emotions listed. Please indicate your assessment with options from 0 (not at all relevant) to 5 (strongly related). If you think another emotion is related to this color, specify it in the Other option.” (*Aşağıda verilmiş olan renk ile sıralanmış her bir duygunun ne kadar ilişkili olduğunu düşündüğünüzü belirtiniz. Lütfen değerlendirmenizi 0 (hiç ilişkili değil) ile 5(güçlü bir şekilde ilişkili) seçenekleriyle belirtiniz. Bu renk ile ilişkili olduğunu düşündüğünüz başka bir duygu varsa Diğer seçeneğinde belirtiniz.*) The emotion words and color terms were in Times New Roman, 72 font size.

2.2.2 Matching emoji- like faces with colors task. The matching emoji-like faces with colors task contained two conditions. Both conditions consisted of randomly presented six emotional emoji-like faces, which were representative of the emotions of anger (*öfke*), sadness (*üzüntü*), happiness (*mutluluk*), surprise (*şaşkınlık*), disgust (tiksinme), and fear (*korku*) and one neutral emoji-like face. Emoji-like faces were taken from everyday materials we use in our telephone messages. They were drawn by a Turkish graphics designer and identified through a pre-test. The background of emoji icons was neutralized by turning its color into white. In the pre-test, 48 individuals were included. They were asked to match six basic emotions and one neutral emotion word with a set of emoji icon faces (The emoji faces and the pre-test analysis are presented in Appendix B). The emoji faces were in 500 x 500-pixel size.

Also, there were randomly presented with ten basic Turkish color words, which were red (*kırmızı*), blue (*mavi*), green (*yeşil*), yellow (*sarı*), black (*siyah*), white (*beyaz*), purple (*mor*), pink (*pembe*), orange (*turuncu*), and grey (*gri*) in both conditions.

In *condition, 1* participant was required to rate the strength of the association between the given emoji face and colors with the instruction, "Please indicate how much you think the emoji face given below is related to the colors listed. Please indicate your rating from 0 (not relevant) to 5 (strongly related). If there is another color that you think is related to this face, specify it in the "Other" option." (*Yukarıda verilmiş olan yüz ile aşağıda sıralanmış olan her bir rengin sizin için ne kadar ilişkili olduğunu belirtiniz. Lütfen değerlendirmenizi 0 (hiç ilişkili değil) ile 5 (güçlü bir şekilde ilişkili) seçenekleriyle belirtiniz. Bu yüz ile ilişkili olduğunu düşündüğünüz başka bir renk varsa “Diğer”*

seçeneğinde belirtiniz.) In *condition 2*, participants are required to rate the strength of the association between a given color term and emoji faces with the instruction, "Please indicate how much you think the color given below is related to each emoji face listed. Please indicate your rating from 0 (not at all relevant) to 5 (strongly related)." (*Yukarıda verilmiş olan renk ile aşağıda sıralanmış olan her bir yüzün sizin için ne kadar ilişkili olduğunu belirtiniz. Lütfen değerlendirmenizi 0 (hiç ilişkili değil) ile 5 (güçlü bir şekilde ilişkili) seçenekleriyle belirtiniz.*)

The rating scale was inspired by the Geneva Emotion Wheel (GEW version 3.0; (Scherer et al., 2013) based on Jonauskaite and her colleagues' work (2019). All the instructions and materials were in Turkish.

2.2.3 Filler task. The filler task consisted of 10 basic intermediate-level arithmetical mathematical problems. It was used as a distractor between conditions in matching emotion words with colors task and emoji-like faces with colors task. The filler task was designed to take five minutes. The filler task is presented in Appendix K.

2.3 Procedure

Studies were conducted online on the SurveyMonkey platform (http://www.surveymonkey.com). At the beginning of the studies, participants received informed consent for the experiments. Both m*atching emotion words with colors task* and m*atching emoji-like faces with colors tasks* include two conditions, so there were four experimental conditions. It aimed to eliminate the possible effect of presentation orders of matching conditions. There were two main experimental procedures, Experiment 1 and Experiment 2. For this purpose, a website was built. On the front page, the website included a brief overview of the study's aim for the participants. Then they were asked to select one of the neutral words ("Biçim" or "Sabit") that were placed on the screen. This way, participants were selected either in Experiment 1 or Experiment 2. Depending on the selected words, participants were directed to the second page. The second page also included two different neutral words (if participants selected "Biçim" the second set of neutral words were "Tabak" or "Sepet" whereas if the participants selected the word "Sabit," they were directed to the page that contained "Tablo" or "Posta" neutral words).

Participants had to select one word and start either the A or B design of the experimental procedures.

The neutral words were taken from Goz's (2003) study. They were 5 to 6 letter length long, moderately frequent words in the Turkish language. The neutral words; "Biçim," "Sabit," "Tabak," "Sepet," "Tablo," and "Posta" in a Times New Roman 72-font size. The word "Taban" was used in experiments 1/A and 1/B experimental conditions as the neutral word. The order of the neutral word was presented in the third position in experiment 1/A, whereas in the fifth position in experiment 1/B.

Participants who participated in Experiments 1/A and 1/B were required toperform the m*atching emotion words with colors task.* In Experiment 1/A, participants had to perform *condition 1* (emotion word presented initially) and then take a filler task. After that, they had to perform *condition 2* (color word presented initially). On the other hand, in Experiment 1/B, participants had to perform the conditions in reverse order. They performed *condition two* first (color word presented initially), took a filler task, and participated in *condition 1* (emotion word presented initially). Both experiments were designed to take 15 to 20 minutes in total.

In Experiments 2/A and 2/B, participants were required to perform the m*atching emoji-like faces with colors task.* In Experiment 2/A, participants had toperform *condition 1* (emoji face presented initially) and then take a filler task. After that,they had to perform *condition 2* (color word presented initially). On the other hand, in Experiment 2/B, participants had to perform the conditions in reverse order. Theyperformed *condition 2* (color word presented initially) first, took a filler task, and participated in *condition 1* (emoji face presented initially). Both experiments were designed to take 15 to 20 minutes in total. Table 1 shows which tasks were used in the experiments and the sequence of the conditions.

Table 1

Procedures of Experiments

	Task	Condition sequence
Experiment 1/A	Matching emotion words with colors task	Condition 1 (*emotion word presented initially*) – Condition 2 (*color word presented initially*)
Experiment 1/B	Matching emotion words with colors task	Condition 2 (*color word presented initially*)– Condition 1 (*emotion word presented initially*)
Experiment 2/A	Matching emoji – like faces with colors task	Condition 1 (*emoji face presented initially*) – Condition 2 (*color word presented initially*)
Experiment 2/B	Matching emoji – like faces with colors task	Condition 2 (*color word presented initially*) – Condition 1 (*emoji face presented initially*)

Demographic information was collected at the end of each experiment. The age, sex, education level, occupation, any other language participants know of, and their level of proficiency in that language, as well as whether they have any problems with perceiving colors in general or specific colors, were collected. Participants with visual impairments were eliminated from the data set before proceeding to the primary analysis. None of the participants received a reward for their participation. Approximately the duration of each experiment was 15 to 20 minutes.

Chapter 3

Results

3.1 Data Analysis Plan

The present exploratory study tried to shed light on all the possible associations between 10 basic colors and six basic (additionally 1 Neutral) emotion categories on repeated analyses. Table 2 presents a plan of data analyses conducted in this manuscript before explaining them in detail in the following sections.

Table 2

Data Analysis Plan

Research Aim	Statistical Analysis
Demographic characteristics of each experimental group	Descriptive analyses for each group
Comparison of four experimental groups in terms of demographic characteristics	Chi-square analyses for categorical variables A one-way ANOVA analysis for continuous variables
Outlier and missing value detection	Evaluation of skewness and kurtosis values and z-scores
The strength of the association between color terms and emotion categories	Conducting Friedman tests for each emotion category separately
The level of agreement among participants	Conducting Kendall's W tests for each emotion category separately

3.2 Demographic Characteristics of Participants

3.2.1 Experiment 1/A. The initial sample for Experiment 1/A consisted of 182 participants. Based on univariate data screening, 79 participants did not proceed to the end of the experimental procedure and had a missing response. Two participants did not agree to attend the study on the informed consent form. Lastly, 1 participant was removed from the dataset due to the pre-requisite of being 20 to 55 years of age, and the individual was

56 years old. After removing all the missing data and participants who were not preferring to attend as well as not appropriate according to the age criteria of the study, the sample of Experiment 1/A consisted of 100 participants (61 (61 %) female). Table 3 presents descriptive statistics of demographic information of Experiment 1/A.

Table 3

Descriptive Statistics of Participants' Demographics in Experiment 1/A

	Sex		Age			
	Frequency	Percent	Min.	Max.	Mean	SD
Female	61	61,0	20	50	31,28	8,58
Male	39	39,0	22	55	39,28	9,22
Total	100		20	55	34,40	9,62

The rest of the demographic information for participants was on their education level, occupation, any other language that they know of, and their level of proficiency in that language, as well as whether they have any problem with perceiving colors in general or specific colors were the information that was collected. Based on these characteristics, the sample of Experiment 1/A showed a diverse profile. In terms of education level, it consisted of participants who have a primary school (1%), secondary school (3%), high school (17%), undergraduate (57%), postgraduate (21%), and doctorate (1%) level. In terms of the languages that participants know, 27 % (27) of the sample know only one language, 40 % (40) of the sample know two languages, 23 % (23) of the sample know three languages, 4 % (4) of the sample know four languages, and 6 % (6) of the sample know five languages. Lastly, none of the participants indicated that they had been diagnosed with color blindness.

3.2.2 Experiment 1/B. The initial sample for Experiment 1/B consisted of 173 individuals. Based on univariate data screening, 69 individuals did not proceed to the end of the experimental procedure and had a missing response. Four individuals did not agree to attend the study during the informed consent phase. Lastly, seven people were removed from the dataset due to the pre-requisite of 20 to 55 years of age. Four of them were above

55, and three of them were below 20 years old. After removing all the missing data and participants who were not preferring to attend as well as not appropriate according to the age criteria of the study, the sample of Experiment 1/B consisted of 93 participants (58 (62.4 %) female). Table 4 presents descriptive statistics of demographic information of Experiment 1/B.

Table 4

Descriptive Statistics of Participants' Demographics in Experiment 1/B

	Sex		Age			
	Frequency	Percent	Min.	Max.	Mean	SD
Female	58	62,4	20	55	30,07	9,67
Male	35	37,6	20	52	33,66	9,42
Total	93		20	55	31,42	9,68

Based on the other demographic information, the sample consisted of participants who have a primary school (2.2 %), secondary school (1.1 %), high school (11.8 %), undergraduate study (66.7 %), postgraduate degree (15.1 %), and doctorate (3.2 %) level of education. In terms of the language that participants know, 26.9 % (25) of the sample know only one language, 41.9 % (39) of the sample know two languages, 22.6 % (21) of the sample know three languages, 6.4 % (6) of the sample know four languages. Lastly, 2.2 % (2) of the sample know five languages. Lastly, none of the participants indicated that they had been diagnosed with color blindness.

3.2.3 Experiment 2/A. The initial sample of Experiment 2/A consisted of 189 individuals. According to univariate data screening, 87 individuals did not proceed to the end of the experimental procedure and had a missing response. Two individuals did not provide consent to attend the study at the beginning. Five people were removed from the dataset due to age pre-requisite. Two of them were below 20 (they were 19 years old), and three (their age was 56, 56, and 58, respectively) were above 55 years old. Lastly, one individual indicated that he had been diagnosed with color blindness, so he was eliminated from the dataset. Besides that, one individual indicated that he had a sensitivity to color perception

and a cataract in his eyes. Therefore, it was thought to be a better option to eliminate this person from the data. After removing all the missing data and people who were not preferring to attend, as well as not appropriate according to age criteria and significant problems in eyesight, the last version of the dataset consisted of 93 individuals. Accordingly, the sample of Experiment 2/A consisted of 31 (33.3 %) male and 62 (66.7 %) female respondents (N= 93). Table 5 presents descriptive statistics of demographic information of Experiment 2/A.

Table 5

Descriptive Statistics of Participants' Demographics in Experiment 2/A

	Sex		Age			
	Frequency	Percent	Min.	Max.	Mean	SD
Female	62	66,7	20	52	30,98	10,33
Male	31	33,3	20	55	33,87	10,25
Total	93		20	55	31,95	10,33

Based on the other demographic information, the sample of Experiment 2/A consisted of participants who have a primary school (3.2 %), secondary school (2.2 %), high school (25.8 %), undergraduate study (54.8 %), postgraduate degree (11.8 %) and doctorate (2.2 %) level of education. In terms of the language that participants know, 32.3 % (30) of the sample know only one language, 37.6 % (35) of the sample know two languages, 21.5% (20) of the sample know three languages, 5.4 % (5) of the sample know four languages. Lastly, 3.2 % (3) of the sample know five languages.

3.2.4 Experiment 2/B. The initial sample for Experiment 2/B consisted of 236 individuals. Based on univariate data screening, 120 individuals did not proceed to the end of the experimental procedure. Five individuals disagreed with attending the study. Three people were removed from the dataset due to age pre-requisite. All of them were below 20 (they were 18, 19, and 19 years old, respectively). Two people indicated that they had been diagnosed with color blindness, so they were eliminated. Lastly, one male participant did not indicate his age, which is why his responses were eliminated as well.

After cleaning, the last version of the dataset consisted of 105 individuals. Accordingly, the sample of Experiment 2/B consisted of 49 (46.7 %) male and 56 (53.3 %) female respondents (N= 105). Table 6 presents descriptive statistics of demographic information of Experiment 2/B.

Table 6

Descriptive Statistics of Participants' Demographics in Experiment 2/B

	Sex		Age			
	Frequency	Percent	Min.	Max.	Mean	SD
Female	56	53,3	20	54	33,43	10,22
Male	49	46,7	20	51	33,69	7,92
Total	105		20	54	33,55	9,18

Based on the other demographic information, the sample of Experiment 2/B consisted of participants who have a primary school (1 %), secondary school (1.9 %), high school (11.4 %), undergraduate study (57.1 %), postgraduate degree (25.7 %), and doctorate (2.9 %) level of education. In terms of the language that participants know, 23.8 % (25) of the sample know only one language, 49.5 % (52) of the sample know two languages, 18.1 % (19) of the sample know three languages, 3.8 % (4) of the sample know four languages. Lastly, 4.8 % (5) of the sample know five languages.

A one-way ANOVA was used to investigate differences across four experimental groups in age. There was no difference among the four groups regarding age $F(3,387) = 2.03$, $p = .109$. Chi-square analyses were conducted for variables of sex, education level, and the number of languages that participants know for four experimental groups. There was no significant difference for sex, X^2 (3) = 3.47, $p = .324$. For educational level there was no significant difference, X^2 (15) = 18.18, $p = .253$. For the number of language(s) that participants know there was no difference between the groups, X^2 (138) = 141.56, $p = .400$ for participants knowing one language, X^2 (147) = 149.11, $p = .436$, X^2 (105) = 101.527, $p = .578$, X^2 (51) = 48.84, $p = .560$, and X^2 (33) = 32.26, $p = .504$. There was no significant difference among the four experimental groups regarding

demographic variables. Table 7 presents the frequency and percentile of categorical variables among four experimental conditions.

Table 7

The Frequency and Percentage in Total for Sex, Education Level, and Language

		Experimental Conditions				
		Experiment 1/A & 1/B-Condition 1	Experiment 1/A &1/B-Condition 2	Experiment 2A & 2/B-Condition 1	Experiment 2A & 2/B-Condition 2	Total
Sex	Female	61 (15.6 %)	58 (14.8%)	62 (15.9%)	56 (14.3%)	237 (60.6%)
	Male	39 (10%)	36 (9.2%)	31 (7.9%)	48 (12.3%)	154 (39.4%)
Education Level	Primary School	1(0.3%)	2 (0.5%)	3 (0.8%)	1 (0.3%)	7 (1.8%)
	Secondary School	3 (0.8%)	1 (0.3%)	2 (0.5%)	2 (0.5 %)	8 (2%)
	High School	17 (4.3%)	11 (2.8%)	24 (6.1%)	12 (3.1%)	64 (16.4%)
	Undergraduate Degree	57 (14.6%)	62 (15.9%)	51 (13%)	60 (15.3%)	230 (58.8%)
	Postgraduate Degree	21 (5.4%)	15 (3.8%)	11 (2.8%)	26 (6.6%)	73 (18.7%)
	Doctorate	1 (0.3%)	3 (3.8%)	2 (0.5)	3 (0.8%)	9 (2.3%)

Table 7 (continued)

The Frequency and Percentage in Total for Sex, Education Level, Language

		Experimental Conditions				
		Experiment 1/A & 1/B- Condition 1	Experiment 1/A &1/B- Condition 2	Experiment 2A & 2/B- Condition 1	Experiment 2A & 2/B- Condition 2	Total
Language	Only 1 Language	27 (27%)	25 (26.9%)	30 (32.3%)	25 (23.8%)	107 (27.3%)
	Only 2 Language	40 (40%)	39 (41.9 %)	35 (37.6%)	52 (49.5%)	166 (42.4%)
	Only 3 Language	23 (23%)	21 (22.6%)	20 (21.5%)	19 (18.1%)	83 (21.2%)
	Only 4 Language	4 (4%)	6 (6.4%)	5 (5.4%)	4 (3.8%)	19 (4.8%)
	Only 5 Language	6 (6%)	2 (2.2%)	3 (3.2%)	5 (4.8%)	16 (4%)

Before proceeding into primary analyses, skewness and kurtosis values were evaluated to detect outliers. No outliers were found for the experiment 1/A and 1/B datasets when the cut-off score was set to be -2 and +2. According to z-scores for each variable, five individuals with above 3.29 z-score were eliminated from the dataset. Therefore, 97 participants for Experiment 1/A and 91 participants for experiment 1/B were included in the primary analyses. The same procedure was administered to experiment 2/A and 2/B datasets, and all scores were found to be within the set threshold points. That is why 93 participants for experiment 2/A and 105 participants for experiment 2/B were included in the primary analyses.

Since the present study focused on the exploratory relationship between 6 basic (+1 Neutral) emotions and 11 basic color terms, there were several intercept conditions between all the possible color and emotion matching pairs, and it is not easy to conduct parametric analysis. Also, the dataset from the final samples was small. Therefore, using a non-parametric test of the Friedman test, an alternative to one-way repeated ANOVA, was a reasonable approach to pursue. Besides the Friedman analysis, Kendall's *W* test was conducted to see the level of agreement among raters. Furthermore, there were several

pairs in experiments 1/A and 1/B and in experiments 2/A and 2/B. Therefore, Bonferroni correction was administered to handle Type I error that might happen because of repeated pair tests. Depending on the number of the pairs significance level is set to be either at $p = 0.0009$ *or* $p = 0.0007$.

The only difference between experiment 1/A with 1/B and experiment 2/A with 2/B was the order of the matching conditions. The order was counterbalanced among participants by splitting experimental conditions into two parts. At first, it was just designed to eliminate whether the order of the matching conditions influenced the ratings so that before primary analyses, groups were combined. However, after careful investigation, ratings for some emotions were statistically significant for one group but not others. Therefore, the results of each experimental condition were analyzed separately. The results of each experiment (Experiment 1/A and 1/B versus Experiment 2/A and 2/B) are presented in the following sections. In this set of experimental procedures, emotion words were used as emotional stimuli. Findings for six emotions are reported separately.

3.3 Experiment 1A & 1B

3.3.1 Anger. In Experiment 1/A, there was no statistically significant difference among colors in terms of to what extent they were associated with anger (Condition 2), $\chi 2$ (11) = 8.25, p = 0.691. Also, there was low agreement among raters, Kendall's W = 0.008. Similarly, there was no statistically significant result in Experiment 1/B, $\chi 2$ (11) = 14.85, p = 0.189. The low agreement among raters also supported the non-significant result, Kendall's W = 0.015.

On the other hand, when the emotion word anger was given first, and participants were asked to make an association with colors (Condition 1), significant results were found. In Experiment 1/A, the Friedman test score was $\chi 2$ (10) = 98.5, $p = 0.000$.
However, the agreement among raters was low, with Kendall's $W = 0.102$. In Experiment 1/B, the Friedman test score was $\chi 2$ (10) = 86.45, $p = 0.000$. Like in Experiment 1/A, a low level of agreement among raters was found, Kendall's $W = 0.095$.

Based on the significant results, Wilcoxon signed-rank test was conducted to see the difference among pairs. In Experiment 1/A, the compared pairs for the association between Anger and 11 (+ 1 Neutral word) colors that were found to be significantly different were blue and red ($Z = -4.42$, $p = 0.000$), green and red ($Z = -4.71$, $p = 0.000$),

white and red (Z = -4.92, p = 0.000), pink and red (Z = -4.82, p = 0.000), orange and red (Z = -4.21, p = 0.000), black and brown (Z = -3.92, p = 0.000), black and yellow (Z = -4.000, p = 0.000), black and blue (Z = -4.26, p = 0.000), black and green (Z = -5.118, p = 0.000), white and black (Z = -4.74, p = 0.000), purple and black (Z = -3.78, p = 0.000), pink and black (Z = -4.47, p = 0.000), orange and black (Z = -4.54, p = 0.000), and gray and black (Z = -4.01, p = 0.000). When the Median (IQR) scores were compared, two colors stood out, which were black at 2 median score (0 to 4) and red at 2 median score (0 to 3.5).

The post - hoc analysis for Experiment 1/B showed similar results. The significantly different pairs were brown and red (Z = -4.42, p = 0.000), blue and red (Z = -4.00, p = 0.000), green and red (Z = -4.04, p = 0.000), white and red (Z = -4.02, p = 0.000), purple and red (Z = -4.53, p = 0.000), pink and red (Z = -5.13, p = 0.000), orange and red (Z = -3.95, p = 0.000), black and brown (Z = -3.97, p = 0.000), black and blue (Z = -4.47, p = 0.000), black and green (Z = -4.19, p = 0.000), white and black (Z = -4.09, p = 0.000), purple and black (Z = -4.42, p = 0.000), pink and black (Z = -5.04, p = 0.000), orange and black (Z = -4.14, p = 0.000), and gray and black (Z = -4.64, p = 0.000). According to the Median (IQR) scores, black and red were the leading colors. In contrast to Experiment 1/A, the median scores were 3 (0 to 5) for black and 3 (1 to 4) for red in Experiment 1/B.

3.3.2 Sadness. In Experiment 1/A, there was no statistically significant difference among colors in terms of to what extent they were associated with sadness (Condition 2), $\chi 2$ (11) = 18.4, p = 0.073. Also, there was low agreement among raters, Kendall's W = 0.017. Similarly, there was no statistically significant result in Experiment 1/B, $\chi 2$ (11) = 12.798, p = 0.307. The low agreement among raters also supported the insignificant result, Kendall's W = 0.013.

Significant results were found when the emotion word sadness was given first, and participants were asked to make an association with colors (Condition 1). The Friedman test score was significant in Experiment 1/A, $\chi 2$ (10) = 26.63, p = 0.003, while the agreement among raters was low, Kendall's W = 0.27. The Friedman test score of Experiment 1/B was significant, $\chi 2$ (10) = 56.38, p = 0.000. Like in Experiment 1/A, Kendall's score implied a low level of agreement among raters; Kendall's W = 0.062.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among conditions. In Experiment 1/A, the pair was found to be statistically different from others for the association between Sadness and 11 (+ 1 Neutral word) colors were gray and black (Z = -3.55, p = 0.000). The Median (IQR) score for the black was 2 (0 to 4) median score. Therefore, the leading color was black in terms of median score comparison.

Experiment 1/B showed slightly different results when pairs were evaluated. There were several significantly different pairs. These were yellow and red (Z = -3.87, p = 0.000), blue and red (Z = -3.61, p = 0.000), green and red (Z = -3.70, p = 0.000), purple and red (Z = -4.19, p = 0.000), pink and red (Z = -4.83, p = 0.000), orange and red (Z = -3.76, p = 0.000), purple and black (Z = -3.65, p = 0.000), and pink and black (Z = - 3.99, p = 0.000). In contrast to Experiment 1/A, the Median (IQR) scores indicated blackand red as leading colors. The median score of black was 3 (0 to 5), and similarly, the score of red was also 3 (1 to 5).

3.3.3 Happiness. In Experiment 1/A, there was a statistically significant difference among colors in terms of to what extent they were associated with happiness (Condition 2), $\chi 2$ (11) = 88.93, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.083. Similarly, there was a statistically significant result in Experiment 1/B $\chi 2$ (11) = 76.26, p = 0.000. The low agreement among raters was also found, Kendall's W = 0.076. Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among conditions in Experiment 1/A. There were several significantly different pairs. These were neutral and red (Z = -6.94, p = 0.000), neutral and brown (Z = -6.40, p = 0.000), neutral and yellow (Z = -6.13, p = 0.000), neutral and blue (Z = -6.37, p = 0.000), green and neutral (Z = -5.89, p = 0.000), black and neutral (Z = -6.18, p = 0.000), white and neutral (Z = -6.83, p = 0.000), purple and neutral (Z = -5.73, p = 0.000), pink and neutral (Z = -6.25, p = 0.000), orange and neutral (Z = -6.45, p = 0.000), and gray and neutral (Z = -6.10, p = 0.000). According to the Median (IQR) scores, there were several standing colors, and they were red with 3 (1 to 4), brown with 3 (1 to 4), blue with 3 (1 to 4), green with 3 (0 to 4), black with 3 (0 to 4), white with 3 (1 to 5), pink with 3 (1 to 4), and lastly orange with 3 (1 to 4) median score.

Experiment 1/B showed slightly different results when pairs were evaluated. The significantly different pairs were neutral and red (Z = -4.96, p = 0.000), neutral and brown (Z = -4.98, p = 0.000), neutral and yellow (Z = -5.57, p = 0.000), neutral and blue (Z = -6.09, p = 0.000), green and neutral (Z = -5.99, p = 0.000), black and neutral (Z = -5.89, p = 0.000), white and neutral (Z = -5.98, p = 0.000), purple and neutral (Z = -6.67, p = 0.000), pink and neutral (Z = -5.44, p = 0.000), orange and neutral (Z = -5.58, p = 0.000), and gray and neutral (Z = -5.83, p = 0.000). In contrast to the group of participants in Experiment 1/A, five colors depended on the median (IQR) scores. They were blue with 3 (0 to 4), black with 3 (1 to 4), white with 3 (1 to 4), purple with 3 (1 to 4), and gray with 3 (1 to 4) median scores.

Significant results were found when the emotion happiness was given first, and participants were asked to make an association with colors (Condition 1). The Friedman test score was significant in Experiment 1/A, $\chi 2$ (10) = 69.37, p = 0.000. The agreement among raters was low, Kendall's W = 0.072. The score of Experiment 1/B was significant, $\chi 2$ (10) = 53.38, p = 0.000. Like in Experiment 1/A the level of agreement wasagain at a low level, Kendall's W = 0.059.

The post - hoc analysis of the Wilcoxon signed-rank test was conducted to see the difference among conditions. For Experiment 1/A, the pairs for the association between Happiness and 11 (+ 1 Neutral word) colors which were found to differ from each other significantly were brown and red (Z = -3.57, p = 0.000), yellow and red (Z = -4.52, p = 0.000), green and red (Z = -4.41, p = 0.000), white and red (Z = -3.99, p = 0.000), pink and red (Z = -4.68, p = 0.000), orange and red (Z = -5.28, p = 0.000), and orange and black (Z = -3.52, p = 0.000). The Median (IQR) scores showed three standing colors. They were red with 2 (0 to 4), black with 2 (0 to 4), and gray with 2 (0 to 3) median score.

When the Experiment 1/B results were analyzed, the significantly different pairs were pink and red (Z = -3.62, p = 0.000), orange and red (Z = -3.80, p = 0.000), pink and yellow (Z = -3.71, p = 0.000), pink and black (Z = -3.57, p = 0.000), and orange and black (Z = -3.81, p = 0.000). In contrast to Experiment 1/A, there was just one color standing out. It was black with a 3 (0 to 5) median score.

3.3.4 Surprise. In Experiment 1/A, there was a statistically significant difference among colors in terms of to what extent they were associated with surprise (Condition 2), $\chi 2$ (11)

= 27.20, p = 0.004. However, there was low agreement among raters, with Kendall's W = 0.025. On the other hand, there was no statistically significant result in Experiment 1/B $\chi 2$ (11) = 19.405, p = 0.054. Also, a low agreement was found between the raters, Kendall's W = 0.019. Therefore, while post hoc analysis was conducted in Experiment 1/A, pair-wise comparisons were not administered in Experiment 1/B.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among conditions in Experiment 1/A. There were several significantly different pairs. These were pink and neutral (Z = -3.65, p = 0.000) and gray and neutral (Z = -3.83, p = 0.000). However, when the Median (IQR) scores were evaluated, none ofthe colors stood out compared to each other. All of them had 0 median scores.

Significant results were found when the emotion surprise was given first, and participants were asked to make an association with colors (Condition 1). The Friedman test score was significant in Experiment 1/A, $\chi 2$ (10) = 73.77, p = 0.000. The agreement between the raters was low, Kendall's W = 0.076. The Friedman test score in Experiment 1/B was significant, $\chi 2$ (10) = 53.67, p = 0.000. Like Experiment 1/A the agreement was low, Kendall's W = 0.059.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among conditions in Experiment 1/A. There were several significantly different pairs. These were blue and red (Z = -4.39, p = 0.000), green and red (Z = -4.22, p = 0.000), white and red (Z = -3.71, p = 0.000), pink and red (Z = -4.35, p = 0.000), orange and red (Z = -4.04, p = 0.000), black and yellow (Z = -3.50, p = 0.000), black and blue (Z = -4.49, p = 0.000), black and green (Z = -4.10, p = 0.000), white and black (Z = -3.76, p = 0.000), purple and black (Z = -3.88, p = 0.000), pink and black (Z = -4.10, p = 0.000), orange and black (Z = -4.21, p = 0.000), and gray and black (Z = -4.82, p = 0.000). The Median (IQR) scores showed two standing colors. They were red with 2 (0 to 4) and black with 2 (0 to 4) median scores.

When Experiment 1/B was investigated, the significantly different pairs were black and brown (Z = -3.61, p = 0.000), black and blue (Z = -3.55, p = 0.000), purple and black (Z = -3.48, p = 0.000), pink and black (Z = -3.82, p = 0.000), and orange and black (Z = -3.87, p = 0.000). In contrast to Experiment 1/A, there were additional colors besides red and black, like yellow and gray. According to the median (IQR) scores, there were

several standing colors black with 2 (0 to 5), red with 2 (0 to 4), yellow with 2 (0 to 4), and finally gray with 2 (0 to 3) median scores.

3.3.5 Disgust. In Experiment 1/A, there was no statistically significant difference among colors in terms of to what extent they were associated with disgust (Condition 2), $\chi 2$ (11) = 14.69, p = 0.197. There was low agreement between raters; Kendall's W = 0.014. Furthermore, there was no statistically significant result in Experiment 1/B, $\chi 2$ (11) = 9.88, p = 0.541. Also, a low agreement between raters was found, depending on Kendall's W = 0.010 scores. Therefore, post hoc analysis was not performed.

Significant results were found when the emotion disgust was given first, and participants were asked to make an association with colors (Condition 1). The Friedman test score was significant in Experiment 1/A, $\chi 2$ (10) = 64.47, p = 0.000. The agreement among raters was low, Kendall's W = 0.066. The Friedman test score of Experiment 1/B was significant, $\chi 2$ (10) = 56.27, p = 0.000. Like in Experiment 1/A, the agreement was again low, Kendall's W = 0.062.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among pairs in Experiment 1/A. There were several significantly different pairs. These were blue and red (Z = -3.95, p = 0.000), white and red (Z = -3.96, p = 0.000), pink and red (Z = -3.93, p = 0.000), black and blue (Z = -3.73, p = 0.000), white and black (Z = -3.93, p = 0.000), and pink and black (Z = -3.68, p = 0.000). When the Median (IQR) scores were evaluated, two colors stood out compared to the others. They were black with a 2 (0 to 4) and red with a 2 (0 to 4) median score.

When Experiment 1/B was investigated, the significantly different pairs were pink and red (Z = -4.01, p = 0.000), black and brown (Z = -3.83, p = 0.000), and pink and black (Z = -4.00, p = 0.000). In contrast to Experiment 1/A, there were additional colors like purple and gray besides red and black. The median (IQR) scores were 2 (0 to 5) for black, 2 (0 to 4) for red, 2 (0 to 3) for purple, and finally, 2 (0 to 4) median scores for gray.

3.3.6 Fear. In Experiment 1/A, there was no statistically significant difference among colors in terms of to what extent they were associated with fear (Condition 2), $\chi 2$ (11) = 7.10, p = 0.718. There was low agreement among the raters; Kendall's W = 0.007. Furthermore, there was no statistically significant result in Experiment 1/B, $\chi 2$ (11) = 6.98, p = 0.727. Also, low agreement among the raters was found, Kendall's W = 0.008.

Significant results were found when the emotion fear was given first, and participants were asked to make an association with colors (Condition 1). The Friedman test score was significant in Experiment 1/A, $\chi 2$ (10) = 65.35, p = 0.000. However, the agreement among raters was low, with Kendall's W = 0.067. The Friedman test score was significant in Experiment 1/B, $\chi 2$ (10) = 79.12, p = 0.000. Like in Experiment 1/A, the agreement score was again low, Kendall's W = 0.087.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among conditions in Experiment 1/A. There were several significantly different pairs. These were brown and red (Z = -3.92, p = 0.000), blue and red (Z = -3.92, p = 0.000), green and red (Z = -4.32, p = 0.000), white and red (Z = -4.20, p = 0.000), pink and red (Z = -4.36, p = 0.000), orange and red (Z = -3.59, p = 0.000), black and brown (Z = -3.50, p = 0.000), white and black (Z = -3.53, p = 0.000), and pink and black (Z = -3.66, p = 0.000). The Median (IQR) scores showed two standing colors. They were red with 2 (0 to 4) and purple with 2 (0 to 3) median scores.

When Experiment 1/B was investigated, the significantly different pairs were blue and red (Z = -4.16, p = 0.000), green and red (Z = -4.52, p = 0.000), white and red (Z = -4.57, p = 0.000), purple and red (Z = -4.53, p = 0.000), pink and red (Z = -5.26, p = 0.000), orange and red (Z = -3.81, p = 0.000), black and brown (Z = -4.26, p = 0.000), black and blue (Z = -3.82, p = 0.000), black and green (Z = -4.29, p = 0.000), white and black (Z = -4.48, p = 0.000), purple and black (Z = -4.10, p = 0.000), pink and black (Z = -4.97, p = 0.000), orange and black (Z = -3.58, p = 0.000), gray and black (Z = -3.62, p = 0.000), and gray and pink (Z = -3.49, p = 0.000). In contrast to Experiment 1/A, the standing-out colors were slightly different. According to the median (IQR) scores, they were black with2 (0 to 5), red with 2 (0 to 5), and gray with 2 (0 to 3).

3.3.7 Neutral. In Experiment 1/A, there was no statistically significant difference among colors in terms of to what extent they were associated with neutral (Condition 2), $\chi 2$ (11) = 6.23, p = 0.857. There was low agreement among raters; Kendall's W = 0.006. Furthermore, there was no statistically significant result in Experiment 1/B, $\chi 2$ (11) = 14.734, p = 0.195. Also, low agreement among raters was found, Kendall's W = 0.015.

Significant results were found when the neutral word was given first, and participants were asked to make an association with colors (Condition 1). The Friedman

test score was significant in Experiment 1/A, $\chi 2$ (10) = 118.87, p = 0.000. However, the agreement among raters was low, Kendall's W = 0.123. The score in Experiment 1/B was $\chi 2$ (10) = 204.17, p = 0.000. Like in Experiment 1/A, the agreement was again low, with Kendall's W = 0.015 scores.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among conditions in Experiment 1/A. There were several significantly different pairs. These were brown and red (Z = -4.51, p = 0.000), black and red (Z = - 4.56, p = 0.000), gray and red (Z = -3.51, p = 0.000), yellow and brown (Z = -4.34, p = 0.000), blue and brown (Z = -5.57, p = 0.000), green and brown (Z = -4.28, p = 0.000), purple and brown (Z = -4.52, p = 0.000), pink and brown (Z = -4.82, p = 0.000), black andyellow (Z = -4.20, p = 0.000), gray and yellow (Z = -3.58, p = 0.000), black and blue (Z = -5.63, p = 0.000), orange and blue (Z = -4.55, p = 0.000), gray and blue (Z = -5.21, p = 0.000), black and green (Z = -4.10, p = 0.000), white and black (Z = -3.84, p = 0.000), purple and black (Z = -4.90, p = 0.000), pink and black (Z = -5.10, p = 0.000), gray and purple (Z = -4.03, p = 0.000), orange and pink (Z = -3.91, p = 0.000), and gray and pink (Z = -4.73, p = 0.000). The Median (IQR) scores loosely implied three colors. They were brown with 1 (0 to 3), black with 1 (0 to 3), and gray with 1 (0 to 3) median score.

When the Experiment 1/B was investigated, the significantly different pairs were brown and red (Z = -5.51, p = 0.000), black and red (Z = -6.49, p = 0.000), gray and red (Z = -5.74, p = 0.000), yellow and brown (Z = -5.96, p = 0.000), blue and brown (Z = -5.93, p = 0.000), green and brown (Z = -4.52, p = 0.000), white and brown (Z = -4.28, p = 0.000), purple and brown (Z = -6.04, p = 0.000), pink and brown (Z = -6.56, p = 0.000), orange and brown (Z = -5.87, p = 0.000), black and yellow (Z = -5.92, p = 0.000), gray and blue (Z = -5.25, p = 0.000), black and green (Z = -4.49, p = 0.000), pink and green (Z = -4.80, p = 0.000), gray and green (Z = -3.55, p = 0.000), white and black (Z = - 4.14, p = 0.000), purple and black (Z = -6.52, p = 0.000), pink and black (Z = -6.75, p = 0.000), orange and black (Z = -6.20, p = 0.000), pink and white (Z = -4.04, p = 0.000), gray and white (Z = -3.64, p = 0.000), gray and purple (Z = -5.58, p = 0.000), gray and pink (Z = -6.39, p = 0.000), and gray and orange (Z = -5.60, p = 0.000). In contrast to Experiment 1/A, the standing out color was only black, with a median (IQR) score of 4 (1-5).

3.4 Summary of Results in Experiment 1/A and 1/B

Overall, the results showed various combinations of colors for each emotion. Ratings for anger indicated red and black in both Experiment 1/A and 1/B. For sadness, the ratings in Experiment 1/A implied only black, while Experiment 1/B had ratings for red in addition to black. Ratings of happiness were the ones where several colors were found depending on the order of two matching conditions. Likewise, ratings of the surprise showed black and red in Experiment 1/A. Yellow and gray aside, the black and red colors stood out in Experiment 1/B. Ratings of disgust indicated red and black colors in Experiment 1/A. Purple and gray colors were found to be additional colors to red and black in Experiment 1/B. Ratings for the fear indicated red and purple in Experiment 1/A, while black, red, and gray were in Experiment 1/B. Lastly, for the ratings of the neutral word, it was found that brown, black, and gray were the leading colors in Experiment 1/A, while black was the only color in Experiment 1/B.

All in all, black and red were the colors associated with all the emotions, even though there were slight changes between the two experiments. Except for happiness (*Friedman scores were significant for both matching conditions*), when the matching condition initially included the presentation of emotion and then made an association with randomly presented colors (*Experiment 1/A*), findings showed statistically significant results. However, within the significant findings, the agreement level of raters was low for all the emotions. Additionally, no associations were found recursively between color and emotions in both experiments. Likewise, it was found that one color would have been influential in one experiment but not in the other one. Moreover, ratings for each given emotion showed average scores when the median scores were investigated. Table 8 presents the results of Experiments 1/A and 1/B.

Table 8

Results of Experiments 1/A & 1/B

	Experiment 1/A						Experiment 1/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
Emotion	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Anger	Sig.	Black, Red	Low	Non-sig.	-	Low	Sig.	Black, Red	Low	Non-sig.	-	Low
Sadness	Sig.	Black	Low	Non-sig.	-	Low	Sig.	Black, Red	Low	Non-sig.	-	Low

(continued)

Table 8 (continued)

Results of Experiments 1/A & 1/B

	Experiment 1/A						Experiment 1/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Emotion												
Happiness	Sig.	Red, Black, Gray	Low	Sig.	Red, Brown, Blue, Green, Black, White, Pink, Orange	Low	Sig.	Black	Low	Sig.	Blue, Black, White, Purple, Gray	Low

(continued)

Table 8 (continued)

Results of Experiments 1/A & 1/B

	Experiment 1/A						Experiment 1/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
Emotion	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Surprise	Sig.	Red, Black	Low	Sig.	None	Low	Sig.	Red, Black, Yellow, Gray	Low	Non-sig.	-	Low

(continued)

Table 8 (continued)

Results of Experiments 1/A & 1/B

	Experiment 1/A						Experiment 1/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
Emotion	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Disgust	Sig.	Black, Red	Low	Non-sig.	-	Low	Sig.	Black, Red, Purple, Gray	Low	Non-sig.	-	Low
Fear	Sig.	Red, Purple	Low	Non-sig.	-	Low	Sig.	Black, Red, Gray	Low	Non-sig.	-	Low

(continued)

Table 8 (continued)

Results of Experiments 1/A & 1/B

	Experiment 1/A						Experiment 1/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
Emotion	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Neutral	Sig.	Brown, Black, Gray	Low	Non-sig.	-	Low	Sig.	Black	Low	Non-sig.	-	Low

3.5 Experiment 2A & 2B

In this set of experimental procedures, emoji faces were used as emotional stimuli. Findings for six emotions are reported separately.

3.5.1 Anger. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with anger (Condition 1), $\chi 2$ (10) = 36.17, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.039. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 25.22, p = 0.005. Also, there was low agreement among raters, Kendall's W = 0.024.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. There were several significantly different pairs. These were blue and red (Z = -3.49, p = 0.000), pink and red (Z = -3.65, p = 0.000), blue and yellow (Z = -3.68, p = 0.000), and pink and yellow (Z = -3.59, p = 0.000). For Experiment 2/A, when the Median (IQR) scores were compared, three colors stood out, which were red at 2 (0 to 4), yellow at 2 (0 to 4), and black at 2 median score (0 to 4).

Experiment 2/B showed similar results. The significantly different pair was found to be only black and blue (Z = -3.55, p = 0.000). According to the Median (IQR) scores, the leading color was black, and it had 2 median score (0 to 4).

When the colors were presented initially (Condition 2), and participants of Experiment 2/A were asked to make an association between emoji face Anger and its corresponding color options, there was no statistically significant difference amongcolors, $\chi 2$ (10) = 9.62, p = 0.475. Also, there was low agreement among raters, Kendall's W = 0.010. Similarly, there was no statistically significant result in Experiment2/B, $\chi 2$ (10) = 3.94, p = 0.95. There was low agreement among raters, Kendall's W = 0.04.

3.5.2 Sadness. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with sadness (Condition 1), $\chi 2$ (10) = 33.97, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.037. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 27.14, p = 0.000. Also, there was low agreement among raters, Kendall's W = 0.026.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. There were several significantly different pairs. These were pink and red (Z = -4.42, p = 0.000) and pink and yellow (Z = -3.85, p = 0.000). According to the Median (IQR) scores, only one color stood out: red at 2 (0 to 4) median score.

For Experiment 2/B, the same post hoc analysis was conducted. However, none of the pairs was found to be significantly different from the other. They were not below the cut-off score of p, which was set to be p = 0.0009 (p = 0.05/ 55 pairs) due to Bonferroni correction.

When the colors were presented initially (Condition 2), and participants were asked to make an association with emoji face Sadness, there was no statistically significant result in Experiment 2/A, $\chi 2$ (10) = 10.36, p = 0.410. A low agreement among raters was found, Kendall's W = 0.011. Similarly, there was no statistically significant result in Experiment 2/B, $\chi 2$ (10) = 11.69, p = 0.307. Also, there was low agreement among raters, Kendall's W = 0.011.

3.5.3 Happiness. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with happiness (Condition 1), $\chi 2$ (10) = 55.03, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.059. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 55.45, p = 0.000. A low agreement among raters was found, Kendall's W = 0.053.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. There were several significantly different pairs. These were blue and red (Z = -4.24, p = 0.000), pink and red (Z = -4.04, p = 0.000), blue and yellow (Z = -3.51, p = 0.000), black and blue (Z = -3.93, p = 0.000), and pink and black (Z = -3.58, p = 0.000). According to the Median (IQR) scores, only two colors stood out, which were red at 2 (0 to 4) and black at 2 (0 to 4).

For the Experiment 2/B, the significantly different pairs were pink and red (Z = -3.77, p = 0.000), pink and brown (Z = -3.53, p = 0.000), pink and black (Z = -3.86, p = 0.000), orange and pink (Z = -3.63, p = 0.000), and gray and pink (Z = -3.76, p = 0.000). The Median (IQR) scores showed two leading colors, which were black with 2 (0 to 4) and gray with 2 median score (0 to 4).

When the colors were presented initially (Condition 2), and participants were asked to make an association with emoji face Happiness, there was no statistically significant result in Experiment 2/A, $\chi 2$ (10) = 4.25, p = 0.936. A low level of agreement among participants was found, Kendall's W = 0.005. Similarly, there was no statistically significant result in Experiment 2/B, $\chi 2$ (10) = 6.21, p = 0.797. A low agreement among raters was found, Kendall's W = 0.006.

3.5.4 Surprise. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with surprise (Condition 1), $\chi 2$ (10) = 29.78, p = 0.001. However, there was low agreement among raters, with Kendall's W = 0.032. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 23.89, p = 0.008. Also, there was low agreement among raters, Kendall's W = 0.023.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. It was pink and yellow (Z = - 3.92, p = 0.000). According to the Median (IQR) scores, several colors were loosely standing out, which were red with 1 (0 to 4), brown with 1 (0 to 3), yellow with 1 (0 to 3), black with 1 (0 to 3), white with 1 (0 to 3), purple with 1 (0 to 3), orange with 1 (0 to 3), and gray with 1 (0 to 3.5) median score.

For Experiment 2/B the same posthoc analysis was conducted. However, none of the pairs was found to be significantly different from the other. They were not below the cut-off score of p, which was set to be p = 0.0009 (p = 0.05/ 55 pairs) due to Bonferroni correction.

When the colors were presented initially (Condition 2), and participants were asked to make an association with emoji face Surprise, there was no statistically significant result in Experiment 2/A, $\chi 2$ (10) = 9.49, p = 0.486. A low agreement among raters was found, Kendall's W = 0.010. Similarly, there was no statistically significant result in Experiment 2/B, $\chi 2$ (10) = 6.131, p = 0.804. A low agreement among raters was found, Kendall's W = 0.006.

3.5.5 Disgust. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with disgust (Condition 1), $\chi 2$ (10) = 31.18, p = 0.001. However, there was low agreement among raters, with Kendall's W =

0.034. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 54.39, p = 0.000. The low agreement among raters was also found, Kendall's W = 0.052.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. It was black and brown (Z = - 3.99, p = 0.000). When the Median (IQR) scores were compared, two colors stood out, which were yellow at 2 (0 to 4) and black at 2 median score (0 to 3.5).

The significantly different pairs in Experiment 2/B were blue and red (Z = -3.77, p = 0.000), pink and red (Z = -4.29, p = 0.000), black and blue (Z = -3.49, p = 0.000), and pink and black (Z = -3.64, p = 0.000). The Median (IQR) scores showed two leading colors, black with 2 (0 to 4) and red with a 2 median score (0 to 4).

When the colors were presented initially (Condition 2), and participants were asked to make an association with emoji face Disgust, there was no statistically significant result in Experiment 2/A, $\chi 2$ (10) = 15.02, p = 0.131. Also, there was a low level of agreement, Kendall's W = 0.016. Similarly, there was no statistically significant result in Experiment 2/B, $\chi 2$ (10) = 8.72, p = 0.559. Again, there was low agreement among raters; Kendall's W = 0.008.

3.5.6 Fear. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with Fear (Condition 1), $\chi 2$ (10) = 48.88, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.053. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 31.12, p = 0.001. A low agreement among raters was found, Kendall's W = 0.030.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. There were several significantly different pairs. These were pink and red (Z = -4.21, p = 0.000) and pink and yellow (Z = -4.10, p = 0.000). According to the Median (IQR) scores, only one color stood out: red at 2 (0 to 3.5). For the second group, none of the pairs could pass the cut score below p = 0.0009.

When the colors were presented initially (Condition 2), and participants were asked to make an association with emoji face Fear, there was no statistically significant result in Experiment 2/A, $\chi 2$ (10) = 5.70, p = 0.840. A low agreement among raters was found, Kendall's W = 0.006. Similarly, there was no statistically significant result in

Experiment 2/B, $\chi 2$ (10) = 9.77, p = 0.461. Also, there was low agreement among raters, Kendall's W = 0.009. Therefore, there was no need to conduct a posthoc analysis.

3.5.7 Neutral. In Experiment 2/A, there was a statistically significant difference among colors in terms of to what extent they were associated with neutral (Condition 1), $\chi 2$ (10) = 49.36, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.053. Similarly, there was a statistically significant result in Experiment 2/B, $\chi 2$ (10) = 69.52, p = 0.000. However, there was low agreement among raters, Kendall's W = 0.066.

Based on the significant results Wilcoxon signed-rank test was conducted to see the difference among associations in Experiment 2/A. There were several significantly different pairs. These were green and red (Z = -3.74, p = 0.000), black and brown (Z = -3.77, p = 0.000), black and blue (Z = -3.66, p = 0.000), black and green (Z = -4.71, p = 0.000), purple and green (Z = -3.65, p = 0.000), gray and green (Z = -3.98, p = 0.000), and pink and black (Z = -3.93, p = 0.000). According to the Median (IQR) scores, only two colors stood out, which were red at 2 (0 to 4) and black at 2 (0 to 4).

In Experiment 2/B, the significantly different pairs were green and red (Z = - 3.62, p = 0.000), pink and red (Z = -3.62, p = 0.000), black and blue (Z = -3.73, p = 0.000),gray and blue (Z = -3.85, p = 0.000), black and green (Z = -4.35, p = 0.000), gray and green (Z = -4.49, p = 0.000), white and black (Z = -3.54, p = 0.000), pink and black (Z = -4.28, p = 0.000), orange and black (Z = -3.49, p = 0.000), gray and white (Z = -3.56, p = 0.000), and gray and pink (Z = -4.26, p = 0.000). The Median (IQR) scores showed two leading colors, which were black with 2 (0 to 4) and gray with 2 median score (0 to 4).

When the colors were presented initially (Condition 2), and participants were asked to make an association with the emoji face Neutral, a statistically significant result was found in Experiment 2/A, $\chi 2$ (10) = 20.09, p = 0.028. However, there was a low agreement among participants, Kendall's W = 0.022. On the other hand, there was no statistically significant result in Experiment 2/B, $\chi 2$ (10) = 2.62, p = 0.989. Also, there was a low agreement among raters, Kendall's W = 0.002. Therefore, there was no need to conduct a post hoc analysis in Experiment 2/B. Based on the significant results in Experiment 2/A Wilcoxon signed-rank test was conducted to see the difference among associations. However, none of the pairs were found to be significantly different from

each other as they were not below the cut-off score of p, which was set to be $p = 0.0009$ ($p = 0.05/ 55$ pairs).

3.6 Summary of Results in Experiment 2/A & 2/B

Ratings of anger showed red, yellow, and black colors in Experiment 2/A. For Experiment 2/B, black was the only color. For sadness, Experiment 2/A's ratings implied only red, while no color was found to be statistically related in Experiment 2/B. Ratings of happiness indicated red and black in Experiment 2/A. For Experiment 2/B, the leading colors were black and gray. Ratings of the surprise loosely implied red, brown, yellow, black, white, purple, orange, and gray in Experiment 2/A. However, no color was found to be significantly related in Experiment 2/B.

Furthermore, ratings of disgust indicated yellow and black colors in Experiment 2/A. Black and red colors were found to be the leading colors in Experiment 2/B. Ratings for the fear indicated only red for Experiment 2/A; no color was found to be significantly loaded on the emotion of fear in Experiment 2/B. Lastly, for the ratings for the neutral word, it was found that black and red were the leading colors in Experiment 2/A, while black and gray were the standing colors in Experiment 2/B.

All in all, black and red were the colors that showed off on several occasions for emotions, with slight variations among the two experimental groups. Also, when emoji faces were presented initially to make an association for randomly presented colors, findings showed statistically significant results. However, within the significant findings, the agreement level of raters was low for all the emotions. Additionally, there needed to be a consensus among the experiments regarding the emotion-color association. Moreover, ratings for each given emoji face showed average scores when the median scores were investigated. Table 9 presents the results of Experiments 2/A and 2/B.

Table 9

Results of Experiments 2/A & 2/B

	Experiment 2/A						Experiment 2/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Emotion												
Anger	Sig.	Red, Yellow Black	Low	Non-sig.	-	Low	Sig.	Black	Low	Non-sig.	-	Low
Sadness	Sig.	Red	Low	Non-sig.	-	Low	Sig.	None	Low	Non-sig.	-	Low

(continued)

Table 9 (continued)

Results of Experiments 2/A & 2/B

	Experiment 2/A						Experiment 2/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Emotion												
Happiness	Sig.	Red, Black	Low	Non-Sig.	-	Low	Sig.	Black, Gray	Low	Non-sig.	-	Low

(continue)

Table 9 (continued)

Results of Experiments 2/A & 2/B

	Experiment 2/A						Experiment 2/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
Emotion	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Surprise	Sig.	Red Brown, Yellow, Black, White, Purple, Orange, Grey	Low	Non-Sig.	-	Low	Sig.	None	Low	Non-sig.	-	Low

(continue)

Table 9 (continued)

Results of Experiments 2/A & 2/B

	Experiment 2/A						Experiment 2/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Emotion												
Disgust	Sig.	Yellow, Black	Low	Non-sig.	-	Low	Sig.	Black, Red	Low	Non-sig.	-	Low
Fear	Sig.	Red	Low	Non-sig.	-	Low	Sig.	None	Low	Non-sig.	-	Low

(continued)

Table 9 (continued)

Results of Experiments 2/A & 2/B

	Experiment 2/A						Experiment 2/B					
	Condition 1			Condition 2			Condition 1			Condition 2		
Emotion	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement	Sig.	Color(s)	Level of Agreement
Neutral	Sig.	Red, Black	Low	Sig.	None	Low	Sig.	Black, Gray	Low	Non-sig.	-	Low

Chapter 4

Discussion

4.1 An Evaluation of Current Research's Findings Within the Scope of the Theoretical Discussion and Literature

The present study aimed to examine the Turkish language's associations between conceptual metaphors and emotions. As a conceptual metaphor, colors were used based on the literature review (Jonauskaite et al., 2019; Jonauskaite et al., 2020). For emotion, six basic emotion categories were analyzed. The purpose was to see which emotions and colors are associated with each other.

The results of experiments 1/A and 1/B showed that when emotion was first presented to participants to make an association with randomly presented colors, anger, sadness, surprise, disgust, fear, and neutral emotion words were found to be associated with the set of colors. Anger was associated with red and black in two experiments. Sadness was associated with black in Experiment 1/A and red and black in Experiment 1/B. The surprise was associated with black and red in Experiment 1/A. Experiment 1/B showed additional colors like yellow and gray. Disgust was associated with red and black in Experiment 1/A. There were purple and gray colors in addition to red and black in Experiment 1/B. In Experiment 1/A, fear matched with red and purple, while Experiment 1/B indicated black and gray beside the color red. The neutral word was loaded on colors like brown, black, and gray in Experiment 1/A, while black was the only color indicated in Experiment 1/B. The last emotion, happiness, has controversial outcomes. Happiness was significantly loaded on several colors in both matching conditions. For instance, Experiment 1/A showed red, brown, pink, blue, green, orange, black, and white colors when colors were presented initially. Experiment 1/B implied blue, black, white, purple, and gray. When the matching condition was reversed, the number of leading colors was small. Experiment 1/A indicated red, black, and gray colors. However, black was the only color indicated in Experiment 1/B.

In Experiments 2/A and 2/B, the results were significant when the emoji-like emotion faces were presented first, and colors were rated accordingly. Anger was associated with red, yellow, and black in Experiment 2/A. Black was the only color in Experiment 2/B. Sadness was matched with red in Experiment 2/A. In contrast, none of

the colors differed from the others in Experiment 2/B. Happiness was associated with red and black in Experiment 2/A, and the leading colors were black and gray in Experiment 2/B. The surprise was associated with red, brown, yellow, black, white, purple, orange, and gray in Experiment 2/A. However, Experiment 2/B did not show any color. Disgust was associated with yellow and black in Experiment 2/A, whereas black and red were indicated in Experiment 2/B. Experiment 2/A indicated a significant association between red and fear, and Experiment 2/B did not show any color. Lastly, the neutral emoji face was matched with black and red in Experiment 2/A and black and gray in Experiment 2/B.

According to neuropsychology literature, emotion refers to an internal state which consists of involuntary physiological responses towards an object or a situation. Based on this definition, most researchers tried to investigate brain circuits for each emotion. In the early 1930s, the limbic lobe and prefrontal cortex were predominately proposed regions that were thought to be aligned with emotional experience. Also, this limbic structure proposition focused on the hippocampus and its connections with the hypothalamus (Kolb & Whishaw, 2021). However, the modern views on the role of limbic systems in emotions focus primarily on the amygdala and prefrontal cortex. Especially, the orbitofrontal cortex (OFC) is essential as it represents positive and negative rewards and facilitates learning behavior (Kolb & Whishaw, 2021). Likewise, based on previous experiences, the orbitofrontal cortex helps an individual categorize the neutral stimuli, either positive or negative, and leads him to experience positive or negative emotions accordingly (Rolls, 2014).

Additionally, the amygdala was founded to play a crucial role in fear (Phillips et al., 1997). Likewise, the study conducted with monkeys, it was demonstrated that monkeys that have impaired amygdala did not show fear response towards threatening stimuli (Rolls, 2014). Furthermore, some other researchers proposed that there is a hemispheric asymmetry between emotion processing. For instance, Gainotti (2019) proposed that the right hemisphere plays a significant role in producing strong negative emotions like fear and anger.

Despite several kinds of research on underlying circuits in the brain for each emotion for many years (Kolb & Whishaw, 2021), there needed to be consistent and specified regions within the brain for each emotion (Barrett et al., 2019). Scherer and

Moors (2019) proposed that there is no localization in the brain for emotions since emotion should be considered an outcome of an interaction between an organism and its environment. Therefore, according to Scherer and Moors's (2019) perspective on emotion, emotion experience consists of how individuals appraise their situation, how they mentally and physically react to it, and what they perceive subjectively. Putting in other words, explaining one situation as fear or not depends on several pieces of information. Overall, neuropsychological findings propose a hardly clear distinction between emotion categories. As Scherer and Moor's (2019) study proposed, emotion perception derives from distinct pieces of information. Therefore, our inconsistent results for each emotion category might have been derived from the fact that studying emotion perception with language structure, as we did in our research, provides insights into a small part of the significant concept. To understand the deep structure behind emotion perception, we must have a comprehensive perspective on emotion.

Depending on the English language corpus analysis, different associations between emotion and color were found. Likewise, corpus analysis which was conducted by Sandford (2014) showed several associations that have a low level of agreement which were black with anger at 23 %, brown with boredom at 22 %, purple with rage at 22 %, and orange with happiness at an 11 % level of agreement. Some pairs have a high level of agreement, such as anger with red at 74 %, rage with red at 53 %, and happiness with yellow at 63 % level of agreement. Also, according to this corpus analysis, there was no associated color for the emotion of surprise. Another corpus analysis conducted by Steinvall (2007) showed similar findings. Likewise, anger was found to be associated with red, happiness with yellow, and surprise did not match with any color. Additionally, blue was associated with joy, green with envy, and grey and black with sadness.

Furthermore, several researchers included different groups of people in their studies to see the associations between emotions and colors. As such, Barchard et al. (2017) conducted a study on American and Indian participants. Based on their investigation of previous literature on English, fourteen metaphoric associations were expected to be found. These associations did not just include colors but also other metaphoric associations. For instance, the expected associations were happiness with up, bright, and warm; sadness with down, dark, blue, and empty; fear with white, cold, dark,

and paralyzed; anger with hot, red, and dark. Results showed that both groups endorsed several associations. For instance, happiness was associated with brightness, whereas negative emotions like anger, sadness, and fear were associated with darkness at 87 %. Anger with red and hot was associated with 66 %. Also, happiness was associated with an up, whereas sadness with a down by 96 %. Sadness was associated with empty at 91 %. Lastly, fear was associated with paralysis at 86 %.

On the other hand, several associations were found to be culture-specific. For example, sadness was associated with blue at 65 % in the American group, but the percentage for this association was 15 for the Indian group. The association between happiness with warmth and fear with cold predominated for the American group, but the Indian group did not endorse it. Lastly, neither group endorsed the pre-assumed association between fear and white contradictory to the researchers' expectations. Another study on Japanese participants showed similar results (Takahashi & Kawabata, 2018). The associations found in this study were anger with red, yellow with joy, bluish colors with sadness, and white with fear and disgust. Contradictory to Sandford's (2014) and Steinvall's (2007) studies, the surprise was found to be associated with yellow and white in Takahashi and Kawabata's (2018) study.

Moreover, Jonauskaite et al. (2019) conducted a study on 55 countries to see the association between yellow and the emotion of joy. The average association percentage for yellow and joy was 48.26%. Results showed that yellow was more joyful in colder and rainier countries. This study showed the effects of geographical, climatological, and seasonal factors on color-emotion association. Another study by Jonauskaite et al. (2020) investigated the compatibility of the presentation of color terms versus color patches in studies of emotion and color associations. Results showed that the usage of color terms versus color patches could provide compatible results. The strongly associated pairs were anger with red, love with red, and yellow with joy. There were one-color-to-one-emotion pairs: blue with sadness, brown with disgust, and white with relief. Finally, some colors matched more than one emotion, like red with love and anger and yellow with joy and amusement.

A study on specificity and consistency of color and emotion pairs conducted by Fugate and Franco (2019) on the English language showed that most of the found

associations had moderate to low levels of agreement. Researchers conducted two online studies. In the first study, participants had to select up to three colors for ten emotions (*sadness, surprise, anger, calmness, contempt, disgust, fear, happiness, jealousy, and envy*). Also, participants had to pick only one color for each emotion in a forced-choice question. The second study included additional colors and emotion terms (*alertness, awe, boredom, disappointment, empathy, guilt, joy, love, pride, and shame*). Results showed that four emotions were consistent: anger with red, fear with black, happiness with yellow, and sadness with gray. The pair of anger with red had a strong association.

Regarding the specificity aspect of the color-emotion association, nine colors out of twenty-three were found to be highly specified for specific emotions. Again, the highly specified pair was red and angry. However, several associations had moderate to low levels of agreement. For example, gray with sadness, yellow with happiness, green with envy, indigo with sadness, chocolate with dark yellow, and light green with disgust. In the second study, three colors showed specificity, and two out of twenty showed consistency to a specific emotion. The highly consistent pairs were disappointment with gray and love with red. The highly specified pairs were dark red with anger, light red with love, and green with envy. It was evident that the two studies needed to provide coherent findings with each other.

In the present study, according to experiments 1/A, 1/B, 2/A, and 2/B, only seven associations were aligned with the previous literature. In experiments 1/A, 1/B, and 2/A, anger was associated with red (e.g., Barchard et al., 2017; Fugate & Franco, 2019; Sandford, 2014; Steinvall, 2007; Takahashi & Kawabata, 2018). Also, anger was associated with black in experiments 1/A, 1/B, 2/A, and 2/B (e.g., Sandford, 2014). Similarly, there were several metaphoric expressions in Turkish such as one’s face becomes red (öfkeden kızarmak) or becomes scarlet red (öfkeden kıpkırmızı kesilmek) or one’s face to become black/ purple by anger (öfkeden yüzü simsiyah olmak, öfkeden mosmor kesilmek) or changes of one’s face's color (öfkeden yüzünün renginin değişmesi) which were assocaited with anger (Akkok, 2017). Sadness was associated with black in experiments 1/A and 1/B (e.g., Steinvall, 2007). Additionally, this association is specifically present in the Turkish language as there is a metaphoric expression of tying black for sadness ("*karalar bağlamak")* (Bas & Buyukkantarcıoglu, 2019). The surprise

was associated with yellow in experiments 1/B and 2/A (e.g., Takahashi & Kawabata, 2018) and it was associated with white in experiments 2/A (e.g., Takahashi & Kawabata, 2018). The last pair was fear with black in experiment 1/B (e.g., Fugate & Franco, 2019). Apart from these associations, no coherent associations were found in this study and the literature. Furthermore, the associations have a low level of agreement. This was also aligned with the previous literature (Barchard et al., 2017; Fugate & Franco, 2019). Furthermore, Fugate and Franco's (2019) study showed that pairs found in one study might not appear in another. According to Fugate and Franco's (2019) proposition, the term consistency refers to the reliable matching of an emotion to a color (s), whereas specific implies the presence of a particular color (s) for an emotion. Therefore, it can be concluded that consistency and specificity were problematic areas in our studies, according to the findings. Fugate and Franco (2019) claimed that experimental procedures might affect color-emotion associations. This manuscript agrees with this point of view. We did not have coherent findings in Experiments 1/A, 1/B, 2/A, and 2/B. In general, results were significant whenever the emotion has presented in either word or emoji-like formats in the initial phase. Similar findings did not appear when conditions included only verbal content. Due to the lack of a larger sample size, we are unsure whether there will be a meaningful difference between the presentation of emotion as a word or emoji-like faces when people associate colors.

Based on the findings of m*atching emoji-like faces with colors task*, the use of emoji faces might be another concern. In Fugate and Franco's (2021) study, they compared emoji faces with anatomical-based changes (AUs) on the face by adopting the Facial Action Coding System (FACS) (Ruch et al., 1997). The comparison was made by using 31 emoji faces which represented ten emotions. Emoji faces were picked up from three different platforms and their two different versions were used (e.g., Google Android [6.0 & 10], Apple [iOS 9.1 & iOS 13.3], Samsung [TouchWiz 5.1 & One UI 1.5]). There were two aims of the study. The initial one was to investigate differences between various electronic platforms that include different formatted emoji faces to refer to emotions. Secondly, researchers investigated the comparability of emoji faces and actual human anatomical representation of emotion. Results showed no exact match for each emotion across various platforms. The differences among platforms were on how well they could

classify each emotion. For instance, Apple (3 faces) and Samsung (4 faces) had a certain number of faces for fear. They were classified by participants correctly as fear. However, this type of classification was not found for Google Android (2 faces for fear).

Furthermore, the level of predicting each emotion was around 58 %. Specific emotions like happiness, sadness, disgust, and anger were the ones that were best predicted but still, there were subtle differences in the rate of classification among platforms (Fugate & Franco, 2021). Overall, using different electronic devices or platforms for emoji keyboards might lead to miscommunication or misunderstanding between two parties (Franco & Fugate, 2020; Miller Hillberg et al., 2018; Rodrigues et al., 2018; Tigwell & Flatla, 2016).

Based on the concerns mentioned above, this study has several experimental strengths. Initially, a pre-test was conducted to create a visual emotion stimulus for the main study to eliminate the interference effect of using emoji faces, which come from different electronic platforms. Secondly, presenting colors as patches might create visual problems in an online study. Therefore, using color words provided us the strength to have control over the presentation of visual stimuli. In this way, results could not be attributed to individual differences in how participants perceived the presented colors on an online platform.

4.2 Future Research Suggestions and Limitations

In addition to the strengths, the present study had several limitations. Firstly, there were several complaints about the length of the study. Therefore, the controversial findings might have been derived from boredom and fatigue. The second problem, assigning participants randomly and counterbalancing between conditions, was done through manual effort due to the technical limitations of the SurveyMonkey platform. Likewise, participants were randomly assigned to four different experimental conditions based on their selection of neutral words over a simple website page. The procedure solved the problem of random assignment and counterbalancing of the condition but finding an adequate number of participants became a problem. Third, based on the literature (e.g., Jonauskaite et al., 2019), snowball sampling was used to reach a large sample size. Also, the most significant advantage of conducting online studies was quickly reaching a large and representative sample of the actual population (Buchanan & Smith, 1999; Kraut et al.,

2004; Reips, 2000). However, snowball sampling in the online study caused disadvantages. We had less control over individual differences (Kraut et al., 2004).

Furthermore, finding associations of black and red colors with most emotions led to the question of whether it derived from individual preferences for these two specific colors. We did not know whether there was favoritism towards any color compared to others. Besides, the aim was to see the association between emotions and colors in Turkish, but several participants know up to 5 languages in addition to Turkish. Even though the level of proficiency varied for each language, it might have been one factor for controversial findings. Conducting an online study was another challenge. It has a higher risk of an elevated dropout rate from the study (Reips, 2000). Several participants gave consent to proceed into the study phase, but in the middle of the study, they left. Although the initial size of the sample (780) seemed adequate to conduct parametric analysis, missing values created a crucial problem in making sense of the dataset. We did not have a chance to investigate the characteristics of the individuals who left the study as participants gave their demographic information at the end of the study. If it had been possible, we could gain insight into the reason that lay behind the abandonment of the study.

Additionally, as seen in experiments 2/A and 2/B, when emoji faces were presented, participants from experiment 2/A made an association between some colors. However, several emotions did not load on any color in experiment 2/B. Emotions of sadness, surprise, and fear were one of these examples. The inconsistent results among groups or matching conditions were not specific to this study as it was replicated in the previous literature. For example, Steinvall's (2007) study investigated the degree of salience between emotion and colors. There were two types of tasks. The first one required the participant to select a color for presented emotions. For the second task, the selection was inversely designed so that this time participants were required to select an emotion for the presented color. According to the results, the two tasks did not provide coherent findings. For instance, anger was associated with mostly red and green in the second task. However, it was found to be associated with white, brown, and purple beside the red and green combination in the first task (Steinvall, 2007). Similarly, neuropsychological findings (e.g., Scherer & Moors, 2019) provide information that the experience of emotion

depends on several components of the individual's subjective experience. Therefore, most of the time, there were no coherent findings for the localization of emotion categories within the brain structure. Still, the non-significant differences among colors for the emotions in Experiment 2/B might lead to whether there might be no embodied cognitive experiences of colors as metaphoric expressions and emotion recognition.

Based on this literature, in future research, associations between emotions and colors in the Turkish language can be investigated with corpus analysis. It will show the deep structure between the metaphorical language structure and emotion perception. As this exploratory study was the initial step for investigating associations between six basic emotion terms and 11 basic color terms in Turkish, several other languages can be included in future research. It will shed light on the differences between languages. Also, we can achieve agreement on whether found associations were universal or language-specific concepts.

Additionally, we used emoji faces as one of the emotional stimuli to see the associations with basic color terms. In future research, genuine human anatomical expressions of the six basic emotions can be used instead of emoji faces to see the relationship. Furthermore, with the COVID pandemic, we acquired new life-sustaining norms. Conducting an online study was one of these drastic changes. This method comes with several difficulties, as we mentioned. One of the problems was reaching a representative sample of the population. The inconsistent results of this study might be attributed to this difficulty. Therefore, in future research, having an equal group of participants in terms of individual differences like education level, age, sex, or size of the sample should be one point to be prioritized. Lastly, emotions generally are categorized according to two dimensions. The initial one refers to valence, which shows the directionality of emotions in positive to negative dimensions. The second one refers to intensity (Russell, 1980). As an example of this definition, happiness and surprise are both the same in valence, so they are positive emotions. In contrast, they differ in intensity, as happiness has low intensity while surprise takes place in a highly intensive dimension. Similarly, anger and sadness are similar in valence, so they are both negative emotions. However, anger has high-intensity characteristics, whereas sadness is in the low-intensity dimension (Anderson & Adolphs, 2014). Furthermore, as Takahashi and Kawabata (2018)

showed in their study, positive emotions were associated with brighter colors, whereas negative emotions were generally loaded with darker colors. In this research, we did not investigate selected emotion categories in valence and intensity aspects. Therefore, in future research, these dimensions should be investigated further to understand the difference between emotion categories among each other.

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